RL78/G1D Group

RL78/G1D Solution Kit – PMOD Module Hardware Manual

Introduction

This document represents RL78/G1D Solution Kit's PMOD module. The document describes hardware platform information such as PMOD™ peripheral connection, RL78/G1D-SK Bluetooth® module interface and its Bluetooth® connectivity, bill of materials, and schematics.

Target Device

RL78/G1D Group (R5F11AGJ)

This Solution Kit's PMOD module includes Renesas' Intelligent Bluetooth® low energy technology device with part number starting with R5F11A (256 KB program flash memory, 20 KB RAM and 8 KB data flash memory).

Contents

1. Overview

RL78/G1D-SK PMOD module has two sections: Bluetooth® module (RL78/G1D-SK) and PMOD™ connector (PMOD) with power consumption measurement.

This module allows you to measure current consumption for RF section and microcontroller (MCU) section using R1 and R4 respectively. To measure current, remove the resistor and attach current probe to the resistor pads. Read the current value from the meter.

The PMOD and RL78/G1D-SK sections are divided by breakaway groove at bottom side. Figure 1 shows top and bottom view of the module including breakaway groove marking. After breaking the board, you get small Bluetooth® low energy technology module (RL78/G1D-SK) which has 30 solder pads at bottom side for power supply, debug/program interface, and I/O interface. Once broken into two pieces, the PMOD™ section is of no use.
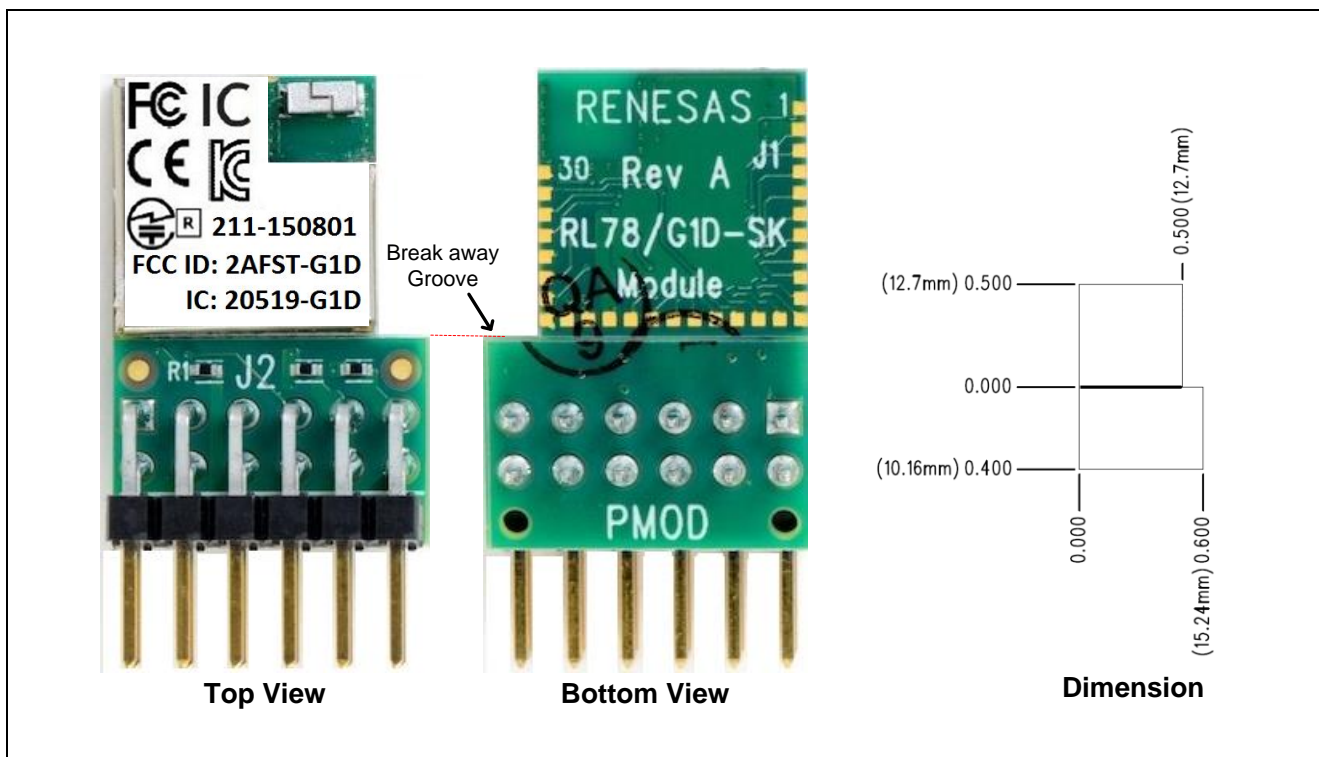

Figure 1 RL78/G1D-SK PMOD module

1.1 Specification Outline

The specification of RL78/G1D-SK PMOD module is described as below Table 1.

Table 1 RL78/G1D-SK PMOD module Specification

Item	Content
Dimension	22.86 mmx 15.24 mm (0.9 inch x 0.6 inch)
Operation Power Supply Voltage	3.0 V
Maximum Power Supply Voltage	3.6 V
Average Operation Current	10 µA Note1
Maximum Total Output Current	150 mA Note2
Operating Ambient Temperature/Humidity	0°C to +60°C, 10% to 80% RH (non condensing)
Storage Temperature	−15°C to +60°C, 10% to 80% RH (non condensing)

Note 1: One-second interval with keeping Bluetooth® connection
Note 2: Refer Electrical Specifications of RL78/G1D User's Manual: Hardware, R01UH0515EJ0110 [1]

2. RL78/G1D-SK PMOD module interface

For interface connection, the RL78/G1D-SK PMOD module has 2x6 pin, standard 0.1-inch pitch right angle male connector. Using this connector, you can program or debug RL78/G1D-SK Bluetooth® module. If you program firmware in Modem configuration, the module can be used for Bluetooth® communication by plugging into one of the PMOD connectors on the Renesas RDK board like YRDKRL78-G14. The PMOD connector pin number and pin orientation are shown in Figure 2, and Table 2 shows the pin configuration.
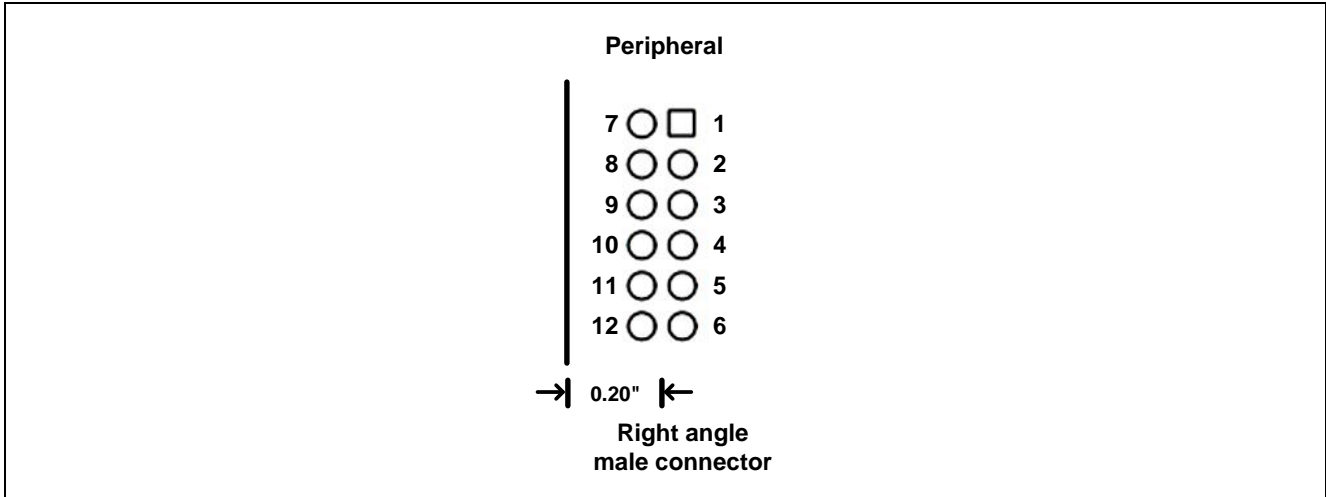
Figure 2 PMOD connector pin assignment for RL78/G1D-SK PMOD module

Table 2 Interface between Host and Peripheral PMOD

PMOD Pin Number	Solution Kit (Host)	RL78/G1D-SK PMOD (Peripheral)	PMOD Signal
1	PMOD-WAKEUP	P30	PMOD_CS
2	PMOD-TxD	P11 (RxD0/SI00)	PMOD_MOSI
3	PMOD-RxD	P12 (TxD0/SO00)	PMOD_MISO
4	PMOD-SCK	P10 (SCK00)	PMOD-SCK
5	GND	GND	GND
6	VDD (3.3 V)	VDD (via R1 and R4)	VDD
7	PMOD-SDIR (INTP)	P21	PMOD_PIN7
8	PMOD-GPIO	nRESET	PMOD_PIN8
9	PMOD-GPIO	P16	PMOD_PIN9
10	PMOD-GPIO	TOOL0	PMOD_PIN10
11	GND	GND	GND
12	VDD (3.3 V)	VDD (via R1 and R4)	VDD

The PMOD connector has flexible interface to communicate either UART or CSI mode. The RL78/G1D-SK PMOD module can support five communication modes based on programmed firmware as below. Refer document R01UW0095EJ0117 [2] for detail.

- ❖ 2-Wire UART
- ❖ 3-Wire UART
- ❖ 2-Wire UART with branch
- ❖ 4-Wire CSI
- ❖ 5-Wire CSI

3. RL78/G1D-SK Bluetooth module Pin Configuration

After breaking away the PMOD connector of the PMOD module, you get Bluetooth® module, with dimensions 12.7x12.7 mm (½ inch square). The module has 30 gold plated pads at bottom layer and their respective functions are described in Table 3 . Refer MCU device detail in RL78/G1D User's Manual: Hardware, R01UH0515EJ0110 [1].
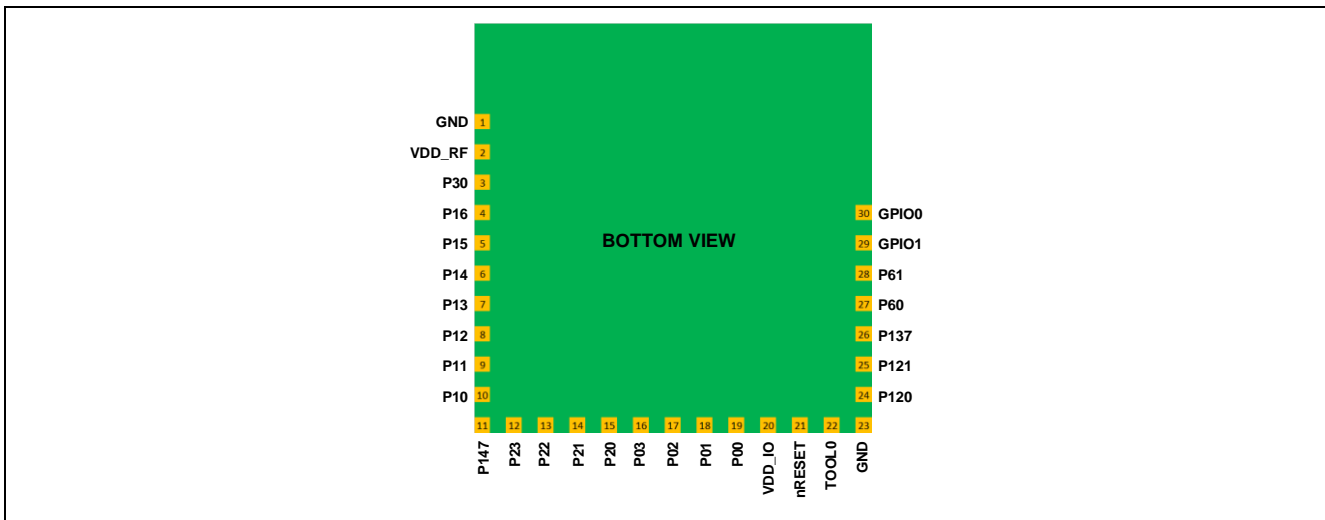

Figure 3 RL78/G1D-SK module pin configuration

Table 3 RL78/G1D-SK module Pin Function

Pin Number	Designator	Description	Remark
1	GND	Ground	
2	VDD_RF	RF +3.0 volt power supply	
3	P30	GPIO/External Interrupt Input 3 / Real-time clock (1 Hz) Output	
4	P16	GPIO/ Timer01 Input, Output / External Interrupt Input 5	
5	P15	GPIO/ CSI20 clock/ I^{2}C 20 clock Output/ Timer02 Input, Output	I^{2}C 20: Simplified I^{2}C
6	P14	GPIO/ CSI20 Input/ I^{2}C 20 Data/IIC0A clock Output/ Timer03 Input, Output	I^{2}C 20: Simplified I^{2}C
7	P13	GPIO/ CSI20 Output/ I^{2}C 0A Data/ Timer04 Input, Output	
8	P12	GPIO/ CSI00 Output / UART 0 Transmit Output / Timer05 Input, Output	
9	P11	GPIO/ CSI00 Input/ UART 0 Receive Input/ I^{2}C00 Data/ Timer06 Input, Output	
10	P10	GPIO/ CSI00 clock / I^{2}C00 clock Output / Timer07 Input, Output	
11	P147	GPIO/ Analog Input 18	
12	P23	GPIO/ Analog Input 3	
13	P22	GPIO/ Analog Input 2	
14	P21	GPIO/ Analog Input 1/ Analog Reference Minus	
15	P20	GPIO/ Analog Input 0/ Analog Reference Plus	
16	P03	GPIO/ Analog Input 16/ UART 1 Receive Input	
17	P02	GPIO/ Analog Input 17/ UART 1 Transmit Output	
18	P01	GPIO/ Timer00 Input	
19	P00	GPIO/ Timer00 Output	
20	VDD_IO	MCU +3.0 volt power supply	
21	nRESET	Reset Input	
22	TOOL0	General purpose Input/ Debug, Programming	
23	GND	Ground	
24	P120	GPIO/ Analog Input 19	
25	P121	General purpose Input	Input only
26	P137	GPIO/ External Interrupt Input 0	
27	P60	GPIO/ I^{2}C 0A clock Output	
28	P61	GPIO/ I^{2}C 0A Data	
29	PGPIO1	RF transmission output for external power amplifier control	Active High
30	PGPIO0	RF transmission output for external power amplifier control	Active Low

Note: General Purpose Input Output (GPIO)

4. RL78/G1D-SK PMOD Module Design Bill of Material

Table 4 shows the bill of material for RL78/G1D-SK PMOD module.

Table 4 Bill of material for RL78/G1D-SK PMOD module

Item	Qty	Reference	Part	Footprint	Description	Manufacturer	Mfg PN
1	3	C1,C2,C10	0.1uF	402	CAP CER 0.1UF 16V 10% X5R 0402	Murata	GRM155R61A104KA01D
2	1	C3	0.47uF	402	CAP CER 0.47UF 6.3V 10% X5R 0402	Taiyo Yuden	JMK105BJ474KV-F
3	1	C11	10uF	603	CAP CER 10UF 6.3V 20% X5R 0603	Murata	GRM188R60J106ME47J
4	1	C9	2.2uF	402	CAP CER 2.2UF 6.3V 10% X6S 0402	Murata	GRM155C80J225KE95D
5	2	C5,C6	8pF	402	CAP CER 8PF 50V NP0 0402	Murata	GRM1555C1H8R0DA01D
6	2	C7,C8	9pF	402	CAP CER 9PF 50V NP0 0402	Murata	GRM1555C1H9R0DA01D
7	0	C4	NLC	402	No load capacitor		
8	1	E1	W3008		ANTENNA BT/WLAN/WIFI CER	Pulse	W3008
9	1	J2	CON12B		CONN HEADER .100" DUAL R/A 12POS	Sullins	PRPC006DBAN-M71RC
10	1	L1	10uH	603	FIXED IND 10UH 50MA 900 MOHM SMD	Murata	LQM18FN100M00D
11	6	R1,R4,R5, R6,R7,R10	0	402	RES 0.0 OHM 1/16W 0402 SMD	Stackpole	RMCF0402ZT0R00
12	3	R2,R8,R9	10K	402	RES 10.0K OHM 1/16W 5% 0402 SMD	Yageo	RC0402JR-0710KL
13	1	R3	1K	402	RES 1.00K OHM 1/16W 5% 0402 SMD	Stackpole	RMCF0402JT1K00
14	1	R11	6.8 M	402	RES 6.8 M OHM 1/16W 5% 0402 SMD	Yageo	RC0402JR-076M8L
15	1	SH1	SHIELD		Shield, metal can	Custom	N/A
16	1	U1	R5F11AGJ	QFN-48, 6x6 mm	CPU,BLE,256K,RL78/G1D	Renesas	R5F11AGJANA
17	1	Y1	32MHz	1.2x1.6	Crystal,32MHz (8pF,20ppm,1.2x1.6)	Abracon	ABM12-32.000MHZ-B2X-T3
18	1	Y2	32.768kHz	1.0x1.6	Crystal,32.768kHz (9pf,20ppm,1.0x1.6)	Abracon	ABS05-32.768KHZ-9-T

5. Circuit Diagrams
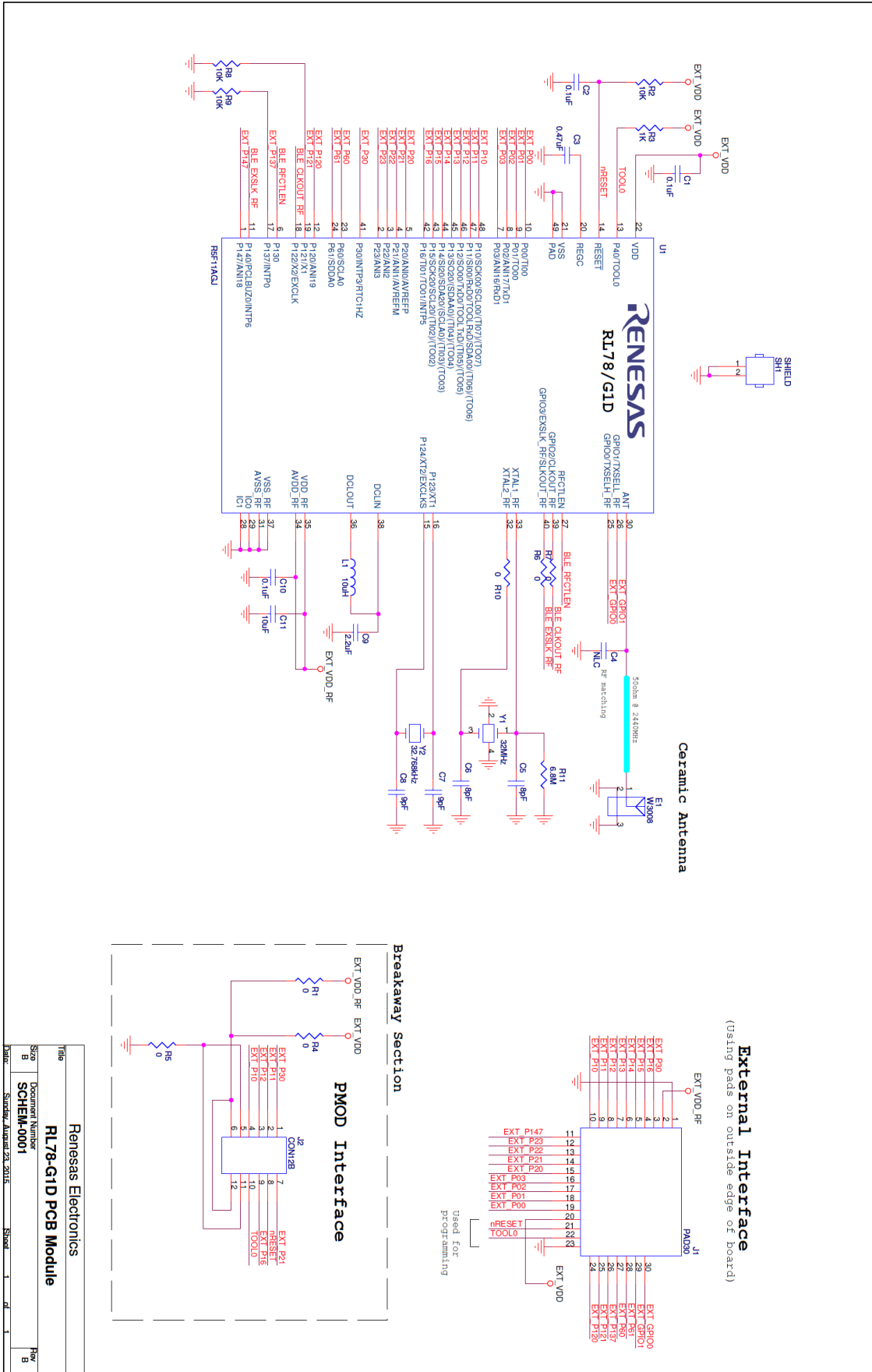
Appendix A - References

[1] RL78/G1D User's Manual: Hardware, R01UH0515EJ0110 Rev.1.10, Sep 25, 2015

[2] Bluetooth® Low Energy Protocol Stack User's Manual, R01UW0095EJ0117 Rev.1.17, Apr 17, 2015

Appendix B - 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 page of module in this document.
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: 2AFST-G1D

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: 20519-G1D

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.

RENESAS

R&TTE Directive

We hereby declare that this product is in compliance with the essential requirements and other EC relevant provisions of
Directive 1999/5/EC.

CE

Declaration of Conformity (DoC) can be available upon request. Contact to local Renesas Sale office.

Korea Radio Regulations

KC

MSIP-CRM-R5E-G1D
해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다.

Japan Radio Law

Contains MIC ID: R1507226
This device complies with the Japan Radio Law (Law No. 131, 1950) and Amendments.

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Revision History

Rev.	Date	Description	
		Page	**Summary**
1.00	July. 31, 2016	—	First edition issued

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

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.

5. Differences between Products

   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.

   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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