

TR-56D-433

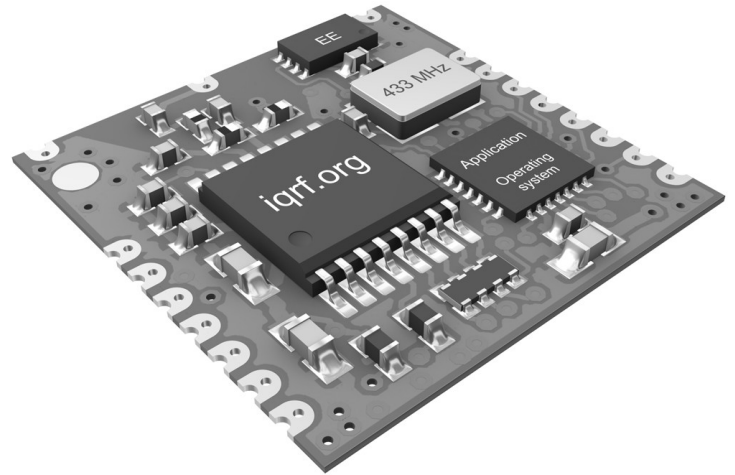
Transceiver Module

Data Sheet



Description

TR-56D-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 except of antenna. Extra low power consumption fits for battery powered applications. SMT mounting and very small dimensions allow space saving.



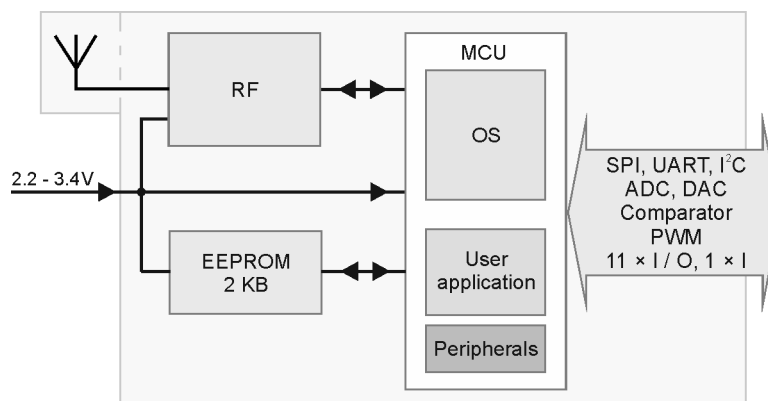
Key features

- Complete solution with operating system, easy to use
- FSK modulation
- Selectable RF band 433 MHz, multiple channel
- 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
- Battery monitoring
- 18 pins, 11 I/Os, 1 input only
- A/D converter (4 channels), D/A converter
- Analog comparator
- Stamp hole pads, SMT mounting, compatible with SIM card connector without metallic holder
- Very small dimensions

Applications

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

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in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.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.

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Electrical specifications

Typical values unless otherwise stated

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

| | |
|--|---|
| Supply voltage (V_{CC}) ¹ | 3.0 V min., 3.4 V max., stabilized |
| Operating temperature ² | -40 °C to +85 °C |
| Supply current | |
| Sleep mode | 380 nA (if all peripherals including MRF49XA disabled ³) |
| Run mode | 1 mA (MRF49XA disabled) |
| Rx mode | STD mode: 13 mA LP mode: 330 μA ⁴ XLP mode: 25 μA ⁴ |
| Tx mode | 14 mA – 24 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 Q4 to Q15 pins | 0 V to V_{CC} |
| A/D converter | 10 bit, 4 inputs, see PIC16LF1938 datasheet |
| Dimensions | 15.2 mm x 14.9 mm x 2.0 mm (TR-56D) 15.2 mm x 14.9 mm x 2.5 mm (TR-56DF) |

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

Note 4: Depends on interferences.

Note 5: 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.

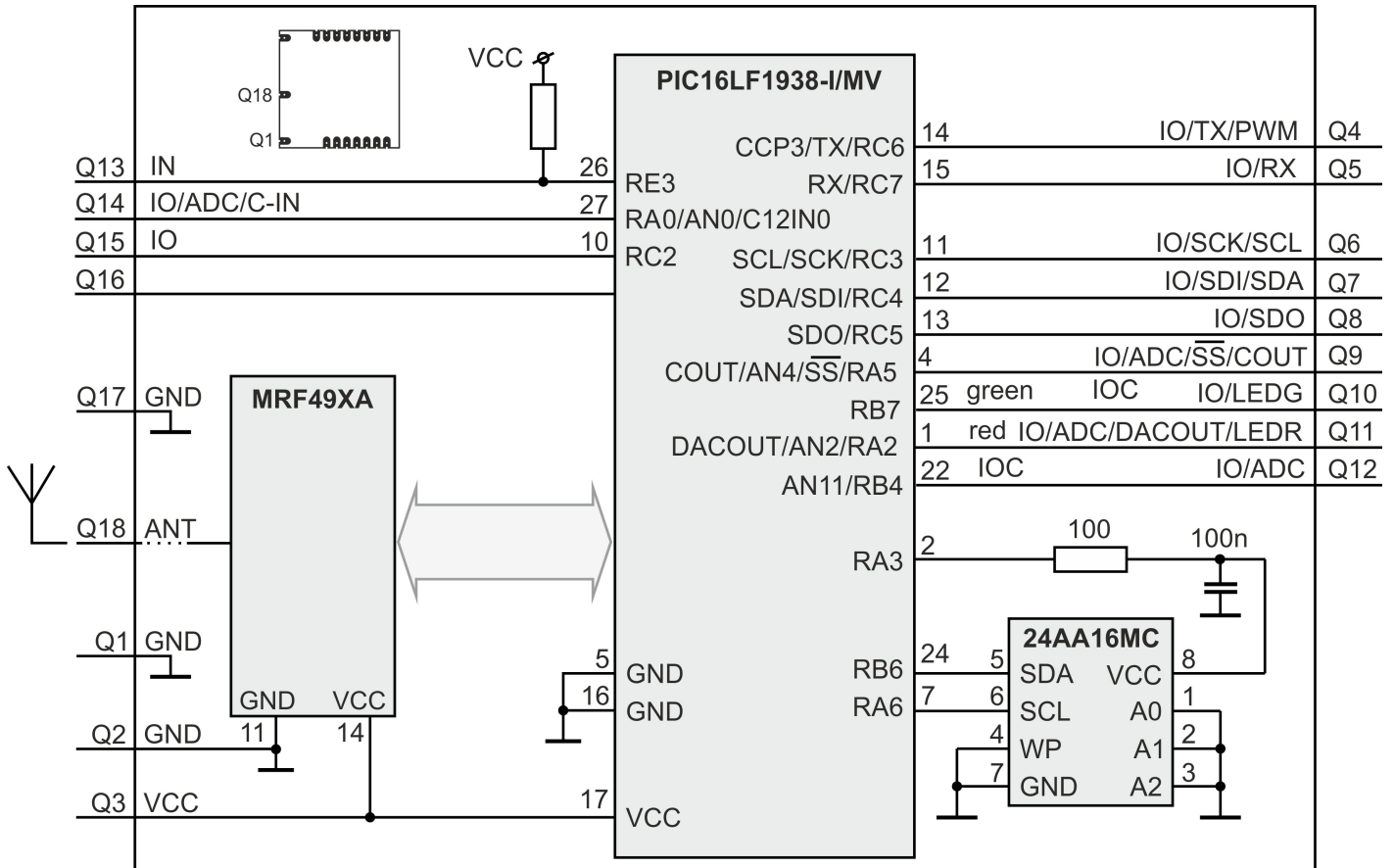
Caution: Electrostatic sensitive device. Observe appropriate precautions for handling

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

Simplified schematic



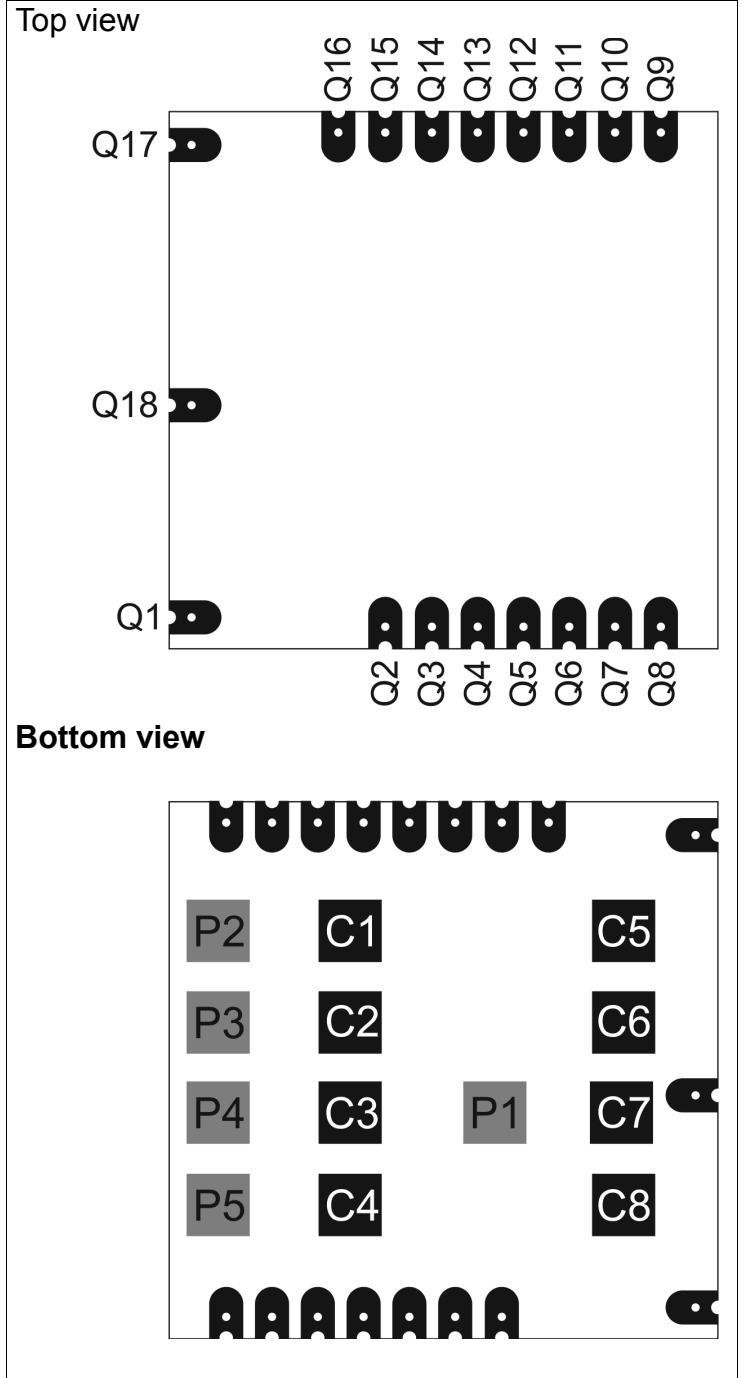
Basic components

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

For more information refer to respective datasheets.

Pin Name Description

| | | |
|----------------------|------------------------------|---|
| Q1 | GND | Ground |
| Q2, C4 | GND | Ground |
| Q3, C3 | VCC | Power supply voltage |
| Q4 | IO / TX / PWM | |
| | RC6 | General I/O pin |
| | TX | UART TX |
| | CCP3 | PWM output |
| Q5 | IO / RX | |
| | RC7 | General I/O pin |
| | RX | UART RX |
| Q6, C6 | IO / SCK / SCL | |
| | RC3 | General I/O pin |
| | SCK | SPI clock input |
| | SCL | I ² C clock |
| Q7, C7 | IO / SDI / SDA | |
| | RC4 | General I/O pin |
| | SDI | SPI data |
| | SDA | I ² C data |
| Q8 ⁶ , C8 | IO / SDO | |
| | RC5 | General I/O pin |
| | SDO | SPI data out |
| Q9, C5 | IO / ADC / -SS / COUT | |
| | RA5 | General I/O pin, RFPGM termination ⁷ |
| | AN4 | Analog A/D input |
| | -SS | SPI Slave select |
| | C2OUT | Comparator output |
| Q10 | IO / LEDG | |
| | RB7 | General I/O pin, programmable pull-up and interrupt/wake-up on change (IOC) |
| | LED1 | LEDR supported by OS |
| Q11 | IO / ADC / LEDR | |
| | RA2 | General I/O pin |
| | AN2 | Analog A/D input |
| | LED2 | LEDR supported by OS |
| | DACOUT | D/A converter output |
| Q12 | IO / ADC | |
| | RB4 | General I/O pin, programmable pull-up and interrupt/wake-up on change (IOC) |
| | | RFPGM termination |
| | AN11 | Analog A/D input |
| Q13 | IN | |
| | RE3 | General input only pin |
| Q14, C1 | IO / ADC / C-IN | |
| | RA0 | General I/O pin |
| | AN0 | Analog A/D input |
| | C12IN0 | Comparator -input |
| Q15, C2 | IO | |
| | RC2 | General I/O pin |
| Q16 | - | Do not use, leave unconnected |
| Q17 | GND | Ground |
| Q18 | ANT | Antenna |
| P1-P5 | | For manufacturer only |



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

Note 7: External pull-up resistor must be used on this pin when used for RFPGM termination.

There are no on-board protection series resistors on I/O pins. It is recommended to use 200 Ω series resistors on each pin.

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

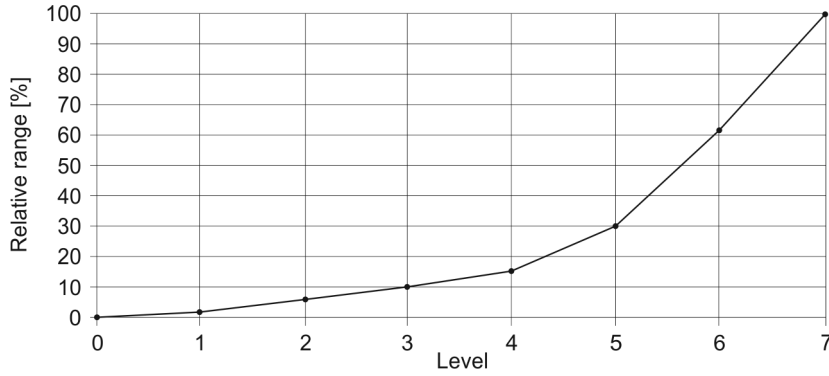
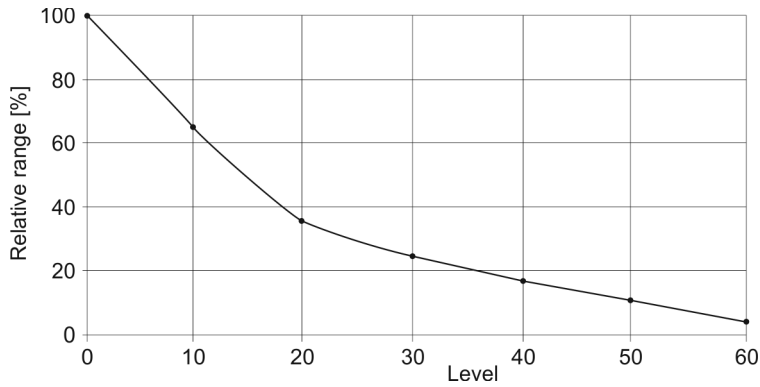
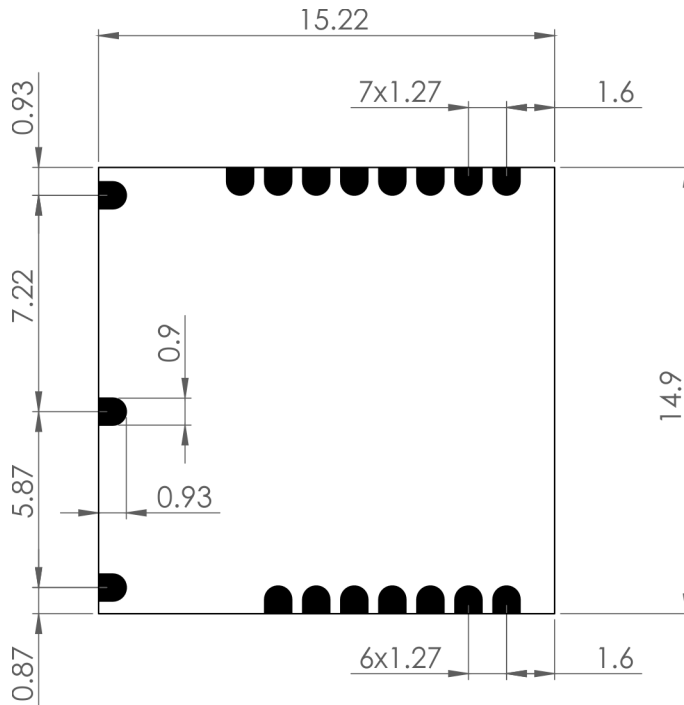


Figure 2: Relative RF range vs. level for the `checkRF(level)` function. Refer to IQRF OS Reference guide.



Mechanical drawings



Top view. Units: mm.

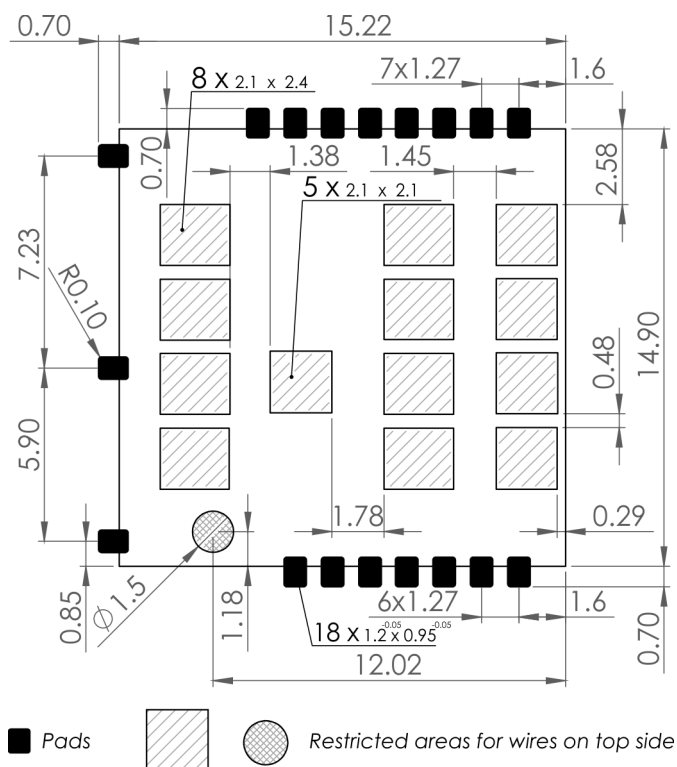
Application

Assembly

For proper mounting of surface mount TR-56Dx-433 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.

Caution: TR-56Dx-433 must not be plugged in a SIM connector with metallic holder.

Recommended PCB layout:



Top view. Units: mm.

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-56Dx-433 modules:

- Wired upload with TR-56Dx-433 plugged via the SIM connector in the CK-USB-04A programmer.
- For TR-56Dx-433 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™ (wireless upload). See the IQRF OS User's guide, Appendix *RF programming*.

Solderless development prototyping

For flexible development of TR-54D and TR-56D applications the TRDB-54DA kit is intended. It is a removable SIM-compatible device containing the TR-54DA (fully compatible with TR-56DA) which can be plugged in the SIM connector in user equipment or in an appropriate IQRF development kit, e.g. DK-EVAL-04. Refer to the TR-DB-54DA User's guide for details.

Product information

Ordering codesT R - 5 6 D P - 433

RF band [MHz]

Peripheral options: *ni1* - No option

| Type | Antenna option | RF shielding |
|------------|--------------------|--------------|
| TR-56D-433 | Soldering pad-hole | - |

Document history

- 150414 TR-56DxF removed from available types.
- 141103 Chapters *Pin description* and *Programming* slightly updated.
Information regarding directives RoHS and WEEE updated and extended.
- 140430 Supply voltage revised.
- 140120 Datasheet file renamed from DS_TR-56D-433_131217 to Datasheet_TR-56D-433_140120.
- 131217 Recommended PCB layout slightly changed.
- 131114 Certification updated for the latest directives.
- 131030 First release

Sales and Service

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



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