

TR-56D

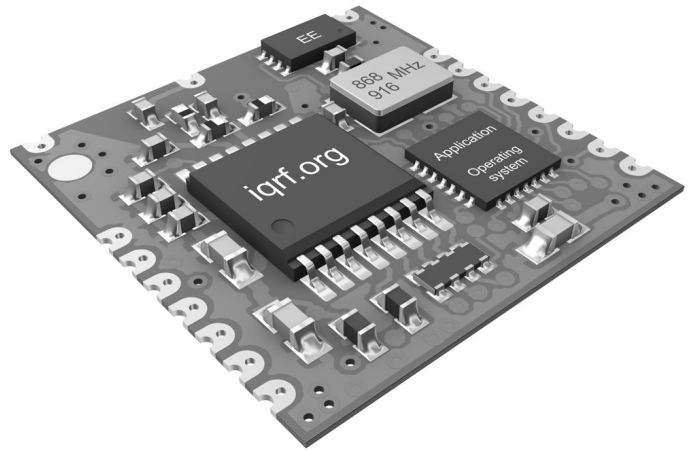
Transceiver Module

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.



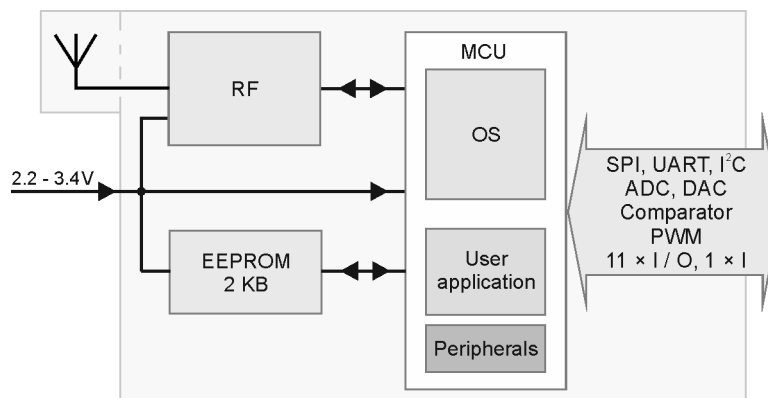
Key features

- 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in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.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	2.2 V min., 3.4 V max., 3.0 V typ. , stabilized.																		
Operating temperature ²	-40 °C to +85 °C																		
Supply current																			
Sleep mode	380 nA (if all peripherals including MRF49XA disabled ⁴)																		
Additional supply current	800 nA (if watchdog enabled) 7.5 µA (if brown-out detection enabled)																		
Run mode	1 mA (MRF49XA disabled)																		
Additional supply current	0.6 mA (MRF49XA on)																		
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)																		
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 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																		
RF sensitivity	Depends on frequency band and bit rate:																		
	<table border="1"> <thead> <tr> <th></th> <th>bit rate [kb/s]</th> <th>1.2⁶</th> <th>19.2</th> <th>57.6⁶</th> <th>86.2⁶</th> </tr> </thead> <tbody> <tr> <td rowspan="2">RF sensitivity [dBm]</td> <td>868 MHz</td> <td>-110</td> <td>-104</td> <td>-99</td> <td>-92</td> </tr> <tr> <td>916 MHz</td> <td>-109</td> <td>-102</td> <td>-97</td> <td>-90</td> </tr> </tbody> </table>		bit rate [kb/s]	1.2 ⁶	19.2	57.6 ⁶	86.2 ⁶	RF sensitivity [dBm]	868 MHz	-110	-104	-99	-92	916 MHz	-109	-102	-97	-90	
	bit rate [kb/s]	1.2 ⁶	19.2	57.6 ⁶	86.2 ⁶														
RF sensitivity [dBm]	868 MHz	-110	-104	-99	-92														
	916 MHz	-109	-102	-97	-90														
RF output power	Programmable in 8 levels (0 – 7), -2.5 dBm/level																		
	<table border="1"> <thead> <tr> <th>level</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>[dBm]</td> <td>-12.5</td> <td>-10</td> <td>-7.5</td> <td>-5</td> <td>-2.5</td> <td>0</td> <td>2.5</td> <td>5</td> </tr> </tbody> </table>	level	0	1	2	3	4	5	6	7	[dBm]	-12.5	-10	-7.5	-5	-2.5	0	2.5	5
level	0	1	2	3	4	5	6	7											
[dBm]	-12.5	-10	-7.5	-5	-2.5	0	2.5	5											
RF range (TR-56DA) ³	Up to 850 m @ 1.2 kb/s ⁶ Up to 650 m @ 19.2 kb/s																		
Input voltage on Q4 to Q15 pins	0 V to V_{CC}																		
A/D converter	10 bit, 4 inputs (multiplexed S&H, successive approximation)																		
Input A/D impedance	10 kΩ max.																		
Dimensions	15.2 mm x 14.9 mm x 2.0 mm (TR-56D)																		

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 is enabled.

Note 5: Depends on interferences.

Note 6: Bit rates different from 19.2 kb/s are preliminary, for experimental purpose only.

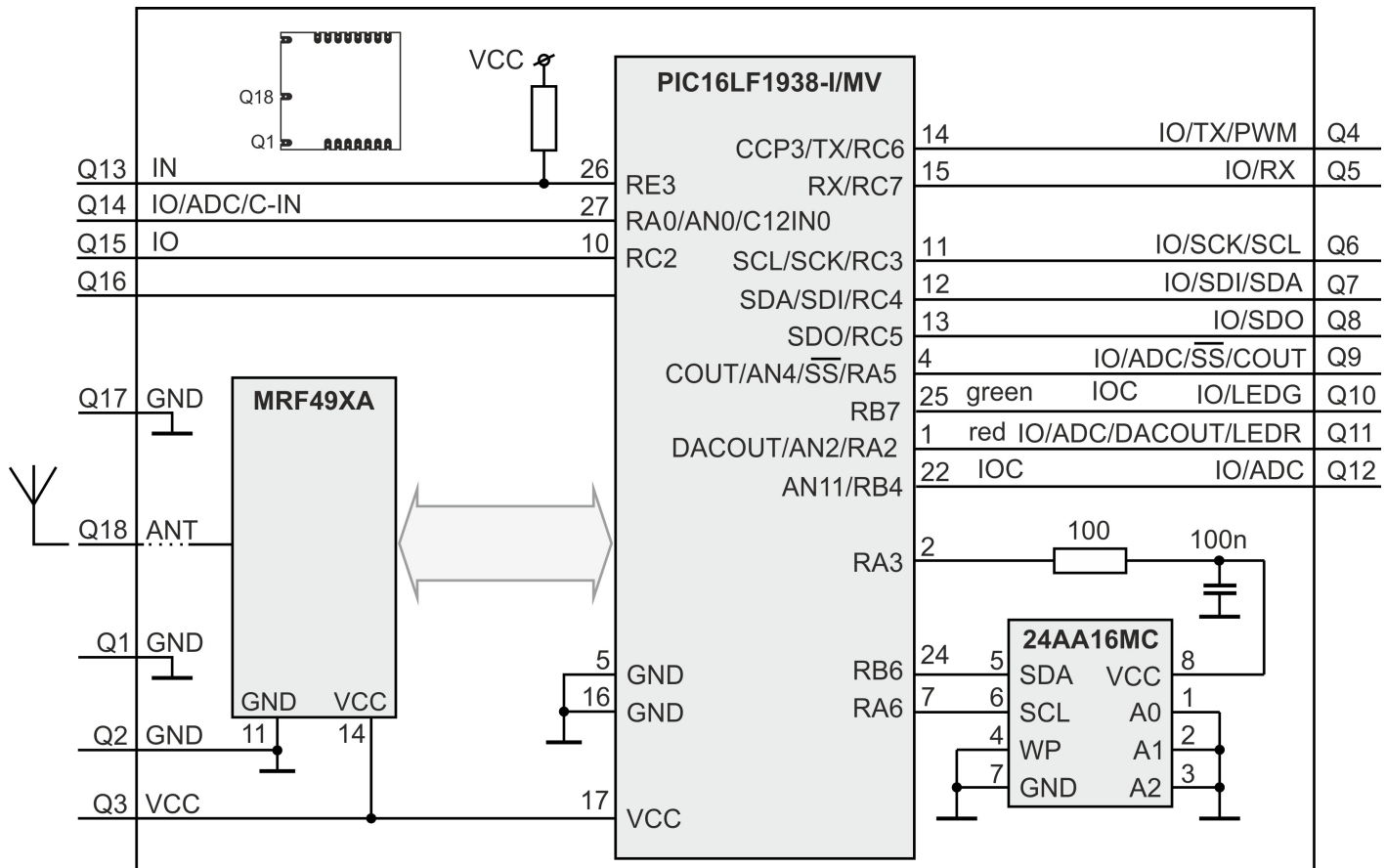
Users have to ensure observing local provisions and restrictions relating to the use of short range devices by software, e.g. the CEPT ERC/REC 70-03 Recommendation and subsequent amendments in EU.

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.

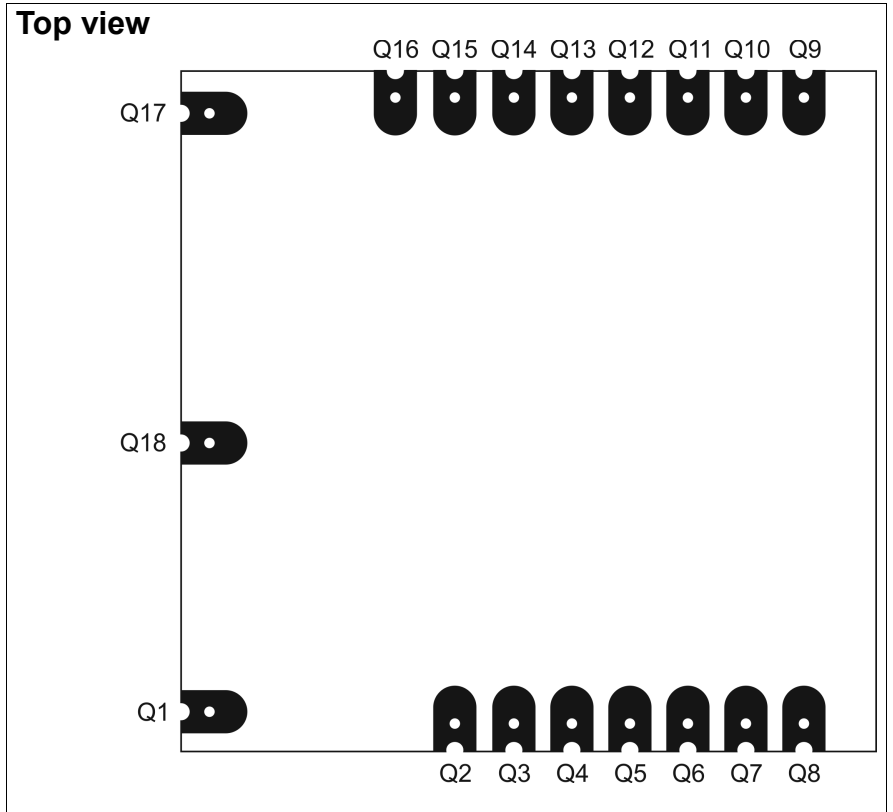
Supply voltage (V_{CC})	4 V
Voltage on Q4 to Q15 pins	-0.3 V to ($V_{CC} + 0.3$ V)
Storage temperature	-50 °C to +100 °C
Ambient temperature under bias	-40 °C to +85 °C

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 ⁷	GND	Ground
Q2	GND	Ground
Q3	VCC	Power supply voltage
Q4	IO/ TX /PWM RC6 TX CCP3	General I/O pin UART TX PWM output
Q5	IO/RX RC7 RX	General I/O pin UART RX
Q6	IO/SCK/SCL RC3 SCK SCL	General I/O pin SPI clock input I ² C clock
Q7	IO/SDI/SDA RC4 SDI SDA	General I/O pin SPI data I ² C data
Q8 ⁸	IO/SDO RC5 SDO	General I/O pin SPI data out
Q9	IO/ADC/-SS/COUT RA5 AN4 -SS C2OUT	General I/O pin, Analog A/D input SPI Slave select Comparator output
Q10	IO/ LEDG RB7 LED1	General I/O pin, programmable pull-up and interrupt/wake-up on change (IOC) LEDR supported by OS
Q11	IO/ADC/ LEDR RA2 AN2 LED2 DACOUT	General I/O pin Analog A/D input LEDR supported by OS D/A converter output
Q12	IO/ ADC RB4 AN11	General I/O pin, programmable pull-up and interrupt/wake-up on change (IOC) Analog A/D input
Q13	IN RE3	General input only pin
Q14	IO/ADC/C-IN RA0 AN0 C12IN0	General I/O pin Analog A/D input Comparator -input
Q15	IO RC2	General I/O pin
Q16	-	Do not use, leave unconnected
Q17 ⁷	GND	Ground
Q18 ⁸	ANT	Antenna



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.

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.

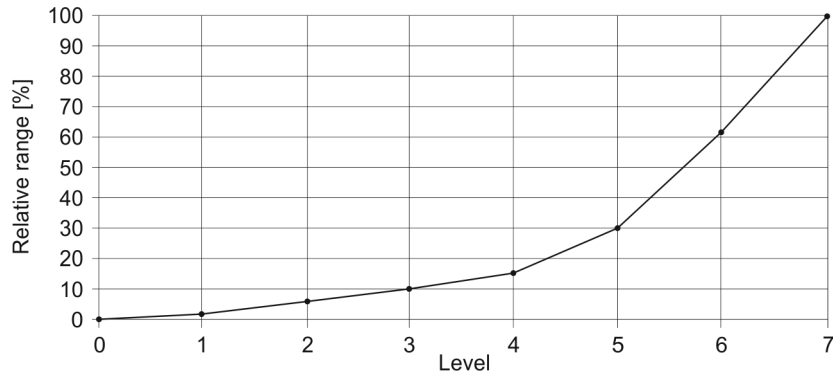


Figure 2: Relative RF range vs. level for the `checkRF(level)` function. Refer to IQRF OS Reference guide.

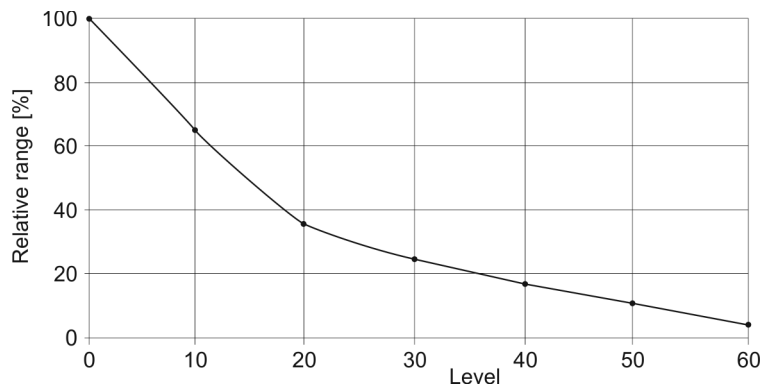
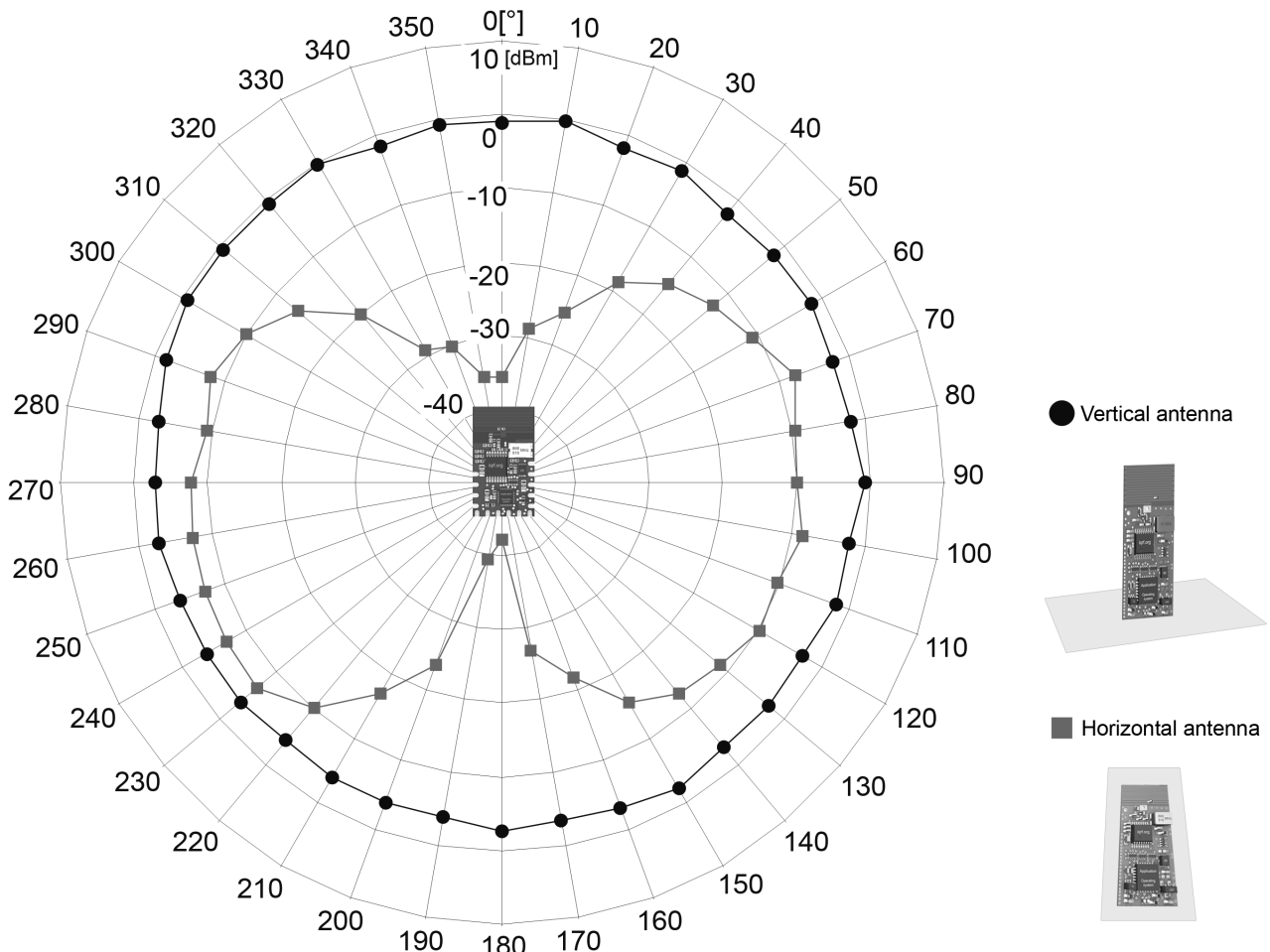


Figure 3: Relative RF range vs. antenna orientation (radiation patterns)



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

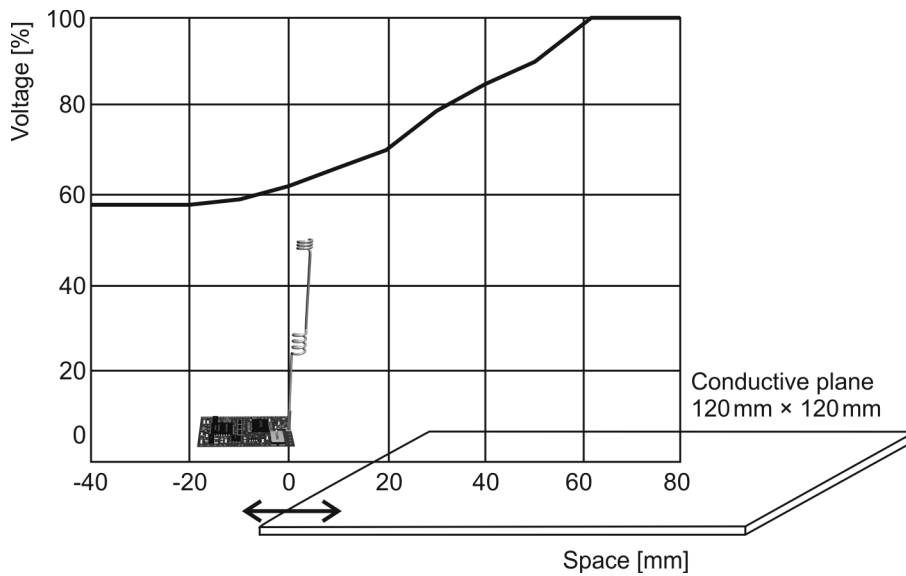
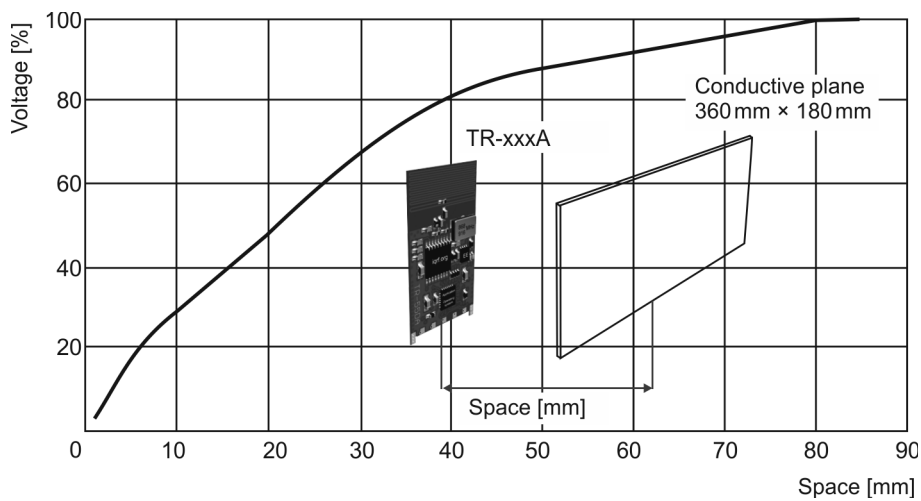
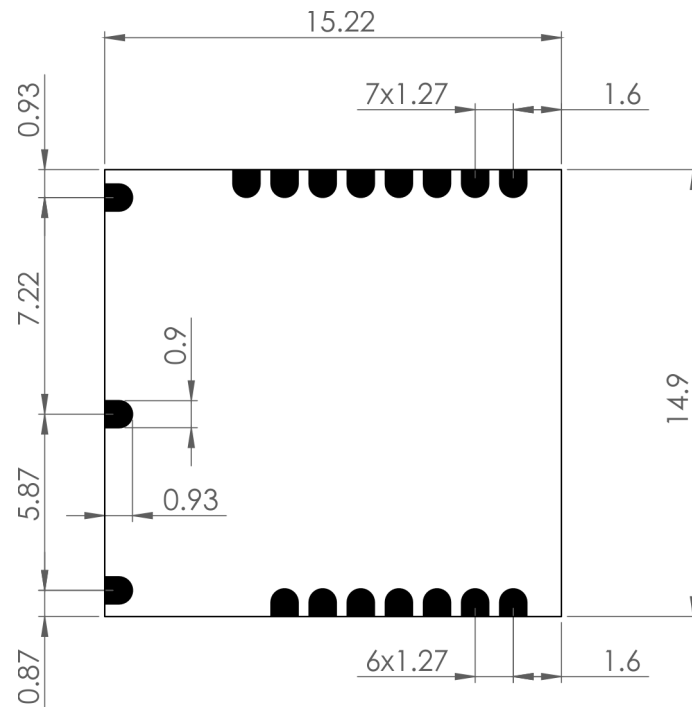


Figure 5: Parallel arrangement



Mechanical drawings

TR-56D



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.

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 two possibilities to upload an application program in TR-56Dx modules soldered in an application:

- For wired upload using the CK-USB-04 programmer the KON-TR-01P adapter is intended. See the KON-TR-01P User's guide for details.
- RFPGM – RF programming™ (wireless upload). See the IQRF OS User's guide, chapter *RF programming*.

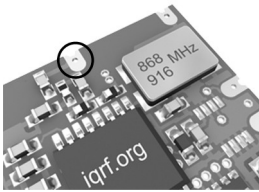
Solderless development prototyping

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.

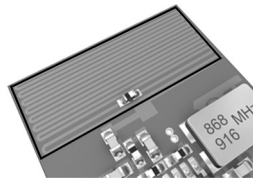
Product information**Ordering codes**

T R - 5 6 D A _____ antenna options: **nil** - soldering pad-hole (no antenna, no U.FL connector)
A - PCB antenna

Type	Antenna option	Serial EEPROM
TR-56D	Soldering pad-hole	2 kB
TR-56DA	Internal PCB antenna	2 kB



TR-56D



TR-56DA

Document history

- 130703 Chapter *Solderless development prototyping* updated.
- 130607 Operational temperature range extended.
- 130405 Preliminary, for HW v1.00.

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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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