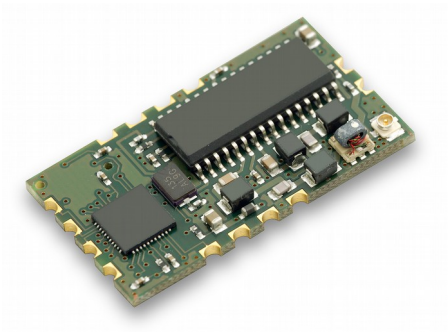
Technical Documentation

for metraTec Dwarf14 HF SMD RFID Module



Date: November 2016

Version: 1.4

Table of Contents

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 Dwarf14 HF SMD 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 Dwarf14 HF SMD 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 Dwarf14 module, it might be useful to also read the metraTec Protocol Guide, which explains the ASCII protocols used to control the module in full detail.

Source: http://www.metratec.com → Support → Downloads → Documentation

2 Product Description

The Dwarf14 HF SMD RFID Module is an easy to use RFID module which can be integrated into your 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 to any tag that follows the protocols using MIFARE® Classic and MIFARE Ultralight® technology in no time. Depending on the external antenna you connect to the module, a read range between 30 and 100mm can be expected (also depending on transponder size and type)

Thanks to the quick firmware, the module is perfect for applications in printers and similar devices where high reading and writing speed is needed.

2.1 Intended Use

The Dwarf14 HF RFID Module reads RFID tags that follow the MIFARE Classic and MIFARE Ultralight protocol on a short range of 30-100 mm. For transponders that use the ISO 15693 protocol, please use our Dwarf15 RFID Module.

2.2 Technical Specification

Power Supply	5 V DC, 180 mA
Communication	5 V UART
Antenna Connector	U.FL / Vias
Transmit frequency	13.56 MHz
RF output power	250 mW
Supported RFID Protocol	MIFARE Classic, MIFARE Ultralight
Temperature Range	-20 °C to +70 °C
Dimensions	22 x 39 mm

2.3 Module Building Blocks

The Dwarf14 module consists of three building blocks, each of them carrying out one of the following functions:

- *UART-communication and power supply* – host communication via 5V UART and 5V power supply are connected to the host board with edge mount vias
- *Microcontroller* – the heart of the Dwarf14 running the metraTec firmware
- *RF Frontend* – generates the signal transmitted to the tag and evaluates the tag response

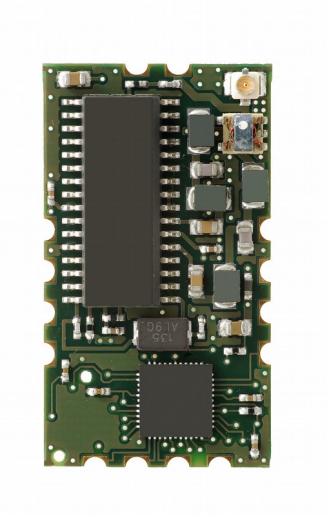


Fig. 1: Dwarf14 Module

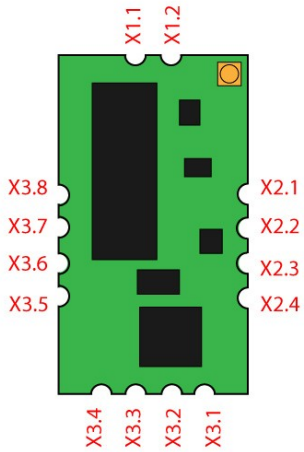


Fig. 2: Vias on the Dwarf14

2.4 Mechanical Specification

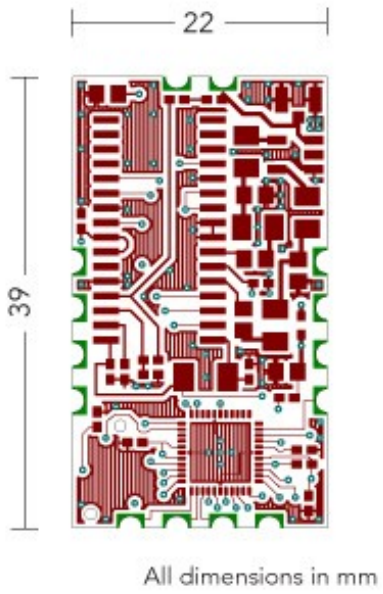


Fig. 3: Dimensions of Dwarf14 (in mm)

For further specification of via locations, see our free Eagle Library which includes a footprint for the Dwarf14 SMD Module.

2.5 Scope of Delivery

The Dwarf14 HF RFID Module comes with the following parts:

- Dwarf14 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 Dwarf14 HF RFID Module:

- UDB Mini Evaluation Board incl. SMD Adapter
- HF Field Detector
- different RFID tags suitable for almost every application

3 Power Supply and Power Consumption

The module does not feature a power supply nor reverse polarity protection. It is the task of the host board to supply a well filtered 5V DC supply in order to achieve an optimum RFID performance.

Via	Via Function
X2.1	5 V DC
X2.2	*GND*

Tab. 1: Power Supply Vias

Power supply voltage	5 V DC
Current consumption, RF on	180 mA
Current consumption, RF off	50 mA
Current consumption, Sleep	10 mA
GPIO voltage level	5 V

Tab. 2: DC characteristics

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 us an EMC optimized layout as well as shielded inductors.

3.1 Hints for additional EMC filtering

The Dwarf14 Module contains an RF generator at 13.56 MHz which generates harmonics. These will be radiated from the module below all official limits. When integrating the module into another device with long cables or big ground planes, this effect might increase. It might be advisable to add additional EMC filtering to comply with all relevant norms.

The following figure shows a possible schematic that can be used to fulfill most relevant norms. If you use this set up, do not connect the GND pin of the UART (between reader module and main device).

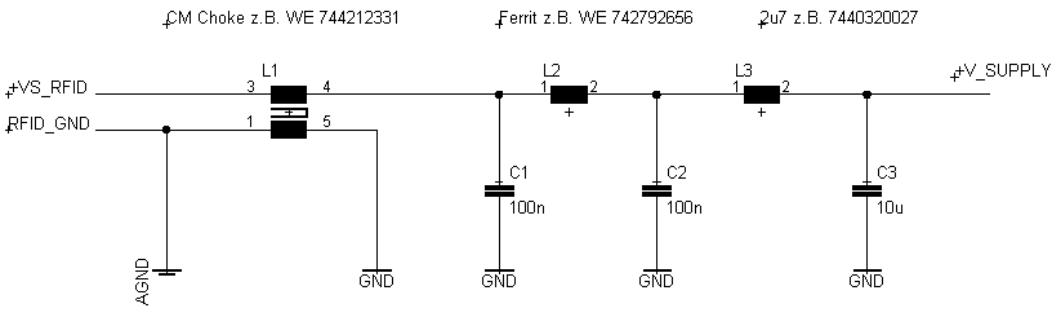


Fig. 4: Schematic for additional EMC filtering

4 Communication

The Dwarf14 HF RFID Module communicates with its host using a 5 V UART connection. This enables direct connection to a host microcontroller. The communication details of the serial interface are 115.200 Baud, 8 Databits, 1 Stopbit, no Parity, no Handshake/Flowcontrol.

There is a range of circuits available to convert the 5 V UART Signal to RS232, RS422/485 or to USB or Ethernet. Please contact metraTec if you need advice on such converter circuits.

Via	Via Function
X2.3	Rx
X2.4	Tx

Tab. 3: UART Via connections

The UART commands used to control the Dwarf14 Module are described in the metraTec 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.

5 External Antenna

The Dwarf14 SMD Module uses an external antenna to communicate with the RFID transponder. This antenna can be connected to the U.FL connector on the module or directly to the two antenna vias. In the later case you can directly bond the module to the antenna with no need of any cables.

Via	Via Function
X1.1	Antenna Ground
X1.2	Antenna Signal / Hot Pin

Tab. 4: Antenna Via connections

Depending on the size of the external antenna, size of the transponder as well as mounting situation, you can expect a read range between 30 mm and 150 mm.

6 Digital Inputs / Outputs (GPIOs)

The Dwarf14 Module has eight freely configurable input/output pins which can be set and read via the module. To use these GPIOs just connect your signals to the corresponding vias (X3). All signals are 5 V DC signals.

ATTENTION

Please make sure that you only connect 5 V level devices to the GPIOs or use the right level shifter if connecting other devices. Some devices use 12 V or even 24 V DC inputs/outputs. If you connect these without proper protection, this will most likely destroy the Dwarf14.

Pin	Pin Function
X3.1	Input/Output 0
X3.2	Input/Output 1
X3.3	Input/Output 2
X3.4	Input/Output 3
X3.5	Input/Output 4
X3.6	Input/Output 5
X3.7	Input/Output 6
X3.8	Input/Output 7

Tab. 5: Overview of digital input/output pins

7 Certification

ATTENTION

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

7.1 CE / ETSI (EU)

The Dwarf14 HF RFID Module complies with ETSI Rule EN 300 330. 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.

7.2 FCC (USA)

The Dwarf14 HF RFID Module complies with Part 15 of the FCC Rules. Since the module has no internal power supply regulation as well as no RF shielding the device has no modular approval according to FCC Rules (see FCC document DA 00-1407).

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.

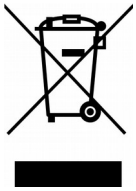
7.3 IC (Canada)

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.

8 Further Notes

Electronic devices like the Dwarf14 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.



9 Version History

Version	*Change*	*Changed by*	*Date*
1.0	created	KD	19.06.2012
1.1	Corrected use of Label MIFARE®	CS	20.01.2014
1.2	Further Notes added, Security Advice added, current consumption and GPIO corrected, minor changes	CS	06.05.2015
1.3	minor changes to certification note	CS	16.06.2015
1.4	update address	KS	29.11.2016

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Changes in function, form, features can happen without prior notice.