Radio Module User Manual

MICRO-RM2.4

MICRORIDGE

www.microridge.com

MicroRidge 2.4 GHz Radio Module

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Table of Contents

1 Introduction

The MICRO-RM2.4 Radio Module from MicroRidge Systems is a small wireless module based on the Atmel ATmega2564RFR2 microcontroller. The ATmega2564RFR2 is a low-powered CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture combined with a high data rate transceiver for the 2.4 GHz ISM (industrial, scientific and medical) band.

The MICRO-RM2.4 contains an on-board chip antenna. The module contains radio certifications for FCC, IC and EU (CE). No additional RF testing is required as long as the application of the MICRO-RM2.4 follows the approved certifications.

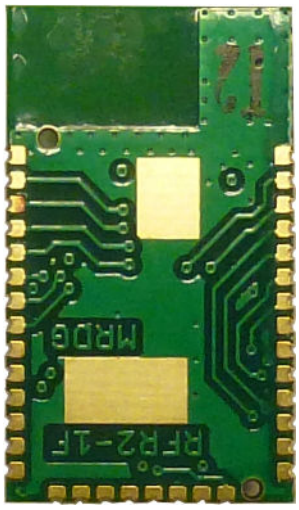
The small size of the MICRO-RM2.4 module allows it to be used in small and compact products. The module measures 12 x 20.75 x 3 mm (.472 x .817 x .118 inches). The module requires a power supply of 1.8 to 3.6 volts DC. This voltage range allows the module to be powered by a single 3 volt coin cell or two 1.5 volt batteries.

Radio Module Images

The photos below show the top and bottom views of the radio module. The 2 large gold pads shown in the bottom view are the ground pads discussed in the Dimensions section 7.

Isometric View

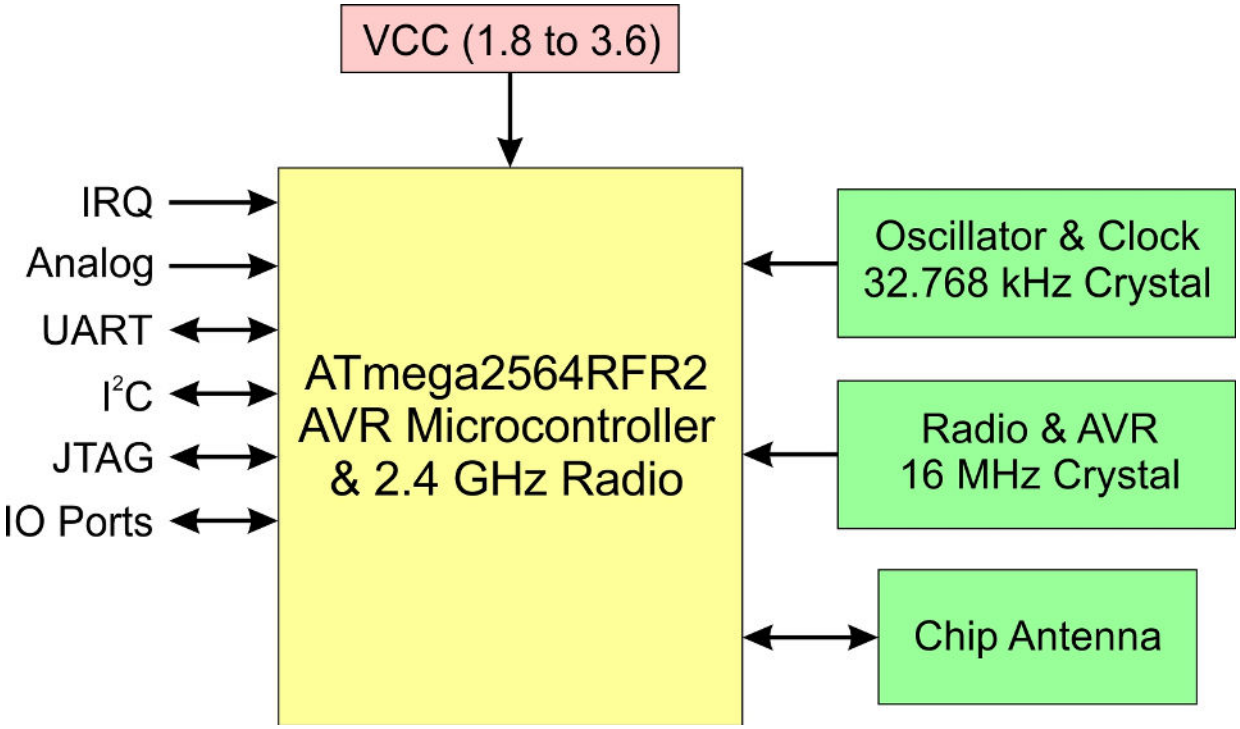
Top View



Bottom View

Basic Block Diagram

A basic block diagram of the MICRO-RM2.4 Radio Module is shown below. Refer to the Atmel ATmega644/1284/2564RFR2 documentation [4] for block diagrams with greater detail.



2 Features

The features of the MICRO-RM2.4 Radio Module are numerous and allow the module to be used in many low powered short range applications. The primary features of this module are as follows:

- Ultra compact size: 12 x 20.75 x 3 mm (.472 x .817 x .118 inches)
- Built-in 32.768 kHz crystal for low power and deep sleep modes
- Built-in 16 MHz crystal for 2.4 GHz transceiver and AVR microcontroller
- Power supply voltage of 1.8 to 3.6 VDC
- Typical power consumption:
  - 0.75 μA in sleep mode (transceiver in Sleep and AVR in Power Save/Down mode)
  - 14.5 ma in TX mode at 3.5 dBm
  - 12.5 ma in RX mode
- Memory resources:
  - 256K bytes In-System Self-Programmable Flash
  - 8K bytes EEPROM
  - 32K bytes SRAM
- High performance RF-CMOS 2.4 GHz radio transceiver targeted for IEEE® 802.15.4™, ZigBee™, IPv6, 6LoWPAN, RF4CE, SP100, WirelessHART™ and ISM applications.
- TX/RX 128 byte frame buffer
- TX output power from -17 dBm to 3.5 dBm
- Receiver sensitivity = -100 dBm
- 14 RF Channels (11 to 25, channel 14 is reserved for internal use)
- Serial bootloader
- Interface connections:
  - 30 I/O ports
  - 2 RS-232 serial ports
  - JTAG programming connection
  - I^2C
- High performance low power AVR® 8-bit microcontroller
- ROHS complainant
- Extensive documentation and software resources available on the Atmel web site

3 Related Documents

Additional information is available about the MICRO-RM2.4 Radio Module components and supporting software from the following sources:

- A complete description of the ATmega2564RFR2 microcontroller used in the module is available on the Atmel web site (www.atmel.com). The document describing this microcontroller is ATmega644/1284/2564RFR2 42073B-MCU Wireless. The document number (42073B-MCU) is updated by Atmel when changes are made to the document.
- Atmel also has additional documentation available that may be helpful in developing wireless applications for the MICRO-RM2.4 module.
- The MicroRidge MICRO-RM2.4 Wireless Communication Library (RM2.4 Library) is available to assist in the development of firmware for the MICRO-RM2.4 Radio Module. In order to use the RM2.4 Library, you must purchase Radio Modules that have the library support enabled. This library is only supported on specific versions of the IAR Embedded Workbench for the AVR microcontroller. Refer to the Wireless Library 15 section in this manual for more information.
- Additional documentation and information dealing with the MICRO-RM2.4 Radio Module will be available at www.MicroRidge-RM.com during the 3rd quarter of 2015.

4 Specifications

The specifications section consists of 4 areas:

Atmel Documentation	This section contains 3 of the tables from the Atmel ATmega644/1284/2564RFR2 documentation. The complete Atmel document is over 600 pages in length. In order to fully understand the radio module and how to work with it, you must become familiar with this Atmel document.
Dimensions	The dimensions for the MICRO-RM2.4 Radio Module, pad locations and bottom side ground pads are presented in this section.
Pin Configuration	The pin connections available on the MICRO-RM2.4 Radio Module are listed in this section.
Soldering	A soldering profile is shown in this section.

4.1 Atmel Documentation

For the complete specifications for the Atmel ATmega2564RFR2 radio transceiver refer to ATmega644/1284/2564RFR2 documentation [4]. The information shown below is only a few of the multiple tables from the Atmel documentation. Refer to the Atmel documentation for the test conditions and references shown in the tables.

General RF Specifications

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
f_{RF}	Frequency range	As specified in [1],[2]	2405		2480	MHz
f_{CH}	Channel spacing	As specified in [1],[2]		5		MHz
f_{HDR}	Header bit rate (SHR, PHR)	As specified in [1],[2]		250		kb/s
f_{PSDU}	PSDU bit rate	As specified in [1],[2] OQPSK_DATA_RATE = 1 OQPSK_DATA_RATE = 2 OQPSK_DATA_RATE = 3		250 500 1000 2000		kb/s kb/s kb/s kb/s
f_{CHIP}	Chip rate	As specified in [1],[2]		2000		kchip/s
f_{CLK}	Crystal oscillator frequency	Reference frequency oscillator		16		MHz
f_{CLK_ACC}	Required reference frequency accuracy	PSDU bit rate 250 kb/s 500 kb/s 1000 kb/s 2000 kb/s	-60(1) -40 -40 -30		+60(1) +40 +40 +30	ppm ppm ppm ppm
t_{XTAL}	Reference oscillator settling time	Leaving SLEEP state to crystal clock available		215	1000	µs
B_{20dB}	20 dB bandwidth			2.8		MHz

Transmitter characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
P_{TX}	TX Output power	Maximum configurable TX output power value Register bit TX_PWR = 0	0	+3.5	+6	dBm
P_{RANGE}	Output power range	16 steps, configurable in register PHY_TX_PWR		20		dB
P_{ACC}	Output power tolerance				±3	dB
	TX Return loss	100+j0 Ω differential impedance, P_{TX} = +3.5 dBm		10		dB
	EVM			8		%rms
P_{HARM}	Harmonics 2nd harmonic 3rd harmonic			 -38 -45		 dBm dBm
P_{SPUR}	Spurious Emissions 30 – ≤ 1000 MHz >1 – 12.75 GHz 1.8 – 1.9 GHz 5.15 – 5.3 GHz	Complies with EN 300 328/440, FCC-CFR-47 part 15, ARIB STD-66, RSS-210		 -36 -30 -47 -47		 dBm dBm dBm dBm

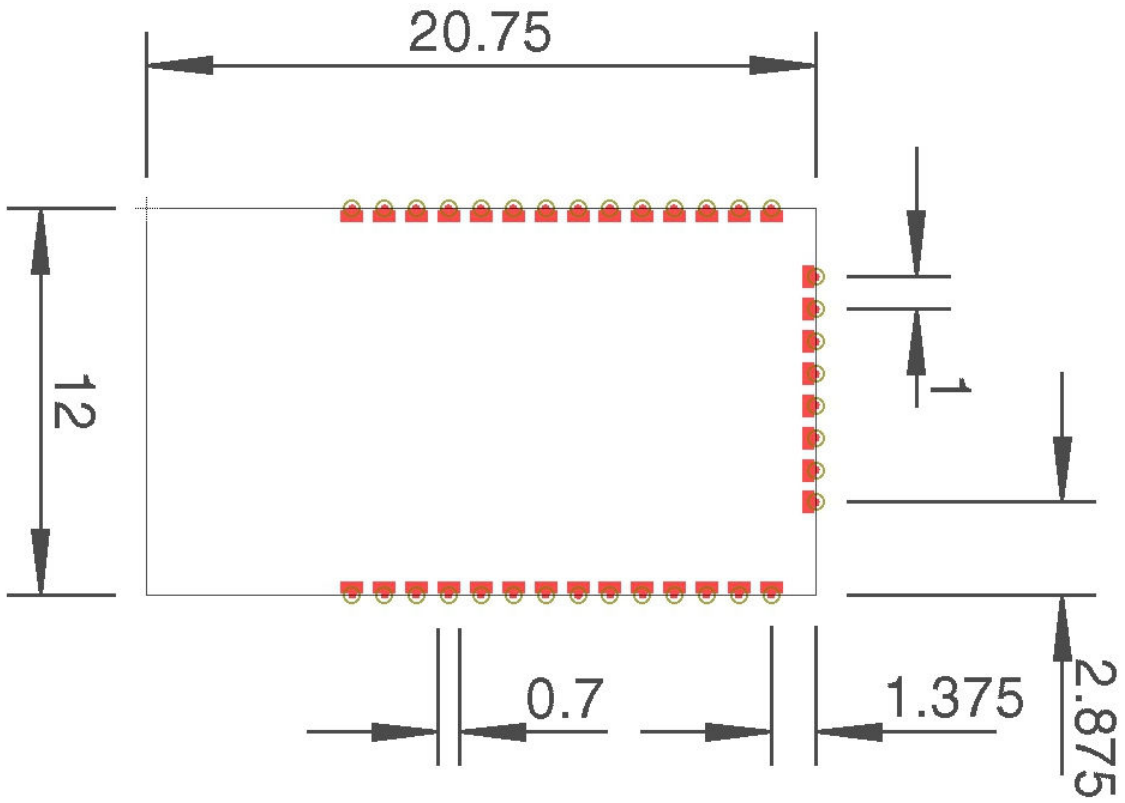
Current Consumptions Specifications

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
I_{BUSY_TX}	Supply current transmit state	P_{TX} = 3.5 dBm P_{TX} = 1.5 dBm P_{TX} = -2.5 dBm P_{TX} = -16.5 dBm (current consumption is reduced at V_{DD} = 1.8V for each output power level)		14.5 10 9 8		mA mA mA mA
$I_{RX\_ON\_RPC}$	Supply current RX_ON state RPC mode enabled[2]	RX_ON state, with register setting RX_PDT_LEVEL < 8[1]		6		mA
$I_{RX\_ON\_P\_RPC}$		RX_ON state, with register setting RX_PDT_LEVEL > 8[1]		5		mA
$I_{RX\_ON\_RPC}$	Supply current PLL_ON state RPC mode enabled[2]			0.45		mA
I_{RX_ON}	Supply current RX_ON state RPC mode disabled[2]	RX_ON state		12.5		mA
$I_{RX\_ON\_P}$		RX_ON state, with register setting RX_PDT_LEVEL > 0[1]		12.0		mA
I_{PLL_ON}	Supply current PLL_ON state RPC mode disabled[2]			5.7		mA
I_{TRX_OFF}	Supply current TRX_OFF state	TRX_OFF state		0.4		mA
I_{SLEEP}	Supply current SLEEP state	SLEEP state		0.02		µA

4.2 Dimensions

Board Dimensions

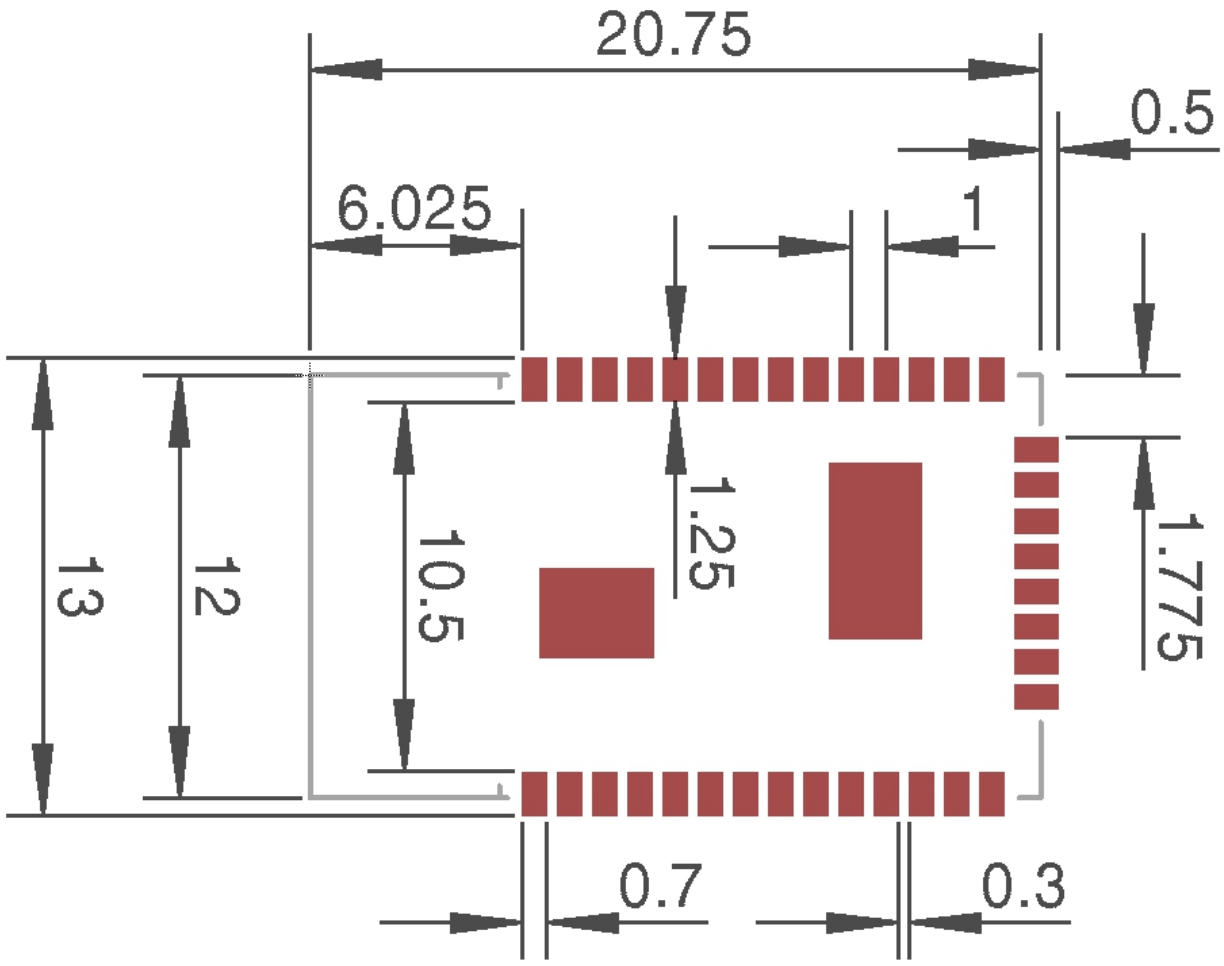
The dimensions for the MICRO-RM2.4 Radio Module are given below. All of the dimensions are in mm. The thickness of the module from the bottom of the module to the top of the RF shield is 3 mm. The pad spacing is 1 mm and the pad width is 0.7 mm.



Board Dimensions (mm) and Solder Pad Placement

Solder Pad Placement

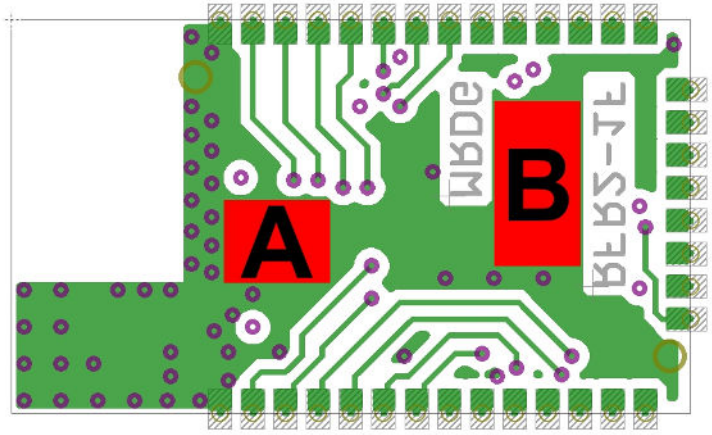
The recommended placement of the solder pads on the application board is shown below. The 2 large pads are ground pads and they are discussed in the Ground Pads section on the next page. All dimensions are in mm.



Ground Pads

The bottom of the module contains 2 ground (GND) pad areas that can be used to help secure the module to the circuit board. In a rough environment, we have seen delamination problems with this type of module board. When adhesive was used to help secure the module board to the application circuit board, we no longer had any delamination problems between the module and application circuit boards. In the stuffing process, the board house can use an adhesive to help secure the wireless module to the application circuit board or solder the ground pads to the application circuit board..

The 2 ground pads are available on the bottom side of the wireless module. These ground pads are shown in red and labeled A and B. These 2 pad areas are part of the bottom ground plane.

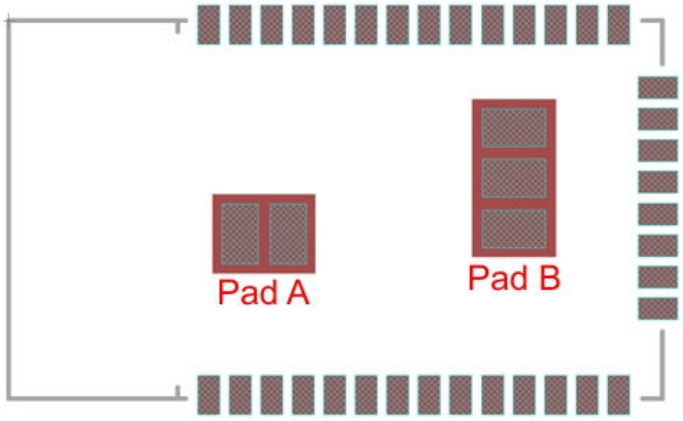


Location of the Ground Pads on the Bottom of the Wireless Module

The size and location of the ground pads are shown in the following table.

Ground Pad	Size		Distance from Upper Left Corner	
	Width, mm	Height, mm	Horizontal, mm	Vertical, mm
A	3.25	2.50	6.50	5.50
B	2.625	5.00	14.75	2.50

4.3 Solder Paste Mask



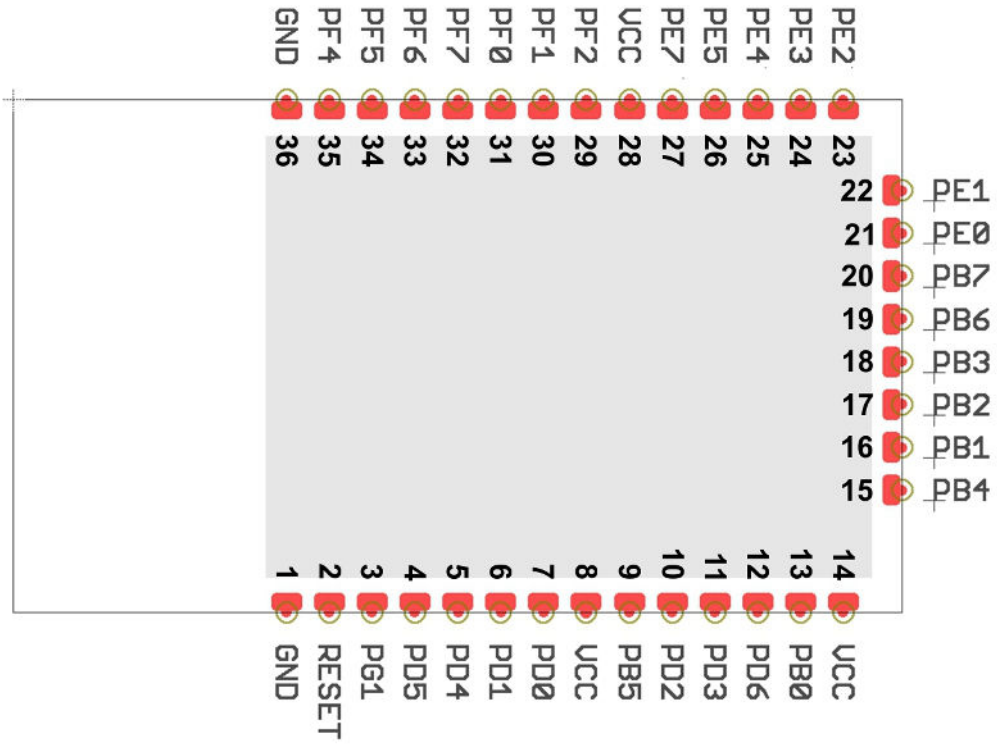
The solder mask for the pads around the edge of the Radio Module should match the size of the solder pads. The solder mask for the ground pads A and B, should made up of several smaller solder mask regions. If you create solder masks that are the same size as the ground pads A and B, you may see a tendency for the Radio Module to be raised off of the circuit board.

The following table details the dimensions and placement of the recommended solder masks for pads A and B. All dimensions are in mm.

Ground Pad	Pad Size	Number of Solder Mask Pad	Size of Pads	Gap Around Pads		Solder Coverage
				Outside	Inside	
A	2.5 x 3.25	2	1.9 x 1.125	.3	.4	52.6%
B	5 x 2.625	3	1.2 x 2.025	.3	.4	55.5%

4.4 Pin Configuration

The pin connections for the MICRO-RM2.4 Radio Module are show below. For a complete description of each pin refer to the Atmel ATmega644/1284/2564RFR2 [4] documentation.



MICRO-RM2.4 Pin Connections

Module Pin	Pin Name	Description
1	GND	Ground (connected to AVSS_RFP, AVSS_RFN, DVSS & AVSS)
2	RESET	Reset input (active low). The radio module also contains a 100K pullup resistor connected between this pin and VCC.
3	PG1	Port PG1
4	PD5	Port PD5 (alternate function XCK1)
5	PD4	Port PD4 (alternate function ICP1)

Module Pin	Pin Name	Description
6	PD1	Port PD1 (alternate functions SDA & INT1)
7	PD0	Port PD0 (alternate functions SCL & INT0)
8	VCC	1.8 to 3.6 VDC (connected to DEVDD & EVDD)
9	PB5	Port PB5 (alternate functions OC1A & PCINT5)
10	PD2	Port PD2 (alternate functions RXD1 & INT2)
11	PD3	Port PD3 (alternate functions TXD1 & INT3)
12	PD6	Port PD6 (alternate function T1)
13	PB0	Port PB0 (alternate functions SSN & PCINT0)
14	VCC	1.8 to 3.6 VDC (connected to DEVDD & EVDD)
15	PB4	Port PB4 (alternate functions OC2A & PCINT4)
16	PB1	Port PB1 (alternate functions SCK & PCINT1)
17	PB2	Port PB2 (alternate functions MOSI, PDI & PCINT2)
18	PB3	Port PB3 (alternate functions MISO, PDO & PCINT3)
19	PB6	Port PB6 (alternate functionsOC1B & PCINT6)
20	PB7	Port PB7 (alternate functions OC0A, OC1C & PCINT7)
21	PE0	Port PE0 (alternate functions RXD0 & PCINT8)
22	PE1	Port PE1 (alternate function TXD0)
23	PE2	Port PE2 (alternate functions XCK0 & AIN0)
24	PE3	Port PE3 (alternate functions OC3A & AIN1)
25	PE4	Port PE4 (alternate functions OC3B & INT4)
26	PE5	Port PE5 (alternate functions OC3C & INT5)
27	PE7	Port PE7 (alternate functions ICP3, INT7 & CLK)
28	VCC	1.8 to 3.6 VDC (connected to DEVDD & EVDD)
29	PF2	Port PF2 (alternate function ADC2)
30	PF1	Port PF1 (alternate function ADC1)
31	PF0	Port PF0 (alternate function ADC0)

Module Pin	Pin Name	Description
32	PF7	Port PF7 (alternate functions JTAG TDI & ADC7)
33	PF6	Port PF6 (alternate functions JTAG TDO & ADC6)
34	PF5	Port PF5 (alternate functions JTAG TMS & ADC5)
35	PF4	Port PF4 (alternate functions JTAG TCK, PF3 & ADC3)
36	GND	Ground (connected to AVSS_RFP, AVSS_RFN, DVSS & AVSS)
--	PD7	Port PD7. Do not use. This ports is used internally by the wireless module. This pin must remain at the default state of input without pullup.
--	TST	Connected to GND in the wireless module.
--	CLKI	Connected to GND in the wireless module.
--	TOSC1	Connected to 32.768 KHz crystal in the wireless module.
--	TOSC2	Connected to 32.768 KHz crystal in the wireless module.
--	XTAL1	Connected to 16 MHz crystal in the wireless module.
--	XTAL2	Connected to 16 MHz crystal in the wireless module.

4.5 Soldering

The following J-STD-020C compliant soldering profile is recommended for the MICRO-RM2.4 Radio Module. Since the FCC and IC IDs are etched into the RF shield, there is no concern about heat from the soldering process damaging a label that contains this ID information.

Profile Feature	Values
Average ramp-up rate (217°C to peak)	3°C/s max
Preheat temperature 175°C ±25°C	180s max
Temperature maintained above 217°C	60s to 150s
Time within 5°C of actual peak temperature	20s to 40s
Peak temperature range	260°C
Ramp-down rate	6°C/s max
Time within 25°C to peak temperature	8 minutes

5 Serial Number

The ATmega2564RFR2 contains 3 flash pages that are dedicated for User Signature data. These signature pages are isolated from the main flash and will not be cleared by a Chip Erase command. Special commands must be used to erase and write data to User Signature pages via the Parallel and JTAG interface. Each User Signature page contains 256 bytes for a total of 768 bytes

The MICRO-RM2.4 Radio Module uses page 1 of the User Signature pages to store information about the Radio Module. The information on page 1 is written by MicroRidge during module testing & verification prior to shipping a module to the customer.

One of the items in this User Signature page is a unique 64-bit serial number. You must not attempt to change any of the information on page 1 of the User Signature data.

The MICRO-RM2.4 Wireless Communications Library[15] can read the 64-bit serial number and return the results as 8 8-bit bytes or 16 4-bit hex characters. The address of the serial number is as follows:

- 0x08 = Address of serial number expressed as 8 8-bit bytes
- 0x10 = Address of serial number expressed as 16 4-bit hex characters

6 Wireless Library

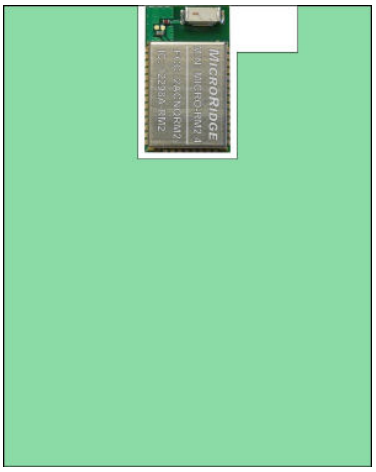
In order to use the wireless communications functions of the MICRO-RM2.4 Radio Module, your firmware must interact with the I/O ports that control the 2.4 GHz transceiver that is part of the Radio Module. You can refer to the various Atmel documents and resources to learn how to get access to the wireless functions or you may be able to use the MICRO-RM2.4 Wireless Communication Library (RM2.4 Library) that MicroRidge has developed. The RM2.4 Library was developed to support point-to-point communications between a transmitter and a receiver. MicroRidge has been using a version of these libraries since 2011.

The library files consist of a compiled library file and a header file for your application. The library was compiled with the IAR Embedded Workbench for the AVR microcontroller. Only the current version of the IAR compiler is supported for the RM2.4 Library.

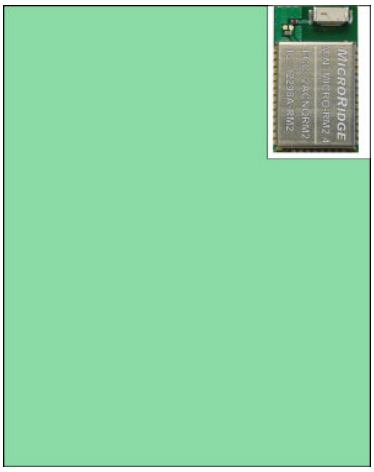
The RM2.4 Library for the MICRO-RM2.4 Radio Module will be released in the 3rd quarter of 2015. These library files will be available at www.MicroRidge-RM.com.

7 Application Board Design

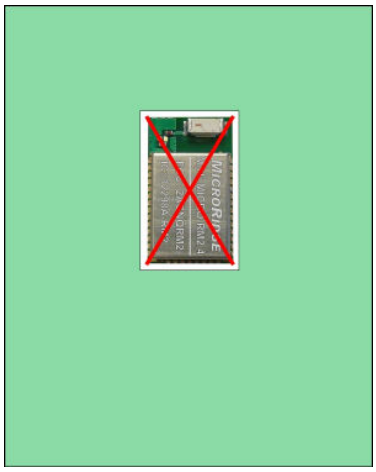
Normally, chip antennas are more tolerant of the board and enclosure materials. However, the recommendations for the radio module placement on the application PCB still apply. The radio module should be placed along an edge of the application PCB as shown below.



Module placed along top edge of PCB.



Module placed along top edge of PCB.



Module placed in center portion of PCB.
Not an acceptable design.

Mounting Information

In general, via holes and traces should not be placed on the application PCB upper layer in the area occupied by the radio module module. The exception to this is if you are soldering the ground pads [9] to the PCB board, you can use via holes and/or traces to connect the pads to the ground. Be careful that you do not place any via holes or traces adjacent to non-ground circuits.

The ground connections along the edges of the radio module should be grounded by via holes located as close as possible to the ground connections on the radio module.

Via Placement

The board design should prevent propagation of microwave fields inside the board material. Electromagnetic waves of high frequency may penetrate the board thus making the edges of the board radiate, which may distort the antenna pattern. To eliminate this effect, via holes should be placed around the board's edges. A common rule of thumb is to make the via spacing less than λ/20 at the maximum operating frequency. For the MICRO-RM2.4 Radio Module, the wavelength at 2.4 GHz is 125 mm and the maximum via spacing would be 6.25 mm.

Other Recommendations

- Metal enclosure should not be used.
- Low profile enclosures might affect antenna performance.
- Avoid placing high profile components next to antenna.
- Radio module should not be placed next to other electronics which might interfere with the 2.4 GHz frequency band.

8 Ordering Information

The MICRO-RM2.4 Radio Module can be ordered directly from MicroRidge Systems. Contact MicroRidge[22] for current pricing and delivery schedules.

The Radio Modules can be ordered with or without support for the MicroRidge MICRO-RM2.4 Wireless Communications Library[15] (RM2.4 Library). This RM2.4 Library provides wireless ZigBee communications support for the MICRO-RM2.4 Radio Module. The RM2.4 Library has been compiled with the IAR Embedded Workbench for the AVR microcontroller and you must use an appropriate version of the IAR compiler in order to use the RM2.4 Library.

The part numbering code for the RM2.4 Library is as follows:

L = Library support enabled via the embedded MICRO-RM2.4 Radio Module serial number

N = No library support enabled

The MICRO-RM2.4 Radio Module are in tube and bulk packaging.

TU = Tubes of 23 modules

SG = Single pieces up to 22 modules

Part Number	Description
MICRO-RM2.4-L-TU	Radio Module with RM2.4 Library support in tubes of 23 modules.
MICRO-RM2.4-N-TU	Radio Module with no wireless library support in tubes of 23 modules.
MICRO-RM2.4-L-SG	Radio Module with RM2.4 Library support. This item can only be ordered in quantities of 22 or less.
MICRO-RM2.4-N-SG	Radio Module with no wireless library support. This item can only be ordered in quantities of 22 or less.

9 Radio Certification

United States (FCC)

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by manufacturer could void the user's authority to operate the equipment.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

47 CFR 15.505

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: 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 the dealer or an experienced radio/ TV technician for help.

The modular transmitter must be labeled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

Contains FCC ID: 2ACNQRM2

The MICRO-RN2.4 Radio Module has a Modular approval and does not need separate approval for this module when used on an application board.

Industry Canada (IC)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT! Tous les changements ou modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actioner cet équipment.

This Class [B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada

This modular transmitter must be labeled with its own IC ID. If the IC ID Certification Number is not visible when installed inside another device, then the device should display a label on the device referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

Contains IC: 12298A-RM2

The MICRO-RN2.4 Radio Module has a Modular approval and does not need separate approval for this module when used on an application board.

European Union (ETSI)

The MICRO-RM2.4 radio module has been certified for use in European countries. The following testing has been completed.

Test standard ETSI EN 300 328 V1.7.1 (2006-10):

- Maximum Transmit Power
- Maximum EIRP Spectral Density
- Frequency Range
- Radiated Emissions

Test standard ETSI EN 301 489-1 V1.9.2 (2011-09) and ETSI EN 301 489-17 V2.2.1 (2012-09):

- Radiated Emissions
- Electro-Static Discharge
- Radiated RF Susceptibility

If this module is incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive.

Furthermore, the manufacturer must maintain a copy of the modules' documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

The 'CE' marking must be affixed to a visible location on the OEM product. The CE mark shall consist of the initials "CE" taking the following form:

The CE marking must have a height of at least 5 mm except where this is not possible on account of the nature of the apparatus.

The CE marking must be affixed visibly, legibly, and indelibly.

More detailed information about CE marking requirements you can find at "DIRECTIVE 1999/5/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL" on 9 March 1999 at section 12.

10 Contact MicroRidge

Email:

Support:	support@microridge.com
Sales:	sales@microridge.com
Information:	info@microridge.com

Phone:

Support:	541.593.1656
Sales:	541.593.3500
Main office:	541.593.1656
Fax:	541.593.5652

Mailing Address:

MicroRidge Systems, Inc.
PO Box 3249
Sunriver, OR 97707-0249

Shipping Address:

MicroRidge Systems, Inc.
56888 Enterprise Drive
Sunriver, OR 97707

Note: There is no mail delivery to this address. This address should only be used for package delivery services such as UPS, FedEx, etc.

MicroRidge Web: www.MicroRidge.com

MICRO-RM2.4 Web: www.MicroRidge-RM.com

11 Revision History

Date	Version	Comments
9-3-2014	1.0.1	▪ Preliminary release of MICRO-RM2.4 User Manual
9-12-2014	1.1.2	▪ Minor revisions to preliminary manual.
10-30-2014	1.2.3	▪ Changed radio module images to reflect final FCC & IC certification numbers. ▪ Revised text for FCC and IC in Radio Certification section.
10-31-2014	1.2.4	▪ Minor word additions to Radio Certification section.
5-6-2015	1.2.5	▪ Minor word changes.
5-20-2015	1.3.6	▪ Updated the Related Documents section. ▪ Updated the Ordering Information section. ▪ Added the Serial Number section. ▪ Added the Wireless Library section. ▪ Minor word changes.
11-23-2015	1.3.7	▪ Added Solder Paste Section.
12-28-2016	1.3.8	▪ Minor word changes.
12-12-2018	1.3.9	▪ Listed the tests done for the European Union certification.