
iqmaxrefdes23 Documentation

Release 1.1.1

IQ2 Development GmbH

May 05, 2017

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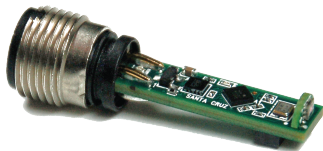
CHAPTER 1

Introduction



Maxim's Santa Cruz (MAXREFDES23#) reference design is the world's smallest IO-Link® light sensor compliant with IEC 61131-9. The entire design fits onto a 6.5mm x 25mm printed circuit board (PCB).

Board Specification

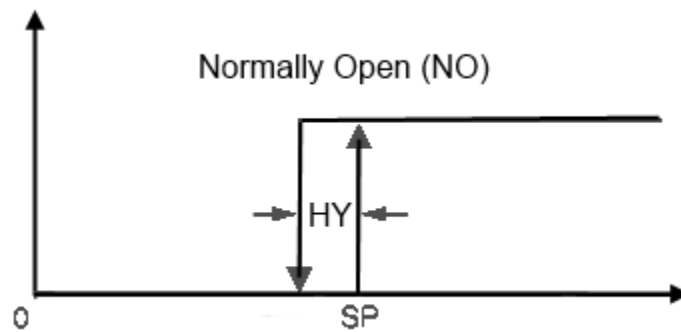


Item	Specification
Oscillator Frequency	18.432 MHz
Microcontroller	Renesas RL78/G1A (R5F10E8EALA)
DC Power	24 V via M12 Connector
LEDs	<ul style="list-style-type: none">• Power indicator: Green x1• IO-Link indicator: Amber x1• Digital output indicator: Red x1
IO-link Connector	Male M12 4-pole A-coded
IO-Link PHY	Maxim MAX14821EWA+
Sensor	Maxim MAX44008EDT+

CHAPTER 2

Sensor Logic

In iqmaxrefdes23 have been implemented simple switch-point hysteresis logic and additionally can be configured as normally open (NO) or normally closed (NC).



By default light switch-point settings (255 is the maximal value):

What	SP (Level)	Hysteresis	Mode
Light intensity	128 (0x80)	16 (0x10)	Normally Open (NO)
Darkness control	16 (0x10)	4 (0x04)	Normally Closed (NC)

Note: When a device is in IO-Link OPERATE mode, light intensity switch-point flag indicated on digital output channel (red LED).

CHAPTER 3

IO-Link Application

iqmaxrefdes23 communicates with an IO-Link Master on COM3 transmission rate (230,4 kbit/s).

Note: When a device is switched to IO-Link SIO mode, sensors chip is switched to shutdown mode, microcontroller fall into HALT and restarting operation upon wake-up interrupt signal.

Process Data In

1. Byte (MSB): Light intensity (from 0 to 255).
2. Byte (LSB): [.....F - light intensity switch-point flag (1bit)].

Process Data Out

Be absent.

Commands

Can be run by IO-Link Index 0x0002:

Value	Description
128 (0x80)	Device Reset
160 (0xA0)	Tech-in light intensity switch-point level

Parameters

IO-Link index	Mode	Description	Default value
16 (0x0010)	read-only	Vendor Name	Renesas Electronics Europe GmbH
17 (0x0011)	read-only	Vendor Text	Major supplier of semiconductor solutions
18 (0x0012)	read-only	Product Name	Santa Cruz (MAXREFDES23#)
19 (0x0013)	read-only	Product ID	MAXREFDES23
20 (0x0014)	read-only	Product Text	IO-Link Light Sensor
23 (0x0017)	read-only	Firmware Revision	v 1.1.1
256 (0x0100)	read/write	Ambient light switch-point level	128 (0x80)
257 (0x0101)	read/write	Ambient light switch-point hysteresis	16 (0x10)
258 (0x0102)	read/write	MAX44008EDT+ sensors chip sensitivity	1 (0x01)
259 (0x0103)	read-only	MAX44008EDT+ sensors chip temperature	unknown

Events

Event code	Description
0x1800	Occurred when a light intensity is very low, see Sensor Logic
0x4210	Device temperature over-run
0x5000	Device hardware fault
0x5111	Primary supply voltage under-run
0x6000	Device software fault
0x7710	Short circuit

Installation Details

There are two ways to experiment with MAXREFDES23#:

- Upload Firmware HEX-file, connect a device to IO-Link Master and play around.
- Clone the source code from Bitbucket repository, go throw and try to debug.

Firmware

Firmware HEX-file, IODDs data and this document in PDF format can be downloaded from the [Bitbucket repository](#) absolutely free without registration.

To upload HEX-file into MAXREFDES23 have to get [Renesas E1 emulator](#) and also [Renesas Flash Programmer](#).

Source Code

The project source code can be cloned from the [Bitbucket repository](#) freely without registration.

Download a trial version of [IAR RL78 Embedded Workbench IDE](#) in order to compile it and also take a look for [Renesas Application Leading Tool \(Applilet\)](#).

Also the [Renesas E1 emulator](#) and [Renesas Flash Programmer](#) needed to start debug session with a device.

CHAPTER 5

Troubleshooting

If during power-on self-test (POST) hardware fails were occurred, then the main sensor application will not started and instead a first appeared hardware fail number was blinked on digital output red-indicator channel continuously.

Blinks Count	Fail Description
1	Renesas RL78 Illegal memory access (a firmware error, contact with developers)
2	Renesas RL78 RAM parity check (a firmware error, contact with developers)
3	Renesas RL78 Illegal instruction (a firmware error, contact with developers)
4	Maxim MAX14821EWA+ selfcheck (the device is possibly corrupt, try to restart)
5	Maxim MAX44008EDT+ selfcheck (the device is possibly corrupt, try to restart)

v1.1.1 (2014-04-23)

- Improvements:
 - Improve MAX14821 the power-on selftest stability and reduce a complexity
- Bug fixes:
 - Fix switch point logic (NO&NC) terminology
 - Suppress 'Darkness warning' disappear event before appear one

v1.1 (2014-04-13)

- **Breaking changes:**
 - Refine IODDs variable for MAX44008EDT+ Chip Temperature and add Firmware Version
 - Stop reading RGB light intensity from MAX44008EDT+ and remove it from IO-Link process data
- New features:
 - Fall into HALT mode and restarting operation upon wake-up MAX14821 interrupt signal
 - Improve dialing with errors for MAX14821 and MAX44008EDT+ (power-on self-test (POST))
- Improvements:
 - Increase sensors ADC accuracy from 8-bit to 14-bit (time increased to 100 ms)

v1.0 (2014-03-25)

- New features:

- Hardware setups:
 - * Renesas RL78/G1A (R5F10E8EALA) microcontroller (with Applilet3 support, see ‘src\applilet3_src’)
 - * MAX14821 IO-Link Device Transceiver (SPI/UART, see ‘src\hw_drivers\c_max1482x.*’)
 - * MAX44008EDT+ RGB Color, Infrared, and Temperature Sensors (IIC, see ‘src\hw_drivers\c_max4400x.*’)
- Porting IO-Link iqStack(R) Device and set up the IO-Link communication (see ‘src\applilet3_src\r_main.c’)
- Write a simple IO-Link Light Sensor Application (with appropriate IODDs, see ‘src\sensor_appl.c’)

CHAPTER 7

License

All source files with the correspondent header notes are the subject to the IQ² Development GmbH terms and conditions defined in file `Allgemeine Vertragsbedingungen.pdf`.

For any other details please [contact with us](#).