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RC1180-MBUS

Wireless M-Bus RF Transceiver Module (EN 13757-4:2005)

ADVANCE INFORMATION
This document contains information on a new product. Specifications and information herein are subject to change without notice.

Product Description

The RC1180-MBUS RF Transceiver Module is a compact surface-mounted module with embedded Wireless MBUS protocol. The module has a UART interface for serial communication and configuration, and a one-pin antenna connection. The module is pre-certified for operation under the European radio regulations for license-free use and measures only 12.7 x 25.4 x 3.3 mm with shielding. When used with quarter-wave antennas a line-of-sight range of 500-600 meter can be achieved. The RC1180-MBUS meets the Wireless MBUS specification S, T and R modes, and operates in 12 channels in the 868 MHz frequency band.

Applications

- Wireless M-Bus
- Automatic Meter Reading (AMR)
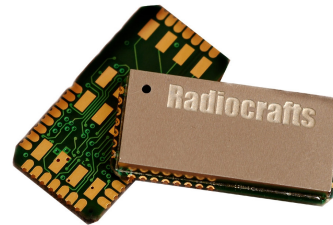- Electricity meters
- Gas meters
- Water meters
- Heat meters

Illustration photo only, shielding is optional

Features

- Embedded protocol supporting EN 13757-4:2005 mode S, T and R2
- 12.7 x 25.4 x 3.3 mm compact module for SMD mounting
- Easy to use UART interface for communication and configuration
- 2 channels (868.3, 868.95 MHz) in mode S and T
- 10 channels in mode R2 (868.03 + n x 0.06 MHz)
- 2.0 – 3.6 V supply voltage, ultra low power modes
- Conforms with EU R&TTE directive (EN 300 220, EN 301 489, EN 60950)
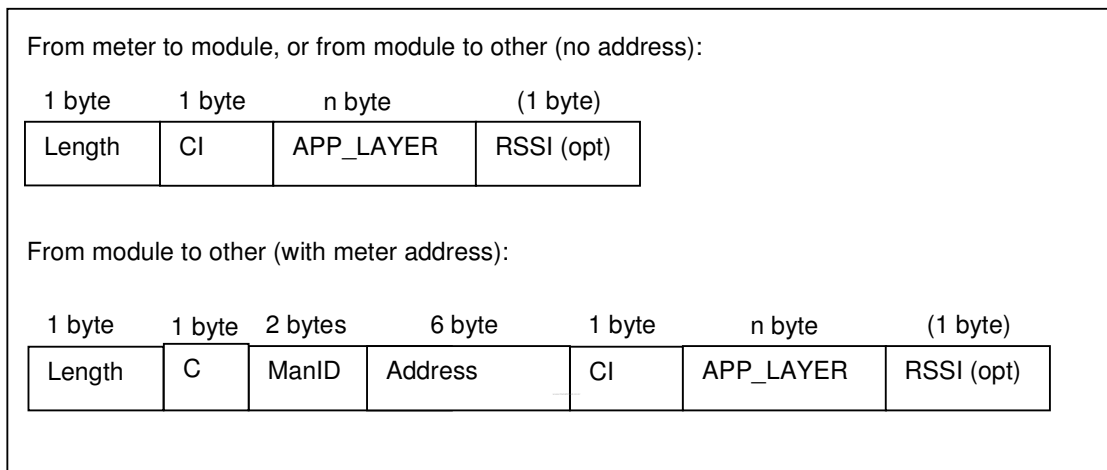- Designed for EX compliance

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Wireless M-Bus modem

The standard RC1180-MBUS module acts like a wireless M-Bus modem. The embedded protocol transmits and receives the wireless M-Bus data packets based on application messages from an external source (the meter or the concentrator). The module automatically adds the Command field, the Manufacturer ID and the Address based on parameters configured in the module.

All timing, and the application layer protocol, is to be handled externally. The UART data can easily be converted to USB or RS485/232 for data collection and cable replacement.

The module is configured through its UART interface.

The protocol for UART application messages is as follows:

From meter to module, or from module to other (no address):

1 byte	1 byte	n byte	(1 byte)
Length	CI	APP_LAYER	RSSI (opt)

From module to other (with meter address):

1 byte	1 byte	2 bytes	6 byte	1 byte	n byte	(1 byte)
Length	C	ManID	Address	CI	APP_LAYER	RSSI (opt)

Similar commands are available for configuration via the UART interface.

Full wireless M-Bus application

As an option, a full wireless M-Bus application layer can be integrated in the module. In this case all the application layer protocol and timing will be handled internally by the module. An S0 (1-pin) pulse interface and/or a serial interface is used to read out values from any meter. Since the protocol for reading out meter information may differ from meter to meter, the embedded firmware is customized for each different meter and application.

One-Button Installation

In the full M-Bus application, the Radiocrafts unique "one-button" installation feature simplifies the installation and reduces installation time substantially. Using an external push-button and a LED connected to dedicated pins on the module, the installation procedure is very simple:
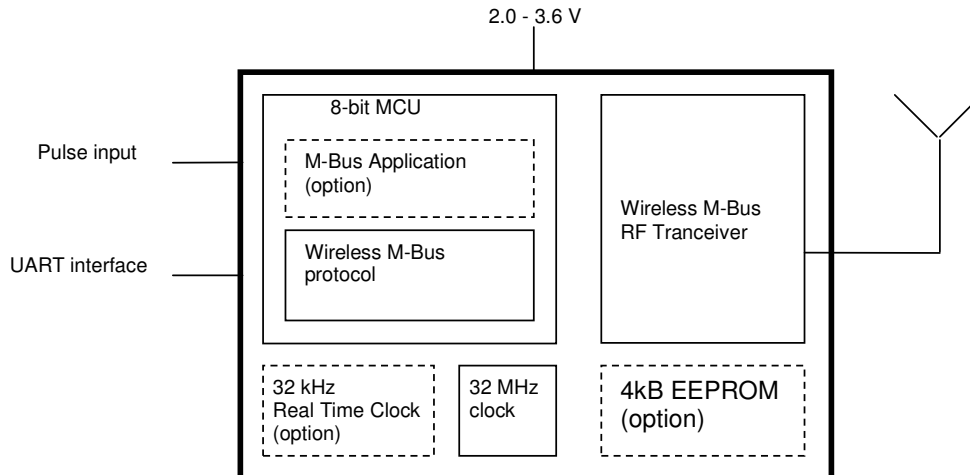
- Press the install button on concentrator
- Press the install button on meter
- Wait 5 seconds for two way communication to concentrator
- See installation LED go on for OK installation (Blinking for error during installation)

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Operating conditions (all modes)		Min	Typ	Max	Unit
Power Supply:	Supply Voltage	2.0		3.6	V
	Current Consumption, RX		22		mA
	Current Consumption, TX, 9 dBm		37		mA
	Current Consumption, Power Down		0.2	0.6	µA
Temperature range:		-20		+55	°C
ET (extended temperature) version		-40		+85	°C

Specifications mode S and T (3.0V, 25°C)		Min	Typ	Max	Unit
General:	Frequency Range	868.3		868.95	MHz
	Frequency stability			25	ppm
	Number of channels		2		
	Chip Rate		32.768		kcps/s
	Data Rate		16.384		kbit/s
TX mode:	Output Power (programmable)	-20		9	dBm
	2nd /3rd harmonic		-56/-60		dBm
	FSK deviation	±40	±50	±80	kHz
	Adjacent Band Power			-37	dBm
Rx Mode:	Sensitivity	-100	-102		dBm
	Blocking, +/- 1 MHz	30	43		dB
	Blocking, +/- 2 MHz	35	49		dB
	Blocking, +/- 5 MHz	50	68		dB
	Blocking, +/- 10 MHz	60	72		dB
	Adjacent Channel Rejection		29		dB
	Alternate Channel Selectivity		53		dB

Specifications mode R (3.0V, 25°C)		Min	Typ	Max	Unit
General:	Frequency Range	868.03		868.6	MHz
	Frequency stability			20	ppm
	Number of channels		10		
	Chip Rate		4.8		kcps/s
	Data Rate		2.4		kbit/s
TX mode:	Output Power (programmable)	-20		9	dBm
	2nd /3rd harmonic		-56/-60		dBm
	FSK deviation	±4.8	±6	±7.2	kHz
	Adjacent Band Power			-37	dBm
Rx Mode:	Sensitivity	-105	-107		dBm
	Blocking, +/- 1 MHz	30	43		dB
	Blocking, +/- 2 MHz	35	49		dB
	Blocking, +/- 5 MHz	50	68		dB
	Blocking, +/- 10 MHz	60	72		dB
	Adjacent Channel Rejection		29		dB
	Alternate Channel Selectivity		53		dB

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Block Diagram

2.0 - 3.6 V

Pulse input ——

UART interface ——

- 8-bit MCU
  - M-Bus Application (option)
  - Wireless M-Bus protocol
- Wireless M-Bus RF Tranceiver
- 32 kHz Real Time Clock (option)
- 32 MHz clock
- 4kB EEPROM (option)

Embedded resources

The module contains a fully embedded protocol supporting EN13757-4:2005 modes:

- Stationary mode S (S1, S1-m, S2)
- Frequent transmit mode T (T1 and T2)
- Frequent receive mode R2

The required M-Bus mode is configured by setting the module in configuration mode and entering appropriate UART commands.

Automatic generation of L, C, M, A and CRC-field, ie;

- Preamble (header + synchronisation)
- CRC
- Postamble

RF is mandatory Manchester coded or "3 out of 6" coded for equipment interoperation.

Manufacturer ID and unique meter Address is entered and stored in the modules' non-volatile memory.

The module has an internal buffer and transmits application data when:

- Whole packet is received based on packet length (first byte)
- Full buffer (configurable)
- Timeout after last character entered (configurable)
- End character received (configurable)

Max total payload is 128 bytes.

Sleep mode can be entered via an UART command and wake-up is triggered on UART traffic.

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Pin Assignment
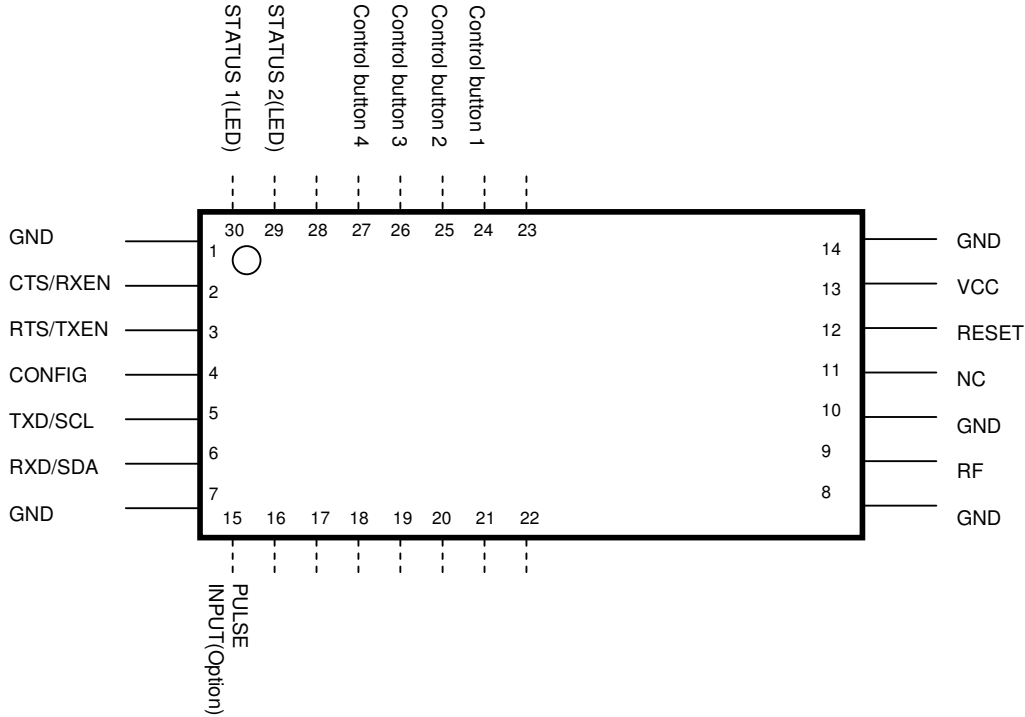
Pin Description

Pin no	Pin name	Description
1	GND	System ground
2	CTS	UART Clear to Send
3	RTS	UART Request to Send.
4	CONFIG	Configuration Enable. Active low.
5	TXD	UART TX Data
6	RXD	UART RX Data
7	GND	System ground
8	GND	System ground
9	RF	RF I/O connection to antenna
10	GND	System ground
11	NC	Not Connected
12	Reset	RESET_N. Active Low
13	VCC	Supply voltage
14	GND	System ground
15	Pulse	Pulse input for connection to pulse output from meter
16-23	NC	Not Connected (reserved)
24	CB1	Function Tampering input option
25	CB2	Function External alarm option
26	CB3	Function Installation button
27	CB4	Function TBD
28	NC	
29	LED2	Alarm
30	LED1	Blinking = installation mode, on= installation ok

Note: In UART mode the TXD and RXD are used for serial data, and CTS and RTS for flow control (optional).
Note: The CONFIG pin is used to enter configuration mode (to change default settings).

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Typical application circuit
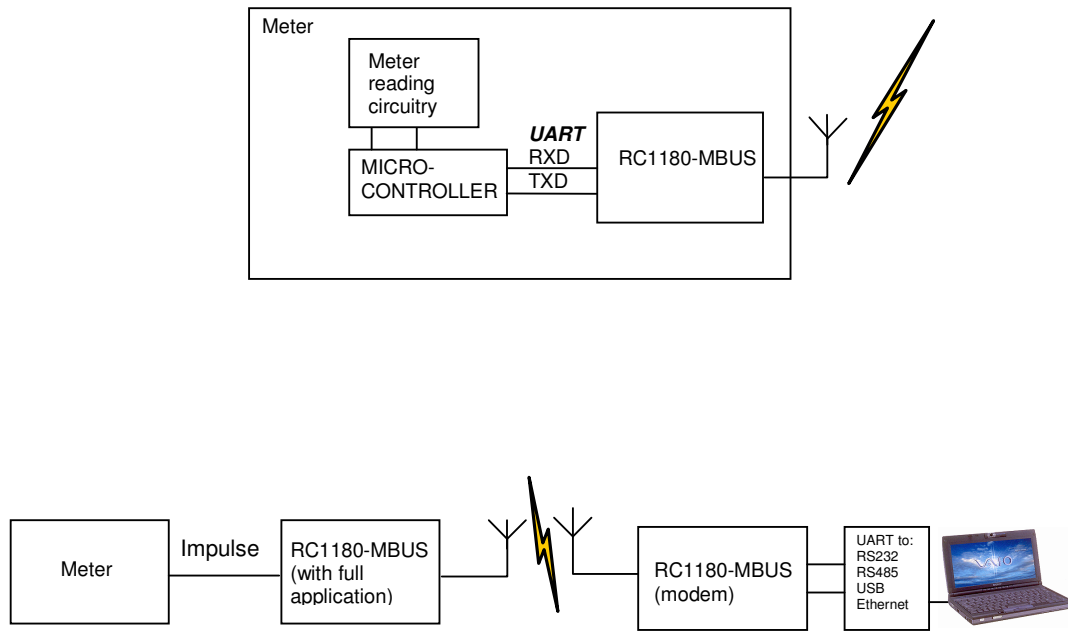
PCB Layout Recommendations

[To be reviewed for LGA pad layout.]

The recommended layout pads for the module are shown in the figure below. All dimensions are in thousands of an inch (mil) and the modules outer dimensions are fixed. The circle in upper left corner is an orientation mark only, and should not be a part of the copper pattern.
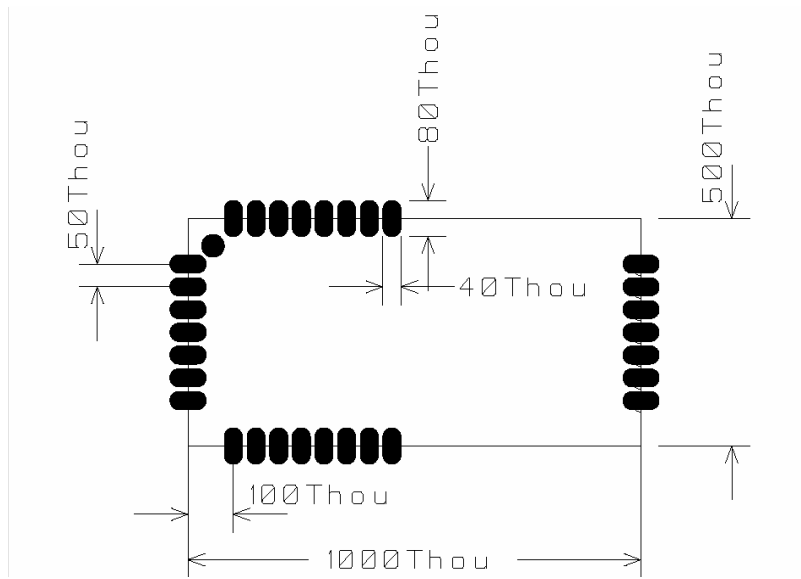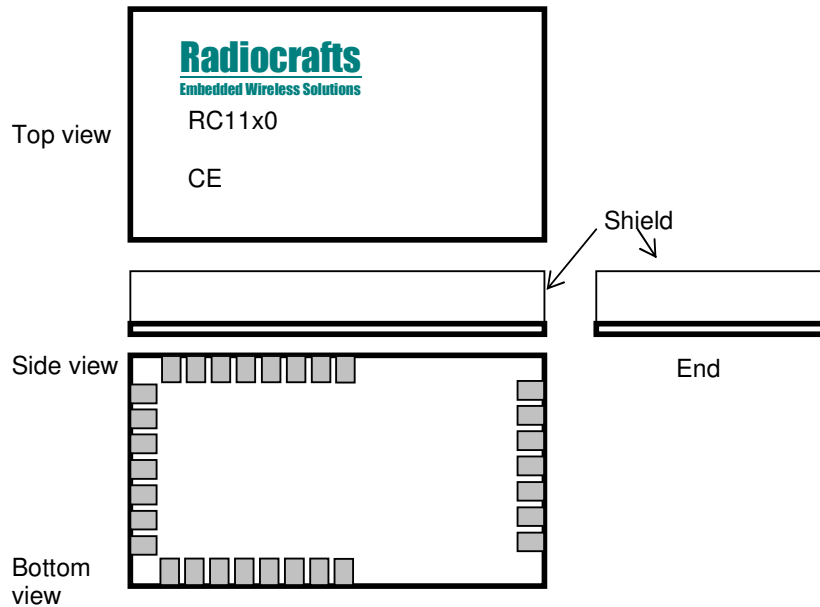

A PCB with two or more layers and with a solid ground plane in one of the inner- or bottom layer(s) is recommended. All GND-pins of the module shall be connected to this ground plane with vias with shortest possible routing, one via per GND-pin.

The area underneath the module should be covered with solder resist. If any routing or vias is required under the module, the routing and vias must be covered with solder resist to prevent short circuiting of pads or vias on the modules bottom layer. It is recommended that all vias are tented.

Reserved pins should be soldered to the pads but the pads must be left floating.

Mechanical Drawing

Top view

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CE

Shield

Side view

End

Bottom view

Drawings are not to scale

Mechanical Dimensions
The module size is 0.5" x 1.0" x 0.22" (12.7 x 25.4 x 3.3 mm). Height is up to 5.5 mm for other variants without shielding.