
RL78/G1D Group

R12AN0057EU0100

RM-110-RFB-2 module User Guide

Rev. 1.00

Sep 30, 2016

Introduction

This document explains the specification and usage of RM-110-RFB-2 Bluetooth® Low Energy module. The document describes hardware platform information such as module interface, peripheral connection, its Bluetooth® connectivity, Radio performance, and its schematics.

This RM-110-RFB-2 Bluetooth® Low Energy module is product of NAITO DENSEI MACHIDA MFG.CO., LTD. [1]

Target Device

RL78/G1D device (R5F11AGJ)

This RM-110-RFB-2 module includes Renesas' Intelligent Bluetooth® Low Energy device, part number starting with R5F11A (256 KB program flash memory, 20 KB RAM and 8 KB data flash memory).

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1. Overview

RM-110-RFB-2 module uses Renesas Bluetooth® Low Energy module, RY7011A0000DZ00. The RM-110-RFB-2 module, therefore, has extended usability for evaluation to Renesas module, RY7011A0000DZ00 [2] with additional 32.768 kHz real time clock as well as external terminals for easy connection.

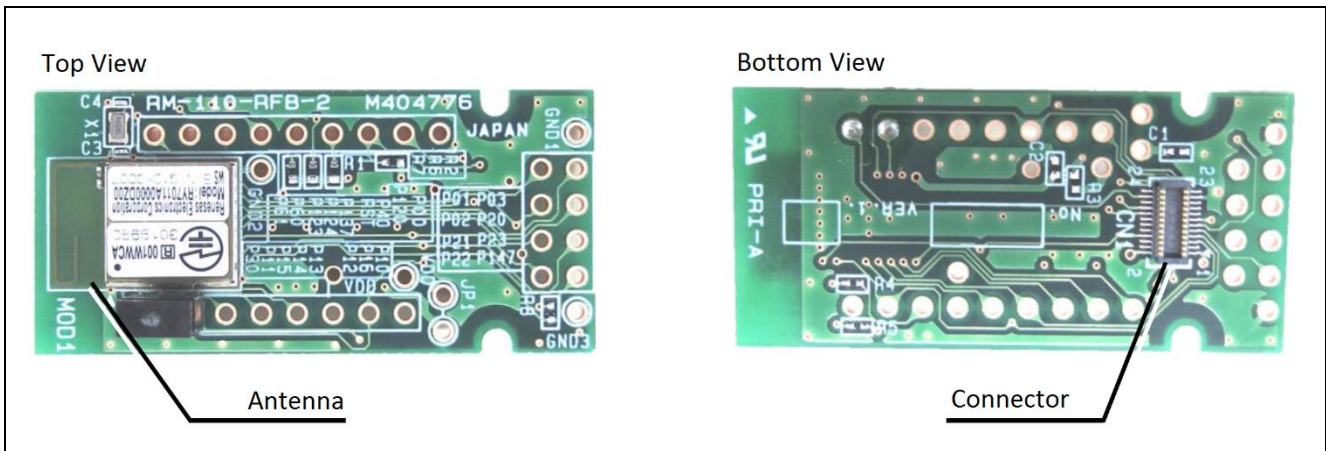


Figure 1-1 RM-110-RFB-2 module

1.1 Specification Outline

The specification of RM-110-RFB-2 module is described as below Table 1.

Table 1 RM-110-RFB-2 Module Specification

Item	Content
Dimension	40 mm x 19 mm x 12mm (1.57 in x 0.75 in x 0.47 in)
Operation Power Supply Voltage	1.6 V to 3.6 V ^{Note1}
Maximum Power Supply Voltage	3.6 V
Average Operation Current	10 μA ^{Note2}
Maximum Total Output Current	150 mA ^{Note1}
Operating Ambient Temperature/Humidity	-25°C to +75°C, 20% to 80% RH (non condensing)
Storage Temperature	-25°C to +85°C, 20% to 80% RH (non condensing)

Note 1: Refer Electrical Specifications of RL78/G1D User’s Manual: Hardware, R01UH0515EJ0100 [4]

Note 2: One-second interval with keeping Bluetooth® connection

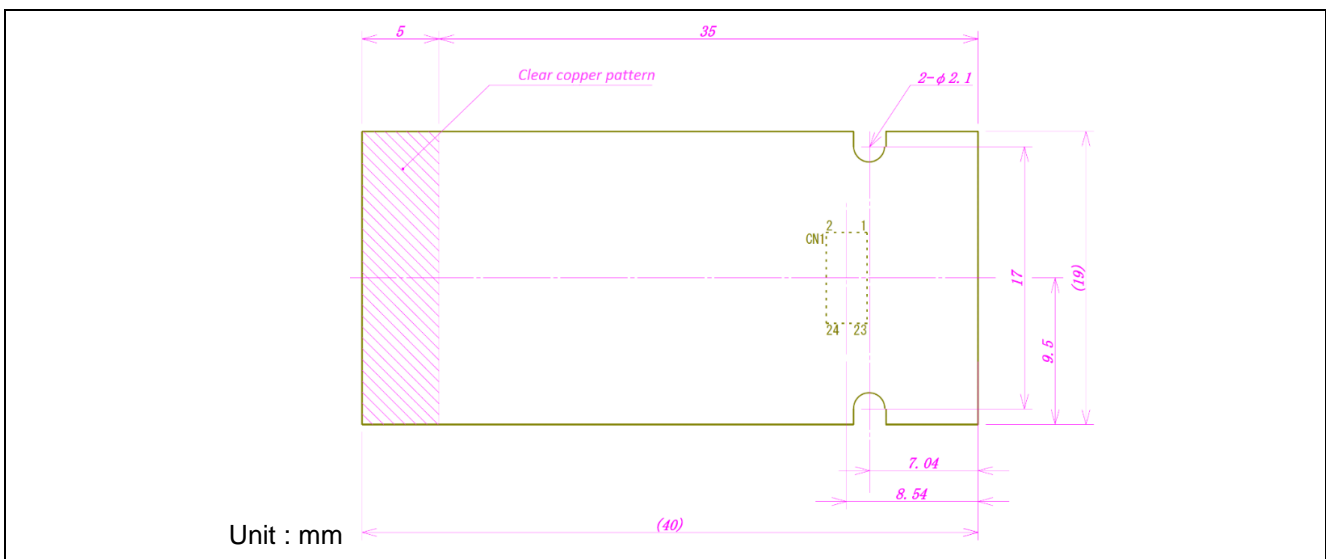


Figure 1-2 RM-110-RFB-2 module dimension (Top View)

2. RM-110-RFB-2 module connection

2.1 Development interface (CN1)

At bottom layer, the module has 2x12 pin connector CN1: part number 14 5602 024 000 829H+ by Kyocera connector. This CN1 connector can be attached to custom design board or extension board known as Bluetooth® Low Energy evaluation board, R0K3ZBBBDBN00BR through its mating connector part numbers, 14 5602 024 000 829S+. Thus, you can program or debug to the RM-110-RFB-2 module via extension board and for detail, refer to RL78/G1D User’s Manual: Evaluation Board [3]. To secure connection to extension board, use screws and nuts as shown in Figure 2-1.

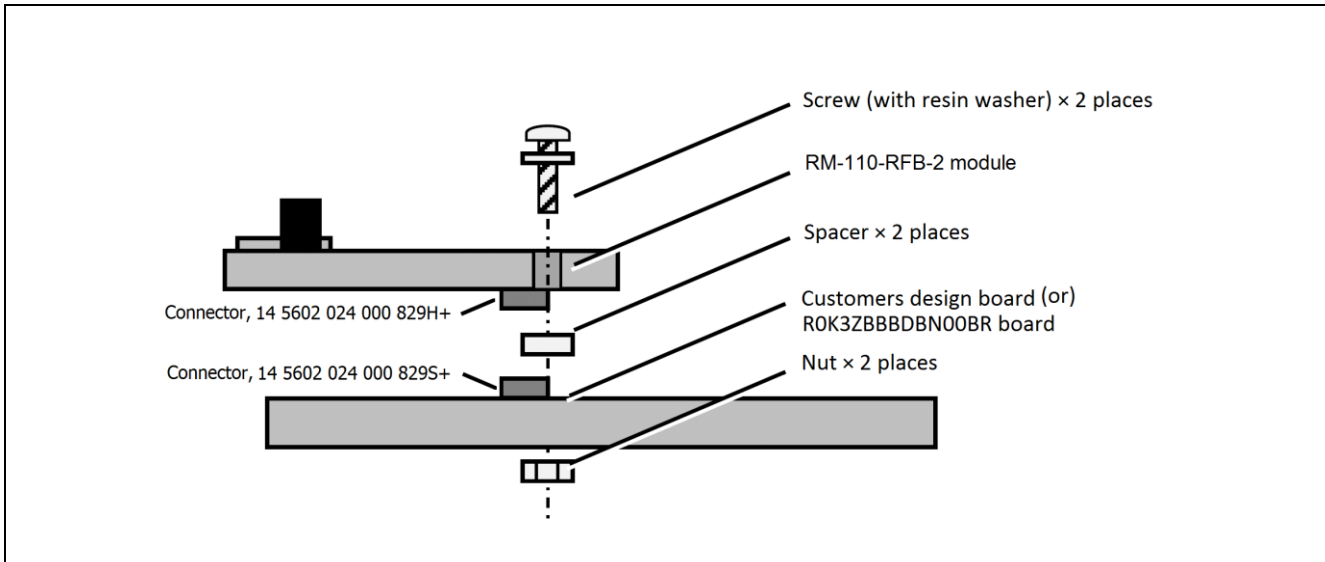


Figure 2-1 RM-110-RFB-2 module mounting on R0K3ZBBBDBN00BR board

Table 2 shows the connector CN1 pin assignment between RM-110-RFB-2 module and the custom design board or extension board, R0K3ZBBBDBN00BR.

Table 2 Connector pin assignment for CN1

Pin Number	Signal Name	Pin Number	Signal Name
1	VSS_1	2	VDD
3	P40/TOOL0	4	No Connection
5	RESET	6	No Connection
7	P60/SCLA0	8	P61/SDAA0
9	P03/ANI16/RXD1	10	P11/SI00/RXD0/TOOLRXD/SDA00
11	P147/ANI18	12	P12/SO00/TXD0/TOOLTXD
13	P02/ANI17/SIO/TXD1	14	P10/SCK00/SCL00
15	TXSELH_RF/GPIO0	16	P22/ANI2
17	XSELL_RF/GPIO1	18	P23/ANI3
19	No Connection	20	P16/T10/TO01/INTP5
21	VSS_21	22	P30/INTP3/RTC1HZ
23	P120/ANI19	24	No Connection

2.2 External expansion terminal (TH)

The RM-110-RFB-2 module provides the through-hole (TH) terminals for the expansion of the module. There are three unpopulated through-hole connectors and they are assigned number from 1 to 25. The assigned through-hole pin from 1 to 9 and from 18 to 25 are single in line 0.1 inch connector for 9 pins and 8 pins respectively. The assigned through-hole pin from 10 to 17 is dual in line 0.1 inch connector. Pin 18 and 19 has two-pin connector for selecting UART communication modes. When insert the jumper at this connector, the interface UART setting will be UART 2-wire branch connection. Removing the jumper will set Simple 2-wire UART mode.

In addition, the module has two ground terminals, one Vdd terminal, and one 2-pin jumper (JP1) for power measurement.

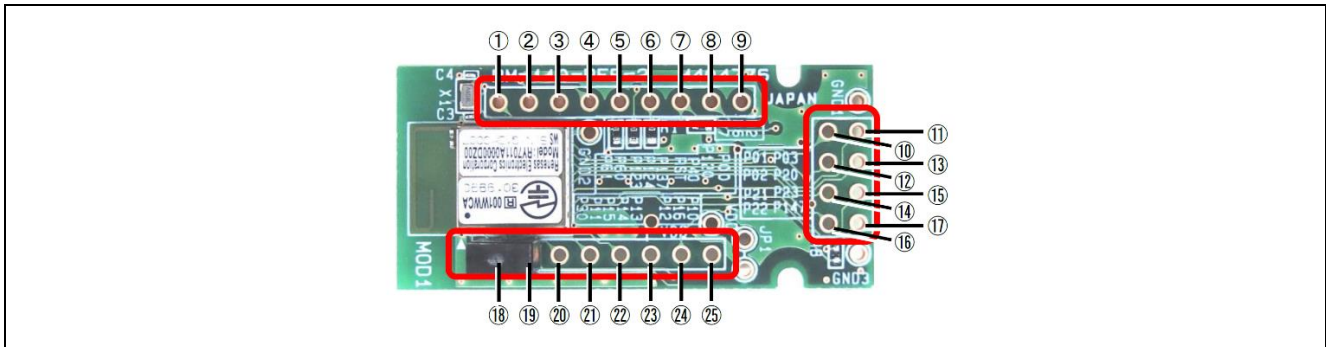


Figure 2-2 RM-110-RFB-2 Module Pin Configuration

The pin assignment of the through-hole terminals are as listed in Table 3.

Table 3 Pin Assignment of Expansion Terminal

No.	TH	Signal name
1	P61	P61/SDAA0
2	P60	P60/SCLA0
3	P123	P123/XT1
4	P124	P124/XT2/EXCLKS
5	P137	P137/INTP0
6	RST	RESET
7	P40	P40/TOOL0
8	P120	P120/ANI19
9	P00	P00/TI00
10	P01	P01/TO00
11	P03	P03/ANI16/RxD1
12	P02	P02/ANI17/TxD1
13	P20	P20/ANI0/AVREFP
14	P21	P21/ANI1/AVREFM
15	P23	P23/ANI3
16	P22	P22/ANI2
17	P147	P147/ANI18
18	P30	P30/INTP3
19	P11	P11/SI00/RxD0/TOOLRxD/SDA00/(TI06)/(TO06)
20	P15	P15/SCK20/SCL20(TI02)/(TO02)
21	P14	P14/SI20/SDA20/(SCLA0)/(TI03)/(TO03)
22	P13	P13/SO20/(SDAA0)/(TI04)/(TO04)
23	P12	P12/SO00/TxD0/TOOLTxD/(TI05)/(TO05)
24	P16	P16/TI01/TO01/INTP5
25	P10	P10/SCK00/SCL00/(TI07)/(TO07)

Note: The function in parentheses can be assigned by setting of the peripheral I/O redirection register (PIOR). For such a signal function, refer to the RY7011A0000DZ00 module manual [2] and RL78/G1D hardware user manual [4].

2.3 Programming and Debugging

Using ground (GND), power (VDD), 7 (TOOL0), and 6 (RESET) terminals, this module can be programmed or debugged by using Renesas E1 programmer/debugger. Table 4 shows the wiring connection for programming and debugging. For detail about how to program or debug, refer to RL78/G1D Module (RY7011), User’s Manual: Hardware [2]. You can also use with extension board for programming or debugging and refer RL78/G1D User’s Manual: Evaluation Board [3].

Table 4 Wiring between RL78/G1D Module and Dedicated Flash Memory Programmer

Pin Configuration of Dedicated Flash Memory Programmer			Signal Name	Pin No. / Pin Name
Signal Name	I/O	Pin Function		
PG-FP5, FL-PR5	E1 On-Chip debugging emulator			
-	TOOL0	I/O	Transmit/receive signal	TOOL0/P40 7
SI/RxD	-	I/O	Transmit/receive signal	
-	/RESET	Output	Reset signal	RESET 6
/RESET	-	Output		
VDD		I/O	VDD voltage generation/Power monitoring	VDD VDD
GND	-	Ground	GND	GND GND
FLMD1	EMVDD	-	Driving power for TOOL0 pin	VDD VDD

2.4 Battery holder

To be operated by itself, the battery holder is needed to solder on this RM-110-RFB-2 module. The Figure 2-3 shows this module with battery holder installed. For typical application, if the module is interfaced with a sensor, it can demonstrate a sensor network.

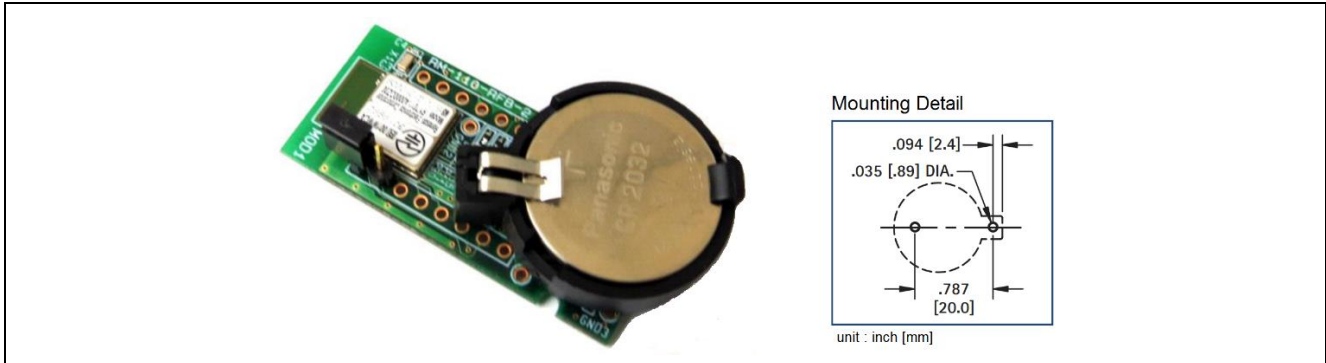


Figure 2-3 RM-110-RFB-2 Module with Installed Coin Cell Battery

The suitable battery holder for this module is compact 20 mm type battery holder, part number 1066 manufactured by KEYSTONE. The CR2032 Coin cell battery can be used with this battery holder, which the Figure 2-4 shows the positive (+) terminal and negative (-) terminal location on the module to be soldered.

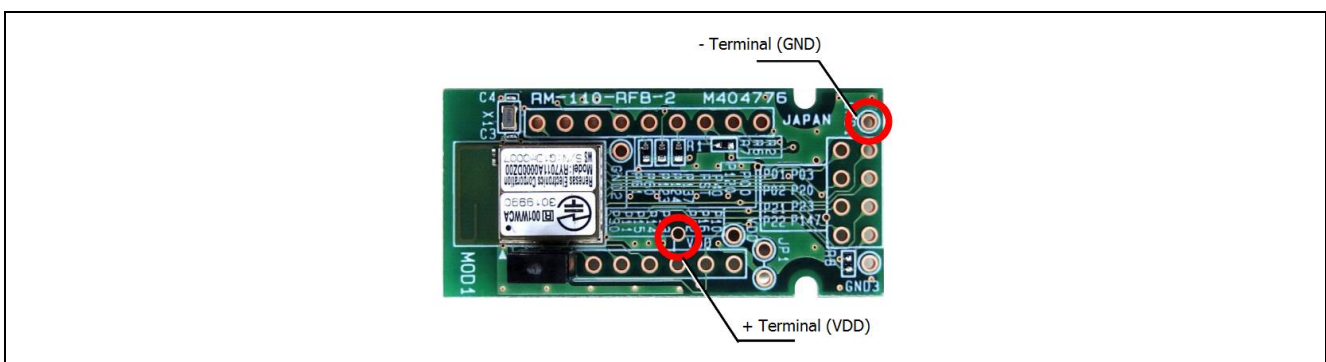
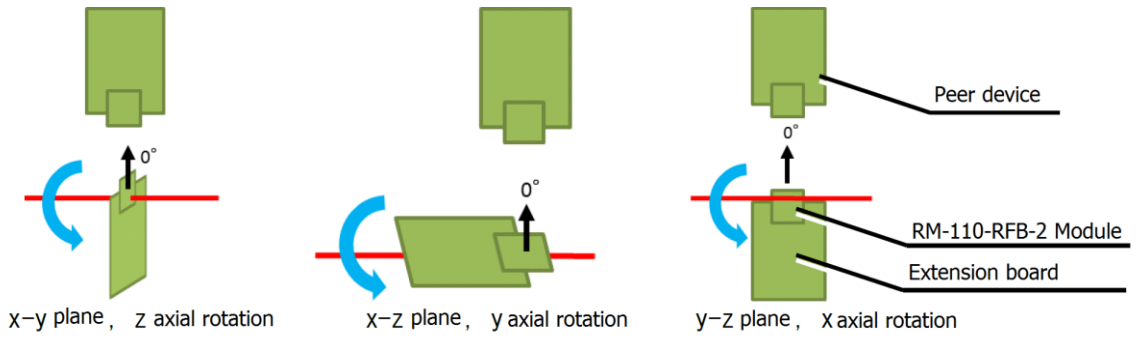


Figure 2-4 Battery Connection Terminals

3. RY7011A0000DZ00 Module Antenna Radiation

3.1 Antenna radiation pattern (directional)

This RM-110-RFB-2 module is mounted on the extension board (RTK0EN0001D01001BZ) for evaluation. The module sends the transmission packet at frequency 2440MHz as of below figures show the antenna radiation pattern (directional).



Note that the below antenna radiation patterns are approximate. Thus, the measurement value will vary depending on the extension board that to be used and surrounding environment.

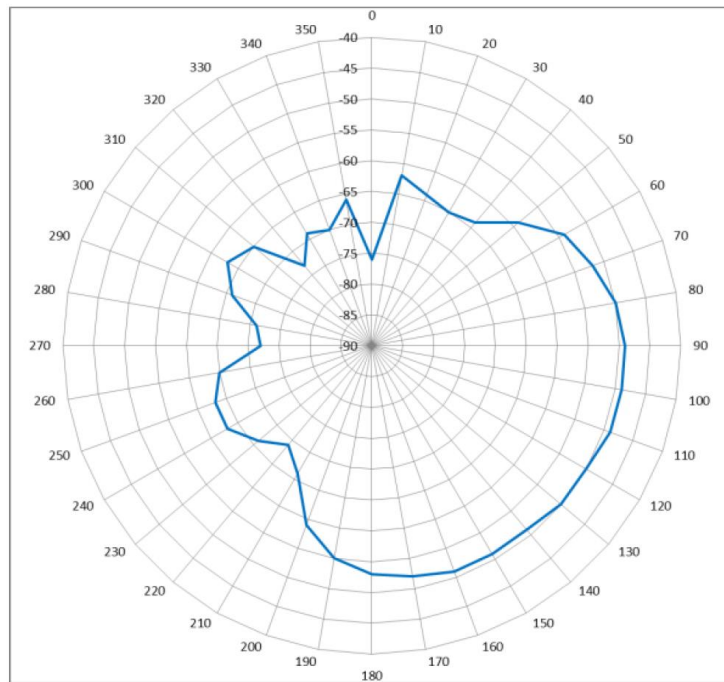


Figure 3-1 Antenna radiation pattern (z-axis rotation)

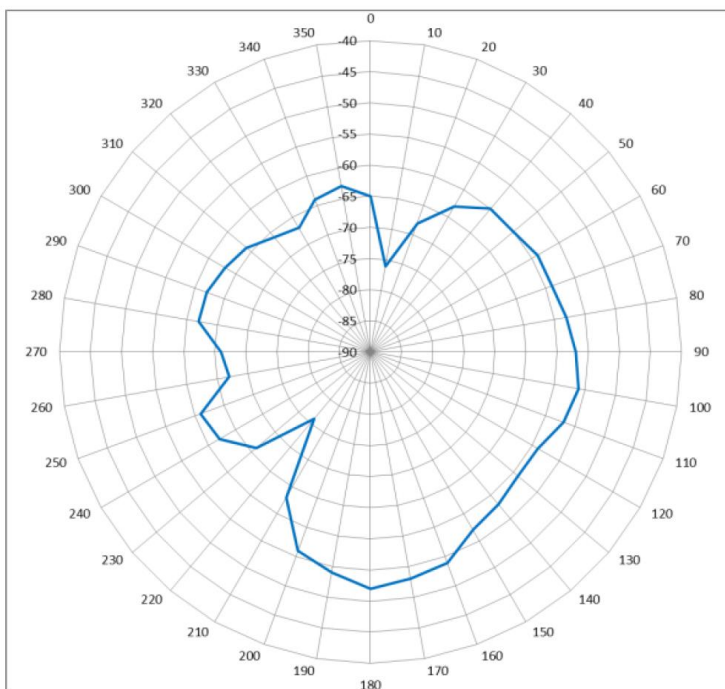


Figure 3-2 Antenna radiation pattern (y-axis rotation)

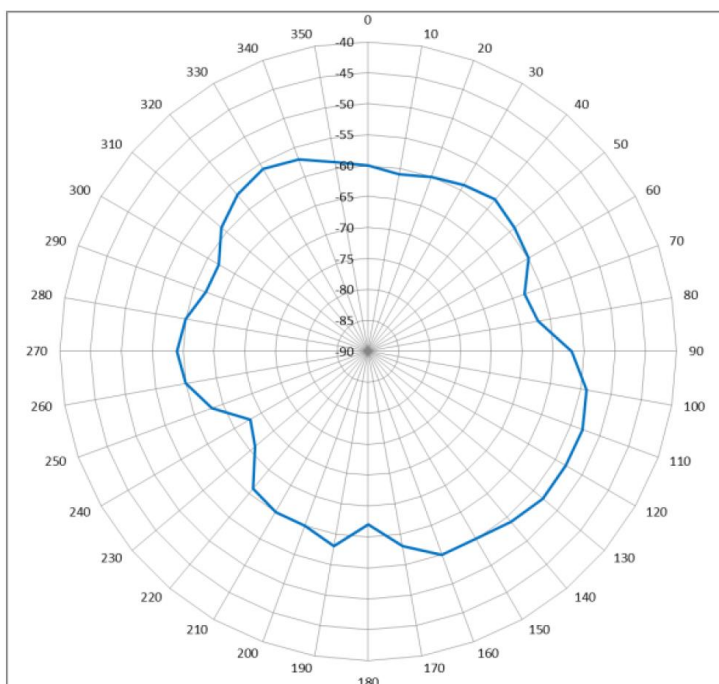


Figure 3-3 Antenna radiation pattern (z-axis rotation)

3.2 Communication distance characteristics

For evaluation, the RM-110-RFB-2 module is attached with the extension board (RTK0EN0001D01001BZ) and the below measurement results show the characteristics of signal strength with respect to distance and of the transmission packet with respect to distance.

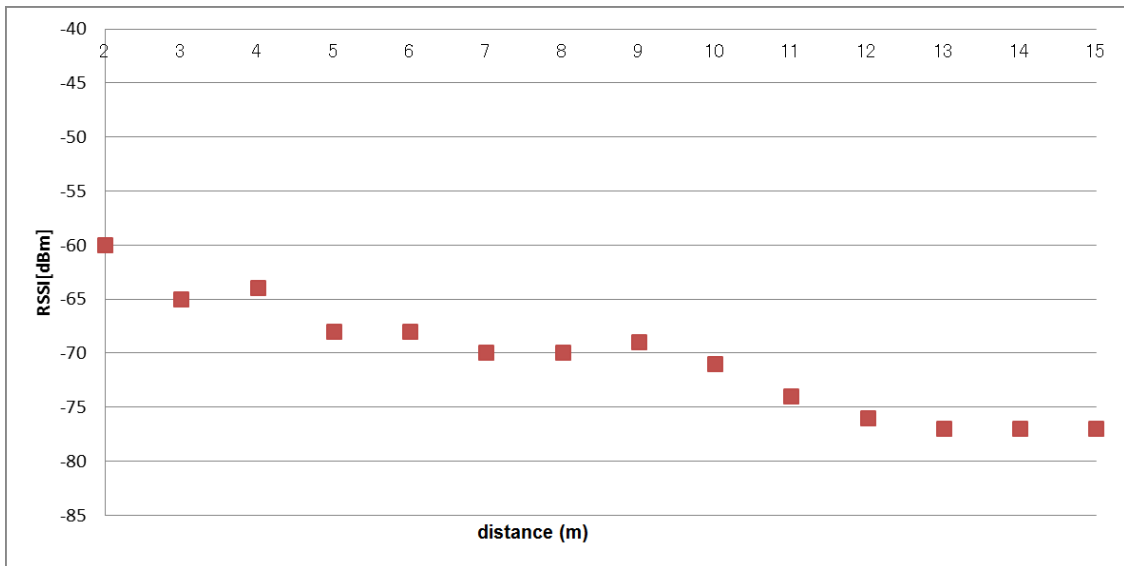


Figure 3-4 Communication measurement (RSSI value)

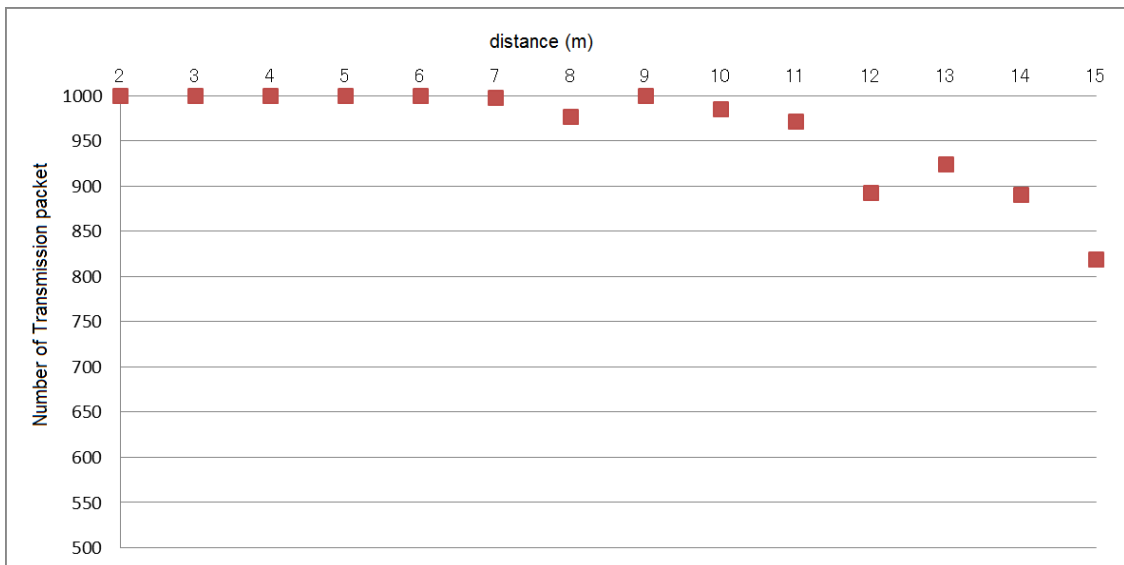
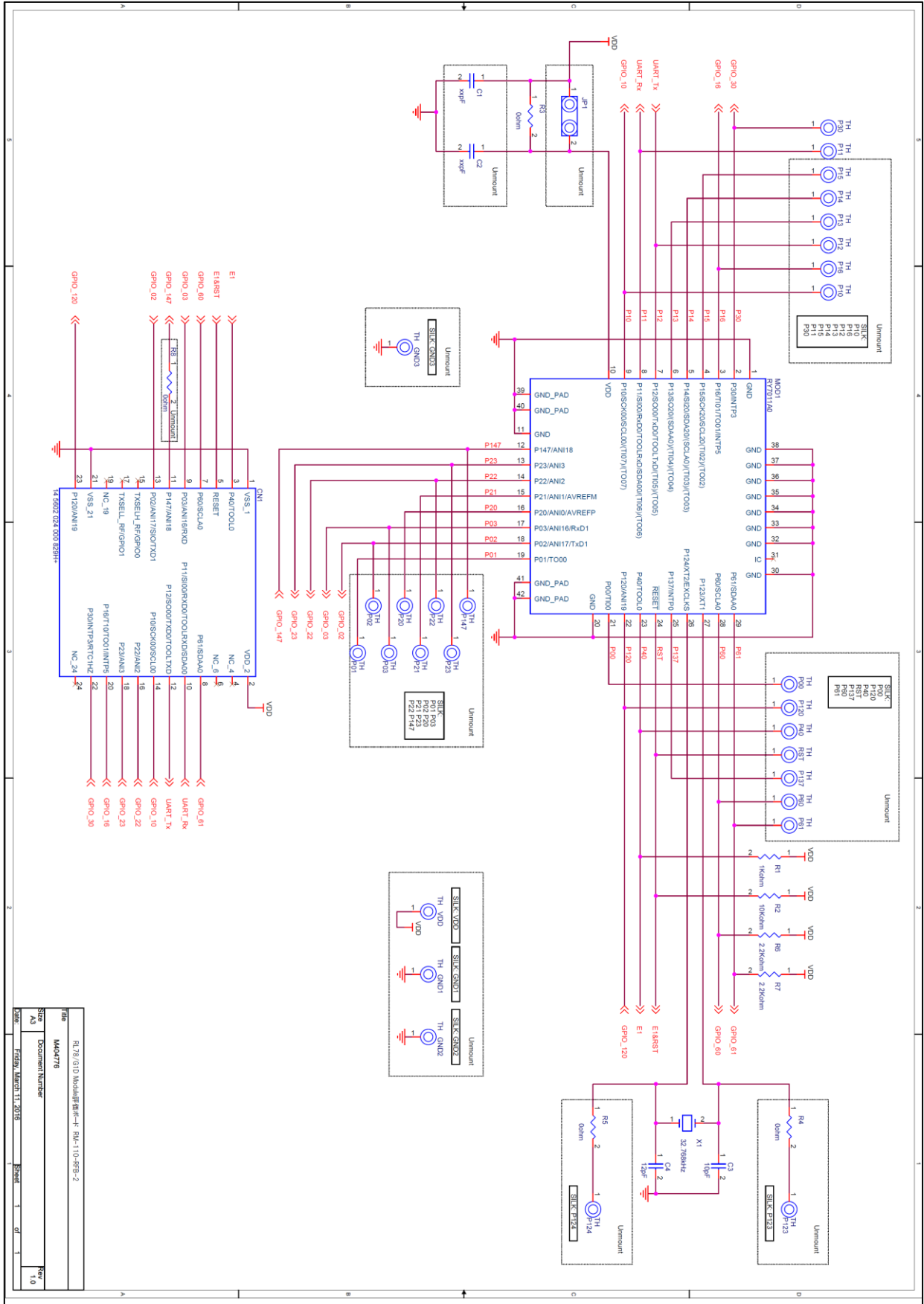


Figure 3-5 Communication measurement (number of packets)

Noted: The characteristic of measurement is reference only. It depends on the extension board to be used and the surrounding environment.

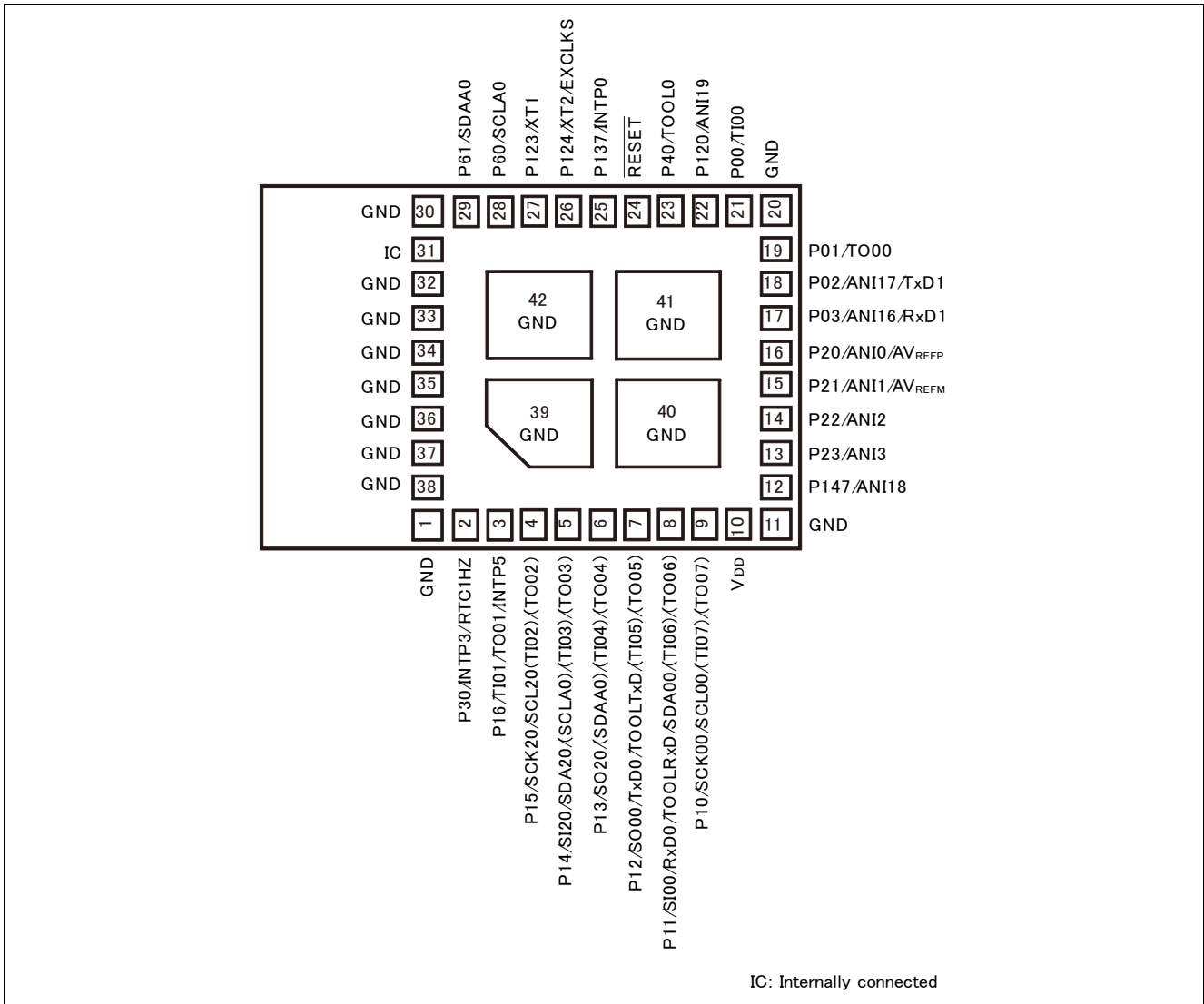
4. Schematics of RM-110-RFB-2 Module



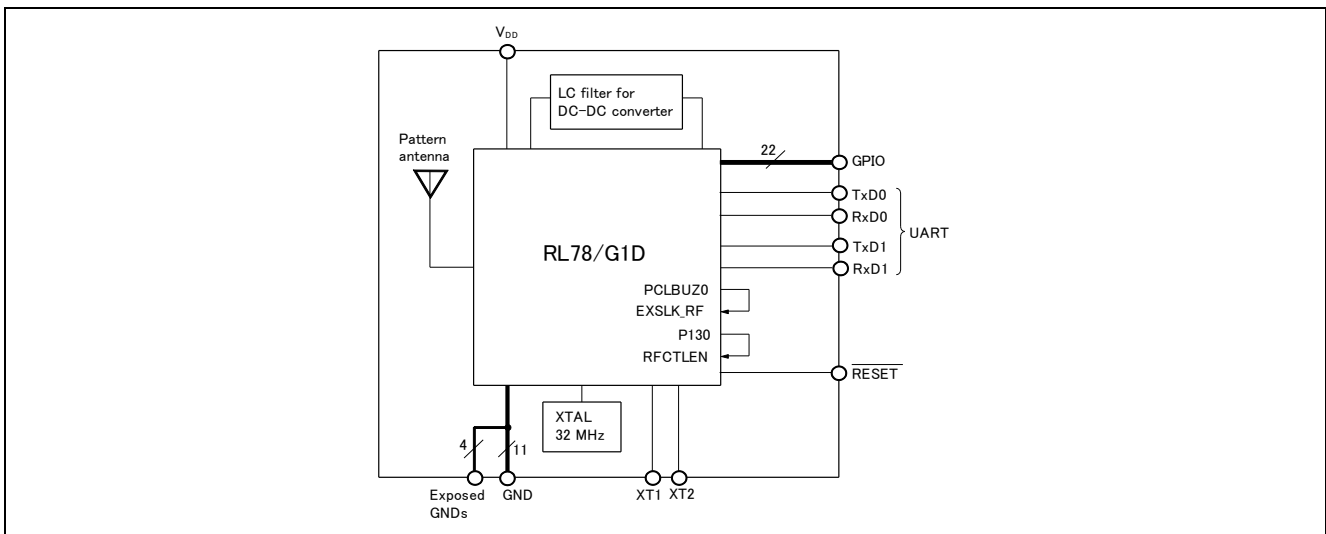
File	RL78/G1D Module 封装图 - RM-110-RFB-2
Size	MA0776
AS	Document Number
Date	Rev 1.0
	Released

Appendix A - RY7011A0000DZ00 Bluetooth module info

1. Pin Configuration (Top View)

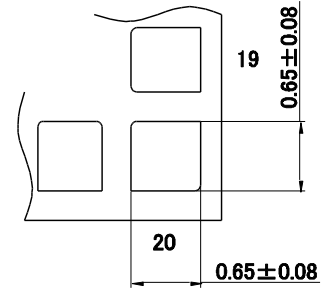
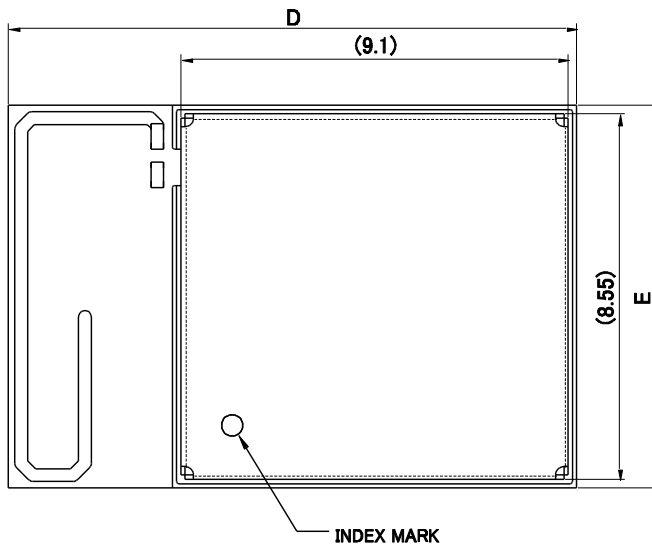


2. Block Diagram

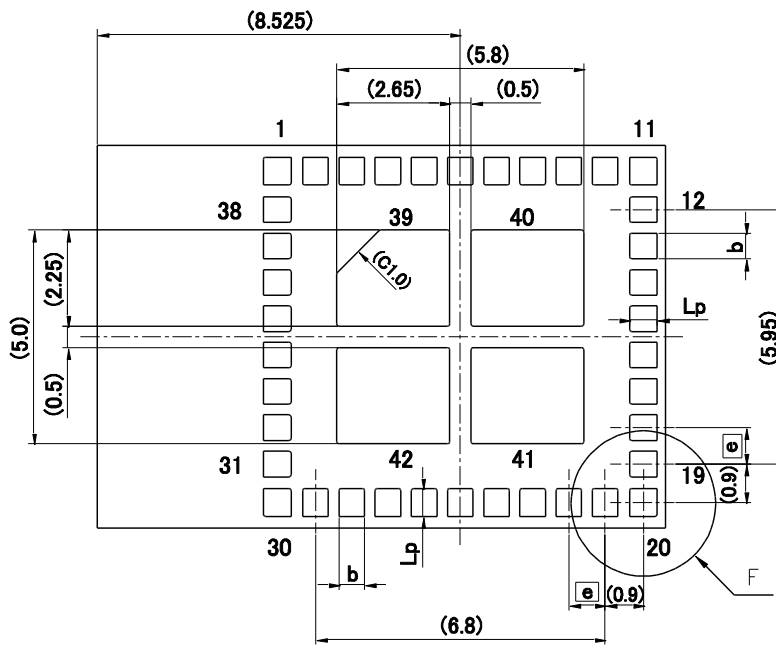
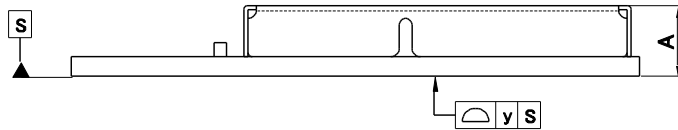


3. Module Drawings

JEITA Package Code	RENESAS Code	Previous Code	MASS [Typ.]
-	MLZZ0042ZA-A	—	0.357 g



Detail F



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	13.20	13.35	13.50
E	8.80	8.95	9.10
A	—	—	1.7
e	—	0.85	—
Lp	0.57	0.65	0.73
b	0.52	0.6	0.68
y	—	—	0.1

Appendix B - References

- [1] NAITO DENSEI MACHIDA MFG.CO., LTD. <http://sys.ndk-m.com/english/>
- [2] RL78/G1D Module (RY7011), User's Manual: Hardware, R02UH0004EJ0101 Rev.1.01, June 3, 2016
- [3] RL78/G1D User's Manual: Evaluation Board, R30UZ0048EJ0130 Rev.1.30, Dec 1, 2015
- [4] RL78/G1D User's Manual: Hardware, R01UH0515EJ0110 Rev.1.10, Sep 25, 2015

Appendix C - Conformity Assessment

FCC/IC Regulatory

Since this module is not sold to general end users directly, there is no user manual of module.

For the details about this module, please refer to the specification sheet of module.

This module should be installed in the host device according to the interface specification (installation procedure).

The following information must be indicated on the host device of this module;

Contains FCC ID: 2AEMXY7011A00000

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.

Contains IC: 20194-Y7011A00000

The following statements must be described on the user manual of the host device of this module;

[for FCC]

FCC CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body.

[for IC]

This device complies with Industry Canada's licence-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.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement émet une énergie RF très faible qui est considérée conforme sans évaluation de l'exposition maximale autorisée. Cependant, il est souhaitable qu'il devrait être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

Japan Radio Law

Contains MIC ID: 007-AE0104

This device complies with the Japan Radio Law (Law No. 131, 1950) and Amendments.

R&TTE Directive

Hereby declare that this product **is required** the final certification tests and CE marking in order to compliance with the essential requirements and other EC relevant provisions.



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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Sep. 30, 2016	—	First edition issued

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1. Handling of Unused Pins

Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

- The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

- The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.

In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.

In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

- When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

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Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

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