

TECHNICAL INFORMATION MANUAL

Revision 02.1 – 09 September 2016

Quark

R1230CB

OEM UHF Multiregional Ultra Compact Reader

R1230CBEVB

Quark Reader Evaluation Board

R1230ADAT

Quark Adapter Board



easy2read[®]



Visit [quark R1230CB](#) web page, you will find the latest revision of data sheets, manuals, certifications, technical drawings, software and firmware. All you need to start using your reader in a few clicks!

Scope of Manual

The goal of this manual is to provide the basic information to work with the QUARK family.

Change Document Record

Date	Revision	Changes	Pages
18 May 2010	00	Preliminary release	-
18 Jan 2011	01	Added information about the <i>Development Kit</i>	7
		Added <i>Installation Notice</i> paragraph	8
		Added <i>Quark R1230CBEVB</i> chapter	19 ÷ 23
		Added <i>Quark R1230ADAT</i> chapter	23 ÷ 26
20 Sep 2012	02	Added <i>Quark Regulatory Compliance</i> chapter	26
		Modified <i>Development Kit</i>	7
		Modified <i>Ordering Options</i> paragraph	9
		Modified <i>Firmware upgrade via R1230CBEVB board</i> paragraph	17
		Added note 5 on VCP drivers in the <i>Technical Specifications Table</i>	19
09 Sep 2016	02.1	Added warning concerning the correct set up of the RF regulation	10
		Modified <i>FCC Compliance</i> paragraph	26
		Modified <i>RoHS EU Directive</i> paragraph	26

Reference Document

[RD1] EPCglobal: EPC Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz – 960 MHz, Version 2.0.1 (April, 2015).

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Federal Communications Commission (FCC) Notice (Preliminary)

This device was tested and found to comply with the limits set forth in Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This device generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, the product may cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference, in which case, the user is required to correct the interference at their own expense. The authority to operate this product is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by CAEN RFID.

Disposal of the product

Do not dispose the product in municipal or household waste. Please check your local regulations for disposal/recycle of electronic products.



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1 INTRODUCTION

Product Description

The Quark (Model R1230CB), the new OEM reader of the easy2read© Family, is an UHF multiregional ultra compact reader for low-power, high performances UHF RFID applications.

With programmable output power in 15 steps from 9dBm to 23dBm, the reader can detect tags at more than 1 mt of distance (depending on antenna and tag dimensions).

Due to its low power consumption, the module is specifically designed to be easily integrated in battery powered devices as well as powered directly by a standard USB port.

The radio frequency core of the module permits to achieve fast reading and to be used in dense reader and dense tag environments for top-class rated performances.

The compactness of the device and the board-to-board connector allow to embed the R1230CB inside the new small form factor industrial handhelds, smartphone accessories, small USB dongles and other compact form factor devices.

The R1230CB complies with and can operate in both European and US regulatory environments and due to its multiregional capabilities, it is ideal for integration in devices requiring compliance to different geographical regions.

The Mod. R1230CBEVB evaluation board allows to manage the Mod. R1230CB OEM UHF multiregional Compact Reader directly via USB.

In case customers want to replace directly with Quark reader others CAEN RFID OEM modules (i.e. A828, A828A, A528), the Mod. R1230ADAT adapter board can be used.



Fig. 1.1: QUARK R1230CB OEM UHF Multiregional compact reader

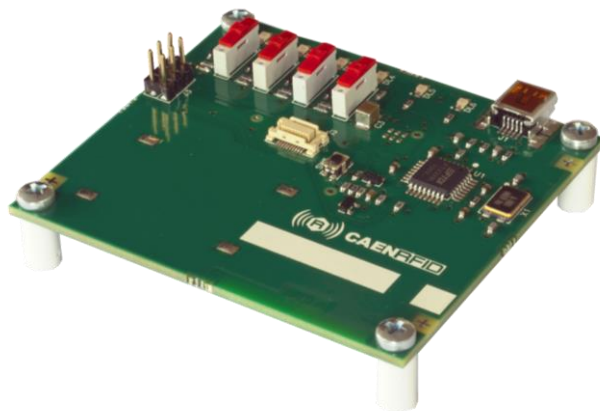


Fig. 1.2: QUARK R1230CBEVB - Quark Reader Evaluation Board

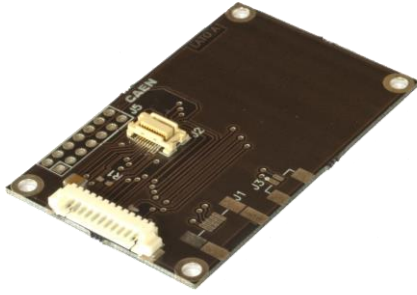


Fig. 1.3: QUARK R1230ADAT - Quark Adapter Board

Development Kit

[R1230DK quark Ultra Compact Embedded UHF RFID Reader Development Kit](#) is available:



Fig. 1.4: R1230DK quark Ultra Compact Embedded UHF RFID Reader Development Kit

The R1230CB (QUARK) reader development kit is a complete RFID set up, for a quick implementation of RFID solutions. It includes:

- n. 1 [R1230CB \(QUARK\) Ultra Compact Embedded RFID Reader](#)
- n. 1 R1230CBEVB Reader evaluation board plus USB cable
- n. 1 Circular polarized antennas for printers (1 ETSI, 1 FCC)
- n. 1 [Set of Labels](#)
- n. 1 [A927Z Temperature Logger Tag](#)
- n. 1 [RT0005 Temperature Logger Tag](#)

Installation Notice

The correct way to connect the Quark R1230CB module to the evaluation board and the adapter board is shown in the following pictures:

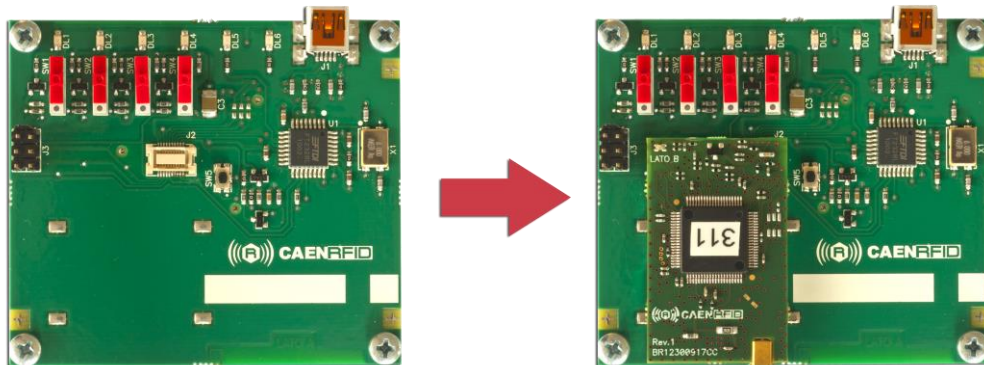


Fig. 1.5: Connection of the R1230CBEVB to the Quark R1230CB module

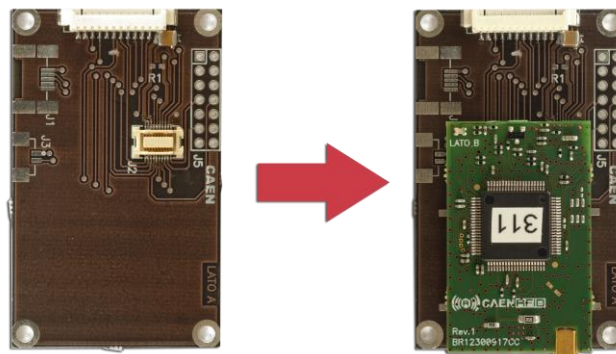


Fig. 1.6: Connection of the R1230ADAT to the Quark R1230CB module

Ordering Options

	Code	Description
Reader	WR1230CXBAAA	R1230CB - Quark Low Power OEM UHF Compact RFID Reader
Development Kit	WR1230CBDKEU	R1230CBDK - Development kit with Quark reader, antenna, tags
Accessories	WR1230ADAT01	R1230ADAT - Quark Adapter Board
	WR1230CBEVBX	R1230CBEVB - Quark Reader Evaluation Board
	WANT021XMMCX	ANT021/MMCX - Quad - Circular polarized quadrifilar antenna (FCC) - MMCX
	WANTENNAX012	Linear polarized antenna for printers 902 - 928 MHz

2 QUARK R1230CB

Technical Specifications Table

Frequency Band	902÷928 MHz (FCC part 15) 865.600÷867.600 MHz (ETSI EN 302 208)
Output Power Level	Programmable in 15 levels (1dB step) from 9dBm to 23dBm (from 8mW to 200mW) conducted
Output Power Accuracy	+/- 1dB
Antenna VSWR Requirement	2:1 or better for optimum performances
Antenna Connector	Nr. 1 MMCX type
Frequency Tolerance	±10 ppm over the entire temperature range
Number of Channels	4 channels (compliant to ETSI EN 302 208 v1.2.1) 50 hopping channels (compliant to FCC part 15.247). All subsets of 902-928 MHz band are supported
Standard Compliance	EPC C1G2 [RD1]
Digital I/O	Four I/O lines 3.3V out @ 3mA; 3.3V input level
UART Serial Port	Baudrate: 115200 Databits: 8 Stopbits: 1 Parity: none Flow control: none 3.3 V I/O voltage level 9.6÷115 kbit/s data rate (settable)
Dimensions	(W)25 x (L)40 x (H)6 mm3 (1.0 x 1.6 x 0.2 inch3)
Supply Voltage Range	2.5V ÷ 5.5V
Power Consumption	- 1.6W @ RF out = 23dBm - 1.3W @ RF out = 17dBm - 0.25W in idle mode
Operating Temperature	-10 °C to +55 °C
Weight	8 g

Tab. 2.1: QUARK R1230CB Technical Specifications



Warning: The RF settings must match the country/region of operating to comply with local laws and regulations.

The usage of the reader in different countries/regions from the one in which the device has been sold is not allowed.

External Connections

The location of the connectors is shown in Fig. 2.1. Their mechanical specifications are listed below:

Antenna Port: RF Coax Connector Huber+Suhner type 82MMCX-S50-0-2/111_K (to be used with Huber+Suhner type 11MMCX-50-1-1/111_O).

Supply and I/O connector: Molex P.N. 53748-0208 (mates with Molex 52991-0208 to be used on the host board).

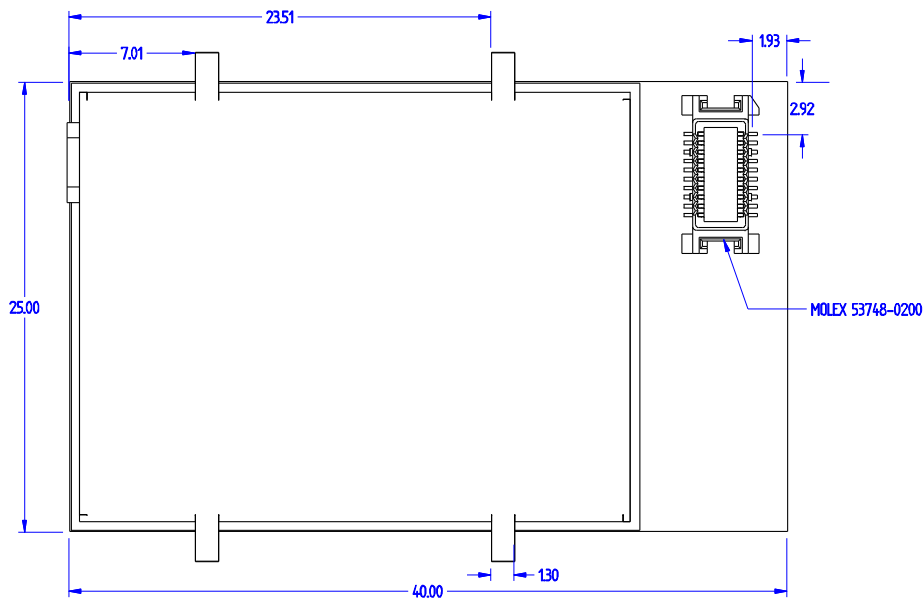


Fig. 2.1: QUARK R1230CB technical drawings: top view

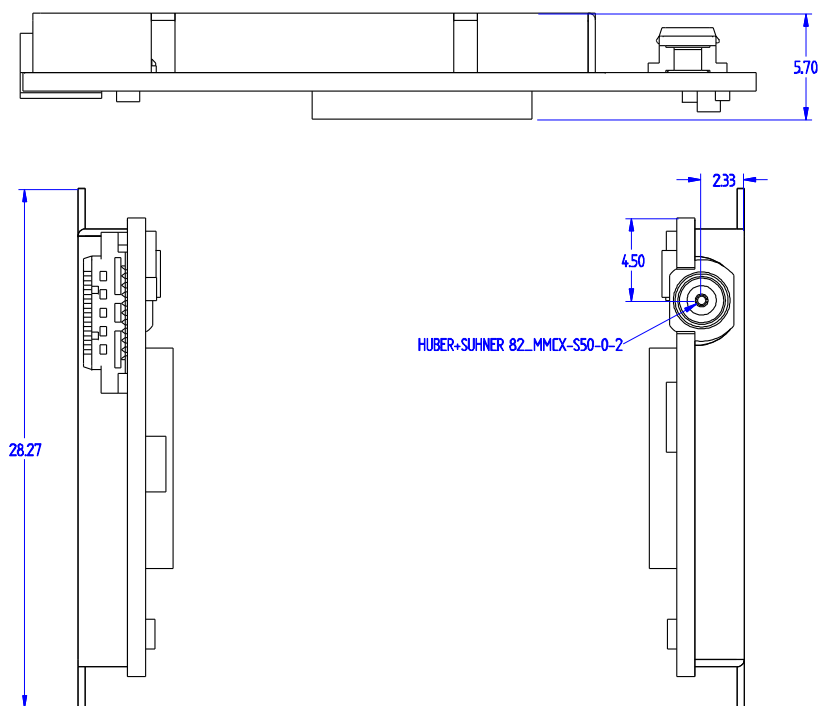


Fig. 2.2: QUARK R1230CB technical drawings: lateral views

Supply and I/O connector pinout is shown in the following table¹:

Pin #	Signal	Description
1	GND	Ground
2	TCK	TCK JTAG signal (debug purpose only)
3	GND	Ground
4	/RST	Reset (active low)
5	TXD	UART TX to host
6	TMS	TMS JTAG signal (debug purpose only)
7	RXD	UART RX from host
8	TDI	TDI JTAG signal (debug purpose only)
9	5V_OUT	5Vdc auxiliary output voltage
10	TDO	TDO JTAG signal (debug purpose only)
11	BSL_SEL	Bootloader interface selection ²
12	TST	TST JTAG signal (also for BSL operation)
13	VDD_M	3.3Vdc auxiliary output voltage
14	GPIO0	General Purpose IO #0
15	VDD_M	3.3Vdc auxiliary output voltage
16	GPIO1	General Purpose IO #1
17	VIN	Input supply voltage
18	GPIO2	General Purpose IO #2
19	VIN	Input supply voltage
20	GPIO3	General Purpose IO #3

Tab. 2.2: QUARK R1230CB connector pinout

The GPIO0-GPIO3 pins are 4 general purpose bidirectional pins, their default direction (or after a Reset) is input.

The RXD/TXD pins are used to communicate with the Quark reader via UART port; to establish a link with the device you must configure your COM port as follows:

Baud rate: 115200
 Parity: None
 Data bits: 8
 Stop bits: 1
 Flow Control: none

JTAG pins, unless otherwise noted, are for internal debug purpose only and shall not be connected by the user.

/RST, BSL_SEL and TST pins shall be properly driven to start the bootloader of R1230CB embedded microcontroller in case the user wants to upgrade the firmware image of the reader. In normal operation BSL_SEL and TST shall be at low level or left unconnected.

See § BLS operation (pag. 16) for the description of bootloader operation.

VDD_M and 5V_OUT are two auxiliary supply sources with 20mA maximum current capability to be used as supply voltages of external components.

¹ Debug purpose and unused pins should not be connected.

² If BSL_SEL is at high level, the UART interface is connected to the serial port dedicated to microcontroller Boot Start Loader operation required for flashing the firmware inside the MCU memory. This pin shall be at low level or left unconnected in normal operation.

R1230CB supply and I/O connector electrical characteristics³

Pin name	Pin No.	Parameter	Min	Type	Max	Unit
GND	1,3					
TCK	2	VIL	-0.3		0.75	V
		VIH	1.5		3.6	V
		Input current			10	μA
/RESET	4	VIL	-0.3		0.6	V
		VIH	1.65		3.6	V
		Internal pull-up resistance		47		kΩ
		Pulse width	10			μs
TXD	5	VOL	0		0.55	V
		VOH	2.5		3.5	V
		Output current			3.0	mA
TMS	6	VIL	-0.3		0.75	V
		VIH	1.5		3.6	V
		Input current			10	μA
RXD	7	VIL	-0.3		0.75	V
		VIH	1.5		3.6	V
		Input current			10	μA
TDI	8	VIL	-0.3		0.75	V
		VIH	1.5		3.6	V
		Input current			10	μA
5V_OUT	9	Output DC voltage	4.75	5.00	5.25	V
		Output current			20	mA
TDO	10	VOL	0		0.55	V
		VOH	2.5		3.5	V
		Output current			3.0	μA
BSL_SEL	11	VIL	-0.3		1.0	V
		VIH	2.2		3.6	V
		Internal pull-down resistance		10		kΩ
TST	12	VIL	-0.3		0.75	V
		VIH	1.5		3.6	V
		Internal pull-down resistance	45			kΩ
VDD_M	13,15	Output DC voltage	3.1	3.3	3.5	V
		Output current			20	mA
GPIO[0:3]	14, 16, 18, 20	VOL	0		0.55	V
		VOH	2.5		3.5	V
		Output current			3.0	mA
		VIL	-0.3		0.75	V
		VIH	1.5		3.6	V
		Input current			10	μA
VIN4	17,19	Input supply voltage	2.5		5.5	V
		Supply current @ Vin = 2.5V		0.68		A
		Supply current @ Vin = 3.7V		0.42		A
		Supply current @ Vin = 5.0V		0.30		A

Tab. 2.3: QUARK R1230CB supply and I/O connector electrical characteristics

³ Exceeding maximum values reported in the table may cause permanent damage to the model.

⁴ External 100uF bypass capacitor between Vin and GND is recommended for proper operation.

Power supply connection

In the following schematic suggested R1230CB power supply connection is shown.

An external 100uF bypass capacitor between Vin and GND is recommended for proper operation.

The use of fuse F1 (or an equivalent solid state current limiter) is recommended since R1230CB doesn't provide internal current limitation protection.

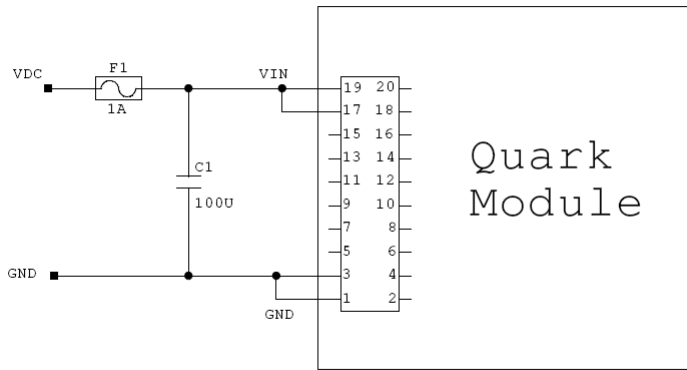


Fig. 2.3: QUARK R1230CB power supply connection

General purpose I/O connections

The GPIO0-GPIO3 pins are 4 general-purpose bidirectional pins. Their default direction after a power on reset or a general reset is set to input.

GPIO, when configured as Outputs, can be used to drive indicators as leds or buzzers or to send trigger signal to others equipments.

GPIO, when configured as Inputs, can accept control signals from other equipments or trigger signals from sensors (i.e. photocells).

In the following schematic an example of application of GPIO is shown.

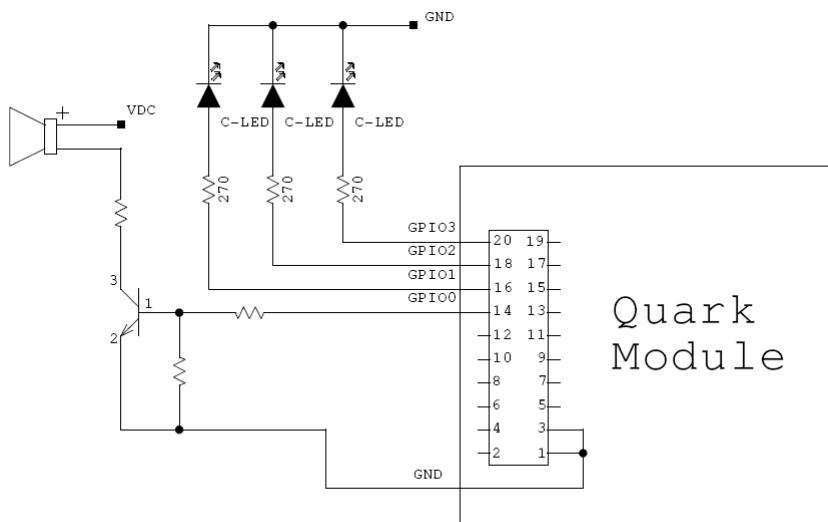


Fig. 2.4: QUARK R1230CB GPIO connection example

External reset

R1230CB manual reset can be performed by forcing at low level /RESET pin for 10µs at least. /RESET pin is pulled-up by an internal resistor.

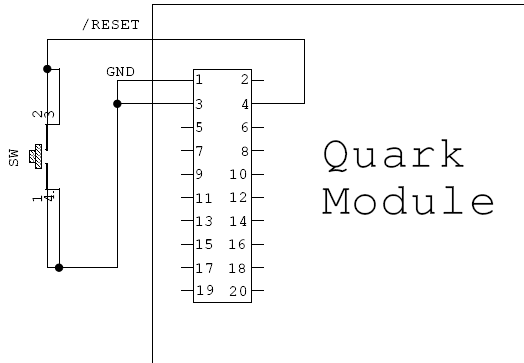


Fig. 2.5: QUARK R1230CB external reset

UART connection

The RXD/TXD pins are used to communicate with the R1230CB board via UART port. Since Quark RX/TX are TTL level signals, in order to connect it with a PC, a TTL/RS232 translator shall be used (please refer to the diagram below).

To establish a link with the device host COM port shall be configured as follows:

- Baud rate: 115200
- Parity: None
- Data bits: 8
- Stop bits: 1
- Flow Control: none

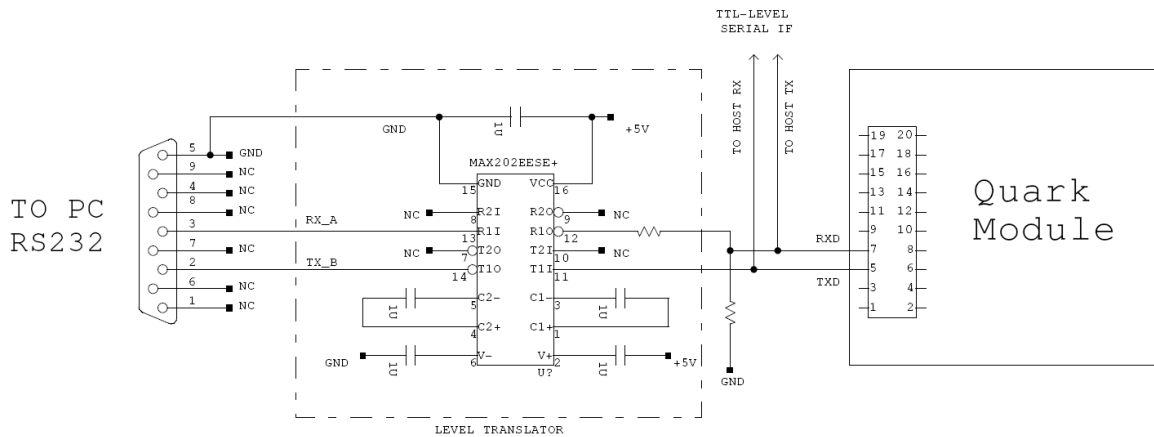


Fig. 2.6: QUARK R1230CB RS232 connection

Antenna port specifications

In the following table the pinout of R1230CB antenna is shown.

Pin #	Function	Direction	Description
INNER	RF OUT	OUT	RF output
OUTER	GND	-	Ground

Tab. 2.4: RF port pinout

Parameter	Min	Typ.	Max	Unit
RF output power	8		200	mW
	9		23	dBm
Output power vs. power setting accuracy			± 1	dB
RF port impedance		50		Ω
Recommended antenna VSWR			2:1	-

Tab. 2.5: RF port electrical characteristics

Reader – Tag Link Profiles

Quark reader supports different modulation and return link profiles according to EPC Class1 Gen2 protocol.

In the following table are reported all profiles that have been tested for the compliance with ETSI and FCC regulations.

Link profile #	Regulation	Modulation	Return Link
0	ETSI - FCC	DSB-ASK; f=40kHz	FMO; f = 40kHz
1	ETSI - FCC	DSB-ASK; f=40kHz	Miller (M=4); f = 256kHz

Tab. 2.6: QUARK R1230CB reader to tag link profiles

Firmware Upgrade

Quark reader firmware upgrade is based on Boot Start Loader (BSL) of the embedded microcontroller inside the module.

An upgrade software has been developed to be used with Quark evaluation board (mod. R1230CBEVB).

Note: It is not possible to upgrade the firmware using the Quark Adapter Board (mod. R1230ADAT).

BSL operation

In order to start the BSL of Quark internal microcontroller /RST, TST and BSL_SEL signal shall be driven as in the picture below:

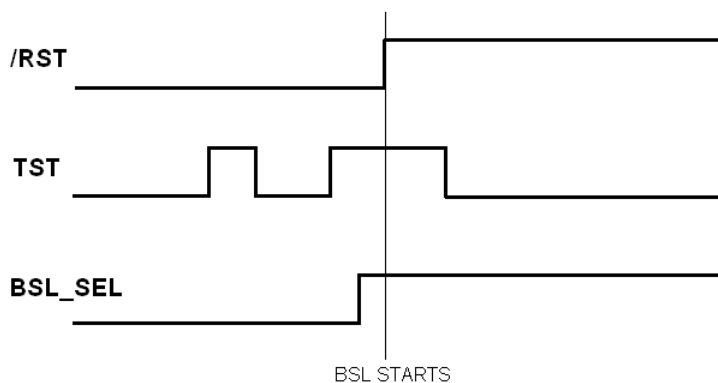


Fig. 2.7: BSL sequence

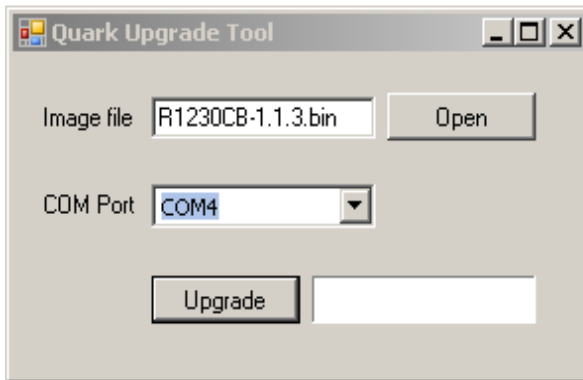
The BSL program execution starts when TST pin has received a minimum of two positive transitions and if TST is high while /RST rises from low to high. BSL_SEL shall be at high level before BSL starts. Pulses length and distance between edges of all signals shall be 10ms at least.

Firmware upgrade via R1230CBEVB board

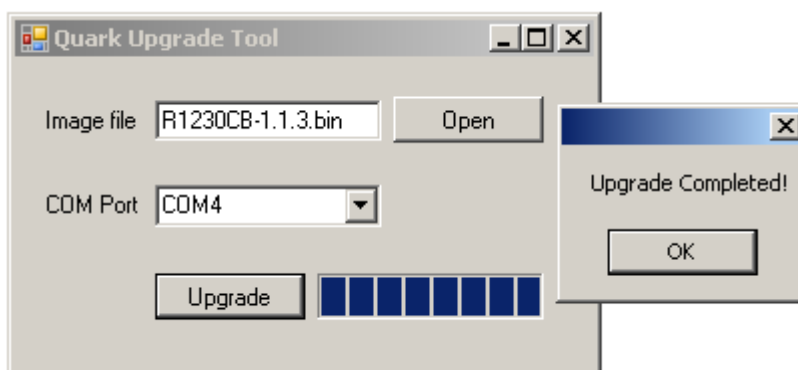
Quark firmware upgrade can be managed via USB by using the evaluation board (mod.R1230CBEVB) and the SW upgrade program. The Quark Upgrade Tool is available for free at [Quark R1230CB page](#) of the CAEN RFID Web Site.

In order to upgrade the firmware follow the steps below:

- Connect to the USB port the evaluation board with the Quark reader installed
- Verify the virtual COM port associated to the board
- Open the FW upgrade program
- Select the COM port
- Select the image file by clicking on "Open" button
- Click on "Upgrade" button



- Wait for the upgrade to be completed



- Disconnect the USB cable from the evaluation board
- Connect again the USB cable in order to restore normal reader operation.

PCB Pad Layout

In the picture below the recommended PCB pad layout to be implemented on the user host board is shown. The 4 square pads shall be used to solder R1230CB shield and shall be connected to ground. In addition is shown the position and the layout required for Molex 52991-0208 connector, which mates with R1230CB supply and I/O connector, and which shall be soldered on the host board.

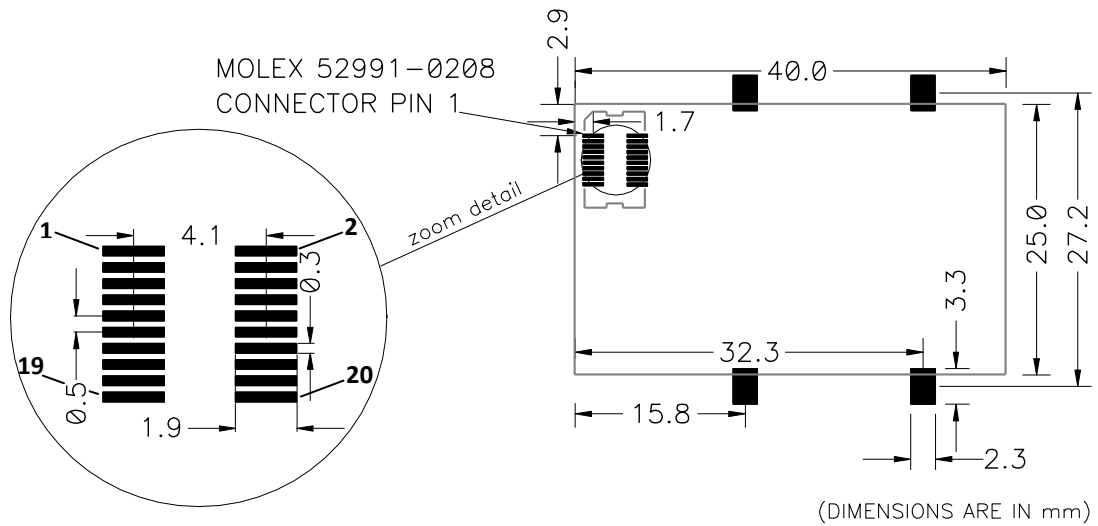


Fig. 2.8: PCB pad layout

3 Quark R1230CBEVB

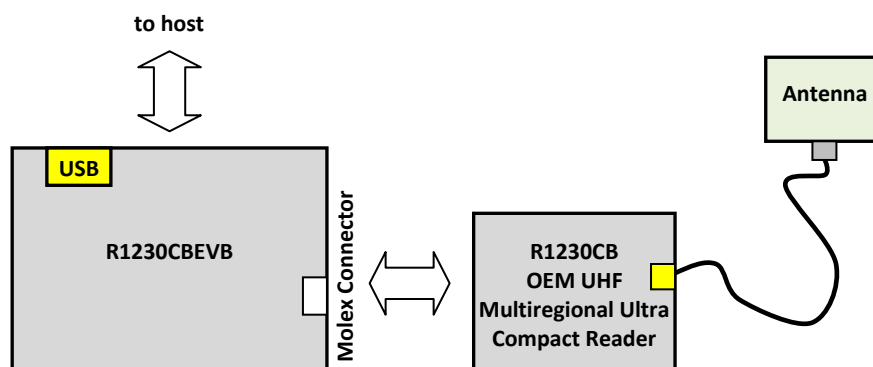
Technical Specifications Table

Switch	SW1= RESET SW2...SW5=GPIO
USB Port	USB Type A plug connector Bus powered USB 2.0 device Must be connected to Hight-power Port (500 mA @ VBUS) It appears as USB serial port Virtual Com Port (VCP) 5 drivers for Windows XP/Vista/Seven (7), Windows CE 4.2, Linux 2.40 and greater Baudrate: 115200 Databits: 8 Stopbits: 1 Parity: none Flow control: none
User Interface	Red LED: Power Yellow LED: USB communication activity Green LED: GPIO[0..3].
Dimensions	(W)70.9 x (L)62.5 x (H)11.6 mm3 (2.8 x 2.5 x 0.5 inch3)
Electrical Power	DC Voltage 5V +/-5% Max 400 mA ⁶
Operating Temperature	-10 °C to +55 °C

Tab. 3.1: QUARK R1230CBEVB Technical Specifications

Connection diagram

The following block diagram shows how to connect the Mod. R1230CB with the PC host via the Mod. R1230CBEVB evaluation board.



⁵ You can download VCP drivers for Windows based systems from the CAEN RFID Web Site at [Quark R1230CB page](http://www.ftdichip.com/Drivers/VCP.htm) or from <http://www.ftdichip.com/Drivers/VCP.htm> for different operating systems (or for the most updated version).

⁶ With Quark reader operating.

Technical drawings

The location of the connectors is shown in Fig. 3.1. Their mechanical specifications are listed below:

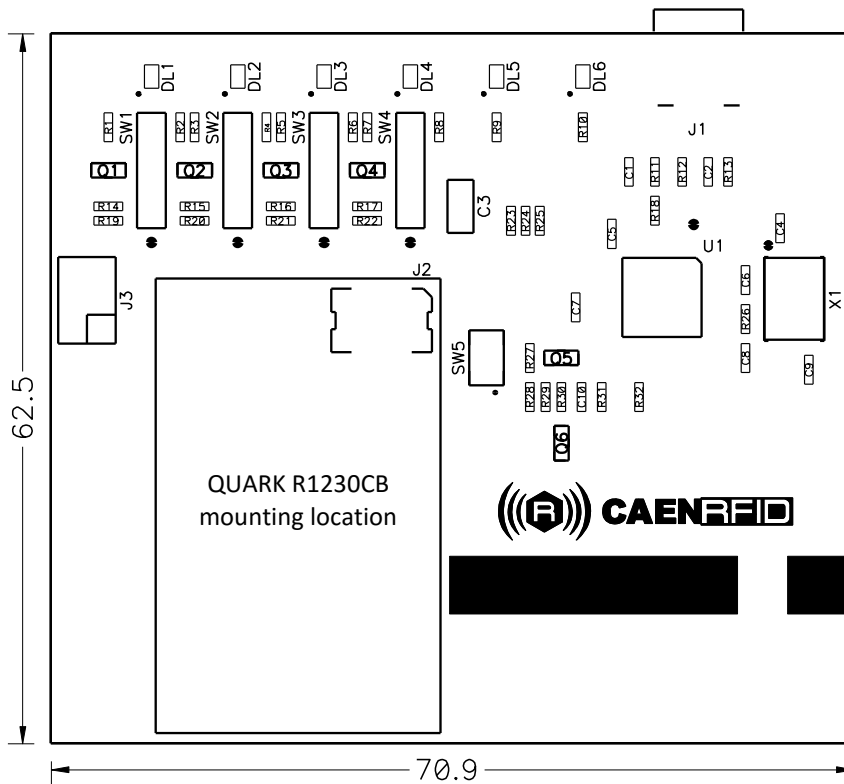


Fig. 3.1: Quark R1230CBEVB technical drawing

Electrical scheme

The electrical scheme of the Quark R1230CEVB is shown in Fig. 3.2.

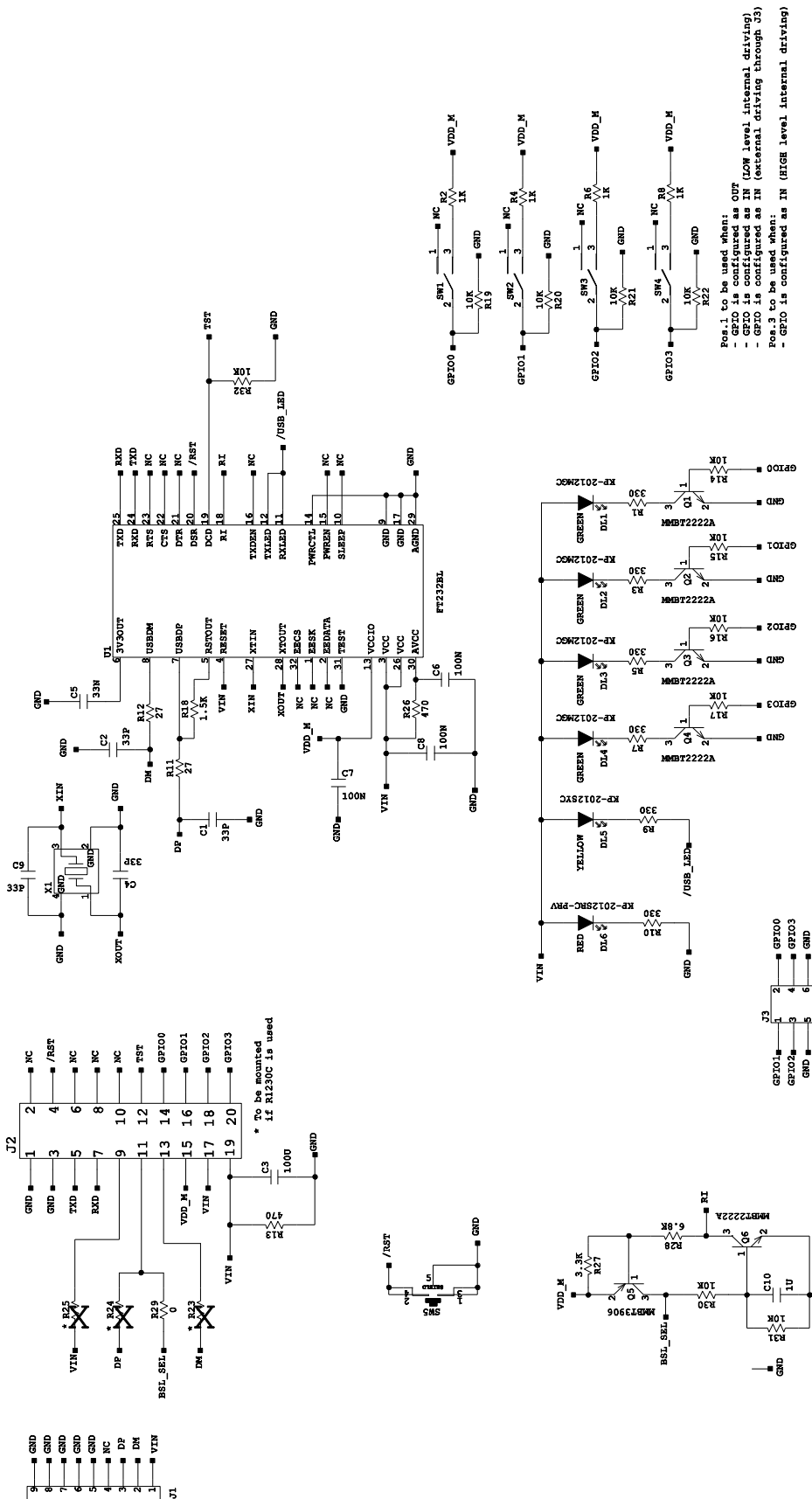


Fig. 3.2: Quark R1230CEVB electrical scheme

External Connections

GPIO connector pinout is shown in the following table:

Pin #	Signal
1	GPIO 1
2	GPIO 0
3	GPIO 2
4	GPIO 3
5	GND
6	GND

Tab. 3.2: QUARK R1230CBEVB connector pinout

4 Quark R1230ADAT

Technical Specifications Table

Digital I/O	Four I/O lines 3.3 V out @ 3mA
UART Serial Port	Baudrate: 115200 Databits: 8 Stopbits: 1 Parity: none Flow control: none 3.3 V I/O voltage level 9.6÷115 kbit/s data rate (settable)
Dimensions	(W)60 x (L)37 x (H)4.6 mm ³ (2.4 x 1.5 x 0.2 inch ³)
Supply Voltage Range	2.5V ÷ 5.5V
Operating Temperature	-10 °C to +55 °C

Tab. 4.1: QUARK R1230ADAT Technical Specifications

Note: It is not possible to upgrade the firmware using the Quark Adapter Board (mod. R1230ADAT).

Technical drawings

The location of the connector is shown in Fig. 4.1. The mechanical specifications are listed below:

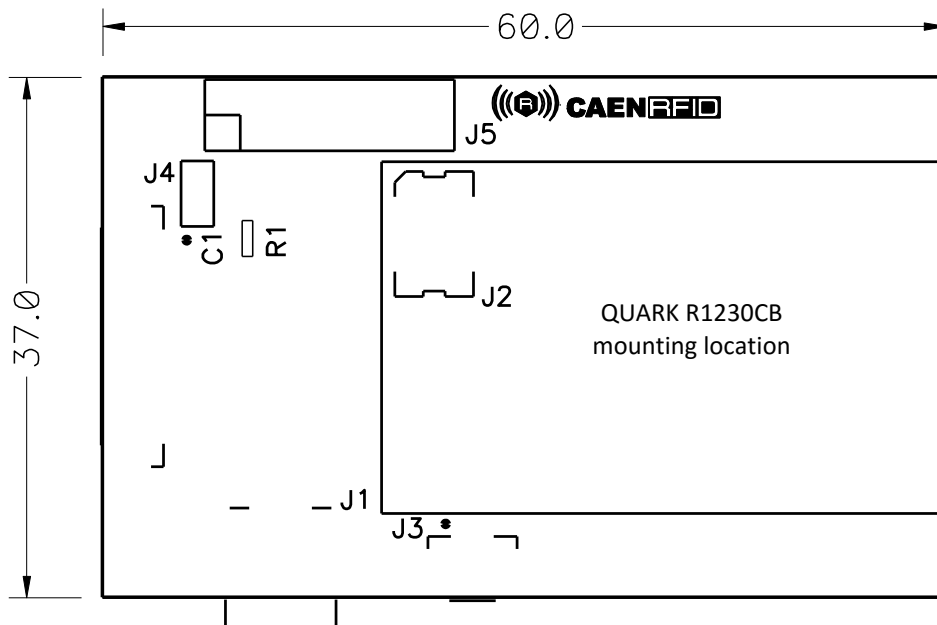


Fig. 4.1: Quark R1230ADAT technical drawing

Electrical scheme

The electrical scheme of the Quark R1230ADAT is shown in Fig. 4.2.

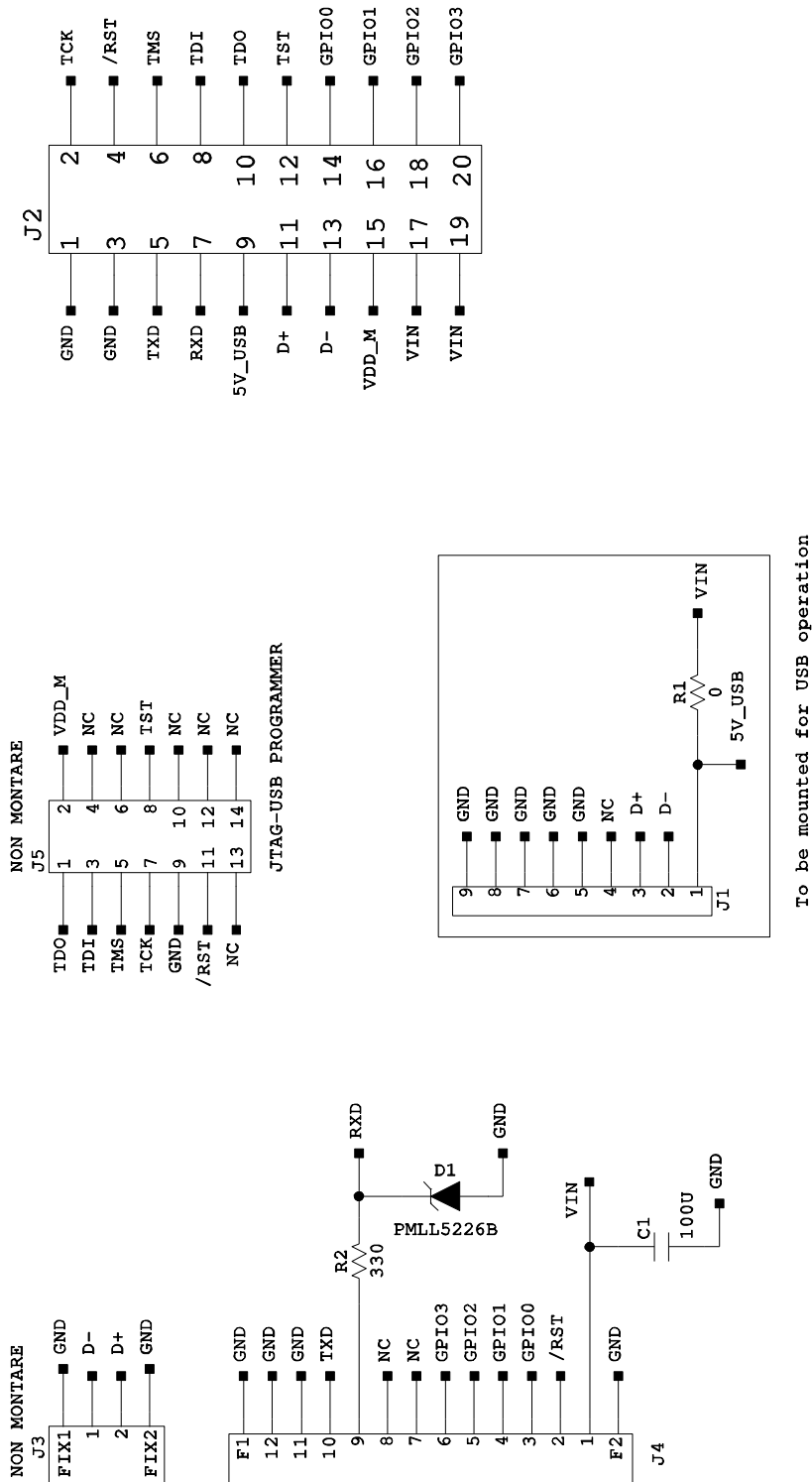


Fig. 4.2: Quark R1230ADAT electrical scheme

External Connections

Supply and I/O connector pinout is shown in the following table:

Pin #	Signal	Description
1	VIN	Input supply voltage
2	/RST	Reset (active low)
3	GPIO0	General Purpose IO #0
4	GPIO1	General Purpose IO #1
5	GPIO2	General Purpose IO #2
6	GPIO3	General Purpose IO #3
7	NC	Not connected
8	NC	Not connected
9	RXD	UART RX from host
10	TXD	UART TX to host
11	GND	Ground
12	GND	Ground

Tab. 4.2: QUARK R1230ADAT connector pinout

5 Quark REGULATORY COMPLIANCE

FCC Compliance

This equipment has been tested and found to comply with Part 15 of the FCC Rules.

NOTE:

- a. Any changes or modification not approved by CAEN RFID could void the user's authority to operate the equipment.
- b. The QUARK R1230CB Module, which is rated at 200 mW output, is approved for operation with the following antennas:
 1. CAENRFID antenna Mod. WANTENNAX012 (Linear polarized antenna 1.3dBi gain 902 - 928 MHz).
 2. CAENRFID antenna Mod. WANT021XMMCX (QUAD Circular Polarized Quadrifilar Antenna; 0.7dBi gain).

Use of other than the approved antennas with this unit may result in harmful interference with other users, and cause the unit to fail to meet regulatory requirements.

- c. This transmitter module is authorized to be used in other devices only by OEM integrators under the following conditions:
 1. The RFID Module antenna shall have a separation distance of at least 20 cm from all persons
 2. The transmitter module must not be co-located with any other antenna or transmitter
- d. In case that the two conditions above are met, further transmitter testing will not be necessary. However, the OEM integrator is still responsible for testing the end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). In the event that these conditions can not be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In such case the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.
- e. If the FCC ID is not visible when the module is installed inside another device, the OEM integrator shall apply a label in a visible area on his product with the following statement:

Contains Transmitter Module FCC ID: UVECAENRFID016

or

Contains FCC ID: UVECAENRFID016

- f. The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

RoHS EU Directive

Quark R1230CB Reader is compliant with the EU Directive 2011/65/CE on the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS).