Features
- Bluetooth® Classic (BR/EDR) and Low Energy (LE)
- Certified to FCC, IC, MIC, KCC, and NCC Radio Regulations
- European R&TTE Directive Assessed Radio Module
- Bluetooth SIG 4.2 Qualified
- Transparent UART mode for seamless serial data over Bluetooth Classic using Serial Port Profile (SPP), and Bluetooth Low Energy (BLE) using Generic Attribute (GATT) Profile
- Easily Programmable through ASCII Commands and easily configurable with available PIC® MCU driver library
- Firmware can be upgraded in the field over UART (Flash version)
- Integral Chip Antenna (RN4678)
- Integrated Crystal, Internal Voltage Regulator, and Matching Circuitry
- Available Configurable I/O Pins for Control or Status Indication
- Supports Apple® iPod Accessory Protocol (iAP2) (only RN4678APL)
- Supports Bluetooth 4.2 LE Secure Connections
- Bluetooth 4.2 LE Data Packet Length Extension
- Small and Compact Surface Mount Module
- Castellated SMT Pads for easy and reliable PCB mounting
- Ideal for Portable Battery-Operated Devices

RF/Analog
- Frequency: 2.402 GHz to 2.480 GHz
- RX Sensitivity: -90 dBm (BR/EDR), -92 dBm (LE)
- Class 2 Output Power (+1.5 dBm typical)

Data Throughput
Data Throughput at 1 Mbps UART Baud Rate:
- BR/EDR: up to 32 KBps
- LE: up to 7 KBps
Data Throughput at 115200 bps UART Baud Rate:
- BR/EDR: up to 10 KBps
- LE: up to 6 KBps

Operating Conditions
- Operating Voltage Range: 3.3V to 4.2V
- Operating Temperature Range: -20°C to +70°C

MAC/Baseband/Higher Layer
- Secure AES128 Encryption
- Bluetooth 3.0: GAP, SPP, SDP, RFCOMM and L2CAP
- Bluetooth 4.2: GAP, GATT, ATT, SMP and L2CAP

Applications
- Internet of Things (IoT)
- Secure Payment
- Home and Security
- Health and Fitness
- Industrial and Data Logger
- LED Lighting (16 configurations)

Description
The RN4678 module is a fully certified, Bluetooth version 4.2 (BR/EDR/LE) dual-mode module available for customers to easily add dual mode Bluetooth wireless capability to their products. The RN4678 is built around Microchip’s IS1678 Bluetooth dual mode chip. Refer to Section 8.0 “Ordering Information”.

The RN4678 provides a convenient method for cable replacement for smartphones or tablets for data transfer and control based on the Bluetooth protocols. Data transfer is achieved through the Bluetooth link by sending or receiving data through SPP in Bluetooth (BT) Classic mode and through Transparent UART in the BLE mode. The ASCII interface provides an easy way to learn the operation and to integrate the module with any microprocessor or Microcontroller (MCU) with a UART interface.
Table of Contents

1.0 Device Overview ................................................................. 3
2.0 Application Information ............................................................... 7
3.0 Electrical Characteristics ............................................................ 15
4.0 Radio Characteristics ............................................................... 19
5.0 Physical Dimensions ............................................................... 21
6.0 Reflow profile ........................................................................ 25
7.0 Module Placement ................................................................. 27
8.0 Ordering Information ............................................................... 31
9.0 Regulatory Approval ............................................................... 33
Appendix A. Revision History ........................................................... 39

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

1.1 Overview

The RN4678 module is a fully certified, Bluetooth version 4.2 (BR/EDR/LE) wireless module. The module includes an on-board Bluetooth stack, power management subsystem, 2.4 GHz transceiver, and RF power amplifier. Customers can embed Bluetooth functionality into any application using the RN4678 module.

The RN4678 enables rapid product development and faster time to market, and it is designed to provide integrators with the following features:
- Simple integration and programming
- Reduced development time
- Superior wireless module with low-cost system
- Interoperability with Bluetooth host
- Wide range of applications

The RN4678 is a complete and fully regulatory certified module with an integral ceramic chip antenna and RF shield.

The RN4678 is a small, compact and surface mounted module with castellated pads for easy and reliable host PCB mounting. The module is compatible with standard pick-and-place equipment and can independently maintain a low-power wireless connection. Low-power usage and flexible power management maximize the lifetime of the RN4678 module in battery-operated devices. A wide operating temperature range enables its applications in indoor and outdoor environments.

Figure 1-1 illustrates the internal block diagram of the RN4678.

FIGURE 1-1: RN4678 INTERNAL BLOCK DIAGRAM
Table 1-1 provides the description of the various pins of the RN4678 module.

<table>
<thead>
<tr>
<th>RN4678 Pin Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 GND</td>
<td>Power</td>
<td>Ground reference</td>
</tr>
<tr>
<td>2 GND</td>
<td>Power</td>
<td>Ground reference</td>
</tr>
<tr>
<td>3 GND</td>
<td>Power</td>
<td>Ground reference</td>
</tr>
<tr>
<td>4 BAT_IN</td>
<td>Power</td>
<td>Battery Input (3.3V to 4.2V) Main positive supply input Connect to 10 µF (X5R/X7R) capacitor</td>
</tr>
<tr>
<td>5 SW_BTN</td>
<td>DI</td>
<td>Software Button H: Power On L: Power Off</td>
</tr>
<tr>
<td>6 LDO33_O</td>
<td>Power</td>
<td>Internal 3.3V LDO output; can source no more than 50 mA</td>
</tr>
<tr>
<td>7 VDD_IO</td>
<td>Power</td>
<td>I/O positive supply input. For internal use only; do not connect to other devices.</td>
</tr>
<tr>
<td>8 LDO18_O</td>
<td>Power</td>
<td>Internal 1.8V LDO output. For internal use only; do not connect to other devices.</td>
</tr>
<tr>
<td>9 WAKEUP</td>
<td>DI</td>
<td>Wake-up from Sleep mode (active-low) (internal pull-up)</td>
</tr>
<tr>
<td>10 PMULDO_O</td>
<td>Power</td>
<td>Power management unit output. For internal use only; do not connect to other devices.</td>
</tr>
<tr>
<td>11 P0_4</td>
<td>DO</td>
<td>Status Indication pin. Indicates the current status of BLE data transmission. High: Data currently transmitting Low: No current data transmission</td>
</tr>
<tr>
<td>12 P1_5</td>
<td>DO</td>
<td>Status Indication pin. Indicates the current connection status. High: Powered On and not connected Low: Connected to peer device</td>
</tr>
<tr>
<td>13 P1_2</td>
<td>DO</td>
<td>GPIO pin. Internally pulled-up by default.</td>
</tr>
<tr>
<td>14 P1_3</td>
<td>DIO</td>
<td>GPIO pin. Internally pulled-up by default.</td>
</tr>
<tr>
<td>15 P1_7/CTS</td>
<td>DIO</td>
<td>Configurable Control or Indication pin or UART CTS (input)</td>
</tr>
<tr>
<td>16 P0_5</td>
<td>DIO</td>
<td>Configurable Control or Indication pin</td>
</tr>
<tr>
<td>17 P0_0/RTS</td>
<td>DIO</td>
<td>Configurable Control or Indication pin or UART RTS (output)</td>
</tr>
<tr>
<td>18 P2_0</td>
<td>DI</td>
<td>System configuration pin. Along with P2_4 and EAN pins, used to set the module in any of the following three modes: Application mode (for normal operation), Test mode (to change EEPROM values), and Write Flash mode (to enter the new firmware into the module); refer to Table 2-1.</td>
</tr>
<tr>
<td>19 P2_4</td>
<td>DI</td>
<td>System configuration pin. Along with P2_0 and EAN pins, used to set the module in any of the following three modes: Application mode (for normal operation), Test mode (to change EEPROM values), and Write Flash mode (to enter new firmware into the module); refer to Table 2-1.</td>
</tr>
<tr>
<td>20 EAN</td>
<td>DI</td>
<td>External address-bus negative pin. System configuration pin along with P2_0 and P2_4 pins, used to set the module in any of the following three modes: Application mode (for normal operation), Test mode (to change EEPROM values), and Write Flash mode (to enter new firmware into the module); refer to Table 2-1. Must be pulled down with 4.7 kΩ to GND.</td>
</tr>
<tr>
<td>21 RST_N</td>
<td>DI</td>
<td>Module Reset (internal pull-up). Apply a pulse of at least 63 ns.</td>
</tr>
<tr>
<td>22 RXD</td>
<td>DI</td>
<td>UART data input</td>
</tr>
<tr>
<td>23 TXD</td>
<td>DO</td>
<td>UART data output</td>
</tr>
</tbody>
</table>
Figure 1-2 illustrates the pin diagram of the RN4678 module.

**FIGURE 1-2: RN4678 PIN DIAGRAM**

![RN4678 Pin Diagram](image-url)

**TABLE 1-1: PIN DESCRIPTION (CONTINUED)**

<table>
<thead>
<tr>
<th>RN4678</th>
<th>Pin Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>P3_1</td>
<td>DIO</td>
<td>Configurable Control or Indication pin (Internally pulled-up, if configured as an input)</td>
</tr>
<tr>
<td>25</td>
<td>P3_2</td>
<td>DIO</td>
<td>Configurable Control or Indication pin (Internally pulled-up, if configured as an input)</td>
</tr>
<tr>
<td>26</td>
<td>P3_3</td>
<td>DIO</td>
<td>Configurable Control or Indication pin (Internally pulled-up, if configured as an input)</td>
</tr>
<tr>
<td>27</td>
<td>P3_4</td>
<td>DIO</td>
<td>Configurable Control or Indication pin (Internally pulled-up, if configured as an input)</td>
</tr>
<tr>
<td>28</td>
<td>P3_6</td>
<td>DIO</td>
<td>Do not connect.</td>
</tr>
<tr>
<td>29</td>
<td>P3_7</td>
<td>DIO</td>
<td>Configurable Control or Indication pin (Internally pulled-up, if configured as an input)</td>
</tr>
<tr>
<td>30</td>
<td>LED</td>
<td>DO</td>
<td>Status LED, connect to LDO33_0</td>
</tr>
<tr>
<td>31</td>
<td>GND</td>
<td>Power</td>
<td>Ground reference</td>
</tr>
<tr>
<td>—</td>
<td>BT_RF</td>
<td>AIO</td>
<td>External antenna connection (50 ohms)</td>
</tr>
<tr>
<td>32</td>
<td>GND</td>
<td>Power</td>
<td>Ground reference</td>
</tr>
<tr>
<td>33</td>
<td>GND</td>
<td>Power</td>
<td>Ground reference</td>
</tr>
</tbody>
</table>

**Legend:**  
A = Analog  
D = Digital  
I = Input  
O = Output

© 2016-2018 Microchip Technology Inc.
2.0 APPLICATION INFORMATION

2.1 Module Configuration

For the I/O pins, P2_0, P2_4 and EAN, place the RN4678 into Operating mode. Each of these pins have internal pull-up and allow configuration settings and firmware to be updated from UART. Table 2-1 provides system configuration details.

2.2 Flow Control

Flow control is enabled by default on the RN4678 module. With the flow control enabled, the RTS and CTS lines need to be connected to the corresponding lines for the module to operate. To pause data flow from the RN4678, the CTS (RN4678 input pin) must be pulled high. The RN4678 pulls the RTS pin (output pin) low to indicate that it can accept data.

2.3 Control and Indication I/O Pins

The GPIO pins of the RN4678 module can be configured to different functions using the ASCII command interface. Table 2-2 shows the various pins in the RN4678 module that are available for configuration and their default configuration settings. Table 2-3 provides details on each of the functions available.

<table>
<thead>
<tr>
<th>TABLE 2-1: SYSTEM CONFIGURATION SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P2_0</strong></td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 2-2: CONTROL AND INDICATION I/O PIN ASSIGNMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PIN Symbol</strong></td>
</tr>
<tr>
<td>P0_0</td>
</tr>
<tr>
<td>P0_5</td>
</tr>
<tr>
<td>P1_7</td>
</tr>
<tr>
<td>P3_1</td>
</tr>
<tr>
<td>P3_2</td>
</tr>
<tr>
<td>P3_3</td>
</tr>
<tr>
<td>P3_4</td>
</tr>
<tr>
<td>P3_7</td>
</tr>
</tbody>
</table>

Note 1: The RTS pin can only be assigned to P0_0 and the CTS pin can only be assigned to P1_7.

2: The RTS and CTS pins can be configured as GPIOs if flow control is disabled.

<table>
<thead>
<tr>
<th>TABLE 2-3: CONFIGURABLE FUNCTIONS AND DESCRIPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function Name</strong></td>
</tr>
<tr>
<td>Low Battery Indication</td>
</tr>
<tr>
<td>RSSI Indication</td>
</tr>
<tr>
<td>Link Drop Control</td>
</tr>
</tbody>
</table>
2.4 Power Tree

Figure 2-1 illustrates the power tree diagram of the RN4678.

**FIGURE 2-1: POWER TREE DIAGRAM**

<table>
<thead>
<tr>
<th>Function Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UART RX Indication</td>
<td>Use this pin to enable communication with the UART when the module is in Low-Power mode. When not in Low-Power mode, the module runs on a 16 MHz clock. If Low-Power mode is enabled on the module by using command SO, 1, the module runs on a 32 kHz clock thus reducing power consumption. However, in Low-Power mode, the host MCU cannot communicate with the module via the UART since the UART is not operational. If the user intends to provide data or commands via UART in the Low-Power mode, then the UART_RX_IND pin must be pulled low and the user needs to wait for at least five milliseconds before sending the data. Pulling the UART_RX_IND pin low allows the module to operate the 16 MHz clock and to enable UART.</td>
</tr>
<tr>
<td>Pairing Key</td>
<td>Use this pin to force the module to enter Standby mode. The pin must be pulled down for at least 160 ms.</td>
</tr>
<tr>
<td>Inquiry Control</td>
<td>This pin forces the module enter Inquiry mode (BT Classic). The pin must be pulled low for at least 240 ms for the device to enter Inquiry mode.</td>
</tr>
<tr>
<td>Profile_IND</td>
<td>This pin is used to indicate whether current connection is in BR/EDR (BT Classic), or in Bluetooth Low Energy (BLE). If the Profile_IND pin is high, then the current connection is BR/EDR connection. If low, then the current connection is a BLE connection. This pin is valid only for Link State.</td>
</tr>
</tbody>
</table>
2.5 Software Button (SW_BTN)

The Software Button (SW_BTN) pin powers the main sections of the module into operation. If the SW_BTN pin is low, the module is turned OFF. After turning the module ON via the SW_BTN, the host MCU must wait for specific time before sending the first command. The timing diagrams for the SW_BTN, other related pins, and the time delay are required before the host MCU sends the first command.

Figure 2-2 through Figure 2-4 show the timing diagrams for the RN4678 with regard to the SW_BTN and the other relevant pins in different states of the module.

FIGURE 2-2: SW_BTN TIME (HIGH) AT APP MODE¹,²

Note 1: Time duration (475 ms) is for reference purpose only. Use the Status Indication pins to verify the exact time when the host MCU can start sending the commands.

2: Reset pin is not connected.
FIGURE 2-3: SW_BTN TIME (LOW) AT ACCESS STATES(1)

Note 1: Reset pin is not connected.

FIGURE 2-4: SW_BTN TIME (LOW) AT LINK STATES(1,2)

Note 1: 830 ms time duration is a typical value measured on iPhone® 6 and this time duration can vary from one smartphone to another.

2: Reset pin is not connected.
2.6 WAKE-UP

The WAKEUP input pin wakes the RN4678 module from Deep-Sleep mode. The WAKEUP pin is active-low and puts module in Standby mode. Figure 2-5 illustrates the timing diagram of the RN4678 in the Wake-Up mode.

**FIGURE 2-5: WAKE-UP TIME**(1)

![WAKE-UP Timing Diagram](image)

**Note 1:** The 85 ms is for reference time. Use the Status Indication pins to verify the exact results.

2.7 External Reset

The RN4678 provides an External Reset pin which resets the module. The Reset pin, RST_N, is active-low. Figure 2-6 shows the timing diagram for the RST_N pin of the RN4678 module.

**FIGURE 2-6: TIMING WAVEFORMS ON RESET**(1,2)

![Reset Timing Diagram](image)

**Note 1:** The RST_N state trigger must be greater than 63 ns.

**Note 2:** Time duration (350 ms) is for reference purpose only. Use the Status Indication pins to verify the exact results.
2.8 LED Driver

The RN4678 has a dedicated LED driver and the LED can be connected directly to this pin as shown in Figure 2-7.

The maximum current sourcing for the LED is 5 mA. The brightness of this LED can be configured via an ASCII command.

2.9 Host MCU Interface over UART

Figure 2-8 illustrates an example of UART interface with host MCU and power scheme using 3.3V to the VDD. From the LDO33_O pin, voltage can be routed to the VDD_IO pin and the external circuitry including the MCU. This power scheme ensures that the RN4678 and the MCU I/O voltages are compatible.

**Note:** The internal 3.3V LDO current source must not exceed 50 mA (maximum).

**Note 1:** Ensure that VDD_IO and MCU VDD voltages are compatible.

2: The control and indication ports are configurable.
2.10 Reference Circuit

Figure illustrates the reference schematic of the power supply design implemented for the RN4678.

FIGURE 2-9: RN4678 REFERENCE CIRCUIT
### 3.0 ELECTRICAL CHARACTERISTICS

This section provides an overview of the electrical characteristics of the RN4678 module. Additional information is provided in future revisions of this document as it becomes available.

Absolute maximum ratings for the RN4678 devices are listed below. Exposure to these maximum rating conditions for extended periods may affect device reliability. Functional operation of the device at these or any other conditions, above the parameters indicated in the operation listings of this specification, is not implied.

#### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min to Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature under bias</td>
<td>-20°C to +70°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>Voltage on VDD with respect to VSS</td>
<td>-0.3V to +3.6V</td>
</tr>
<tr>
<td>Maximum output current sunk by any I/O pin</td>
<td>12 mA</td>
</tr>
<tr>
<td>Maximum output current sourced by any I/O pin</td>
<td>12 mA</td>
</tr>
</tbody>
</table>

**Note:** Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions, above those indicated in the operation listings of this specification, is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.
Table 3-1 through Table 3-7 provide the recommended operating conditions and the electrical specifications of the module.

### TABLE 3-1: RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Operating Temperature Range</td>
<td>-20ºC</td>
<td>+25ºC</td>
<td>+70ºC</td>
</tr>
<tr>
<td>Relative Humidity (Operating)</td>
<td>10%</td>
<td>—</td>
<td>90%</td>
</tr>
<tr>
<td>Relative Humidity (Storage)</td>
<td>10%</td>
<td>—</td>
<td>90%</td>
</tr>
<tr>
<td>ESD HDMI</td>
<td>—</td>
<td>±2 KV</td>
<td>—</td>
</tr>
<tr>
<td>HTOL(1)</td>
<td>—</td>
<td>1000 hrs</td>
<td>—</td>
</tr>
<tr>
<td>Supply Voltage: BAT_IN</td>
<td>3.3V</td>
<td>—</td>
<td>4.2V</td>
</tr>
<tr>
<td>Supply Voltage: 1V8, VCC_RF, VDD_XO, AVDD_SAR</td>
<td>1.8V</td>
<td>1.9V</td>
<td>2.1V</td>
</tr>
<tr>
<td>SW_BTN</td>
<td>3.3V</td>
<td>—</td>
<td>4.2V</td>
</tr>
<tr>
<td>Reset VTH.res threshold voltage</td>
<td>—</td>
<td>1.6V</td>
<td>—</td>
</tr>
<tr>
<td>VIL Input Logic Level Low</td>
<td>-0.3V</td>
<td>—</td>
<td>0.8V</td>
</tr>
<tr>
<td>VIH Input Logic Level High</td>
<td>2.0V</td>
<td>—</td>
<td>3.6V</td>
</tr>
<tr>
<td>VOL Output Logic Level Low (IOL = 12 mA)</td>
<td>—</td>
<td>—</td>
<td>0.4V</td>
</tr>
<tr>
<td>VOH Output Logic Level High (IOH = 12 mA)</td>
<td>2.4V</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RF continuous TX mode</td>
<td>—</td>
<td>—</td>
<td>43 mA</td>
</tr>
<tr>
<td>RF continuous RX mode</td>
<td>—</td>
<td>—</td>
<td>37 mA</td>
</tr>
</tbody>
</table>

**Note 1:** HTOL life test condition: +125ºC, BAT_IN = 4.2V, LDO33_O = 3.3V, LDO18_O = 1.9V

### TABLE 3-2: 3.3V LDO ELECTRICAL PARAMETERS (1,2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-20</td>
<td>—</td>
<td>+70</td>
</tr>
<tr>
<td>Output Current (VIN = 3.6V /load regulation with 100 mV drop)</td>
<td>—</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>Quiescent Current (VIN = 3.6V)</td>
<td>—</td>
<td>150</td>
<td>—</td>
</tr>
</tbody>
</table>

**Note 1:** With 10 uF capacitor at LDO33_O as the condition for IP verification.

2: Output voltage can be calibrated using the MP tool.

### TABLE 3-3: PMU LDO(1,2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-20</td>
<td>—</td>
<td>+70</td>
</tr>
<tr>
<td>Output Current (VIN = 3.6V/load regulation with 0.3 mV drop)</td>
<td>—</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>Quiescent Current (VIN = 3.6V)</td>
<td>—</td>
<td>120</td>
<td>—</td>
</tr>
</tbody>
</table>

**Note 1:** With 1µF capacitor at PMULDO_O as the condition for IP verification.

2: Output voltage can be calibrated by using the MP tool.
### TABLE 3-4:  SAR-ADC AND BATTERY VOLTAGE DETECTOR

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-20</td>
<td>—</td>
<td>+70</td>
<td>ºC</td>
</tr>
<tr>
<td>AVDD_SAR Power Supply</td>
<td>—</td>
<td>1.8</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>SAR_BAT Detection(^{(1)})</td>
<td>3.3</td>
<td>—</td>
<td>4.2</td>
<td>V</td>
</tr>
<tr>
<td>Resolution</td>
<td>—</td>
<td>10</td>
<td>—</td>
<td>bit</td>
</tr>
<tr>
<td>Operating Current (including bandgap)</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>mA</td>
</tr>
<tr>
<td>Deep-Sleep Current</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>µA</td>
</tr>
</tbody>
</table>

\(^{(1)}\) SAR_BAT is connected with BAT_IN internally for battery voltage detection.

### TABLE 3-5:  INTENSITY CONTROLLABLE LED DRIVER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-20</td>
<td>—</td>
<td>+70</td>
<td>ºC</td>
</tr>
<tr>
<td>Open-Drain Voltage</td>
<td>—</td>
<td>—</td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td>Current Step</td>
<td>—</td>
<td>0.3</td>
<td>—</td>
<td>mA</td>
</tr>
<tr>
<td>Programmable Current Range</td>
<td>0</td>
<td>—</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Intensity Control</td>
<td>—</td>
<td>16</td>
<td>—</td>
<td>step</td>
</tr>
<tr>
<td>Power Down Open-Drain Current</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>µA</td>
</tr>
<tr>
<td>Deep-Sleep Current</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>µA</td>
</tr>
</tbody>
</table>

### TABLE 3-6:  POWER CONSUMPTION-CLASSIC\(^{(1)}\)

<table>
<thead>
<tr>
<th>Test Condition</th>
<th>Current Consumption (avg.) (mA)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standby mode</td>
<td>2.543</td>
<td>—</td>
</tr>
<tr>
<td>Deep-Sleep mode</td>
<td>0.187</td>
<td>—</td>
</tr>
<tr>
<td>Connected+Sniff, Master (no data)</td>
<td>0.541</td>
<td>No data was transmitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sniff interval = 500 ms</td>
</tr>
<tr>
<td>Connected+Sniff, Slave (no data)</td>
<td>0.551</td>
<td>No data was transmitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sniff interval = 500 ms</td>
</tr>
<tr>
<td>Data, Master</td>
<td>10.67</td>
<td>Data transmitted at 115200 bps;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>block size = 500</td>
</tr>
<tr>
<td>Data, Slave</td>
<td>14.87</td>
<td>Data transmitted at 115200 bps;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>block size = 500</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Classic BR/EDR and RX_IND functions are enabled.
### TABLE 3-7: POWER CONSUMPTION-LOW ENERGY\(^{(1,2)}\)

<table>
<thead>
<tr>
<th>Test Condition</th>
<th>Current Consumption (avg.) (mA)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep-Sleep mode</td>
<td>0.13</td>
<td>—</td>
</tr>
<tr>
<td>LE fast advertising</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.21</td>
<td>LE fast advertising interval = 100 ms</td>
</tr>
<tr>
<td></td>
<td>0.88</td>
<td>LE fast advertising interval = 160 ms</td>
</tr>
<tr>
<td></td>
<td>0.48</td>
<td>LE fast advertising interval = 500 ms</td>
</tr>
<tr>
<td></td>
<td>1.72</td>
<td>LE fast advertising interval = 100 ms + Beacon 100 ms</td>
</tr>
<tr>
<td></td>
<td>0.62</td>
<td>LE fast advertising interval = 500 ms + Beacon 500 ms</td>
</tr>
<tr>
<td>Reduced power advertising</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.39</td>
<td>LE Reduced Power advertising interval = 961 ms</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>LE Reduced Power advertising interval = 961 ms + Beacon 100 ms</td>
</tr>
<tr>
<td></td>
<td>0.51</td>
<td>LE Reduced Power advertising interval = 961 ms + Beacon 500 ms</td>
</tr>
<tr>
<td>Connected (No data)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.39</td>
<td>Connection interval = 1500 ms</td>
</tr>
<tr>
<td></td>
<td>0.43</td>
<td>Connection interval = 600 ms</td>
</tr>
<tr>
<td>Connected (iPhone 6 to module)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.45</td>
<td>Connection interval = 500 ms</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>Connection interval = 200 ms</td>
</tr>
<tr>
<td>Connected (module to iPhone 6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.6</td>
<td>Connection interval = 500 ms</td>
</tr>
<tr>
<td></td>
<td>7.0</td>
<td>Connection interval = 200 ms</td>
</tr>
</tbody>
</table>

**Note 1:** Low energy, RX_IND function is enabled.

**2:** Only low energy.
4.0 RADIO CHARACTERISTICS

Table 4-1 provides the transmitter performance characteristics of the RN4678 module.

**TABLE 4-1: TRANSMITTER PERFORMANCE (1,2)**

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
<th>Bluetooth Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDR power</td>
<td>—</td>
<td>1.5</td>
<td>—</td>
<td>-6 ~ +4</td>
<td>dBm</td>
</tr>
<tr>
<td>EDR (2M/3M) power</td>
<td>—</td>
<td>-1</td>
<td>—</td>
<td>-6 ~ +4</td>
<td>dBm</td>
</tr>
<tr>
<td>LE power</td>
<td>—</td>
<td>0.5</td>
<td>—</td>
<td>-20 ~ +10</td>
<td>dBm</td>
</tr>
</tbody>
</table>

**Note 1:** The RF Transmit power can be calibrated during production by using the MP Tool software and the MT8852 Bluetooth Test equipment.

2: Test condition: VCC RF = 1.80V, temperature = 25°C.

Table 4-2 provides the receiver performance characteristics of the RN4678 module.

**TABLE 4-2: RECEIVER PERFORMANCE (1)**

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
<th>Bluetooth Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDR Sensitivity</td>
<td>—</td>
<td>-90</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>EDR 2M Sensitivity</td>
<td>—</td>
<td>-90</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>EDR 3M Sensitivity</td>
<td>—</td>
<td>-82</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>LE Sensitivity</td>
<td>—</td>
<td>-92</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
</tbody>
</table>

**Note 1:** Test condition: VCC RF = 1.80V, temperature = 25°C
5.0 PHYSICAL DIMENSIONS

Figure 5-1 illustrates the physical dimensions of the RN4678 module.

FIGURE 5-1: RN4678 MODULE DIMENSIONS

Dimensions are in millimeters
Tolerances:
PCB Outline: +/- 0.4 mm
PCB Thickness: +/- 0.06 mm
Figure 5-2 illustrates the recommended host PCB footprint.

FIGURE 5-2: RN4678 RECOMMENDED PCB FOOTPRINT

(Top View)

- Top Copper
- Keep Out Area
- 0.5mm
- 1.5mm
- 0.7mm
- 1.1mm
Figure 5-3 illustrates the recommendations for mounting the RN4678 on the host PCB, and also shows the minimum ground plane area to the left and right of the module for the best antenna performance. Avoid top copper layer near the test pin area. When designing the host PCB, the areas under the antenna must not contain any top, inner or bottom copper layer.

A low-impedance ground plane ensures best radio performance (best range and lowest noise). The ground plane can be extended beyond the minimum recommended as required for the host PCB EMC noise reduction. For best range performance, keep all external metal at least 31 mm away from the ceramic chip antenna.

**FIGURE 5-3: RN4678 HOST PCB MOUNTING SUGGESTION**

This area needs to have top metal copper that is connected to Ground for optimal functioning of the chip antenna.

This area (purple with dots) needs to have both top and bottom copper layers connected to Ground for optimal operation of the antenna.

This purple hashed area must not have any top metal layer copper. It can have bottom copper layer.

Top Copper Layer

Bottom Copper Layer
6.0 REFLOW PROFILE

The RN4678 is highly recommended to be assembled using a standard lead-free reflow profile, IPC/JEDEC J-STD-020. The RN4678 can be soldered to the host PCB by using the standard leaded and lead-free solder reflow profile.

To avoid damage to the module, follow these recommendations:

- Follow solder reflow recommendations provided in Microchip Technology Application Note “AN233 Solder Reflow Recommendation (DS00233)”.  
- Refer to the solder paste data sheet for specific reflow profile recommendations.  
- Do not exceed the peak temperature (TP) of 250°C.  
- Use no-clean flux solder paste.  
- Do not wash as moisture can be trapped under the shield.  
- Use only one flow. If the PCB requires multiple flows, apply the module on the final flow.

FIGURE 6-1: REFLOW PROFILE

- Standard: IPC/JEDEC J-STD-020  
  - Condition: Preheat: 150~200 ºC for 60~120 seconds.  
  - Average ramp-up rate (217 ºC to peak): 3 ºC/sec max.  
  - Temperature maintained above 217 ºC: 60~150 seconds.  
  - Time within 5 ºC of peak temperature: 30 ~ 40 seconds.  
  - Peak temperature: 260 +5/-0 ºC.  
  - Ramp-down rate (peak to 217): 6 ºC/sec. max.  
  - Time 25 ºC to peak temperature: 8 minutes max.  
  - Cycle interval: 5 minutes
7.0 MODULE PLACEMENT

For a Bluetooth wireless product, the antenna placement affects the performance of the whole system. The antenna requires free space to radiate the RF signal and it cannot be surrounded by the ground plane. Microchip recommends that the areas underneath the antenna on the host PCB must not contain copper on top, inner or bottom layer. Figure 7-1 illustrates an example of good and poor antenna placement on a host PCB with ground plane.

The ground plane can be extended beyond the minimum recommended as required for the main PCB EMC noise reduction. For the best range performance, keep all external metal away from the ceramic chip antenna, that is minimum 15 mm away.

FIGURE 7-1: MODULE PLACEMENT EXAMPLES

TABLE 7-1: RECOMMENDED ANTENNA

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturer Part Number</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT ANT3216A063R2400A PIFA 2.4 GHz L3.2W1.6</td>
<td>ANT3216A063R2400A</td>
<td>YAGEO</td>
</tr>
</tbody>
</table>
Figure 7-2 illustrates the RN4678 module mounted on the RN4678 Evaluation Board (EVB). It also shows the recommended keep out area for the antenna.

FIGURE 7-2: KEEP OUT AREA RECOMMENDED FOR ANTENNA

1~5: Keep out of metal >15 mm

Note: For additional information on free space for antenna placement design, refer to the design rule document of the antenna manufacturer.
7.1 RN4678 Ceramic Chip Antenna

The RN4678 contains an integral ceramic chip antenna. Figure 7-3 illustrates the antenna radiation pattern of the ceramic chip antenna on the RN4678.

FIGURE 7-3: RN4678 ANTENNA RADIATION PATTERN

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2450 MHz</td>
</tr>
<tr>
<td>Peak Gain</td>
<td>1.63 dBi</td>
</tr>
<tr>
<td>Efficiency</td>
<td>71.55%</td>
</tr>
</tbody>
</table>
## 8.0 ORDERING INFORMATION

Table 8-1 provides ordering information for the RN4678 module.

<table>
<thead>
<tr>
<th>Device</th>
<th>Microchip IC</th>
<th>Antenna</th>
<th>Description</th>
<th>Shield</th>
<th>Regulatory Certification</th>
<th>Ordering Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN4678-V/RM100</td>
<td>IS1678SM</td>
<td>On-board</td>
<td>BT4.2 Dual Mode, Class 2</td>
<td>Yes</td>
<td>FCC, IC, CE, MIC, KCC, NCC, JRF</td>
<td>RN4678-V/RM100</td>
</tr>
<tr>
<td>RN4678APL-V/RM100</td>
<td>IS1678SM</td>
<td>On-board</td>
<td>BT4.2 Dual Mode, Class 2, Use with Apple MFI</td>
<td>Yes</td>
<td>FCC, IC, CE, MIC, KCC, NCC, JRF</td>
<td>RN4678APL-V/RM100</td>
</tr>
</tbody>
</table>

Go to [http://www.microchip.com](http://www.microchip.com) for current pricing and a list of distributors carrying Microchip products.
NOTES:
9.0 REGULATORY APPROVAL

This section outlines the regulatory information for the RN4678 module for the following countries:

• United States
• Canada
• Europe
• Japan
• Korea
• Taiwan
• Other Regulatory Jurisdictions

9.1 United States

The RN4678 module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” single-modular approval in accordance with Part 15.212 Modular Transmitter approval. Single-modular transmitter approval is defined as a complete RF transmission sub-assembly, designed to be incorporated into another device, that must demonstrate compliance with FCC rules and policies independent of any host. A transmitter with a modular grant can be installed in different end-use products (referred to as a host, host product, or host device) by the grantee or other equipment manufacturer, then the host product may not require additional testing or equipment authorization for the transmitter function provided by that specific module or limited module device.

A host product itself is required to comply with all other applicable FCC equipment authorization regulations, requirements, and equipment functions that are not associated with the transmitter module portion. For example, compliance must be demonstrated: to regulations for other transmitter components within a host product; to requirements for unintentional radiators (Part 15 Subpart B), 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) as appropriate (e.g., Bluetooth and Wi-Fi transmitter modules may also contain digital logic functions).

9.1.1 LABELING AND USER INFORMATION REQUIREMENTS

The RN4678 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: A8TBM78ABCDEFGH
or
Contains FCC ID: A8TBM78ABCDEFGH

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 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) http://apps.fcc.gov/oetcf/kdb/index.cfm.
9.1.2 RF EXPOSURE
All transmitters regulated by FCC must comply with RF exposure requirements. KDB Publication 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).

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. This module is approved for installation into mobile or/and portable host platforms.

9.1.3 HELPFUL WEB SITES
Federal Communications Commission (FCC):
http://www.fcc.gov
FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):
http://apps.fcc.gov/oetcf/kdb/index.cfm

9.2 Canada
The RN4678 module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-Gen and RSS-247. Modular approval permits the installation of a module in a host device without the need to recertify the device.

9.2.1 LABELING AND USER INFORMATION REQUIREMENTS
Labeling Requirements (from Section 3.1, RSS-Gen, Issue 4, November 2014): The host device shall be properly labeled to identify the module within the host device.

Modular Devices (from RSP-100 - Issue 10, Section 7): 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. 12246A-BM78SPPSSM2

User Manual Notice for License-Exempt Radio Apparatus (from Section 8.4, RSS-Gen, Issue 4, November 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's license-exempt RSSs. 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;
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

9.2.2 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).

9.2.3 HELPFUL WEB SITES
Industry Canada: http://www.ic.gc.ca/
9.3 Europe

The RN4678 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 RN4678 module has been tested to R&TTE Directive 1999/5/EC Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2) and are summarized in Table 9-1 European Compliance Testing. A Notified Body Opinion has also been issued. All test reports are available on the RN4678 product web page at http://www.microchip.com.


9.3.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN4678 module must follow CE marking requirements. The R&TTE Compliance Association Technical Guidance Note 01 provides guidance on final product CE marking.

Note: To maintain conformance to the testing listed in Table 9-1, 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.

9.3.2 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]

The European Compliance Testing listed in Section Table 9-1 European Compliance Testing for RN4678 was performed using the integral ceramic chip antenna.

9.3.3 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:

- European Radio Communications Office (ERO): http://www.ero.dk/
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA):

<table>
<thead>
<tr>
<th>Certification</th>
<th>Standards</th>
<th>Article</th>
<th>Laboratory</th>
<th>Report Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>EN 300 328 V1.9.1 / EN 62479:2010</td>
<td></td>
<td></td>
<td>10052796 001 &amp; 10052797 001</td>
</tr>
<tr>
<td>EMC</td>
<td>EN 301 489-1 V1.9.2</td>
<td>(3.1(b))</td>
<td>TUV Rheinland, Taiwan</td>
<td>10052437 001</td>
</tr>
<tr>
<td></td>
<td>EN 301 489-17 V2.2.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>EN 300 328 V1.9.1</td>
<td>(3.2)</td>
<td></td>
<td>10052796 001 &amp; 10052797 001</td>
</tr>
<tr>
<td>Notified Body Opinion</td>
<td>CE0197</td>
<td></td>
<td></td>
<td>10048937 001</td>
</tr>
</tbody>
</table>
9.4 Japan

The RN4678 module has received type certification and is labeled with its own technical conformity mark and certification number as required to conform to the technical standards regulated by the Ministry of Internal Affairs and Communications (MIC) of Japan pursuant to the Radio Act of Japan.

Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

• If the host product is subject to electrical appliance safety (for example, powered from an AC mains), the host product may require Product Safety Electrical Appliance and Material (PSE) testing. The integrator should contact their conformance laboratory to determine if this testing is required.

• There is a voluntary Electromagnetic Compatibility (EMC) test for the host product administered by VCCI: http://www.vcci.jp/vcci_e/index.html

9.4.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN4678 module must follow Japan marking requirements. The integrator of the module should refer to the labeling requirements for Japan available at the Ministry of Internal Affairs and Communications (MIC) website.

The RN4678 module is labeled with its own technical conformity mark and certification number. The final product in which this module is being used must have a label referring to the type certified module inside:

Contains transmitter module with certificate number:

9.4.2 HELPFUL WEB SITES

Ministry of Internal Affairs and Communications (MIC): http://www.tele.soumu.go.jp/e/index.htm

Association of Radio Industries and Businesses (ARIB): http://www.arib.or.jp/english/

9.5 Korea

The RN4678 module has received certification of conformity in accordance with the Radio Waves Act. Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

9.5.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN4678 module must follow KC marking requirements. The integrator of the module should refer to the labeling requirements for Korea available on the Korea Communications Commission (KCC) website.

The RN4678 module is labeled with its own KC mark. The final product requires the KC mark and certificate number of the module:

Contains transmitter module with certificate number:

9.5.2 HELPFUL WEB SITES


9.6 Taiwan

The RN4678 module has received compliance approval in accordance with the Telecommunications Act. Customers seeking to use the compliance approval in their product should contact Microchip Technology sales or distribution partners to obtain a Letter of Authority.

Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

9.6.1 LABELING AND USER INFORMATION REQUIREMENTS

The RN4678 module is labeled with its own NCC ID number, and if the NCC ID is not visible when the module is installed inside another device, then the outside of the device must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

The user's manual should contain below warning (for RF device) in traditional Chinese:

注意！

依據低功率電波輻射性電機管理辦法

第十二條 經型式認證合格之低功率射頻電機,

非經許可,公商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；

經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

9.7 Other Regulatory Jurisdictions

Should other regulatory jurisdiction certification be required by the customer, or the customer need to recertify the module for other reasons, a certification utility is available. For further regulatory Certification Utility and documentation, contact your local Microchip Technology sales office.

National Communications Commission (NCC):
http://www.ncc.gov.tw.
APPENDIX A: REVISION HISTORY

Revision A (June 2016)
This is the initial released version of the document.

Revision B (January 2018)
• Updated Figure 1-1, Figure 1-2, and Figure 5-3.
• Updated Table 1-1.
• Added Section 2.2 “Flow Control”.
• Updated Section 8.0 “Ordering Information”
• Updated Section “Product Identification System”
• Removed Figure 1-3, Figure 2-9, Figure 5-4, Figure 5-5, and Figure 5-6.
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 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 this document.

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

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.
PRODUCT IDENTIFICATION SYSTEM

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

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>V Temperature Range</th>
<th>RM Package</th>
<th>XXX Firmware Revision Number</th>
<th>Example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device:</td>
<td>RN4678: Ceramic Chip Antenna</td>
<td></td>
<td></td>
<td>RN4678-V/RM100: Various temperature</td>
</tr>
<tr>
<td>Temperature Range:</td>
<td>V = -20°C to +70°C (Various)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Package:</td>
<td>RM = Radio Module</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 =

© 2016-2018 Microchip Technology Inc.
DS50002519B-page 43
# 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](http://www.microchip.com/support)  
Web Address: [www.microchip.com](http://www.microchip.com)

- **Atlanta**  
  Duluth, GA  
  Tel: 678-957-9614  
  Fax: 678-957-1455
- **Austin, TX**  
  Tel: 512-257-3370
- **Boston**  
  Westborough, MA  
  Tel: 508-368-8900  
  Fax: 508-368-8907
- **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

- **Australia - Sydney**  
  Tel: 61-2-9888-6733
- **China - Beijing**  
  Tel: 86-10-8569-7000
- **China - Chengdu**  
  Tel: 86-28-8665-5511
- **China - Chongqing**  
  Tel: 86-23-8980-9588
- **China - Dongguan**  
  Tel: 86-769-8702-9880
- **China - Guangzhou**  
  Tel: 86-20-8755-8029
- **China - Hangzhou**  
  Tel: 86-571-8792-8115
- **China - Hong Kong SAR**  
  Tel: 852-2943-5100
- **China - Nanjing**  
  Tel: 86-25-8473-2460
- **China - Qingdao**  
  Tel: 86-532-8502-7355
- **China - Shanghai**  
  Tel: 86-21-3326-8000
- **China - Shenyang**  
  Tel: 86-24-2334-2829
- **China - Shenzhen**  
  Tel: 86-755-8864-2200
- **China - Suzhou**  
  Tel: 86-188-6233-1526
- **China - Wuhan**  
  Tel: 86-27-5980-5300
- **China - Xian**  
  Tel: 86-29-8833-7252
- **China - Xiamen**  
  Tel: 86-592-2386138
- **China - Zhuhai**  
  Tel: 86-756-3210040
- **India - Bangalore**  
  Tel: 91-80-3090-4444
- **India - New Delhi**  
  Tel: 91-11-4160-8631
- **India - Pune**  
  Tel: 91-20-3019-1500
- **Japan - Osaka**  
  Tel: 81-6-6152-7160
- **Japan - Tokyo**  
  Tel: 81-3-6880-3770
- **Korea - Daegu**  
  Tel: 82-53-744-4301
- **Korea - Seoul**  
  Tel: 82-2-554-7200
- **Malaysia - Kuala Lumpur**  
  Tel: 60-3-7651-7906
- **Malaysia - Penang**  
  Tel: 60-4-227-8870
- **Philippines - Manila**  
  Tel: 63-2-634-9065
- **Singapore**  
  Tel: 65-6334-8870
- **Taiwan - Hsin Chu**  
  Tel: 886-3-577-8366
- **Taiwan - Kaohsiung**  
  Tel: 886-7-213-7830
- **Taiwan - Taipei**  
  Tel: 886-2-2508-8600
- **Thailand - Bangkok**  
  Tel: 66-2-694-1351
- **Vietnam - Ho Chi Minh**  
  Tel: 84-28-5448-2100

## 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
- **Germany - Garching**  
  Tel: 49-8931-9700
- **Germany - Haan**  
  Tel: 49-2129-3766400
- **Germany - Heilbronn**  
  Tel: 49-7131-67-3636
- **Germany - Karlsruhe**  
  Tel: 49-7271-625370
- **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 - Gothenburg**  
  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