RL78/G15,G16 INTRODUCTION

Date 26.June.2023 Rev. 1.31

MCU product marketing Department
MCU Device Solution Division
Embedded Processing, Digital Power and
Signal Chain Solutions Group
RENESAS ELECTRONICS CORPORATION

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AGENDA

- RL78 Concept
- RL78 Family Roadmap
- RL78/G15, G16 Specifications
- RL78/G15, G16 Features
- RL78/G16 Touch Solution
- Development Environment
- Use Case
- Appendix

RL78 CONCEPT

LOW POWER CONSUMPTION & INTELLIGENT FEATURES MEET A WIDE RANGE OF MARKET NEEDS

RL78 Family features

Low Power

W/W No.1 Low Power
- ULPMark®-Peripheral Profile: 125
- Operation Current: Min 37.5 µA/MHz

High Performance

Excellent CPU Performance
- CoreMark®: 28.49 CoreMark at 32MHz
- Drystone: 1.6DMIPS/MHz

Cost Reduction

Reduce system cost
- High precision internal oscillator, Temperature sensor, LVD、PO
- Data flash, extensive lineup

ULPMark®-Peripheral Profile

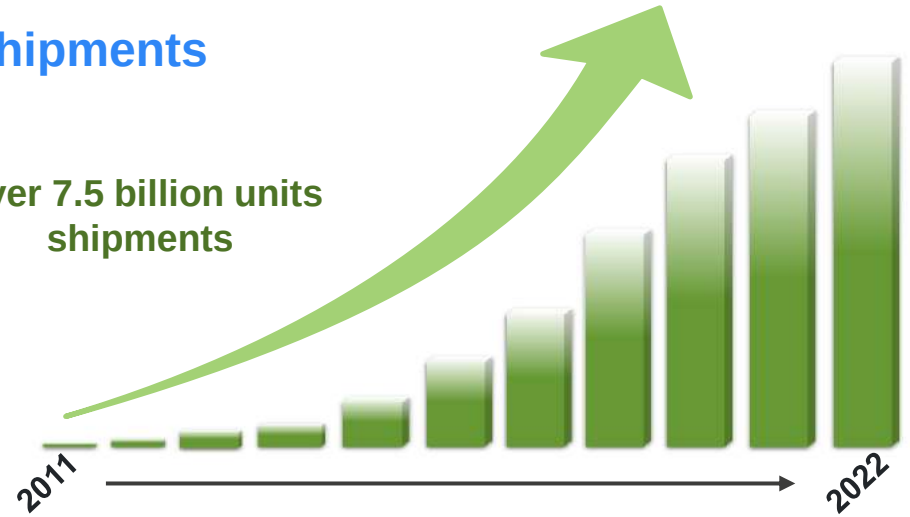
: benchmark for measuring the energy efficiency of MCU peripherals

*as of Apr. 2023

Hardware	Vendor Score	Cert.	Periph. Profile (3.0 V)↓	No.1
Renesas Electronics R7F102GGE	✓		150	RL78/G22
Renesas Electronics R7F100GLG	✓	✓	125	RL78/G23
Renesas Electronics R5F117GC	✓	✓	122	RL78/I1D

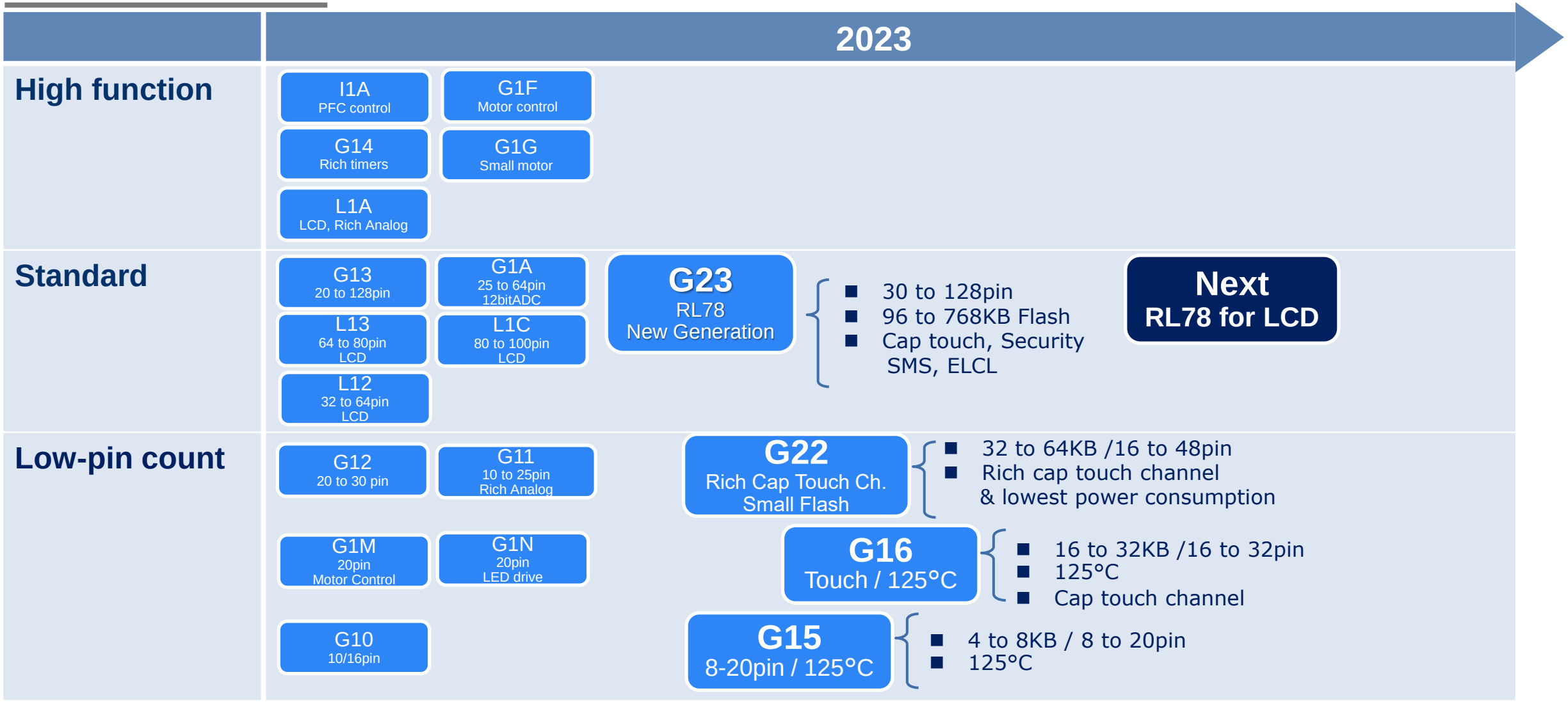
Shipments

Over 7.5 billion units shipments



PRODUCT ROADMAP - RL78 -

MP | Under planning



RL78/G15, G16 SPECIFICATIONS

RL78/G15, G16
SUMMARY

G15	
Pin	8 pin ~ 20 pin
ROM	4KB / 8KB

G16	
Pin	10 pin ~ 32 pin
ROM	16KB / 32KB

Standard general purpose MCU

8pin - Extensive small packages lineup

- 8-pin to 32-pin, 8 packages
- Minimum 3mmx3mm PKG
- All I/Os except power and GND can be used for I/O.

Operating ambient temperature Max125°C

- Three product groups are available for different applications.
  A-version: -40°C ~ 85°C
  G-version: -40°C ~ 105°C
  M-version: -40°C ~ 125°C

Extensive peripheral functions

- Cap. Touch Function (RL78/G16)
- Safety Function(RL78/G16)
- High precision HOCO ±1%
- Comparator2ch
- Debugging at 3.3V, 5V
- Self-programming & Data Flash

MEMORY/PIN LINE-UP PLAN

ENHANCE LOW-PIN-COUNT FOR THE 8-BIT MCU MARKET

- ✓ **Expand 8-pin small packages and SSOP packages**
- ✓ **RL78/G15 has compatible pin functions with RL78/G10 (10pin, 16pin) and RL78/G12 (20pin)**
- ✓ **RL78/G16 has compatible pin functions with RL78/G12(20pin)**

  * Only 3-pin:ANI, 16-pin:TOOLTxD, 15-pin:TOOLRxD are different from G12 (20-pin)

RAM / Data Flash [KB] [KB]

: RL78/G22 Lineup

: RL78/G12 Lineup

: RL78/G10 Lineup

Code Flash \ Pin	8	10	16	16	20	24	32
32 KB		2 / 1	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1
16 KB		2 / 1	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1
8 KB	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1		RL78/G16
4 KB	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1		
2 KB					RL78/G15		
1 KB							
Package	WDFN (3mmx3mm) 	LSSOP (4.4mmx3.6mm) 	SSOP (4.4mmx5mm) 	HWQFN (3mmx3mm) 	LSSOP (4.4mmx6.5mm) 	HWQFN (4mmx4mm)	LQFP (7mmx7mm) HWQFN (5mmx5mm)

G15 RENESAS RL78/G15 MCU

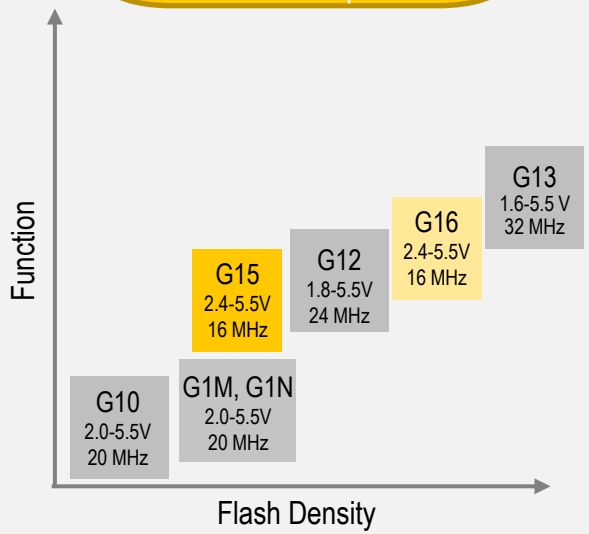
8-pin to 20-pin, 4/8KB

Comparison with RL78/G12

Change point

Technology

General Purpose



- Operating temperature range: -40 to 125 degree C
- **Strong points:**
  - Extensive lineup of small packages
  - Wide range operating temperature range (-40～125°C)
  - Extensive peripheral functions (High-Speed OCO, Comparator. Serial I/F)

16-MHz RL78-S2 CPU Core — RL78/G15 — 20pin

Memory

- Code Flash (4 KB / 8 KB)
- SRAM (1 KB)
- 2.4 to 5.5 V Flash Writing
- Memory Mirror Function
- Data Flash (1 KB)

Analog

- 10-bit A/D Converter (11 ch.)
- Internal Reference Voltage(0.815V)
- Comparator (2 ch.)

Timing & Control

- Timer Array Unit 16-Bit, 8 ch.
- Interval Timer 12-Bit, 1 ch.
- Watchdog Timer (WDT)

Human Machine Interface (HMI)

- ~~Key Interrupt Function~~
- Buzzer output controller

Connectivity

- CSI x2 / UART / Simple I2C x2
- I2C (Multi-master)

System & Power Management

- Interrupt Controller (4 Levels)
- High-Speed OCO 16 MHz ±1%(*1)
- Low-Speed OCO 15 kHz
- External Clock Controller(12MHz)
- Selectable Power-on Reset (SPOR) (4 Levels)
- On-chip Debug (Single-wire, double-wire)(2.4V to 5.5V)
- ~~DMA controller~~

Safety

- ~~A/D test~~
- ~~CRC Calculator~~
- ~~RAM parity error detection~~
- ~~Frequency detection~~
- ~~Invalid memory access detection~~

Security & Encryption

Packages

- DFN: 8-pin
- SSOP: 10,16,20-pin
- HWQFN :16-pin
- General purpose I/O up to 18 I/Os

*1)
A-ver : ±2.0%(-40 to 85°C)
G/M-ver : ±1.0%(-20 to 85°C)
±1.5%(-40 to -20°C)
±1.5%(85 to 125°C)

G16 RENESAS RL78/G16 MCU

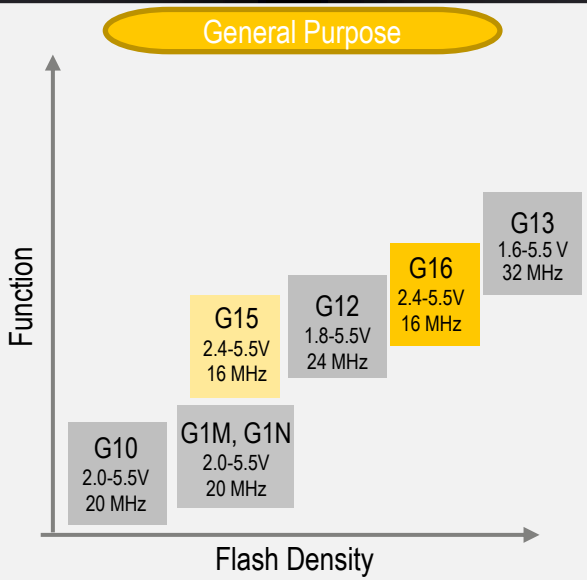
10-pin to 32-pin, 16/32KB

Comparison with RL78/G13

Change point

Technology

General Purpose



- Operating temperature range: -40 to 125 degree C
- **Strong points:**
  - Extensive lineup of small packages
  - Wide range operating temperature range (-40～125°C)
  - Extensive peripheral functions (Cap.Touch, High-Speed OCO, Comparator, Serial I/F)

16-MHz RL78-S2 CPU Core | **RL78/G16** | 32pin

Memory

- Code Flash (16 KB / 32 KB)
- SRAM (Parity) (2 KB)
- 2.4 to 5.5 V Flash Writing
- Memory Mirror Function
- ~~Boot swap~~
- Data Flash (1 KB)

Analog

- 10-bit A/D Converter (11 ch.)
- Internal Reference Voltage (0.815V)
- Temperature Sensor
- Comparator (2 ch.)

Timing & Control

- Timer Array Unit 16-bit, 8 ch.
- Interval Timer 12-bit, 1 ch.
- Watchdog Timer (WDT)
- Reset-less Real-time clock (RTC) Calendar function

Human Machine Interface (HMI)

- ~~Key Interrupt Function~~
- Buzzer output controller
- Capacitive touch sensor (CTSUb)

Connectivity

- I²C (Multi-master) x1
- CSI x1 / UART / Simple I²C x1
- CSI x1 / UART / Simple I²C x1
- CSI x1 / UART~~(LIN-bus)~~ / Simple I²C x1

System & Power Management

- Interrupt Controller (4 Levels)
- High-Speed OCO 16 MHz ±1%(*1)
- Low-Speed OCO 15 kHz
- External Clock Controller (12MHz/32.768kHz)
- Selectable Power-on Reset (SPOR)
- ~~MUL/DIV/MAC~~
- On-chip Debug (2.4V to 5.5V) (Single-wire, double-wire)

Safety

- A/D test
- CRC Calculator
- RAM parity error detection
- Frequency detection
- Invalid memory access detection

Security & Encryption

Packages

- LQFP: 32-pin
- SSOP: 10,16,20-pin
- HWQFN :16,24,32-pin
- General purpose I/O up to 30 I/Os

*1)
A-ver : ±2.0%(-40 to 85°C)
G/M-ver : ±1.0%(-20 to 85°C)
±1.5%(-40 to -20°C)
±1.5%(85 to 125°C)

RL78/G15, G16 FEATURES

HIGH-SPEED ON-CHIP OSCILLATOR WITH HIGH ACCURACY (HOCO)

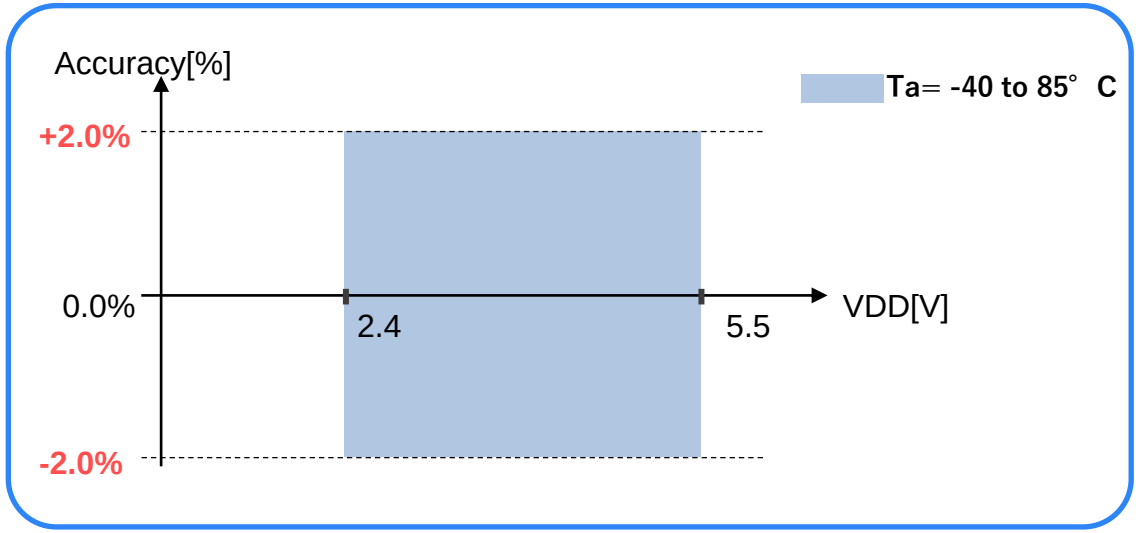
HOCO accuracy of ±2% or less

G15
G16

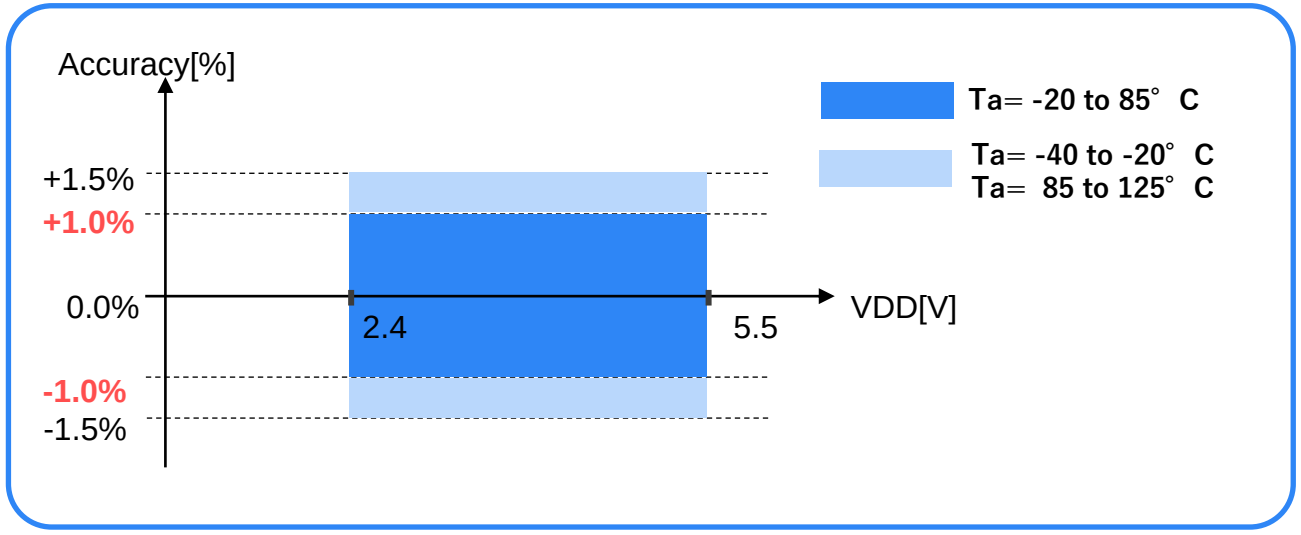
Three lineups are available according to operating temperature range and high-speed on-chip oscillator accuracy

- **A-version**(-40 to 85°C, Consumer application) ; HOCO accuracy of ±2% over all temperature and voltage ranges
- **G-version**(-40 to 105°C, Industrial applications) ; HOCO accuracy of ±1% at -20 to 85°C
- **M-version** (-40 to 125°C, Industrial applications) ; HOCO accuracy of ±1% at -20 to 85°C

A-version



G-version, M-version



PIN FUNCTIONS FOR EXPANDABILITY AND COMPATIBILITY

G15
G16

Many Function Options

- ✓ Many ADC channel placements (Placed on 11 pins of the 18 pins)
- ✓ Serial functions can be repositioned in a variety of ways (Placed on 13 of the 18 pins).
- ✓ Many alternate functions are provided on the RESET pin. (Input port, INTP, Comparator output, Serial data input)

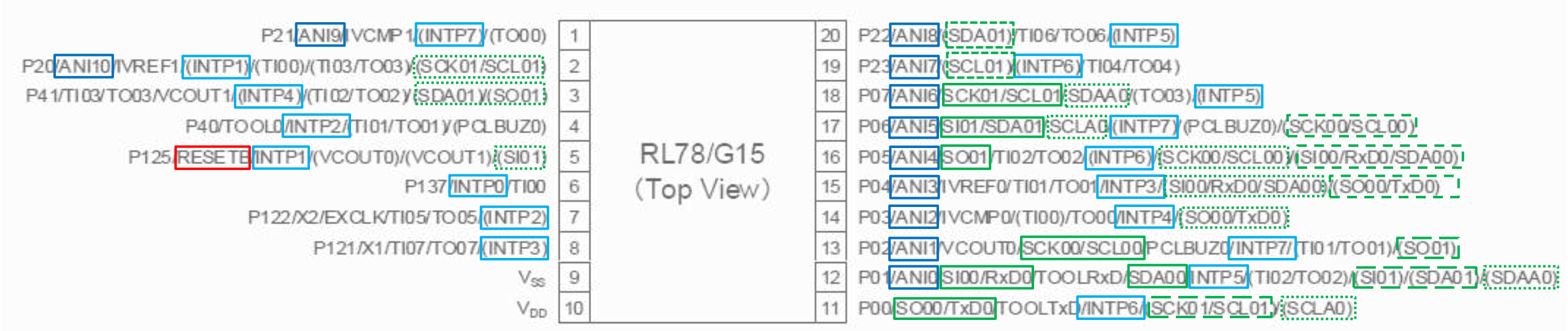
All pins except Power/GND can be used as pin functions.

- ✓ No need for internal power supply capacitors (no REGC pin)
- ✓ INTP function with good response is arranged on all pins except VDD/VSS.

Pin-compatible with existing products

- ✓ RL78/G15 has compatible with RL78/G10 (10pin, 16pin) and RL78/G12 (20pin) in terms of pin functions. *

* Only 3-pin:ANI, 16-pin:TOOLTxD, 15-pin:TOOLRxD are different from G12 (20-pin)



Examples : RL78/G15 20-pin

RL78/G16 TOUCH SOLUTION

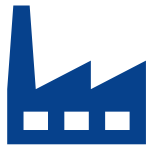
Capacitive Touch Sensor

Touch Function By Detecting Capacitance For Switch, Touch Sensor

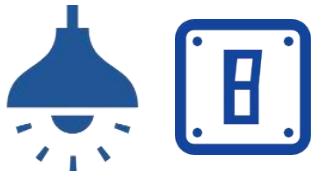
	Capacitive Touch Button		Mechanical Bottom	
BOM Cost	○	All you need is just an electrode (PCB pattern)	△	Higher cost
Durability	○	No physical wear/fatigue, higher tolerance	△	High failure rate
Dust and Water	○	Electrode in the device, no need to deal with dust/dirt and water drops	△	Need the measurements against dust/dirt and water drops
Maintenance	○	Easy to clean on the flat surface	△	Dirt due to unevenness
Design	○	Stealth touch panel in combination with LED	△	Low flexibility

Home

Industry



Lighting Switch



Door lock

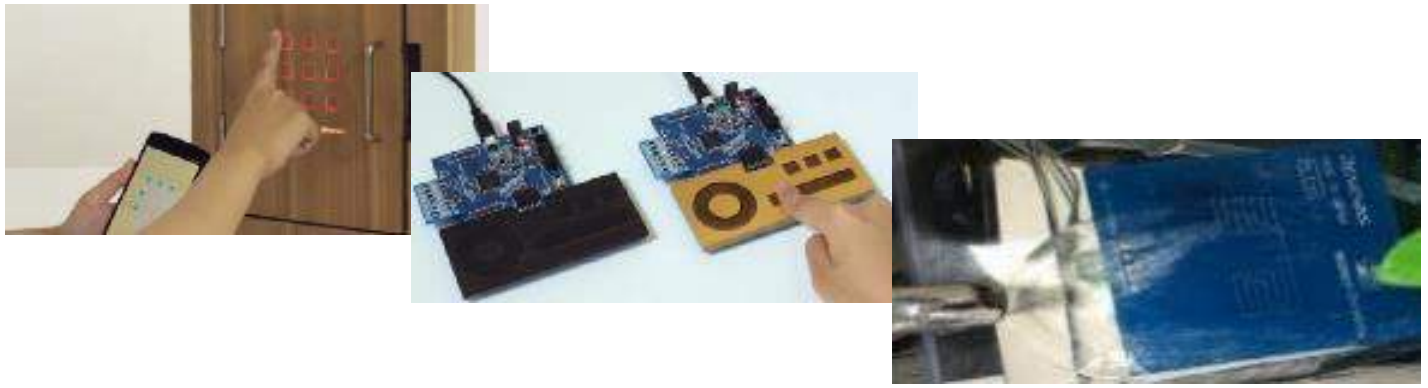
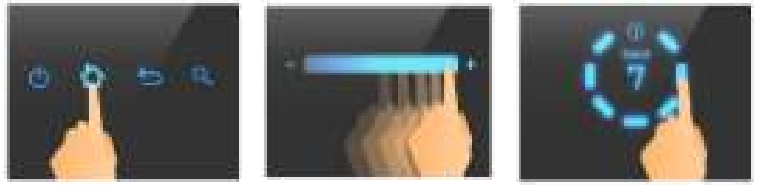
Touch sensors will be more popular in the future

CAPACITIVE SENSING UNIT (CTSUb)

Features of Renesas touch key

*1 Immunity test against radiation of electromagnetic field

G16

Feature	Applications
By measurement method with current-frequency conversion **High-sensitivity sensing**	Sensing with **“10mm thick acrylic”** or **“Wood”** in between is also possible This makes it easier to improve product design and waterproof design 
Certified IEC 61000 4-3*1 level3 **High noise tolerance**	
By Self-capacitance measurement mode **Basic touch operation**	Basic Touch such as **“Key/slider/wheel”** and **“Simple Proximity Sensor”** 
By Mutual capacitance measurement mode **High-precision sensing**	**“Touchless Button”**, **“Proximity Sensor”**, and **“Material detection (liquid level detection, etc.)”**  Sensing OK

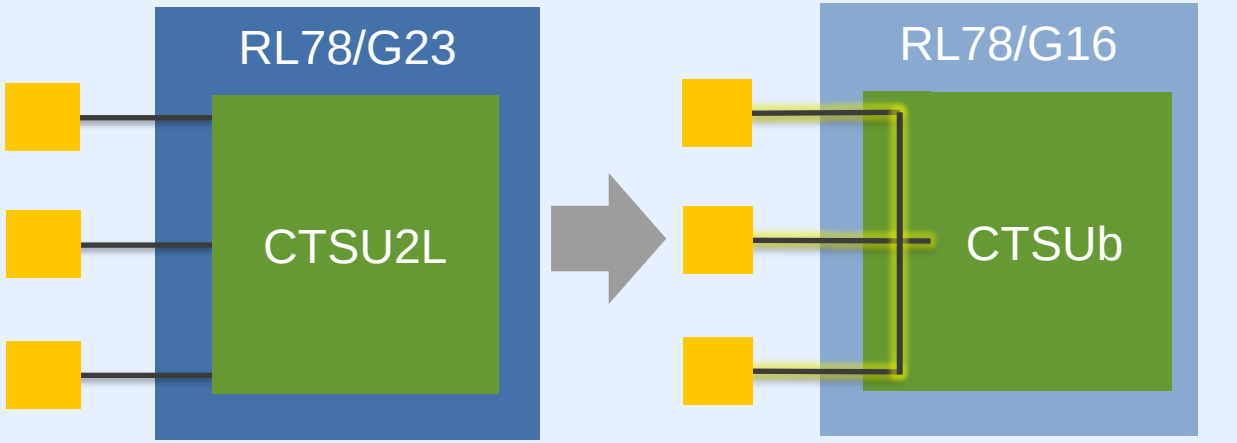
New Function

MULTIPLE ELECTRODE CONNECTION (MEC)

G16

- ✓ Reduces power consumption as touch channel measurements are completed in a single scan
- ✓ CPU is recovered from standby by touch

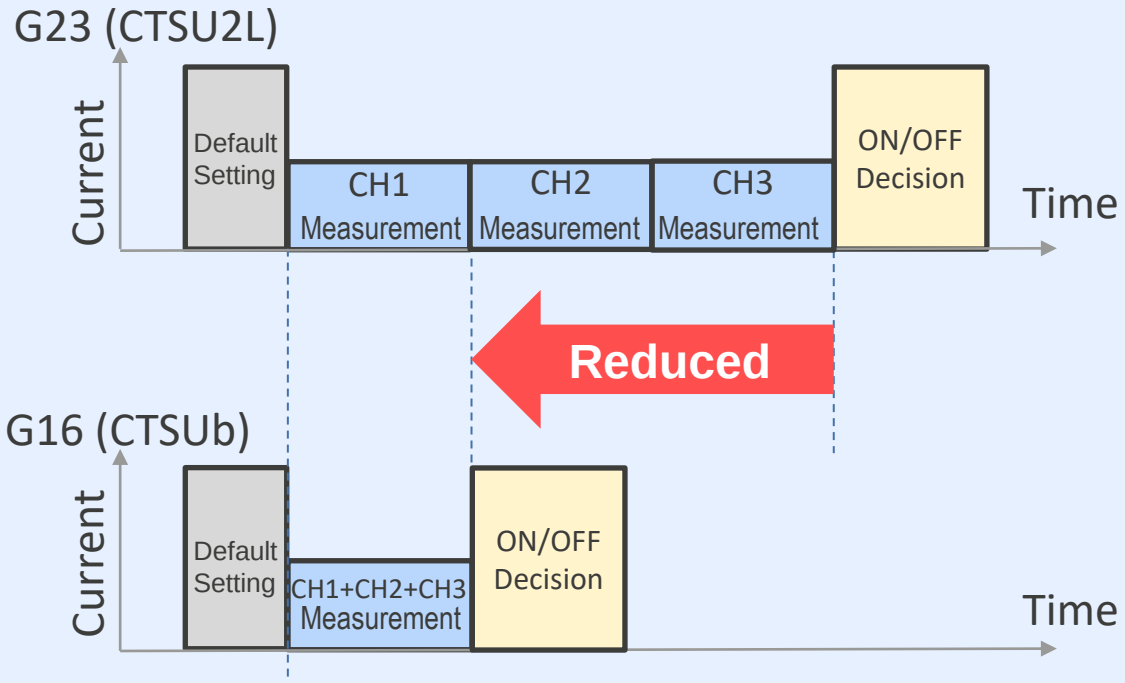
◆ Multiple electrodes connected as one electrode



Detects touches in order on each channel , one at a time

Connect all channels, detects touch as a single channel

◆ To reduce measurement time



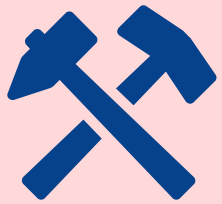
EASY EVEN FOR BEGINNERS!

TOUCH DEVELOPMENT ENVIRONMENT

G16

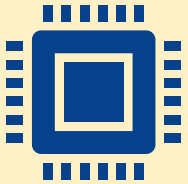
✓ Renesas offers all the tools, boards, and documentation you need for touch development and evaluation

1. Development Support Tools



- Easy setup with GUI
- Automatic Code Generation
- Automatic Tuning & Monitoring

2. Evaluation board



- Evaluated immediately after purchase
- Ideal for prototype development
- 3 types* of touch keys can be evaluated
  *Button, Wheel, Slider

3. Useful Info

- Documents
- Sample Codes
- Videos

1. DEVELOPMENT SUPPORT TOOLS

Smart Configurator & QE for Capacitive Touch

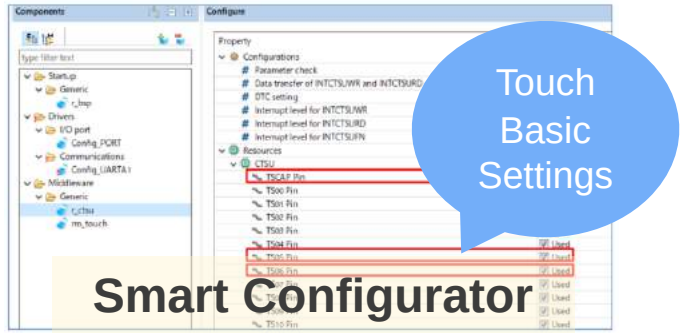
G16

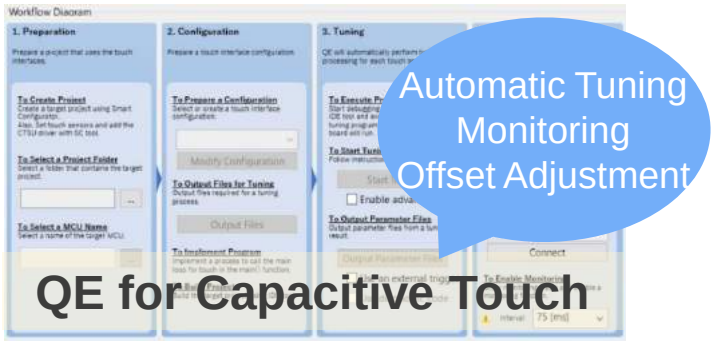
Web Site

QE for Capacitive touch

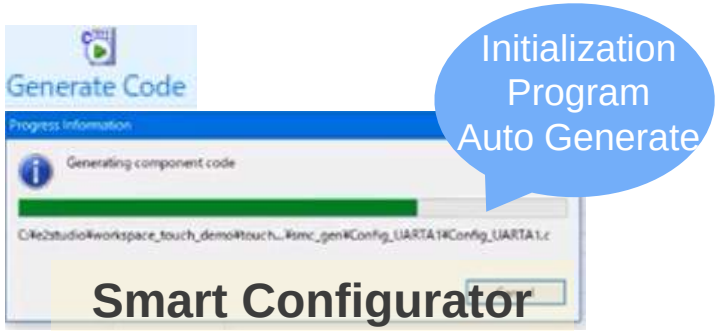
- ✓ Simply follow the guide and perform simple GUI operations.
- ✓ Automatic generation of necessary code and files
- ✓ Automatic tuning and monitoring of touch sensor sensitivity

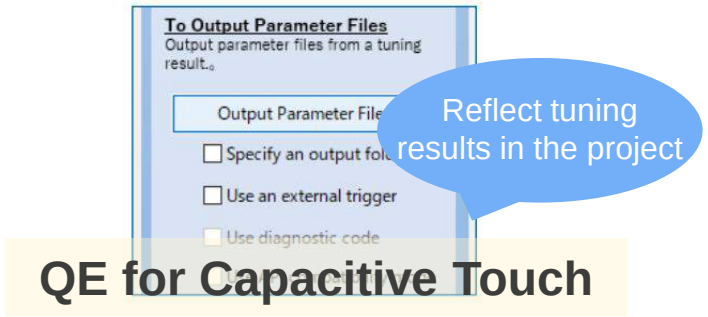
Easy setup with GUI





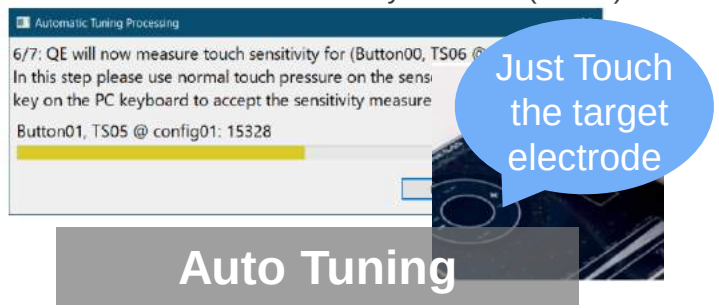
Automatic Code Generation

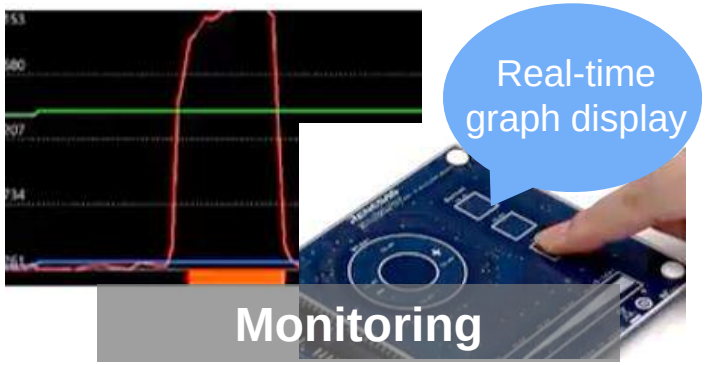




Automatic Tuning* Monitoring*

*Execute only via serial (UART)

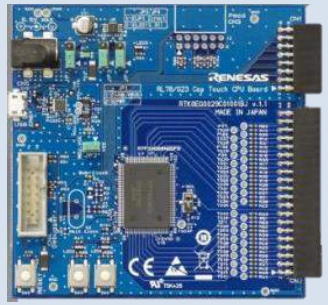




2. EVALUATION BOARD
CAPACITIVE TOUCH EVALUATION SYSTEM

G16

- ✓ Evaluation kit boards are available to help customers develop touch boards
- ✓ Evaluation can begin immediately after getting the kit



CPU Board

RL78/G16

Application Board

Evaluation Items

- Switch
- Slider
- Wheel

Evaluation Board Details

Capacitive Touch Evaluation System for RL78/G16

Development Steps

Develop using e² studio

Develop using CS+

Sample code of evaluation board

Code

Document

3. USEFUL INFO

FULL SUPPORT CONTENTS FROM DESIGN TO MASS PRODUCTION

Code | Video | Document | Web Site

G16

Development Steps

Develop using e² studio

Develop using CS+

Sample Codes

Code

Document

Development Support Tools

QE for Capacitive Touch

Web Site | Overview | Tutorial | Tuning | Monitoring

Core Technology

RL78 Family TOUCH Module

RL78 Family CTSU Module

Hardware

Capacitive Touch Electrode Design Guide

DEVELOPMENT ENVIRONMENT

DEVELOPMENT TOOL

Allows for rapid evaluation and development

G15
G16

Explore

[Web Simulator]

Evaluate

[Evaluation Board]
Fast Prototyping Board

[Solution Kits]
Renesas Solution Starter Kit
for Capacitive sensor
※Only RL78/G16

Develop

E2 Lite/E2

or

USB to UART Bridge

[Debugger & Programmer]
Debugging by
E2 Lite/E2 or
USB to UART Bridge

Manufacture

or

USB to UART Bridge

[Programmer]
Programming by PG-FP6 or
USB to Serial IC

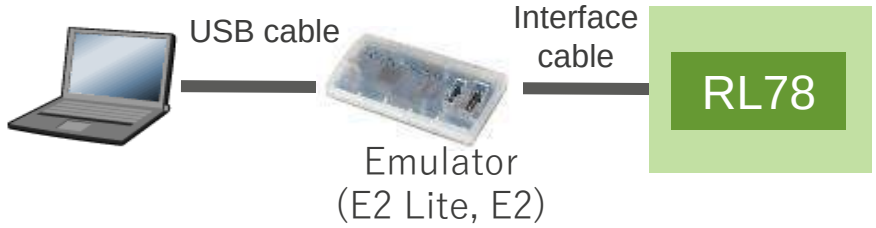
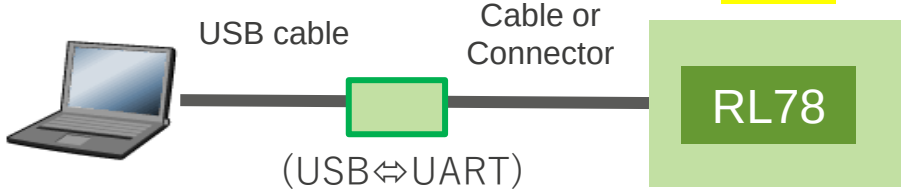
Software Tool

Compiler	RENESAS CC-RL	LLVM COMPILER INFRASTRUCTURE LLVM/Clang	IAR SYSTEMS	
IDE	CS+	e²studio	IAR SYSTEMS	ARDUINO
Development Support Tool	Smart Configurator	QE for Capacitive Touch *Only RL78/G16		

DEBUGGING ENVIRONMENT

Supports an inexpensive debugging environment without emulator

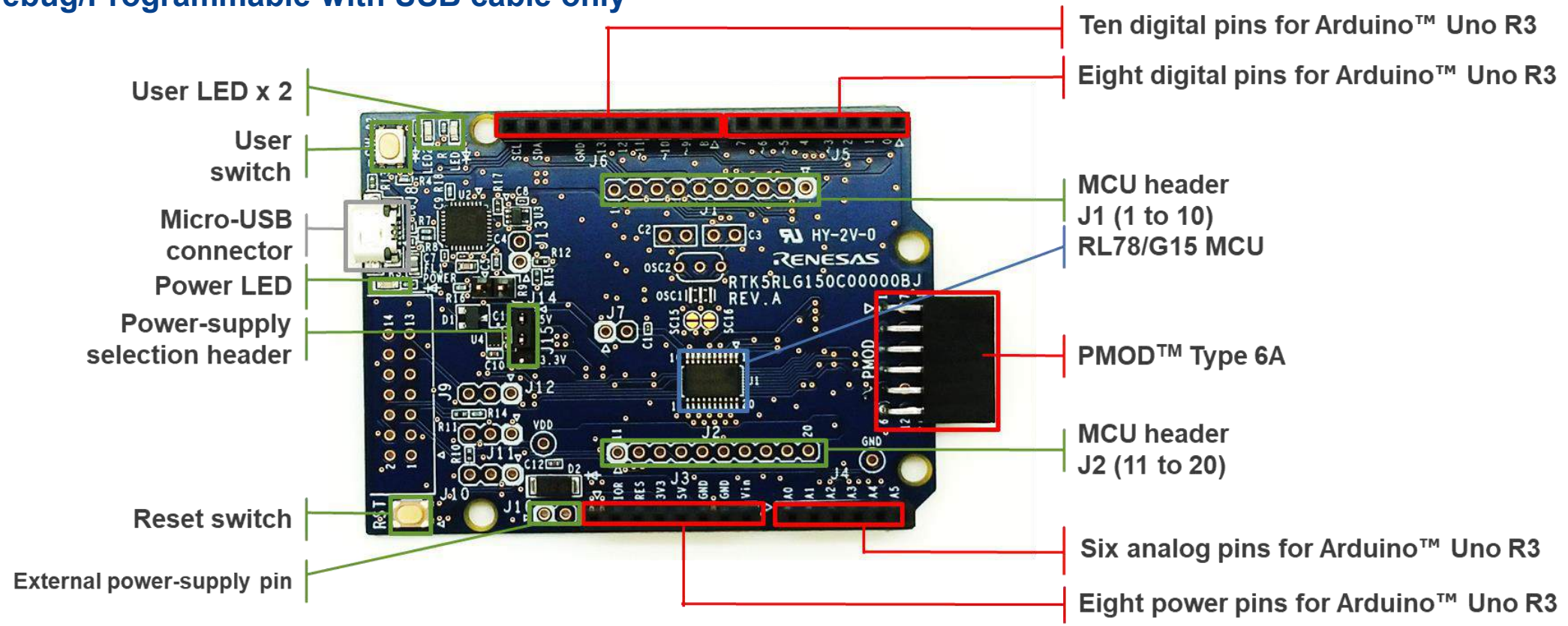
G15
G16

	Using Emulator	Using by USB to Serial IC
		New! 
Products	All RL78 products	RL78/G23, G24, G22, G15, G16
Debugging function	・Break function (hardware break, software break, forced break) ・Memory reference/change during program execution ・Pin reset mask	・Break function (hardware break, software break, forced break) ・Memory reference/change during program execution
Pin used	1 pin (TOOL0)	3 pins (TOOL0, TOOLTxD, TOOLRxD)
Cost	Tens of $	Several $
Comments	Full-scale development is possible with just one pin by using an on-chip debug emulator	USB to Serial bridge convertor IC enables **debugging without an emulator**

RL78/G15 EVALUATION BOARD

RL78/G15 Fast Prototyping Board (RTK5RLG150C00000BJ)

- ✓ Built-in Arduino Uno interface, Pmod™ Type 6A interface
- ✓ Provides access to all MCU pins
- ✓ Debug/Programmable with USB cable only



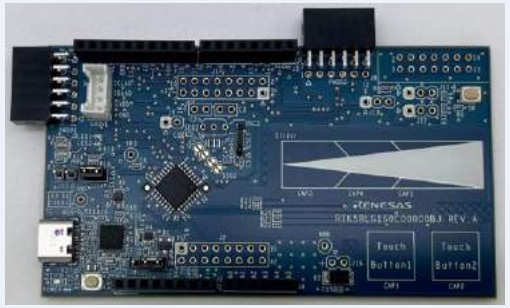
RL78/G16 EVALUATION BOARDS

G16

FPB (Fast Prototyping Board)

RL78/G16 Fast Prototyping Board

*Part Number: RTK5RLG160C00000BJ
*MCU: RL78/G16 32pin/32KB LQFP

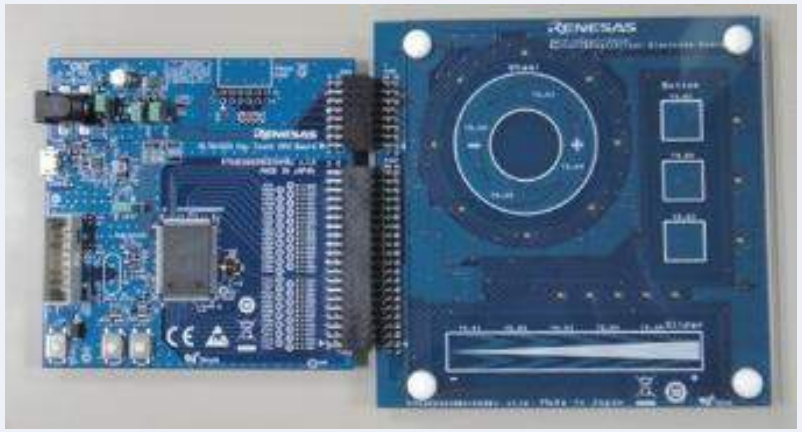


•Built-in Arduino Uno interface, Pmod™ interface (Type 6A, Type 2A), Grove interface (I2C)
•Provides access to all MCU pins
•Built-in Capacitive touch button 2ch /slider
•Debug/Programmable with USB cable only

RSSK (Renesas Solution Starter Kit)

RL78G16 Cap Touch Evaluation System

*Part Number: RTK0EG0047S01001BJ
*MCU: RL78/G16 32pin/32KB LQFP



・Evaluation of various touch keys (buttons, sliders, wheels)
・Easily adjust sensitivity using QE for Capacitive Touch

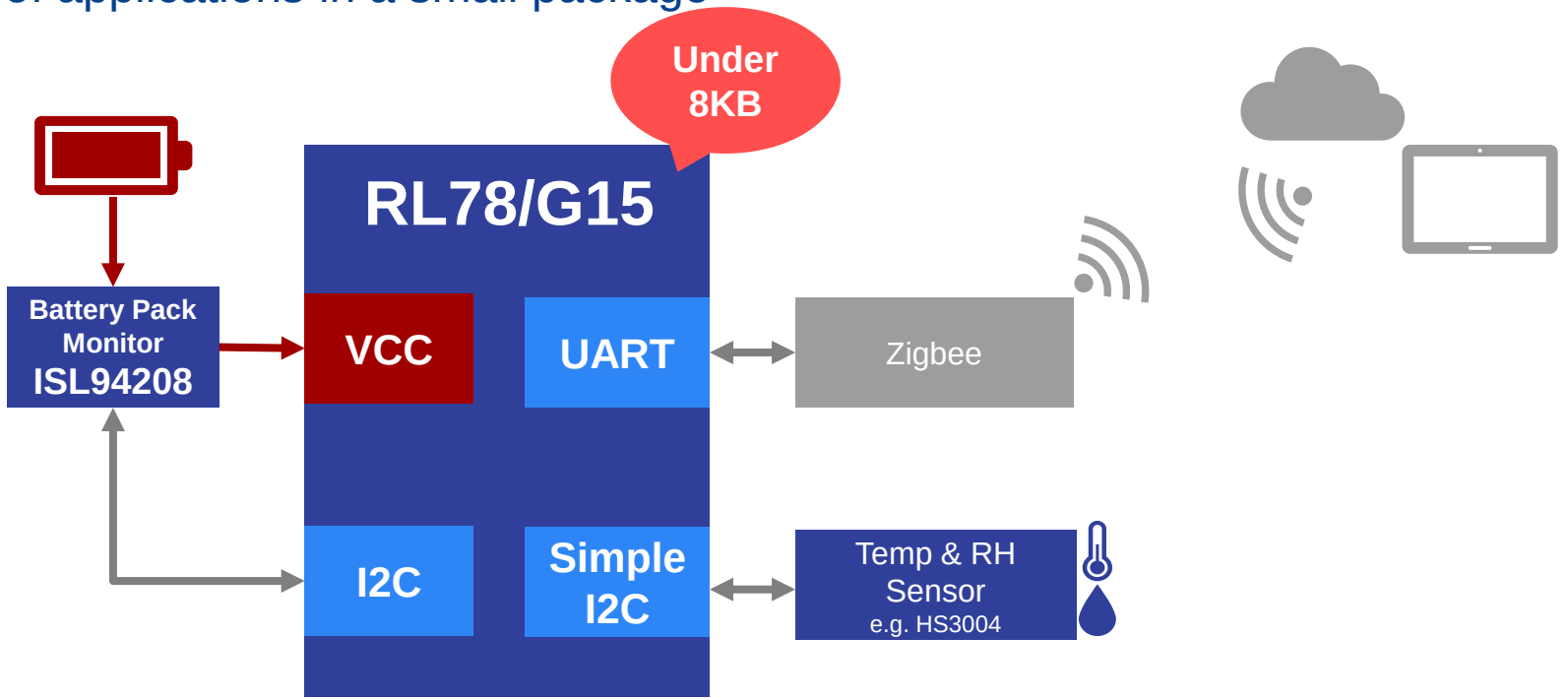
USE CASE

USE CASE : Monitoring System for Temperature/Humidity

G15

✓ IoT applications with Small Pin/ Small Memory MCU

- RL78/G15 Compact MCU with up to 8KB/1KB ROM/RAM and MAX 125°C operating ambient temperature
- ISL94208 Analog front-end IC for Li-ion battery management designed for MCU
- HS300x High accuracy, Fast measurement response, Relative humidity and temperature sensor suitable for a wide range of applications in a small package



Winning Combo

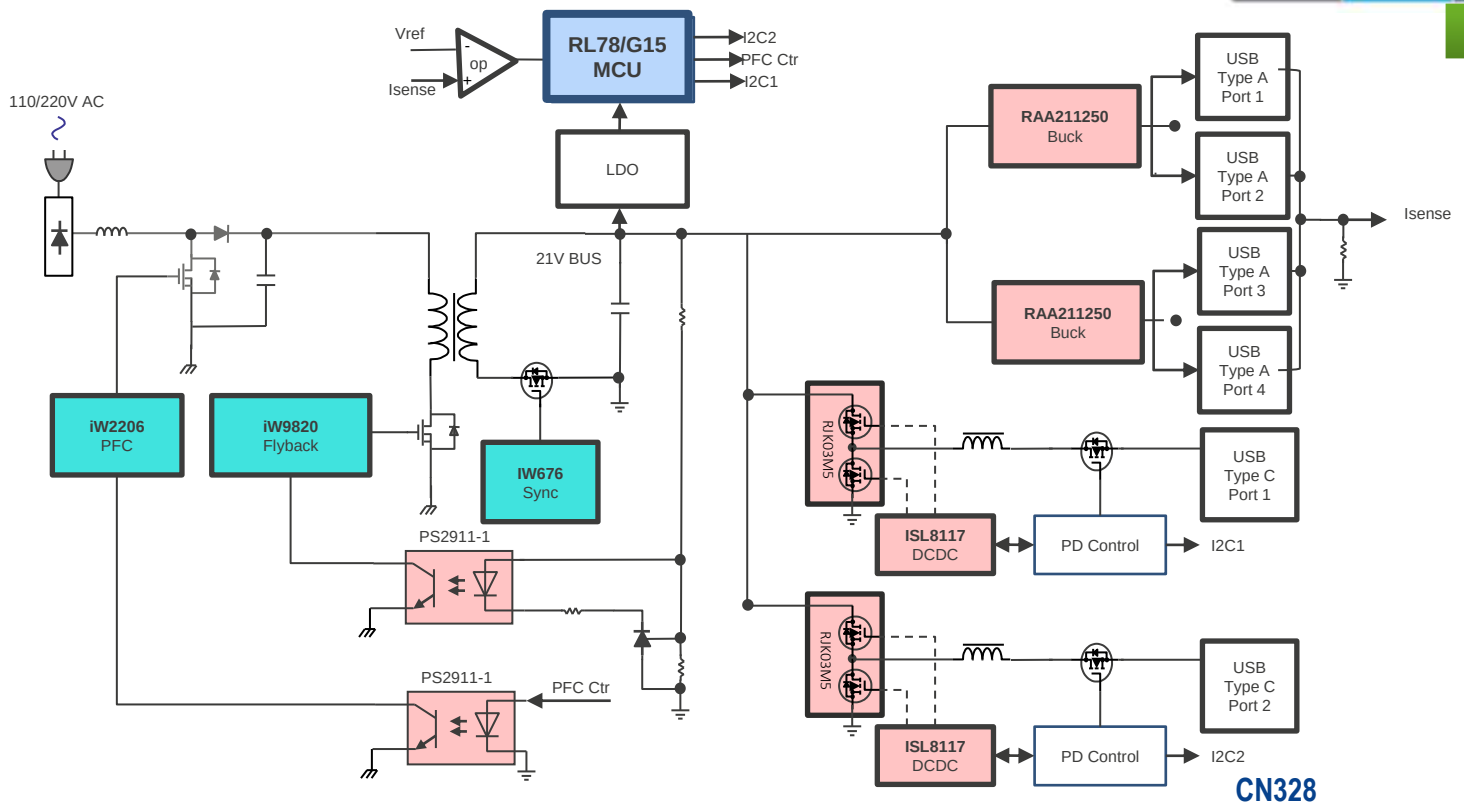
100W PD with Multi-output

WINNING COMBOS

G15

System Overview

In modern life, the more electronic products are popular in our lives, and the chargers of each electronic product are incompatible, resulting in us going out, we need to carry different kinds of chargers, people are eager to appear a new easily carried product can be compatible with notebook, tablets, mobile phones at the same time.
Renesas can provide a total IC solution for this application, including boost PFC、quasi-resonant (QR) flyback controller power、DC-DC buck、USB PD controller and MCU.



System benefits

- High-performance PFC and AC/DC Control、High-performance DC-DC buck devices provide efficient power
- Low-pin-count, Low power and high performance Renesas's MCU RL78/G15 series and PD control

Target Applications

- Quick Adapter
- Phone Charger

Device Category	P/N	Key Features
MCU	RL78/G15	Low-pin-count Low Power Microcontrollers for General Purpose Applications Ideal for Sub-MCU
Power	ISL8117	Synchronous Step-Down PWM Controllers
	RAA211250	Wide input 4.5V to 24V, 5A output current, 200μA Max quiescent current
	RJK03M5	Nch Single Power Mosfet 30V 25A 6.3Mohm HWSON-8
Dialog	IW2206	boost PFC controller uses Dialog's PF-BoostTM to provide high power factor and low THD
	IW9820	100W Digital Zero Voltage Switching RapidCharge™ AC/DC Controller
	IW676	Digital synchronous rectifier adopt Dialog's primary-side controllers
Analog	PS2911-1	High CTR, 4-Pin Ultra Small Package Flat-lead Photocoupler

Winning Combo

INDUCTION HEATING RICE COOKER

G16

System Overview

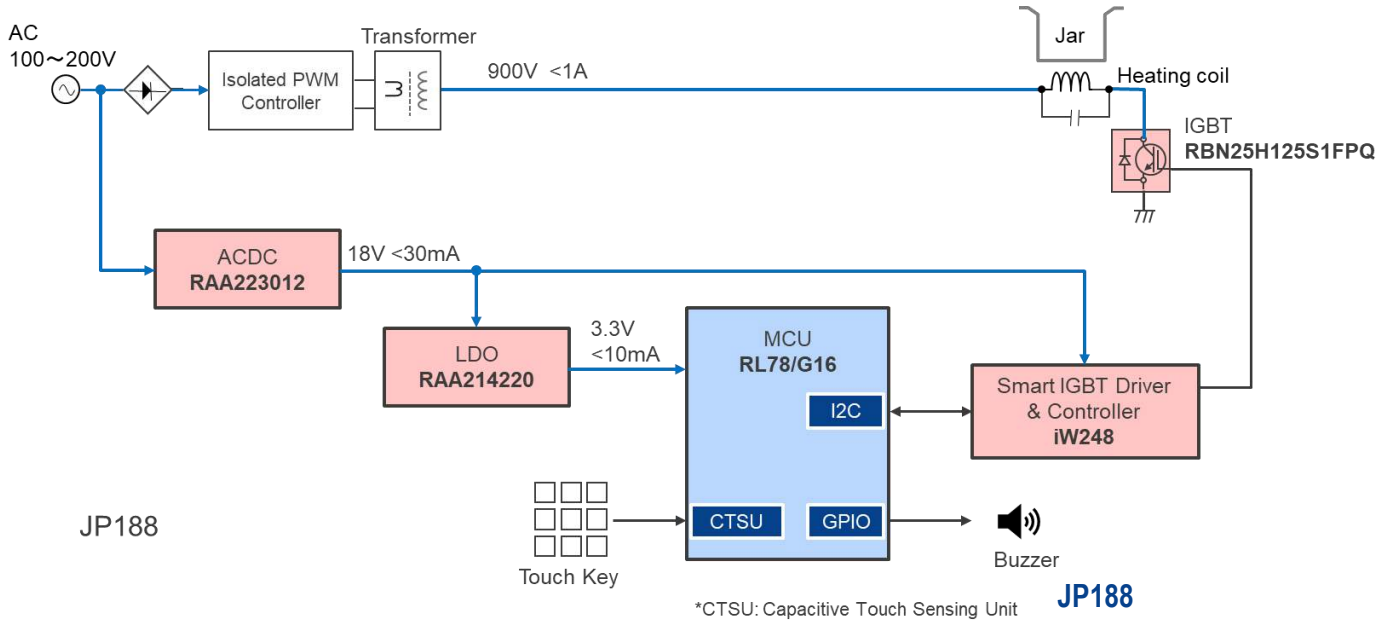
This is a total solution for an induction heating (IH) rice cooker that includes a heating block and human machine interface (HMI). A highly integrated smart insulated-gate bipolar transistor (IGBT) driver and controller, as well as a low loss IGBT help to realize a simple and high-performance IH rice cooker.

System Benefits

- Total IH solution with the iW248 smart IGBT driver/controller and RBN25H125S1FPQ IGBT makes for a simpler and easier design for high-performance IH applications.
- System controller RL78/G16 microcontroller (MCU) supports simple HMI with touch key.
- RAA223012 700V AC/DC buck regulator provides ultra-low standby power and up to 2.5W output power.

Target Applications

- Induction heating (IH) rice cooker
- Induction heating (IH) cooker



Device Category	P/N	Key Features
MCU	RL78/G16	16-Bit Standard MCU with Capacitive Touch Sensing Unit
Power	iW248	Highly integrated Smart IGBT driver & controller
	RAA223012	Compact Synchronous Buck Regulators
	RAA214220	Low Noise with LDO Low I_Q, High PSRR
	RBN25H125S1FPQ	IGBT 1250V 25A TO-247A Built-In FRD

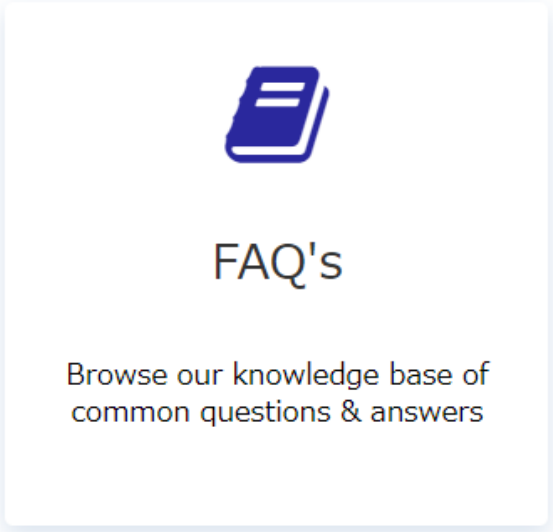
Renesas.com

These products are in the planning and development stages and this Material is strictly confidential. Don't disclose to any third party.

APPENDIX

REFERENCE INFORMATION

- ✓ **FAQs related to RL78/G15, G16 are available**



RL78/G15 FAQ

RL78/G16 FAQ Coming Soon…

Capacitive Touch FAQ

- ✓ **Arduino IDE is available for RL78/G15, G16**
- ✓ **For more information, please visit GitHub website**

ARDUINO

Renesas Electronics

Home · renesas/Arduino Wiki · GitHub

FUNCTION COMPARISON

Items	RL78/G10	RL78/G15	RL78/G12	RL78/G16	RL78/G13	R78/G22	RL78/G23
CPU-Core	RL78 S1-core	**RL78 S2-core**	RL78 S2-core	**RL78 S2-core**	RL78 S2-core	RL78 S3-core	RL78 S3-core
Maximum Operating Frequency	20MHz	**16MHz**	32MHz	**16MHz**	32MHz	32MHz	32MHz
Operating Voltage Range	2.0V to 5.5V	**2.4V to 5.5V**	1.8V to 5.5V	**2.4V to 5.5V**	1.6V to 5.5V	1.6V to 5.5V	1.6V to 5.5V
Pin Number	10-pin to 16-pin	**8-pin to 20-pin**	20-pin to 30-pin	**10-pin to 32-pin**	20-pin to 128- pin	16-pin to 48 pin	30-pin to 128- pin
Capacitor For Internal Power Supply	No REGC	**No REGC**	No REGC(20,24-pin) Need(30-pin)	**No need**	Need	Need	Need
Code Flash	1KB to 4KB	**4KB to 8KB**	2KB to 16KB	**16KB / 32KB**	16KB to 512KB	32KB / 64KB	96KB to 768KB
Data Flash	-	**1KB**	2KB	**1KB**	4KB to 8KB	2KB	8KB
RAM	128B to 512B	**1KB**	256B to 2KB	**2KB**	2KB to 32KB	4KB	12KB to 48 KB
Writing Flash Voltage	4.5 to 5.5V	**2.4 to 5.5V**	1.8 to 5.5V	**2.4 to 5.5V**	1.8 to 5.5V	1.8 to 5.5V	1.6 to 5.5V
Self Programming (w/, w/o BGO)	-	○ **w/o BGO**	○ w/ BGO	○ **w/o BGO**	○ w/ BGO	○ w/ BGO	○ w/ BGO
Cap. Touch	-	**-**	-	**3ch to 15ch**	-	5ch to 29ch	2ch to 32ch
ADC	10,8-bit 4ch to 7ch	**10,8-bit** **3ch to 11ch**	10,8-bit 8ch to 11ch	**10,8-bit** **4ch to 11ch**	10,8-bit 6ch to 26ch	10,8-bit 4ch to 10ch	12,10,8-bit 8ch to 26ch
Comparator	0ch to 1ch	**1ch to 2ch**	-	**1ch to 2ch**	-	-	2ch
DAC	-	**-**	-	**-**	-	-	10-bit 1ch to 2ch
Maximum Operating Temperature Range[°C]	-40 to 85	**-40 to 125**	-40 to 105	**-40 to 125**	-40 to 105	-40 to 105	-40 to 105

G15

Differences in product specifications by number of pins

		8-pin	10-pin	16-pin	20-pin
Code Flash memory		4 to 8KB	4 to 8KB	4 to 8KB	4 to 8KB
Data Flash memory		1KB	1KB	1KB	1KB
RAM		1KB	1KB	1KB	1KB
I/O		**6**	**8**	**14**	**18**
Clock	HOCO (High-speed on-chip oscillator)	16MHz	16MHz	16MHz	16MHz
	LOCO (Low-speed on-chip oscillator)	15kHz	15kHz	15kHz	15kHz
16-bit Timer	**TI/TO terminal (PWM output)**	**3(2)**	**3(2)**	**6(4)**	**8(7)**
	Timer channel	8	8	8	8
Comp		1	1	1	2
12-bit Interval timer		1	1	1	1
Watch-dog timer		1	1	1	1
Clock/Buzzer output		1	1	1	1
External interrupt		**6**	**8**	**8**	**8**
10-bit A/D converter channel		**3**	**4**	**7**	**11**
Serial interface channel C : CSI channel count U : UART channel count I : Simplify I2C channel count		C 1 / U 1 / I 1	C 1 / U 1 / I 1	C 2 / U 1 / I 2	C 2/ U1 / I 2
Multi master/slave I2C		1	1	1	1

G16

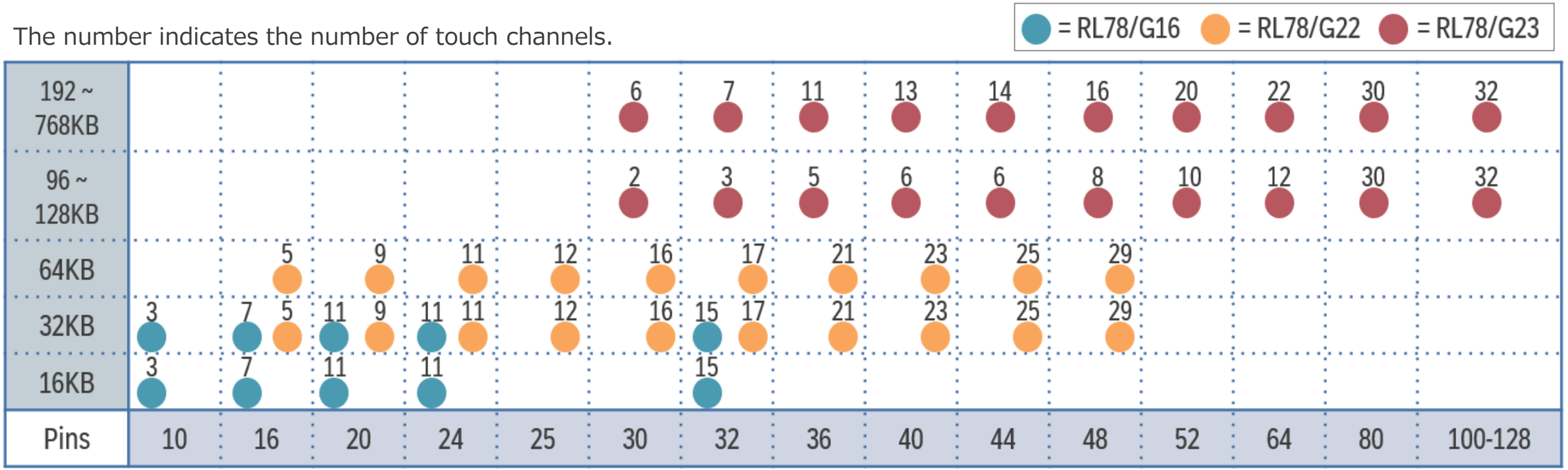
Differences in product specifications by number of pins

		10-pin	16-pin	20-pin	24-pin	32-pin
Code Flash memory		16 to 32KB	16 to 32KB	16 to 32KB	16 to 32KB	16 to 32KB
Data Flash memory		1KB	1KB	1KB	1KB	1KB
RAM		2KB	2KB	2KB	2KB	2KB
I/O (N-ch O.D)		**8(0)**	**14(0)**	**18(0)**	**22(2)**	**30(2)**
Clock	HOCO (High-speed on-chip oscillator)	16MHz	16MHz	16MHz	16MHz	16MHz
	HOCO (High-speed on-chip oscillator)	15kHz	15kHz	15kHz	15kHz	15kHz
	MOSC/SOSC	**None**	**12MHz/32.768kHz**	**12MHz/32.768kHz**	**12MHz/32.768kHz**	**12MHz/32.768kHz**
16-bit Timer	**TO/TI (PWM output)**	**3(2)**	**8(7)**	**8(7)**	**8(7)**	**8(7)**
	Channel	8	8	8	8	8
12-bit Interval timer		1	1	1	1	1
Watch-dog timer		1	1	1	1	1
Real time clock		**None**	**1**	**1**	**1**	**1**
Clock/Buzzer output		1	1	1	1	1
Cap. touch sensor (CTSUb)		**3**	**7**	**11**	**11**	**15**
External interrupt		**8**	**8**	**8**	**10**	**10**
10-bit A/D converter	**Channel**	**4**	**7**	**11**	**11**	**11**
Comparator		**1**	**2**	**2**	**2**	**2**
Serial interface channel C : CSI channel count U : UART channel count, I : Simplify I2C channel count		・C 1 / U 1 / I 1	・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1	・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1	・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1	・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1 ・C 1 / U 1 / I 1
Multi master/slave I2C		1	1	1	1	1

RL78 FAMILY TOUCH MCU LINE-UP

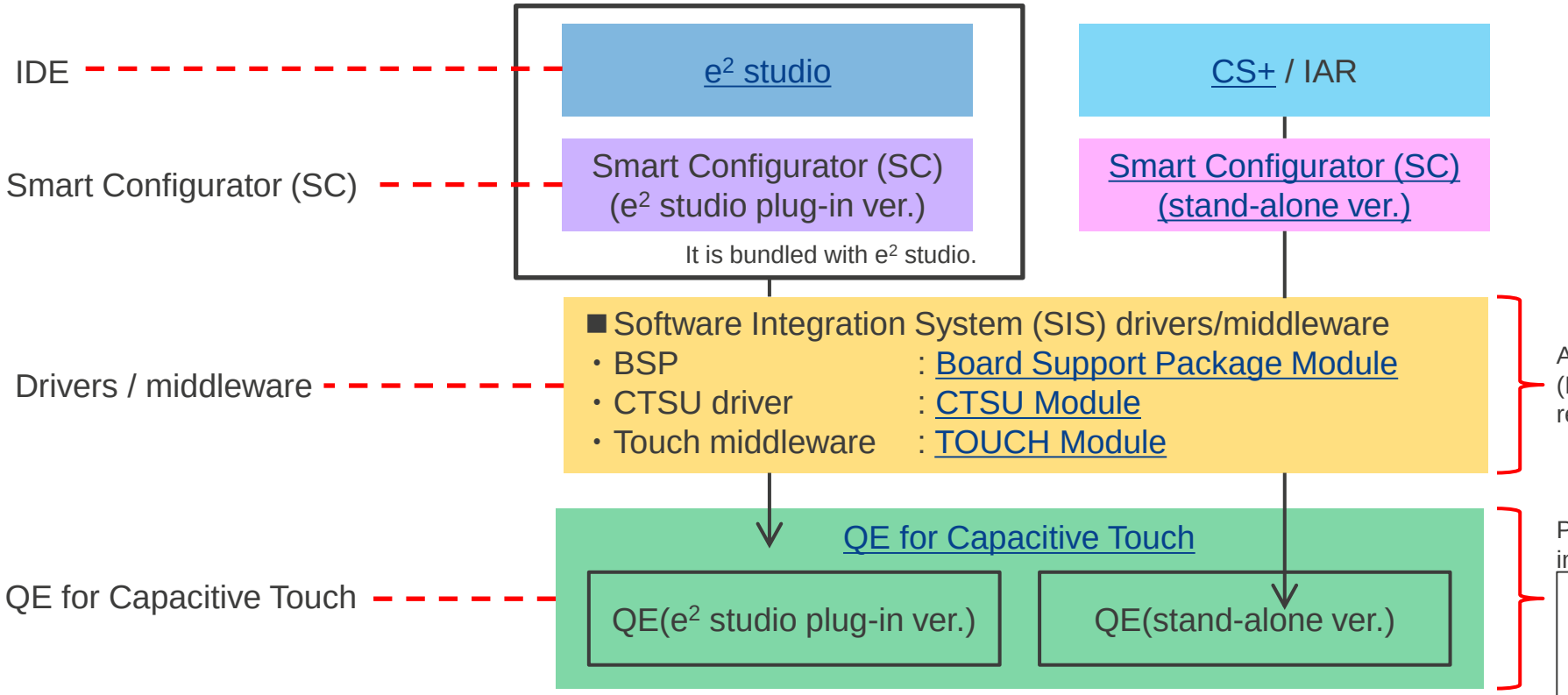
- ✓ **RL78 family offers a wide range of touch microcontrollers**
- ✓ **RL78/G16 has the smallest pin package with touch function :3ch@10pin, 15ch@32pin**

The number indicates the number of touch channels.



*RL78/G16 :CTSUb
*RL78/G22 :CTSU2La
*RL78/G23 :CTSU2L

Complete set of touch development environment tools for the RL78 family



How to obtain the tools.

Available via the "Download" button in the SC Tool (It can also be obtained from the WEB. However, it is recommended to obtain it via SC Tool).

Please refer to the following Release Note for information on how to install each version of QE.

■ Release Note
QE for Capacitive Touch Vx.x.x Release Note
→"2.1.2 Install using QE (zip file) downloaded from the Renesas website"

R78 Family Touch Development Environment Supported Tools Table (Combination of IDE, SC and QE)

e² studio

✓ Supported — Not supported ☐ Recommended usage

Tool name / Version / Function				RL78/G16	RL78/G22	RL78/G23
Smart Configurator (SC)	e² studio plug-in ver.			✓	✓	✓
QE for Capacitive Touch	e² studio plug-in ver.	monitoring and tuning	via emulator	—	✓	✓
			via serial (UART)	✓ (Note2)	✓	✓
	stand-alone ver. (Note1)	monitoring and tuning	via serial (UART)	✓ (Note2)	✓	✓

Note1: If you only want to monitor touch performance without starting e² studio after completing the development of your touch application, you can also use QE (stand-alone ver.).

Note2: In the case of RL78/G16, it is not possible to check variable values with the IDE functions during monitoring via serial communication (UART).

CS+ / IAR

Tool name / Version / Function			RL78/G16	RL78/G22	RL78/G23
Smart Configurator (SC)	stand-alone ver.		✓	✓	✓
QE for Capacitive Touch	stand-alone ver.	monitoring and tuning via serial (UART)	✓ (Note2)	✓	✓

Note2: In the case of RL78/G16, it is not possible to check variable values with the IDE functions during monitoring via serial communication (UART).

Caution1: Monitoring is recommended to be performed via serial (UART) for smooth execution.
(For the RL78 family, monitoring via the emulator is not recommended as performance is limited by the OCD (On-Chip Debugging) function).

Caution2: RL78/G16 only supports tuning and monitoring via serial (UART).
(Due to the small RAM memory capacity of the RL78/G16, tuning and monitoring via an emulator is not possible.)
In addition, monitoring via serial communication (UART) cannot be executed when variables are registered in IDE functions
(e2 studio: expression window, CS+: watch expression).

Application notes for reference on developing touch applications

✓ Available　　— Not available

Title	Document No.	Development environment used				RL78/G16 (Note1)	RL78/G22	RL78/G23
		IDE	Smart Configurator (SC)	QE	Tuning method			
RL78 Family Using QE and SIS to Develop Capacitive Touch Applications	R01AN5512	e² studio	e² studio plug-in ver.	e² studio plug-in ver.	via emulator	—	✓	✓
RL78 Family Using the standalone version of QE to Develop Capacitive Touch Applications	R01AN6574	CS+	stand-alone ver.	stand-alone ver.	via serial (UART)	✓ (Note2)	✓	✓
RL78 Family Using QE (standalone ver.) to Develop Touch Applications for FPB board	R01AN6741	CS+	stand-alone ver.	stand-alone ver.	via serial (UART)	✓ (Note2)	✓	✓

Note1: RL78/G16 only supports tuning and monitoring via serial (UART).
(Due to the small RAM memory capacity of the RL78/G16, tuning and monitoring via an emulator is not possible.)

Note2: The relevant reference application note uses CS+ and SC (stand-alone ver.),
but it can be developed using e² studio and SC (e² studio plug-in ver.) by operating the same configuration items.

PART NUMBERS OUTLINE

RL78/G15: SERIES TYPE NUMBER SCHEME

Product information for the RL78/G15 (20-pin) with product number R5F12068MSP#00 is shown as an example.

R5 F 120 6 8 M SP #00

- R5: Renesas MCU
- F: ROM Type F: Flash

Product group

120	RL78/G15 Group

Pin count

0	8
1	10
4	16
6	20

ROM Size (KB)

7	4
8	8

Fields of application

A	Consumer applications、T_A = −40～+85°C
G	Industrial applications、T_A = −40～+105°C
M	Industrial applications、T_A = −40～+125°C

Package, Pin Pitch

SP	SSOP 0.65 mm
NA	HWQFN 0.5 mm
NS	WDFN 0.65 mm

Packaging, Material (Pb-free)

#00	Tray（Full carton) (HWQFN)
#10	Tray（Full carton) (LSSOP, SSOP, WDFN)
#20	Tray（HWQFN)
#30	Tray（LSSOP, SSOP, WDFN） Tube（LSSOP(20pin)）
#40	Embossed Tape（HWQFN）
#50	Embossed Tape（LSSOP, SSOP, WDFN）

RL78/G16: SERIES TYPE NUMBER SCHEME

Product information for the RL78/G16 (20-pin) with product number R5F1216CMSP#00 is shown as an example.

R5 F 121 6 C M SP #00

- R5: Renesas MCU
- F: ROM Type F: Flash
- 121: Product group
- 6: Pin count
- C: ROM Size (KB)
- M: Fields of application
- SP: Package, Pin Pitch
- #00: Packaging, Material (Pb-free)

121	RL78/G16 Group

1	10
4	16
6	20
7	24
B	32

A	16
C	32

FP	LQFP 0.8 mm
SP	SSOP 0.65 mm
NA	HWQFN 0.5 mm

A	Consumer applications、T_A = −40～+85°C
G	Industrial applications、T_A = −40～+105°C
M	Industrial applications、T_A = −40～+125°C

#00	Tray（Full carton) (HWQFN)
#10	Tray（Full carton) (LSSOP (10pin), SSOP, LQFP)
#20	Tray（HWQFN)
#30	Tray（LSSOP, SSOP, LQFP） Tube（LSSOP(20pin)）
#40	Embossed Tape（HWQFN）
#50	Embossed Tape（LSSOP, SSOP, LQFP）