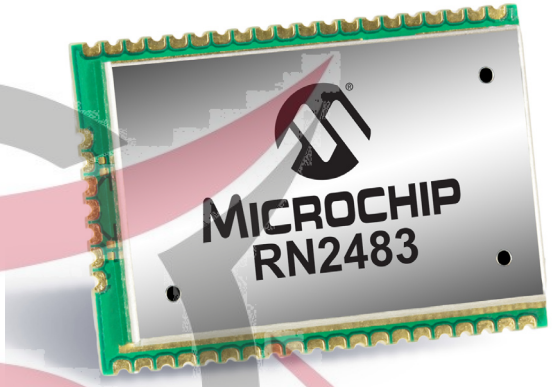
RN2483

Low-Power Long Range LoRa® Technology Transceiver Module

General Features

- On-Board LoRaWAN™ Protocol Stack
- ASCII Command Interface over UART
- Compact Form Factor: 17.8 x 26.7 x 3.34 mm
- Castellated SMT Pads for Easy and Reliable PCB Mounting
- Environmentally Friendly, RoHS Compliant
- European R&TTE Directive Assessed Radio Module
- Device Firmware Upgrade (DFU) over UART, see *"RN2483 LoRa® Technology Module Command Reference User's Guide"* (DS40001784)



Operational

- Single Operating Voltage: 2.1V to 3.6V (3.3V typical)
- Temperature Range: -40°C to +85°C
- Low-Power Consumption
- Programmable RF Communication Bit Rate up to 300 kbps with FSK Modulation, 10937 bps with LoRa® Technology Modulation
- Integrated MCU, Crystal, EUI-64 Node Identity Serial EEPROM, Radio Transceiver with Analog Front End, Matching Circuitry
- 14 GPIOs for Control and Status, Shared with 13 Analog Inputs

RF/Analog Features

- Low-Power Long Range Transceiver Operating in the 433 MHz and 868 MHz Frequency Bands
- High Receiver Sensitivity: Down to -146 dBm
- TX Power: Adjustable up to +14 dBm high Efficiency PA
- FSK, GFSK, and LoRa Technology Modulation
- IIP3 = -11 dBm
- Up to 15 km Coverage at Suburban and up to 5 km Coverage at Urban Area

Description

Microchip's RN2483 Low-Power Long Range LoRa Technology Transceiver module provides an easy to use, low-power solution for long range wireless data transmission. The advanced command interface offers rapid time to market.

The RN2483 module complies with the LoRaWAN Class A protocol specifications. It integrates RF, a baseband controller, command Application Programming Interface (API) processor, making it a complete long range solution.

The RN2483 module is suitable for simple long range sensor applications with external host MCU.

Applications

- Automated Meter Reading
- Home and Building Automation
- Wireless Alarm and Security Systems
- Industrial Monitoring and Control
- Machine to Machine (M2M)
- Internet of Things (IoT)

Table of Contents

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1.0 DEVICE OVERVIEW

The RN2483 transceiver module features LoRa Technology RF modulation, which provides long range spread spectrum communication with high interference immunity.

Using LoRa Technology modulation technique, RN2483 can achieve a receiver sensitivity of -146 dBm. The high sensitivity combined with the integrated +14 dBm power amplifier yields industry leading link budget, which makes it optimal for applications requiring extended range and robustness.

LoRa Technology modulation also provides significant advantages in both blocking and selectivity compared to the conventional modulation techniques, solving the traditional design compromise between extended range, interference immunity, and low-power consumption.

The RN2483 module delivers exceptional phase noise, selectivity, receiver linearity, and IIP3 for significantly lower power consumption. Figure 1-1, Figure 1-2, and Figure 1-3 show the top view, the pinout, and the block diagram of the module.

FIGURE 1-1: RN2483 TOP VIEW

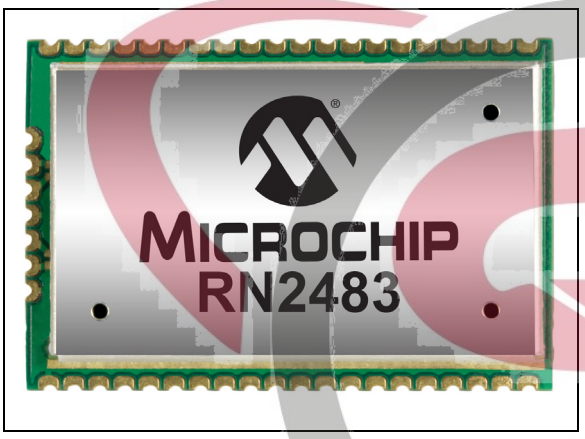


FIGURE 1-2: RN2483 PIN DIAGRAM

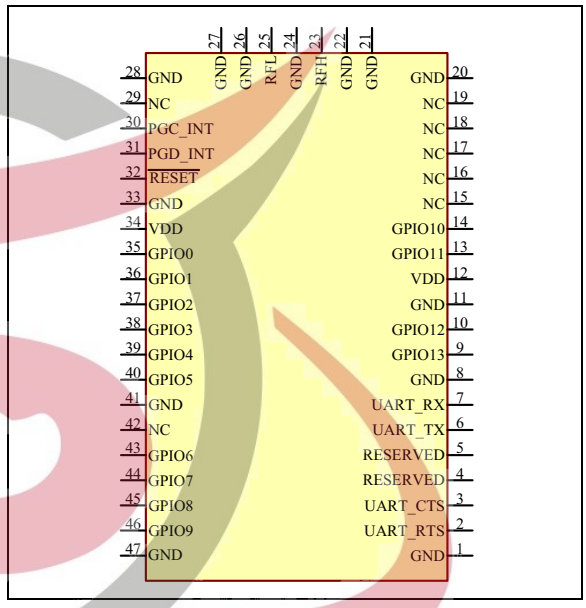


FIGURE 1-3: RN2483 BLOCK DIAGRAM

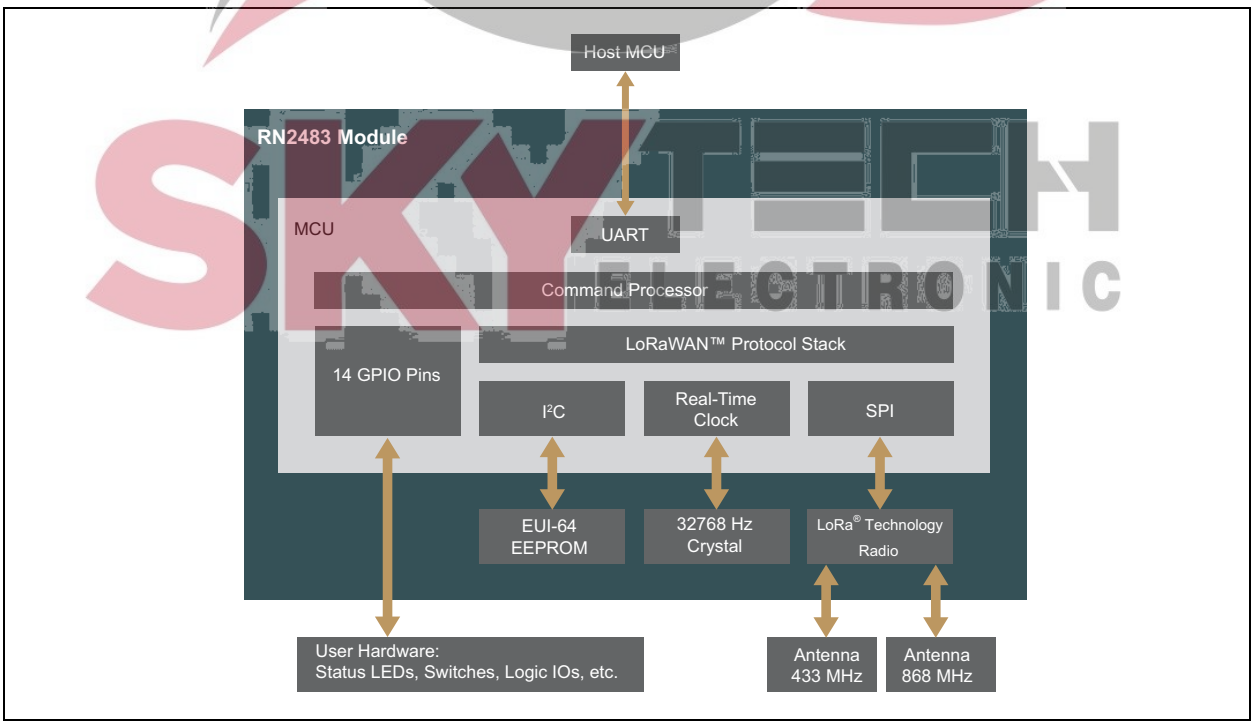


Table 1-1 describes the RN2483 pins.

TABLE 1-1: PIN DESCRIPTION

Pin	Name	Type	Description
1	GND	Power	Ground supply terminal
2	UART_RTS	Output	Communication UART RTS signal(1), or GPIO
3	UART_CTS	Input	Communication UART CTS signal(1), or GPIO
4	RESERVED	—	Do not connect
5	RESERVED	—	Do not connect
6	UART_TX	Output	Communication UART Transmit (TX)
7	UART_RX	Input	Communication UART Receive (RX)
8	GND	Power	Ground supply terminal
9	GPIO13	Input/Output	General purpose I/O pin or analog input
10	GPIO12	Input/Output	General purpose I/O pin or analog input
11	GND	Power	Ground supply terminal
12	VDD	Power	Positive supply terminal
13	GPIO11	Input/Output	General purpose I/O pin or analog input
14	GPIO10	Input/Output	General purpose I/O pin or analog input
15	NC	—	Not connected
16	NC	—	Not connected
17	NC	—	Not connected
18	NC	—	Not connected
19	NC	—	Not connected
20	GND	Power	Ground supply terminal
21	GND	Power	Ground supply terminal
22	GND	Power	Ground supply terminal
23	RFH	RF analog	RF signal pin for high band
24	GND	Power	Ground supply terminal
25	RFL	RF analog	RF signal pin for low band
26	GND	Power	Ground supply terminal
27	GND	Power	Ground supply terminal
28	GND	Power	Ground supply terminal
29	NC	—	Not connected
30	PGC_INT	Input/Output	Internal MCU ICSP program clock or general purpose I/O pin(2)
31	PGD_INT	Input/Output	Internal MCU ICSP program data or general purpose I/O pin (2)
32	$\overline{\text{RESET}}$	Input	Active-low device Reset input
33	GND	Power	Ground supply terminal
34	VDD	Power	Positive supply terminal
35	GPIO0	Input/Output	General purpose I/O pin or analog input
36	GPIO1	Input/Output	General purpose I/O pin or analog input
37	GPIO2	Input/Output	General purpose I/O pin or analog input
38	GPIO3	Input/Output	General purpose I/O pin or analog input
39	GPIO4	Input/Output	General purpose I/O pin
40	GPIO5	Input/Output	General purpose I/O pin or analog input
41	GND	Power	Ground supply terminal
42	NC	—	Not connected

TABLE 1-1: PIN DESCRIPTION (CONTINUED)

Pin	Name	Type	Description
43	GPIO6	Input/Output	General purpose I/O pin or analog input
44	GPIO7	Input/Output	General purpose I/O pin or analog input
45	GPIO8	Input/Output	General purpose I/O pin or analog input
46	GPIO9	Input/Output	General purpose I/O pin or analog input
47	GND	Power	Ground supply terminal

Note 1: Optional handshake lines are supported in future firmware releases.

2: The *"RN2483 LoRa® Technology Module Command Reference User's Guide"* (DS40001784F) uses the pin name TEST0 for PGC_INT and TEST1 for PGD_INT.

2.0 GENERAL SPECIFICATIONS

Table 2-1 provides the general specifications for the module. Table 2-2, Table 2-3, and Table 2-4 provide the electrical characteristics, current consumption, and dimensions of the module, respectively. Table 2-5 shows the RF output power calibration data. Table 2-6 shows the RF output power at different supply voltages and temperatures.

TABLE 2-1: GENERAL SPECIFICATIONS

Specification	Description
Frequency Band	863.000 MHz to 870.000 MHz; 433.050 MHz to 434.790 MHz
Modulation Method	FSK, GFSK, and LoRa® Technology modulation
Maximum Over-the-Air Data Rate	300 kbps with FSK modulation; 10937 bps with LoRa Technology modulation
RF Connection	Board edge connection
Interface	UART
Operation Range	Up to 15 km coverage at suburban; up to 5 km coverage at urban area
Sensitivity at 1% PER	-146 dBm(1)
RF TX Power	Adjustable up to max. 10 dBm on 433 MHz band (limited to meet regulations); max. 14 dBm on the 868 MHz band(2)
Temperature (operating)	-40°C to +85°C
Temperature (storage)	-40°C to +115°C
Humidity	10% ~ 90% non-condensing

Note 1: Dependent on modulation settings, Receiver Bandwidth (RBW), and Spreading Factor (SF).

2: TX power is adjustable. For more information, refer to the *"RN2483 LoRa® Technology Module Command Reference User's Guide"* (DS40001784).

TABLE 2-2: ELECTRICAL CHARACTERISTICS

Parameter	Min.	Typ.	Max.	Units
Supply Voltage	2.1	—	3.6	V
Voltage on any pin with respect to VSS (except VDD) and $\overline{\text{RESET}}$	-0.3	—	VDD + 0.3	V
Voltage on VDD with respect to VSS	-0.3	—	3.9	V
Voltage on $\overline{\text{RESET}}$ with respect to VSS	0	—	+11	V
Input Clamp Current (IIK) (VI < 0 or VI > VDD)	—	—	+/-20	mA
Output Clamp Current (IOK) (VO < 0 or VO > VDD)	—	—	+/-20	mA
GPIO sink/source current each	—	—	25/25	mA
Total GPIO sink/source current	—	—	200/185	mA
RAM Data Retention Voltage (in Sleep mode or Reset state)	1.5	—	—	V
VDD Start Voltage to ensure internal Power-on Reset signal	—	—	0.7	V
VDD Rise Rate to ensure internal Power-on Reset signal	0.05	—	—	V/ms
Brown-out Reset Voltage	1.75	1.9	2.05	V
Logic Input Low Voltage	—	—	0.15 x VDD	V
Logic Input High Voltage	0.8 x VDD	—	—	V
Input Leakage at <25°C (VSS<VPIN<VDD, Pin at high-impedance)	—	0.1	50	nA
Input Leakage at +60°C (VSS<VPIN<VDD, Pin at high-impedance)	—	0.7	100	nA
Input Leakage at +85°C (VSS<VPIN<VDD, Pin at high-impedance)	—	4	200	nA
RF Input Level	—	—	+10	dBm

TABLE 2-3: CURRENT CONSUMPTION

Mode	Temperature (°C)	Typical Current (mA)		
		VDD = 2.1V	VDD = 3.3V	VDD = 3.6V
Idle	-40 to +85	1.7	2.8	3.1
Transmit	25	28.6	38.9	44.5
Sleep	-40	0.0011	0.0013	0.0014
	25	0.0015	0.0016	0.0016
	85	0.002	0.0026	0.0026

TABLE 2-4: MODULE DIMENSIONS

Parameter	Value
Dimensions	17.8 x 26.7 x 3.34 mm
Weight	2.05g

TABLE 2-5: OUTPUT POWER OF TX POWER SETTING

Band	TX Power Setting	Output Power (dBm)	Typical Supply Current at 3.3V (mA)
868 MHz	-3	-4.0	17.3
	-2	-2.9	18.0
	-1	-1.9	18.7
	0	-1.7	20.2
	1	-0.6	21.2
	2	0.4	22.3
	3	1.4	23.5
	4	2.5	24.7
	5	3.6	26.1
	6	4.7	27.5
	7	5.8	28.8
	8	6.9	30.0
	9	8.1	31.2
	10	9.3	32.4
	11	10.4	33.7
	12	11.6	35.1
	13	12.5	36.5
	14	13.5	38.0
	15	14.1	38.9

TABLE 2-5: OUTPUT POWER OF TX POWER SETTING (CONTINUED)

Band	TX Power Setting	Output Power (dBm)	Typical Supply Current at 3.3V (mA)
433 MHz	-3	-3.5	14.7
	-2	-2.3	15.1
	-1	-1.3	15.6
	0	-2.3	15.8
	1	-1.2	16.4
	2	-0.1	17.0
	3	1.0	17.7
	4	2.1	18.5
	5	3.2	19.4
	6	4.3	20.3
	7	5.4	21.4
	8	6.5	22.3
	9	7.6	23.3
	10	8.8	24.5
	11	9.9	25.8
	12	10.9	27.3
	13	11.9	28.8
	14	12.9	30.7
	15	13.6	32.9

TABLE 2-6: OUTPUT POWER OF SUPPLY VOLTAGE AND TEMPERATURE

Temperature (°C)	Typical Output Power at 868 MHz (dBm)		
	VDD = 2.1V	VDD = 3.3V	VDD = 3.6V
-40	10.5	13.8	13.7
25	10.0	14.1	14.6
85	9.1	13.4	13.7

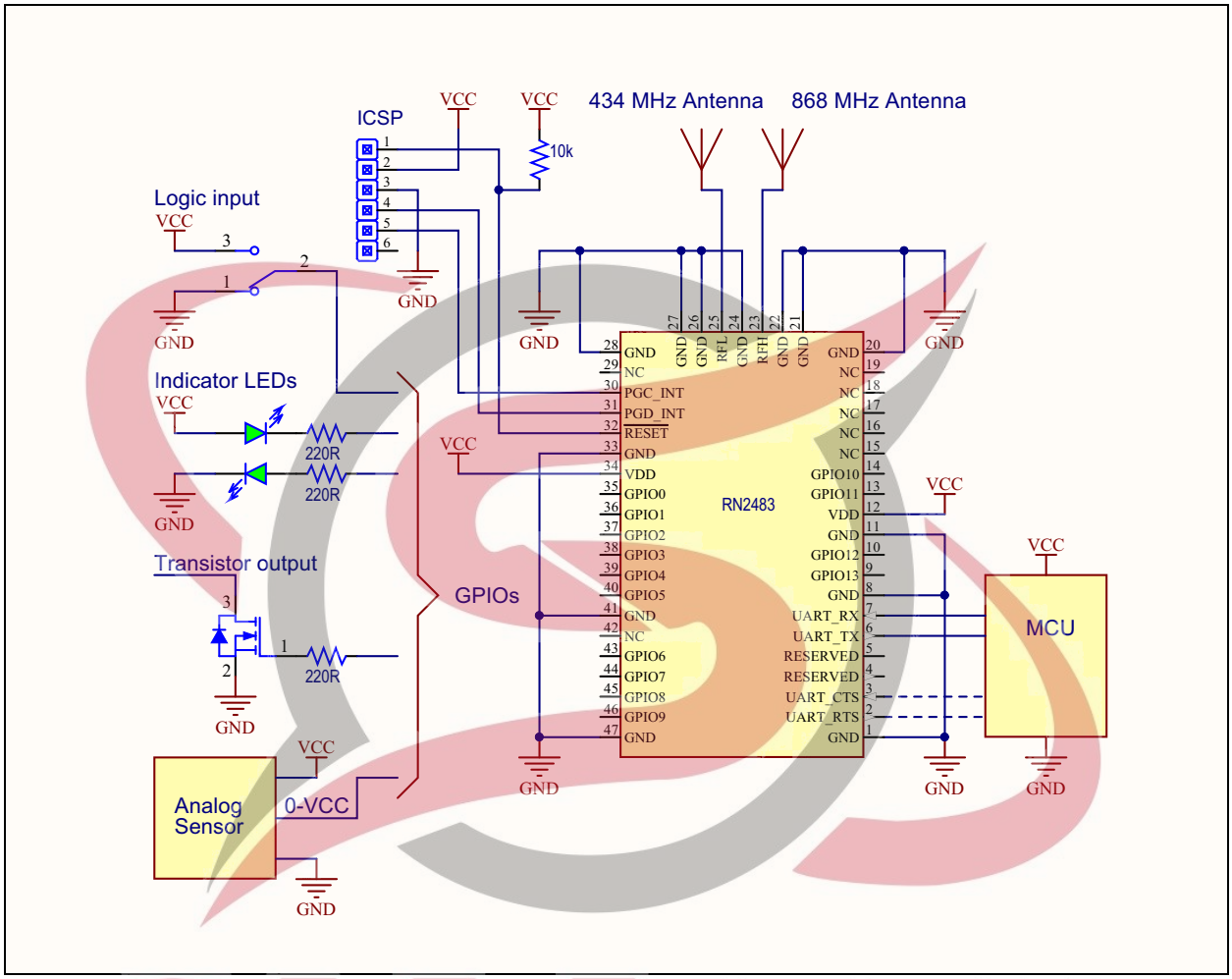
TABLE 2-7: OUTPUT POWER OF SUPPLY VOLTAGE AND TEMPERATURE

Temperature (°C)	Typical Output Power at 434 MHz (dBm)		
	VDD = 2.1V	VDD = 3.3V	VDD = 3.6V
-40	10.1	13.2	13.2
25	9.7	13.6	14.2
85	9.3	13.0	13.4

3.0 TYPICAL HARDWARE CONNECTIONS

Figure 3-1 shows the typical hardware connections.

FIGURE 3-1: HARDWARE CONNECTIONS



3.1 Interface to Host MCU

The RN2483 module has a dedicated UART interface to communicate with a host controller. Optional handshake lines are supported in future firmware releases. The *"RN2483 LoRa® Technology Module Command Reference User's Guide"* (DS40001784) provides a detailed UART command description. Table 3-1 shows the default settings for the UART communication.

TABLE 3-1: DEFAULT UART SETTINGS

Specification	Description
Baud Rate	57600 bps
Packet Length	8 bit
Parity Bit	No
Stop Bits	1 bit
Hardware Flow Control	No

3.2 GPIO Pins (GPIO0-GPIO13)

The module has 14 GPIO pins. These lines can be connected to switches, LEDs, and relay outputs. The pins can be either logic inputs or outputs, and some pins (see Table 1-1) have analog input capability that can be accessed via the module firmware. These pins have limited sink and source capabilities. Electrical characteristics are described in Table 2-2. For more information, see *"RN2483 LoRa® Technology Module Command Reference User's Guide"* (DS40001784).

3.3 RF Connections (RFL, RFH)

RFL is the RF analog port for the lower frequency band (433 MHz) while RFH is for the higher frequency band (868 MHz). When routing RF paths, use proper strip lines with an impedance of 50 Ohm.

3.4 $\overline{\text{RESET}}$ Pin

The $\overline{\text{RESET}}$ pin of the module is an active-low logic input. An internal weak pull-up resistor is enabled when the pin is configured as the MCLR input.

3.5 Power Pins

It is recommended to connect power pins (Pin 12 and 34) to a stable supply voltage with sufficient source current. Table 2-3 shows the current consumption.

Additional filtering capacitors are not required but used to ensure stable supply voltage in a noisy environment.

3.6 Internal Program Pins

PGC_INT (Pin 30) and PGD_INT (Pin 31) are internal program pins used during manufacturing. For normal operation, these pins can be left unconnected.

The normal firmware upgrade method is through the internal bootloader of the module via the UART. The method is documented in the *"RN2483 LoRa® Technology Module Command Reference User's Guide"* (DS40001784).

However, for backup firmware update purposes the user can place a 6-pin ICSP header on their host PCB with PGC_INT (Pin 30), PGD_INT (Pin 31), $\overline{\text{RESET}}$ (Pin 32), power and ground.

During High Voltage In-Circuit Serial Programming mode, the $\overline{\text{RESET}}$ pin is driven with high-voltage (9V), therefore protection may be necessary for sensitive devices.

Note:	Only official Microchip Technology firmware released for the RN2483 module shall be used to maintain FCC and IC certification.

4.0 PHYSICAL DIMENSIONS

Figure 4-1 and Figure 4-2 illustrate the physical dimensions and the recommended PCB layout for the RN2483 module.

FIGURE 4-1: RN2483 PHYSICAL DIMENSIONS

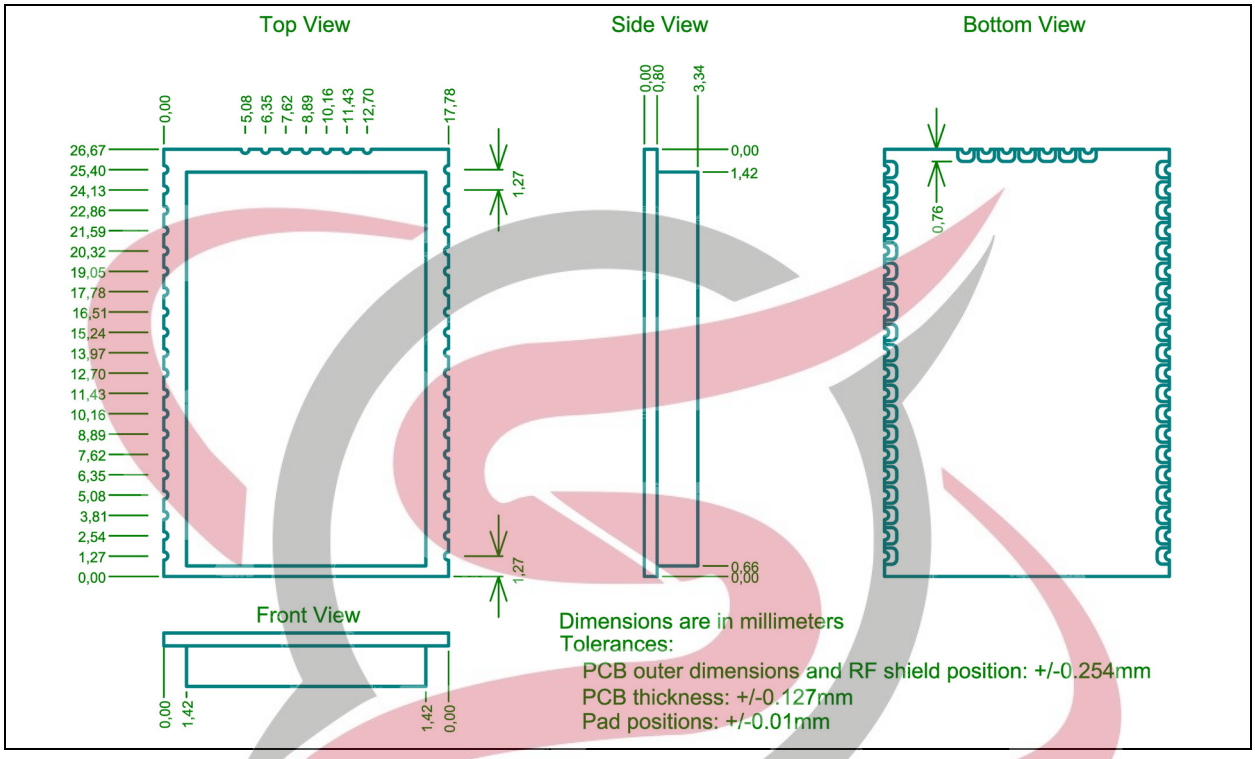
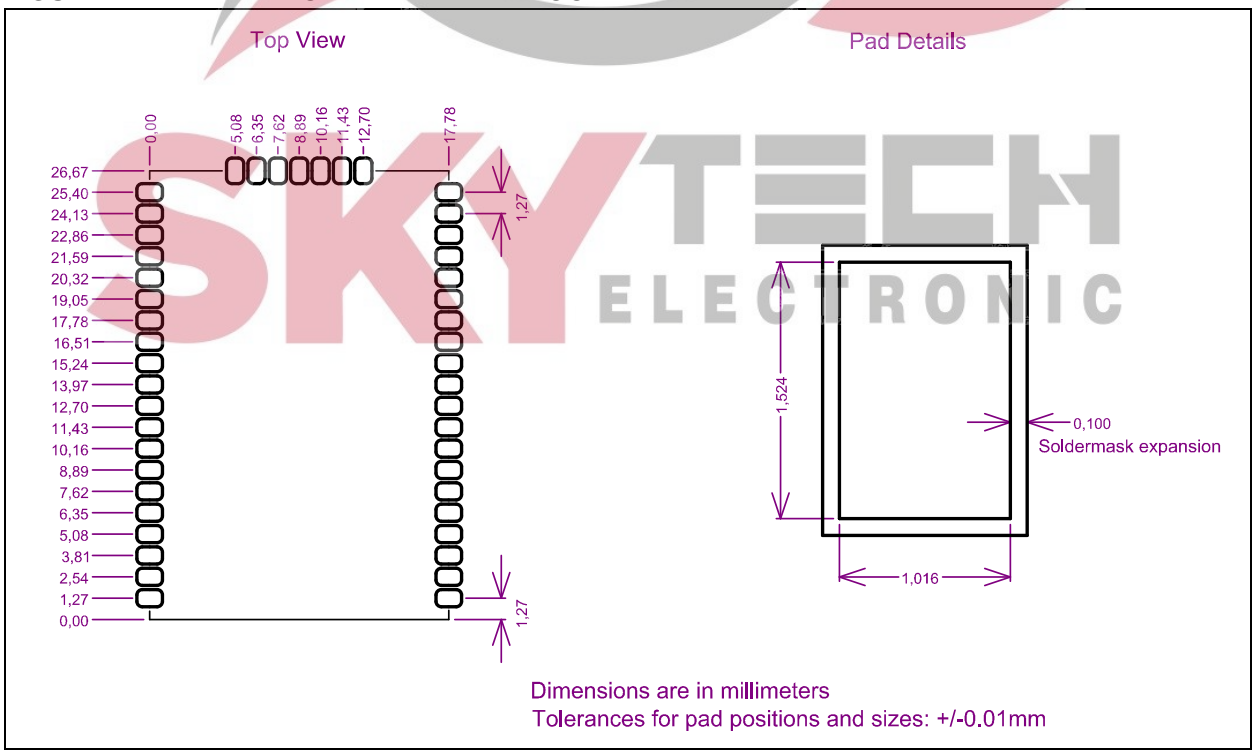


FIGURE 4-2: RECOMMENDED PCB FOOTPRINT

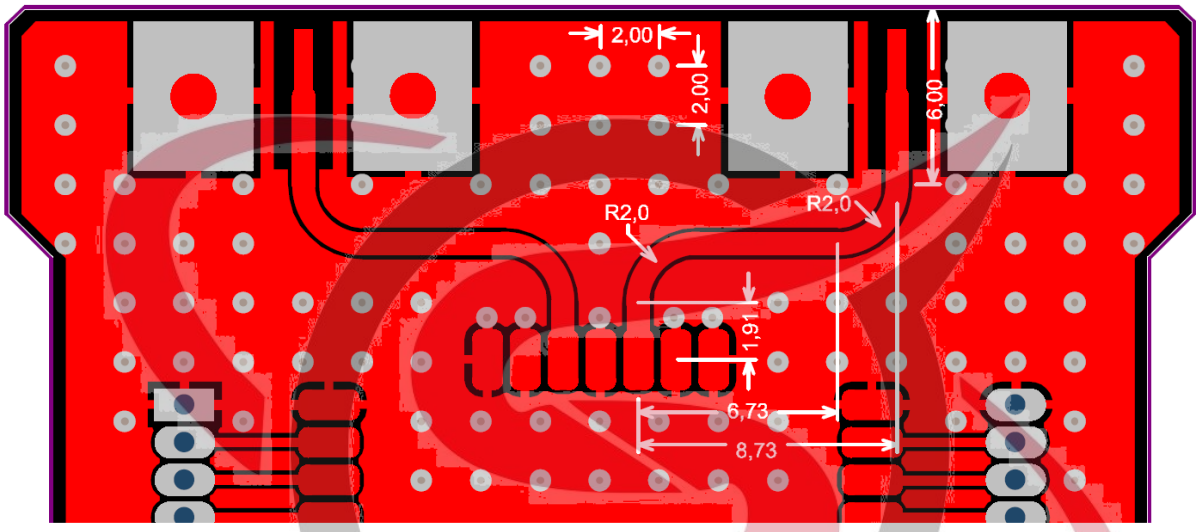


5.0 APPLICATION INFORMATION

5.1 RF Trace Layout Design

The RN2483 modular transmitter is certified with a PCB edge SMA connector and micro-strip trace layout as shown in Figure 5-1 and Figure 5-2. The two RF paths are axisymmetric with the same linear dimensions. The host PCB can follow these trace design to maintain compliance under the modular grant (FCC) and certificate (IC). Gerber files are available on the RN2483 product web page at www.microchip.com/RN2483.

FIGURE 5-1: RF TRACE ROUTING (TOP LAYER)

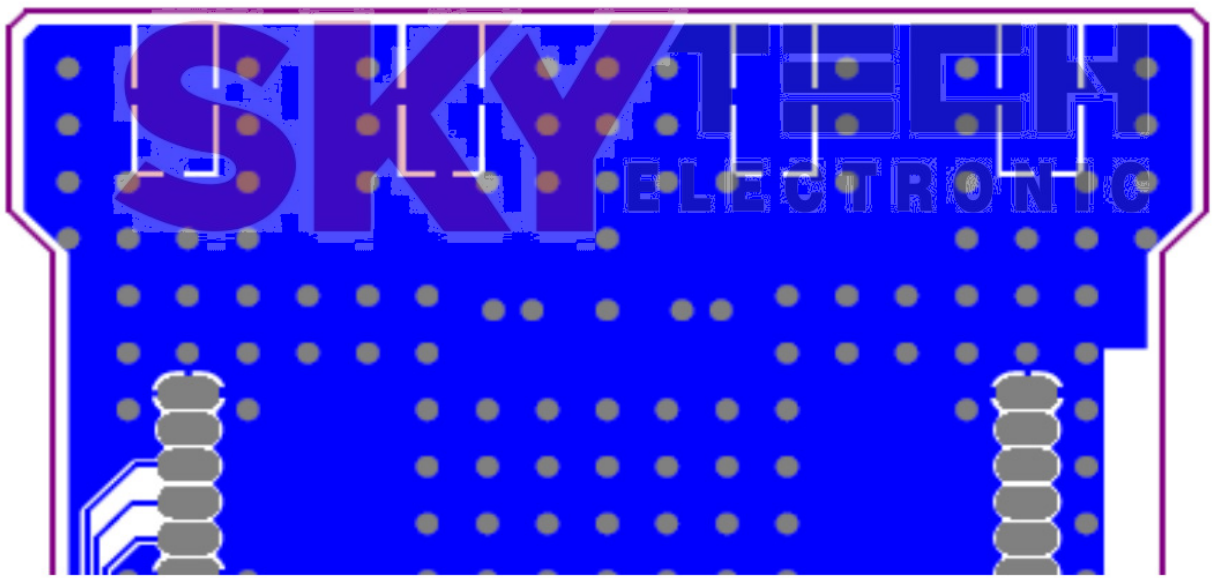


PCB Details:
- Two layer, plated through hole
- FR4
- Thickness: 1.55 mm
- Via stitching with 0.25 mm plated

Trace Dimensions:
- Trace width: 0.75
- Trace gap: 0.15
- Finished Copper Weight: 1 ounce

Dimensions are in millimeters

FIGURE 5-2: RF TRACE ROUTING (BOTTOM LAYER)



6.0 REGULATORY APPROVAL

This section outlines the regulatory information for the RN2483 module for Europe.

6.1 Europe

The RN2483 module is an R&TTE Directive assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.

The RN2483 module has been tested to R&TTE Directive 1999/5/EC Essential Requirements for Health and Safety (Article 3.1a), Electromagnetic Compatibility (EMC) (Article 3.1b), and Radio (Article 3.2) and are summarized in Table 6-1: European Compliance Testing. A Notified Body Opinion has also been issued. All test reports are available on the product web page at http://www.microchip.com.

The R&TTE Compliance Association provides guidance on modular devices in document **Technical Guidance Note 01** available at http://www.rtteca.com/html/download_area.htm.

Note:	To maintain conformance to the testing listed in Table 6-1: European Compliance Testing, the module shall be installed in accordance with the installation instructions in this data sheet and shall not be modified. When integrating a radio module into a completed product the integrator becomes the manufacturer of the final product and is therefore responsible for demonstrating compliance of the final product with the essential requirements of the R&TTE Directive.

6.1.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN2483 module must follow CE marking requirements. The *"R&TTE Compliance Association Technical Guidance Note 01"* provides guidance on final product CE marking.

6.1.2 EXTERNAL ANTENNA REQUIREMENTS

From R&TTE Compliance Association document **Technical Guidance Note 01**:

Provided the integrator installing an assessed radio module with an integral or specific antenna and installed in conformance with the radio module manufacturer's installation instructions requires no further evaluation under Article 3.2 of the R&TTE Directive and does not require further involvement of an R&TTE Directive Notified Body for the final product (Section 2.2.4).

6.1.3 HELPFUL WEB SITES

A document that can be used as a starting point in understanding the use of Short Range Devices (SRD) in Europe is the European Radio Communications Committee (ERC) Recommendation 70-03 E, which can be downloaded from the European Radio Communications Office (ERO) at: http://www.ero.dk/.

Additional helpful web sites are:

- Radio and Telecommunications Terminal Equipment (R&TTE): http://ec.europa.eu/enterprise/sectors/rtte/regulatory-framework/index_en.htm
- European Conference of Postal and Telecommunications Administrations (CEPT): http://www.cept.org
- European Telecommunications Standards Institute (ETSI): http://www.etsi.org
- European Radio Communications Office (ERO): http://www.ero.dk/
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA): http://www.rtteca.com/

TABLE 6-1: EUROPEAN COMPLIANCE TESTING

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	IEC 60950-1:2005 (2nd Ed: A1:2009)	(3.1a)	TRaC Global Ltd.	TRA-025134-43-00A	2/12/2015
Health	EN 62479	—	TRaC Global Ltd.	TRA-025134-01-47-03A	2/12/2015
EMC	EN 301 489-3 v1.6.1	(3.1b)	TRaC Global Ltd.	TRA-025134-43-00A	2/12/2015
Radio	EN 300 220-2 v2.4.1	(3.2)	TRaC Global Ltd.	TRA-025134-01-47-00A (433 MHz) TRA-025134-01-47-01A(868MHz)	2/12/2015

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (March 2015)

This is the initial release of this document.

Revision B (December 2015)

This revision includes the following updates:

- Updated Deep Sleep value in Table 2-3
- Updated Dimensions value in Table 2-4
- Updated Figure 4-1
- Updated Figure 4-2
- Added Figure 5-2
- Updated information for **Section 5.1 "RF Trace Layout Design"**.

Revision C (April 2017)

This revision includes the following updates:

- Updated Figure 1-2 and Figure 3-1
- Updated Table 1-1, Table 2-2, and Table 2-3
- Added Table 2-6 and Table 2-7
- Updated **Section 3.4 "RESET Pin"**
- Added **Section 3.6 "Internal Program Pins"**
- Deleted Section "5.2 Application Schematic".

NOTES:

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- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
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NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	I	RM	XXX
Device	Temperature Range	Package	Firmware Revision Number

Device:	RN2483:		Low-Power Long Range LoRa® Technology Transceiver module
Temperature Range:	I	=	-40°C to +85°C (Industrial)
Package:	RM	=	Radio Module

Examples:

RN2483A-I/RM: Industrial temperature

NOTES:

Note the following details of the code protection feature on Microchip devices:

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- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

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