

TR-54D

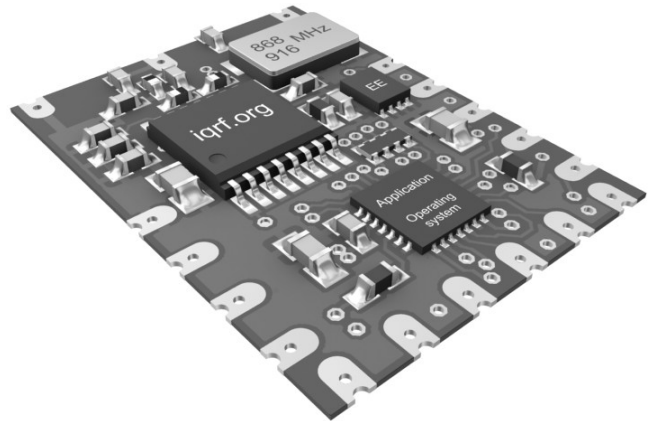
Transceiver Module

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.



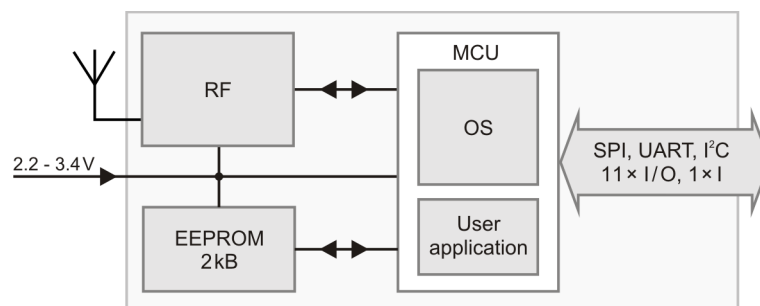
Applications

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

Key features

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

Block schematics



Electrical specifications	<i>(Typical values unless otherwise stated, for brief guidance only)</i>
Supply voltage (V_{CC}) ¹	2.2 V min., 3.4 V max., 3.0 V typ. , 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 ⁴)
Additional supply current	800 nA (if watchdog enabled) 7.5 μ A (if brown-out detection enabled)
Run mode	1 mA (MRF49XA disabled)
Additional supply current	0.6 mA (MRF49XA on)
Rx mode	13 mA (STD mode) 400 μ A (LP mode ⁵) 35 μ A (XLP mode ⁵)
Tx mode	14 mA – 24 mA (according to RF output power)
RF sensitivity ²	-110 dBm @ 868 MHz, 1.2 kb/s - 99 dBm @ 868 MHz, 19.2 kb/s -109 dBm @ 916 MHz, 1.2 kb/s -102 dBm @ 916 MHz, 19.2 kb/s
RF output power	Up to 5 dBm, programmable in 8 steps (7 – 0), -3dBm/step
RF range (TR-52DA) ³	Up to 850 m @ 1.2 kb/s Up to 650 m @ 19.2 kb/s
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, 19.2 kb/s, 57.6 kb/s, 86.2 kb/s
Input voltage on Q4 to Q15 pins	0 V to V_{CC}
A/D converter	10 b, 4 inputs (multiplexed S&H, successive approximation)
Input A/D impedance	10 k Ω 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 sensitivity depends on frequency band and bit rate.

Note 3: RF range strongly depends on module orientation and surroundings.

Note 4: Additional current is consumed when a peripheral is enabled.

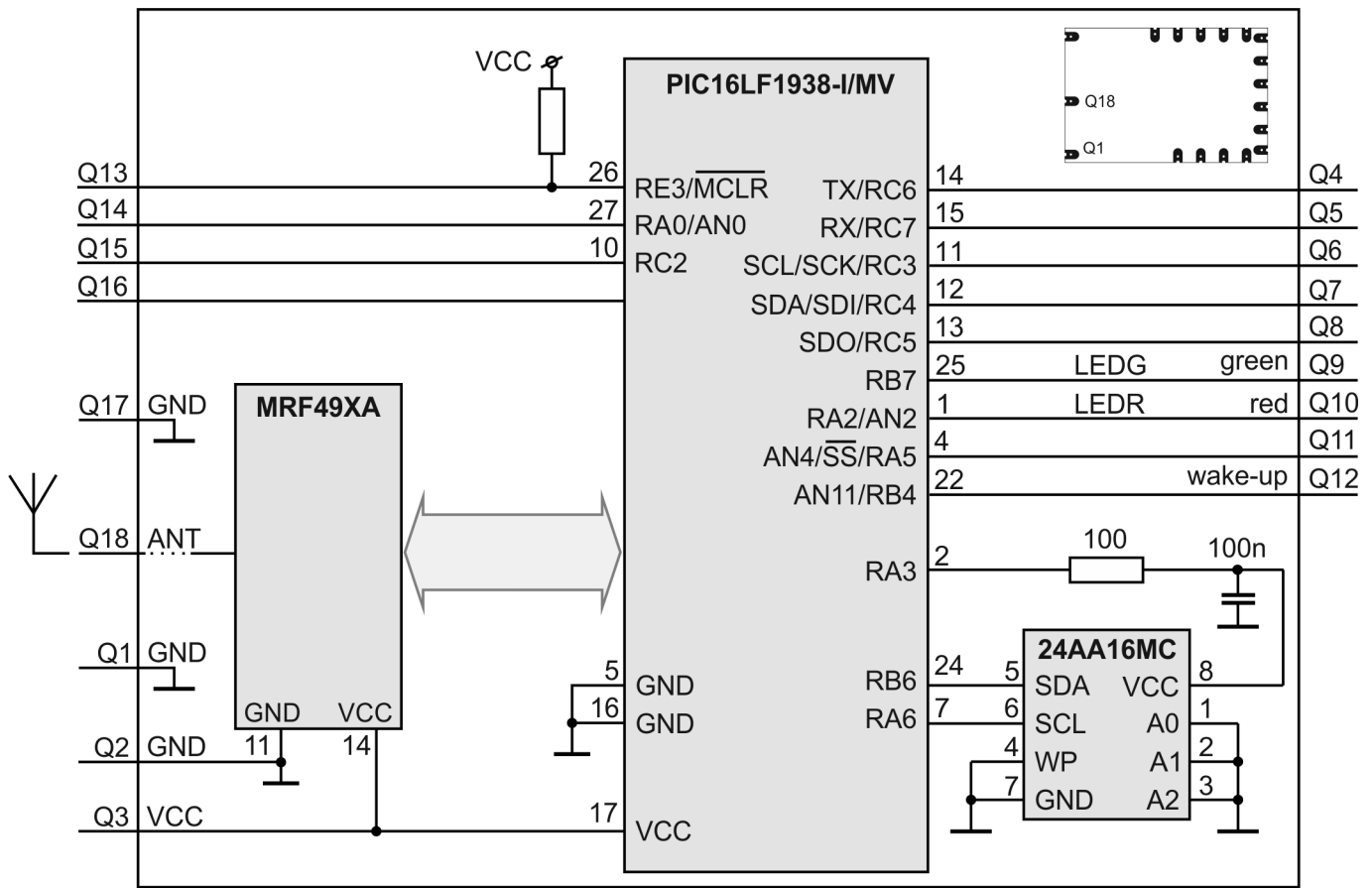
Note 5: Depends on interferences.

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

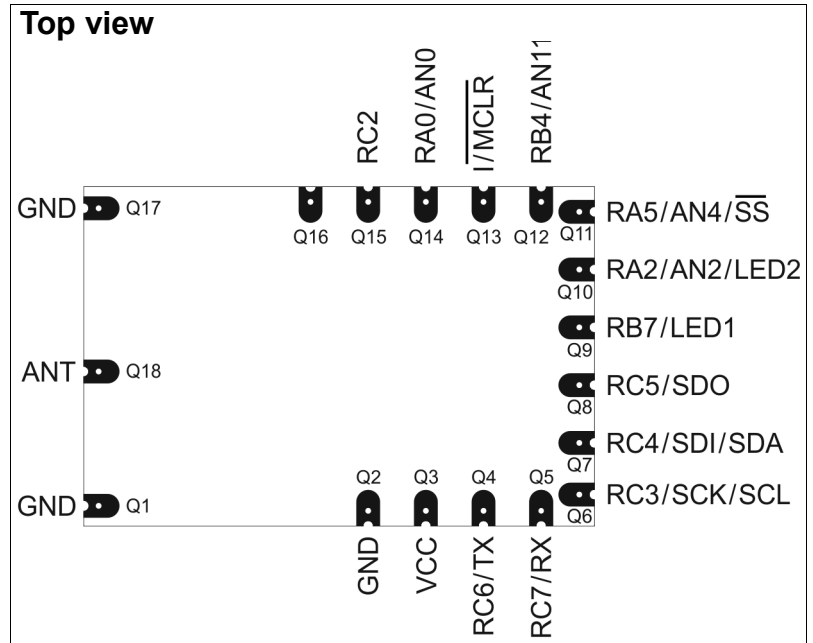
Supply voltage (V_{CC})	4 V
Voltage on Q4 to Q15 pins	-0.3 V to ($V_{CC} + 0.3$ V)
Storage temperature	-50 °C to +100 °C
Ambient temperature under bias	-40 °C to +85 °C

Simplified schematics

Basic parts

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

For more information refer to respective datasheets.

Pin	Name	Description
Q1 ⁶	GND	Ground
Q2	GND	Ground
Q3	VCC	Power supply voltage
Q4	IO/TX RC6 TX	General I/O pin UART TX
Q5	IO/RX RC7 RX	General I/O pin UART RX
Q6	IO/SCK/SCL RC3 SCK SCL	General I/O pin SPI clock input I ² C clock
Q7	IO/SDI/SDA RC4 SDI SDA	General I/O pin SPI data I ² C data
Q8 ⁷	IO/SDO RC5 SDO	General I/O pin SPI data out
Q9	IO/LED1 RB7 LED1	General I/O pin LEDR supported by OS
Q10	IO/AN/LED2 RA2 AN2 LED2	General I/O pin Analog A/D input LEDR supported by OS
Q11	IO/AN/-SS RA5 AN4 -SS	General I/O pin, Analog A/D input SPI Slave select
Q12	IO/AN RB4 AN11	General I/O pin Analog A/D input
Q13	I RE3	General input only pin
Q14	IO/AN RA0 AN0	General I/O pin Analog A/D input
Q15	IO RC2	General I/O pin
Q16		Do not use, leave unconnected
Q17 ⁶	GND	Ground
Q18 ⁶	ANT	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 series resistors 200 Ω on each pin used to protect against collisions due to possible failures in HW or SW.

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

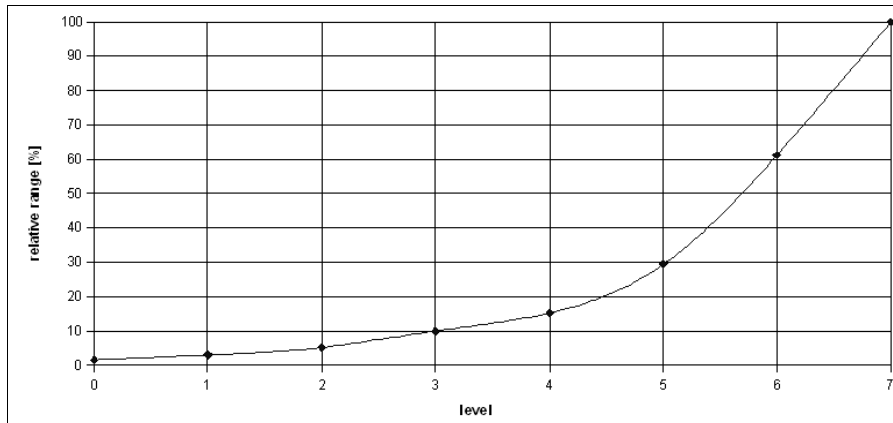


Figure 2: Relative RF range vs. level for the `checkRF(level)` detection. Refer to IQRF OS Reference guide.

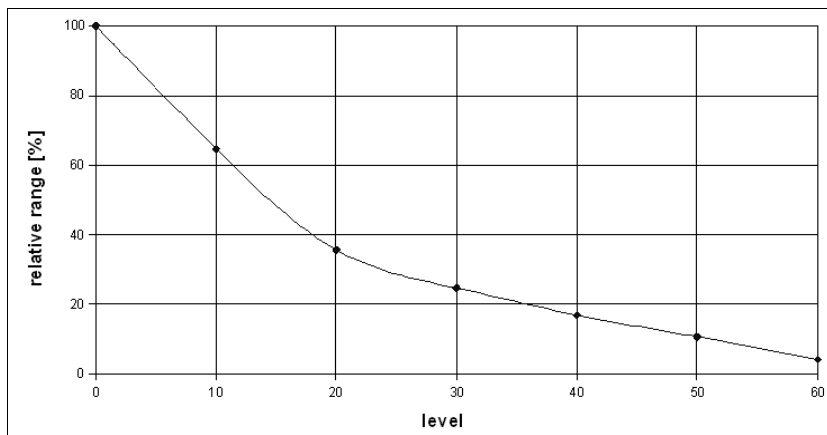
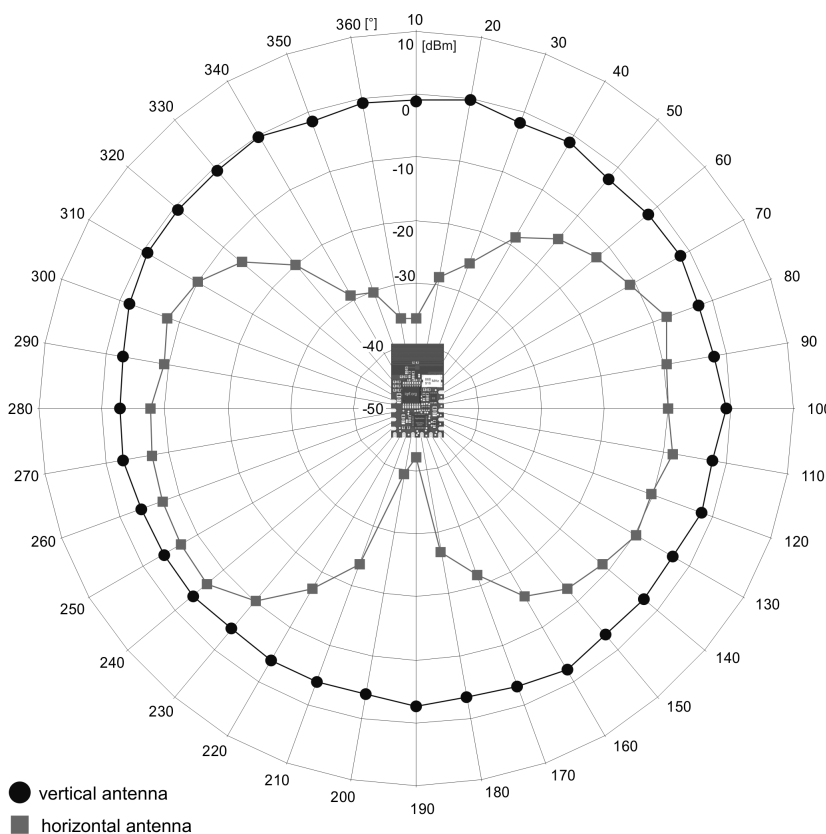


Figure 3: Relative RF range vs. antenna orientation (radiation patterns)



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

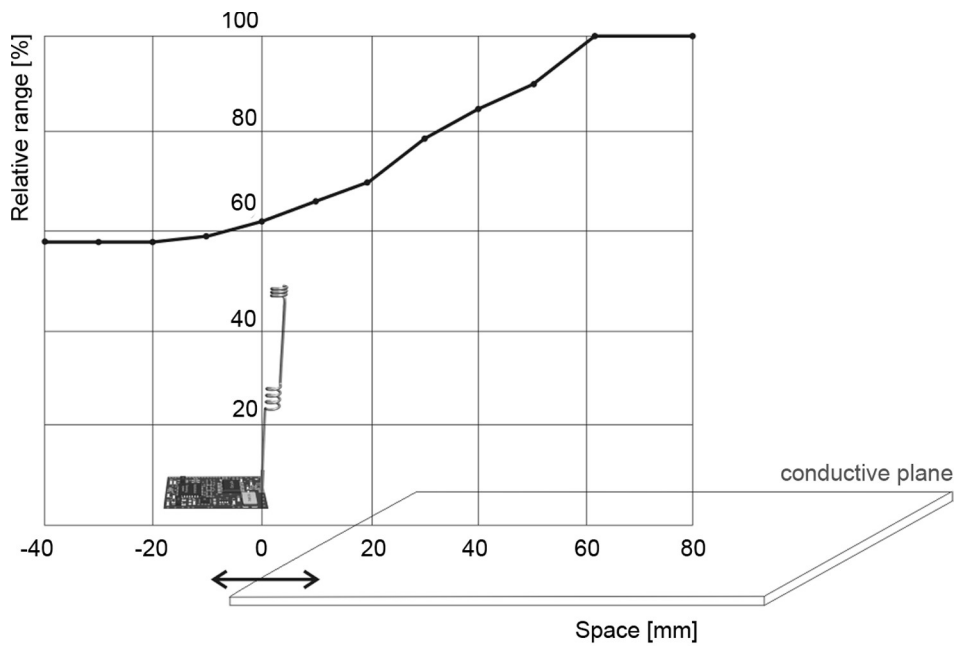
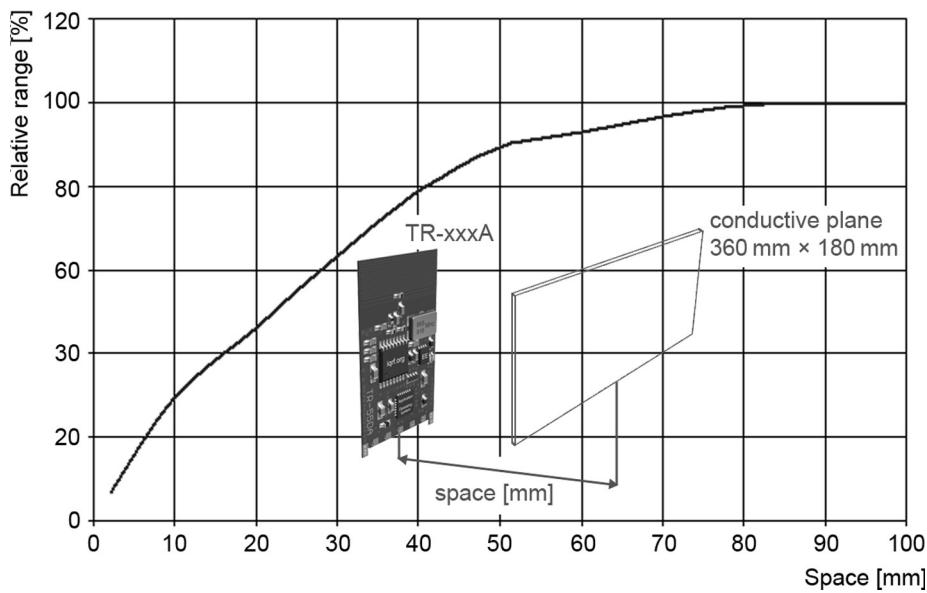
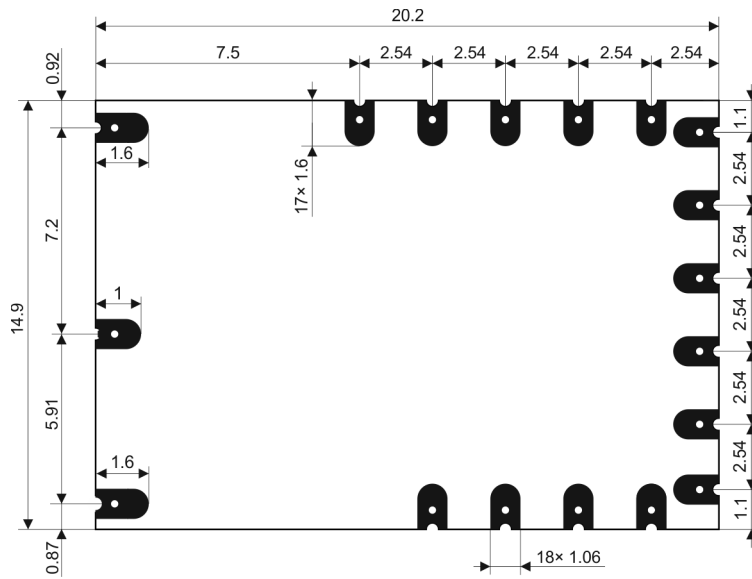


Figure 5: Parallel arrangement

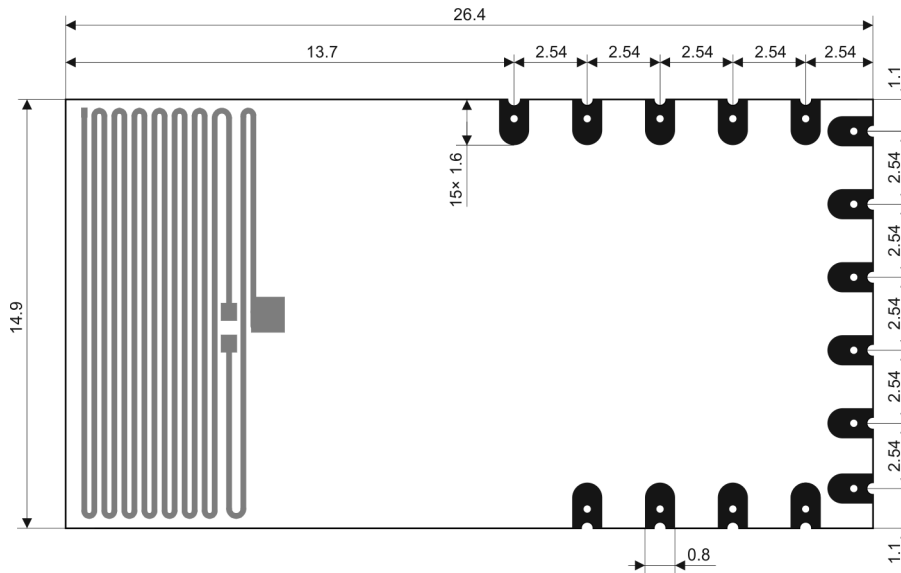


Dimensions

TR-54D

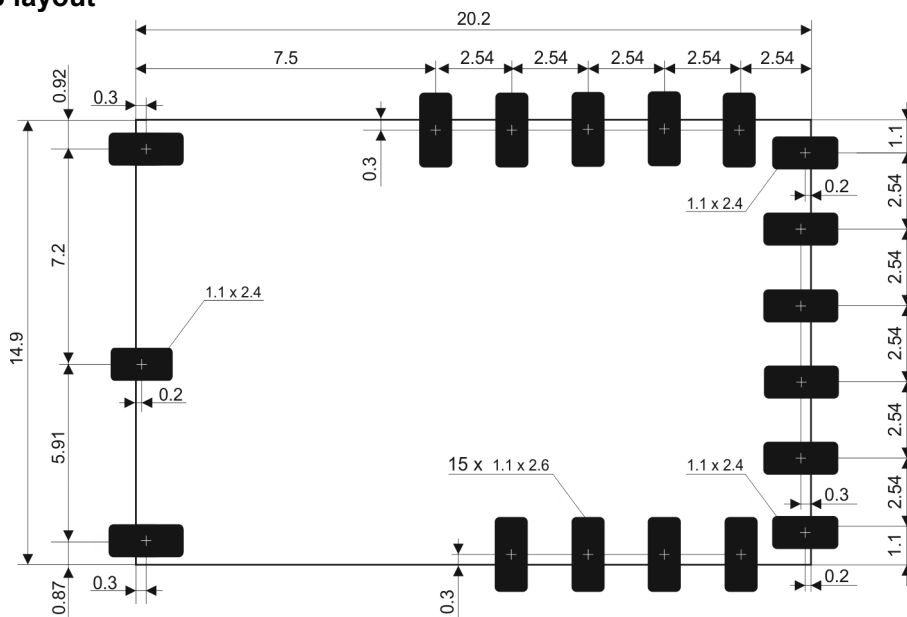


TR-54DA



Top view, units: mm

Recommended PCB layout



Top view, units: mm

Application

See IQRF OS User's guide, IQRF OS Reference guide, Application examples and www.iqrf.org.

Development

TR-54Dx must not be plugged in a SIM connector with metallic holder. To utilize advantages of SIM connector for development, the TR-DB-54DA kit containing the TR-54DA is intended. Refer to the TR-DB-54DA User's guide for details.

Programming

There are two possibilities how to upload a user program in TR-54Dx modules soldered in an application:

- Wireless upload (RFPGM). See the IQRF OS User's guide.
- For wired upload using the CK-USB-04 programmer the KON-PGM-01 adapter is intended. GND and SPI pins must be connected between the adapter and TR. SPI pins must be disconnected from application circuitry during the upload.
 - Supplying from the adapter is possible for low consumption applications only.
 - For higher consumption, the application must be supplied from its own power source during uploading. In this case the following sequence must be observed to set TR-54D in programming mode:
 - Connect a resistor (typically 1 kΩ) between the SDI and SDO pins.
 - Switch application power on.
 - Wait about 1 s and then remove the resistor.
 - Run IQRF IDE.

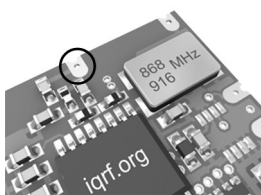
See the KON-PGM-01 User's guide for details.

Product information

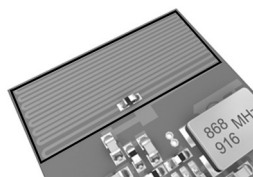
Ordering codes

TR - 5 4 D A
 antenna options: **nil** - soldering pad-hole (no antenna, no U.FL connector)
 A - PCB antenna

Type	Antenna option	Serial EEPROM
TR-54D	Soldering pad-hole	2 kB
TR-54DA	Internal PCB antenna	2 kB



TR-54D



TR-54DA

Document history

- 120622 Block schematics and Figure 5 added. Chapter Programming precised. Figures Dimensions and Recommended PCB layout precised.
- 120601 Electrical specifications updated. Chapters Pin description, Development and Programming updated. Recommended PCB layout added. All TR-54Dx are equipped with serial EEPROM.
- 120425 Changes in pins, dimensions and antenna options. RF range specified. Fig. 4 added. Schematics simplified. Preliminary.
- 111011 Preliminary.

Sales and Service

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