



LG8271/LG9271

Low-Power Long Range (LoRa[®]) Technology Gateway Module for US (LG9271) and EU (LG8271)

General Features

- Supports LoRa[®]/LoraWAN[™] Technology RF Packets
- Up to eight receive and one transmit channel(s)
- UART (TTL) interface with built-in control protocol
- Compact form factor 90.0 mm x 30.0 mm
- mPCIe physical connector
- Environmentally friendly RoHS compliant
- Compliance:
 - LG8271: Certified to R&TTE RF Standards
 - LG9271: Certified to FCC Modular Transmitter Standards
- Device Firmware Upgrade (DFU) over UART, see *"LoRa[®] Technology Gateway Module Software Specifications"*

Operational

- Single operating voltage: 3.0V to 3.6V (3.3V nominal)
- Temperature range: -40 to +85 °C
- Supports LoRa Technology (12.5 kbps) and FSK (EU only) (up to 300 kbps) modulations
- Integrated frequency matched RF front end, RF transceiver, baseband processor, and MCU

Description

Microchip's LG8271/LG9271 Low-Power Long Range (LoRa) Technology transceiver modules provide an easy to use, low-power solution for long range wireless data reception. Each module provides eight LoRa Technology receive channels (125 kHz Bandwidth (BW)). In addition to the eight LoRa Technology receive channels, the modules provide two additional receive channels. The first is a LoRa Technology modulation receive channel capable of 125, 250 or 500 kHz BW. The second provides an FSK/GFSK (EU only) receive channel.

Beyond its receiver capability, the modules provide a single flexibly transmit channel. This transmit channel is capable of both LoRa Technology and FSK/GFSK modulations at multiple bandwidths (LoRa Technology) or baud rates (FSK/GFSK).

The multi-channel, flexible nature of these modules makes them ideal for use in LoRa Technology gateway applications.

The advanced command protocol available over the UART interface provides complete control over the full capabilities of RF subsystem in addition to packet reception and transmission.

Applications

Applications deploying LoRa Technology where gateway devices are required include:

- 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

Device Overview	3
General Specifications	7
Typical Hardware Connections	11
Application Information	13
Regulatory Approval	15
Appendix A: Revision History	19
The Microchip Web Site	21
Customer Change Notification Service	21
Customer Support	21
Product Identification System	22

TO OUR VALUED CUSTOMERS

It is our intention to provide our valued customers with the best documentation possible to ensure successful use of your Microchip products. To this end, we will continue to improve our publications to better suit your needs. Our publications will be refined and enhanced as new volumes and updates are introduced.

If you have any questions or comments regarding this publication, please contact the Marketing Communications Department via E-mail at docerrors@microchip.com. We welcome your feedback.

Most Current Data Sheet

To obtain the most up-to-date version of this data sheet, please register at our Worldwide Web site at:

<http://www.microchip.com>

You can determine the version of a data sheet by examining its literature number found on the bottom outside corner of any page. The last character of the literature number is the version number, (e.g., DS30000000A is version A of document DS30000000).

Errata

An errata sheet, describing minor operational differences from the data sheet and recommended workarounds, may exist for current devices. As device/documentation issues become known to us, we will publish an errata sheet. The errata will specify the revision of silicon and revision of document to which it applies.

To determine if an errata sheet exists for a particular device, please check with one of the following:

- Microchip's Worldwide Web site; <http://www.microchip.com>
- Your local Microchip sales office (see last page)

When contacting a sales office, please specify which device, revision of silicon and data sheet (include literature number) you are using.

Customer Notification System

Register on our web site at www.microchip.com to receive the most current information on all of our products.

1.0 DEVICE OVERVIEW

The LG8271/LG9271 transceiver modules feature LoRa Technology RF modulation, which provides long range spread spectrum communication with high interference immunity.

Each module supports eight (8) receive channels allowing it to receive up to eight LoRa Technology modulated packets simultaneously. By using LoRa Technology modulation technique, LG8271/LG9271 can achieve a receiver sensitivity of -146 dBm. When combined with LoRa Technology transmission devices, the LG8271/LG9271 can provide a system with industry leading link budget, which makes it optimal for applications requiring extended range and robustness.

The LG8271/LG9271 modules also contain an integrated output power amplifier (LNA) providing optimal downlink signal levels.

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 LG8271/LG9271 modules deliver exceptional RF selectivity and their multi-channel performance make them ideal for use in LoRa Technology gateway applications.

Figure 1-1, Figure 1-2 and Figure 1-3 show the top and bottom view, the pinout, and the block diagram of the modules.

FIGURE 1-1: TOP VIEW

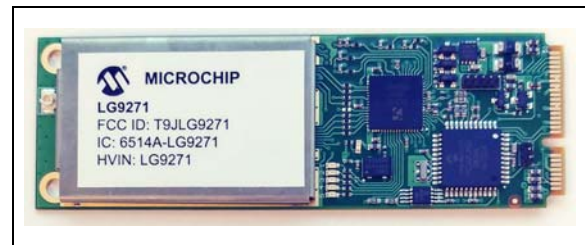
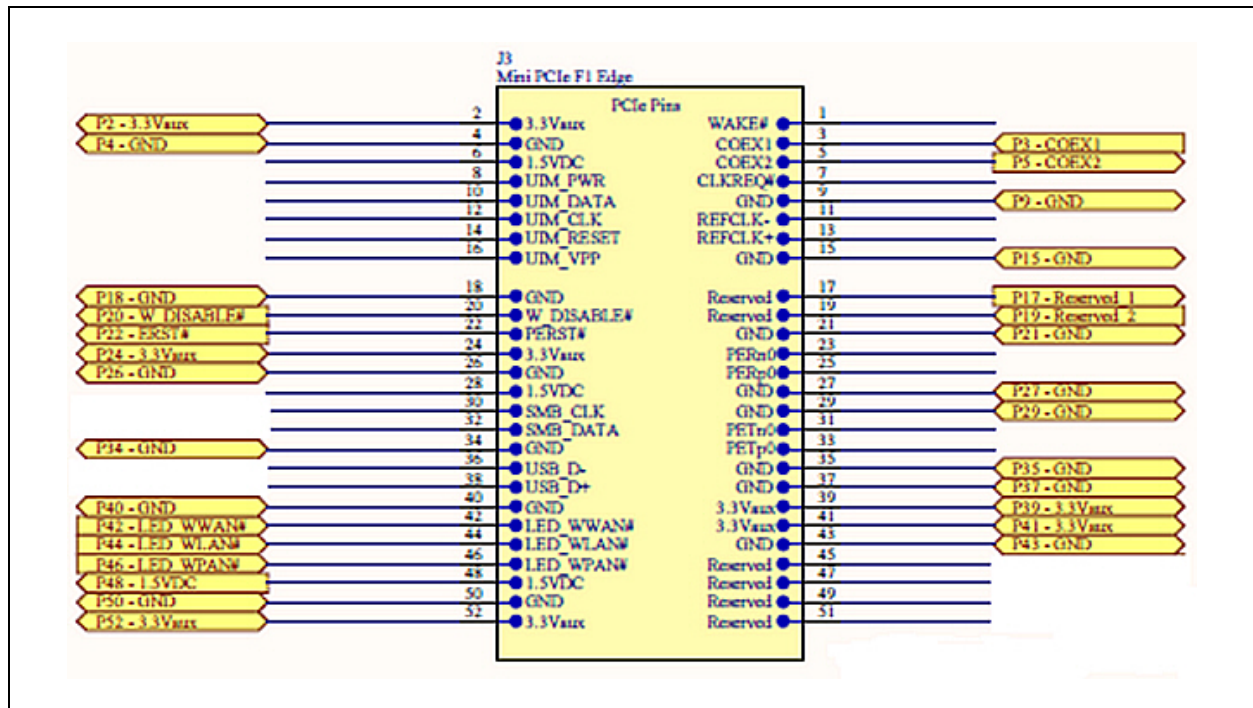


FIGURE 1-2: PIN DIAGRAM



LG8271/LG9271

FIGURE 1-3: BLOCK DIAGRAM

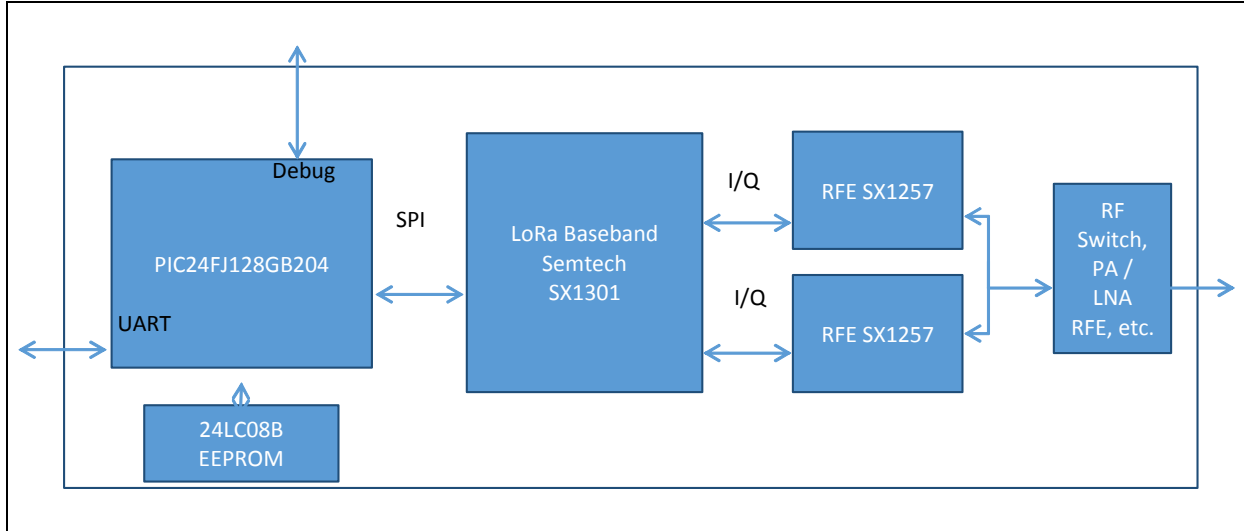


Table 1-1 describes the pins of the module.

TABLE 1-1: PIN DESCRIPTION

Pin	Symbol	Type	Description
1	NC	—	Not Connected
2	VDD	Power	Positive Supply Terminal
3	HOST_INT	Output	Interrupt to the Host CPU
4	GND	Power	Ground Supply Terminal
5	PPS	Input	GPS PPS Input signal
6	NC	—	Not Connected
7	NC	—	Not Connected
8	NC	—	Not Connected
9	GND	Power	Ground Supply Terminal
10	NC	—	Not Connected
11	NC	—	Not Connected
12	NC	—	Not Connected
13	NC	—	Not Connected
14	NC	—	Not Connected
15	GND	Power	Ground Supply Terminal
16	NC	—	Not Connected
17	HOST_URX	Input	Module UART Receive
18	GND	Power	Ground Supply Terminal
19	HOST_UTX	Output	Module UART Transmit
20	RF_ENABLE	Input	RF Enable Input
21	GND	Power	Ground Supply Terminal
22	RESET	Input	Reset Module
23	NC	—	Not Connected
24	VDD	Power	Positive Supply Terminal
25	NC	—	Not Connected
26	GND	Power	Ground Supply Terminal
27	GND	Power	Ground Supply Terminal
28	NC	—	Not Connected

TABLE 1-1: PIN DESCRIPTION (CONTINUED)

Pin	Symbol	Type	Description
29	GND	Power	Ground Supply Terminal
30	HOST_CLK	Input	Host I ² C Clock
31	NC	—	Not Connected
32	HOS_SDA	Input/Output	HOST I ² C Data
33	NC	—	Not Connected
34	GND	Power	Ground Supply Terminal
35	GND	Power	Ground Supply Terminal
36	USB_D-	—	Host USB D-
37	GND	Power	Ground Supply Terminal
38	USB_D+	—	Host USB D+
39	VDD	Power	Positive Supply Terminal
40	GND	Power	Ground Supply Terminal
41	VDD	Power	Positive Supply Terminal
42	LED1	Output	LED1 Output
43	GND	Power	Ground Supply Terminal
44	LED2	Output	LED2 Output
45	HOST_MISO	Ouput	Module SPI Slave Output
46	LED3	Output	LED3 Output
47	HOST_MISO	Input	Module SPI Slave Input
48	PIC_DETECT	Input/Output	PCI Bus Detect Input. Low = SPI Mode, High = mPCIe/UART
49	HOST_SS	Input	Module SPI Slave Select Input
50	GND	Power	Ground Supply Terminal
51	HOST_SCK	Input	Module SPI Clock Input
52	VDD	Power	Positive Supply Terminal

LG8271/LG9271

NOTES:

2.0 GENERAL SPECIFICATIONS

Table 2-1 provide the general specifications for the module. Table 2-2 through Table 2-4 provide the electrical characteristics, RF receiver characteristics, LoRa Technology data rate and sensitivity versus spreading factor.

TABLE 2-1: GENERAL SPECIFICATION

Specification	Description
Frequency Band - LG9271	902.000 MHz to 928.000 MHz
Frequency Band - LG8271	863.000 MHz to 870.000 MHz
Modulation Method	FSK (EU only), GFSK (EU only), and LoRa [®] Technology modulation
Maximum Over-the-Air Data Rate	200 kbps (FSK); 21875 bps (LoRa Technology, see Table 2-4) ⁽¹⁾
RF Connection	On-board U.FL connector
Interface	UART (TTL)
Operation Range	Up to 15 km coverage at suburban; up to 5 km coverage at urban area
RF TX Power - LG9271	Adjustable, < +18.5 dBm ⁽²⁾
RF TX Power - LG8271	Adjustable, < +14.0 dBm ⁽²⁾
Generated Conductive Harmonics Level	Below -70 dBm
Temperature (operating)	-40°C to +85°C
Temperature (storage)	-40°C to +115°C
Humidity	10% ~ 90% Non-condensing

Note 1: Depends on modulation and Expand Spreading Factor (SF)

2: TX power is adjustable. For more information, refer to the “LoRa[®] Technology Gateway Module Software Specifications”

TABLE 2-2: ELECTRICAL CHARACTERISTICS

Parameter	Min.	Typ.	Max.	Units
Supply Voltage	3.0	—	3.6	V
Voltage on any pin with respect to VSS (except VDD)	-0.3	—	-VDD + 0.3	V
Voltage on VDD with respect to VSS	-0.3	—	3.9	V
Input Clamp Current (I _{IK}) (V _I < 0 or V _I > VDD)	—	—	+/-20	mA
Output Camp Current (I _{OK}) (V _O < 0 or V _O > 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 < V _{PIN} < VDD, Pin at high-impedance)	—	0.1	50	nA

LG8271/LG9271

TABLE 2-2: ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter	Min.	Typ.	Max.	Units
Input Leakage at +60°C (VSS<VPIN<VDD, Pin at high-impedance)	—	0.7	100	nA
RF Input Level	—	0	+6	dBm

TABLE 2-3: RF RECEIVER CHARACTERISTICS

Descriptions	Conditions	Typ	Unit
LoRa Technology sensitivity at SF12 : IF8 path	BW = 125 kHz	-140	dBm
	BW = 250 kHz	-137	
	BW = 500 kHz	-134	
LoRa Technology sensitivity at SF12 : IF0 to 7 paths	BW = 125 kHz	-140	dBm
Receiver CW interferer rejection at 1Mhz offset at SF12	BW = 125 kHz	+80	dB
Co-channel rejection at SF12	Wanted signal 10 dB above sensitivity	+25	dB
LoRa Technology sensitivity at SF7 : IF8 path	BW = 125 kHz	-126	dBm
	BW = 250 kHz	-123	
	BW = 500 kHz	-120	
LoRa Technology sensitivity at SF7 : IF0 to 7 paths	BW = 125 kHz	-126	dBm
Receiver CW interferer rejection at 1 Mhz offset	BW = 125 kHz	+70	dB
Co-channel rejection at SF7	Wanted signal 10 dB above sensitivity	+9	dB
FSK sensitivity	FDev = 50 kHz, Bit Rate = 100 kb/s	-103	dBm
Bit rate FSK ⁽¹⁾	Programmable	1.2 to 100	kbps
Frequency deviation (FDev), FSK	Programmable	0.6 to 200	kHz

Note 1: Bit rate limited by: FDev + Bit Rate/2 < 250 kHz

TABLE 2-4: LoRa TECHNOLOGY DATA RATE (BPS) AND SENSITIVITY VERSUS SPREADING FACTOR (SF)

SF	125 kHz		250 kHz ⁽¹⁾		500 kHz ⁽¹⁾	
	Data Rate	Sensitivity	Data Rate	Sensitivity	Data Rate	Sensitivity
7	5496	-130.0	10938	-127.0	21875	-124.0
8	2125	-132.5	6250	-129.5	12500	-126.5
9	1758	-135.0	3516	-132.0	7031	-129.0
10	977	-137.5	1953	-134.5	3906	-131.5
11	537	-140.0	1074	-137.0	2148	-134.0
12	293	-142.5	586	-139.5	1172	-136.5

Note 1: 250 kHz and 500 kHz LoRa Technology bandwidths are available *only* on IF8.

Table 2-5 through Table 2-7 provide the current consumption, dimensions of the modules and the RF output power versus TX power settings.

TABLE 2-5: CURRENT CONSUMPTION (3.3V)

Mode	Current (Typical) mA	Current (Max.) mA
RF Idle	75	100
RX Active	570	850
TX Active	570	900

TABLE 2-6: MODULE DIMENSIONS

Parameter	Value
Dimensions	90.0 x 30.0 mm
Weight	16g

TABLE 2-7: RF OUTPUT POWER (DBM) VERSUS TX POWER SETTING (NOMINAL)

Setting	Power	Setting	Power	Setting	Power	Setting	Power	Setting	Power
-6	-6	1	0	8	6	15 ⁽¹⁾	14	22 ⁽¹⁾	20
-5	-6	2	0	9	6	16 ⁽¹⁾	16	23 ⁽¹⁾	23
-4	-6	3	3	10	10	17 ⁽¹⁾	16	24 ⁽¹⁾	23
-3	-3	4	3	11	11	18 ⁽¹⁾	16	25 ⁽¹⁾	25
-2	-3	5	3	12	12	19 ⁽¹⁾	16	26 ⁽¹⁾	26
-1	-3	6	6	13	13	20 ⁽¹⁾	20	27 ⁽¹⁾	27
0	0	7	6	14 ⁽¹⁾	14	21 ⁽¹⁾	20		

Note 1: Power settings 14 - 27 may violate ETSI maximum RF transmit power levels. Verify RF output power before using these settings.

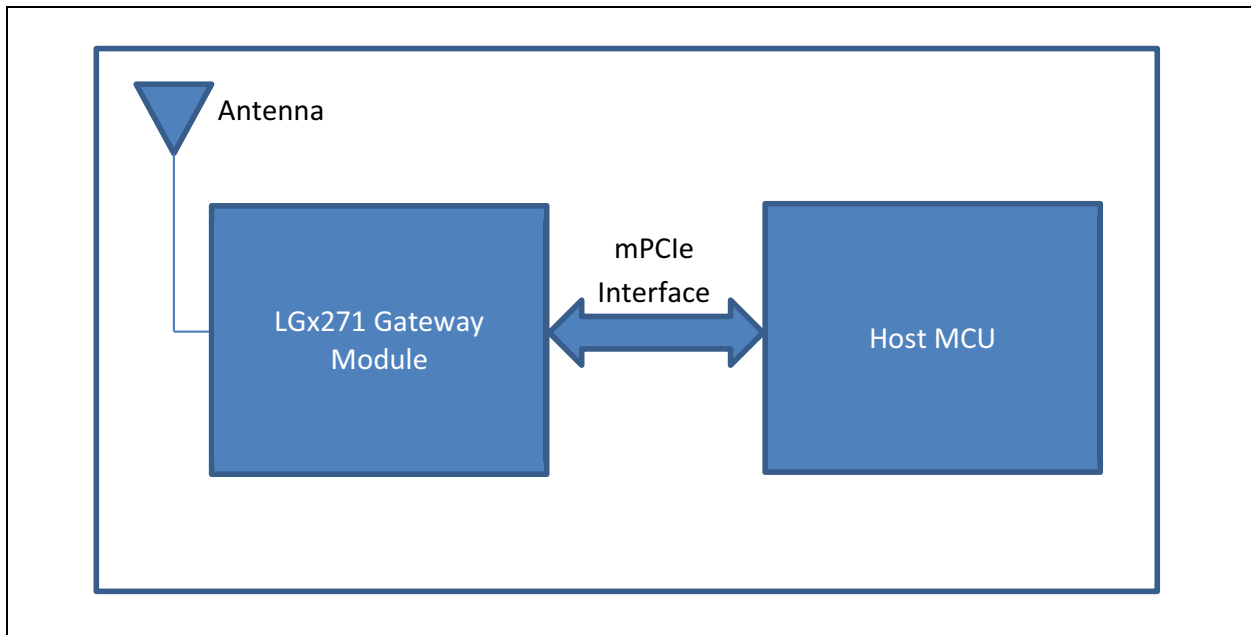
LG8271/LG9271

NOTES:

3.0 TYPICAL HARDWARE CONNECTIONS

Figure 3-1 shows the typical hardware connections for the module. Interfacing to the module requires connecting to the signals provided on the mPCIe connector as listed in Table 1-1. Specific interface connections are discussed in this chapter.

FIGURE 3-1: HARDWARE CONNECTIONS



3.1 INTERFACE TO HOST MCU

The LG8271/LG9271 modules have a dedicated UART interface to communicate with a host controller. The “LoRa® Technology Gateway Module Software Specifications” provides a detailed UART command description. Table 3-1 shows the default settings for the UART interface.

TABLE 3-1: UART SETTINGS

Specification	Value
Signal Levels	TTL
Baud Rate	115200 bps
Packet Length	8 bit
Parity Bit	No
Stop Bits	1 bit
Hardware Flow Control	No

3.2 RF CONNECTION

The LG8271/LG9271 modules have a U.FL connector for interfacing with an external antenna. For proper operation, antenna selection must consider frequency band and impedance.

3.3 POWER PINS

The LG8271/LG9271 modules have multiple power and ground pins available on the mPCIe connector. It is recommended that all power and ground pins be used when connecting to the module.

3.4 RESET PIN

The LG8271/LG9271 modules have an active-low reset input. Pulling this signal low during normal operation will cause the module to execute a reset cycle.

3.5 RF_ENABLE

The LG8271/LG9271 modules have an input signal used to enable the RF radio on the module. A low level on the RF_ENABLE pin will disable all RF transmission and reception.

LG8271/LG9271

3.6 PCI_DETECT

The LG8271/LG9271 modules have an input signal used to select the active host interface. The signal is sampled at module start up and the selected interface is initialized and configured. A LOW signal on this line at start up selects the SPI interface (unsupported). A HIGH signal on this line selects the UART interface.

3.7 LED OUTPUTS

The LG8271/LG9271 modules have three buffered outputs that can sink sufficient current to activate off board LEDs. These signals are entirely controlled by commands from the host MCU. Refer to the “*LoRa[®] Technology Gateway Module Software Specifications*” for details regarding the commands used to activate these signals.

3.8 HOST INTERRUPT

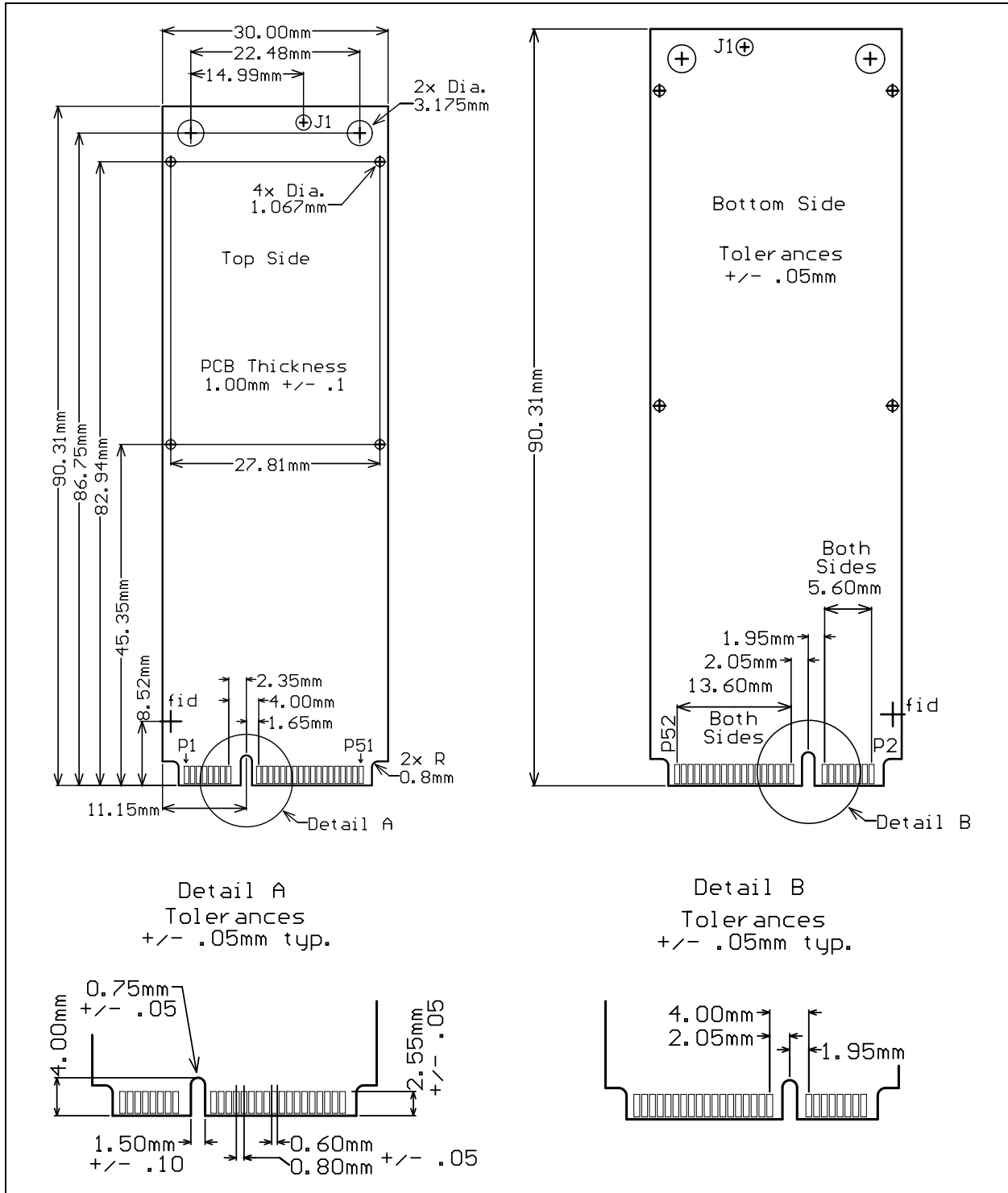
The LG8271/LG9271 modules have an output signal that can be used to provide an interrupt to a host MCU. This feature is currently implemented.

4.0 APPLICATION INFORMATION

4.1 Physical Dimensions

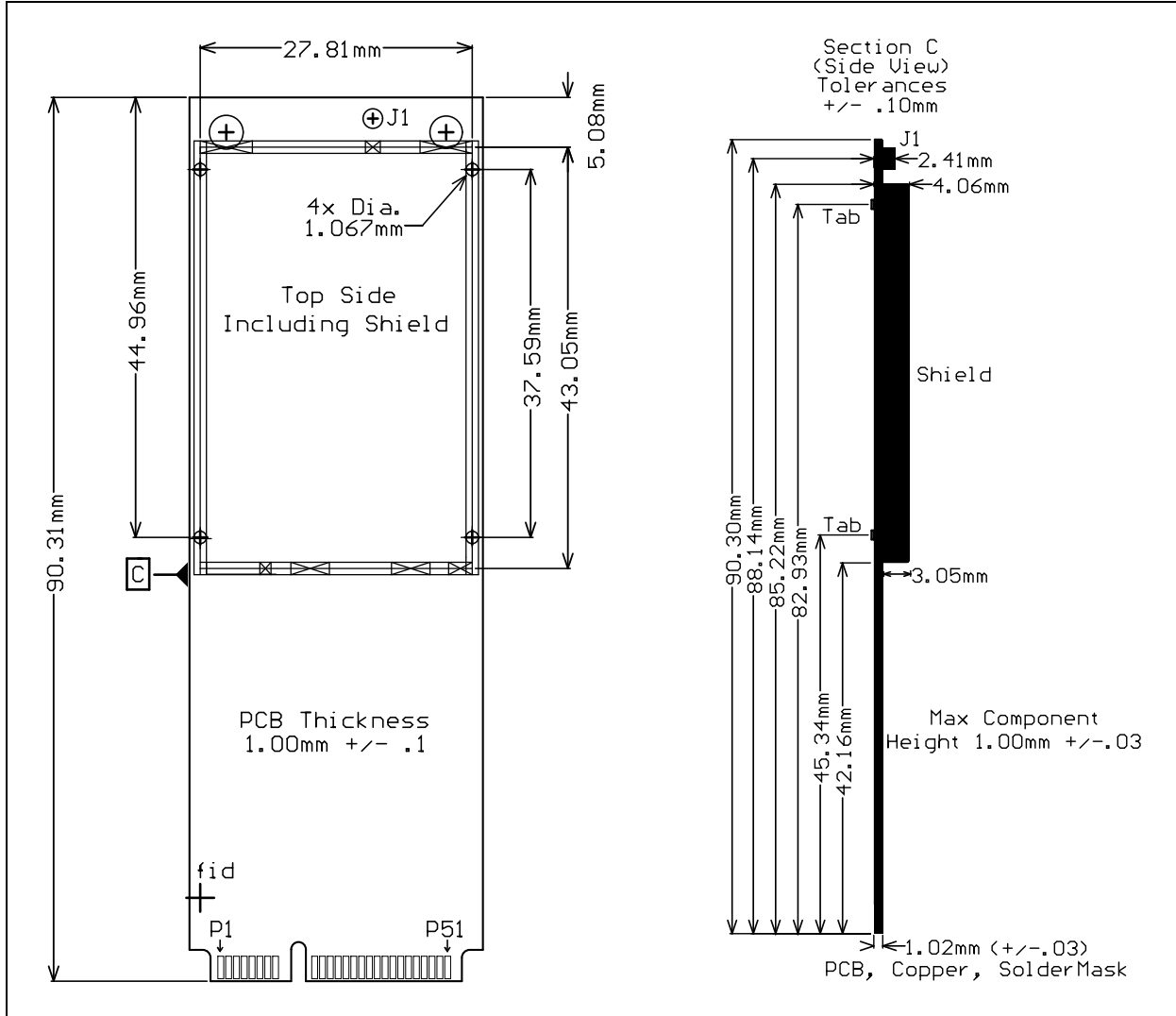
Figure 4-1 and Figure 4-2 illustrate the physical dimensions of the LG8271/LG9271 modules.

FIGURE 4-1: TOP AND BOTTOM VIEW



LG8271/LG9271

FIGURE 4-2: TOP VIEW WITH SHIELD AND SIDE VIEW



4.2 Approved Antennas

Modular certification of the LG9271 module is performed with the external antenna type in [Table 4-1](#).

For specific regulatory requirements by country, refer to [Section 5.0 "Regulatory Approval"](#).

TABLE 4-1: TESTED EXTERNAL ANTENNA TYPES

Type	Gain (dBi)
Sleeve Dipole	5

5.0 REGULATORY APPROVAL

This section outlines the regulatory information for the LG8271/LG9271 module for the following countries:

- Europe (LG8271)
- United States (LG9271)

5.1 Europe

The LG8271 module has been tested in accordance with the ETSI EN 300 220-2 V2.4.1 (2012-05) RF standard and been determined to be compliant. [Table 5-1](#) lists the summary report documenting the compliance.

Additional R&TTE testing is required for Health and Safety (Article (3.1(a)) and Electromagnetic Compatibility (EMC) (Article 3.1(b)).

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

Note: To maintain conformance to the testing listed in [Table 5-1](#): 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.

5.1.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the LG8271 module must follow CE marking requirements. The “*R&TTE Compliance Association Technical Guidance Note 01*” provides guidance on final product CE marking.

TABLE 5-1: EUROPEAN COMPLIANCE TESTING

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	IEC 60950-1:2005 (2nd Ed: A1:2009)	(3.1(a))			
Health	EN 62479	—			
EMC	EN 301 489-3 v1.6.1	(3.1(b))			
Radio	EN 300 220-2 v2.4.1	(3.2)	TÜV SÜD AMERICA INC.	TP72121077.100	11/14/2015

5.1.2 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]

5.1.3 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.rteca.com/>

5.2 United States

The LG9271 module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” modular approval in accordance with Part 15.212 Modular Transmitter approval. Modular approval allows the end user to integrate the LG9271 module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user's authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15 Subpart B “Unintentional Radiators”), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity) (e.g., transmitter modules may also contain digital logic functions) as appropriate.

5.2.1 LABELING AND USER INFORMATION REQUIREMENTS

The LG9271 module has been 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 finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains Transmitter Module FCC ID: T9JLG9271

or

Contains FCC ID: T9JLG9271

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.

A user's manual for the finished product should include the following statement:

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.

Additional information on labeling and user information requirements for Part 15 devices can be found in KDB Publication 784748 available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB)

<https://apps.fcc.gov/oetcf/kdb/index.cfm>

5.2.2 RF EXPOSURE

All transmitters regulated by FCC must comply with RF exposure requirements. KDB 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).

From the LG9271 FCC Grant: Output power listed is conducted. This grant is valid only when the module is sold to OEM integrators and must be installed by the OEM or OEM integrators. This transmitter is restricted for use with the specific antenna(s) tested in this application for Certification and must not be co-located or operating in conjunction with any other antenna or transmitters within a host device, except in accordance with FCC multi-transmitter product procedures.

5.2.3 APPROVED EXTERNAL ANTENNA TYPES

To maintain modular approval in the United States, only the antenna types that have been tested shall be used. It is permissible to use different antenna manufacturer provided the same antenna type and antenna gain (equal to or less than) is used.

Testing of the LG9271 module was performed with the antenna types listed in [Table 4-1](#) Tested External Antenna Types.

5.2.4 HELPFUL WEB SITES

Federal Communications Commission (FCC):
<http://www.fcc.gov>

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):
<https://apps.fcc.gov/oetcf/kdb/index.cfm>

5.3 Canada

The LG8271 module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-247 and RSS-Gen. Modular approval permits the installation of a module in a host device without the need to recertify the device.

5.3.1 LABELING AND USER INFORMATION REQUIREMENTS

Labeling Requirements for the Host Device (from Section 3.1, RSS-Gen, Issue 4, November 13, 2014): The host device shall be properly labeled to identify the module within the host device.

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of

the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 6514A-LG9271.

User Manual Notice for License-Exempt Radio Apparatus (from Section 8.4 RSS-Gen, Issue 4, November 13, 2014): User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device complies with Industry Canada license-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, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Transmitter Antenna (from Section 8.3 RSS-Gen, Issue 4, November 13, 2014): User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

The above notice may be affixed to the device instead of displayed in the user manual.

LG8271/LG9271

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

5.3.2 RF EXPOSURE

All transmitters regulated by IC must comply with RF exposure requirements listed in RSS-102 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands). Currently this device is approved for use for when 20 cm can be maintained between the antenna and users.

Specific Absorption Rate (SAR) evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm. Exceptions are listed in RSS-102. Note that integration < 20 cm will require further certification with IC such as a Multiple Listing and Class IV Permissive Change application.

Tous les émetteurs régulés par Industrie Canada doivent être conformes à la notice RSS-102 d'Industrie Canada concernant la Conformité des appareils de radiocommunication aux limites d'exposition humaine aux radiofréquences (toutes bandes de fréquences). Ce produit est ainsi approuvé pour une utilisation d'au moins 20 cm entre l'antenne et toute personne à proximité.

Une évaluation du Débit d'Absorption Spécifique (DAS) est requise si cette distance de séparation est inférieure ou égale à 20 cm. Des exceptions sont toutefois répertoriés dans la notice RSS-102. Mais il est souligné que l'utilisation d'un dispositif à moins de 20 cm nécessite une certification supplémentaire avec Industrie Canada, comme un complément d'information et l'application à la notice de Changement Permissif de Classe IV.

5.3.3 APPROVED EXTERNAL ANTENNA TYPES

Transmitter Antenna (from Section 8.3 RSS-Gen, Issue 4, November 13, 2014):

The LG9271 module can only be sold or operated with antennas with which it was approved. Transmitter may be approved with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest gain antenna of each combination of transmitter and antenna type for which approval is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type having equal or lesser gain as an antenna that had been successfully tested with the transmitter, will also be considered approved with the transmitter, and may be used and marketed with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

Testing of the LG9271 module was performed with the antenna types listed in [Table 4-1 Tested External Antenna Types](#).

5.3.4 HELPFUL WEB SITES

Industry Canada: <http://www.ic.gc.ca/>

APPENDIX A: REVISION HISTORY

Revision A (March 2017)

This is the initial released version of the document.

LG8271/LG9271

NOTES:

THE MICROCHIP WEB SITE

Microchip provides online support via our WWW site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at www.microchip.com. Under "Support", click on "Customer Change Notification" and follow the registration instructions.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of tRN4678his document.

Technical support is available through the web site at: <http://microchip.com/support>

LG8271/LG9271

PRODUCT IDENTIFICATION SYSTEM

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

<u>PART NO.</u>	↓	<u>RM</u>	<u>XXX</u>	Example:
Device	Temperature Range	Package	Firmware Revision Number	LG8271-I/RM000: Industrial temperature
Device:	LG8271/LG9271: Low-Power Long Range LoRa® Technology Transceiver module			
Temperature Range:	I	=-40°C to +85°C (Industrial)		
Package:	RM	= Radio Module		

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

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- 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.

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. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELoQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
= ISO/TS 16949 =**

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KEELoQ, KEELoQ logo, Kleer, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICKit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2017, Microchip Technology Incorporated, All Rights Reserved.
ISBN:



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong
Tel: 852-2943-5100
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR
Tel: 852-2943-5100
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-3326-8000
Fax: 86-21-3326-8021

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8864-2200
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-3019-1500

Japan - Osaka
Tel: 81-6-6152-7160
Fax: 81-6-6152-9310

Japan - Tokyo
Tel: 81-3-6880-3770
Fax: 81-3-6880-3771

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

France - Saint Cloud
Tel: 33-1-30-60-70-00

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-67-3636

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7289-7561

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820