

TR-56D

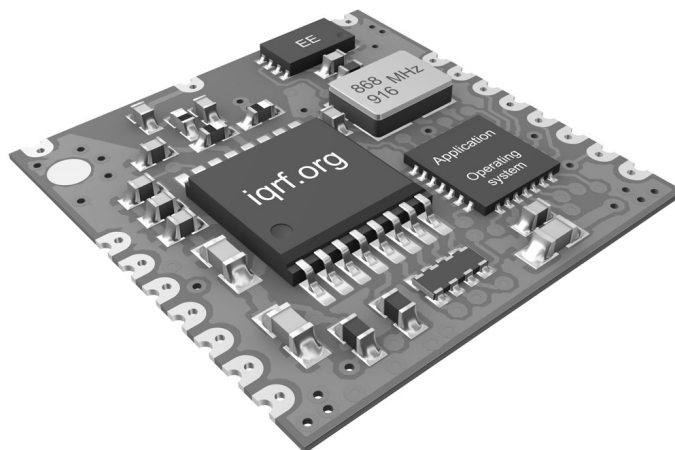
Transceiver Module

Data Sheet



Description

TR-56D 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 very small dimensions allow space saving.



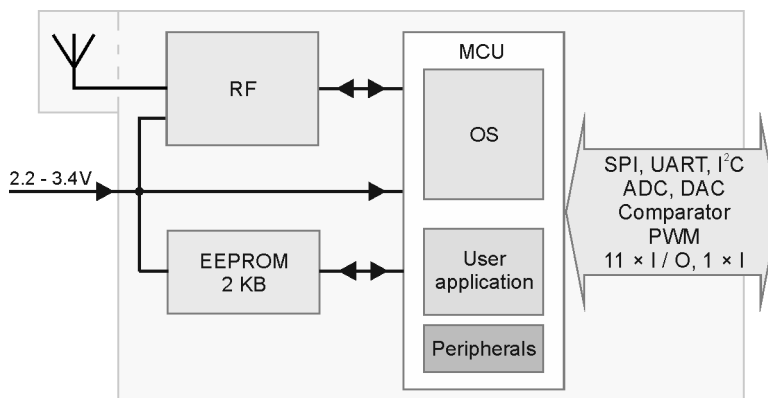
Key features

- Complete solution with operating system, easy to use
- FSK modulation
- Selectable RF band 868 / 916 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
- Optional on-board antenna
- Stamp hole pads, SMT mounting, no SIM card compatible
- 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in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.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 ⁴)
Run mode	1 mA (MRF49XA disabled)
Rx mode	STD mode: 13 mA LP mode ⁵ : OS v3.01D: 400 µA, from OS v3.02D: 330 µA XLP mode ⁵ : OS v3.01D: 35 µA, from OS v3.02D: 25 µA
Tx mode	14 mA – 24 mA (according to RF output power)
RF band	868 MHz or 916 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 ⁶ , 19.2 kb/s, 57.6 kb/s ⁶ , 86.2 kb/s ⁶
RFIC RF sensitivity	See MRF49XA datasheet
RFIC RF output power	Programmable in 8 levels (0 – 7), -2.5 dBm/level, see MRF49XA datasheet
RF range (TR-56DA) ³	Up to 300 m @ 19.2 kb/s ⁶
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) 23.3 mm x 14.9 mm x 2.0 mm (TR-56DA) 15.2 mm x 14.9 mm x 2.5 mm (TR-56DF) 23.3 mm x 14.9 mm x 2.5 mm (TR-56DAF)

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: RF range strongly depends on module orientation and surroundings.

Note 4: Additional current is consumed when a peripheral (e.g. watchdog, Brown-out detection etc.) is enabled.

Note 5: Depends on interferences.

Note 6: 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.

TR-56DxF (with metallic shielding of RF circuitry) must be used in countries where FCC provision is valid.

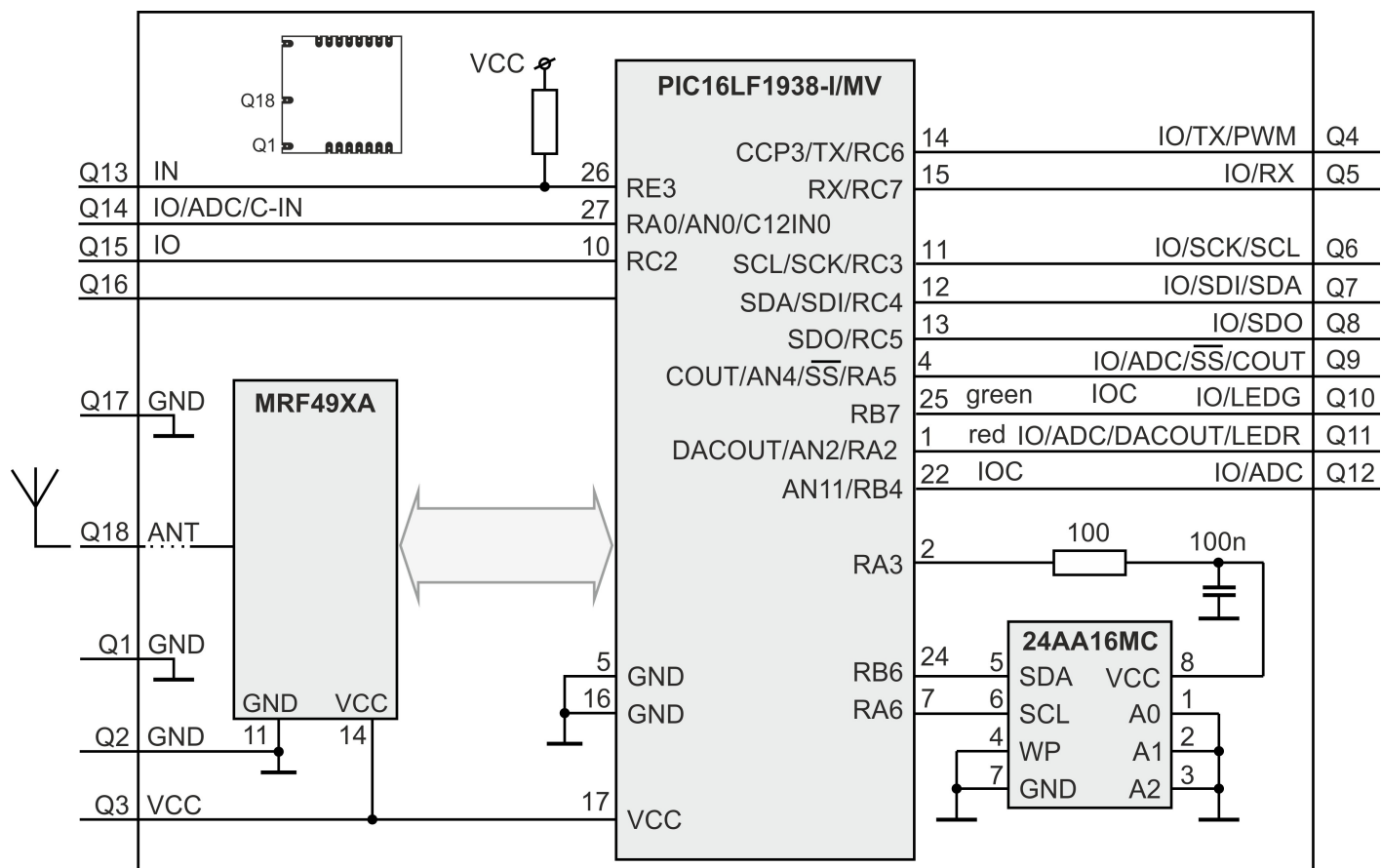
Caution: Electrostatic sensitive device. Observe appropriate precautions for handling

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



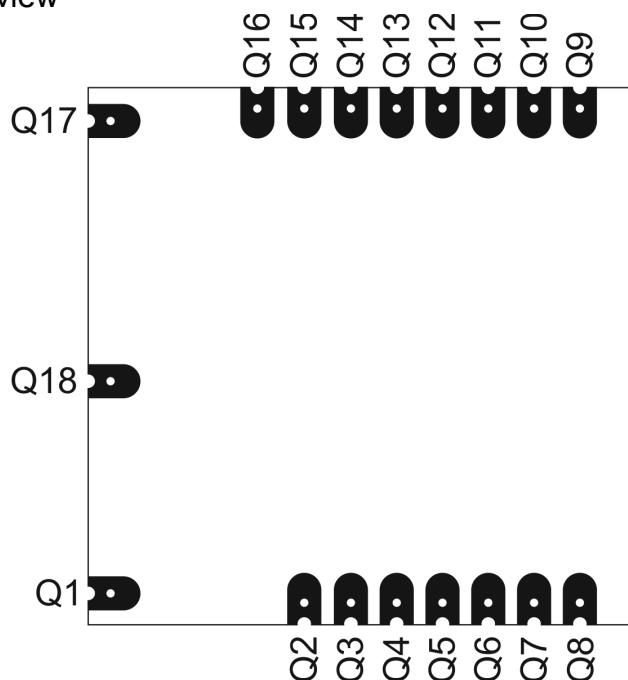
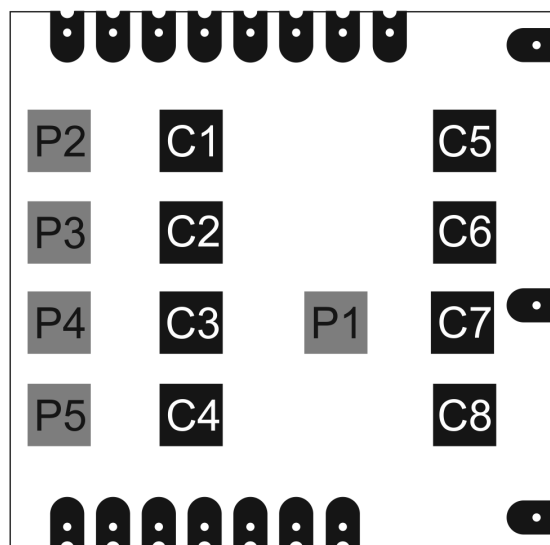
Basic components

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
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Q1 ⁷	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 ⁸ , 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 ⁹
	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 ⁷	GND	Ground
Q18 ⁸	ANT	Antenna
P1–P5		For manufacturer only

Top view

Bottom view


Note 7: Not implemented for TR-56DAx.

Note 8: This pin is used as output during initial ~250 ms boot-up to recognize programming mode.

Note 9: 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.

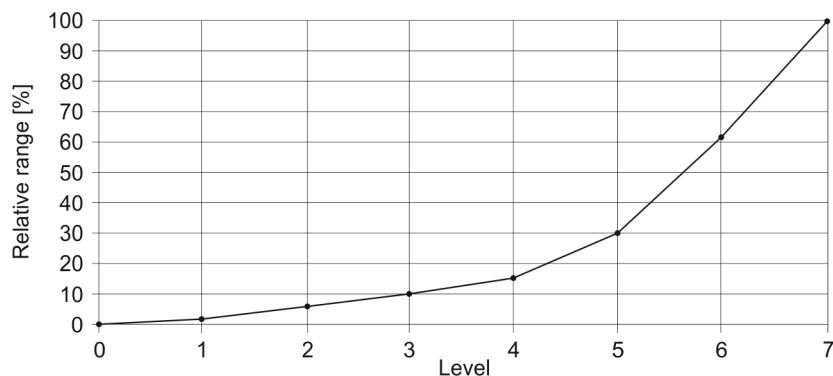


Figure 2: Relative RF range vs. level for the `checkRF(level)` function. Refer to IQRF OS Reference guide.

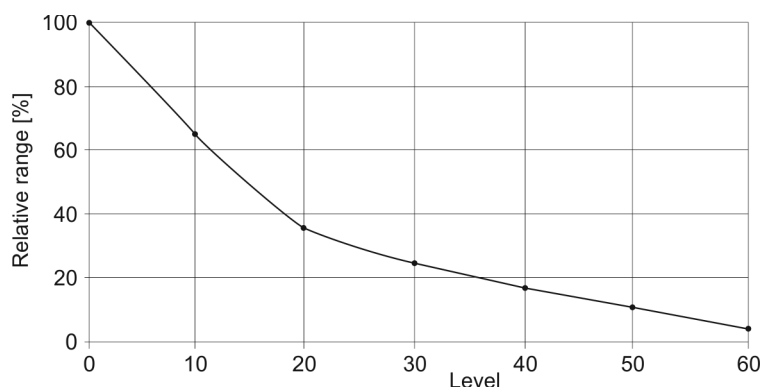
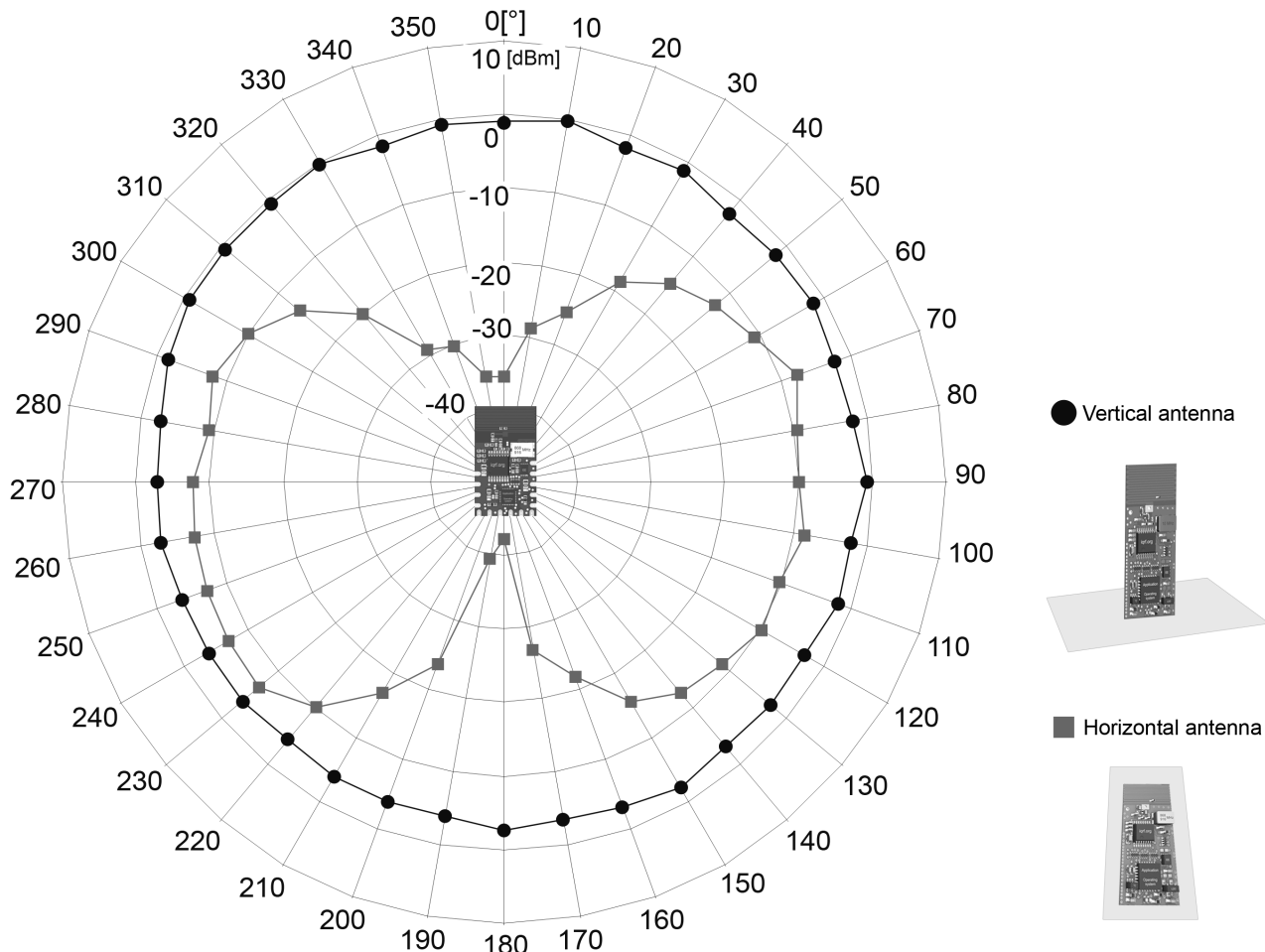


Figure 3: Relative RF range vs. antenna orientation (radiation patterns)



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

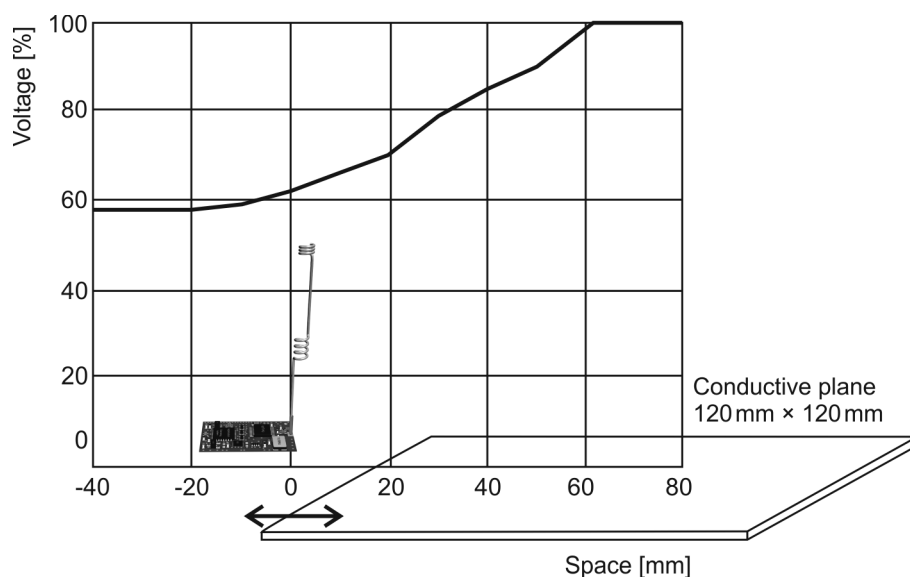
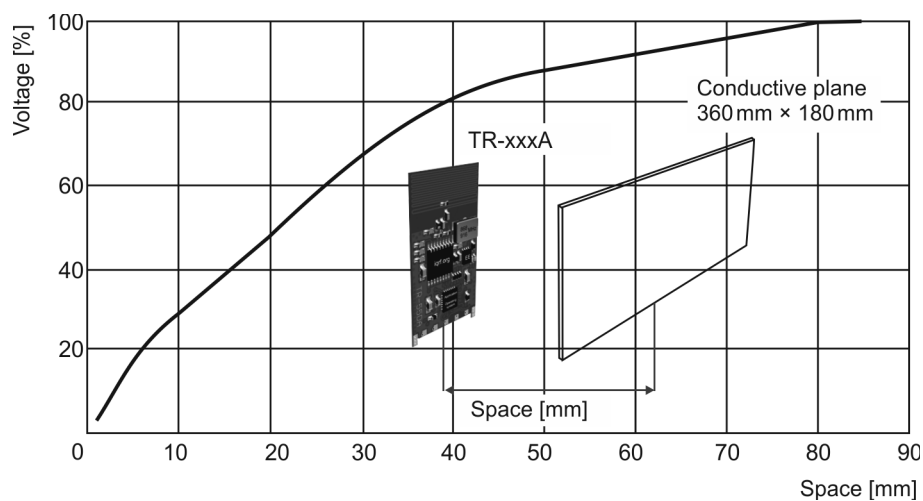
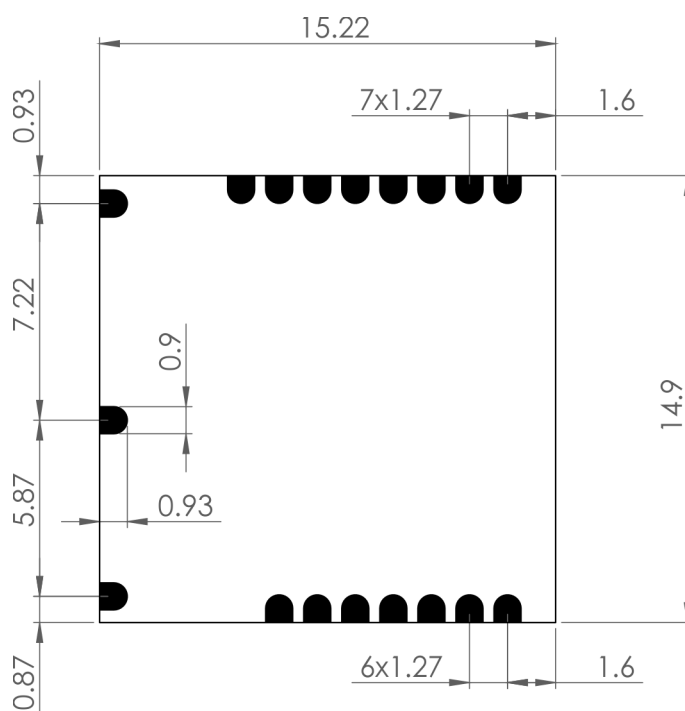


Figure 5: Parallel arrangement

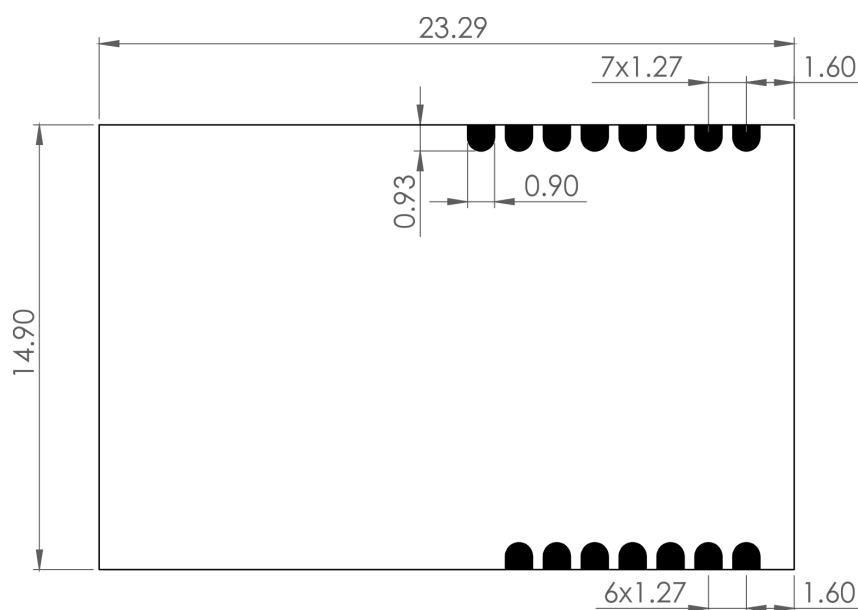


Mechanical drawings

TR-56D



TR-56DA



Top view. Units: mm.

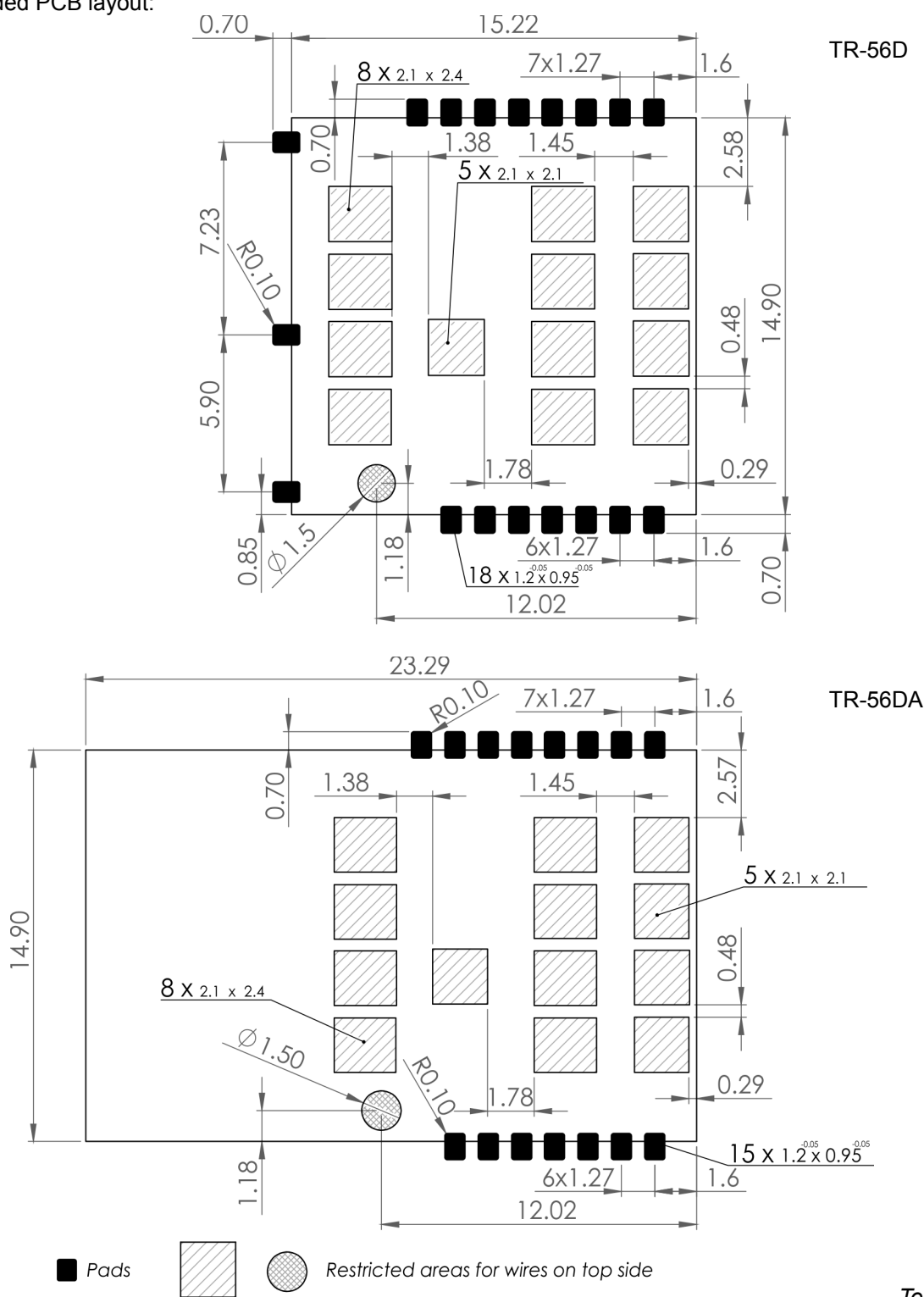
Application

Assembly

For proper mounting of surface mount TR-56Dx 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 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 modules:

- Wired upload with TR-56Dx plugged via the SIM connector in the CK-USB-04A programmer.
- For TR-56Dx 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.

In countries where FCC provision is valid, the requirements stated in CB-400-Modular Approval Checklist_JS_WIP.pdf have to be observed. Refer to www.iqrf.org/download, „FCC checklist“.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can *radiate* radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult IQRF support or an experienced local distributor technician for help.

Product information

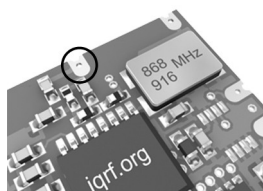
Ordering codes

T R - 5 6 D A PP

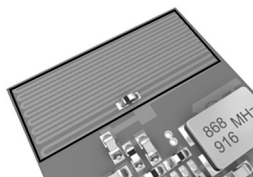
peripheral options: **nil** - No shielding
F - RF shielding

antenna options: **nil** - Soldering padhole (no antenna, no U.FL connector)
A - PCB antenna,
C - U.FL connector (mini coax)

Type	Antenna option	RF shielding
TR-56D	Soldering pad-hole	–
TR-56DA	Internal PCB antenna	–
TR-56DF	Soldering pad-hole	Yes
TR-56DAF	Internal PCB antenna	Yes



TR-56D



TR-56DA



TR-56DF

Document history

- 141219 Information regarding FCC directives updated.
- 141103 Chapters *Pin description* and *Programming* slightly updated.
Information regarding directives FCC, RoHS and WEEE updated and extended.
- 140430 Supply voltage and RF range revised.
- 140120 Datasheet file renamed from DS_TR-56D_131217 to Datasheet_TR-56D_140120.
- 131217 Recommended PCB design slightly changed.
- 131114 Certification updated for the latest directives.
- 130906 Pin description extended, bottom view added. TR-56DA mechanical drawing added. F-option with RF shielding available. Recommended PCB layout added. Electrical specification simplified.
- 130703 Chapter *Solderless development prototyping* updated.
- 130607 Operational temperature range extended.
- 130405 Preliminary, for HW v1.00.

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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 FCC directives Part 15 Low Power Communication Device Transmitter. FCC ID: R24TR-5XDX.

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



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