RS232-B1 User Manual

V1.4

23/01/2018

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1. Introduction

1.1 Device Overview

Features

- Low cost RFID Reader with Mifare Classic, Ultralight and NTAG2 support
- LED indicator of a tag presence in the antenna field
- Stand-alone mode (polling)
- Command interface via RS232 Port with optional AES-128 encryption
- UART baud rate up to 921600 bps
- High transponder read and write speed
- -25°C to 85°C operating range
- 4 configurable GPIOs with interrupts
- 3 configurable PWMs
- Comparator
- ADC
- Current Output DAC
- AES-128 encryption engine
- Multiple internal reference voltages
- RoHS compliant

Applications

- Access control
- Monitoring goods
- Approval and monitoring consumables
- Pre-payment systems
- Managing resources
- Contact-less data storage systems
- Evaluation and development of RFID systems
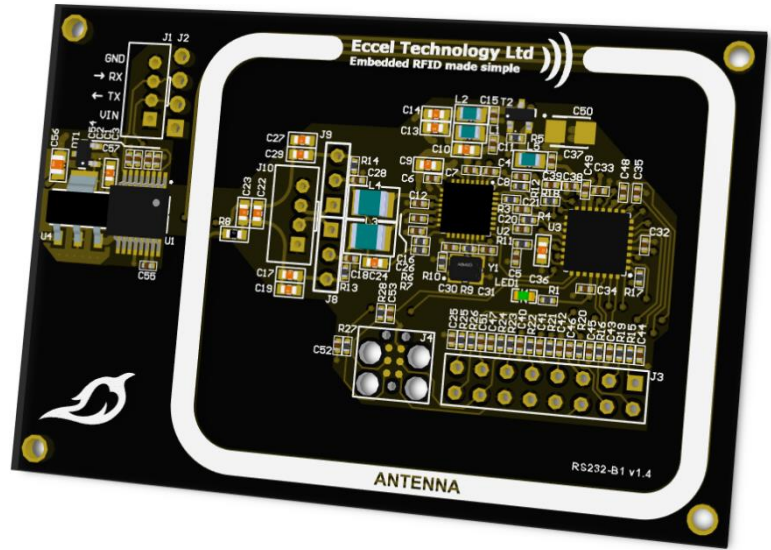
Description

The RS232-B1 module is an expansion of the RFID B1 module - the second in an evolving family of 13.56 MHz sub assemblies from Eccel Technology Ltd (IB Technology). The product is designed with both embedded applications and computing / PLC platforms in mind. This product is an ideal design choice if the user wishes to add RFID capability to their design quickly and without requiring extensive RFID and embedded software expertise and time. An on board low power ARM microcontroller handles the RFID configuration setup and provides the user with a powerful yet simple command interface to facilitate fast and easy read/write access to the memory and features of the various transponders supported by this module.

1.2 System Overview

The RS232-B1 device is an extension of our RFID B1 module. Below, In Figure 1-1 the System Diagram is presented.
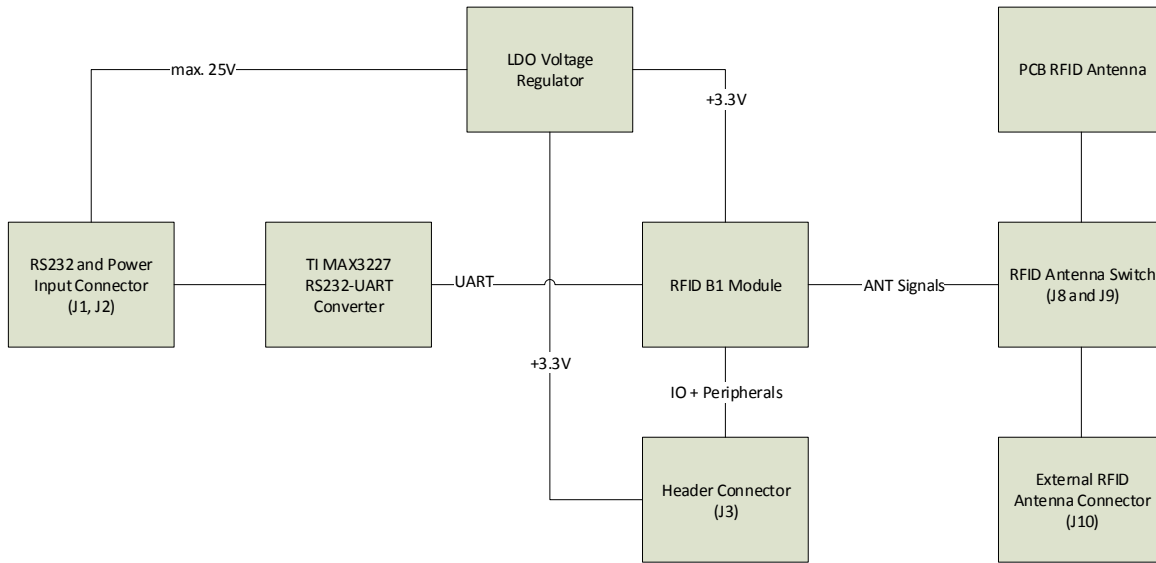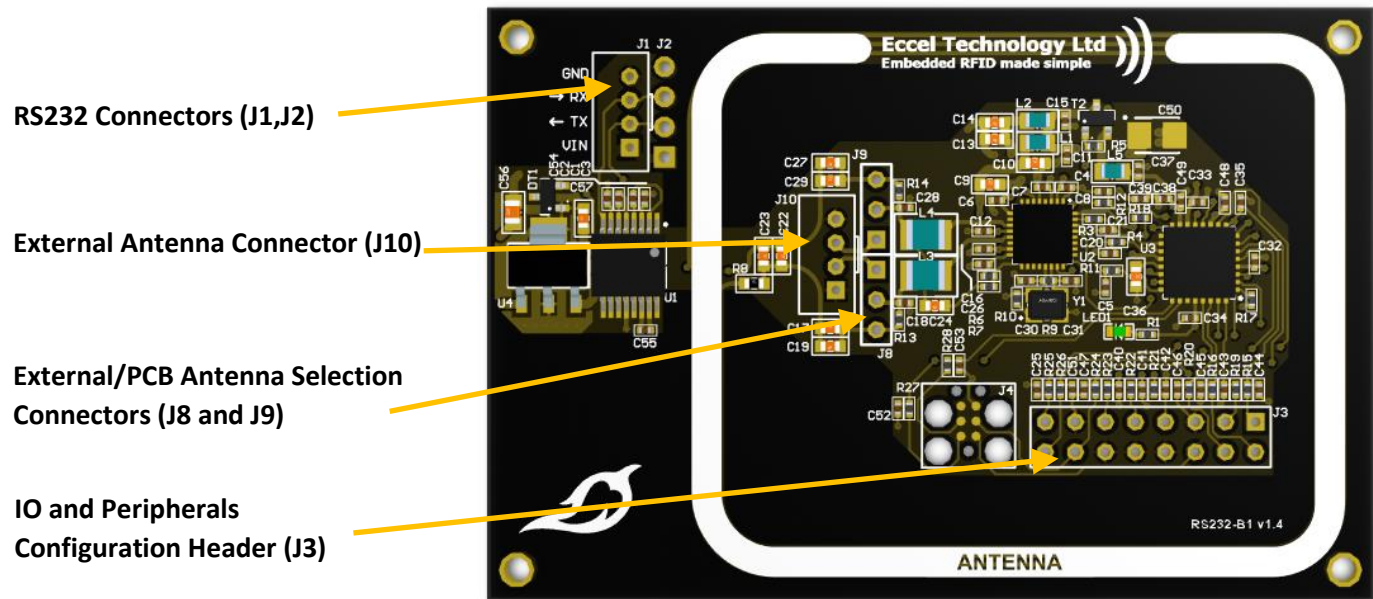
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                              ┌──────────────┐                    ┌──────────────┐
         ──max. 25V────────── │ LDO Voltage  │                    │ PCB RFID     │
                              │ Regulator    │                    │ Antenna      │
                              └──────────────┘      +3.3V         └──────────────┘
                                      │
┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ANT Signals  ┌──────────────┐
│ RS232 and    │  │ TI MAX3227   │  │              │              │ RFID Antenna │
│ Power Input  │──│ RS232-UART   │──│ RFID B1      │──────────────│ Switch       │
│ Connector    │  │ Converter    │  │ Module       │              │ (J8 and J9)  │
│ (J1, J2)     │  │              │UART              │              │              │
└──────────────┘  └──────────────┘  └──────────────┘              └──────────────┘
                            +3.3V          │
                                    IO + Peripherals
                                   ┌──────────────┐              ┌──────────────┐
                                   │ Header       │              │ External RFID│
                                   │ Connector    │              │ Antenna      │
                                   │ (J3)         │              │ Connector    │
                                   └──────────────┘              │ (J10)        │
                                                                 └──────────────┘
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Figure 1-1 System Diagram

1.3 Features

Parameter	Typical Value
Range (dependent upon antenna dimensions and tuning, tag: Mifare 1k ISO card)	
a) PCB antenna (on board)	up to 50 mm
b) External PCB antenna 50x50mm (RFID-ANT1356-50x50-300 v1)	up to 70 mm
c) External PCB antenna 25x25mm (RFID-ANT1356-25x25-300 v1)	up to 40 mm
Nominal RF frequency	13.56 MHz
Supported tags	Mifare Classic, Ultralight, NTAG2
Time needed to read the whole tag memory (Classic 1k)	0.5 s
Time needed to write the whole tag memory (Classic 1k)	0.6 s
Width x Length	75 x 50 mm

Table 1-1

1.4   Connectors

Picture 1-1

RS232 Connectors (J1,J2)

External Antenna Connector (J10)

External/PCB Antenna Selection Connectors (J8 and J9)

IO and Peripherals Configuration Header (J3)

In Picture 1-1 there are marked connectors available for the user when working with the RS232-B1 device. The connectors used on the RS232-B1 are described below.

1.4.1   RS232 Connectors (J1, J2)

The device provides communication and power via the RS232 connectors: J1, J2. The connectors J1 and J2 have a pin spacing of 2mm and 2.54mm respectively. The MAX3227 (Texas Instruments) RS232-UART converter provides communication between the host and the RS232-B1 via the RS232 interface.
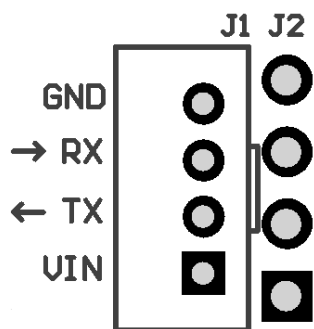
J1.1, J2.1 – VIN (max. 25V)
J1.2, J2.2 – RS232 TX (data form the module)
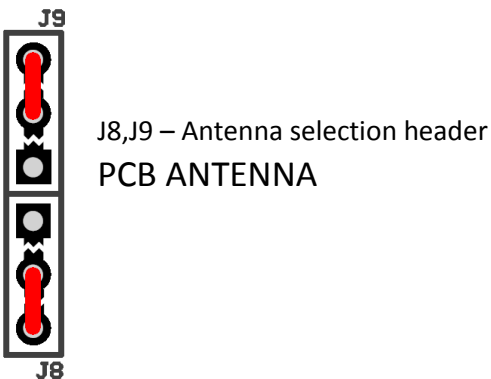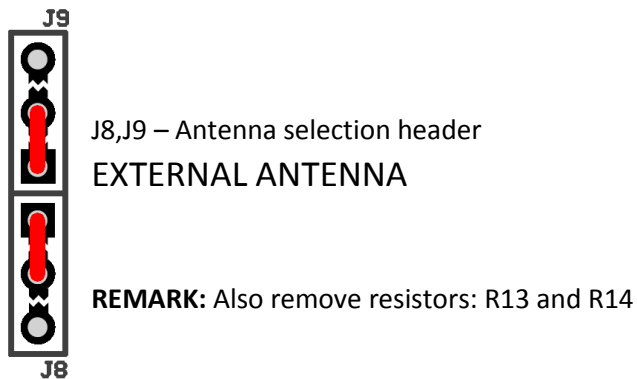J1.3, J2.3 – RS232 RX (data to the module)
J1.4, J2.4 – GND

1.4.2   External Antenna Connector (J10)

The user has the option to use an external RFID antenna connected to the RS232-B1 device. The J10 connector is where this should be connected. Eccel Technology Ltd provides a variety of RFID antennas which the user can use with this device.

J10 – External Antenna Socket
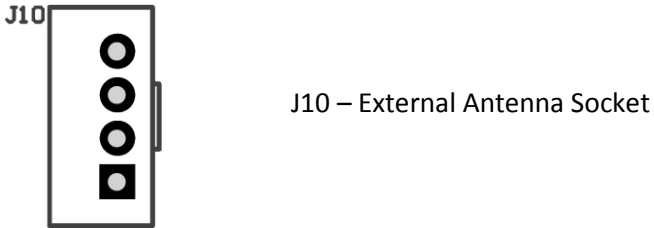
1.4.3   External / PCB Antenna Selection Connectors J8 and J9

To switch between the PCB antenna and an external antenna, two jumpers have to be used with the J8 and J9 connectors.

J8,J9 – Antenna selection header
EXTERNAL ANTENNA

REMARK: Also remove resistors: R13 and R14

J8,J9 – Antenna selection header
PCB ANTENNA

We recommend using our external antennas from series *RFID-ANT1356-50X50-xxx*, where *xxx* is the cable length in mm. They have a read range of about 70mm, 50x50mm in size and 300 or 800mm cable length. We can also design antennas with higher read range and custom dimensions on request.

More information about antennas: http://www.eccel.co.uk/antennas/

1.4.4   IO and Peripheral Configuration Header

The device PCB connects the pins on this header to all IOs and peripherals provided by the onboard RFID B1 module and a few pins are available providing +3.3V and GND signals.
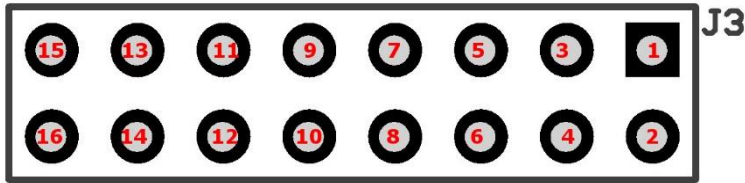
J3.1 – GPIO 0

J3.2 – GPIO 2

J3.3 – GPIO 1

J3.4 – GPIO 3

J3.5 – GND

J3.6 – 3.3 V

J3.7 – IDAC (Digital to Analog Converter with current-type output)

J3.8 – GND

J3.9 – COMP (Comparator positive input)

J3.10 – GND

J3.11 – ADC (Analog to Digital Converter input)

J3.12 – GND

J3.13 – GND

J3.14 – nRST (nRESET – reset input signal – active low)

J3.15 – nSLEEP (Output signal indicating the device is in Sleep Mode or Power Down Mode – active low)

J3.16 – nPWRDN (Power Down Request input signal – active low)

2. Electrical Characteristics

2.1 Test Conditions

Typical device parameters were measured at an ambient temperature 22°C ±3°C and using a power supply of 5V ±5%.

2.2 Absolute Maximum Ratings

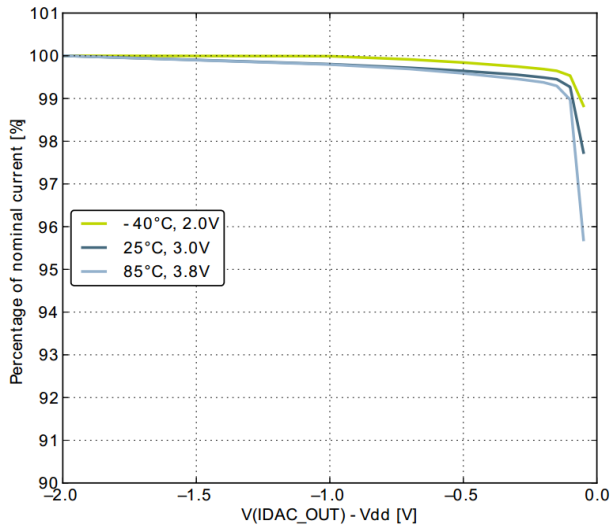| Symbol	Parameter	Min	Max	Unit	Notes
T_S	Storage Temperature	-40	150	°C	
V_{IN_MAX}	Max Supply Voltage	0	36	V	
V_{IOMAX}	Input Pin Voltage	-0.3	3.5	V	
I_{IOMAX}	Output Pin Current	0	6	mA	
I_{ANT}	ANT1 and ANT2 Current	0	100	mA	Maximum continuous current. This depends upon the impedance of the circuit between ANT1 and ANT2 at 13.56MHz.

Table 2-1

2.3 Operating Conditions

Symbol	Parameter	Min	Max	Unit
T_O	Ambient Temperature	-25	85	°C
V_{IN}	Supply Voltage	4.5	25	V
V_{3V3}	+3.3V Generated Voltage	3.235	3.365	V

Table 2-2

2.4 GPIO

Symbol	Parameter	Min	Typ	Max	Unit	Notes
V_{IOIL}	Input Low Voltage			$0.3V_{3V3}$	V	
V_{IOIH}	Input High Voltage	$0.7V_{3V3}$			V	
I_{IOMAX}	Output Pin Current			± 6	mA	
I_{IOLEAK}	Input Leakage Current		± 0.1	± 40	nA	High impedance IO connected to V_{3V3} or GND.
R_{IOESD}	Internal ESD Series Resistor		200		Ω	
V_{IOHYST}	IO Pin Histeresis	$0.1V_{3V3}$			V	

Table 2-3

2.5 Antenna Output

Symbol	Parameter	Min	Typ	Max	Unit	Notes
f_{ANT}	Antenna Signal Frequency		13.56		MHz	±30 ppm (-20°C - 70°C).
f_{ANTAG}	Antenna Signal Frequency Aging	0		3	ppm	At 25°C.
V_{ANTH}	Antenna High Level Output Voltage	V_{3V3} - 0.64			V	I_{ANT} = 80mA.
V_{ANTL}	Antenna Low Level Output Voltage			0.64	V	I_{ANT} = 80mA.
I_{ANT}	ANT1 and ANT2 Current	0	60	100	mA	Maximum continuous current. This depends upon the impedance of the circuit between ANT1 and ANT2 at 13.56MHz.

Table 2-4

2.6 Flash

Symbol	Parameter	Min	Typ	Max	Unit	Notes
C_{FE}	Flash Erase Cycles Before Failure	20000			cycles	
T_{FDR}	Flash Data Retention Time	10			years	For ambient temperature < 85°C
		20			years	For ambient temperature < 70°C

Table 2-5

2.7 IDAC

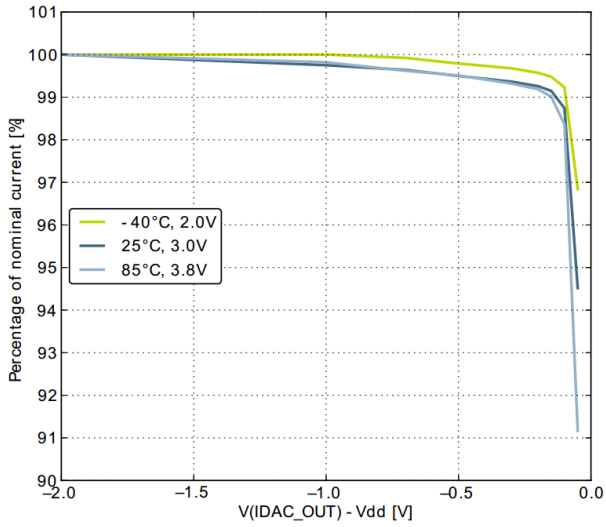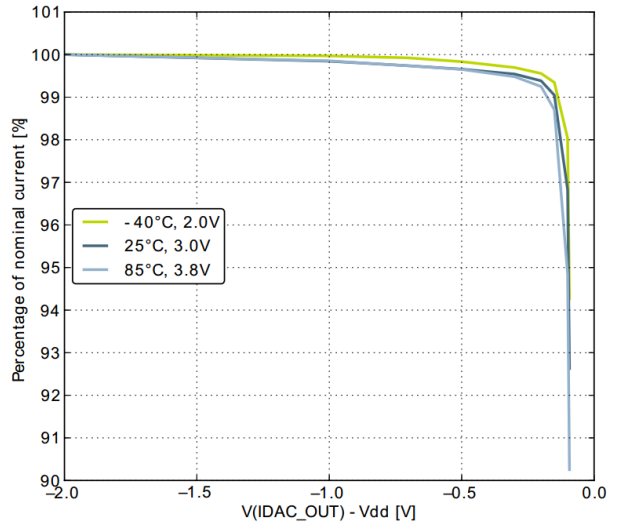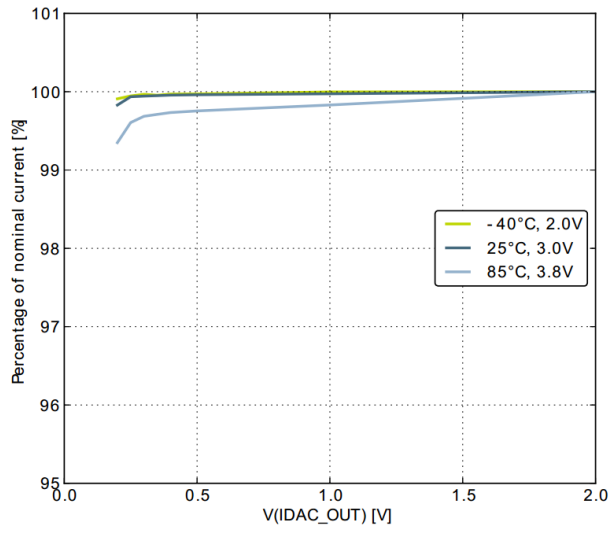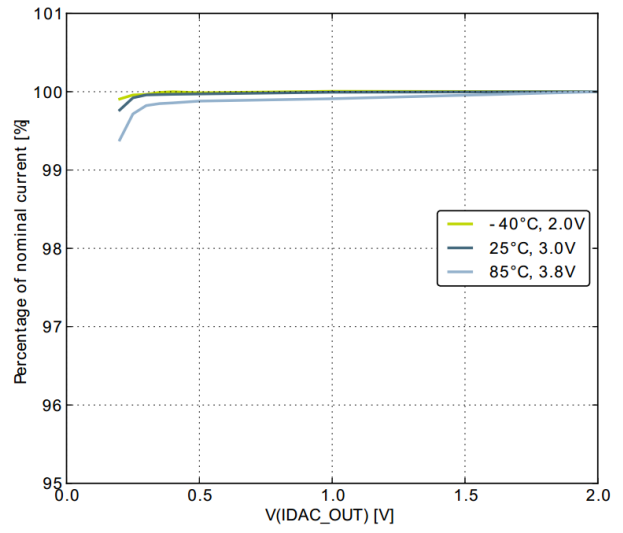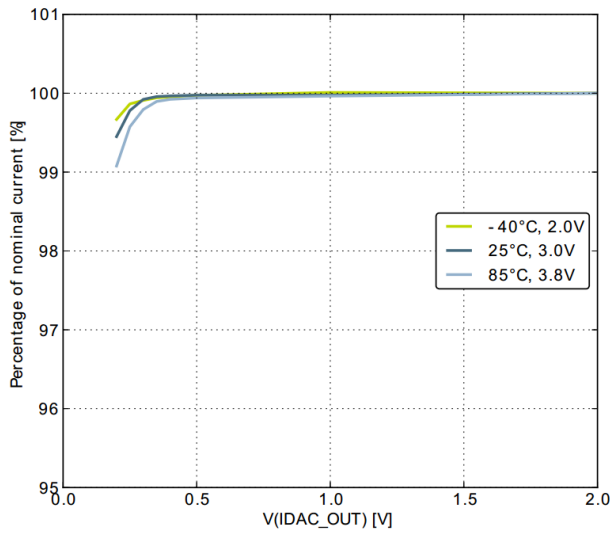| IDAC Parameters									
Precision				Source			Sink		
Range No	Range [µA]	Step Size [nA]	Nominal Current [µA]	Current drop at Vdd - 100 mV [%]	Temperature coefficient [nA/°C]	Voltage coefficient [nA/V]	Current drop at 200 mV [%]	Temperature coefficient [nA/°C]	Voltage coefficient [nA/V]
0	< 0 ; 1.6 >	50	0.85	0.79	0.3	11.7	0.3	0.2	12.5
1	(1.6 ; 4.7 >	100	3.2	0.75	0.7	38.4	0.32	0.7	40.9
2	(4.7 ; 16 >	500	8.5	1.22	2.8	96.6	0.62	2.8	94.4
3	(16 ; 64 >	2000	34	3.54	10.9	159.5	1.75	10.9	148.6

Table 2-6
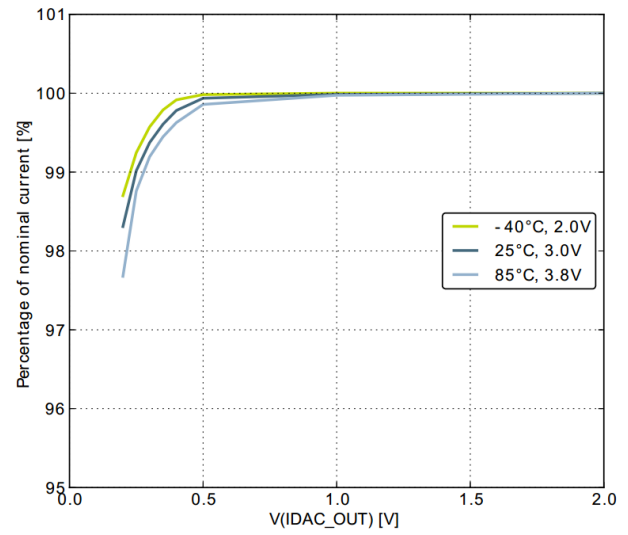
Range 0
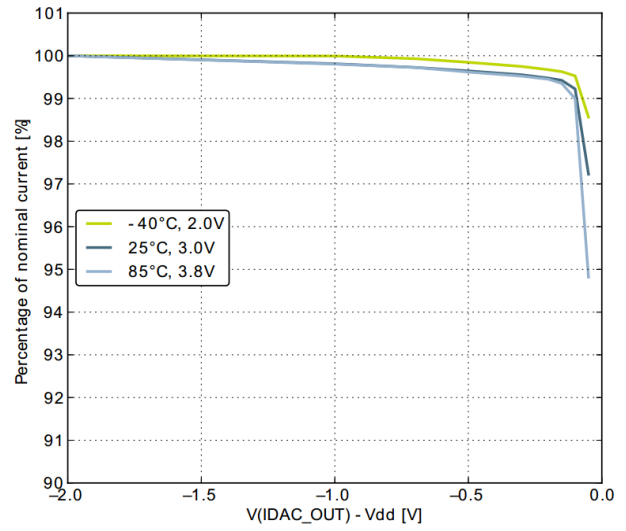
Range 1

Range 2

Range 3

Figure 2-1 Source Current

Range 0

Range 1

Range 2

Range 3

Figure 2-2 Sink Current

2.8 PWM

PWM Parameters				
Period		Frequency		
Minimum [μs]	Maximum [s]	Minimum [Hz]	Maximum [kHz]	Maximum Error [%]
4.81	3.19	0.313	207.9	3

Table 2-7

2.9 ADC

Symbol	Parameter	Min	Typ	Max	Unit	Notes
V_{ADCIN}	Input Voltage Range	0		2.5	V	Internal 2.5V reference voltage used.
I_{ADCIN}	Input Current			100	nA	
C_{ADCIN}	Input Capacitance			2	pF	
R_{ADCIN}	Input On Resistance	1			MΩ	

Table 2-8

2.10 Comparator

Symbol	Parameter	Min	Typ	Max	Unit	Notes
V_{CMPIN}	Input Voltage Range	0		V_{3V3}	V	
$V_{CMPOFST}$	Offset Voltage	-12	0	12	mV	
$V_{CMPHYST}$	Hysteresis		50		mV	

Table 2-9

3. Installation and operation

From the system and functionality point of view, the RS232-B1 device gives the same features as the RFID B1 module, and the user should refer to the RFID B1 User Manual when working with the RS232-B1. The Texas Instruments chip expands communication interface to the on-board RFID B1 module and allows the board to be connected to a host and communicate with the device via a RS232 interface. For a quick test, the user can also use an RS232-USB converter and simply connect the RS232-B1 to a computer e.g. **USB-RS232-WE-1800-BT_0.0** (FTDI) or similar and then start the B1-client application which allows the user to test all features of the device. The B1-client along with the user guide can be downloaded from here. The best read range can be achieved when the tag is parallel to the surface of the reader (see Figure 3-1). There is also LED1 (green) which indicates a tag presence in the antenna field.
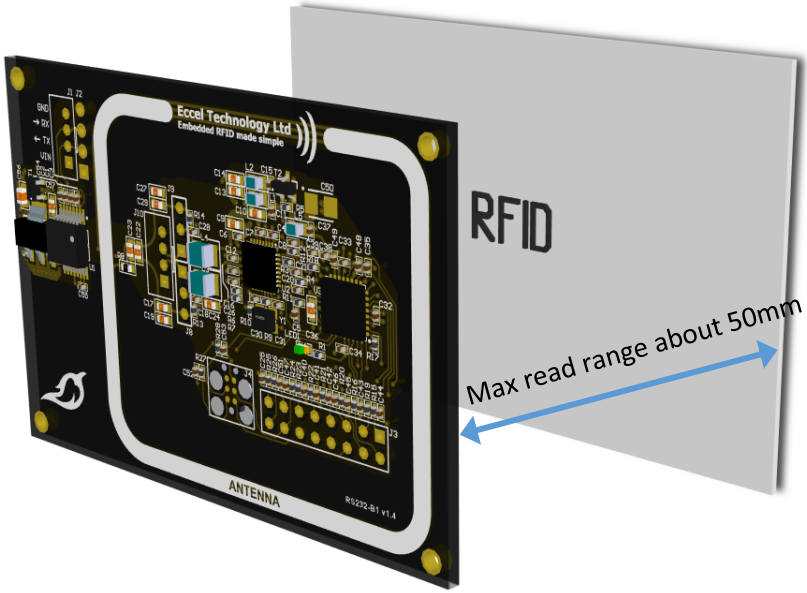

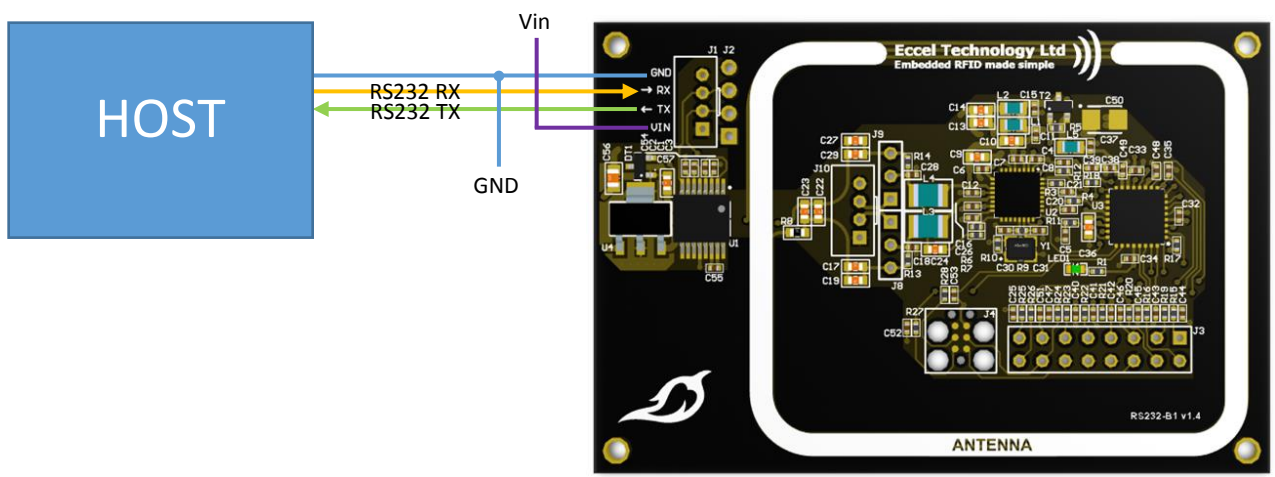*Figure 3-1 The correct way to read a RFID tag*

Figure 3-2 Connection to the host system.

The RS232-B1 can also operate in a stand-alone mode. The user can control all GPIO's and add tags to the whitelist (a list of defined tags). For easy configuration of polling parameters we provide the B1 Stand-Alone Configurator application which can be downloaded from here. This application allows the user to simply search for a new tag, add it to the whitelist, configure polling parameters, enable/disable all of GPIOs and control them. For more information please refer to the RFID-B1 User Manual.
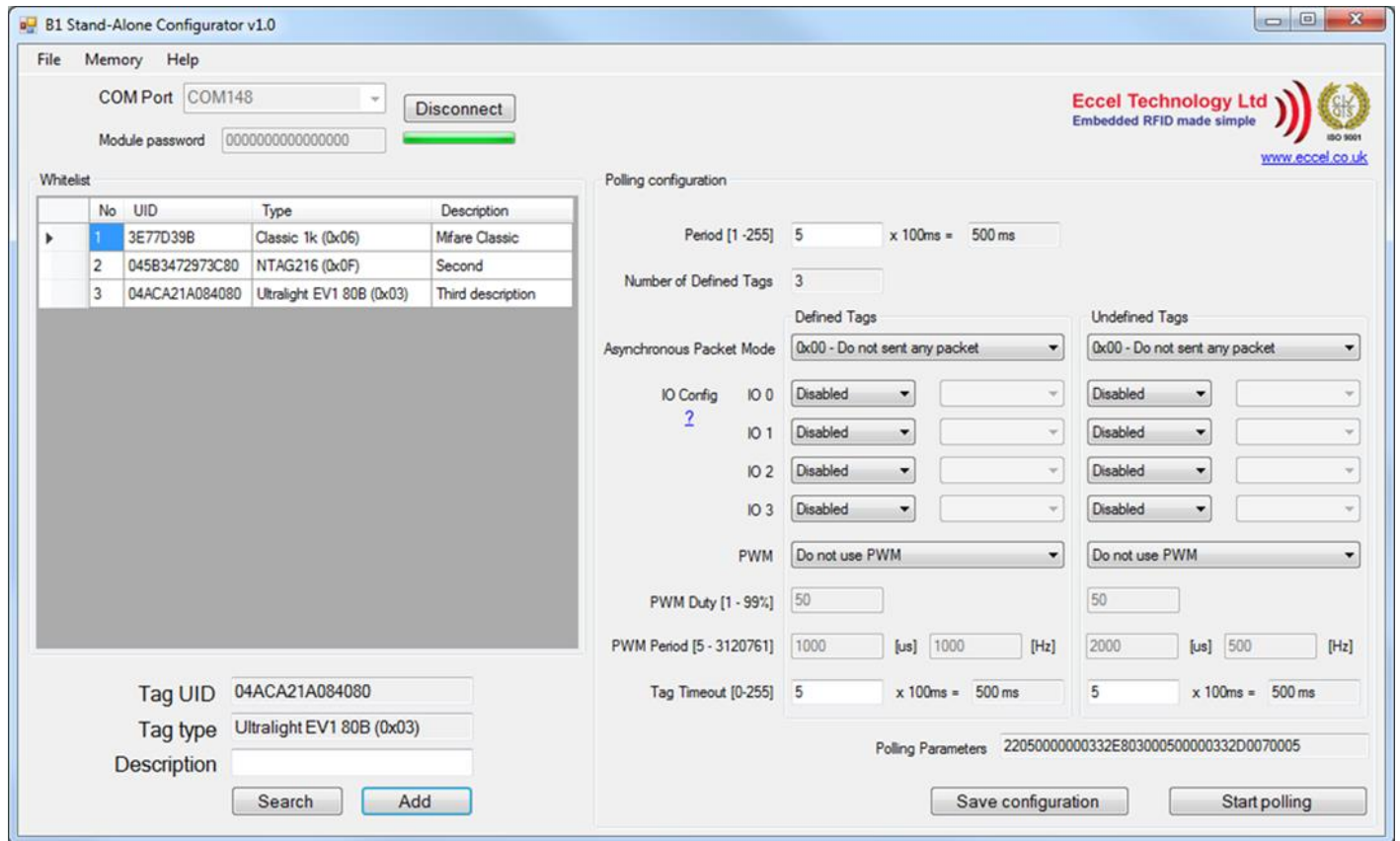

Figure 3-3 The main window of the B1 Stand-Alone Configurator

4. Mechanical Dimensions

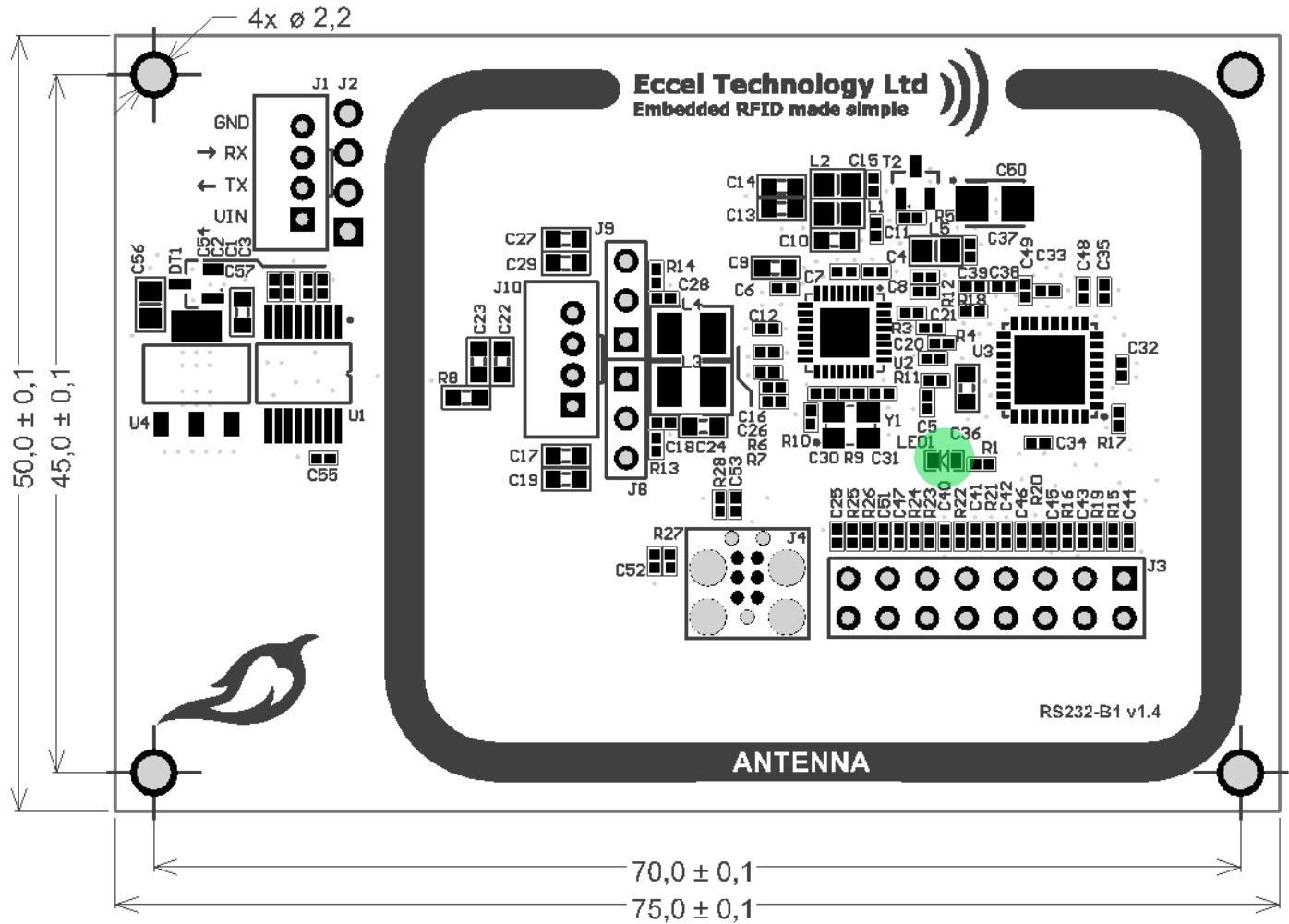Dimensions in mm. LED1 is marked with green circle. This LED indicates a tag presence in the antenna field.

Figure 4-1

No responsibility is taken for the method of integration or final use of the B1 based modules

More information about the B1 module and other products can be found at the Internet site:

http://www.eccel.co.uk

or alternatively contact ECCEL Technology (IB Technology) by e-mail at:

sales@eccel.co.uk