Welcome to

What is "**Embedded - Microcontrollers**"?

"**Embedded - Microcontrollers**" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "**Embedded - Microcontrollers**"

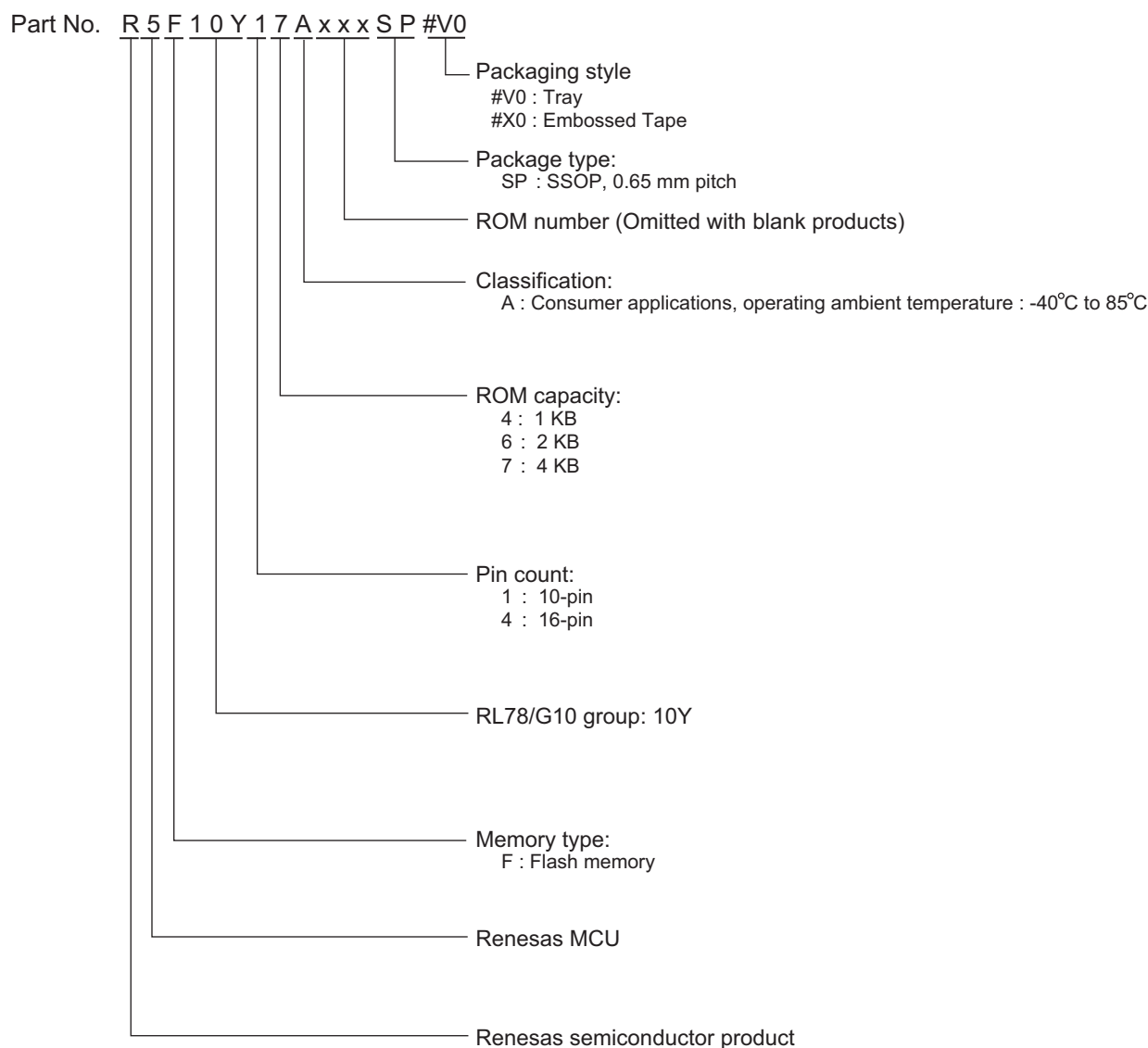| Details	
Product Status	Active
Core Processor	RL78
Core Size	16-Bit
Speed	20MHz
Connectivity	CSI, I²C, LINbus, UART/USART
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	6
Program Memory Size	4KB (4K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	512 x 8
Voltage - Supply (Vcc/Vdd)	2V ~ 5.5V
Data Converters	A/D 4x8/10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	10-LSSOP (0.173", 4.40mm Width)
Supplier Device Package	10-LSSOP
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f10y17asp-50

○ ROM, RAM capacities

Flash ROM	RAM	10 pins	16 pins
4 KB	512 B	–	R5F10Y47ASP [Note 2]
2 KB	256 B	R5F10Y16ASP	R5F10Y46ASP [Note 2]
1 KB	128 B	R5F10Y14ASP	R5F10Y44ASP [Note 2]

Notes 1. 16-pin products only

2. Under development

Remark The functions mounted depend on the product. See **1.6 Outline of Functions**.

1.2 List of Part Number

Figure 1-1. Classification of Part Number

Part No.   R 5 F 1 0 Y 1 7 A x x x S P #V0

Packaging style
    #V0 : Tray
    #X0 : Embossed Tape

Package type:
    SP : SSOP, 0.65 mm pitch

ROM number (Omitted with blank products)

Classification:
    A : Consumer applications, operating ambient temperature : -40℃ to 85℃

ROM capacity:
    4 : 1 KB
    6 : 2 KB
    7 : 4 KB

Pin count:
    1 : 10-pin
    4 : 16-pin

RL78/G10 group: 10Y

Memory type:
    F : Flash memory

Renesas MCU

Renesas semiconductor product

Pin count	Package	Part Number
10 pins	10-pin plastic LSSOP (4.4 × 3.6 mm, 0.65mmpitch)	R5F10Y16ASP#V0, R5F10Y16ASP#X0
		R5F10Y14ASP#V0, R5F10Y14ASP#X0
16 pins	16-pin plastic SSOP (4.4 × 5.0 mm, 0.65mmpitch)	R5F10Y47ASP [Note]
		R5F10Y46ASP [Note]
		R5F10Y44ASP [Note]

Note   Under development

Caution   **The part number represents the number at the time of publication.**
          Be sure to review the latest part number through the target product page in the Renesas Electronics
          Corp.website.

1.3 Pin Configuration (Top View)

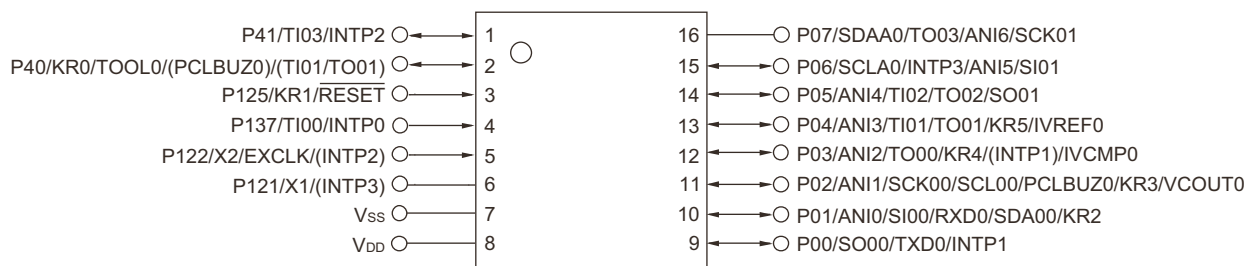### 1.3.1 10-pin products

- 10-pin plastic LSSOP (4.4 × 3.6)
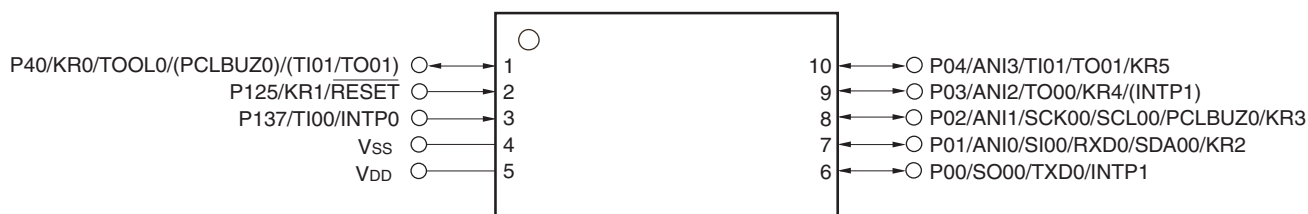
P40/KR0/TOOL0/(PCLBUZ0)/(TI01/TO01) → 1   10 ←→ P04/ANI3/TI01/TO01/KR5
P125/KR1/$\overline{\text{RESET}}$ → 2   9 ←→ P03/ANI2/TO00/KR4/(INTP1)
P137/TI00/INTP0 → 3   8 ←→ P02/ANI1/SCK00/SCL00/PCLBUZ0/KR3
V$_{SS}$ ← 4   7 ←→ P01/ANI0/SI00/RXD0/SDA00/KR2
V$_{DD}$ ← 5   6 ←→ P00/SO00/TXD0/INTP1

Remarks 1. For pin identification, see **1.4 Pin Identification**.

2. Functions in parentheses in the above figure can be assigned via settings in the peripheral I/O redirection register (PIOR).

1.3.2 16-pin products

- 16-pin plastic SSOP (4.4 × 5.0)

P41/TI03/INTP2 ←→ 1   16 → P07/SDAA0/TO03/ANI6/SCK01
P40/KR0/TOOL0/(PCLBUZ0)/(TI01/TO01) ←→ 2   15 ←→ P06/SCLA0/INTP3/ANI5/SI01
P125/KR1/$\overline{\text{RESET}}$ → 3   14 ←→ P05/ANI4/TI02/TO02/SO01
P137/TI00/INTP0 → 4   13 ←→ P04/ANI3/TI01/TO01/KR5/IVREF0
P122/X2/EXCLK/(INTP2) → 5   12 ←→ P03/ANI2/TO00/KR4/(INTP1)/IVCMP0
P121/X1/(INTP3) → 6   11 ←→ P02/ANI1/SCK00/SCL00/PCLBUZ0/KR3/VCOUT0
V$_{SS}$ ← 7   10 ←→ P01/ANI0/SI00/RXD0/SDA00/KR2
V$_{DD}$ ← 8   9 ←→ P00/SO00/TXD0/INTP1

Remarks 1. For pin identification, see **1.4 Pin Identification**.

2. Functions in parentheses in the above figure can be assigned via settings in the peripheral I/O redirection register (PIOR).

1.4 Pin Identification

ANI0 to ANI6	: Analog Input
INTP0 to INTP3	: External Interrupt Input
KR0 to KR5	: Key Return
P00 to P07	: Port 0
P40, P41	: Port 4
P121, P122, P125	: Port 12
P137	: Port 13
PCLBUZ0	: Programmable Clock Output/ Buzzer Output
EXCLK	: External Clock Input
X1, X2	: Crystal Oscillator
IVCMP0	: Comparator Input
VCOUT0	: Comparator Output
IVREF0	: Comparator Reference Input
$\overline{\text{RESET}}$	: Reset
RxD0	: Receive Data
SCK00, SCK01	: Serial Clock Input/Output
SCL00, SCLA0	: Serial Clock Output
SDA00, SDAA0	: Serial Data Input/Output
SI00, SI01	: Serial Data Input
SO00, SO01	: Serial Data Output
TI00 to TI03	: Timer Input
TO00 to TO03	: Timer Output
TOOL0	: Data Input/Output for Tool
TxD0	: Transmit Data
V_{DD}	: Power Supply
V_{SS}	: Ground

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1.5 Block Diagram

1.5.1 10-pin products
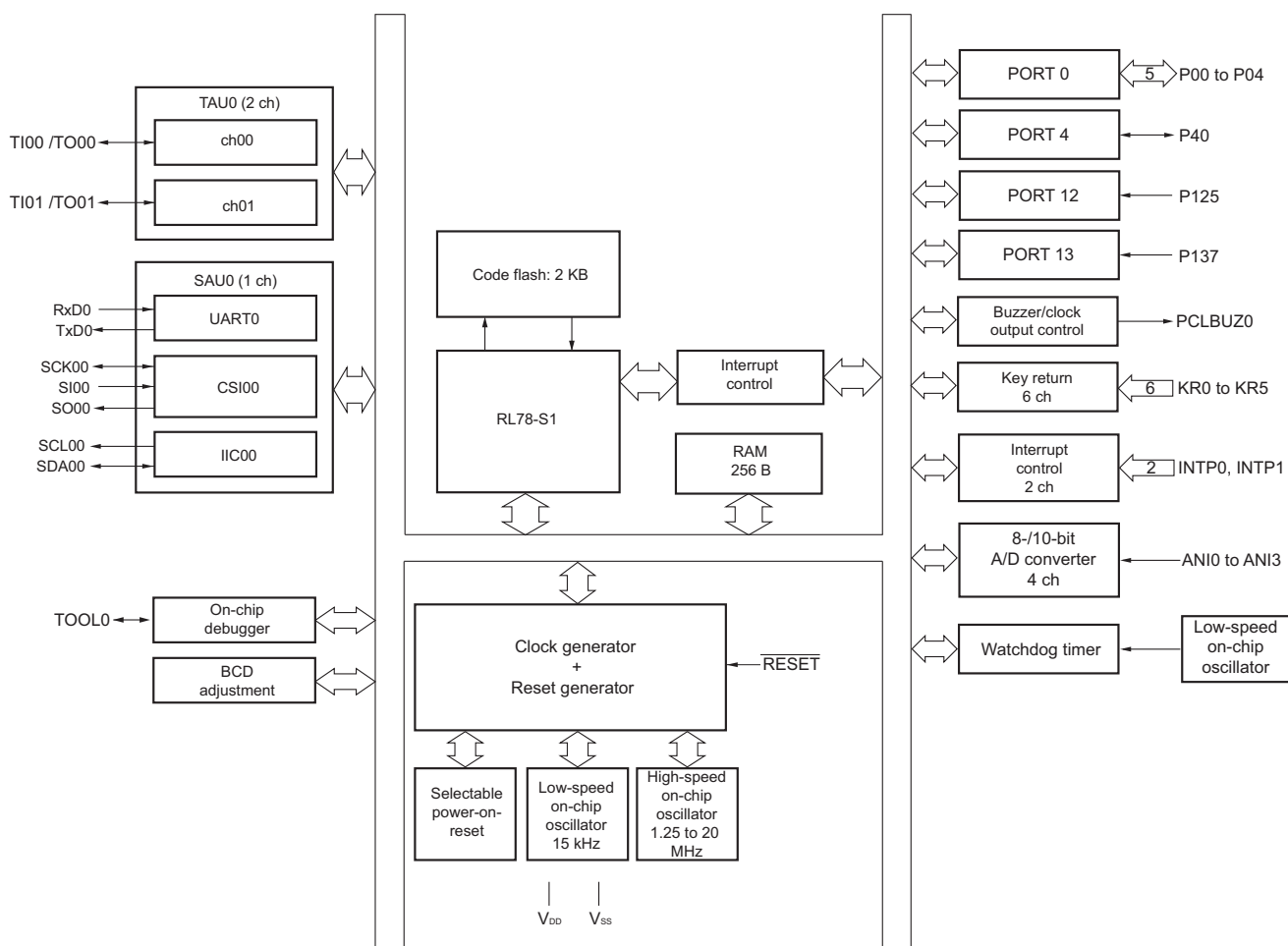
1.5.2 16-pin products
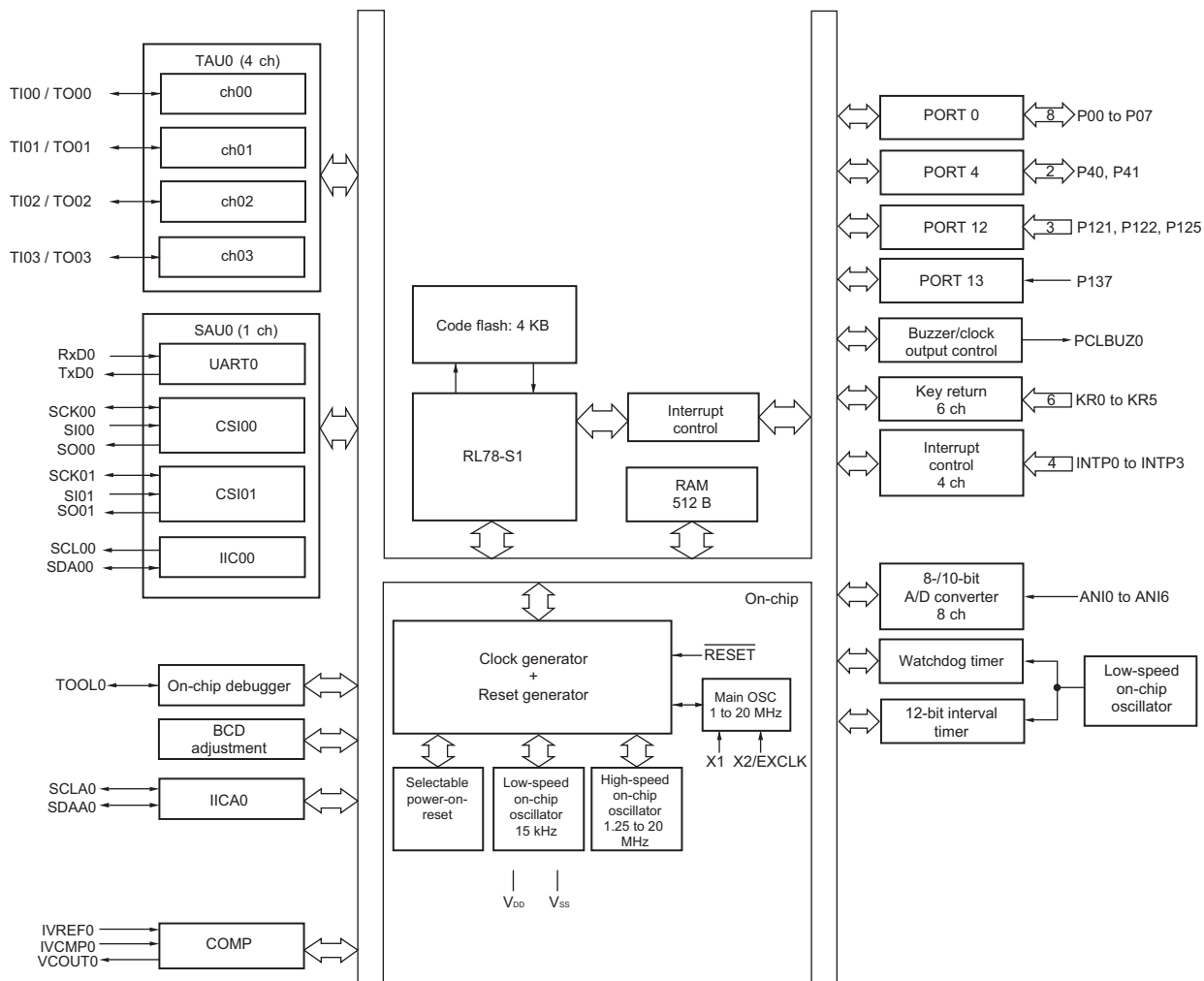
Notes 1. The number of outputs varies, depending on the setting of channels in use and the number of the master (see **6.8.3 Operation as multiple PWM output function in the RL78/G10 User's Manual**).

2. The illegal instruction is generated when instruction code FFH is executed. Reset by the illegal instruction execution not issued by emulation with the on-chip debug emulator.

2. ELECTRICAL SPECIFICATIONS

Cautions 1. This chapter explains the electrical specifications of two products, the R5F10Y16ASP and the R5F10Y14ASP.

2. Electrical specifications for the 16-pin products are T. B. D. because these products are under development.

3. The RL78/G10 has an on-chip debug function, which is provided for development and evaluation. Do not use the on-chip debug function in products designated for mass production, because the guaranteed number of rewritable times of the flash memory may be exceeded when this function is used, and product reliability therefore cannot be guaranteed. Renesas Electronics is not liable for problems occurring when the on-chip debug function is used.

4. The pins mounted depend on the product. Refer to 2.1 Port Functions and 2.2.1 Functions for each product in the RL78/G10 User's Manual.

2.1 Absolute Maximum Ratings

(T_A = 25°C)

Parameter	Symbols	Conditions		Ratings	Unit
Supply Voltage	V_{DD}			−0.5 to +6.5	V
Input Voltage	V_{I1}			−0.3 to V_{DD} + 0.3[Note]	V
Output Voltage	V_{O1}			−0.3 to V_{DD} + 0.3	V
Output current, high	I_{OH1}	Per pin		−40	mA
		Total of all pins -140 mA	P40	−40	mA
			P00 to P04	−100	mA
Output current, low	I_{OL1}	Per pin		40	mA
		Total of all pins 140 mA	P40	40	mA
			P00 to P04	100	mA
Operating ambient temperature	T_A			−40 to +85	°C
Storage temperature	T_{stg}			−65 to +150	°C

Note Must be 6.5 V or lower.

Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

Remarks 1. Unless specified otherwise, the characteristics of alternate-function pins are the same as those of the port pins.
**2.** The reference voltage is V_{SS}.

2.2 Oscillator Characteristics

2.2.1 On-chip oscillator characteristics

(T_A = −40 to +85°C, 2.0 V ≤ V_{DD} ≤ 5.5 V, V_{SS} = 0 V)

Oscillators	Parameters	Conditions	MIN.	TYP.	MAX.	Unit
High-speed on-chip oscillator oscillation clock frequency [Notes 1, 2]	f_{IH}		1.25		20	MHz
High-speed on-chip oscillator oscillation clock frequency accuracy		T_A = -20 to +85°C	-2.0		+2.0	%
		T_A = -40 to -20°C	-3.0		+3.0	%
Low-speed on-chip oscillator oscillation clock frequency [Note 3]	f_{IL}			15		kHz
Low-speed on-chip oscillator oscillation clock frequency accuracy			-15		+15	%

Notes 1. High-speed on-chip oscillator frequency is selected by bits 0 to 2 of option byte (000C2H).
2. This only indicates the oscillator characteristics. Refer to AC Characteristics for instruction execution time.
3. This only indicates the oscillator characteristics.

- Total output current of pins = $(I_{OH} \times 0.7)/(n \times 0.01)$

  \<Example\> Where n = 80 % and I_{OH} = - 10.0 mA

  Total output current of pins = $(- 10.0 \times 0.7)/(80 \times 0.01) \cong - 8.7$ mA

- Total output current of pins = $(I_{OL} \times 0.7)/(n \times 0.01)$

  \<Example\> Where n = 80 % and I_{OL} = 10.0 mA

  Total output current of pins = $(10.0 \times 0.7)/(80 \times 0.01) \cong 8.7$ mA

However, the current that is allowed to flow into one pin does not vary depending on the duty factor. A current higher than the absolute maximum rating must not flow into one pin.

4. Value of current at which the device operation is guaranteed even if the current flows from an output pin to the V_{SS} pin.

5. The value under the condition which satisfies the high-level output current (I_{OH1}).

6. The value under the condition which satisfies the low-level output current (I_{OL1}).

Cautions 1.   P00 and P01 do not output high level in N-ch open-drain mode.

2.   The maximum value of V_{IH} of P00 and P01 is V_{DD} even in N-ch open-drain mode.

Remark   Unless specified otherwise, the characteristics of alternate-function pins are the same as those of the port.

2.3.2 Supply current characteristics

(T_A = –40 to +85°C, 2.0 V ≤ V_{DD} ≤ 5.5 V, V_{SS} = 0 V)

Parameter	Symbol	Conditions				MIN.	TYP.	MAX.	Unit
Supply current [Note 1]	I_{DD1}	Operating mode	Basic operation	f_{IH} = 20 MHz	V_{DD} = 3.0 V, 5.0 V		0.91		mA
			Normal operation	f_{IH} = 20 MHz	V_{DD} = 3.0 V, 5.0 V		1.57	2.04	
				f_{IH} = 5 MHz	V_{DD} = 3.0 V, 5.0 V		0.85	1.15	
	I_{DD2} [Note 2]	HALT mode		f_{IH} = 20 MHz	V_{DD} = 3.0 V, 5.0 V		350	820	μA
				f_{IH} = 5 MHz	V_{DD} = 3.0 V, 5.0 V		290	600	
	I_{DD3} [Note 3]	STOP mode		V_{DD} = 3.0 V			0.56	2.00	μA
WDT supply current [Note 4]	I_{WDT}	f_{IL} = 15 kHz					0.31		μA
ADC supply current [Note 5]	I_{ADC}	During conversion at the highest speed		V_{DD} = 5.0 V			1.30	1.90	mA
				V_{DD} = 3.0 V			0.50		

Notes 1. Total current flowing into V_{DD}, including the input leakage current flowing when the level of the input pin is fixed to V_{DD} or V_{SS}. The values below the MAX. column include the peripheral operation current. However, not including the current flowing into the watchdog timer, A/D converter, I/O port, and on-chip pull-up/pull-down resistors.

2. During HALT instruction execution by flash memory.

3. When the high-speed on-chip oscillator is stopped.

4. Current flowing only to the watchdog timer (including the operating current of the low-speed on-chip oscillator). The current value of the RL78 microcontrollers is the sum of I_{DD1}, I_{DD2} or I_{DD3} and I_{WDT} when the watchdog timer operates.

5. Current flowing only to the A/D converter. The current value of the RL78 microcontrollers is the sum of I_{DD1} or I_{DD2} and I_{ADC} when the A/D converter operates in an operation mode or the HALT mode.

Remarks 1. f_{IL}: Low-speed on-chip oscillator clock frequency

2. f_{IH}: High-speed on-chip oscillator clock frequency

3. Temperature condition of the TYP. value is T_A = 25°C

Interrupt Request Input Timing

INTP0, INTP1

t_{INTL} t_{INTH}
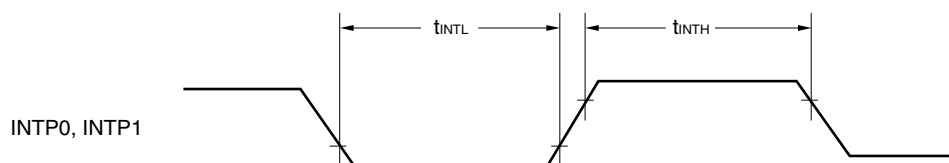
Key Interrupt Input Timing

KR0 to KR5

t_{KR}
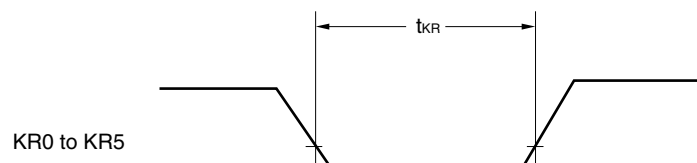
__RESET__ **Input Timing**

$\overline{RESET}$

t_{RSL}
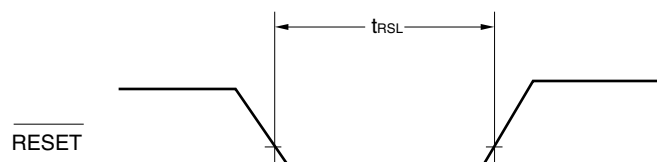
2.5 Serial Communication Characteristics

2.5.1 Serial array unit

(1) UART mode

(T_A = −40 to +85°C, 2.0 V ≤ V_{DD} ≤ 5.5 V, V_{SS} = 0 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Transfer rate					$f_{MCK}/6$	bps
		Theoretical value of the maximum transfer rate f_{CLK} = f_{MCK} = 20 MHz			3.3	Mbps

UART mode connection diagram
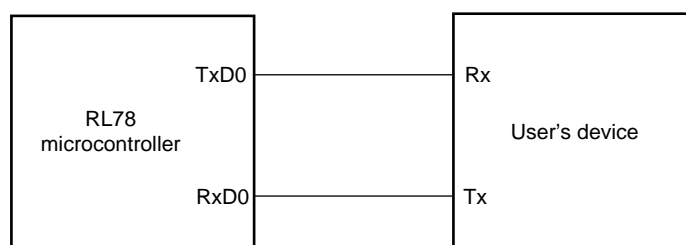
UART mode bit width (reference)
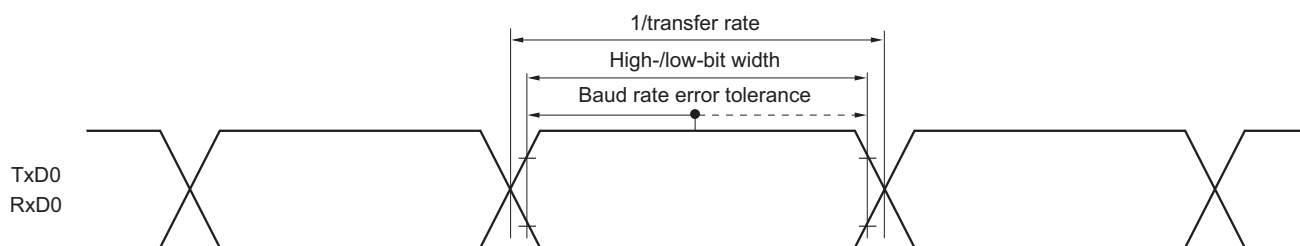
Remark f_{MCK}: Serial array unit operation clock frequency

           (Operation clock to be set by the CKSmn bit of serial mode register mn (SMRmn).

           m: Unit number, n: Channel number (mn = 00))

(4) Simplified I²C mode

(T$_A$ = −40 to +85°C, 2.0 V ≤ V$_{DD}$ ≤ 5.5 V, V$_{SS}$ = 0 V)

Parameter	Symbol	Conditions	MIN.	MAX.	Unit
SCLr clock frequency	f$_{SCL}$	2.0 V ≤ V$_{DD}$ ≤ 5.5 V, C$_b$ = 100 pF, R$_b$ = 3 kΩ		400 [Note 1]	kHz
Hold time when SCLr = "L"	t$_{LOW}$	2.0 V ≤ V$_{DD}$ ≤ 5.5 V, C$_b$ = 100 pF, R$_b$ = 3 kΩ	1150		ns
Hold time when SCLr = "H"	t$_{HIGH}$	2.0 V ≤ V$_{DD}$ ≤ 5.5 V, C$_b$ = 100 pF, R$_b$ = 3 kΩ	1150		ns
Data setup time (reception)	t$_{SU: DAT}$	2.0 V ≤ V$_{DD}$ ≤ 5.5 V, C$_b$ = 100 pF, R$_b$ = 3 kΩ	1/f$_{MCK}$ + 145 [Note 2]		ns
Data hold time (transmission)	t$_{HD: DAT}$	2.0 V ≤ V$_{DD}$ ≤ 5.5 V, C$_b$ = 100 pF, R$_b$ = 3 kΩ	0	355	ns

Notes 1. The value must also be equal to or less than f$_{MCK}$/4.

     2. Set the f$_{MCK}$ value to keep the hold time of SCLr = "L" and SCLr = "H".

Caution Select the N-ch open drain output (V$_{DD}$ tolerance) mode for the SDAr pin by using the port output mode register 0 (POM0).

Remarks 1. R$_b$ [Ω]: Communication line (SDAr) pull-up resistance, C$_b$ [F]: Communication line (SCLr, SDAr) load capacitance

     2. r: IIC number (r = 00)

     3. f$_{MCK}$: Serial array unit operation clock frequency

        (Operation clock to be set by the CKSmn bit of serial mode register mn (SMRmn).

        m: Unit number, n: Channel number (mn = 00))

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2.6.4 Data retention power supply voltage characteristics

(T_A = −40 to +85°C, Vss = 0 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Data retention power supply voltage range	V_{DDDR}		1.9		5.5	V

Caution Data is retained until the power supply voltage becomes under the minimum value of the data retention power supply voltage range. Note that data in the RAM and RESF registers might not be cleared even if the power supply voltage becomes under the minimum value of the data retention power supply voltage range.

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2.9 Timing of Entry to Flash Memory Programming Modes

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
How long from when an external reset ends until the initial communication settings are specified	t_{SUINIT}	SPOR reset must end before the external reset ends.			100	ms
How long from when the TOOL0 pin is placed at the low level until an external reset ends	t_{SU}	SPOR reset must end before the external reset ends.	10			μs
How long the TOOL0 pin must be kept at the low level after an external reset ends	t_{HD}	SPOR reset must end before the external reset ends.	1			ms
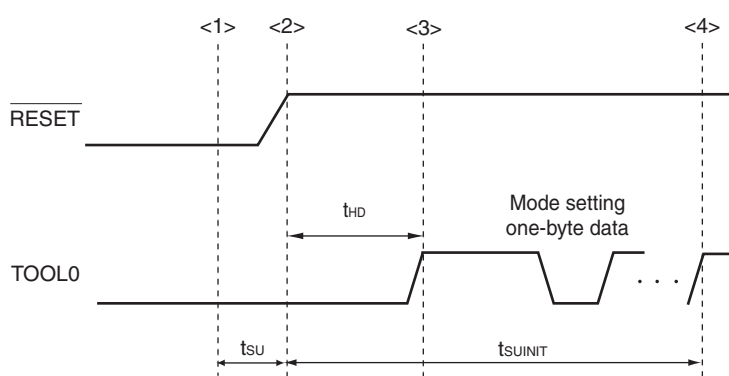
<1> The low level is input to the TOOL0 pin.

<2> The external reset ends (SPOR reset must end before the external reset ends.).

<3> The TOOL0 pin is set to the high level.

<4> Setting of entry to the flash memory programming mode by UART reception.

Remark t_{SUINIT}: The segment shows that it is necessary to finish specifying the initial communication settings within 100 ms from when the resets end.

t_{SU}: How long from when the TOOL0 pin is placed at the low level until an external reset ends (MIN. 10 μs)

t_{HD}: How long to keep the TOOL0 pin at the low level from when the external reset ends

3. PACKAGE DRAWINGS

3.1 10-pin products

R5F10Y16ASP, R5F10Y14ASP

JEITA Package Code	RENESAS Code	Previous Code	MASS (TYP.) [g]
P-LSSOP10-4.4x3.6-0.65	PLSP0010JA-A	P10MA-65-CAC-2	0.05

detail of lead end

(UNIT:mm)

ITEM	DIMENSIONS
A	3.60±0.10
B	0.50
C	0.65 (T.P.)
D	0.24±0.08
E	0.10±0.05
F	1.45 MAX.
G	1.20±0.10
H	6.40±0.20
I	4.40±0.10
J	1.00±0.20
K	$0.17{}^{+0.08}_{-0.07}$
L	0.50
M	0.13
N	0.10
P	$3°{}^{+5°}_{-3°}$
T	0.25 (T.P.)
U	0.60±0.15
V	0.25 MAX.
W	0.15 MAX.
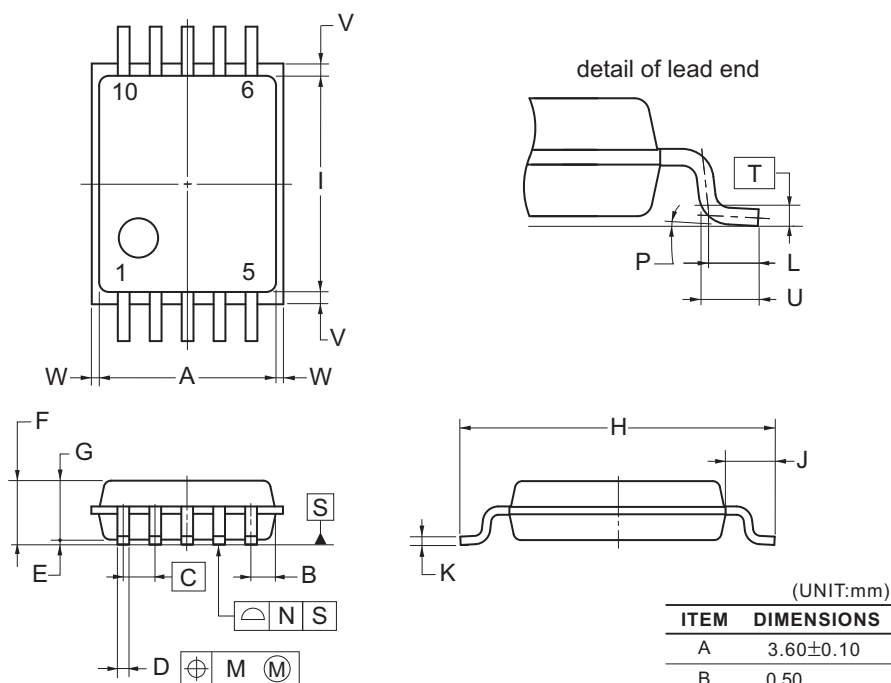
NOTE
Each lead centerline is located within 0.13 mm
of its true position (T.P.) at maximum material
condition.

3.2 16-pin products

R5F10Y47ASP, R5F10Y46ASP, R5F10Y44ASP

JEITA Package Code	RENESAS Code	Previous Code	MASS (TYP.) [g]
P-SSOP16-4.4x5-0.65	PRSP0016JC-A	P16MA-65-FAA-2	0.08

detail of lead end
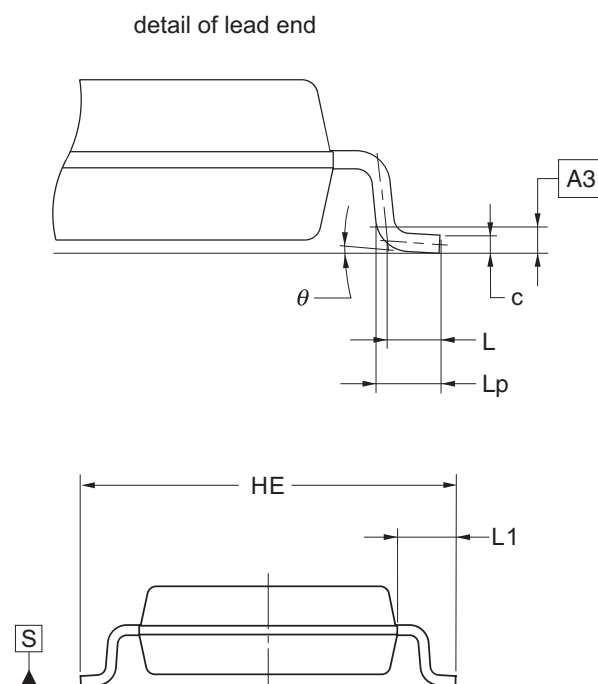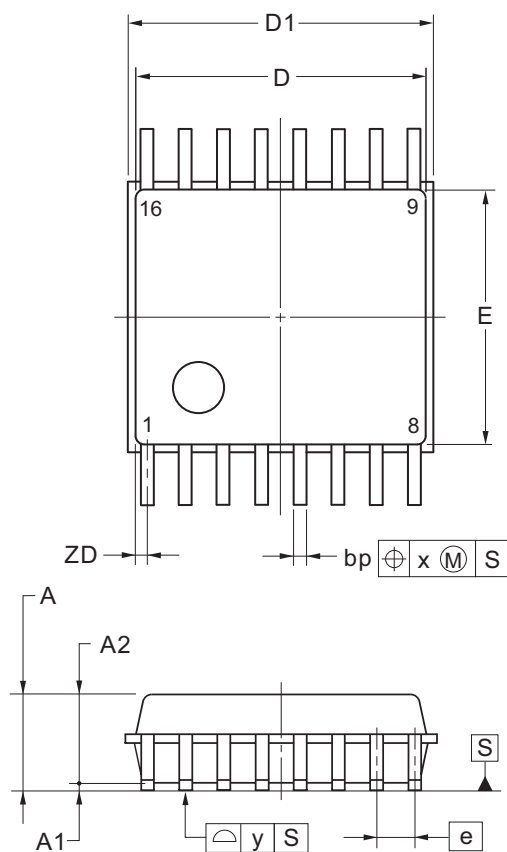
(UNIT:mm)

ITEM	DIMENSIONS
D	5.00±0.15
D1	5.20±0.15
E	4.40±0.20
HE	6.40±0.20
A	1.725 MAX.
A1	0.125±0.05
A2	1.50
A3	0.25
e	0.65
bp	$0.22^{+0.08}_{-0.07}$
c	$0.15^{+0.03}_{-0.04}$
L	0.50
Lp	0.60±0.10
L1	1.00±0.20
x	0.13
y	0.10
θ	$3°^{+5°}_{-3°}$
ZD	0.325

Rev.	Date	Description	
		Page	**Summary**
1.00	Apr 15, 2013	-	First Edition issued

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