RL78/G22
GUIDE FOR ENGINEER

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EMBEDDED PROCESSING 2ND BUSINESS DIVISION
EMBEDDED PROCESSING PRODUCT GROUP
RENESAS ELECTRONICS CORPORATION

The information/materials required at the time of product development summarized and listed for each development phase. Application notes are a list of regrouped by contents.
Please use it as a guidebook when developing.

CONTENT

We summarized and listed up various information and materials required at the time of product development by each development phase.

Also, You can select what you need for your application from our rich selection of application notes that describing how to use a peripheral punction, example applications, how to create a program, and more.

Please use these information, materials and application notes as a guidebook when developing.

List of information and materials required for product development

- Step1: MCU selection
- Step2: Designing and evaluating
- Step3: Mass production

List of application notes

STEP1 MCU SELECTION

	Item	Content	Link
1	Hardware information	Datasheet	Doc
2	Products & Solutions	RL78 Family Features	Web site
3		Video	Web site
4		Blog	Web site
5		Reference designs (Winning combination)	Web site
6	Product longevity program (PLP)	Overview of product longevity program (PLP)	Web site
7		Product selection (product selector) Note: Refer to PLP column in the chart.	Web site
8	Product Specification Comparison	Introductory Guide to RL78 Microcontrollers	Web site
9		RL78 FAMILY Selection Guide	Doc

STEP2 DESIGNING AND EVALUATING (1/3)

	Item	Content	Link
Common			
1	Hardware	User's manual: Hardware	Doc
2		Hardware manual guide (Electrical Characteristic edition)	Doc
3		Technical update (errata information)	Web site
4		Product change notice (PCN)	Web site
5		Part number guide for RL78 family product (the meaning of character in part number)	Doc
6		Semiconductor reliability handbook	Doc
7		RELIABILITY REPORT	Doc
8		RoHS Product Options → Part Number →Package information → RoHS Info	Web site
9	Software information	RL78 Family User's Manual: Software	Doc
10		RL78 Software Porting Guide Porting sample code generated by Smart Configurator (CS+, e2 studio, IAR)	Doc
11	Evaluation board (for general purpose)	RL78/G22 Fast Prototyping Board (RL78/G22 FPB)	Web site
12	Solution Board	Capacitive Touch Evaluation System for RL78/G22	Web site
13	Partner information	Partner products (system solutions provider)	Web site
14		RL78 Partner Ecosystem	Web site

STEP2 DESIGNING AND EVALUATING (2/3)

	Item	Content	Link
Hardware design			
1	Board simulates	ECAD model Note: ECAD can be found by clicking on the respective part number of the product options.	Web site
2	Other	Package information (package outline information, mount manual, etc.)	Web site
3	Development environment	E1/E20/E2 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connection of RL78)	Doc
Software design			
1	Software information	Getting Started with the RL78 Family Development Environment	Web site
2		RL78 Family Development Environment — Development Tools	Web site
3		RL78 Family Development Environment — Software	Web site
4		RL78 Smart Configurator User's Guide: e² studio	Doc
5		RL78 Smart Configurator User's Guide: CS+	Doc
6		RL78 Smart Configurator User's Guide: IAREW	Doc
7	Training information	RL78 Family Software & Tool Course (Video Collection)	Web site
8	System design	RL78 Low Power MCU	Doc

STEP2 DESIGNING AND EVALUATING (3/3)

	Item	Content	Link
Solution			
1	Capacitive Touch portal page	Capacitive Touch Sensor Solutions	Web site
2	LoRa®-based Solutions	LoRa®-based Solutions for RL78 Family	Web site
3	IoT Solutions	IoT Solutions	Doc
Support			
1	Support information	FAQ (frequently asked inquiries)	Web site
2		RL78 forum (community)	Web site
3		Ask to technical support Note: Please click login in the upper right corner	Web site

STEP3 MASS PRODUCTION

	Item		Content	Link
1	Writing a program	Programmer	PG-FP6	Web site
2		Writing tool	Renesas flash programmer (GUI tool for PC)	Web site
3	Firmware update	Application note	RL78/G22,RL78/G23,RL78/G24 Firmware Update Module	Doc | Sample

RL78/G22 APPLICATION NOTE

SUPPLEMENTARY INFORMATION: PLEASE REFER TO THE APPLICATION NOTE LIST AS NECESSARY.

#	Main items	Overview
1	Basic	Hardware Design/Clock/Voltage/Memory
2	Peripheral	MCU peripheral function
3	Safety	Safety function
4	Self programming	Flash writing
5	Security / Crypto	Security/Crypto
6	SMS	SNOOZE mode sequencer
7	Connectivity	Wireless of Wi-Fi/BLE/LTE , Wired of Modbus ASCII/RTU
8	Lora	LoRa
9	Flash program	Flash programming
10	Memory Driver	Memory driver
11	File System	FAT file system
12	Sound	ADPCM
13	Firmware update	Firmware update
14	Sensor	Sensor
15	Touch	Capacitive Touch
16	Software relation	Software
17	Others	Other

RL78/G22 APPLICATION NOTE [BASIC]

Item	Title	Summary	Sample code
1	RL78 Family Board Support Package Module Using Software Integration System	The Renesas board support package SIS module (r_bsp) forms the foundation of any project that uses Software Integration System (SIS) modules.	Download
2	RL78 Family RL78 Hardware CRC Functions	Many applications need to check the integrity of a code image or data communication stream by using a CRC function to verify data errors have not occurred.	Download
3	RL78/G23 Operation State Switching)	The application note shows the register setting sequence for the switch of RL78/G23 operation state, using the Operation State Control.	Download
4	RL78/G23 CPU Clock Changing and Standby Settings	This application note describes how to change the RL78/G23's CPU clock and set it to standby (changing operation modes).	Download
5	RL78/G22 High-speed On-chip Oscillator (HOCO) Clock Frequency Correction	This application note explains how to correct the oscillation clock frequency of the high-speed on-chip oscillator (HOCO) by using the high-speed on-chip oscillator trimming register (HIOTRM) incorporated in RL78/G22.	Download
6	RL78/G23 Middle-speed On-chip Oscillator (MOCO) Clock Frequency Correction	This application note explains how to correct the oscillation clock frequency of the middle-speed on-chip oscillator (MOCO) by using the middle-speed on-chip oscillator trimming register (MIOTRM) incorporated in RL78/G23.	Download
7	RL78/G23 Low-speed On-chip Oscillator (LOCO) Clock Frequency Correction	This application note explains how to correct the oscillation clock frequency of the low-speed on-chip oscillator (LOCO) by using the low-speed on-chip oscillator trimming register (LIOTRM) incorporated in RL78/G23.	Download
8	Current Consumption Tuning Solution (E2 Emulator, e2 studio)	This application note introduces the current consumption tuning solution using the E2 emulator.	-
9	Current Consumption Tuning Solution(E2 Emulator, CS+)	This application note introduces the current consumption tuning solution using the E2 emulator.	-
10	RL78/G23 Voltage Detector	This application note describes how to use the two voltage detectors (LVD) mounted on the RL78/G23 to detect two voltage values.	Download
11	RL78/G23 Using VBAT Pin	This application note describes how to use the VBAT pin (battery backup power) of RL78/G23.	Download
12	RL78 Minimizing Power Consumption when Sensing Switch Inputs	This document describes methods to minimize power dissipation when monitoring switch inputs.	-

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RL78/G22 APPLICATION NOTE [PERIPHERAL(1/2)]

Item	Title	Summary	Sample code
1	RL78/G23 Realtime Clock	This application note shows usage examples of the fixed-cycle interrupt function and the alarm interrupt function of the realtime clock (RTC).	Download
2	RL78/G23 Transferring A/D Conversion Result Using the DTC	This application note describes how to store A/D conversion results of multiple channels in the on-chip RAM using the RL78/G23 DTC and A/D converter (hardware trigger wait mode, select mode, and sequential conversion mode).	Download
3	RL78/G22 Timer Array Unit (Interval timer)	This application note describes the interval timer function of the timer array unit (TAU).	Download
4	RL78/G22 Timer Array Unit (PWM output)	This application note describes how to use the PWM output function of the timer array unit (TAU).	Download
5	RL78/G22 Timer Array Unit (Pulse Interval Measurement:Period)	This application note describes how the timer array unit (TAU) measures the interval of the pulse.	Download
6	RL78/G22 Timer Array Unit (Pulse Interval Measurement:Width)	This application note describes how the timer array unit (TAU) measures the interval of the pulse.	Download
7	RL78/G23 32-Bit Interval Timer (8-bit counter mode)	This application note describes how to use the 32-bit interval timer channels in 8-bit counter mode.	Download
8	RL78/G14, RL78/G1C, RL78/L12, RL78/L13, RL78/L1C, RL78/G23 Group Clock Synchronous Single Master Control Software Using CSI Mode of Serial Array Unit	This application note explains clock synchronous control of a single master by using the 3-wire serial I/O communications (CSI mode) of the serial array unit (SAU) of the RL78/G14, RL78/G1C, RL78/L12, RL78/L13, RL78/L1C, RL78/G23 Group and describes how to use the sample code for this application.	Download
9	RL78/G23 Handshake-based SPI Slave Transmission/Reception	This application note describes how the serial array unit (SAU) performs slave transmission/reception by the simple SPI (CSI).	Download
10	RL78/G23 Handshake-based SPI Master Transmission/Reception	This application note describes how the serial array unit (SAU) performs master transmission/reception by the simple SPI (CSI).	Download

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RL78/G22 APPLICATION NOTE [PERIPHERAL(2/2)]

Item	Title	Summary	Sample code
11	RL78/G22 Serial Array Unit (UART Communication)	This application note explains how to use UART communication through the serial array unit (SAU). ASCII characters transmitted from the device on the opposite side are analyzed to make responses.	Download
12	RL78/G23 Serial Interface UARTA	This application note explains how to use UART communication through the serial interface (UARTA).	Download
13	RL78/G23 I2C Supporting Multiple Slave Address (Master)	This application note describes how to use the master function of the I2C bus by using the IICA serial interface. In the procedure described, you will operate four serial memory areas (256 bytes x 4) specified by different slave addresses.	Download
14	RL78/G22 A/D Converter (Software Trigger and Sequential Conversion Modes)	This application note describes how to convert an analog voltage to a digital voltage with the RL78/G22 A/D converter (supporting software trigger and sequential conversion modes).	Download
15	RL78/G22 A/D Converter (Software Trigger and Scan Conversion Modes)	This application note describes how to convert an analog voltage to a digital voltage with the RL78/G22 A/D converter (software trigger and scan mode, and sequential conversion mode).	Download

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RL78/G22 APPLICATION NOTE [SAFETY]

Item	Title	Summary	Sample code
1	RL78/G23 Safety Function (A/D Test)	This application note explains the sample code for the A/D test function, which is one of the safety functions of the RL78/G23.	Download
2	RL78/G23 Safety Function (Frequency Detection)	This application note describes the frequency detection function which is one of the safety features offered by the RL78/G23.	Download
3	RL78/G23 Safety Function (Flash Memory CRC Operation Function)	This application note explains how to use the flash memory CRC operation function, which is one of the safety functions incorporated in the RL78/G23.	Download
4	RL78/G23 Method of Setting Flash Read Protection	This application note describes the flash read protection function of the RL78/G23.	-

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RL78/G22 APPLICATION NOTE [SELF PROGRAMMING]

Item	Title	Summary	Sample code
1	RL78 Family Renesas Flash Driver RL78 Type 01 SC version (Flash Common)	This document explains Renesas Flash Driver RL78 Type 01 for the RL78/G2x group in the case of using Smart Configurator(SC).	Download
2	Renesas Flash Driver RL78 Type 01 User's Manual for RL78/G2x	Renesas Flash Driver RL78 Type 01 (hereafter called RFD RL78 Type 01) is software for reprogramming the flash memory in the RL78/G2x.	-
3	RL78 Family Renesas Flash Driver RL78 Type 01 SC version (Code Flash)	This document explains Renesas Flash Driver RL78 Type 01 for the RL78/G2x group in the case of using Smart Configurator(SC).	Download
4	RL78 Family Renesas Flash Driver RL78 Type 01 SC version (Extra Area)	This document explains Renesas Flash Driver RL78 Type 01 for the RL78/G2x group in the case of using Smart Configurator(SC).	Download
5	RL78/G23 Self-Programming Using Boot Swapping via UART communications	This manual is intended to give users an understanding of the methods for using the Renesas Flash Driver (RFD) RL78 Type 01 to reprogram the flash memory in the RL78/G2x microcontroller.	Download
6	RL78 Family Renesas Flash Driver RL78 Type 01 SC version (Data Flash)	This document explains Renesas Flash Driver RL78 Type 01 for the RL78/G2x group in the case of using Smart Configurator(SC).	Download
7	Data FLASH Converter (Data FLASH memory image generation)	The Data FLASH Converter is a windows based tool that generates a Data FLASH memory image from EEPROM emulation data and/or from a program code file that is mapped to the Data FLASH area of a Renesas microcontroller.	-
8	EEPROM Emulation Software RL78 Type 01 User's Manual for RL78/G2x	EEPROM emulation is a feature used to store data in the on-board flash memory in the same way as EEPROM. In EEPROM emulation, EEPROM Emulation Software RL78 Type 01 operates the Renesas Flash Driver (RFD) RL78 Type 01. And RFD writes and reads the data flash memory	Download

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RL78/G22 APPLICATION NOTE [SECURITY / CRYPTO]

Item	Title	Summary	Sample code
1	RL78 Family AES Library: Introduction Guide	This document explains AES Library for the RL78 Family (hereafter referred to as "AES Library") that depends on MCUs.	Download
2	RL78 Family SHA Hash Function Library: Introduction Guide	This document explains SHA Hash Function Library for the RL78 Family (hereafter referred to as "SHA Libraly") that depends on MCUs	Download
3	RL78 Family True Random Number Generator (TRNG) Software Driver	This document describes the specifications and usage of the software driver that generates random numbers using the true random number generator (TRNG) on an RL78 Family MCU.	Download
4	RL78 Family How to change devices in the sample project for the DSP Library and the Security Library	This document describes the procedures for migrating the driver and middleware sample code projects shown in the table below to other RL78 family devices	-
5	RL78/G23 Unique ID Read Driver	Each RL78/G2x chip is programmed with a unique ID. The unique ID can be used to prevent unauthorized use of software IP and is useful for managing products individually.	Download
6	RL78/G23 Third-Party Program Protection	This application note describes the third-party program protection functionality of the RL78/G23.	-

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RL78/G22 APPLICATION NOTE [SMS]

Item	Title	Summary	Sample code
1	RL78/G23 SNOOZE Mode Sequencer Application Guide	This application note describes the advantages of using the SNOOZE mode sequencer (SMS) mounted on the RL78/G23.	-
2	RL78/G23 SMS HS300x Humidity sensor control by I2C communication	This application note describes an example of controlling a humidity sensor (HS300x) with RL78/G23 to measure indoor air quality. It uses the SNOOZE mode sequencer (SMS), data transfer controller (DTC) and serial interface IICA (IICA) to control the HS300x with the I2C communication protocol during SNOOZE mode.	Download
3	RL78/G23 SMS Smoke Fire Detection Operation	This application note describes how to use the SNOOZE mode sequencer to detect fires.	Download
4	RL78/G23 SMS Fire Detection Operation	This application note describes how to use the SNOOZE mode sequencer to detect fires.	Download
5	RL78/G23 SMS LED Blinking Dimming Control	This application note describes how to control the LEDs using the SNOOZE mode sequencer and the 32-bit interval timer.	Download
6	RL78/G23 SMS Power Supply Monitoring	This application note describes how to build a power supply monitoring system using the SNOOZE mode sequencer.	Download

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RL78/G22 APPLICATION NOTE [CONNECTIVITY]

Item	Title	Summary	Sample code
1	RL78/G22 Wi-Fi Communication (Soft AP mode) with DA16200/DA16600	This application note describes the usage of the US159-DA16XXXMEVZ Wi-Fi control module, which conforms to the Software Integration System (SIS) standard.	Download
2	RL78/G22 LTE MQTT Communication	This application note explains how to perform LTE communication using RL78/G22 and RYZ024A. RYZ024A is a cellular module capable of LTE Cat M1/NB1/NB2 communication.	Download
3	RL78/G22 Modbus ASCII/RTU	This Application Note describes a sample program that combines an RL78 microcontroller with a Renesas RS-485 transceiver to enable master/slave functionality over Modbus ASCII/RTU.	Download

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RL78/G22 APPLICATION NOTE [LORA]

Item	Title	Summary	Sample code
1	LoRaWAN® Stack Reference Guide	This application note describes information to use the LoRaWAN® stack and its APIs.	-
2	LoRaWAN Stack Sample Application	This document describes a sample software to use LoRaWAN® stack. This application operates the LoRaWAN stack by user with some commands from a Host PC.	-
3	RL78/G23, RL78/G22, RL78/G14 LoRaWAN® Sensor Demo	This application note describes a LoRaWAN® sensor network solution and introduces how to visualize sensor data transmitted by the RL78/G23, RL78/G22 and RL78/G14 Sensor Node to the Cloud (AWS/Azure/Cayenne) via LoRaWAN® networks.	Download
4	RL78/G23, RL78/G22, RL78/G14 LoRa®-based Wireless Software Package	This software package includes the following sample software and tools to evaluate the LoRa and LoRaWAN based wireless communication software for RL78 devices.	Download
5	Private LoRa® Stack Reference Guide	This application note describes information to use the Private LoRa® stack and its APIs.	-
6	Private LoRa® Stack Sample Application	This document describes a sample software to use Private LoRa® stack. This application operates the Private LoRa stack by user with some commands from a Host PC	-
7	Combination of Private LoRa® and LoRaWAN® Stack Reference Guide	This application note describes information to use the combination of Private LoRa® and LoRaWAN® stack.	-
8	Radio Driver Reference Guide	This application note is an API reference guide for the Radio Driver and MCU timer driver.	-
9	Radio Driver Support Functions for Regional Radio Regulations	This application note provides the information necessary to use the radio drivers described in the Radio Driver Reference Guide in compliance with the regional radio regulations.	-
10	Radio Evaluation Program Commands Reference	This document is the AT Command Reference Manual for the Radio Evaluation Program (RadioEvalApp).	-

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RL78/G22 APPLICATION NOTE [FLASH PROGRAM]

Item	Title	Summary	Sample code
1	RL78 Microcontroller (RL78 Protocol C) Serial Programming Guide	This application note describes the specifications of the boot firmware in RL78 microcontrollers. If the firmware is used in a way that does not conform with the descriptions in this document, correct operation is not guaranteed.	-
2	RL78 Flash Programmer (RL78 Protocol A)	This application note describes how to write the program to the internal flash memory of the RL78 microcontroller that supports the RL78 Protocol A.	Download
3	RL78 Flash Programmer (RL78 Protocol B)	This application note describes how to write the program to the internal flash memory of the RL78 microcontroller that supports the RL78 Protocol B.	Download
4	RL78 Flash Programmer (RL78 Protocol C)	This application note describes how to write the program to the internal flash memory of the RL78 microcontroller that supports the RL78 Protocol C.	Download
5	Flash programmer with Raspberry Pi (RL78 Protocol C)	This application note describes a sample program for a flash programmer that writes to the flash memory of a microcontroller that supports Protocol C.	Download

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RL78/G22 APPLICATION NOTE [MEMORY DRIVER]

Item	Title	Summary	Sample code
1	RL78 Family Serial NOR Flash Memory Control Module Software Integration System	This application note describes the serial NOR flash memory control module conforming to the Software Integration System (SIS).	Download
2	RX Family, RL78 Family, 78K0R/Kx3-L Macronix International MX25/66L Family Serial NOR Flash Memory Control Software	This application note describes how to control MX25/66L serial NOR flash memory, manufactured by Macronix International Co., Ltd., using an MCU manufactured by Renesas Electronics, and it explains the usage of the sample code provided for that purpose.	Download

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RL78/G22 APPLICATION NOTE [FILE SYSTEM]

Item	Title	Summary	Sample code
1	RL78 Family Open Source FAT File System M3S-TFAT-Tiny: Introduction Guide	This document explains the usage of the Open Source FAT File System M3S-TFAT-Tiny for RL78 Family (hereafter referred to as "TFAT library") along with a sample program.	Download
2	RL78 Family SPI mode MultiMediaCard Driver: Introduction Guide	This application note describes the integration method for enabling use of the M3S-TFAT-Tiny open-source FAT file system (referred to below as the TFAT library) and SPI mode multimedia card driver (referred to below as the MMC driver) in combination.	Download
3	RL78 Family Example of Integration of SPI Mode Multimedia Card Driver into M3S-TFAT-Tiny Open-Source FAT File System	This application note describes the integration method for enabling use of the M3S-TFAT-Tiny open-source FAT file system (referred to below as the TFAT library) and SPI mode multimedia card driver (referred to below as the MMC driver) in combination.	Download

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RL78/G22 APPLICATION NOTE [SOUND]

Item	Title	Summary	Sample code
1	RL78 Family Sound Playback/Compression System (Original ADPCM Codec) M3S-S2-Tiny: Introduction Guide	This document explains M3S-S2-Tiny for the RL78 Family (hereafter referred to as "S2 library").	Download

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RL78/G22 APPLICATION NOTE [FIRMWARE UPDATE]

Item	Title	Summary	Sample code
1	RL78/G22, RL78/G23, RL78/G24 Firmware Update Module	This application note describes the firmware update module for the RL78/G22 and RL78/G23,RL78/G24. The module is referred to below as the firmware update module.	Download
2	RL78/G22 OTA Firmware Update for a Secondary MCU	This application note is for a system in which an RX65N microcontroller is used as a primary MCU that communicates with Amazon Web ServicesTM (hereafter, referred to as “AWS”) and an RL78 microcontroller is used as a secondary MCU that receives data measured by sensors.	Download

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RL78/G22 APPLICATION NOTE [SENSOR]

Item	Title	Summary	Sample code
1	RL78 Family Sensor I2C Communication Middleware Control Module Software Integration System	This application note explains sensor I2C communication middleware control module for Renesas sensors using Software Integration System (SIS).	Download
2	RL78 Family Sensor Control Modules Software Integration System	This application note explains the sensor control modules for HS300x and HS400x (Renesas high performance relative humidity and temperature sensor), FS2012, FS3000 and FS1015 (Renesas High Performance Flow Sensor Module), ZMOD4410 and ZMOD4510 (Digital Gas Sensors), OB1203 (Heart Rate, Blood Oxygen Concentration, Pulse Oximetry, Proximity, Light and Color Sensor) and I2C communication middleware for Renesas sensors using Software Integration System (SIS).	-
3	RL78 Family HS300x Sensor Control Module Software Integration System	This application note explains the sensor control module for Renesas sensor HS300x (Renesas high performance relative humidity and temperature sensor) using Software Integration System (SIS).	Download
4	RL78 Family HS400X Sensor Control Module Software Integration System	This application note explains the sensor control module for Renesas sensor HS400x (Renesas high performance relative humidity and temperature sensor) using Software Integration System (SIS).	Download
5	RL78 Family FS2012 Sensor Control Module Software Integration System	This application note explains the sensor control modules for FS2012 (Renesas High Performance Flow Sensor Module) using Software Integration System (SIS).	Download
6	RL78 Family FS3000 Sensor Control Module Software Integration System	This application note explains the sensor control module for FS3000 (Renesas air velocity sensor) sensor using Software Integration System (SIS).	Download
7	RL78 Family FS1015 Sensor Control Module Software Integration System	This application note explains the sensor control module for FS1015 (Renesas air velocity sensor) sensor using Software Integration System (SIS).	Download
8	RL78 Family OB1203 Sensor Control Module Software Integration System	This application note explains the sensor control module for OB1203 (Heart Rate, Blood Oxygen Concentration, Pulse Oximetry, Proximity, Light and Color Sensor) using Software Integration System (SIS).	Download
9	RL78 Family ZMOD4410, ZMOD4450 and ZMOD4510 Sensor Control Module Software Integration System	This application note explains the sensor control modules for ZMOD4410, ZMOD4450 and ZMOD4510 (Digital Gas Sensors) using Software Integration System (SIS)	Download
10	Sensor Software Combination Manual	This application note describes code changes required to use the multiple sensor software combinations and runs on certain MCUs of the RA family, RX family, RL78 family and RZ family	-

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RL78/G22 APPLICATION NOTE [TOUCH(1/2)]

Item	Title	Summary	Sample code
1	Capacitive Sensor Microcontrollers CTSU Capacitive Touch Introduction Guide	This application note is an introduction guide for customers who use the Capacitive Touch Sensor Unit (Capacitive Touch Sensing Unit: hereinafter referred to as CTSU) for the first time.	-
2	RL78/G22 Capacitive Touch Evaluation System Sample Code	This document describes the sample code for the RL78/G22 Capacitive Touch Evaluation System.	Download
3	Using QE and SIS to Develop Capacitive Touch Applications	This document will demonstrate the needed steps to create an application example that integrates capacitive touch sensing using Renesas RL78 Microcontrollers.	-
4	Capacitive Sensor Microcontrollers CTSU Capacitive Touch Electrode Design Guide	This application note describes how to design electrode patterns, with sample patterns for reference, for MCUs embedding the Capacitive Touch Sensing Unit (CTSU).	-
5	RL78 Family Capacitive Touch Low Power Application Development using SMS	This application note describes the procedure required to create a capacitive touch low power application using the RL78 SNOOZE mode sequencer (SMS). Automatic judgment measurement using the SMS can be used to achieve low power touch applications.	-
6	RL78/G22 Capacitive Touch Low Power Guide (SMS / MEC function)	This application note describes how to use SNOOZE Mode Sequencer (SMS) and Multiple Electrode Connection (MEC) function to achieve low power consumption when measuring capacitance touch.	Download
7	Using the standalone version of QE to Develop Capacitive Touch	This application note explains the steps to create an application example that uses capacitive touch sensing using Renesas RL78 Microcontrollers.	-
8	RL78 Family Using QE (standalone ver.) to Develop Touch Applications for FPB board	This application note explains the steps to create an application example that uses capacitive touch sensing using the RL78/G22 FPB (Fast Prototyping Board) (product name: RTK7RLG220C00000BJ) with mounted touch electrodes.	Download
9	Capacitive Touch Sensing Unit (CTSU2L) Operation Explanation	This application note explains Capacitive Touch Sensing Unit (CTSU2L).The number of output channels of the capacitive sensing unit depends on the produc	-
10	RL78 Family TOUCH Module Software Integration System	This application note describes the RL78 Family TOUCH Module.	Download

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RL78/G22 APPLICATION NOTE [TOUCH(2/2)]

Item	Title	Summary	Sample code
11	RL78 Family CTSU Module Software Integration System	This application note describes the CTSU Module.	Download
12	Capacitive Sensor MCU QE for Capacitive Touch Advanced Mode Parameter Guide	QE for Capacitive Touch is a tool that generates tuning data which is used by Renesas MCU which have the CTSU peripheral (Capacitive Touch Sensing Unit).	-
13	Capacitive Sensor MCU Capacitive Touch Noise Immunity Guide	The Renesas Capacitive Touch Sensor Unit (CTSU) can be susceptible to noise in its surrounding environment because it can detect minute changes in capacitance, generated by unwanted spurious electrical signals (noise).	-
14	CTSU Self Test Software	This application note explains the Functional safety solution for capacitive touch of Renesas Electronics.	-
15	RL78/G23 Group Touchless Button Demo Solution Sample Software	This application note describes touchless button demo solution (RTK0EG0036D01001BJ) Software specification using a sample application of self-capacitance method based on Capacitive Touch Sensor Unit2L (CTSU2L), the hardware that detects the contact or approach of human by measuring capacitance generated between touch electrodes and the human body.	Download
16	Capacitive Sensor Microcontrollers Touchless Button Electrode Board	This application note describes how to use the hardware of the Touchless button electrode board.	-
17	RL78 Family RL78/G22 Sample S/W for home appliance panel UI demo using MEC function	This application note introduces PoC for the home appliance panel UI demo set using CTSU2La on RL78/G22 with touch buttons and MEC (Multiple Electrode Connection) function (hereinafter RL78/G22 PoC).	

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RL78/G22 APPLICATION NOTE [SOFTWARE RELATION]

Item	Title	Summary	Sample code
1	RL78 Software Porting Guide Porting sample code generated by Smart Configurator (CS+, e2 studio, IAR)	This application note describes how to port a software generated by RL78 Smart Configurator to another RL78. As an example, this application note explains the procedure to port the RL78/G23 sample code to the RL78/G15 sample code.	-
2	RL78 Software Porting Guide RL78/G13 sample code porting (CC-RL) (CS+, e2 studio)	This application note describes how to port the RL78/G13 peripheral sample code to another RL78.	-
3	RL78 Software Migration Guide Source Code Migration from Assembly Language to C Language CC-RL	This application note describes how to migrate the program in the assembly language for the CS+, which is the integrated development environment (IDE), to the inline assembler functions in the C language.	-
4	RL78 Software Migration Guide Migrating from CA78K0R to CC-RL (CS+)	This application note describes how to replace the source codes created by the CA78K0R C compiler for the integrated development environment CS+ with the source codes supported by the CC-RL C compiler for the integrated development environment CS+.	-
5	RL78 Debugging Functions Using the Serial Port	This application note describes how to use the RL78 debugging functions using the serial port.	-
6	RL78 Family C compiler CC-RL Programming Techniques	This application note describes how to reduce the code size, increase the execution speed, and programming techniques to avoid bugs when using the C compiler CC-RL.	-
7	RL78 Family C Compiler Package (CC-RL) Application Guide: Programming Techniques	This application note describes methods of programming for efficiency in terms of code size, speed of execution, and ROM size.	-
8	IAR Embedded Workbench for RL78 Programming Techniques	This application note describes how to reduce the code size, increase the execution speed, and programming techniques to avoid bugs when using IAR Embedded Workbench for RL78.	-
9	Integrated Development Environment e² studio How to use IAR Systems compiler in e² studio	This document describes the procedure for using the IAR Systems compiler on the e2 studio.	-

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RL78/G22 APPLICATION NOTE [OTHERS]

Item	Title	Summary	Sample code
1	RL78 Family Notes and Countermeasures Against Noise	This document describes notes and countermeasures against noise for the RL78 Family.	-
2	RL78 Family FFT Library: Deployment Guide	This document provides information for deploying FFT Library. Fast Fourier transform (FFT) is an algorithm that executes the discrete Fourier transform at high speed.	Download
3	RL78 Family RL78 Digital Signal Controller Library - Filter	This document presents the specifications for a Digital Signal Controller(DSC) Library function library for the Renesas RL78 which includes generic specifications, detailed specifications for filter algorithm kernels and guidelines for the DSC Library API.	Download
4	Application execution from RAM	A lot of applications require the code execution from RAM like for example due to safety reasons or e.g. in case of bootloader for flash self-programming. This document will help you to set-up the projects based on the IAR environment.	-

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