(DC)TR-72D

Transceiver Module

Data Sheet

Smarter wireless. Simply.

Description

(DC)TR-72D 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 containing MCU, RF circuitry, integrated LDO regulator, serial EEPROM, optional temperature sensor and optional on-board antenna requires no external components. Extended RF power result in higher RF range. Ultra low power consumption fits for battery powered applications. MCU with built-in operating system significantly reduces application development time. Optional DPA framework supports applications even without programming.

This document is valid for TR as well as DCTR transceiver versions. For simplicity, only TR is used further on throughout the document.

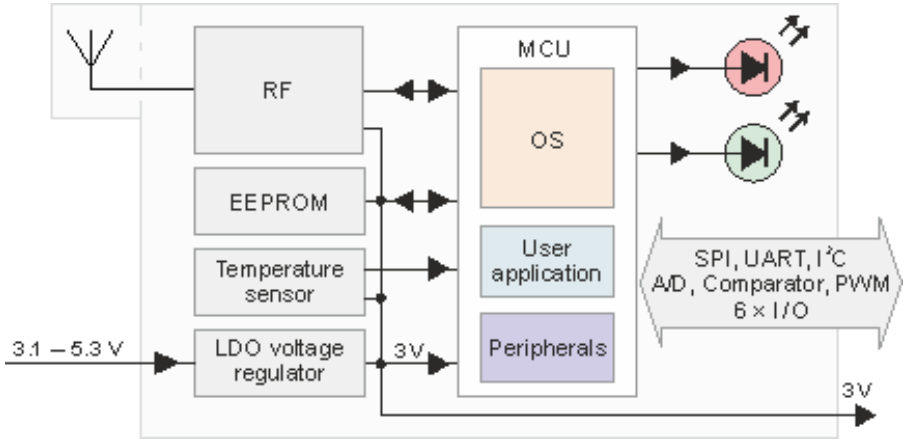
Key features

- Operating system (upgradeable at the user), easy to use
- DPA framework implementing DCTR (Data Controlled Transceiver)
- GFSK modulation
- Selectable RF band 868 / 916 MHz, multiple channel
- Selectable RF bit rate
- RF output power 12.5 mW
- MCU with extended resources, user interrupt capability
- Extra low power consumption, power management modes
- SPI interface supported by OS in background
- Serial EEPROM 256 Kb
- 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
- Shielding can

Applications

- Point-to-point or network wireless connectivity
- Telemetry, AMR (automatic meter reading)
- WSN (wireless sensor network)
- Building automation
- Street lighting control
- Wireless monitoring, control and regulation
- Remote data acquisition
- RF connectivity in many other fields
- Also for municipal and indoor areas
- Internet of Things

Block diagram



Electrical specifications

*Typical values **unless otherwise stated***

Parameters specified in this datasheet are typical values. They are at power supply VOUT = 3 V only. VOUT 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	2.9 µA (if all peripherals including RF IC disabled [3])
Run mode	
RF sleep	1.6 mA
RF ready	3.0 mA
RX mode	
STD	12.3 mA
LP [4]	234 µA
XLP [4]	16 µA
TX mode	8.3 mA – 19 mA (according to RF output power)
Additional LED supply current	About 2 mA per LED. Rough value for brief guidance only.
RF band	868 MHz or 916 MHz [6] (software configurable)
RF channels	See IQRF OS User's guide, Appendix *Channel maps*
RF data modulation	GFSK (Gaussian Frequency Shift Keying)
RF data transmission bit rate [5]	19.836 kb/s
RFIC RF sensitivity	-106 dBm (STD RX mode, `checkRF(0)`)
RFIC RF output power	11 dBm (for 50 Ω load), programmable in 8 levels (0 – 7)
RF range (TR-72DA)	500 m [2A], 1100 m [2B]
Input voltage on C1, C2, C5 to C8 pins	0 V to V_{OUT}
A/D converter	10 bit, 2 inputs. Refer to MCU datasheet.
Temperature sensor	MCP9808E/MC (for TR types with 'T' postfix only, e.g. TR-72DT)
Size (L x W x H)	25.0 mm x 14.9 mm x 3.3 mm (TR-72Dx) 31.8 mm x 14.9 mm x 3.3 mm (TR-72DAx)

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: Arrangement:

2A: Two TR-72DA transceivers plugged in DK-EVAL-04x kits, vertically, 1.6 m above the ground, in free space (with reflective planes at min. 100 m distance).

2B: Two TR-72DA transceivers plugged in DK-EVAL-04x kits through the RNG-EXT-01 adapters, vertically, 1.6 m above the ground, in free space (with reflective planes at min. 100 m distance).

Test software: E09-LINK example (STD mode, `setRFpower(7)`, `checkRF(0)`), bit rate 19.836 kb/s.

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: Several RF bit rates different from 19.836 kb/s will be available in future IQRF OS versions.

Note 6: 916 MHz band will be available in future IQRF OS versions.

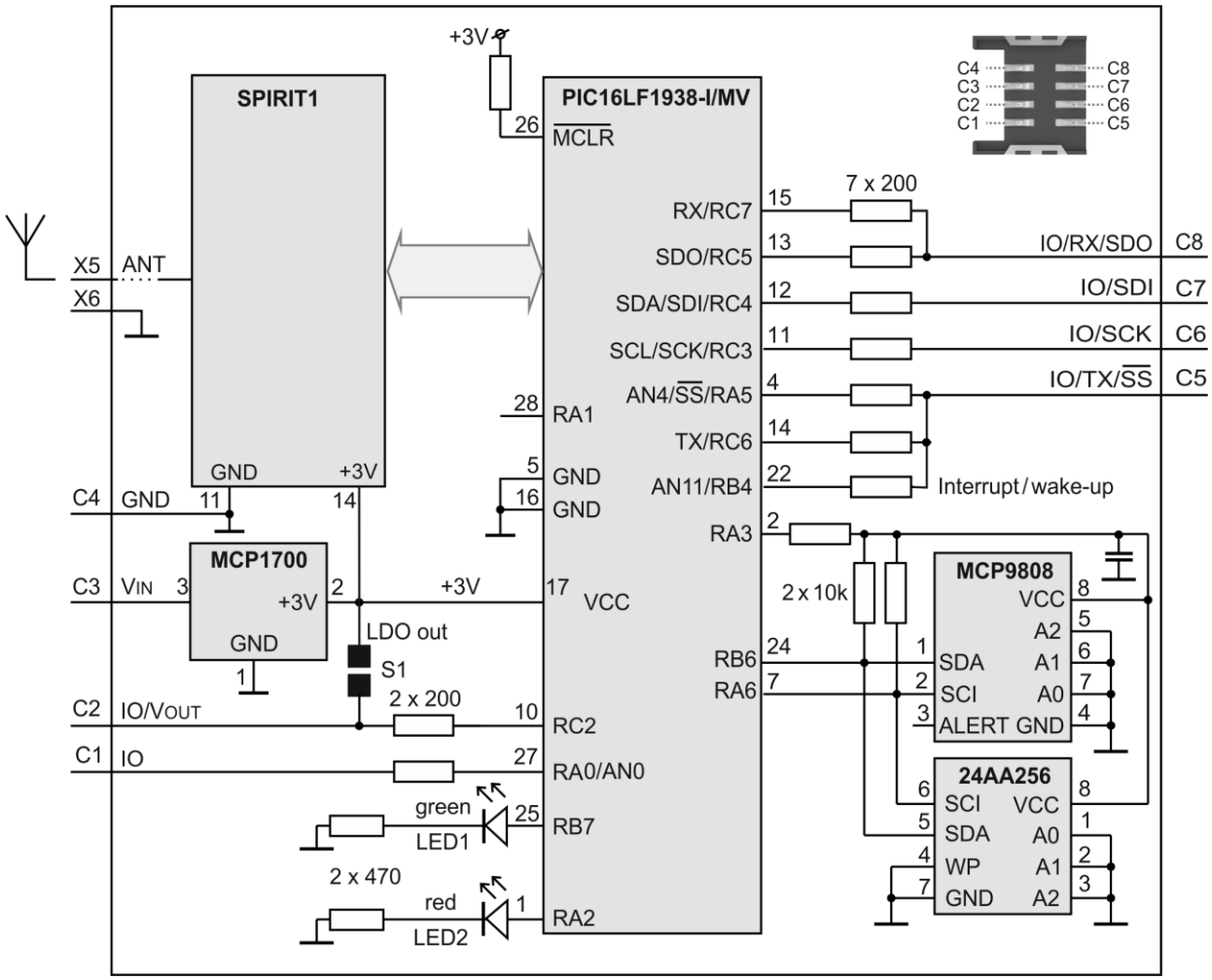
***Caution:** Electrostatic sensitive device. Observe appropriate precautions for handling.*

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 (configured as inputs) 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

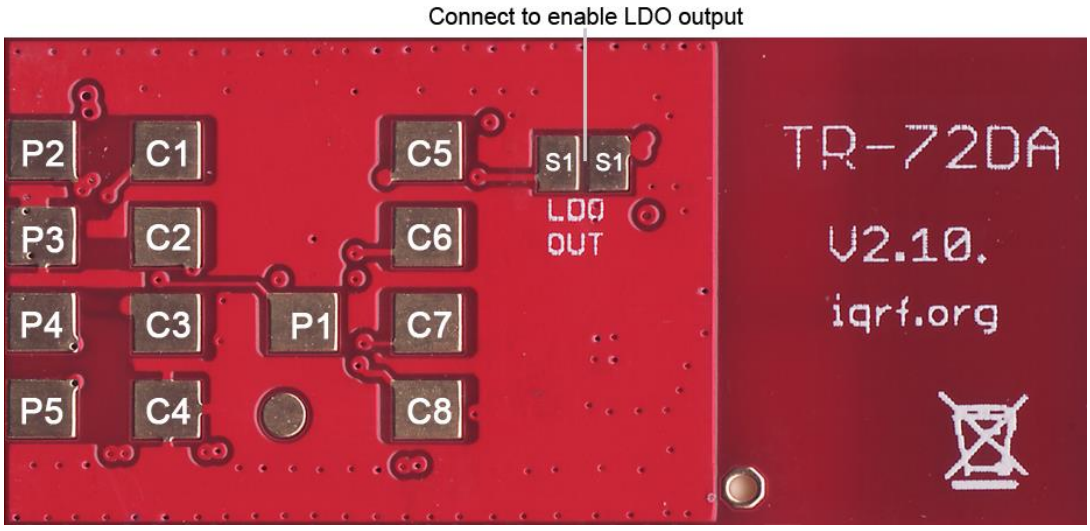


Basic components

IC	Type	Manufacturer	Note
MCU	PIC16LF1938–I/MV	Microchip	
RF IC	SPIRIT1	STMicroelectronics	
RF balun	BALF-SPI-01D3	STMicroelectronics	
LDO voltage regulator	MCP1700T-3002E/TT	Microchip	
Temperature sensor	MCP9808E/MC	Microchip	For types with ‘T‘ postfix only, e.g. TR-72DT
EEPROM	24AA256-I/CS16K	Microchip	256 Kb

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 (when S1 disconnected)
	VOUT	On-board +3 V LDO output (when 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, with 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	I^2C clock
C7	**IO / SDI / SDA**	
	RC4	General I/O pin. Used as input during initial about 200 ms boot-up (after power supply rising-up) to recognize programming mode.
	SDI	SPI data
	SDA	I^2C data
C8	**IO / RX / SDO**	
	RC5	General I/O pin. Used as output during initial about 200 ms boot-up (after power supply rising-up) to recognize programming mode. That is why it should not be interconnected with the C7 pin.
	SDO	SPI data out
	RC7	General I/O pin
	RX	UART RX
X5	**ANT**	Antenna input
X6	**GND**	Ground
P1–P5		For manufacturer only
S1		LDO output enable. Interconnect both S1 pads to enable. Default (from factory) disabled.



Bottom view

Relative RF range

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

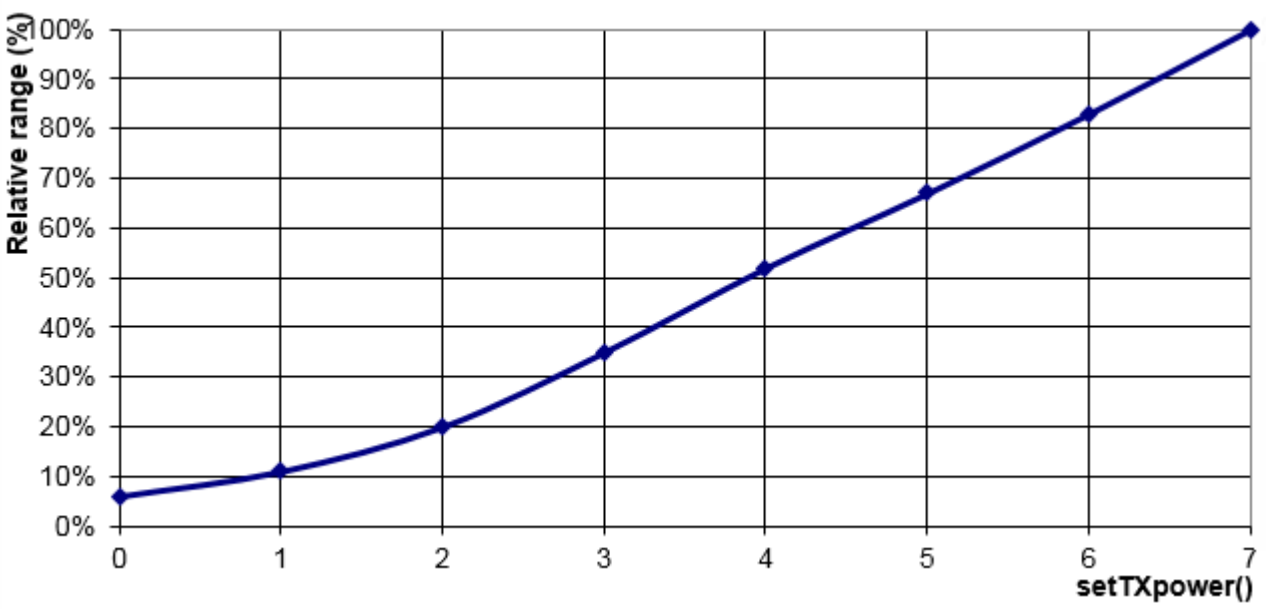


Figure 2: Relative RF range vs. level in the `checkRF(level)` function. Refer to IQRF OS Reference guide.

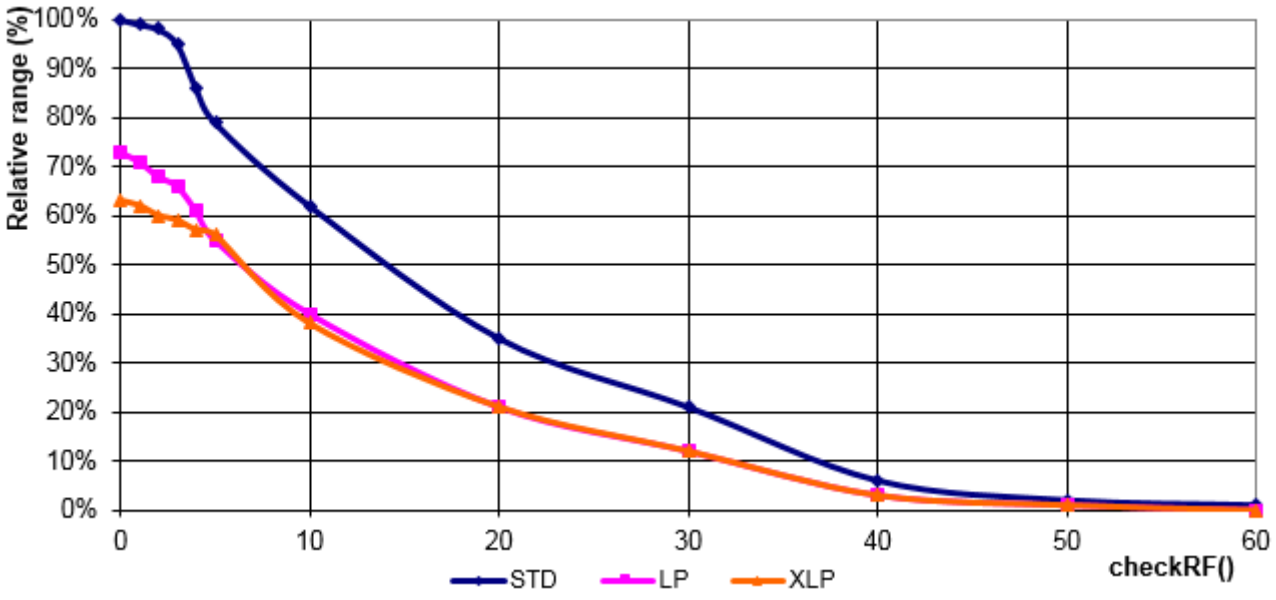
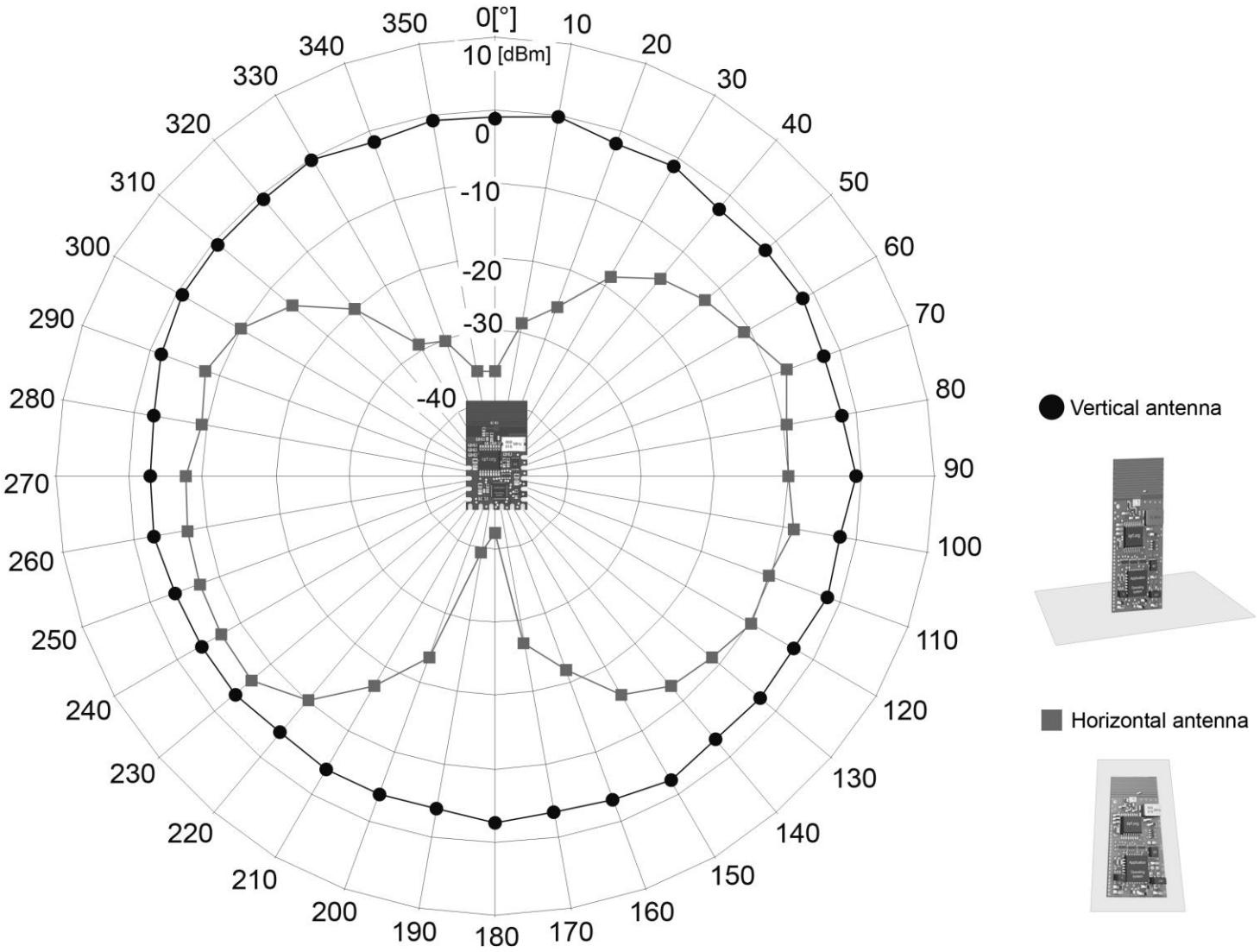


Figure 3: TR-72DA relative RF range vs. antenna orientation (radiation patterns)



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

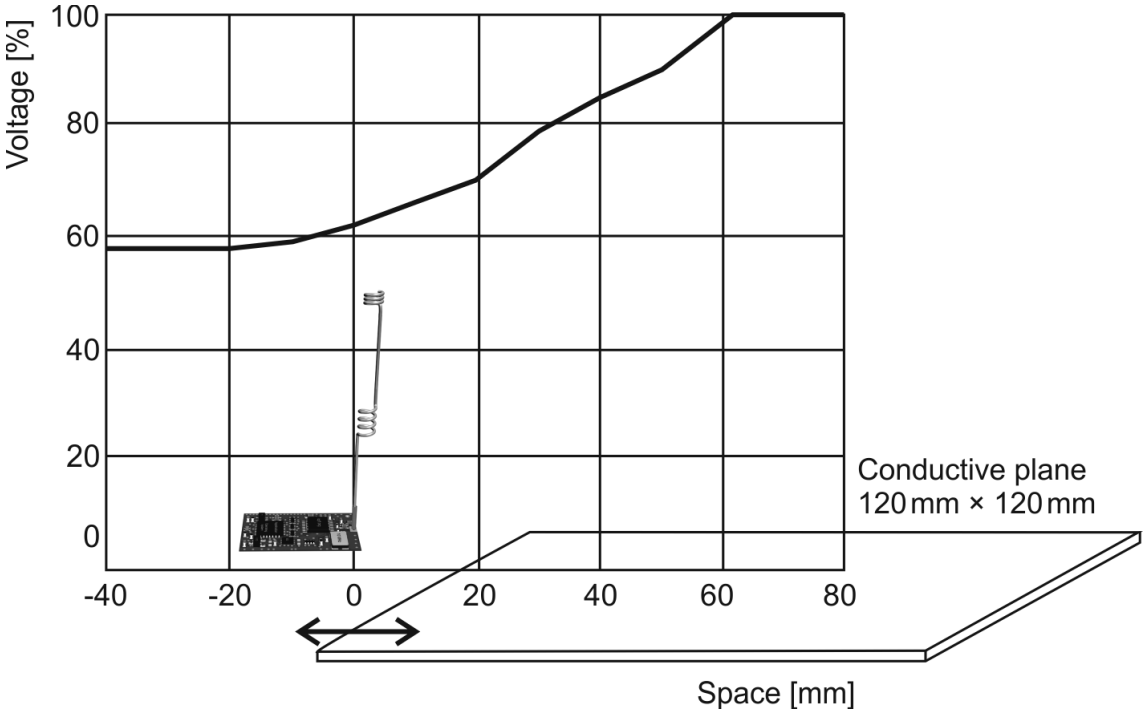
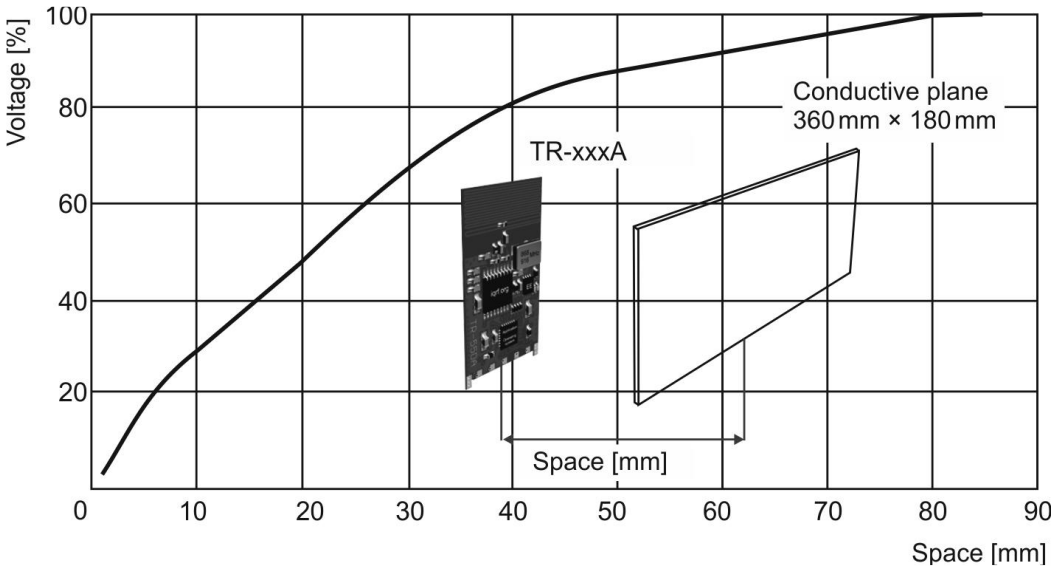
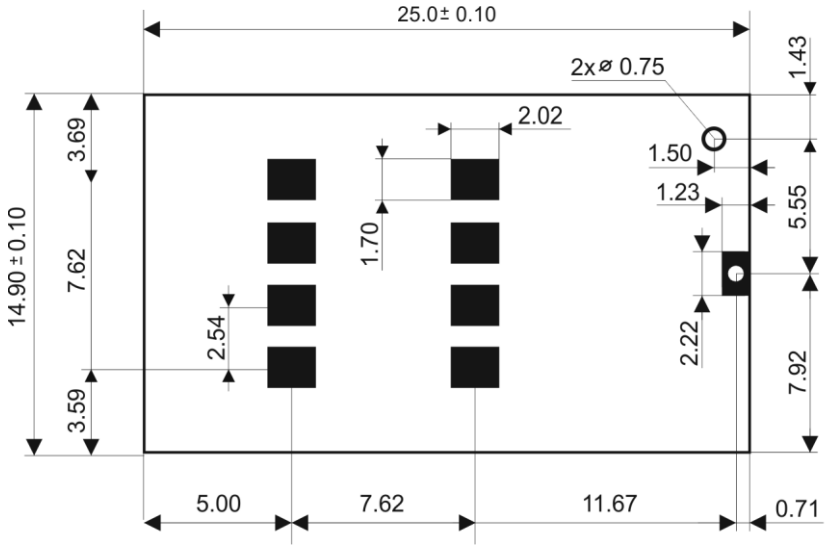


Figure 5: Parallel arrangement

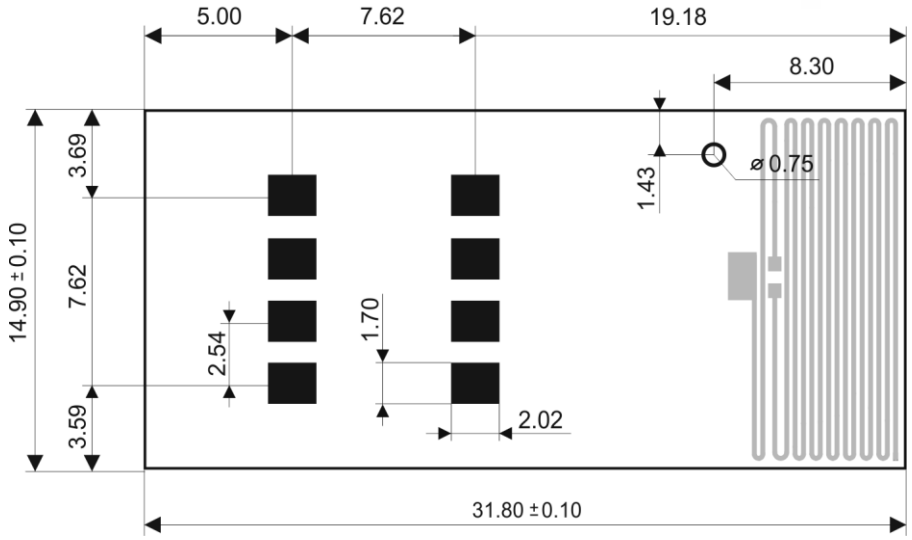


Dimensions

TR-72D(C)(T)



TR-72DA(T)



Top view, Units: mm

Hardware revision

- TR-72D(A) v2.12 Standard production
- TR-72D(A) v2.10 EAP samples, standard dimensions
- TR-72DA v2.02 EAP samples, length 33.8 mm.

Application

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.

See IQRF video tutorial set on www.iqrf.org/videos.

Assembly

TR-72Dx 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.

DPA framework and DCTR

See DPA Framework technical guide.

Application software

See IQRF Quick start guide and IQRF application examples.

Programming (upload)

There are the following possibilities to upload an application program in TR-72Dx modules:

- Wired upload with TR-72Dx plugged via the SIM connector in the CK-USB-04(A) programmer.
- For TR-72Dx modules populated in an application:
  - Wired upload
    - Using the CK-USB-04A programmer. See the CK-USB-04A User's guide.
    - Using the CK-USB-04 programmer and the KON-TR-01P adapter. See the KON-TR-01P User's guide.
  - Wireless upload: See the IQRF OS User's guide, Appendix *RFPGM – RF programming™*.

Product information

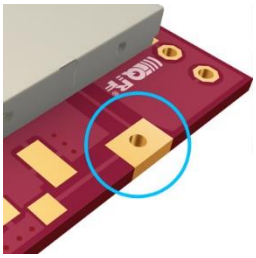
Ordering codes

DC T R-72D A P

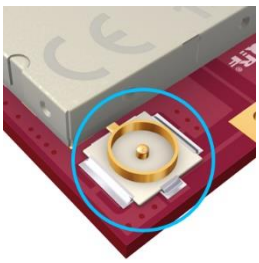
- Peripheral options
  - **nil** - No other option
  - **T** - Temperature sensor
- Antenna options
  - **nil** - soldering pad-hole (no antenna, no U.FL connector)
  - **A** - PCB antenna
  - **C** - U.FL connector (mini coax)
- Transceiver series
- DCTR / TR options
  - **nil** - TR
  - **DC** - DCTR

Type	Antenna connection	Temperature sensor
(DC)TR-72D	Soldering pad-hole	–
(DC)TR-72DC	U.FL connector	–
(DC)TR-72DA	PCB antenna	–

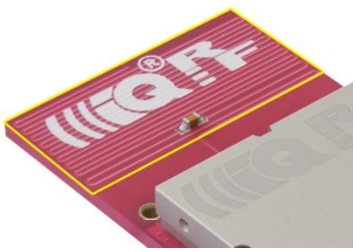
Type	Antenna connection	Temperature sensor
(DC)TR-72DT	Soldering pad-hole	Yes
(DC)TR-72DCT	U.FL connector	Yes
(DC)TR-72DAT	PCB antenna	Yes



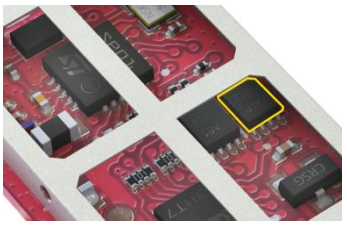
TR-72D



TR-72DC



TR-72DA



TR-72DT

Document history

- 160302 Notice about local provisions added to chapter *Application*.
- 160219 More detailed RF range specification. C7 and C8 pin description extended.
- 151005 ETSI directives updated.
- 150810 Revised. Preliminary.
- 140430 Preliminary.

Sales and Service

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Partners and distribution

Please visit www.iqrf.org/partners.

Quality management

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/10/05.2014-3.

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

Trademarks

Legal

On-line support: support@iqrf.org

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