Simba Documentation

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Erik Moqvist

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Contents

Simba is an Embedded Programming Platform. It aims to make embedded programming easy and portable.

Simba is written in C.

Project homepage: https://github.com/eerimoq/simba

CHAPTER 1

Videos

Transmit CAN frames between a Nano32 and an Arduino Due. More videos are available on the *Videos* page.

Getting Started

Installation

There are three build systems available; *PlatformIO*, *Arduino IDE* and *Simba build system*. The *Simba build system* has more features than to the other two. It supports executing test suites, generating code coverage, profiling and more. Still, if you are familiar with *Arduino IDE* or *PlatformIO*, use that instead since it will be less troublesome.

PlatformIO

Install *Simba* in PlatformIO.

1. Install the PlatformIO IDE.
2. Start the *PlatformIO IDE* and open *PlatformIO -> Project Examples* and select *simba/blink*.
3. Click on *Upload* (the arrow image) in the top left corner.
4. The built-in LED blinks!
5. Done!

Arduino IDE

Install *Simba* in the Arduino IDE 1.6.10 as a third party board using the Boards Manager.

1. Open *File -> Preferences*.

2. Add these URL:s to *Additional Boards Manager URLs* (click on the icon to the right of the text field) and press *OK*.

```
https://raw.githubusercontent.com/eerimoq/simba-releases/master/arduino/avr/
↪package_simba_avr_index.json
https://raw.githubusercontent.com/eerimoq/simba-releases/master/arduino/sam/
↪package_simba_sam_index.json
https://raw.githubusercontent.com/eerimoq/simba-releases/master/arduino/esp/
↪package_simba_esp_index.json
https://raw.githubusercontent.com/eerimoq/simba-releases/master/arduino/esp32/
↪package_simba_esp32_index.json
```

3. Open *Tools* -> *Board: ...* -> *Boards Manager...* and type *simba* in the search box.
4. Click on *Simba by Erik Moqivst version x.y.z* and click *Install* and press *Close*.
5. Open *Tools* -> *Board: ...* -> *Boards Manager...* and select one of the Simba boards in the list.
6. Open *File* -> *Examples* -> *Simba* -> *blink*.
7. Verify and upload the sketch to your device.
8. The built-in LED blinks!
9. Done!

Simba build system

The *Simba* development environment can be installed on *Linux (Ubuntu 14)*.

1. Execute the one-liner below to install *Simba*.

```
$ mkdir simba && \
  cd simba && \
  sudo apt install ckermit valgrind cppcheck cloc python python-pip doxygen git␣
↪lcov && \
  sudo apt install avrdude gcc-avr binutils-avr gdb-avr avr-libc && \
  sudo apt install bossa-cli gcc-arm-none-eabi && \
  sudo apt install make unrar autoconf automake libtool gcc g++ gperf \
                       flex bison texinfo gawk ncurses-dev libexpat-dev \
                       python-serial sed libtool-bin pmccabe help2man \
                       python-pyelftools unzip && \
  sudo pip install pyserial xpect readchar sphinx breathe sphinx_rtd_theme && \
  (git clone --recursive https://github.com/pfalcon/esp-open-sdk && \
   cd esp-open-sdk && \
   make) && \
  wget https://github.com/eerimoq/simba-releases/raw/master/arduino/esp32/tools/
↪xtensa-esp32-elf-linux$(getconf LONG_BIT)-1.22.0-59.tar.gz && \
  tar xf xtensa-esp32-elf-linux$(getconf LONG_BIT)-1.22.0-59.tar.gz && \
  rm xtensa-esp32-elf-linux$(getconf LONG_BIT)-1.22.0-59.tar.gz && \
  git clone --recursive https://github.com/eerimoq/simba
```

2. Setup the environment.

```
$ cd simba
$ source setup.sh
```

2. Build and upload the blink example to your device. Replace `<my-serial-port>` with your serial port name.

```
$ cd examples/blink
$ make -s BOARD=nano32 SERIAL_PORT=<my-serial-port> upload
```

3. The built-in LED blinks!
4. Done!

Note: Some boards, such as the *SPC56D Discovery*, require a specific toolchain to build. Such cases are documented on the individual board documentation page.

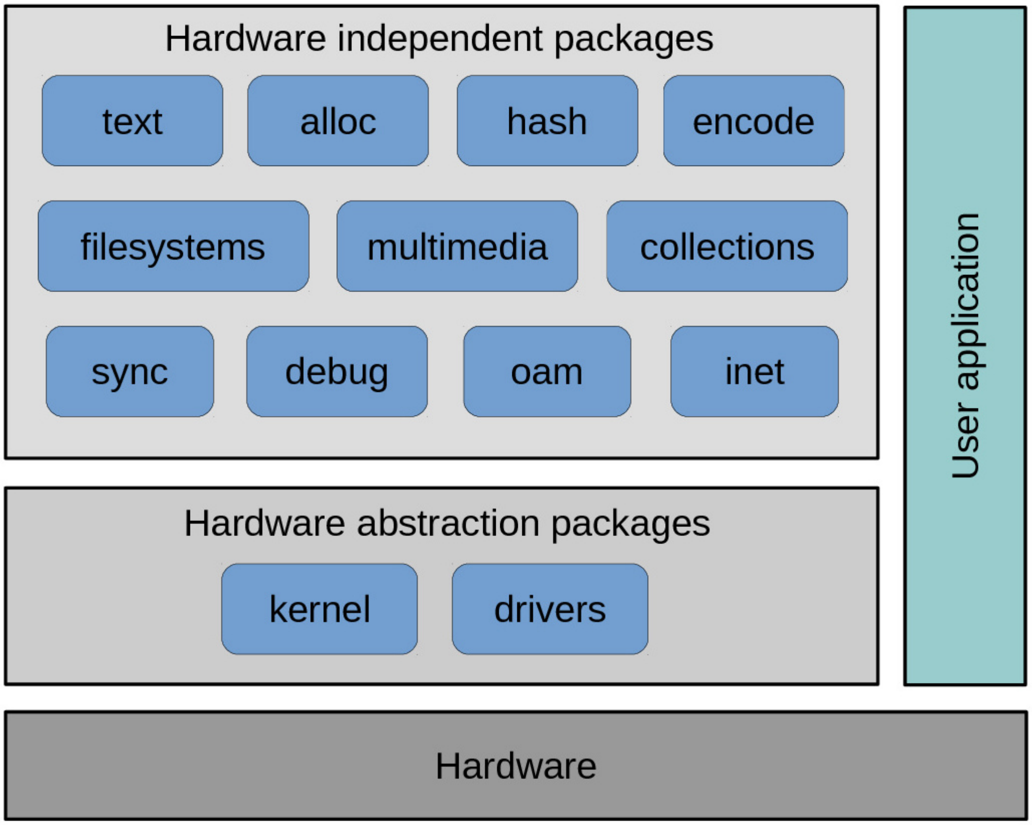
User Guide

This guide is intended for users of the Simba Embedded Programming Platform and the *Simba build system*. Parts of the guide is applicable to other build systems as well, in particular the configuration section.

The Simba installation guide can be found on the *Getting Started* page.

Software architecture

Below is a picture of all packages and their relation to the hardware. At the bottom is the hardware. On top of the hardware is the kernel and drivers packages, which exports a hardware independent interface that other packages and the user application can use. The user application on the right can use any package, and in rare cases directly access the hardware registers.



Contents:

Environment setup

The first step is always to setup the *Simba* environment. It's a simple matter of sourcing a setup-script in the simba root folder.

This step only applies to the *Simba build system*, and not to the *Arduino IDE* or *PlatformIO*.

```
$ cd simba/simba
$ source setup.sh
```

Hello World application

Let's start with the *Simba* "Hello World" application. It examplifies what an application is and how to build and run it.

It consists of two files; `main.c` and `Makefile`.

main.c

main.c defines the application entry function `main()`.

```
#include "simba.h"

int main()
```

```
{
    /* Initialize modules and start the scheduler. */
    sys_start();

    std_printf(FSTR("Hello world!\n"));

    return (0);
}
```

Makefile

Makefile contains build configuration of the application.

```
NAME = hello_world
BOARD ?= linux

RUN_END_PATTERN = "Hello world!"
RUN_END_PATTERN_SUCCESS = "Hello world!"

SIMBA_ROOT = ../..
include $(SIMBA_ROOT)/make/app.mk
```

Build and run

Compile, link and run it by typing the commands below in a shell:

```
$ cd examples/hello_world
$ make -s run
<build system output>
Hello world!
$
```

Cross-compile, link and then run on an Arduino Due:

```
$ cd examples/hello_world
$ make -s BOARD=arduino_due run
<build system output>
Hello world!
$
```

Applications, packages and modules

Simba has three software components; the application, the package and the module.

Application

An application is an executable consisting of zero or more packages.

```
myapp
- main.c
- Makefile
```

Development workflow

Build and run often! More to be added, hopefully.

Package

A package is a container of modules.

A package file tree **must** be organized as seen below. This is required by the build framework and *Simba* tools.

See the inline comments for details about the files and folders contents.

```
mypkg
- mypkg
|   - doc                       # package documentation
|   - __init__.py
|   - src                       # package source code
|   |   - mypkg
|   |   |   - module1.c
|   |   |   - module1.h
|   |   - mypkg.h               # package header file
|   |   - mypkg.mk              # package makefile
|   - tst                       # package test code
|       - module1
|           - main.c
|           - Makefile
- setup.py
```

Development workflow

The package development workflow is fairly straight forward. Suppose we want to add a new module to the file tree above. Create `src/mypkg/module2.h` and `src/mypkg/module2.c`, then include `mypkg/module2.h` in `src/mypkg.h` and add `mypkg/module2.c` to the list of source files in `src/mypkg.mk`. Create a test suite for the module. It consists of the two files `tst/module2/main.c` and `tst/module2/Makefile`.

It's often conveniant to use an existing modules' files as skeleton for the new module.

After adding the module `module2` the file tree looks like this.

```
mypkg
- mypkg
|   - doc
|   - __init__.py
|   - src
|   |   - mypkg
|   |   |   - module1.c
|   |   |   - module1.h
|   |   |   - module2.c
|   |   |   - module2.h
|   |   - mypkg.h
|   |   - mypkg.mk
|   - tst
|       - module1
|       |   - main.c
|       |   - Makefile
|       - module2
```

```
|           - main.c
|           - Makefile
- setup.py
```

Now, build and run the test suite to make sure the empty module implementation compiles and can be executed.

```
$ cd tst/module2
$ make -s run
```

Often the module development is started by implementing the module header file and at the same time write test cases. Test cases are not only useful to make sure the implementation works, but also to see how the module is intended to be used. The module interface becomes cleaner and easier to use it you actually start to use it yourself by writing test cases! All users of your module will benefit from this!

So, now we have an interface and a test suite. It's time to start the implementation of the module. Usually you write some code, then run the test suite, then fix the code, then run the tests again, then you realize the interface is bad, change it, change the implementation, change the test, change, change... and so it goes on until you are satisfied with the module.

Try to update the comments and documentation during the development process so you don't have to do it all in the end. It's actually quite useful for yourself to have comments. You know, you forget how to use your module too!

The documentation generation framework uses doxygen, breathe and sphinx. That means, all comments in the source code should be written for doxygen. Breathe takes the doxygen output as input and creates input for sphinx. Sphinx then generates the html documentation.

Just run `make` in the `doc` folder to generate the html documentation.

```
$ cd doc
$ make
$ firefox _build/html/index.html    # open the docs in firefox
```

Namespaces

All exported symbols in a package must have the prefix `<package>_<module>_`. This is needed to avoid namespace clashes between modules with the same name in different packages.

There cannot be two packages with the same name, for the namespace reason. All packages must have unique names! There is one exception though, the three *Simba* packages; kernel, drivers and slib. Those packages does *not* have the package name as prefix on exported symbols.

```
int mypackage_module1_foo(void);

int mypackage_module2_bar(void);
```

Module

A module is normally a header and a source file.

Configuration

Standard Library

The *Library Reference* is configured at compile time using defines named `CONFIG_*`. The default configuration includes most functionality, as most application wants that. If an application has special requirements, for example memory constraints, it has to be configured to remove unnecessaray functionality.

Search order

Highest priority first.

Simba build system

1. Command line as `CDEFS_EXTRA="<configuration variable>=<value>"`.
2. A file named `config.h` in the application root folder.
3. The default configuration file, src/config_default.h.

PlatformIO

1. The variable `build_flags` in `platformio.ini` as `build_flags = -D<configuration variable>=<value>`.
2. A file named `config.h` in the application source folder `src`.
3. The default configuration file, src/config_default.h.

Arduino IDE

1. A file (also called a *tab*) named `config.h` in the sketch.
2. The default configuration file, src/config_default.h.

Variables

All configuration variables are listed below. Their default values are defined in src/config_default.h.

Defines

CONFIG_SYS_CONFIG_STRING

CONFIG_SYS_SIMBA_MAIN_STACK_MAX
Main thread stack size for ports with a fixed size main thread stack.

CONFIG_SYS_RESET_CAUSE
Read, and when needed clear, the reset cause at startup.

CONFIG_SYS_PANIC_KICK_WATCHDOG
Kick the watchdog in `sys_panic()` before writing to the console.

CONFIG_ASSERT
Assertions are used to check various conditions during the application execution. A typical usage is to validate function input arguments.

CONFIG_ASSERT_FORCE_FATAL
Force all assertions to be fatal.

CONFIG_FATAL_ASSERT
Enable fatal assertions, `FATAL_ASSERT*()`.

CONFIG_PANIC_ASSERT
Enable panic assertions, `PANIC_ASSERT*()`.

CONFIG_DEBUG
Include more debug information.

CONFIG_LINUX_SOCKET_DEVICE
Enable linux driver implementations as TCP sockets. Can be used to simulate driver communication in an application running on linux.

CONFIG_ADC
Enable the adc driver.

CONFIG_ANALOG_INPUT_PIN
Enable the analog_input_pin driver.

CONFIG_ANALOG_OUTPUT_PIN
Enable the analog_output_pin driver.

CONFIG_CAN
Enable the can driver.

CONFIG_CAN_FRAME_TIMESTAMP
Timestamp received CAN frames.

CONFIG_CHIPID
Enable the chipid driver.

CONFIG_RANDOM
Enable the random driver.

CONFIG_LED_7SEG_HT16K33
Enable the led_7seg_ht16k33 driver.

CONFIG_SHT3XD
Enable the sht3xd driver.

CONFIG_DAC
Enable the dac driver.

CONFIG_DS18B20
Enable the ds18b20 driver.

CONFIG_DS3231
Enable the ds3231 driver.

CONFIG_ESP_WIFI
Enable the esp_wifi driver.

CONFIG_EXTI
Enable the exti driver.

CONFIG_FLASH
Enable the flash driver.

CONFIG_I2C
Enable the i2c driver.

CONFIG_I2C_SOFT
Enable the i2c_soft driver.

CONFIG_MCP2515
Enable the mcp2515 driver.

CONFIG_NRF24L01
Enable the nrf24l01 driver.

CONFIG_OWI
Enable the owi driver.

CONFIG_PIN
Enable the pin driver.

CONFIG_PWM
Enable the pwm driver.

CONFIG_PWM_SOFT
Enable the pwm_soft driver.

CONFIG_SD
Enable the sd driver.

CONFIG_SPI
Enable the spi driver.

CONFIG_UART
Enable the uart driver.

CONFIG_UART_SOFT
Enable the uart_soft driver.

CONFIG_USB
Enable the usb driver.

CONFIG_USB_DEVICE
Enable the usb_device driver.

CONFIG_USB_HOST
Enable the usb_host driver.

CONFIG_WATCHDOG
Enable the watchdog driver.

CONFIG_MODULE_INIT_RWLOCK
Initialize the module at system startup.

CONFIG_MODULE_INIT_FS
Initialize the fs module at system startup.

CONFIG_MODULE_INIT_SETTINGS
Initialize the settings module at system startup.

CONFIG_MODULE_INIT_STD
Initialize the std module at system startup.

CONFIG_MODULE_INIT_SEM
Initialize the sem module at system startup.

CONFIG_MODULE_INIT_TIMER
Initialize the timer module at system startup.

CONFIG_MODULE_INIT_LOG
Initialize the log module at system startup.

CONFIG_MODULE_INIT_CHAN
Initialize the chan module at system startup.

CONFIG_MODULE_INIT_THRD
Initialize the thrd module at system startup.

CONFIG_MODULE_INIT_ADC
Initialize the adc driver module at system startup.

CONFIG_MODULE_INIT_ANALOG_INPUT_PIN
Initialize the analog_input_pin driver module at system startup.

CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN
Initialize the analog_output_pin driver module at system startup.

CONFIG_MODULE_INIT_CAN
Initialize the can driver module at system startup.

CONFIG_MODULE_INIT_CHIPID
Initialize the chipid driver module at system startup.

CONFIG_MODULE_INIT_RANDOM
Initialize the random driver module at system startup.

CONFIG_MODULE_INIT_DAC
Initialize the dac driver module at system startup.

CONFIG_MODULE_INIT_DS18B20
Initialize the ds18b20 driver module at system startup.

CONFIG_MODULE_INIT_DS3231
Initialize the ds3231 driver module at system startup.

CONFIG_MODULE_INIT_ESP_WIFI
Initialize the esp_wifi driver module at system startup.

CONFIG_MODULE_INIT_EXTI
Initialize the exti driver module at system startup.

CONFIG_MODULE_INIT_FLASH
Initialize the flash driver module at system startup.

CONFIG_MODULE_INIT_I2C
Initialize the i2c driver module at system startup.

CONFIG_MODULE_INIT_I2C_SOFT
Initialize the i2c_soft driver module at system startup.

CONFIG_MODULE_INIT_MCP2515
Initialize the mcp2515 driver module at system startup.

CONFIG_MODULE_INIT_NRF24L01
Initialize the nrf24l01 driver module at system startup.

CONFIG_MODULE_INIT_OWI
Initialize the owi driver module at system startup.

CONFIG_MODULE_INIT_PIN
Initialize the pin driver module at system startup.

CONFIG_MODULE_INIT_PWM
Initialize the pwm driver module at system startup.

CONFIG_MODULE_INIT_PWM_SOFT
Initialize the pwm_soft driver module at system startup.

CONFIG_MODULE_INIT_SD
Initialize the sd driver module at system startup.

CONFIG_MODULE_INIT_SPI
Initialize the spi driver module at system startup.

CONFIG_MODULE_INIT_UART
Initialize the uart driver module at system startup.

CONFIG_MODULE_INIT_UART_SOFT
Initialize the uart_soft driver module at system startup.

CONFIG_MODULE_INIT_USB
Initialize the usb driver module at system startup.

CONFIG_MODULE_INIT_USB_DEVICE
Initialize the usb_device driver module at system startup.

CONFIG_MODULE_INIT_USB_HOST
Initialize the usb_host driver module at system startup.

CONFIG_MODULE_INIT_WATCHDOG
Initialize the watchdog driver module at system startup.

CONFIG_MODULE_INIT_BUS
Initialize the bus module at system startup.

CONFIG_MODULE_INIT_INET
Initialize the inet module at system startup.

CONFIG_MODULE_INIT_PING
Initialize the ping module at system startup.

CONFIG_MODULE_INIT_SOCKET
Initialize the socket module at system startup.

CONFIG_MODULE_INIT_NETWORK_INTERFACE
Initialize the network_interface module at system startup.

CONFIG_MODULE_INIT_SSL
Initialize the ssl module at system startup.

CONFIG_MODULE_INIT_UPGRADE
Initialize the upgrade module at system startup.

CONFIG_FS_CMD_DS18B20_LIST
Debug file system command to list all DS18B20 sensors on the bus.

CONFIG_FS_CMD_ESP_WIFI_STATUS
Debug file system command to print the Espressif WiFi status.

CONFIG_FS_CMD_FS_APPEND
Debug file system command to append to a file.

CONFIG_FS_CMD_FS_COUNTERS_LIST
Debug file system command to list all counters.

CONFIG_FS_CMD_FS_COUNTERS_RESET
Debug file system command to set all counters to zero.

CONFIG_FS_CMD_FS_FILESYSTEMS_LIST
Debug file system command to list all registered file systems.

CONFIG_FS_CMD_FS_LIST
Debug file system command to list all registered file systems.

CONFIG_FS_CMD_FS_FORMAT
Debug file system command to format a file system.

CONFIG_FS_CMD_FS_PARAMETERS_LIST
Debug file system command to list all parameters.

CONFIG_FS_CMD_FS_READ
Debug file system command to read from a file.

CONFIG_FS_CMD_FS_REMOVE
Debug file system command to remove a file.

CONFIG_FS_CMD_FS_WRITE
Debug file system command to write to a file.

CONFIG_FS_CMD_I2C_READ
Debug file system command to read from a i2c bus.

CONFIG_FS_CMD_I2C_WRITE
Debug file system command to write to a i2c bus.

CONFIG_FS_CMD_LOG_LIST
Debug file system command to list all log objects.

CONFIG_FS_CMD_LOG_PRINT
Debug file system command to create a log entry and print it. Mainly used for debugging.

CONFIG_FS_CMD_LOG_SET_LOG_MASK
Debug file system command to set the log mask of a log object.

CONFIG_FS_CMD_NETWORK_INTERFACE_LIST
Debug file system command to list all network interfaces.

CONFIG_FS_CMD_PIN_READ
Debug file system command to read the current value of a pin.

CONFIG_FS_CMD_PIN_SET_MODE
Debug file system command to set the mode of a pin.

CONFIG_FS_CMD_PIN_WRITE
Debug file system command to write a value to a pin.

CONFIG_FS_CMD_PING_PING
Debug file system command to ping a host.

CONFIG_FS_CMD_SERVICE_LIST
Debug file system command to list all services.

CONFIG_FS_CMD_SERVICE_START
Debug file system command to start a service.

CONFIG_FS_CMD_SERVICE_STOP
Debug file system command to stop a services.

CONFIG_FS_CMD_SETTINGS_LIST
Debug file system command to list all settings.

CONFIG_FS_CMD_SETTINGS_READ
Debug file system command to read the value of a setting.

CONFIG_FS_CMD_SETTINGS_RESET
Debug file system command to reset the settings to their original values.

CONFIG_FS_CMD_SETTINGS_WRITE
Debug file system command to write a value to a setting.

CONFIG_FS_CMD_SYS_CONFIG
Debug file system command to print the system configuration.

CONFIG_FS_CMD_SYS_INFO
Debug file system command to print the system information.

CONFIG_FS_CMD_SYS_UPTIME
Debug file system command to print the system uptime.

CONFIG_FS_CMD_SYS_PANIC
Debug file system command to force a panic of the system.

CONFIG_FS_CMD_SYS_REBOOT
Debug file system command to reboot the system.

CONFIG_FS_CMD_SYS_BACKTRACE
Debug file system command to print a backtrace.

CONFIG_FS_CMD_SYS_RESET_CAUSE
Debug file system command to print the system reset cause.

CONFIG_FS_CMD_THRD_LIST
Debug file system command to list threads' information.

CONFIG_FS_CMD_THRD_SET_LOG_MASK
Debug file system command to set the log mask of a thread.

CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER
Debug file system command to enter the application.

CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE
Debug file system command to erase the application.

CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID
Debug file system command to check if the application is valid.

CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER
Debug file system command to enter the bootloader.

CONFIG_FS_CMD_USB_DEVICE_LIST
Debug file system command to list all USB devices.

CONFIG_FS_CMD_USB_HOST_LIST
Debug file system command to list all USB devices connected to the USB host.

CONFIG_FS_CMD_NVM_READ
Debug file system command to read for non-volatile memory.

CONFIG_FS_CMD_NVM_WRITE
Debug file system command to write for non-volatile memory.

CONFIG_FS_PATH_MAX
The maximum length of an absolute path in the file system.

CONFIG_MONITOR_THREAD
Start the monitor thread to gather statistics of the scheulder.

CONFIG_MONITOR_THREAD_PERIOD_US
Default period of the monitor thread in microseconds.

CONFIG_PREEMPTIVE_SCHEDULER
Use a preemptive scheduler.

CONFIG_PROFILE_STACK
Profile the stack usage in runtime. It's a cheap operation and is recommended to have enabled.

CONFIG_SETTINGS_AREA_SIZE
Size of the settings area. This size *MUST* have the same size as the settings generated by the settings.py script.

CONFIG_SETTINGS_BLOB
Enable the blob setting type.

CONFIG_SHELL_COMMAND_MAX
Maximum number of characters in a shell command.

CONFIG_SHELL_HISTORY_SIZE
Size of the shell history buffer.

CONFIG_SHELL_MINIMAL
Minimal shell functionality to minimize the code size of the shell module.

CONFIG_SHELL_PROMPT
The shell prompt string.

CONFIG_SOCKET_RAW
Raw socket support.

CONFIG_SPIFFS
SPIFFS is a flash file system applicable for boards that has a reasonably big modifiable flash.

CONFIG_FAT16
FAT16 is a file system.

CONFIG_FILESYSTEM_GENERIC
Generic file system.

CONFIG_START_CONSOLE
Start the console device (UART/USB CDC) on system startup.

CONFIG_START_CONSOLE_DEVICE_INDEX
Console device index.

CONFIG_START_CONSOLE_UART_BAUDRATE
Console UART baudrate.

CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE
Console UART baudrate.

CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE
Console USB CDC control interface number.

CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN
Console USB CDC input endpoint.

CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT
Console USB CDC output endpoint.

CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION
Wait for the host to connect after starting the console.

CONFIG_START_FILESYSTEM
Configure a default file system.

CONFIG_START_FILESYSTEM_ADDRESS
Configure a default file system start address.

CONFIG_START_FILESYSTEM_SIZE
Configure a default file system size.

CONFIG_START_NVM
Configure a default non-volatile memory.

CONFIG_NVM_SIZE
Non-volatile memory size in bytes.

CONFIG_NVM_EEPROM_SOFT
Use the software EEPROM implementation in the non-volatile memory module.

CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE
Non-volatile memory software EEPROM block 0 size. Must be a multiple of `CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE`.

CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE
Non-volatile memory software EEPROM block 1 size. Must be a multiple of `CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE`.

CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE
Non-volatile software EEPROM chunk size. Must be a power of two.

CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX
Non-volatile software EEPROM flash device index.

CONFIG_START_NETWORK
Setup the ip stack and connect to all configured networks.

CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT
WiFi connect timeout is seconds.

CONFIG_START_NETWORK_INTERFACE_WIFI_SSID
SSID of the WiFi to connect to.

CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD
Password of the WiFi to connect to.

CONFIG_START_SHELL
Start a shell thread communication over the console channels.

CONFIG_START_SHELL_PRIO
Shell thread priority.

CONFIG_START_SHELL_STACK_SIZE
Shell thread stack size in words.

CONFIG_START_SOAM
Start a SOAM thread communication over the console channels.

CONFIG_START_SOAM_PRIO
SOAM thread priority.

CONFIG_START_SOAM_STACK_SIZE
SOAM thread stack size in words.

CONFIG_STD_OUTPUT_BUFFER_MAX
Maximum number of bytes in the print output buffer.

CONFIG_FLOAT
Use floating point numbers instead of intergers where applicable.

CONFIG_SYSTEM_TICK_FREQUENCY
System tick frequency in Hertz.

CONFIG_SYSTEM_INTERRUPTS
Use interrupts.

CONFIG_SYSTEM_INTERRUPT_STACK_SIZE
Interrupt stack size in bytes. Set to a value greater than zero to enable the interrupt stack.

CONFIG_THRD_CPU_USAGE
Calculate thread CPU usage.

CONFIG_THRD_DEFAULT_LOG_MASK
Default thread log mask.

CONFIG_THRD_ENV
Each thread has a list of environment variables associated with it. A typical example of an environment variable is "CWD" - Current Working Directory.

CONFIG_THRD_IDLE_STACK_SIZE
Stack size of the idle thread.

CONFIG_THRD_MONITOR_STACK_SIZE
Stack size of the monitor thread.

CONFIG_THRD_SCHEDULED
Count the number of times each thread has been scheduled.

CONFIG_THRD_STACK_HEAP
Enable the thread stack heap allocator.

CONFIG_THRD_STACK_HEAP_SIZE
Size in bytes of the thread stack heap.

CONFIG_THRD_TERMINATE
Threads are allowed to terminate.

CONFIG_USB_DEVICE_VID
USB device vendor id.

CONFIG_USB_DEVICE_PID
USB device product id.

CONFIG_EMACS_COLUMNS_MAX
Number of colums in Emacs text editor.

CONFIG_EMACS_ROWS_MAX
Number of rows in Emacs text editor.

CONFIG_EMACS_HEAP_SIZE
Heap size of the emacs text editor.

CONFIG_SYSTEM_TICK_SOFTWARE
System tick using a software timer instead of a hardware timer. Suitable for ESP8266 to enable software PWM.

CONFIG_HTTP_SERVER_SSL
Add support to wrap the HTTP server in SSL, creating a HTTPS server.

CONFIG_HARNESS_SLEEP_MS
Sleep in the test harness before executing the first testcase.

CONFIG_HARNESS_EXPECT_BUFFER_SIZE
Maximum buffer size the expect function can handle.

CONFIG_HARNESS_HEAP_MAX
Size of the harness heap, required for harness_mock_write() and harness_mock_read().

CONFIG_HARNESS_MOCK_VERBOSE
Verbose mock framework.

CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE
Size of the HTTP server request buffer. This buffer is used when parsing received HTTP request headers.

CONFIG_CRC_TABLE_LOOKUP
Use lookup tables for CRC calculations. It is faster, but uses more memory.

CONFIG_SPC5_BOOT_ENTRY_RCHW

CONFIG_SPC5_RAM_CLEAR_ALL

CONFIG_TIME_UNIX_TIME_TO_DATE
Include the function time_unix_time_to_date().

CONFIG_SOAM_EMBEDDED_DATABASE
Embed the SOAM database in the application.

CONFIG_SYS_LOG_MASK
System module log mask.

CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ
The external oscillator frequency in Hertz.

CONFIG_FLASH_DEVICE_SEMAPHORE
Semaphore protected device access in the flash driver module.

CONFIG_EEPROM_SOFT_SEMAPHORE
Semaphore protected software eeprom accesses.

CONFIG_EEPROM_SOFT_CRC_32

CONFIG_EEPROM_SOFT_CRC_CCITT

CONFIG_EEPROM_SOFT_CRC
Software eeprom crc algorithm.

lwIP

Use `config.h` to fully configure lwIP and all of its modules. You do not need to define every option that lwIP provides; if you do not define an option, a default value will be used. Therefore, your `config.h` provides a way to override much of the behavior of lwIP.

By default *Simba* overrides a few of the variables in src/inet/lwipopts.h.

Module support (Code size)

Enabling and disabling modules

You can tune your code size by only compiling the features you really need. The following is a list of what gets compiled in "out of the box" with lwIP.

Default inclusions:

- ARP (`LWIP_ARP`)
- IP and fragmentation (`IP_FRAG`) and reassembly (`IP_REASSEMBLY`)
- Raw IP PCB support (`LWIP_RAW`)
- UDP (`LWIP_UDP`) and UDP-Lite (`LWIP_UDPLITE`)
- TCP (`LWIP_TCP`) – this is a big one!
- Statistics (`LWIP_STATS`)

Default exclusions:

- DHCP (`LWIP_DHCP`)
- AUTOIP (`LWIP_AUTOIP`)
- SNMP (`LWIP_SNMP`)
- IGMP (`LWIP_IGMP`)
- PPP (`PPP_SUPPORT`)

If you would like to change this, then you just need to set the options listed below. For example, if you would like to disable UDP and enable DHCP, the following `config.h` file would do it:

```
/* Disable UDP */
#define LWIP_UDP 0

/* Enable DHCP */
#define LWIP_DHCP 1
```

Memory management (RAM usage)

Memory pools

In an embedded environment, memory pools make for fast and efficient memory allocation. lwIP provides a flexible way to manage memory pool sizes and organization.

lwIP reserves a fixed-size static chunk of memory in the data segment, which is subdivided into the various pools that lwip uses for the various data structures. For example, there is a pool just for struct tcp_pcb's, and another pool just for struct udp_pcb's. Each pool can be configured to hold a fixed number of data structures; this number can be changed in the `config.h` file by changing the various `MEMP_NUM_*` values. For example, `MEMP_NUM_TCP_PCB` and `MEMP_NUM_UDP_PCB` control the maximum number of tcp_pcb and udp_pcb structures that can be active in the system at any given time.

It is also possible to create custom memory pools in addition to the standard ones provided by lwIP.

Dynamic allocation: mem_malloc

lwIP uses a custom function mem_malloc for all dynamic allocation; therefore, it is easy to change how lwIP uses its RAM. There are three possibilities provided out-of-the-box:

1. (default) lwIP's custom heap-based mem_malloc. By default, lwIP uses a statically-allocated chunk of memory like a heap for all memory operations. Use `MEM_SIZE` to change the size of the lwIP heap.
2. C standard library malloc and free. If you wish to have lwIP use the standard library functions provided by your compiler/architecture, then define the option `MEM_LIBC_MALLOC`.
3. Memory pools. lwIP can also emulate dynamic allocation using custom memory pools (see that chapter for more information). This involves the options `MEM_USE_POOLS` and `MEMP_USE_CUSTOM_POOLS` and a new custom file `lwippools.h`.

Understanding/changing memory usage

lwIP uses memory for:

- code (depending on your system, may use ROM instead of RAM)
- statically allocated variables (some initialized, some not initialized)
- task stack
- dynamically allocated memory
  - heap
  - memp pools

Unless you use a C library heap implementation (by defining `MEM_LIBC_MALLOC` to 1), dynamically allocated memory must be statically allocated somewhere. This means you reserve a specific amount of memory for the heap or the memp pools from which the code dynamically allocates memory at runtime.

The size of this heap and memp pools can be adjusted to save RAM:

There are 3 types of pbufs:

- REF/ROM, RAM and POOL. `PBUF_POOL_SIZE` * `PBUF_POOL_BUFSIZE` only refers to type POOL.
- RAM pbufs are allocated in the memory defined by `MEM_SIZE` (this memory is not used much aside from RAM pbufs) - this is the *heap* and it is allocated as mem_memory.
- REF/ROM pbufs as well as pcbs and some other stuff is allocated from dedicated pools per structure type. The amount of structures is defined by the various `MEMP_NUM_` defines. Together, this memory is allocated as memp_memory and it *includes* the pbuf POOL.

However, if you define `MEMP_MEM_MALLOC` to 1 in your `config.h`, *every* piece of dynamically allocated memory will come from the heap (the size of which is defined by `MEM_SIZE`). If you then even define `MEM_LIBC_MALLOC` to 1, too, lwIP doesn't need extra memory for dynamically allocated memory but only uses the C library heap instead. However, you then have to make sure that this heap is big enough to run your application.

To tweak the various `MEMP_NUM_` defines, define `LWIP_STATS=1` and `LWIP_STATS_DISPLAY=1` and call *stats_display()* to see how many entries of each pool are used (or have a look at the global variable `lwip_stats` instead).

Fine-tuning even more

To see the options that you can set, open 3pp/lwip-1.4.1/src/include/lwip/opt.h. This file is fully commented and explains how many of the options are used.

Build system

The *Simba* build system is based on *GNU Make*.

Targets

Name	Description
all	Compile and link the application.
clean	Remove all generated files and folders.
new	clean + all
upload	all + Upload the application to the device.
console	Open a serial console on /dev/arduino with baudrate BAUDRATE.
run	all + upload + Wait for application output.
run-debugger	Run the application in the debugger, break at main.
report	Print the test report from a previous run.
test	run + report
release	Compile with NASSERT=yes.
size	Print application size information.
help	Show the help.

Variables

There are plenty of make variables used to control the build process. Below is a list of the most frequently used variables. The advanced user may read the make files in make.

Name	Description
SIMBA_ROOT	Path to the *Simba* root folder.
BOARD	The `BOARD` variable selects which board to build for. It can be assigned to one of the boards listed *here*. For example, the command to build for *Arduino Due* is `make BOARD=arduino_due`.
BAUDRATE	Serial port baudrate used by console and run targets.
SERIAL_PORT	Serial port used by console and run targets.
VERSION	The application version string. Usually on the form <major>.<minor>.<revision>.
SETTINGS_INI	Path to the settings file.
INC	Include paths.
SRC	Source files (.c, .asm, .rs).
CFLAGS_EXTRA	Extra flags passed to the compiler.
LDFLAGS_EXTRA	Extra flags passed to the linker.
NASSERT	Build the application without assertions.

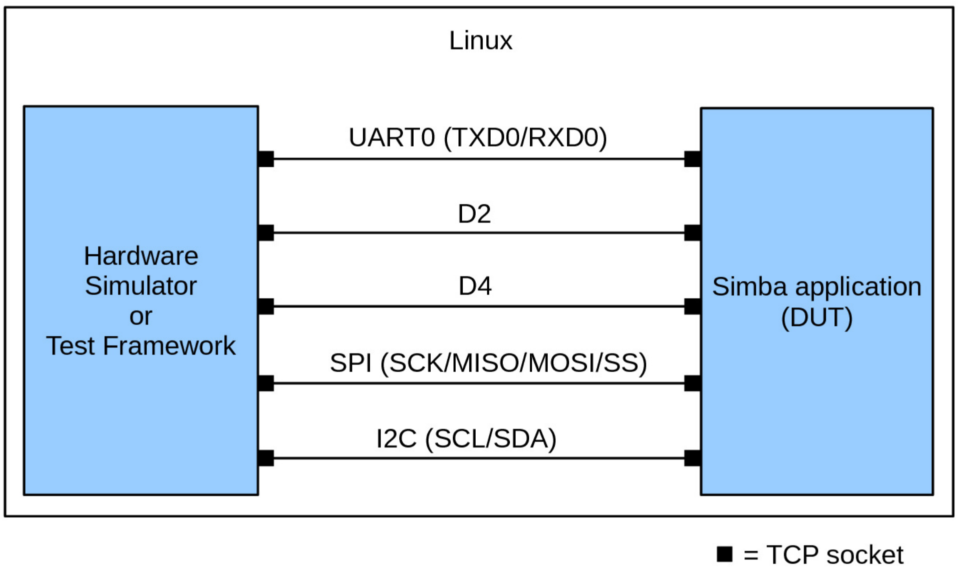
Socket devices

The Linux socket device drivers implementation allows an external program to simulate the hardware. The external program communicates with the Simba application using TCP sockets, one socket for each device.

The Python script socket_device.py can be used to monitor and send data to a device.

Arduino Mega example

In this example socket_device.py is the hardware simulator (to the left in the image below), and socket_device is the Simba application (to the right in the image below). The five horizontal lines each represents input and output of one device.



First build and run the linux application with the Arduino Mega pinout...

```
$ make BOARD=linux PINOUT=arduino_mega run
```

...and then, in a second terminal, monitor digital pin 2, `d2`.

```
> socket_device.py pin d2
Connecting to localhost:47000... done.
Requesting pin device d2... done.
$
14:48:10.004512 pin(d2) RX: high
14:48:52.535323 pin(d2) RX: high
14:49:20.123124 pin(d2) RX: low
```

Alternatively, monitor all devices at the same time with the monitor make target.

```
$ make BOARD=linux PINOUT=arduino_mega monitor
socket_device.py monitor
Connecting to localhost:47000... done.
Requesting uart device 0... done.
...
Connecting to localhost:47000... done.
Requesting pin device 2... done.
Connecting to localhost:47000... done.
```

```
Requesting pin device 4... done.
...
$
14:51:50.531761 pin(2) RX: low
14:51:50.541784 uart(0) RX: b'\n'
14:51:51.178744 pin(4) RX: high
```

Python modules

There are two Python modules in the folder bin/socket_device in the Simba repository. Both modules implements the same interface as the default Python module/package with the same name, and can be used to communicate over a socket device instead of using the hardware.

- serial.py implements the pyserial interface.
- can.py implements the python-can interface.

Use the environment variable `PYTHONPATH` to import the socket device modules instead of the default modules/packages.

```
> export PYTHONPATH=$(readlink -f ${SIMBA_ROOT}/bin)
> export PYTHONPATH=${PYTHONPATH}:$(readlink -f ${SIMBA_ROOT}/bin/socket_device)
> bpython3
>>> import serial
>>> serial
<module 'serial' from '/home/erik/workspace/simba/bin/socket_device/serial.py'>
>>> import can
>>> can
<module 'can' from '/home/erik/workspace/simba/bin/socket_device/can.py'>
>>>
```

Protocol

At startup the Simba application creates a socket and starts listening for clients on TCP port 47000.

Devices

These drivers supports the socket device protocol at the moment. More to be added when needed.

Uart

The UART socket is equivalent to a serial port, it streams data to and from the application.

Pin

Sends `high` or `low` when written to given device. Input is not supported yet.

Pwm

Sends `frequency=<value>` and `duty_cycle=<value>` when set on given device.

Can

Sends and receives frames on the format `id=<id>,extended=<extended>,size=<size>,data=<data>`. `<id>` and `<data>` are hexadecimal numbers not prefixed with `0x`. `size` and `<extended>` is a decimal integers.

```
> socket_device.py can 0
Connecting to localhost:47000... done.
Requesting can device 0... done.
$ id=00000005,extended=1,size=2,data=0011<Enter>
14:57:22.344321 can(0) TX: id=00000005,extended=1,size=2,data=0011
14:57:22.346321 can(0) RX: id=00000006,extended=1,size=2,data=0112
```

I2c

Sends and receives data on the format `address=<address>,size=<size>,data=<data>`. `<address>` is an decimal integer, while `<size>` and `<data>` is a hexadecimal numbers.

```
> socket_device.py i2c 0
Connecting to localhost:47000... done.
Requesting i2c device 0... done.
$
14:57:22.346321 i2c(0) RX: address=0006,size=0003,data=1a2b3c
```

Device request message

This message is sent to the Simba application to request a device.

```
+---------+---------+----------------+
| 4b type | 4b size | <size>b device |
+---------+---------+----------------+

`device` is the device name as a string without NULL termination.

TYPE  SIZE  DESCRIPTION
--------------------------------------
   1     n  Uart device request.
   3     n  Pin device request.
   5     n  Pwm device request.
   7     n  Can device request.
   9     n  I2c device request.
  11     n  Spi device request.
```

Device response message

This message is the response to the request message.

```
+---------+---------+-----------+
| 4b type | 4b size | 4b result |
+---------+---------+-----------+

`result` is zero(0) on success, and otherwise a negative error
code.
```

```
Defined error codes are:

   ENODEV(19): No device found matching requested device name.

   EADDRINUSE(98): The requested device is already requested and in
                   use.

TYPE  SIZE  DESCRIPTION
--------------------------------------
   2     4  Uart device response.
   4     4  Pin device response.
   6     4  Pwm device response.
   8     4  Can device response.
  10     4  I2c device response.
  12     4  Spi device response.
```

Developer Guide

This guide is intended for developers of the Simba Embedded Programming Platform. Users are advised to read the *User Guide* instead.

Contents:

Boards and mcus

A board is the top level configuration entity in the build framework. It contains information about the MCU and the pin mapping.

In turn, the MCU contains information about available devices and clock frequencys in the microcontroller.

See src/boards/ and src/mcus for available configurations.

Only one MCU per board is supported. If there are two MCU:s on one physical board, two board configurations have to be created, one for each MCU.

The porting guide *Porting* shows how to port *Simba* to a new board.

Threads and channels

A thread is the basic execution entity. A scheduler controls the execution of threads.

A simple thread that waits for an event from another thread.

```
#include "simba.h"

struct event_t event;

void *my_thread_main(void *arg_p)
{
    uint32_t mask;

    while (1) {
        mask = 0x1;
        event_read(&event, &mask, sizeof(mask));
```

```
        std_printf(FSTR("Event received!\r\n"));
    }

    return (NULL);
}
```

Threads usually communicates over channels. There are many kinds of channels; queue, socket and event, to mention a few. All three implementing the same abstract channel interface (see src/sync/chan.h). This abstraction makes channel very powerful as a synchronization primitive. They can be seen as limited functionality file descriptors in linux.

The most common channel is the *queue — Queue channel*. It can be either synchronous or semi-asynchronous. In the synchronous version the writing thread will block until all written data has been read by the reader. In the semi-asynchronous version the writer writes to a buffer within the queue, and only blocks all data does not fit in the buffer. The buffer size is selected by the application.

File tree

This is the file tree of the Simba repository.

```
simba                        - this directory
- 3pp                      - third party products
- bin                      - executables and scripts
- doc                      - documentation source
- environment              - environment setup
- examples                 - example applications
- LICENSE                  - license
- make                     - build and run files
- README.rst               - readme
- setup.sh                 - setup script
- src                      - source code directory
|   - alloc                - alloc package
|   - boards               - board configurations
|   - collections          - collections package
|   - debug                - debug package
|   - drivers              - drivers package
|   - encode               - encode package
|   - filesystems          - filesystems package
|   - hash                 - hash package
|   - inet                 - inet package
|   - kernel               - kernel package
|   - mcus                 - mcu configurations
|   - multimedia           - multimedia package
|   - oam                  - oam package
|   - sync                 - sync package
|   - text                 - text package
|   - simba.h              - includes all package headers
|   - simba.mk             - build system configuration
- tst                      - test suites
|   - alloc                - alloc package test suite
|   - collections          - collections package test suite
|   - debug                - debug package test suite
|   - drivers              - drivers package test suite
|   - encode               - encode package test suite
|   - filesystems          - filesystems package test suite
|   - hash                 - hash package test suite
|   - inet                 - inet package test suite
```

```
|   - kernel            - kernel package test suite
|   - multimedia        - multimedia package test suite
|   - oam               - oam package test suite
|   - sync              - sync package test suite
|   - text              - text package test suite
- VERSION.txt           - `Simba` version
```

Testing

To ensure high code quility each release is tested extensively by many test suites. The test suites are executed both on native Linux and on many of the supported boards. See *Test suites* for a list of all test suites that are executed before each release.

The native Linux test suites are executed automatically on each commit.

Test result: https://travis-ci.org/eerimoq/simba

Code coverage: https://codecov.io/gh/eerimoq/simba

Unit tests

Each module shall have unit tests to verify that the implementation works as expected and that future refactoring does not break legacy.

All unit tests except low level drivers and networking are hardware independent. This makes it possible to use common Linux tools (gcov, valgrind, gdb, etc.) to debug and gather statistics of a module, which is very useful.

For low level drivers where the majority of the code is hardware specific (ports folder), testing on real hardware is important. It's preferable to have a hardware independent test suite with stubbed interfaces for drivers without any port specific code, and having an example application in examples to test on real hardware.

All unit tests are found in the tst folder.

Hardware setup

Below is a picture of all supported boards connected to a USB hub. The USB hub is connected to a linux PC (not in the picture) that executes test suites on all boards.

A short description of the setup:

- The DS3231 device (on the breadboard to the left) is connected over i2c to the *Arduino Mega*.
- CAN0 is connected to CAN1 on the *Arduino Due*. The CAN driver is tested by sending frames between the two CAN devices.
- The UART of the *STM32VLDISCOVERY* board is connected to a serial to USB adaptor. DTR on the adaptor is used to reset the board.
- The *ESP-12E Development Board* also has a serial to USB adaptor connected. RTS is used to set the board in flashing mode (GPIO0) and DTR is used to reset the board (REST).

Test suites

Below is a list of all test suites that are executed before every release. They are listed per board.

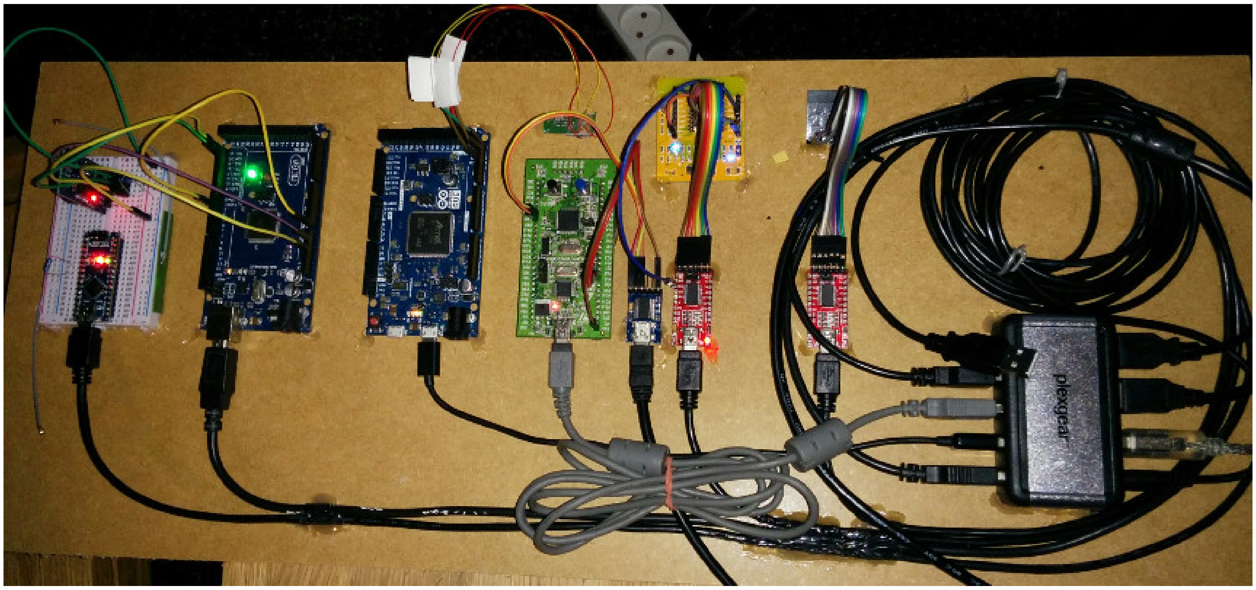


Fig. 1.1: The boards are (from left to right): *Arduino Nano*, *Arduino Mega*, *Arduino Due*, *STM32VLDISCOVERY*, *ESP-12E Development Board* and *ESP-01*

Arduino Due

- kernel/sys
- kernel/thrd
- kernel/time
- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- alloc/heap
- text/configfile
- text/std
- text/re
- debug/log

- oam/settings
- oam/shell
- filesystems/fs
- filesystems/spiffs
- encode/base64
- encode/json
- hash/crc
- hash/sha1
- drivers/chipid
- drivers/can
- drivers/flash

Arduino Mega

- kernel/sys
- kernel/thrd
- kernel/time
- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- alloc/heap
- text/configfile
- text/std
- text/re
- debug/log
- oam/settings
- oam/shell
- filesystems/fat16
- filesystems/fs

- encode/base64
- hash/crc
- hash/sha1
- inet/http_websocket_client
- inet/http_websocket_server
- inet/inet
- inet/mqtt_client
- inet/ping
- drivers/adc
- drivers/analog_input_pin
- drivers/ds3231
- drivers/sd
- drivers/pin

Arduino Nano

- drivers/ds18b20
- drivers/analog_output_pin
- drivers/exti
- drivers/owi

Arduino Pro Micro

- kernel/sys
- kernel/thrd
- kernel/timer

Arduino Uno

ESP-01

ESP-12E Development Board

- kernel/sys
- kernel/thrd
- kernel/timer

ESP32-DevKitC

Adafruit HUZZAH ESP8266 breakout

Linux

- kernel/sys
- kernel/thrd
- kernel/time
- kernel/timer
- sync/bus
- sync/chan
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/circular_buffer
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- alloc/heap
- text/configfile
- text/emacs
- text/std
- text/re
- debug/log
- debug/harness
- oam/nvm
- oam/service
- oam/settings
- oam/shell
- oam/soam
- oam/upgrade
- oam/upgrade/http
- oam/upgrade/kermit
- oam/upgrade/uds

- filesystems/fat16
- filesystems/fs
- filesystems/spiffs
- encode/base64
- encode/json
- hash/crc
- hash/sha1
- inet/http_server
- inet/http_websocket_client
- inet/http_websocket_server
- inet/inet
- inet/isotp
- inet/mqtt_client
- inet/ping
- inet/slip
- inet/ssl
- inet/tftp_server
- multimedia/midi

Maple-ESP32

Nano32

- kernel/sys
- kernel/thrd
- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- text/std
- text/re

- debug/log
- oam/shell
- encode/base64
- encode/json
- hash/crc
- hash/sha1
- inet/http_websocket_client
- inet/http_websocket_server
- inet/inet
- inet/mqtt_client_network
- inet/network_interface/wifi_esp
- inet/ping
- filesystems/fs
- filesystems/spiffs

NodeMCU

- kernel/sys
- kernel/thrd
- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- text/std
- text/re
- debug/log
- oam/shell
- encode/base64
- encode/json
- hash/crc

- hash/sha1
- inet/http_websocket_client
- inet/http_websocket_server
- inet/inet
- inet/mqtt_client
- inet/network_interface/wifi_esp
- inet/ping
- drivers/pin
- drivers/random
- filesystems/fs
- filesystems/spiffs

Particle IO Photon

- kernel/sys
- kernel/thrd
- kernel/time
- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- text/std
- text/re
- debug/log
- oam/shell
- encode/base64
- encode/json
- hash/crc
- hash/sha1
- inet/http_websocket_client

- inet/http_websocket_server
- inet/inet
- inet/mqtt_client
- inet/ping

SPC56D Discovery

- kernel/sys
- kernel/thrd
- kernel/time
- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- text/std
- text/re
- debug/log
- oam/shell
- oam/soam
- encode/base64
- encode/json
- hash/crc
- hash/sha1
- drivers/eeprom_soft

STM32F3DISCOVERY

STM32VLDISCOVERY

- kernel/sys
- kernel/thrd

- kernel/timer
- sync/bus
- sync/event
- sync/queue
- sync/rwlock
- sync/sem
- collections/binary_tree
- collections/bits
- collections/fifo
- collections/hash_map
- alloc/circular_heap
- text/std
- text/re
- debug/log
- oam/shell
- encode/base64
- encode/json
- hash/crc
- hash/sha1
- inet/http_websocket_client
- inet/http_websocket_server
- inet/inet
- inet/mqtt_client
- inet/ping
- drivers/pin
- drivers/random

WEMOS D1 mini

Releasing

Follow these steps to create a new release:

1. Write the new version in `VERSION.txt`. The version should hace the format `<major>.<minor>.<revision>`.

   Increment `<major>` for non-backwards compatible changes.

   Increment `<minor>` for new features.

   Increment `<revision>` for bug fixes.

2. Write the new version in `package.json`. This file is used by *PlatformIO 3* to find the current *Simba* release.

3. Run the test suites and generate the documentation and other files.

```
make -s -j8 test-all-boards
make -s -j8 release-test
```

4. Commit the generated files.
5. Generate files for Arduino and PlatformIO releases. The generated archives and Arduino manifests are copied to the release repository.

```
make -s release
```

6. Add, commit and push the Simba Arduino releases in the release repository.

```
(cd ../simba-releases && \
 git add arduino/*/*.zip platformio/*.zip && \
 git commit && \
 git push origin master)
```

7. Start a http server used to download package manifests in the Arduino IDE.

```
(cd make/arduino && python -m SimpleHTTPServer)
```

8. Start the Arduino IDE and add these URL:s in Preferences.

```
http://localhost:8000/avr/package_simba_avr_index.json
http://localhost:8000/esp/package_simba_esp_index.json
http://localhost:8000/esp32/package_simba_esp32_index.json
http://localhost:8000/sam/package_simba_sam_index.json
```

9. Install all four packages and run the blink example for each one of them.
10. Commit the manifests, tag the commit with `<major>.<minor>.<revision>` and push.

```
git commit
git tag <major>.<minor>.<revision>
git push origin master
```

11. Add, commit and push the Simba Arduino package manifests in the release repository.

```
(cd ../simba-releases && \
 git add arduino/*/*.json && \
 git commit && \
 git push origin master)
```

12. Done.

Porting

Adding a new board

Often the board you want to use in your project is not yet supported by *Simba*. If you are lucky, *Simba* is already ported to the MCU on your board. Just create a folder with you board name in src/boards/ and populate it with the `board.h`, `board.c` and `board.mk`. Also, create board documentation in doc/boards/, and add a pinout image in doc/images/boards/.

The same files as a file tree:

```
simba/
+-- doc/
|   +-- boards/
|   |   +-- <board-name>.rst
|   +-- images/
|       +-- boards/
|           +-- <board-name>-pinout.jpg
+-- src/
    +-- boards/
        +-- <board-name>.h
        +-- <board-name>.c
        +-- <board-name>.mk
```

If *Simba* is not ported to your MCU, the kernel and drivers has to be ported.

Kernel

Porting the kernel is a matter of configuring the system tick timer and inplement a few locking primitives. If you are familiar with your CPU, the port can be implemented quickly.

A kernel port is roughly 400 lines of code.

Kernel ports are implemented in src/kernel/ports.

Drivers

The required work to port the drivers depends of which drivers you are intrested in. The more drivers you have to port, the longer time it takes, obviously.

A drivers port is roughly 200 lines of code per driver.

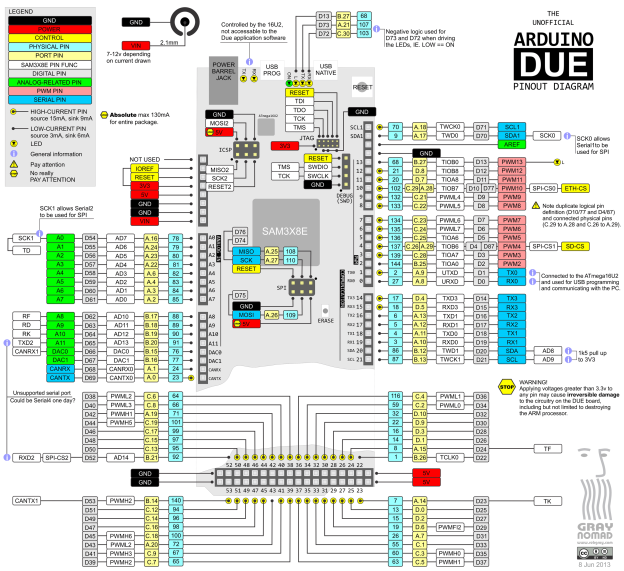
Drivers ports are implemented in src/drivers/ports.

Boards

The boards supported by *Simba*.

Arduino Due

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *can — Controller Area Network*
- *chipid — Chip identity*
- *dac — Digital to analog convertion*
- *ds18b20 — One-wire temperature sensor*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *mcp2515 — CAN BUS chipset*
- *owi — One-Wire Interface*
- *pin — Digital pins*

- *sd — Secure Digital memory*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *usb — Universal Serial Bus*
- *usb_host — Universal Serial Bus - Host*

Library Reference

Read more about board specific functionality in the *Arduino Due* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	6144	1672
default-configuration	128000	10194

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	1
CONFIG_CHIPID	1
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	1
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	0
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1

Continued on next page

Table 1.1 – continued from previous page

Name	Value
CONFIG_FLASH	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1

Continued on next page

Table 1.1 – continued from previous page

Name	Value
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	1
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	1
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	1
CONFIG_MODULE_INIT_DAC	1
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	0
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	1
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	1
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	1
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	1
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	1

Continued on next page

Table 1.1 – continued from previous page

Name	Value
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	0
CONFIG_SD	1
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	115200
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x000e0000
CONFIG_START_FILESYSTEM_SIZE	32768
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	1536
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0

Continued on next page

Table 1.1 – continued from previous page

Name	Value
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	384
CONFIG_THRD_MONITOR_STACK_SIZE	512
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	1
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	1
CONFIG_WATCHDOG	0

Homepage

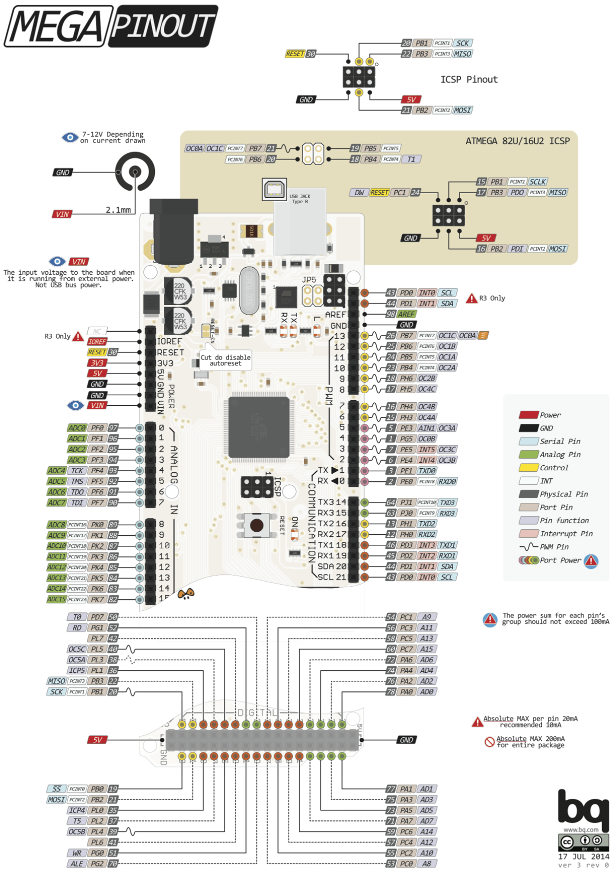
https://www.arduino.cc/en/Main/ArduinoBoardDue

Mcu

sam3x8e

Arduino Mega

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *analog_output_pin — Analog output pin*
- *ds18b20 — One-wire temperature sensor*
- *ds3231 — RTC clock*
- *exti — External interrupts*
- *i2c — I2C*

- *i2c_soft — Software I2C*
- *mcp2515 — CAN BUS chipset*
- *nrf24l01 — Wireless communication*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm — Pulse width modulation*
- *pwm_soft — Software pulse width modulation*
- *sd — Secure Digital memory*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*
- *watchdog — Hardware watchdog*

Library Reference

Read more about board specific functionality in the *Arduino Mega* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	1734	279
default-configuration	64434	4005

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	1
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0

Continued on next page

Table 1.2 – continued from previous page

Name	Value
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	0
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1

Continued on next page

Table 1.2 – continued from previous page

Name	Value
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	1
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	1
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	0
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	1
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	1

Continued on next page

Table 1.2 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	1
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	1
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	1
CONFIG_MONITOR_THREAD	1
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	1
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	256
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	1
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	0
CONFIG_SD	1
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0

Continued on next page

Table 1.2 – continued from previous page

Name	Value
CONFIG_SOCKET_RAW	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	156
CONFIG_THRD_MONITOR_STACK_SIZE	256
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1

Continued on next page

Table 1.2 – continued from previous page

Name	Value
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	1

Homepage

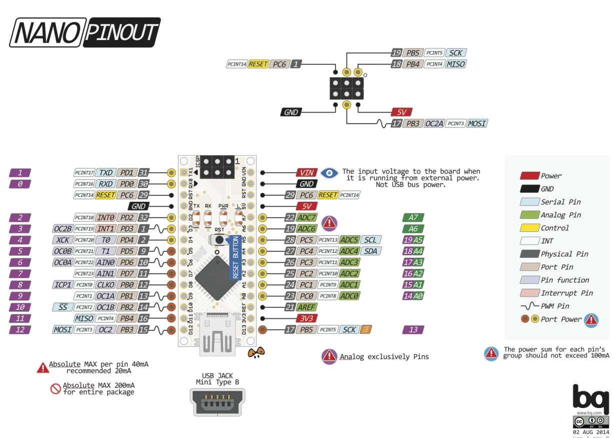
https://www.arduino.cc/en/Main/ArduinoBoardMega

Mcu

atmega2560

Arduino Nano

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*

- *analog_output_pin — Analog output pin*
- *ds18b20 — One-wire temperature sensor*
- *ds3231 — RTC clock*
- *exti — External interrupts*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *mcp2515 — CAN BUS chipset*
- *nrf24l01 — Wireless communication*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm — Pulse width modulation*
- *pwm_soft — Software pulse width modulation*
- *sd — Secure Digital memory*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*
- *watchdog — Hardware watchdog*

Library Reference

Read more about board specific functionality in the *Arduino Nano* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	1548	279
default-configuration	13340	1038

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	1

Continued on next page

Table 1.3 – continued from previous page

Name	Value
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	0
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	0
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	0
CONFIG_FS_CMD_FS_COUNTERS_LIST	0
CONFIG_FS_CMD_FS_COUNTERS_RESET	0
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	0
CONFIG_FS_CMD_FS_FORMAT	0
CONFIG_FS_CMD_FS_LIST	0
CONFIG_FS_CMD_FS_PARAMETERS_LIST	0
CONFIG_FS_CMD_FS_READ	0
CONFIG_FS_CMD_FS_REMOVE	0
CONFIG_FS_CMD_FS_WRITE	0
CONFIG_FS_CMD_I2C_READ	0
CONFIG_FS_CMD_I2C_WRITE	0
CONFIG_FS_CMD_LOG_LIST	0
CONFIG_FS_CMD_LOG_PRINT	0
CONFIG_FS_CMD_LOG_SET_LOG_MASK	0
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	0
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	0
CONFIG_FS_CMD_PIN_SET_MODE	0

Continued on next page

Table 1.3 – continued from previous page

Name	Value
CONFIG_FS_CMD_PIN_WRITE	0
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	0
CONFIG_FS_CMD_SETTINGS_READ	0
CONFIG_FS_CMD_SETTINGS_RESET	0
CONFIG_FS_CMD_SETTINGS_WRITE	0
CONFIG_FS_CMD_SYS_BACKTRACE	0
CONFIG_FS_CMD_SYS_CONFIG	0
CONFIG_FS_CMD_SYS_INFO	0
CONFIG_FS_CMD_SYS_PANIC	0
CONFIG_FS_CMD_SYS_REBOOT	0
CONFIG_FS_CMD_SYS_RESET_CAUSE	0
CONFIG_FS_CMD_SYS_UPTIME	0
CONFIG_FS_CMD_THRD_LIST	0
CONFIG_FS_CMD_THRD_SET_LOG_MASK	0
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	0
CONFIG_FS_CMD_USB_HOST_LIST	0
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	16
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	1
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	1
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	0
CONFIG_MODULE_INIT_FS	1

Continued on next page

Table 1.3 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	1
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	1
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	1
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	1
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	1
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	1
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	256
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	1
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	0
CONFIG_SD	1
CONFIG_SETTINGS_AREA_SIZE	256

Continued on next page

Table 1.3 – continued from previous page

Name	Value
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	1
CONFIG_SHELL_PROMPT	"$ "
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	0
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	0
CONFIG_SYS_LOG_MASK	-1
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	0
CONFIG_THRD_IDLE_STACK_SIZE	156
CONFIG_THRD_MONITOR_STACK_SIZE	256

Continued on next page

Table 1.3 – continued from previous page

Name	Value
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	1

Homepage

https://www.arduino.cc/en/Main/ArduinoBoardNano

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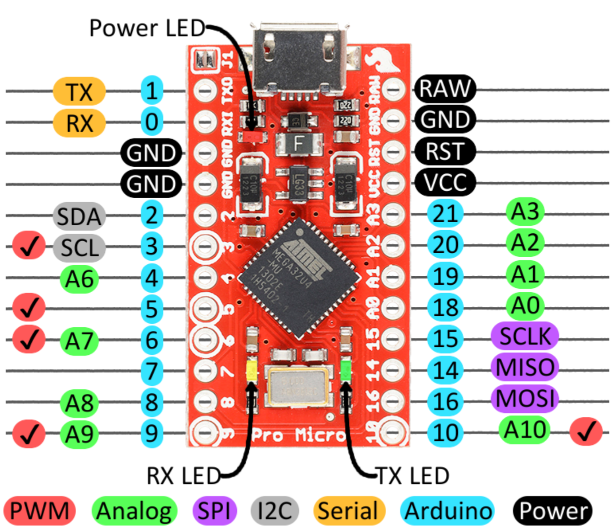
atmega328p

Arduino Pro Micro

Pinout



Enter the bootloader

Recover a bricked board by entering the bootloader.

1. Power up the board.

2. Connect RST to GND for a second to enter the bootloader and stay in it for 8 seconds.

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *analog_output_pin — Analog output pin*
- *ds18b20 — One-wire temperature sensor*
- *ds3231 — RTC clock*
- *exti — External interrupts*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *mcp2515 — CAN BUS chipset*
- *nrf24l01 — Wireless communication*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm — Pulse width modulation*
- *pwm_soft — Software pulse width modulation*
- *sd — Secure Digital memory*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*
- *usb — Universal Serial Bus*
- *usb_device — Universal Serial Bus - Device*
- *watchdog — Hardware watchdog*

Library Reference

Read more about board specific functionality in the *Arduino Pro Micro* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	6578	520
default-configuration	15084	1165

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	1
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	0
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	0
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	0
CONFIG_FS_CMD_FS_COUNTERS_LIST	0

Continued on next page

Table 1.4 – continued from previous page

Name	Value
CONFIG_FS_CMD_FS_COUNTERS_RESET	0
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	0
CONFIG_FS_CMD_FS_FORMAT	0
CONFIG_FS_CMD_FS_LIST	0
CONFIG_FS_CMD_FS_PARAMETERS_LIST	0
CONFIG_FS_CMD_FS_READ	0
CONFIG_FS_CMD_FS_REMOVE	0
CONFIG_FS_CMD_FS_WRITE	0
CONFIG_FS_CMD_I2C_READ	0
CONFIG_FS_CMD_I2C_WRITE	0
CONFIG_FS_CMD_LOG_LIST	0
CONFIG_FS_CMD_LOG_PRINT	0
CONFIG_FS_CMD_LOG_SET_LOG_MASK	0
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	0
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	0
CONFIG_FS_CMD_PIN_SET_MODE	0
CONFIG_FS_CMD_PIN_WRITE	0
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	0
CONFIG_FS_CMD_SETTINGS_READ	0
CONFIG_FS_CMD_SETTINGS_RESET	0
CONFIG_FS_CMD_SETTINGS_WRITE	0
CONFIG_FS_CMD_SYS_BACKTRACE	0
CONFIG_FS_CMD_SYS_CONFIG	0
CONFIG_FS_CMD_SYS_INFO	0
CONFIG_FS_CMD_SYS_PANIC	0
CONFIG_FS_CMD_SYS_REBOOT	0
CONFIG_FS_CMD_SYS_RESET_CAUSE	0
CONFIG_FS_CMD_SYS_UPTIME	0
CONFIG_FS_CMD_THRD_LIST	0
CONFIG_FS_CMD_THRD_SET_LOG_MASK	0
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	0
CONFIG_FS_CMD_USB_HOST_LIST	0
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	16
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0

Continued on next page

Table 1.4 – continued from previous page

Name	Value
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	1
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	1
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	0
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	1
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	1
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	1
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	1
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	1
CONFIG_MODULE_INIT_USB_DEVICE	1
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	1

Continued on next page

Table 1.4 – continued from previous page

Name	Value
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	1
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	256
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	1
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	0
CONFIG_SD	1
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	1
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_USB_CDC
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	0
CONFIG_START_SHELL_PRIO	30

Continued on next page

Table 1.4 – continued from previous page

Name	Value
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	0
CONFIG_SYS_LOG_MASK	-1
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	0
CONFIG_THRD_IDLE_STACK_SIZE	156
CONFIG_THRD_MONITOR_STACK_SIZE	256
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	1
CONFIG_USB_DEVICE	1
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	1

Homepage

https://www.sparkfun.com/products/12640

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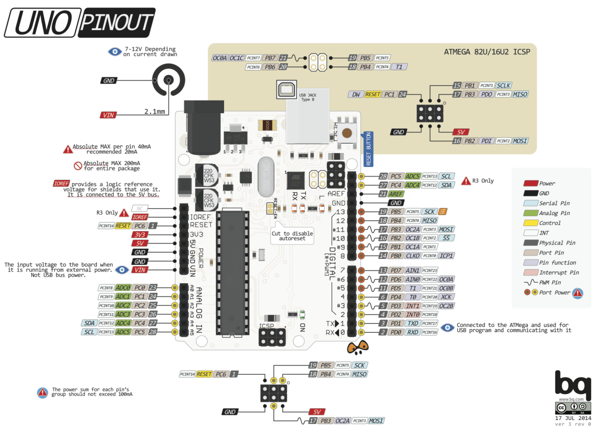
atmega32u4

Arduino Uno

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *analog_output_pin — Analog output pin*
- *ds18b20 — One-wire temperature sensor*
- *ds3231 — RTC clock*
- *exti — External interrupts*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *mcp2515 — CAN BUS chipset*
- *nrf24l01 — Wireless communication*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm — Pulse width modulation*
- *pwm_soft — Software pulse width modulation*
- *sd — Secure Digital memory*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*

- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*
- *watchdog — Hardware watchdog*

Library Reference

Read more about board specific functionality in the *Arduino Uno* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	1548	279
default-configuration	13340	1038

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	1
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1

Continued on next page

Table 1.5 – continued from previous page

Name	Value
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	0
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	0
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	0
CONFIG_FS_CMD_FS_COUNTERS_LIST	0
CONFIG_FS_CMD_FS_COUNTERS_RESET	0
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	0
CONFIG_FS_CMD_FS_FORMAT	0
CONFIG_FS_CMD_FS_LIST	0
CONFIG_FS_CMD_FS_PARAMETERS_LIST	0
CONFIG_FS_CMD_FS_READ	0
CONFIG_FS_CMD_FS_REMOVE	0
CONFIG_FS_CMD_FS_WRITE	0
CONFIG_FS_CMD_I2C_READ	0
CONFIG_FS_CMD_I2C_WRITE	0
CONFIG_FS_CMD_LOG_LIST	0
CONFIG_FS_CMD_LOG_PRINT	0
CONFIG_FS_CMD_LOG_SET_LOG_MASK	0
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	0
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	0
CONFIG_FS_CMD_PIN_SET_MODE	0
CONFIG_FS_CMD_PIN_WRITE	0
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	0
CONFIG_FS_CMD_SETTINGS_READ	0
CONFIG_FS_CMD_SETTINGS_RESET	0
CONFIG_FS_CMD_SETTINGS_WRITE	0
CONFIG_FS_CMD_SYS_BACKTRACE	0
CONFIG_FS_CMD_SYS_CONFIG	0
CONFIG_FS_CMD_SYS_INFO	0
CONFIG_FS_CMD_SYS_PANIC	0
CONFIG_FS_CMD_SYS_REBOOT	0
CONFIG_FS_CMD_SYS_RESET_CAUSE	0
CONFIG_FS_CMD_SYS_UPTIME	0
CONFIG_FS_CMD_THRD_LIST	0
CONFIG_FS_CMD_THRD_SET_LOG_MASK	0
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	0

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Table 1.5 – continued from previous page

Name	Value
CONFIG_FS_CMD_USB_HOST_LIST	0
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	16
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	1
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	1
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	0
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	1
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	1
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	1
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	1
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1

Continued on next page

Table 1.5 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	1
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	1
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	256
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	1
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	0
CONFIG_SD	1
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	1
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0

Continued on next page

Table 1.5 – continued from previous page

Name	Value
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	0
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	0
CONFIG_SYS_LOG_MASK	-1
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	0
CONFIG_THRD_IDLE_STACK_SIZE	156
CONFIG_THRD_MONITOR_STACK_SIZE	256
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	1

Homepage

https://www.arduino.cc/en/Main/ArduinoBoardUno

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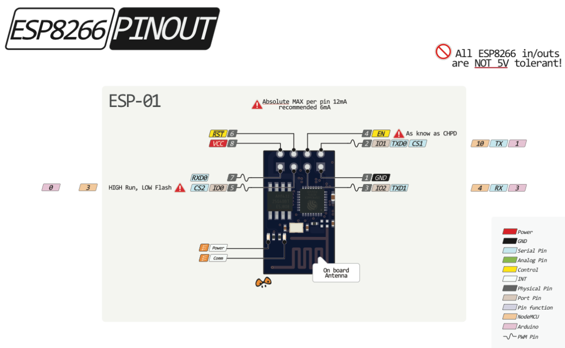
atmega328p

ESP-01

Pinout



Flashing

1. Connect VCC to 3.3 V and GND to ground.
2. Connect GPIO0 to GND.
3. Connect EN/CHPH to 3.3 V.
4. Turn on the power.
5. Upload the software to Flash using esptool.

Boot from flash

1. Connect VCC to 3.3 V and GND to ground.
2. Connect GPIO0 to 3.3 V.
3. Connect EN/CHPH to 3.3 V.
4. Turn on the power.

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*

- *analog_input_pin — Analog input pin*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *led_7seg_ht16k33 — LED 7-Segment HT16K33*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm_soft — Software pulse width modulation*
- *random — Random numbers.*
- *sht3xd — SHT3x-D Humidity and Temperature Sensor*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *ESP-01* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	265820	34064
default-configuration	312160	47196

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0

Continued on next page

Table 1.6 – continued from previous page

Name	Value
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	1
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1

Continued on next page

Table 1.6 – continued from previous page

Name	Value
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	1
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1

Continued on next page

Table 1.6 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256

Continued on next page

Table 1.6 – continued from previous page

Name	Value
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	1
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	76800
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x0006b000
CONFIG_START_FILESYSTEM_SIZE	0x10000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	1536
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	1
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	768

Continued on next page

Table 1.6 – continued from previous page

Name	Value
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

http://espressif.com

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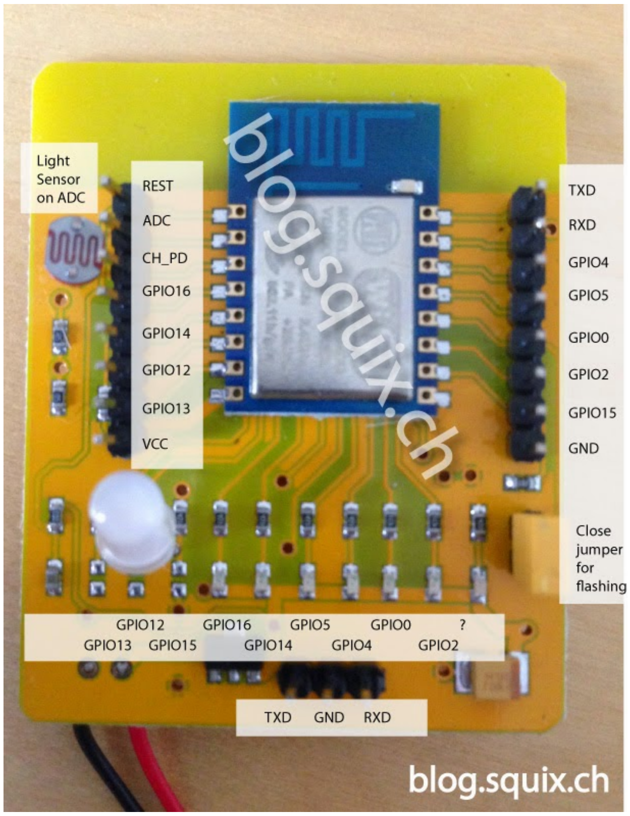
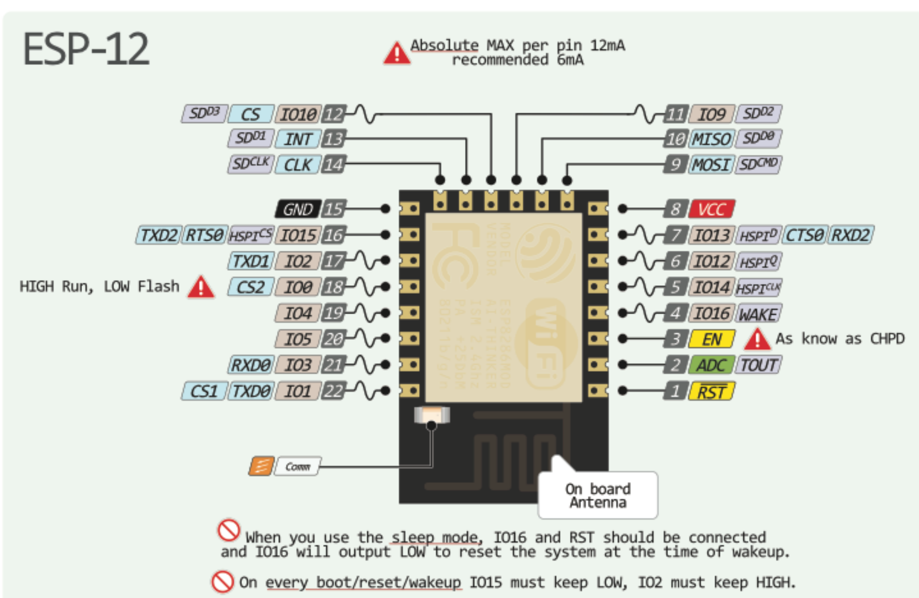
esp8266

ESP-12E Development Board

Pinout



ESP-12 pinout



Flashing

1. Connect 3.3 V to VCC and ground to GND.
2. Attach the flash jumper (to the right in the picture).
3. Turn on the power.
4. Upload the software to Flash using esptool.
5. The application starts automatically when the download is completed.

Hardware

- 3.3 V power supply and logical level voltage.
- Boot message at 76800 buad on a virgin board. Blue, red and RGB LEDs turned on.
- 4 MB Flash.

How to determine the Flash size:

```
$ python esptool.py --port /dev/ttyUSB0 flash_id
Connecting...
head: 0 ;total: 0
erase size : 0
Manufacturer: e0
Device: 4016
```

Device 4016 gives a Flash of size `2 ^ (16 - 1) / 8 = 4096 kB = 4 MB`.

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*

- *i2c_soft — Software I2C*
- *led_7seg_ht16k33 — LED 7-Segment HT16K33*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm_soft — Software pulse width modulation*
- *random — Random numbers.*
- *sht3xd — SHT3x-D Humidity and Temperature Sensor*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *ESP-12E Development Board* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	265820	34064
default-configuration	312276	47216

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1

Continued on next page

Table 1.7 – continued from previous page

Name	Value
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	1
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1

Continued on next page

Table 1.7 – continued from previous page

Name	Value
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	1
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1

Continued on next page

Table 1.7 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	1
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1

Continued on next page

Table 1.7 – continued from previous page

Name	Value
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	76800
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x00300000
CONFIG_START_FILESYSTEM_SIZE	0xFB000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	1536
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	1
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	768
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0

Continued on next page

Table 1.7 – continued from previous page

Name	Value
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

http://espressif.com

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ESP32-DevKitC

Pinout

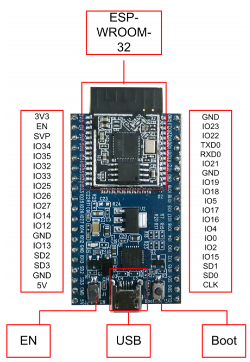

Figure 1-1. ESP32-DevKitC Layout

Default pin mapping

Here is a list of additional pin mappings not part of the picture above.

Device function	GPIO
LED	16
UART 0 TX	1
UART 0 RX	3
UART 1 TX	19
UART 1 RX	23
UART 2 TX	18
UART 2 RX	5
CAN TX	16
CAN RX	17

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *can — Controller Area Network*
- *dac — Digital to analog convertion*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *random — Random numbers.*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *ws2812 — NeoPixels*

Library Reference

Read more about board specific functionality in the *ESP32-DevKitC* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	91428	8644
default-configuration	356256	83420

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	1
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	1
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1

Continued on next page

Table 1.8 – continued from previous page

Name	Value
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	1
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1

Continued on next page

Table 1.8 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_CAN	1
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	1
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	1
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	1
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040

Continued on next page

Table 1.8 – continued from previous page

Name	Value
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	115200
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	512
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x00300000
CONFIG_START_FILESYSTEM_SIZE	0x20000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	4096
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	4096
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100

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Table 1.8 – continued from previous page

Name	Value
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	8192
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	1024
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

https://espressif.com/en/products/hardware/esp32-devkitc/overview

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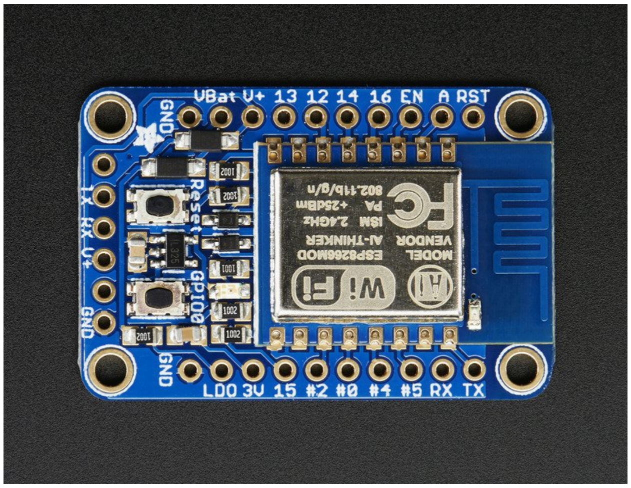
Adafruit HUZZAH ESP8266 breakout

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *led_7seg_ht16k33 — LED 7-Segment HT16K33*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm_soft — Software pulse width modulation*
- *random — Random numbers.*

- *sht3xd — SHT3x-D Humidity and Temperature Sensor*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *Adafruit HUZZAH ESP8266 breakout* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	265820	34064
default-configuration	311452	46672

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1

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Table 1.9 – continued from previous page

Name	Value
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1

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Table 1.9 – continued from previous page

Name	Value
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	1
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1

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Table 1.9 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	1
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	76800
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0

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Table 1.9 – continued from previous page

Name	Value
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	1536
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	1
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	768
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

https://www.adafruit.com/product/2471

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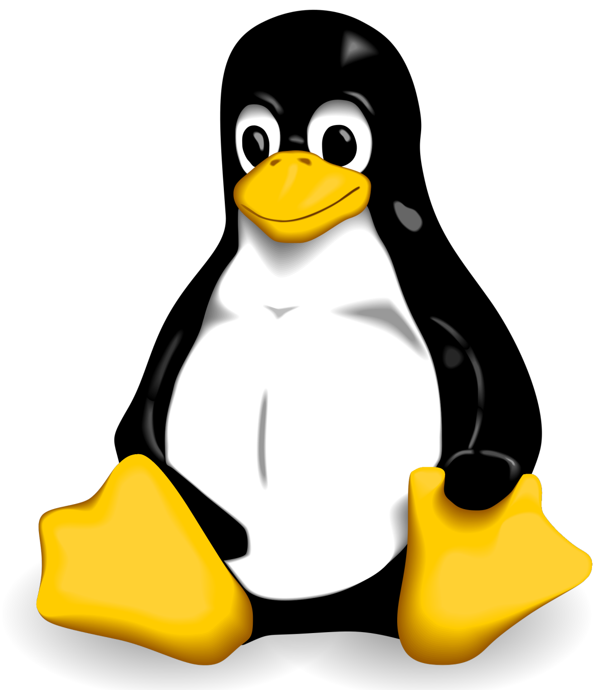
esp8266

Linux

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *analog_output_pin — Analog output pin*
- *can — Controller Area Network*

- *dac — Digital to analog convertion*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm — Pulse width modulation*
- *pwm_soft — Software pulse width modulation*
- *random — Random numbers.*
- *sd — Secure Digital memory*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *Linux* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	145132	320056
default-configuration	385403	474608

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	1
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	1

Continued on next page

Table 1.10 – continued from previous page

Name	Value
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	1
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1

Continued on next page

Table 1.10 – continued from previous page

Name	Value
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	1
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	1
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	1
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	1
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1

Continued on next page

Table 1.10 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	1
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	1
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	1
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	1
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	1
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	1
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	1
CONFIG_SD	1
CONFIG_SETTINGS_AREA_SIZE	1028
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768

Continued on next page

Table 1.10 – continued from previous page

Name	Value
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	"$ "
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	512
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	1024
CONFIG_THRD_MONITOR_STACK_SIZE	1024
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0

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Table 1.10 – continued from previous page

Name	Value
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

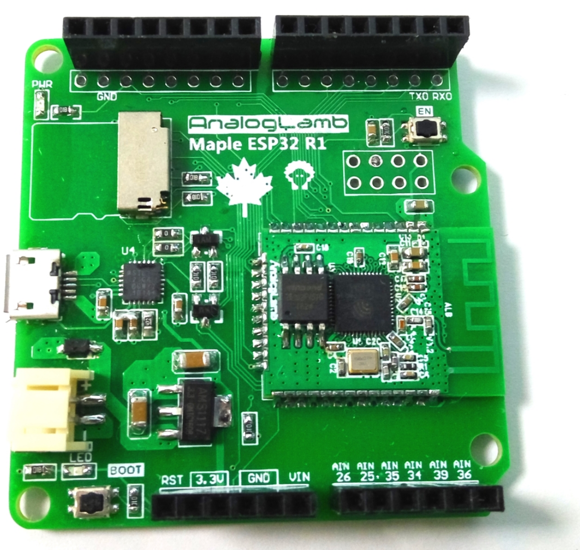
http://www.kernel.org

Mcu

linux

Maple-ESP32

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *can — Controller Area Network*
- *dac — Digital to analog convertion*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *random — Random numbers.*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *ws2812 — NeoPixels*

Library Reference

Read more about board specific functionality in the *Maple-ESP32* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	91428	8644
default-configuration	356256	83420

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	1
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	1
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1

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Table 1.11 – continued from previous page

Name	Value
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	1
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	1
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	1

Continued on next page

Table 1.11 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	1
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	1
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0

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Table 1.11 – continued from previous page

Name	Value
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	"$ "
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	115200
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	512
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x00300000
CONFIG_START_FILESYSTEM_SIZE	0x20000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	4096
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	4096
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0

Continued on next page

Table 1.11 – continued from previous page

Name	Value
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	8192
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	1024
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

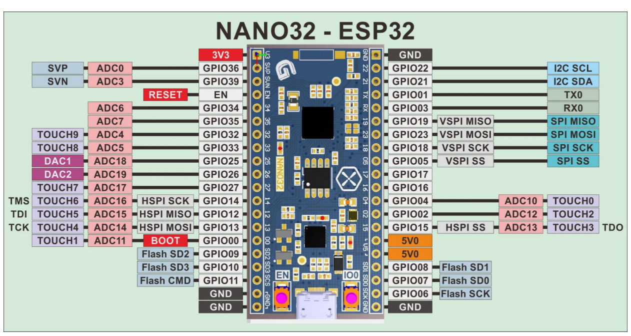
http://www.analoglamb.com/product/maple-esp32/

Mcu

esp32

Nano32

Pinout



Default pin mapping

Here is a list of additional pin mappings not part of the picture above.

Device function	GPIO
UART 0 TX	1
UART 0 RX	3
UART 1 TX	19
UART 1 RX	23
UART 2 TX	18
UART 2 RX	5
CAN TX	16
CAN RX	17

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *can — Controller Area Network*
- *dac — Digital to analog convertion*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *random — Random numbers.*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *ws2812 — NeoPixels*

Library Reference

Read more about board specific functionality in the *Nano32* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	91428	8644
default-configuration	356248	83420

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	1
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	1
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1

Continued on next page

Table 1.12 – continued from previous page

Name	Value
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	1

Continued on next page

Table 1.12 – continued from previous page

Name	Value
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	1
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	1
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	1
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	1
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0

Continued on next page

Table 1.12 – continued from previous page

Name	Value
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	115200
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	512
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x00300000
CONFIG_START_FILESYSTEM_SIZE	0x20000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1

Continued on next page

Table 1.12 – continued from previous page

Name	Value
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	4096
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	4096
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	8192
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	1024
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

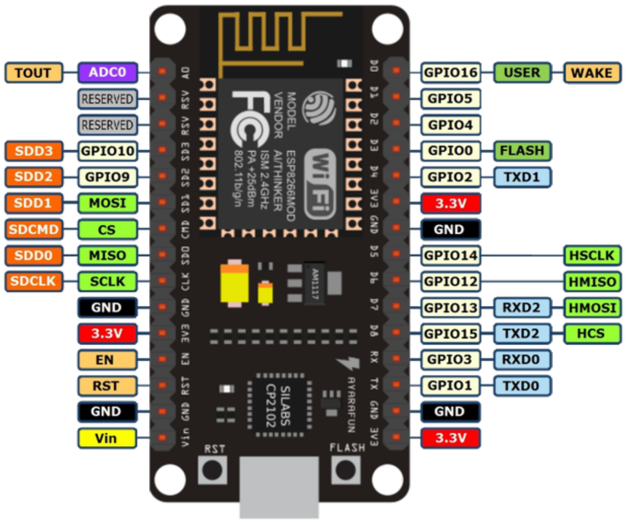
http://esp32.de

Mcu

esp32

NodeMCU

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *led_7seg_ht16k33 — LED 7-Segment HT16K33*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm_soft — Software pulse width modulation*

- *random — Random numbers.*
- *sht3xd — SHT3x-D Humidity and Temperature Sensor*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *NodeMCU* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	265820	34064
default-configuration	312316	47196

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24

Continued on next page

Table 1.13 – continued from previous page

Name	Value
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	1
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1

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Table 1.13 – continued from previous page

Name	Value
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	1
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1

Continued on next page

Table 1.13 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	1
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	76800
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32

Continued on next page

Table 1.13 – continued from previous page

Name	Value
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x00300000
CONFIG_START_FILESYSTEM_SIZE	0xFB000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	1536
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	1
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	768
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

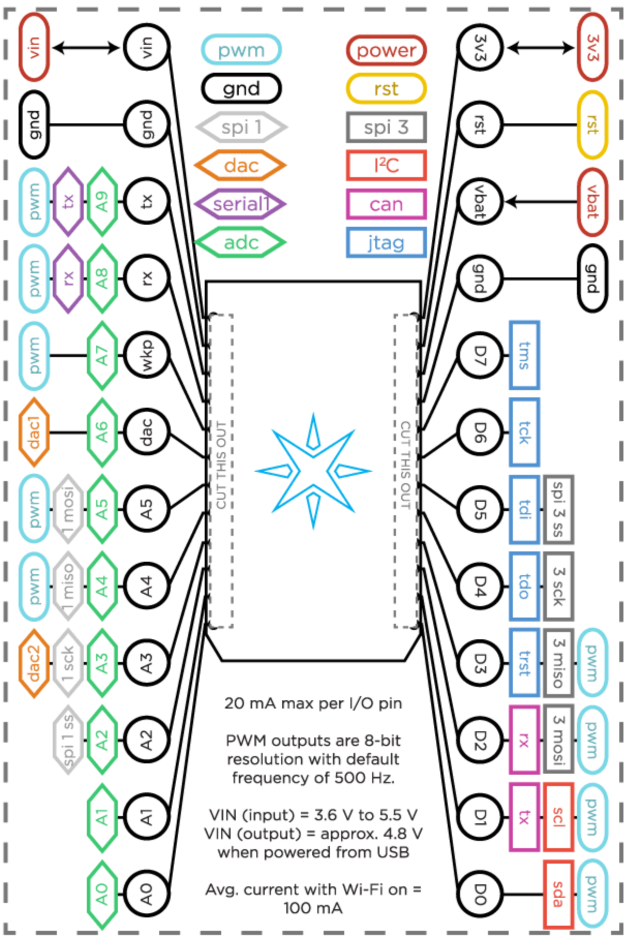
http://www.nodemcu.com

Mcu

esp8266

Particle IO Photon

Pinout



Detailed pinout

Right side pins

USB	Pin	Exposed Functions					STM32 Pin	PØ Pin #	PØ Pin Name
PHOTON	3V3	3V3							
	RST	RST					E8	26	MICRO_RST_N
	VBAT	VBAT					A9	28	VBAT
	GND	GND							
	D7	JTAG_TMS					PA13	44	MICRO_JTAG_TMS
	D6	JTAG_TCK					PA14	40	MICRO_JTAG_TCK
	D5	JTAG_TDI	SPI3_SS			I2S3_WS	PA15	43	MICRO_JTAG_TDI
	D4	JTAG_TDO	SPI3_SCK			I2S3_SCK	PB3	41	MICRO_JTAG_TDO
	D3	JTAG_TRST	SPI3_MISO		TIM3_CH1		PB4	42	MICRO_JTAG_TRSTN
	D2		SPI3_MOSI	CAN2_RX	TIM3_CH2	I2S3_SD	PB5	3	MICRO_GPIO_5
	D1	SCL		CAN2_TX	TIM4_CH1		PB6	5	MICRO_GPIO_3
	D0	SDA			TIM4_CH2		PB7	4	MICRO_GPIO_4

Left side pins

Pin	USB	Exposed Functions					STM32 Pin	PØ Pin #	PØ Pin Name
VIN	PHOTON	VIN							
GND		GND							
TX				USART1_TX	TIM1_CH2		PA9	39	MICRO_UART_TX
RX				USART1_RX	TIM1_CH3		PA10	38	MICRO_UART_RX
WKP		ADC0			TIM5_CH1		PA0	27	MICRO_WKUP
DAC		ADC4				DAC1	PA4	22	MICRO_SPI_SSN
A5		ADC7	SPI1_MOSI		TIM3_CH2		PA7	23	MICRO_SPI_MOSI
A4		ADC6	SPI1_MISO		TIM3_CH1		PA6	25	MICRO_SPI_MISO
A3		ADC5	SPI1_SCK			DAC2	PA5	24	MICRO_SPI_SCK
A2		ADC12	SPI1_SS				PC2	2	MICRO_GPIO_6
A1		ADC13					PC3	1	MICRO_GPIO_7
A0		ADC15					PC5	54	MICRO_GPIO_8

User I/O

	User I/O	Photon Pin #	Exposed Functions			STM32 Pin	PØ Pin #	PØ Pin Name
PHOTON	RGB LED - RED	27		TIM2_CH2		PA1	8	MICRO_GPIO_0
	RGB LED - GREEN	28		TIM2_CH3		PA2	7	MICRO_GPIO_1
	RGB LED - BLUE	29		TIM2_CH4		PA3	6	MICRO_GPIO_2
	Setup Button	26		TIM3_CH2	I2S3_MCK	PC7	53	MICRO_GPIO_9
	Reset Button	23				E8	26	MICRO_RST_N
	USB Data+	31				PB15	51	MICRO_USB_HS_DP
	USB Data-	30				PB14	52	MICRO_USB_HS_DM
	SMPS Enable	25						
	Peripheral Key	ADC	SPI	PWM/Servo/Tone				
		JTAG	SPI1	I2S	DAC			
		I2C/Wire	Serial1	CAN				

Prerequisites

Install the dfu-utility.

```
git clone git://git.code.sf.net/p/dfu-util/dfu-util
cd dfu-util
sudo apt-get build-dep dfu-util
./autogen.sh
./configure
make
sudo make install
cd ..

# Give users access to the device.
sudo cp simba/environment/udev/49-photon.rules /etc/udec/rules.d
```

Flashing

The Photon must enter DFU mode before software can be uploaded to it. It's recommended to use the manual method to verify that software can be successfully uploaded to the board, and then start using the automatic method to reduce the manual work for each software upload.

Automatic (recommended)

- Connect DTR on the serial adapter to the RST pin on the Photon.
- Connect RTS on the serial adapter to the SETUP pad on the bottom side of the Photon. This requires soldering a cable to the SETUP pad.

Upload the software with `make BOARD=photon upload`.

Manual

To enter DFU Mode:

1. Hold down the RESET and SETUP buttons.
2. Release only the RESET button, while holding down the SETUP button.
3. Wait for the LED to start flashing yellow (it will flash magenta first).
4. Release the SETUP button.

NOTE: Do **not** connect DTR and/or RTS using manual upload. They must only be connected using the automatic method.

Upload the software with `make BOARD=photon upload`.

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- *Debug shell.*

Drivers

Supported drivers for this board.

- *eeprom_soft — Software EEPROM*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *pin — Digital pins*
- *uart — Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *Particle IO Photon* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	2668	1672
default-configuration	63848	5998

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	0
CONFIG_ANALOG_INPUT_PIN	0
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	0
CONFIG_DS3231	0
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1

Continued on next page

Table 1.14 – continued from previous page

Name	Value
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	0
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	0
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0

Continued on next page

Table 1.14 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_DS18B20	0
CONFIG_MODULE_INIT_DS3231	0
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	0
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	0
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	1
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	1
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	0
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0

Continued on next page

Table 1.14 – continued from previous page

Name	Value
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	0
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	0
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0

Continued on next page

Table 1.14 – continued from previous page

Name	Value
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	384
CONFIG_THRD_MONITOR_STACK_SIZE	512
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

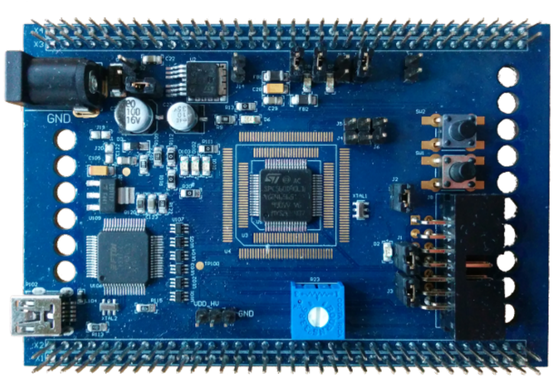
https://docs.particle.io/datasheets/photon-datasheet/

Mcu

stm32f205rg

SPC56D Discovery

Pinout



Pin functions

These are the default pin functions in Simba.

List	Index	Pin	Function
X1	12	PB0	CAN TX
X2	9	PB1	CAN RX
X1	10	PB2	UART0 TX
X2	10	PB3	UART0 RX
X4	6	PC2	LED (D8)

Toolchain

Download S32 Design Studio for Power v1.1 for Linux and install it.

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- *Debug shell.*

Drivers

Supported drivers for this board.

- *can — Controller Area Network*
- *eeprom_soft — Software EEPROM*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *pin — Digital pins*
- *uart — Universal Asynchronous Receiver/Transmitter*
- *watchdog — Hardware watchdog*

Library Reference

Read more about board specific functionality in the *SPC56D Discovery* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.

- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	13636	952
default-configuration	75308	5954

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	0
CONFIG_ANALOG_INPUT_PIN	0
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	1
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	0
CONFIG_DS3231	0
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	0
CONFIG_FS_CMD_FS_COUNTERS_LIST	0
CONFIG_FS_CMD_FS_COUNTERS_RESET	0
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	0
CONFIG_FS_CMD_FS_FORMAT	0
CONFIG_FS_CMD_FS_LIST	0
CONFIG_FS_CMD_FS_PARAMETERS_LIST	0
CONFIG_FS_CMD_FS_READ	0

Continued on next page

Table 1.15 – continued from previous page

Name	Value
CONFIG_FS_CMD_FS_REMOVE	0
CONFIG_FS_CMD_FS_WRITE	0
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	0

Continued on next page

Table 1.15 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	0
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	1
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	0
CONFIG_MODULE_INIT_DS3231	0
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	0
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	0
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	1
CONFIG_MONITOR_THREAD	1
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	1
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384

Continued on next page

Table 1.15 – continued from previous page

Name	Value
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	1
CONFIG_NVM_SIZE	2040
CONFIG_OWI	0
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	0
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	1028
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	"$ "
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	0
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	115200
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16

Continued on next page

Table 1.15 – continued from previous page

Name	Value
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	256
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	156
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	1

Homepage

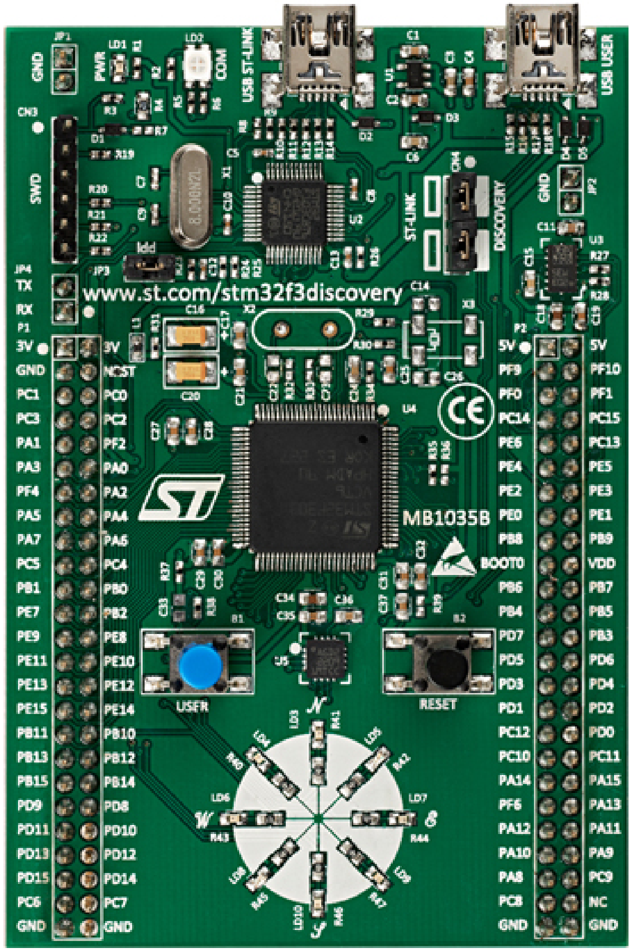
http://www.st.com/en/evaluation-tools/spc56d-discovery.html

Mcu

spc56d40l1

STM32F3DISCOVERY

Pinout



Pin functions

These are the default pin functions in Simba.

Function	Pin
UART0 TX	PA9
UART0 RX	PA10
UART1 TX	PA2
UART1 RX	PA3
UART2 TX	PB10
UART2 RX	PB11
SPI0 SCK	PA5
SPI0 MISO	PA6
SPI0 MOSI	PA7
SPI1 SCK	PA13
SPI1 MISO	PA14
SPI1 MOSI	PA15
SPI2 SCK	PC10
SPI2 MISO	PC11
SPI2 MOSI	PC12
I2C0 SCL	PB8
I2C0 SDA	PB9
I2C1 SCL	PF0
I2C1 SDA	PF1
CAN TX	PD1
CAN RX	PD0

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- *Debug shell.*

Drivers

Supported drivers for this board.

- *eeprom_soft — Software EEPROM*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *pin — Digital pins*
- *uart — Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *STM32F3DISCOVERY* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	2816	1672
default-configuration	62976	5502

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	0
CONFIG_ANALOG_INPUT_PIN	0
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	0
CONFIG_DS3231	0
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1

Continued on next page

Table 1.16 – continued from previous page

Name	Value
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0

Continued on next page

Table 1.16 – continued from previous page

Name	Value
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	0
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	0
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	0
CONFIG_MODULE_INIT_DS3231	0
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	0
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	0
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0

Continued on next page

Table 1.16 – continued from previous page

Name	Value
CONFIG_MONITOR_THREAD	1
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	1
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	0
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	0
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	0
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1

Continued on next page

Table 1.16 – continued from previous page

Name	Value
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	384
CONFIG_THRD_MONITOR_STACK_SIZE	512
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

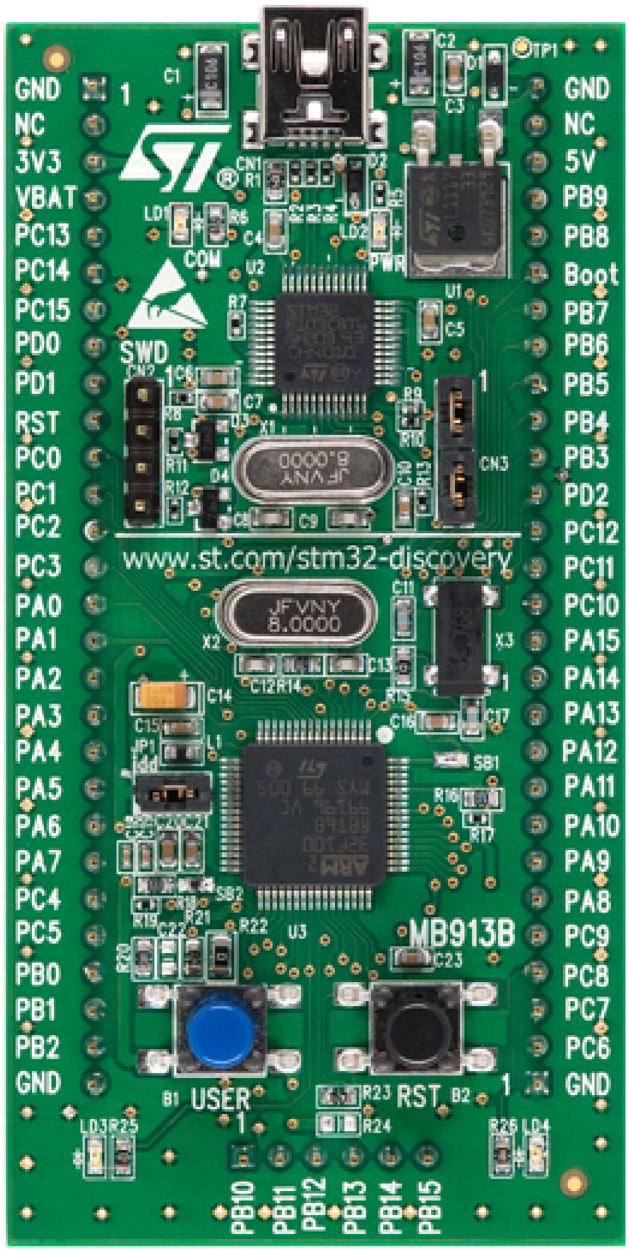
http://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/mcu-eval-tools/stm32-mcu-eval-tools/stm32-mcu-discovery-kits/stm32f3discovery.html

Mcu

stm32f303vc

STM32VLDISCOVERY

Pinout



st-link

```
sudo apt install libusb-1.0-0-dev
git clone https://github.com/eerimoq/stlink
./autogen.sh
./configure
make
sudo cp etc/udev/rules.d/49* /etc/udev/rules.d
udevadm control --reload-rules
udevadm trigger
```

```
modprobe -r usb-storage && modprobe usb-storage quirks=483:3744:i

st-util -1
arm-none-eabi-gdb app.out
$ target extended-remote localhost:4242
```

Plug in the board in the PC.

Pin functions

These are the default pin functions in Simba.

Function	Pin
UART0 TX	PA9
UART0 RX	PA10
UART1 TX	PA2
UART1 RX	PA3
UART2 TX	PC10
UART2 RX	PC11
SPI0 SCK	PA5
SPI0 MISO	PA6
SPI0 MOSI	PA7
I2C0 SCL	PB8
I2C0 SDA	PB9

Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- *Debug shell.*

Drivers

Supported drivers for this board.

- *eeprom_soft — Software EEPROM*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *pin — Digital pins*
- *uart — Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *STM32VLDISCOVERY* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	2816	1672
default-configuration	64256	6006

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	0
CONFIG_ANALOG_INPUT_PIN	0
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	1
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	0
CONFIG_DS3231	0
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	0
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	0
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1

Continued on next page

Table 1.17 – continued from previous page

Name	Value
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0

Continued on next page

Table 1.17 – continued from previous page

Name	Value
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	0
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	0
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	0
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	0
CONFIG_MODULE_INIT_DS3231	0
CONFIG_MODULE_INIT_ESP_WIFI	0
CONFIG_MODULE_INIT_EXTI	0
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	0
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	0
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	0
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	0
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	0
CONFIG_MODULE_INIT_RANDOM	0
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	0
CONFIG_MODULE_INIT_SPI	0
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	0
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0

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Table 1.17 – continued from previous page

Name	Value
CONFIG_MONITOR_THREAD	1
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	1
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	0
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	0
CONFIG_RANDOM	0
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	0
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	0
CONFIG_SPIFFS	0
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	38400
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	0
CONFIG_START_FILESYSTEM_ADDRESS	0
CONFIG_START_FILESYSTEM_SIZE	65536
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1

Continued on next page

Table 1.17 – continued from previous page

Name	Value
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	768
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	840
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	0
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	384
CONFIG_THRD_MONITOR_STACK_SIZE	512
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	0
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

http://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/mcu-eval-tools/stm32-mcu-eval-tools/stm32-mcu-discovery-kits/stm32vldiscovery.html?sc=internet/evalboard/product/250863.jsp

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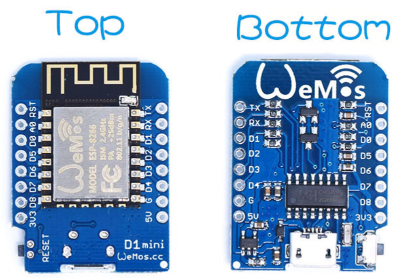
stm32f100rb

WEMOS D1 mini

Pinout



Default system features

The default configuration includes those major features. They are all initialized by `sys_start()` at the startup of the application.

- *Console.*
- File system.
- *Debug shell.*

Drivers

Supported drivers for this board.

- *adc — Analog to digital convertion*
- *analog_input_pin — Analog input pin*
- *ds18b20 — One-wire temperature sensor*
- *eeprom_soft — Software EEPROM*
- *esp_wifi — Espressif WiFi*
- *exti — External interrupts*
- *flash — Flash memory*
- *i2c — I2C*
- *i2c_soft — Software I2C*
- *led_7seg_ht16k33 — LED 7-Segment HT16K33*
- *owi — One-Wire Interface*
- *pin — Digital pins*
- *pwm_soft — Software pulse width modulation*
- *random — Random numbers.*
- *sht3xd — SHT3x-D Humidity and Temperature Sensor*
- *spi — Serial Peripheral Interface*
- *uart — Universal Asynchronous Receiver/Transmitter*

- *uart_soft — Software Universal Asynchronous Receiver/Transmitter*

Library Reference

Read more about board specific functionality in the *WEMOS D1 mini* module documentation in the Library Reference.

Memory usage

Below is the memory usage of two applications:

- The minimal-configuration application is configured to only include the bare minimum of functionality for the low level kernel to run. That is, the thread scheduler and system tick.
- The default-configuration application is built with the default configuration, including a lot more functionality. See the list of *Default system features* above for a summary.

Application	Flash	RAM
minimal-configuration	265820	34064
default-configuration	311488	46700

Default configuration

Default Standard Library configuration.

Name	Value
CONFIG_ADC	1
CONFIG_ANALOG_INPUT_PIN	1
CONFIG_ANALOG_OUTPUT_PIN	0
CONFIG_ASSERT	0
CONFIG_ASSERT_FORCE_FATAL	1
CONFIG_CAN	0
CONFIG_CAN_FRAME_TIMESTAMP	1
CONFIG_CHIPID	0
CONFIG_CRC_TABLE_LOOKUP	1
CONFIG_DAC	0
CONFIG_DEBUG	1
CONFIG_DS18B20	1
CONFIG_DS3231	1
CONFIG_EEPROM_SOFT_CRC	CONFIG_EEPROM_SOFT_CRC_32
CONFIG_EEPROM_SOFT_CRC_32	0
CONFIG_EEPROM_SOFT_CRC_CCITT	1
CONFIG_EEPROM_SOFT_SEMAPHORE	1
CONFIG_EMACS_COLUMNS_MAX	80
CONFIG_EMACS_HEAP_SIZE	32768
CONFIG_EMACS_ROWS_MAX	24
CONFIG_ESP_WIFI	1
CONFIG_EXTERNAL_OSCILLATOR_FREQUENCY_HZ	16000000
CONFIG_EXTI	1
CONFIG_FAT16	1
CONFIG_FATAL_ASSERT	1
CONFIG_FILESYSTEM_GENERIC	1

Continued on next page

Table 1.18 – continued from previous page

Name	Value
CONFIG_FLASH	1
CONFIG_FLASH_DEVICE_SEMAPHORE	1
CONFIG_FLOAT	1
CONFIG_FS_CMD_DS18B20_LIST	1
CONFIG_FS_CMD_ESP_WIFI_STATUS	0
CONFIG_FS_CMD_FS_APPEND	1
CONFIG_FS_CMD_FS_COUNTERS_LIST	1
CONFIG_FS_CMD_FS_COUNTERS_RESET	1
CONFIG_FS_CMD_FS_FILESYSTEMS_LIST	1
CONFIG_FS_CMD_FS_FORMAT	1
CONFIG_FS_CMD_FS_LIST	1
CONFIG_FS_CMD_FS_PARAMETERS_LIST	1
CONFIG_FS_CMD_FS_READ	1
CONFIG_FS_CMD_FS_REMOVE	1
CONFIG_FS_CMD_FS_WRITE	1
CONFIG_FS_CMD_I2C_READ	1
CONFIG_FS_CMD_I2C_WRITE	1
CONFIG_FS_CMD_LOG_LIST	1
CONFIG_FS_CMD_LOG_PRINT	1
CONFIG_FS_CMD_LOG_SET_LOG_MASK	1
CONFIG_FS_CMD_NETWORK_INTERFACE_LIST	1
CONFIG_FS_CMD_NVM_READ	1
CONFIG_FS_CMD_NVM_WRITE	1
CONFIG_FS_CMD_PING_PING	1
CONFIG_FS_CMD_PIN_READ	1
CONFIG_FS_CMD_PIN_SET_MODE	1
CONFIG_FS_CMD_PIN_WRITE	1
CONFIG_FS_CMD_SERVICE_LIST	1
CONFIG_FS_CMD_SERVICE_START	1
CONFIG_FS_CMD_SERVICE_STOP	1
CONFIG_FS_CMD_SETTINGS_LIST	1
CONFIG_FS_CMD_SETTINGS_READ	1
CONFIG_FS_CMD_SETTINGS_RESET	1
CONFIG_FS_CMD_SETTINGS_WRITE	1
CONFIG_FS_CMD_SYS_BACKTRACE	1
CONFIG_FS_CMD_SYS_CONFIG	1
CONFIG_FS_CMD_SYS_INFO	1
CONFIG_FS_CMD_SYS_PANIC	1
CONFIG_FS_CMD_SYS_REBOOT	1
CONFIG_FS_CMD_SYS_RESET_CAUSE	1
CONFIG_FS_CMD_SYS_UPTIME	1
CONFIG_FS_CMD_THRD_LIST	1
CONFIG_FS_CMD_THRD_SET_LOG_MASK	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ENTER	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_ERASE	1
CONFIG_FS_CMD_UPGRADE_APPLICATION_IS_VALID	1
CONFIG_FS_CMD_UPGRADE_BOOTLOADER_ENTER	1
CONFIG_FS_CMD_USB_DEVICE_LIST	1
CONFIG_FS_CMD_USB_HOST_LIST	1

Continued on next page

Table 1.18 – continued from previous page

Name	Value
CONFIG_FS_PATH_MAX	64
CONFIG_HARNESS_EXPECT_BUFFER_SIZE	512
CONFIG_HARNESS_HEAP_MAX	2048
CONFIG_HARNESS_MOCK_VERBOSE	1
CONFIG_HARNESS_SLEEP_MS	300
CONFIG_HTTP_SERVER_REQUEST_BUFFER_SIZE	128
CONFIG_HTTP_SERVER_SSL	0
CONFIG_I2C	1
CONFIG_I2C_SOFT	1
CONFIG_LED_7SEG_HT16K33	1
CONFIG_LINUX_SOCKET_DEVICE	0
CONFIG_MCP2515	0
CONFIG_MODULE_INIT_ADC	1
CONFIG_MODULE_INIT_ANALOG_INPUT_PIN	1
CONFIG_MODULE_INIT_ANALOG_OUTPUT_PIN	0
CONFIG_MODULE_INIT_BUS	1
CONFIG_MODULE_INIT_CAN	0
CONFIG_MODULE_INIT_CHAN	1
CONFIG_MODULE_INIT_CHIPID	0
CONFIG_MODULE_INIT_DAC	0
CONFIG_MODULE_INIT_DS18B20	1
CONFIG_MODULE_INIT_DS3231	1
CONFIG_MODULE_INIT_ESP_WIFI	1
CONFIG_MODULE_INIT_EXTI	1
CONFIG_MODULE_INIT_FLASH	1
CONFIG_MODULE_INIT_FS	1
CONFIG_MODULE_INIT_I2C	1
CONFIG_MODULE_INIT_I2C_SOFT	1
CONFIG_MODULE_INIT_INET	1
CONFIG_MODULE_INIT_LOG	1
CONFIG_MODULE_INIT_MCP2515	0
CONFIG_MODULE_INIT_NETWORK_INTERFACE	1
CONFIG_MODULE_INIT_NRF24L01	0
CONFIG_MODULE_INIT_OWI	1
CONFIG_MODULE_INIT_PIN	1
CONFIG_MODULE_INIT_PING	1
CONFIG_MODULE_INIT_PWM	0
CONFIG_MODULE_INIT_PWM_SOFT	1
CONFIG_MODULE_INIT_RANDOM	1
CONFIG_MODULE_INIT_RWLOCK	1
CONFIG_MODULE_INIT_SD	0
CONFIG_MODULE_INIT_SEM	1
CONFIG_MODULE_INIT_SETTINGS	1
CONFIG_MODULE_INIT_SOCKET	1
CONFIG_MODULE_INIT_SPI	1
CONFIG_MODULE_INIT_SSL	0
CONFIG_MODULE_INIT_STD	1
CONFIG_MODULE_INIT_THRD	1
CONFIG_MODULE_INIT_TIMER	1

Continued on next page

Table 1.18 – continued from previous page

Name	Value
CONFIG_MODULE_INIT_UART	1
CONFIG_MODULE_INIT_UART_SOFT	1
CONFIG_MODULE_INIT_UPGRADE	0
CONFIG_MODULE_INIT_USB	0
CONFIG_MODULE_INIT_USB_DEVICE	0
CONFIG_MODULE_INIT_USB_HOST	0
CONFIG_MODULE_INIT_WATCHDOG	0
CONFIG_MONITOR_THREAD	0
CONFIG_MONITOR_THREAD_PERIOD_US	2000000
CONFIG_NRF24L01	0
CONFIG_NVM_EEPROM_SOFT	0
CONFIG_NVM_EEPROM_SOFT_BLOCK_0_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_BLOCK_1_SIZE	16384
CONFIG_NVM_EEPROM_SOFT_CHUNK_SIZE	(CONFIG_NVM_SIZE + 8)
CONFIG_NVM_EEPROM_SOFT_FLASH_DEVICE_INDEX	0
CONFIG_NVM_SIZE	2040
CONFIG_OWI	1
CONFIG_PANIC_ASSERT	1
CONFIG_PIN	1
CONFIG_PREEMPTIVE_SCHEDULER	0
CONFIG_PROFILE_STACK	1
CONFIG_PWM	0
CONFIG_PWM_SOFT	1
CONFIG_RANDOM	1
CONFIG_SD	0
CONFIG_SETTINGS_AREA_SIZE	256
CONFIG_SETTINGS_BLOB	1
CONFIG_SHELL_COMMAND_MAX	64
CONFIG_SHELL_HISTORY_SIZE	768
CONFIG_SHELL_MINIMAL	0
CONFIG_SHELL_PROMPT	“$ “
CONFIG_SHT3XD	1
CONFIG_SOAM_EMBEDDED_DATABASE	0
CONFIG_SOCKET_RAW	1
CONFIG_SOFTWARE_I2C	1
CONFIG_SPC5_BOOT_ENTRY_RCHW	1
CONFIG_SPC5_RAM_CLEAR_ALL	1
CONFIG_SPI	1
CONFIG_SPIFFS	1
CONFIG_START_CONSOLE	CONFIG_START_CONSOLE_UART
CONFIG_START_CONSOLE_DEVICE_INDEX	0
CONFIG_START_CONSOLE_UART_BAUDRATE	76800
CONFIG_START_CONSOLE_UART_RX_BUFFER_SIZE	32
CONFIG_START_CONSOLE_USB_CDC_CONTROL_INTERFACE	0
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_IN	2
CONFIG_START_CONSOLE_USB_CDC_ENDPOINT_OUT	3
CONFIG_START_CONSOLE_USB_CDC_WAIT_FOR_CONNETION	1
CONFIG_START_FILESYSTEM	1
CONFIG_START_FILESYSTEM_ADDRESS	0x00300000

Continued on next page

Table 1.18 – continued from previous page

Name	Value
CONFIG_START_FILESYSTEM_SIZE	0xFB000
CONFIG_START_NETWORK	0
CONFIG_START_NETWORK_INTERFACE_WIFI_CONNECT_TIMEOUT	30
CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD	MyWiFiPassword
CONFIG_START_NETWORK_INTERFACE_WIFI_SSID	MyWiFiSSID
CONFIG_START_NVM	1
CONFIG_START_SHELL	1
CONFIG_START_SHELL_PRIO	30
CONFIG_START_SHELL_STACK_SIZE	1536
CONFIG_START_SOAM	0
CONFIG_START_SOAM_PRIO	30
CONFIG_START_SOAM_STACK_SIZE	1536
CONFIG_STD_OUTPUT_BUFFER_MAX	16
CONFIG_SYSTEM_INTERRUPTS	1
CONFIG_SYSTEM_INTERRUPT_STACK_SIZE	0
CONFIG_SYSTEM_TICK_FREQUENCY	100
CONFIG_SYSTEM_TICK_SOFTWARE	1
CONFIG_SYS_CONFIG_STRING	1
CONFIG_SYS_LOG_MASK	LOG_UPTO(INFO)
CONFIG_SYS_PANIC_KICK_WATCHDOG	0
CONFIG_SYS_RESET_CAUSE	1
CONFIG_SYS_SIMBA_MAIN_STACK_MAX	4096
CONFIG_THRD_CPU_USAGE	1
CONFIG_THRD_DEFAULT_LOG_MASK	LOG_UPTO(INFO)
CONFIG_THRD_ENV	1
CONFIG_THRD_IDLE_STACK_SIZE	768
CONFIG_THRD_MONITOR_STACK_SIZE	768
CONFIG_THRD_SCHEDULED	1
CONFIG_THRD_STACK_HEAP	0
CONFIG_THRD_STACK_HEAP_SIZE	0
CONFIG_THRD_TERMINATE	1
CONFIG_TIME_UNIX_TIME_TO_DATE	1
CONFIG_UART	1
CONFIG_UART_SOFT	1
CONFIG_USB	0
CONFIG_USB_DEVICE	0
CONFIG_USB_DEVICE_PID	0x8037
CONFIG_USB_DEVICE_VID	0x2341
CONFIG_USB_HOST	0
CONFIG_WATCHDOG	0

Homepage

https://wiki.wemos.cc/products:d1:d1_mini

Mcu

esp8266

Examples

Below is a list of simple examples that are useful to understand the basics of *Simba*.

There are a lot more examples and unit tests on Github that shows how to use most of the *Simba* modules.

Analog Read

About

Read the value of an analog pin periodically once every second and print the read value to standard output.

Source code

```
/**
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 *
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 *
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 * modify, merge, publish, distribute, sublicense, and/or sell copies
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 * furnished to do so, subject to the following conditions:
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 * ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
 * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

int main()
{
    int value;
    struct analog_input_pin_t pin;

    sys_start();
    analog_input_pin_module_init();

    /* Initialize the analog input pin. */
```

```
    if (analog_input_pin_init(&pin, &pin_a0_dev) != 0) {
        std_printf(FSTR("Failed to initialize the analog input pin.\r\n"));
        return (-1);
    }

    while (1) {
        /* Read the analog pin value and print it. */
        value = analog_input_pin_read(&pin);
        std_printf(FSTR("value = %d\r\n"), value);

        /* Wait 100 ms. */
        thrd_sleep_ms(100);
    }

    return (0);
}
```

The source code can also be found on Github in the examples/analog_read folder.

Build and run

Build and run the application.

```
$ cd examples/analog_read
$ make -s BOARD=<board> run
value = 234
value = 249
value = 230
```

Analog Write

About

Write analog values to an analog output pin to form a sawtooth wave. Connect a LED to the analog output pin and watch the brightness of the LED change.

Source code

```
/**
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 *
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 *
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 * of the Software, and to permit persons to whom the Software is
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```

```
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 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

int main()
{
    int value;
    struct analog_output_pin_t pin;

    sys_start();
    analog_output_pin_module_init();

    /* Initialize the analog output pin. */
    analog_output_pin_init(&pin, &pin_d10_dev);

    value = 0;

    while (1) {
        /* Write a sawtooth wave to the analog output pin. */
        analog_output_pin_write(&pin, value);
        value += 5;
        value %= 1024;

        /* Wait ten milliseconds. */
        thrd_sleep_ms(10);
    }

    return (0);
}
```

The source code can also be found on Github in the examples/analog_write folder.

Build and run

Build and upload the application.

```
$ cd examples/analog_write
$ make -s BOARD=<board> upload
```

Blink

About

Turn a LED on and off periodically once a second. This example illustrates how to use digital pins and sleep a thread.

Source code

```
/**
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 *
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 *
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 * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

int main()
{
    struct pin_driver_t led;

    /* Start the system. */
    sys_start();

    /* Initialize the LED pin as output and set its value to 1. */
    pin_init(&led, &pin_led_dev, PIN_OUTPUT);
    pin_write(&led, 1);

    while (1) {
        /* Wait half a second. */
        thrd_sleep_ms(500);

        /* Toggle the LED on/off. */
        pin_toggle(&led);
    }
```

```
    return (0);
}
```

The source code can also be found on Github in the examples/blink folder.

Build and run

Build and upload the application.

```
$ cd examples/blink
$ make -s BOARD=<board> upload
```

DS18B20

About

Read and print the temperature measured with one or more DS18B20 sensors.

Source code

```
/**
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 *
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 * ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
 * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

int main()
```

```
{
    struct owi_driver_t owi;
    struct ds18b20_driver_t ds;
    struct owi_device_t devices[4];
    char temperature[16], *temperature_p;
    int number_of_sensors;
    int i;

    /* Initialization. */
    sys_start();
    ds18b20_module_init();
    owi_init(&owi, &pin_d7_dev, devices, membersof(devices));
    ds18b20_init(&ds, &owi);
    time_busy_wait_us(50000);

    /* Search for devices on the OWI bus. */
    number_of_sensors = owi_search(&owi);
    std_printf(FSTR("Number of sensors: %d\r\n"), number_of_sensors);

    while (1) {
        /* Take a new temperature sample. */
        ds18b20_convert(&ds);

        for (i = 0; i < owi.len; i++) {
            if (devices[i].id[0] != DS18B20_FAMILY_CODE) {
                continue;
            }

            temperature_p = ds18b20_get_temperature_str(&ds,
                                                        devices[i].id,
                                                        temperature);

            if (temperature_p == NULL) {
                temperature_p = "failed to get";
            }

            std_printf(FSTR("Device id: %02x %02x %02x %02x %02x %02x %02x %02x,"
                            " Temperature: %s\r\n"),
                       (unsigned int)devices[i].id[0],
                       (unsigned int)devices[i].id[1],
                       (unsigned int)devices[i].id[2],
                       (unsigned int)devices[i].id[3],
                       (unsigned int)devices[i].id[4],
                       (unsigned int)devices[i].id[5],
                       (unsigned int)devices[i].id[6],
                       (unsigned int)devices[i].id[7],
                       temperature_p);
        }
    }

    return (0);
}
```

The source code can also be found on Github in the examples/ds18b20 folder.

Build and run

Build and run the application.

```
$ cd examples/ds18b20
$ make -s BOARD=<board> run
Number of sensors: 2
Device id: 28 9c 1d 5d 05 00 00 32, Temperature: 22.6250
Device id: 28 95 32 5d 05 00 00 33, Temperature: 22.6875
```

Filesystem

About

Create the file `counter.txt` and write `0` to it. Everytime the application is restarted the counter is incremented by one.

Source code

```
/**
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 *
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 *
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 * ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
 * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

#if !defined(BOARD_ARDUINO_DUE) && !defined(ARCH_ESP) && !defined(ARCH_ESP32)
#    error "This example can only be built for Arduino Due, ESP and ESP32."
#endif
```

```
/**
 * Increment the counter in 'counter.txt'.
 */
static int increment_counter(void)
{
    char buf[32];
    struct fs_file_t file;
    long counter;
    size_t size;

    std_printf(FSTR("Incrementing the counter in 'counter.txt'.\r\n"));

    if (fs_open(&file, "counter.txt", FS_RDWR) != 0) {
        /* Create the file if missing. */
        if (fs_open(&file,
                    "counter.txt",
                    FS_CREAT | FS_TRUNC | FS_RDWR) != 0) {
            return (-1);
        }

        if (fs_write(&file, "0", 2) != 2) {
            return (-2);
        }

        if (fs_seek(&file, 0, FS_SEEK_SET) != 0) {
            return (-3);
        }
    }

    if (fs_read(&file, buf, 16) <= 0) {
        return (-4);
    }

    if (std_strtol(buf, &counter) == NULL) {
        return (-5);
    }

    /* Increment the counter. */
    counter++;
    std_sprintf(buf, FSTR("%lu"), counter);
    size = strlen(buf) + 1;

    if (fs_seek(&file, 0, FS_SEEK_SET) != 0) {
        return (-6);
    }

    if (fs_write(&file, buf, size) != size) {
        return (-7);
    }

    if (fs_close(&file) != 0) {
        return (-8);
    }

    std_printf(FSTR("Counter incremented to %lu\r\n"), counter);

    return (0);
}
```

```
int main()
{
    int res;

    sys_start();
    std_printf(sys_get_info());

    /* Increment the counter. */
    res = increment_counter();

    if (res != 0) {
        std_printf(FSTR("Failed to increment the counter with error %d.\r\n"),
                   res);
    }

    /* The shell thread is started in sys_start() so just suspend this
       thread. */
    thrd_suspend(NULL);

    return (0);
}
```

The source code can also be found on Github in the examples/filesystem folder.

Build and run

Build and run the application.

```
$ cd examples/filesystem
$ make -s BOARD=arduino_due upload
```

The output in the terminal emulator:

```
Incrementing the counter in 'counter.txt'.
Counter incremented to 1.
<manually reset the board>
Incrementing the counter in 'counter.txt'.
Counter incremented to 2.
<manually reset the board>
Incrementing the counter in 'counter.txt'.
Counter incremented to 3.
```

Hello World

About

This application prints “Hello world!” to standard output.

Source code

```
/**
 * @section License
```

```
 *
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 *
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 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

int main()
{
    /* Start the system. */
    sys_start();

    std_printf(FSTR("Hello world!\r\n"));

    return (0);
}
```

The source code can also be found on Github in the examples/hello_world folder.

Build and run

Build and run the application.

```
$ cd examples/hello_world
$ make -s BOARD=<board> run
...
Hello world!
$
```

HTTP Client

About

Conenct to a remote host perform a HTTP GET action to fetch the root page '/' from the remote host.

Define `CONFIG_START_NETWORK_INTERFACE_WIFI_SSID` and `CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWOR` in `config.h` to the SSID and password of your WiFi, otherwise the board will fail to connect to the WiFi network. Alternatively, the defines can be given as defines on the make command line as seen in the example below.

Source code

```
/**
 * @section License
 *
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 *
 * Copyright (c) 2014-2017, Erik Moqvist
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 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

/* The ip address of the host to connect to. */
#define REMOTE_HOST_IP 216.58.211.142

int main()
{
    struct socket_t socket;
    char http_request[] =
        "GET / HTTP/1.1\r\n"
        "Host: " STRINGIFY(REMOTE_HOST_IP) "\r\n"
        "\r\n";
    char http_response[64];
    char remote_host_ip[] = STRINGIFY(REMOTE_HOST_IP);
    struct inet_addr_t remote_host_address;

    /* Start the system. Brings up the configured network interfaces
```

```
       and starts the TCP/IP-stack. */
    sys_start();

    /* Open the tcp socket. */
    socket_open_tcp(&socket);

    std_printf(FSTR("Connecting to '%s'.\r\n"), remote_host_ip);

    if (inet_aton(remote_host_ip, &remote_host_address.ip) != 0) {
        std_printf(FSTR("Bad ip address ''.\r\n"), remote_host_ip);
        return (-1);
    }

    remote_host_address.port = 80;

    if (socket_connect(&socket, &remote_host_address) != 0) {
        std_printf(FSTR("Failed to connect to '%s'.\r\n"), remote_host_ip);
        return (-1);
    }

    /* Send the HTTP request... */
    if (socket_write(&socket,
                     http_request,
                     strlen(http_request)) != strlen(http_request)) {
        std_printf(FSTR("Failed to send the HTTP request.\r\n"));
        return (-1);
    }

    /* ...and receive the first 64 bytes of the response. */
    if (socket_read(&socket,
                    http_response,
                    sizeof(http_response)) != sizeof(http_response)) {
        std_printf(FSTR("Failed to receive the response.\r\n"));
    }

    std_printf(FSTR("First 64 bytes of the response:\r\n"
                    "%s"),
               http_response);

    /* Close the socket. */
    socket_close(&socket);

    return (0);
}
```

The source code can also be found on Github in the examples/http_client folder.

Build and run

Build and run the application. It must be built for ESP12E or ESP01 since those are the only boards with a network connection (WiFi).

```
$ cd examples/http_client
$ make -s BOARD=esp12e CDEFS_EXTRA="CONFIG_START_NETWORK_INTERFACE_WIFI_SSID=Qvist␣
↪CONFIG_START_NETWORK_INTERFACE_WIFI_PASSWORD=FooBar" run
...
Connecting to WiFi with SSID 'Qvist'.
```

```
Connected to WiFi with SSID 'Qvist'. Got IP address '192.168.1.103'.
Connecting to '216.58.211.142'.
First 64 bytes of the response:
HTTP/1.1 301 Moved Permanently
Location: http://www.google.com/GET / HTTP/1.1
Host: 216.58.211.142
...
$
```

Ping

About

Ping a remote host periodically once every second.

Source code

```
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 *
 * This file is part of the Simba project.
 */

#include "simba.h"

/* The ip address of the host to ping. */
#define REMOTE_HOST_IP 216.58.211.142

int main()
{
```

```
    int res, attempt;
    char remote_host_ip[] = STRINGIFY(REMOTE_HOST_IP);
    struct inet_ip_addr_t remote_host_ip_address;
    struct time_t round_trip_time, timeout;

    sys_start();

    if (inet_aton(remote_host_ip, &remote_host_ip_address) != 0) {
        std_printf(FSTR("Bad ip address '%s'.\r\n"), remote_host_ip);
        return (-1);
    }

    timeout.seconds = 3;
    timeout.nanoseconds = 0;
    attempt = 1;

    /* Ping the remote host once every second. */
    while (1) {
        res = ping_host_by_ip_address(&remote_host_ip_address,
                                      &timeout,
                                      &round_trip_time);

        if (res == 0) {
            std_printf(FSTR("Successfully pinged '%s' (#%d).\r\n"),
                       remote_host_ip,
                       attempt);
        } else {
            std_printf(FSTR("Failed to ping '%s' (#%d).\r\n"),
                       remote_host_ip,
                       attempt);
        }

        attempt++;
        thrd_sleep(1);
    }

    return (0);
}
```

The source code can also be found on Github in the examples/ping folder.

Build and run

Build and run the application.

```
$ cd examples/ping
$ make -s BOARD=<board> run
Successfully pinged '192.168.1.100' in 20 ms (#1).
Successfully pinged '192.168.1.100' in 20 ms (#2).
Successfully pinged '192.168.1.100' in 20 ms (#3).
```

Queue

About

Use a queue to communicate between two threads.

Source code

```
/**
 * @section License
 *
 * The MIT License (MIT)
 *
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 * ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
 * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

static struct queue_t queue;

static THRD_STACK(writer_stack, 256);

static void *writer_main(void *arg_p)
{
    int value;

    /* Write to the queue. */
    value = 1;
    queue_write(&queue, &value, sizeof(value));

    return (NULL);
}

int main()
{
    int value;
```

```
    sys_start();
    queue_init(&queue, NULL, 0);
    thrd_spawn(writer_main, NULL, 0, writer_stack, sizeof(writer_stack));

    /* Read from the queue. */
    queue_read(&queue, &value, sizeof(value));

    std_printf(FSTR("read value = %d\r\n"), value);

    return (0);
}
```

The source code can also be found on Github in the examples/queue folder.

Build and run

Build and upload the application.

```
$ cd examples/queue
$ make -s BOARD=<board> run
read value = 1
```

Shell

About

Use the serial port to monitor and control the application.

Source code

```
/**
 * @section License
 *
 * The MIT License (MIT)
 *
 * Copyright (c) 2014-2017, Erik Moqvist
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```

```
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 * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
 * SOFTWARE.
 *
 * This file is part of the Simba project.
 */

#include "simba.h"

/* Hello world command. */
static struct fs_command_t cmd_hello_world;

static struct shell_t shell;

/**
 * The shell command callback for "/hello_world".
 */
static int cmd_hello_world_cb(int argc,
                              const char *argv[],
                              void *out_p,
                              void *in_p,
                              void *arg_p,
                              void *call_arg_p)
{
    /* Write "Hello World!" to the output channel. */
    std_fprintf(out_p, OSTR("Hello World!\r\n"));

    return (0);
}

int main()
{
    /* Start the system. */
    sys_start();

    std_printf(sys_get_info());

    /* Register the hello world command. */
    fs_command_init(&cmd_hello_world,
                    CSTR("/hello_world"),
                    cmd_hello_world_cb,
                    NULL);
    fs_command_register(&cmd_hello_world);

    /* Start the shell. */
    shell_init(&shell,
               sys_get_stdin(),
               sys_get_stdout(),
               NULL,
               NULL,
               NULL,
               NULL);
    shell_main(&shell);

    return (0);
}
```

The source code can also be found on Github in the examples/shell folder.

Build and run

Build and run the application.

```
$ cd examples/shell
$ make -s BOARD=<board> upload
```

Communicate with the board using a serial terminal emulator, for example *TeraTerm*.

Type `hello_world` in the terminal emulator and press Enter. `Hello World!` is printed.

Press Tab to print a list of all registered commands and try them if you want to.

```
$ hello_world
Hello World!
$ <tab>
drivers/
filesystems/
hello_world
help
history
kernel/
logout
oam/
$ kernel/thrd/list
            NAME        STATE  PRIO   CPU  MAX-STACK-USAGE  LOGMASK
           shell      current     0    0%       358/  5575     0x0f
            idle        ready   127    0%        57/   156     0x0f
$
```

Timer

About

Start a periodic timer that writes an event to the main thread. The main thread reads the event and prints "timeout" to the standard output.

Source code

```
/**
 * @section License
 *
 * The MIT License (MIT)
 *
 * Copyright (c) 2014-2017, Erik Moqvist
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```

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 *
 * This file is part of the Simba project.
 */

#include "simba.h"

#define TIMEOUT_EVENT    0x1

static struct event_t event;
static struct timer_t timer;

static void timer_cb(void *arg_p)
{
    uint32_t mask;

    mask = TIMEOUT_EVENT;
    event_write_isr(&event, &mask, sizeof(mask));
}

int main()
{
    uint32_t mask;
    struct time_t timeout;

    sys_start();
    event_init(&event);

    /* Initialize and start a periodic timer. */
    timeout.seconds = 1;
    timeout.nanoseconds = 0;
    timer_init(&timer, &timeout, timer_cb, NULL, TIMER_PERIODIC);
    timer_start(&timer);

    while (1) {
        mask = TIMEOUT_EVENT;
        event_read(&event, &mask, sizeof(mask));

        std_printf(FSTR("timeout\r\n"));
    }

    return (0);
}
```

The source code can also be found on Github in the examples/timer folder.

Build and run

Build and upload the application.

```
$ cd examples/timer
$ make -s BOARD=<board> run
timeout
timeout
timeout
```

Library Reference

Simba's standard library is very extensive, offering a wide range of facilities as indicated by the long table of contents listed below. The library contains modules used by many developers in their everyday programming.

Besides the generated documentation, the source code of the interfaces and their implementatins are available on Github.

kernel

The kernel package is the heart in *Simba*. It implements the thread scheduler.

The kernel package on Github.

`assert` — Assertions

Source code: src/kernel/assert.h

Defines

FATAL (n)

IS_FATAL (n)
Check is an error code is fatal (negative error code).

ASSERT (cond, ...)
Assert given condition and print an error message on assertion failure. Call the system on fatal callback with error code `EASSERT` on fatal error, otherwise return NULL.

ASSERTN (cond, n, ...)
Assert given condition and print an error message on assertion failure. Call the system on fatal callback with given error code `n` on fatal error, otherwise return the error code negated.

ASSERTRV (cond, ...)
Assert given condition and print an error message on assertion failure. Call the system on fatal callback with error code `EASSERT` on fatal error, otherwise return NULL.

ASSERTRN (cond, ...)
Assert given condition and print an error message on assertion failure. Call the system on fatal callback with error code `EASSERT` on fatal error, otherwise return NULL.

ASSERTNR (cond, n, ...)
Assert given condition and print an error message. Call the system on fatal callback with given error code `n` on fatal error, otherwise return given error code `res`.

ASSERTNRV (cond, n, ...)
Assert given condition and print an error message on assertion failure. Call the system on fatal callback with given error code `n` on fatal error, otherwise return.

ASSERTNRN (cond, n, ...)
Assert given condition and print an error message on assertion failure. Call the system on fatal callback with given error code `n` on fatal error, otherwise return NULL.

FATAL_ASSERTN (cond, n, ...)
Assert given condition and print an error message on assertion failure, then call the system on fatal callback with given error code `n`.

This assertion is not affected by `CONFIG_ASSERT`, but instead `CONFIG_FATAL_ASSERT`.

FATAL_ASSERT (cond, ...)
Assert given condition and print an error message on assertion failure, then call the system on fatal callback with error code `EASSERT`.

This assertion is not affected by `CONFIG_ASSERT`, but instead `CONFIG_FATAL_ASSERT`.

PANIC_ASSERTN (cond, n, ...)
Assert given condition and call `sys_panic()` with given error code `n` on assertion failure.

This assertion is not affected by `CONFIG_ASSERT`, but instead `CONFIG_PANIC_ASSERT`.

PANIC_ASSERT (cond, ...)
Assert given condition and call `sys_panic()` with error code `EASSERT`.

This assertion is not affected by `CONFIG_ASSERT`, but instead `CONFIG_PANIC_ASSERT`.

`errno` — Error numbers

Source code: src/kernel/errno.h

Defines

EPERM

ENOENT
No such file or directory.

ESRCH
No such process.

EINTR
Interrupted system call.

EIO
I/O error.

ENXIO
No such device or address.

E2BIG
Argument list too long.

ENOEXEC
Exec format error.

EBADF
Bad file number.

ECHILD
No child processes.

EAGAIN
Try again.

ENOMEM
Out of memory.

EACCES
Permission denied.

EFAULT
Bad address.

ENOTBLK
Block device required.

EBUSY
Device or resource busy.

EEXIST
File exists.

EXDEV
Cross-device link.

ENODEV
No such device.

ENOTDIR
Not a directory.

EISDIR
Is a directory.

EINVAL
Invalid argument.

ENFILE
File table overflow.

EMFILE
Too many open files.

ENOTTY
Not a typewriter.

ETXTBSY
Text file busy.

EFBIG
File too large.

ENOSPC
No space left on device.

ESPIPE
Illegal seek.

EROFS
Read-only file system.

EMLINK
Too many links.

EPIPE
Broken pipe.

EDOM
Math argument out of domain of func.

ERANGE
Math result not representable.

EDEADLK
Resource deadlock would occur.

ENAMETOOLONG
File name too long.

ENOLCK
No record locks available.

ENOSYS
Function not implemented.

ENOTEMPTY
Directory not empty.

ELOOP
Too many symbolic links encountered.

EWOULDBLOCK
Operation would block.

ENOMSG
No message of desired type.

EIDRM
Identifier removed.

ECHRNG
Channel number out of range.

EL2NSYNC
Level 2 not synchronized.

EL3HLT
Level 3 halted.

EL3RST
Level 3 reset.

ELNRNG
Link number out of range.

EUNATCH
Protocol driver not attached.

ENOCSI
No CSI structure available.

EL2HLT
Level 2 halted.

EBADE
Invalid exchange.

EBADR
Invalid request descriptor.

EXFULL
Exchange full.

ENOANO
No anode.

EBADRQC
Invalid request code.

EBADSLT
Invalid slot.

EDEADLOCK
Deadlock.

EBFONT
Bad font file format.

ENOSTR
Device not a stream.

ENODATA
No data available.

ETIME
Timer expired.

ENOSR
Out of streams resources.

ENONET
Machine is not on the network.

ENOPKG
Package not installed.

EREMOTE
Object is remote.

ENOLINK
Link has been severed.

EADV
Advertise error.

ESRMNT
Srmount error.

ECOMM
Communication error on send.

EPROTO
Protocol error.

EMULTIHOP
Multihop attempted.

EDOTDOT
RFS specific error.

EBADMSG
Not a data message.

EOVERFLOW
Value too large for defined data type.

ENOTUNIQ
Name not unique on network.

EBADFD
File descriptor in bad state.

EREMCHG
Remote address changed.

ELIBACC
Can not access a needed shared library.

ELIBBAD
Accessing a corrupted shared library.

ELIBSCN
.lib section in a.out corrupted.

ELIBMAX
Attempting to link in too many shared libraries.

ELIBEXEC
Cannot exec a shared library directly.

EILSEQ
Illegal byte sequence.

ERESTART
Interrupted system call should be restarted.

ESTRPIPE
Streams pipe error.

EUSERS
Too many users.

ENOTSOCK
Socket operation on non-socket.

EDESTADDRREQ
Destination address required.

EMSGSIZE
Message too long.

EPROTOTYPE
Protocol wrong type for socket.

ENOPROTOOPT
Protocol not available.

EPROTONOSUPBOARD
Protocol not supported.

ESOCKTNOSUPBOARD
Socket type not supported.

EOPNOTSUPP
Operation not supported on transport endpoint.

EPFNOSUPBOARD
Protocol family not supported.

EAFNOSUPBOARD
Address family not supported by protocol.

EADDRINUSE
Address already in use.

EADDRNOTAVAIL
Cannot assign requested address.

ENETDOWN
Network is down.

ENETUNREACH
Network is unreachable.

ENETRESET
Network dropped connection because of reset.

ECONNABORTED
Software caused connection abort.

ECONNRESET
Connection reset by peer.

ENOBUFS
No buffer space available.

EISCONN
Transport endpoint is already connected.

ENOTCONN
Transport endpoint is not connected.

ESHUTDOWN
Cannot send after transport endpoint shutdown.

ETOOMANYREFS
Too many references: cannot splice.

ETIMEDOUT
Connection timed out.

ECONNREFUSED
Connection refused.

EHOSTDOWN
Host is down.

EHOSTUNREACH
No route to host.

EALREADY
Operation already in progress.

EINPROGRESS
Operation now in progress.

ESTALE
Stale NFS file handle.

EUCLEAN
Structure needs cleaning.

ENOTNAM
Not a XENIX named type file.

ENAVAIL
No XENIX sems available.

EISNAM
Is a named type file.

EREMOTEIO
Remote I/O error.

EDQUOT
Quota exceeded.

ENOMEDIUM
No medium found.

EMEDIUMTYPE
Wrong medium type.

ECANCELED
Operation Canceled.

ENOKEY
Required key not available.

EKEYEXPIRED
Key has expired.

EKEYREVOKED
Key has been revoked.

EKEYREJECTED
Key was rejected by service.

ESTACK
Stack corrupt.

EBTASSERT
Test assertion.

EASSERT
Assertion.

ENOCOMMAND
Command not found.

sys — System

System level functionality and definitions.

Source code: src/kernel/sys.h, src/kernel/sys.c

Test code: tst/kernel/sys/main.c

Test coverage: src/kernel/sys.c

Defines

VERSION_STR

SYS_TICK_MAX

Typedefs

typedef uint32_t **sys_tick_t**

typedef uint32_t **cpu_usage_t**

typedef void(* sys_on_fatal_fn_t) (int error) __attribute__((noreturn))

Enums

enum sys_reset_cause_t

System reset causes.

Values:

sys_reset_cause_unknown_t = 0

sys_reset_cause_power_on_t

sys_reset_cause_watchdog_timeout_t

sys_reset_cause_software_t

sys_reset_cause_external_t

sys_reset_cause_jtag_t

sys_reset_cause_max_t

Functions

static *sys_tick_t* **t2st** (**const struct** *time_t* **time_p*)

Convertion from the time struct to system ticks.

static void **st2t** (*sys_tick_t tick*, **struct** *time_t* **time_p*)

Convertion from system ticks to the time struct.

int **sys_module_init**(void)
Initialize the sys module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **sys_start**(void)
Start the system and convert this context to the main thread.

This function initializes a bunch of enabled features in the simba platform. Many low level features (scheduling, timers, ...) are always enabled, but higher level features are only enabled if configured.

This function **must** be the first function call in main().

Return zero(0) or negative error code.

void **sys_stop**(int *error*)
Stop the system.

Return Never returns.

Parameters

- `error`: Error code.

void **sys_panic**(**const** char **message_p*)
System panic. Write given message, a backtrace and other port specific debug information to the console and then reboot the system.

This function may be called from interrupt context and with the system lock taken.

Return Never returns.

Parameters

- `message_p`: Panic message to write to the console.

void **sys_reboot**(void)
Reboot the system. Also known as a soft reset.

Return Never returns.

int **sys_backtrace**(void ***buf_p*, size_t *size*)
Store the backtrace in given buffer.

Return Backtrace depth.

Parameters

- `buf_p`: Buffer to store the backtrace in.
- `size`: Size of the buffer.

enum *sys_reset_cause_t* **sys_reset_cause**(void)
Get the system reset cause.

Return The reset cause.

int **sys_uptime**(**struct** *time_t* **uptime_p*)

Get the system uptime.

Return zero(0) or negative error code.

Parameters

- `uptime_p`: System uptime.

int **sys_uptime_isr**(**struct** *time_t* **uptime_p*)

Get the system uptime from interrupt context or with the system lock taken.

Return zero(0) or negative error code.

Parameters

- `uptime_p`: System uptime.

void **sys_set_on_fatal_callback**(sys_on_fatal_fn_t *callback*)

Set the on-fatal-callback function to given callback.

The on-fatal-callback is called when a fatal error occurs. The default on-fatal-callback is `sys_stop()`.

Return void

Parameters

- `callback`: Callback called when a fatal error occurs.

void **sys_set_stdin**(void **chan_p*)

Set the standard input channel.

Return void.

Parameters

- `chan_p`: New standard input channel.

void ***sys_get_stdin**(void)

Get the standard input channel.

Return Standard input channel.

void **sys_set_stdout**(void **chan_p*)

Set the standard output channel.

Return void.

Parameters

- `chan_p`: New standard output channel.

void ***sys_get_stdout**(void)

Get the standard output channel.

Return Standard output channel.

void **sys_lock**(void)

Take the system lock. Turns off interrupts.

Return void.

void **sys_unlock** (void)
Release the system lock. Turn on interrupts.

Return void.

void **sys_lock_isr** (void)
Take the system lock from isr. In many ports this has no effect.

Return void.

void **sys_unlock_isr** (void)
Release the system lock from isr. In many ports this function has no effect.

Return void.

far_string_t **sys_get_info** (void)
Get a pointer to the application information string.

The buffer contains various information about the application; for example the application name and the build date.

Return The pointer to the application information string.

far_string_t **sys_get_config** (void)
Get a pointer to the application configuration string.

The buffer contains a string of all configuration variables and their values.

Return The pointer to the application configuration string.

cpu_usage_t **sys_interrupt_cpu_usage_get** (void)
Get the current interrupt cpu usage counter.

Return cpu usage, 0-100.

void **sys_interrupt_cpu_usage_reset** (void)
Reset the interrupt cpu usage counter.

Variables

const char ***sys_reset_cause_string_map**[sys_reset_cause_max_t]
System reset cause strings map.

struct *sys_t* **sys**

struct sys_t

Public Members

sys_on_fatal_fn_t **on_fatal_callback**

void ***stdin_p**

void ***stdout_p**

uint32_t **start**

uint32_t **time**

struct sys_t::@71 sys_t::interrupt

thrd — Threads

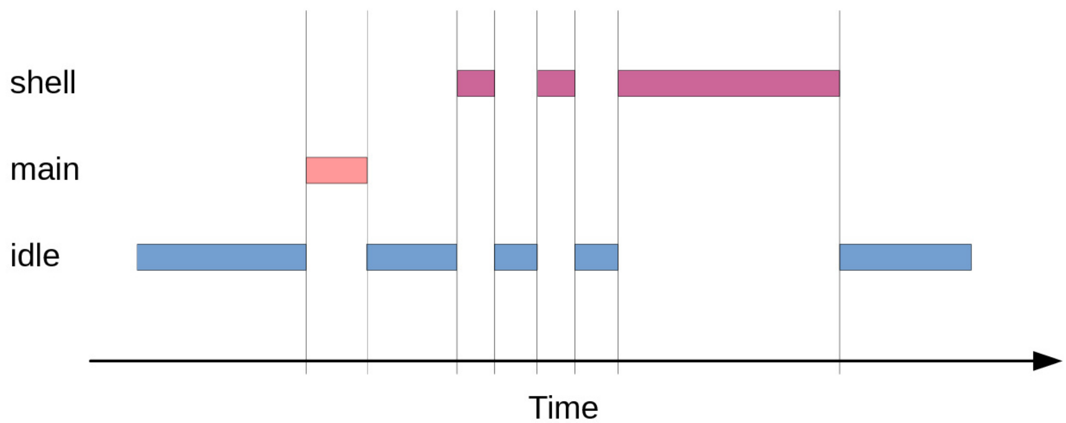
A thread is the basic execution entity in the OS. A pre-emptive or cooperative scheduler controls the execution of threads.

Scheduler

The single core scheduler is configured as cooperative or preemptive at compile time. The cooperative scheduler is implemented for all boards, but the preemptive scheduler is only implemented for a few boards.

There are two threads that are always present; the main thread and the idle thread. The main thread is the root thread in the system, created in the `main()` function by calling `sys_start()`. The idle thread is running when no other thread is ready to run. It simply waits for an interrupt to occur and then reschedules to run other ready threads.

The diagram below is an example of how three threads; `shell`, `main` and `idle` are scheduled over time.



As it is a single core scheduler only one thread is runnng at a time. In the beginning the system is idle and the `idle` thread is running. After a while the `main` and `shell` threads have some work to do, and since they have higher priority than the `idle` thread they are scheduled. At the end the `idle` thread is running again.

Debug file system commands

Four debug file system commands are available, all located in the directory `kernel/thrd/`.

Command	Description
`list`	Print a list of all threads.
`set_log_mask <thread name> <mask>`	Set the log mask of thread `<thread name>` to `mask`.
`monitor/set_period_ms <ms>`	Set the monitor thread sampling period to `<ms>` milliseconds.
`monitor/set_print <state>`	Enable(`1`)/disable(`0`) monitor statistics to be printed periodically.

Example output from the shell:

```
$ kenel/thrd/list
            NAME        STATE  PRIO   CPU   SCHEDULED  LOGMASK
            main      current     0    0%           1     0x0f
                        ready   127    0%           0     0x0f
                        ready   -80    0%           0     0x0f
```

Source code: src/kernel/thrd.h, src/kernel/thrd.c

Test code: tst/kernel/thrd/main.c

Test coverage: src/kernel/thrd.c

Defines

THRD_STACK (name, size)

THRD_CONTEXT_STORE_ISR
Push all callee-save registers not part of the context struct. The preemptive scheduler requires this macro before the `thrd_yield_isr()` function is called from interrupt context.

THRD_CONTEXT_LOAD_ISR
Pop all callee-save registers not part of the context struct. The preemptive scheduler requires this macro after the thrd_yield_isr() function is called from interrupt context.

THRD_RESCHEDULE_ISR
Reschuedule from isr. Used by preemptive systems to interrupt low priority threads in favour of high priority threads.

Functions

int **thrd_module_init** (void)
Initialize the thread module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code

struct *thrd_t* ***thrd_spawn** (void *(**main*)) void *
, void **arg_p*, int *prio*, void **stack_p*, size_t *stack_size*Spawn a thread with given main (entry) function and argument. The thread is initialized and added to the ready queue in the scheduler for execution when prioritized.

Return Thread id, or NULL on error.

Parameters

- `main`: Thread main (entry) function. This function normally contains an infinate loop waiting for events to occur.
- `arg_p`: Main function argument. Passed as arg_p to the main function.
- `prio`: Thread scheduling priority. [-127..127], where -127 is the highest priority and 127 is the lowest.
- `stack_p`: Stack pointer. The pointer to a stack created with the macro `THRD_STACK()`.
- `stack_size`: The stack size in number of bytes.

int **thrd_suspend**(**const struct** *time_t* **timeout_p*)

Suspend current thread and wait to be resumed or a timeout occurs (if given).

Return zero(0), -ETIMEOUT on timeout or other negative error code.

Parameters

- `timeout_p`: Time to wait to be resumed before a timeout occurs and the function returns.

int **thrd_resume**(**struct** *thrd_t* **thrd_p*, int *err*)

Resume given thread. If resumed thread is not yet suspended it will not be suspended on next suspend call to `thrd_suspend()` or `thrd_suspend_isr()`.

Return zero(0) or negative error code.

Parameters

- `thrd_p`: Thread id to resume.
- `err`: Error code to be returned by `thrd_suspend()` or `thrd_suspend_isr()`.

int **thrd_yield**(void)

Put the currently executing thread on the ready list and reschedule.

This function is often called periodically from low priority work heavy threads to give higher priority threads the chance to execute.

Return zero(0) or negative error code.

int **thrd_join**(**struct** *thrd_t* **thrd_p*)

Wait for given thread to terminate.

Return zero(0) or negative error code.

Parameters

- `thrd_p`: Thread to wait for.

int **thrd_sleep**(float *seconds*)

Pauses the current thread for given number of seconds.

Return zero(0) or negative error code.

Parameters

- `seconds`: Seconds to sleep.

int **thrd_sleep_ms** (int *ms*)
Pauses the current thread for given number of milliseconds.

Return zero(0) or negative error code.

Parameters

- `ms`: Milliseconds to sleep.

int **thrd_sleep_us** (long *us*)
Pauses the current thread for given number of microseconds.

Return zero(0) or negative error code.

Parameters

- `us`: Microseconds to sleep.

struct *thrd_t* ***thrd_self** (void)
Get current thread's id.

Return Thread id.

int **thrd_set_name** (**const** char **name_p*)
Set the name of the current thread.

Return zero(0) or negative error code.

Parameters

- `name_p`: New thread name.

const char ***thrd_get_name** (void)
Get the name of the current thread.

Return Current thread name.

struct *thrd_t* ***thrd_get_by_name** (**const** char **name_p*)
Get the pointer to given thread.

Return Thraed pointer or NULL if the thread was not found.

int **thrd_set_log_mask** (**struct** *thrd_t* **thrd_p*, int *mask*)
Set the log mask of given thread.

Return Old log mask.

Parameters

- `thrd_p`: Thread to set the log mask of.
- `mask`: Log mask. See the log module for available levels.

int **thrd_get_log_mask** (void)
Get the log mask of the current thread.

Return Log mask of current thread.

int **thrd_set_prio** (**struct** *thrd_t* **thrd_p*, int *prio*)
Set the priority of given thread.

Return zero(0) or negative error code.

Parameters

- `thrd_p`: Thread to set the priority for.
- `prio`: Priority.

int **thrd_get_prio** (void)
Get the priority of the current thread.

Return Priority of current thread.

int **thrd_init_global_env** (**struct** *thrd_environment_variable_t* **variables_p*, int *length*)
Initialize the global environment variables storage. These variables are shared among all threads.

Return zero(0) or negative error code.

Parameters

- `variables_p`: Variables array.
- `length`: Length of the variables array.

int **thrd_set_global_env** (**const** char **name_p*, **const** char **value_p*)
Set the value of given environment variable. The pointers to given name and value are stored in the current global environment array.

Return zero(0) or negative error code.

Parameters

- `name_p`: Name of the environment variable to set.
- `value_p`: Value of the environment variable. Set to NULL to remove the variable.

const char ***thrd_get_global_env** (**const** char **name_p*)
Get the value of given environment variable in the global environment array.

Return Value of given environment variable or NULL if it is not found.

Parameters

- `name_p`: Name of the environment variable to get.

int **thrd_init_env** (**struct** *thrd_environment_variable_t* **variables_p*, int *length*)
Initialize the current threads' environment variables storage.

Return zero(0) or negative error code.

Parameters

- `variables_p`: Variables are to be used by this therad.
- `length`: Length of the variables array.

int **thrd_set_env** (**const** char **name_p*, **const** char **value_p*)
Set the value of given environment variable. The pointers to given name and value are stored in the current threads' environment array.

Return zero(0) or negative error code.

Parameters

- `name_p`: Name of the environment variable to set.
- `value_p`: Value of the environment variable. Set to NULL to remove the variable.

const char ***thrd_get_env** (**const** char **name_p*)
Get the value of given environment variable. If given variable is not found in the current threads' environment array, the global environment array is searched.

Return Value of given environment variable or NULL if it is not found.

Parameters

- `name_p`: Name of the environment variable to get.

int **thrd_suspend_isr** (**const struct** *time_t* **timeout_p*)
Suspend current thread with the system lock taken (see `sys_lock()`) and wait to be resumed or a timeout occurs (if given).

Return zero(0), -ETIMEOUT on timeout or other negative error code.

Parameters

- `timeout_p`: Time to wait to be resumed before a timeout occurs and the function returns.

int **thrd_resume_isr** (**struct** *thrd_t* **thrd_p*, int *err*)
Resume given thread from isr or with the system lock taken (see `sys_lock()`). If resumed thread is not yet suspended it will not be suspended on next suspend call to `thrd_suspend()` or `thrd_suspend_isr()`.

Return zero(0) or negative error code.

Parameters

- `thrd_p`: Thread id to resume.
- `err`: Error code to be returned by `thrd_suspend()` or `thrd_suspend_isr()`.

int **thrd_yield_isr** (void)
Yield current thread from isr (preemptive scheduler only) or with the system lock taken.

Return zero(0) or negative error code.

void ***thrd_stack_alloc** (size_t *size*)
Allocate a thread stack of given size.

Return The pointer to allocated thread stack, or NULL on error.

int **thrd_stack_free** (void **stack_p*)
Free given thread stack.

Return zero(0) or negative error code.

const void ***thrd_get_bottom_of_stack**(**struct** *thrd_t* **thrd_p*)

Get the pointer to given threads' bottom of stack.

Return The pointer to given threds' bottom of stack, or NULL on error.

const void ***thrd_get_top_of_stack**(**struct** *thrd_t* **thrd_p*)

Get the pointer to given threads' top of stack.

Return The pointer to given threds' top of stack, or NULL on error.

int **thrd_prio_list_init**(**struct** *thrd_prio_list_t* **self_p*)

Initialize given prio list.

void **thrd_prio_list_push_isr**(**struct** *thrd_prio_list_t* **self_p*, **struct** *thrd_prio_list_elem_t* **elem_p*)

Push given element on given priority list. The priority list is a linked list with the highest priority thread first. The pushed element is added *after* any already pushed elements with the same thread priority.

Return void.

Parameters

- `self_p`: Priority list to push on.
- `elem_p`: Element to push.

struct *thrd_prio_list_elem_t* ***thrd_prio_list_pop_isr**(**struct** *thrd_prio_list_t* **self_p*)

Pop the highest priority element from given priority list.

Return Poped element or NULL if the list was empty.

Parameters

- `self_p`: Priority list to pop from.

int **thrd_prio_list_remove_isr**(**struct** *thrd_prio_list_t* **self_p*, **struct** *thrd_prio_list_elem_t* **elem_p*)

Remove given element from given priority list.

Return zero(0) or negative error code.

Parameters

- `self_p`: Priority list to remove given element from.
- `elem_p`: Element to remove.

struct thrd_environment_variable_t

#include <*thrd.h*> A thread environment variable.

Public Members

const char ***name_p**

const char ***value_p**

struct thrd_environment_t

Public Members

struct *thrd_environment_variable_t* ***variables_p**

size_t **number_of_variables**

size_t **max_number_of_variables**

struct thrd_t

Public Members

struct *thrd_prio_list_elem_t* **elem**

struct thrd_t::@72 thrd_t::scheduler

struct thrd_port_t **port**

int **prio**

int **state**

int **err**

int **log_mask**

struct *timer_t* ***timer_p**

const char ***name_p**

struct *thrd_t* ***next_p**

struct thrd_t::@73 thrd_t::statistics

size_t **stack_size**

`time` — System time

Source code: src/kernel/time.h, src/kernel/time.c

Test code: tst/kernel/time/main.c

Test coverage: src/kernel/time.c

Functions

int **time_get** (**struct** *time_t* **now_p*)

Get current time in seconds and nanoseconds. The resolution of the time is implementation specific and may vary a lot between different architectures.

Return zero(0) or negative error code.

Parameters

- `now_p`: Read current time.

int **time_set** (**struct** *time_t* **new_p*)

Set current time in seconds and nanoseconds.

Return zero(0) or negative error code.

Parameters

- `new_p`: New current time.

int **time_add**(**struct** *time_t* *res_p, **struct** *time_t* *left_p, **struct** *time_t* *right_p)
Add given times.

Return zero(0) or negative error code.

Parameters

- `res_p`: The result of the adding `left_p` to `right_p`.
- `left_p`: First operand.
- `right_p`: Second operand.

int **time_subtract**(**struct** *time_t* *res_p, **struct** *time_t* *left_p, **struct** *time_t* *right_p)
Subtract given times.

Return zero(0) or negative error code.

Parameters

- `res_p`: The result of the subtrancting `left_p` from `right_p`.
- `left_p`: The operand to subtract from.
- `right_p`: The operand to subtract.

void **time_busy_wait_us**(long *useconds*)
Busy wait for given number of microseconds.

NOTE: The maximum allowed time to sleep is target specific.

Return void

Parameters

- `useconds`: Microseconds to busy wait.

int **time_unix_time_to_date**(**struct** *date_t* *date_p, **struct** *time_t* *time_p)
Convert given unix time to a date.

Return zero(0) or negative error code.

Parameters

- `date_p`: Converted time.
- `time_p`: Unix time to convert.

struct time_t
#include <time.h>

Public Members

int32_t **seconds**
Number of seconds.

int32_t **nanoseconds**
Number of nanoseconds.

struct date_t
#include <time.h> A date in year, month, date, day, hour, minute and seconds.

Public Members

int **second**
Second [0..59].

int **minute**
Minute [0..59].

int **hour**
Hour [0..23].

int **day**
Weekday [1..7], where 1 is Monday and 7 is Sunday.

int **date**
Day in month [1..31]

int **month**
Month [1..12] where 1 is January and 12 is December.

int **year**
Year [1970..].

`timer` — Timers

Timers are started with a timeout, and when the time is up the timer expires and the timer callback function is called from interrupt context.

The timeout resolution is the system tick period. Timeouts are always rounded up to the closest system tick. That is, a timer can never expire early, but may expire slightly late.

An application requiring timers with higher precision than the system tick must use the hardware timers.

Source code: src/kernel/timer.h, src/kernel/timer.c

Test code: tst/kernel/timer/main.c

Test coverage: src/kernel/timer.c

Defines

TIMER_PERIODIC

Typedefs

typedef void (***timer_callback_t**)(void *arg_p)
Time callback prototype.

Functions

int **timer_module_init**(void)
Initialize the timer module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **timer_init**(**struct** *timer_t* **self_p*, **const struct** *time_t* **timeout_p*, *timer_callback_t* *callback*, void **arg_p*, int *flags*)
Initialize given timer object with given timeout and expiry callback. The timer resolution directly depends on the system tick frequency and is rounded up to the closest possible value. This applies to both single shot and periodic timers.

Return zero(0) or negative error code.

Parameters

- `self_p`: Timer object to initialize with given parameters.
- `timeout_p`: The timer timeout value.
- `callback`: Functaion called when the timer expires. Called from interrupt context.
- `arg_p`: Function callback argument. Passed to the callback when the timer expires.
- `flags`: Set TIMER_PERIODIC for periodic timer.

int **timer_start**(**struct** *timer_t* **self_p*)
Start given initialized timer object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Timer object to start.

int **timer_start_isr**(**struct** *timer_t* **self_p*)
See `timer_start()` for a description.

This function may only be called from an isr or with the system lock taken (see `sys_lock()`).

int **timer_stop**(**struct** *timer_t* **self_p*)
Stop given timer object. This has no effect on a timer that already expired or was never started.

Return true(1) if the timer was stopped, false(0) if the timer already expired or was never started, and otherwise negative error code.

Parameters

- `self_p`: Timer object to stop.

int **timer_stop_isr** (struct *timer_t* **self_p*)
See `timer_stop()` for description.

This function may only be called from an isr or with the system lock taken (see `sys_lock()`).

struct **timer_t**

Public Members

struct *timer_t* ***next_p**

sys_tick_t **delta**

sys_tick_t **timeout**

int **flags**

timer_callback_t **callback**

void ***arg_p**

`types` — Common types

Source code: src/kernel/types.h

Defines

UNUSED (v)

STRINGIFY (x)
Create a string of an identifier using the pre-processor.

STRINGIFY2 (x)
Used internally by `STRINGIFY()`.

TOKENPASTE (x, y)
Concatenate two tokens.

TOKENPASTE2 (x, y)
Used internally by `TOKENPASTE()`.

UNIQUE (x)
Create a unique token.

PRINT_FILE_LINE
Debug print of file and line.

STD_PRINTF_DEBUG (...)

membersof (a)
Get the number of elements in an array.

As an example, the code below outputs `number of members in foo = 10`.

```
int foo[10];

std_printf(FSTR("number of members in foo = %d\\r\\n"),
           membersof(foo));
```

container_of (ptr, type, member)

DIV_CEIL (n, d)
Integer division that rounds the result up.

DIV_ROUND (n, d)
Integer division that rounds the result to the closest integer.

MIN (a, b)
Get the minimum value of the two.

MAX (a, b)
Get the maximum value of the two.

BIT (pos)

BITFIELD_SET (name, value)

BITFIELD_GET (name, value)

OSTR (string)

CSTR (string)

Typedefs

typedef uint8_t **u8_t**

typedef int8_t **s8_t**

typedef uint16_t **u16_t**

typedef int16_t **s16_t**

typedef uint32_t **u32_t**

typedef int32_t **s32_t**

struct thrd_prio_list_elem_t

Public Members

struct *thrd_prio_list_elem_t* ***next_p**

struct *thrd_t* ***thrd_p**

struct thrd_prio_list_t

Public Members

struct *thrd_prio_list_elem_t* ***head_p**

sync

Thread synchronization refers to the idea that multiple threads are to join up or handshake at a certain point, in order to reach an agreement or commit to a certain sequence of action.

The sync package on Github.

bus — Message bus

A message bus provides a software-bus abstraction that gathers all the communications between a group of threads over a single shared virtual channel. Messages are transferred on the bus from a sender to one or more attached listeners. The concept is analogous to the bus concept found in computer hardware architecture.

Example

In this example there is a bus with three listeners attached; listerner *0*, *1* and *2*. Listener *0* and *1* are attached to the bus listening for message id *7*, and listener *2* for message id *9*.

Any thread can write a message to the bus by calling `bus_write()`. If a message with id *7* is written to the bus, both listerner *0* and *1* will receive the message. Listener *2* will receive messages with id *9*.

Messages are read from the listener channel by the thread that owns the listener.

```
      +--------------+               +--------------+
      |  listener 0  |               |  listener 2  |
      | id:7, chan:0 |               | id:9, chan:2 |
      +-------+------+               +-------+------+
              |                              |
BUS   ========+==============+==============+=======
                             |
                     +-------+------+
                     |  listener 1  |
                     | id:7, chan:1 |
                     +--------------+
```

Source code: src/sync/bus.h, src/sync/bus.c

Test code: tst/sync/bus/main.c

Test coverage: src/sync/bus.c

Functions

int **bus_module_init** (void)

Initialize the bus module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code

int **bus_init** (**struct** *bus_t* **self_p*)

Initialize given bus.

Return zero(0) or negative error code.

Parameters

- `self_p`: Bus to initialize.

int **bus_listener_init** (**struct** *bus_listener_t* **self_p*, int *id*, void **chan_p*)
Initialize given listener to receive messages with given id, after the listener is attached to the bus. A listener can only receive messages of a single id, though, the same channel may be used in multiple listeners with different ids (if the channel supports it).

Return zero(0) or negative error code.

Parameters

- `self_p`: Listener to initialize.
- `id`: Message id to receive.
- `chan_p`: Channel to receive messages on.

int **bus_attach** (**struct** *bus_t* **self_p*, **struct** *bus_listener_t* **listener_p*)
Attach given listener to given bus. Messages written to the bus will be written to all listeners initialized with the written message id.

Return zero(0) or negative error code.

Parameters

- `self_p`: Bus to attach the listener to.
- `listener_p`: Listener to attach to the bus.

int **bus_detatch** (**struct** *bus_t* **self_p*, **struct** *bus_listener_t* **listener_p*)
Detatch given listener from given bus. A detached listener will not receive any messages from the bus.

Return zero(0) or negative error code.

Parameters

- `self_p`: Bus to detach listener from.
- `listener_p`: Listener to detach from the bus.

int **bus_write** (**struct** *bus_t* **self_p*, int *id*, **const** void **buf_p*, size_t *size*)
Write given message to given bus. All attached listeners to given bus will receive the message.

Return Number of listeners that received the message, or negative error code.

Parameters

- `self_p`: Bus to write the message to.
- `id`: Message identity.
- `buf_p`: Buffer to write to the bus. All listeners with given message id will receive this data.
- `size`: Number of bytes to write.

struct bus_t
#include <bus.h>

Public Members

struct *rwlock_t* **rwlock**

struct *binary_tree_t* **listeners**

struct **bus_listener_t**

Public Members

struct *binary_tree_node_t* **base**

int **id**

void ***chan_p**

struct *bus_listener_t* ***next_p**

chan — Abstract channel communication

Threads often communicate over channels. The producer thread or isr writes data to a channel and the consumer reads it. The may be multiple producers writing to a single channel, but only one consumer is allowed.

In the first example, `thread 0` and `thread 1` communicates over a channel. `thread 0` writes data to the channel and `thread 1` read the written data.

```
+------------+              +------------+
|  thread 0  |  channel 0   |  thread 1  |
|            +==============+            |
|  producer  |              |  consumer  |
+------------+              +------------+
```

In the socond example, `isr 0` and `thread 2` communicates over a channel. `isr 0` writes data to the channel and `thread 2` read the written data.

```
+------------+              +------------+
|   isr 0    |  channel 1   |  thread 2  |
|            +==============+            |
|  producer  |              |  consumer  |
+------------+              +------------+
```

Source code: src/sync/chan.h, src/sync/chan.c

Test coverage: src/sync/chan.c

Defines

CHAN_CONTROL_LOG_BEGIN

CHAN_CONTROL_LOG_END
End of a log entry.

CHAN_CONTROL_PRINTF_BEGIN
Beginning of printf output.

CHAN_CONTROL_PRINTF_END
End of printf output.

Typedefs

typedef ssize_t (***chan_read_fn_t**) (void *self_p, void *buf_p, size_t size)
Channel read function callback type.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Channel to read from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

typedef ssize_t (***chan_write_fn_t**) (void *self_p, **const** void *buf_p, size_t size)
Channel write function callback type.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Channel to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

typedef int (***chan_control_fn_t**) (void *self_p, int operation)
Channel control function callback type.

Return Operation specific.

Parameters

- `self_p`: Channel to read from.
- `operation`: Control operation.

typedef int (***chan_write_filter_fn_t**) (void *self_p, **const** void *buf_p, size_t size)
Channel write filter function callback type.

Return true(1) if the buffer shall be written to the channel, otherwise false(0).

Parameters

- `self_p`: Channel to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes in buffer.

typedef size_t (***chan_size_fn_t**) (void *self_p)
Channel size function callback type.

Return Number of bytes available.

Parameters

- `self_p`: Channel to get the size of.

Functions

int **chan_module_init**(void)

Initialize the channel module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **chan_init**(**struct** *chan_t* **self_p*, *chan_read_fn_t read*, *chan_write_fn_t write*, *chan_size_fn_t size*)

Initialize given channel with given callbacks. A channel must be initialized before it can be used.

Return zero(0) or negative error code.

Parameters

- `self_p`: Channel to initialize.
- `read`: Read function callback. This function must implement the channel read functionality, and will be called when the user reads data from the channel.
- `write`: Write function callback. This function must implement the channel write functionality, and will be called when the user writes data to the channel.
- `size`: Size function callback. This function must return the size of the channel. It should return zero(0) if there is no data available in the channel, and otherwise a positive integer.

int **chan_set_write_isr_cb**(**struct** *chan_t* **self_p*, *chan_write_fn_t write_isr_cb*)

Set the write isr function callback.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `filter`: Write isr function to set.

int **chan_set_write_filter_cb**(**struct** *chan_t* **self_p*, *chan_write_filter_fn_t write_filter_cb*)

Set the write filter callback function. The write filter function is called when data is written to the channel, and its return value determines if the data shall be written to the underlying channel implementation, or discarded.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `write_filter_cb`: filter Write filter function to set.

int **chan_set_write_filter_isr_cb**(**struct** *chan_t* **self_p*, *chan_write_filter_fn_t write_filter_isr_cb*)

Set the write isr filter callback function. The write filter function is called when data is written to the channel, and its return value determines is the data shall be written to the underlying channel implementation, or discarded.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `write_filter_isr_cb`: filter Write filter function to set.

int **chan_set_control_cb**(**struct** *chan_t* **self_p*, *chan_control_fn_t* *control_cb*)

Set control function callback.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `control`: Control function to set.

ssize_t **chan_read**(void **self_p*, void **buf_p*, size_t *size*)

Read data from given channel. The behaviour of this function depends on the channel implementation. Often, the calling thread will be blocked until all data has been read or an error occurs.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Channel to read from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **chan_write**(void **self_p*, **const** void **buf_p*, size_t *size*)

Write data to given channel. The behaviour of this function depends on the channel implementation. Some channel implementations blocks until the receiver has read the data, and some returns immediately.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Channel to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

size_t **chan_size**(void **self_p*)

Get the number of bytes available to read from given channel.

Return Number of bytes available.

Parameters

- `self_p`: Channel to get the size of.

int **chan_control**(void **self_p*, int *operation*)

Control given channel.

Return Operation specific.

ssize_t **chan_write_isr**(void **self_p*, **const** void **buf_p*, size_t *size*)

Write data to given channel from interrupt context or with the system lock taken. The behaviour of this function depends on the channel implementation. Some channel implementations blocks until the receiver has read the data, and some returns immediately.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Channel to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

int **chan_is_polled_isr**(**struct** *chan_t* **self_p*)
Check if a channel is polled. May only be called from isr or with the system lock taken (see `sys_lock()`).

Return true(1) or false(0).

Parameters

- `self_p`: Channel to check.

int **chan_list_init**(**struct** *chan_list_t* **list_p*, void **workspace_p*, size_t *size*)
Initialize an empty list of channels. A list is used to wait for data on multiple channel at the same time. When there is data on at least one channel, the poll function returns and the application can read from the channel with data.

Return zero(0) or negative error code.

Parameters

- `list_p`: List to initialize.
- `workspace_p`: Workspace for internal use.
- `size`: Size of the workspace in bytes.

int **chan_list_destroy**(**struct** *chan_list_t* **list_p*)
Destroy an initialized list of channels.

Return zero(0) or negative error code.

Parameters

- `list_p`: List to destroy.

int **chan_list_add**(**struct** *chan_list_t* **list_p*, void **chan_p*)
Add given channel to list of channels.

Return zero(0) or negative error code.

Parameters

- `list_p`: List of channels.
- `chan_p`: Channel to add.

int **chan_list_remove**(**struct** *chan_list_t* **list_p*, void **chan_p*)
Remove given channel from list of channels.

Return zero(0) or negative error code.

Parameters

- `list_p`: List of channels.

- `chan_p`: Channel to remove.

void ***chan_list_poll**(**struct** *chan_list_t* **list_p*, **const struct** *time_t* **timeout_p*)

Poll given list of channels for events. Blocks until at least one of the channels in the list has data ready to be read or an timeout occurs.

Return Channel with data or NULL on timeout.

Parameters

- `list_p`: List of channels to poll.
- `timeout_p`: Time to wait for data on any channel before a timeout occurs. Set to NULL to wait forever.

void ***chan_poll**(void **chan_p*, **const struct** *time_t* **timeout_p*)

Poll given channel for events. Blocks until the channel has data ready to be read or an timeout occurs.

Return The channel or NULL on timeout.

Parameters

- `chan_p`: Channel to poll.
- `timeout_p`: Time to wait for data on the channel before a timeout occurs. Set to NULL to wait forever.

void ***chan_null**(void)

Get a reference to the null channel. This channel will ignore all written data but return that it was successfully written.

Return The null channel.

ssize_t **chan_read_null**(void **self_p*, void **buf_p*, size_t *size*)

Null channel read function callback. Pass to `chan_init()` if no read function callback is needed for the channel.

Return Always returns -1.

ssize_t **chan_write_null**(void **self_p*, **const** void **buf_p*, size_t *size*)

Null channel write function callback. Pass to `chan_init()` if no write function callback is needed for the channel.

Return Always returns `size`.

size_t **chan_size_null**(void **self_p*)

Null channel size function callback. Pass to `chan_init()` if no size function callback is needed for the channel.

Return Always returns zero(0).

int **chan_control_null**(void **self_p*, int *operation*)

Null channel control function callback. Will silently ignore the control request.

Return Always returns zero(0).

struct chan_list_t

Public Members

struct *chan_t* ****chans_pp**

size_t **max**

size_t **len**

int **flags**

struct chan_t

#include <chan.h> Channel datastructure.

Public Members

chan_read_fn_t **read**

chan_write_fn_t **write**

chan_size_fn_t **size**

chan_control_fn_t **control**

chan_write_filter_fn_t **write_filter_cb**

chan_write_fn_t **write_isr**

chan_write_filter_fn_t **write_filter_isr_cb**

struct *thrd_t* ***reader_p**

struct *chan_list_t* ***list_p**

`event` — Event channel

An event channel consists of a 32 bits bitmap, where each bit corresponds to an event state. If the bit is set, the event is active. Since an event only has two states, active and inactive, signalling the same event multiple times will just result in the event to be active. There is no internal counter of how "active" an event is, it's simply active or inactive.

Source code: src/sync/event.h, src/sync/event.c

Test code: tst/sync/event/main.c

Test coverage: src/sync/event.c

Functions

int **event_init** (**struct** *event_t* **self_p*)

Initialize given event channel.

Return zero(0) or negative error code

Parameters

- `self_p`: Event channel to initialize.

ssize_t **event_read** (**struct** *event_t* **self_p*, void **buf_p*, size_t *size*)

Wait for an event to occur in given event mask. This function blocks until at least one of the events in the event mask has been set. When the function returns, given event mask has been overwritten with the events that actually occured.

Return sizeof(mask) or negative error code.

Parameters

- `self_p`: Event channel object.
- `buf_p`: The mask of events to wait for. When the function returns the mask contains the events that have occured.
- `size`: Size to read (always sizeof(mask)).

ssize_t **event_write** (**struct** *event_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write given event(s) to given event channel.

Return sizeof(mask) or negative error code.

Parameters

- `self_p`: Event channel object.
- `buf_p`: The mask of events to write.
- `size`: Must always be sizeof(mask).

ssize_t **event_write_isr** (**struct** *event_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write given events to the event channel from isr or with the system lock taken (see `sys_lock()`).

Return sizeof(mask) or negative error code.

Parameters

- `self_p`: Event channel object.
- `buf_p`: The mask of events to write.
- `size`: Must always be sizeof(mask).

ssize_t **event_size** (**struct** *event_t* **self_p*)

Checks if there are events active on the event channel.

Return one(1) is at least one event is active, otherwise zero(0).

Parameters

- `self_p`: Event channel object.

struct event_t

#include <event.h>

Public Members

struct *chan_t* **base**

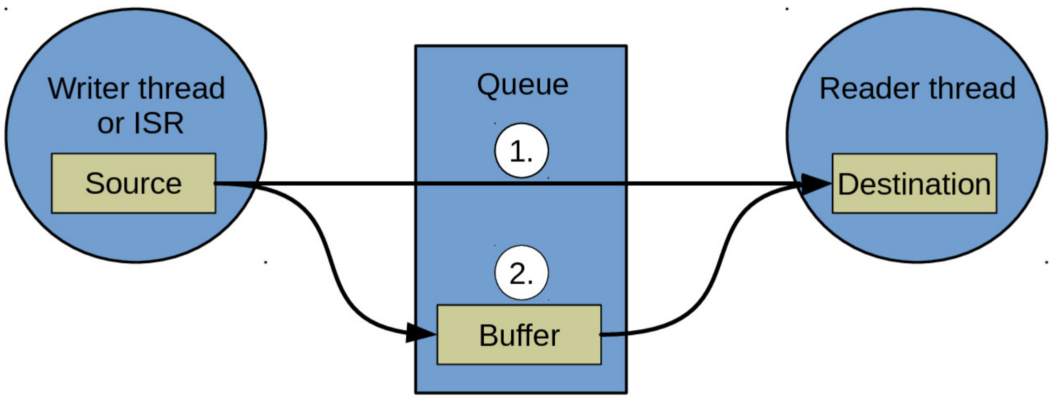
uint32_t **mask**

uint32_t **reader_mask**

queue — Queue channel

The most common channel is the queue. It can be either synchronous or semi-asynchronous. In the synchronous version the writing thread will block until all written data has been read by the reader. In the semi-asynchronous version the writer writes to a buffer within the queue, and only blocks all data does not fit in the buffer. The buffer size is selected by the application when initializing the queue.

The diagram below shows how two threads communicates using a queue. The writer thread writes from its source buffer to the queue. The reader thread reads from the queue to its destination buffer.



The data is either copied directly from the source to the destination buffer (1. in the figure), or via the internal queue buffer (2. in the figure).

1. The reader thread is waiting for data. The writer writes from its source buffer directly to the readers' destination buffer.
2. The reader thread is *not* waiting for data. The writer writes from its source buffer into the queue buffer. Later, the reader reads data from the queue buffer to its destination buffer.

Source code: src/sync/queue.h, src/sync/queue.c

Test code: tst/sync/queue/main.c

Test coverage: src/sync/queue.c

Example code: examples/queue/main.c

Defines

QUEUE_INIT_DECL (_name, _buf, _size)

Enums

enum queue_state_t

Values:

QUEUE_STATE_INITIALIZED = 0
Queue initialized state.

QUEUE_STATE_RUNNING
Queue running state.

QUEUE_STATE_STOPPED
Queue stopped state.

Functions

int **queue_init** (**struct** *queue_t* **self_p*, void **buf_p*, size_t *size*)
Initialize given queue.

Return zero(0) or negative error code

Parameters

- `self_p`: Queue to initialize.
- `buf_p`: Buffer.
- `size`: Size of buffer.

int **queue_start** (**struct** *queue_t* **self_p*)
Start given queue. It is not required to start a queue unless it has been stopped.

Return zero(0) or negative error code.

Parameters

- `self_p`: Queue to start.

int **queue_stop** (**struct** *queue_t* **self_p*)
Stop given queue. Any ongoing read and write operations will return with the currently read/written number of bytes. Any read and write operations on a stopped queue will return zero(0).

Return true(1) if a thread was resumed, false(0) if no thread was resumed, or negative error code.

Parameters

- `self_p`: Queue to stop.

int **queue_stop_isr** (**struct** *queue_t* **self_p*)
Same as `queue_stop()` but from isr or with the system lock taken (see `sys_lock()`).

ssize_t **queue_read** (**struct** *queue_t* **self_p*, void **buf_p*, size_t *size*)
Read from given queue. Blocks until size bytes has been read.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Queue to read from.
- `buf_p`: Buffer to read to.
- `size`: Size to read.

ssize_t **queue_write** (**struct** *queue_t* **self_p*, **const** void **buf_p*, size_t *size*)
Write bytes to given queue. Blocks until size bytes has been written.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Queue to write to.
- `buf_p`: Buffer to write from.
- `size`: Number of bytes to write.

ssize_t **`queue_write_isr`** (**struct** *queue_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write bytes to given queue from isr or with the system lock taken (see `sys_lock()`). May write less than size bytes.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Queue to write to.
- `buf_p`: Buffer to write from.
- `size`: Number of bytes to write.

ssize_t **`queue_size`** (**struct** *queue_t* **self_p*)

Get the number of bytes currently stored in the queue. May return less bytes than number of bytes stored in the channel.

Return Number of bytes in queue.

Parameters

- `self_p`: Queue.

ssize_t **`queue_unused_size`** (**struct** *queue_t* **self_p*)

Get the number of unused bytes in the queue.

Return Number of bytes unused in the queue.

Parameters

- `self_p`: Queue.

ssize_t **`queue_unused_size_isr`** (**struct** *queue_t* **self_p*)

Get the number of unused bytes in the queue from isr or with the system lock taken (see `sys_lock()`).

Return Number of bytes unused in the queue.

Parameters

- `self_p`: Queue.

struct `queue_buffer_t`

Public Members

char ***`begin_p`**

char ***`read_p`**

char ***`write_p`**

char ***`end_p`**

size_t **size**

struct queue_writer_elem_t

Public Members

struct *thrd_prio_list_elem_t* **base**

void ***buf_p**

size_t **size**

size_t **left**

struct queue_t

Public Members

struct *chan_t* **base**

struct *thrd_prio_list_t* **writers**

struct *queue_writer_elem_t* ***writer_p**

char ***buf_p**

size_t **size**

size_t **left**

struct queue_t::@103 queue_t::reader

struct *queue_buffer_t* **buffer**

queue_state_t **state**

`rwlock` — Reader-writer lock

An RW lock allows concurrent access for read-only operations, while write operations require exclusive access. This means that multiple threads can read the data in parallel but an exclusive lock is needed for writing or modifying data. When a writer is writing the data, all other writers or readers will be blocked until the writer is finished writing. A common use might be to control access to a data structure in memory that cannot be updated atomically and is invalid (and should not be read by another thread) until the update is complete.

Source code: src/sync/rwlock.h, src/sync/rwlock.c

Test code: tst/sync/rwlock/main.c

Test coverage: src/sync/rwlock.c

Functions

int **rwlock_module_init** (void)
Initialize the reader-writer lock module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code

int **rwlock_init** (**struct** *rwlock_t* **self_p*)
Initialize given reader-writer lock object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock to initialize.

int **rwlock_reader_take** (**struct** *rwlock_t* **self_p*)
Take given reader-writer lock. Multiple threads can have the reader lock at the same time.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock to take.

int **rwlock_reader_give** (**struct** *rwlock_t* **self_p*)
Give given reader-writer lock.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock give.

int **rwlock_reader_give_isr** (**struct** *rwlock_t* **self_p*)
Give given reader-writer lock from isr or with the system lock taken.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock to give.

int **rwlock_writer_take** (**struct** *rwlock_t* **self_p*)
Take given reader-writer lock as a writer. Only one thread can have the lock at a time, including both readers and writers.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock to take.

int **rwlock_writer_give** (**struct** *rwlock_t* **self_p*)
Give given reader-writer lock.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock to give.

int **rwlock_writer_give_isr** (**struct** *rwlock_t* **self_p*)

Give given reader-writer lock from isr or with the system lock taken.

Return zero(0) or negative error code.

Parameters

- `self_p`: Reader-writer lock to give.

struct rwlock_t

#include <rwlock.h>

Public Members

int **number_of_readers**

int **number_of_writers**

volatile struct rwlock_elem_t ***readers_p**

volatile struct rwlock_elem_t ***writers_p**

`sem` — Counting semaphores

The semaphore is a synchronization primitive used to protect a shared resource. A semaphore counts the number of resources taken, and suspends threads when the maximum number of resources are taken. When a resource becomes available, a suspended thread is resumed.

A semaphore initialized with *count_max* one(1) is called a binary semaphore. A binary semaphore can only be taken by one thread at a time and can be used to signal that an event has occured. That is, *sem_give()* may be called multiple times and the semaphore resource count will remain at zero(0) until *sem_take()* is called.

Source code: src/sync/sem.h, src/sync/sem.c

Test code: tst/sync/sem/main.c

Test coverage: src/sync/sem.c

Defines

SEM_INIT_DECL (name, _count, _count_max)

Functions

int **sem_module_init** (void)

Initialize the semaphore module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code

int **sem_init** (**struct** *sem_t* **self_p*, int *count*, int *count_max*)

Initialize given semaphore object. Maximum count is the number of resources that can be taken at any given moment.

Return zero(0) or negative error code.

Parameters

- `self_p`: Semaphore to initialize.
- `count`: Initial taken resource count. Set the initial count to the same value as count_max to initialize the semaphore with all resources taken.
- `count_max`: Maximum number of resources that can be taken at any given moment.

int **sem_take** (**struct** *sem_t* **self_p*, **struct** *time_t* **timeout_p*)

Take given semaphore. If the semaphore count is zero the calling thread will be suspended until count is incremented by `sem_give()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Semaphore to take.
- `timeout_p`: Timeout.

int **sem_give** (**struct** *sem_t* **self_p*, int *count*)

Give given count to given semaphore. Any suspended thread waiting for this semaphore, in `sem_take()`, is resumed. This continues until the semaphore count becomes zero or there are no threads in the suspended list.

Giving a count greater than the currently taken count is allowed and results in all resources available. This is especially useful for binary semaphores where `sem_give()` if often called more often than `sem_take()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Semaphore to give count to.
- `count`: Count to give.

int **sem_give_isr** (**struct** *sem_t* **self_p*, int *count*)

Give given count to given semaphore from isr or with the system lock taken.

Return zero(0) or negative error code.

Parameters

- `self_p`: Semaphore to give count to.
- `count`: Count to give.

struct **sem_t**

Public Members

int **count**
Number of used resources.

int **count_max**
Maximum number of resources.

struct *thrd_prio_list_t* **waiters**
Wait list.

drivers

The drivers package on Github.

Modules:

adc — Analog to digital convertion

Source code: src/drivers/adc.h, src/drivers/adc.c

Test code: tst/drivers/adc/main.c

Defines

ADC_REFERENCE_VCC

Functions

int **adc_module_init** (void)
Initialize the ADC driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **adc_init** (**struct** adc_driver_t **self_p*, **struct** adc_device_t **dev_p*, **struct** pin_device_t **pin_dev_p*, int *reference*, long *sampling_rate*)
Initialize given driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: ADC device to use.
- `pin_dev_p`: Pin device to use.
- `reference`: Voltage reference. Only `ADC_REFERENCE_VCC` is supported.

- `sampling_rate`: Sampling rate in Hz. The lowest allowed value is one and the highest value depends on the architechture. The sampling rate is not used in single sample convertions, ie. calls to `adc_async_convert()` and `adc_convert()` with length one; or calls to `adc_convert_isr()`.

int **adc_async_convert** (**struct** adc_driver_t **self_p*, uint16_t **samples_p*, size_t *length*)

Start an asynchronous convertion of analog signal to digital samples. Call `adc_async_wait()` to wait for the convertion to complete.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `samples_p`: Converted samples.
- `length`: Length of samples array.

int **adc_async_wait** (**struct** adc_driver_t **self_p*)

Wait for an asynchronous convertion to complete.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **adc_convert** (**struct** adc_driver_t **self_p*, uint16_t **samples_p*, size_t *length*)

Start a synchronous convertion of an analog signal to digital samples. This is equivalent to `adc_async_convert()` + `adc_async_wait()`, but in a single function call.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `samples_p`: Converted samples.
- `length`: Length of samples array.

int **adc_convert_isr** (**struct** adc_driver_t **self_p*, uint16_t **sample_p*)

Start a synchronous convertion of analog signal to digital samples from isr or with the system lock taken. This function will poll the ADC hardware until the sample has been coverted.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `sample_p`: Converted sample.

int **adc_is_valid_device** (**struct** adc_device_t **dev_p*)

Check if given ADC device is valid.

Return true(1) if the pin device is valid, otherwise false(0).

Parameters

- `dev_p`: ADC device to validate.

Variables

struct adc_device_t **adc_device**[ADC_DEVICE_MAX]

`analog_input_pin` — Analog input pin

Source code: src/drivers/analog_input_pin.h, src/drivers/analog_input_pin.c

Test code: tst/drivers/analog_input_pin/main.c

Functions

int **analog_input_pin_module_init**(void)

Initialize the analog input pin module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **analog_input_pin_init**(**struct** *analog_input_pin_t* **self_p*, **struct** pin_device_t **dev_p*)

Initialize given driver object with given device and mode.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Device to use.

int **analog_input_pin_read**(**struct** *analog_input_pin_t* **self_p*)

Read the current value of given pin.

Return Analog pin value, otherwise negative error code.

Parameters

- `self_p`: Driver object.

int **analog_input_pin_read_isr**(**struct** *analog_input_pin_t* **self_p*)

Read the current value of given pin from an isr or with the system lock taken.

Return Analog pin value, otherwise negative error code.

Parameters

- `self_p`: Driver object.

struct analog_input_pin_t

#include <analog_input_pin.h>

Public Members

struct adc_driver_t **adc**

`analog_output_pin` — Analog output pin

Source code: src/drivers/analog_output_pin.h, src/drivers/analog_output_pin.c

Test code: tst/drivers/analog_output_pin/main.c

Functions

int **analog_output_pin_module_init**(void)

Initialize the analog output pin module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **analog_output_pin_init**(**struct** *analog_output_pin_t* **self_p*, **struct** pin_device_t **dev_p*)

Initialize given driver object with given device and mode.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Device to use.

int **analog_output_pin_write**(**struct** *analog_output_pin_t* **self_p*, int *value*)

Write given value to the analog pin.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `value`: The value to write to the pin. A number in the range 0 to 1023, where 0 is lowest output and 1023 is highest output.

int **analog_output_pin_read**(**struct** *analog_output_pin_t* **self_p*)

Read the value that is currently written to given analog output pin.

Return Value in the range 0 to 1023, or negative error code.

Parameters

- `self_p`: Driver object.

struct analog_output_pin_t

#include <analog_output_pin.h>

Public Members

struct pwm_driver_t **pwm**

can — Controller Area Network

A Controller Area Network (CAN bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other in applications without a host computer. It is a message-based protocol, designed originally for multiplex electrical wiring within automobiles, but is also used in many other contexts.

Below is a short example of how to use this module. The error handling is left out for readability.

```
struct can_frame_t can_rx_buf[8];
struct can_frame_t frame;

/* Initialize and start the CAN conroller. */
can_init(&can,
         &can_device[0],
         CAN_SPEED_500KBPS,
         can_rx_buf,
         sizeof(can_rx_buf)) == 0);
can_start(&can);

/* Read a frame from the bus. */
can_read(&can, &frame, sizeof(frame));

/* Stop the CAN controller. */
can_stop(&can);
```

Source code: src/drivers/can.h, src/drivers/can.c

Test code: tst/drivers/can/main.c

Defines

CAN_SPEED_1000KBPS

CAN_SPEED_500KBPS

CAN_SPEED_250KBPS

Functions

int **can_module_init** (void)

Initialize CAN module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **can_init** (**struct** can_driver_t **self_p*, **struct** can_device_t **dev_p*, uint32_t *speed*, void **rxbuf_p*, size_t *size*)

Initialize given driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `dev_p`: CAN device to use.
- `speed`: Can bus speed. One of the defines with the prefix`CAN_SPEED_`.
- `rxbuf_p`: CAN frame reception buffer.
- `size`: Size of the reception buffer in bytes.

int **can_start** (**struct** can_driver_t **self_p*)

Starts the CAN device using configuration in given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **can_stop** (**struct** can_driver_t **self_p*)

Stops the CAN device referenced by given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

ssize_t **can_read** (**struct** can_driver_t **self_p*, **struct** *can_frame_t* **frame_p*, size_t *size*)

Read one or more CAN frames from the CAN bus. Blocks until the frame(s) are received.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `frame_p`: Array of read frames.
- `size`: Size of frames buffer in bytes. Must be a multiple of `sizeof(struct can_frame_t)`.

ssize_t **can_write** (**struct** can_driver_t **self_p*, **const struct** *can_frame_t* **frame_p*, size_t *size*)

Write one or more CAN frames to the CAN bus. Blocks until the frame(s) have been transmitted.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `frame_p`: Array of frames to write.
- `size`: Size of frames buffer in bytes. Must be a multiple of `sizeof(struct can_frame_t)`.

Variables

struct can_device_t **can_device**[CAN_DEVICE_MAX]

struct can_frame_t

Public Members

uint32_t **id**

uint8_t **extended_frame**

uint8_t **rtr**

uint8_t **size**

struct can_frame_t::@0 can_frame_t::@1

uint8_t **u8**[8]

uint32_t **u32**[2]

union can_frame_t::@2 can_frame_t::data

`chipid` — Chip identity

Source code: src/drivers/chipid.h, src/drivers/chipid.c

Test code: tst/drivers/chipid/main.c

Functions

int **chipid_read**(**struct** chipid_t **id_p*)

`dac` — Digital to analog convertion

Source code: src/drivers/dac.h, src/drivers/dac.c

Test code: tst/drivers/dac/main.c

Functions

int **dac_module_init**(void)

Initialize DAC driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **dac_init**(**struct** dac_driver_t **self_p*, **struct** dac_device_t **dev_p*, **struct** pin_device_t **pin0_dev_p*, **struct** pin_device_t **pin1_dev_p*, int *sampling_rate*)

Initialize given driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Device to use.
- `pin0_dev_p`: Pin used for mono or first stereo channel.
- `pin1_dev_p`: Second stereo pin.
- `sampling_rate`: Sampling rate in Hz.

int **dac_async_convert** (**struct** dac_driver_t **self_p*, void **samples_p*, size_t *length*)
Start an asynchronous convertion of samples to an analog signal.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `samples`: Samples to convert to an analog signal.
- `length`: Length of samples array.

int **dac_async_wait** (**struct** dac_driver_t **self_p*)
Wait for ongoing asynchronous convertion to finish.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **dac_convert** (**struct** dac_driver_t **self_p*, void **samples_p*, size_t *length*)
Start synchronous convertion of samples to an analog signal.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `samples`: Converted samlpes.
- `length`: Length of samples array.

Variables

struct dac_device_t **dac_device**[DAC_DEVICE_MAX]

`ds18b20` — One-wire temperature sensor

Source code: src/drivers/ds18b20.h, src/drivers/ds18b20.c

Test code: tst/drivers/ds18b20/main.c

Defines

DS18B20_FAMILY_CODE

Functions

int **ds18b20_module_init** (void)

Initialize the DS18B20 driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **ds18b20_init** (**struct** *ds18b20_driver_t* **self_p*, **struct** *owi_driver_t* **owi_p*)

Initialize given driver object. The driver object will communicate with all DS18B20 devices on given OWI bus.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `owi_p`: One-Wire (OWI) driver.

int **ds18b20_convert** (**struct** *ds18b20_driver_t* **self_p*)

Start temperature convertion on all sensors.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.

int **ds18b20_get_temperature** (**struct** *ds18b20_driver_t* **self_p*, **const** uint8_t **id_p*, int **temp_p*)

Get the temperature for given device identity.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `id_p`: Device identity.
- `temp_p`: Measured temperature in Q4.4 to Q8.4 depending on resolution.

char ***ds18b20_get_temperature_str** (**struct** *ds18b20_driver_t* **self_p*, **const** uint8_t **id_p*, char **temp_p*)

Get temperature for given device identity formatted as a string.

Return `temp_p` on success, NULL otherwise.

Parameters

- `self_p`: Driver object to be initialized.
- `id_p`: Device identity.
- `temp_p`: Measured formatted temperature.

struct ds18b20_driver_t

Public Members

struct *owi_driver_t* ***owi_p**

struct *ds18b20_driver_t* ***next_p**

ds3231 — RTC clock

Source code: src/drivers/ds3231.h, src/drivers/ds3231.c

Test code: tst/drivers/ds3231/main.c

Functions

int **ds3231_init** (**struct** *ds3231_driver_t* **self_p*, **struct** i2c_driver_t **i2c_p*)

Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `i2c_p`: I2C driver to use.

int **ds3231_set_date** (**struct** *ds3231_driver_t* **self_p*, **struct** *date_t* **date_p*)

Set date in the DS3231 device.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `date_p`: Date to set in the device.

int **ds3231_get_date** (**struct** *ds3231_driver_t* **self_p*, **struct** *date_t* **date_p*)

Get date from the DS3231 device.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `date_p`: Date read from the device.

struct ds3231_driver_t

#include <ds3231.h>

Public Members

struct i2c_driver_t ***i2c_p**

`eeprom_soft` — Software EEPROM

Source code: src/drivers/eeprom_soft.h, src/drivers/eeprom_soft.c

Test code: tst/drivers/eeprom_soft/main.c

Functions

int **eeprom_soft_module_init** (void)

Initialize software EEPROM module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **eeprom_soft_init** (**struct** *eeprom_soft_driver_t* **self_p*, **struct** flash_driver_t **flash_p*, **const struct** *eeprom_soft_block_t* **blocks_p*, int *number_of_blocks*, size_t *chunk_size*)

Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `flash_p`: Flash driver.
- `blocks_p`: Flash memory blocks to use.
- `number_of_blocks`: Number of blocks.
- `chunk_size`: Chunk size in bytes. This is the size of the EEPROM. Eight bytes of the chunk will be used to store metadata, so only `chunk_size - 8` bytes are available to the user.

int **eeprom_soft_mount** (**struct** *eeprom_soft_driver_t* **self_p*)

Mount given software EEPROM.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to mount.

int **eeprom_soft_format** (**struct** *eeprom_soft_driver_t* **self_p*)

Format given software EEPROM.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to format.

ssize_t **eeprom_soft_read** (**struct** *eeprom_soft_driver_t* **self_p*, void **dst_p*, uintptr_t *src*, size_t *size*)

Read into given buffer from given address.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `dst_p`: Buffer to read into.
- `src`: Software EEPROM address to read from. Addressing starts at zero(0).
- `size`: Number of bytes to read.

ssize_t **eeprom_soft_write** (**struct** *eeprom_soft_driver_t* **self_p*, uintptr_t *dst*, **const** void **src_p*, size_t *size*)

Write given buffer to given address.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `dst`: Software EEPROM address to write to. Addressing starts at zero(0).
- `src_p`: Buffer to write.
- `size`: Number of bytes to write.

struct eeprom_soft_block_t

#include <eeprom_soft.h>

Public Members

uintptr_t **address**

size_t **size**

struct eeprom_soft_driver_t

Public Members

struct flash_driver_t ***flash_p**

const struct *eeprom_soft_block_t* ***blocks_p**

int **number_of_blocks**

size_t **chunk_size**

size_t **eeprom_size**

const struct *eeprom_soft_block_t* ***block_p**

uintptr_t **chunk_address**

uint16_t **revision**

struct eeprom_soft_driver_t::@3 eeprom_soft_driver_t::current

`esp_wifi` — Espressif WiFi

This module is a wrapper for the Espressif WiFi interface.

Configure the WiFi as a Station and an Access Point at the same time. The application tries to connect to a Wifi with SSID *ssid* and will accept connections to the SSID *Simba*.

```
esp_wifi_set_op_mode(esp_wifi_op_mode_station_softap_t);
esp_wifi_softap_init("Simba", NULL);
esp_wifi_station_init("ssid", "password", NULL, NULL);
```

Configure the WiFi as an Access Point. The application will accept connections to the SSID *Simba*.

```
esp_wifi_set_op_mode(esp_wifi_op_mode_softap_t);
esp_wifi_softap_init("Simba", NULL);
```

Configure the WiFi as a Station. The application tries to connect to a Wifi with SSID *ssid*.

```
esp_wifi_set_op_mode(esp_wifi_op_mode_station_t);
esp_wifi_station_init("ssid", "password", NULL, NULL);
```

Configure the WiFi as a Station specifying the MAC address of the access point. The application tries to connect to a Wifi with a MAC of *c8:d7:19:0f:04:66* and SSID *ssid*.

```
esp_wifi_set_op_mode(esp_wifi_op_mode_station_t);
esp_wifi_station_init("ssid",
                      "password",
                      (uint8_t[]){0xc8, 0xd7, 0x19, 0x0f, 0x04, 0x66},
                      NULL);
```

Submodules:

`esp_wifi_softap` — Espressif WiFi SoftAP

This module is a wrapper for the Espressif WiFi SoftAP interface.

Source code: src/drivers/esp_wifi/softap.h, src/drivers/esp_wifi/softap.c

Test code: tst/drivers/esp_wifi/softap/main.c

Functions

int **esp_wifi_softap_init** (**const** char **ssid_p*, **const** char **password_p*)

Initialize the WiFi SoftAP interface.

Return zero(0) or negative error code.

Parameters

- `ssid_p`: SSID of the SoftAP.
- `password_p`: Password of SoftAP.

int **esp_wifi_softap_set_ip_info**(**const struct** *inet_if_ip_info_t* **info_p*)
Set the ip address, netmask and gateway of the WiFi SoftAP.

Return zero(0) or negative error code.

int **esp_wifi_softap_get_ip_info**(**struct** *inet_if_ip_info_t* **info_p*)
Get the SoftAP ip address, netmask and gateway.

Return zero(0) or negative error code.

Parameters

- `info_p`: Read ip information.

int **esp_wifi_softap_get_number_of_connected_stations**(void)
Get the number of stations connected to the SoftAP.

Return Number of conencted stations.

int **esp_wifi_softap_get_station_info**(**struct** *esp_wifi_softap_station_info_t* **info_p*, int *length*)
Get the information of stations connected to the SoftAP, including MAC and IP addresses.

Return Number of valid station information entries or negative error code.

Parameters

- `info_p`: An array to write the station information to.
- `length`: Length of the info array.

int **esp_wifi_softap_dhcp_server_start**(void)
Enable the SoftAP DHCP server.

Return zero(0) or negative error code.

int **esp_wifi_softap_dhcp_server_stop**(void)
Disable the SoftAP DHCP server. The DHCP server is enabled by default.

Return zero(0) or negative error code.

enum *esp_wifi_dhcp_status_t* **esp_wifi_softap_dhcp_server_status**(void)
Get the SoftAP DHCP server status.

Return DHCP server status.

struct esp_wifi_softap_station_info_t
#include <softap.h>

Public Members

uint8_t **bssid**[6]

struct *inet_ip_addr_t* **ip_address**

`esp_wifi_station` — Espressif WiFi Station

This module is a wrapper for the Espressif WiFi station interface.

Source code: src/drivers/esp_wifi/station.h, src/drivers/esp_wifi/station.c

Test code: tst/drivers/esp_wifi/station/main.c

Enums

enum esp_wifi_station_status_t

Values:

esp_wifi_station_status_idle_t = 0

esp_wifi_station_status_connecting_t

esp_wifi_station_status_auth_failure_t

esp_wifi_station_status_no_ap_found_t

esp_wifi_station_status_connect_fail_t

esp_wifi_station_status_got_ip_t

esp_wifi_station_status_connected_t

Functions

int **esp_wifi_station_init** (**const** char **ssid_p*, **const** char **password_p*, **const** uint8_t **bssid_p*, **const** **struct** *inet_if_ip_info_t *info_p*)

Initialize the WiFi station.

Return zero(0) or negative error code.

Parameters

- `ssid_p`: WiFi SSID to connect to.
- `password_p`: WiFi password.
- `bssid_p`: WiFi station MAC (BSSID) or NULL to ignore.
- `info_p`: Static ip configration or NULL to use DHCP.

int **esp_wifi_station_connect** (void)

Connect the WiFi station to the Access Point (AP).

Return zero(0) or negative error code.

int **esp_wifi_station_disconnect** (void)

Disconnect the WiFi station from the AP.

Return zero(0) or negative error code.

int **esp_wifi_station_set_ip_info**(**const struct** *inet_if_ip_info_t* **info_p*)
Set the ip address, netmask and gateway of the WiFi station.

Return zero(0) or negative error code.

int **esp_wifi_station_get_ip_info**(**struct** *inet_if_ip_info_t* **info_p*)
Get the station ip address, netmask and gateway.

Return zero(0) or negative error code.

int **esp_wifi_station_set_reconnect_policy**(int *policy*)
Set whether the station will reconnect to the AP after disconnection. It will do so by default.

Return zero(0) or negative error code.

Parameters

- `policy`: If it's true, it will enable reconnection; if it's false, it will disable reconnection.

int **esp_wifi_station_get_reconnect_policy**(void)
Check whether the station will reconnect to the AP after disconnection.

Return true(1) or false(0).

enum *esp_wifi_station_status_t* **esp_wifi_station_get_status**(void)
Get the connection status of the WiFi station.

Return The connection status.

int **esp_wifi_station_dhcp_client_start**(void)
Enable the station DHCP client.

Return zero(0) or negative error code.

int **esp_wifi_station_dhcp_client_stop**(void)
Disable the station DHCP client.

Return zero(0) or negative error code.

enum *esp_wifi_dhcp_status_t* **esp_wifi_station_dhcp_client_status**(void)
Get the station DHCP client status.

Return Station DHCP client status.

const char ***esp_wifi_station_status_as_string**(**enum** *esp_wifi_station_status_t* *status*)
Convert given status code to a string.

Return Status code as a string.

Source code: src/drivers/esp_wifi.h, src/drivers/esp_wifi.c

Test code: tst/drivers/esp_wifi/main.c

Enums

enum **esp_wifi_op_mode_t**
Values:

esp_wifi_op_mode_null_t = 0

esp_wifi_op_mode_station_t

esp_wifi_op_mode_softap_t

esp_wifi_op_mode_station_softap_t

esp_wifi_op_mode_max_t

enum **esp_wifi_phy_mode_t**
Physical WiFi mode.

Values:

esp_wifi_phy_mode_11b_t = 1

esp_wifi_phy_mode_11g_t

esp_wifi_phy_mode_11n_t

enum **esp_wifi_dhcp_status_t**
DHCP status.

Values:

esp_wifi_dhcp_status_stopped_t = 0

esp_wifi_dhcp_status_running_t

Functions

int **esp_wifi_module_init** (void)
Initialize the Espressif WiFi module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **esp_wifi_set_op_mode** (**enum** *esp_wifi_op_mode_t mode*)
Set the WiFi operating mode to None, Station, SoftAP or Station + SoftAP. The default mode is SoftAP.

Return zero(0) or negative error code.

Parameters

- `mode`: Operating mode to set.

enum *esp_wifi_op_mode_t* **esp_wifi_get_op_mode** (void)
Get the current WiFi operating mode. The operating mode can be None, Station, SoftAP, or Station + SoftAP.

Return Current operating mode.

int **esp_wifi_set_phy_mode** (**enum** *esp_wifi_phy_mode_t mode*)
Set the WiFi physical mode (802.11b/g/n).

The SoftAP only supports b/g.

Return zero(0) or negative error code.

Parameters

- `mode`: Physical mode.

enum *esp_wifi_phy_mode_t* **esp_wifi_get_phy_mode** (void)
Get the physical mode (802.11b/g/n).

Return WiFi physical mode.

void **esp_wifi_print** (void **chout_p*)
Print information about the WiFi.

`exti` — External interrupts

Source code: src/drivers/exti.h, src/drivers/exti.c

Test code: tst/drivers/exti/main.c

Defines

EXTI_TRIGGER_BOTH_EDGES
Trigger an interrupt on both rising and falling edges.

EXTI_TRIGGER_FALLING_EDGE
Trigger an interrupt on falling edges.

EXTI_TRIGGER_RISING_EDGE
Trigger an interrupt on both rising edges.

Functions

int **exti_module_init** (void)
Initialize the external interrupt (EXTI) module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **exti_init** (**struct** exti_driver_t **self_p*, **struct** exti_device_t **dev_p*, int *trigger*, void (**on_interrupt*)) void *arg_p
, void **arg_p*Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Device to use.
- `trigger`: One of `EXTI_TRIGGER_BOTH_EDGES`, `EXTI_TRIGGER_FALLING_EDGE` or `EXTI_TRIGGER_RISING_EDGE`.
- `on_interrupt`: Function callback called when an interrupt occurs.
- `arg_p`: Fucntion callback argument.

int **exti_start** (**struct** exti_driver_t **self_p*)
Starts the EXTI device using given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **exti_stop** (**struct** exti_driver_t **self_p*)
Stops the EXTI device referenced by given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **exti_clear** (**struct** exti_driver_t **self_p*)
Clear the interrupt flag.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

Variables

struct exti_device_t **exti_device**[EXTI_DEVICE_MAX]

`flash` — Flash memory

Source code: src/drivers/flash.h, src/drivers/flash.c

Test code: tst/drivers/flash/main.c

Functions

int **flash_module_init** (void)
Initialize the flash module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **flash_init** (**struct** flash_driver_t **self_p*, **struct** flash_device_t **dev_p*)
Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `dev_p`: Device to use.

ssize_t **flash_read** (**struct** flash_driver_t **self_p*, void **dst_p*, uintptr_t *src*, size_t *size*)
Read data from given flash memory.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `dst_p`: Buffer to read into.
- `src`: Address in flash memory to read from.
- `size`: Number of bytes to receive.

ssize_t **flash_write** (**struct** flash_driver_t **self_p*, uintptr_t *dst*, **const** void **src_p*, size_t *size*)
Write data to given flash memory.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `dst`: Address in flash memory to write to.
- `src_p`: Buffer to write.
- `size`: Number of bytes to write.

int **flash_erase** (**struct** flash_driver_t **self_p*, uintptr_t *addr*, size_t *size*)
Erase all sectors part of given memory range.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `dst`: Address in flash memory to erase from.
- `size`: Number of bytes to erase.

Variables

struct flash_device_t **flash_device**[FLASH_DEVICE_MAX]

i2c — I2C

I2C is a data transfer bus. Normally one master and one or more slaves are connected to the bus. The master addresses one slave at a time to transfer data between the devices.

The master is normally fairly easy to implement since it controls the bus clock and no race conditions can occur. The slave, on the other hand, can be implemented in various ways depending on the application requirements. In this implementation the slave will always send an acknowledgement when addressed by the master, and lock the bus by pulling SCL low until it is ready for the transmission.

This driver is for systems with hardware I2C support. For systems without hardware I2C support the *i2c_soft — Software I2C* driver can be used.

Source code: src/drivers/i2c.h, src/drivers/i2c.c

Test code: tst/drivers/i2c/master/main.c

Defines

I2C_BAUDRATE_3_2MBPS

I2C_BAUDRATE_1MBPS

I2C_BAUDRATE_400KBPS

I2C_BAUDRATE_100KBPS

Functions

int **i2c_module_init**()

Initialize the i2c module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **i2c_init**(**struct** i2c_driver_t **self_p*, **struct** i2c_device_t **dev_p*, int *baudrate*, int *address*)

Initialize given driver object. The same driver object is used for both master and slave modes. Use `i2c_start()` to start the device as a master, and `i2c_slave_start()` to start it as a slave.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `dev_p`: I2C device to use.
- `baudrates`: Bus baudrate when in master mode. Unused in slave mode.
- `address`: Slave address when in slave mode. Unused in master mode.

int **i2c_start**(**struct** i2c_driver_t **self_p*)

Start given driver object in master mode. Enables data reception and transmission, but does not start any transmission. Use `i2c_read()` and `i2c_write()` to exchange data with the peer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

int **i2c_stop**(**struct** i2c_driver_t **self_p*)
Stop given driver object. Disables data reception and transmission in master mode.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

ssize_t **i2c_read**(**struct** i2c_driver_t **self_p*, int *address*, void **buf_p*, size_t *size*)
Read given number of bytes into given buffer from given slave.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Driver object.
- `address`: Slave address to read from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **i2c_write**(**struct** i2c_driver_t **self_p*, int *address*, **const** void **buf_p*, size_t *size*)
Write given number of bytes from given buffer to given slave.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Driver object.
- `address`: Slave address to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

int **i2c_scan**(**struct** i2c_driver_t **self_p*, int *address*)
Scan the i2c bus for a slave with given address.

Return true(1) if a slave responded to given address, otherwise false(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `address`: Address of the slave to scan for.

int **i2c_slave_start**(**struct** i2c_driver_t **self_p*)
Start given driver object in slave mode. Enables data reception and transmission, but does not start any transmission. Data transfers are started by calling the `i2c_slave_read()` and `i2c_slave_write()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

int **i2c_slave_stop** (**struct** i2c_driver_t **self_p*)

Stop given driver object. Disables data reception and transmission in slave mode.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

ssize_t **i2c_slave_read** (**struct** i2c_driver_t **self_p*, void **buf_p*, size_t *size*)

Read into given buffer from the next master that addresses this slave.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **i2c_slave_write** (**struct** i2c_driver_t **self_p*, **const** void **buf_p*, size_t *size*)

Write given buffer to the next master that addresses this slave.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Driver object.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

Variables

struct i2c_device_t **i2c_device**[I2C_DEVICE_MAX]

`i2c_soft` — Software I2C

I2C is a data transfer bus. Normally one master and one or more slaves are connected to the bus. The master addresses one slave at a time to transfer data between the devices.

This driver implements I2C in software for MCUs without I2C hardware support. For systems with hardware I2C support, the *i2c — I2C* driver will probably be preferable.

Source code: src/drivers/i2c_soft.h, src/drivers/i2c_soft.c

Test code: tst/drivers/i2c/master_soft/main.c

Functions

int **i2c_soft_module_init**(void)

Initialize the i2c soft module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **i2c_soft_init**(**struct** *i2c_soft_driver_t* **self_p*, **struct** pin_device_t **scl_dev_p*, **struct** pin_device_t **sda_dev_p*, long *baudrate*, long *max_clock_stretching_us*, long *clock_stretching_sleep_us*)

Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `scl_dev_p`: The I2C clock pin (SCL).
- `sda_dev_p`: The I2C data pin (SDA).
- `baudrate`: Bus baudrate.
- `max_clock_stretching_us`: Maximum number of microseconds to wait for the clock stretching to end.
- `clock_stretching_sleep_us`: SCL poll interval in number of microseconds waiting for clock stretching to end.

int **i2c_soft_start**(**struct** *i2c_soft_driver_t* **self_p*)

Start given driver object. Enables data reception and transmission, but does not start any transmission. Data tarnsfers are started by calling the `i2c_soft_read()` and `i2c_soft_write()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

int **i2c_soft_stop**(**struct** *i2c_soft_driver_t* **self_p*)

Stop given driver object. Disables data reception and transmission.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

ssize_t **i2c_soft_read**(**struct** *i2c_soft_driver_t* **self_p*, int *address*, void **buf_p*, size_t *size*)

Read given number of bytes into given buffer from given slave.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Driver object.
- `address`: Slave address to read from.

- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **i2c_soft_write** (**struct** *i2c_soft_driver_t* **self_p*, int *address*, **const** void **buf_p*, size_t *size*)

Write given number of bytes from given buffer to given slave.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Driver object.
- `address`: Slave address to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

int **i2c_soft_scan** (**struct** *i2c_soft_driver_t* **self_p*, int *address*)

Scan the i2c bus for a slave with given address.

Return true(1) if a slave responded to given address, otherwise false(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `address`: Address of the slave to scan for.

struct i2c_soft_driver_t

#include <i2c_soft.h>

Public Members

struct pin_device_t ***scl_p**

struct pin_device_t ***sda_p**

long **baudrate**

long **baudrate_us**

long **max_clock_stretching_us**

long **clock_stretching_sleep_us**

`led_7seg_ht16k33` — LED 7-Segment HT16K33

This is a driver for **'Adafruit 0.56" 4-Digit 7-Segment Display w/I2C Backpack'_** or compatible devices which uses the Holtek HT16K33 chip.

At this time the driver only supports using the *i2c_soft — Software I2C* driver to communicate with the HT16K33, not the *i2c — I2C* driver.

Source code: src/drivers/led_7seg_ht16k33.h, src/drivers/led_7seg_ht16k33.c

Defines

LED_7SEG_HT16K33_BRIGHTNESS_MIN
Minimum brightness.

LED_7SEG_HT16K33_BRIGHTNESS_MAX
Maximum brightness.

LED_7SEG_HT16K33_DEFAULT_I2C_ADDR
Default I2C address for HT16K33.

Functions

int **led_7seg_ht16k33_module_init**(void)
Initialize the driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **led_7seg_ht16k33_init**(**struct** *led_7seg_ht16k33_driver_t* **self_p*, **struct** *i2c_soft_driver_t* **i2c_p*, int *i2c_addr*)
Initialize driver object. The driver object will be used for a single display.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialize.
- `i2c_p`: The I2C driver pointer.
- `i2c_addr`: The address of the HT16K33 controller. Probably LED_7SEG_HT16K33_DEFAULT_I2C_ADDR.

int **led_7seg_ht16k33_start**(**struct** *led_7seg_ht16k33_driver_t* **self_p*)
Start driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **led_7seg_ht16k33_display**(**struct** *led_7seg_ht16k33_driver_t* **self_p*)
Send content of display buffer to the display.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **led_7seg_ht16k33_clear**(**struct** *led_7seg_ht16k33_driver_t* **self_p*)
Clear content of display buffer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **led_7seg_ht16k33_brightness** (**struct** *led_7seg_ht16k33_driver_t* **self_p*, int *brightness*)
Set display brightness.

Return zero(0) or negative error code.

Parameters

- `brightness`: Brightness from LED_7SEG_HT16K33_BRIGHTNESS_MIN to LED_7SEG_HT16K33_BRIGHTNESS_MAX.

int **led_7seg_ht16k33_set_num** (**struct** *led_7seg_ht16k33_driver_t* **self_p*, int *num*, int *base*)
Set a number in the display buffer.

Number cannot be more than 4 digits AKA base^4 - 1.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `num`: Number to set.
- `base`: Base of *num*.

int **led_7seg_ht16k33_show_colon** (**struct** *led_7seg_ht16k33_driver_t* **self_p*, int *show_colon*)
Set show/hide of colon in the display buffer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `show_colon`: If true light colon, otherwise turn off.

int **led_7seg_ht16k33_show_dot** (**struct** *led_7seg_ht16k33_driver_t* **self_p*, int *position*, int *show_colon*)
Set show/hide of dot in the display buffer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `position`: The position to light colon or not. Range: 0 to 3.
- `show_dot`: If true light dot, otherwise turn off.

struct led_7seg_ht16k33_driver_t
#include <led_7seg_ht16k33.h>

Public Members

struct *i2c_soft_driver_t* ***i2c_p**

int **i2c_addr**

uint8_t **buf**[5]

mcp2515 — CAN BUS chipset

Source code: src/drivers/mcp2515.h, src/drivers/mcp2515.c

Test code: tst/drivers/mcp2515/main.c

Defines

MCP2515_SPEED_1000KBPS

MCP2515_SPEED_500KBPS

MCP2515_MODE_NORMAL

MCP2515_MODE_LOOPBACK

Functions

int **mcp2515_init** (**struct** *mcp2515_driver_t* **self_p*, **struct** spi_device_t **spi_p*, **struct** pin_device_t **cs_p*, **struct** exti_device_t **exti_p*, void **chin_p*, int *mode*, int *speed*)

Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `spi_p`: SPI driver to use.
- `cs_p`: SPI chip select pin.
- `exti_p`: External interrupt tp use.
- `chin_p`: Frames received from the hardware are written to this channel.
- `mode`: Device mode.
- `speed`: CAN bus speed in kbps.

int **mcp2515_start** (**struct** *mcp2515_driver_t* **self_p*)

Starts the CAN device using given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **mcp2515_stop** (**struct** *mcp2515_driver_t* **self_p*)
Stops the CAN device referenced by driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

ssize_t **mcp2515_read** (**struct** *mcp2515_driver_t* **self_p*, **struct** *mcp2515_frame_t* **frame_p*)
Read a CAN frame.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `frame_p`: Read frame.

ssize_t **mcp2515_write** (**struct** *mcp2515_driver_t* **self_p*, **const struct** *mcp2515_frame_t* **frame_p*)
Write a CAN frame.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `frame_p`: Frame to write.

struct mcp2515_frame_t

Public Members

uint32_t **id**

int **size**

int **rtr**

uint32_t **timestamp**

uint8_t **data**[8]

struct mcp2515_driver_t

Public Functions

mcp2515_driver_t::THRD_STACK(stack, 1024)

Public Members

struct spi_driver_t **spi**

struct exti_driver_t **exti**

int **mode**

int **speed**

struct *chan_t* **chout**

struct *chan_t* ***chin_p**

struct *sem_t* **isr_sem**

struct *sem_t* **tx_sem**

`nrf24l01` — Wireless communication

Source code: src/drivers/nrf24l01.h, src/drivers/nrf24l01.c

Functions

int **nrf24l01_module_init**(void)
Initialize NRF24L01 module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **nrf24l01_init**(**struct** *nrf24l01_driver_t* **self_p*, **struct** spi_device_t **spi_p*, **struct** pin_device_t **cs_p*, **struct** pin_device_t **ce_p*, **struct** exti_device_t **exti_p*, uint32_t *address*)
Initialize given driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `spi_p`: SPI device.
- `cs_p`: Chip select pin device.
- `ce_p`: CE pin device.
- `exti_p`: External interrupt flagdevice.
- `address`: 4 MSB:s of RX pipes. LSB is set to 0 through 5 for the 6 pipes.

int **nrf24l01_start**(**struct** *nrf24l01_driver_t* **self_p*)
Starts the NRF24L01 device using given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **nrf24l01_stop**(**struct** *nrf24l01_driver_t* **self_p*)
Stops the NRF24L01 device referenced by driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

ssize_t **nrf24l01_read** (**struct** *nrf24l01_driver_t* **self_p*, void **buf_p*, size_t *size*)
Read data from the NRF24L01 device.

Return Number of received bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read (must be 32).

ssize_t **nrf24l01_write** (**struct** *nrf24l01_driver_t* **self_p*, uint32_t *address*, uint8_t *pipe*, **const** void **buf_p*, size_t *size*)
Write data to the NRF24L01 device.

Return number of sent bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `address`: 4 MSB:s of TX address.
- `pipe`: LSB of TX address.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write (must be 32).

struct nrf24l01_driver_t
#include <nrf24l01.h>

Public Members

struct spi_driver_t **spi**

struct exti_driver_t **exti**

struct pin_driver_t **ce**

struct *queue_t* **irqchan**

struct *queue_t* **chin**

struct *thrd_t* ***thrd_p**

uint32_t **address**

char **irqbuf**[8]

char **chinbuf**[32]

char **stack**[256]

`owi` — One-Wire Interface

Source code: src/drivers/owi.h, src/drivers/owi.c

Test code: tst/drivers/owi/main.c

Defines

OWI_SEARCH_ROM

OWI_READ_ROM

OWI_MATCH_ROM

OWI_SKIP_ROM

OWI_ALARM_SEARCH

Functions

int **owi_init** (**struct** *owi_driver_t* **self_p*, **struct** pin_device_t **dev_p*, **struct** *owi_device_t* **devices_p*, size_t *nmemb*)

Initialize driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Pin device to use.
- `devices_p`: Storage for devices found when searching.
- `nmemb`: Number of members in devices.

int **owi_reset** (**struct** *owi_driver_t* **self_p*)

Send reset on one wire bus.

Return true(1) if one or more devices are connected to the bus, false(0) if no devices were found, otherwise negative error code.

Parameters

- `self_p`: Driver object.

int **owi_search** (**struct** *owi_driver_t* **self_p*)

Search for devices on given one wire bus. The device id of all found devices are stored in the devices array passed to `owi_init()`.

Return Number of devices found or negative error code.

Parameters

- `self_p`: Driver object.

ssize_t **owi_read** (**struct** *owi_driver_t* **self_p*, void **buf_p*, size_t *size*)

Read into buffer from one wire bus.

Return Number of bits read or negative error code.

Parameters

- `self_p`: Driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bits to read.

ssize_t **owi_write** (**struct** *owi_driver_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write buffer to given one wire bus.

Return Number of bits written or negative error code.

Parameters

- `self_p`: Driver object.
- `buf_p`: Buffer to write.
- `size`: Number of bits to write.

struct owi_device_t

Public Members

uint8_t **id**[8]

struct owi_driver_t

Public Members

struct pin_driver_t **pin**

struct *owi_device_t* ***devices_p**

size_t **nmemb**

size_t **len**

`pin` — Digital pins

Debug file system commands

Three debug file system commands are available, all located in the directory `drivers/pin/`. These commands directly access the pin device registers, without using the pin driver object.

Command	Description
`set_mode <pin> <mode>`	Set the mode of the pin `<pin>` to `<mode>`, where `<mode>` is one of `output` and `input`.
`read <pin>`	Read current input or output value of the pin `<pin>`. `high` or `low` is printed.
`write <pin> <value>`	Write the value `<value>` to pin `<pin>`, where `<value>` is one of `high` and `low`.

Example output from the shell:

```
$ drivers/pin/set_mode d2 output
$ drivers/pin/read d2
low
$ drivers/pin/write d2 high
$ drivers/pin/read d2
high
$ drivers/pin/set_mode d3 input
$ drivers/pin/read d3
low
```

Source code: src/drivers/pin.h, src/drivers/pin.c

Test code: tst/drivers/pin/main.c

Defines

PIN_OUTPUT

PIN_INPUT
Configure the pin as an input pin.

Functions

int **pin_module_init** (void)
Initialize the pin module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **pin_init** (**struct** pin_driver_t **self_p*, **struct** pin_device_t **dev_p*, int *mode*)
Initialize given driver object with given device and mode.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Device to use.
- `mode`: Pin mode. One of `PIN_INPUT` or `PIN_OUTPUT`.

int **pin_write** (**struct** pin_driver_t **self_p*, int *value*)
Write given value to given pin.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `value`: `1` for high and `0` for low output.

int **pin_read** (**struct** pin_driver_t **self_p*)
Read the current value of given pin.

Return `1` for high and `0` for low input, otherwise negative error code.

Parameters

- `self_p`: Driver object.

int **pin_toggle** (**struct** pin_driver_t **self_p*)
Toggle the pin output value (high/low).

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **pin_set_mode** (**struct** pin_driver_t **self_p*, int *mode*)
Set the pin mode of given pin.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `mode`: New pin mode.

static int **pin_device_set_mode** (**const struct** pin_device_t **dev_p*, int *mode*)
Pin device mode to set. One of `PIN_INPUT` or `PIN_OUTPUT`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Pin device.
- `mode`: New pin mode.

static int **pin_device_read** (**const struct** pin_device_t **dev_p*)
Read the value of given pin device.

Return `1` for high and `0` for low input, otherwise negative error code.

Parameters

- `self_p`: Pin device.

static int **pin_device_write_high** (**const struct** pin_device_t **dev_p*)
Write high to given pin device.

Return zero(0) or negative error code.

Parameters

- `self_p`: Pin device.

static int **pin_device_write_low** (**const struct** pin_device_t **dev_p*)
Write low to given pin device.

Return zero(0) or negative error code.

Parameters

- `self_p`: Pin device.

int **pin_is_valid_device** (**struct** pin_device_t **dev_p*)
Check if given pin device is valid.

Return true(1) if the pin device is valid, otherwise false(0).

Parameters

- `dev_p`: Pin device to validate.

Variables

struct pin_device_t **pin_device**[PIN_DEVICE_MAX]

`pwm` — Pulse width modulation

Source code: src/drivers/pwm.h, src/drivers/pwm.c

Functions

int **pwm_module_init** (void)
Initialize the pwm module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **pwm_init** (**struct** pwm_driver_t **self_p*, **struct** pwm_device_t **dev_p*, long *frequency*, long *duty_cycle*)
Initialize given PWM driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: PWM device to use.
- `frequency`: Frequency.
- `duty_cycle`: Duty cycle.

int **pwm_start** (**struct** pwm_driver_t **self_p*)
Start given PWM driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to start.

int **pwm_stop** (**struct** pwm_driver_t **self_p*)
Stop given PWM driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to stop.

int **pwm_set_frequency** (**struct** pwm_driver_t **self_p*, long *value*)
Set the frequency of the PWM signal.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `value`: Frequency. Use `pwm_frequency()` to convert a frequency in Hertz to a value expected by this function.

long **pwm_get_frequency** (**struct** pwm_driver_t **self_p*)
Get current frequency.

Return Current frequency.

Parameters

- `self_p`: Driver object.

int **pwm_set_duty_cycle** (**struct** pwm_driver_t **self_p*, long *value*)
Set the duty cycle of the signal.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `value`: Duty cycle. Use `pwm_duty_cycle()` to convert a duty cycle percentage to a value expected by this function.

long **pwm_get_duty_cycle** (**struct** pwm_driver_t **self_p*)
Get current duty cycle.

Return Current duty cycle.

Parameters

- `self_p`: Driver object.

long **pwm_frequency** (int *hertz*)
Convert a duty cycle percentage to a value for `pwm_set_frequency()`.

Return Frequency.

Parameters

- `hertz`: Frequency in Hertz.

int **pwm_frequency_as_hertz** (long *value*)
Convert a frequency value returned by `pwm_get_frequency()` to Hertz.

Return Frequency in Hertz.

Parameters

- `value`: Frequency.

long **pwm_duty_cycle** (int *percentage*)
Convert a duty cycle percentage to a value for `pwm_set_duty_cycle()`.

Return Duty cycle.

Parameters

- `percentage`: Duty cycle percentage.

int **pwm_duty_cycle_as_percent** (long *value*)
Convert a duty cycle value returned by `pwm_get_duty_cycle()` to a percentage.

Return Duty cycle percentage.

Parameters

- `value`: Duty cycle.

struct pwm_device_t ***pwm_pin_to_device** (**struct** pin_device_t **pin_p*)
Get the PWM device for given pin.

Return PWM device, or NULL on error.

Parameters

- `pin_p`: The pin device to get the PWM device for.

Variables

struct pwm_device_t **pwm_device**[PWM_DEVICE_MAX]

`pwm_soft` — Software pulse width modulation

This module implements software PWM on all digital pins. In general, software PWM outputs an inaccurate, low frequency signal. Keep that in mind designing your application.

If an accurate and/or high frequency PWM signal is required, a *hardware PWM* should be used instead.

Here is a short example of how to use this module. A software PWM driver is initialized for digital pin 3 (D3). A software PWM signal with duty cycle 10% is outputted on D3 after the calling *pwm_soft_start()*.

```
struct pwm_soft_driver_t pwm_soft;

pwm_soft_module_init(500);
pwm_soft_init(&pwm_soft, &pin_d3_dev, pwm_soft_duty_cycle(10));
pwm_soft_start(&pwm_soft);
```

Change the duty cycle to 85% by calling *pwm_soft_set_duty_cycle()*.

```
pwm_soft_set_duty_cycle(&pwm_soft, pwm_soft_duty_cycle(85));
```

Stop outputting the software PWM signal to D3 by calling *pwm_soft_stop()*.

```
pwm_soft_stop(&pwm_soft);
```

Source code: src/drivers/pwm_soft.h, src/drivers/pwm_soft.c

Test code: tst/drivers/pwm_soft/main.c

Functions

int **pwm_soft_module_init** (long *frequency*)

Initialize the software PWM module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

Parameters

- `frequency`: PWM module frequency in Hertz. All software PWM:s will run at this frequency. The frequency can later be changed by calling `pwm_soft_set_frequency()`.

int **pwm_soft_set_frequency** (long *value*)

Set the frequency. The frequency is the same for all software PWM:s. All software PWM:s must be stopped before calling this function, otherwize a negative error code will be returned.

Return zero(0) or negative error code.

Parameters

- `value`: Frequency to set in Hertz. All software PWM:s will run at this frequency.

long **pwm_soft_get_frequency** (void)

Get current frequency.

Return Current frequency in Hertz.

int **pwm_soft_init** (**struct** *pwm_soft_driver_t* **self_p*, **struct** pin_device_t **pin_dev_p*, long *duty_cycle*)

Initialize given software PWM driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `pin_dev_p`: Pin device to use.
- `duty_cycle`: Initial duty cycle.

int **pwm_soft_start** (**struct** *pwm_soft_driver_t* **self_p*)

Start outputting the PWM signal on the pin given to `pwm_soft_init()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to start.

int **pwm_soft_stop** (**struct** *pwm_soft_driver_t* **self_p*)

Stop outputting the PWM signal on the pin given to `pwm_soft_init()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to stop.

int **pwm_soft_set_duty_cycle** (**struct** *pwm_soft_driver_t* **self_p*, long *value*)

Set the duty cycle. Calls `pwm_soft_stop()` and `pwm_soft_start()` to restart outputting the PWM signal with the new duty cycle.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `value`: Duty cycle. Use `pwm_soft_duty_cycle()` to convert a duty cycle percentage to a value expected by this function.

unsigned int **pwm_soft_get_duty_cycle** (**struct** *pwm_soft_driver_t* **self_p*)

Get current duty cycle. Use `pwm_soft_duty_cycle_as_percent()` to convert a duty cycle to a percentage.

Return Current duty cycle.

Parameters

- `self_p`: Driver object.

long **pwm_soft_duty_cycle** (int *percentage*)

Convert a duty cycle percentage to a value for `pwm_soft_init()` and `pwm_soft_set_duty_cycle()`.

Return Duty cycle.

Parameters

- `percentage`: Duty cycle percentage.

int **pwm_soft_duty_cycle_as_percent** (long *value*)

Convert a duty cycle value for `pwm_soft_init()` and `pwm_soft_set_duty_cycle()` to a percentage.

Return Duty cycle percentage.

Parameters

- `value`: Duty cycle.

struct pwm_soft_driver_t

#include <pwm_soft.h>

Public Members

struct pin_device_t ***pin_dev_p**

long **frequency**

long **duty_cycle**

unsigned int **delta**

struct *thrd_t* ***thrd_p**

struct *pwm_soft_driver_t* ***next_p**

`random` — Random numbers.

Source code: src/drivers/random.h, src/drivers/random.c

Test code: tst/drivers/random/main.c

Functions

int **random_module_init** (void)

uint32_t **random_read** (void)
Read a random number from the hardware.

Return Read random number.

`sd` — Secure Digital memory

Source code: src/drivers/sd.h, src/drivers/sd.c

Test code: tst/drivers/sd/main.c

Defines

SD_ERR_NORESPONSE_WAIT_FOR_DATA_START_BLOCK

SD_ERR_GO_IDLE_STATE

SD_ERR_CRC_ON_OFF

SD_ERR_SEND_IF_COND

SD_ERR_CHECK_PATTERN

SD_ERR_SD_SEND_OP_COND

SD_ERR_READ_OCR

SD_ERR_READ_COMMAND

SD_ERR_READ_DATA_START_BLOCK

SD_ERR_READ_WRONG_DATA_CRC

SD_ERR_WRITE_BLOCK

SD_ERR_WRITE_BLOCK_TOKEN_DATA_RES_ACCEPTED

SD_ERR_WRITE_BLOCK_WAIT_NOT_BUSY

SD_ERR_WRITE_BLOCK_SEND_STATUS

SD_BLOCK_SIZE

SD_CCC (csd_p)

SD_C_SIZE (csd_p)

SD_C_SIZE_MULT (csd_p)

SD_SECTOR_SIZE (csd_p)

SD_WRITE_BL_LEN (csd_p)

SD_CSD_STRUCTURE_V1

SD_CSD_STRUCTURE_V2

Functions

int **sd_init** (**struct** *sd_driver_t* **self_p*, **struct** spi_driver_t **spi_p*)

Initialize given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.

int **sd_start** (**struct** *sd_driver_t* **self_p*)

Start given SD card driver. This resets the SD card and performs the initialization sequence.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **sd_stop** (**struct** *sd_driver_t* **self_p*)

Stop given SD card driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

ssize_t **sd_read_cid** (**struct** *sd_driver_t* **self_p*, **struct** *sd_cid_t* **cid_p*)

Read card CID register. The CID contains card identification information such as Manufacturer ID, Product name, Product serial number and Manufacturing date.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `cid`: pointer to cid data store.

ssize_t **sd_read_csd** (**struct** *sd_driver_t* **self_p*, **union** *sd_csd_t* **csd_p*)
Read card CSD register. The CSD contains that provides information regarding access to the card's contents.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `csd`: pointer to csd data store.

ssize_t **sd_read_block** (**struct** *sd_driver_t* **self_p*, void **dst_p*, uint32_t *src_block*)
Read given block from SD card.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to read into.
- `src_block`: Block to read from.

ssize_t **sd_write_block** (**struct** *sd_driver_t* **self_p*, uint32_t *dst_block*, **const** void **src_p*)
Write data to the SD card.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `dst_block`: Block to write to.
- `src_p`: Buffer to write.

Variables

struct *sd_csd_v2_t* **PACKED**

struct sd_cid_t

Public Members

uint8_t **mid**

char **oid**[2]

char **pnm**[5]

uint8_t **prv**

uint32_t **psn**

uint16_t **mdt**

uint8_t **crc**

struct **sd_csd_v1_t**

Public Members

uint8_t **reserved1**

uint8_t **csd_structure**

uint8_t **taac**

uint8_t **nsac**

uint8_t **tran_speed**

uint8_t **ccc_high**

uint8_t **read_bl_len**

uint8_t **ccc_low**

uint8_t **c_size_high**

uint8_t **reserved2**

uint8_t **dsr_imp**

uint8_t **read_blk_misalign**

uint8_t **write_blk_misalign**

uint8_t **read_bl_partial**

uint8_t **c_size_mid**

uint8_t **vdd_r_curr_max**

uint8_t **vdd_r_curr_min**

uint8_t **c_size_low**

uint8_t **c_size_mult_high**

uint8_t **vdd_w_curr_max**

uint8_t **vdd_w_curr_min**

uint8_t **sector_size_high**

uint8_t **erase_blk_en**

uint8_t **c_size_mult_low**

uint8_t **wp_grp_size**

uint8_t **sector_size_low**

uint8_t **write_bl_len_high**

uint8_t **r2w_factor**

uint8_t **reserved3**

uint8_t **wp_grp_enable**

uint8_t **reserved4**

uint8_t **write_bl_partial**

uint8_t **write_bl_len_low**

uint8_t **reserved5**

uint8_t **file_format**

uint8_t **tmp_write_protect**

uint8_t **perm_write_protect**

uint8_t **copy**

uint8_t **file_format_grp**

uint8_t **crc**

struct sd_csd_v2_t

Public Members

uint8_t **reserved1**

uint8_t **csd_structure**

uint8_t **taac**

uint8_t **nsac**

uint8_t **tran_speed**

uint8_t **ccc_high**

uint8_t **read_bl_len**

uint8_t **ccc_low**

uint8_t **reserved2**

uint8_t **dsr_imp**

uint8_t **read_blk_misalign**

uint8_t **write_blk_misalign**

uint8_t **read_bl_partial**

uint8_t **c_size_high**

uint8_t **reserved3**

uint8_t **c_size_mid**

uint8_t **c_size_low**

uint8_t **sector_size_high**

uint8_t **erase_blk_en**

uint8_t **reserved4**

uint8_t **wp_grp_size**

uint8_t **sector_size_low**

uint8_t **write_bl_len_high**

uint8_t **r2w_factor**

uint8_t **reserved5**

uint8_t **wp_grp_enable**

uint8_t **reserved6**

uint8_t **write_bl_partial**

uint8_t **write_bl_len_low**

uint8_t **reserved7**

uint8_t **file_format**

uint8_t **tmp_write_protect**

uint8_t **perm_write_protect**

uint8_t **copy**

uint8_t **file_format_grp**

uint8_t **crc**

union sd_csd_t

Public Members

struct *sd_csd_v1_t* **v1**

struct *sd_csd_v2_t* **v2**

struct sd_driver_t

Public Members

struct spi_driver_t ***spi_p**

int **type**

sht3xd — SHT3x-D Humidity and Temperature Sensor

The Sensirion SHT3x-D is a series of digital of Humidity and Temperature Sensors. This driver supports the SHT30-D, SHT31-D, and SHT35-D using an I2C interface. The analog SHT3x-A, such as SHT30-A and SHT31-A are not supported.

The SHT3x-D sensors supports I2C speed of up to 1MHz.

Current limitations of this driver:

- Only supports using the *i2c_soft — Software I2C* driver to communicate with the SHT3x sensor, not the *i2c — I2C* driver.

- Only supports basic functionality and high repeatability mode.
- Does not perform check CRC of sensor result.

Datasheet: Datasheet SHT3x-DIS

Source code: src/drivers/sht3xd.h, src/drivers/sht3xd.c

Defines

SHT3X_DIS_I2C_ADDR_A
SHT3x-DIS default I2C address.

SHT3X_DIS_I2C_ADDR_B
SHT3x-DIS alternate I2C address.

MEASUREMENT_DURATION_HIGH_MS
Max measurement time for high repeatability.

Functions

int **sht3xd_module_init** (void)
Initialize the driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **sht3xd_init** (**struct** *sht3xd_driver_t* **self_p*, **struct** *i2c_soft_driver_t* **i2c_p*, int *i2c_addr*)
Initialize driver object. The driver object will be used for a single sensor.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialize.
- `i2c_p`: The I2C driver pointer.
- `i2c_addr`: The address of the SHT3x-D. Probably SHT3X_DIS_I2C_ADDR_A.

int **sht3xd_start** (**struct** *sht3xd_driver_t* **self_p*)
Start the driver.

This verify the sensor is present.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.

int **sht3xd_get_temp_humid** (**struct** *sht3xd_driver_t* **self_p*, float **temp_p*, float **humid_p*)
Get measurements and return it from the SHD3x-DIS chip.

This is a "high level" function which will block for the time it takes the sensor to perform the measurement.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `temp_p`: Tempererature in Celsius, or NULL.
- `humid_p`: Relative Humidity, or NULL.

int **sht3xd_get_serial**(**struct** *sht3xd_driver_t* **self_p*, uint32_t **serial_p*)

Get the serial number from the SHD3x-D.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `serial_p`: Serial number of the SHT3x-D sensor.

struct sht3xd_driver_t

#include <sht3xd.h>

Public Members

struct *i2c_soft_driver_t* ***i2c_p**

int **i2c_addr**

uint32_t **serial**

`spi` — Serial Peripheral Interface

Source code: src/drivers/spi.h, src/drivers/spi.c

Defines

SPI_MODE_SLAVE

SPI_MODE_MASTER

SPI_SPEED_8MBPS

SPI_SPEED_4MBPS

SPI_SPEED_2MBPS

SPI_SPEED_1MBPS

SPI_SPEED_500KBPS

SPI_SPEED_250KBPS

SPI_SPEED_125KBPS

Functions

int **spi_module_init**(void)

Initialize SPI module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **spi_init**(**struct** spi_driver_t **self_p*, **struct** spi_device_t **dev_p*, **struct** pin_device_t **ss_pin_p*, int *mode*, int *speed*, int *polarity*, int *phase*)

Initialize driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `dev_p`: Device to use.
- `ss_pin_p`: Slave select pin device.
- `mode`: Master or slave mode.
- `speed`: Speed in kbps.
- `polarity`: Set to 0 or 1.
- `phase`: Set to 0 or 1.

int **spi_start**(**struct** spi_driver_t **self_p*)

Start given SPI driver. Configures the SPI hardware.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **spi_stop**(**struct** spi_driver_t **self_p*)

Stop given SPI driver. Deconfigures the SPI hardware if given driver currently ownes the bus.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **spi_take_bus**(**struct** spi_driver_t **self_p*)

In multi master application the driver must take ownership of the SPI bus before performing data transfers. Will re-configure the SPI hardware if configured by another driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **spi_give_bus**(**struct** spi_driver_t **self_p*)

In multi master application the driver must give ownership of the SPI bus to let other masters take it.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **spi_select** (**struct** spi_driver_t **self_p*)
Select the slave by asserting the slave select pin.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **spi_deselect** (**struct** spi_driver_t **self_p*)
Deselect the slave by de-asserting the slave select pin.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

ssize_t **spi_transfer** (**struct** spi_driver_t **self_p*, void **rxbuf_p*, **const** void **txbuf_p*, size_t *size*)
Simultaniuos read/write operation over the SPI bus.

Return Number of transferred bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `rxbuf_p`: Buffer to read into.
- `txbuf_p`: Buffer to write.
- `size`: Number of bytes to transfer.

ssize_t **spi_read** (**struct** spi_driver_t **self_p*, void **buf_p*, size_t *size*)
Read data from the SPI bus.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to receive.

ssize_t **spi_write** (**struct** spi_driver_t **self_p*, **const** void **buf_p*, size_t *size*)
Write data to the SPI bus.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to write.

- `size`: Number of bytes to write.

ssize_t **spi_get** (**struct** spi_driver_t **self_p*, uint8_t **data_p*)
Get one byte of data from the SPI bus.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `data_p`: Read data.

ssize_t **spi_put** (**struct** spi_driver_t **self_p*, uint8_t *data*)
Put one byte of data to the SPI bus.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `data`: data to write.

Variables

struct spi_device_t **spi_device**[SPI_DEVICE_MAX]

`uart` — Universal Asynchronous Receiver/Transmitter

Source code: src/drivers/uart.h, src/drivers/uart.c

Test code: tst/drivers/uart/main.c

Defines

uart_read (self_p, buf_p, size)
Read data from the UART.

Return Number of received bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to receive.

uart_write (self_p, buf_p, size)
Write data to the UART.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

Typedefs

typedef int (***uart_rx_filter_cb_t**) (char c)

Functions

int **uart_module_init** (void)

Initialize UART module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **uart_init** (**struct** uart_driver_t **self_p*, **struct** uart_device_t **dev_p*, long *baudrate*, void **rxbuf_p*, size_t *size*)

Initialize driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: Device to use.
- `baudrate`: Baudrate.
- `rxbuf_p`: Reception buffer.
- `size`: Reception buffer size.

int **uart_set_rx_filter_cb** (**struct** uart_driver_t **self_p*, *uart_rx_filter_cb_t* *rx_filter_cb*)

Set the reception filter callback function.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `rx_filter_cb`: Callback to set.

int **uart_start** (**struct** uart_driver_t **self_p*)

Starts the UART device using given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **uart_stop** (**struct** uart_driver_t **self_p*)

Stops the UART device referenced by driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **uart_device_start**(**struct** uart_device_t **dev_p*, long *baudrate*)

Starts the UART device using given configration. The UART device group of functions does not use interrupts, but instead polls the hardware for events. The driver and device functions may not be used for the same UART device.

Return zero(0) or negative error code.

Parameters

- `dev_p`: UART device to start.
- `baudrate`: Baudrate.

int **uart_device_stop**(**struct** uart_device_t **dev_p*)

Stops given UART device.

Return zero(0) or negative error code.

Parameters

- `dev_p`: UART device to stop.

ssize_t **uart_device_read**(**struct** uart_device_t **dev_p*, void **buf_p*, size_t *size*)

Read data from the UART. This function does not wait for interrupts, but instead busy-waits for data by polling UART registers.

Return Number of received bytes or negative error code.

Parameters

- `dev_p`: UART device to read from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to receive.

ssize_t **uart_device_write**(**struct** uart_device_t **dev_p*, **const** void **buf_p*, size_t *size*)

Write data to the UART. This function does not wait for interrupts, but instead busy-waits for data by polling UART registers.

Return Number of written bytes or negative error code.

Parameters

- `dev_p`: UART device to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

Variables

struct uart_device_t **uart_device**[UART_DEVICE_MAX]

`uart_soft` — Software Universal Asynchronous Receiver/Transmitter

Source code: src/drivers/uart_soft.h, src/drivers/uart_soft.c

---

Defines

`uart_soft_read`(self_p, buf_p, size)
Read data from the UART.

Return Number of received bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to receive.

`uart_soft_write`(self_p, buf_p, size)
Write data to the UART.

Return number of sent bytes or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

Functions

int **`uart_soft_init`**(**struct** *uart_soft_driver_t* **self_p*, **struct** pin_device_t **tx_dev_p*, **struct** pin_device_t **rx_dev_p*, **struct** exti_device_t **rx_exti_dev_p*, int *baudrate*, void **rxbuf_p*, size_t *size*)
Initialize driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `tx_dev_p`: TX pin device.
- `rx_dev_p`: RX pin device.
- `rx_exti_dev_p`: RX pin external interrupt device.
- `baudrate`: Baudrate.
- `rxbuf_p`: Reception buffer.
- `size`: Reception buffer size.

struct `uart_soft_driver_t`
#include <uart_soft.h>

Public Members

struct pin_driver_t **tx_pin**

struct pin_driver_t **rx_pin**

struct exti_driver_t **rx_exti**

struct *chan_t* **chout**

struct *queue_t* **chin**

int **sample_time**

int **baudrate**

usb — Universal Serial Bus

Source code: src/drivers/usb.h, src/drivers/usb.c

Defines

REQUEST_TYPE_DATA_MASK

REQUEST_TYPE_DATA_DIRECTION_HOST_TO_DEVICE

REQUEST_TYPE_DATA_DIRECTION_DEVICE_TO_HOST

REQUEST_TYPE_TYPE_MASK

REQUEST_TYPE_TYPE_STANDARD

REQUEST_TYPE_TYPE_CLASS

REQUEST_TYPE_TYPE_VENDOR

REQUEST_TYPE_RECIPIENT_MASK

REQUEST_TYPE_RECIPIENT_DEVICE

REQUEST_TYPE_RECIPIENT_INTERFACE

REQUEST_TYPE_RECIPIENT_ENDPOINT

REQUEST_TYPE_RECIPIENT_OTHER

REQUEST_GET_STATUS

REQUEST_SET_ADDRESS

REQUEST_GET_DESCRIPTOR

REQUEST_SET_CONFIGURATION

DESCRIPTOR_TYPE_DEVICE

DESCRIPTOR_TYPE_CONFIGURATION

DESCRIPTOR_TYPE_STRING

DESCRIPTOR_TYPE_INTERFACE

DESCRIPTOR_TYPE_ENDPOINT

DESCRIPTOR_TYPE_INTERFACE_ASSOCIATION

DESCRIPTOR_TYPE_RPIPE

DESCRIPTOR_TYPE_CDC

USB_CLASS_USE_INTERFACE

USB_CLASS_AUDIO

USB_CLASS_CDC_CONTROL

USB_CLASS_HID

USB_CLASS_PHYSICAL

USB_CLASS_IMAGE

USB_CLASS_PRINTER

USB_CLASS_MASS_STORAGE

USB_CLASS_HUB

USB_CLASS_CDC_DATA

USB_CLASS_SMART_CARD

USB_CLASS_CONTENT_SECURITY

USB_CLASS_VIDEO

USB_CLASS_PERSONAL_HEALTHCARE

USB_CLASS_AUDIO_VIDEO_DEVICES

USB_CLASS_BILLBOARD_DEVICE_CLASS

USB_CLASS_DIAGNOSTIC_DEVICE

USB_CLASS_WIRELESS_CONTROLLER

USB_CLASS_MISCELLANEOUS

USB_CLASS_APPLICATION_SPECIFIC

USB_CLASS_VENDOR_SPECIFIC

ENDPOINT_ENDPOINT_ADDRESS_DIRECTION (address)

ENDPOINT_ENDPOINT_ADDRESS_NUMBER (address)

ENDPOINT_ATTRIBUTES_USAGE_TYPE (attributes)

ENDPOINT_ATTRIBUTES_SYNCHRONISATION_TYPE (attributes)

ENDPOINT_ATTRIBUTES_TRANSFER_TYPE (attributes)

ENDPOINT_ATTRIBUTES_TRANSFER_TYPE_CONTROL

ENDPOINT_ATTRIBUTES_TRANSFER_TYPE_ISOCHRONOUS

ENDPOINT_ATTRIBUTES_TRANSFER_TYPE_BULK

ENDPOINT_ATTRIBUTES_TRANSFER_TYPE_INTERRUPT

CONFIGURATION_ATTRIBUTES_BUS_POWERED

USB_CDC_LINE_CODING

USB_CDC_CONTROL_LINE_STATE

USB_CDC_SEND_BREAK

USB_MESSAGE_TYPE_ADD

USB_MESSAGE_TYPE_REMOVE

Functions

int **usb_format_descriptors**(void **out_p*, uint8_t **buf_p*, size_t *size*)
Format the descriptors and write them to given channel.

Return zero(0) or negative error code.

Parameters

- `out_p`: Output channel.
- `buf_p`: Pointer to the descriptors to format.
- `size`: Number of bytes in the descriptors buffer.

struct *usb_descriptor_configuration_t* ***usb_desc_get_configuration**(uint8_t **desc_p*, size_t *size*, int *configuration*)
Get the configuration descriptor for given configuration index.

Return Configuration or NULL on failure.

Parameters

- `buf_p`: Pointer to the descriptors.
- `size`: Number of bytes in the descriptors buffer.
- `configuration`: Configuration to find.

struct *usb_descriptor_interface_t* ***usb_desc_get_interface**(uint8_t **desc_p*, size_t *size*, int *configuration*, int *interface*)
Get the interface descriptor for given configuration and interface index.

Return Interface or NULL on failure.

Parameters

- `buf_p`: Pointer to the descriptors.
- `size`: Number of bytes in the descriptors buffer.
- `configuration`: Configuration to find.
- `interface`: Interface to find.

struct *usb_descriptor_endpoint_t* ***usb_desc_get_endpoint**(uint8_t **desc_p*, size_t *size*, int *configuration*, int *interface*, int *endpoint*)
Get the endpoint descriptor for given configuration, interface and endpoint index.

Return Endpoint or NULL on failure.

Parameters

- `buf_p`: Pointer to the descriptors.
- `size`: Number of bytes in the descriptors buffer.

- `configuration`: Configuration to find.
- `interface`: Interface to find.
- `endpoint`: Endpoint to find.

int **usb_desc_get_class** (uint8_t **buf_p*, size_t *size*, int *configuration*, int *interface*)
Get the interface class.

Return

Parameters

- `buf_p`: Pointer to the descriptors.
- `size`: Number of bytes in the descriptors buffer.
- `configuration`: Configuration to find.
- `interface`: Interface to find.

Variables

struct usb_device_t **usb_device**[USB_DEVICE_MAX]

struct usb_setup_t

Public Members

uint8_t **request_type**

uint8_t **request**

uint16_t **feature_selector**

uint16_t **zero_interface_endpoint**

struct usb_setup_t::@20::@21 usb_setup_t::clear_feature

uint16_t **zero0**

uint16_t **zero1**

struct usb_setup_t::@20::@22 usb_setup_t::get_configuration

uint8_t **descriptor_index**

uint8_t **descriptor_type**

uint16_t **language_id**

struct usb_setup_t::@20::@23 usb_setup_t::get_descriptor

uint16_t **device_address**

uint16_t **zero**

struct usb_setup_t::@20::@24 usb_setup_t::set_address

uint16_t **configuration_value**

struct usb_setup_t::@20::@25 usb_setup_t::set_configuration

uint16_t **value**

uint16_t **index**

struct usb_setup_t::@20::@26 usb_setup_t::base

union usb_setup_t::@20 usb_setup_t::u

uint16_t **length**

struct **usb_descriptor_header_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

struct **usb_descriptor_device_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint16_t **bcd_usb**

uint8_t **device_class**

uint8_t **device_subclass**

uint8_t **device_protocol**

uint8_t **max_packet_size_0**

uint16_t **id_vendor**

uint16_t **id_product**

uint16_t **bcd_device**

uint8_t **manufacturer**

uint8_t **product**

uint8_t **serial_number**

uint8_t **num_configurations**

struct **usb_descriptor_configuration_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint16_t **total_length**

uint8_t **num_interfaces**

uint8_t **configuration_value**

uint8_t **configuration**

uint8_t **configuration_attributes**

uint8_t **max_power**

struct **usb_descriptor_interface_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **interface_number**

uint8_t **alternate_setting**

uint8_t **num_endpoints**

uint8_t **interface_class**

uint8_t **interface_subclass**

uint8_t **interface_protocol**

uint8_t **interface**

struct **usb_descriptor_endpoint_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **endpoint_address**

uint8_t **attributes**

uint16_t **max_packet_size**

uint8_t **interval**

struct **usb_descriptor_string_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **string**[256]

struct **usb_descriptor_interface_association_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **first_interface**

uint8_t **interface_count**

uint8_t **function_class**

uint8_t **function_subclass**

uint8_t **function_protocol**

uint8_t **function**

struct **usb_descriptor_cdc_header_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **sub_type**

uint16_t **bcd**

struct **usb_descriptor_cdc_acm_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **sub_type**

uint8_t **capabilities**

struct **usb_descriptor_cdc_union_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **sub_type**

uint8_t **master_interface**

uint8_t **slave_interface**

struct **usb_descriptor_cdc_call_management_t**

Public Members

uint8_t **length**

uint8_t **descriptor_type**

uint8_t **sub_type**

uint8_t **capabilities**

uint8_t **data_interface**

union **usb_descriptor_t**

Public Members

struct *usb_descriptor_header_t* **header**

struct *usb_descriptor_device_t* **device**

struct *usb_descriptor_configuration_t* **configuration**

struct *usb_descriptor_interface_t* **interface**

struct *usb_descriptor_endpoint_t* **endpoint**

struct *usb_descriptor_string_t* **string**

struct **usb_cdc_line_info_t**

Public Members

uint32_t **dte_rate**

uint8_t **char_format**

uint8_t **parity_type**

uint8_t **data_bits**

struct **usb_message_header_t**

Public Members

int **type**

struct **usb_message_add_t**

Public Members

struct *usb_message_header_t* **header**

int **device**

union **usb_message_t**

Public Members

struct *usb_message_header_t* **header**

struct *usb_message_add_t* **add**

usb_device — Universal Serial Bus - Device

A USB device is powered and enumerated by a USB host.

The implementation of this module aims to be simple, but yet flexible. It's possible to change the USB configuration descriptors at runtime by stopping the current driver, initialize a new driver and start the new driver. For simple devices only a single configuration is normally needed.

Using the USB device module is fairly easy. First write the USB descriptors, then initialize the class drivers, then initialize the USB device driver and then start it.

See the test code below for an example usage.

Class driver modules:

usb_device_class_cdc — CDC ACM (serial port over USB)

USB CDC (Communications Device Class) ACM (Abstract Control Model) is a vendor-independent publicly documented protocol that can be used for emulating serial ports over USB.

More information on Wikipedia.

Source code: src/drivers/usb/device/class/cdc.h, src/drivers/usb/device/class/cdc.c

Test code: tst/drivers/usb_device/main.c

Defines

usb_device_class_cdc_read (self_p, buf_p, size)
Read data from the CDC driver.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

usb_device_class_cdc_write (self_p, buf_p, size)
Write data to the CDC driver.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

Functions

int **usb_device_class_cdc_module_init** (void)
Initialize the CDC module.

Return zero(0) or negative error code.

int **usb_device_class_cdc_init** (**struct** *usb_device_class_cdc_driver_t* **self_p*, int *control_interface*, int *endpoint_in*, int *endpoint_out*, void **rxbuf_p*, size_t *size*)
Initialize driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `rxbuf_p`: Reception buffer.
- `size`: Reception buffer size.

int **usb_device_class_cdc_input_isr** (**struct** *usb_device_class_cdc_driver_t* **self_p*)
Called by the USB device driver periodically to let the CDC driver read received data from the hardware.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **usb_device_class_cdc_is_connected** (**struct** *usb_device_class_cdc_driver_t* **self_p*)
Check if the CDC is connected to the remote endpoint.

Return true(1) if connected, false(0) if disconnected, otherwise negative error code.

Parameters

- `self_p`: Initialized driver object.

struct usb_device_class_cdc_driver_t
#include <cdc.h>

Public Members

struct usb_device_driver_base_t **base**

struct usb_device_driver_t ***drv_p**

int **control_interface**

int **endpoint_in**

int **endpoint_out**

int **line_state**

struct *usb_cdc_line_info_t* **line_info**

struct *chan_t* **chout**

struct *queue_t* **chin**

Source code: src/drivers/usb_device.h, src/drivers/usb_device.c

Test code: tst/drivers/usb_device/main.c

Functions

int **usb_device_module_init** (void)

int usb_device_init(struct usb_device_driver_t * self_p, struct usb_device_t * dev_p, s

Initialize the USB device driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: USB device to use.
- `drivers_pp`: An array of initialized drivers.
- `drivers_max`: Length of the drivers array.
- `descriptors_pp`: A NULL terminated array of USB descriptors.

int **usb_device_start** (**struct** usb_device_driver_t **self_p*)

Start the USB device device using given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **usb_device_stop** (**struct** usb_device_driver_t **self_p*)

Stop the USB device device referenced by driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

ssize_t **usb_device_write** (**struct** usb_device_driver_t **self_p*, int *endpoint*, **const** void **buf_p*, size_t *size*)

Write data to given endpoint.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `endpoint`: Endpoint to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

ssize_t **usb_device_read_isr** (**struct** usb_device_driver_t **self_p*, int *endpoint*, void **buf_p*, size_t *size*)

Read data from given endpoint from an isr or with the system lock taken.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `endpoint`: Endpoint to read data from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **usb_device_write_isr** (**struct** usb_device_driver_t **self_p*, int *endpoint*, **const** void **buf_p*, size_t *size*)

Write data to given endpoint from an isr or with the system lock taken.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `endpoint`: Endpoint to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

`usb_host` — Universal Serial Bus - Host

A USB host powers the bus and enumerates connected USB devices.

Class driver modules:

`usb_host_class_hid` — Human Interface Device (HID)

In computing, the USB human interface device class (USB HID class) is a part of the USB specification for computer peripherals: it specifies a device class (a type of computer hardware) for human interface devices such as keyboards, mice, game controllers and alphanumeric display devices.

More information on Wikipedia.

Source code: src/drivers/usb/host/class/hid.h, src/drivers/usb/host/class/hid.c

---

Defines

USB_CLASS_HID_SUBCLASS_NONE

USB_CLASS_HID_SUBCLASS_BOOT_INTERFACE

USB_CLASS_HID_PROTOCOL_NONE

USB_CLASS_HID_PROTOCOL_KEYBOARD

USB_CLASS_HID_PROTOCOL_MOUSE

Functions

int **usb_host_class_hid_init** (**struct** *usb_host_class_hid_driver_t* **self_p*, **struct** usb_host_driver_t **usb_p*, **struct** *usb_host_class_hid_device_t* **devices_p*, size_t *length*)

Initialize driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `usb_p`: USB driver to use.
- `devices_p`: Array of devices. One entry in this array is allocated for each HID device that is connected to the host.
- `length`: Length of the devices array.

int **usb_host_class_hid_start** (**struct** *usb_host_class_hid_driver_t* **self_p*)

Starts the HID driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object to start.

int **usb_host_class_hid_stop** (**struct** *usb_host_class_hid_driver_t* **self_p*)

Stops the HID driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized to stop.

struct usb_host_class_hid_device_t

Public Members

uint8_t **buf**[1]

struct usb_host_class_hid_driver_t

Public Members

struct usb_host_driver_t ***usb_p**

struct *usb_host_class_hid_device_t* ***devices_p**

size_t **length**

size_t **size**

struct usb_host_class_hid_driver_t::@18 usb_host_class_hid_driver_t::report

struct *usb_host_device_driver_t* **device_driver**

`usb_host_class_mass_storage` — Mass Storage

The USB mass storage device class (also known as USB MSC or UMS) is a set of computing communications protocols defined by the USB Implementers Forum that makes a USB device accessible to a host computing device and enables file transfers between the host and the USB device. To a host, the USB device acts as an external hard drive; the protocol set interfaces with a number of storage devices.

More information on Wikipedia.

Source code: src/drivers/usb/host/class/mass_storage.h, src/drivers/usb/host/class/mass_storage.c

---

Functions

int **usb_host_class_mass_storage_init** (**struct** *usb_host_class_mass_storage_driver_t* **self_p*, **struct** usb_host_driver_t **usb_p*, **struct** *usb_host_class_mass_storage_device_t* **devices_p*, size_t *length*)

int **usb_host_class_mass_storage_start** (**struct** *usb_host_class_mass_storage_driver_t* **self_p*)

int **usb_host_class_mass_storage_stop** (**struct** *usb_host_class_mass_storage_driver_t* **self_p*)

ssize_t **usb_host_class_mass_storage_device_read** (**struct** *usb_host_device_t* **device_p*, void **buf_p*, size_t *address*, size_t *size*)

struct usb_host_class_mass_storage_device_t
#include <mass_storage.h>

Public Members

uint8_t **buf**[1]

struct usb_host_class_mass_storage_driver_t

Public Members

struct usb_host_driver_t *__usb_p__

struct *usb_host_class_mass_storage_device_t* *__devices_p__

size_t **length**

size_t **size**

struct usb_host_class_mass_storage_driver_t::@19 usb_host_class_mass_storage_driver_t

struct *usb_host_device_driver_t* **device_driver**

Source code: src/drivers/usb_host.h, src/drivers/usb_host.c

Defines

USB_HOST_DEVICE_STATE_NONE

USB_HOST_DEVICE_STATE_ATTACHED

USB_PIPE_TYPE_CONTROL

USB_PIPE_TYPE_INTERRUPT

USB_PIPE_TYPE_ISOCHRONOUS

USB_PIPE_TYPE_BULK

Functions

int **usb_host_module_init** (void)

Initialize the USB host module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **usb_host_init** (**struct** usb_host_driver_t **self_p*, **struct** usb_device_t **dev_p*, **struct** *usb_host_device_t* **devices_p*, size_t *length*)

Initialize the USB host driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `dev_p`: USB device to use.
- `devices_p`: An array of devices. One entry in this array is allocated for each USB device that is connected to the host.
- `length`: Length of the devices array.

int **usb_host_start** (**struct** usb_host_driver_t **self_p*)
Start the USB host device using given driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **usb_host_stop** (**struct** usb_host_driver_t **self_p*)
Stop the USB host device referenced by driver object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.

int **usb_host_driver_add** (**struct** usb_host_driver_t **self_p*, **struct** *usb_host_device_driver_t* **driver_p*, void **arg_p*)
Add given class/vendor driver to the USB host driver.

When a USB device is plugged in, its class and vendor information is read by the host. Those values are used to find the device driver for this particular device. If there is no driver, the device cannot be configured and will not work.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `driver_p`: USB device driver to add.

int **usb_host_driver_remove** (**struct** usb_host_driver_t **self_p*, **struct** *usb_host_device_driver_t* **driver_p*)
Remove given class/vendor driver from the USB host driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver object.
- `driver_p`: USB device driver to remove.

struct *usb_host_device_t* ***usb_host_device_open** (**struct** usb_host_driver_t **self_p*, int *device*)
Open given device in given driver. Open a device before reading and writing data to it with usb_host_device_read() or usb_host_device_write().

Return Opened device or NULL on failure.

Parameters

- `self_p`: Initialized driver.
- `device`: Device to open.

int **usb_host_device_close** (**struct** usb_host_driver_t **self_p*, int *device*)
Close given device in given driver.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized driver.
- `device`: Device to close.

ssize_t **usb_host_device_read** (**struct** *usb_host_device_t* **device_p*, int *endpoint*, void **buf_p*, size_t *size*)

Read data from given endpoint for given device.

Return Number of bytes read or negative error code.

Parameters

- `device_p`: Device to read from.
- `endpoint`: Endpoint to read data from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **usb_host_device_write** (**struct** *usb_host_device_t* **device_p*, int *endpoint*, **const** void **buf_p*, size_t *size*)

Write data to given endpoint for given device.

Return Number of bytes written or negative error code.

Parameters

- `device_p`: Device to write to.
- `endpoint`: Endpoint to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

ssize_t **usb_host_device_control_transfer** (**struct** *usb_host_device_t* **device_p*, **struct** *usb_setup_t* **setup_p*, void **buf_p*, size_t *size*)

Perform a control transfer on endpoint zero(0).

A control transfer can have up to three stages. First the setup stage, then an optional data stage, and at last a status stage.

Return Number of bytes read/written or negative error code.

Parameters

- `device_p`: Device to write to.
- `setup_p`: Setup packet to write.
- `buf_p`: Buffer to read/write. May be NULL if no data shall be transferred.
- `size`: Number of bytes to read/write.

int **usb_host_device_set_configuration** (**struct** *usb_host_device_t* **device_p*, uint8_t *configuration*)

Set configuration for given device.

Return zero(0) or negative error code.

Parameters

- `device_p`: Device to use.
- `configuration`: Configuration to set.

struct usb_host_device_t

#include <usb_host.h> An USB device as seen by the host.

Public Members

int **id**

int **state**

int **address**

int **vid**

int **pid**

char ***description_p**

size_t **max_packet_size**

uint8_t **configuration**

struct *usb_descriptor_device_t* ***dev_p**

struct *usb_descriptor_configuration_t* ***conf_p**

struct usb_host_device_t::@27::@29 usb_host_device_t::descriptor

struct usb_host_device_t::@27 usb_host_device_t::current

struct usb_host_driver_t ***self_p**

struct usb_pipe_t ***pipes**[32]

size_t **size**

uint8_t **buf**[128]

struct usb_host_device_t::@28 usb_host_device_t::descriptors

struct usb_host_device_driver_t

#include <usb_host.h> Used to find a device driver.

Public Members

int (***supports**) (**struct** *usb_host_device_t* *)

int (***enumerate**) (**struct** *usb_host_device_t* *)

struct *usb_host_device_driver_t* ***next_p**

`watchdog` — Hardware watchdog

Source code: src/drivers/watchdog.h, src/drivers/watchdog.c

Typedefs

typedef void (***watchdog_isr_fn_t**)(void)

Functions

int **watchdog_module_init**(void)

Initialize the watchdog driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **watchdog_start_ms**(int *timeout*, *watchdog_isr_fn_t on_interrupt*)

Start the watchdog with given timeout. Use `watchdog_kick()` to periodically restart the timer.

Return zero(0) or negative error code.

Parameters

- `timeout`: Watchdog timeout in milliseconds.
- `on_interrupt`: Function callback called when a watchdog interrupt occurs. Not all MCU:s supports this feature.

int **watchdog_stop**(void)

Stop the watchdog.

Return zero(0) or negative error code.

int **watchdog_kick**(void)

Kick the watchdog. Restarts the watchdog timer with its original timeout given to `watchdog_start_ms()`. The board will be reset if this function is not called before the watchdog timer expires.

Return zero(0) or negative error code.

`ws2812` — NeoPixels

Source code: src/drivers/ws2812.h, src/drivers/ws2812.c

Defines

WS2812_PIN_DEVICES_MAX

Functions

int **ws2812_module_init** (void)

Initialize the WS2812 driver module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **ws2812_init** (**struct** *ws2812_driver_t* **self_p*, **struct** pin_device_t ***pin_devices_pp*, int *number_of_pin_devices*)

Initialize given driver object from given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to be initialized.
- `pin_devices_pp`: An array of pin device(s) to use. The maximum length of the array is defined as `WS2812_PIN_DEVICES_MAX`.
- `number_of_pin_devices`: Number of pin devices in the pin devices array.

int **ws2812_write** (**struct** *ws2812_driver_t* **self_p*, **const** uint8_t **colors_p*, int *number_of_pixles*)

Write given RGB colors to the NeoPixels.

CAUTION: Interrupts are disabled during the write to meet the strict timing requirements on the pulse train. It takes ~30 us to write to one pixel, that is, interrupts are disabled for ~30 * number_of_pixles us. Long pixel chains may cause the rest of the system to misbehave.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object.
- `colors_p`: An array of GRB colors to write to the NeoPixels. All pin devices green component first, then all red, and last all blue, repeated for all NeoPixels. For example, when a single pin device is configured the array is G0, R0, B0, G1, R1, B1, ...
- `number_of_pixles`: Number of GRB colors per pin device in `colors_p`.

struct ws2812_driver_t

Public Members

struct pin_device_t ****pins_pp**

int **number_of_pins**

uint32_t **mask**

filesystems

File systems and file system like frameworks.

The filesystems package on Github.

fat16 — FAT16 filesystem

File Allocation Table (FAT) is a computer file system architecture and a family of industry-standard file systems utilizing it. The FAT file system is a legacy file system which is simple and robust. It offers good performance even in light-weight implementations, but cannot deliver the same performance, reliability and scalability as some modern file systems. It is, however, supported for compatibility reasons by nearly all currently developed operating systems for personal computers and many mobile devices and embedded systems, and thus is a well-suited format for data exchange between computers and devices of almost any type and age from 1981 up to the present.

Example

Here is the pseudo-code for mounting a file system, performing file operations and unmounting the file system.

All function arguments are omitted in this example.

```
/* Mount the file system. This is normally done once when the
   application starts. */
fat16_init();
fat16_mount();

/* Perform file operations. */
fat16_file_open();
fat16_file_read();
fat16_file_close();

fat16_file_open();
fat16_file_write();
fat16_file_close();

/* Unmount the file system when it is no long needed. Normally when
   the application stops. */
fat16_unmount();
```

Source code: src/filesystems/fat16.h, src/filesystems/fat16.c

Test code: tst/filesystems/fat16/main.c

Test coverage: src/filesystems/fat16.c

Example code: examples/fat16/main.c

Defines

FAT16_SEEK_SET

FAT16_SEEK_CUR

The offset is relative to the current position indicator.

FAT16_SEEK_END
The offset is relative to the end of the file.

FAT16_EOF
End of file indicator.

O_READ
Open for reading.

O_RDONLY
Same as O_READ.

O_WRITE
Open for write.

O_WRONLY
Same as O_WRITE.

O_RDWR
Open for reading and writing.

O_APPEND
The file position indicator shall be set to the end of the file prior to each write.

O_SYNC
Synchronous writes.

O_CREAT
Create the file if non-existent.

O_EXCL
If O_CREAT and O_EXCL are set, file open shall fail if the file exists.

O_TRUNC
Truncate the file to zero length.

DIR_ATTR_READ_ONLY
File is read-only.

DIR_ATTR_HIDDEN
File should hidden in directory listings.

DIR_ATTR_SYSTEM
Entry is for a system file.

DIR_ATTR_VOLUME_ID
Directory entry contains the volume label.

DIR_ATTR_DIRECTORY
Entry is for a directory.

DIR_ATTR_ARCHIVE
Old DOS archive bit for backup support.

Typedefs

typedef ssize_t (***fat16_read_t**) (void *arg_p, void *dst_p, uint32_t src_block)
Block read function callback.

typedef ssize_t (***fat16_write_t**) (void *arg_p, uint32_t dst_block, **const** void *src_p)
Block write function callback.

typedef uint16_t **fat_t**
A FAT entry.

Functions

int **fat16_init** (**struct** *fat16_t* **self_p*, *fat16_read_t* *read*, *fat16_write_t* *write*, void **arg_p*, unsigned int *partition*)
Initialize a FAT16 volume.

Return zero(0) or negative error code.

Parameters

- `self_p`: FAT16 object to initialize.
- `read`: Callback function used to read blocks of data.
- `write`: Callback function used to write blocks of data.
- `arg_p`: Argument passed as the first arguemtn to read() and write().
- `partition`: Partition to be used. Legal values for a partition are 1-4 to use the corresponding partition on a device formatted with a MBR, Master Boot Record, or zero if the device is formatted as a super floppy with the FAT boot sector in block zero.

int **fat16_mount** (**struct** *fat16_t* **self_p*)
Mount given FAT16 volume.

Return zero(0) or negative error code.

Parameters

- `self_p`: FAT16 object.

int **fat16_unmount** (**struct** *fat16_t* **self_p*)
Unmount given FAT16 volume.

Return zero(0) or negative error code.

Parameters

- `self_p`: FAT16 object.

int **fat16_format** (**struct** *fat16_t* **self_p*)
Create an empty FAT16 file system on the device.

Parameters

- `self_p`: FAT16 object.

int **fat16_print** (**struct** *fat16_t* **self_p*, void **chan_p*)
Print volume information to given channel.

Return zero(0) or negative error code.

Parameters

- `self_p`: FAT16 object.
- `chan_p`: Output channel.

int **fat16_file_open** (**struct** *fat16_t* **self_p*, **struct** *fat16_file_t* **file_p*, **const** char **path_p*, int *oflag*)
Open a file by file path and mode flags.

Return zero(0) or negative error code.

Parameters

- `self_p`: FAT16 object.
- `file_p`: File object to be initialized.
- `path_p`: A valid 8.3 DOS name for a file path.
- `oflag`: mode of file open (create, read, write, etc).

int **fat16_file_close** (**struct** *fat16_file_t* **file_p*)
Close a file and force cached data and directory information to be written to the media.

Return zero(0) or negative error code.

Parameters

- `file_p`: File object.

ssize_t **fat16_file_read** (**struct** *fat16_file_t* **file_p*, void **buf_p*, size_t *size*)
Read data to given buffer with given size from the file.

Return Number of bytes read or EOF(-1).

Parameters

- `file_p`: File object.
- `buf_p`: Buffer to read into.
- `size`: number of bytes to read.

ssize_t **fat16_file_write** (**struct** *fat16_file_t* **file_p*, **const** void **buf_p*, size_t *size*)
Write data from buffer with given size to the file.

Return Number of bytes written or EOF(-1).

Parameters

- `file_p`: File object.
- `buf_p`: Buffer to write.
- `size`: number of bytes to write.

int **fat16_file_seek** (**struct** *fat16_file_t* **file_p*, int *pos*, int *whence*)
Sets the file's read/write position relative to mode.

Return zero(0) or negative error code.

Parameters

- `file_p`: File object.
- `pos`: New position in bytes from given mode.
- `whence`: Absolute, relative or from end.

ssize_t **fat16_file_tell** (**struct** *fat16_file_t* **file_p*)
Return current position in the file.

Return Current position or negative error code.

Parameters

- `file_p`: File object.

int **fat16_file_truncate** (**struct** *fat16_file_t* **file_p*, size_t *size*)
Truncate given file to a size of precisely `size` bytes.

If the file previously was larger than this size, the extra data is lost. If the file previously was shorter, it is extended, and the extended part reads as null bytes ('\0').

Return zero(0) or negative error code.

Parameters

- `file_p`: File object.
- `size`: New size of the file in bytes.

ssize_t **fat16_file_size** (**struct** *fat16_file_t* **file_p*)
Return number of bytes in the file.

Return File size in bytes or negative error code.

Parameters

- `file_p`: File object.

int **fat16_file_sync** (**struct** *fat16_file_t* **file_p*)
Causes all modified data and directory fields to be written to the storage device.

Return zero(0) or negative error code.

Parameters

- `file_p`: File object.

int **fat16_dir_open** (**struct** *fat16_t* **self_p*, **struct** *fat16_dir_t* **dir_p*, **const** char **path_p*, int *oflag*)
Open a directory by directory path and mode flags.

Return zero(0) or negative error code.

Parameters

- `self_p`: FAT16 object.
- `dir_p`: Directory object to be initialized.
- `path_p`: A valid 8.3 DOS name for a directory path.
- `oflag`: mode of the directory to open (create, read, etc).

int **fat16_dir_close** (**struct** *fat16_dir_t* **dir_p*)
Close given directory.

Return zero(0) or negative error code.

Parameters

- `dir_p`: Directory object.

int **fat16_dir_read** (**struct** *fat16_dir_t* **dir_p*, **struct** *fat16_dir_entry_t* **entry_p*)

Read the next file or directory within the opened directory.

Return true(1) if an entry was read or false(0) if no entry could be read, otherwise negative error code.

Parameters

- `dir_p`: Directory object.
- `entry_p`: Read entry.

int **fat16_stat** (**struct** *fat16_t* **self_p*, **const** char **path_p*, **struct** *fat16_stat_t* **stat_p*)

Gets file status by path.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `path_p`: The path of the file to stat.
- `stat_p`: The stat struct to populate.

Variables

struct *dir_t* **PACKED**

union fat16_time_t

#include <fat16.h> FAT Time Format. A FAT directory entry time stamp is a 16-bit field that has a granularity of 2 seconds. Here is the format (bit 0 is the LSB of the 16-bit word, bit 15 is the MSB of the 16-bit word).

Bits 0-4: 2-second count, valid value range 0-29 inclusive (0-58 seconds). Bits 5-10: Minutes, valid value range 0-59 inclusive. Bits 11-15: Hours, valid value range 0-23 inclusive.

The valid time range is from Midnight 00:00:00 to 23:59:58.

Public Members

uint16_t **as_uint16**

uint16_t **seconds**

uint16_t **minutes**

uint16_t **hours**

struct fat16_time_t::@30 fat16_time_t::bits

union fat16_date_t

#include <fat16.h> FAT date representation support Date Format. A FAT directory entry date stamp is a 16-bit field that is basically a date relative to the MS-DOS epoch of 01/01/1980. Here is the format (bit 0 is the LSB of the 16-bit word, bit 15 is the MSB of the 16-bit word):

Bits 0-4: Day of month, valid value range 1-31 inclusive. Bits 5-8: Month of year, 1 = January, valid value range 1-12 inclusive. Bits 9-15: Count of years from 1980, valid value range 0-127 inclusive (1980-2107).

Public Members

uint16_t **as_uint16**

uint16_t **day**

uint16_t **month**

uint16_t **year**

struct fat16_date_t::@31 fat16_date_t::bits

struct part_t

#include <fat16.h> MBR partition table entry. A partition table entry for a MBR formatted storage device. The MBR partition table has four entries.

Public Members

uint8_t **boot**

Boot Indicator. Indicates whether the volume is the active partition. Legal values include: 0x00. Do not use for booting. 0x80 Active partition.

uint8_t **begin_head**

Head part of Cylinder-head-sector address of the first block in the partition. Legal values are 0-255. Only used in old PC BIOS.

unsigned **begin_sector**

Sector part of Cylinder-head-sector address of the first block in the partition. Legal values are 1-63. Only used in old PC BIOS.

unsigned **begin_cylinder_high**

High bits cylinder for first block in partition.

uint8_t **begin_cylinder_low**

Combine beginCylinderLow with beginCylinderHigh. Legal values are 0-1023. Only used in old PC BIOS.

uint8_t **type**

Partition type. See defines that begin with PART_TYPE_ for some Microsoft partition types.

uint8_t **end_head**

head part of cylinder-head-sector address of the last sector in the partition. Legal values are 0-255. Only used in old PC BIOS.

unsigned **end_sector**

Sector part of cylinder-head-sector address of the last sector in the partition. Legal values are 1-63. Only used in old PC BIOS.

unsigned **end_cylinder_high**

High bits of end cylinder

uint8_t **end_cylinder_low**

Combine endCylinderLow with endCylinderHigh. Legal values are 0-1023. Only used in old PC BIOS.

uint32_t **first_sector**

Logical block address of the first block in the partition.

uint32_t **total_sectors**

Length of the partition, in blocks.

struct bpb_t

#include <fat16.h> BIOS parameter block; The BIOS parameter block describes the physical layout of a FAT volume.

Public Members

uint16_t **bytes_per_sector**

Count of bytes per sector. This value may take on only the following values: 512, 1024, 2048 or 4096

uint8_t **sectors_per_cluster**

Number of sectors per allocation unit. This value must be a power of 2 that is greater than 0. The legal values are 1, 2, 4, 8, 16, 32, 64, and 128.

uint16_t **reserved_sector_count**

Number of sectors before the first FAT. This value must not be zero.

uint8_t **fat_count**

The count of FAT data structures on the volume. This field should always contain the value 2 for any FAT volume of any type.

uint16_t **root_dir_entry_count**

For FAT12 and FAT16 volumes, this field contains the count of 32-byte directory entries in the root directory. For FAT32 volumes, this field must be set to 0. For FAT12 and FAT16 volumes, this value should always specify a count that when multiplied by 32 results in a multiple of bytesPerSector. FAT16 volumes should use the value 512.

uint16_t **total_sectors_small**

This field is the old 16-bit total count of sectors on the volume. This count includes the count of all sectors in all four regions of the volume. This field can be 0; if it is 0, then totalSectors32 must be non-zero. For FAT32 volumes, this field must be 0. For FAT12 and FAT16 volumes, this field contains the sector count, and totalSectors32 is 0 if the total sector count fits (is less than 0x10000).

uint8_t **media_type**

This dates back to the old MS-DOS 1.x media determination and is no longer usually used for anything. 0xf8 is the standard value for fixed (non-removable) media. For removable media, 0xf0 is frequently used. Legal values are 0xf0 or 0xf8-0xff.

uint16_t **sectors_per_fat**

Count of sectors occupied by one FAT on FAT12/FAT16 volumes. On FAT32 volumes this field must be 0, and sectorsPerFat32 contains the FAT size count.

uint16_t **sectors_per_track**

Sectors per track for interrupt 0x13. Not used otherwise.

uint16_t **head_count**

Number of heads for interrupt 0x13. Not used otherwise.

uint32_t **hiddden_sectors**

Count of hidden sectors preceding the partition that contains this FAT volume. This field is generally only relevant for media visible on interrupt 0x13.

uint32_t **total_sectors_large**

This field is the new 32-bit total count of sectors on the volume. This count includes the count of all sectors in all four regions of the volume. This field can be 0; if it is 0, then totalSectors16 must be non-zero.

struct fbs_t

#include <fat16.h> Boot sector for a FAT16 or FAT32 volume.

Public Members

uint8_t **jmp_to_boot_code**[3]
X86 jmp to boot program

char **oem_name**[8]
Informational only - don't depend on it

struct *bpb_t* **bpb**
BIOS Parameter Block

uint8_t **drive_number**
For int0x13 use value 0x80 for hard drive

uint8_t **reserved1**
Used by Windows NT - should be zero for FAT

uint8_t **boot_signature**
0x29 if next three fields are valid

uint32_t **volume_serial_number**
Usually generated by combining date and time

char **volume_label**[11]
Should match volume label in root dir

char **file_system_type**[8]
Informational only - don't depend on it

uint8_t **boot_code**[448]
X86 boot code

uint16_t **boot_sector_sig**
Must be 0x55AA

struct mbr_t
#include <fat16.h> Master Boot Record. The first block of a storage device that is formatted with a MBR.

Public Members

uint8_t **codeArea**[440]
Code Area for master boot program.

uint32_t **diskSignature**
Optional WindowsNT disk signature. May contain more boot code.

uint16_t **usuallyZero**
Usually zero but may be more boot code.

struct *part_t* **part**[4]
Partition tables.

uint16_t **mbr_sig**
First MBR signature byte. Must be 0x55

struct dir_t
#include <fat16.h> FAT short directory entry. Short means short 8.3 name, not the entry size.

Public Members

uint8_t **name**[11]
Short 8.3 name. The first eight bytes contain the file name with blank fill. The last three bytes contain the file extension with blank fill.

uint8_t **attributes**
Entry attributes. The upper two bits of the attribute byte are reserved and should always be set to 0 when a file is created and never modified or looked at after that. See defines that begin with DIR_ATT_.

uint8_t **reserved1**
Reserved for use by Windows NT. Set value to 0 when a file is created and never modify or look at it after that.

uint8_t **creation_time_tenths**
The granularity of the seconds part of creationTime is 2 seconds so this field is a count of tenths of a second and its valid value range is 0-199 inclusive. (WHG note - seems to be hundredths)

uint16_t **creation_time**
Time file was created.

uint16_t **creation_date**
Date file was created.

uint16_t **last_access_date**
Last access date. Note that there is no last access time, only a date. This is the date of last read or write. In the case of a write, this should be set to the same date as lastWriteDate.

uint16_t **first_cluster_high**
High word of this entry's first cluster number (always 0 for a FAT12 or FAT16 volume).

uint16_t **last_write_time**
Time of last write. File creation is considered a write.

uint16_t **last_write_date**
Date of last write. File creation is considered a write.

uint16_t **first_cluster_low**
Low word of this entry's first cluster number.

uint32_t **file_size**
32-bit unsigned holding this file's size in bytes.

union fat16_cache16_t

Public Members

uint8_t **data**[512]

fat_t **fat**[256]

struct *dir_t* **dir**[16]

struct *mbr_t* **mbr**

struct *fbs_t* **fbs**

struct fat16_cache_t

Public Members

uint32_t **block_number**

uint8_t **dirty**

uint32_t **mirror_block**

union *fat16_cache16_t* **buffer**

struct fat16_t

Public Members

fat16_read_t **read**

fat16_write_t **write**

void ***arg_p**

unsigned int **partition**

uint8_t **fat_count**

uint8_t **blocks_per_cluster**

uint16_t **root_dir_entry_count**

fat_t **blocks_per_fat**

fat_t **cluster_count**

uint32_t **volume_start_block**

uint32_t **fat_start_block**

uint32_t **root_dir_start_block**

uint32_t **data_start_block**

struct *fat16_cache_t* **cache**

struct fat16_file_t

Public Members

struct *fat16_t* ***fat16_p**

uint8_t **flags**

int16_t **dir_entry_block**

int16_t **dir_entry_index**

fat_t **first_cluster**

size_t **file_size**

fat_t **cur_cluster**

size_t **cur_position**

struct fat16_dir_t

Public Members

int16_t **root_index**

struct *fat16_file_t* **file**

struct fat16_dir_entry_t

Public Members

char **name**[256]

int **is_dir**

size_t **size**

struct *date_t* **latest_mod_date**

struct fat16_stat_t

Public Members

size_t **size**

int **is_dir**

`fs` — Debug file system

The debug file system is not really a file system, but rather a file system like tree of commands, counters, parameters, and "real" file systems.

- A command is a file path mapped to a function callback. The callback is invoked when its path is passed to the `fs_call()` function. Commands are registered into the debug file system by a call to `fs_command_register()`.
- A counter is a file path mapped to a 64 bit value. The value can be incremented and read by the application. Counters are registered into the debug file system by a call to `fs_counter_register()`.
- A parameter is file path mapped to a value stored in ram that can be easily read and modified by the user from a shell. Parameters are registered into the debug file system by a call to `fs_parameter_register()`.
- A "real" file system is a file path, or mount point, mapped to a file system instance. The debug file system has a file access interface. The purpose of this interface is to have a common file access interface, independent of the underlying file systems interface. File systems are registered into the debug file system by a call to `fs_filesystem_register()`.

Debug file system commands

The debug file system module itself registers seven commands, all located in the directory `filesystems/fs/`.

Command	Description
`filesystems/list`	Print a list of all registered file systems.
`list [<folder>]`	Print a list of all files and folders in given folder.
`read <file>`	Read from given file.
`write <file> <data>`	Create and write to a file. Overwrites existing files.
`append <file> <data>`	Append data to an existing file.
`counters/list`	Print a list of all registered counters.
`counters/reset`	Rest all counters to zero.
`parameters/list`	Print a list of all registered parameters.

Example output from the shell:

```
$ filesystems/fs/filesystems/list
MOUNT-POINT                    MEDIUM   TYPE     AVAILABLE  SIZE  USAGE
/tmp                           ram      fat16          54K   64K    14%
/home/erik                     sd       fat16         1.9G    2G     5%
/etc                           flash    spiffs        124K  128K     3%
$ filesystems/fs/write tmp/foo.txt "Hello "
$ filesystems/fs/append tmp/foo.txt world!
$ filesystems/fs/read tmp/foo.txt
Hello world!
$ filesystems/fs/list tmp
xxxx-xx-xx xx-xx       12 foo.txt
$ filesystems/fs/counters/list
NAME                                                 VALUE
/your/counter                                        0000000000000034
/my/counter                                          0000000000000002
$ filesystems/fs/counters/reset
$ filesystems/fs/counters/list
NAME                                                 VALUE
/your/counter                                        0000000000000000
/my/counter                                          0000000000000000
$ filesystems/fs/parameters/list
NAME                                                 VALUE
/foo/bar                                             -2
```

Source code: src/filesystems/fs.h, src/filesystems/fs.c

Test code: tst/filesystems/fs/main.c

Test coverage: src/filesystems/fs.c

Defines

FS_SEEK_SET

FS_SEEK_CUR
The offset is relative to the current position indicator.

FS_SEEK_END
The offset is relative to the end of the file.

FS_READ
Open for reading.

FS_WRITE
Open for write.

FS_RDWR
Open for reading and writing.

FS_APPEND
The file position indicator shall be set to the end of the file prior to each write.

FS_SYNC
Synchronous writes.

FS_CREAT
Create the file if non-existent.

FS_EXCL
If FS_CREAT and FS_EXCL are set, file open shall fail if the file exists.

FS_TRUNC
Truncate the file to zero length.

FS_TYPE_FILE

FS_TYPE_DIR

FS_TYPE_HARD_LINK

FS_TYPE_SOFT_LINK

Typedefs

typedef int (***fs_callback_t**)(int argc, **const** char *argv[], void *out_p, void *in_p, void *arg_p, void *call_arg_p)
Command callback prototype.

Return zero(0) or negative error code.

Parameters

- `argc`: Number of arguements in argv.
- `argv`: An array of agruments.
- `out_p`: Output channel.
- `in_p`: Input channel.
- `arg_p`: Argument passed to the init function of given command.
- `call_arg_p`: Argument passed to the `fs_call` function.

typedef int (***fs_parameter_set_callback_t**)(void *value_p, **const** char *src_p)
Parameter setter callback prototype.

Return zero(0) or negative error code.

Parameters

- `value_p`: Buffer the new value should be written to.
- `src_p`: Value to set as a string.

typedef int (***fs_parameter_print_callback_t**) (void *chout_p, void *value_p)
Parameter printer callback prototype.

Return zero(0) or negative error code.

Parameters

- `chout_p`: Channel to write the formatted value to.
- `value_p`: Value to format and print to the output channel.

Enums

enum fs_type_t
Values:

fs_type_fat16_t = 0

fs_type_spiffs_t

fs_type_generic_t

Functions

int **fs_module_init** (void)
Initialize the file system module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **fs_call** (char **command_p*, void **chin_p*, void **chout_p*, void **arg_p*)
Call given file system command with given input and output channels. Quote an argument if it contains spaces, otherwise it is parsed as multiple arguments. Any quotation mark in an argument string must be escaped with a backslash (\), otherwise it is interpreted as a string quotation mask.

Return zero(0) or negative error code.

Parameters

- `command_p`: Command string to call. The command string will be modified by this function, so don't use it after this function returns.
- `chin_p`: Input channel.
- `chout_p`: Output channel.
- `arg_p`: User argument passed to the command callback function as `call_arg_p`.

int **fs_open** (**struct** *fs_file_t* **self_p*, **const** char **path_p*, int *flags*)
Open a file by file path and mode flags. File operations are permitted after the file has been opened.

The path can be either absolute or relative. It's an absolute path if it starts with a forward slash `/`, and relative otherwise. Relative paths are are relative to the current working directory, given by the thread environment variable `CWD`.

Return zero(0) or negative error code.

Parameters

- `self_p`: File object to be initialized.
- `path_p`: Path of the file to open. The path can be absolute or relative.
- `flags`: Mode of file open. A combination of `FS_READ`, `FS_RDONLY`, `FS_WRITE`, `FS_WRONLY`, `FS_RDWR`, `FS_APPEND`, `FS_SYNC`, `FS_CREAT`, `FS_EXCL` and `FS_TRUNC`.

int **fs_close** (**struct** *fs_file_t* **self_p*)
Close given file. No file operations are permitted on a closed file.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized file object.

ssize_t **fs_read** (**struct** *fs_file_t* **self_p*, void **dst_p*, size_t *size*)
Read from given file into given buffer.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Initialized file object.
- `dst_p`: Buffer to read data into.
- `size`: Number of bytes to read.

ssize_t **fs_read_line** (**struct** *fs_file_t* **self_p*, void **dst_p*, size_t *size*)
Read one line from given file into given buffer. The function reads one character at a time from given file until the destination buffer is full, a newline `\n` is found or end of file is reached.

Return If a line was found the number of bytes read not including the null-termination is returned. If the destination buffer becomes full before a newline character, the destination buffer size is returned. Otherwise a negative error code is returned.

Parameters

- `self_p`: Initialized file object.
- `dst_p`: Buffer to read data into. Should fit the whole line and null-termination.
- `size`: Size of the destination buffer.

ssize_t **fs_write** (**struct** *fs_file_t* **self_p*, **const** void **src_p*, size_t *size*)
Write from given buffer into given file.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Initialized file object.
- `dst_p`: Buffer to write.
- `size`: Number of bytes to write.

int **fs_seek** (**struct** *fs_file_t* **self_p*, int *offset*, int *whence*)
Sets the file's read/write position relative to whence.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized file object.
- `offset`: New position in bytes from given whence.
- `whence`: Absolute (`FS_SEEK_SET`), relative (`FS_SEEK_CUR`) or from end (`FS_SEEK_END`).

ssize_t **fs_tell** (**struct** *fs_file_t* **self_p*)
Return current position in the file.

Return Current position or negative error code.

Parameters

- `self_p`: Initialized file object.

int **fs_dir_open** (**struct** *fs_dir_t* **dir_p*, **const** char **path_p*, int *oflag*)
Open a directory by directory path and mode flags.

Return zero(0) or negative error code.

Parameters

- `dir_p`: Directory object to be initialized.
- `path_p`: A valid path name for a directory path.
- `oflag`: mode of the directory to open (create, read, etc).

int **fs_dir_close** (**struct** *fs_dir_t* **dir_p*)
Close given directory.

Return zero(0) or negative error code.

Parameters

- `dir_p`: Directory object.

int **fs_dir_read** (**struct** *fs_dir_t* **dir_p*, **struct** *fs_dir_entry_t* **entry_p*)
Read the next file or directory within the opened directory.

Return true(1) if an entry was read or false(0) if no entry could be read, otherwise negative error code.

Parameters

- `dir_p`: Directory object.
- `entry_p`: Read entry.

int **fs_remove** (**const** char **path_p*)
Remove file by given path.

Return zero(0) or negative error code.

Parameters

- `path_p`: The path of the file to remove.

int **fs_stat** (**const** char **path_p*, **struct** *fs_stat_t* **stat_p*)
Gets file status by path.

Return zero(0) or negative error code.

Parameters

- `path_p`: The path of the file to stat.
- `stat_p`: The stat struct to populate.

int **fs_mkdir**(**const** char **path_p*)

Craete a directory with given path.

Return zero(0) or negative error code.

Parameters

- `path_p`: The path of the directoy to create.

int **fs_format**(**const** char **path_p*)

Format file system at given path.

Return zero(0) or negative error code.

Parameters

- `path_p`: The path to the root of the file system to format. All data in the file system will be deleted.

int **fs_ls**(**const** char **path_p*, **const** char **filter_p*, void **chout_p*)

List files and folders in given path. Optionally with given filter. The list is written to the output channel.

Return zero(0) or negative error code.

Parameters

- `path_p`: Directory to list.
- `filter_p`: Filter out files and folders.
- `chout_p`: Output chan.

int **fs_list**(**const** char **path_p*, **const** char **filter_p*, void **chout_p*)

List files (callbacks) and directories in given path. Optionally with given filter. The list is written to the output channel.

Return zero(0) or negative error code.

Parameters

- `path_p`: Directory to list.
- `filter_p`: Filter out files and folders.
- `chout_p`: Output chan.

int **fs_auto_complete**(char **path_p*)

Auto-complete given path.

Return >=1 if completion happened. Number of autocompleted characters added to the path. 0 if no completion happend, or negative error code.

Parameters

- `path_p`: Absolute or relative path to auto-complete.

void **fs_split** (char **buf_p*, char ***path_pp*, char ***cmd_pp*)
Split buffer into path and command inplace.

Return zero(0) or negative error code.

Parameters

- `buf_p`: Buffer to split.
- `path_pp`: Path or NULL if no path was found.
- `cmd_pp`: Command or empty string.

void **fs_merge** (char **path_p*, char **cmd_p*)
Merge path and command previously split using `fs_split()`.

Return zero(0) or negative error code.

Parameters

- `path_p`: Path from spilt.
- `cmd_p`: Command from split.

int **fs_filesystem_init_generic** (**struct** *fs_filesystem_t* **self_p*, **const** char **name_p*, **struct** *fs_filesystem_operations_t* **ops_p*)
Initialize given generic file system.

Return zero(0) or negative error code.

Parameters

- `self_p`: File system to initialize.
- `name_p`: Path to register.
- `ops_p`: File system function callbacks.

int **fs_filesystem_register** (**struct** *fs_filesystem_t* **self_p*)
Register given file system. Use the functions `fs_open()`, `fs_read()`, `fs_write()`, `fs_close()`, `fs_seek()`, fs_tell() and `fs_read_line()` to access files in a registerd file system.

Return zero(0) or negative error code.

Parameters

- `self_p`: File system to register.

int **fs_filesystem_deregister** (**struct** *fs_filesystem_t* **self_p*)
Deregister given file system.

Return zero(0) or negative error code.

Parameters

- `self_p`: File system to deregister.

int **fs_command_init** (**struct** *fs_command_t* **self_p*, far_string_t *path_p*, *fs_callback_t* *callback*, void **arg_p*)
Initialize given command.

Return zero(0) or negative error code.

Parameters

- `self_p`: Command to initialize.
- `path_p`: Path to register.
- `callback`: Command callback function.
- `arg_p`: Callback argument.

int **fs_command_register** (**struct** *fs_command_t* **command_p*)
Register given command. Registered commands are called by the function `fs_call()`.

Return zero(0) or negative error code.

Parameters

- `command_p`: Command to register.

int **fs_command_deregister** (**struct** *fs_command_t* **command_p*)
Deregister given command.

Return zero(0) or negative error code.

Parameters

- `command_p`: Command to deregister.

int **fs_counter_init** (**struct** *fs_counter_t* **self_p*, far_string_t *path_p*, uint64_t *value*)
Initialize given counter.

Return zero(0) or negative error code.

Parameters

- `self_p`: Counter to initialize.
- `path_p`: Path to register.
- `value`: Initial value of the counter.

int **fs_counter_increment** (**struct** *fs_counter_t* **self_p*, uint64_t *value*)
Increment given counter.

Return zero(0) or negative error code.

Parameters

- `self_p`: Command to initialize.
- `value`: Increment value.

int **fs_counter_register** (**struct** *fs_counter_t* **counter_p*)
Register given counter.

Return zero(0) or negative error code.

Parameters

- `counter_p`: Counter to register.

int **fs_counter_deregister** (**struct** *fs_counter_t *counter_p*)
Deregister given counter.

Return zero(0) or negative error code.

Parameters

- `counter_p`: Counter to deregister.

int **fs_parameter_init** (**struct** *fs_parameter_t *self_p*, far_string_t *path_p*, *fs_parameter_set_callback_t set_cb*, *fs_parameter_print_callback_t print_cb*, void **value_p*)
Initialize given parameter.

Return zero(0) or negative error code.

Parameters

- `self_p`: Parameter to initialize.
- `path_p`: Path to register.
- `set_cb`: Callback function set set the parameter value.
- `print_cb`: Callback function set print the parameter value.
- `value_p`: Value storage area.

int **fs_parameter_register** (**struct** *fs_parameter_t *parameter_p*)
Register given parameter.

Return zero(0) or negative error code.

Parameters

- `parameter_p`: Parameter to register.

int **fs_parameter_deregister** (**struct** *fs_parameter_t *parameter_p*)
Deregister given parameter.

Return zero(0) or negative error code.

Parameters

- `parameter_p`: Parameter to deregister.

int **fs_parameter_int_set** (void **value_p*, **const** char **src_p*)
Integer parameter setter function callback

Return zero(0) or negative error code.

Parameters

- `value_p`: Buffer the new value should be written to.
- `src_p`: Value to set as a string.

int **fs_parameter_int_print** (void **chout_p*, void **value_p*)
Integer parameter printer function callback

Return zero(0) or negative error code.

Parameters

- chout_p: Channel to write the formatted value to.
- value_p: Value to format and print to the output channel.

struct fs_filesystem_t

Public Members

const char *__name_p__

fs_type_t **type**

struct *fs_filesystem_operations_t* ***ops_p**

struct fs_filesystem_t::@32::@34 fs_filesystem_t::generic

union fs_filesystem_t::@32 fs_filesystem_t::fs

union fs_filesystem_t::@33 fs_filesystem_t::config

struct *fs_filesystem_t* ***next_p**

struct fs_file_t

Public Members

struct *fs_filesystem_t* ***filesystem_p**

union fs_file_t::@35 fs_file_t::u

struct fs_stat_t

#include <fs.h> Path stats.

Public Members

uint32_t **size**

uint8_t **type**

struct fs_command_t

Public Members

far_string_t **path_p**

fs_callback_t **callback**

void ***arg_p**

struct *fs_command_t* ***next_p**

struct fs_counter_t

Public Members

struct *fs_command_t* **command**

long long unsigned int fs_counter_t::value

struct *fs_counter_t* ***next_p**

struct fs_parameter_t

Public Members

struct *fs_command_t* **command**

fs_parameter_set_callback_t **set_cb**

fs_parameter_print_callback_t **print_cb**

void ***value_p**

struct *fs_parameter_t* ***next_p**

struct fs_dir_t

Public Members

struct *fs_filesystem_t* ***filesystem_p**

union fs_dir_t::@36 fs_dir_t::u

struct fs_dir_entry_t

Public Members

char **name**[256]

int **type**

size_t **size**

struct *date_t* **latest_mod_date**

struct fs_filesystem_operations_t

Public Members

int (***file_open**) (**struct** *fs_filesystem_t* *filesystem_p, **struct** *fs_file_t* *self_p, **const** char *path_p, int flags)

int (***file_close**) (**struct** *fs_file_t* *self_p)

ssize_t (***file_read**) (**struct** *fs_file_t* *self_p, void *dst_p, size_t size)

ssize_t (***file_write**) (**struct** *fs_file_t* *self_p, **const** void *src_p, size_t size)

int (***file_seek**) (**struct** *fs_file_t* *self_p, int offset, int whence)

ssize_t (***file_tell**) (**struct** *fs_file_t* *self_p)

`spiffs` — SPI Flash File System

The source code of this module is based on https://github.com/pellepl/spiffs.

About

Spiffs is a file system intended for SPI NOR flash devices on embedded targets.

Spiffs is designed with following characteristics in mind:

- Small (embedded) targets, sparse RAM without heap.
- Only big areas of data (blocks) can be erased.
- An erase will reset all bits in block to ones.
- Writing pulls one to zeroes.
- Zeroes can only be pulled to ones by erase.
- Wear leveling.

Source code: src/filesystems/spiffs.h, src/filesystems/spiffs.c

Test code: tst/filesystems/spiffs/main.c

Defines

SPIFFS_OK

SPIFFS_ERR_NOT_MOUNTED

SPIFFS_ERR_FULL

SPIFFS_ERR_NOT_FOUND

SPIFFS_ERR_END_OF_OBJECT

SPIFFS_ERR_DELETED

SPIFFS_ERR_NOT_FINALIZED

SPIFFS_ERR_NOT_INDEX

SPIFFS_ERR_OUT_OF_FILE_DESCS

SPIFFS_ERR_FILE_CLOSED

SPIFFS_ERR_FILE_DELETED

SPIFFS_ERR_BAD_DESCRIPTOR

SPIFFS_ERR_IS_INDEX

SPIFFS_ERR_IS_FREE

SPIFFS_ERR_INDEX_SPAN_MISMATCH

SPIFFS_ERR_DATA_SPAN_MISMATCH

SPIFFS_ERR_INDEX_REF_FREE

SPIFFS_ERR_INDEX_REF_LU

SPIFFS_ERR_INDEX_REF_INVALID

SPIFFS_ERR_INDEX_FREE

SPIFFS_ERR_INDEX_LU

SPIFFS_ERR_INDEX_INVALID

SPIFFS_ERR_NOT_WRITABLE

SPIFFS_ERR_NOT_READABLE

SPIFFS_ERR_CONFLICTING_NAME

SPIFFS_ERR_NOT_CONFIGURED

SPIFFS_ERR_NOT_A_FS

SPIFFS_ERR_MOUNTED

SPIFFS_ERR_ERASE_FAIL

SPIFFS_ERR_MAGIC_NOT_POSSIBLE

SPIFFS_ERR_NO_DELETED_BLOCKS

SPIFFS_ERR_FILE_EXISTS

SPIFFS_ERR_NOT_A_FILE

SPIFFS_ERR_RO_NOT_IMPL

SPIFFS_ERR_RO_ABORTED_OPERATION

SPIFFS_ERR_PROBE_TOO_FEW_BLOCKS

SPIFFS_ERR_PROBE_NOT_A_FS

SPIFFS_ERR_NAME_TOO_LONG

SPIFFS_ERR_INTERNAL

SPIFFS_ERR_TEST

SPIFFS_DBG (...)

SPIFFS_GC_DBG (...)

SPIFFS_CACHE_DBG (...)

SPIFFS_CHECK_DBG (...)

SPIFFS_APPEND
Any write to the filehandle is appended to end of the file.

SPIFFS_O_APPEND

SPIFFS_TRUNC
If the opened file exists, it will be truncated to zero length before opened.

SPIFFS_O_TRUNC

SPIFFS_CREAT
If the opened file does not exist, it will be created before opened.

SPIFFS_O_CREAT

SPIFFS_RDONLY
The opened file may only be read.

SPIFFS_O_RDONLY

SPIFFS_WRONLY
The opened file may only be written.

SPIFFS_O_WRONLY

SPIFFS_RDWR
The opened file may be both read and written.

SPIFFS_O_RDWR

SPIFFS_DIRECT
Any writes to the filehandle will never be cached but flushed directly.

SPIFFS_O_DIRECT

SPIFFS_EXCL
If SPIFFS_O_CREAT and SPIFFS_O_EXCL are set, SPIFFS_open() shall fail if the file exists.

SPIFFS_O_EXCL

SPIFFS_SEEK_SET

SPIFFS_SEEK_CUR

SPIFFS_SEEK_END

SPIFFS_TYPE_FILE

SPIFFS_TYPE_DIR

SPIFFS_TYPE_HARD_LINK

SPIFFS_TYPE_SOFT_LINK

SPIFFS_LOCK(fs)

SPIFFS_UNLOCK(fs)

Typedefs

typedef int16_t **spiffs_file_t**
Spiffs file descriptor index type. must be signed.

typedef uint16_t **spiffs_flags_t**
Spiffs file descriptor flags.

typedef uint16_t **spiffs_mode_t**
Spiffs file mode.

typedef uint8_t **spiffs_obj_type_t**
Object type.

typedef int32_t (***spiffs_read_cb_t**)(uint32_t addr, uint32_t size, uint8_t *dst_p)
Spi read call function type.

typedef int32_t (***spiffs_write_cb_t**)(uint32_t addr, uint32_t size, uint8_t *src_p)
Spi write call function type.

typedef int32_t (***spiffs_erase_cb_t**)(uint32_t addr, uint32_t size)
Spi erase call function type.

typedef void (***spiffs_check_callback_t**) (**enum** *spiffs_check_type_t* type, **enum** *spiffs_check_report_t* report, uint32_t arg1, uint32_t arg2)
File system check callback function.

typedef void (***spiffs_file_callback_t**) (**struct** *spiffs_t* *fs_p, **enum** *spiffs_fileop_type_t* op, spiffs_obj_id_t obj_id, spiffs_page_ix_t pix)
File system listener callback function.

typedef spiffs_block_ix_t **spiffs_block_ix**

typedef spiffs_page_ix_t **spiffs_page_ix**

typedef spiffs_obj_id_t **spiffs_obj_id**

typedef spiffs_span_ix_t **spiffs_span_ix**

typedef struct *spiffs_t* **spiffs**

typedef *spiffs_file_t* **spiffs_file**

typedef *spiffs_flags_t* **spiffs_flags**

typedef *spiffs_obj_type_t* **spiffs_obj_type**

typedef *spiffs_mode_t* **spiffs_mode**

typedef enum *spiffs_fileop_type_t* **spiffs_fileop_type**

typedef struct *spiffs_config_t* **spiffs_config**

typedef *spiffs_check_callback_t* **spiffs_check_callback**

typedef struct *spiffs_dirent_t* **spiffs_dirent**

typedef struct *spiffs_dir_t* **spiffs_DIR**

typedef *spiffs_file_callback_t* **spiffs_file_callback**

Enums

enum spiffs_check_type_t
File system check callback report operation.

Values:

SPIFFS_CHECK_LOOKUP = 0

SPIFFS_CHECK_INDEX

SPIFFS_CHECK_PAGE

enum spiffs_check_report_t
File system check callback report type.

Values:

SPIFFS_CHECK_PROGRESS = 0

SPIFFS_CHECK_ERROR

SPIFFS_CHECK_FIX_INDEX

SPIFFS_CHECK_FIX_LOOKUP

SPIFFS_CHECK_DELETE_ORPHANED_INDEX

SPIFFS_CHECK_DELETE_PAGE

SPIFFS_CHECK_DELETE_BAD_FILE

enum spiffs_fileop_type_t
File system listener callback operation.

Values:

SPIFFS_CB_CREATED = 0
The file has been created.

SPIFFS_CB_UPDATED
The file has been updated or moved to another page.

SPIFFS_CB_DELETED
The file has been deleted.

Functions

int32_t **spiffs_mount** (**struct** *spiffs_t* **self_p*, **struct** *spiffs_config_t* **config_p*, uint8_t **work_p*, uint8_t **fd_space_p*, uint32_t *fd_space_size*, void **cache_p*, uint32_t *cache_size*, *spiffs_check_callback_t* *check_cb*)
Initializes the file system dynamic parameters and mounts the filesystem. If SPIFFS_USE_MAGIC is enabled the mounting may fail with SPIFFS_ERR_NOT_A_FS if the flash does not contain a recognizable file system. In this case, SPIFFS_format must be called prior to remounting.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `config_p`: The physical and logical configuration of the file system.
- `work_p`: A memory work buffer comprising 2*config->log_page_size bytes used throughout all file system operations
- `fd_space_p`: Memory for file descriptors.
- `fd_space_size`: Memory size of file descriptors.
- `cache_p`: Memory for cache, may be NULL.
- `cache_size`: Memory size of cache.
- `check_cb`: Callback function for reporting during consistency checks.

void **spiffs_unmount** (**struct** *spiffs_t* **self_p*)
Unmounts the file system. All file handles will be flushed of any cached writes and closed.

Return void.

Parameters

- `self_p`: The file system struct.

int32_t **spiffs_creat** (**struct** *spiffs_t* **self_p*, **const** char **path_p*, *spiffs_mode_t* *mode*)
Creates a new file.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `path_p`: The path of the new file.
- `mode`: Ignored, for posix compliance.

spiffs_file_t **spiffs_open** (**struct** *spiffs_t* **self_p*, **const** char **path_p*, *spiffs_flags_t flags*, *spiffs_mode_t mode*)

Opens/creates a file.

Parameters

- `self_p`: The file system struct.
- `path_p`: The path of the new file.
- `flags`: The flags for the open command, can be combinations of SPIFFS_O_APPEND, SPIFFS_O_TRUNC, SPIFFS_O_CREAT, SPIFFS_O_RDONLY, SPIFFS_O_WRONLY, SPIFFS_O_RDWR, SPIFFS_O_DIRECT, SPIFFS_O_EXCL.
- `mode`: Ignored, for posix compliance.

spiffs_file_t **spiffs_open_by_dirent** (**struct** *spiffs_t* **self_p*, **struct** *spiffs_dirent_t* **ent_p*, *spiffs_flags_t flags*, *spiffs_mode_t mode*)

Opens a file by given dir entry.

Optimization purposes, when traversing a file system with SPIFFS_readdir a normal SPIFFS_open would need to traverse the filesystem again to find the file, whilst SPIFFS_open_by_dirent already knows where the file resides.

Parameters

- `self_p`: The file system struct.
- `e_p`: The dir entry to the file.
- `flags`: The flags for the open command, can be combinations of SPIFFS_APPEND, SPIFFS_TRUNC, SPIFFS_CREAT, SPIFFS_RD_ONLY, SPIFFS_WR_ONLY, SPIFFS_RDWR, SPIFFS_DIRECT. SPIFFS_CREAT will have no effect in this case.
- `mode`: Ignored, for posix compliance.

spiffs_file_t **spiffs_open_by_page** (**struct** *spiffs_t* **self_p*, spiffs_page_ix_t *page_ix*, *spiffs_flags_t flags*, *spiffs_mode_t mode*)

Opens a file by given page index.

Optimization purposes, opens a file by directly pointing to the page index in the spi flash. If the page index does not point to a file header SPIFFS_ERR_NOT_A_FILE is returned.

Parameters

- `self_p`: The file system struct.
- `page_ix`: The page index.
- `flags`: The flags for the open command, can be combinations of SPIFFS_APPEND, SPIFFS_TRUNC, SPIFFS_CREAT, SPIFFS_RD_ONLY, SPIFFS_WR_ONLY, SPIFFS_RDWR, SPIFFS_DIRECT. SPIFFS_CREAT will have no effect in this case.
- `mode`: Ignored, for posix compliance.

int32_t **spiffs_read** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*, void **buf_p*, int32_t *len*)
Reads from given filehandle.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle.
- `buf_p`: Where to put read data.
- `len`: How much to read.

int32_t **spiffs_write** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*, void **buf_p*, int32_t *len*)
Writes to given filehandle.

Return Number of bytes written, or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle.
- `buf_p`: The data to write.
- `len`: How much to write.

int32_t **spiffs_lseek** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*, int32_t *offs*, int *whence*)
Moves the read/write file offset. Resulting offset is returned or negative if error.

lseek(fs, fd, 0, SPIFFS_SEEK_CUR) will thus return current offset.

If SPIFFS_SEEK_CUR, the file offset shall be set to its current location plus offset.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle.
- `offs`: How much/where to move the offset.
- `whence`: If SPIFFS_SEEK_SET, the file offset shall be set to offset bytes.

If SPIFFS_SEEK_END, the file offset shall be set to the size of the file plus offse, which should be negative.

Return zero(0) or negative error code.

int32_t **spiffs_remove** (**struct** *spiffs_t* **self_p*, **const** char **path_p*)
Removes a file by path.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `path_p`: The path of the file to remove.

int32_t **spiffs_fremove** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*)
Removes a file by filehandle.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle of the file to remove.

int32_t **spiffs_stat** (**struct** *spiffs_t* **self_p*, **const** char **path_p*, **struct** *spiffs_stat_t* **stat_p*)
Gets file status by path.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `path_p`: The path of the file to stat.
- `stat_p`: The stat struct to populate.

int32_t **spiffs_fstat** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*, **struct** *spiffs_stat_t* **stat_p*)
Gets file status by filehandle.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle of the file to stat.
- `stat_p`: The stat struct to populate.

int32_t **spiffs_fflush** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*)
Flushes all pending write operations from cache for given file.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle of the file to flush.

int32_t **spiffs_close** (**struct** *spiffs_t* **self_p*, *spiffs_file_t fh*)
Closes a filehandle. If there are pending write operations, these are finalized before closing.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle of the file to close.

int32_t **spiffs_rename** (**struct** *spiffs_t* **self_p*, **const** char **old_path_p*, **const** char **new_path_p*)
Renames a file.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `old_path_p`: Path of file to rename.
- `new_path_p`: New path of file.

int32_t **spiffs_errno** (**struct** *spiffs_t* **self_p*)

Returns last error of last file operation.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.

void **spiffs_clearerr** (**struct** *spiffs_t* **self_p*)

Clears last error.

Return void.

Parameters

- `self_p`: The file system struct.

struct *spiffs_dir_t* ***spiffs_opendir** (**struct** *spiffs_t* **self_p*, **const** char **name_p*, **struct** *spiffs_dir_t* **dir_p*)

Opens a directory stream corresponding to the given name. The stream is positioned at the first entry in the directory. On hydrogen builds the name argument is ignored as hydrogen builds always correspond to a flat file structure - no directories.

Parameters

- `self_p`: The file system struct.
- `name_p`: The name of the directory.
- `dir_p`: Pointer the directory stream to be populated.

int32_t **spiffs_closedir** (**struct** *spiffs_dir_t* **dir_p*)

Closes a directory stream

Return zero(0) or negative error code.

Parameters

- `dir_p`: The directory stream to close.

struct *spiffs_dirent_t* ***spiffs_readdir** (**struct** *spiffs_dir_t* **dir_p*, **struct** *spiffs_dirent_t* **ent_p*)

Reads a directory into given spifs_dirent struct.

Return NULL if error or end of stream, else given dirent is returned.

Parameters

- `dir_p`: Pointer to the directory stream.
- `ent_p`: The dirent struct to be populated.

int32_t **spiffs_check** (**struct** *spiffs_t* **self_p*)

Runs a consistency check on given filesystem.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.

int32_t **spiffs_info** (**struct** *spiffs_t* **self_p*, uint32_t **total_p*, uint32_t **used_p*)

Returns number of total bytes available and number of used bytes. This is an estimation, and depends on if there a many files with little data or few files with much data.

NB: If used number of bytes exceeds total bytes, a SPIFFS_check should run. This indicates a power loss in midst of things. In worst case (repeated powerlosses in mending or gc) you might have to delete some files.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `total_p`: Total number of bytes in filesystem.
- `used_p`: Used number of bytes in filesystem.

int32_t **spiffs_format** (**struct** *spiffs_t* **self_p*)

Formats the entire file system. All data will be lost. The filesystem must not be mounted when calling this.

NB: formatting is awkward. Due to backwards compatibility, SPIFFS_mount MUST be called prior to formatting in order to configure the filesystem. If SPIFFS_mount succeeds, SPIFFS_unmount must be called before calling SPIFFS_format. If SPIFFS_mount fails, SPIFFS_format can be called directly without calling SPIFFS_unmount first.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.

uint8_t **spiffs_mounted** (**struct** *spiffs_t* **self_p*)

Returns nonzero if spiffs is mounted, or zero if unmounted.

Parameters

- `self_p`: The file system struct.

int32_t **spiffs_gc_quick** (**struct** *spiffs_t* **self_p*, uint16_t *max_free_pages*)

Tries to find a block where most or all pages are deleted, and erase that block if found. Does not care for wear levelling. Will not move pages around.

If parameter max_free_pages are set to 0, only blocks with only deleted pages will be selected.

NB: the garbage collector is automatically called when spiffs needs free pages. The reason for this function is to give possibility to do background tidying when user knows the system is idle.

Use with care.

Setting max_free_pages to anything larger than zero will eventually wear flash more as a block containing free pages can be erased.

Will set err_no to SPIFFS_OK if a block was found and erased, SPIFFS_ERR_NO_DELETED_BLOCK if no matching block was found, or other error.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `max_free_pages`: maximum number allowed free pages in block.

int32_t **spiffs_gc** (**struct** *spiffs_t* **self_p*, uint32_t *size*)

Will try to make room for given amount of bytes in the filesystem by moving pages and erasing blocks. If it is physically impossible, err_no will be set to SPIFFS_ERR_FULL. If there already is this amount (or more) of free space, SPIFFS_gc will silently return. It is recommended to call SPIFFS_info before invoking this method in order to determine what amount of bytes to give.

NB: the garbage collector is automatically called when spiffs needs free pages. The reason for this function is to give possibility to do background tidying when user knows the system is idle.

Use with care.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `size`: Amount of bytes that should be freed.

int32_t **spiffs_eof** (**struct** *spiffs_t* **self_p*, *spiffs_file_t* *fh*)

Check if EOF reached.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle of the file to check.

int32_t **spiffs_tell** (**struct** *spiffs_t* **self_p*, *spiffs_file_t* *fh*)

Get position in file.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `fh`: The filehandle of the file to check.

int32_t **spiffs_set_file_callback_func** (**struct** *spiffs_t* **self_p*, *spiffs_file_callback_t* *cb_func*)

Registers a callback function that keeps track on operations on file headers. Do note, that this callback is called from within internal spiffs mechanisms. Any operations on the actual file system being callbacked from in this callback will mess things up for sure - do not do this. This can be used to track where files are and move around during garbage collection, which in turn can be used to build location tables in ram. Used in conjuction with SPIFFS_open_by_page this may improve performance when opening a lot of files. Must be invoked after mount.

Return zero(0) or negative error code.

Parameters

- `self_p`: The file system struct.
- `cb_func`: The callback on file operations.

struct spiffs_config_t
#include <spiffs.h> Spiffs spi configuration struct.

Public Members

spiffs_read_cb_t **hal_read_f**
Physical read function.

spiffs_write_cb_t **hal_write_f**
Physical write function.

spiffs_erase_cb_t **hal_erase_f**
Physical erase function.

uint32_t **phys_size**
Physical size of the spi flash.

uint32_t **phys_addr**
Physical offset in spi flash used for spiffs, must be on block boundary.

uint32_t **phys_erase_block**
Physical size when erasing a block.

uint32_t **log_block_size**
Logical size of a block, must be on physical block size boundary and must never be less than a physical block.

uint32_t **log_page_size**
Logical size of a page, must be at least log_block_size /

1.

struct spiffs_t

Public Members

struct *spiffs_config_t* **cfg**
File system configuration.

uint32_t **block_count**
Number of logical blocks.

spiffs_block_ix_t **free_cursor_block_ix**
Cursor for free blocks, block index.

int **free_cursor_obj_lu_entry**
Cursor for free blocks, entry index.

spiffs_block_ix_t **cursor_block_ix**
Cursor when searching, block index.

int **cursor_obj_lu_entry**
Cursor when searching, entry index.

uint8_t ***lu_work**
Primary work buffer, size of a logical page.

uint8_t ***work**
Secondary work buffer, size of a logical page.

uint8_t ***fd_space**
File descriptor memory area.

uint32_t **fd_count**
Available file descriptors.

int32_t **err_code**
Last error.

uint32_t **free_blocks**
Current number of free blocks.

uint32_t **stats_p_allocated**
Current number of busy pages.

uint32_t **stats_p_deleted**
Current number of deleted pages.

uint8_t **cleaning**
Flag indicating that garbage collector is cleaning.

spiffs_obj_id_t **max_erase_count**
Max erase count amongst all blocks.

spiffs_check_callback_t **check_cb_f**
Check callback function.

spiffs_file_callback_t **file_cb_f**
File callback function.

uint8_t **mounted**
Mounted flag.

void ***user_data**
User data.

uint32_t **config_magic**
Config magic.

struct spiffs_stat_t
#include <spiffs.h> Spiffs file status struct.

Public Members

spiffs_obj_id_t **obj_id**

uint32_t **size**

spiffs_obj_type_t **type**

spiffs_page_ix_t **pix**

uint8_t **name**[SPIFFS_OBJ_NAME_LEN]

struct spiffs_dirent_t

Public Members

spiffs_obj_id_t **obj_id**

uint8_t **name**[SPIFFS_OBJ_NAME_LEN]

spiffs_obj_type_t **type**

uint32_t **size**

spiffs_page_ix_t **pix**

struct spiffs_dir_t

Public Members

struct *spiffs_t* ***fs**

spiffs_block_ix_t **block**

int **entry**

inet

The inet package on Github.

Modules:

`http_server` — HTTP server

A HTTP server serves HTTP client requests, typically from a web browser.

A HTTP server can be wrapped in SSL, a secutiry layer, to create a HTTPS server.

Source code: src/inet/http_server.h, src/inet/http_server.c

Test code: tst/inet/http_server/main.c

Test coverage: src/inet/http_server.c

Example code: examples/http_server/main.c, examples/https_server/main.c

---

Typedefs

typedef int (***http_server_route_callback_t**) (**struct** *http_server_connection_t* *connection_p, **struct** *http_server_request_t* *request_p)

Enums

enum http_server_request_action_t

Values:

http_server_request_action_get_t = 0

http_server_request_action_post_t = 1

enum http_server_content_type_t

Content type.

Values:

http_server_content_type_text_plain_t = 0

http_server_content_type_text_html_t = 1

enum **http_server_response_code_t**
Response codes.

Values:

http_server_response_code_200_ok_t = 200

http_server_response_code_400_bad_request_t = 400

http_server_response_code_401_unauthorized_t = 401

http_server_response_code_404_not_found_t = 404

enum **http_server_connection_state_t**
Connection state.

Values:

http_server_connection_state_free_t = 0

http_server_connection_state_allocated_t

Functions

int **http_server_init** (**struct** *http_server_t* **self_p*, **struct** *http_server_listener_t* **listener_p*, **struct** *http_server_connection_t* **connections_p*, **const** char **root_path_p*, **const struct** *http_server_route_t* **routes_p*, *http_server_route_callback_t* *on_no_route*)
Initialize given http server with given root path and maximum number of clients.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http server to initialize.
- `listener_p`: Listener.
- `connections_p`: A NULL terminated list of connections.
- `root_path_p`: Working directory for the connection threads.
- `routes_p`: An array of routes.
- `on_no_route`: Callback called for all requests without a matching route in route_p.

int **http_server_wrap_ssl** (**struct** *http_server_t* **self_p*, **struct** *ssl_context_t* **context_p*)
Wrap given HTTP server in SSL, to make it secure.

This function must be called after `http_server_init()` and before `http_server_start()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http server to wrap in SSL.
- `context_p`: SSL context to wrap the server in.

int **http_server_start** (**struct** *http_server_t* **self_p*)

Start given HTTP server.

Spawn the threads and start listening for connections.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http server.

int **http_server_stop** (**struct** *http_server_t* **self_p*)

Stop given HTTP server.

Closes the listener and all open connections, and then kills the threads.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http server.

int **http_server_response_write** (**struct** *http_server_connection_t* **connection_p*, **struct** *http_server_request_t* **request_p*, **struct** *http_server_response_t* **response_p*)

Write given HTTP response to given connected client. This function should only be called from the route callbacks to respond to given request.

Return zero(0) or negative error code.

Parameters

- `connection_p`: Current connection.
- `request_p`: Current request.
- `response_p`: Current response. If `buf_p` in the response to NULL this function will only write the HTTP header, including the size, to the socket. After this function returns write the payload by calling `socket_write()`.

struct http_server_request_t

#include <http_server.h> HTTP request.

Public Members

http_server_request_action_t **action**

char **path**[64]

int **present**

char **value**[20]

struct http_server_request_t::@38::@39 http_server_request_t::sec_websocket_key

struct http_server_request_t::@38::@40 http_server_request_t::content_type

long **value**

struct http_server_request_t::@38::@41 http_server_request_t::content_length

struct http_server_request_t::@38::@42 http_server_request_t::authorization

struct http_server_request_t::@38::@43 http_server_request_t::expect

struct http_server_request_t::@38 http_server_request_t::headers

struct http_server_response_t

#include <http_server.h> HTTP response.

Public Members

int **type**

http_server_response_code_t **code**

const char ***buf_p**

size_t **size**

struct http_server_response_t::@44 http_server_response_t::content

struct http_server_listener_t

Public Members

const char ***address_p**

int **port**

const char ***name_p**

void ***buf_p**

size_t **size**

struct http_server_listener_t::@45::@46 http_server_listener_t::stack

struct *thrd_t* ***id_p**

struct http_server_listener_t::@45 http_server_listener_t::thrd

struct *socket_t* **socket**

struct http_server_connection_t

Public Members

http_server_connection_state_t **state**

const char ***name_p**

void ***buf_p**

size_t **size**

struct http_server_connection_t::@47::@48 http_server_connection_t::stack

struct *thrd_t* ***id_p**

struct http_server_connection_t::@47 http_server_connection_t::thrd

struct *http_server_t* ***self_p**

struct *socket_t* **socket**

void *chan_p

struct *event_t* events

struct http_server_route_t
#include <http_server.h> Call given callback for given path.

Public Members

const char *path_p

http_server_route_callback_t callback

struct http_server_t

Public Members

const char *root_path_p

const struct *http_server_route_t* *routes_p

http_server_route_callback_t on_no_route

struct *http_server_listener_t* *listener_p

struct *http_server_connection_t* *connections_p

struct *ssl_context_t* *ssl_context_p

struct *event_t* events

http_websocket_client — HTTP websocket client

Source code: src/inet/http_websocket_client.h, src/inet/http_websocket_client.c

Test code: tst/inet/http_websocket_client/main.c

Test coverage: src/inet/http_websocket_client.c

Functions

int http_websocket_client_init (struct *http_websocket_client_t* *self_p*, const char **server_p*, int *port*, const char **path_p*)
Initialize given http.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http to initialize.
- `server_p`: Server hostname to connect to.
- `port`: Port to connect to.
- `path_p`: Path.

int **http_websocket_client_connect** (**struct** *http_websocket_client_t* **self_p*)
Connect given http to the server.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http to connect.

int **http_websocket_client_disconnect** (**struct** *http_websocket_client_t* **self_p*)
Disconnect given http from the server.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http to connect.

ssize_t **http_websocket_client_read** (**struct** *http_websocket_client_t* **self_p*, void **buf_p*, size_t *size*)
Read from given http.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Http to read from.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read..

ssize_t **http_websocket_client_write** (**struct** *http_websocket_client_t* **self_p*, int *type*, **const** void **buf_p*, uint32_t *size*)
Write given data to given http.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Http to write to.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

struct http_websocket_client_t
#include <http_websocket_client.h>

Public Members

struct *socket_t* **socket**

const char ***host_p**

int **port**

struct http_websocket_client_t::@49 http_websocket_client_t::server

size_t **left**

struct http_websocket_client_t::@50 http_websocket_client_t::frame

const char ***path_p**

`http_websocket_server` — HTTP websocket server

Source code: src/inet/http_websocket_server.h, src/inet/http_websocket_server.c

Test code: tst/inet/http_websocket_server/main.c

Test coverage: src/inet/http_websocket_server.c

Functions

int **http_websocket_server_init** (**struct** *http_websocket_server_t* **self_p*, **struct** *socket_t* **socket_p*)

Initialize given websocket server. The server uses the http module interface to communicate with the client.

Return zero(0) or negative error code.

Parameters

- `self_p`: Http to initialize.
- `socket_p`: Connected socket.

int **http_websocket_server_handshake** (**struct** *http_websocket_server_t* **self_p*, **struct** *http_server_request_t* **request_p*)

Read the handshake request from the client and send the handshake response.

Return zero(0) or negative error code.

Parameters

- `self_p`: Websocket server.
- `request_p`: Read handshake request.

ssize_t **http_websocket_server_read** (**struct** *http_websocket_server_t* **self_p*, int **type_p*, void **buf_p*, size_t *size*)

Read a message from given websocket.

Return Number of bytes read or negative error code.

Parameters

- `self_p`: Websocket to read from.
- `type_p`: Read message type.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read. Longer messages will be truncated and the leftover data dropped.

ssize_t **http_websocket_server_write** (**struct** *http_websocket_server_t* **self_p*, int *type*, **const** void **buf_p*, uint32_t *size*)

Write given message to given websocket.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Websocket to write to.
- `type`: One of `HTTP_TYPE_TEXT` and `HTTP_TYPE_BINARY`.
- `buf_p`: Buffer to write.
- `size`: Number of bytes to write.

struct `http_websocket_server_t`
#include <http_websocket_server.h>

Public Members

struct *socket_t* ***`socket_p`**

`inet` — Internet utilities

Source code: src/inet/inet.h, src/inet/inet.c

Test code: tst/inet/inet/inet.c

Test coverage: src/inet/inet.c

Functions

int **`inet_module_init`** (void)
Initialize the inet module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **`inet_aton`** (**const** char **src_p*, **struct** *inet_ip_addr_t* **dst_p*)
Convert the Internet host address src_p from the IPv4 numbers-and-dots notation into binary form (in network byte order) and stores it in the structure that dst_p points to.

The address supplied in src_p can have one of the following forms:

- a.b.c.d Each of the four numeric parts specifies a byte of the address; the bytes are assigned in left-to-right order to produce the binary address.

Return zero(0) or negative error code.

Parameters

- `src_p`: Address a.b.c.d to convert into a number.
- `dst_p`: Converted address.

char ***`inet_ntoa`** (**const struct** *inet_ip_addr_t* **src_p*, char **dst_p*)
Convert the Internet host src_p from the IPv4 binary form (in network byte order) to numbers-and-dots notation and stores it in the structure that dst_p points to.

Return Converted address pointer or NULL on failure.

Parameters

- `src_p`: Address to convert into a string.
- `dst_p`: Converted address as a string.

uint16_t **inet_checksum**(void **buf_p*, size_t *size*)

Calculate the internet checksum of given buffer.

Return Calculated checksum.

Parameters

- `buf_p`: Buffer to calculate the chechsum of.
- `size`: Size of the buffer.

struct inet_ip_addr_t

#include <inet.h>

Public Members

uint32_t **number**

IPv4 address.

struct inet_addr_t

Public Members

struct *inet_ip_addr_t* **ip**

IPv4 address.

uint16_t **port**

Port.

struct inet_if_ip_info_t

#include <inet.h> Interface IP information.

Public Members

struct *inet_ip_addr_t* **address**

struct *inet_ip_addr_t* **netmask**

struct *inet_ip_addr_t* **gateway**

`isotp` — ISO-TP

Source code: src/inet/isotp.h, src/inet/isotp.c

Test code: tst/inet/isotp/main.c

Defines

ISOTP_FLAGS_NO_FLOW_CONTROL

Functions

int **isotp_init** (**struct** *isotp_t* **self_p*, uint8_t **message_p*, size_t *size*, int *flags*)

Initialize given ISO-TP object. An object can *either* be used to transmit or receive an ISO-TP message. Once `isotp_input()` or `isotp_output()` returns a positive value the message transmission is completed.

An object can only be used to transmit one message. Initialize a new object to transmit another message.

Return zero(0) or negative error code.

Parameters

- `self_p`: Driver object to initialize.
- `message_p`: ISO-TP message to transmit, or a reception buffer for an incoming message.
- `size`: Size of the message buffer in bytes.
- `flags`: Configuration flags.

ssize_t **isotp_input** (**struct** *isotp_t* **self_p*, **const** uint8_t **buf_p*, size_t *size*)

Input a CAN frame into given ISO-TP object. Always call isotp_output() after this function returns zero(0) to check if there are frames to transmit.

For an ISO-TP object that transmits a message this function always returns zero(0) or negative error code.

Return Once a complete ISO-TP message has been received the size of the message is returned. Meanwhile, zero(0) is returned if the frame was expected. A negative error code is returned if the frame was unexpected or invalid.

Parameters

- `self_p`: Initialized ISO-TP object.
- `buf_p`: Input data.
- `size`: Data buffer length is bytes.

ssize_t **isotp_output** (**struct** *isotp_t* **self_p*, uint8_t **buf_p*, size_t **size_p*)

Check if there is data to be transmitted. The caller must transmit all frames this function creates.

For an ISO-TP object that receives a message this function always returns zero(0) or negative error code.

Return Once a complete ISO-TP message has been transmitted the size of the message is returned. Meanwhile, zero(0) or negative error code is returned.

Parameters

- `self_p`: Initialized ISO-TP object.
- `buf_p`: Output data to be transmitted to the peer. The size of this buffer must be at least eight bytes.
- `size_p`: Number of bytes to be transmitted.

struct isotp_t

Public Members

uint8_t ***message_p**

size_t **size**

int **state**

int **flags**

size_t **offset**

int **next_index**

struct isotp_t::@51 isotp_t::message

`mqtt_client` — MQTT client

MQTT is a publish-subscribe-based lightweight messaging protocol.

Note: This driver only implements the MQTT protocol, not the transport layer (normally TCP). That has to be set up using channels.

The driver works by running the processing code in a thread which communicate with the MQTT broker on one side using channels, and the application on the other side using queues.

This means the application has to set up appropriate channels, which is already ready to communicate with the MQTT server, e.g. using TCP, and the thread running the MQTT client.

Basic example of initializing MQTT over TCP (error checking left out for brevity).

```
static size_t on_publish(struct mqtt_client_t *client_p,
                         const char *topic_p,
                         void *chin_p,
                         size_t size)
{
    uint8_t buf[32];

    chan_read(chin_p, buf, size);
    buf[size] = '\0';
    std_printf(OSTR("on_publish: %s\r\n"), &buf[0]);

    return (0);
}
```

```
struct inet_addr_t remote_host_address;

inet_aton("127.0.0.1", &remote_host_address.ip);
remote_host_address.port = 1883;
socket_open_tcp(&server_sock);
socket_connect(&server_sock, &remote_host_address);

mqtt_client_init(&client,
                 "mqtt_client",
                 NULL,
                 &server_sock,
                 &server_sock,
                 on_publish,
```

```
                 NULL);

thrd_spawn(mqtt_client_main,
           &client,
           0,
           stack,
           sizeof(stack));

mqtt_client_connect(&client);
```

Source code: src/inet/mqtt_client.h, src/inet/mqtt_client.c

Test code: tst/inet/mqtt_client/main.c

Test coverage: src/inet/mqtt_client.c

Example code: examples/mqtt_client/main.c

Typedefs

typedef size_t (*`mqtt_on_publish_t`) (**struct** *mqtt_client_t* *client_p, **const** char *topic_p, void *chin_p, size_t size)

Prototype of the on-publish callback function.

Return Number of bytes read from the input channel.

Parameters

- `client_p`: The client.
- `topic_p`: The received topic.
- `chin_p`: The channel to read the value from.
- `size`: Number of bytes of the value to read from chin_p.

typedef int (*`mqtt_on_error_t`) (**struct** *mqtt_client_t* *client_p, int error)

Prototype of the on-error callback function.

Return zero(0) or nagative error code.

Parameters

- `client_p`: The client.
- `error`: The number of error that occured.

Enums

enum `mqtt_client_state_t`

Values:

`mqtt_client_state_disconnected_t`

`mqtt_client_state_connected_t`

`mqtt_client_state_connecting_t`

enum mqtt_qos_t
Quality of Service.

Values:

mqtt_qos_0_t = 0

mqtt_qos_1_t = 1

mqtt_qos_2_t = 2

Functions

int **mqtt_client_init** (**struct** *mqtt_client_t* **self_p*, **const** char **name_p*, **struct** *log_object_t* **log_object_p*, void **chout_p*, void **chin_p*, *mqtt_on_publish_t* *on_publish*, *mqtt_on_error_t* *on_error*)
Initialize given MQTT client.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.
- `name_p`: Name of the thread.
- `log_object_p`: Log object.
- `chout_p`: Output channel for client to server packets.
- `chin_p`: Input channel for server to client packets.
- `on_publish`: On-publish callback function. Called when the server publishes a message.
- `on_error`: On-error callback function. Called when an error occurs. If NULL, a default handler is used.

void ***mqtt_client_main** (void **arg_p*)
MQTT client thread.

Return Never returns.

Parameters

- `arg_p`: MQTT client.

int **mqtt_client_connect** (**struct** *mqtt_client_t* **self_p*)
Establish a connection to the server.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.

int **mqtt_client_disconnect** (**struct** *mqtt_client_t* **self_p*)
Disconnect from the server.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.

int **mqtt_client_ping**(**struct** *mqtt_client_t* **self_p*)

Send a ping request to the server (broker) and wait for the ping response.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.

int **mqtt_client_publish**(**struct** *mqtt_client_t* **self_p*, **struct** *mqtt_application_message_t* **message_p*)

Publish given topic.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.
- `topic_p`: Topic.
- `payload_p`: Payload to publish. May be NULL.
- `payload_size`: Number of bytes in the payload.

int **mqtt_client_subscribe**(**struct** *mqtt_client_t* **self_p*, **struct** *mqtt_application_message_t* **message_p*)

Subscribe to given message.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.
- `message_p`: The message to subscribe to. The payload part of the message is not used. The topic may use wildcards, given that the server supports it.

int **mqtt_client_unsubscribe**(**struct** *mqtt_client_t* **self_p*, **struct** *mqtt_application_message_t* **message_p*)

Unsubscribe from given message.

Return zero(0) or negative error code.

Parameters

- `self_p`: MQTT client.
- `message_p`: The message to unsubscribe from. Only the topic in the message is used.

struct mqtt_client_t

#include <mqtt_client.h> MQTT client.

Public Members

const char ***name_p**

struct *log_object_t* ***log_object_p**

int **state**

int **type**

void ***data_p**

struct mqtt_client_t::@52 mqtt_client_t::message

void ***out_p**

void ***in_p**

struct mqtt_client_t::@53 mqtt_client_t::transport

struct *queue_t* **out**

struct *queue_t* **in**

struct mqtt_client_t::@54 mqtt_client_t::control

mqtt_on_publish_t **on_publish**

mqtt_on_error_t **on_error**

struct mqtt_application_message_t

#include <mqtt_client.h> MQTT application message.

Public Members

const char ***buf_p**

size_t **size**

struct mqtt_application_message_t::@55 mqtt_application_message_t::topic

const void ***buf_p**

struct mqtt_application_message_t::@56 mqtt_application_message_t::payload

mqtt_qos_t **qos**

network_interface — Network interface

The network interface module has a list of all network interfaces and their states.

Network interface modules:

network_interface_slip — Serial Link Internet Protocol

Serial Line Internet Protocol (SLIP) is a link layer internet protocol used to transfer TCP/IP packets over a point-to-point serial line.

It is documented in RFC 1055.

Source code: src/inet/network_interface/slip.h

Example code: examples/inet/slip/main.c

Defines

NETWORK_INTERFACE_SLIP_FRAME_SIZE_MAX

Enums

enum network_interface_slip_state_t
Values:

NETWORK_INTERFACE_SLIP_STATE_NORMAL = 0

NETWORK_INTERFACE_SLIP_STATE_ESCAPE

Functions

int **network_interface_slip_module_init** (void)
Initialize the slip module.

Return zero(0) or negative error code.

int **network_interface_slip_init** (**struct** *network_interface_slip_t* **self_p*, **struct** *inet_ip_addr_t* **ipaddr_p*, **struct** *inet_ip_addr_t* **netmask_p*, **struct** *inet_ip_addr_t* **gateway_p*, void **chout_p*)
Initialize given slip network interface with given configuration and output channel.

Return zero(0) or negative error code.

Parameters

- `self_p`: Slip to initialize.
- `ipaddr_p`: Network interface IP address.
- `netmask_p`: Network interface netmask.
- `gateway_p`: Network interface gateway.
- `chout_p`: Output channel.

int **network_interface_slip_input** (**struct** *network_interface_slip_t* **self_p*, uint8_t *data*)
Input a byte into the SLIP IP stack. Normally a user thread reads one byte at a time from the UART and calls this functions with the read byte as argument.

Return Number of bytes written to the input frame or negative error code.

Parameters

- `self_p`: Slip to initialize.
- `data`: Byte to input into the stack.

struct network_interface_slip_t

Public Members

network_interface_slip_state_t **state**

struct pbuf ***pbuf_p**

uint8_t ***buf_p**

size_t **size**

struct network_interface_slip_t::@57 network_interface_slip_t::frame

void ***chout_p**

struct *network_interface_t* **network_interface**

`network_interface_wifi` — WiFi network interface

WiFi network interface driver modules:

`network_interface_driver_esp` — ESP WiFi network interface driver

Source code: src/inet/network_interface/driver/esp.h, src/inet/network_interface/driver/esp.c

Test code: tst/inet/network_interface/wifi_esp/main.c

Variables

struct *network_interface_wifi_driver_t* **network_interface_wifi_driver_esp_station**

struct *network_interface_wifi_driver_t* **network_interface_wifi_driver_esp_softap**
Esressif WiFi SoftAP driver callbacks. To be used as driver in the wifi network interface.

Source code: src/inet/network_interface/wifi.h, src/inet/network_interface/wifi.c

Test code: tst/inet/network_interface/wifi_esp/main.c

Functions

int **network_interface_wifi_module_init** (void)
Initialize the WiFi network interface module.

Return zero(0) or negative error code.

int **network_interface_wifi_init** (**struct** *network_interface_wifi_t* **self_p*, **const** char **name_p*, **struct** *network_interface_wifi_driver_t* **driver_p*, void **arg_p*, **const** char **ssid_p*, **const** char **password_p*)
Initialize given WiFi network interface with given configuration.

Return zero(0) or negative error code.

Parameters

- `self_p`: The WiFi network interface to initialize.
- `name_p`: Name to assign the to interface.
- `driver_p`: Driver virtualization callbacks to use.
- `arg_p`: Argument passed to the driver callbacks. In case of ESP chips and WiFi station mode - compound literal of uint8_t[6] specifying the access point MAC.
- `ssid_p`: Access Point SSID.
- `password_p`: Access Point password.

int **network_interface_wifi_start** (**struct** *network_interface_wifi_t* **self_p*)
Start given WiFi network interface.

Return zero(0) or negative error code.

Parameters

- `self_p`: WiFi network interface to start.

int **network_interface_wifi_stop** (**struct** *network_interface_wifi_t* **self_p*)
Stop given WiFi network interface.

Return zero(0) or negative error code.

Parameters

- `self_p`: WiFi network interface to stop.

int **network_interface_wifi_is_up** (**struct** *network_interface_wifi_t* **self_p*)
Get the connection status of given network interface.

Return true(1) if the network interface is up, false(0) is it is down, and otherwise negative error code.

Parameters

- `self_p`: Network interface to get the connection status of.

int **network_interface_wifi_set_ip_info** (**struct** *network_interface_wifi_t* **self_p*, **const struct** *inet_if_ip_info_t* **info_p*)
Set the ip address, netmask and gateway of given network interface.

Return zero(0) if the interface has valid IP information, otherwise negative error code.

Parameters

- `self_p`: Network interface.
- `info_p`: Interface IP information to set.

int **network_interface_wifi_get_ip_info** (**struct** *network_interface_wifi_t* **self_p*, **struct** *inet_if_ip_info_t* **info_p*)
Get the ip address, netmask and gateway of given network interface.

Return zero(0) if the interface has valid IP information, otherwise negative error code.

Parameters

- `self_p`: Network interface.
- `info_p`: Interface IP information. Only valid if this function returns zero(0).

struct network_interface_wifi_t
#include <wifi.h>

Public Members

struct *network_interface_t* **network_interface**

struct *network_interface_wifi_driver_t* ***driver_p**

void ***arg_p**

const char ***ssid_p**

const char ***password_p**

const struct *inet_if_ip_info_t* ***info_p**

struct network_interface_wifi_driver_t
#include <wifi.h> Driver virtualization callbacks. See the `driver/` subfolder for available drivers.

Public Members

int (***init**)(void *arg_p)

int (***start**)(void *arg_p, **const** char *ssid_p, **const** char *password_p, **const struct** *inet_if_ip_info_t* *info_p)

int (***stop**)(void *arg_p)

int (***is_up**)(void *arg_p)

int (***set_ip_info**)(void *arg_p, **const struct** *inet_if_ip_info_t* *info_p)

int (***get_ip_info**)(void *arg_p, **struct** *inet_if_ip_info_t* *info_p)

Debug file system commands

One debug file system command is available, located in the directory `inet/network_interface/`.

Command	Description
`list`	Print a list of all registered network interfaces.

Example output from the shell:

```
$ inet/network_interface/list
NAME              STATE  ADDRESS             TX BYTES    RX BYTES
esp-wlan-ap       up     192.168.4.1                -           -
esp-wlan-sta      up     192.168.0.5                -           -
```

Source code: src/inet/network_interface.h, src/inet/network_interface.c

Test coverage: src/inet/network_interface.c

Typedefs

typedef int (***network_interface_start_t**) (**struct** *network_interface_t* *netif_p)

typedef int (***network_interface_stop_t**) (**struct** *network_interface_t* *netif_p)

typedef int (***network_interface_is_up_t**) (**struct** *network_interface_t* *netif_p)

typedef int (***network_interface_set_ip_info_t**) (**struct** *network_interface_t* *netif_p, **const struct** *inet_if_ip_info_t* *info_p)

typedef int (***network_interface_get_ip_info_t**) (**struct** *network_interface_t* *netif_p, **struct** *inet_if_ip_info_t* *info_p)

Functions

int **network_interface_module_init** (void)

Initialize the network interface module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **network_interface_add** (**struct** *network_interface_t* **netif_p*)

Add given network interface to the global list of network interfaces. Call `network_interface_start()` to enable the interface.

Return zero(0) or negative error code.

Parameters

- `netif_p`: Network interface to register.

int **network_interface_start** (**struct** *network_interface_t* **netif_p*)

Start given network interface. Enables the interface in the IP stack to allow packets to be sent and received. If the interface is a WiFi station interface it will try initiate the connection to its configured access point. Use `network_interface_is_up()` to check if the interface is connected to its access point.

Return zero(0) or negative error code.

Parameters

- `netif_p`: Network interface to start.

int **network_interface_stop** (**struct** *network_interface_t* **netif_p*)

Stop given network interface. Disconnects from any WiFi access points and disables the interface in the IP stack. No packets can be sent or received on this interface after this function is called.

Return zero(0) or negative error code.

Parameters

- `netif_p`: Network interface to stop.

int **network_interface_is_up** (**struct** *network_interface_t* **netif_p*)

Get the connection status of given network interface. PAckets can only be sent and received when the interface in up.

Return true(1) if the network interface is up, false(0) is it is down, and otherwise negative error code.

Parameters

- `netif_p`: Network interface to get the connection status of.

struct *network_interface_t* ***network_interface_get_by_name**(**const** char **name_p*)

Search the global list of network interfaces for an interface with given name and return it.

Return Found network interface or NULL if it was not found.

Parameters

- `name_p`: Name of the network interface to find.

int **network_interface_set_ip_info**(**struct** *network_interface_t* **netif_p*, **const struct** *inet_if_ip_info_t* **info_p*)

Set the IP information of given network interface.

Return zero(0) or negative error code.

Parameters

- `netif_p`: Network interface to get the IP information of.
- `info_p`: IP information to set.

int **network_interface_get_ip_info**(**struct** *network_interface_t* **netif_p*, **struct** *inet_if_ip_info_t* **info_p*)

Get the IP information of given network interface.

Return zero(0) or negative error code.

Parameters

- `netif_p`: Network interface to get the IP information of.
- `info_p`: Read IP information.

struct network_interface_t

Public Members

const char ***name_p**

struct *inet_if_ip_info_t* **info**

network_interface_start_t **start**

network_interface_stop_t **stop**

network_interface_is_up_t **is_up**

network_interface_set_ip_info_t **set_ip_info**

network_interface_get_ip_info_t **get_ip_info**

void ***netif_p**

struct *network_interface_t* ***next_p**

`ping` — Ping

Debug file system commands

One debug file system command is available, located in the directory `inet/ping/`.

Command	Description
`ping <remote host>`	Ping a remote host by given ip address.

Example output from the shell:

```
$ inet/ping/ping 192.168.1.100
Successfully pinged '192.168.1.100' in 10 ms.
$
```

Source code: src/inet/ping.h, src/inet/ping.c

Test code: tst/inet/ping/main.c

Test coverage: src/inet/ping.c

Functions

int **ping_module_init** (void)

int **ping_host_by_ip_address** (**struct** *inet_ip_addr_t* **address_p*, **struct** *time_t* **timeout_p*, **struct** *time_t* **round_trip_time_p*)

Ping host by given ip address. Send an echo request packet to given host and wait for the echo reply packet. No extra payload data is transmitted, only the ICMP header.

Return zero(0) or negative error code.

Parameters

- `address_p`: IP address of the host to ping.
- `timeout_p`: Number of seconds to wait for the echo reply packet.
- `round_trip_time_p`: The time it took from sending the echo request packet to receiving the echo reply packet. Only valid if this functions returns zero(0).

`socket` — Internet communication

Sockets are used to communicate over IP networks. TCP and UDP are the most common transport protocols.

No more than one thread may read from a socket at any given moment. The same applies when writing to a socket. The reader and writer may be different threads, though. The behaviour is undefined if more threads use the same socket simultaneously. The application will likely crash. Add a semaphore to protect the socket if more threads need access to a socket.

Below is a TCP client example that connects to a server and sends data.

```
uint8_t buf[16];
struct socket_t tcp;
struct inet_addr_t local_addr, remote_addr;

/* Set the local and remote addresses. */
inet_aton("192.168.1.103", &local_addr.ip);
local_addr.port = 6000;
inet_aton("192.168.1.106", &remote_addr.ip);
remote_addr.port = 5000;

/* Initialize the socket and connect to the server. */
socket_open_tcp(&tcp);
socket_bind(&tcp, &local_addr);
socket_connect(&tcp, &remote_addr);

/* Send the data. */
memset(buf, 0, sizeof(buf));
socket_write(&tcp, buf, sizeof(buf));

/* Close the connection. */
socket_close(&tcp);
```

And below is the same scenario for UDP.

```
uint8_t buf[16];
struct socket_t udp;
struct socket_addr_t local_addr, remote_addr;

/* Set the local and remote addresses. */
inet_aton("192.168.1.103", &local_addr.ip);
local_addr.port = 6000;
inet_aton("192.168.1.106", &remote_addr.ip);
remote_addr.port = 5000;

/* Initialize the socket and connect to the server. */
socket_open_udp(&udp);
socket_bind(&udp, &local_addr);
socket_connect(&udp, &remote_addr);

/* Send the data. */
memset(buf, 0, sizeof(buf));
socket_send(&udp, buf, sizeof(buf));

/* Close the connection. */
socket_close(&udp);
```

Source code: src/inet/socket.h, src/inet/socket.c

Defines

SOCKET_DOMAIN_INET

SOCKET_TYPE_STREAM
TCP socket type.

SOCKET_TYPE_DGRAM
UDP socket type.

SOCKET_TYPE_RAW
RAW socket type.

SOCKET_PROTO_ICMP

Functions

int **socket_module_init**(void)
Initialize the socket module. This function will start the lwIP TCP/IP stack. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **socket_open_tcp**(**struct** *socket_t* **self_p*)
Initialize given TCP socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket to initialize.

int **socket_open_udp**(**struct** *socket_t* **self_p*)
Initialize given UDP socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket to initialize.

int **socket_open_raw**(**struct** *socket_t* **self_p*)
Initialize given RAW socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket to initialize.

int **socket_open**(**struct** *socket_t* **self_p*, int *domain*, int *type*, int *protocol*)
Initialize given socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket to initialize.
- `domain`: Socket domain.
- `type`: Socket type.
- `protocol`: Socket protocol.

int **socket_close** (**struct** *socket_t* **self_p*)
Close given socket. No data transfers are allowed on after the socket has been closed.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket to close.

int **socket_bind** (**struct** *socket_t* **self_p*, **const struct** *inet_addr_t* **local_addr_p*)
Bind given local address to given socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket.
- `local_addr_p`: Local address.

int **socket_listen** (**struct** *socket_t* **self_p*, int *backlog*)
Listen for connections from remote clients. Only applicable for TCP sockets.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket to listen on.
- `backlog`: Unused.

int **socket_connect** (**struct** *socket_t* **self_p*, **const struct** *inet_addr_t* **remote_addr_p*)
Connect to given remote address. Connecting a UDP socket sets the default remote address for outgoing datagrams. For TCP a three-way handshake with the remote peer is initiated.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket.
- `remote_addr_p`: Remote address.

int **socket_connect_by_hostname** (**struct** *socket_t* **self_p*, **const** char **hostname_p*, uint16_t *port*)
Connect to the remote device with given hostname.

In computer networking, a hostname (archaically nodename) is a label that is assigned to a device connected to a computer network and that is used to identify the device in various forms of electronic communication, such as the World Wide Web.

Return zero(0) or negative error code.

Parameters

- `self_p`: Socket.
- `hostname_p`: The hostname of the remote device to connect to.
- `port`: Remote device port to connect to.

int **socket_accept** (**struct** *socket_t* **self_p*, **struct** *socket_t* **accepted_p*, **struct** *inet_addr_t* **remote_addr_p*)

Accept a client connect attempt. Only applicable for TCP sockets that are listening for connections.

Return zero(0) or negative error code.

Parameters

- `self_p`: TCP socket.
- `accepted_p`: New client socket of the accepted client.
- `remote_addr_p`: Address of the client.

ssize_t **socket_sendto** (**struct** *socket_t* **self_p*, **const** void **buf_p*, size_t *size*, int *flags*, **const struct** *inet_addr_t* **remote_addr_p*)

Write data to given socket. Only used by UDP sockets.

Return Number of sent bytes or negative error code.

Parameters

- `self_p`: Socket to send data on.
- `buf_p`: Buffer to send.
- `size`: Size of buffer to send.
- `flags`: Unused.
- `remote_addr_p`: Remote address to send the data to.

ssize_t **socket_recvfrom** (**struct** *socket_t* **self_p*, void **buf_p*, size_t *size*, int *flags*, **struct** *inet_addr_t* **remote_addr_p*)

Read data from given socket. Only used by UDP sockets.

Return Number of received bytes or negative error code.

Parameters

- `self_p`: Socket to receive data on.
- `buf_p`: Buffer to read into.
- `size`: Size of buffer to read.
- `flags`: Unused.
- `remote_addr_p`: Remote address to receive data from.

ssize_t **socket_write** (**struct** *socket_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write data to given TCP or UDP socket. For UDP sockets, `socket_connect()` must have been called prior to calling this function.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: Socket.
- `buf_p`: Buffer to send.
- `size`: Numer of bytes to send.

ssize_t **socket_read** (**struct** *socket_t* **self_p*, void **buf_p*, size_t *size*)

Read data from given socket.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: Socket.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **socket_size** (**struct** *socket_t* **self_p*)

Get the number of input bytes currently stored in the socket. May return less bytes than number of bytes stored in the channel.

Return Number of input bytes in the socket.

Parameters

- `self_p`: Socket.

struct socket_t

Public Members

struct *chan_t* **base**

int **type**

ssize_t **left**

struct socket_t::@59::@61::@63 socket_t::common

struct pbuf ***pbuf_p**

struct *inet_addr_t* **remote_addr**

int **closed**

struct socket_t::@59::@61::@64 socket_t::recvfrom

struct tcp_pcb ***pcb_p**

struct socket_t::@59::@61::@65 socket_t::accept

union socket_t::@59::@61 socket_t::u

int **state**

void ***args_p**

struct *thrd_t* ***thrd_p**

struct socket_t::@59::@62 socket_t::cb

struct socket_t::@59 socket_t::input

struct socket_t::@60::@66 socket_t::cb

struct socket_t::@60 socket_t::output

void ***pcb_p**

`ssl` — Secure socket layer

SSL/TLS based on mbedTLS. Server side sockets works, but not client side.

> **Warning:** This module may lead to a false sense of security, as it is implemented by a TLS/SSL novice, me. Use with care!

Simplified server and client side examples to illustrate how to use the module. All error checking is left out to make the example easier to understand. There are links to the full examples further down in this document.

Server side:

```
/* Create the SSL context. */
ssl_context_init(&context, ssl_protocol_tls_v1_0);
ssl_context_load_cert_chain(&context, &certificate[0], &key[0]);

/* Create the TCP listener socket. */
socket_open_tcp(&listener_sock);
socket_bind(&listener_sock, &addr);
socket_listen(&listener_sock, 5);

/* Accept a client.*/
socket_accept(&listener_sock, &sock, &addr);
ssl_socket_open(&ssl_sock,
                &context,
                &sock,
                SSL_SOCKET_SERVER_SIDE,
                NULL);

/* Communicate with the client. */
ssl_socket_read(&ssl_sock, &buf[0], 6);
ssl_socket_write(&ssl_sock, "Goodbye!", 8);
ssl_socket_close(&ssl_sock);
socket_close(&sock);
```

Client side:

```
/* Create the SSL context. */
ssl_context_init(&context, ssl_protocol_tls_v1_0);
ssl_context_load_verify_location(&context, &certificate[0]);

/* Create the TCP socket and connect to the server. */
socket_open_tcp(&sock);
socket_connect(&sock, &addr);
ssl_socket_open(&ssl_sock,
                &context,
                &sock,
                0,
                "foobar.org");

/* Communicate with the client. */
ssl_socket_write(&ssl_sock, "Hello!", 6);
ssl_socket_read(&ssl_sock, &buf[0], 8);
ssl_socket_close(&ssl_sock);
socket_close(&ssl_sock);
```

Source code: src/inet/ssl.h, src/inet/ssl.c

Test code: tst/inet/ssl/main.c,

Test coverage: src/inet/ssl.c

Example code: examples/ssl_client/main.c, examples/ssl_server/main.c

---

Defines

SSL_SOCKET_SERVER_SIDE

Enums

enum ssl_protocol_t

Values:

ssl_protocol_tls_v1_0

enum ssl_verify_mode_t

Values:

ssl_verify_mode_cert_none_t = 0

ssl_verify_mode_cert_required_t = 2

Functions

int **ssl_module_init** (void)

Initialize the SSL module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **ssl_context_init** (**struct** *ssl_context_t* **self_p*, **enum** *ssl_protocol_t* *protocol*)

Initialize given SSL context. A SSL context contains settings that lives longer than a socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL context to initialize.
- `protocol`: SSL protocol to use.

int **ssl_context_destroy** (**struct** *ssl_context_t* **self_p*)

Destroy given SSL context. The context may not be used after it has been destroyed.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL context to destroy.

int **ssl_context_load_cert_chain** (**struct** *ssl_context_t* **self_p*, **const** char **cert_p*, **const** char **key_p*)

Load given certificate chain into given context.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL context.
- `self_p`: Certificate to load.
- `self_p`: Optional key to load. May be NULL.

int **ssl_context_load_verify_location** (**struct** *ssl_context_t* **self_p*, **const** char **ca_certs_p*)

Load a set of "certification authority" (CA) certificates used to validate other peers' certificates when `verify_mode` is other than `ssl_verify_mode_cert_none_t`.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL context.
- `ca_certs_p`: CA certificates.

int **ssl_context_set_verify_mode** (**struct** *ssl_context_t* **self_p*, **enum** *ssl_verify_mode_t* *mode*)

Whether to try to verify other peers' certificates.

Load CA certificates with `ssl_context_load_verify_location()`.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL context.
- `mode`: Mode to set.

int **ssl_socket_open** (**struct** *ssl_socket_t* **self_p*, **struct** *ssl_context_t* **context_p*, void **socket_p*, int *flags*, **const** char **server_hostname_p*)

Initialize given SSL socket with given socket and SSL context. Performs the SSL handshake.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL socket to initialize.
- `context_p`: SSL context to execute in.
- `socket_p`: Socket to wrap in the SSL socket.
- `flags`: Give as `SSL_SOCKET_SERVER_SIDE` for server side sockets. Otherwise 0.
- `server_hostname_p`: The server hostname used by client side sockets to verify the server. Give as NULL to skip the verification. Must be NULL for server side sockets.

int **ssl_socket_close** (**struct** *ssl_socket_t* **self_p*)

Close given SSL socket.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL socket to close.

ssize_t **ssl_socket_write** (**struct** *ssl_socket_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write data to given SSL socket.

Return Number of written bytes or negative error code.

Parameters

- `self_p`: SSL socket.
- `buf_p`: Buffer to send.
- `size`: Numer of bytes to send.

ssize_t **ssl_socket_read** (**struct** *ssl_socket_t* **self_p*, void **buf_p*, size_t *size*)

Read data from given SSL socket.

Return Number of read bytes or negative error code.

Parameters

- `self_p`: SSL socket.
- `buf_p`: Buffer to read into.
- `size`: Number of bytes to read.

ssize_t **ssl_socket_size** (**struct** *ssl_socket_t* **self_p*)

Get the number of input bytes currently stored in the SSL socket.

Return Number of input bytes in the SSL socket.

Parameters

- `self_p`: SSL socket.

const char ***ssl_socket_get_server_hostname** (**struct** *ssl_socket_t* **self_p*)

Get the hostname of the server.

Return Server hostname or NULL.

Parameters

- `self_p`: SSL socket.

int **ssl_socket_get_cipher** (**struct** *ssl_socket_t* **self_p*, **const** char ***cipher_pp*, **const** char ***protocol_pp*, int **number_of_secret_bits_p*)

Get the cipher information.

Return zero(0) or negative error code.

Parameters

- `self_p`: SSL socket.
- `cipher_pp`: Connection cipher.
- `protocol_pp`: Connection protocol.
- `number_of_secret_bits_p`: Number of secret bits.

struct ssl_context_t

Public Members

ssl_protocol_t **protocol**

void ***conf_p**

int **server_side**

int **verify_mode**

struct ssl_socket_t

Public Members

struct *chan_t* **base**

void ***ssl_p**

void ***socket_p**

tftp_server — TFTP server

TFTP is a simple file transfer protocol.

Only binary mode is supported.

Source code: src/inet/tftp_server.h, src/inet/tftp_server.c

Test code: tst/inet/tftp_server/main.c

Test coverage: src/inet/tftp_server.c

Example code: examples/tftp_server/main.c

Functions

int **tftp_server_init** (**struct** *tftp_server_t* **self_p*, **struct** *inet_addr_t* **addr_p*, int *timeout_ms*, **const** char **name_p*, **const** char **root_p*, void **stack_p*, size_t *stack_size*)

Initialize given TFTP server.

Return zero(0) or negative error code.

Parameters

- `self_p`: TFTP server to initialize.
- `addr_p`: Ip address and port of the server.
- `timeout_ms`: Packet reception timeout.
- `name_p`: Name of the server thread.
- `root_p`: File system root path.

- `stack_p`: Server thread stack.
- `stack_size`: Server thread stack size.

int **tftp_server_start** (**struct** *tftp_server_t* **self_p*)

Start given TFTP server.

Return zero(0) or negative error code.

Parameters

- `self_p`: TFTP server to start.

struct tftp_server_t

#include <tftp_server.h>

Public Members

struct *inet_addr_t* **addr**

struct *socket_t* **listener**

int **timeout_ms**

const char ***name_p**

const char ***root_p**

void ***stack_p**

size_t **stack_size**

struct *thrd_t* ***thrd_p**

oam

Operations and maintenence of an application is essential to configure, debug and monitor its operation.

The oam package on Github.

`console` — System console

The system console is the default communication channel to an application. The console input and output channels are often terminated by a shell to enable the user to control and debug the application.

Configure the console by changing the *configuration variables* called `CONFIG_START_CONSOLE*`.

Source code: src/oam/console.h, src/oam/console.c

Test coverage: src/oam/console.c

Functions

int **console_module_init** (void)

int **console_init** (void)
Initialize the console.

Return zero(0) or negative error code.

int **console_start** (void)
Start the console.

Return zero(0) or negative error code.

int **console_stop** (void)
Stop the console.

Return zero(0) or negative error code.

int **console_set_input_channel** (void **chan_p*)
Set the pointer to the input channel.

Return zero(0) or negative error code.

void ***console_get_input_channel** (void)
Get the pointer to the input channel.

Return Input channel or NULL.

void ***console_set_output_channel** (void **chan_p*)
Set the pointer to the output channel.

Return zero(0) or negative error code.

void ***console_get_output_channel** (void)
Get the pointer to the output channel.

Return Output channel or NULL.

`nvm` — Non-volatile memory

A non-volatile memory is typically used for long-term persistent storage.

This module implements a singleton non-volatile memory, often on top of an EEPROM or software emulated EEPROM.

Source code: src/oam/nvm.h, src/oam/nvm.c

Test coverage: src/oam/nvm.c

Functions

int **nvm_module_init** (void)

int **nvm_mount** (void)

Mount the non-volatile memory.

Return zero(0) if the memory was successfully mounted, otherwise negative error code.

int **nvm_format** (void)

Format the non-volatile memory, writing 0xff/erasing to the whole memory. A formatted NVM can always be mounted with `nvm_mount()`.

Return zero(0) or negative error code.

ssize_t **nvm_read** (void **dst_p*, uint32_t *src*, size_t *size*)

Read into given buffer from given NVM address.

Return Number of bytes read or negative error code.

Parameters

- `dst_p`: Buffer to read into.
- `src`: Address in NVM to read from. Addressing starts at zero(0).
- `size`: Number of bytes to read.

ssize_t **nvm_write** (uint32_t *dst*, **const** void **src_p*, size_t *size*)

Write given buffer to given NVM address.

Return Number of bytes written or negative error code.

Parameters

- `dst`: Address in NVM to write to. Addressing starts at zero(0).
- `src_p`: Buffer to write.
- `size`: Number of bytes to write.

`service` — Services

A service is as a background task. A service is either running or stopped.

Debug file system commands

Three debug file system commands is available, all located in the directory `oam/service/`.

Command	Description
`list`	List all registered services.
`start <service>`	Start given service.
`stop <service>`	Stop given service.

Example output from the shell:

```
$ oam/service/list
NAME                    STATUS
http_server             running
ftp_server              stopped
network_manager         running
$ oam/service/start ftp_server
$ oam/service/stop http_server
$ oam/service/list
NAME                    STATE
http_server             stopped
ftp_server              running
network_manager         running
```

Source code: src/oam/service.h, src/oam/service.c

Test code: tst/oam/service/main.c

Test coverage: src/oam/service.c

Defines

SERVICE_CONTROL_EVENT_START

SERVICE_CONTROL_EVENT_STOP
Serviece stop event.

Typedefs

typedef enum *service_status_t* (***service_get_status_cb_t**)(**struct** *service_t* *self_p)

Enums

enum service_status_t
Values:

service_status_running_t = 0

service_status_stopped_t = 1

Functions

int **service_module_init**(void)
Initialize the service module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **service_init**(**struct** *service_t* **self_p*, **const** char **name_p*, *service_get_status_cb_t* *status_cb*)
Initialize a service with given name and status callback.

Return zero(0) or negative error code.

Parameters

- `self_p`: Service to initialize.
- `name_p`: Name of the service.
- `status_callback`: Callback function returning the service status.

int **service_start** (**struct** *service_t* **self_p*)

Start given service.

The event `SERVICE_CONTROL_EVENT_START` will be written to the control channel of given service and it's up to the service to act on this event. All services should act on all control events.

Return zero(0) or negative error code.

Parameters

- `self_p`: Service to start.

int **service_stop** (**struct** *service_t* **self_p*)

Stop given service.

The event `SERVICE_CONTROL_EVENT_STOP` will be written to the control channel of given service and it's up to the service to act on this event. All services should act on all control events.

Return zero(0) or negative error code.

Parameters

- `self_p`: Service to stop.

int **service_register** (**struct** *service_t* **service_p*)

Register given service to the global list of services.

Return zero(0) or negative error code.

Parameters

- `service_p`: Service to register.

int **service_deregister** (**struct** *service_t* **service_p*)

Deregister given service from the global list of services.

Return zero(0) or negative error code.

Parameters

- `service_p`: Service to deregister.

struct service_t

#include <service.h> A service with name and control event channel.

Public Members

const char ***name_p**

struct *event_t* **control**

service_get_status_cb_t **status_cb**

struct *service_t* ***next_p**

settings — Persistent application settings

Settings are stored in a non-volatile memory (NVM). In other words, settings are perserved after a board reset or power cycle.

Application settings are defined in an ini-file that is used to generate the c source code. A setting has a type, a size, an address and a default value, all defined in the ini-file.

Supported types are:

- `int32_t` A 32 bits signed integer.
- `string` An ASCII string.
- `blob` A chunk of data.

The size is the number of bytes of the value. For the standard integer types the size must be the value returned by *sizeof()*. For strings it is the length of the string, including null termination.

The address for each setting is defined by the user, starting at address 0 and increasing from there.

The build system variable `SETTINGS_INI` contains the path to the ini-file used by the build system.

Debug file system commands

Four debug file system commands are available, all located in the directory `oam/settings/`.

Command	Description
`list`	Print a list of the current settings.
`reset`	Overwrite the current settings values with their default values (the values defined in the ini-file values).
`read <name>`	Read the value of setting `<name>`.
`write <name> <value>`	Write `<value>` to setting `<name>`.

Example output from the shell:

```
$ oam/settings/list
NAME                  TYPE      SIZE  VALUE
version               int32_t      4  1
value_1               int32_t      4  24567
value_2               blob_t       4  cafebabe
value_3               string_t    16  foobar
$ oam/settings/read value_1
24567
$ oam/settings/write value_1 -5
$ oam/settings/read value_1
-5
$ oam/settings/reset
$ oam/settings/list
NAME                  TYPE      SIZE  VALUE
version               int32_t      4  1
value_1               int32_t      4  24567
value_2               blob_t       4  cafebabe
value_3               string_t    16  foobar
```

Example

In this example the ini-file has one setting defined, `foo`. The type is `int32_t`, the address is `0x00`, the size is `4` and the default value is `-4`.

```
[values]
foo = -4

[types]
foo = int32_t

[addresses]
foo = 0x00

[sizes]
foo = 4
```

The settings can be read and written with the functions *settings_read()* and *settings_write()*. Give the generated defines `SETTING_FOO_ADDR` and `SETTING_FOO_SIZE` as arguments to those functions.

```
int my_read_write_foo()
{
    int32_t foo;

    /* Read the foo setting. */
    if (settings_read(&foo,
                      SETTING_FOO_ADDR,
                      SETTING_FOO_SIZE) != 0) {
        return (-1);
    }

    foo -= 1;

    /* Write the foo setting. */
    if (settings_write(SETTING_FOO_ADDR,
                       &foo,
                       SETTING_FOO_SIZE) != 0) {
        return (-1);
    }

    return (0);
}
```

Source code: src/oam/settings.h, src/oam/settings.c

Test code: tst/oam/settings/main.c

Test coverage: src/oam/settings.c

Defines

SETTINGS_AREA_CRC_OFFSET

Enums

enum setting_type_t
Settings types. Each setting must have be one of these types.

Values:

setting_type_int32_t = 0

setting_type_string_t

setting_type_blob_t

Functions

int **settings_module_init**(void)
Initialize the settings module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

ssize_t **settings_read**(void **dst_p*, size_t *src*, size_t *size*)
Read the value of given setting by address.

Return Number of words read or negative error code.

Parameters

- `dst_p`: The read value.
- `src`: Setting source address.
- `size`: Number of words to read.

ssize_t **settings_write**(size_t *dst*, **const** void **src_p*, size_t *size*)
Write given value to given setting by address.

Return Number of words written or negative error code.

Parameters

- `dst`: Destination setting address.
- `src_p`: Value to write.
- `size`: Number of bytes to write.

ssize_t **settings_read_by_name**(**const** char **name_p*, void **dst_p*, size_t *size*)
Read the value of given setting by name.

Return Number of words read or negative error code.

Parameters

- `name_p`: Setting name.
- `dst_p`: The read value.
- `size`: Size of the destination buffer.

ssize_t **settings_write_by_name** (**const** char **name_p*, **const** void **src_p*, size_t *size*)
Write given value to given setting by name.

Return Number of words read or negative error code.

Parameters

- `name_p`: Setting name.
- `src_p`: Value to write.
- `size`: Number of bytes to write.

int **settings_reset** (void)
Overwrite all settings with their default values.

Return zero(0) or negative error code.

struct setting_t

Public Members

FAR const char* setting_t::name_p

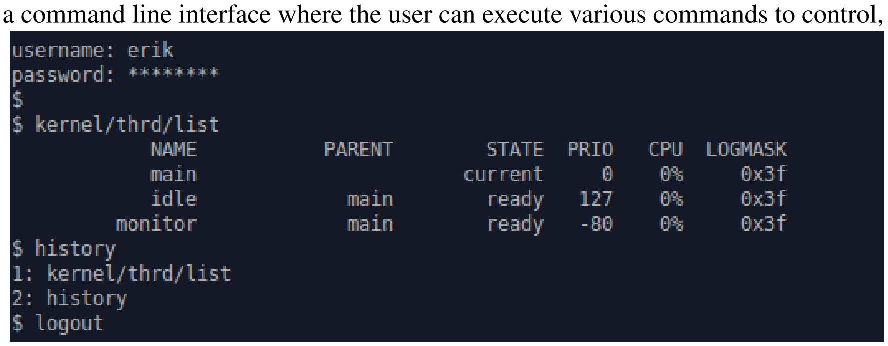
setting_type_t **type**

uint32_t **address**

size_t **size**

`shell` — Debug shell

The shell is a command line interface where the user can execute various commands to control, debug and monitor its application.



The shell module has a few configuration variables that can be used to tailor the shell to the application requirements. Most noticeably is the configuration variable `CONFIG_SHELL_MINIMAL`. If set to `0` all the shell functionality is built; including tab completion, cursor movement, line editing and command history. If set to `1` only the minimal functionality is built; only including tab completion and line editing at the end of the line.

See *Configuration* for a list of all configuration variables.

Source code: src/oam/shell.h, src/oam/shell.c

Test code: tst/oam/shell/main.c

Test coverage: src/oam/shell.c

Example code: examples/shell/main.c

Functions

int **shell_module_init** (void)

Initialize the shell module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **shell_init** (**struct** *shell_t* **self_p*, void **chin_p*, void **chout_p*, void **arg_p*, **const** char **name_p*, **const** char **username_p*, **const** char **password_p*)

Initialize a shell with given parameters.

Parameters

- `chin_p`: The shell input channel. The shell waits for commands on this channel.
- `chout_p`: The shell output channel. The shell writes responses on this channel.
- `arg_p`: User supplied argument passed to all commands.
- `name_p`: The shell thread name.
- `username_p`: Shell login username, or NULL if no username is required to use the shell.
- `password_p`: Shell login password. This field is unused if `username_p` is NULL.

void ***shell_main** (void **arg_p*)

The shell main function that listens for commands on the input channel and send response on the output channel. All received commands are passed to the debug file system function `fs_call()` for execution.

Here is an example of using the shell to list and execute debug file system commands.

```
$ <tab>
drivers/
kernel/
$ kernel/ <tab>
fs/
sys/
thrd/
$ kernel/thrd/list
            NAME        STATE  PRIO   CPU  LOGMASK
            main      current     0    0%     0x0f
            idle        ready   127    0%     0x0f
         monitor        ready   -80    0%     0x0f
$
```

Return Never returns.

Parameters

- `arg_p`: Pointer to the shell arguemnt struct `struct shell_t`. See the struct definition for a description of it's content.

struct shell_history_elem_t

#include <shell.h>

Public Members

struct *shell_history_elem_t* ***next_p**

struct *shell_history_elem_t* ***prev_p**

char **buf**[1]

struct shell_line_t

Public Members

char **buf**[CONFIG_SHELL_COMMAND_MAX]

int **length**

int **cursor**

struct shell_t

Public Members

void ***chin_p**

void ***chout_p**

void ***arg_p**

const char ***name_p**

const char ***username_p**

const char ***password_p**

struct *shell_line_t* **line**

struct *shell_line_t* **prev_line**

int **carriage_return_received**

int **newline_received**

int **authorized**

struct *shell_history_elem_t* ***head_p**

struct *shell_history_elem_t* ***tail_p**

struct *shell_history_elem_t* ***current_p**

struct *shell_line_t* **pattern**

struct *shell_line_t* **match**

int **line_valid**

struct *circular_heap_t* **heap**

uint8_t **buf**[CONFIG_SHELL_HISTORY_SIZE]

struct shell_t::@99::@100 shell_t::heap

struct shell_t::@99 shell_t::history

`soam` — Simba OAM

Simba Operation And Maintenence (SOAM) is a framed debug protocol with enumerated format strings and file system commands. This both saves memory and makes the communication more reliable.

Two macros are defined; `OSTR()` and `CSTR()`, both required by the SOAM build system. It is considered good practice to always use these macros, even if SOAM is not used.

- The `OSTR()` macro.

  An output format string.

```
/* Log object. */
log_object_print(NULL, LOG_INFO, OSTR("Hello %s!\r\n"), "Erik");

/* File system command output. */
static int cmd_foo_cb(...)
{
    std_fprintf(chout_p, OSTR("Foo %d!\r\n"), 1);

    return (0);
}

/* Regular printf. */
std_printf(OSTR("Hello 0x%x!\r\n"), 0xbabe);
```

- The `CSTR()` macro.

  A file system command string.

```
fs_command_init(&cmd_foo, CSTR("/foo"), cmd_foo_cb, NULL);
```

Usage

Enable SOAM by adding `SOAM=yes` to the application makefile.

Connect to the board with `soam.py` instead of a serial terminal program. The only required argument is the string database file.

Here is an example usage of the script. *Ctrl-D* is pressed to exit the script.

```
> soam.py --port /dev/arduino --baudrate 115200 \
      build/arduino_due/soam.soamdb
Welcome to the SOAM shell.

Type help or ? to list commands.

$ kernel/sys/info
app:    soam-master built 2017-03-05 21:26 CET by erik.
board:  Arduino Due
mcu:    Atmel SAM3X8E Cortex-M3 @ 84MHz, 96k sram, 512k flash
OK
$ kernel/thrd/list
            NAME        STATE  PRIO   CPU   SCHEDULED  MAX-STACK-USAGE  LOGMASK
            soam      current    30    0%         112        748/  1542     0x0f
         monitor    suspended   -80    0%          22        176/   518     0x0f
            idle        ready   127   99%         594        276/   390     0x0f
            main    suspended     0    0%         305        540/ 88898     0x00
```

```
OK
$ kernel/thrd/set_log_mask foo 0
ERROR(-3)
$ <Ctrl-D>

Bye!
>
```

`OK` is printed by the shell if the file system command returned *zero(0)*, otherwise `ERROR(error code)` is printed.

Source code: src/oam/soam.h, src/oam/soam.c

Test code: tst/oam/soam/main.c

Test coverage: src/oam/soam.c

Example code: examples/soam/main.c

Functions

int **soam_module_init**(void)
Initialize the soam module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **soam_init**(**struct** *soam_t* **self_p*, void **buf_p*, size_t *size*, void **chout_p*)
Initialize given soam object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Object to initialize.
- `buf_p`: Transmission buffer.
- `size`: Transmission buffer size.
- `chout_p`: Soam packets are written to this channel.

int **soam_input**(**struct** *soam_t* **self_p*, uint8_t **buf_p*, size_t *size*)
Process given soam packet.

Return zero(0) or negative error code.

Parameters

- `self_p`: Soam object.
- `buf_p`: Buffer to input.
- `size`: Size to input in bytes.

ssize_t **soam_write_begin**(**struct** *soam_t* **self_p*, int *type*)
Start outputting a soam packet of given type.

Return zero(0) or negative error code.

Parameters

- `self_p`: Soam object.
- `type`: Packet type.

ssize_t **soam_write_chunk** (**struct** *soam_t* **self_p*, **const** void **buf_p*, size_t *size*)

Add given chunk of data to current packet.

Return zero(0) or negative error code.

Parameters

- `self_p`: Soam object.
- `buf_p`: Buffer to output.
- `size`: Size to output in bytes.

ssize_t **soam_write_end** (**struct** *soam_t* **self_p*)

Finalize current packet and transmit it.

Return zero(0) or negative error code.

Parameters

- `self_p`: Soam object.

ssize_t **soam_write** (**struct** *soam_t* **self_p*, int *type*, **const** void **buf_p*, size_t *size*)

Create and transmit a soam packet of given type and data.

Return zero(0) or negative error code.

Parameters

- `self_p`: Soam object.
- `type`: Packet type.
- `buf_p`: Buffer to output.
- `size`: Size to output in bytes.

void ***soam_get_log_input_channel** (**struct** *soam_t* **self_p*)

Get the log input channel. This channel can be set as output channel of the log module with `log_set_default_handler_output_channel()`.

Return Log input channel.

Parameters

- `self_p`: Soam object.

void ***soam_get_stdout_input_channel** (**struct** *soam_t* **self_p*)

Get the standard output input channel. This channel can be set as standard output channel of the sys module with `sys_set_stdout()`.

Return Standard output input channel.

Parameters

- `self_p`: Soam object.

struct soam_t
#include <soam.h>

Public Members

int **is_printf**

uint8_t **transaction_id**

uint8_t ***buf_p**

size_t **size**

ssize_t **pos**

struct *sem_t* **sem**

void ***chout_p**

uint8_t **packet_index**

struct soam_t::@101 soam_t::tx

struct *chan_t* **stdout_chan**

struct *chan_t* **log_chan**

struct *chan_t* **command_chan**

`upgrade` — Software upgrade

Upgrade/upload an application over the air (OTA) or using a cable. HTTP, TFTP, Kermit and UDS protocols are supported.

The flash memory is partitioned into two partitions; the bootloader partition and the application partition. The software in the bootloader partition can perform a software upgrade of the application partition by using the erase and write commands.

Warning: The WiFi connection is often lost during the erase operation on ESP32. Troubleshooting ongoing...

Debug file system commands

Five debug file system commands are available, all located in the directory `oam/upgrade/`.

Command	Description
`application/enter`	Enter the appliaction.
`application/erase`	Erase the appliaction. May not be called from the application about to be erased.
`application/is_valid`	Check is there is a valid application in the memory.
`kermit/upload`	Upload a upgrade binary file using the Kermit file transfer protocol.
`bootloader/enter`	Enter the bootloader.

Example output from the shell:

```
$ oam/upgrade/application/is_valid
yes
```

HTTP requests

Five HTTP requests are available. Form the URL by prefixing them with `http://<hostname>/oam/upgrade/`, ie. `http://<hostname>/oam/upgrade/application/is_valid`.

Request	Type	Description
`application/enter`	GET	Enter the appliaction.
`application/erase`	GET	Erase the appliaction. May not be called from the application about to be erased.
`application/is_valid`	GET	Check is there is a valid application in the memory.
`upload`	POST	Upload a upgrade binary file using the Kermit file transfer protocol.
`bootloader/enter`	GET	Enter the bootloader.

TFTP file transfer

Only upload, aka "put", in binary mode is supported.

Examples

Here are a few examples of how to upgrade the application using the different supported protocols.

HTTP

Build and upload the bootloader to the board over the serial port.

```
> make -C bootloader -s BOARD=nano32 run
```

Build the test application and use curl to upload it to the Nano32 over HTTP.

```
> make -C application -s BOARD=nano32
> cd application/build/nano32
> curl http://192.168.0.7/oam/upgrade/application/is_valid
no
> curl --header "Content-Type: application/octet-stream" \
       --data-binary @application.ubin \
       http://192.168.0.7/oam/upgrade/upload
> curl http://192.168.0.7/oam/upgrade/application/is_valid
yes
```

Then start it using HTTP.

```
> curl http://192.168.0.7/oam/upgrade/application/enter
Welcome to the test application!
```

TFTP

Build and upload the bootloader to the board over the serial port.

```
> make -C bootloader -s BOARD=nano32 run
```

Build the test application and use tftp to upload it to the Nano32 over TFTP.

```
> make -C application -s BOARD=nano32
> cd application/build/nano32
> tftp 192.168.0.7
tftp> mode binary
tftp> put application.ubin
5460544 bytes
tftp> q
```

Then start it using the serial port.

```
> kermit
C-Kermit>connect
$ oam/upgrade/application/is_valid
yes
$ oam/upgrade/application/enter
Welcome to the test application!
```

Kermit

Build and upload the bootloader to the board over the serial port.

```
> make -s -C bootloader BOARD=arduino_due run
```

Build the test application and use Kermit to upload it to the Arduino Due over the serial port.

```
> make -s -C application BOARD=arduino_due
> cd application/build/arduino_due
> kermit
C-Kermit>connect
$ oam/upgrade/application/is_valid
no
$ oam/upgrade/application/erase
$ oam/upgrade/kermit/upload       # Type '\+c' to return to kermit.
C-Kermit> send application.ubin
```

Then start it using the serial port.

```
C-Kermit> connect
$ oam/upgrade/application/is_valid
yes
$ oam/upgrade/application/enter
Welcome to the test application!
```

Source code: src/oam/upgrade.h, src/oam/upgrade.c, src/oam/upgrade

Test code: tst/oam/upgrade/main.c, tst/oam/upgrade/kermit/main.c, tst/oam/upgrade/uds/main.c

Test coverage: src/oam/upgrade.c, src/oam/upgrade

Example code: examples/upgrade/bootloader/main.c, examples/upgrade/application/main.c

---

Functions

int **upgrade_module_init**(void)

int **upgrade_bootloader_enter**(void)
Enter the bootloader. This function does not return if all preconditions for entering the bootloader are met.

Return zero(0) or negative error code.

int **upgrade_bootloader_stay_set**(void)
Stay in the bootloader after next system reboot.

Return zero(0) or negative error code.

int **upgrade_bootloader_stay_clear**(void)
Do not stay in the bootloader after next system reboot.

Return zero(0) or negative error code.

int **upgrade_bootloader_stay_get**(void)
Check if the bootlaoder is forced to enter its main loop instead of calling any valid application.

Return true(1) if the bootloder shall not call the application, otherwise false(0).

int **upgrade_application_enter**(void)
Enter the application. This function does not return if all preconditions for entering the application are met.

Return zero(0) or negative error code.

int **upgrade_application_erase**(void)
Erase the application area.

Return zero(0) or negative error code.

int **upgrade_application_is_valid**(int *quick*)
Returns true(1) if there is a valid application in the application area.

Return true(1) if a valid application exists in the memory region, otherwise false(0).

Parameters

- `quick`: Perform a quick validation. The quick validation is port specific, while the non-quick validation always calculates a checksum of the application and compares it to the expected checksum.

int **upgrade_binary_upload_begin**(void)
Begin an upload transaction of a .ubin file.

Return zero(0) or negative error code.

int **upgrade_binary_upload**(**const** void **buf_p*, size_t *size*)
Add data to current upload transaction.

Return zero(0) or negative error code.

Parameters

- `buf_p`: Buffer to write.
- `size`: Size of the buffer.

int **upgrade_binary_upload_end**(void)
End current upload transaction.

Return zero(0) or negative error code.

debug

The debug package on Github.

harness — Test harness

In software testing, a test harness or automated test framework is a collection of software and test data configured to test a program unit by running it under varying conditions and monitoring its behavior and outputs. It has two main parts: the test execution engine and the test script repository.

This module implements the test execution engine.

The test scripts are part of the build system.

Stubs

Symbols can be stubbed per C-file using the `STUB()` macro and `STUB` make variable. The `STUB` make variable is a list of source files and the symbols to stub within given file.

For example, stub functions `foo_bar()` and `foo_fie()` in `fum.c` by defining stub functions `STUB(foo_bar)()` and `STUB(foo_fie)()`, and set the make variable `STUB` to `fum.c:foo_bar,foo_fie`.

Prototypes for `foo_bar()` and `foo_fie()` in `foo.h`:

```
int foo_bar();
int foo_fie();
```

`foo_bar()` and `foo_fie()` called in `fum.c`. Both function calls will call the stubbed version on the respective function.

```
int fum_init()
{
   foo_bar();
   foo_fie();
}
```

The stubbed implementations, often defined in the test suite file `main.c`:

```
int STUB(foo_bar)()
{
    return (0);
}

int STUB(foo_fie)()
{
    return (0);
}
```

And last, add the stubbed symbol to the test suite makefile `Makefile`:

```
STUB = fum.c:foo_bar,foo_fie
```

Example test suite

Below is an example of a test suite using the harness. It has three test cases; `test_passed`, `test_failed` and `test_skipped`.

The test macro `BTASSERT(condition)` should be used to validate conditions.

```
#include "simba.h"

static int test_passed(struct harness_t *harness_p)
{
    /* Return zero(0) when a test case passes. */
    return (0);
}

static int test_failed(struct harness_t *harness_p)
{
    /* Return a negative integer when a test case fails. BTASSERT
       will return -1 when the condition is false. */
    BTASSERT(0);

    return (0);
}

static int test_skipped(struct harness_t *harness_p)
{
    /* Return a positive integer when a test case is skipped. */
    return (1);
}

int main()
{
    /* Test harness and NULL terminated list of test cases.*/
    struct harness_t harness;
    struct harness_testcase_t harness_testcases[] = {
        { test_passed, "test_passed" },
        { test_failed, "test_failed" },
        { test_skipped, "test_skipped" },
        { NULL, NULL }
    };

    sys_start();

    harness_init(&harness);
    harness_run(&harness, harness_testcases);

    return (0);
}
```

The output from the test suite is:

```
app:    test_suite-7.0.0 built 2016-07-25 17:38 CEST by erik.
board:  Linux
```

```
mcu:    Linux

enter: test_passed
exit: test_passed: PASSED

enter: test_failed
exit: test_failed: FAILED

enter: test_skipped
exit: test_skipped: SKIPPED

            NAME        STATE  PRIO   CPU  LOGMASK
            main      current     0    0%     0x0f
                        ready   127    0%     0x0f
harness report: total(3), passed(1), failed(1), skipped(1)
```

There are plenty of test suites in the tst folder on Github.

Source code: src/debug/harness.h, src/debug/harness.c

Defines

_ASSERTFMT (fmt, ...)

_ASSERTHEX (actual_str, actual, expected_str, expected, size)

BTASSERTRM (cond, cond_str, res, msg)
Assert given condition. Print an error message and return given value `res` on error.

BTASSERTR (cond, cond_str, res, ...)
Assert given condition. Print an error message and return given value `res` on error.

BTASSERTN (cond, ...)
Assert given condition. Print an error message and return given value on error.

BTASSERT (cond, ...)
Assert given condition. Print an error message and return.

BTASSERTI (actual, operator, expected)
Compare two integers `actual` and `expected` with given operator `operator`. Print an error message if the condition is not true and return.

BTASSERTM (actual, expected, size)
Comapre two memory positions `actual` and `expected`. Print an error message if they are not equal and return.

BTASSERTV (cond, ...)
Assert given condition in a testcase. Print an error message and return -1 on error.

STUB (function)
Stub given function. Used with the make variable STUB to preprocess object file(s).

Typedefs

typedef int (***harness_testcase_cb_t**) (**struct** *harness_t* *harness_p)

The testcase function callback.

Return zero(0) if the testcase passed, a negative error code if the testcase failed, and a positive value if the testcase was skipped.

Parameters

- `harness_t`: The harness object.

Functions

int **harness_init** (**struct** *harness_t* **self_p*)

Initialize given test harness.

Return zero(0) or negative error code.

Parameters

- `self_p`: Test harness to initialize.

int **harness_run** (**struct** *harness_t* **self_p*, **struct** *harness_testcase_t* **testcases_p*)

Run given testcases in given test harness.

Return zero(0) or negative error code.

Parameters

- `self_p`: Test harness.
- `testcases_p`: An array of testcases to run. The last element in the array must have `callback` and `name_p` set to NULL.

int **harness_expect** (void **chan_p*, **const** char **pattern_p*, **const struct** *time_t* **timeout_p*)

Continiously read from the channel and return when given pattern has been read, or when a timeout occurs.

Return Number of bytes read from the channel when match occured, or negative error code.

Parameters

- `chan_p`: Channel to read from.
- `pattern_p`: Pattern to wait for.
- `timeout_p`: Timeout, or NULL to wait forever.

ssize_t **harness_mock_write** (**const** char **id_p*, **const** void **buf_p*, size_t *size*)

Write given data buffer to a mock entry with given id.

Return Number of written words or negative error code.

Parameters

- `id_p`: Mock id string to write.
- `buf_p`: Data for given mock id.
- `size`: Buffer size in words.

ssize_t **harness_mock_read**(**const** char **id_p*, void **buf_p*, size_t *size*)
Read data from mock entry with given id.

Return Number of read words or negative error code.

Parameters

- `id_p`: Mock id string to read.
- `buf_p`: Buffer to read into.
- `size`: Buffer size in words.

struct harness_testcase_t

Public Members

harness_testcase_cb_t **callback**

const char ***name_p**

struct harness_t

Public Members

struct uart_driver_t **uart**

`log` — Logging

The logging module consists of log objects and log handlers. A log object filters log entries and a log handler writes log entries to an output channel.

A log object called "log" and a log handler writing to standard output are created during the log module initialization. The log handler can be replaced by calling *log_set_default_handler_output_channel()*.

Normally one log object is created for each subsystem in an application. This gives the user the power to control which parts of the system to debug and/or monitor at runtime.

It's also possible to print log entries without using log objects, but instead use the current threads' log mask to filter log entries. Just give `NULL` as the first arguement to `log_object_print()`, and the threads' log mask will be used. See *thrd — Threads* details on how to change the threads' log mask.

Sometimes it's useful to write log entries to multiple channels. This is possible by creating and adding another log handler to the log module.

Log levels

There are five log levels defined; fatal, error, warning, info and debug. The log levels are defined as `LOG_<upper case level>` in the log module header file.

Log entry format

A log entry consists of a timestamp, log level, thread name, log object name and the message. The timestamp is the log entry creation time and the log level is one of fatal, error, warning, info and debug. The thread name is the name of the thread that created the log entry and the log object name is the name of the log object the entry was printed on. The message is a user defined string.

```
<timestamp>:<log level>:<thread name>:<log object name>: <message>
```

Debug file system commands

Three debug file system commands are available, all located in the directory `debug/log/`.

Command	Description
`list`	Print a list of all log objects.
`print <string>`	Print a log entry using the default log object and log level `LOG_INFO`. This command has no use except to test that the log module works.
`set_log_mask <object> <mask>`	Set the log mask to `<mask>` for log object `<object>`.

Example output from the shell:

```
$ debug/log/list
     OBJECT NAME  MASK
         default  0x0f
$ debug/log/print "Hello World!"
$ debug/log/set_log_mask default 0x1f
$ debug/log/list
     OBJECT NAME  MASK
         default  0x1f
$ debug/log/print "Hello World!!!"
56:info:main:default: Hello World!!!
```

Example

Here is an example of how to create two log objects; *foo* and *bar*, and then use them and the default log object *default*.

The source code:

```
/* Initialize the log objects foo and bar. */
struct log_object_t foo;
struct log_object_t bar;

log_object_init(&foo, "foo", LOG_UPTO(INFO));
log_object_init(&bar, "bar", LOG_UPTO(DEBUG));

/* Print four log entries. */
log_object_print(&foo, LOG_INFO, OSTR("A foo info message."));
log_object_print(&bar, LOG_INFO, OSTR("A bar info message."));
log_object_print(&bar, LOG_DEBUG, OSTR("A bar debug message."));
log_object_print(NULL, LOG_ERROR, OSTR("A default error message."));
```

All logs are printed from the main thread as can be seen in the third field in the entries in the output below.

```
23.0:info:main:foo: A foo info message.
24.0:info:main:bar: A bar info message.
37.0:debug:main:bar: A bar debug message.
56.0:error:main:default: A default error message.
```

Source code: src/debug/log.h, src/debug/log.c

Test code: tst/debug/log/main.c

Test coverage: src/debug/log.c

Defines

LOG_FATAL

LOG_ERROR
A handable error conditions.

LOG_WARNING
A warning.

LOG_INFO
Generic (useful) information about system operation.

LOG_DEBUG
Developer debugging messages.

LOG_MASK (level)
Craete a log mask with given level set.

LOG_UPTO (level)
Set all levels up to and including given level.

LOG_ALL
Set all levels.

LOG_NONE
Clear all levels.

Functions

int **log_module_init** (void)
Initialize the logging module. This function must be called before calling any other function in this module.

The module will only be initialized once even if this function is called multiple times.

Return zero(0) or negative error code.

int **log_object_init** (**struct** *log_object_t* **self_p*, **const** char **name_p*, char *mask*)
Initialize given log object with given name and mask.

Return zero(0) or negative error code.

Parameters

- `self_p`: Log object to initialize.
- `name_p`: Log object name.
- `mask`: Log object mask.

int **log_object_set_log_mask**(**struct** *log_object_t* **self_p*, char *mask*)
Set given log mask for given log object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Log object.
- `mask`: Log object mask.

char **log_object_get_log_mask**(**struct** *log_object_t* **self_p*)
Get the log mask of given log object.

Return Log mask.

Parameters

- `self_p`: Log object.

int **log_object_is_enabled_for**(**struct** *log_object_t* **self_p*, int *level*)
Check if given log level is enabled in given log object.

Return true(1) if given log level is enabled, false(0) if given log level is disabled, otherwise negative error code.

Parameters

- `self_p`: Log object, or NULL to check the level in the thread log mask.
- `level`: Log level to check.

int **log_object_print**(**struct** *log_object_t* **self_p*, int *level*, **const** char **fmt_p*, ...)
Check if given log level is set in the log object mask. If so, format a log entry and write it to all log handlers.

`self_p` may be NULL, and in that case the current thread's log mask is used instead of the log object mask.

Return zero(0) or negative error code.

Parameters

- `self_p`: Log object, or NULL to use the thread's log mask.
- `level`: Log level.
- `fmt_p`: Log format string.
- `...`: Variable argument list.

int **log_handler_init**(**struct** *log_handler_t* **self_p*, void **chout_p*)
Initialize given log handler with given output channel.

Return zero(0) or negative error code.

Parameters

- `self_p`: Log handler to initialize.

- `chout_p`: Output handler.

int **log_add_handler** (**struct** *log_handler_t* **handler_p*)

Add given log handler to the list of log handlers. Log entries will be written to all log handlers in the list.

Return zero(0) or negative error code.

Parameters

- `handler_p`: Log handler to add.

int **log_remove_handler** (**struct** *log_handler_t* **handler_p*)

Remove given log handler from the list of log handlers.

Return zero(0) or negative error code.

Parameters

- `handler_p`: Log handler to remove.

int **log_add_object** (**struct** *log_object_t* **object_p*)

Add given log object to the list of log objects. There are file system commands to list all log objects in the list and also modify their log mask.

Return zero(0) or negative error code.

Parameters

- `object_p`: Log object to add.

int **log_remove_object** (**struct** *log_object_t* **object_p*)

Remove given log object from the list of log objects.

Return zero(0) or negative error code.

Parameters

- `object_p`: Object to remove.

int **log_set_default_handler_output_channel** (void **chout_p*)

Set the output channel of the default log handler.

Return zero(0) or negative error code.

Parameters

- `chout_p`: Channel to set as the default output channel. May be NULL if no output should be written.

struct log_handler_t

Public Members

void ***chout_p**

struct *log_handler_t* ***next_p**

struct log_object_t

Public Members

const char ***name_p**

char **mask**

struct *log_object_t* ***next_p**

collections

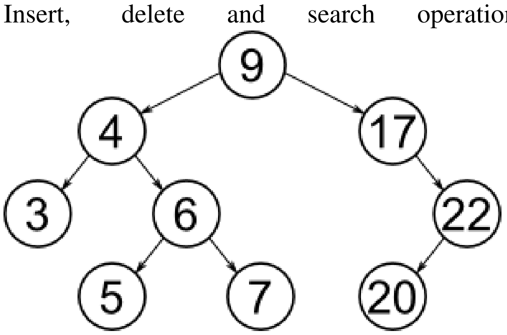
In computer science, a data structure is a particular way of organizing data in a computer so that it can be used efficiently.

The collections package on Github.

`binary_tree` — Binary tree

A binary search tree consists of nodes, where each node has zero, one or two siblings. The left sibling has a lower value and the right sibling has a higher value than the parent.

Insert, delete and search operations all have the time complexity of O(log n).



Source code: src/collections/binary_tree.h, src/collections/binary_tree.c

Test code: tst/collections/binary_tree/main.c

Test coverage: src/collections/binary_tree.c

Functions

int **binary_tree_init** (**struct** *binary_tree_t* **self_p*)

Initialize given binary tree.

Return zero(0) or negative error code.

Parameters

- `self_p`: Binary tree.

int **binary_tree_insert** (**struct** *binary_tree_t* **self_p*, **struct** *binary_tree_node_t* **node_p*)

Insert given node into given binary tree.

There can not be two or more nodes in the tree with the same key. This function returns -1 if a node with the same key is already in the binary tree.

Return zero(0) on success, -1 if a node with the same key is already in the binary tree, otherwise negative error code.

Parameters

- `self_p`: Binary tree to insert the node into.
- `node_p`: Node to insert.

int **binary_tree_delete** (**struct** *binary_tree_t* **self_p*, int *key*)

Delete given node from given binary tree.

Return zero(0) on success, -1 if the node was not found, otherwise negative error code.

Parameters

- `self_p`: Binary tree to delete the node from.
- `key`: Key of the node to delete.

struct *binary_tree_node_t* ***binary_tree_search** (**struct** *binary_tree_t* **self_p*, int *key*)

Search the binary tree for the node with given key.

Return Pointer to found node or NULL if a node with given key was not found in the tree.

Parameters

- `self_p`: Binary tree to search in.
- `key`: Key of the binary tree node to search for.

void **binary_tree_print** (**struct** *binary_tree_t* **self_p*)

Print given binary tree.

Parameters

- `self_p`: Binary tree to print.

struct binary_tree_node_t

#include <binary_tree.h>

Public Members

int **key**

int **height**

struct *binary_tree_node_t* ***left_p**

struct *binary_tree_node_t* ***right_p**

struct binary_tree_t

Public Members

struct *binary_tree_node_t* ***root_p**

`bits` — Bitwise operations

Source code: src/collections/bits.h

Test code: tst/collections/bits/main.c

Functions

static uint32_t **`bits_insert_32`** (uint32_t *dst*, int *position*, int *size*, uint32_t *src*)

`circular_buffer` — Circular buffer

Source code: src/collections/circular_buffer.h, src/collections/circular_buffer.c

Test code: tst/collections/circular_buffer/main.c

Test coverage: src/collections/circular_buffer.c

Functions

int **`circular_buffer_init`** (**struct** *circular_buffer_t* **self_p*, void **buf_p*, size_t *size*)

Initialize given circular buffer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Circular buffer to initialize.
- `buf_p`: Memory buffer.
- `size`: Size of the memory buffer.

ssize_t **`circular_buffer_write`** (**struct** *circular_buffer_t* **self_p*, **const** void **buf_p*, size_t *size*)

Write data to given circular buffer.

Return Number of bytes written or negative error code.

Parameters

- `self_p`: Circular buffer.
- `buf_p`: Memory buffer to write.
- `size`: Size of the memory buffer.

ssize_t **`circular_buffer_read`** (**struct** *circular_buffer_t* **self_p*, void **buf_p*, size_t *size*)

Read data from given circular buffer.

Return Number of bytes read or negative error code. The buffer is empty if zero(0) is returned.

Parameters

- `self_p`: Circular buffer to free to.

- `buf_p`: Memory buffer to read into.
- `size`: Size of the memory buffer.

ssize_t **circular_buffer_used_size** (**struct** *circular_buffer_t* **self_p*)
Returns the number of used bytes in given circular buffer.

Return Number of used bytes.

Parameters

- `self_p`: Circular buffer.

ssize_t **circular_buffer_unused_size** (**struct** *circular_buffer_t* **self_p*)
Returns the number of unused bytes in given circular buffer.

Return Number of unused bytes.

Parameters

- `self_p`: Circular buffer.

ssize_t **circular_buffer_skip_front** (**struct** *circular_buffer_t* **self_p*, size_t *size*)
Skip given number of written bytes at the front of the buffer.

Return Number of skipped bytes or negative error code.

Parameters

- `self_p`: Circular buffer.
- `size`: Number of bytes to skip.

ssize_t **circular_buffer_reverse_skip_back** (**struct** *circular_buffer_t* **self_p*, size_t *size*)
Skip given number of written bytes at the back of the buffer.

Return Number of skipped bytes or negative error code.

Parameters

- `self_p`: Circular buffer.
- `size`: Number of bytes to skip.

ssize_t **circular_buffer_array_one** (**struct** *circular_buffer_t* **self_p*, void ***buf_pp*, size_t *size*)
Get a pointer to the next byte to read from the buffer. Use `circular_buffer_array_two()` to get the second array, if there is a wrap around.

Return Number of bytes in array or negative error code.

Parameters

- `self_p`: Circular buffer.
- `buf_pp`: A poitner to the start of the array. Only valid if the return value is greater than zero(0).
- `size`: Number of bytes asked for.

ssize_t **circular_buffer_array_two** (**struct** *circular_buffer_t* **self_p*, void ***buf_pp*, size_t *size*)
Get a pointer to the next byte to read from the buffer, following a wrap around.

Return Number of bytes in array or negative error code.

Parameters

- `self_p`: Circular buffer.
- `buf_pp`: A poitner to the start of the array. Only valid if the return value is greater than zero(0).
- `size`: Number of bytes asked for.

struct **circular_buffer_t**
#include <circular_buffer.h>

Public Members

char ***buf_p**

size_t **size**

size_t **writepos**

size_t **readpos**

fifo — First In First Out queuing

Source code: src/collections/fifo.h

Test code: tst/collections/fifo/main.c

Defines

FIFO_DEFINE_TEMPLATE(type)
Define the fifo structure and functions for a given type.

```
FIFO_DEFINE_TEMPLATE(int);

int foo()
{
    struct fifo_int_t fifo;
    int buf[4];
    int value;

    fifo_init_int(&fifo, buf, membersof(buf));

    // Put a value into the fifo.
    value = 10;
    fifo_put_int(&fifo, &value);

    // Get the value from the fifo.
    fifo_get_int(&fifo, &value);

    // Prints 'value = 10'.
    std_printf(FSTR("value=  %d\r\n", value));
}
```

Parameters

- `type`: Type of the elements in the defined fifo.

Functions

static int **fifo_init** (**struct** *fifo_t* **self_p*, int *max*)
Initialize given fifo.

Return zero(0) or negative error code.

Parameters

- `self_p`: Fifo to initialize.
- `max`: Maximum number of elements in the fifo.

static int **fifo_put** (**struct** *fifo_t* **self_p*)
Put an element in the fifo.

Return Added element index in fifo, or -1 if there are no free positions.

Parameters

- `self_p`: Initialized fifo.

static int **fifo_get** (**struct** *fifo_t* **self_p*)
Get the next element from the fifo.

Return The fetched element index in fifo , or -1 if the fifo is empty.

Parameters

- `self_p`: Initialized fifo.

struct fifo_t
#include <fifo.h>

Public Members

int **rdpos**

int **wrpos**

void ***buf_p**

int **max**

`hash_map` — Hash map

Source code: src/collections/hash_map.h, src/collections/hash_map.c

Test code: tst/collections/hash_map/main.c

Test coverage: src/collections/hash_map.c

Typedefs

typedef int (***hash_function_t**) (long key)

Functions

int **hash_map_init** (**struct** *hash_map_t* **self_p*, **struct** *hash_map_bucket_t* **buckets_p*, size_t *buckets_max*, **struct** *hash_map_entry_t* **entries_p*, size_t *entries_max*, *hash_function_t* *hash*)

Initialize hash map with given parameters.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized hash map.
- `buckets_p`: Array of buckets.
- `buckets_max`: Number of entries in `buckets_p`.
- `entries_p`: Array of empty entries.
- `entries_max`: Number of entries in `entries_p`.
- `hash`: Hash function.

int **hash_map_add** (**struct** *hash_map_t* **self_p*, long *key*, void **value_p*)

Add given key-value pair into hash map. Overwrites old value if the key is already present in map.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized hash map.
- `key`: Key to hash.
- `value_p`: Value to insert for key.

int **hash_map_remove** (**struct** *hash_map_t* **self_p*, long *key*)

Remove given key from hash map.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized hash map.
- `key`: Key to hash.

void ***hash_map_get** (**struct** *hash_map_t* **self_p*, long *key*)

Get value for given key.

Return Value for key or NULL if key was not found in the map.

Parameters

- `self_p`: Initialized hash map.
- `key`: Key to hash.

struct **hash_map_entry_t**

Public Members

struct *hash_map_entry_t* ***next_p**

long **key**

void ***value_p**

struct **hash_map_bucket_t**

Public Members

struct *hash_map_entry_t* ***list_p**

struct **hash_map_t**

Public Members

struct *hash_map_bucket_t* ***buckets_p**

size_t **buckets_max**

struct *hash_map_entry_t* ***entries_p**

hash_function_t **hash**

`list` — Abstract lists

Source code: src/collections/list.h

Defines

LIST_SL_INIT (list_p)
Initialize given singly linked list object.

Parameters

- `list_p`: List object to initialize.

LIST_SL_INIT_STRUCT

LIST_SL_PEEK_HEAD (list_p, element_pp)
Peek at the first element in the list.

Parameters

- `list_p`: List object.
- `element_pp`: First element of the list.

LIST_SL_ADD_HEAD (list_p, element_p)
Add given element to the beginning of given list.

Parameters

- `list_p`: List object.
- `element_p`: Element to add.

LIST_SL_ADD_TAIL (list_p, element_p)
Add given element to the end of given list.

Parameters

- `list_p`: List object.
- `element_p`: Element to add.

LIST_SL_REMOVE_HEAD (list_p, element_pp)
Get the first element of given list and then remove it from given list.

Parameters

- `list_p`: List object.
- `element_pp`: First element of the list.

LIST_SL_ITERATOR_INIT (iterator_p, list_p)
Initialize given iterator object.

Parameters

- `iterator_p`: Iterator to initialize.
- `list_p`: List object to iterate over.

LIST_SL_ITERATOR_NEXT (iterator_p, element_pp)
Get the next element from given iterator object.

Parameters

- `iterator_p`: Iterator object.
- `element_pp`: Next element of the list.

LIST_SL_REMOVE_ELEM (list_p, iterator_p, element_p, iterator_element_p, previous_element_p)
Remove given element from given list.

Parameters

- `list_p`: List object.
- `iterator_p`: Used internally.
- `element_p`: Element to remove.
- `iterator_element_p`: Used internally.
- `previous_element_p`: Used internally.

struct list_next_t
#include <list.h>

Public Members

void ***next_p**

struct list_singly_linked_t

Public Members

void ***head_p**

void ***tail_p**

struct list_sl_iterator_t

Public Members

void ***next_p**

alloc

Memory management is the act of managing computer memory. The essential requirement of memory management is to provide ways to dynamically allocate portions of memory to programs at their request, and free it for reuse when no longer needed.

The alloc package on Github.

`circular_heap` — Circular heap

The circular heap is a dynamic memory allocator allocating buffers in a circular buffer. This puts a restriction on the user to free allocated buffers in the same order as they were allocated. This allocator is useful if you know the allocation order and need a low memory overhead on each allocated buffer and no memory fragmentation.

Below is an example of the internal state of a circular heap when buffers are allocated and freed.

1. After initialization *begin*, *alloc* and *free* have the same value. All memory is available for allocation.

```
begin
alloc
 free                                                  end
  |----------------------------------------------------|
```

2. Allocating a buffer increments *alloc*.

```
begin
 free                    alloc                         end
  |=========================|--------------------------|
```

3. Allocating another buffer increments *alloc* once again.

```
begin
 free                                    alloc       end
  |========================================|----------|
```

4. Freeing the first buffer increments *free* to the position of the first *alloc*.

```
begin                     free           alloc       end
  |-------------------------|================|----------|
```

5. Allocating a buffer that is bigger than the available space between *alloc* and *end* results in a buffer starting at *begin*. The memory between the old *alloc* and *end* will be unused.

```
begin             alloc   free                       end
  |==================|------|================|oooooooooo|
```

6. Freeing the second buffer increments *free* to the position of the second *alloc*.

```
begin             alloc                       free       end
  |==================|----------------------|oooooooooo|
```

7. Freeing the third buffer sets *free* to *alloc*. All memory is available for allocation once again.

```
                  alloc
begin              free                              end
  |------------------|----------------------------------|
```

8. Done!

Source code: src/alloc/circular_heap.h, src/alloc/circular_heap.c

Test code: tst/alloc/circular_heap/main.c

Test coverage: src/alloc/circular_heap.c

Functions

int **circular_heap_init** (**struct** *circular_heap_t* **self_p*, void **buf_p*, size_t *size*)

Initialize given circular_heap.

Return zero(0) or negative error code.

Parameters

- `self_p`: Circular heap to initialize.
- `buf_p`: Memory buffer.
- `size`: Size of the memory buffer.

void ***circular_heap_alloc** (**struct** *circular_heap_t* **self_p*, size_t *size*)

Allocate a buffer of given size from given circular heap.

Return Pointer to allocated buffer, or NULL on failure.

Parameters

- `self_p`: Circular heap to allocate from.
- `size`: Number of bytes to allocate.

int **circular_heap_free** (**struct** *circular_heap_t* **self_p*, void **buf_p*)
Free the oldest allocated buffer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Circular heap to free to.
- `buf_p`: Buffer to free. Must be the oldest allocated buffer.

struct circular_heap_t
#include <circular_heap.h>

Public Members

void ***begin_p**

void ***end_p**

void ***alloc_p**

void ***free_p**

heap — Heap

Source code: src/alloc/heap.h, src/alloc/heap.c

Test code: tst/alloc/heap/main.c

Test coverage: src/alloc/heap.c

Defines

HEAP_FIXED_SIZES_MAX

Functions

int **heap_init** (**struct** *heap_t* **self_p*, void **buf_p*, size_t *size*, size_t *sizes*[HEAP_FIXED_SIZES_MAX])
Initialize given heap.

Return zero(0) or negative error code.

Parameters

- `self_p`: Heap to initialize.
- `buf_p`: Heap memory buffer.
- `size`: Size of the heap memory buffer.

void ***heap_alloc** (**struct** *heap_t* **self_p*, size_t *size*)

Allocate a buffer of given size from given heap.

Return Pointer to allocated buffer, or NULL on failure.

Parameters

- `self_p`: Heap to allocate from.
- `size`: Number of bytes to allocate.

int **heap_free** (**struct** *heap_t* **self_p*, void **buf_p*)

Decrement the share count by once and free the buffer if the count becomes zero(0).

Return Share count after the free, or negative error code.

Parameters

- `self_p`: Heap of given buffer.
- `buf_p`: Memory buffer to free.

int **heap_share** (**struct** *heap_t* **self_p*, **const** void **buf_p*, int *count*)

Share given buffer `count` times.

Return zero(0) or negative error code.

Parameters

- `self_p`: Heap of given buffer.
- `buf_p`: Buffer to share.
- `count`: Share count.

struct heap_fixed_t

Public Members

void ***free_p**

size_t **size**

struct heap_dynamic_t

Public Members

void ***free_p**

struct heap_t

Public Members

void ***buf_p**

size_t **size**

void ***next_p**

struct *heap_fixed_t* **fixed**[HEAP_FIXED_SIZES_MAX]

struct *heap_dynamic_t* **dynamic**

text

Text parsing, editing and colorization.

The text package on Github.

`color` — ANSI colors

Source code: src/text/color.h

Defines

COLOR_RESET

COLOR_BOLD_ON

COLOR_ITALICS_ON

COLOR_UNDERLINE_ON

COLOR_INVERSE_ON

COLOR_STRIKETHROUGH_ON

COLOR_BOLD_OFF

COLOR_ITALICS_OFF

COLOR_UNDERLINE_OFF

COLOR_INVERSE_OFF

COLOR_STRIKETHROUGH_OFF

COLOR_FOREGROUND_BLACK

COLOR_FOREGROUND_RED

COLOR_FOREGROUND_GREEN

COLOR_FOREGROUND_YELLOW

COLOR_FOREGROUND_BLUE

COLOR_FOREGROUND_MAGENTA

COLOR_FOREGROUND_CYAN

COLOR_FOREGROUND_WHITE

COLOR_FOREGROUND_DEFAULT

COLOR_BACKGROUND_BLACK

COLOR_BACKGROUND_RED

COLOR_BACKGROUND_GREEN

COLOR_BACKGROUND_YELLOW

COLOR_BACKGROUND_BLUE

COLOR_BACKGROUND_MAGENTA

COLOR_BACKGROUND_CYAN

COLOR_BACKGROUND_WHITE

COLOR_BACKGROUND_DEFAULT

COLOR (...)

`configfile` — Configuration file (INI-file)

The INI file format is an informal standard for configuration files for some platforms or software. INI files are simple text files with a basic structure composed of sections, properties, and values.

More information on Wikipedia.

File format description

- Line terminators: `\n`, `\r\n` or `\n\r`.
- Opening bracket (`[`) at the beginning of a line indicates a section. The section name is all characters until a closing bracket (`]`).
- A property line starts with its name, then a colon (`:`) or equal sign (`=`), and then the value.
- Semicolon (`;`) or number sign (`#`) at the beginning of a line indicate a comment.

Example file

```
; last modified 1 April 2001 by John Doe
[owner]
name = John Doe
organization = Acme Widgets Inc.

[database]
; use IP address in case network name resolution is not working
server = 192.0.2.62
port = 143
file = "payroll.dat"
```

Source code: src/text/configfile.h, src/text/configfile.c

Test code: tst/text/configfile/main.c

Test coverage: src/text/configfile.c

Functions

int **configfile_init** (**struct** *configfile_t* **self_p*, char **buf_p*, size_t *size*)

Initialize given configuration file object.

Return zero(0) or negative error code.

Parameters

- `self_p`: Object to initialize.
- `buf_p`: Configuration file contents as a NULL terminated string.
- `size`: Size of the configuration file contents.

int **configfile_set** (**struct** *configfile_t* **self_p*, **const** char **section_p*, **const** char **property_p*, **const** char **value_p*)

Set the value of given property in given section.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized parser.
- `section_p`: Section to set the property from.
- `property_p`: Property to set the value for.
- `value_p`: NULL terminated value to set.

char ***configfile_get** (**struct** *configfile_t* **self_p*, **const** char **section_p*, **const** char **property_p*, char **value_p*, int *length*)

Get the value of given property in given section.

Return Value pointer or NULL on failure.

Parameters

- `self_p`: Initialized parser.
- `section_p`: Section to get the property from.
- `property_p`: Property to get the value for.
- `value_p`: Value of given property in given section.
- `size`: Size of the value buffer.

int **configfile_get_long** (**struct** *configfile_t* **self_p*, **const** char **section_p*, **const** char **property_p*, long **value_p*)

Get the value of given property in given section, converted to an integer.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized parser.
- `section_p`: Section to get the property from.
- `property_p`: Property to get the value for.
- `value_p`: Value of given property in given section.

int **configfile_get_float** (**struct** *configfile_t* **self_p*, **const** char **section_p*, **const** char **property_p*, float **value_p*)

Get the value of given property in given section, converted to a float.

Return zero(0) or negative error code.

Parameters

- `self_p`: Initialized parser.
- `section_p`: Section to get the property from.
- `property_p`: Property to get the value for.
- `value_p`: Value of given property in given section.

struct configfile_t

#include <configfile.h>

Public Members

char ***buf_p**

size_t **size**

`emacs` — Emacs text editor

Emacs is a text editor originally written by Richard Stallman and Guy L. Steele, Jr. in 1976. This module contains a minimal functional Emacs called Atto.

Help and key bindings: https://github.com/eerimoq/atto#atto-key-bindings

Atto Emacs project on GitHub: https://github.com/hughbarney/atto

---

Source code: src/text/emacs.h, src/text/emacs.c

Functions

int **emacs** (**const** char **path_p*, void **chin_p*, void **chout_p*)

`re` — Regular expressions

Source code: src/text/re.h, src/text/re.c

Test code: tst/text/re/main.c

Test coverage: src/text/re.c

Defines

RE_IGNORECASE

RE_DOTALL
Make the `'.'` special character match any character at all, including a newline; without this flag, `'.'` will match anything except a newline.

RE_MULTILINE
When specified, the pattern character `'^'` matches at the beginning of the string and at the beginning of each line (immediately following each newline); and the pattern character `'$'` matches at the end of the string and at the end of each line (immediately preceding each newline). By default, '^' matches only at the beginning of the string, and `'$'` only at the end of the string and immediately before the newline (if any) at the end of the string.

Functions

char ***re_compile**(char **compiled_p*, **const** char **pattern_p*, char *flags*, size_t *size*)
Compile given pattern.

Pattern syntax:

- `'.'` - Any character.
- `'^'` - Beginning of the string (**not yet supported**).
- `'$'` - End of the string (**not yet supported**).
- `'?'` - Zero or one repetitions (greedy).
- `'*'` - Zero or more repetitions (greedy).
- `'+'` - One or more repetitions (greedy).
- `'??'` - Zero or one repetitions (non-greedy).
- `*?` - Zero or more repetitions (non-greedy).
- `+?` - One or more repetitions (non-greedy).
- `{m}` - Exactly `m` repetitions.
- `\\` - Escape character.
- `[]` - Set of characters.
- `'|'` - Alternatives (**not yet supported**).
- `(...)` - Groups (**not yet supported**).
- `\\d` - Decimal digits `[0-9]`.
- `\\w` - Alphanumerical characters `[a-ZA-Z0-9_]`.
- `\\s` - Whitespace characters `[ \t\r\n\f\v]`.

Return Compiled patten, or NULL if the compilation failed.

Parameters

- `compiled_p`: Compiled regular expression pattern.
- `pattern_p`: Regular expression pattern.

- `flags`: A combination of the flags `RE_IGNORECASE`, `RE_DOTALL` and `RE_MULTILINE` (`RE_MULTILINE` is **not yet supported**).
- `size`: Size of the compiled buffer.

ssize_t **re_match** (**const** char **compiled_p*, **const** char **buf_p*, size_t *size*, **struct** *re_group_t* **groups_p*, size_t **number_of_groups_p*)

Apply given regular expression to the beginning of given string.

Return Number of matched bytes or negative error code.

Parameters

- `compiled_p`: Compiled regular expression pattern. Compile a pattern with `re_compile()`.
- `buf_p`: Buffer to apply the compiled pattern to.
- `size`: Number of bytes in the buffer.
- `groups_p`: Read groups or NULL.
- `number_of_groups_p`: Number of read groups or NULL.

struct re_group_t

Public Members

const char ***buf_p**

ssize_t **size**

`std` — Standard functions

Source code: src/text/std.h, src/text/std.c

Test code: tst/text/std/main.c

Test coverage: src/text/std.c

Functions

int **std_module_init** (void)

ssize_t **std_sprintf** (char **dst_p*, far_string_t *fmt_p*, ...)

Format and write data to destination buffer. The buffer must be big enough to fit the formatted string. The output is null terminated.

A format specifier has this format:

%[flags][width][length]specifier

where

- flags: `0` or `-`
- width: `0..127`
- length: `l` for long or nothing

•specifier: `c`, `s`, `d`, `i`, `u`, `x` or `f`

Return Length of the string written to the destination buffer, not inclusing the null termination, or negative error code.

Parameters

- `dst_p`: Destination buffer. The formatted string is written to this buffer.
- `fmt_p`: Format string.
- `...`: Variable arguments list.

ssize_t **std_snprintf**(char **dst_p*, size_t *size*, far_string_t *fmt_p*, ...)
Format and write data to given buffer. The output is null terminated.

Return Length of the string written to the destination buffer, not inclusing the null termination, or negative error code.

Parameters

- `dst_p`: Destination buffer. The formatted string is written to this buffer.
- `size`: Size of the destination buffer.
- `fmt_p`: Format string.
- `...`: Variable arguments list.

ssize_t **std_vsprintf**(char **dst_p*, far_string_t *fmt_p*, va_list **ap_p*)
Format and write data to given buffer. The output is null terminated.

Return Length of the string written to the destination buffer, not inclusing the null termination, or negative error code.

Parameters

- `dst_p`: Destination buffer. The formatted string is written to this buffer.
- `fmt_p`: Format string.
- `ap_p`: Variable arguments list.

ssize_t **std_vsnprintf**(char **dst_p*, size_t *size*, far_string_t *fmt_p*, va_list **ap_p*)
Format and write data to given buffer. The output is null terminated.

Return Length of the string written to the destination buffer, not inclusing the null termination, or negative error code.

Parameters

- `dst_p`: Destination buffer. The formatted string is written to this buffer.
- `size`: Size of the destination buffer.
- `fmt_p`: Format string.
- `ap_p`: Variable arguments list.

ssize_t **std_printf**(far_string_t *fmt_p*, ...)
Format and print data to standard output. The output is not null terminated.

See `std_sprintf()` for the the format string specification.

Return Number of characters written to standard output, or negative error code.

Parameters

- `fmt_p`: Format string.
- `...`: Variable arguemnts list.

ssize_t **std_vprintf**(far_string_t *fmt_p*, va_list **ap_p*)

Format and print data to standard output. The output is not null terminated.

See `std_sprintf()` for the the format string specification.

Return Number of characters written to standard output, or negative error code.

Parameters

- `fmt_p`: Format string.
- `ap_p`: Variable arguemnts list.

ssize_t **std_fprintf**(void **chan_p*, far_string_t *fmt_p*, ...)

Format and print data to channel. The output is not null terminated.

See `std_sprintf()` for the the format string specification.

Return Number of characters written to given channel, or negative error code.

Parameters

- `chan_p`: Output channel.
- `fmt_p`: Format string.
- `...`: Variable arguemnts list.

ssize_t **std_vfprintf**(void **chan_p*, far_string_t *fmt_p*, va_list **ap_p*)

Format and print data to channel. The output is not null terminated.

See `std_sprintf()` for the the format string specification.

Return Number of characters written to given channel, or negative error code.

Parameters

- `chan_p`: Output channel.
- `fmt_p`: Format string.
- `...`: Variable arguemnts list.

const char ***std_strtol**(**const** char **str_p*, long **value_p*)

Convert string to integer.

Return Pointer to the next byte or NULL on failure.

Parameters

- `str_p`: Integer string.
- `value_p`: Integer value.

const char ***std_strtod**(**const** char **str_p*, double **value_p*)

Convert string to double.

Return Pointer to the next byte or NULL on failure.

Parameters

- `str_p`: Double string.
- `value_p`: Double value.

int **std_strcpy**(char **dst_p*, far_string_t *src_p*)

Copy string from far memory to memory.

Return String length or negative error code.

Parameters

- `dst_p`: Normal memory string.
- `src_p`: Far memory string.

int **std_strcmp**(**const** char **str_p*, far_string_t *fstr_p*)

Compare a string with a far string.

Return zero(0) if match, otherwise the difference of the mismatched characters

Parameters

- `str_p`: Normal memory string.
- `fstr_p`: Far memory string.

int **std_strcmp_f**(far_string_t *fstr0_p*, far_string_t *fstr1_p*)

Compare two far strings.

Return zero(0) if match, otherwise the difference of the mismatched characters.

Parameters

- `fstr0_p`: Far memory string.
- `fstr1_p`: Far memory string.

int **std_strncmp**(far_string_t *fstr_p*, **const** char **str_p*, size_t *size*)

Compare at most `size` bytes of one far string and one string.

Return zero(0) if match, otherwise the difference of the mismatched characters.

Parameters

- `fstr_p`: Far memory string.
- `str_p`: String.
- `size`: Compare at most size number of bytes.

int **std_strncmp_f**(far_string_t *fstr0_p*, far_string_t *fstr1_p*, size_t *size*)

Compare at most `size` bytes of two far strings.

Return zero(0) if match, otherwise the difference of the mismatched characters.

Parameters

- `fstr0_p`: Far memory string.

- `fstr1_p`: Far memory string.
- `size`: Compare at most size number of bytes.

int **std_strlen**(far_string_t *fstr_p*)
Get the length in bytes of given far string, not including null termination.

Return String length in number of bytes (not including the null termination).

Parameters

- `fstr_p`: Far memory string.

char ***std_strip**(char **str_p*, **const** char **strip_p*)
Strip leading and trailing characters from a string. The characters to strip are given by `strip_p`.

Return Pointer to the stripped string.

Parameters

- `str_p`: String to strip characters from.
- `strip_p`: Characters to strip or NULL for whitespace characters. Must be null-terminated.

ssize_t **std_hexdump**(void **chan_p*, **const** void **buf_p*, size_t *size*)
Write a hex dump of given data to given channel.

Return Number of characters written to given channel, or negative error code.

Parameters

- `chan_p`: Channel to write the hexdump to.
- `buf_p`: Buffer to dump.
- `size`: Size of buffer.

encode

In computing, a character encoding is used to represent a repertoire of characters by some kind of an encoding system.

The encode package on Github.

`base64` — Base64 encoding and decoding.

Source code: src/encode/base64.h, src/encode/base64.c

Test code: tst/encode/base64/main.c

Test coverage: src/encode/base64.c

Functions

int **base64_encode**(char **dst_p*, **const** void **src_p*, size_t *size*)

int **base64_decode**(void **dst_p*, **const** char **src_p*, size_t *size*)

Decode given base64 encoded buffer. The decoded data will be ~25% smaller than the destination data. Choose the destination buffer size accordingly.

Return zero(0) or negative error code.

Parameters

- `dst_p`: Output data.
- `src_p`: Encoded input data.
- `size`: Number of bytes in the encoded input data.

`json` — JSON encoding and decoding

Source code: src/encode/json.h, src/encode/json.c

Test code: tst/encode/json/main.c

Test coverage: src/encode/json.c

Enums

enum json_type_t

Values:

JSON_UNDEFINED = 0

Undefined type.

JSON_OBJECT = 1

Object, `{}`.

JSON_ARRAY = 2

Array, `[]`.

JSON_STRING = 3

String, `\"...\\"`.

JSON_PRIMITIVE = 4

Other primitive: number, boolean (true/false) or null.

enum json_err_t

Values:

JSON_ERROR_NOMEM = -1

Not enough tokens were provided.

JSON_ERROR_INVAL = -2

Invalid character inside JSON string.

JSON_ERROR_PART = -3

The string is not a full JSON packet, more bytes expected.

Functions

int **json_init** (**struct** *json_t* **self_p*, **struct** *json_tok_t* **tokens_p*, int *num_tokens*)

Initialize given JSON object. The JSON object must be initialized before it can be used to parse and dump JSON data.

Return zero(0) or negative error code.

Parameters

- `self_p`: JSON object to initialize.
- `tokens_p`: Array of tokens. The tokens are either filled by the parsing function `json_parse()`, or already filled by the user when calling this function. The latter can be used to dump the tokens as a string by calling `json_dump()` or `json_dumps()`.
- `num_tokens`: Number of tokens in the array.

int **json_parse** (**struct** *json_t* **self_p*, **const** char **js_p*, size_t *len*)

Parse given JSON data string into and array of tokens, each describing a single JSON object.

Return Number of decoded tokens or negative error code.

Parameters

- `self_p`: JSON object.
- `js_p`: JSON string to parse.
- `len`: JSON string length in bytes.

ssize_t **json_dumps** (**struct** *json_t* **self_p*, **struct** *json_tok_t* **tokens_p*, char **js_p*)

Format and write given JSON tokens into a string.

Return Dumped string length (not including termination) or negative error code.

Parameters

- `self_p`: JSON object.
- `tokens_p`: Root token to dump. Set to NULL to dump the whole object.
- `js_p`: Dumped null terminated JSON string.

ssize_t **json_dump** (**struct** *json_t* **self_p*, **struct** *json_tok_t* **tokens_p*, void **out_p*)

Format and write given JSON tokens to given channel.

Return Dumped string length (not including termination) or negative error code.

Parameters

- `self_p`: JSON object.
- `tokens_p`: Root token to dump. Set to NULL to dump the whole object.
- `out_p`: Channel to dump the null terminated JSON string to.

struct *json_tok_t* ***json_root** (**struct** *json_t* **self_p*)

Get the root token.

Return The root token or NULL on failure.

Parameters

- `self_p`: JSON object.

struct *json_tok_t* ***json_object_get*** (struct *json_t* **self_p*, const char **key_p*, struct *json_tok_t* **object_p*)

Get the value the string token with given key.

Return Token or NULL on error.

Parameters

- `self_p`: JSON object.
- `key_p`: Key of the value to get.
- `object_p`: The object to get the value from.

struct *json_tok_t* ***json_object_get_primitive*** (struct *json_t* **self_p*, const char **key_p*, struct *json_tok_t* **object_p*)

Get the value of the primitive token with given key.

Return Token or NULL on error.

Parameters

- `self_p`: JSON object.
- `key_p`: Key of the value to get.
- `object_p`: The object to get the value from.

struct *json_tok_t* ***json_array_get*** (struct *json_t* **self_p*, int *index*, struct *json_tok_t* **array_p*)

Get the token of given array index.

Return Token or NULL on error.

Parameters

- `self_p`: JSON object.
- `index`: Index to get.
- `array_p`: The array to get the element from.

void **json_token_object** (struct *json_tok_t* **token_p*, int *num_keys*)

Initialize a JSON object token.

Parameters

- `token_p`: Initialized token.
- `num_keys`: Number of keys in the object.

void **json_token_array** (struct *json_tok_t* **token_p*, int *num_elements*)

Initialize a JSON array token.

Parameters

- `token_p`: Initialized token.
- `num_elements`: Number of array elements.

void **json_token_true** (**struct** *json_tok_t* **token_p*)
Initialize a JSON boolean true token.

Parameters

- `token_p`: Initialized token.

void **json_token_false** (**struct** *json_tok_t* **token_p*)
Initialize a JSON boolean false token.

Parameters

- `token_p`: Initialized token.

void **json_token_null** (**struct** *json_tok_t* **token_p*)
Initialize a JSON null token.

Parameters

- `token_p`: Initialized token.

void **json_token_number** (**struct** *json_tok_t* **token_p*, **const** char **buf_p*, size_t *size*)
Initialize a JSON number (integer/float) token.

Parameters

- `token_p`: Initialized token.
- `buf_p`: Number as a string.
- `size`: String length.

void **json_token_string** (**struct** *json_tok_t* **token_p*, **const** char **buf_p*, size_t *size*)
Initialize a JSON string token.

Parameters

- `token_p`: Initialized token.
- `buf_p`: String.
- `size`: String length.

struct json_tok_t

Public Members

json_type_t **type**

const char ***buf_p**

size_t **size**

int **num_tokens**

struct json_t

Public Members

unsigned int **pos**
Offset in the JSON string.

unsigned int **toknext**
Next token to allocate.

int **toksuper**
Superior token node, e.g parent object or array.

struct *json_tok_t* ***tokens_p**
Array of tokens.

int **num_tokens**
Number of tokens in the tokens array.

hash

A hash function is any function that can be used to map data of arbitrary size to data of fixed size.

The hash package on Github.

`crc` — Cyclic Redundancy Checks

Source code: src/hash/crc.h, src/hash/crc.c

Test code: tst/hash/crc/main.c

Test coverage: src/hash/crc.c

Defines

CRC_8_POLYNOMIAL_8_5_4_0

Functions

uint32_t **crc_32** (uint32_t *crc*, **const** void **buf_p*, size_t *size*)
Calculate a 32 bits crc using the polynomial `x^32+x^26+x^23+x^22+x^16+x^12+x^11+x^10+x^8+x^7+x^5+x^4+x`

Return Calculated crc.

Parameters

- `crc`: Initial crc. Often 0x00000000.
- `buf_p`: Buffer to calculate crc of.
- `size`: Size of the buffer.

uint16_t **crc_ccitt** (uint16_t *crc*, **const** void **buf_p*, size_t *size*)
Calculate a 16 bits crc using the CCITT algorithm (polynomial `x^16+x^12+x^5+x^1`).

Return Calculated crc.

Parameters

- `crc`: Initial crc. Should be 0xffff for CCITT.
- `buf_p`: Buffer to calculate crc of.
- `size`: Size of the buffer.

uint16_t **crc_xmodem** (uint16_t *crc*, **const** void **buf_p*, size_t *size*)

Calculate a 16 bits crc using the XModem algorithm (polynomial `x^16+x^12+x^5+x^1`).

Return Calculated crc.

Parameters

- `crc`: Initial crc. Should be 0x0000 for XModem.
- `buf_p`: Buffer to calculate crc of.
- `size`: Size of the buffer.

uint8_t **crc_7** (**const** void **buf_p*, size_t *size*)

Calculate a 8 bits crc using the CRC-7 algorithm (polynomial `x^7+x^3+1`).

Return Calculated crc.

Parameters

- `buf_p`: Buffer to calculate crc of.
- `size`: Size of the buffer.

uint8_t **crc_8** (uint8_t *crc*, uint8_t *polynomial*, **const** void **buf_p*, size_t *size*)

Calculate a 8 bits crc using given polynomial.

Return Calculated crc.

Parameters

- `crc`: Initial crc. Must be 0x00 on first call.
- `polynimial`: CRC polynomial.
- `buf_p`: Buffer to calculate crc of.
- `size`: Size of the buffer.

`sha1` — SHA1

Source code: src/hash/sha1.h, src/hash/sha1.c

Test code: tst/hash/main.c

Test coverage: src/hash/sha1.c

Functions

int **sha1_init** (**struct** *sha1_t* **self_p*)

Initialize given SHA1 object.

Return zero(0) or negative error code.

Parameters

- `self_p`: SHA1 object.

int **sha1_update** (**struct** *sha1_t* **self_p*, void **buf_p*, size_t *size*)

Update the sha object with the given buffer. Repeated calls are equivalent to a single call with the concatenation of all the arguments.

Return zero(0) or negative error code.

Parameters

- `self_p`: SHA1 object.
- `buf_p`: Buffer to update the sha object with.
- `size`: Size of the buffer.

int **sha1_digest** (**struct** *sha1_t* **self_p*, uint8_t **hash_p*)

Return the digest of the strings passed to the sha1_update() method so far. This is a 20-byte value which may contain non-ASCII characters, including null bytes.

Return zero(0) or negative error code.

Parameters

- `self_p`: SHA1 object.
- `hash_p`: Hash sum.

struct sha1_t

#include <sha1.h>

Public Members

uint8_t **buf**[64]

uint32_t **size**

struct sha1_t::@37 sha1_t::block

uint32_t **h**[5]

uint64_t **size**

multimedia

The multimedia package on Github.

midi — Musical Instrument Digital Interface

Source code: src/multimedia/midi.h, src/multimedia/midi.c

Test code: tst/multimedia/midi/main.c

Test coverage: src/multimedia/midi.c

Defines

MIDI_BAUDRATE

MIDI_NOTE_OFF

MIDI_NOTE_ON

MIDI_POLYPHONIC_KEY_PRESSURE

MIDI_CONTROL_CHANGE

MIDI_PROGRAM_CHANGE

MIDI_CHANNEL_PRESSURE

MIDI_PITCH_BEND_CHANGE

MIDI_SET_INTRUMENT

MIDI_PERC

MIDI_NOTE_MAX

MIDI_NOTE_A0

MIDI_NOTE_B0

MIDI_NOTE_C1

MIDI_NOTE_D1

MIDI_NOTE_E1

MIDI_NOTE_F1

MIDI_NOTE_G1

MIDI_NOTE_A1

MIDI_NOTE_B1

MIDI_NOTE_C2

MIDI_NOTE_D2

MIDI_NOTE_E2

MIDI_NOTE_F2

MIDI_NOTE_G2

MIDI_NOTE_A2

MIDI_NOTE_B2

MIDI_NOTE_C3

MIDI_NOTE_D3

MIDI_NOTE_E3

MIDI_NOTE_F3

MIDI_NOTE_G3

MIDI_NOTE_A3

MIDI_NOTE_B3

MIDI_NOTE_C4

MIDI_NOTE_D4

MIDI_NOTE_E4

MIDI_NOTE_F4

MIDI_NOTE_G4

MIDI_NOTE_A4

MIDI_NOTE_B4

MIDI_NOTE_C5

MIDI_NOTE_D5

MIDI_NOTE_E5

MIDI_NOTE_F5

MIDI_NOTE_G5

MIDI_NOTE_A5

MIDI_NOTE_B5

MIDI_NOTE_C6

MIDI_NOTE_D6

MIDI_NOTE_E6

MIDI_NOTE_F6

MIDI_NOTE_G6

MIDI_NOTE_A6

MIDI_NOTE_B6

MIDI_NOTE_C7

MIDI_NOTE_D7

MIDI_NOTE_E7

MIDI_NOTE_F7

MIDI_NOTE_G7

MIDI_NOTE_A7

MIDI_NOTE_B7

MIDI_NOTE_C8

MIDI_PERC_ACOUSTIC_BASS_DRUM

MIDI_PERC_BASS_DRUM_1

MIDI_PERC_SIDE_STICK

MIDI_PERC_ACOUSTIC_SNARE

MIDI_PERC_HAND_CLAP

MIDI_PERC_ELECTRIC_SNARE

MIDI_PERC_LOW_FLOOR_TOM

MIDI_PERC_CLOSED_HI_HAT

MIDI_PERC_HIGH_FLOOR_TOM

MIDI_PERC_PEDAL_HI_HAT

MIDI_PERC_LOW_TOM

MIDI_PERC_OPEN_HI_HAT

MIDI_PERC_LOW_MID_TOM

MIDI_PERC_HI_MID_TOM

MIDI_PERC_CRASH_CYMBAL_1

MIDI_PERC_HIGH_TOM

MIDI_PERC_RIDE_CYMBAL_1

MIDI_PERC_CHINESE_CYMBAL

MIDI_PERC_RIDE_BELL

MIDI_PERC_TAMBOURINE

MIDI_PERC_SPLASH_CYMBAL

MIDI_PERC_COWBELL

MIDI_PERC_CRASH_CYMBAL_2

MIDI_PERC_VIBRASLAP

MIDI_PERC_RIDE_CYMBAL_2

MIDI_PERC_HI_BONGO

MIDI_PERC_LOW_BONGO

MIDI_PERC_MUTE_HI_CONGA

MIDI_PERC_OPEN_HI_CONGA

MIDI_PERC_LOW_CONGA

MIDI_PERC_HIGH_TIMBALE

MIDI_PERC_LOW_TIMBALE

MIDI_PERC_HIGH_AGOGO

MIDI_PERC_LOW_AGOGO

MIDI_PERC_CABASA

MIDI_PERC_MARACAS

MIDI_PERC_SHORT_WHISTLE

MIDI_PERC_LONG_WHISTLE

MIDI_PERC_SHORT_GUIRO

MIDI_PERC_LONG_GUIRO

MIDI_PERC_CLAVES

MIDI_PERC_HI_WOOD_BLOCK

MIDI_PERC_LOW_WOOD_BLOCK

MIDI_PERC_MUTE_CUICA

MIDI_PERC_OPEN_CUICA

MIDI_PERC_MUTE_TRIANGLE

MIDI_PERC_OPEN_TRIANGLE

Functions

float **midi_note_to_frequency**(int *note*)

Get the frequency for given note.

Return Note frequency.

Parameters

- `note`: MIDI note.

boards

The boards supported by *Simba*.

The boards on Github.

`arduino_due` — Arduino Due

Source code: src/boards/arduino_due/board.h, src/boards/arduino_due/board.c

Hardware reference: *Arduino Due*

Defines

pin_d0_dev

pin_d1_dev

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_d11_dev

pin_d12_dev

pin_d13_dev

pin_d14_dev

pin_d15_dev

pin_d16_dev

pin_d17_dev

pin_d18_dev

pin_d19_dev

pin_d20_dev

pin_d21_dev

pin_d22_dev

pin_d23_dev

pin_d24_dev

pin_d25_dev

pin_d26_dev

pin_d27_dev

pin_d28_dev

pin_d29_dev

pin_d30_dev

pin_d31_dev

pin_d32_dev

pin_d33_dev

pin_d34_dev

pin_d35_dev

pin_d36_dev

pin_d37_dev

pin_d38_dev

pin_d39_dev

pin_d40_dev

pin_d41_dev

pin_d42_dev

pin_d43_dev

pin_d44_dev

pin_d45_dev

pin_d46_dev

pin_d47_dev

pin_d48_dev

pin_d49_dev

pin_d50_dev

pin_d51_dev

pin_d52_dev

pin_d53_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_a6_dev

pin_a7_dev

pin_a8_dev

pin_a9_dev

pin_a10_dev

pin_a11_dev

pin_led_dev

pin_dac0_dev

pin_dac1_dev

exti_d0_dev

exti_d1_dev

exti_d2_dev

exti_d3_dev

exti_d4_dev

exti_d5_dev

exti_d6_dev

exti_d7_dev

exti_d8_dev

exti_d9_dev

exti_d10_dev

exti_d11_dev

exti_d12_dev

exti_d13_dev

exti_d14_dev

exti_d15_dev

exti_d16_dev

exti_d17_dev

exti_d18_dev

exti_d19_dev

exti_d20_dev

exti_d21_dev

exti_d22_dev

exti_d23_dev

exti_d24_dev

exti_d25_dev

exti_d26_dev

exti_d27_dev

exti_d28_dev

exti_d29_dev

exti_d30_dev

exti_d31_dev

exti_d32_dev

exti_d33_dev

exti_d34_dev

exti_d35_dev

exti_d36_dev

exti_d37_dev

exti_d38_dev

exti_d39_dev

exti_d40_dev

exti_d41_dev

exti_d42_dev

exti_d43_dev

exti_d44_dev

exti_d45_dev

exti_d46_dev

exti_d47_dev

exti_d48_dev

exti_d49_dev

exti_d50_dev

exti_d51_dev

exti_d52_dev

exti_d53_dev

exti_a0_dev

exti_a1_dev

exti_a2_dev

exti_a3_dev

exti_a4_dev

exti_a5_dev

exti_a6_dev

exti_a7_dev

exti_a8_dev

exti_a9_dev

exti_a10_dev

exti_a11_dev

exti_led_dev

exti_dac0_dev

exti_dac1_dev

pwm_d2_dev

pwm_d3_dev

pwm_d5_dev

pwm_d6_dev

pwm_d7_dev

pwm_d8_dev

pwm_d9_dev

pwm_d10_dev

pwm_d11_dev

pwm_d12_dev

adc_0_dev

dac_0_dev

flash_0_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)
Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`arduino_mega` — Arduino Mega

Source code: src/boards/arduino_mega/board.h, src/boards/arduino_mega/board.c

Hardware reference: *Arduino Mega*

Defines

pin_d0_dev

pin_d1_dev

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_d11_dev

pin_d12_dev

pin_d13_dev

pin_d14_dev

pin_d15_dev

pin_d16_dev

pin_d17_dev

pin_d18_dev

pin_d19_dev

pin_d20_dev

pin_d21_dev

pin_d22_dev

pin_d23_dev

pin_d24_dev

pin_d25_dev

pin_d26_dev

pin_d27_dev

pin_d28_dev

pin_d29_dev

pin_d30_dev

pin_d31_dev

pin_d32_dev

pin_d33_dev

pin_d34_dev

pin_d35_dev

pin_d36_dev

pin_d37_dev

pin_d38_dev

pin_d39_dev

pin_d40_dev

pin_d41_dev

pin_d42_dev

pin_d43_dev

pin_d44_dev

pin_d45_dev

pin_d46_dev

pin_d47_dev

pin_d48_dev

pin_d49_dev

pin_d50_dev

pin_d51_dev

pin_d52_dev

pin_d53_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_a6_dev

pin_a7_dev

pin_a8_dev

pin_a9_dev

pin_a10_dev

pin_a11_dev

pin_a12_dev

pin_a13_dev

pin_a14_dev

pin_a15_dev

pin_led_dev

exti_d2_dev

exti_d3_dev

exti_d18_dev

exti_d19_dev

exti_d20_dev

exti_d21_dev

pwm_d2_dev

pwm_d3_dev

pwm_d5_dev

pwm_d6_dev

pwm_d7_dev

pwm_d8_dev

pwm_d9_dev

pwm_d10_dev

pwm_d11_dev

pwm_d12_dev

adc_0_dev

i2c_0_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`arduino_nano` — Arduino Nano

Source code: src/boards/arduino_nano/board.h, src/boards/arduino_nano/board.c

Hardware reference: *Arduino Nano*

Defines

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_d11_dev

pin_d12_dev

pin_d13_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_led_dev

exti_d2_dev

exti_d3_dev

pwm_d3_dev

pwm_d9_dev

pwm_d10_dev

pwm_d11_dev

adc_0_dev

i2c_0_dev

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)
Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`arduino_pro_micro` — Arduino Pro Micro

Source code: src/boards/arduino_pro_micro/board.h, src/boards/arduino_pro_micro/board.c

Hardware reference: *Arduino Pro Micro*

Defines

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_d14_dev

pin_d15_dev

pin_d16_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_led_dev

exti_d2_dev

exti_d3_dev

pwm_d3_dev

pwm_d9_dev

pwm_d10_dev

pwm_d11_dev

adc_0_dev

i2c_0_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)
Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`arduino_uno` — Arduino Uno

Source code: src/boards/arduino_uno/board.h, src/boards/arduino_uno/board.c

Hardware reference: *Arduino Uno*

Defines

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_d11_dev

pin_d12_dev

pin_d13_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_led_dev

exti_d2_dev

exti_d3_dev

pwm_d3_dev

pwm_d9_dev

pwm_d10_dev

pwm_d11_dev

adc_0_dev

i2c_0_dev

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`esp01` — ESP8266 Development Board

Source code: src/boards/esp01/board.h, src/boards/esp01/board.c

Hardware reference: *ESP-01*

Defines

pin_gpio0_dev

pin_gpio1_dev

pin_gpio2_dev

pin_d0_dev

pin_d1_dev

pin_d2_dev

pin_led_dev

flash_0_dev

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)
Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`esp12e` — ESP8266 Development Board

Source code: src/boards/esp12e/board.h, src/boards/esp12e/board.c

Hardware reference: *ESP-12E Development Board*

Defines

pin_gpio0_dev

pin_gpio2_dev

pin_gpio4_dev

pin_gpio5_dev

pin_gpio12_dev

pin_gpio13_dev

pin_gpio14_dev

pin_gpio15_dev

pin_gpio16_dev

pin_d0_dev

pin_d2_dev

pin_d4_dev

pin_d5_dev

pin_d12_dev

pin_d13_dev

pin_d14_dev

pin_d15_dev

pin_d16_dev

pin_led_dev

pin_a0_dev

adc_0_dev

flash_0_dev

ADC_PINS_MAX

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)
Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`esp32_devkitc` — ESP32-DevKitC

Source code: src/boards/esp32_devkitc/board.h, src/boards/esp32_devkitc/board.c

Hardware reference: *ESP32-DevKitC*

Defines

pin_gpio00_dev

pin_gpio01_dev

pin_gpio02_dev

pin_gpio03_dev

pin_gpio04_dev

pin_gpio05_dev

pin_gpio06_dev

pin_gpio07_dev

pin_gpio08_dev

pin_gpio09_dev

pin_gpio10_dev

pin_gpio11_dev

pin_gpio12_dev

pin_gpio13_dev

pin_gpio14_dev

pin_gpio15_dev

pin_gpio16_dev

pin_gpio17_dev

pin_gpio18_dev

pin_gpio19_dev

pin_gpio21_dev

pin_gpio22_dev

pin_gpio23_dev

pin_gpio25_dev

pin_gpio26_dev

pin_gpio27_dev

pin_gpio32_dev

pin_gpio33_dev

pin_gpio34_dev

pin_gpio35_dev

pin_gpio36_dev

pin_gpio39_dev

pin_led_dev

pin_dac1_dev

pin_dac2_dev

pin_a0_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_a6_dev

pin_a7_dev

i2c_dev

spi_h_dev

spi_v_dev

adc_0_dev

adc_1_dev

flash_0_dev

dac_0_dev

ADC_PINS_MAX

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`huzzah` — Huzzah

Source code: src/boards/huzzah/board.h, src/boards/huzzah/board.c

Hardware reference: *Adafruit HUZZAH ESP8266 breakout*

Defines

pin_gpio0_dev

pin_gpio2_dev

pin_gpio4_dev

pin_gpio5_dev

pin_gpio12_dev

pin_gpio13_dev

pin_gpio14_dev

pin_gpio15_dev

pin_gpio16_dev

pin_d0_dev

pin_d2_dev

pin_d4_dev

pin_d5_dev

pin_d12_dev

pin_d13_dev

pin_d14_dev

pin_d15_dev

pin_d16_dev

pin_led_dev

pin_a0_dev

adc_0_dev

flash_0_dev

ADC_PINS_MAX

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`linux` — Linux

Source code: src/boards/linux/board.h, src/boards/linux/board.c

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Defines

PIN_DEVICE_BASE

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_d11_dev

pin_d12_dev

pin_d13_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_a6_dev

pin_a7_dev

pin_led_dev

pwm_d3_dev

pwm_d9_dev

pwm_d10_dev

pwm_d11_dev

adc_0_dev

pin_dac0_dev

pin_dac1_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`maple_esp32` — Maple Esp32

Source code: src/boards/maple_esp32/board.h, src/boards/maple_esp32/board.c

Hardware reference: *Maple-ESP32*

Defines

pin_gpio00_dev

pin_gpio01_dev

pin_gpio02_dev

pin_gpio03_dev

pin_gpio04_dev

pin_gpio05_dev

pin_gpio06_dev

pin_gpio07_dev

pin_gpio08_dev

pin_gpio09_dev

pin_gpio10_dev

pin_gpio11_dev

pin_gpio12_dev

pin_gpio13_dev

pin_gpio14_dev

pin_gpio15_dev

pin_gpio16_dev

pin_gpio17_dev

pin_gpio18_dev

pin_gpio19_dev

pin_gpio21_dev

pin_gpio22_dev

pin_gpio23_dev

pin_gpio25_dev

pin_gpio26_dev

pin_gpio27_dev

pin_gpio32_dev

pin_gpio33_dev

pin_gpio34_dev

pin_gpio35_dev

pin_gpio36_dev

pin_gpio39_dev

pin_led_dev

pin_dac1_dev

pin_dac2_dev

pin_a0_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_a6_dev

pin_a7_dev

i2c_dev

spi_h_dev

spi_v_dev

adc_0_dev

adc_1_dev

flash_0_dev

dac_0_dev

ADC_PINS_MAX

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

nano32 — Nano32

Source code: src/boards/nano32/board.h, src/boards/nano32/board.c

Hardware reference: *Nano32*

Defines

pin_gpio00_dev

pin_gpio01_dev

pin_gpio02_dev

pin_gpio03_dev

pin_gpio04_dev

pin_gpio05_dev

pin_gpio06_dev

pin_gpio07_dev

pin_gpio08_dev

pin_gpio09_dev

pin_gpio10_dev

pin_gpio11_dev

pin_gpio12_dev

pin_gpio13_dev

pin_gpio14_dev

pin_gpio15_dev

pin_gpio16_dev

pin_gpio17_dev

pin_gpio18_dev

pin_gpio19_dev

pin_gpio21_dev

pin_gpio22_dev

pin_gpio23_dev

pin_gpio25_dev

pin_gpio26_dev

pin_gpio27_dev

pin_gpio32_dev

pin_gpio33_dev

pin_gpio34_dev

pin_gpio35_dev

pin_gpio36_dev

pin_gpio39_dev

pin_led_dev

pin_dac1_dev

pin_dac2_dev

pin_a0_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_a6_dev

pin_a7_dev

i2c_dev

spi_h_dev

spi_v_dev

adc_0_dev

adc_1_dev

flash_0_dev

dac_0_dev

ADC_PINS_MAX

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`nodemcu` — NodeMCU

Source code: src/boards/nodemcu/board.h, src/boards/nodemcu/board.c

Hardware reference: *NodeMCU*

Defines

pin_d0_dev

pin_d1_dev

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_d9_dev

pin_d10_dev

pin_led_dev

pin_a0_dev

adc_0_dev

flash_0_dev

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`photon` — Photon

Source code: src/boards/photon/board.h, src/boards/photon/board.c

Hardware reference: *Photon*

Defines

pin_d0_dev

pin_d1_dev

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_a0_dev

pin_a1_dev

pin_a2_dev

pin_a3_dev

pin_a4_dev

pin_a5_dev

pin_led_dev

pin_dac0_dev

pin_dac1_dev

pwm_d0_dev

pwm_d1_dev

pwm_d2_dev

pwm_d3_dev

pwm_a4_dev

pwm_a5_dev

flash_0_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`spc56ddiscovery` — SPC56D-Discovery

Source code: src/boards/spc56ddiscovery/board.h, src/boards/spc56ddiscovery/board.c

Hardware reference: *SPC56D Discovery*

Defines

pin_pa0_dev

pin_pa1_dev

pin_pa2_dev

pin_pa3_dev

pin_pa4_dev

pin_pa5_dev

pin_pa6_dev

pin_pa7_dev

pin_pa8_dev

pin_pa9_dev

pin_pa10_dev

pin_pa11_dev

pin_pa12_dev

pin_pa13_dev

pin_pa14_dev

pin_pa15_dev

pin_pb0_dev

pin_pb1_dev

pin_pb2_dev

pin_pb3_dev

pin_pb4_dev

pin_pb5_dev

pin_pb6_dev

pin_pb7_dev

pin_pb8_dev

pin_pb9_dev

pin_pb10_dev

pin_pb11_dev

pin_pb12_dev

pin_pb13_dev

pin_pb14_dev

pin_pb15_dev

pin_pc0_dev

pin_pc1_dev

pin_pc2_dev

pin_pc3_dev

pin_pc4_dev

pin_pc5_dev

pin_pc6_dev

pin_pc7_dev

pin_pc8_dev

pin_pc9_dev

pin_pc10_dev

pin_led_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`stm32f3discovery` — STM32F3DISCOVERY

Source code: src/boards/stm32f3discovery/board.h, src/boards/stm32f3discovery/board.c

Hardware reference: *STM32F3DISCOVERY*

Defines

pin_pa0_dev

pin_pa1_dev

pin_pa2_dev

pin_pa3_dev

pin_pa4_dev

pin_pa5_dev

pin_pa6_dev

pin_pa7_dev

pin_pa8_dev

pin_pa9_dev

pin_pa10_dev

pin_pa11_dev

pin_pa12_dev

pin_pa13_dev

pin_pa14_dev

pin_pa15_dev

pin_pb0_dev

pin_pb1_dev

pin_pb2_dev

pin_pb3_dev

pin_pb4_dev

pin_pb5_dev

pin_pb6_dev

pin_pb7_dev

pin_pb8_dev

pin_pb9_dev

pin_pb10_dev

pin_pb11_dev

pin_pb12_dev

pin_pb13_dev

pin_pb14_dev

pin_pb15_dev

pin_pc0_dev

pin_pc1_dev

pin_pc2_dev

pin_pc3_dev

pin_pc4_dev

pin_pc5_dev

pin_pc6_dev

pin_pc7_dev

pin_pc8_dev

pin_pc9_dev

pin_pc10_dev

pin_pc11_dev

pin_pc12_dev

pin_pc13_dev

pin_pc14_dev

pin_pc15_dev

pin_pd0_dev

pin_pd1_dev

pin_pd2_dev

pin_pd3_dev

pin_pd4_dev

pin_pd5_dev

pin_pd6_dev

pin_pd7_dev

pin_pd8_dev

pin_pd9_dev

pin_pd10_dev

pin_pd11_dev

pin_pd12_dev

pin_pd13_dev

pin_pd14_dev

pin_pd15_dev

pin_pe0_dev

pin_pe1_dev

pin_pe2_dev

pin_pe3_dev

pin_pe4_dev

pin_pe5_dev

pin_pe6_dev

pin_pe7_dev

pin_pe8_dev

pin_pe9_dev

pin_pe10_dev

pin_pe11_dev

pin_pe12_dev

pin_pe13_dev

pin_pe14_dev

pin_pe15_dev

uart_0_dev

uart_1_dev

uart_2_dev

spi_0_dev

spi_1_dev

spi_2_dev

i2c_0_dev

i2c_1_dev

can_0_dev

flash_0_dev

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

stm32vldiscovery — STM32VLDISCOVERY

Source code: src/boards/stm32vldiscovery/board.h, src/boards/stm32vldiscovery/board.c

Hardware reference: *STM32VLDISCOVERY*

Defines

pin_pa0_dev

pin_pa1_dev

pin_pa2_dev

pin_pa3_dev

pin_pa4_dev

pin_pa5_dev

pin_pa6_dev

pin_pa7_dev

pin_pa8_dev

pin_pa9_dev

pin_pa10_dev

pin_pa11_dev

pin_pa12_dev

pin_pa13_dev

pin_pa14_dev

pin_pa15_dev

pin_pb0_dev

pin_pb1_dev

pin_pb2_dev

pin_pb3_dev

pin_pb4_dev

pin_pb5_dev

pin_pb6_dev

pin_pb7_dev

pin_pb8_dev

pin_pb9_dev

pin_pb10_dev

pin_pb11_dev

pin_pb12_dev

pin_pb13_dev

pin_pb14_dev

pin_pb15_dev

pin_pc0_dev

pin_pc1_dev

pin_pc2_dev

pin_pc3_dev

pin_pc4_dev

pin_pc5_dev

pin_pc6_dev

pin_pc7_dev

pin_pc8_dev

pin_pc9_dev

pin_pc10_dev

pin_pc11_dev

pin_pc12_dev

pin_pc13_dev

pin_pc14_dev

pin_pc15_dev

pin_pd0_dev

pin_pd1_dev

pin_pd2_dev

pin_led_dev

pin_ld3_dev

pin_ld4_dev

uart_0_dev

uart_1_dev

uart_2_dev

spi_0_dev

spi_1_dev

spi_2_dev

i2c_0_dev

i2c_1_dev

flash_0_dev

Functions

int **board_pin_string_to_device_index**(**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

`wemos_d1_mini` — WEMOS D1 Mini

Source code: src/boards/wemos_d1_mini/board.h, src/boards/wemos_d1_mini/board.c

Hardware reference: *WEMOS D1 mini*

Defines

pin_gpio0_dev

pin_gpio2_dev

pin_gpio4_dev

pin_gpio5_dev

pin_gpio12_dev

pin_gpio13_dev

pin_gpio14_dev

pin_gpio15_dev

pin_gpio16_dev

pin_d0_dev

pin_d1_dev

pin_d2_dev

pin_d3_dev

pin_d4_dev

pin_d5_dev

pin_d6_dev

pin_d7_dev

pin_d8_dev

pin_led_dev

pin_a0_dev

adc_0_dev

flash_0_dev

ADC_PINS_MAX

Functions

int **board_pin_string_to_device_index** (**const** char **str_p*)

Convert given pin string to the pin number.

Return Pin number or negative error code.

Parameters

- `str_p`: Pin as a string.

mcus

The Micro Controller Units (MCU:s) supported by *Simba*.

The MCU:s on Github.

`atmega2560` — ATMega2560

Source code: src/mcus/atmega2560/mcu.h

Defines

PIN_DEVICE_MAX

EXTI_DEVICE_MAX

SPI_DEVICE_MAX

UART_DEVICE_MAX

PWM_DEVICE_MAX

ADC_DEVICE_MAX

I2C_DEVICE_MAX

atmega328p — ATMega328p

Source code: src/mcus/atmega328p/mcu.h

Defines

PIN_DEVICE_MAX

EXTI_DEVICE_MAX

SPI_DEVICE_MAX

UART_DEVICE_MAX

PWM_DEVICE_MAX

ADC_DEVICE_MAX

I2C_DEVICE_MAX

USART0_TX_vect

USART0_RX_vect

USART0_UDRE_vect

atmega32u4 — ATMega32u4

Source code: src/mcus/atmega32u4/mcu.h

Defines

PIN_DEVICE_MAX

EXTI_DEVICE_MAX

SPI_DEVICE_MAX

UART_DEVICE_MAX

PWM_DEVICE_MAX

ADC_DEVICE_MAX

I2C_DEVICE_MAX

USB_DEVICE_MAX

USART0_TX_vect

USART0_RX_vect

USART0_UDRE_vect

UCSZ00

UCSZ01

UCSZ02

UPM00

UPM01

USBS0

U2X0

UPE0

DOR0

FE0

TXC0

RXCIE0

RXEN0

TXEN0

UDRE0

UDRIE0

TXCIE0

esp32 — Esp32

Hardware reference: https://github.com/eerimoq/hardware-reference/tree/master/esp32

Source code: src/mcus/esp32/mcu.h

Defines

PIN_DEVICE_MAX

EXTI_DEVICE_MAX

SPI_DEVICE_MAX

UART_DEVICE_MAX

ADC_DEVICE_MAX

I2C_DEVICE_MAX

FLASH_DEVICE_MAX

CAN_DEVICE_MAX

DAC_DEVICE_MAX

esp8266 — Esp8266

Hardware reference: https://github.com/eerimoq/hardware-reference/tree/master/esp8266

Source code: src/mcus/esp8266/mcu.h

Defines

PIN_DEVICE_MAX

EXTI_DEVICE_MAX

SPI_DEVICE_MAX

UART_DEVICE_MAX

ADC_DEVICE_MAX

FLASH_DEVICE_MAX

I2C_DEVICE_MAX

linux — Linux

Source code: src/mcus/linux/mcu.h

Defines

PIN_DEVICE_MAX

EXTI_DEVICE_MAX

SPI_DEVICE_MAX

UART_DEVICE_MAX

CAN_DEVICE_MAX

PWM_DEVICE_MAX

ADC_DEVICE_MAX

FLASH_DEVICE_MAX

DAC_DEVICE_MAX

I2C_DEVICE_MAX

sam3x8e — SAM3X8E

Source code: src/mcus/sam/mcu.h

Defines

SAM_PA

SAM_PB

SAM_PC

SAM_PD

spc56d40l1 — SPC56D40L1

Source code: src/mcus/spc56d40l1/mcu.h

Defines

PIN_DEVICE_MAX

UART_DEVICE_MAX

FLASH_DEVICE_MAX

CAN_DEVICE_MAX

I2C_DEVICE_MAX

stm32f100rb — STM32F100RB

Source code: src/mcus/stm32f100rb/mcu.h

Defines

PIN_DEVICE_MAX

UART_DEVICE_MAX

SPI_DEVICE_MAX

I2C_DEVICE_MAX

CAN_DEVICE_MAX

FLASH_DEVICE_MAX

stm32f205rg — STM32F205RG

Source code: src/mcus/stm32f205rg/mcu.h

Defines

PIN_DEVICE_MAX

UART_DEVICE_MAX

SPI_DEVICE_MAX

I2C_DEVICE_MAX

CAN_DEVICE_MAX

FLASH_DEVICE_MAX

stm32f303vc — STM32F303VC

Source code: src/mcus/stm32f303vc/mcu.h

Defines

PIN_DEVICE_MAX

UART_DEVICE_MAX

SPI_DEVICE_MAX

I2C_DEVICE_MAX

CAN_DEVICE_MAX

FLASH_DEVICE_MAX

License

The Simba project as a whole is licensed under the following MIT license:

The following files are subjected to other licenses:

- 3pp/*: Various licenses.
- src/filesystems/fat16.*: GNU LGPL License

Videos

#6 Simba: CAN client-server test suite on Nano32 (ESP32) and Arduino Due.

Transmit CAN frames between a Nano32 and an Arduino Due.

#5 Simba: Room temperature (DS18B20).

Read and print the room temperature measured with a DS18B20 sensor.

#4 Simba: Hello world.

This application prints "Hello world!" to standard output.

#3 Simba: Analog read.

Read the value of an analog pin periodically once every second and print the read value to standard output.

#2 Simba: Blink example.

This video demonstrates the classic blink application. It's run on a Arduino Due that has a SAM2X8E ARM MCU.

#1 Simba: Gource of the Simba repository.

Gource visualizes the Simba Git repository file tree over time. In this project the source, test and documentation was written simultaneously, a perfect school book example of software development.

Links

This page contains links to external websites that are related to Simba.

Feel free to add your project to the list by submitting a pull request of this page on Github.

Pumbaa - MicroPython on Simba

Python on microcontrollers thanks to MicroPython (and in this case Simba).

Documentation: http://pumbaa.readthedocs.io

Github: https://github.com/eerimoq/pumbaa

MicroPython: http://www.micropython.org

Wingfence

A BWF for a home made robot mower.

Github: https://github.com/wingstar74/wingfence

CHAPTER 2

Features

- *Threads* scheduled by a priority based cooperative or preemptive scheduler.
- Channels for inter-thread communication (*Queue*, *Event*).
- *Timers*.
- *Counting semaphores*.
- Device drivers (*SPI*, *UART*, ...)
- A simple *shell*.
- *Logging*.
- Internet protocols (*TCP*, *UDP*, *HTTP*, ...).
- *Debug file system*.
- File systems (*FAT16*, *SPIFFS*).

See the *Library Reference* for a full list of features.

CHAPTER 3

Testing

To ensure high code quility each module is tested extensively by many test suites. See *Testing* for details.

CHAPTER 4

Design goals

- Rapid development.
- Clean interfaces.
- Small memory footprint.
- No dynamic memory allocation.
- Portability.

CHAPTER 5

Indices and tables

- genindex
- modindex
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