TR-52D-433

Transceiver Module

Data Sheet

IQRF

*Smarter wireless. Simply.*

Description

TR-52D-433 is a family of IQRF transceiver modules operating in the 433 MHz license free ISM (Industry, Scientific and Medical) frequency band. Its highly integrated ready-to-use design requires no external components. Microcontroller with built-in operating system, excellent development support, integrated LDO regulator, serial EEPROM and optional temperature sensor dramatically reduce time of application development. Ultra low power consumption predetermines these modules for use in battery powered applications.
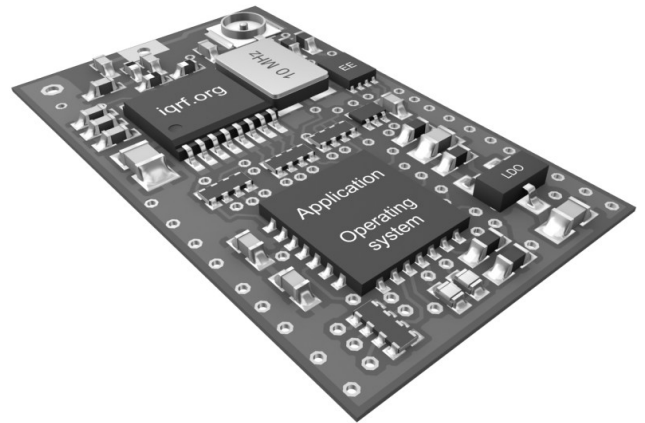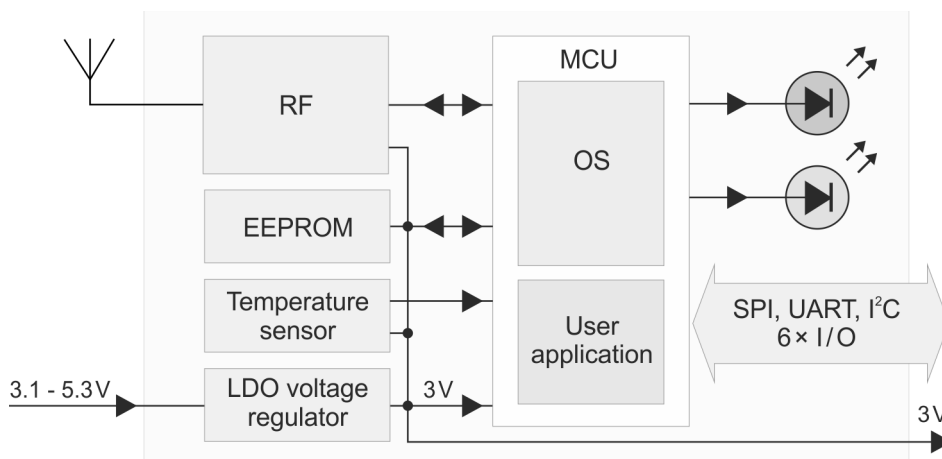
Key features

- Complete solution with operating system, easy to use
- FSK modulation
- RF band 433 MHz, multiple channel
- Selectable RF bit rate
- MCU with extended resources, user interrupt capability
- Extra low power consumption, power management modes
- SPI interface supported by OS on background
- Serial EEPROM
- PWM output
- Programmable HW timer
- +3 V LDO regulator output, battery monitoring
- 2 LEDs
- 8 pins, 6 I/Os
- A/D converter (2 channels), analog comparator
- Options: on-board antenna, U.FL connector, temperature sensor
- SIM card format

Applications

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

Block diagram

Electrical specifications   *Typical values* *unless otherwise stated*

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

Supply voltage (V_{CC})	3.1 V to 5.3 V
LDO output (V_{OUT})	+3 V ± 60 mV (V_{CC} > 3.1 V), 100 mA max.
Operating temperature [1]	-40 °C to +85 °C
Supply current	
Sleep mode	1.9 µA (if all peripherals including MRF49XA disabled [3])
Run mode	1 mA (MRF49XA disabled)
Additional LED supply current	cca 2 mA (if one or two LEDs on). Rough value for brief guidance only.
RX mode	STD mode: 12 mA
	LP mode [4]: 330 µA
	XLP mode [4]: 25 µA
TX mode	13 mA – 23 mA (according to RF output power)
RF band	433 MHz
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 [5], 19.2 kb/s, 57.6 kb/s [5], 86.2 kb/s [5]
RFIC RF sensitivity	See MRF49XA datasheet
RFIC RF output power	Programmable in 8 levels (0 – 7), -2.5 dBm/level, see MRF49XA datasheet
Input voltage on C1, C2, C5 to C8 pins	0 V to V_{OUT}
A/D converter	10 bit, 2 inputs, see PIC16LF1938 datasheet
Temperature sensor	TMP112 (for TR modules with the "T" postfix only, e.g. TR-52DT-433)
Size (L x W x H)	25.0 mm x 14.9 mm x 2.0 mm

Note 1: RF range may change with lower temperature. Frost, condensation or humidity over 85% may disable module functionality. Module suitability should be tested in final application before volume use.

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

Note 3: Additional current is consumed when a peripheral (e.g. watchdog, Brown-out detection etc.) is enabled.

Note 4: Depends on interferences.

Note 5: RF 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.

Caution: Electrostatic sensitive device. Observe appropriate precautions for handling

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 (V_{CC})	5.5 V
Voltage on C1, C2, C5 to C8 pins vs. GND	-0.3 V to (V_{OUT} + 0.3 V)
Storage temperature	-40 °C to +85 °C
Ambient temperature under bias	-40 °C to +85 °C

Simplified schematic
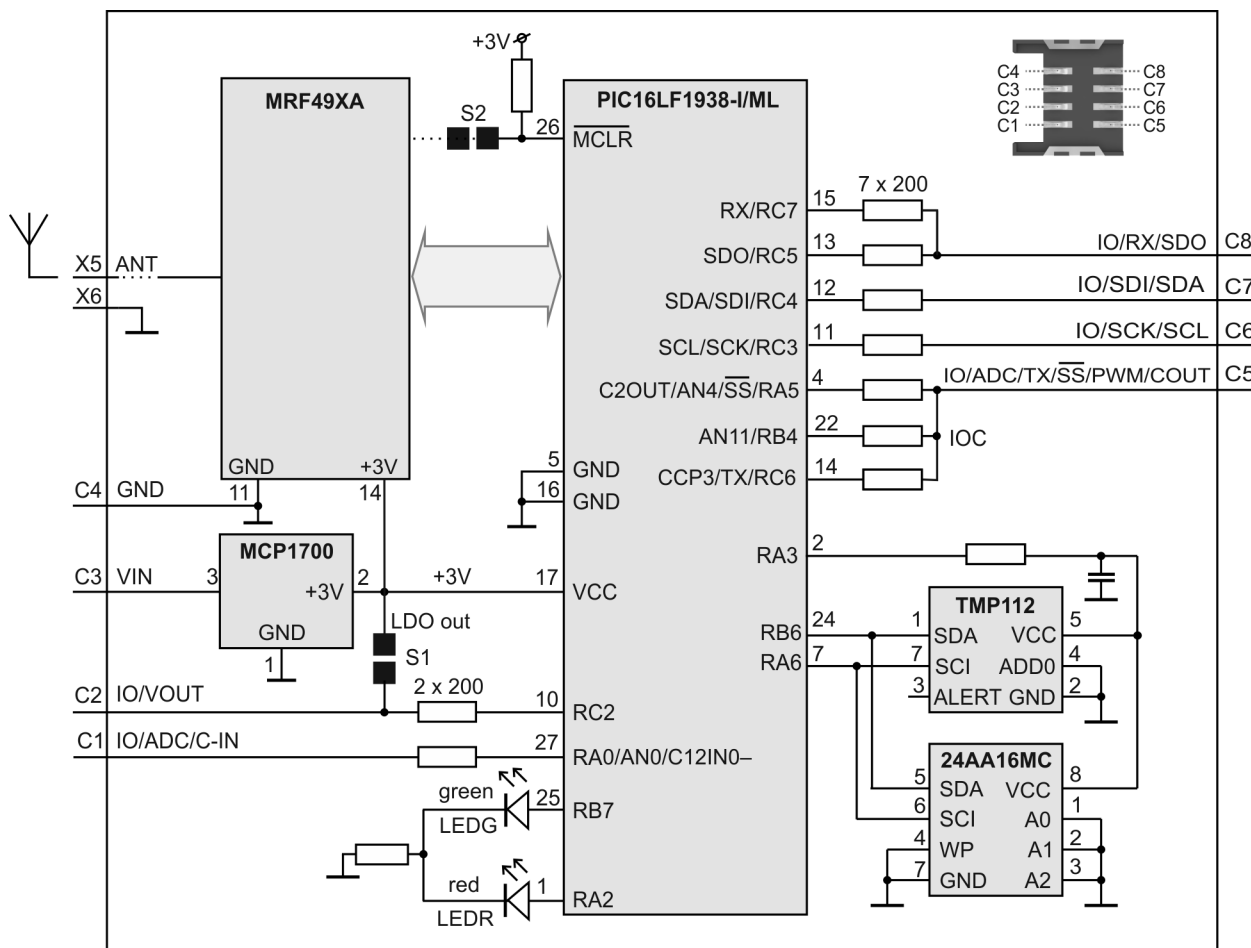
Basic components

IC	Type	Manufacturer	Note
MCU	PIC16LF1938–I/ML	Microchip	
RF IC	MRF49XA	Microchip	
LDO voltage regulator	MCP1700	Microchip	
Temperature sensor	TMP112	Texas Instruments	TR-52DxTx-433 only
EEPROM	24AA16/MC	Microchip	

For more information refer to datasheets of ICs used.

Pin	Name	Description
C1	**IO / ADC / C-IN**	
	RA0	General I/O pin
	AN0	Analog A/D input
	C12IN0	Comparator –input
C2	**IO / VOUT**	
	RC2	General I/O pin (S1 disconnected)
	VOUT	On-board +3 V LDO output (S1 connected)
C3	**VIN**	Power supply voltage
C4	**GND**	Ground
C5	**IO / ADC / TX / -SS / PWM / COUT**	
	RA5	General I/O pin,
	-SS	SPI Slave select
	AN4	Analog A/D input
	C2OUT	Comparator output
	RC6	General I/O pin
	TX	UART TX
	CCP3	PWM output
	RB4	General I/O pin, programmable pull-up and interrupt/wake-up on change (IOC), RFPGM termination
	AN11	Analog A/D input
C6	**IO / SCK / SCL**	
	RC3	General I/O pin
	SCK	SPI clock input
	SCL	I²C clock
C7	**IO / SDI / SDA**	
	RC4	General I/O pin
	SDI	SPI data
	SDA	I²C data
C8	**IO / RX / SDO**[6]	
	RC5	General I/O pin
	SDO	SPI data out
	RC7	General I/O pin
	RX	UART RX
X5	**ANT**	Antenna input
X6	**GND**	Ground
P1–P5		For factory programming only
S1		LDO output enable. Connect to enable (default disabled).
S2		Leave disconnected.

Connect to enable LDO output

Bottom view
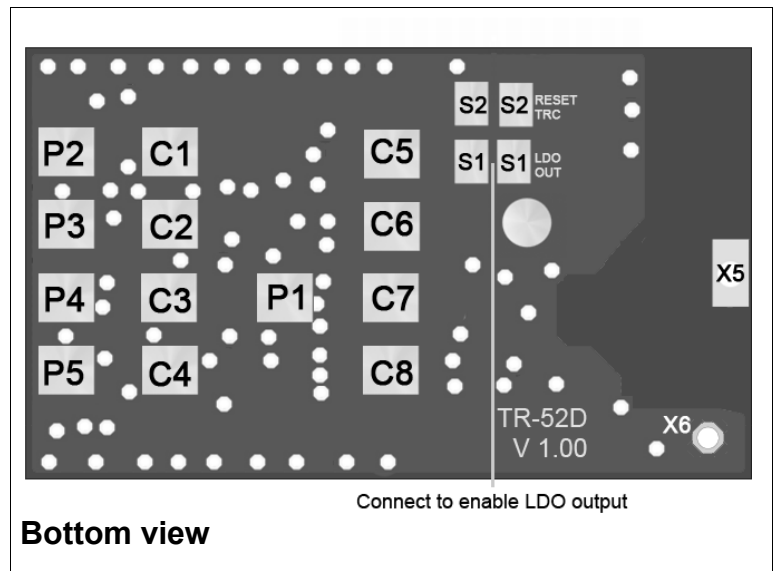
Note 6: This pin is used as output during initial ~250 ms boot-up to recognize programming mode.

Figure 1: Relative RF range vs. level for the `setTXpower(level)` function. Refer to IQRF OS Reference guide.
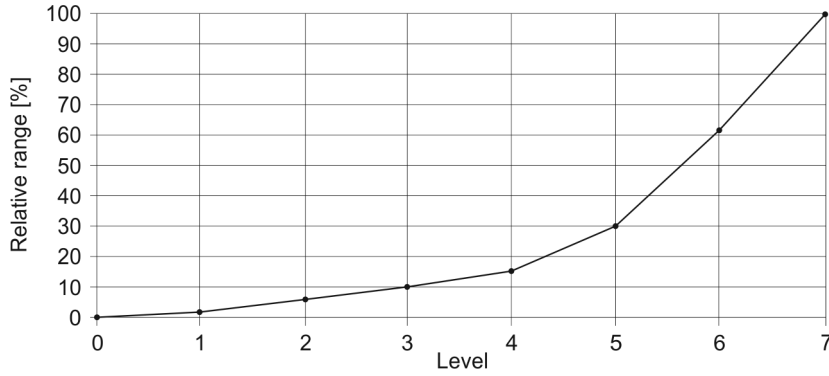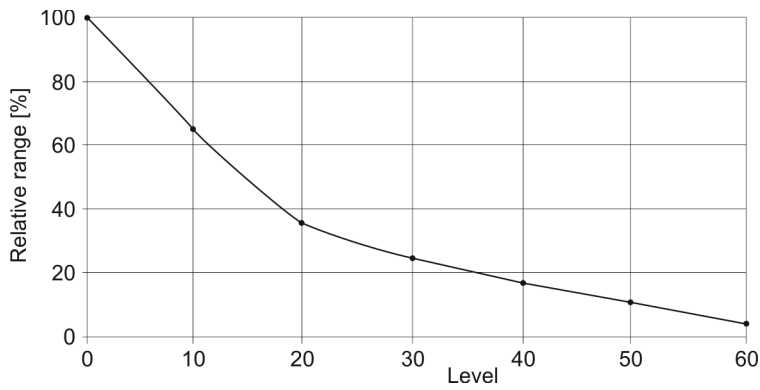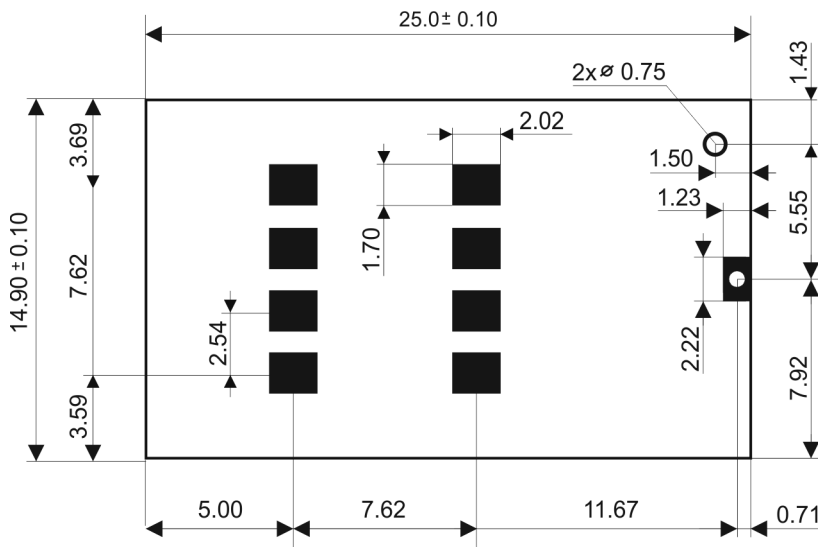
Figure 2: Relative RF range vs. level for the `checkRF(level)` function. Refer to IQRF OS Reference guide.

Dimensions

Top view, Units: mm

Application

Assembly

TR-52Dxxx-433 modules should be mounted in SIM connector. They are not intended for SMT reflow soldering. Recommended SIM connector: KON-SIM-01.

Operating system

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

Software

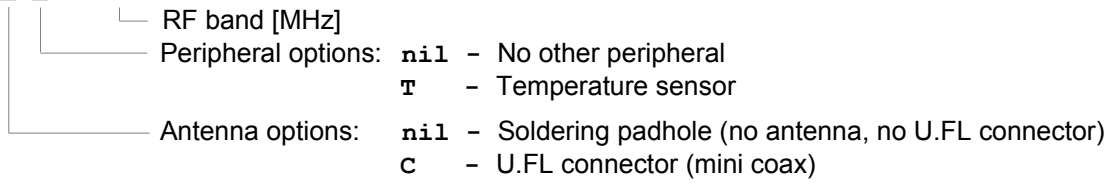See Application examples on www.iqrf.org website.

Programming

There are the following possibilities to upload an application program in TR-52Dx modules:
- Wired upload with TR-52Dx plugged via the SIM connector in the CK-USB-04 or CK-USB-04A programmer.
- For TR-52Dx modules populated in an application:
  - Wired upload using the CK-USB-04A programmer. See the CK-USB-04A User's guide.
  - 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^{TM} (wireless upload). See the IQRF OS User's guide, Appendix *RF programming*.

Product information

Ordering codes

```
T R – 5 2 D A P – 433
```
RF band [MHz]

Peripheral options: `nil` – No other peripheral
`T` – Temperature sensor

Antenna options: `nil` – Soldering padhole (no antenna, no U.FL connector)
`C` – U.FL connector (mini coax)

Type	Antenna connection	Temperature sensor	RF shielding
TR-52D-433	Soldering hole	–	–
TR-52DC-433	U.FL connector	–	–

Type	Antenna connection	Temperature sensor	RF shielding
TR-52DT-433	Soldering hole	Yes	–
TR-52DCT-433	U.FL connector	Yes	–
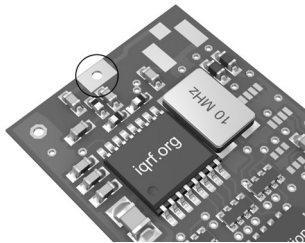
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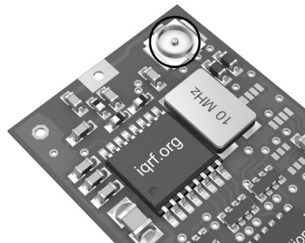
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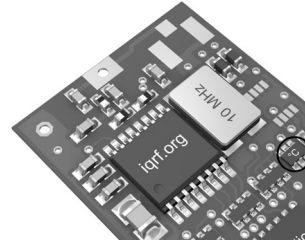
TR-52DT-433

Document history

- 150414   TR-52DxF removed from available types.
- 141103   Chapters *Pin description* and *Programming* slightly updated.
      Information regarding directives RoHS and WEEE updated and extended.
- 140120   Datasheet file renamed from DS_TR-52D-433_131114 to Datasheet_TR-52D-433_140120
- 131114   Certification updated for the latest directives.
- 130906   First release.

Sales and Service

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Partners and distribution

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Quality management

CE

ISO 9001 : 2009 certified

Complies with ETSI directives EN 301489-1 V1.9.2:2011, EN 301489-3 V1.6.1:2013, EN 300220-1 V2.4.1:2012, EN 300220-2 V2.4.1:2012 and VO-R/10/04.2012-7.

Complies with directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).

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