

# **TR-54D**

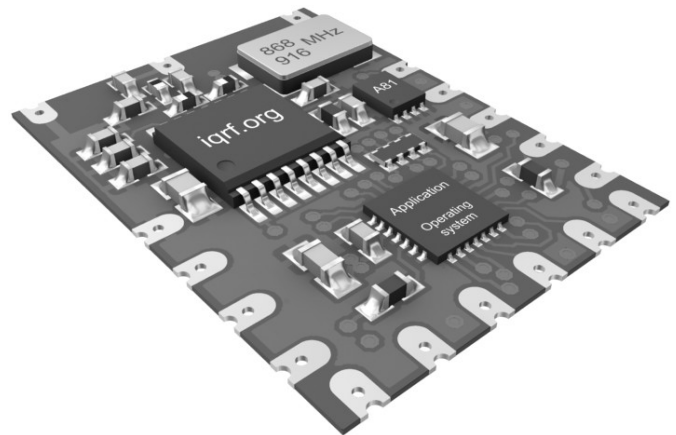
## **Transceiver Module**

### **Data Sheet**



## Description

TR-54D is a family of IQRF transceiver modules operating in the 868 MHz and 916 MHz license free ISM (Industry, Scientific and Medical) frequency band. Its highly integrated ready-to-use design requires no external components. Extra low power consumption fits for battery powered applications. SMT mounting and very small dimensions allow space saving.



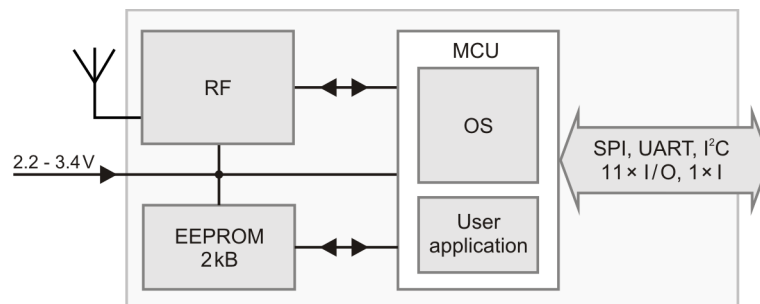
## Key features

- Complete solution with operating system, easy to use
- FSK modulation
- Selectable RF band 868 / 916 MHz, multiple channel
- Selectable RF bit rate
- MCU with extended resources
- Extra low power consumption, power management modes
- SPI interface supported by OS on background
- Serial EEPROM
- Battery monitoring
- 18 pins, 11 I/Os, 1 input only, 4 analog inputs (A/D)
- Optional on-board antenna
- Stamp hole pads, SMT mounting, no SIM card compatible
- Very small dimensions

## Applications

- Telemetry
- Building automation
- Control & regulation
- Remote data acquisition
- Communication links
- Wireless networks
- RF connectivity in many other areas

## Block diagram



**Electrical specifications**
*(Typical values unless otherwise stated, for brief guidance only)*

Supply voltage ( $V_{CC}$ ) <sup>1</sup>	2.2 V min., 3.4 V max., <b>3.0 V typ.</b> , stabilized.
Operating temperature	0 °C to +70 °C -40 °C to +85 °C (Industrial) available on request
Supply current	
Sleep mode	380 nA (if all peripherals including MRF49XA disabled <sup>3</sup> )
Additional supply current	800 nA (if watchdog enabled) 7.5 µA (if brown-out detection enabled)
Run mode	1 mA (MRF49XA disabled)
Additional supply current	0.6 mA (MRF49XA on)
Rx mode	STD mode: 13 mA LP mode: OS v3.01D: 400 µA, from OS v3.02D: 330 µA XLP mode: OS v3.01D: 35 µA, from OS v3.02D: 25 µA
Tx mode	14 mA – 24 mA (according to RF output power)
Nominal frequency	868.35 MHz or 916.50 MHz (software selectable)
Channels	See IQRF OS User's guide, Appendix 2, Channel maps
RF data modulation	FSK (frequency-shift keying)
RF data transmission bit rate	1.2 kb/s <sup>5</sup> , 19.2 kb/s, 57.6 kb/s <sup>5</sup> , 86.2 kb/s <sup>5</sup>
RF sensitivity	Depends on frequency band and bit rate:

	bit rate [kb/s]	1.2 <sup>5</sup>	19.2	57.6 <sup>5</sup>	86.2 <sup>5</sup>
RF sensitivity [dBm]	868 MHz	-110	-104	-99	-92
	916 MHz	-109	-102	-97	-90

RF output power

Programmable in 8 levels (0 – 7), -2.5 dBm/level

level	0	1	2	3	4	5	6	7
[dBm]	-12.5	-10	-7.5	-5	-2.5	0	2.5	5

 RF range (TR-54DA)<sup>2</sup>

 Up to 850 m @ 1.2 kb/s<sup>5</sup>  
 Up to 650 m @ 19.2 kb/s

Input voltage on Q4 to Q15 pins

 0 V to  $V_{CC}$ 

A/D converter

10 bit, 4 inputs (multiplexed S&amp;H, successive approximation)

Input A/D impedance

10 kΩ max.

Dimensions

 20.2 mm x 14.9 mm x 3.0 mm (TR-54D)  
 26.4 mm x 14.9 mm x 3.0 mm (TR-54DA)

**Note 1:** RF power and other parameters depend on supply voltage. Refer to datasheets of MCU and RF IC used. Test your application with respect to required supply voltage range.

**Note 2:** RF range strongly depends on module orientation and surroundings.

**Note 3:** Additional current is consumed when a peripheral is enabled.

**Note 4:** Depends on interferences.

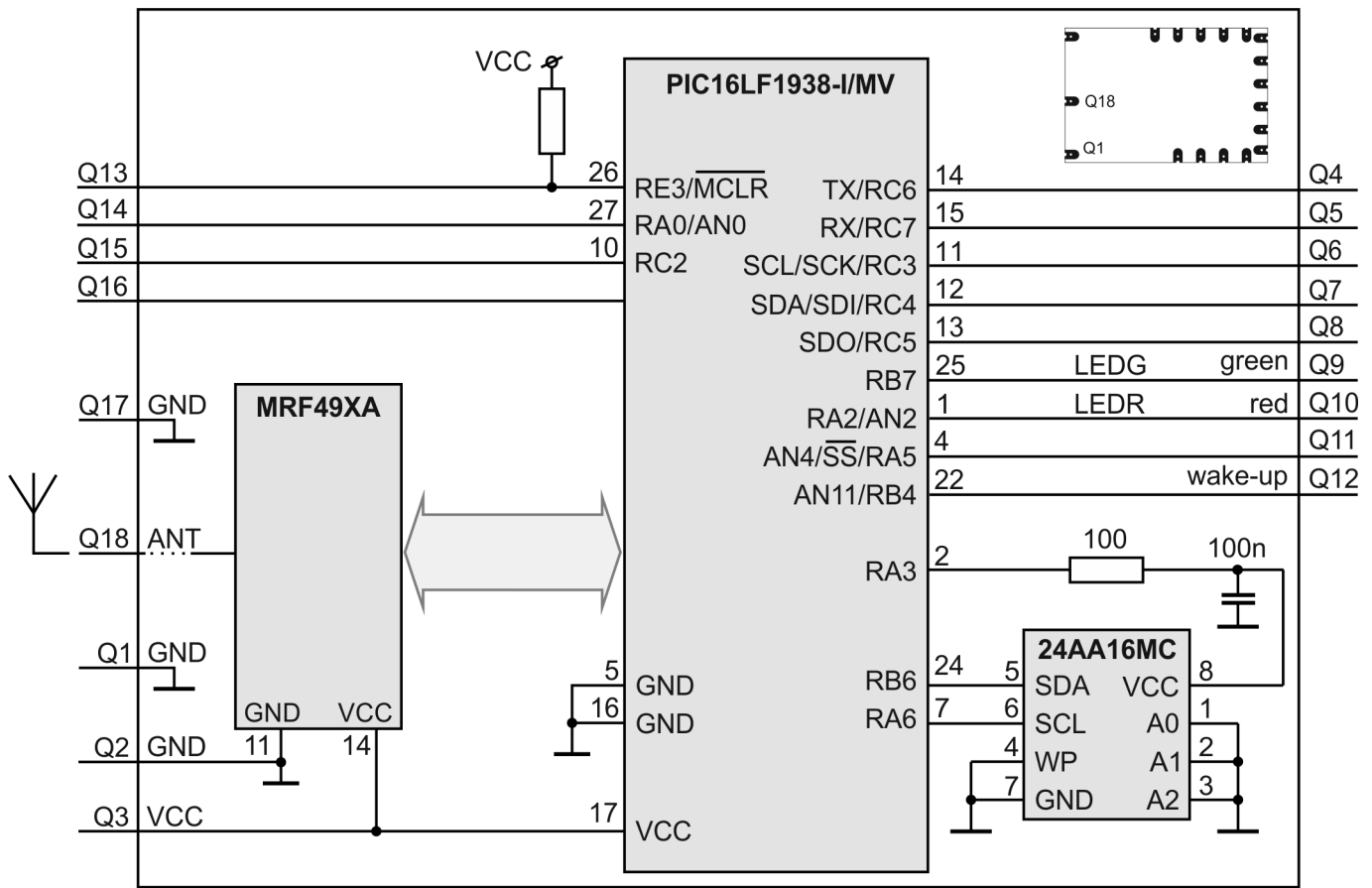
**Note 5:** Bit rates different from 19.2 kb/s are preliminary, for experimental purpose only.

*Users have to ensure observing local provisions and restrictions relating to the use of short range devices by software, e.g. the CEPT ERC/REC 70-03 Recommendation and subsequent amendments in EU.*

**Absolute maximum ratings**

Stresses above the following values may cause permanent damage to the device. Exposure to maximum rating conditions for extended periods may affect device reliability.

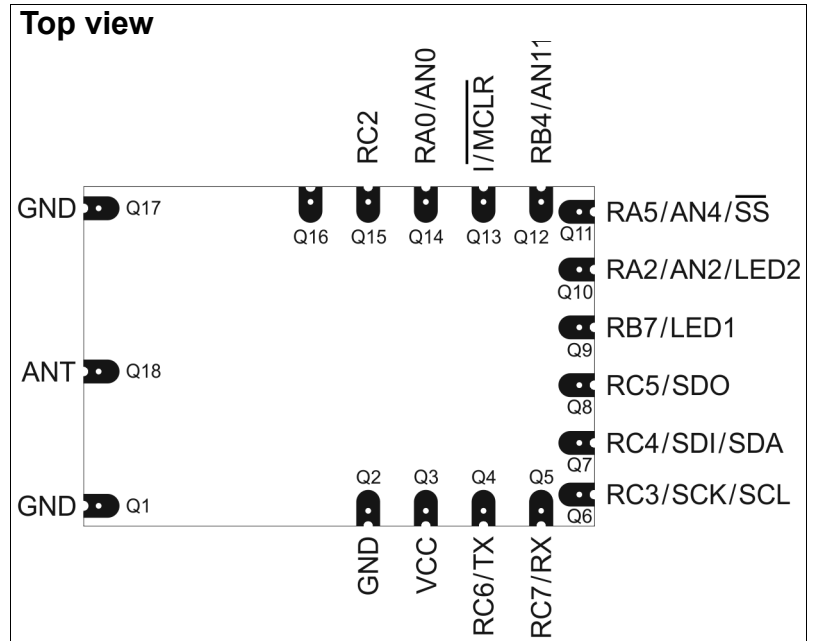
Supply voltage ( $V_{CC}$ )	4 V
Voltage on Q4 to Q15 pins	-0.3 V to ( $V_{CC} + 0.3 V$ )
Storage temperature	-50 °C to +100 °C
Ambient temperature under bias	-40 °C to +85 °C

**Simplified schematic**

**Basic parts**

Part	Type	Manufacturer	Note
MCU	PIC16LF1938-I/MV	Microchip	
RF IC	MRF49XA	Microchip	
EEPROM	24AA16/MC	Microchip	2 kB

For more information refer to respective datasheets.

Pin	Name	Description
Q1 <sup>6</sup>	<b>GND</b>	Ground
Q2	<b>GND</b>	Ground
Q3	<b>VCC</b>	Power supply voltage
Q4	<b>IO/TX</b> RC6 TX	General I/O pin UART TX
Q5	<b>IO/RX</b> RC7 RX	General I/O pin UART RX
Q6	<b>IO/SCK/SCL</b> RC3 SCK SCL	General I/O pin SPI clock input I <sup>2</sup> C clock
Q7	<b>IO/SDI/SDA</b> RC4 SDI SDA	General I/O pin SPI data I <sup>2</sup> C data
Q8 <sup>7</sup>	<b>IO/SDO</b> RC5 SDO	General I/O pin SPI data out
Q9	<b>IO/LED1</b> RB7 LED1	General I/O pin LEDR supported by OS
Q10	<b>IO/AN/LED2</b> RA2 AN2 LED2	General I/O pin Analog A/D input LEDR supported by OS
Q11	<b>IO/AN/-SS</b> RA5 AN4 -SS	General I/O pin, Analog A/D input SPI Slave select
Q12	<b>IO/AN</b> RB4 AN11	General I/O pin Analog A/D input
Q13	<b>I</b> RE3	General input only pin
Q14	<b>IO/AN</b> RA0 AN0	General I/O pin Analog A/D input
Q15	<b>IO</b> RC2	General I/O pin
Q16		Do not use, leave unconnected
Q17 <sup>6</sup>	<b>GND</b>	Ground
Q18 <sup>6</sup>	<b>ANT</b>	Antenna

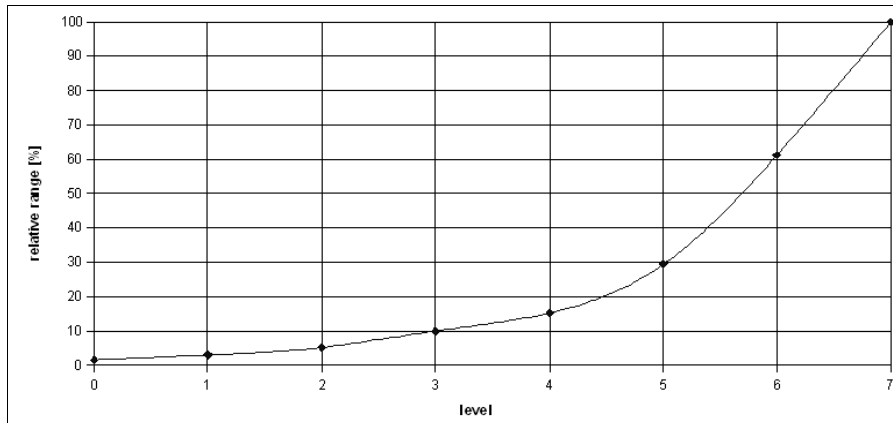


**Note 6:** Not implemented for TR-54DAx.

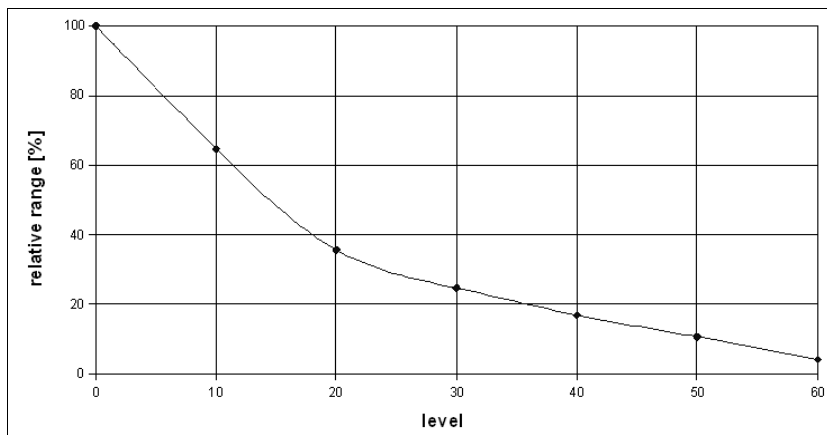
**Note 7:** This pin is used as output during initial ~250 ms boot-up to recognize programming mode.

There are no on-board protection series resistors on I/O pins. It is recommended to use 200 Ω series resistors on each pin.

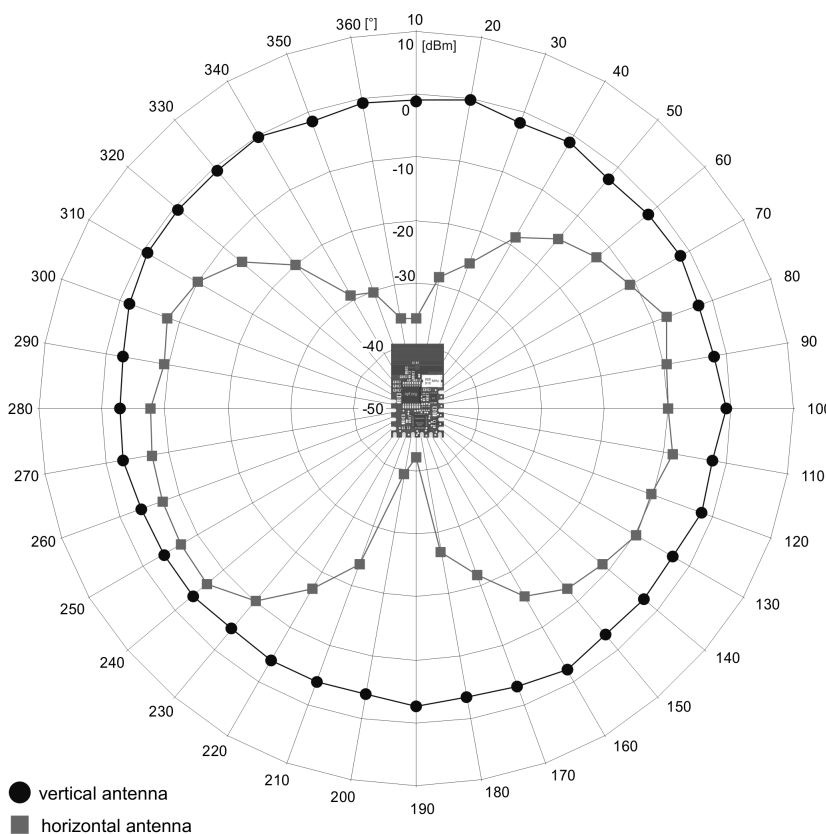
**Figure 1:** Relative RF range vs. level for the `setTXpower(level)` function. Refer to IQRF OS Reference guide.



**Figure 2:** Relative RF range vs. level for the `checkRF(level)` function. Refer to IQRF OS Reference guide.

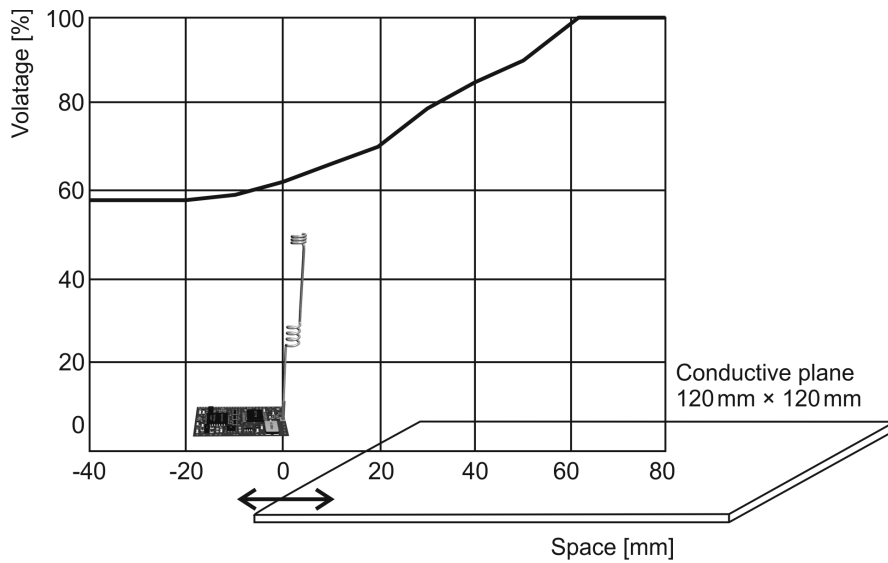
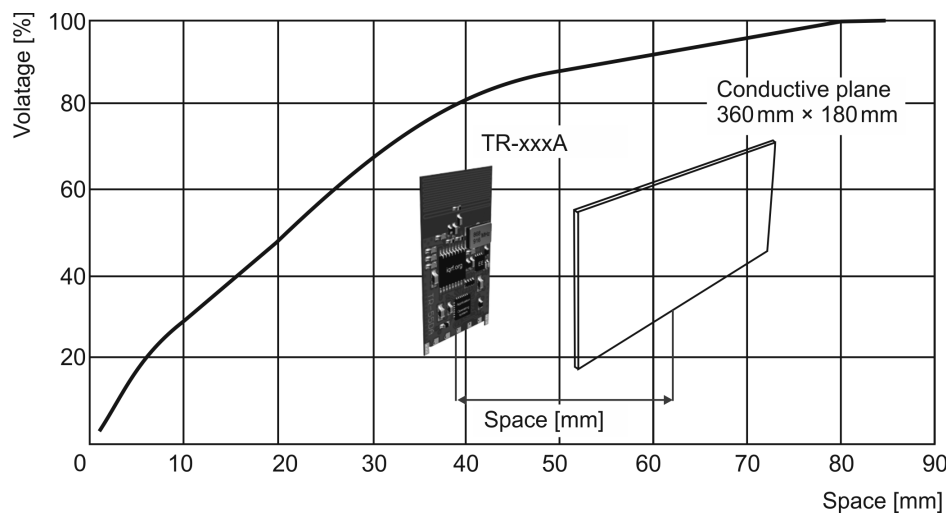


**Figure 3:** TR-54DA relative RF range vs. antenna orientation (radiation patterns)



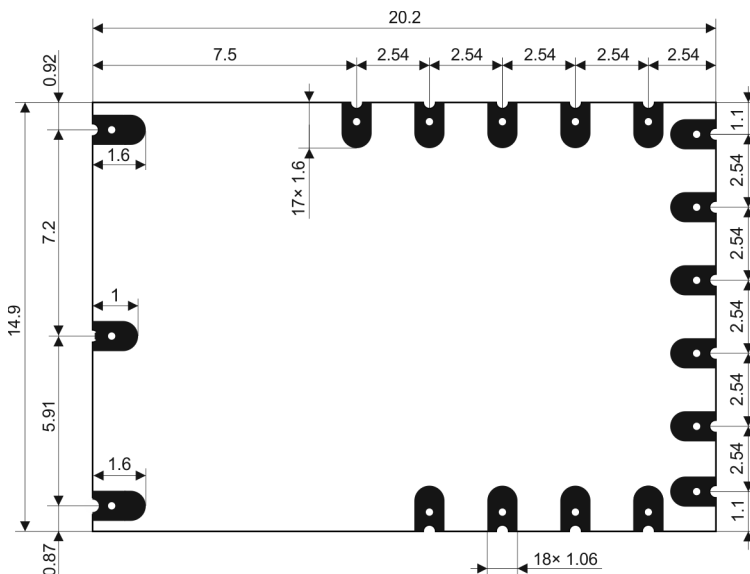
**Relative decrease of RF input signal vs. antenna edge spacing to conductive areas**

Conductive areas close to the antenna must be avoided.

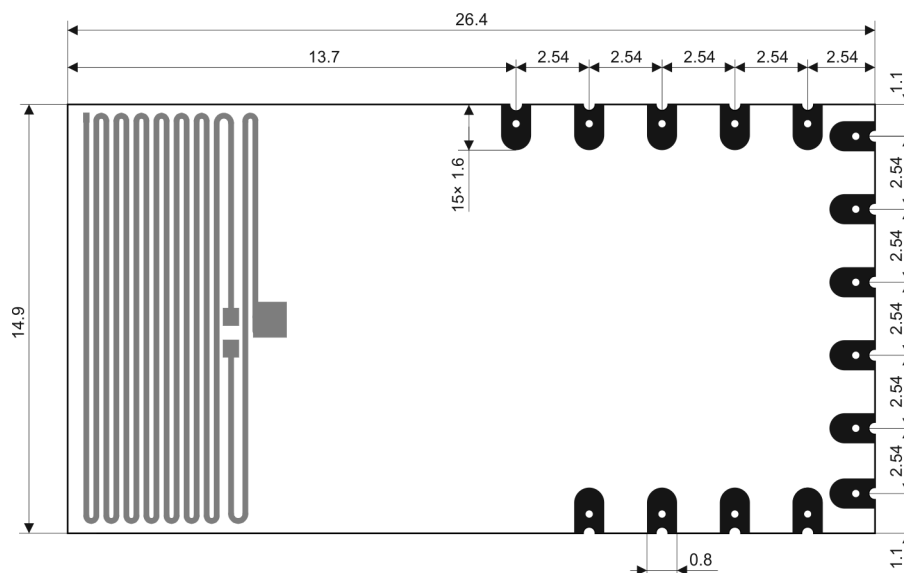
**Figure 4: Perpendicular arrangement****Figure 5: Parallel arrangement**

## Dimensions

TR-54D

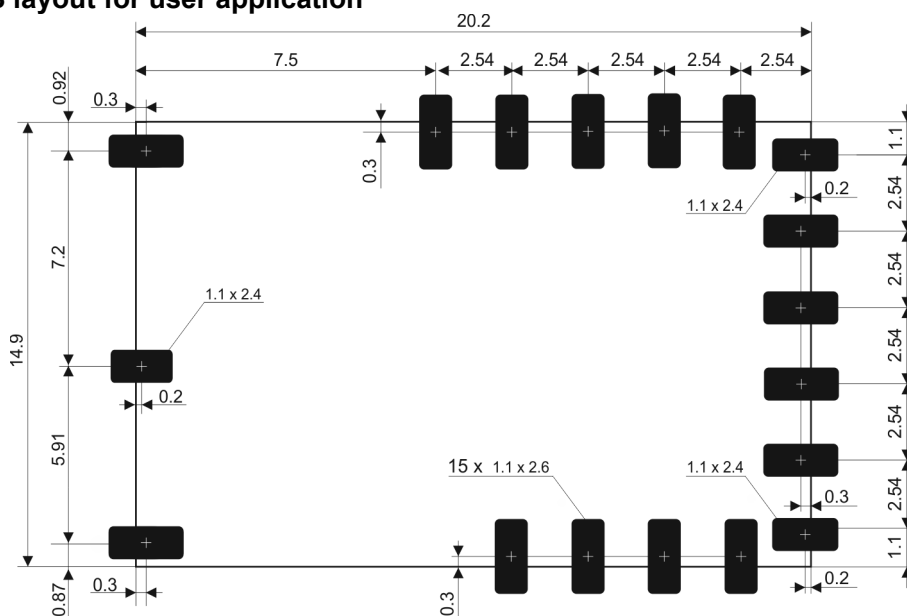


TR-54DA



Top view, units: mm

## Recommended PCB layout for user application



Top view, units: mm





---

# Sales and Service

---

## Corporate office

MICRORISC s.r.o., Delnicka 222, 506 01 Jicin, Czech Republic, EU  
Tel: +420 493 538 125, Fax: +420 493 538 126, [www.microrisc.com](http://www.microrisc.com)

## Partners and distribution

Please visit [www.iqrf.org/partners](http://www.iqrf.org/partners)

---

## Quality management

*ISO 9001 : 2009 certified*

*Complies with ETSI directives EN 30279 V.1.2.1:99, ETS 30683:97, ETSI EN 301489-1:00,  
ETSI EN 300220-1:00, ETSI EN 300390-2V.1.1.1:00*

*Complies with FCC directives FCC CFR, Title 47, Part 15, Section 15.209, FCC CFR, Title 47, Part 15, Section 15.249*

*Complies with Directive 2002/95/EC (RoHS)*



## Trademarks

*The IQRF name and logo are registered trademarks of MICRORISC s.r.o.  
PIC, SPI, Microchip, RFM and all other trademarks mentioned herein are property of their respective owners.*

## Legal

*All information contained in this publication is intended through suggestion only and may be superseded by updates without prior notice. No representation or warranty is given and no liability is assumed by MICRORISC s.r.o. with respect to the accuracy or use of such information.*

*Without written permission it is not allowed to copy or reproduce this information, even partially.*

*No licenses are conveyed, implicitly or otherwise, under any intellectual property rights.*

*The IQRF products utilize several patents (CZ, EU, US)*

---

**On-line support: [support@iqrf.org](mailto:support@iqrf.org)**

---



Smarter wireless. Simply.