

TR-54D

Transceiver Module

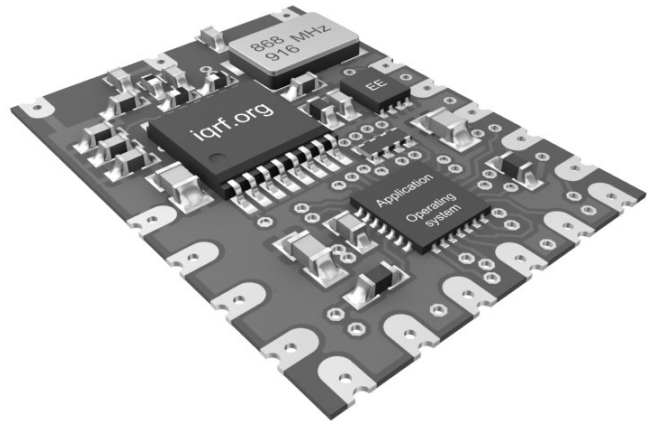
Data Sheet

Preliminary



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 small dimensions allow space saving.



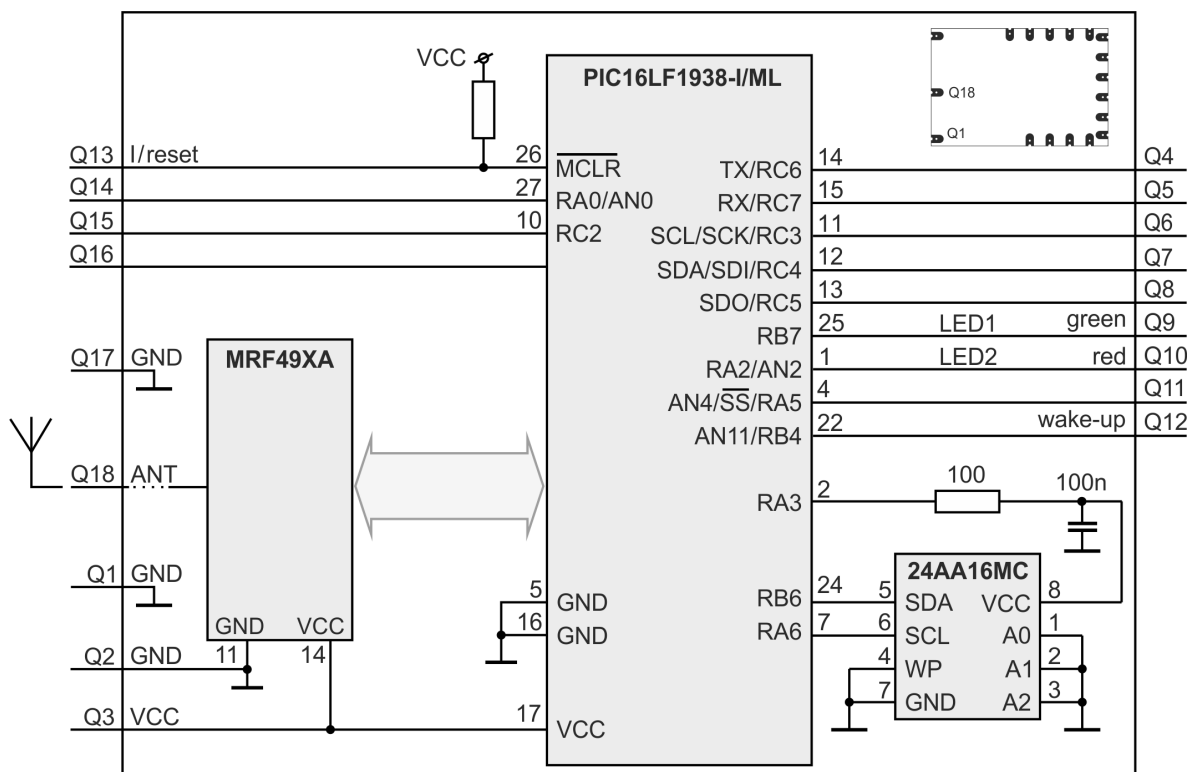
Applications

- 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
- Extra low power consumption, power management modes
- SPI interface supported by OS on background
- 18 pins, 11 I/Os, 1 input, 4 A/D inputs
- Stamp hole pads, SMT mounting, no SIM card compatible
- Optional serial EEPROM
- Small dimensions

Simplified schematics



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

Supply voltage (V_{CC})	3.0 V \pm 0.1 V
Operating temperature	0 °C to +70 °C -40 °C to +85 °C (Industrial) available on request
Supply current	
Sleep mode	900 nA (all peripherals including MRF49XA disabled)
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 ³) 35 μ A (XLP mode ³)
Tx mode	14 mA – 24 mA (according to RF output power)
RF sensitivity ¹	-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) ²	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 sensitivity depends on frequency band and bit rate.

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

Note 3: 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.

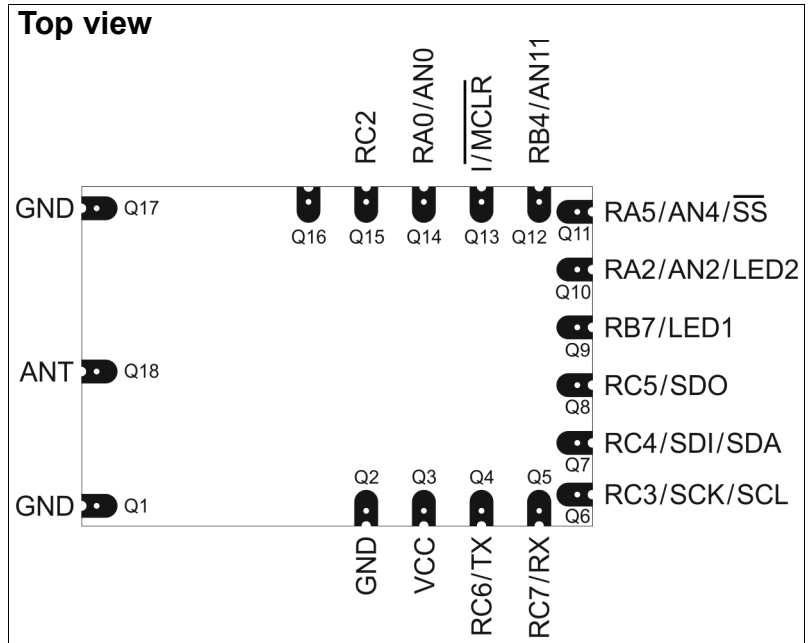
Supply voltage (V_{CC})	4 V
Voltage on Q4 to Q15 pins	-0.3 V to ($V_{CC} + 0.3$ V)
Storage temperature	-50 °C to +100 °C
Ambient temperature under bias	-40 °C to +85 °C

Basic parts

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

For more information refer to respective datasheets.

Pin	Name	Description
Q1 ⁴	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 ³	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 ⁴	GND	Ground
Q18 ⁴	ANT	Antenna



Note 3: This pin is used as output during initial ~250 ms boot-up to recognize programming mode.

Note 4: Not implemented for TR-54DAx.

There are no on-board protection serial resistors on I/O pins.

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

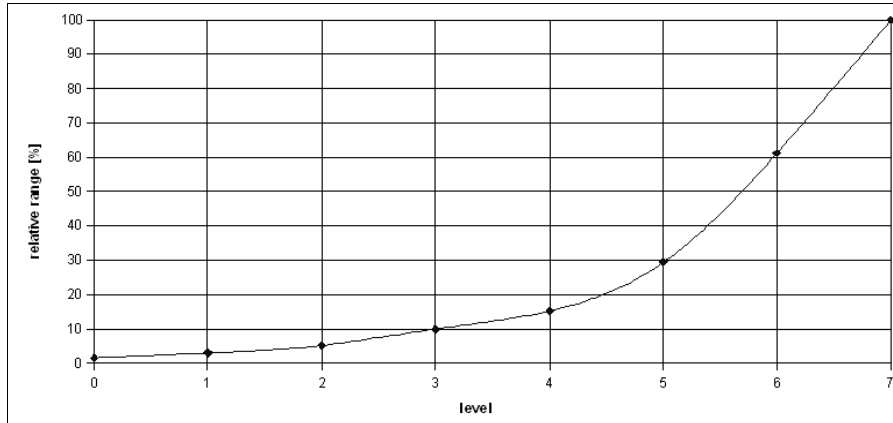


Figure 2: Relative RF range vs. level for the `checkRF(level)` detection. Refer to IQRF OS Reference guide.

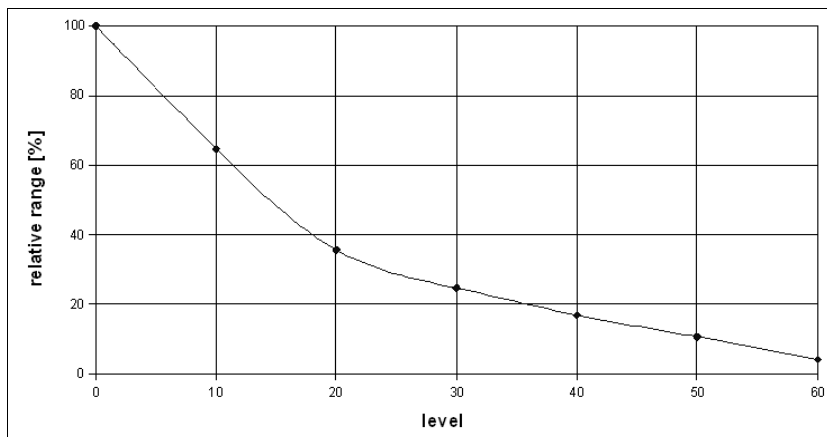
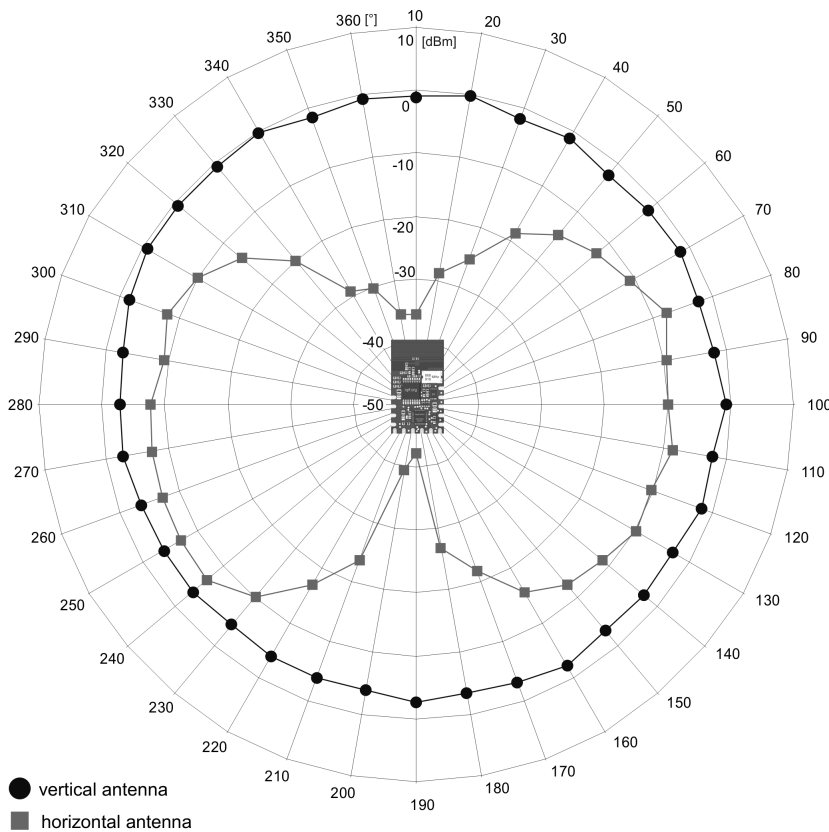
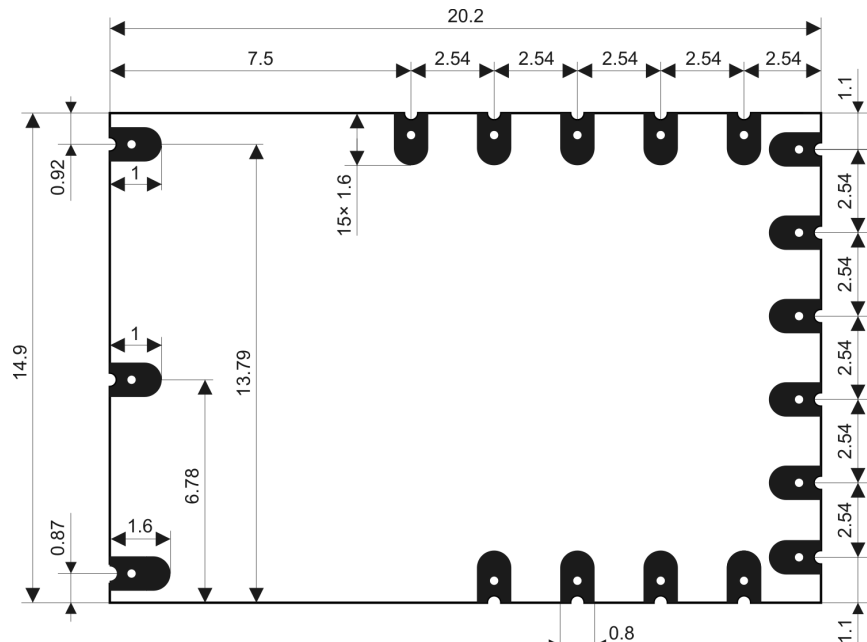


Figure 3: Relative RF range vs. antenna orientation (radiation patterns)

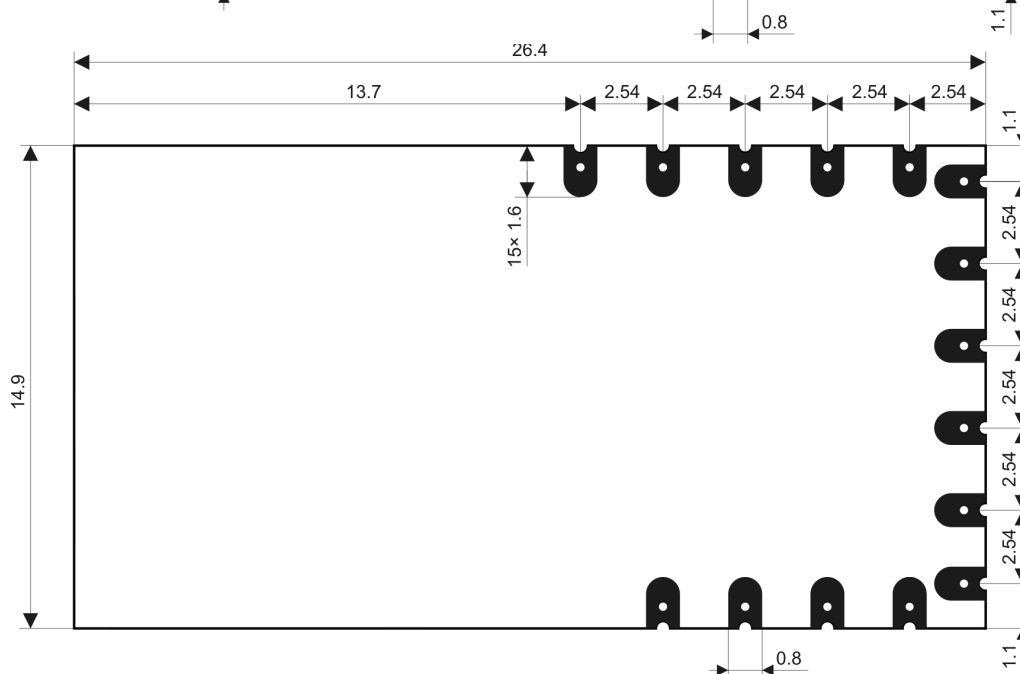


Dimensions

TR-54D(C)(E)

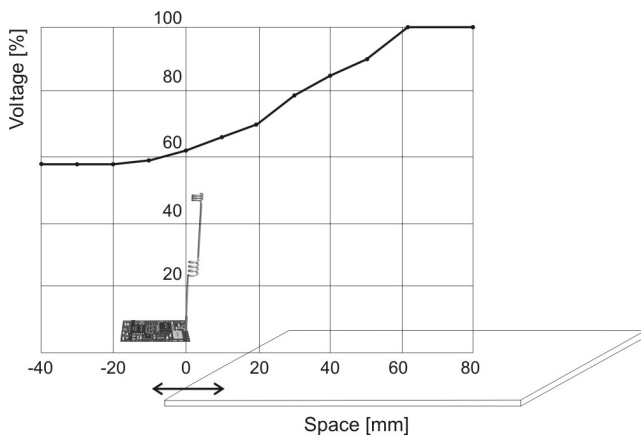


TR-54DA(E)



Top view, units: mm

Figure 4: Relative decrease of RF input signal vs. antenna edge spacing to conductive areas



Conductive areas close to the antenna must be avoided. Recommended minimal spacing is 10 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. For development, the TR-54DAE-SIM is intended. It is a kit containing the TR-54DAE to be plugged in the SIM connector allowing to use this TR like other TR modules in SIM card formats. Refer to the DK-54D-01 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 (RF PGM). See the Application note AN009.
- Wired upload. Standard IQRF programmer (e.g. CK-USB-04) with the programming adapter can be used. Connect power supply, GND and SPI pins between the programmer and the application. SPI pins as well as power supply must be disconnected from application circuitry during the upload.

Product information

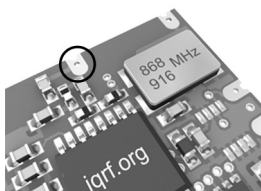
Ordering codes

TR - 5 4 D A EE

peripheral options: **nil** - no serial EEPROM
E - serial EEPROM

antenna options: **nil** - soldering pad/hole (no antenna, no U.FL connector)
A - PCB antenna

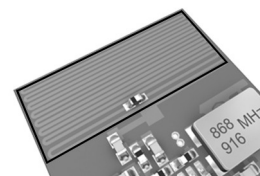
Type	Antenna option	Serial EEPROM
TR-54D	Soldering pad/hole	-
TR-54DE	Soldering pad/hole	Yes
TR-54DA	Internal PCB antenna	-
TR-54DAE	Internal PCB antenna	Yes



TR-54D



TR-54DE



TR-54DA

Document history

- 120425 Changes in pins, dimensions and antenna options. RF range specified. Fig. 4 added. Schematics simplified. Preliminary.
- 111011 Preliminary.

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

Partners and distribution

Please visit 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



Smarter wireless. Simply.