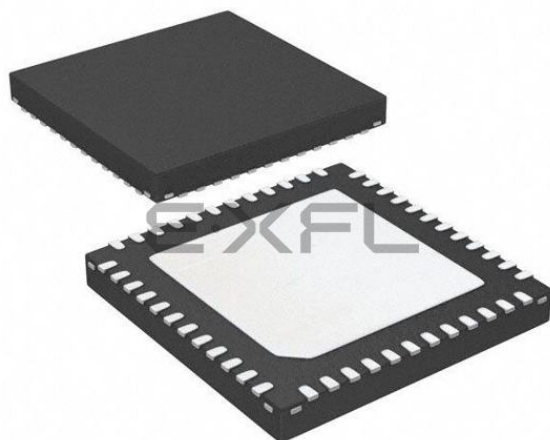




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### What is "[Embedded - Microcontrollers](#)"?

"[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              | 34                                                                                                                                                                            |
| Program Memory Size        | 96KB (96K x 8)                                                                                                                                                                |
| Program Memory Type        | FLASH                                                                                                                                                                         |
| EEPROM Size                | 8K x 8                                                                                                                                                                        |
| RAM Size                   | 12K x 8                                                                                                                                                                       |
| Voltage - Supply (Vcc/Vdd) | 1.6V ~ 5.5V                                                                                                                                                                   |
| Data Converters            | A/D 10x8/10b; D/A 2x8b                                                                                                                                                        |
| Oscillator Type            | Internal                                                                                                                                                                      |
| Operating Temperature      | -40°C ~ 85°C (TA)                                                                                                                                                             |
| Mounting Type              | Surface Mount                                                                                                                                                                 |
| Package / Case             | 48-WFQFN Exposed Pad                                                                                                                                                          |
| Supplier Device Package    | 48-HWQFN (7x7)                                                                                                                                                                |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f104gfana-u0">https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f104gfana-u0</a> |

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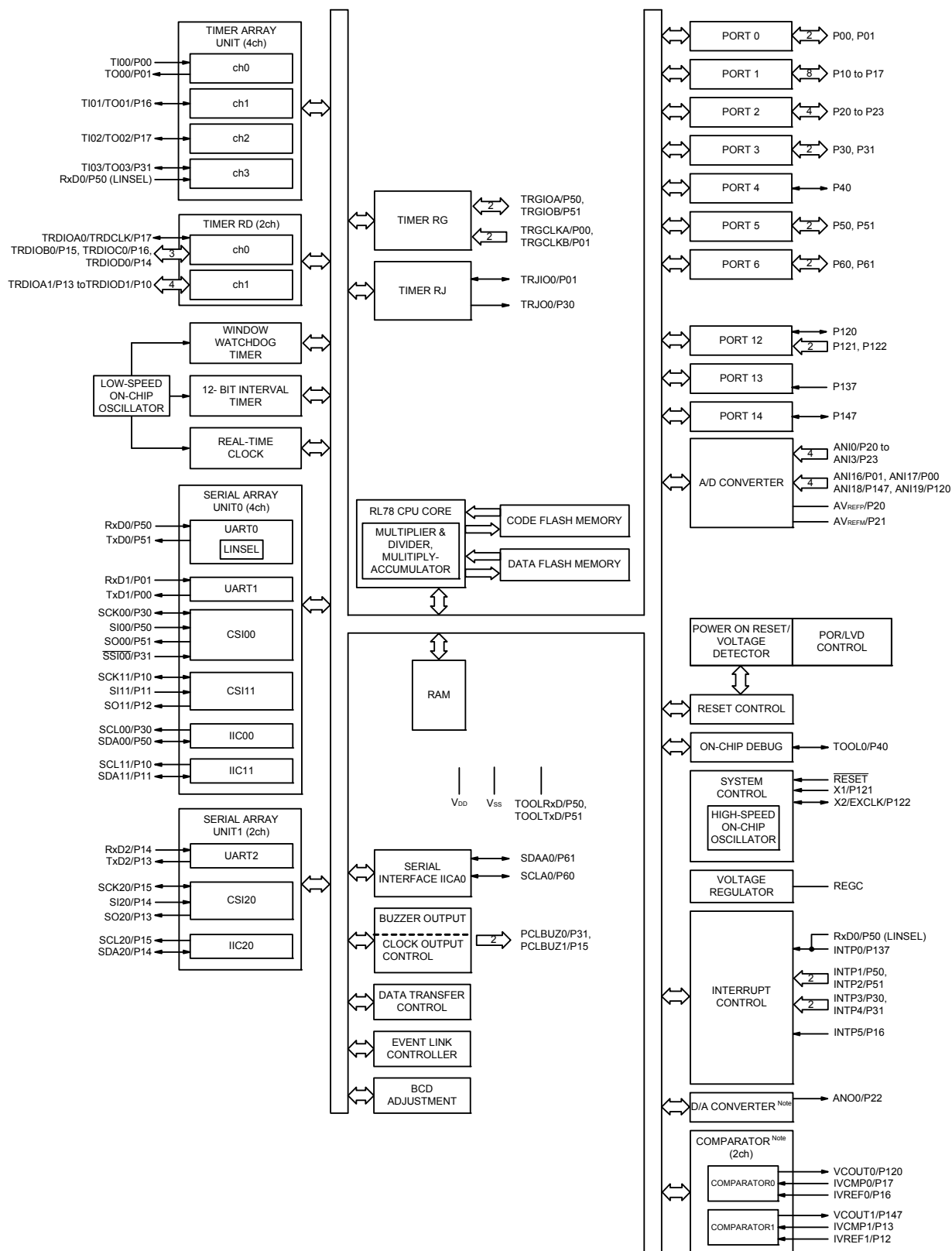
| Pin count | Package                                            | Fields of Application Note | Ordering Part Number                                                                                                                                                                                                                                                                                         |
|-----------|----------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 64 pins   | 64-pin plastic LQFP<br>(12 × 12 mm, 0.65 mm pitch) | A                          | R5F104LCAFA#V0, R5F104LDAFA#V0, R5F104LEAFA#V0, R5F104LFAFA#V0,<br>R5F104LGFA#V0, R5F104LHFA#V0, R5F104LJFA#V0<br>R5F104LCAFA#X0, R5F104LDAFA#X0, R5F104LEAFA#X0, R5F104LFAFA#X0,<br>R5F104LGFA#X0, R5F104LHFA#X0, R5F104LJFA#X0<br>R5F104LKFA#30, R5F104LLAFA#30<br>R5F104LKFA#50, R5F104LLAFA#50           |
|           |                                                    | D                          | R5F104LCDF#V0, R5F104LDDFA#V0, R5F104LEDFA#V0, R5F104LFDFA#V0,<br>R5F104LGDF#V0, R5F104LHDF#V0, R5F104LJDF#V0<br>R5F104LCDF#X0, R5F104LDDFA#X0, R5F104LEDFA#X0, R5F104LFDFA#X0,<br>R5F104LGDF#X0, R5F104LHDF#X0, R5F104LJDF#X0                                                                               |
|           |                                                    | G                          | R5F104LCGFA#V0, R5F104LDGFA#V0, R5F104LEGFA#V0, R5F104LFGFA#V0,<br>R5F104LGGFA#V0, R5F104LHGFA#V0, R5F104LJGFA#V0<br>R5F104LCGFA#X0, R5F104LDGFA#X0, R5F104LEGFA#X0, R5F104LFGFA#X0,<br>R5F104LGGFA#X0, R5F104LHGFA#X0, R5F104LJGFA#X0<br>R5F104LKGFA#30, R5F104LLGFA#30<br>R5F104LKGFA#50, R5F104LLGFA#50   |
|           | 64-pin plastic LQFP<br>(10 × 10 mm, 0.5 mm pitch)  | A                          | R5F104LCAFB#V0, R5F104LDAFB#V0, R5F104LEAFB#V0, R5F104LFAFB#V0,<br>R5F104LGAFB#V0, R5F104LHAFB#V0, R5F104LJAFB#V0<br>R5F104LCAFB#X0, R5F104LDAFB#X0, R5F104LEAFB#X0, R5F104LFAFB#X0,<br>R5F104LGAFB#X0, R5F104LHAFB#X0, R5F104LJAFB#X0<br>R5F104LKAFB#30, R5F104LLAFB#30<br>R5F104LKAFB#50, R5F104LLAFB#50   |
|           |                                                    | D                          | R5F104LCDFB#V0, R5F104LDDFB#V0, R5F104LEDFB#V0, R5F104LDFB#V0,<br>R5F104LGDFB#V0, R5F104LHDFB#V0, R5F104LJDFB#V0<br>R5F104LCDFB#X0, R5F104LDDFB#X0, R5F104LEDFB#X0, R5F104LDFB#X0,<br>R5F104LGDFB#X0, R5F104LHDFB#X0, R5F104LJDFB#X0                                                                         |
|           |                                                    | G                          | R5F104LCGFB#V0, R5F104LDGFB#V0, R5F104LEGFB#V0, R5F104LFGFB#V0,<br>R5F104LGGFB#V0, R5F104LHGFB#V0, R5F104LJGFB#V0<br>R5F104LCGFB#X0, R5F104LDGFB#X0, R5F104LEGFB#X0, R5F104LFGFB#X0,<br>R5F104LGGFB#X0, R5F104LHGFB#X0, R5F104LJGFB#X0<br>R5F104LKGFB#30, R5F104LLGFB#30<br>R5F104LKGFB#50, R5F104LLGFB#50   |
|           | 64-pin plastic FLGA<br>(5 × 5 mm, 0.5 mm pitch)    | A                          | R5F104LCA#U0, R5F104LDA#U0, R5F104LEA#U0, R5F104LFA#U0,<br>R5F104LGA#U0, R5F104LHA#U0, R5F104LJA#U0<br>R5F104LCA#W0, R5F104LDA#W0, R5F104LEA#W0, R5F104LFA#W0,<br>R5F104LGA#W0, R5F104LHA#W0, R5F104LJA#W0<br>R5F104LKA#U0, R5F104LLA#U0<br>R5F104LKA#W0, R5F104LLA#W0                                       |
|           |                                                    | G                          | R5F104LCGLA#U0, R5F104LDGLA#U0, R5F104LEGLA#U0, R5F104LFLGA#U0,<br>R5F104LGGLA#U0, R5F104LHGLA#U0, R5F104LJGLA#U0, R5F104LKGLA#U0,<br>R5F104LLGLA#U0<br>R5F104LCGLA#W0, R5F104LDGLA#W0, R5F104LEGLA#W0, R5F104LFLGA#W0,<br>R5F104LGGLA#W0, R5F104LHGLA#W0, R5F104LJGLA#W0, R5F104LKGLA#W0,<br>R5F104LLGLA#W0 |
|           | 64-pin plastic LQFP<br>(14 × 14 mm, 0.8 mm pitch)  | A                          | R5F104LCAFP#V0, R5F104LDAFP#V0, R5F104LEAFP#V0, R5F104LFAFP#V0,<br>R5F104LGAFP#V0, R5F104LHAFP#V0, R5F104LJAFP#V0<br>R5F104LCAFP#X0, R5F104LDAFP#X0, R5F104LEAFP#X0, R5F104LFAFP#X0,<br>R5F104LGAFP#X0, R5F104LHAFP#X0, R5F104LJAFP#X0                                                                       |
|           |                                                    | D                          | R5F104LCDFP#V0, R5F104LDDFP#V0, R5F104LEDFP#V0, R5F104LDFP#V0,<br>R5F104LGDFP#V0, R5F104LHDFP#V0, R5F104LJDFP#V0<br>R5F104LCDFP#X0, R5F104LDDFP#X0, R5F104LEDFP#X0, R5F104LDFP#X0,<br>R5F104LGDFP#X0, R5F104LHDFP#X0, R5F104LJDFP#X0                                                                         |
|           |                                                    | G                          | R5F104LCGFP#V0, R5F104LDGFP#V0, R5F104LEGFP#V0, R5F104LFGFP#V0,<br>R5F104LGGFP#V0, R5F104LHGFP#V0, R5F104LJGFP#V0<br>R5F104LCGFP#X0, R5F104LDGFP#X0, R5F104LEGFP#X0, R5F104LFGFP#X0,<br>R5F104LGGFP#X0, R5F104LHGFP#X0, R5F104LJGFP#X0                                                                       |

**Note** For the fields of application, refer to **Figure 1 - 1 Part Number, Memory Size, and Package of RL78/G14**.

**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.

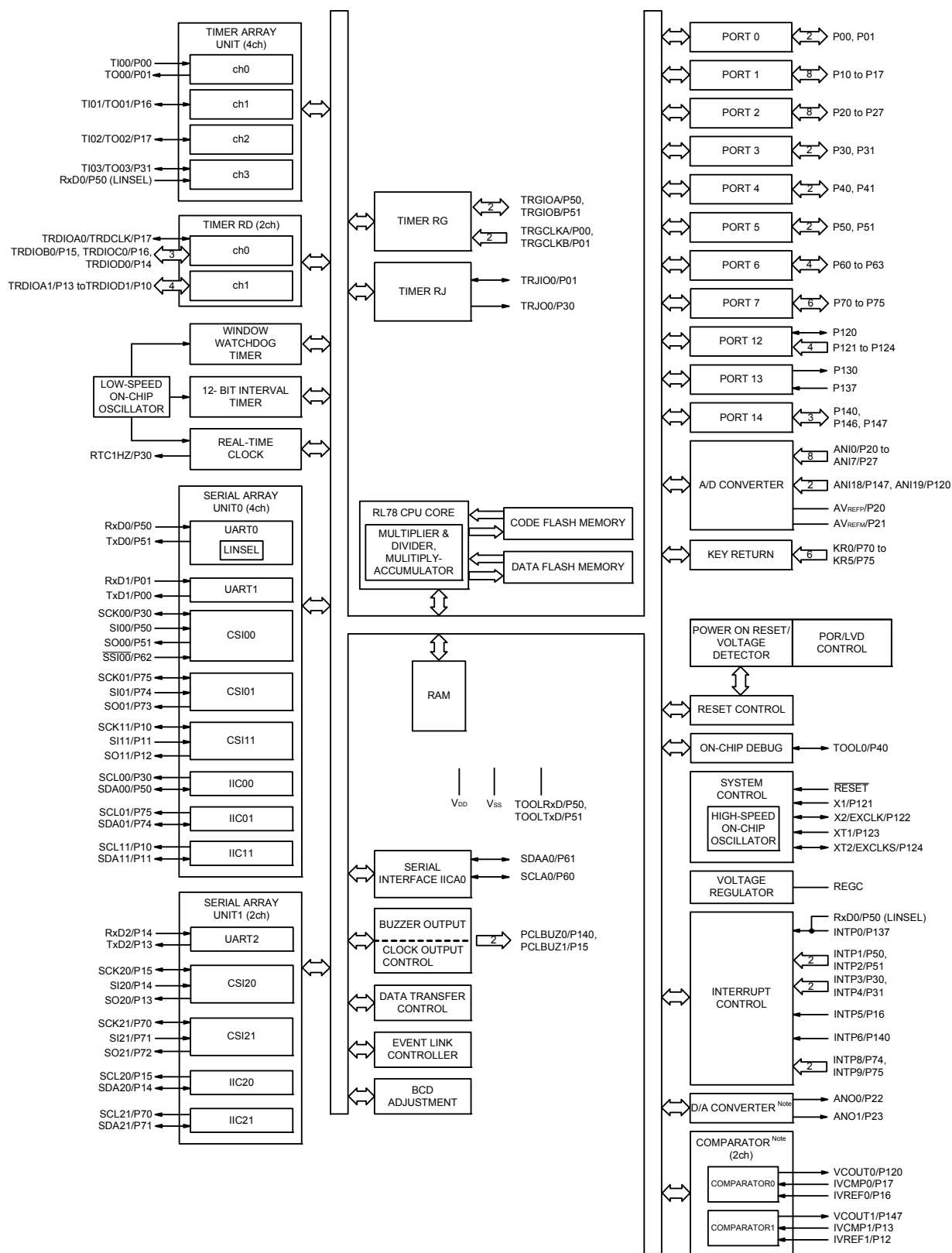
## 1.5 Block Diagram

### 1.5.1 30-pin products



**Note** Mounted on the 96 KB or more code flash memory products.

### 1.5.6 48-pin products



**Note** Mounted on the 96 KB or more code flash memory products.

(2/2)

| Item                              |                      | 30-pin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 32-pin                      | 36-pin                      | 40-pin                                     |
|-----------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|--------------------------------------------|
|                                   |                      | R5F104Ax<br>(x = A, C to E)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | R5F104Bx<br>(x = A, C to E) | R5F104Cx<br>(x = A, C to E) | R5F104Ex<br>(x = A, C to E)                |
| Clock output/buzzer output        |                      | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2                           | 2                           | 2                                          |
|                                   |                      | [30-pin, 32-pin, 36-pin products]<br>• 2.44 kHz, 4.88 kHz, 9.76 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz<br>(Main system clock: $f_{MAIN} = 20$ MHz operation)<br>[40-pin products]<br>• 2.44 kHz, 4.88 kHz, 9.76 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz<br>(Main system clock: $f_{MAIN} = 20$ MHz operation)<br>• 256 Hz, 512 Hz, 1.024 kHz, 2.048 kHz, 4.096 kHz, 8.192 kHz, 16.384 kHz, 32.768 kHz<br>(Subsystem clock: $f_{SUB} = 32.768$ kHz operation)                                                                                                                      |                             |                             |                                            |
| 8/10-bit resolution A/D converter |                      | 8 channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 8 channels                  | 8 channels                  | 9 channels                                 |
| Serial interface                  |                      | [30-pin, 32-pin products]<br>• CSI: 1 channel/UART (UART supporting LIN-bus): 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 1 channel/UART: 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 1 channel/UART: 1 channel/simplified I <sup>2</sup> C: 1 channel<br>[36-pin, 40-pin products]<br>• CSI: 1 channel/UART (UART supporting LIN-bus): 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 1 channel/UART: 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 2 channels/UART: 1 channel/simplified I <sup>2</sup> C: 2 channels |                             |                             |                                            |
|                                   | I <sup>2</sup> C bus | 1 channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1 channel                   | 1 channel                   | 1 channel                                  |
| Data transfer controller (DTC)    |                      | 28 sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                             | 29 sources                                 |
| Event link controller (ELC)       |                      | Event input: 19<br>Event trigger output: 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                             | Event input: 20<br>Event trigger output: 7 |
| Vectored interrupt sources        | Internal             | 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 24                          | 24                          | 24                                         |
|                                   | External             | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6                           | 6                           | 7                                          |
| Key interrupt                     |                      | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | —                           | —                           | 4                                          |
| Reset                             |                      | • Reset by RESET pin<br>• Internal reset by watchdog timer<br>• Internal reset by power-on-reset<br>• Internal reset by voltage detector<br>• Internal reset by illegal instruction execution <sup>Note</sup><br>• Internal reset by RAM parity error<br>• Internal reset by illegal-memory access                                                                                                                                                                                                                                                                             |                             |                             |                                            |
| Power-on-reset circuit            |                      | • Power-on-reset: 1.51 ±0.04 V ( $T_A = -40$ to +85°C)<br>1.51 ±0.06 V ( $T_A = -40$ to +105°C)<br>• Power-down-reset: 1.50 ±0.04 V ( $T_A = -40$ to +85°C)<br>1.50 ±0.06 V ( $T_A = -40$ to +105°C)                                                                                                                                                                                                                                                                                                                                                                           |                             |                             |                                            |
| Voltage detector                  |                      | 1.63 V to 4.06 V (14 stages)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                             |                                            |
| On-chip debug function            |                      | Provided                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                             |                                            |
| Power supply voltage              |                      | $V_{DD} = 1.6$ to 5.5 V ( $T_A = -40$ to +85°C)<br>$V_{DD} = 2.4$ to 5.5 V ( $T_A = -40$ to +105°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |                             |                                            |
| Operating ambient temperature     |                      | $T_A = -40$ to +85°C (A: Consumer applications, D: Industrial applications),<br>$T_A = -40$ to +105°C (G: Industrial applications)                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                             |                                            |

**Note** The illegal instruction is generated when instruction code FFH is executed.  
 Reset by the illegal instruction execution not is issued by emulation with the in-circuit emulator or on-chip debug emulator.

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| Item                              |                      | 30-pin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 32-pin                                   | 36-pin                 | 40-pin                                     |
|-----------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------|--------------------------------------------|
|                                   |                      | R5F104Ax<br>(x = F, G)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | R5F104Bx<br>(x = F, G)                   | R5F104Cx<br>(x = F, G) | R5F104Ex<br>(x = F to H)                   |
| Clock output/buzzer output        |                      | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2                                        | 2                      | 2                                          |
|                                   |                      | [30-pin, 32-pin, 36-pin products]<br>• 2.44 kHz, 4.88 kHz, 9.76 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz<br>(Main system clock: $f_{MAIN} = 20$ MHz operation)<br>[40-pin products]<br>• 2.44 kHz, 4.88 kHz, 9.76 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz<br>(Main system clock: $f_{MAIN} = 20$ MHz operation)<br>• 256 Hz, 512 Hz, 1.024 kHz, 2.048 kHz, 4.096 kHz, 8.192 kHz, 16.384 kHz, 32.768 kHz<br>(Subsystem clock: $f_{SUB} = 32.768$ kHz operation)                                                                                                                      |                                          |                        |                                            |
| 8/10-bit resolution A/D converter |                      | 8 channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 8 channels                               | 8 channels             | 9 channels                                 |
| D/A converter                     |                      | 1 channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 channels                               |                        |                                            |
| Comparator                        |                      | 2 channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                        |                                            |
| Serial interface                  |                      | [30-pin, 32-pin products]<br>• CSI: 1 channel/UART (UART supporting LIN-bus): 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 1 channel/UART: 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 1 channel/UART: 1 channel/simplified I <sup>2</sup> C: 1 channel<br>[36-pin, 40-pin products]<br>• CSI: 1 channel/UART (UART supporting LIN-bus): 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 1 channel/UART: 1 channel/simplified I <sup>2</sup> C: 1 channel<br>• CSI: 2 channels/UART: 1 channel/simplified I <sup>2</sup> C: 2 channels |                                          |                        |                                            |
|                                   | I <sup>2</sup> C bus | 1 channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1 channel                                | 1 channel              | 1 channel                                  |
| Data transfer controller (DTC)    |                      | 30 sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                        | 31 sources                                 |
| Event link controller (ELC)       |                      | Event input: 21<br>Event trigger output: 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Event input: 21, Event trigger output: 9 |                        | Event input: 22<br>Event trigger output: 9 |
| Vectored interrupt sources        | Internal             | 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 24                                       | 24                     | 24                                         |
|                                   | External             | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6                                        | 6                      | 7                                          |
| Key interrupt                     |                      | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | —                                        | —                      | 4                                          |
| Reset                             |                      | • Reset by $\overline{RESET}$ pin<br>• Internal reset by watchdog timer<br>• Internal reset by power-on-reset<br>• Internal reset by voltage detector<br>• Internal reset by illegal instruction execution <sup>Note</sup><br>• Internal reset by RAM parity error<br>• Internal reset by illegal-memory access                                                                                                                                                                                                                                                                |                                          |                        |                                            |
| Power-on-reset circuit            |                      | • Power-on-reset: 1.51 ±0.04 V ( $T_A = -40$ to +85°C)<br>1.51 ±0.06 V ( $T_A = -40$ to +105°C)<br>• Power-down-reset: 1.50 ±0.04 V ( $T_A = -40$ to +85°C)<br>1.50 ±0.06 V ( $T_A = -40$ to +105°C)                                                                                                                                                                                                                                                                                                                                                                           |                                          |                        |                                            |
| Voltage detector                  |                      | 1.63 V to 4.06 V (14 stages)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                          |                        |                                            |
| On-chip debug function            |                      | Provided                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                          |                        |                                            |
| Power supply voltage              |                      | $V_{DD} = 1.6$ to 5.5 V ( $T_A = -40$ to +85°C)<br>$V_{DD} = 2.4$ to 5.5 V ( $T_A = -40$ to +105°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                          |                        |                                            |
| Operating ambient temperature     |                      | $T_A = -40$ to +85°C (A: Consumer applications, D: Industrial applications),<br>$T_A = -40$ to +105°C (G: Industrial applications)                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                          |                        |                                            |

**Note** The illegal instruction is generated when instruction code FFH is executed.  
 Reset by the illegal instruction execution not is issued by emulation with the in-circuit emulator or on-chip debug emulator.

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| Item                              |          | 44-pin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 48-pin                      | 52-pin                   | 64-pin                   |
|-----------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------|--------------------------|
|                                   |          | R5F104Fx<br>(x = A, C to E)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | R5F104Gx<br>(x = A, C to E) | R5F104Jx<br>(x = C to E) | R5F104Lx<br>(x = C to E) |
| Clock output/buzzer output        |          | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2                           | 2                        | 2                        |
|                                   |          | <ul style="list-style-type: none"> <li>2.44 kHz, 4.88 kHz, 9.76 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz<br/>(Main system clock: f<sub>MAIN</sub> = 20 MHz operation)</li> <li>256 Hz, 512 Hz, 1.024 kHz, 2.048 kHz, 4.096 kHz, 8.192 kHz, 16.384 kHz, 32.768 kHz<br/>(Subsystem clock: f<sub>SUB</sub> = 32.768 kHz operation)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                          |                          |
| 8/10-bit resolution A/D converter |          | 10 channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10 channels                 | 12 channels              | 12 channels              |
| Serial interface                  |          | <p>[44-pin products]</p> <ul style="list-style-type: none"> <li>CSI: 1 channel/UART (UART supporting LIN-bus): 1 channel/simplified I<sup>2</sup>C: 1 channel</li> <li>CSI: 1 channel/UART: 1 channel/simplified I<sup>2</sup>C: 1 channel</li> <li>CSI: 2 channels/UART: 1 channel/simplified I<sup>2</sup>C: 2 channels</li> </ul> <p>[48-pin, 52-pin products]</p> <ul style="list-style-type: none"> <li>CSI: 2 channels/UART (UART supporting LIN-bus): 1 channel/simplified I<sup>2</sup>C: 2 channels</li> <li>CSI: 1 channel/UART: 1 channel/simplified I<sup>2</sup>C: 1 channel</li> <li>CSI: 2 channels/UART: 1 channel/simplified I<sup>2</sup>C: 2 channels</li> </ul> <p>[64-pin products]</p> <ul style="list-style-type: none"> <li>CSI: 2 channels/UART (UART supporting LIN-bus): 1 channel/simplified I<sup>2</sup>C: 2 channels</li> <li>CSI: 2 channels/UART: 1 channel/simplified I<sup>2</sup>C: 2 channels</li> <li>CSI: 2 channels/UART: 1 channel/simplified I<sup>2</sup>C: 2 channels</li> </ul> |                             |                          |                          |
| I <sup>2</sup> C bus              |          | 1 channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 channel                   | 1 channel                | 1 channel                |
| Data transfer controller (DTC)    |          | 29 sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 30 sources                  |                          | 31 sources               |
| Event link controller (ELC)       |          | Event input: 20<br>Event trigger output: 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                          |                          |
| Vectored interrupt sources        | Internal | 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 24                          | 24                       | 24                       |
|                                   | External | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10                          | 12                       | 13                       |
| Key interrupt                     |          | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6                           | 8                        | 8                        |
| Reset                             |          | <ul style="list-style-type: none"> <li>Reset by <math>\overline{\text{RESET}}</math> pin</li> <li>Internal reset by watchdog timer</li> <li>Internal reset by power-on-reset</li> <li>Internal reset by voltage detector</li> <li>Internal reset by illegal instruction execution <sup>Note</sup></li> <li>Internal reset by RAM parity error</li> <li>Internal reset by illegal-memory access</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                             |                          |                          |
| Power-on-reset circuit            |          | <ul style="list-style-type: none"> <li>Power-on-reset: 1.51 ±0.04 V (T<sub>A</sub> = -40 to +85°C)<br/>1.51 ±0.06 V (T<sub>A</sub> = -40 to +105°C)</li> <li>Power-down-reset: 1.50 ±0.04 V (T<sub>A</sub> = -40 to +85°C)<br/>1.50 ±0.06 V (T<sub>A</sub> = -40 to +105°C)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                          |                          |
| Voltage detector                  |          | 1.63 V to 4.06 V (14 stages)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                          |                          |
| On-chip debug function            |          | Provided                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                          |                          |
| Power supply voltage              |          | V <sub>DD</sub> = 1.6 to 5.5 V (T <sub>A</sub> = -40 to +85°C)<br>V <sub>DD</sub> = 2.4 to 5.5 V (T <sub>A</sub> = -40 to +105°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |                          |                          |
| Operating ambient temperature     |          | T <sub>A</sub> = -40 to +85°C (A: Consumer applications, D: Industrial applications),<br>T <sub>A</sub> = -40 to +105°C (G: Industrial applications)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |                          |                          |

**Note** The illegal instruction is generated when instruction code FFH is executed.  
 Reset by the illegal instruction execution is not issued by emulation with the in-circuit emulator or on-chip debug emulator.

(2/2)

| Item                              |                      | 80-pin                                                                                                                                                                                                                                                                                                                                                                   | 100-pin                     |
|-----------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                                   |                      | R5F104Mx<br>(x = F to H, J)                                                                                                                                                                                                                                                                                                                                              | R5F104Px<br>(x = F to H, J) |
| Clock output/buzzer output        |                      | 2                                                                                                                                                                                                                                                                                                                                                                        | 2                           |
|                                   |                      | • 2.44 kHz, 4.88 kHz, 9.76 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz<br>(Main system clock: f <sub>MAIN</sub> = 20 MHz operation)<br>• 256 Hz, 512 Hz, 1.024 kHz, 2.048 kHz, 4.096 kHz, 8.192 kHz, 16.384 kHz, 32.768 kHz<br>(Subsystem clock: f <sub>SUB</sub> = 32.768 kHz operation)                                                                                      |                             |
| 8/10-bit resolution A/D converter |                      | 17 channels                                                                                                                                                                                                                                                                                                                                                              | 20 channels                 |
| D/A converter                     |                      | 2 channels                                                                                                                                                                                                                                                                                                                                                               | 2 channels                  |
| Comparator                        |                      | 2 channels                                                                                                                                                                                                                                                                                                                                                               | 2 channels                  |
| Serial interface                  |                      | [80-pin, 100-pin products]<br>• CSI: 2 channels/UART (UART supporting LIN-bus): 1 channel/simplified I <sup>2</sup> C: 2 channels<br>• CSI: 2 channels/UART: 1 channel/simplified I <sup>2</sup> C: 2 channels<br>• CSI: 2 channels/UART: 1 channel/simplified I <sup>2</sup> C: 2 channels<br>• CSI: 2 channels/UART: 1 channel/simplified I <sup>2</sup> C: 2 channels |                             |
|                                   | I <sup>2</sup> C bus | 2 channels                                                                                                                                                                                                                                                                                                                                                               | 2 channels                  |
| Data transfer controller (DTC)    |                      | 39 sources                                                                                                                                                                                                                                                                                                                                                               | 39 sources                  |
| Event link controller (ELC)       |                      | Event input: 26<br>Event trigger output: 9                                                                                                                                                                                                                                                                                                                               |                             |
| Vectored interrupt sources        | Internal             | 32                                                                                                                                                                                                                                                                                                                                                                       | 32                          |
|                                   | External             | 13                                                                                                                                                                                                                                                                                                                                                                       | 13                          |
| Key interrupt                     |                      | 8                                                                                                                                                                                                                                                                                                                                                                        | 8                           |
| Reset                             |                      | • Reset by $\overline{\text{RESET}}$ pin<br>• Internal reset by watchdog timer<br>• Internal reset by power-on-reset<br>• Internal reset by voltage detector<br>• Internal reset by illegal instruction execution <sup>Note</sup><br>• Internal reset by RAM parity error<br>• Internal reset by illegal-memory access                                                   |                             |
| Power-on-reset circuit            |                      | • Power-on-reset: 1.51 ±0.04 V (T <sub>A</sub> = -40 to +85°C)<br>1.51 ±0.06 V (T <sub>A</sub> = -40 to +105°C)<br>• Power-down-reset: 1.50 ±0.04 V (T <sub>A</sub> = -40 to +85°C)<br>1.50 ±0.06 V (T <sub>A</sub> = -40 to +105°C)                                                                                                                                     |                             |
| Voltage detector                  |                      | 1.63 V to 4.06 V (14 stages)                                                                                                                                                                                                                                                                                                                                             |                             |
| On-chip debug function            |                      | Provided                                                                                                                                                                                                                                                                                                                                                                 |                             |
| Power supply voltage              |                      | V <sub>DD</sub> = 1.6 to 5.5 V (T <sub>A</sub> = -40 to +85°C)<br>V <sub>DD</sub> = 2.4 to 5.5 V (T <sub>A</sub> = -40 to +105°C)                                                                                                                                                                                                                                        |                             |
| Operating ambient temperature     |                      | T <sub>A</sub> = -40 to +85°C (A: Consumer applications, D: Industrial applications),<br>T <sub>A</sub> = -40 to +105°C (G: Industrial applications)                                                                                                                                                                                                                     |                             |

**Note** The illegal instruction is generated when instruction code FFH is executed.  
 Reset by the illegal instruction execution is not issued by emulation with the in-circuit emulator or on-chip debug emulator.

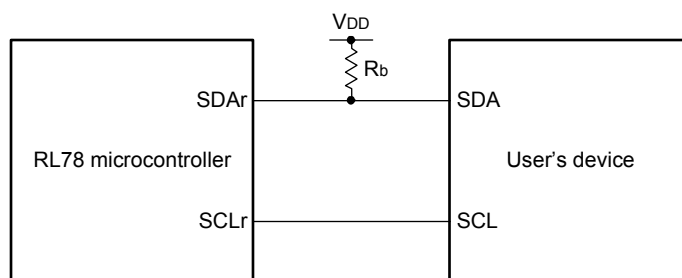
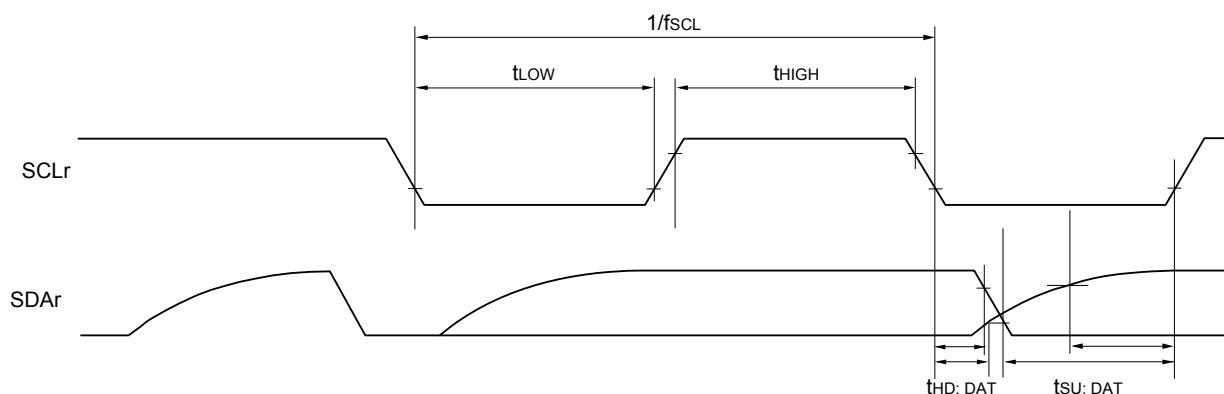
### 2.3.2 Supply current characteristics

#### (1) Flash ROM: 16 to 64 KB of 30- to 64-pin products

(TA = -40 to +85°C, 1.6 V ≤ EVDD0 ≤ VDD ≤ 5.5 V, VSS = EVSS0 = 0 V)

| Parameter                | Symbol | Conditions     |                                   |                                        |                  |                      |  | MIN. | TYP. | MAX. | Unit |
|--------------------------|--------|----------------|-----------------------------------|----------------------------------------|------------------|----------------------|--|------|------|------|------|
| Supply current<br>Note 1 | IDD1   | Operating mode | HS (high-speed main) mode Note 5  | fHOCO = 64 MHz,<br>fIH = 32 MHz Note 3 | Basic operation  | VDD = 5.0 V          |  | 2.4  |      |      | mA   |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 2.4  |      |      |      |
|                          |        |                |                                   | fHOCO = 32 MHz,<br>fIH = 32 MHz Note 3 | Basic operation  | VDD = 5.0 V          |  | 2.1  |      |      |      |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 2.1  |      |      |      |
|                          |        |                | HS (high-speed main) mode Note 5  | fHOCO = 64 MHz,<br>fIH = 32 MHz Note 3 | Normal operation | VDD = 5.0 V          |  | 5.1  | 8.7  |      | mA   |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 5.1  | 8.7  |      |      |
|                          |        |                |                                   | fHOCO = 32 MHz,<br>fIH = 32 MHz Note 3 | Normal operation | VDD = 5.0 V          |  | 4.8  | 8.1  |      |      |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 4.8  | 8.1  |      |      |
|                          |        |                |                                   | fHOCO = 48 MHz,<br>fIH = 24 MHz Note 3 | Normal operation | VDD = 5.0 V          |  | 4.0  | 6.9  |      |      |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 4.0  | 6.9  |      |      |
|                          |        |                |                                   | fHOCO = 24 MHz,<br>fIH = 24 MHz Note 3 | Normal operation | VDD = 5.0 V          |  | 3.8  | 6.3  |      |      |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 3.8  | 6.3  |      |      |
|                          |        |                |                                   | fHOCO = 16 MHz,<br>fIH = 16 MHz Note 3 | Normal operation | VDD = 5.0 V          |  | 2.8  | 4.6  |      |      |
|                          |        |                |                                   |                                        |                  | VDD = 3.0 V          |  | 2.8  | 4.6  |      |      |
|                          |        |                | LS (low-speed main) mode Note 5   | fHOCO = 8 MHz,<br>fIH = 8 MHz Note 3   | Normal operation | VDD = 3.0 V          |  | 1.3  | 2.0  |      | mA   |
|                          |        |                |                                   |                                        |                  | VDD = 2.0 V          |  | 1.3  | 2.0  |      |      |
|                          |        |                | LV (low-voltage main) mode Note 5 | fHOCO = 4 MHz,<br>fIH = 4 MHz Note 3   | Normal operation | VDD = 3.0 V          |  | 1.3  | 1.8  |      | mA   |
|                          |        |                |                                   |                                        |                  | VDD = 2.0 V          |  | 1.3  | 1.8  |      |      |
|                          |        |                | HS (high-speed main) mode Note 5  | fMX = 20 MHz Note 2,<br>VDD = 5.0 V    | Normal operation | Square wave input    |  | 3.3  | 5.3  |      | mA   |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 3.4  | 5.5  |      |      |
|                          |        |                |                                   | fMX = 20 MHz Note 2,<br>VDD = 3.0 V    | Normal operation | Square wave input    |  | 3.3  | 5.3  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 3.4  | 5.5  |      |      |
|                          |        |                |                                   | fMX = 10 MHz Note 2,<br>VDD = 5.0 V    | Normal operation | Square wave input    |  | 2.0  | 3.1  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 2.1  | 3.2  |      |      |
|                          |        |                |                                   | fMX = 10 MHz Note 2,<br>VDD = 3.0 V    | Normal operation | Square wave input    |  | 2.0  | 3.1  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 2.1  | 3.2  |      |      |
|                          |        |                | LS (low-speed main) mode Note 5   | fMX = 8 MHz Note 2,<br>VDD = 3.0 V     | Normal operation | Square wave input    |  | 1.2  | 1.9  |      | mA   |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 1.2  | 2.0  |      |      |
|                          |        |                |                                   | fMX = 8 MHz Note 2,<br>VDD = 2.0 V     | Normal operation | Square wave input    |  | 1.2  | 1.9  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 1.2  | 2.0  |      |      |
|                          |        |                | Subsystem clock operation         | fSUB = 32.768 kHz Note 4<br>TA = -40°C | Normal operation | Square wave input    |  | 4.7  | 6.1  |      | μA   |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 4.7  | 6.1  |      |      |
|                          |        |                |                                   | fSUB = 32.768 kHz Note 4<br>TA = +25°C | Normal operation | Square wave input    |  | 4.7  | 6.1  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 4.7  | 6.1  |      |      |
|                          |        |                |                                   | fSUB = 32.768 kHz Note 4<br>TA = +50°C | Normal operation | Square wave input    |  | 4.8  | 6.7  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 4.8  | 6.7  |      |      |
|                          |        |                |                                   | fSUB = 32.768 kHz Note 4<br>TA = +70°C | Normal operation | Square wave input    |  | 4.8  | 7.5  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 4.8  | 7.5  |      |      |
|                          |        |                |                                   | fSUB = 32.768 kHz Note 4<br>TA = +85°C | Normal operation | Square wave input    |  | 5.4  | 8.9  |      |      |
|                          |        |                |                                   |                                        |                  | Resonator connection |  | 5.4  | 8.9  |      |      |

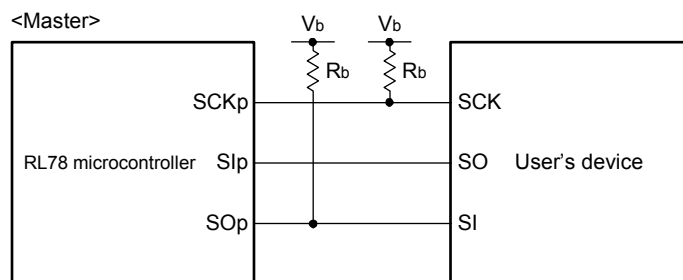
(Notes and Remarks are listed on the next page.)

**Simplified I<sup>2</sup>C mode connection diagram (during communication at same potential)****Simplified I<sup>2</sup>C mode serial transfer timing (during communication at same potential)**

**Remark 1.**  $R_b[\Omega]$ : Communication line (SDAr) pull-up resistance,  $C_b[F]$ : Communication line (SDAr, SCLr) load capacitance

**Remark 2.** r: IIC number (r = 00, 01, 10, 11, 20, 21, 30, 31), g: PIM number (g = 0, 1, 3 to 5, 14),  
h: POM number (h = 0, 1, 3 to 5, 7, 14)

**Remark 3.**  $f_{MCK}$ : Serial array unit operation clock frequency  
(Operation clock to be set by the CKSmn bit of serial mode register mn (SMRmn). m: Unit number (m = 0, 1),  
n: Channel number (n = 0 to 3), mn = 00 to 03, 10 to 13)

**CSI mode connection diagram (during communication at different potential)**

**Remark 1.** R<sub>b</sub>[Ω]: Communication line (SCKp, SOp) pull-up resistance, C<sub>b</sub>[F]: Communication line (SCKp, SOp) load capacitance, V<sub>b</sub>[V]: Communication line voltage

**Remark 2.** p: CSI number (p = 00, 01, 10, 20, 30, 31), m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3), g: PIM and POM number (g = 0, 1, 3 to 5, 14)

**Remark 3.** f<sub>MCK</sub>: 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))

**Remark 4.** CSI01 of 48-, 52-, 64-pin products, and CSI11 and CSI21 cannot communicate at different potential. Use other CSI for communication at different potential.

### 3. ELECTRICAL SPECIFICATIONS (G: INDUSTRIAL APPLICATIONS $T_A = -40$ to $+105^{\circ}\text{C}$ )

This chapter describes the following electrical specifications.

Target products G: Industrial applications  $T_A = -40$  to  $+105^{\circ}\text{C}$

R5F104xxGxx

**Caution 1.** The RL78 microcontrollers have an on-chip debug function, which is provided for development and evaluation. Do not use the on-chip debug function in products designated for mass production, because the guaranteed number of rewritable times of the flash memory may be exceeded when this function is used, and product reliability therefore cannot be guaranteed. Renesas Electronics is not liable for problems occurring when the on-chip debug function is used.

**Caution 2.** With products not provided with an EVDD0, EVDD1, EVSS0, or EVSS1 pin, replace EVDD0 and EVDD1 with VDD, or replace EVSS0 and EVSS1 with VSS.

**Caution 3.** The pins mounted depend on the product. Refer to 2.1 Port Functions to 2.2.1 Functions for each product in the RL78/G14 User's Manual.

**Caution 4.** Please contact Renesas Electronics sales office for derating of operation under  $T_A = +85$  to  $+105^{\circ}\text{C}$ . Derating is the systematic reduction of load for the sake of improved reliability.

**Remark** When RL78/G14 is used in the range of  $T_A = -40$  to  $+85^{\circ}\text{C}$ , see 2. ELECTRICAL SPECIFICATIONS ( $T_A = -40$  to  $+85^{\circ}\text{C}$ ).

## (2) Flash ROM: 96 to 256 KB of 30- to 100-pin products

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

(2/2)

| Parameter                | Symbol         | Conditions                |                                             |                                           |                      | MIN. | TYP.  | MAX. | Unit  |    |
|--------------------------|----------------|---------------------------|---------------------------------------------|-------------------------------------------|----------------------|------|-------|------|-------|----|
| Supply current<br>Note 1 | IDD2<br>Note 2 | HALT mode                 | HS (high-speed main) mode<br>Note 7         | fHOCO = 64 MHz,<br>fIH = 32 MHz<br>Note 4 | VDD = 5.0 V          |      | 0.79  | 4.86 | mA    |    |
|                          |                |                           |                                             |                                           | VDD = 3.0 V          |      | 0.79  | 4.86 |       |    |
|                          |                |                           |                                             | fHOCO = 32 MHz,<br>fIH = 32 MHz<br>Note 4 | VDD = 5.0 V          |      | 0.49  | 4.17 |       |    |
|                          |                |                           |                                             |                                           | VDD = 3.0 V          |      | 0.49  | 4.17 |       |    |
|                          |                |                           |                                             | fHOCO = 48 MHz,<br>fIH = 24 MHz<br>Note 4 | VDD = 5.0 V          |      | 0.62  | 3.82 |       |    |
|                          |                |                           |                                             |                                           | VDD = 3.0 V          |      | 0.62  | 3.82 |       |    |
|                          |                |                           |                                             | fHOCO = 24 MHz,<br>fIH = 24 MHz<br>Note 4 | VDD = 5.0 V          |      | 0.4   | 3.25 |       |    |
|                          |                |                           |                                             |                                           | VDD = 3.0 V          |      | 0.4   | 3.25 |       |    |
|                          |                |                           |                                             | fHOCO = 16 MHz,<br>fIH = 16 MHz<br>Note 4 | VDD = 5.0 V          |      | 0.38  | 2.28 |       |    |
|                          |                |                           |                                             |                                           | VDD = 3.0 V          |      | 0.38  | 2.28 |       |    |
|                          |                |                           | HS (high-speed main) mode<br>Note 7         | fMX = 20 MHz<br>Note 3,<br>VDD = 5.0 V    | Square wave input    |      | 0.30  | 2.65 | mA    |    |
|                          |                |                           |                                             |                                           | Resonator connection |      | 0.40  | 2.77 |       |    |
|                          |                |                           |                                             | fMX = 20 MHz<br>Note 3,<br>VDD = 3.0 V    | Square wave input    |      | 0.30  | 2.65 |       |    |
|                          |                |                           |                                             |                                           | Resonator connection |      | 0.40  | 2.77 |       |    |
|                          |                |                           |                                             | fMX = 10 MHz<br>Note 3,<br>VDD = 5.0 V    | Square wave input    |      | 0.20  | 1.36 |       |    |
|                          |                |                           |                                             |                                           | Resonator connection |      | 0.25  | 1.46 |       |    |
|                          |                |                           |                                             | fMX = 10 MHz<br>Note 3,<br>VDD = 3.0 V    | Square wave input    |      | 0.20  | 1.36 |       |    |
|                          |                |                           |                                             |                                           | Resonator connection |      | 0.25  | 1.46 |       |    |
|                          |                | Subsystem clock operation | fSUB = 32.768 kHz<br>Note 5,<br>TA = -40°C  | Square wave input                         |                      | 0.28 | 0.66  | μA   |       |    |
|                          |                |                           |                                             | Resonator connection                      |                      | 0.47 | 0.85  |      |       |    |
|                          |                |                           | fSUB = 32.768 kHz<br>Note 5,<br>TA = +25°C  | Square wave input                         |                      | 0.34 | 0.66  |      |       |    |
|                          |                |                           |                                             | Resonator connection                      |                      | 0.53 | 0.85  |      |       |    |
|                          |                |                           | fSUB = 32.768 kHz<br>Note 5,<br>TA = +50°C  | Square wave input                         |                      | 0.37 | 2.35  |      |       |    |
|                          |                |                           |                                             | Resonator connection                      |                      | 0.56 | 2.54  |      |       |    |
|                          |                |                           | fSUB = 32.768 kHz<br>Note 5,<br>TA = +70°C  | Square wave input                         |                      | 0.61 | 4.08  |      |       |    |
|                          |                |                           |                                             | Resonator connection                      |                      | 0.80 | 4.27  |      |       |    |
|                          |                |                           | fSUB = 32.768 kHz<br>Note 5,<br>TA = +85°C  | Square wave input                         |                      | 1.55 | 8.09  |      |       |    |
|                          |                |                           |                                             | Resonator connection                      |                      | 1.74 | 8.28  |      |       |    |
|                          |                |                           | fSUB = 32.768 kHz<br>Note 5,<br>TA = +105°C | Square wave input                         |                      | 6.00 | 51.00 |      |       |    |
|                          |                |                           |                                             | Resonator connection                      |                      | 6.00 | 51.00 |      |       |    |
|                          | IDD3<br>Note 6 | STOP mode<br>Note 8       | TA = -40°C                                  |                                           |                      |      |       | 0.19 | 0.57  | μA |
|                          |                |                           | TA = +25°C                                  |                                           |                      |      |       | 0.25 | 0.57  |    |
|                          |                |                           | TA = +50°C                                  |                                           |                      |      |       | 0.33 | 2.26  |    |
|                          |                |                           | TA = +70°C                                  |                                           |                      |      |       | 0.52 | 3.99  |    |
|                          |                |                           | TA = +85°C                                  |                                           |                      |      |       | 1.46 | 8.00  |    |
|                          |                |                           | TA = +105°C                                 |                                           |                      |      |       | 5.50 | 50.00 |    |

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

**(2) During communication at same potential (CSI mode) (master mode, SCKp... internal clock output)****( $T_A = -40$  to  $+105^\circ\text{C}$ ,  $2.4\text{ V} \leq \text{EVDD0} = \text{EVDD1} \leq \text{VDD} \leq 5.5\text{ V}$ ,  $\text{VSS} = \text{EVSS0} = \text{EVSS1} = 0\text{ V}$ )**

| Parameter                                              | Symbol                           | Conditions                                         | HS (high-speed main) mode                          |      | Unit |
|--------------------------------------------------------|----------------------------------|----------------------------------------------------|----------------------------------------------------|------|------|
|                                                        |                                  |                                                    | MIN.                                               | MAX. |      |
| SCKp cycle time                                        | $t_{\text{KCY1}}$                | $t_{\text{KCY1}} \geq 4/f_{\text{CLK}}$            | $2.7\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | 250  | ns   |
|                                                        |                                  |                                                    | $2.4\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | 500  | ns   |
| SCKp high-/low-level width                             | $t_{\text{KH1}}, t_{\text{KL1}}$ | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | $t_{\text{KCY1}}/2 - 24$                           |      | ns   |
|                                                        |                                  | $2.7\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | $t_{\text{KCY1}}/2 - 36$                           |      | ns   |
|                                                        |                                  | $2.4\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | $t_{\text{KCY1}}/2 - 76$                           |      | ns   |
| Slp setup time (to SCKp $\uparrow$ ) Note 1            | $t_{\text{SIK1}}$                | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | 66                                                 |      | ns   |
|                                                        |                                  | $2.7\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | 66                                                 |      | ns   |
|                                                        |                                  | $2.4\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ | 113                                                |      | ns   |
| Slp hold time (from SCKp $\uparrow$ ) Note 2           | $t_{\text{SH1}}$                 |                                                    | 38                                                 |      | ns   |
| Delay time from SCKp $\downarrow$ to SOp output Note 3 | $t_{\text{KS01}}$                | $C = 30\text{ pF}$ Note 4                          |                                                    | 50   | ns   |

**Note 1.** When  $\text{DAPmn} = 0$  and  $\text{CKPmn} = 0$ , or  $\text{DAPmn} = 1$  and  $\text{CKPmn} = 1$ . The Slp setup time becomes “to SCKp $\downarrow$ ” when  $\text{DAPmn} = 0$  and  $\text{CKPmn} = 1$ , or  $\text{DAPmn} = 1$  and  $\text{CKPmn} = 0$ .

**Note 2.** When  $\text{DAPmn} = 0$  and  $\text{CKPmn} = 0$ , or  $\text{DAPmn} = 1$  and  $\text{CKPmn} = 1$ . The Slp hold time becomes “from SCKp $\downarrow$ ” when  $\text{DAPmn} = 0$  and  $\text{CKPmn} = 1$ , or  $\text{DAPmn} = 1$  and  $\text{CKPmn} = 0$ .

**Note 3.** When  $\text{DAPmn} = 0$  and  $\text{CKPmn} = 0$ , or  $\text{DAPmn} = 1$  and  $\text{CKPmn} = 1$ . The delay time to SOp output becomes “from SCKp $\uparrow$ ” when  $\text{DAPmn} = 0$  and  $\text{CKPmn} = 1$ , or  $\text{DAPmn} = 1$  and  $\text{CKPmn} = 0$ .

**Note 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).

**Remark 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 number (g = 0, 1, 3 to 5, 14)

**Remark 2.**  $f_{\text{MCK}}$ : 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))

**(6) Communication at different potential (1.8 V, 2.5 V, 3 V) (CSI mode) (master mode, SCKp... internal clock output)****( $T_A = -40$  to  $+105^\circ\text{C}$ ,  $2.4\text{ V} \leq \text{EVDD0} = \text{EVDD1} \leq \text{VDD} \leq 5.5\text{ V}$ ,  $\text{VSS} = \text{EVSS0} = \text{EVSS1} = 0\text{ V}$ )****(3/3)**

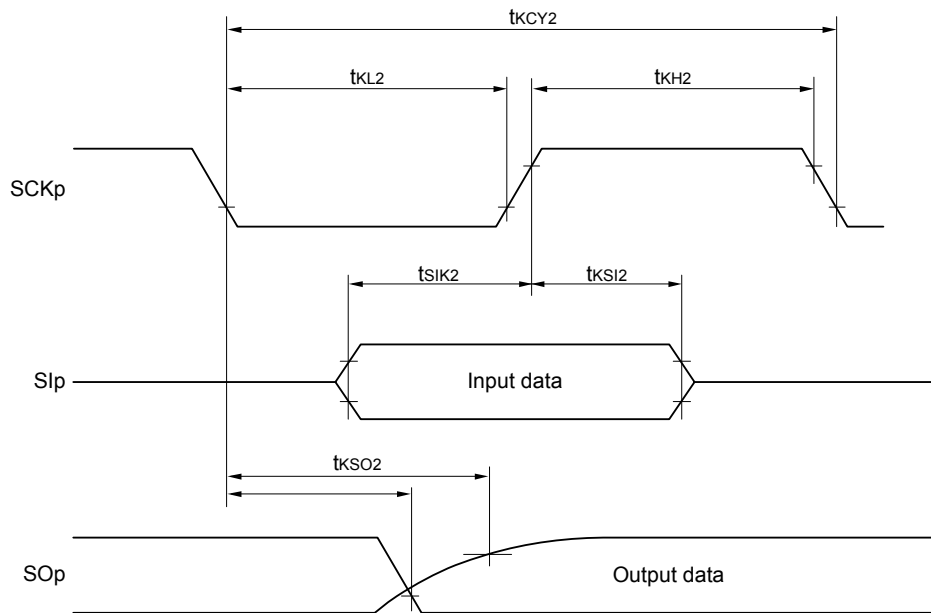
| Parameter                                           | Symbol | Conditions                                                                                                                                                                 | HS (high-speed main) mode |      | Unit |
|-----------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------|------|
|                                                     |        |                                                                                                                                                                            | MIN.                      | MAX. |      |
| Slp setup time (to SCKp↓) <sup>Note</sup>           | tsik1  | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq \text{Vb} \leq 4.0\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 1.4\text{ k}\Omega$ | 88                        |      | ns   |
|                                                     |        | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq \text{Vb} \leq 2.7\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 2.7\text{ k}\Omega$    | 88                        |      | ns   |
|                                                     |        | $2.4\text{ V} \leq \text{EVDD0} < 3.3\text{ V}$ ,<br>$1.6\text{ V} \leq \text{Vb} \leq 2.0\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 5.5\text{ k}\Omega$    | 220                       |      | ns   |
| Slp hold time (from SCKp↓) <sup>Note</sup>          | tkS11  | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq \text{Vb} \leq 4.0\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 1.4\text{ k}\Omega$ | 38                        |      | ns   |
|                                                     |        | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq \text{Vb} \leq 2.7\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 2.7\text{ k}\Omega$    | 38                        |      | ns   |
|                                                     |        | $2.4\text{ V} \leq \text{EVDD0} < 3.3\text{ V}$ ,<br>$1.6\text{ V} \leq \text{Vb} \leq 2.0\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 5.5\text{ k}\Omega$    | 38                        |      | ns   |
| Delay time from SCKp↑ to SOp output <sup>Note</sup> | tkSO1  | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq \text{Vb} \leq 4.0\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 1.4\text{ k}\Omega$ |                           | 50   | ns   |
|                                                     |        | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq \text{Vb} \leq 2.7\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 2.7\text{ k}\Omega$    |                           | 50   | ns   |
|                                                     |        | $2.4\text{ V} \leq \text{EVDD0} < 3.3\text{ V}$ ,<br>$1.6\text{ V} \leq \text{Vb} \leq 2.0\text{ V}$ ,<br>$\text{Cb} = 30\text{ pF}$ , $\text{Rb} = 5.5\text{ k}\Omega$    |                           | 50   | ns   |

**Note** When DAPmn = 0 and CKPmn = 1, or DAPmn = 1 and CKPmn = 0.

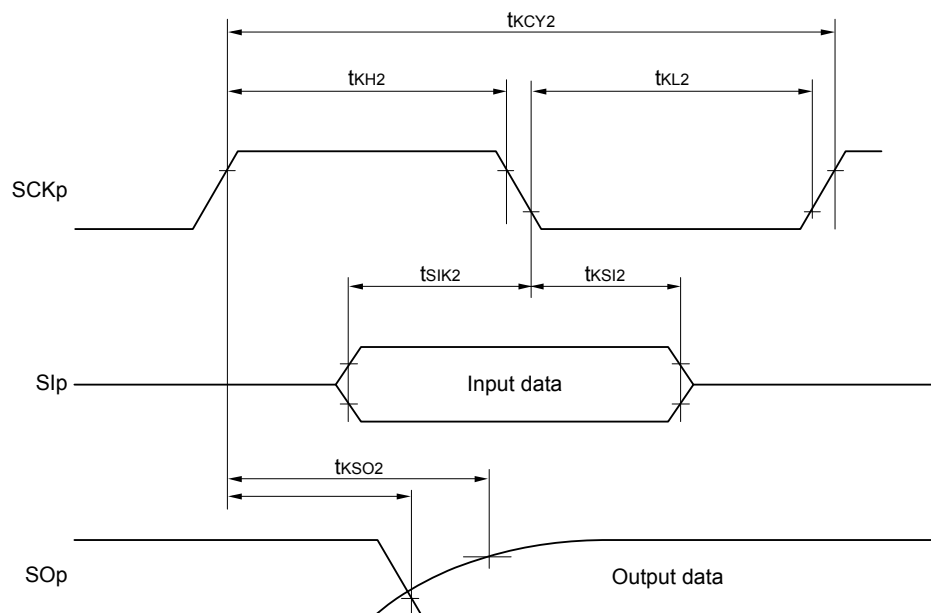
**Caution** Select the TTL input buffer for the Slp pin and the N-ch open drain output ( $\text{VDD}$  tolerance (for the 30- to 52-pin products)/ $\text{EVDD}$  tolerance (for the 64- to 100-pin products)) mode for the SOp pin and SCKp pin by using port input mode register g (PIMg) and port output mode register g (POMg). For  $\text{V}_{IH}$  and  $\text{V}_{IL}$ , see the DC characteristics with TTL input buffer selected.

(Remarks are listed on the next page.)

**CSI mode serial transfer timing (slave mode) (during communication at different potential)**  
**(When DAPmn = 0 and CKPmn = 0, or DAPmn = 1 and CKPmn = 1.)**



**CSI mode serial transfer timing (slave mode) (during communication at different potential)**  
**(When DAPmn = 0 and CKPmn = 1, or DAPmn = 1 and CKPmn = 0.)**



**Remark 1.** p: CSI number (p = 00, 01, 10, 20, 30, 31), m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),  
g: PIM and POM number (g = 0, 1, 3 to 5, 14)

**Remark 2.** CSI01 of 48-, 52-, 64-pin products, and CSI11 and CSI21 cannot communicate at different potential. Use other CSI for communication at different potential.  
Also, communication at different potential cannot be performed during clock synchronous serial communication with the slave select function.

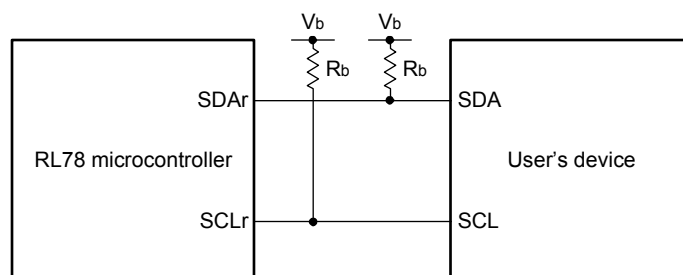
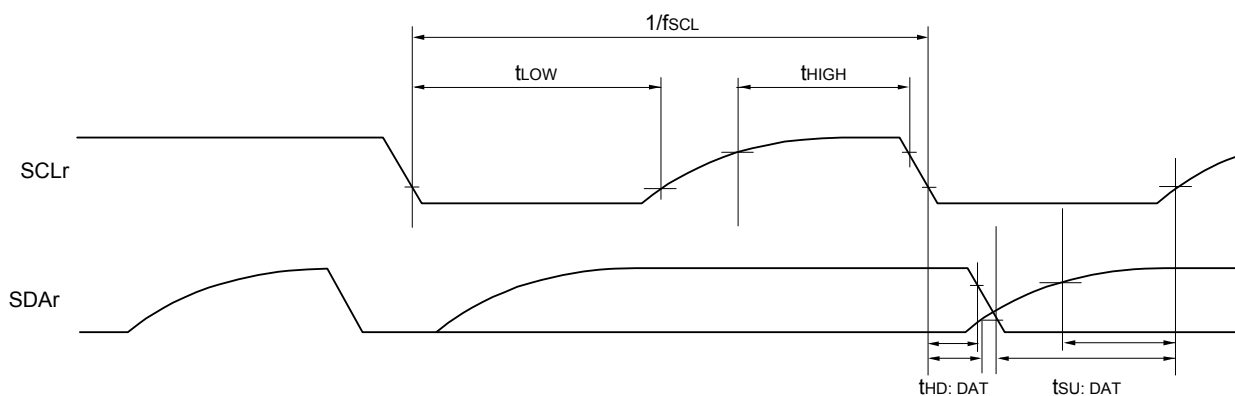
**(8) Communication at different potential (1.8 V, 2.5 V, 3 V) (simplified I<sup>2</sup>C mode)****( $T_A = -40$  to  $+105^\circ\text{C}$ ,  $2.4\text{ V} \leq \text{EVDD0} = \text{EVDD1} \leq \text{VDD} \leq 5.5\text{ V}$ ,  $\text{VSS} = \text{EVSS0} = \text{EVSS1} = 0\text{ V}$ )****(2/2)**

| Parameter                     | Symbol              | Conditions                                                                                                                                                | HS (high-speed main) mode       |      | Unit |
|-------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------|------|
|                               |                     |                                                                                                                                                           | MIN.                            | MAX. |      |
| Data setup time (reception)   | $t_{\text{SU:DAT}}$ | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq V_b \leq 4.0\text{ V}$ ,<br>$C_b = 50\text{ pF}$ , $R_b = 2.7\text{ k}\Omega$  | $1/f_{\text{MCK}} + 340$ Note 2 |      | ns   |
|                               |                     | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq V_b \leq 2.7\text{ V}$ ,<br>$C_b = 50\text{ pF}$ , $R_b = 2.7\text{ k}\Omega$     | $1/f_{\text{MCK}} + 340$ Note 2 |      | ns   |
|                               |                     | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq V_b \leq 4.0\text{ V}$ ,<br>$C_b = 100\text{ pF}$ , $R_b = 2.8\text{ k}\Omega$ | $1/f_{\text{MCK}} + 760$ Note 2 |      | ns   |
|                               |                     | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq V_b \leq 2.7\text{ V}$ ,<br>$C_b = 100\text{ pF}$ , $R_b = 2.7\text{ k}\Omega$    | $1/f_{\text{MCK}} + 760$ Note 2 |      | ns   |
|                               |                     | $2.4\text{ V} \leq \text{EVDD0} < 3.3\text{ V}$ ,<br>$1.6\text{ V} \leq V_b \leq 2.0\text{ V}$ ,<br>$C_b = 100\text{ pF}$ , $R_b = 5.5\text{ k}\Omega$    | $1/f_{\text{MCK}} + 570$ Note 2 |      | ns   |
| Data hold time (transmission) | $t_{\text{HD:DAT}}$ | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq V_b \leq 4.0\text{ V}$ ,<br>$C_b = 50\text{ pF}$ , $R_b = 2.7\text{ k}\Omega$  | 0                               | 770  | ns   |
|                               |                     | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq V_b \leq 2.7\text{ V}$ ,<br>$C_b = 50\text{ pF}$ , $R_b = 2.7\text{ k}\Omega$     | 0                               | 770  | ns   |
|                               |                     | $4.0\text{ V} \leq \text{EVDD0} \leq 5.5\text{ V}$ ,<br>$2.7\text{ V} \leq V_b \leq 4.0\text{ V}$ ,<br>$C_b = 100\text{ pF}$ , $R_b = 2.8\text{ k}\Omega$ | 0                               | 1420 | ns   |
|                               |                     | $2.7\text{ V} \leq \text{EVDD0} < 4.0\text{ V}$ ,<br>$2.3\text{ V} \leq V_b \leq 2.7\text{ V}$ ,<br>$C_b = 100\text{ pF}$ , $R_b = 2.7\text{ k}\Omega$    | 0                               | 1420 | ns   |
|                               |                     | $2.4\text{ V} \leq \text{EVDD0} < 3.3\text{ V}$ ,<br>$1.6\text{ V} \leq V_b \leq 2.0\text{ V}$ ,<br>$C_b = 100\text{ pF}$ , $R_b = 5.5\text{ k}\Omega$    | 0                               | 1215 | ns   |

**Note 1.** The value must also be equal to or less than  $f_{\text{MCK}}/4$ .**Note 2.** Set the  $f_{\text{MCK}}$  value to keep the hold time of  $\text{SCLr} = \text{"L"}$  and  $\text{SCLr} = \text{"H"}$ .

**Caution** Select the TTL input buffer and the N-ch open drain output ( $\text{VDD}$  tolerance (for the 30- to 52-pin products)/ $\text{EVDD}$  tolerance (for the 64- to 100-pin products)) mode for the  $\text{SDAr}$  pin and the N-ch open drain output ( $\text{VDD}$  tolerance (for the 30- to 52-pin products)/ $\text{EVDD}$  tolerance (for the 64- to 100-pin products)) mode for the  $\text{SCLr}$  pin by using port input mode register g (PIMg) and port output mode register g (POMg). For  $V_{\text{IH}}$  and  $V_{\text{IL}}$ , see the DC characteristics with TTL input buffer selected.

(Remarks are listed on the next page.)

**Simplified I<sup>2</sup>C mode connection diagram (during communication at different potential)****Simplified I<sup>2</sup>C mode serial transfer timing (during communication at different potential)**

**Remark 1.**  $R_b[\Omega]$ : Communication line (SDAr, SCLr) pull-up resistance,  $C_b[F]$ : Communication line (SDAr, SCLr) load capacitance,  $V_b[V]$ : Communication line voltage

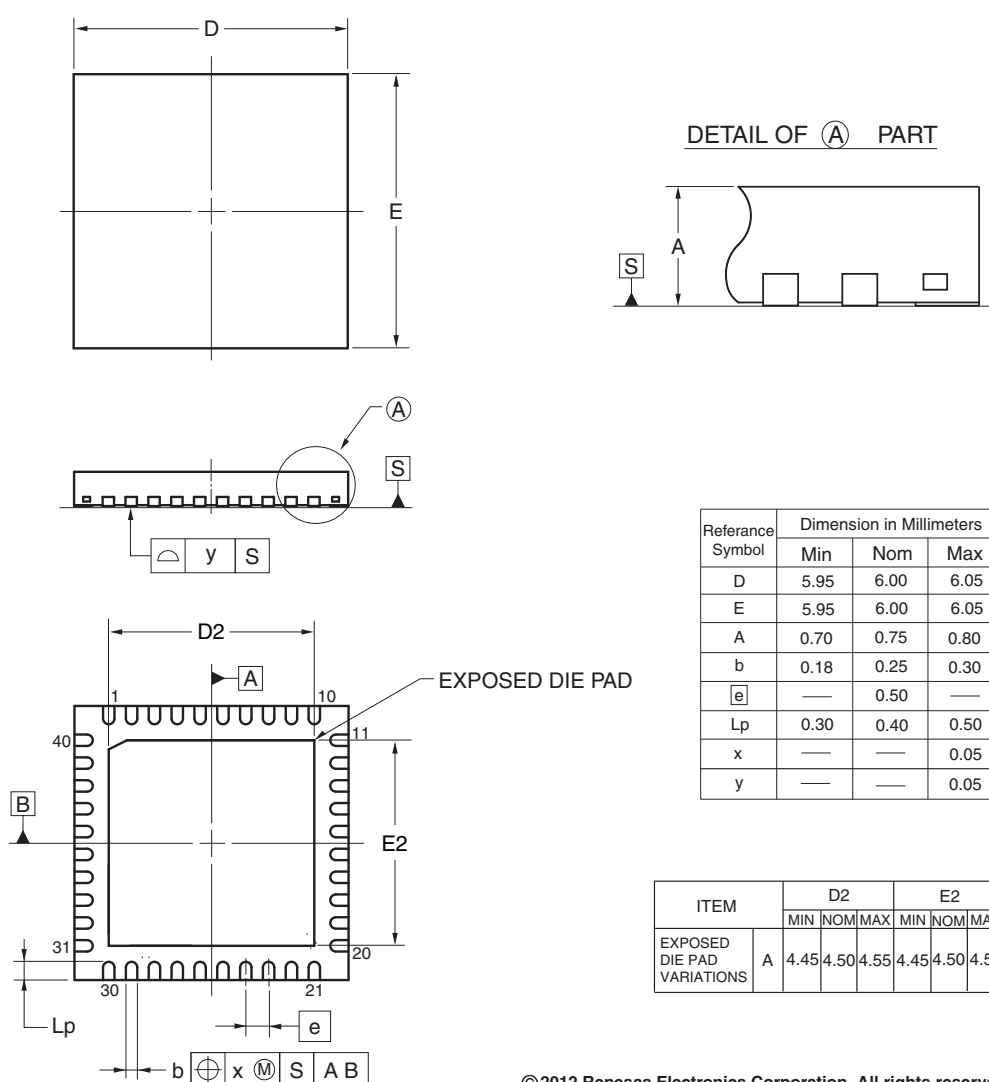
**Remark 2.**  $r$ : IIC number ( $r = 00, 01, 10, 11, 20, 30, 31$ ),  $g$ : PIM, POM number ( $g = 0, 1, 3$  to  $5, 14$ )

**Remark 3.**  $f_{MCK}$ : Serial array unit operation clock frequency  
(Operation clock to be set by the CKSmn bit of serial mode register mn (SMRmn).  $m$ : Unit number ( $m = 0, 1$ ),  
 $n$ : Channel number ( $n = 0, 2$ ),  $mn = 00, 01, 02, 10, 12, 13$ )

#### 4.4 40-pin products

R5F104EAANA, R5F104ECANA, R5F104EDANA, R5F104EEANA, R5F104EFANA, R5F104EGANA,  
 R5F104EHANA  
 R5F104EADNA, R5F104ECDNA, R5F104EDDNA, R5F104EEDNA, R5F104EFDNA, R5F104EGDNA,  
 R5F104EHDNA  
 R5F104EAGNA, R5F104ECGNA, R5F104EDGNA, R5F104EEGNA, R5F104EFGNA, R5F104EGGNA,  
 R5F104EHGNA

| JEITA Package Code | RENESAS Code | Previous Code  | MASS (TYP.) [g] |
|--------------------|--------------|----------------|-----------------|
| P-HWQFN40-6x6-0.50 | PWQN0040KC-A | P40K8-50-4B4-4 | 0.09            |

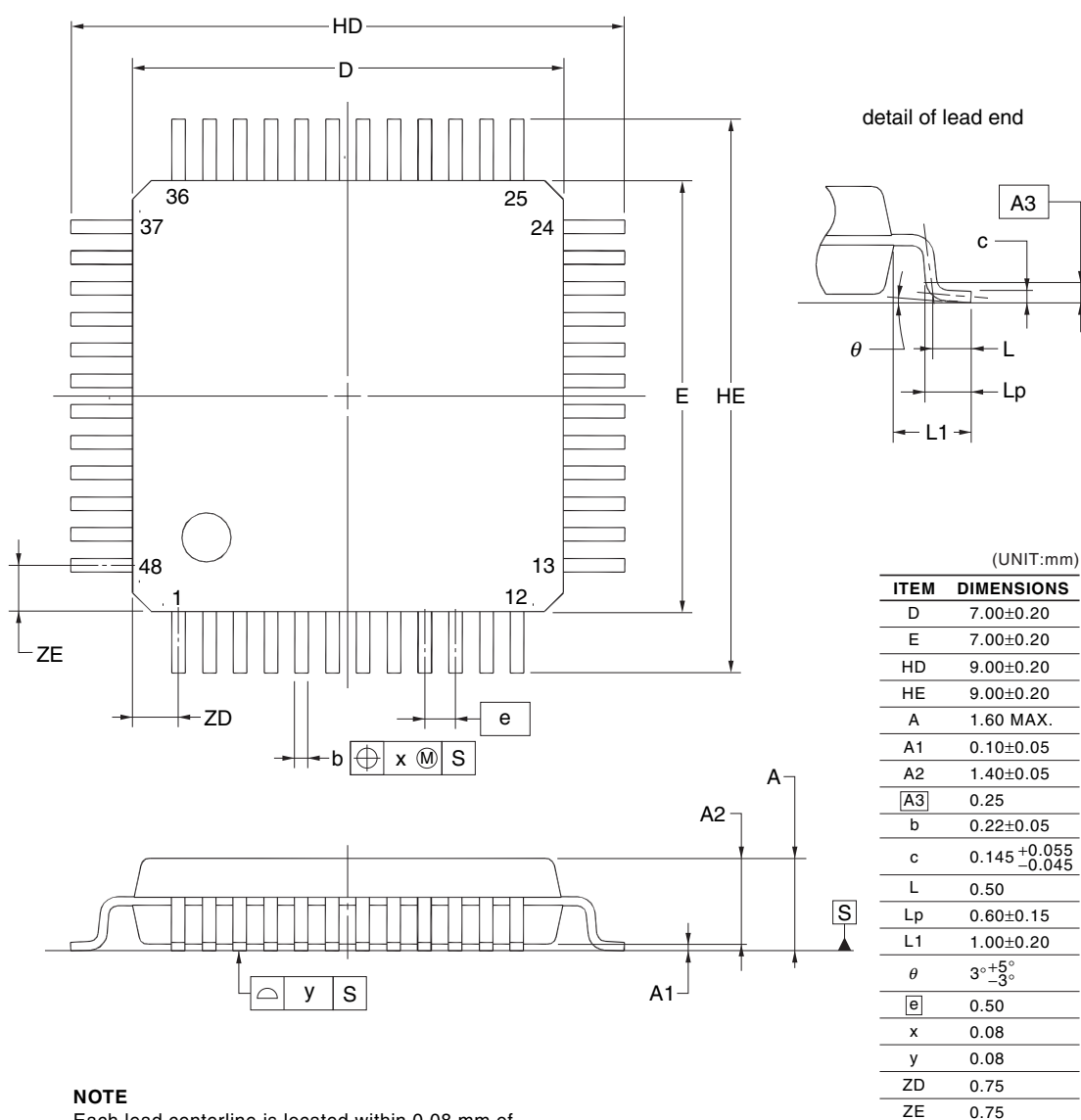


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## 4.6 48-pin products

R5F104GAAFB, R5F104GCAFB, R5F104GDAFB, R5F104GEAFB, R5F104GFAFB, R5F104GGAFB,  
 R5F104GHAFB, R5F104GJAFB  
 R5F104GADFB, R5F104GCDFB, R5F104GDDFB, R5F104GEDFB, R5F104GFDFB, R5F104GGDFB,  
 R5F104GHDFB, R5F104JDFB  
 R5F104GAGFB, R5F104GCGFB, R5F104GDGFB, R5F104GEGFB, R5F104GFGFB, R5F104GGGFB,  
 R5F104GHGFB, R5F104GJGFB

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



R5F104LKAFB, R5F104LLAFB  
R5F104LKGFB, R5F104LLGFB

