TR-53B

Transceiver Module

Data Sheet





Description

TR-53B 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 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 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
- Battery monitoring
- +3 V LDO regulator output, 2 LEDs
- Up to 7 I/Os, up to 3 analog inputs (A/D)
- Mounting: SIM connector, SMT or through-slot soldering
- · Coaxial antenna connector (optional)
- On-board antenna (optional)



Block diagram



Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

MICRORISC MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND TO STATED CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE and disclaims all liability arising from this information and its use. Use of MICRORISC devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless MICRORISC from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any MICRORISC intellectual property rights.

Electrical specifications

Typical values unless otherwise stated

Parameters specified in this datasheet are typical values. They are at power supply V_{cc} = 3 V only. V_{cc} voltage different from 3 V can impact on RF range and other parameters.

Supply voltage (V _{cc}) LDO output (V _{OUT})	3.1 V to 5.3 V +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 Additional watchdog supply current	2 μΑ 2 μΑ typ., 4 μΑ max. (watchdog enabled)
Run mode Additional supply current	1 mA @ 8 MHz (MRF49XA in standby mode) 0.6 mA (MRF49XA on) 2 mA (one or two LEDs on)
Rx mode	13 mA (STD mode) 400 μA (LP mode ³) 35 μA max. (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 RF range (TR-53BAx) ²	up to 5 dBm, programmable in 8 steps (7-0), -3dBm/step up to 250 m @ 19.2 kb/s
Nominal frequency Channels RF data modulation RF data transmission bit rate	 868.35 MHz or 916.50 MHz (software selectable) See IQRF OS User's guide, Appendix 2, Channel maps FSK (frequency-shift-keyed) 1.2 kb/s – preliminary, for experimental purpose only 19.2 kb/s 57.6 kb/s – preliminary, for experimental purpose only 86.2 kb/s – preliminary, for experimental purpose only
Input voltage on C1, C2, C5 to C8 pins	0 V to V _{OUT}
A/D converter Input A/D impedance	10 b, 3 inputs (multiplexed S&H, successive approximation) 10 k Ω max.
Size (L x W x H)	28.4 mm x 14.9 mm x 3.0 mm 33.6 mm x 14.9 mm x 3.0 mm (TR-53BA)

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 listed maximum values may cause permanent damage to the device and affect device reliability. Functional operation at these or any other conditions beyond those specified is not supported.

Supply voltage (VCC) Voltage on C1, C2, C5, to C8 pins Storage temperature Ambient temperature under bias

5.5 V -0.3 V to (V_{OUT} + 0.3 V) -50 °C to +100 °C -40 °C to +85 °C

Caution: Electrostatic sensitive device. Observe appropriate precautions for handling

Simplified schematic



 Table 1: Basic components:

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

For more information refer to datasheets of ICs used.



Pin	Name	Description	
C1 Q4	IO/AN RA0 AN0	General I/O pin Analog A/D input	
C2 Q5	IO/AN/VOUT RC2 VOUT	r General I/O pin (S1 On-board +3 V LDC	disconnected) 9 output (S1 connected)
C3 Q3	VIN	Power supply voltage	је
C4 Q2	GND	Ground	
C5 Q6	IO/AN/TX/-S RA5 -SS AN4 RC6 TX	S General I/O pin, SPI Slave select Analog A/D input General I/O pin UART Tx	
	RB4 AN11	General I/O pin, wal Analog A/D input	ke-up on change
C6 Q7	IO/SCK/SCL RC3 SCK SCL	General I/O pin SPI clock input I²C clock	Bottom view Q1
C7 Q8	IO/SDI/SDA RC4 SDI SDA	General I/O pin SPI data I²C data	Q2 P2 C1 C5 S1 S1 C2 P6 C6 TR-53B
C8 Q9	IO/RX/SDO ⁴ RC5, RC7 RX SDO	General I/O pin UART Rx SPI data out	
Q10	IO/AN RA3 AN3	Antenna input General I/O pin, Analog A/D input	
Q1	GND	Ground	Orrest with the state O11
Q11	GND	Ground	
X5	ANT	Antenna input	
P1–P6		For factory program	iming only
S1		LDO output enable.	. Connect to enable (default disabled).
S2		Leave disconnected	d.

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



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













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-53B, TR-53BC



TR-53BA





Application

Assembly

Vertical mounting

Mounting vertically through a rectangular slot in the application board, pads soldered from the bottom. Double layer PCB with metallized holes are recommended otherwise the module should be glue fixed from the top.



Recommended PCB layout for user application:

PCB slot 1 x 11.2 For single layer PCB Glue fixing needed



PCB slot 1 x 11.2 For double layer PCB with metallized holes

Units: mm



Horizontal mounting

Surface mounting by solder reflow is also possible.



Recommended PCB layout for user application:



Top view, units: mm

For proper mounting of surface mount TR-53Bx modules and avoiding damage during solder reflow assembly the IPC/JEDEC J-STD-020C standard must be observed. The parts must be baked dry according to IPC/JEDEC J-STD-033C, MSL 4 before reflow soldering. For reflow profile and details refer to the AN010 Application note – SMT mounting of IQRF TR modules.

SIM connector

TR-53Bx modules can be mounted in SIM connector as well. Recommended SIM connector: KON-SIM-01.

Operating system

See IQRF OS User's guide and IQRF OS Reference guide.

Software

See Application examples www.iqrf.org website.

Programming

There are three possibilities to upload a user program in TR-53Bx modules:

- Wired upload with TR-53Bx plugged via the SIM connector in the CK-USB-04 programmer.
- For TR-53Bx modules soldered in an application:
 - Wired upload using the CK-USB-04 programmer and the KON-TR-01P adapter. See the KON-TR-01P User's guide.
 - RFPGM RF programming[™] (wireless upload). See the IQRF OS User's guide, chapter *RF programming*.

Ordering codes

Туре	frequency [MHz]	antenna connector
TR-53B	868 / 916	soldering hole
TR-53BC	868 / 916	KON-U.FL-R-SMT (mini coax) for AN-05-C or CAB-U.FL
TR-53BA	868 / 916	built-in PCB antenna







TR-53B

TR-53BC

Document history

- 140430 RF range revised.
- 130405 Revised. Chapters Specifications and Application precised.
- 120327 Figure 4 added. Schematics slightly simplified.
- 110919 Slightly revised and updated.
- 110621 Electrical specifications and absolute maximum ratings updated and EEPROM added to Table 1.
- 110124 Power consumption updated for IQRF OS v3.00. Recommended PCB footprint corrected.
- 100601 First release

•



Sales and Service

Corporate office

MICRORISC s.r.o., Prumyslova 1275, 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 and MICRORISC name are registered trademarks of MICRORISC s.r.o. PIC, SPI, Microchip 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

