

# Datasheet QR NFC

Version: 1.0

Date: July 2024

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# 1. General Information / Security Advice

## 1.1. Notes on the Use of this Documentation

This user manual and integration guide uses different symbols to point out potentially dangerous situations. The following signs and symbols are used throughout the document.



### ATTENTION

Declares a potentially hazardous situation. If this is not avoided, the product or something in its surrounding could be damaged.



### NOTES

Declares notes for the user as well as other useful information, where no harmful or dangerous situations can be expected.

## 1.2. Security Advice

The QR NFC HF RFID Module was not designed for use in dangerous environments. Using this product in applications where a failure could directly result in severe injuries or death (“high risk activities”) is not permitted. This includes but is not limited to applications in nuclear facilities, flight control systems, life support systems or weapon systems. The manufacturer denies the suitability of this device for such scenarios.

## 1.3. Export Restriction

The QR NFC HF RFID Module contains components that underlie US export restrictions. It is therefore forbidden to export the product to countries that are on the US trade embargo list. The same applies to any countries that are on the EU embargo list.

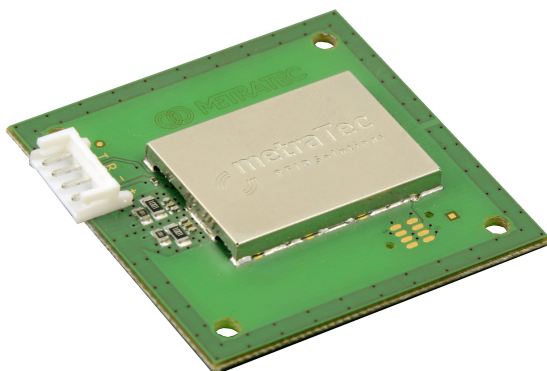
## 1.4. Further Documentation

While this documentation explains the electrical and mechanical characteristics of the QR NFC module, it might be useful to also read the Metratec HF AT Protocol Guide, which explains the AT protocol used to control the module in full detail. Source: <https://www.metratec.com>

## 2. Product Description

The QR NFC HF RFID Module is an easy to use RFID module which can be integrated into host electronics without big effort. This allows you to equip your product with RFID functionality without designing your own RF board. Thanks to the tested and extremely flexible firmware you can read and write data tags that follow the NFC standard in no time. The output power can be adjusted to a maximum of 200mW allowing a read and write range of up to 10cm with credit card sized tags. The module integrates an inductive loop antenna, no additional RF cables or external antennas required.

Thanks to the versatile firmware, the module is perfect for applications like customer or operator identification, identification of consumables, access control and similar.



*Figure 1. QR NFC Module Shield Cage Side*

### 2.1. Intended Use

The QR NFC HF RFID Module reads and writes RFID tags that operate in the 13.56MHz ISM band. The QR NFC is available in a single version for worldwide operation. The supported standards are adopted worldwide and require no modifications neither in hardware nor in software when changing regions.

The supported standards are:

- ISO 14443-A
- ISO 15693

- NFC Forum specifications
- NXP's Mifare Classic, Ultralight and DESFire protocol

This results in a rather long list of compatible Tag Types which is not complete. If your tag is not included in the table below please contact Metrattec to check compatibility.

*Table 1. TTagTypes*

Name	NFC Forum Tag Type	Standard
Mifare Ultralight	NFC Type 2	ISO 14443A
NXP NTAGX	NFC Type 2	ISO14443A
ST Micro ST25TN	NFC Type 2	ISO 14443A
TI TagIt	NFC Type 5	ISO 15693
NXP Icode SLI / SLIX	NFC Type 5	ISO 15693
ST Micro ST25TV	NFC Type 5	ISO 15693
NXP Mifare Classic 1k / 4k	n.a.	ISO 14443A

The host communication protocol is identical across the Metrattec NFC product family. This family includes:

- DeskID NFC, an USB Desktop NFC reader

## 2.2. Technical Specification

The following table shows the technical specification of the QR NFC module with minimum, typical and maximum values for each parameter (where applicable).

*Table 2. Technical Specification*

	Min.	Typ.	Max.
Supply Voltage Vcc	4.7 V	5.0 V	5.3 V

	Min.	Typ.	Max.
Supply Current Standby		10 mA	15 mA
Supply Current RF on	70 mA	90 mA	125 0mA
RF output power	100mW		200mW
Carrier Frequency worldwide		13.56 MHz	
Operating Temperature (RFID performance may vary with temperature, check in application)	-20°C	20°C	+70°C
Dimensions		40 x 36 x 6.5 mm	
Antenna Connector		internal antenna	
Antenna Gain		n.a.	
Humidity		Non-condensing	
Communication Interface		3V3 UART	
V_In_low UART	-0.3V	0V	0.9V
V_In_high UART	2.3V	3.3V	3.45V
V_out_low UART *	0V	0.1V	0.4V
V_out_high UART *	2.9V	3.3V	3.45V
GPIO voltage level		3V3	
V_In_low	-0.3V	0V	0.9V
V_In_high	2.3V	3.3V	3.45V
V_out_low *	0V	0.1V	0.4V

	Min.	Typ.	Max.
V <sub>out_high</sub> *	2.9V	3.3V	3.45V
Output drive strength	1mA	2mA	4mA

- Output voltages at a typical load current of 100µA / 33 kOhm load impedance.

### 2.3. Pin Assignments and Description

All connections (power and UART) are available on a 4 pin 2.5 mm pitch wire to board connector. By default a JST S4B-EH-SN 4 pole pin header with horizontal entry. There is no RF antenna connector as the NFC antenna is integrated into the module.

An Eagle library is available for download from our website for easy integration into the host PCB designs. A variety of 2.5 and 2.54 mm pitch pin headers as well as socket strips fit can be ordered as custom options. Please contact Metratec in case you require an alternative connector.

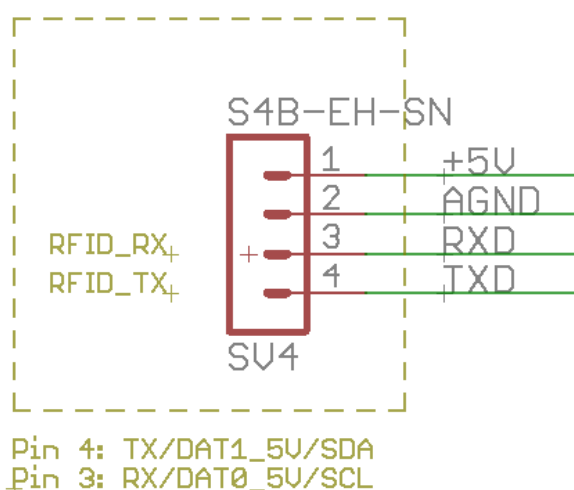


Figure 2. QR NFC Pin Header Pinout



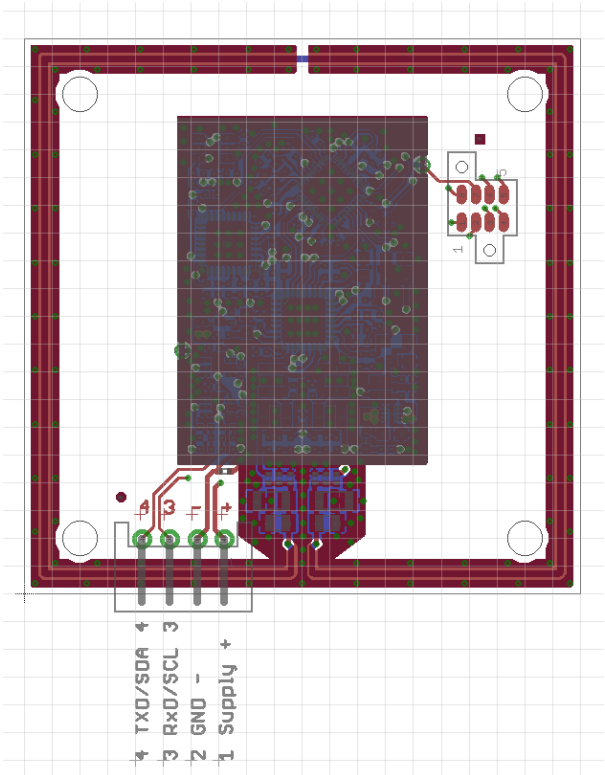


Figure 3. QR NFC Pin Positions and Naming (top view, shieldcage side)

Table 3. Pin Connections

Pin Name	Pin No.	Direction	Function
+5V	1	in	5V0 power input
GND	2	pas	RF GND
RXD	4	in	3V3 UART receive data input, I2C SCL signal
TXD	3	out	3V3 UART transmit data output, I2C SDA signal

## 2.4. Mechanical Specification

PCB dimensions as well as pin positions are shown in the figure. A STEP model is available for download on the Metratec website to facilitate your mechanical design.

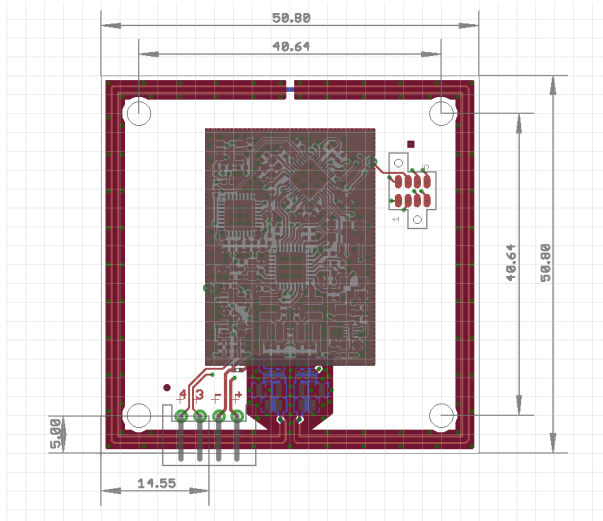


Figure 4. Mechanical Dimensions QR NFC

## 2.5. Scope of Delivery

The QR NFC HF RFID Module comes with the following parts:

- QR NFC HF RFID Module
- Documentation, Drivers and Demo Software are available via download from Metratec's website

## 2.6. Accessories

The following accessories and modules are available to extend and evaluate the functionality of the QR NFC HF RFID module:

- Development Board (Metratec UDB4)
- Starter Kit incl. Development Board and tags
- different NFC RFID tags suitable for almost every application

## 2.7. Ordering information

The QR NFC is available in two versions:

- QR NFC (UART version) Art. Nr. 22003433
- QR NFC (I2C version) Art. Nr. 22003462

### 3. RFID Integration Hints

HF RFID systems are sensitive to noise. For the best performance:

- do not operate several systems in the same band close together in an unsynchronised manner
- keep away from high frequency noise sources
- use a well filtered power supply

HF RFID systems are sensitive to antenna mismatch. Follow these hints to avoid any issues:

- do not place metallic parts in front of the antenna
- liberately cutout the copper in your mainboard in all layers if the mainboard overlaps with the QR\_NFC module
- do not place large plastic parts directly at the antenna
- contact Metratec for advice when the performance of your RFID application is behind expectations or does not match performance of the starter kit.

#### 3.1. List of applicable radio standards

When designing our module into your product, please keep in mind that HF RFID applications must comply with:

- Europe: ETSI EN 300 330 - Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
- US/FCC: FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices \*CAN/ISED: Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

### 3.2. Specific operational use conditions

Not applicable.

### 3.3. Limited module procedures

Not applicable.

### 3.4. Trace antenna designs

Not applicable.

### 3.5. RF exposure considerations

US/FCC: The conducted/radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized.

CAN/ISED: This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps. Ce transmetteur ne doit pas être placé au même endroit ou utilisé simultanément avec un autre transmetteur ou antenne.

### 3.6. Antennas

The module may not be operated using external antennas.

## 4. Power Supply and Power Consumption



The module does not feature a reverse polarity protection. It is the task of the host board to supply a well filtered 5 V DC supply in order to achieve an optimum RFID performance.

All internal voltages are derived from the 5V supply using onboard regulators. However, RFID systems require a very high level supply quality. Use linear regulators with high precision and high control speed whenever possible. When using switching power supplies make sure the switching speed is above 500 kHz and use an EMC optimized layout as well as shielded inductors.

Please contact Metratec if you have any questions regarding your own power supply design when integrating our module into your board.

### 4.1. Hints for additional EMC filtering

When integrating the module into another device with long cables or big ground planes, radiated emissions might increase. It is advisable to follow good layout practices and add additional EMC filtering to comply with all relevant norms. A short four wire connection to the QR NFC using +5V, GND, RXD and TXD is usually best.

## 5. Communication

The QR NFC HF RFID Module communicates with its host using a 3V3 UART connection. This enables direct connection to a modern host microcontroller. The communication details of the serial interface are given in the table below.

*Table 4. UART Communication Interface Specification*

	Min.	Typ.	Max.
Baudrate	114 000	115 200	116 500
Databits		8	
Parity		None	
Stopbits	1	1	1.5

There is a range of circuits and adaptor devices available to convert the 3.3 V UART Signal to RS232, USB or Ethernet. Please contact Metratec if you need advice on converter circuits.

The UART commands used to control the QR NFC Module are described in the Metratec NFC AT Protocol Guide. This guide comprises a detailed description of all commands, response formats and examples. As this protocol is shared among several Metratec products the guide is available in a separate document from Metratec's website.

An I2C slave interface supporting standard and fast mode is available optionally on pins 3 and 4. The I2C bus pull-up resistors are part of the bus master and therefor not part of the module. See the ordering information for ordering the I2C version.

*Table 5. I2C Communication Interface Specification*

	Min.	Typ.	Max.
Baudrate	1	100 000	400 000
Slave address width		7 Bit	
Default Slave address		0x69	

Other interfaces may be implemented on the UART or GPIO pins by Metrattec in the future. Please inquire in case you require a custom host interface for your project.

## 6. Certification



### ATTENTION

Changes or modifications to the module not expressly approved by Metratec could void the user's authority to operate the equipment.

### 6.1. CE / ETSI (EU)

The QR NFC HF RFID Module complies with ETSI EN 302 330. Nonetheless, the integrator of the module has to make sure that all requirements are met by the final product. It is his obligation to declare product conformity. We recommend to assign this task to a qualified third-party test lab specialized on EMC measurements.

### 6.2. FCC (USA)

To fulfill all FCC requirements the integrator must test the final product to comply with FCC regulations regarding intentional and unintentional radiators before declaring FCC compliance of his own product. The FCC version of the module meets the requirements for an FCC modular approval as a single-modular transmitter. Please contact Metratec in case a modular approval is beneficial for your integration project.

### 6.3. IC (Canada)

Certification requirements for Industry Canada (IC) are similar to those of the FCC. Limits of ICES-003 for radiated emissions are similar to the formats specified in FCC Part 15 and CISPR 22. Industry Canada accepts FCC test reports or CISPR 22 test reports for compliance with ICES-003. The integrator is responsible for its product to comply with all relevant IC rules.



## 7. Further Notes

Electronic devices like the QR NFC HF RFID Module are covered by the (German) ElektroG (electronic waste law) as well as the European WEEE directive and as such may not be disposed of by way of the normal household trash. Instead they have to be recycled properly. For you as our customer this is no additional burden, however, as you can send the device back to us for proper recycling. We assure you that the devices received back will be recycled properly and in an environmentally friendly way. Our WEEE Registration ID is DE 56060482.

When selecting electronic components we additionally made sure that all components are free of heavy metals and other harmful substances as required by the RoHS Directive for many industries. Hence, our products are produced in the most environmentally friendly way possible.



## 8. Version History

The following table shows the different version of this file.

Table 6. Version History

Version	Change	by	Date
1.0	Initial version	TM	29.7.2024

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