RENESAS
BIG IDEAS FOR EVERY SPACE

# RL78/G1D Bluetooth® LE Solution & Resource Quick Start Guide

R01QS0068EJ0101 Rev.1.01
Dec.23.22

Introducing solutions and resources (including related information) for each development phase of your product.

## Development Phase

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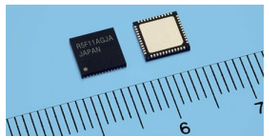
| *Bluetooth Specifications* | | | |
| | All Specifications | WEB | Bluetooth SIG WEB Site - Active All Specifications |
| | Bluetooth Core Specification | WEB | Bluetooth SIG WEB Site - Active Core Specifications |
| | Bluetooth Mesh Specification | WEB | Bluetooth SIG WEB Site - Active Mesh Specifications |
| *Hardware Specifications* | | | |
| | RL78/G1D IC(R5F11Axxxxx)<br><br>RL78/G1D Module(RY7011A0000DZ00) | WEB | RL78/G1D microcontrollers support Bluetooth LE and realized the lowest level of current consumption in the industry at 4.3 mA RF transmission current (0 dBm output) and 3.5 mA RF receiving current. A dedicated "Beacon Stack" that pursues low power consumption is also available.<br>The RL78/G1D module has built-in an antenna and RF circuit, and the abundant function pins of RL78/G1D can be used as they are, and has obtained Radio Law (Japan, FCC, IC, and CE). |
| | | RL78/G1D Datasheet | PDF | This is a Microcomputer Datasheet. |
| | | RL78/G1D User's Manual: Hardware | PDF | Understand the hardware functions and electrical characteristics of microcomputer. |
| | | RL78/G1D Module (RY7011) User's Manual: Hardware | PDF | Understand the hardware functions and electrical characteristics of module. |
| *Software Specifications* | | | |
| | RL78 Family User's Manual: Software | PDF | Understand the various kinds of instruction functions of RL78 microcontrollers. |
| | RL78/G1D Module Firmware User's Manual | PDF | This manual describe the structure, function, and usage of the RL78/G1D module firmware. |



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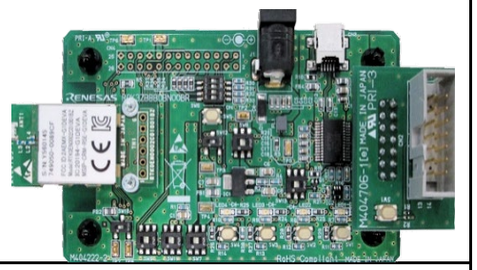
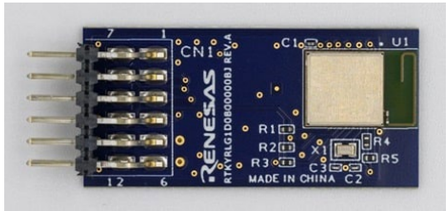
| *Evaluation Boards* | | | |
| | RL78/G1D Evaluation Board : RTK0EN0001D01001BZ | WEB | The RL78/G1D evaluation board can evaluate and develop applications for the Bluetooth Low Energy solution RL78/G1D provided by Renesas. You can start the evaluation immediately after purchasing the evaluation board using the software that can be downloaded from the Web site. This evaluation board has gained FCC, IC, CE, KC and MIC (Japan) certifications.  |
| | | RL78/G1D Evaluation Board User's Manual | PDF | Describes the hardware specifications. |
| | RL78/G1D BLE Module Expansion Board : RTKYRLG1D0B00000BJ | WEB | The RL78/G1D BLE Module Expansion Board (RTKYRLG1D0B00000BJ) is an evaluation board with a Pmod™ interface that incorporates the RL78/G1D module. It can connect to the RL78/G14 Fast Prototyping Board (RTK5RLG140C00000BJ) and can be used to evaluate Bluetooth LE functions. Additionally, you can use the RL78/G1D evaluation board to develop new Bluetooth LE applications. Use the expansion board together with sensor devices to easily evaluate and develop IoT applications.  |
| | | RL78/G1D BLE Module Expansion Board Quick Start Guide | PDF | Describes board specifications, parts layout, and Pmod interfaces. |
| | | RL78/G1D BLE Module Expansion Board User's Manual | PDF | Describes the hardware functions of the RL78/G1D BLE Module Expansion Board and electrical characteristics of the MCU. |
| *Attached Document : Evaluation Board Design Data* | | | |
| | Design data of the RL78/G1D Evaluation Module | ZIP | Describes the design data of the RL78/G1D Evaluation module (RTK0EN0002C01001BZ) that are mounted on the RL78/G1D Evaluation board (RTK0EN0001D01001BZ). The design data includes schematics, BOM list, Gerber data and board layout diagram. |
| *Attached Document : Current Consumption Measurement Data* | | | |
| | RL78/G1D Measurement of Current Consumption | PDF | This document describes measurement method of current consumption when Bluetooth LE connection. |

| *Board Design Guides* | | | |
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| | RL78/G1D Guidelines for RF Board Design | PDF | This document describes guidelines to be observed when designing an RF board. Describes cautionary points when designing the oscillation circuit, antenna connection pin, external circuit for DC-DC converter, and power supply / ground pattern. |
| | RL78/G1D Design of a Reference Antenna | PDF | Describes an example of the design of a pattern antenna and its characteristics when connected with the RL78/G1D. |
| | Bluetooth Low Energy microcomputer Design Guidelines for a Pattern Antenna | PDF | Introduces an outline of antennas and a procedure and example of the design of a pattern antenna for connection with the Bluetooth Low Energy technology compatible microcomputer. |

*Evaluation Tools*

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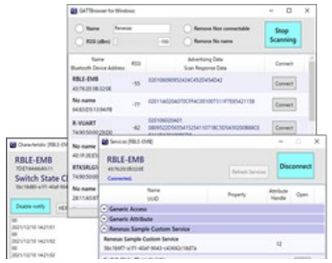
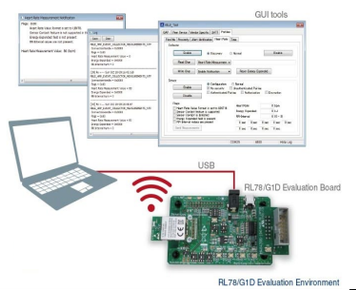
| GATTBrowser (Smartphone Application) | | A generic data communication application for checking the operation of Bluetooth LE. You can experience data communication with Bluetooth LE by scanning Bluetooth LE devices operating in the vicinity and connecting to those devices.   |
| GATTBrowser for iOS Smartphone Application Instruction manual | PDF | Describes how to use the iOS smartphone application "GATTBrowser" for confirm the operation of Bluetooth LE. |
| GATTBrowser for Android Smartphone Application Instruction manual | PDF | Describes how to use the Android smartphone application "GATTBrowser" for confirm the operation of Bluetooth LE. |
| GATTBrowser (for iOS) (App Store) | WEB | GATT Browser download link for iOS. |
| GATTBrowser (for Android) (Google Play) | WEB | GATT Browser download link for Android. |
| GATTBrowser (Windows Application) | | This is a general-purpose data communication application for confirm the operation of Bluetooth LE. You can use the Windows PC to scan nearby Bluetooth LE devices and connect to them to experience Bluetooth LE data communication.   |
| GATTBrowser for Windows Windows Application Instruction manual | ZIP | GATTBrowser download link for Windows.<br>Describes how to use the Windows application "GATTBrowser" to confirm the operation of Bluetooth LE. |
| GUI Tool (Windows Application) | | Even if you are not familiar with Bluetooth Low Energy, you can easily conduct Bluetooth Low Energy communication using the GUI tool without writing a program. You can confirm the API execution procedure and the setting values for various parameters while actually conducting communication activities. Additionally, you can also develop a program smoothly while referring to the results (logs) of the operation check.   |
| Bluetooth Low Energy Protocol Stack GUI Tool | ZIP | Download link for GUI tools for Windows.<br>The included application note describes how to install, configure, and use the GUI tools. |

| *Development Guidelines* | | | |
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| Bluetooth LE wireless communication | | | |
| | Bluetooth Low Energy Protocol Stack Quick Start Guide | PDF | This quick start guide describes the procedure from install until execute a suite of software including the Bluetooth LE Protocol Stack that complies with the Bluetooth LE wireless communication standard. |
| | Bluetooth Low Energy Protocol Stack Application Development Guide | PDF | This document guides how to develop an application that supports Bluetooth LE.<br>Describes about the outline of Bluetooth LE Protocol Stack, how to use API (rBLE API) to use the function of protocol stack, how to use simple OS (RWKE) used in Embedded configuration, outline of profile, and how to create custom profile. |
| | BLE Virtual UART Application Android programming guide | PDF | This programming guide describes the programming method an Android application that performs data communication between PC (terminal software) and Android terminal via the BLE virtual UART function that operates on the RL78/G1D evaluation board. |
| Bluetooth LE Beacon | | | |
| | RL78/G1D Bluetooth Beacon Applications | PDF | Describes application examples using the beacon function, the requirements for beacon devices, formats of beacon transmission data, and how to implement beacon. |

*Development Tools*

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| Integrated Development Environment (IDE) | | | |
| | $e^2$ studio | WEB | An integrated development environment for Renesas microcontrollers based on the open source Eclipse IDE and CDT (C/C++ development Tooling).<br>Use the installer to install the e2 studio body and each component. |
| | $e^2$ studio User's Manual : Quick Start Guide | PDF | Understand the features of $e^2$ studio when starting hardware and software system development using target devices. |
| | CS+ | WEB | The CS+ integrated development environment provides simplicity, security, and ease of use in developing software through iterative cycles of editing, building, and debugging. You can use the basic software tools for developing software for Renesas MCUs immediately after the initial installation. CS+ is also compatible with Renesas hardware tools including the E2 and E1 on-chip debugging emulators, which facilitates advanced debugging. Abundant extensions and functions for user support ensure a dependable environment for all users.<br>Compiler packages for the target products include CS+. |
| | CS+ Integrated Development Environment User's Manual: CC-RL Build Tool Operation | PDF | Understand the software functions of CS+ (overview of build tool plug-in, build procedures using CS+, and prime functions related to build). |
| $e^2$ studio Extension Plug-in | | | |
| | QE for BLE (for RL78 Family) | WEB | The QE for BLE is a dedicated tool for developing embedded software in systems which support the Bluetooth Low Energy protocol stack. This solution toolkit runs in the $e^2$ studio integrated development environment (IDE). The combination of the $e^2$ studio and QE for BLE makes it easy to test the communications features of RL78/G1D Bluetooth LE MCU, thus reducing development periods for products being placed on the market. It can also design and generate the custom profile. |
| | QE for BLE: A Dedicated Tool for Bluetooth Low Energy. Usage Guide | PDF | This document describes the usage of QE for BLE (for RL78 Family) with examples. |
| | [technical preview version]QE for BLE | ZIP | Download QE for BLE (for RL78 family). |
| C/C++ Compiler | | | |
| | C Compiler Package for RL78 Family | WEB | In development of embedded systems, C Compilers for RL78 Family offers the powerful optimizations for enhancing execution speed and code efficiency, and the utilities to increase productivity. |
| | RL78 Compiler CC-RL V1.03.00 | EXE | This is a compiler package for CC-RL V1.03.00 used in the Bluetooth Low Energy Protocol Stack.<br>This compiler packages include CS+. |

*Development Tools*

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| On-chip Debugging Emulator (When using RSSK) | | | | |
| | E2 Emulator[RTE0T00020KCE00000R] | WEB | The E2 emulator is an advanced on-chip debugging emulator and flash programmer developed with the concept of greater efficiency in development. The combination of its high-speed downloading and various software and hardware solutions will contribute to reducing development times.<br>A USB cable (A-miniB) is included in the product package. | |
| | E2 emulator Lite [RTE0T0002LKCE00000R] | WEB | The E2 emulator Lite (abbreviated as "E2 Lite") is an on-chip debugging emulator and flash programmer for MCUs of the RX families. The E2 Lite is more economical than the E1, and is suitable for work across the whole range from hobbyist projects and education to professional development.<br>A USB cable (A-miniB) is included in the product package. | |
| Renesas Flash Programmer | | WEB | On-chip flash memory writing tool of Renesas microcontrollers (Programming GUI). | |
| Terminal Emulator Tera Term | | WEB | Used as a serial terminal tool. | Used in Windows 10 Bluetooth LE Application, Bluetooth LE Sample Programs, Bluetooth LE Beacon Sample Programs, and Bluetooth LE Embedded Configuration Sample Programs. |
| Visual C++ Redistributable for Visual Studio 2012 Update 4 | | WEB | The Visual C++ Redistributable Package installs the runtime components required to execute C ++ application GUI tool built with Visual Studio 2012. | |

*Software Library*

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| Bluetooth LE Protocol Stack | | | |
| | Bluetooth Low Energy Protocol Stack User's Manual | PDF | Describes setup method, organization, and features of the Bluetooth Low Energy Protocol Stack, which is used to develop Bluetooth LE applications. |
| | Bluetooth Low Energy Protocol Stack API Reference Manual | PDF | Describes the API specification of the Bluetooth Low Energy Protocol Stack, which is used to develop Bluetooth LE applications. |
| | Bluetooth Low Energy Protocol Stack | ZIP | Download the Bluetooth Low Energy Protocol Stack. |
| | Bluetooth Low Energy Protocol Stack Security Library | PDF | Security Library provides APIs to ease the usage of security features provided by BLE protocol stack. Security Library shall use with BLE protocol stack V1.20 or later. The Security Library is available for all roles (Central / Peripheral) and all configurations (Embedded / Modem). |
| | Bluetooth Low Energy Protocol Stack rBLE Command Specification | PDF | Describes the **rBLE Command** Specification used for communication between the application MCU and the Bluetooth LE MCU (RL78 / G1D) when the Bluetooth Low Energy Protocol Stack for RL78 / G1D is used in the Modem configuration. |
| | RL78/G1D Beacon Stack User's Manual | PDF | The Beacon Stack is a dedicated Bluetooth LE protocol stack that reduces current consumption by 40% in Beacon operations that constantly transmit radio waves. This manual describes the specification, functions, and API of the RL78/G1D Beacon Stack.<br>The RL78/G1D Beacon Stack Library is included with each Bluetooth LE Beacon Sample Program. |
| Flash Library | | | |
| | Code Flash Library<br>Flash Self Programming Library for RL78 Family | ZIP | The Code Flash Library is free-of-charge software for rewriting the code flash memory by the user program. Refer to the Bluetooth Low Energy Protocol Stack User's Manual for uses, installation procedures, and precautions for use. |
| | Data Flash Library<br>EEPROM Emulation Library for RL78 Family | ZIP | The Data Flash Library is free-of-charge software for rewriting the data flash memory by the user program. Refer to the Bluetooth Low Energy Protocol Stack User's Manual for uses, installation procedures, and precautions for use. |

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| *Bluetooth LE Sample Programs* | | | |
| | Bluetooth Low Energy Protocol Stack Sample Program<br>Basic Bluetooth LE Application Development | PDF | Describes the installation procedure, configuration, and usage of the sample program included in the Bluetooth Low Energy Protocol Stack. This sample program supports two types of system configurations (Modem and Embedded configuration).<br>Two types sample programs, "Console-based Sample Program" that executes Bluetooth LE functions from the console using the command line interface and "Simple Sample Program" with Embedded configuration that operates on the RL78/G1D evaluation board with a smartphone as the remote device, are available.<br>For details on the "Simple Sample Program", refer to the Bluetooth Low Energy Protocol Stack Embedded Configuration Sample Program. |
| *Bluetooth LE Modem Configuration Sample Programs* | | | |
| | RL78/G1D Module Module Control Software<br>Modem Configuration Application Development | ZIP | This software controls the RL78 / G1D module (RY7011) and operates on PC and Host MCU (RL78 / G1D). The package includes the source code of the module firmware. |
| | Bluetooth Low Energy Protocol Stack RL78/G14 Host Sample<br>Modem Configuration Application Development | ZIP | This host sample operates on the Renesas Starter Kit for RL78/G14, controls the Bluetooth Low Energy Protocol Stack (Modem configuration) installed on the serially connected RL78/G1D evaluation board using the **rBLE command**, and performs Bluetooth LE wireless communication with a smartphone. |
| | Bluetooth Low Energy Protocol Stack RX113 Host Sample<br>Modem Configuration Application Development | ZIP | This host sample operates on the Renesas Starter Kit for RX113, controls the Bluetooth Low Energy Protocol Stack (Modem configuration) installed on the serially connected RL78/G1D evaluation board using the **rBLE command**, and performs Bluetooth LE wireless communication with a smartphone. |
| | Bluetooth Low Energy Protocol Stack Host MCU Simple API for RL78/G14<br>Modem Configuration Application Development | ZIP | This application operates on the Renesas Starter Kit for RL78/G14, controls the Bluetooth Low Energy protocol stack (Modem configuration) installed on the serially connected RL78/G1D module (RY7011) or RL78/G1D evaluation board using the **Simple API**, and performs Bluetooth LE wireless communication with a smartphone in any format using custom profile. |
| | Bluetooth Low Energy Protocol Stack Host MCU Simple API for RX113<br>Modem Configuration Application Development | ZIP | This application operates on the Renesas Starter Kit for RX113, controls the Bluetooth Low Energy protocol stack (Modem configuration) installed on the serially connected RL78/G1D module (RY7011) or RL78/G1D evaluation board using the **Simple API**, and performs Bluetooth LE wireless communication with a smartphone in any format using custom profile. |
| | Bluetooth Low Energy Protocol Stack Fast Prototyping Board Host Sample<br>Sensor Application Development | ZIP | This Host Sample operates on the RL78/G14 Fast Prototyping Board, controls the RL78/G1D BLE Module Expansion Board (equipped with the RL78/G1D module (RY7011)) connected by Pmod™ using the **rBLE command**, and transmits the sensor (Renesas HS3001 Humidity and Temperature Sensor Module) information to a smartphone via Bluetooth LE wireless communication. |

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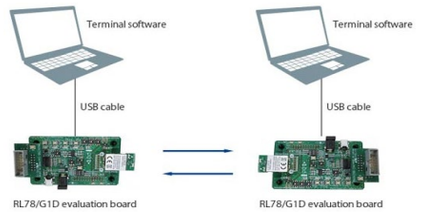
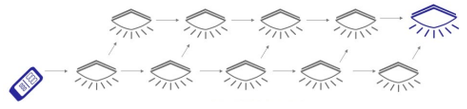
| *Bluetooth LE Embedded Configuration Sample Programs* | | | |
| | Bluetooth Low Energy Protocol Stack BLE Virtual UART Application<br>**Wireless Serial Communication App Development** | ZIP | This sample program realizes serial communication and wireless communication between embedded devices. It has a simple AT command execution function to control and set Bluetooth LE wireless communication, thereby realizing virtual UART communication where characters are transmitted/received via Bluetooth LE wireless communication.<br>  |
| | Bluetooth Low Energy Protocol Stack Embedded Configuration Sample Program<br>**Embedded Configuration Application Development** | ZIP | This sample program provides an example implementation of the embedded configuration application. The embedded configuration application performs two behavior, Bluetooth LE behavior and application behavior, on RL78/G1D. The source codes can be used as a base when developing a program with an Embedded configuration. |
| | Bluetooth Low Energy Protocol Stack Sensor Application<br>**Sensor Application Development** | ZIP | This application operates on Bluetooth Low Energy microcontroller RL78/G1D device and transmits sensor measured data to a remote device (Android smartphone). The sample program contains not only the code files and firmware of the sensor application for RL78/G1D but also Android application (apk file) to confirm sensor measured data transmitted by the sensor application. |
| *Bluetooth LE Beacon Sample Programs* | | | |
| | RL78/G1D Beacon Stack Basic Operation Sample Program<br>**Beacon Application Development** | ZIP | This sample program operates on the RL78/G1D evaluation board and executes the basic functions transmission of beacon information (Advertising), receiving beacon information (Scanning), and Direct Test Mode (DTM) for evaluate RF characteristics. This sample program includes the RL78/G1D Beacon Stack Library. |
| | RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program<br>**Beacon Application Development** | ZIP | This sample program operates on RL78/G1D evaluation board, and executes Advertising for providing information and executes connecting to smartphone (GATTBrowser App installed) in order to update configuration and data.<br>This sample program includes the RL78/G1D Beacon Stack Library. |
| | RL78/G1D Beacon Stack Multi-Hop Feature (without Security)<br>**Multi-Hop Application Development** | ZIP | This sample program operates on the RL78/G1D device and supports the Multi-Hop (data relay by flooding method) function using the Advertising and Scan operations of the RL78/G1D Beacon Stack. By using this function, executes "Transmit setting information" or "Collect measurement data" to far remote device via multiple devices. This sample program includes the RL78/G1D Beacon Stack Library.<br>  |
| | RL78/G1D Beacon Stack Multi-Hop Feature (with Security) | – | For the "with Security" version, please contact nearest Renesas sales or distributor.<br>Document Number : R01AN4466 |

| *Case Studies* | | | | |
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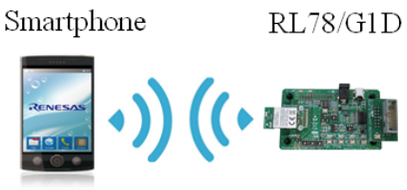
| | Bluetooth Low Energy Protocol Stack<br>Case studies for good connectivity with smartphones | PDF | This document describes case studies of good connectivity with smartphones when using the "Bluetooth Low Energy protocol stack". |  |

*Windows Sample Apps*

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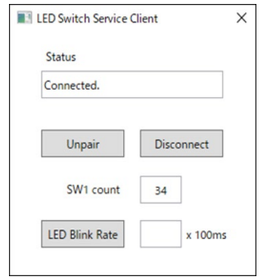
| Windows 10 Bluetooth LE Application | | | The Windows 10 Bluetooth LE application provides a set of projects that can be used in Visual Studio 2017, and is a application example that can be used as a development base for Bluetooth LE communication apps for Windows.<br>This sample application communicates with the firmware pre-installed on the evaluation board equipped with RX23W, controls the LED blinking interval on the evaluation board, and counts the number of times the switch is pressed.<br>  |
| | Bluetooth LE microcomputer / module Windows 10 Bluetooth LE Application<br>Windows Application Development | ZIP | When using a Windows 10 Bluetooth LE application as a development base for a Bluetooth LE communication app that executes on Windows 10. |
| | | | Download a suite of project available in Visual Studio 2017 and use it as a development base for Bluetooth LE communication apps that execute on Windows 10. |
| | | | When using the Windows 10 Bluetooth LE application as an evaluation app |
| | | | Download the Windows 10 Bluetooth LE application  for Windows and operating instructions manual. |

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| *Windows App Development Environment* | | | | | |
| | Windows App Development Environment | | | | |
| | | Visual Studio Express 2015 for Windows Desktop | WEB | Visual Studio Express is a free-of-charge edition of the Visual Studio product family, which is an integrated development environment.<br>Select "2015" from the previous version to download. | Used in Bluetooth Low Energy Protocol Stack Sample Program and RL78/G1D Module Module Control Software. |
| | | Visual Studio 2017 | EXE | Visual Studio 2017 supports building to management applications and native desktop applications. | Used in Windows 10 Bluetooth LE Application. |
| | | Windows 10 SDK  Version 2004 (10.0.19041.0) | EXE | The Windows SDK provides headers, libraries, metadata, and tools for building Windows apps. You can use this SDK to build Universal Windows Platform (UWP) and Win32 applications. | Used in Windows 10 Bluetooth LE Application. |

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| *Bluetooth Qualification* | | | | |
| | Bluetooth LE microcomputer / module Bluetooth qualification acquisition Application Note | PDF | When selling a device equipped with a Renesas Bluetooth LE microcomputer or module as a Bluetooth product, product registration (declaration) using the Qualified Design Identification number (QDID) of our certified and registered design is required. This document describes how to do it. | |
| | Launch Studio | WEB | Interface to guide the Bluetooth qualification process (login required). | |
| | Listing Search | WEB | Search for qualified designs and declared products. | |
| | Bluetooth Qualification Test Facility (BQTF) | WEB | Bluetooth Qualification Test Facility (BQTF) is recognized by the Bluetooth SIG as competent to execute qualification test cases identified within the Test Case Reference List (TCRL) as “Category A at or below the Host Controller Interface (HCI) layer.” A list of BQTFs is published on this site. | |
| | Test Case Reference List (TCRL) | WEB | The Test Case Reference List (TCRL) is a qualification reference for all Bluetooth Special Interest Group (SIG) members. It is a document that introduces new test cases, removes test cases, and categorizes test cases. | Thies informations are required when implementing profiles / services of versions or specifications that are unsupported by Renesas. |
| | Profile Tuning Suite (PTS) | WEB | Test software that automates compliance testing of the Bluetooth Host part. | |
| *Radio Law Certification* | | | | |
| | RL78/G1D Testing for Certification of Compliance with the Radio Law (Japan) | PDF | Describes how to prepare an application for obtaining certification of compliance with the Radio Law in Japan and the operations involved in testing. | |
| | RF Test Tool | — | The Bluetooth Low Energy Protocol Stack Sample Program is available as an RF test tool. | |

## Revision History

| Rev. | Date | Description |
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| 1.00 | Jun.10.22 | First edition issued |
| 1.01 | Dec.23.22 | Add "case studies" page |
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# 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. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. 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 the 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.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between $V_{IL}$ (Max.) and $V_{IH}$ (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between $V_{IL}$ (Max.) and $V_{IH}$ (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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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(Rev.5.0-1 October 2020)

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