RX23W Group

BLE QE Utility Module Firmware Integration Technology

Introduction

This application note describes the module used for supporting QE (Quick and Effective tool solution) for BLE (Bluetooth Low Energy). In this document, this module is referred to as the BLE QE Utility Module.

Target Device

RX23W Group

Related Document

- Bluetooth Core Specification (https://www.bluetooth.com)
- RX23W Group User's Manual: Hardware (R01UH0823)
- Firmware Integration Technology User's Manual (R01AN1833)
- Adding Firmware Integration Technology Modules to Projects (R01AN1723)
- Adding Firmware Integration Technology Modules to CS+ Projects (R01AN1826)
- Renesas e^2 studio Smart Configurator User Guide (R20AN0451)
- RX23W Group BLE Module Firmware Integration Technology (R01AN4860)
- Bluetooth Low Energy Profile Developer's Guide (R01AN4553)
- Bluetooth Low Energy Protocol Stack Basic Package: User's Manual (R01UW0205)
- RX23W Group Bluetooth Low Energy Application Developer's Guide (R01AN5504)

Contents

1. Overview

1.1 BLE QE Utility Module

QE for BLE is a tool which you can configure profile easily by using GUI. QE for BLE allows you to configure Bluetooth specification profiles and your own specification profiles (custom profile). Profiles configured by QE for BLE generates programs can be used on BLE protocol stack.

BLE QE Utility module is necessary for the program generation function of QE for BLE. For more information about profile development, refer to “Bluetooth Low Energy Profile Developer’s Guide (R01AN4553)”.

1.2 Supported Service

QE for BLE configures profile by adding services.

Table 1.1 describes the list of services supported by QE for BLE.

Table 1.1 List of supported services

Service Name	Abbreviation	Version	Service Name	Abbreviation	Version
Alert Notification Service	AN	1.0	Automation IO Service	AIO	1.0
Battery Service	BA	1.0	Blood Pressure Service	BP	1.0
Body Composition Service	BC	1.0	Bond Management Service	BM	1.0
Continuous Glucose Monitoring Service	CGM	1.0.1	Current Time Service	CT	1.1
Cycling Power Service	CP	1.1	Cycling Speed and Cadence Service	CSC	1.0
Device Information Service	DI	1.1	Environmental Sensing Service	ES	1.0
Fitness Machine Service	FM	1.0	Glucose Service	GL	1.0
Health Thermometer Service	HT	1.0	Heart Rate Service	HR	1.0
Human Interface Device Service	HID	1.0	Immediate Alert Service	IA	1.0
Insulin Delivery Service	ID	1.0	Link Loss Service	LL	1.0.1
Location and Navigation Service	LN	1.0	Next DST Change Service	NDC	1.0
Object Transfer Service	OT	1.0	Phone Alert Status Service	PAS	1.0
Pulse Oximeter Service	PLX	1.0	Reconnection Configuration Service	RC	1.0
Reference Time Update Service	RTU	1.0	Running Speed and Cadence Service	RSC	1.0
Scan Parameters Service	SCP	1.0	Tx Power Service	TP	1.0
User Data Service	UD	1.0	Weight Scale Service	WS	1.0

2. Usage

2.1 Adding FIT Module to Your Project

This module must be added to each project in which it is used. Renesas recommends using “Smart Configurator” described in (1) or (3).

(1) Adding the FIT module to your project using “Smart Configurator” in e^2 studio. By using the “Smart Configurator” in e^2 studio, the FIT module is automatically added to your project. Refer to “Renesas e^2 studio Smart Configurator User Guide (R20AN0451)” for details.

(2) Adding the FIT module to your project using “FIT Configurator” in e^2 studio. By using the “FIT Configurator” in e^2 studio, the FIT module is automatically added to your project. Refer to “Adding Firmware Integration Technology Modules to Projects (R01AN1723)” for details.

(3) Adding the FIT module to your project using “Smart Configurator” on CS+ By using the “Smart Configurator Standalone version” in CS+, the FIT module is automatically added to your project. Refer to “Renesas e^2 studio Smart Configurator User Guide (R20AN0451)” for details.

(4) Adding the FIT module to your project in CS+ In CS+, please manually add the FIT module to your project. Refer to “Adding Firmware Integration Technology Modules to CS+ Projects (R01AN1826)” for details.

Revision History

Rev.	Date	Description	
		Page	Summary
0.90	Oct.24.19	—	First edition issued.
1.00	Nov.15.19	3	Added version information to table1.1.
		program	● Changed encode/decode function of Bluetooth specification services. ● Added profile definition of FTMP, IDS, RCP, WSP. ● Changed characteristic name of DIS.
1.10	Jan.22.21	1	Add following document to “Related Document”. ● Bluetooth Low Energy Protocol Stack Basic Package: User's Manual (R01UW0205) ● RX23W Group Bluetooth Low Energy Application Developer’s Guide (R01AN5504)
		program	Code generation function ● Supported 64-bit version of e^2 studio. Application (app_main.c) ● Supported FreeRTOS. ● Added code block function which protects user code from code regeneration. ● Added Queue setting process (R_BLE_GATTS_SetPrepareQueue) for Prepare Write Operation. ● Merged "ble_gap_cb" process to "gap_cb". ● Changed "ble_app_init" function name to "ble_init". ● Changed local device address type to static address in scan operation or connect operation. GATT database (gatt_db.c, gatt_db.h) ● Fixed Attribute Permissions macros set when service Aux Properties are set. ● Fixed 128-bit UUID descriptor to support service discovery. ● Fixed macros for "Disable", "Const", "Variable length" corresponding to Aux Properties of characteristic and descriptor. ● Fixed "Included Service" to include 128-bit UUID Service. ● Added comments which describes the structure of GATT database. Custom Profile API (r_ble_[service].c, r_ble_[service].h) ● Fixed adding descriptors function for adding CCCD as 2nd descriptor in characteristic that has multiple descriptors. ● Added client API to access characteristic which has "Write Without Response". ● Changed naming rule of structure generated to custom service. before) st_ble_[characteristic]_[Field]_t after) st_ble_[service][S or C]_[characteristic]_[Field]_t SIG standard service API (r_ble_[service].c, r_ble_[service].h) ● Fixed CCCD value access problem of BAS, CTS, ESS, HRS, GAT by adding API argument to put connection handle. ● Fixed UUID of "External Report Reference Descriptor" in HIDS. ● Added encode/decode process of "Service Changed Characteristic" in client of GATT service. ● Fixed include position of file "r_ble_rx23w_if.h".

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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