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### 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             | Obsolete                                                                                                                                                                      |
| Core Processor             | RL78                                                                                                                                                                          |
| Core Size                  | 16-Bit                                                                                                                                                                        |
| Speed                      | 32MHz                                                                                                                                                                         |
| Connectivity               | CSI, I <sup>2</sup> C, LINbus, UART/USART                                                                                                                                     |
| Peripherals                | DMA, LVD, POR, PWM, WDT                                                                                                                                                       |
| Number of I/O              | 38                                                                                                                                                                            |
| Program Memory Size        | 192KB (192K x 8)                                                                                                                                                              |
| Program Memory Type        | FLASH                                                                                                                                                                         |
| EEPROM Size                | 8K x 8                                                                                                                                                                        |
| RAM Size                   | 16K x 8                                                                                                                                                                       |
| Voltage - Supply (Vcc/Vdd) | 1.6V ~ 5.5V                                                                                                                                                                   |
| Data Converters            | A/D 12x8/10b                                                                                                                                                                  |
| Oscillator Type            | Internal                                                                                                                                                                      |
| Operating Temperature      | -40°C ~ 85°C (TA)                                                                                                                                                             |
| Mounting Type              | Surface Mount                                                                                                                                                                 |
| Package / Case             | 52-LQFP                                                                                                                                                                       |
| Supplier Device Package    | 52-LQFP (10x10)                                                                                                                                                               |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f100jhdfa-x0">https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f100jhdfa-x0</a> |

Table 1-1. List of Ordering Part Numbers

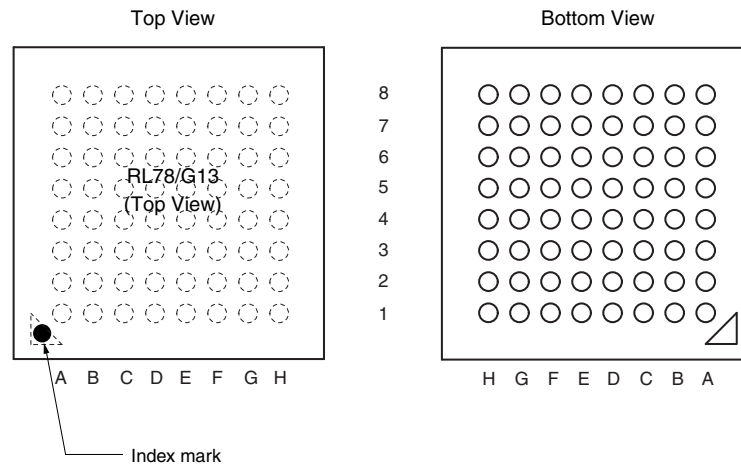
(12/12)

| Pin count | Package                                             | Data flash  | Fields of Application <sup>Note</sup>      | Ordering Part Number                                                                                                                                                                                                                                                             |
|-----------|-----------------------------------------------------|-------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 128 pins  | 128-pin plastic LFQFP<br>(14 × 20 mm, 0.5 mm pitch) | Mounted     | A<br><br><br><br><br><br><br><br><br><br>D | R5F100SHAFB#V0, R5F100SJAFB#V0,<br>R5F100SKAFB#V0, R5F100SLAFB#V0<br>R5F100SHAFB#X0, R5F100SJAFB#X0,<br>R5F100SKAFB#X0, R5F100SLAFB#X0<br>R5F100SHDFB#V0, R5F100SJDFB#V0,<br>R5F100SKDFB#V0, R5F100SLDFB#V0<br>R5F100SHDFB#X0, R5F100SJDFB#X0,<br>R5F100SKDFB#X0, R5F100SLDFB#X0 |
|           |                                                     | Not mounted | A<br><br><br><br><br><br><br><br><br><br>D | R5F101SHAFB#V0, R5F101SJAFB#V0,<br>R5F101SKAFB#V0, R5F101SLAFB#V0<br>R5F101SHAFB#X0, R5F101SJAFB#X0,<br>R5F101SKAFB#X0, R5F101SLAFB#X0<br>R5F101SHDFB#V0, R5F101SJDFB#V0,<br>R5F101SKDFB#V0, R5F101SLDFB#V0<br>R5F101SHDFB#X0, R5F101SJDFB#X0,<br>R5F101SKDFB#X0, R5F101SLDFB#X0 |

**Note** For the fields of application, refer to **Figure 1-1 Part Number, Memory Size, and Package of RL78/G13**.

**Caution** The ordering part numbers represent the numbers at the time of publication. For the latest ordering part numbers, refer to the target product page of the Renesas Electronics website.

- 64-pin plastic VFBGA (4 × 4 mm, 0.4 mm pitch)



| Pin No. | Name                          | Pin No. | Name                        | Pin No. | Name                                        | Pin No. | Name                        |
|---------|-------------------------------|---------|-----------------------------|---------|---------------------------------------------|---------|-----------------------------|
| A1      | P05/TI05/TO05                 | C1      | P51/INTP2/SO11              | E1      | P13/TxD2/SO20/(SDAA0)/(TI04)/(TO04)         | G1      | P146                        |
| A2      | P30/INTP3/RTC1HZ/SCK11/SCL11  | C2      | P71/KR1/SI21/SDA21          | E2      | P14/RxD2/SI20/SDA20/(SCLA0)/(TI03)/(TO03)   | G2      | P25/ANI5                    |
| A3      | P70/KR0/SCK21/SCL21           | C3      | P74/KR4/INTP8/SI01/SDA01    | E3      | P15/SCK20/SCL20/(TI02)/(TO02)               | G3      | P24/ANI4                    |
| A4      | P75/KR5/INTP9/SCK01/SCL01     | C4      | P52/(INTP10)                | E4      | P16/TI01/TO01/INTP5/(SI00)/(RxD0)           | G4      | P22/ANI2                    |
| A5      | P77/KR7/INTP11/(TxD2)         | C5      | P53/(INTP11)                | E5      | P03/ANI16/SI10/RxD1/SDA10                   | G5      | P130                        |
| A6      | P61/SDAA0                     | C6      | P63                         | E6      | P41/TI07/TO07                               | G6      | P02/ANI17/SO10/TxD1         |
| A7      | P60/SCLA0                     | C7      | V <sub>SS</sub>             | E7      | RESET                                       | G7      | P00/TI00                    |
| A8      | EV <sub>DD0</sub>             | C8      | P121/X1                     | E8      | P137/INTP0                                  | G8      | P124/XT2/EXCLKS             |
| B1      | P50/INTP1/SI11/SDA11          | D1      | P55/(PCLBUZ1)/(SCK00)       | F1      | P10/SCK00/SCL00/(TI07)/(TO07)               | H1      | P147/ANI18                  |
| B2      | P72/KR2/SO21                  | D2      | P06/TI06/TO06               | F2      | P11/SI00/RxD0/TOOLRxD/SDA00/(TI06)/(TO06)   | H2      | P27/ANI7                    |
| B3      | P73/KR3/SO01                  | D3      | P17/TI02/TO02/(SO00)/(TxD0) | F3      | P12/SO00/TxD0/TOOLTxD/(INTP5)/(TI05)/(TO05) | H3      | P26/ANI6                    |
| B4      | P76/KR6/INTP10/(RxD2)         | D4      | P54                         | F4      | P21/ANI1/AV <sub>REFM</sub>                 | H4      | P23/ANI3                    |
| B5      | P31/TI03/TO03/INTP4/(PCLBUZ0) | D5      | P42/TI04/TO04               | F5      | P04/SCK10/SCL10                             | H5      | P20/ANI0/AV <sub>REFP</sub> |
| B6      | P62                           | D6      | P40/TOOL0                   | F6      | P43                                         | H6      | P141/PCLBUZ1/INTP7          |
| B7      | V <sub>DD</sub>               | D7      | REGC                        | F7      | P01/TO00                                    | H7      | P140/PCLBUZ0/INTP6          |
| B8      | EV <sub>SS0</sub>             | D8      | P122/X2/EXCLK               | F8      | P123/XT1                                    | H8      | P120/ANI19                  |

**Cautions** 1. Make EV<sub>SS0</sub> pin the same potential as V<sub>SS</sub> pin.

2. Make V<sub>DD</sub> pin the potential that is higher than EV<sub>DD0</sub> pin.

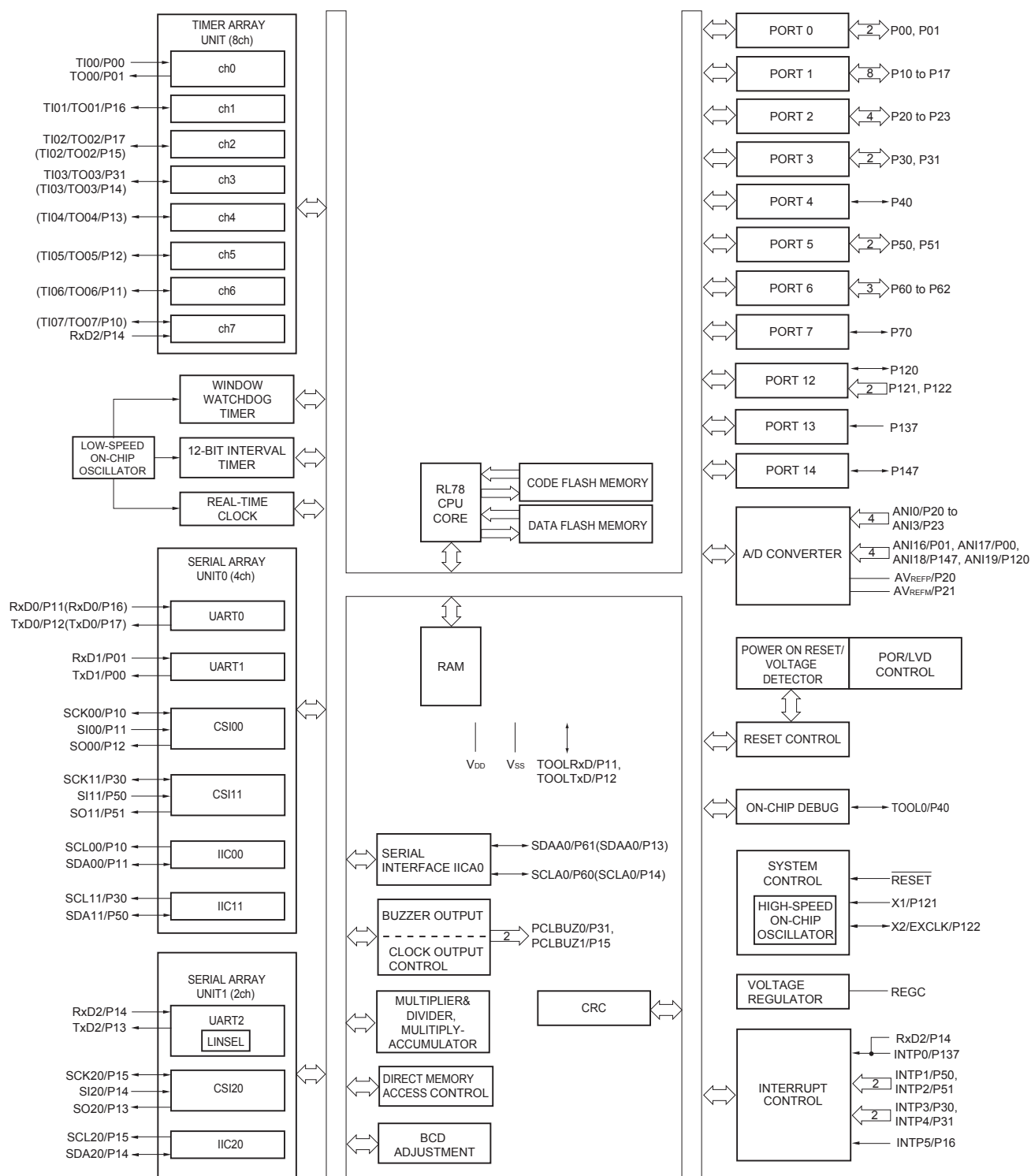
3. Connect the REGC pin to V<sub>SS</sub> via a capacitor (0.47 to 1  $\mu$ F).

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

2. When using the microcontroller for an application where the noise generated inside the microcontroller must be reduced, it is recommended to supply separate powers to the V<sub>DD</sub> and EV<sub>DD0</sub> pins and connect the V<sub>SS</sub> and EV<sub>SS0</sub> pins to separate ground lines.

3. Functions in parentheses in the above figure can be assigned via settings in the peripheral I/O redirection register (PIOR). Refer to **Figure 4-8 Format of Peripheral I/O Redirection Register (PIOR)** in the RL78/G13 User's Manual.

## 1.5.5 32-pin products



**Remark** Functions in parentheses in the above figure can be assigned via settings in the peripheral I/O redirection register (PIOR). Refer to **Figure 4-8 Format of Peripheral I/O Redirection Register (PIOR)** in the RL78/G13 User's Manual.

## 1.6 Outline of Functions

[20-pin, 24-pin, 25-pin, 30-pin, 32-pin, 36-pin products]

**Caution** This outline describes the functions at the time when Peripheral I/O redirection register (PIOR) is set to 00H.

(1/2)

| Item                               |                                        | 20-pin                                                                                                                                                                                                                                                                                                                                                                                  |          | 24-pin                                                       |          | 25-pin                                                       |          | 30-pin                                                                                                              |          | 32-pin                                                       |          | 36-pin                                                        |          |
|------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------|----------|--------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------|----------|---------------------------------------------------------------|----------|
|                                    |                                        | R5F1006x                                                                                                                                                                                                                                                                                                                                                                                | R5F1016x | R5F1007x                                                     | R5F1017x | R5F1008x                                                     | R5F1018x | R5F100Ax                                                                                                            | R5F101Ax | R5F100Bx                                                     | R5F101Bx | R5F100Cx                                                      | R5F101Cx |
| Code flash memory (KB)             |                                        | 16 to 64                                                                                                                                                                                                                                                                                                                                                                                |          | 16 to 64                                                     |          | 16 to 64                                                     |          | 16 to 128                                                                                                           |          | 16 to 128                                                    |          | 16 to 128                                                     |          |
| Data flash memory (KB)             |                                        | 4                                                                                                                                                                                                                                                                                                                                                                                       | –        | 4                                                            | –        | 4                                                            | –        | 4 to 8                                                                                                              | –        | 4 to 8                                                       | –        | 4 to 8                                                        | –        |
| RAM (KB)                           |                                        | 2 to 4 <sup>Note1</sup>                                                                                                                                                                                                                                                                                                                                                                 |          | 2 to 4 <sup>Note1</sup>                                      |          | 2 to 4 <sup>Note1</sup>                                      |          | 2 to 12 <sup>Note1</sup>                                                                                            |          | 2 to 12 <sup>Note1</sup>                                     |          | 2 to 12 <sup>Note1</sup>                                      |          |
| Address space                      |                                        | 1 MB                                                                                                                                                                                                                                                                                                                                                                                    |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| Main system clock                  | High-speed system clock                | X1 (crystal/ceramic) oscillation, external main system clock input (EXCLK)<br>HS (High-speed main) mode: 1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),<br>HS (High-speed main) mode: 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V),<br>LS (Low-speed main) mode: 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V),<br>LV (Low-voltage main) mode: 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V) |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    | High-speed on-chip oscillator          | HS (High-speed main) mode: 1 to 32 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),<br>HS (High-speed main) mode: 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V),<br>LS (Low-speed main) mode: 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V),<br>LV (Low-voltage main) mode: 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)                                                                               |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| Subsystem clock                    |                                        | –                                                                                                                                                                                                                                                                                                                                                                                       |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| Low-speed on-chip oscillator       |                                        | 15 kHz (TYP.)                                                                                                                                                                                                                                                                                                                                                                           |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| General-purpose registers          |                                        | (8-bit register × 8) × 4 banks                                                                                                                                                                                                                                                                                                                                                          |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| Minimum instruction execution time |                                        | 0.03125 μs (High-speed on-chip oscillator: f <sub>IH</sub> = 32 MHz operation)                                                                                                                                                                                                                                                                                                          |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    |                                        | 0.05 μs (High-speed system clock: f <sub>MX</sub> = 20 MHz operation)                                                                                                                                                                                                                                                                                                                   |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| Instruction set                    |                                        | <ul style="list-style-type: none"><li>• Data transfer (8/16 bits)</li><li>• Adder and subtractor/logical operation (8/16 bits)</li><li>• Multiplication (8 bits × 8 bits)</li><li>• Rotate, barrel shift, and bit manipulation (Set, reset, test, and Boolean operation), etc.</li></ul>                                                                                                |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
| I/O port                           | Total                                  | 16                                                                                                                                                                                                                                                                                                                                                                                      |          | 20                                                           |          | 21                                                           |          | 26                                                                                                                  |          | 28                                                           |          | 32                                                            |          |
|                                    | CMOS I/O                               | 13<br>(N-ch O.D. I/O [V <sub>DD</sub> withstand voltage]: 5)                                                                                                                                                                                                                                                                                                                            |          | 15<br>(N-ch O.D. I/O [V <sub>DD</sub> withstand voltage]: 6) |          | 15<br>(N-ch O.D. I/O [V <sub>DD</sub> withstand voltage]: 6) |          | 21<br>(N-ch O.D. I/O [V <sub>DD</sub> withstand voltage]: 9)                                                        |          | 22<br>(N-ch O.D. I/O [V <sub>DD</sub> withstand voltage]: 9) |          | 26<br>(N-ch O.D. I/O [V <sub>DD</sub> withstand voltage]: 10) |          |
|                                    | CMOS input                             | 3                                                                                                                                                                                                                                                                                                                                                                                       |          | 3                                                            |          | 3                                                            |          | 3                                                                                                                   |          | 3                                                            |          | 3                                                             |          |
|                                    | CMOS output                            | –                                                                                                                                                                                                                                                                                                                                                                                       |          | –                                                            |          | 1                                                            |          | –                                                                                                                   |          | –                                                            |          | –                                                             |          |
|                                    | N-ch O.D. I/O (withstand voltage: 6 V) | –                                                                                                                                                                                                                                                                                                                                                                                       |          | 2                                                            |          | 2                                                            |          | 2                                                                                                                   |          | 3                                                            |          | 3                                                             |          |
| Timer                              | 16-bit timer                           | 8 channels                                                                                                                                                                                                                                                                                                                                                                              |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    | Watchdog timer                         | 1 channel                                                                                                                                                                                                                                                                                                                                                                               |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    | Real-time clock (RTC)                  | 1 channel <sup>Note 2</sup>                                                                                                                                                                                                                                                                                                                                                             |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    | 12-bit interval timer (IT)             | 1 channel                                                                                                                                                                                                                                                                                                                                                                               |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    | Timer output                           | 3 channels (PWM outputs: 2 <sup>Note 3</sup> )                                                                                                                                                                                                                                                                                                                                          |          | 4 channels (PWM outputs: 3 <sup>Note 3</sup> )               |          |                                                              |          | 4 channels (PWM outputs: 3 <sup>Note 3</sup> ),<br>8 channels (PWM outputs: 7 <sup>Note 3</sup> ) <sup>Note 4</sup> |          |                                                              |          |                                                               |          |
|                                    | RTC output                             | –                                                                                                                                                                                                                                                                                                                                                                                       |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |
|                                    |                                        |                                                                                                                                                                                                                                                                                                                                                                                         |          |                                                              |          |                                                              |          |                                                                                                                     |          |                                                              |          |                                                               |          |

- Notes**
- The flash library uses RAM in self-programming and rewriting of the data flash memory. The target products and start address of the RAM areas used by the flash library are shown below.  
 R5F100xD, R5F101xD (x = 6 to 8, A to C): Start address FF300H  
 R5F100xE, R5F101xE (x = 6 to 8, A to C): Start address FEF00H  
 For the RAM areas used by the flash library, see **Self RAM list of Flash Self-Programming Library for RL78 Family (R20UT2944)**.
  - Only the constant-period interrupt function when the low-speed on-chip oscillator clock (f<sub>IL</sub>) is selected

## 2.3.2 Supply current characteristics

## (1) Flash ROM: 16 to 64 KB of 20- to 64-pin products

(T<sub>A</sub> = -40 to +85°C, 1.6 V ≤ E<sub>VDD0</sub> ≤ V<sub>DD</sub> ≤ 5.5 V, V<sub>SS</sub> = E<sub>VSS0</sub> = 0 V) (1/2)

| Parameter                        | Symbol           | Conditions     |                                             |                                                                           |                                                                         | MIN.                    | TYP.                    | MAX. | Unit |     |    |
|----------------------------------|------------------|----------------|---------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------|-------------------------|------|------|-----|----|
| Supply current <sup>Note 1</sup> | I <sub>DD1</sub> | Operating mode | HS (high-speed main) mode <sup>Note 5</sup> | f <sub>IH</sub> = 32 MHz <sup>Note 3</sup>                                | Basic operation                                                         | V <sub>DD</sub> = 5.0 V |                         | 2.1  |      | mA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | V <sub>DD</sub> = 3.0 V |                         | 2.1  |      | mA  |    |
|                                  |                  |                |                                             |                                                                           | Normal operation                                                        | V <sub>DD</sub> = 5.0 V |                         | 4.6  | 7.0  | mA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | V <sub>DD</sub> = 3.0 V |                         | 4.6  | 7.0  | mA  |    |
|                                  |                  |                |                                             | f <sub>IH</sub> = 24 MHz <sup>Note 3</sup>                                | Normal operation                                                        | V <sub>DD</sub> = 5.0 V |                         | 3.7  | 5.5  | mA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | V <sub>DD</sub> = 3.0 V |                         | 3.7  | 5.5  | mA  |    |
|                                  |                  |                |                                             | f <sub>IH</sub> = 16 MHz <sup>Note 3</sup>                                | Normal operation                                                        | V <sub>DD</sub> = 5.0 V |                         | 2.7  | 4.0  | mA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | V <sub>DD</sub> = 3.0 V |                         | 2.7  | 4.0  | mA  |    |
|                                  |                  |                |                                             | LS (low-speed main) mode <sup>Note 5</sup>                                | f <sub>IH</sub> = 8 MHz <sup>Note 3</sup>                               | Normal operation        | V <sub>DD</sub> = 3.0 V |      | 1.2  | 1.8 | mA |
|                                  |                  |                |                                             |                                                                           |                                                                         |                         | V <sub>DD</sub> = 2.0 V |      | 1.2  | 1.8 | mA |
|                                  |                  |                |                                             | LV (low-voltage main) mode <sup>Note 5</sup>                              | f <sub>IH</sub> = 4 MHz <sup>Note 3</sup>                               | Normal operation        | V <sub>DD</sub> = 3.0 V |      | 1.2  | 1.7 | mA |
|                                  |                  |                |                                             |                                                                           |                                                                         |                         | V <sub>DD</sub> = 2.0 V |      | 1.2  | 1.7 | mA |
|                                  |                  |                | HS (high-speed main) mode <sup>Note 5</sup> | f <sub>MX</sub> = 20 MHz <sup>Note 2</sup> ,<br>V <sub>DD</sub> = 5.0 V   | Normal operation                                                        | Square wave input       |                         | 3.0  | 4.6  | mA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 3.2  | 4.8  | mA  |    |
|                                  |                  |                |                                             |                                                                           | Normal operation                                                        | Square wave input       |                         | 3.0  | 4.6  | mA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 3.2  | 4.8  | mA  |    |
|                                  |                  |                |                                             |                                                                           | f <sub>MX</sub> = 10 MHz <sup>Note 2</sup> ,<br>V <sub>DD</sub> = 5.0 V | Normal operation        | Square wave input       |      | 1.9  | 2.7 | mA |
|                                  |                  |                |                                             |                                                                           |                                                                         |                         | Resonator connection    |      | 1.9  | 2.7 | mA |
|                                  |                  |                |                                             |                                                                           | f <sub>MX</sub> = 10 MHz <sup>Note 2</sup> ,<br>V <sub>DD</sub> = 3.0 V | Normal operation        | Square wave input       |      | 1.9  | 2.7 | mA |
|                                  |                  |                |                                             |                                                                           |                                                                         |                         | Resonator connection    |      | 1.9  | 2.7 | mA |
|                                  |                  |                |                                             | LS (low-speed main) mode <sup>Note 5</sup>                                | f <sub>MX</sub> = 8 MHz <sup>Note 2</sup> ,<br>V <sub>DD</sub> = 3.0 V  | Normal operation        | Square wave input       |      | 1.1  | 1.7 | mA |
|                                  |                  |                |                                             |                                                                           |                                                                         |                         | Resonator connection    |      | 1.1  | 1.7 | mA |
|                                  |                  |                |                                             |                                                                           | f <sub>MX</sub> = 8 MHz <sup>Note 2</sup> ,<br>V <sub>DD</sub> = 2.0 V  | Normal operation        | Square wave input       |      | 1.1  | 1.7 | mA |
|                                  |                  |                |                                             |                                                                           |                                                                         |                         | Resonator connection    |      | 1.1  | 1.7 | mA |
|                                  |                  |                | Subsystem clock operation                   | f <sub>SUB</sub> = 32.768 kHz <sup>Note 4</sup><br>T <sub>A</sub> = −40°C | Normal operation                                                        | Square wave input       |                         | 4.1  | 4.9  | μA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 4.2  | 5.0  | μA  |    |
|                                  |                  |                |                                             | f <sub>SUB</sub> = 32.768 kHz <sup>Note 4</sup><br>T <sub>A</sub> = +25°C | Normal operation                                                        | Square wave input       |                         | 4.1  | 4.9  | μA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 4.2  | 5.0  | μA  |    |
|                                  |                  |                |                                             | f <sub>SUB</sub> = 32.768 kHz <sup>Note 4</sup><br>T <sub>A</sub> = +50°C | Normal operation                                                        | Square wave input       |                         | 4.2  | 5.5  | μA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 4.3  | 5.6  | μA  |    |
|                                  |                  |                |                                             | f <sub>SUB</sub> = 32.768 kHz <sup>Note 4</sup><br>T <sub>A</sub> = +70°C | Normal operation                                                        | Square wave input       |                         | 4.3  | 6.3  | μA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 4.4  | 6.4  | μA  |    |
|                                  |                  |                |                                             | f <sub>SUB</sub> = 32.768 kHz <sup>Note 4</sup><br>T <sub>A</sub> = +85°C | Normal operation                                                        | Square wave input       |                         | 4.6  | 7.7  | μA  |    |
|                                  |                  |                |                                             |                                                                           |                                                                         | Resonator connection    |                         | 4.7  | 7.8  | μA  |    |

(Notes and Remarks are listed on the next page.)

**(2) Flash ROM: 96 to 256 KB of 30- to 100-pin products****(T<sub>A</sub> = -40 to +85°C, 1.6 V ≤ EV<sub>DD0</sub> = EV<sub>DD1</sub> ≤ V<sub>DD</sub> ≤ 5.5 V, V<sub>SS</sub> = EV<sub>SS0</sub> = EV<sub>SS1</sub> = 0 V) (1/2)**

| Parameter                | Symbol           | Conditions     |                                      |                                                                   |                  |                         | MIN. | TYP. | MAX. | Unit |
|--------------------------|------------------|----------------|--------------------------------------|-------------------------------------------------------------------|------------------|-------------------------|------|------|------|------|
| Supply current<br>Note 1 | I <sub>DD1</sub> | Operating mode | HS (high-speed main) mode<br>Note 5  | f <sub>IH</sub> = 32 MHz<br>Note 3                                | Basic operation  | V <sub>DD</sub> = 5.0 V |      | 2.3  |      | mA   |
|                          |                  |                |                                      |                                                                   |                  | V <sub>DD</sub> = 3.0 V |      | 2.3  |      | mA   |
|                          |                  |                |                                      |                                                                   | Normal operation | V <sub>DD</sub> = 5.0 V |      | 5.2  | 8.5  | mA   |
|                          |                  |                |                                      |                                                                   |                  | V <sub>DD</sub> = 3.0 V |      | 5.2  | 8.5  | mA   |
|                          |                  |                |                                      | f <sub>IH</sub> = 24 MHz<br>Note 3                                | Normal operation | V <sub>DD</sub> = 5.0 V |      | 4.1  | 6.6  | mA   |
|                          |                  |                |                                      |                                                                   |                  | V <sub>DD</sub> = 3.0 V |      | 4.1  | 6.6  | mA   |
|                          |                  |                |                                      | f <sub>IH</sub> = 16 MHz<br>Note 3                                | Normal operation | V <sub>DD</sub> = 5.0 V |      | 3.0  | 4.7  | mA   |
|                          |                  |                |                                      |                                                                   |                  | V <sub>DD</sub> = 3.0 V |      | 3.0  | 4.7  | mA   |
|                          |                  |                | LS (low-speed main) mode<br>Note 5   | f <sub>IH</sub> = 8 MHz<br>Note 3                                 | Normal operation | V <sub>DD</sub> = 3.0 V |      | 1.3  | 2.1  | mA   |
|                          |                  |                |                                      |                                                                   |                  | V <sub>DD</sub> = 2.0 V |      | 1.3  | 2.1  | mA   |
|                          |                  |                | LV (low-voltage main) mode<br>Note 5 | f <sub>IH</sub> = 4 MHz<br>Note 3                                 | Normal operation | V <sub>DD</sub> = 3.0 V |      | 1.3  | 1.8  | mA   |
|                          |                  |                |                                      |                                                                   |                  | V <sub>DD</sub> = 2.0 V |      | 1.3  | 1.8  | mA   |
|                          |                  |                | HS (high-speed main) mode<br>Note 5  | f <sub>MX</sub> = 20 MHz<br>Note 2, V <sub>DD</sub> = 5.0 V       | Normal operation | Square wave input       |      | 3.4  | 5.5  | mA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 3.6  | 5.7  | mA   |
|                          |                  |                |                                      | f <sub>MX</sub> = 20 MHz<br>Note 2, V <sub>DD</sub> = 3.0 V       | Normal operation | Square wave input       |      | 3.4  | 5.5  | mA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 3.6  | 5.7  | mA   |
|                          |                  |                |                                      | f <sub>MX</sub> = 10 MHz<br>Note 2, V <sub>DD</sub> = 5.0 V       | Normal operation | Square wave input       |      | 2.1  | 3.2  | mA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 2.1  | 3.2  | mA   |
|                          |                  |                |                                      | f <sub>MX</sub> = 10 MHz<br>Note 2, V <sub>DD</sub> = 3.0 V       | Normal operation | Square wave input       |      | 2.1  | 3.2  | mA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 2.1  | 3.2  | mA   |
|                          |                  |                | LS (low-speed main) mode<br>Note 5   | f <sub>MX</sub> = 8 MHz<br>Note 2, V <sub>DD</sub> = 3.0 V        | Normal operation | Square wave input       |      | 1.2  | 2.0  | mA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 1.2  | 2.0  | mA   |
|                          |                  |                |                                      | f <sub>MX</sub> = 8 MHz<br>Note 2, V <sub>DD</sub> = 2.0 V        | Normal operation | Square wave input       |      | 1.2  | 2.0  | mA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 1.2  | 2.0  | mA   |
|                          |                  |                | Subsystem clock operation            | f <sub>SUB</sub> = 32.768 kHz<br>Note 4<br>T <sub>A</sub> = -40°C | Normal operation | Square wave input       |      | 4.8  | 5.9  | μA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 4.9  | 6.0  | μA   |
|                          |                  |                |                                      | f <sub>SUB</sub> = 32.768 kHz<br>Note 4<br>T <sub>A</sub> = +25°C | Normal operation | Square wave input       |      | 4.9  | 5.9  | μA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 5.0  | 6.0  | μA   |
|                          |                  |                |                                      | f <sub>SUB</sub> = 32.768 kHz<br>Note 4<br>T <sub>A</sub> = +50°C | Normal operation | Square wave input       |      | 5.0  | 7.6  | μA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 5.1  | 7.7  | μA   |
|                          |                  |                |                                      | f <sub>SUB</sub> = 32.768 kHz<br>Note 4<br>T <sub>A</sub> = +70°C | Normal operation | Square wave input       |      | 5.2  | 9.3  | μA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 5.3  | 9.4  | μA   |
|                          |                  |                |                                      | f <sub>SUB</sub> = 32.768 kHz<br>Note 4<br>T <sub>A</sub> = +85°C | Normal operation | Square wave input       |      | 5.7  | 13.3 | μA   |
|                          |                  |                |                                      |                                                                   |                  | Resonator connection    |      | 5.8  | 13.4 | μA   |

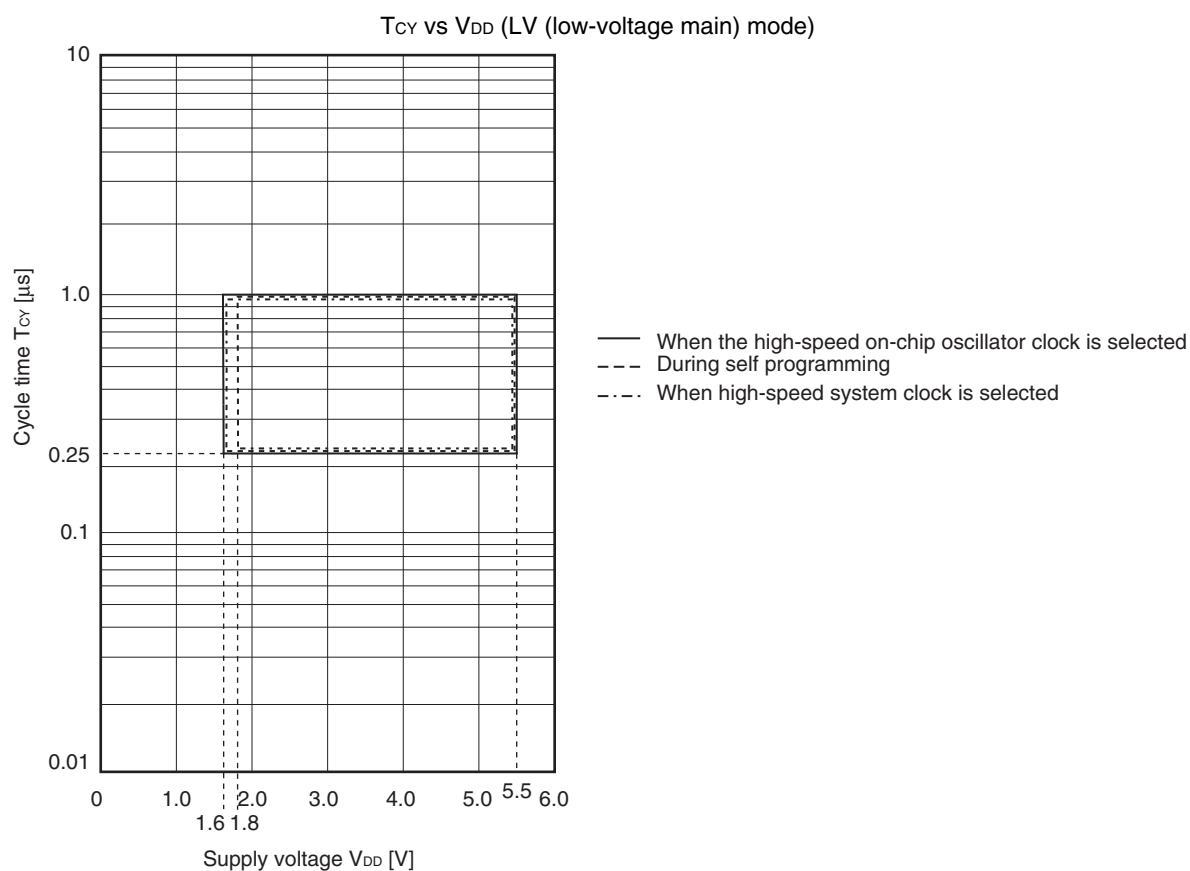
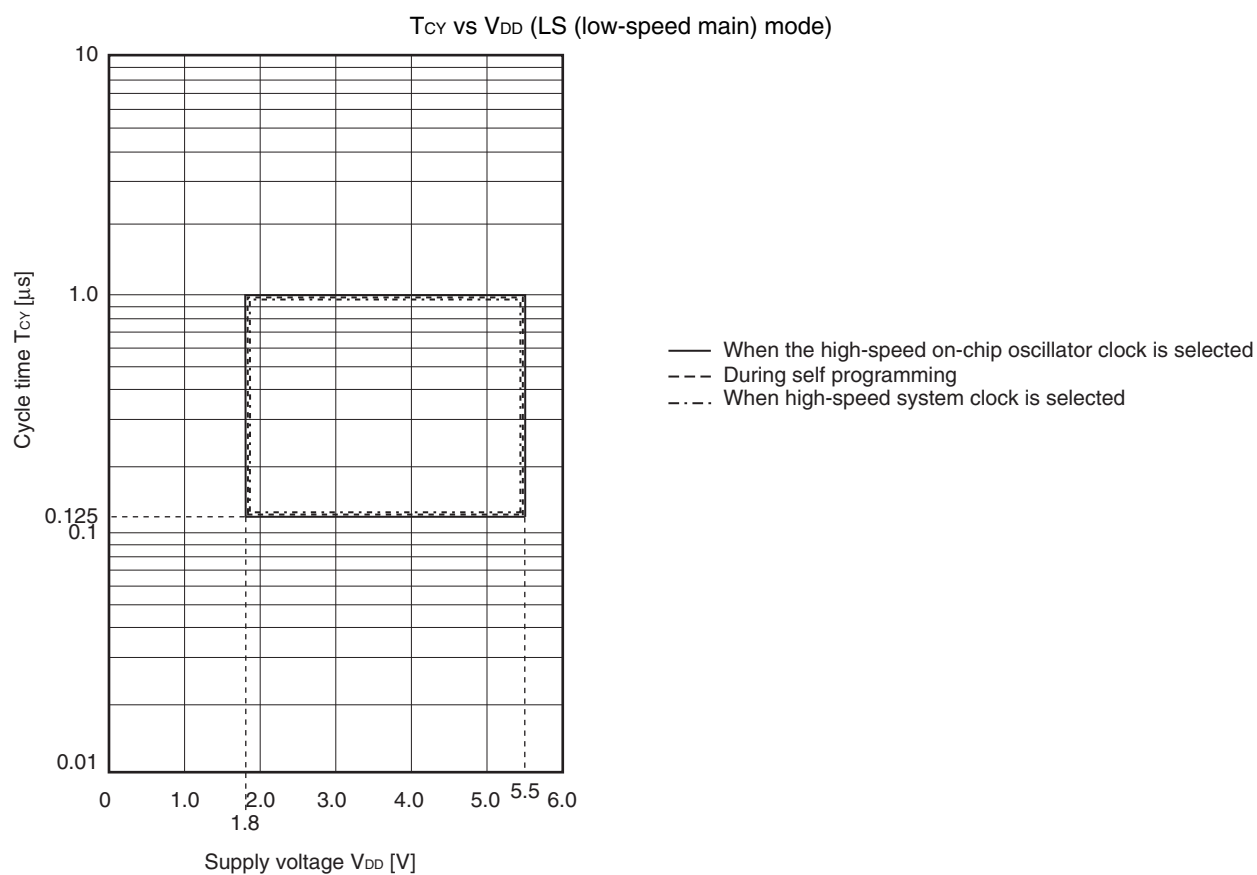
(Notes and Remarks are listed on the next page.)

## 2.4 AC Characteristics

(T<sub>A</sub> = -40 to +85°C, 1.6 V ≤ EV<sub>DD0</sub> = EV<sub>DD1</sub> ≤ V<sub>DD</sub> ≤ 5.5 V, V<sub>SS</sub> = EV<sub>SS0</sub> = EV<sub>SS1</sub> = 0 V)

| Items                                                              | Symbol                                | Conditions                                       |                                   | MIN.                              | TYP.    | MAX. | Unit               |
|--------------------------------------------------------------------|---------------------------------------|--------------------------------------------------|-----------------------------------|-----------------------------------|---------|------|--------------------|
| Instruction cycle (minimum instruction execution time)             | T <sub>CY</sub>                       | Main system clock (f <sub>MAIN</sub> ) operation | HS (high-speed main) mode         | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 0.03125 | 1    | μs                 |
|                                                                    |                                       |                                                  |                                   | 2.4 V ≤ V <sub>DD</sub> < 2.7 V   | 0.0625  | 1    | μs                 |
|                                                                    |                                       |                                                  | LS (low-speed main) mode          | 1.8 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 0.125   | 1    | μs                 |
|                                                                    |                                       |                                                  | LV (low-voltage main) mode        | 1.6 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 0.25    | 1    | μs                 |
|                                                                    |                                       | Subsystem clock (f <sub>SUB</sub> ) operation    |                                   | 1.8 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 28.5    | 30.5 | 31.3 μs            |
|                                                                    |                                       | In the self programming mode                     | HS (high-speed main) mode         | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 0.03125 | 1    | μs                 |
|                                                                    |                                       |                                                  |                                   | 2.4 V ≤ V <sub>DD</sub> < 2.7 V   | 0.0625  | 1    | μs                 |
|                                                                    |                                       |                                                  | LS (low-speed main) mode          | 1.8 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 0.125   | 1    | μs                 |
|                                                                    |                                       |                                                  | LV (low-voltage main) mode        | 1.8 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 0.25    | 1    | μs                 |
| External system clock frequency                                    | f <sub>EX</sub>                       | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V                  |                                   | 1.0                               |         | 20.0 | MHz                |
|                                                                    |                                       | 2.4 V ≤ V <sub>DD</sub> < 2.7 V                  |                                   | 1.0                               |         | 16.0 | MHz                |
|                                                                    |                                       | 1.8 V ≤ V <sub>DD</sub> < 2.4 V                  |                                   | 1.0                               |         | 8.0  | MHz                |
|                                                                    |                                       | 1.6 V ≤ V <sub>DD</sub> < 1.8 V                  |                                   | 1.0                               |         | 4.0  | MHz                |
|                                                                    | f <sub>EXS</sub>                      |                                                  |                                   | 32                                |         | 35   | kHz                |
| External system clock input high-level width, low-level width      | t <sub>EXH</sub> , t <sub>EXL</sub>   | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V                  |                                   | 24                                |         |      | ns                 |
|                                                                    |                                       | 2.4 V ≤ V <sub>DD</sub> < 2.7 V                  |                                   | 30                                |         |      | ns                 |
|                                                                    |                                       | 1.8 V ≤ V <sub>DD</sub> < 2.4 V                  |                                   | 60                                |         |      | ns                 |
|                                                                    |                                       | 1.6 V ≤ V <sub>DD</sub> < 1.8 V                  |                                   | 120                               |         |      | ns                 |
|                                                                    | t <sub>EXHS</sub> , t <sub>EXLS</sub> |                                                  |                                   | 13.7                              |         |      | μs                 |
| Ti00 to Ti07, Ti10 to Ti17 input high-level width, low-level width | t <sub>TIH</sub> , t <sub>TIL</sub>   |                                                  |                                   | 1/f <sub>MCK</sub> +10            |         |      | ns <sup>Note</sup> |
| TO00 to TO07, TO10 to TO17 output frequency                        | f <sub>TO</sub>                       | HS (high-speed main) mode                        |                                   | 4.0 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |         | 16   | MHz                |
|                                                                    |                                       |                                                  |                                   | 2.7 V ≤ EV <sub>DD0</sub> < 4.0 V |         | 8    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.8 V ≤ EV <sub>DD0</sub> < 2.7 V |         | 4    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V |         | 2    | MHz                |
|                                                                    |                                       | LS (low-speed main) mode                         |                                   | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |         | 4    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V |         | 2    | MHz                |
|                                                                    |                                       | LV (low-voltage main) mode                       |                                   | 1.6 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |         | 2    | MHz                |
| PCLBUZ0, PCLBUZ1 output frequency                                  | f <sub>PCL</sub>                      | HS (high-speed main) mode                        |                                   | 4.0 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |         | 16   | MHz                |
|                                                                    |                                       |                                                  |                                   | 2.7 V ≤ EV <sub>DD0</sub> < 4.0 V |         | 8    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.8 V ≤ EV <sub>DD0</sub> < 2.7 V |         | 4    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V |         | 2    | MHz                |
|                                                                    |                                       | LS (low-speed main) mode                         |                                   | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |         | 4    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V |         | 2    | MHz                |
|                                                                    |                                       | LV (low-voltage main) mode                       |                                   | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |         | 4    | MHz                |
|                                                                    |                                       |                                                  |                                   | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V |         | 2    | MHz                |
| Interrupt input high-level width, low-level width                  | t <sub>INTH</sub> , t <sub>INTL</sub> | INTP0                                            | 1.6 V ≤ V <sub>DD</sub> ≤ 5.5 V   | 1                                 |         |      | μs                 |
|                                                                    |                                       | INTP1 to INTP11                                  | 1.6 V ≤ EV <sub>DD0</sub> ≤ 5.5 V | 1                                 |         |      | μs                 |
| Key interrupt input low-level width                                | t <sub>KR</sub>                       | KR0 to KR7                                       | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V | 250                               |         |      | ns                 |
|                                                                    |                                       |                                                  | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V | 1                                 |         |      | μs                 |
| RESET low-level width                                              | t <sub>RSL</sub>                      |                                                  |                                   | 10                                |         |      | μs                 |

(Note and Remark are listed on the next page.)



(5) During communication at same potential (simplified I<sup>2</sup>C mode) (2/2)(T<sub>A</sub> = -40 to +85°C, 1.6 V ≤ EV<sub>DD0</sub> = EV<sub>DD1</sub> ≤ V<sub>DD</sub> ≤ 5.5 V, V<sub>SS</sub> = EV<sub>SS0</sub> = EV<sub>SS1</sub> = 0 V)

| Parameter                     | Symbol              | Conditions                                                                            | HS (high-speed main) Mode            |      | LS (low-speed main) Mode             |      | LV (low-voltage main) Mode           |      | Unit |
|-------------------------------|---------------------|---------------------------------------------------------------------------------------|--------------------------------------|------|--------------------------------------|------|--------------------------------------|------|------|
|                               |                     |                                                                                       | MIN.                                 | MAX. | MIN.                                 | MAX. | MIN.                                 | MAX. |      |
| Data setup time (reception)   | t <sub>SU:DAT</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V,<br>C <sub>b</sub> = 50 pF, R <sub>b</sub> = 2.7 kΩ | 1/f <sub>MCK</sub><br>+ 85<br>Note2  |      | 1/f <sub>MCK</sub><br>+ 145<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 145<br>Note2 |      | ns   |
|                               |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 3 kΩ  | 1/f <sub>MCK</sub><br>+ 145<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 145<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 145<br>Note2 |      | ns   |
|                               |                     | 1.8 V ≤ EV <sub>DD0</sub> < 2.7 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 5 kΩ  | 1/f <sub>MCK</sub><br>+ 230<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 230<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 230<br>Note2 |      | ns   |
|                               |                     | 1.7 V ≤ EV <sub>DD0</sub> < 1.8 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 5 kΩ  | 1/f <sub>MCK</sub><br>+ 290<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 290<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 290<br>Note2 |      | ns   |
|                               |                     | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 5 kΩ  | —                                    |      | 1/f <sub>MCK</sub><br>+ 290<br>Note2 |      | 1/f <sub>MCK</sub><br>+ 290<br>Note2 |      | ns   |
| Data hold time (transmission) | t <sub>HD:DAT</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V,<br>C <sub>b</sub> = 50 pF, R <sub>b</sub> = 2.7 kΩ | 0                                    | 305  | 0                                    | 305  | 0                                    | 305  | ns   |
|                               |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 3 kΩ  | 0                                    | 355  | 0                                    | 355  | 0                                    | 355  | ns   |
|                               |                     | 1.8 V ≤ EV <sub>DD0</sub> < 2.7 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 5 kΩ  | 0                                    | 405  | 0                                    | 405  | 0                                    | 405  | ns   |
|                               |                     | 1.7 V ≤ EV <sub>DD0</sub> < 1.8 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 5 kΩ  | 0                                    | 405  | 0                                    | 405  | 0                                    | 405  | ns   |
|                               |                     | 1.6 V ≤ EV <sub>DD0</sub> < 1.8 V,<br>C <sub>b</sub> = 100 pF, R <sub>b</sub> = 5 kΩ  | —                                    |      | 0                                    | 405  | 0                                    | 405  | ns   |

**Notes** 1. The value must also be equal to or less than f<sub>MCK</sub>/4.2. Set the f<sub>MCK</sub> value to keep the hold time of SCLr = "L" and SCLr = "H".

**Caution** Select the normal input buffer and the N-ch open drain output (V<sub>DD</sub> tolerance (When 20- to 52-pin products)/EV<sub>DD</sub> tolerance (When 64- to 128-pin products)) mode for the SDAr pin and the normal output mode for the SCLr pin by using port input mode register g (PIMg) and port output mode register h (POMh).

(Remarks are listed on the next page.)

(2) I<sup>2</sup>C fast mode(T<sub>A</sub> = -40 to +85°C, 1.6 V ≤ EV<sub>DD0</sub> = EV<sub>DD1</sub> ≤ V<sub>DD</sub> ≤ 5.5 V, V<sub>SS</sub> = EV<sub>SS0</sub> = EV<sub>SS1</sub> = 0 V)

| Parameter                                       | Symbol              | Conditions                               |                                   | HS (high-speed main) Mode |      | LS (low-speed main) Mode |      | LV (low-voltage main) Mode |      | Unit |
|-------------------------------------------------|---------------------|------------------------------------------|-----------------------------------|---------------------------|------|--------------------------|------|----------------------------|------|------|
|                                                 |                     |                                          |                                   | MIN.                      | MAX. | MIN.                     | MAX. | MIN.                       | MAX. |      |
| SCLA0 clock frequency                           | f <sub>SCL</sub>    | Fast mode:<br>f <sub>CLK</sub> ≥ 3.5 MHz | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V | 0                         | 400  | 0                        | 400  | 0                          | 400  | kHz  |
|                                                 |                     |                                          | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V | 0                         | 400  | 0                        | 400  | 0                          | 400  | kHz  |
| Setup time of restart condition                 | t <sub>SU:STA</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
| Hold time <sup>Note 1</sup>                     | t <sub>HD:STA</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
| Hold time when SCLA0 = "L"                      | t <sub>LOW</sub>    | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 1.3                       |      | 1.3                      |      | 1.3                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 1.3                       |      | 1.3                      |      | 1.3                        |      | μs   |
| Hold time when SCLA0 = "H"                      | t <sub>HIGH</sub>   | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
| Data setup time (reception)                     | t <sub>SU:DAT</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 100                       |      | 100                      |      | 100                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 100                       |      | 100                      |      | 100                        |      | μs   |
| Data hold time (transmission) <sup>Note 2</sup> | t <sub>HD:DAT</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0                         | 0.9  | 0                        | 0.9  | 0                          | 0.9  | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0                         | 0.9  | 0                        | 0.9  | 0                          | 0.9  | μs   |
| Setup time of stop condition                    | t <sub>SU:STO</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 0.6                       |      | 0.6                      |      | 0.6                        |      | μs   |
| Bus-free time                                   | t <sub>BUF</sub>    | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 1.3                       |      | 1.3                      |      | 1.3                        |      | μs   |
|                                                 |                     | 1.8 V ≤ EV <sub>DD0</sub> ≤ 5.5 V        |                                   | 1.3                       |      | 1.3                      |      | 1.3                        |      | μs   |

**Notes** 1. The first clock pulse is generated after this period when the start/restart condition is detected.2. The maximum value (MAX.) of t<sub>HD:DAT</sub> is during normal transfer and a wait state is inserted in the ACK (acknowledge) timing.**Caution** The values in the above table are applied even when bit 2 (PIOR2) in the peripheral I/O redirection register (PIOR) is 1. At this time, the pin characteristics (I<sub>OH1</sub>, I<sub>OL1</sub>, V<sub>OH1</sub>, V<sub>OL1</sub>) must satisfy the values in the redirect destination.**Remark** The maximum value of C<sub>b</sub> (communication line capacitance) and the value of R<sub>b</sub> (communication line pull-up resistor) at that time in each mode are as follows.Fast mode: C<sub>b</sub> = 320 pF, R<sub>b</sub> = 1.1 kΩ

&lt;R&gt;

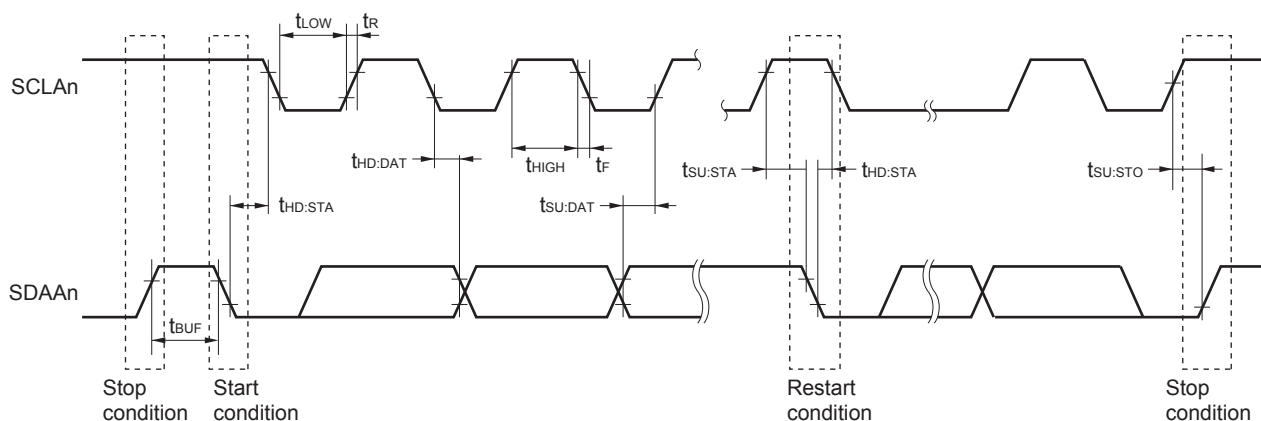
**(3) I<sup>2</sup>C fast mode plus**(T<sub>A</sub> = -40 to +85°C, 1.6 V ≤ EV<sub>DD0</sub> = EV<sub>DD1</sub> ≤ V<sub>DD</sub> ≤ 5.5 V, V<sub>SS</sub> = EV<sub>SS0</sub> = EV<sub>SS1</sub> = 0 V)

| Parameter                                       | Symbol              | Conditions                                   |                                   | HS (high-speed main) Mode |      | LS (low-speed main) Mode |      | LV (low-voltage main) Mode |      | Unit |
|-------------------------------------------------|---------------------|----------------------------------------------|-----------------------------------|---------------------------|------|--------------------------|------|----------------------------|------|------|
|                                                 |                     |                                              |                                   | MIN.                      | MAX. | MIN.                     | MAX. | MIN.                       | MAX. |      |
| SCLA0 clock frequency                           | f <sub>SCL</sub>    | Fast mode plus:<br>f <sub>CLK</sub> ≥ 10 MHz | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V | 0                         | 1000 | —                        | —    | —                          | —    | kHz  |
| Setup time of restart condition                 | t <sub>SU:STA</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0.26                      |      | —                        | —    | —                          | —    | μs   |
| Hold time <sup>Note 1</sup>                     | t <sub>HD:STA</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0.26                      |      | —                        | —    | —                          | —    | μs   |
| Hold time when SCLA0 = "L"                      | t <sub>LOW</sub>    | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0.5                       |      | —                        | —    | —                          | —    | μs   |
| Hold time when SCLA0 = "H"                      | t <sub>HIGH</sub>   | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0.26                      |      | —                        | —    | —                          | —    | μs   |
| Data setup time (reception)                     | t <sub>SU:DAT</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 50                        |      | —                        | —    | —                          | —    | μs   |
| Data hold time (transmission) <sup>Note 2</sup> | t <sub>HD:DAT</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0                         | 0.45 | —                        | —    | —                          | —    | μs   |
| Setup time of stop condition                    | t <sub>SU:STO</sub> | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0.26                      |      | —                        | —    | —                          | —    | μs   |
| Bus-free time                                   | t <sub>BUF</sub>    | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V            |                                   | 0.5                       |      | —                        | —    | —                          | —    | μs   |

**Notes** 1. The first clock pulse is generated after this period when the start/restart condition is detected.<R> 2. The maximum value (MAX.) of t<sub>HD:DAT</sub> is during normal transfer and a wait state is inserted in the ACK (acknowledge) timing.

**Caution** The values in the above table are applied even when bit 2 (PIOR2) in the peripheral I/O redirection register (PIOR) is 1. At this time, the pin characteristics (I<sub>OH1</sub>, I<sub>OL1</sub>, V<sub>OH1</sub>, V<sub>OL1</sub>) must satisfy the values in the redirect destination.

**Remark** The maximum value of C<sub>b</sub> (communication line capacitance) and the value of R<sub>b</sub> (communication line pull-up resistor) at that time in each mode are as follows.

Fast mode plus: C<sub>b</sub> = 120 pF, R<sub>b</sub> = 1.1 kΩ**I<sup>2</sup>C serial transfer timing****Remark** n = 0, 1

## 2.8 Flash Memory Programming Characteristics

( $T_A = -40$  to  $+85^\circ\text{C}$ ,  $1.8\text{ V} \leq V_{DD} \leq 5.5\text{ V}$ ,  $V_{SS} = 0\text{ V}$ )

| Parameter                                                     | Symbol     | Conditions                                        | MIN.    | TYP.      | MAX. | Unit  |
|---------------------------------------------------------------|------------|---------------------------------------------------|---------|-----------|------|-------|
| CPU/peripheral hardware clock frequency                       | $f_{CLK}$  | $1.8\text{ V} \leq V_{DD} \leq 5.5\text{ V}$      | 1       |           | 32   | MHz   |
| Number of code flash rewrites<br><small>Notes 1, 2, 3</small> | $C_{erwr}$ | Retained for 20 years<br>$T_A = 85^\circ\text{C}$ | 1,000   |           |      | Times |
| Number of data flash rewrites<br><small>Notes 1, 2, 3</small> |            | Retained for 1 years<br>$T_A = 25^\circ\text{C}$  |         | 1,000,000 |      |       |
|                                                               |            | Retained for 5 years<br>$T_A = 85^\circ\text{C}$  | 100,000 |           |      |       |
|                                                               |            | Retained for 20 years<br>$T_A = 85^\circ\text{C}$ | 10,000  |           |      |       |

**Notes** 1. 1 erase + 1 write after the erase is regarded as 1 rewrite.

The retaining years are until next rewrite after the rewrite.

2. When using flash memory programmer and Renesas Electronics self programming library

3. These are the characteristics of the flash memory and the results obtained from reliability testing by Renesas Electronics Corporation.

## 2.9 Dedicated Flash Memory Programmer Communication (UART)

( $T_A = -40$  to  $+85^\circ\text{C}$ ,  $1.8\text{ V} \leq EV_{DD0} = EV_{DD1} \leq V_{DD} \leq 5.5\text{ V}$ ,  $V_{SS} = EV_{SS0} = EV_{SS1} = 0\text{ V}$ )

| Parameter     | Symbol | Conditions                | MIN.    | TYP. | MAX.      | Unit |
|---------------|--------|---------------------------|---------|------|-----------|------|
| Transfer rate |        | During serial programming | 115,200 |      | 1,000,000 | bps  |

## 3.4 AC Characteristics

(T<sub>A</sub> =  $-40$  to  $+105^\circ\text{C}$ ,  $2.4\text{ V} \leq \text{EV}_{\text{DD}0} = \text{EV}_{\text{DD}1} \leq \text{V}_{\text{DD}} \leq 5.5\text{ V}$ ,  $\text{V}_{\text{SS}} = \text{EV}_{\text{SS}0} = \text{EV}_{\text{SS}1} = 0\text{ V}$ )

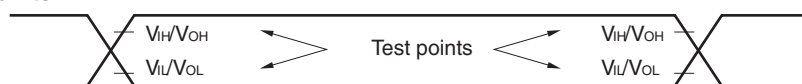
| Items                                                              | Symbol                                | Conditions                                       |                                   |                                 | MIN.                   | TYP. | MAX. | Unit               |
|--------------------------------------------------------------------|---------------------------------------|--------------------------------------------------|-----------------------------------|---------------------------------|------------------------|------|------|--------------------|
| Instruction cycle (minimum instruction execution time)             | T <sub>cy</sub>                       | Main system clock (f <sub>MAIN</sub> ) operation | HS (high-speed main) mode         | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V | 0.03125                |      | 1    | μs                 |
|                                                                    |                                       |                                                  |                                   | 2.4 V ≤ V <sub>DD</sub> < 2.7 V | 0.0625                 |      | 1    | μs                 |
|                                                                    |                                       | Subsystem clock (f <sub>SUB</sub> ) operation    |                                   | 2.4 V ≤ V <sub>DD</sub> ≤ 5.5 V | 28.5                   | 30.5 | 31.3 | μs                 |
|                                                                    |                                       | In the self programming mode                     | HS (high-speed main) mode         | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V | 0.03125                |      | 1    | μs                 |
|                                                                    |                                       |                                                  |                                   | 2.4 V ≤ V <sub>DD</sub> < 2.7 V | 0.0625                 |      | 1    | μs                 |
| External system clock frequency                                    | f <sub>EX</sub>                       | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V                  |                                   |                                 | 1.0                    |      | 20.0 | MHz                |
|                                                                    |                                       | 2.4 V ≤ V <sub>DD</sub> < 2.7 V                  |                                   |                                 | 1.0                    |      | 16.0 | MHz                |
|                                                                    | f <sub>EXS</sub>                      |                                                  |                                   |                                 | 32                     |      | 35   | kHz                |
| External system clock input high-level width, low-level width      | t <sub>EXH</sub> , t <sub>EXL</sub>   | 2.7 V ≤ V <sub>DD</sub> ≤ 5.5 V                  |                                   |                                 | 24                     |      |      | ns                 |
|                                                                    |                                       | 2.4 V ≤ V <sub>DD</sub> < 2.7 V                  |                                   |                                 | 30                     |      |      | ns                 |
|                                                                    | t <sub>EXHS</sub> , t <sub>EXLS</sub> |                                                  |                                   |                                 | 13.7                   |      |      | μs                 |
| TI00 to TI07, TI10 to TI17 input high-level width, low-level width | t <sub>TIH</sub> , t <sub>TIL</sub>   |                                                  |                                   |                                 | 1/f <sub>MCK</sub> +10 |      |      | ns <sup>Note</sup> |
| TO00 to TO07, TO10 to TO17 output frequency                        | f <sub>TO</sub>                       | HS (high-speed main) mode                        | 4.0 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |                                 |                        |      | 16   | MHz                |
|                                                                    |                                       |                                                  | 2.7 V ≤ EV <sub>DD0</sub> < 4.0 V |                                 |                        |      | 8    | MHz                |
|                                                                    |                                       |                                                  | 2.4 V ≤ EV <sub>DD0</sub> < 2.7 V |                                 |                        |      | 4    | MHz                |
| PCLBUZ0, PCLBUZ1 output frequency                                  | f <sub>PCL</sub>                      | HS (high-speed main) mode                        | 4.0 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |                                 |                        |      | 16   | MHz                |
|                                                                    |                                       |                                                  | 2.7 V ≤ EV <sub>DD0</sub> < 4.0 V |                                 |                        |      | 8    | MHz                |
|                                                                    |                                       |                                                  | 2.4 V ≤ EV <sub>DD0</sub> < 2.7 V |                                 |                        |      | 4    | MHz                |
| Interrupt input high-level width, low-level width                  | t <sub>INTH</sub> , t <sub>INTL</sub> | INTP0                                            | 2.4 V ≤ V <sub>DD</sub> ≤ 5.5 V   |                                 | 1                      |      |      | μs                 |
|                                                                    |                                       | INTP1 to INTP11                                  | 2.4 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |                                 | 1                      |      |      | μs                 |
| Key interrupt input low-level width                                | t <sub>KR</sub>                       | KR0 to KR7                                       | 2.4 V ≤ EV <sub>DD0</sub> ≤ 5.5 V |                                 | 250                    |      |      | ns                 |
| RESET low-level width                                              | t <sub>RSL</sub>                      |                                                  |                                   |                                 | 10                     |      |      | μs                 |

**Note** The following conditions are required for low voltage interface when  $\text{EV}_{\text{DD}0} < \text{V}_{\text{DD}}$   
 $2.4\text{ V} \leq \text{EV}_{\text{DD}0} < 2.7\text{ V}$  : MIN. 125 ns

**Remark** f<sub>MCK</sub>: Timer array unit operation clock frequency  
 (Operation clock to be set by the CKSmn0, CKSmn1 bits of timer mode register mn (TMRmn).  
 m: Unit number (m = 0, 1), n: Channel number (n = 0 to 7))

### 3.5 Peripheral Functions Characteristics

#### AC Timing Test Points



#### 3.5.1 Serial array unit

##### (1) During communication at same potential (UART mode)

( $T_A = -40$  to  $+105^\circ\text{C}$ ,  $2.4\text{ V} \leq E_{VDD0} = E_{VDD1} \leq V_{DD} \leq 5.5\text{ V}$ ,  $V_{SS} = E_{VSS0} = E_{VSS1} = 0\text{ V}$ )

| Parameter                       | Symbol | Conditions                                                                                        | HS (high-speed main) Mode |                                | Unit |
|---------------------------------|--------|---------------------------------------------------------------------------------------------------|---------------------------|--------------------------------|------|
|                                 |        |                                                                                                   | MIN.                      | MAX.                           |      |
| Transfer rate <sup>Note 1</sup> |        | Theoretical value of the maximum transfer rate<br>$f_{CLK} = 32\text{ MHz}$ , $f_{MCK} = f_{CLK}$ |                           | $f_{MCK}/12$ <sup>Note 2</sup> | bps  |
|                                 |        |                                                                                                   |                           | 2.6                            | Mbps |

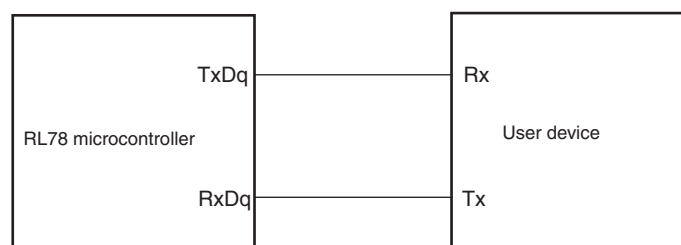
**Notes 1.** Transfer rate in the SNOOZE mode is 4800 bps only.

**2.** The following conditions are required for low voltage interface when  $E_{VDD0} < V_{DD}$ .

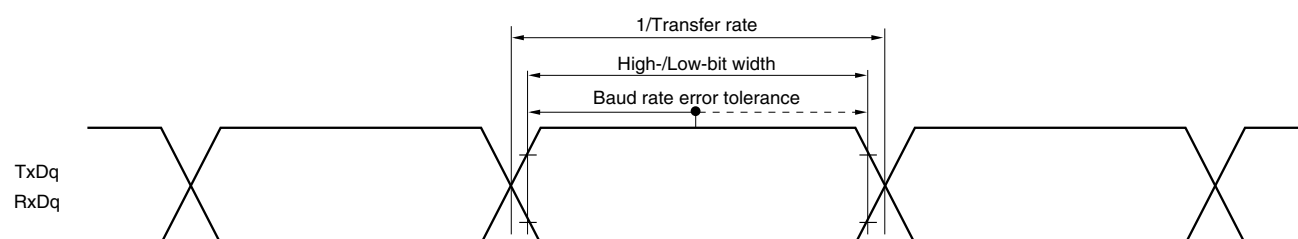
$2.4\text{ V} \leq E_{VDD0} < 2.7\text{ V}$  : MAX. 1.3 Mbps

**Caution** Select the normal input buffer for the RxDq pin and the normal output mode for the TxDq pin by using port input mode register g (PIMg) and port output mode register g (POMg).

#### UART mode connection diagram (during communication at same potential)



#### UART mode bit width (during communication at same potential) (reference)



**Remarks 1.** q: UART number (q = 0 to 3), g: PIM and POM number (g = 0, 1, 8, 14)

**2.**  $f_{MCK}$ : 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 to 03, 10 to 13))

## (2) During communication at same potential (CSI mode) (master mode, SCKp... internal clock output)

(T<sub>A</sub> =  $-40$  to  $+105^\circ\text{C}$ ,  $2.4\text{ V} \leq \text{EV}_{\text{DD}0} = \text{EV}_{\text{DD}1} \leq \text{V}_{\text{DD}} \leq 5.5\text{ V}$ ,  $\text{V}_{\text{SS}} = \text{EV}_{\text{SS}0} = \text{EV}_{\text{SS}1} = 0\text{ V}$ )

| Parameter                                             | Symbol                                 | Conditions                             | HS (high-speed main) Mode |      | Unit |
|-------------------------------------------------------|----------------------------------------|----------------------------------------|---------------------------|------|------|
|                                                       |                                        |                                        | MIN.                      | MAX. |      |
| SCKp cycle time                                       | t <sub>KCY1</sub>                      | t <sub>KCY1</sub> ≥ 4/f <sub>CLK</sub> | 250                       |      | ns   |
|                                                       |                                        | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | 500                       |      | ns   |
| SCKp high-/low-level width                            | t <sub>KH1</sub> ,<br>t <sub>KL1</sub> | 4.0 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | t <sub>KCY1</sub> /2 – 24 |      | ns   |
|                                                       |                                        | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | t <sub>KCY1</sub> /2 – 36 |      | ns   |
|                                                       |                                        | 2.4 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | t <sub>KCY1</sub> /2 – 76 |      | ns   |
| Slp setup time (to SCKp↑) <sup>Note 1</sup>           | t <sub>SIK1</sub>                      | 4.0 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | 66                        |      | ns   |
|                                                       |                                        | 2.7 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | 66                        |      | ns   |
|                                                       |                                        | 2.4 V ≤ EV <sub>DD0</sub> ≤ 5.5 V      | 113                       |      | ns   |
| Slp hold time (from SCKp↑) <sup>Note 2</sup>          | t <sub>KSI1</sub>                      |                                        | 38                        |      | ns   |
| Delay time from SCKp↓ to SOp output <sup>Note 3</sup> | t <sub>KSO1</sub>                      | C = 30 pF <sup>Note 4</sup>            |                           | 50   | ns   |

- Notes**
1. When DAP<sub>mn</sub> = 0 and CKP<sub>mn</sub> = 0, or DAP<sub>mn</sub> = 1 and CKP<sub>mn</sub> = 1. The Slp setup time becomes “to SCKp↓” when DAP<sub>mn</sub> = 0 and CKP<sub>mn</sub> = 1, or DAP<sub>mn</sub> = 1 and CKP<sub>mn</sub> = 0.
  2. When DAP<sub>mn</sub> = 0 and CKP<sub>mn</sub> = 0, or DAP<sub>mn</sub> = 1 and CKP<sub>mn</sub> = 1. The Slp hold time becomes “from SCKp↓” when DAP<sub>mn</sub> = 0 and CKP<sub>mn</sub> = 1, or DAP<sub>mn</sub> = 1 and CKP<sub>mn</sub> = 0.
  3. When DAP<sub>mn</sub> = 0 and CKP<sub>mn</sub> = 0, or DAP<sub>mn</sub> = 1 and CKP<sub>mn</sub> = 1. The delay time to SOp output becomes “from SCKp↑” when DAP<sub>mn</sub> = 0 and CKP<sub>mn</sub> = 1, or DAP<sub>mn</sub> = 1 and CKP<sub>mn</sub> = 0.
  4. C is the load capacitance of the SCKp and SOp output lines.

**Caution** Select the normal input buffer for the Slp pin and the normal output mode for the SOp pin and SCKp pin by using port input mode register g (PIMg) and port output mode register g (POMg).

- Remarks**
1. p: CSI number (p = 00, 01, 10, 11, 20, 21, 30, 31), m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),  
g: PIM and POM numbers (g = 0, 1, 4, 5, 8, 14)
  2. f<sub>MCK</sub>: Serial array unit operation clock frequency  
(Operation clock to be set by the CKS<sub>mn</sub> bit of serial mode register mn (SMR<sub>mn</sub>). m: Unit number, n: Channel number (mn = 00 to 03, 10 to 13))

## 3.5.2 Serial interface IICA

(TA = -40 to +105°C, 2.4 V ≤ EVDD0 = EVDD1 ≤ VDD ≤ 5.5 V, VSS = EVSS0 = EVSS1 = 0 V)

| Parameter                                       | Symbol              | Conditions                              | HS (high-speed main) Mode |      |           |      | Unit |
|-------------------------------------------------|---------------------|-----------------------------------------|---------------------------|------|-----------|------|------|
|                                                 |                     |                                         | Standard Mode             |      | Fast Mode |      |      |
|                                                 |                     |                                         | MIN.                      | MAX. | MIN.      | MAX. |      |
| SCLA0 clock frequency                           | f <sub>SCL</sub>    | Fast mode: f <sub>CLK</sub> ≥ 3.5 MHz   | –                         | –    | 0         | 400  | kHz  |
|                                                 |                     | Standard mode: f <sub>CLK</sub> ≥ 1 MHz | 0                         | 100  | –         | –    | kHz  |
| Setup time of restart condition                 | t <sub>SU:STA</sub> |                                         | 4.7                       |      | 0.6       |      | μs   |
| Hold time <sup>Note 1</sup>                     | t <sub>HD:STA</sub> |                                         | 4.0                       |      | 0.6       |      | μs   |
| Hold time when SCLA0 = “L”                      | t <sub>LOW</sub>    |                                         | 4.7                       |      | 1.3       |      | μs   |
| Hold time when SCLA0 = “H”                      | t <sub>HIGH</sub>   |                                         | 4.0                       |      | 0.6       |      | μs   |
| Data setup time (reception)                     | t <sub>SU:DAT</sub> |                                         | 250                       |      | 100       |      | ns   |
| Data hold time (transmission) <sup>Note 2</sup> | t <sub>HD:DAT</sub> |                                         | 0                         | 3.45 | 0         | 0.9  | μs   |
| Setup time of stop condition                    | t <sub>SU:STO</sub> |                                         | 4.0                       |      | 0.6       |      | μs   |
| Bus-free time                                   | t <sub>BUF</sub>    |                                         | 4.7                       |      | 1.3       |      | μs   |

**Notes** 1. The first clock pulse is generated after this period when the start/restart condition is detected.

<R> 2. The maximum value (MAX.) of tHD:DAT is during normal transfer and a wait state is inserted in the ACK (acknowledge) timing.

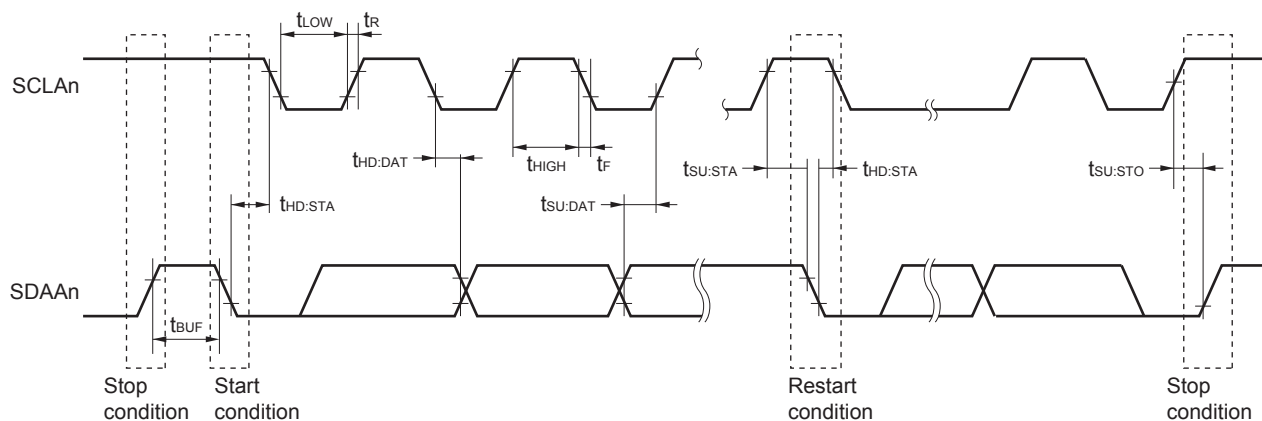
**Caution** The values in the above table are applied even when bit 2 (PIOR2) in the peripheral I/O redirection register (PIOR) is 1. At this time, the pin characteristics (IOH1, IOL1, VOH1, VOL1) must satisfy the values in the redirect destination.

**Remark** The maximum value of Cb (communication line capacitance) and the value of Rb (communication line pull-up resistor) at that time in each mode are as follows.

Standard mode: Cb = 400 pF, Rb = 2.7 kΩ

Fast mode: Cb = 320 pF, Rb = 1.1 kΩ

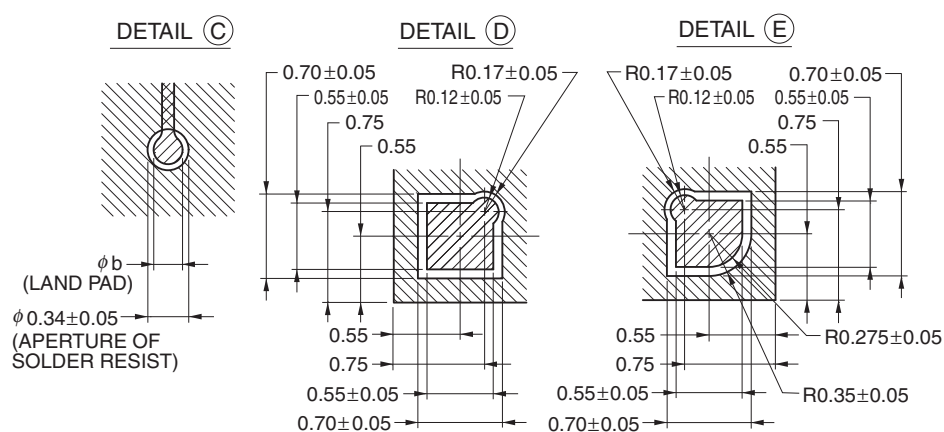
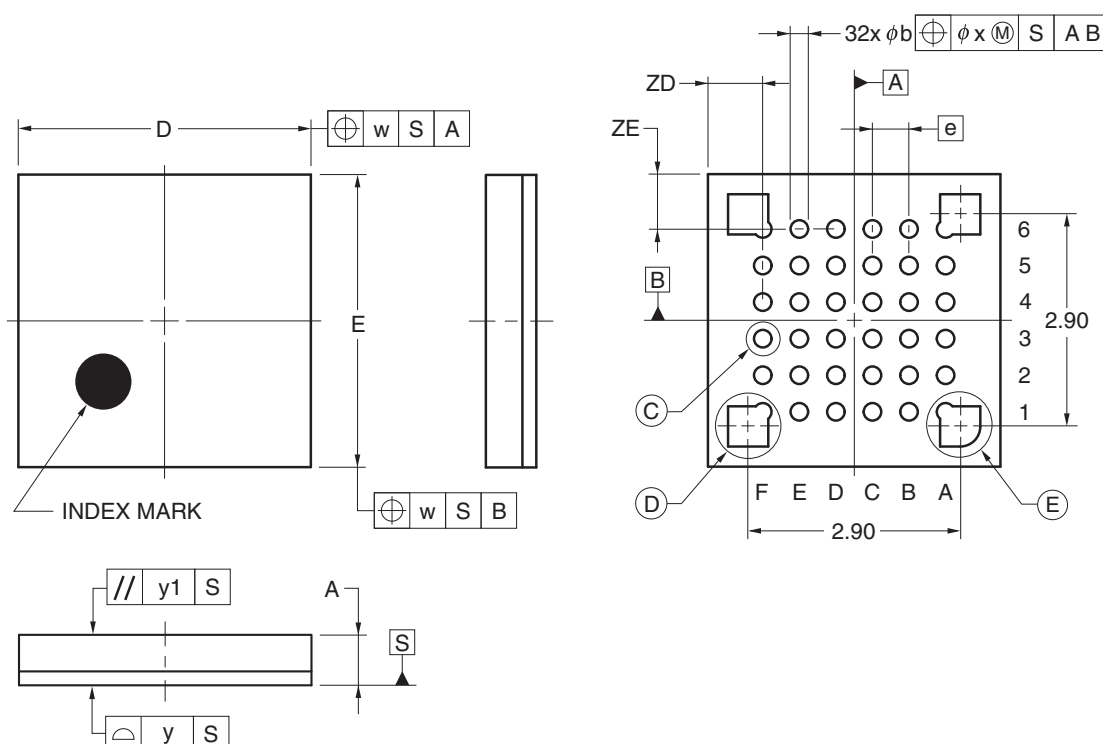
IICA serial transfer timing

**Remark** n = 0, 1

## 4.6 36-pin Products

R5F100CAALA, R5F100CCALA, R5F100CDALA, R5F100CEALA, R5F100CFALA, R5F100CGALA  
 R5F101CAALA, R5F101CCALA, R5F101CDALA, R5F101CEALA, R5F101CFALA, R5F101CGALA  
 R5F100CAGLA, R5F100CCGLA, R5F100CDGLA, R5F100CEGLA, R5F100CFGLA, R5F100CGGLA

| JEITA Package Code | RENESAS Code | Previous Code  | MASS (TYP.) [g] |
|--------------------|--------------|----------------|-----------------|
| P-WFLGA36-4x4-0.50 | PWLG0036KA-A | P36FC-50-AA4-2 | 0.023           |



(UNIT:mm)

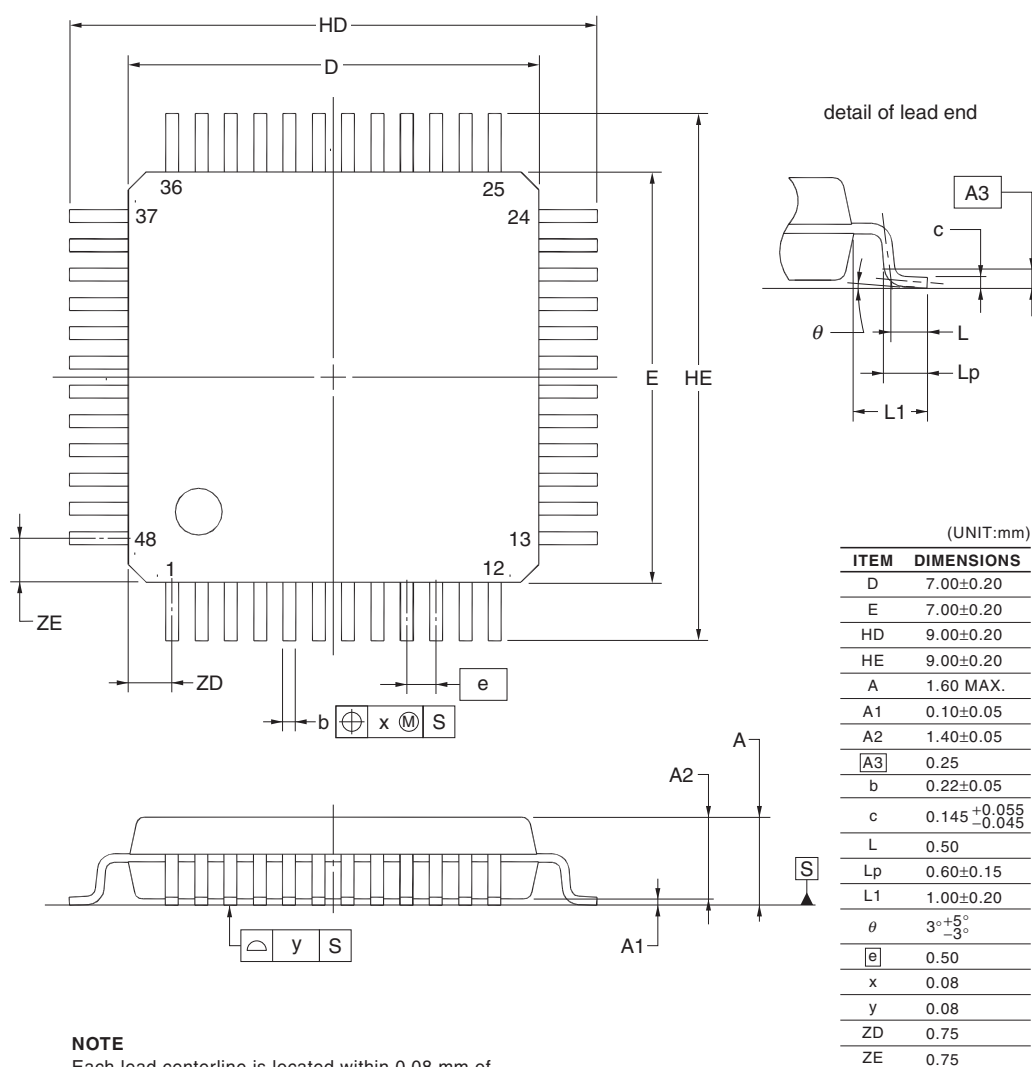
| ITEM | DIMENSIONS |
|------|------------|
| D    | 4.00±0.10  |
| E    | 4.00±0.10  |
| w    | 0.20       |
| e    | 0.50       |
| A    | 0.69±0.07  |
| b    | 0.24±0.05  |
| x    | 0.05       |
| y    | 0.08       |
| y1   | 0.20       |
| ZD   | 0.75       |
| ZE   | 0.75       |

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## 4.9 48-pin Products

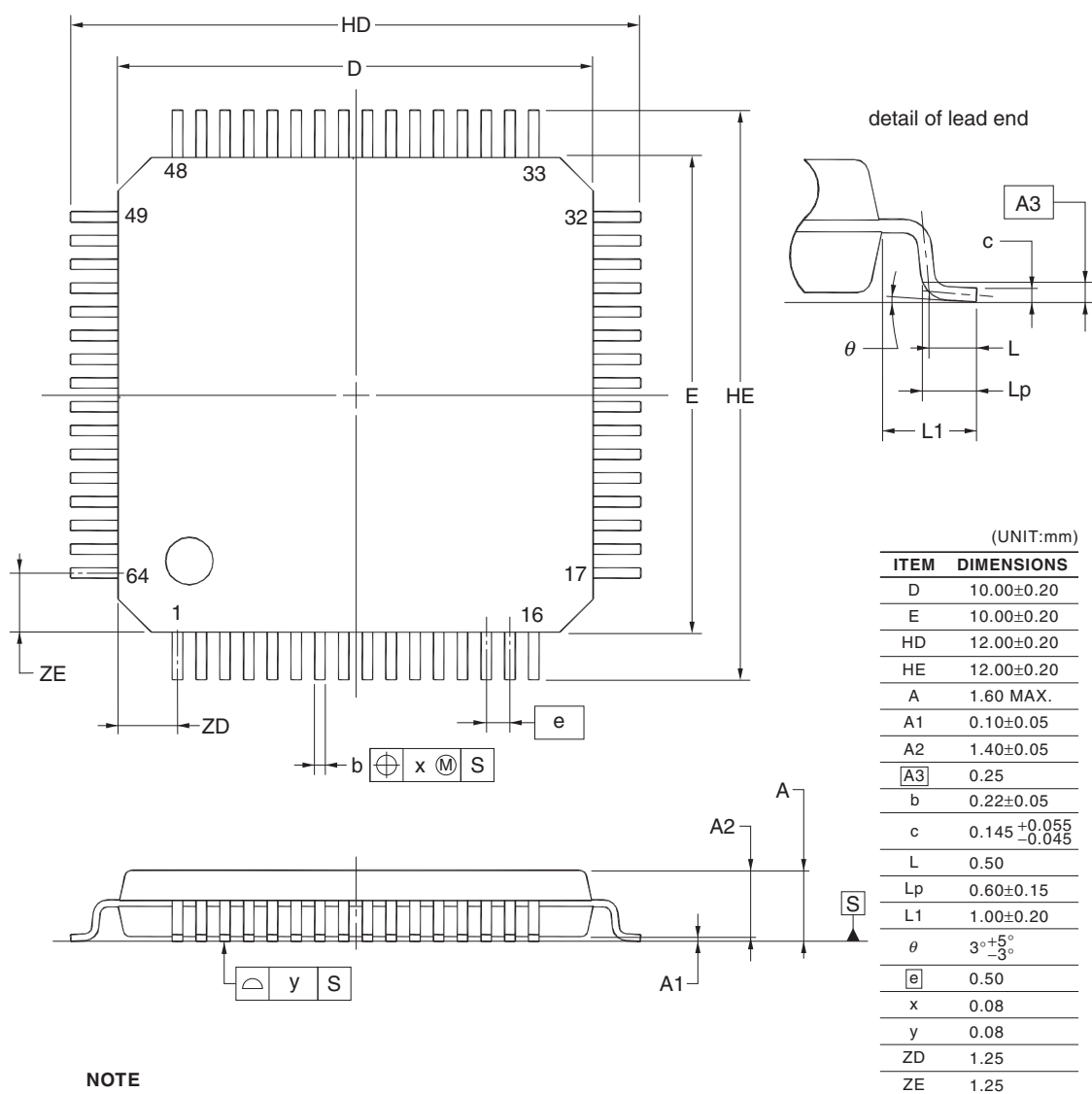
R5F100GAAFB, R5F100GCAFB, R5F100GDAFB, R5F100GEAFB, R5F100GFAFB, R5F100GGAFB,  
 R5F100GHAFB, R5F100GJAFB, R5F100GKAFB, R5F100GLAFB  
 R5F101GAAFB, R5F101GCAFB, R5F101GDAFB, R5F101GEAFB, R5F101GFAFB, R5F101GGAFB,  
 R5F101GHAFB, R5F101GJAFB, R5F101GKAFB, R5F101GLAFB  
 R5F100GADFB, R5F100GCDFB, R5F100GDDFB, R5F100GEDFB, R5F100GFDFB, R5F100GGDFB,  
 R5F100GHDFB, R5F100GJDFB, R5F100GKDFB, R5F100GLDFB  
 R5F101GADFB, R5F101GCDFB, R5F101GDDFB, R5F101GEDFB, R5F101GFDFB, R5F101GGDFB,  
 R5F101GHDFB, R5F101GJDFB, R5F101GKDFB, R5F101GLDFB  
 R5F100GAGFB, R5F100GCGFB, R5F100GDGFB, R5F100GEGFB, R5F100GFGFB, R5F100GGGFB,  
 R5F100GHGFB, R5F100GJGFB

| JEITA Package Code | RENESAS Code | Previous Code  | MASS (TYP.) [g] |
|--------------------|--------------|----------------|-----------------|
| P-LFQFP48-7x7-0.50 | PLQP0048KF-A | P48GA-50-8EU-1 | 0.16            |



R5F100LCAFB, R5F100LDAFB, R5F100LEAFB, R5F100LFAFB, R5F100LGAFB, R5F100LHAFB, R5F100LJAFB,  
 R5F100LKAFB, R5F100LLAFB  
 R5F101LCAFB, R5F101LDAFB, R5F101LEAFB, R5F101LFAFB, R5F101LGAFB, R5F101LHAFB,  
 R5F101LJAFB, R5F101LKAFB, R5F101LLAFB  
 R5F100LCDFB, R5F100LDDFB, R5F100LEDDB, R5F100LFDDB, R5F100LGDFB, R5F100LHDFB, R5F100LJDFB,  
 R5F100LKDFB, R5F100LLDFB  
 R5F101LCDFB, R5F101LDDFB, R5F101LEDDB, R5F101LFDDB, R5F101LGDFB, R5F101LHDFB,  
 R5F101LJDFB, R5F101LKDFB, R5F101LLDFB  
 R5F100LCGFB, R5F100LDGFB, R5F100LEGFB, R5F100LFGFB, R5F100LGGFB, R5F100LHGFB,  
 R5F100LJGFB

| JEITA Package Code   | RENESAS Code | Previous Code  | MASS (TYP.) [g] |
|----------------------|--------------|----------------|-----------------|
| P-LFQFP64-10x10-0.50 | PLQP0064KF-A | P64GB-50-UEU-2 | 0.35            |



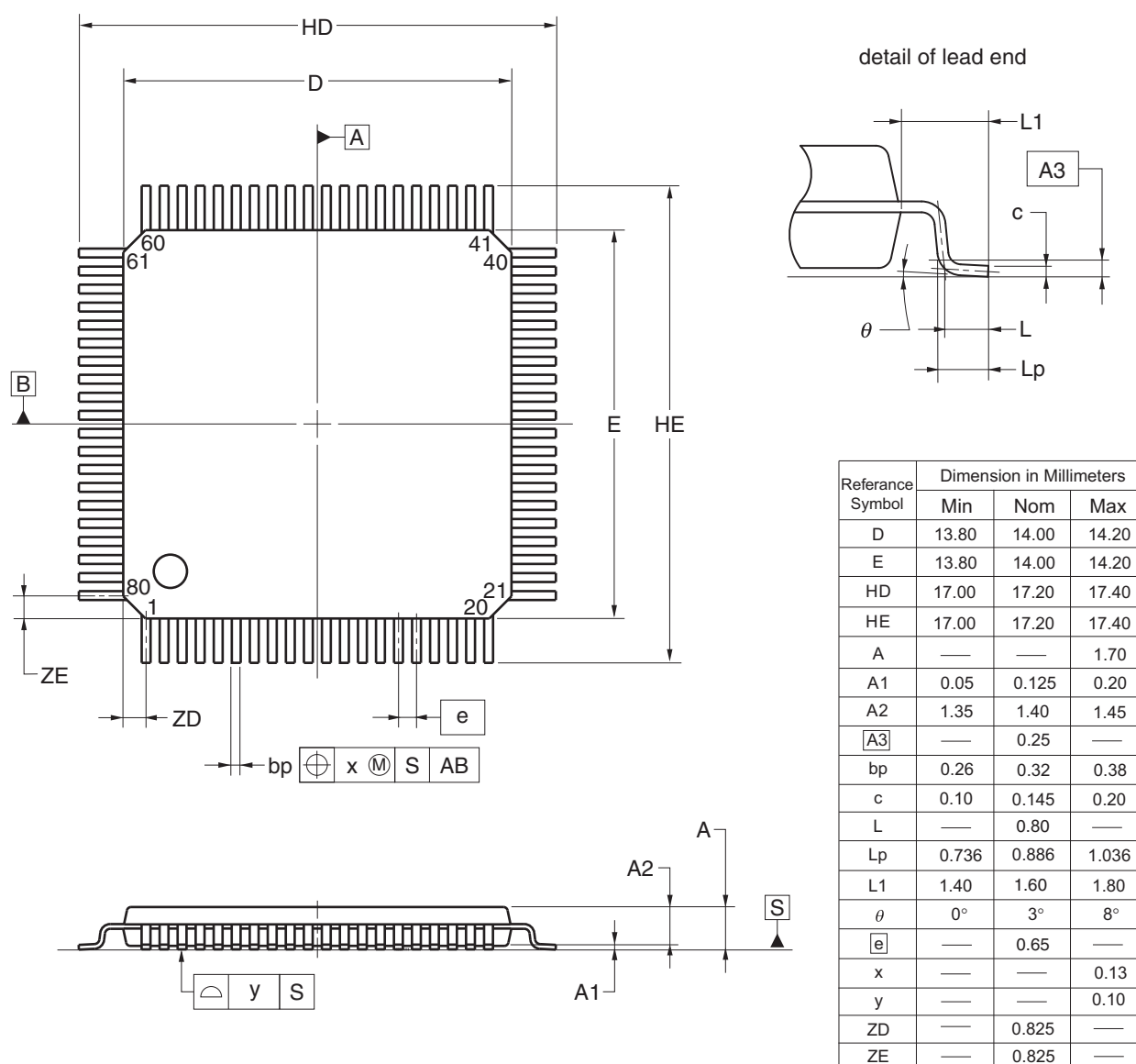
#### NOTE

Each lead centerline is located within 0.08 mm of its true position at maximum material condition.

## 4.12 80-pin Products

R5F100MFAFA, R5F100MGFAFA, R5F100MHAFA, R5F100MJFAFA, R5F100MKAFA, R5F100MLAFA  
 R5F101MFAFA, R5F101MGFAFA, R5F101MHAFA, R5F101MJFAFA, R5F101MKAFA, R5F101MLAFA  
 R5F100MFDFA, R5F100MGDFA, R5F100MHDFA, R5F100MJDFA, R5F100MKDFA, R5F100MLDFA  
 R5F101MFDFA, R5F101MGDFA, R5F101MHDFA, R5F101MJDFA, R5F101MKDFA, R5F101MLDFA  
 R5F100MFGFA, R5F100MGGFA, R5F100MHGFA, R5F100MJGFA

| JEITA Package Code  | RENESAS Code | Previous Code  | MASS (TYP.) [g] |
|---------------------|--------------|----------------|-----------------|
| P-LQFP80-14x14-0.65 | PLQP0080JB-E | P80GC-65-UBT-2 | 0.69            |



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