

# **TR-52B**

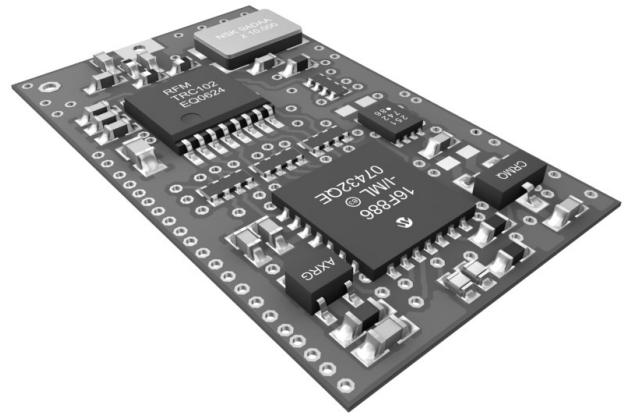
## **Transceiver Module**

### **Data Sheet**



## Description

TR-52B 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. The microcontroller with built-in operating system, excellent development support, integrated LDO regulator, temperature sensor and serial EEPROM dramatically reduce time of application development. Ultra low power consumption predetermines these modules for use in battery powered applications.



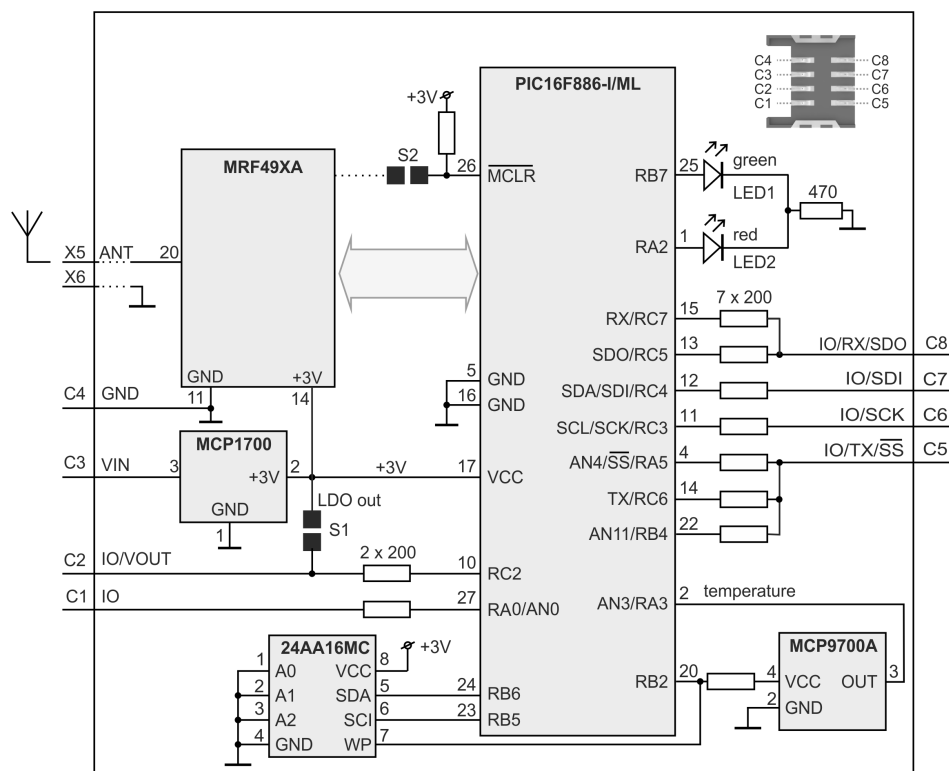
## Applications

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

## Key features

- Complete solution with operating system, easy to use
- Extended RF power, FSK modulation, selectable RF bit rate
- Selectable band 868 / 916 MHz, multiple channel
- MCU with extended Flash memory, additional serial EEPROM
- Ultra low power consumption, power management modes
- SPI interface supported by OS on background
- On-board temperature sensor and battery monitoring
- +3 V LDO regulator output, 2 LEDs
- Up to 6 I/Os, up to 2 analog inputs (A/D)
- SIM card format, low cost
- Coaxial antenna connector (optional)
- On-board antenna (optional)

## Simplified schematics



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

Supply voltage ( $V_{CC}$ )	3.1 V to 5.3 V
LDO output ( $V_{OUT}$ )	+3 V $\pm$ 60 mV ( $V_{CC} > 3.1$ V), 100 mA max.
Operating temperature	0 °C to +70 °C -40 °C to +85 °C (Industrial) available on request
Supply current	
Sleep mode	2 $\mu$ A
Additional watchdog supply current	2 $\mu$ A typ., 4 $\mu$ A max. (if watchdog enabled)
Run mode	1 mA @ 8 MHz (MRF49XA in standby mode)
Additional supply current	0.6 mA ( MRF49XA on) 2 mA (one or two LEDs on)
Rx mode	13 mA (STD mode) 400 $\mu$ A (LP mode <sup>3</sup> ) 35 $\mu$ A max. (XLP mode <sup>3</sup> )
Tx mode	14 mA – 24 mA (according to RF output power)
RF sensitivity <sup>1</sup>	-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-52BA) <sup>2</sup>	up to 700 m @ 1.2 kb/s up to 500 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-keyed)
RF data transmission bit rate	1.2 kb/s – preliminary 19.2 kb/s 57.6 kb/s – preliminary 86.2 kb/s – preliminary
Input voltage on C1, C2, C5 to C8 pins	0 V to $V_{OUT}$
A/D converter	10 b, 2 inputs (multiplexed S&H, successive approximation)
Input A/D impedance	10 k $\Omega$ max.
Temperature sensor accuracy	0.5°C max. (0°C to +65°C)
Size (L x W x H)	25.0 mm x 14.9 mm x 3.0 mm 31.8 mm x 14.9 mm x 3.0 mm (TR-52DA)

**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.

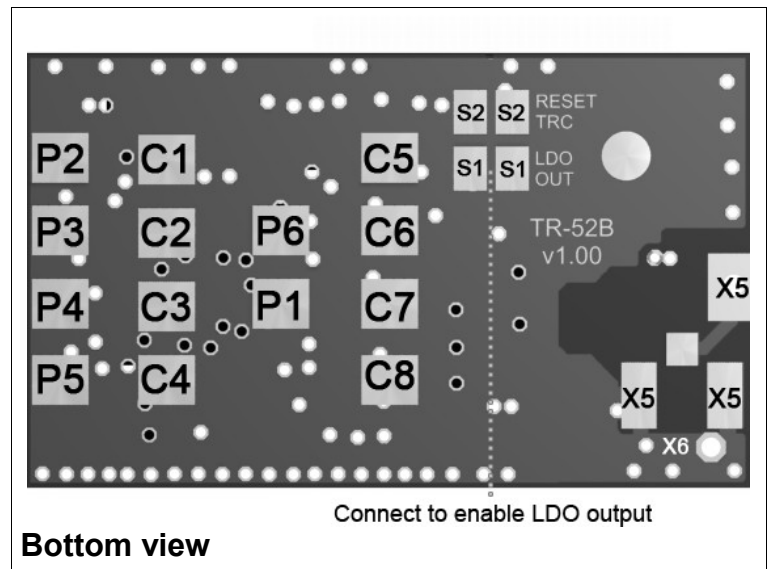
Supply voltage ( $V_{CC}$ )	5.5 V
Voltage on C1, C2, C5, to C8 pins	-0.3 V to ( $V_{OUT} + 0.3$ V)
Storage temperature	-50 °C to +100 °C
Ambient temperature under bias	-40 °C to +85 °C

Table 1: For more information refer to datasheets of ICs used:

IC	type	manufacturer	note
MCU	PIC16F886-I/ML	Microchip	
RF IC	MRF49XA	Microchip	
LDO voltage regulator	MCP1700	Microchip	
Temperature sensor	MCP9700A	Microchip	
EEPROM	24AA16/MC	Microchip	for OS only

Pin	Name	Description
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C1	<b>IO/AN</b> RA0 AN0	General I/O pin Analog A/D input
C2	<b>IO/AN/VOUT</b> RC2 VOUT	General I/O pin (S1 disconnected) On-board +3 V LDO output (S1 connected)
C3	<b>VIN</b>	Power supply voltage
C4	<b>GND</b>	Ground
C5	<b>IO/AN/TX/-SS</b> RA5 -SS AN4	General I/O pin, SPI Slave select Analog A/D input
	RC6 TX	General I/O pin UART Tx
	RB4 AN4, AN11	General I/O pin, wake-up on change Analog A/D input
C6	<b>IO/SCK/SCL</b> RC3 SCK SCL	General I/O pin SPI clock input I <sup>2</sup> C clock
C7	<b>IO/SDI/SDA</b> RC4 SDI SDA	General I/O pin SPI data I <sup>2</sup> C data
C8	<b>IO/RX/SDO<sup>4</sup></b> RC5, RC7 RX SDO	General I/O pin UART Rx SPI data out
X5	<b>ANT</b>	Antenna input
X6	<b>GND</b>	Ground (for dipole antenna)
P1–P6		For factory programming only
S1		LDO output enable. Connect to enable (default disabled).
S2		Leave disconnected.

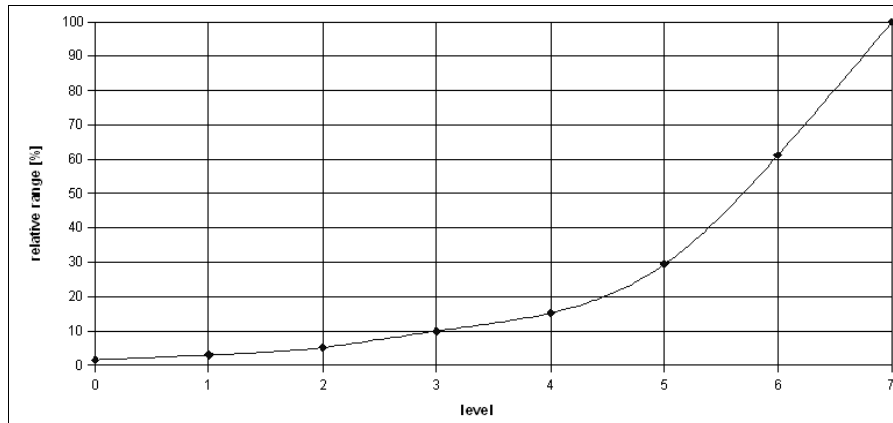


**Note 4:** This pin is used as output during initial ~250 ms boot-up to recognize programming mode.

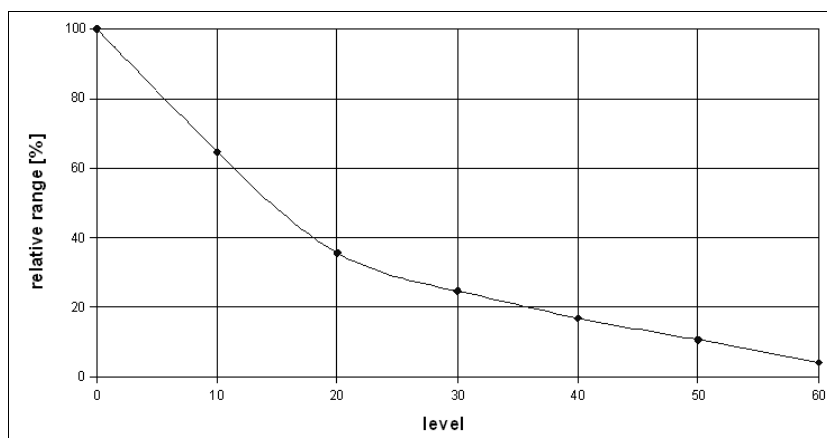
## Application

See IQRF OS User's guide, IQRF OS Reference guide, Application examples and [www.iqrf.org](http://www.iqrf.org).

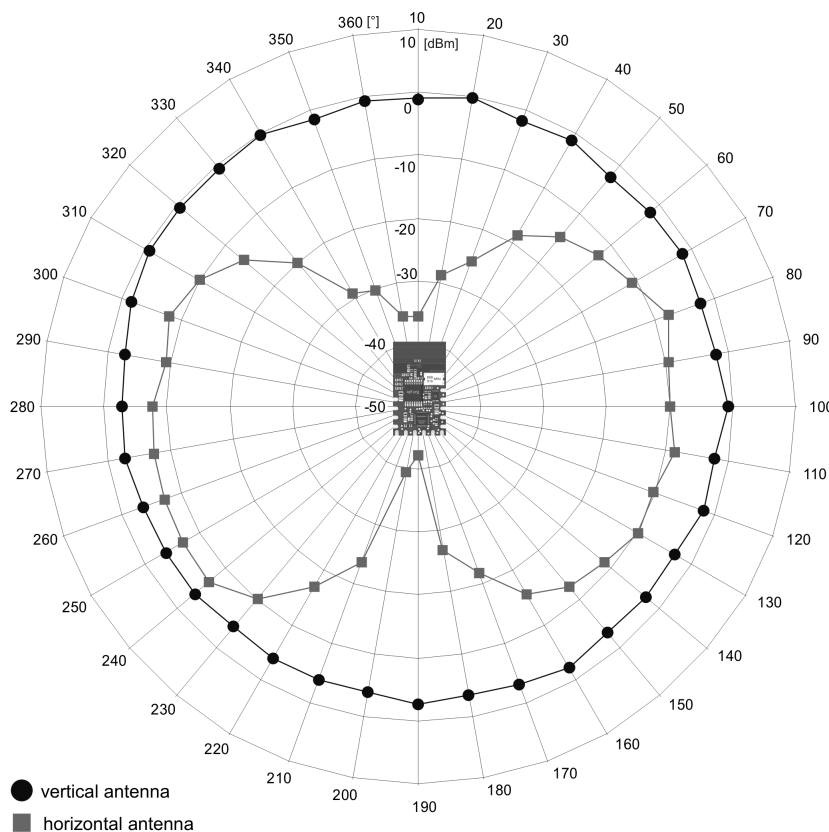
**Table 2:** Relative RF range vs. level for the `setTXpower(level)` function. Refer to IQRF OS Reference guide.



**Table 3:** Relative RF range vs. level for the `checkRF(level)` detection. Refer to IQRF OS Reference guide.

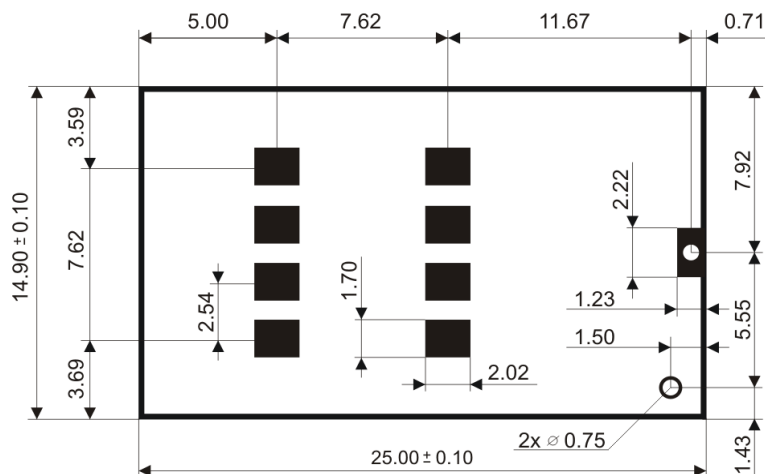


**Figure 4:** Relative RF range vs. antenna orientation (radiation patterns)

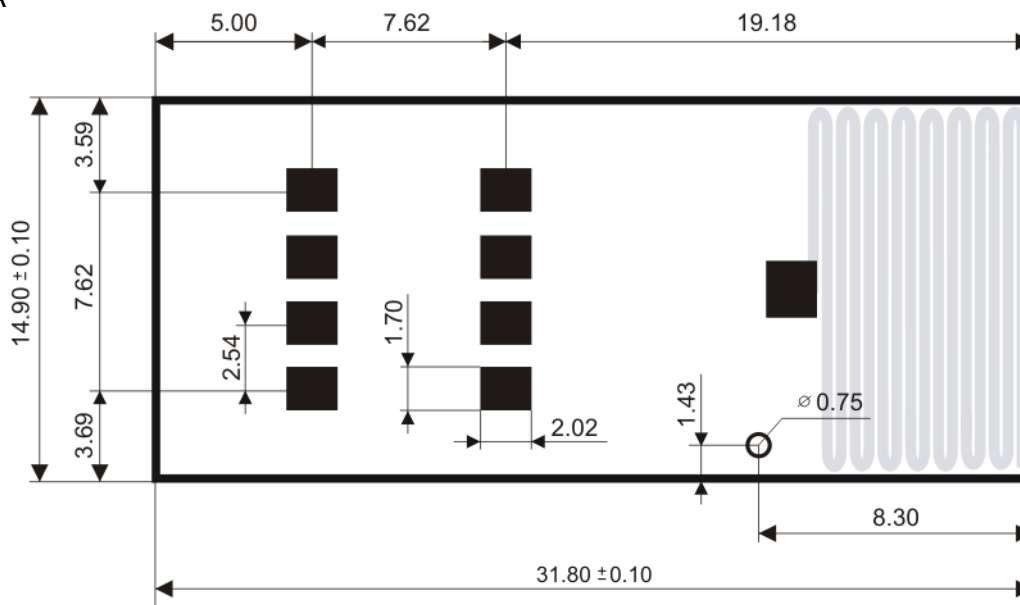


## Dimensions

TR-52B, TR-52BK, TR-52BC



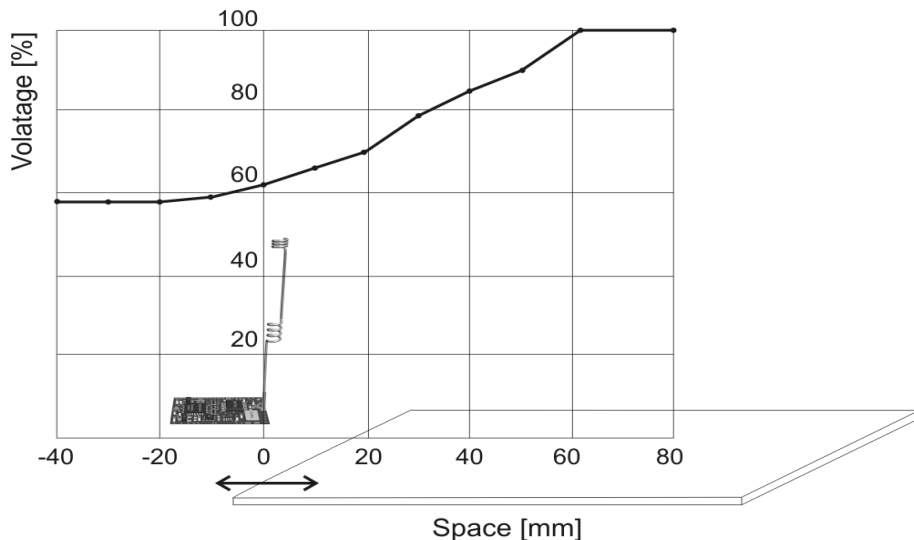
TR-52BA



Units: mm

Recommended SIM connector: KON-SIM-01

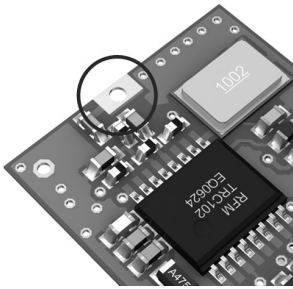
**Table 5:** Relative decrease of RF input signal vs. antenna edge spacing to conductive areas:



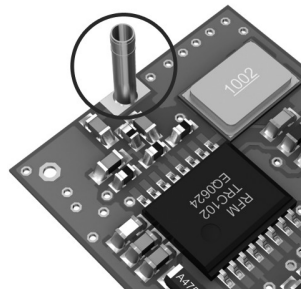
Conductive areas close to the integrated antenna must be avoided. Recommended minimal spacing is 10 mm.

## Ordering codes

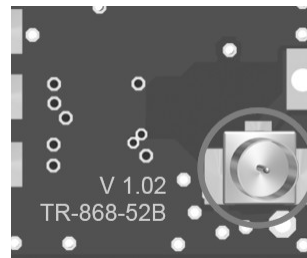
Type	frequency [MHz]	antenna connector
<b>TR-52B</b>	868 / 916	soldering hole
<b>TR-52BK</b>	868 / 916	KON-AN-03 for AN-03 (¼ whip)
<b>TR-52BC</b>	868 / 916	KON-U.FL-R-SMT (mini coax) for AN-05-C or CAB-U.FL
<b>TR-52BA</b>	868 / 916	built-in PCB antenna



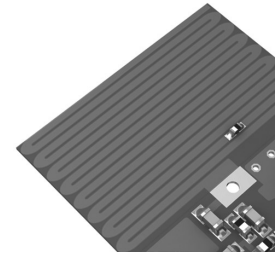
TR-52B



TR-52BK



TR-52BC



TR-52BA

## Document history

- 120327 Figure 4 added. Schematics slightly simplified.
- 110919 Slightly revised and updated.
- 110621 Electrical specifications and absolute maximum ratings updated. EEPROM added to Table 1. Table 5 added.
- 110124 Power consumption updated for IQRF OS v3.00.
- 100927 Error in dimensions on page 3 corrected.
- 100506 Info about the temperature sensor, Note 5 and local restrictions added/corrected.
- 100421 Slightly revised and updated.
- 100209 First release.
- 090612 Preliminary.

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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)*



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