

# S1C63567

## 4-bit Single Chip Microcomputer



- Original Architecture Core CPU
- Low Current Consumption
- Wide-range Operating Voltage (2.2V to 5.5V)
- High Speed Operation in Low Voltage (0.56μsec/3.58MHz)

### DESCRIPTION

The S1C63567 is a microcomputer which has a high-performance 4-bit CPU S1C63000 as the core CPU, ROM (16,384 words × 13 bits), RAM (5,120 words × 4 bits), serial interface, watchdog timer, programmable timer, time base counters (2 systems), SVD circuit, a dot-matrix LCD driver that can drive a maximum 60 segments × 17 commons, DTMF/DP generator and sound generator built-in. The S1C63567 features high speed operation and low current consumption in an operating voltage range (2.2 V to 5.5 V), this makes it suitable for applications working with batteries. It is also suitable for caller ID and portable data bank systems because it has a large capacity of RAM built-in.

### FEATURES

- OSC1 oscillation circuit ..... 32.768 kHz (Typ.) crystal or 60 kHz (Typ.) CR oscillation circuit (\*1)
- OSC3 oscillation circuit ..... 3.58 MHz (Typ.) ceramic or 1.8 MHz (Typ.) CR oscillation circuit (\*1)
- Instruction set ..... Basic instruction: 46 types (411 instructions with all)  
Addressing mode: 8 types
- Instruction execution time ..... During operation at 32.768 kHz: 61 μsec 122 μsec 183 μsec  
During operation at 3.58 MHz: 0.56 μsec 1.12 μsec 1.68 μsec
- ROM capacity ..... Code ROM: 16,384 words × 13 bits  
Data ROM: 2,048 words × 4 bits (= 8K bits)
- RAM capacity ..... Data memory: 5,120 words × 4 bits  
Display memory: 1,020 bits (240 words × 4 bits + 60 × 1 bit)
- Input port ..... 8 bits (Pull-up resistors may be supplemented \*1)
- Output port ..... 12 bits (It is possible to switch the 8 bits to special output \*2)
- I/O port ..... 16 bits (It is possible to switch the 2 bits to special output and the 4 bits to serial I/F input/output \*2)
- Serial interface ..... Built-in (8-bit clock synchronous or asynchronous system is selectable)
- LCD driver ..... 60 segments × 8, 16 or 17 commons (\*2)
- Time base counter ..... 2 systems (Clock timer, stopwatch timer)
- Programmable timer ..... Built-in, 2 inputs × 8 bits, with event counter function
- Watchdog timer ..... Built-in
- DTMF generator ..... Built-in
- DP generator ..... Built-in
- Sound generator ..... With envelope and 1-shot output functions
- Supply voltage detection (SVD) circuit ... 12 values, programmable (2.20 V to 3.30 V)  
(It is possible to switch 1 value to the external voltage detection \*1)
- External interrupt ..... Input port interrupt: 2 systems
- Internal interrupt ..... Clock timer interrupt: 4 systems  
Stopwatch timer interrupt: 2 systems  
Programmable timer interrupt: 2 systems  
Serial interface interrupt: 3 systems  
Dialer interrupt: 1 system
- Power supply voltage ..... 2.2 V to 5.5 V

# S1C63567

- Operating temperature range ..... -20°C to 70°C
- Current consumption (Typ.) ..... Low-speed operation (OSC1: crystal oscillation):
 

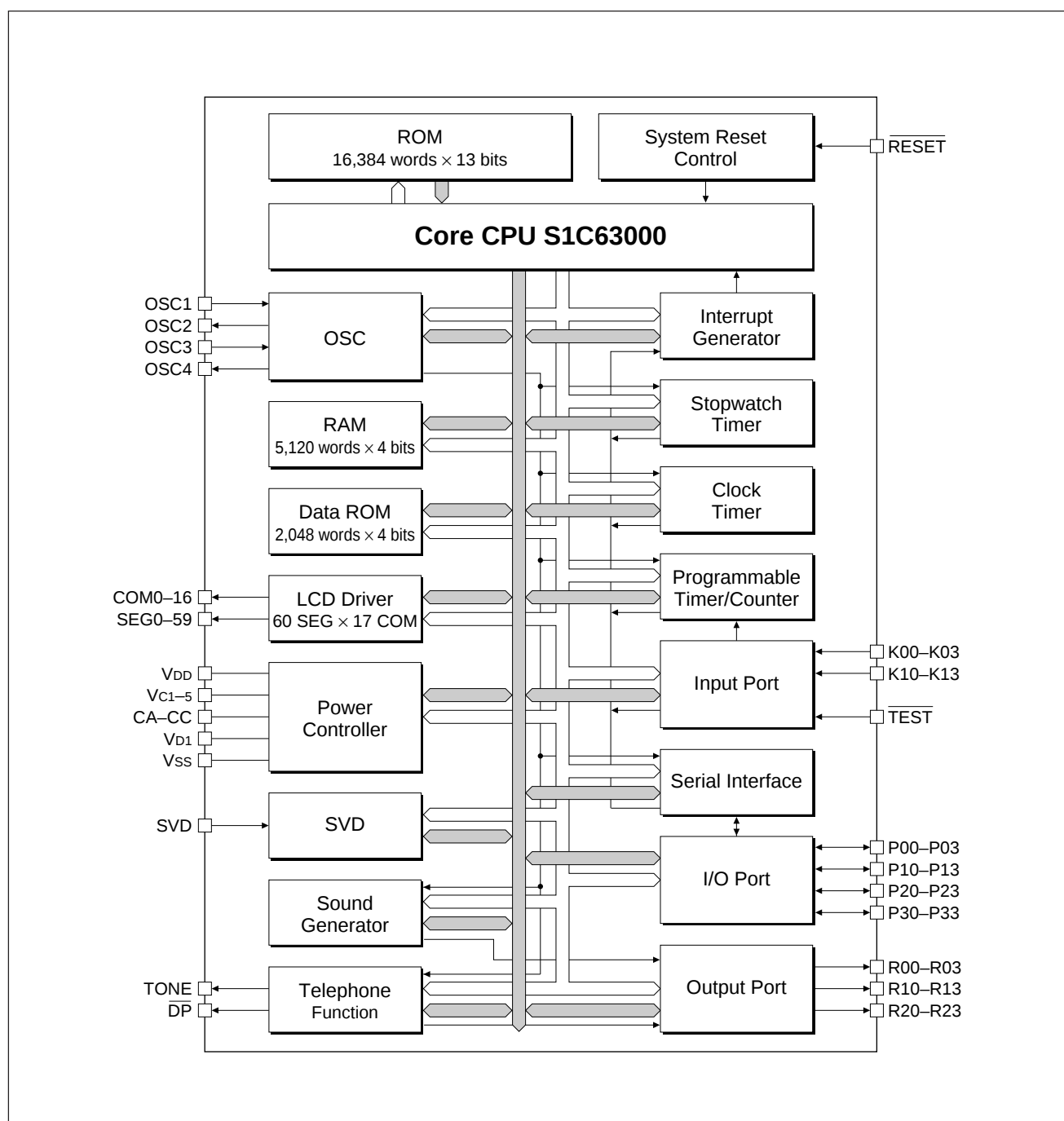
|                           |                       |             |
|---------------------------|-----------------------|-------------|
| During HALT (32 kHz)      | 3.0 V (LCD power OFF) | 1.5 $\mu$ A |
|                           | 3.0 V (LCD power ON)  | 4 $\mu$ A   |
| During operation (32 kHz) | 3.0 V (LCD power ON)  | 10 $\mu$ A  |

 High-speed operation (OSC3: ceramic oscillation):
 

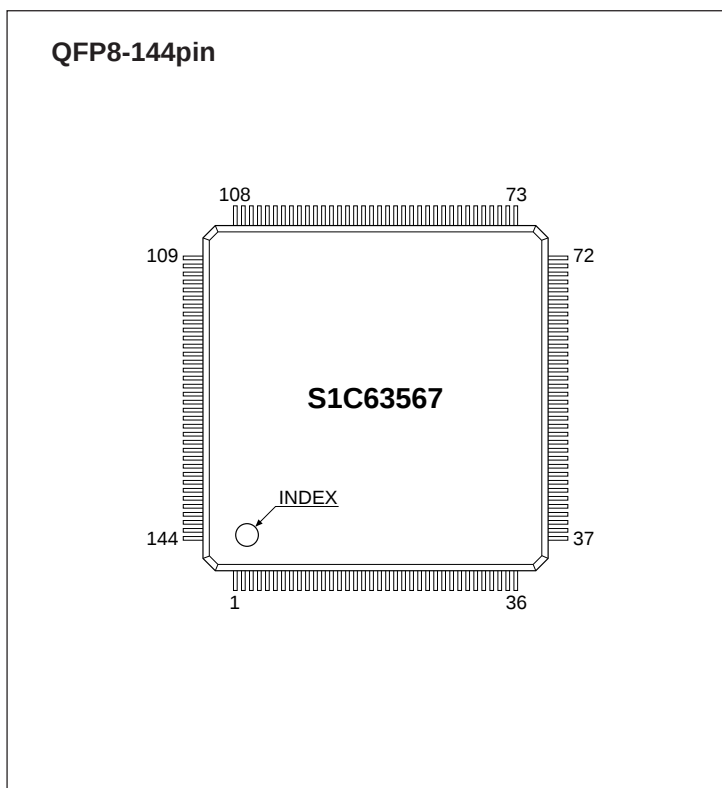
|                             |                      |             |
|-----------------------------|----------------------|-------------|
| During operation (3.58 MHz) | 3.0 V (LCD power ON) | 600 $\mu$ A |
|-----------------------------|----------------------|-------------|
- Package ..... QFP8-144pin (plastic) or chip
 

\*1: Can be selected with mask option      \*2: Can be selected with software

## ■ BLOCK DIAGRAM



## PIN CONFIGURATION



| No. | Name  | No. | Name | No. | Name  | No. | Name  |
|-----|-------|-----|------|-----|-------|-----|-------|
| 1   | N.C.  | 37  | N.C. | 73  | N.C.  | 109 | N.C.  |
| 2   | SEG16 | 38  | N.C. | 74  | K11   | 110 | N.C.  |
| 3   | SEG15 | 39  | DP   | 75  | K10   | 111 | N.C.  |
| 4   | SEG14 | 40  | R23  | 76  | K03   | 112 | SEG47 |
| 5   | SEG13 | 41  | R22  | 77  | K02   | 113 | SEG46 |
| 6   | SEG12 | 42  | R21  | 78  | K01   | 114 | SEG45 |
| 7   | SEG11 | 43  | R20  | 79  | K00   | 115 | SEG44 |
| 8   | SEG10 | 44  | R13  | 80  | SVD   | 116 | SEG43 |
| 9   | SEG9  | 45  | R12  | 81  | Vc1   | 117 | SEG42 |
| 10  | SEG8  | 46  | R11  | 82  | Vc23  | 118 | SEG41 |
| 11  | SEG7  | 47  | R10  | 83  | Vc4   | 119 | SEG40 |
| 12  | SEG6  | 48  | R03  | 84  | Vc5   | 120 | SEG39 |
| 13  | SEG5  | 49  | R02  | 85  | CC    | 121 | SEG38 |
| 14  | SEG4  | 50  | R01  | 86  | CB    | 122 | SEG37 |
| 15  | SEG3  | 51  | R00  | 87  | CA    | 123 | SEG36 |
| 16  | SEG2  | 52  | P33  | 88  | COM8  | 124 | SEG35 |
| 17  | SEG1  | 53  | P32  | 89  | COM9  | 125 | SEG34 |
| 18  | SEG0  | 54  | P31  | 90  | COM10 | 126 | SEG33 |
| 19  | COM7  | 55  | P30  | 91  | COM11 | 127 | SEG32 |
| 20  | COM6  | 56  | P23  | 92  | COM12 | 128 | SEG31 |
| 21  | COM5  | 57  | P22  | 93  | COM13 | 129 | SEG30 |
| 22  | COM4  | 58  | P21  | 94  | COM14 | 130 | SEG29 |
| 23  | COM3  | 59  | P20  | 95  | COM15 | 131 | SEG28 |
| 24  | COM2  | 60  | P13  | 96  | COM16 | 132 | SEG27 |
| 25  | COM1  | 61  | P12  | 97  | SEG59 | 133 | SEG26 |
| 26  | COM0  | 62  | P11  | 98  | SEG58 | 134 | SEG25 |
| 27  | Vss   | 63  | P10  | 99  | SEG57 | 135 | SEG24 |
| 28  | OSC1  | 64  | P03  | 100 | SEG56 | 136 | SEG23 |
| 29  | OSC2  | 65  | P02  | 101 | SEG55 | 137 | SEG22 |
| 30  | Vd1   | 66  | P01  | 102 | SEG54 | 138 | SEG21 |
| 31  | OSC3  | 67  | P00  | 103 | SEG53 | 139 | SEG20 |
| 32  | OSC4  | 68  | K13  | 104 | SEG52 | 140 | SEG19 |
| 33  | VDD   | 69  | K12  | 105 | SEG51 | 141 | SEG18 |
| 34  | RESET | 70  | N.C. | 106 | SEG50 | 142 | SEG17 |
| 35  | TEST  | 71  | N.C. | 107 | SEG49 | 143 | N.C.  |
| 36  | TONE  | 72  | N.C. | 108 | SEG48 | 144 | N.C.  |

N.C. : No Connection

## PIN DESCRIPTION

| Pin name   | Pin No.               | I/O | Function                                                                 |
|------------|-----------------------|-----|--------------------------------------------------------------------------|
| VDD        | 33                    | —   | Power (+) supply pin                                                     |
| Vss        | 27                    | —   | Power (–) supply pin                                                     |
| Vd1        | 30                    | —   | Oscillation system regulated voltage output pin                          |
| Vc1–Vc5    | 81–84                 | —   | LCD system power supply pin (1/4 bias generated internally)              |
| CA–CC      | 87–85                 | —   | LCD system boosting/reducing capacitor connecting pin                    |
| OSC1       | 28                    | I   | Crystal oscillation input pin                                            |
| OSC2       | 29                    | O   | Crystal oscillation output pin                                           |
| OSC3       | 31                    | I   | Ceramic oscillation input pin                                            |
| OSC4       | 32                    | O   | Ceramic oscillation output pin                                           |
| K00–K03    | 79–76                 | I   | Input port                                                               |
| K10–K13    | 75, 74, 69, 68        | I   | Input port                                                               |
| P00–P03    | 67–64                 | I/O | I/O port                                                                 |
| P10–P13    | 63–60                 | I/O | I/O port (switching to serial I/F input/output is possible by software)  |
| P20        | 59                    | I/O | I/O port                                                                 |
| P21        | 58                    | I/O | I/O port                                                                 |
| P22        | 57                    | I/O | I/O port (switching to CL signal output is possible by software)         |
| P23        | 56                    | I/O | I/O port (switching to FR signal output is possible by software)         |
| P30–P33    | 55–52                 | I/O | I/O port                                                                 |
| R00        | 51                    | O   | Output port (switching to XBZ signal output is possible by software)     |
| R01        | 50                    | O   | Output port (switching to BZ signal output is possible by software)      |
| R02        | 49                    | O   | Output port (switching to TOUT signal output is possible by software)    |
| R03        | 48                    | O   | Output port (switching to FOUT signal output is possible by software)    |
| R10        | 47                    | O   | Output port (switching to XTmute signal output is possible by software)  |
| R11        | 46                    | O   | Output port (switching to XRMute signal output is possible by software)  |
| R12        | 45                    | O   | Output port (switching to HDO signal output is possible by software)     |
| R13        | 44                    | O   | Output port (switching to HFO signal output is possible by software)     |
| R20–R23    | 43–40                 | O   | Output port                                                              |
| COM0–COM16 | 26–19, 88–96          | O   | LCD common output pin (1/8, 1/16, 1/17 duty can be selected by software) |
| SEG0–SEG59 | 18–2, 142–112, 108–97 | O   | LCD segment output pin                                                   |
| SVD        | 80                    | I   | SVD external voltage input pin                                           |
| DP         | 39                    | O   | Dial pulse output pin                                                    |
| TONE       | 36                    | O   | DTMF output pin                                                          |
| RESET      | 34                    | I   | Initial reset input pin                                                  |
| TEST       | 35                    | I   | Testing input pin                                                        |

## ■ OPTION LIST

### 1 OSC1 SYSTEM CLOCK

- ☐ 1. Crystal
- ☐ 2. CR

### 2 OSC3 SYSTEM CLOCK

- ☐ 1. Ceramic
- ☐ 2. CR

### 3 MULTIPLE KEY ENTRY RESET COMBINATION

- ☐ 1. Not Use
- ☐ 2. Use (K00, K01, K02, K03)
- ☐ 3. Use (K00, K01, K02)
- ☐ 4. Use (K00, K01)

### 4 MULTIPLE KEY ENTRY RESET TIME AUTHORIZE

- ☐ 1. Not Use
- ☐ 2. Use

### 5 INPUT PORT PULL UP RESISTOR

- |             |                                           |                                         |
|-------------|-------------------------------------------|-----------------------------------------|
| • K00 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K01 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K02 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K03 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K10 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K11 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K12 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |
| • K13 ..... | <input type="checkbox"/> 1. With Resistor | <input type="checkbox"/> 2. Gate Direct |

### 6 OUTPUT PORT OUTPUT SPECIFICATION

- |             |                                           |                                           |
|-------------|-------------------------------------------|-------------------------------------------|
| • R00 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R01 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R02 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R03 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R10 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R11 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R12 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R13 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R20 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R21 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R22 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • R23 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |

### 7 I/O PORT OUTPUT SPECIFICATION

- |             |                                           |                                           |
|-------------|-------------------------------------------|-------------------------------------------|
| • P00 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P01 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P02 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P03 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P10 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P11 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P12 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P13 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P20 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |
| • P21 ..... | <input type="checkbox"/> 1. Complementary | <input type="checkbox"/> 2. Nch-OpenDrain |

- P22 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P23 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P30 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P31 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P32 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P33 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain

#### 8 I/O PORT PULL UP RESISTOR

- P0x ..... ☐ 1. With Resistor ☐ 2. Gate Direct
- P1x ..... ☐ 1. With Resistor ☐ 2. Gate Direct
- P20 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
- P21 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
- P22 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
- P23 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
- P3x ..... ☐ 1. With Resistor ☐ 2. Gate Direct

#### 9 DP PORT OUTPUT SPECIFICATION

- ☐ 1. Complementary
- ☐ 2. Nch-OpenDrain

#### 10 SVD EXTERNAL VOLTAGE DETECTION

- ☐ 1. Not Use
- ☐ 2. Use

#### 11 DTMF "DTS"

- ☐ 1. Not Use
- ☐ 2. Use

## ■ ELECTRICAL CHARACTERISTICS

### ● Absolute Maximum Ratings

(V<sub>SS</sub>=0V)

| Rating                              | Symbol            | Value                         | Unit |
|-------------------------------------|-------------------|-------------------------------|------|
| Supply voltage                      | V <sub>DD</sub>   | -0.5 to 7.0                   | V    |
| Input voltage (1)                   | V <sub>I</sub>    | -0.5 to V <sub>DD</sub> + 0.3 | V    |
| Input voltage (2)                   | V <sub>IOSC</sub> | -0.5 to V <sub>D1</sub> + 0.3 | V    |
| Permissible total output current *1 | ΣI <sub>VDD</sub> | 10                            | mA   |
| Operating temperature               | T <sub>opr</sub>  | -20 to 70                     | °C   |
| Storage temperature                 | T <sub>stg</sub>  | -65 to 150                    | °C   |
| Soldering temperature / time        | T <sub>sol</sub>  | 260°C, 10sec (lead section)   | —    |
| Permissible dissipation *2          | P <sub>d</sub>    | 250                           | mW   |

\*1: The permissible total output current is the sum total of the current (average current) that simultaneously flows from the output pins (or is draw in).

\*2: In case of plastic package (QFP8-144pin).

### ● Recommended Operating Conditions

(T<sub>a</sub>=-20 to 70°C)

| Condition                  | Symbol          | Remark                                    | Min. | Typ.   | Max.  | Unit |
|----------------------------|-----------------|-------------------------------------------|------|--------|-------|------|
| Supply voltage             | V <sub>DD</sub> | V <sub>SS</sub> =0V                       | 2.2  | 3.0    | 5.5   | V    |
| Oscillation frequency      | fosc1           | Crystal oscillation                       | —    | 32.768 | —     | kHz  |
|                            |                 | CR oscillation                            | 40   | 60     | 80    | kHz  |
|                            | fosc3           | CR oscillation                            | —    | 1,800  | 2,250 | kHz  |
|                            |                 | Ceramic oscillation                       | —    | 3.58   | —     | MHz  |
| SVD terminal input voltage | SVD             | SVD≤V <sub>DD</sub> , V <sub>SS</sub> =0V | 0    |        | 5.5   | V    |

## ● DC Characteristics

(Unless otherwise specified:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $f_{osc1}=32.768kHz$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{D1}/V_{C1}/V_{C23}/V_{C4}/V_{C5}$  are internal voltage,  $C_1-C_7=0.2\mu F$ )

| Characteristic                | Symbol    | Condition                                                                                           | Min.               | Typ. | Max.               | Unit    |
|-------------------------------|-----------|-----------------------------------------------------------------------------------------------------|--------------------|------|--------------------|---------|
| High level input voltage (1)  | $V_{IH1}$ | K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33                                                    | $0.8 \cdot V_{DD}$ |      | $V_{DD}$           | V       |
| High level input voltage (2)  | $V_{IH2}$ | RESET, TEST                                                                                         | $0.9 \cdot V_{DD}$ |      | $V_{DD}$           | V       |
| Low level input voltage (1)   | $V_{IL1}$ | K00-03, K10-13                                                                                      | 0                  |      | $0.2 \cdot V_{DD}$ | V       |
| Low level input voltage (2)   | $V_{IL2}$ | P00-03, P10-13, P20-23, P30-33                                                                      | 0                  |      | 0.4                | V       |
| Low level input voltage (3)   | $V_{IL3}$ | RESET, TEST                                                                                         | 0                  |      | $0.1 \cdot V_{DD}$ | V       |
| High level input current      | $I_{IH}$  | $V_{IH}=3.0V$<br>K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33<br>RESET, TEST                    | 0                  |      | 0.5                | $\mu A$ |
| Low level input current (1)   | $I_{IL1}$ | $V_{IL1}=V_{SS}$<br>No Pull-up<br>K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33<br>RESET, TEST   | -0.5               |      | 0                  | $\mu A$ |
| Low level input current (2)   | $I_{IL2}$ | $V_{IL2}=V_{SS}$<br>With Pull-up<br>K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33<br>RESET, TEST | -16                | -10  | -6                 | $\mu A$ |
| High level output current (1) | $I_{OH1}$ | $V_{OH1}=0.9 \cdot V_{DD}$<br>R02, R03, R10-13, R20-23<br>P00-03, P10-13, P20-23, P30-33            |                    |      | -0.6               | mA      |
| High level output current (2) | $I_{OH2}$ | $V_{OH2}=0.9 \cdot V_{DD}$<br>R00, R01                                                              |                    |      | -0.6               | mA      |
| Low level output current (1)  | $I_{OL1}$ | $V_{OL1}=0.1 \cdot V_{DD}$<br>R02, R03, R10-13, R20-23<br>P00-03, P10-13, P20-23, P30-33            | 1.5                |      |                    | mA      |
| Low level output current (2)  | $I_{OL2}$ | $V_{OL2}=0.1 \cdot V_{DD}$<br>R00, R01                                                              | 1.5                |      |                    | mA      |
| Common output current         | $I_{OH3}$ | $V_{OH3}=V_{C5}-0.05V$<br>COM0-16                                                                   |                    |      | -25                | $\mu A$ |
|                               | $I_{OL3}$ | $V_{OL3}=V_{SS}+0.05V$                                                                              | 25                 |      |                    | $\mu A$ |
| Segment output current        | $I_{OH4}$ | $V_{OH4}=V_{C5}-0.05V$<br>SEG0-59                                                                   |                    |      | -10                | $\mu A$ |
|                               | $I_{OL4}$ | $V_{OL4}=V_{SS}+0.05V$                                                                              | 10                 |      |                    | $\mu A$ |

(Unless otherwise specified:  $V_{DD}=5.0V$ ,  $V_{SS}=0V$ ,  $f_{osc1}=32.768kHz$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{D1}/V_{C1}/V_{C23}/V_{C4}/V_{C5}$  are internal voltage,  $C_1-C_7=0.2\mu F$ )

| Characteristic                | Symbol    | Condition                                                                                           | Min.               | Typ. | Max.               | Unit    |
|-------------------------------|-----------|-----------------------------------------------------------------------------------------------------|--------------------|------|--------------------|---------|
| High level input voltage (1)  | $V_{IH1}$ | K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33                                                    | $0.8 \cdot V_{DD}$ |      | $V_{DD}$           | V       |
| High level input voltage (2)  | $V_{IH2}$ | RESET, TEST                                                                                         | $0.9 \cdot V_{DD}$ |      | $V_{DD}$           | V       |
| Low level input voltage (1)   | $V_{IL1}$ | K00-03, K10-13                                                                                      | 0                  |      | $0.2 \cdot V_{DD}$ | V       |
| Low level input voltage (2)   | $V_{IL2}$ | P00-03, P10-13, P20-23, P30-33                                                                      | 0                  |      | 0.4                | V       |
| Low level input voltage (3)   | $V_{IL3}$ | RESET, TEST                                                                                         | 0                  |      | $0.1 \cdot V_{DD}$ | V       |
| High level input current      | $I_{IH}$  | $V_{IH}=5.0V$<br>K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33<br>RESET, TEST                    | 0                  |      | 0.5                | $\mu A$ |
| Low level input current (1)   | $I_{IL1}$ | $V_{IL1}=V_{SS}$<br>No Pull-up<br>K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33<br>RESET, TEST   | -0.5               |      | 0                  | $\mu A$ |
| Low level input current (2)   | $I_{IL2}$ | $V_{IL2}=V_{SS}$<br>With Pull-up<br>K00-03, K10-13<br>P00-03, P10-13, P20-23, P30-33<br>RESET, TEST | -25                | -15  | -10                | $\mu A$ |
| High level output current (1) | $I_{OH1}$ | $V_{OH1}=0.9 \cdot V_{DD}$<br>R02, R03, R10-13, R20-23<br>P00-03, P10-13, P20-23, P30-33            |                    |      | -1.5               | mA      |
| High level output current (2) | $I_{OH2}$ | $V_{OH2}=0.9 \cdot V_{DD}$<br>R00, R01                                                              |                    |      | -1.5               | mA      |
| Low level output current (1)  | $I_{OL1}$ | $V_{OL1}=0.1 \cdot V_{DD}$<br>R02, R03, R10-13, R20-23<br>P00-03, P10-13, P20-23, P30-33            | 3.5                |      |                    | mA      |
| Low level output current (2)  | $I_{OL2}$ | $V_{OL2}=0.1 \cdot V_{DD}$<br>R00, R01                                                              | 3.5                |      |                    | mA      |
| Common output current         | $I_{OH3}$ | $V_{OH3}=V_{C5}-0.05V$<br>COM0-16                                                                   |                    |      | -25                | $\mu A$ |
|                               | $I_{OL3}$ | $V_{OL3}=V_{SS}+0.05V$                                                                              | 25                 |      |                    | $\mu A$ |
| Segment output current        | $I_{OH4}$ | $V_{OH4}=V_{C5}-0.05V$<br>SEG0-59                                                                   |                    |      | -10                | $\mu A$ |
|                               | $I_{OL4}$ | $V_{OL4}=V_{SS}+0.05V$                                                                              | 10                 |      |                    | $\mu A$ |

# ● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $f_{osc1}=32.768kHz$ ,  $C_G=25pF$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{D1}/V_{C1}/V_{C23}/V_{C4}/V_{C5}$  are internal voltage,  $C_1-C_7=0.2\mu F$ )

| Characteristic                               | Symbol           | Condition                                                                          | Min.                                 | Typ. | Max.                                 | Unit    |
|----------------------------------------------|------------------|------------------------------------------------------------------------------------|--------------------------------------|------|--------------------------------------|---------|
| LCD drive voltage                            | Vc1              | Connect 1 M $\Omega$ load resistor between Vss and Vc1 (without panel load)        | $1/2 \cdot V_{C23}$<br>-0.1          |      | $1/2 \cdot V_{C23}$<br>$\times 0.95$ | V       |
|                                              |                  | Connect 1 M $\Omega$ load resistor between Vss and Vc23 (without panel load)       |                                      |      |                                      |         |
|                                              | Vc23             | LC0-3="0"                                                                          |                                      | 1.95 |                                      |         |
|                                              |                  | LC0-3="1"                                                                          |                                      | 1.98 |                                      |         |
|                                              |                  | LC0-3="2"                                                                          |                                      | 2.01 |                                      |         |
|                                              |                  | LC0-3="3"                                                                          |                                      | 2.04 |                                      |         |
|                                              |                  | LC0-3="4"                                                                          |                                      | 2.07 |                                      |         |
|                                              |                  | LC0-3="5"                                                                          |                                      | 2.10 |                                      |         |
|                                              |                  | LC0-3="6"                                                                          |                                      | 2.13 |                                      |         |
|                                              |                  | LC0-3="7"                                                                          | Typ.<br>$\times 0.88$                | 2.16 | Typ.<br>$\times 1.12$                | V       |
|                                              |                  | LC0-3="8"                                                                          |                                      | 2.19 |                                      |         |
|                                              |                  | LC0-3="9"                                                                          |                                      | 2.22 |                                      |         |
|                                              |                  | LC0-3="10"                                                                         |                                      | 2.25 |                                      |         |
|                                              |                  | LC0-3="11"                                                                         |                                      | 2.28 |                                      |         |
|                                              |                  | LC0-3="12"                                                                         |                                      | 2.31 |                                      |         |
|                                              |                  | LC0-3="13"                                                                         |                                      | 2.34 |                                      |         |
|                                              |                  | LC0-3="14"                                                                         |                                      | 2.37 |                                      |         |
|                                              |                  | LC0-3="15"                                                                         |                                      | 2.40 |                                      |         |
| SVD voltage<br>( $T_a=25^{\circ}C$ )         | VSVD1            | Connect 1 M $\Omega$ load resistor between Vss and Vc4 (without panel load)        | $3/2 \cdot V_{C23}$<br>$\times 0.95$ |      | $3/2 \cdot V_{C23}$                  | V       |
|                                              |                  | Connect 1 M $\Omega$ load resistor between Vss and Vc5 (without panel load)        | $2 \cdot V_{C23}$<br>$\times 0.95$   |      | $2 \cdot V_{C23}$                    | V       |
|                                              |                  | SVDS0-3="0" (internal)                                                             |                                      | 2.20 |                                      |         |
|                                              |                  | SVDS0-3="1"                                                                        |                                      | 2.20 |                                      |         |
|                                              |                  | SVDS0-3="2"                                                                        |                                      | 2.20 |                                      |         |
|                                              |                  | SVDS0-3="3"                                                                        |                                      | 2.20 |                                      |         |
|                                              |                  | SVDS0-3="4"                                                                        |                                      | 2.20 |                                      |         |
|                                              |                  | SVDS0-3="5"                                                                        |                                      | 2.30 |                                      |         |
|                                              |                  | SVDS0-3="6"                                                                        |                                      | 2.40 |                                      |         |
|                                              |                  | SVDS0-3="7"                                                                        | Typ.<br>$\times 0.93$                | 2.50 | Typ.<br>$\times 1.07$                | V       |
|                                              |                  | SVDS0-3="8"                                                                        |                                      | 2.60 |                                      |         |
|                                              |                  | SVDS0-3="9"                                                                        |                                      | 2.70 |                                      |         |
|                                              |                  | SVDS0-3="10"                                                                       |                                      | 2.80 |                                      |         |
|                                              |                  | SVDS0-3="11"                                                                       |                                      | 2.90 |                                      |         |
|                                              |                  | SVDS0-3="12"                                                                       |                                      | 3.00 |                                      |         |
|                                              |                  | SVDS0-3="13"                                                                       |                                      | 3.10 |                                      |         |
|                                              |                  | SVDS0-3="14"                                                                       |                                      | 3.20 |                                      |         |
|                                              |                  | SVDS0-3="15"                                                                       |                                      | 3.30 |                                      |         |
| SVD voltage (external) *3                    | VSVD2            | SVDS0-3="0" (external), $T_a = 25^{\circ}C$                                        | 0.85                                 | 0.95 | 1.05                                 | V       |
| SVD circuit response time                    | t <sub>SVD</sub> | $T_a = 25^{\circ}C$                                                                |                                      |      | 100                                  | $\mu S$ |
| Current consumption<br>( $T_a=25^{\circ}C$ ) | I <sub>OP</sub>  | During HALT (32 kHz crystal oscillation)                                           | LCD power OFF *1, *2                 | 1.5  | 3                                    | $\mu A$ |
|                                              |                  |                                                                                    | LCD power ON *1, *2                  | 4    | 8                                    | $\mu A$ |
|                                              |                  | During execution (32 kHz crystal oscillation)                                      | LCD power ON *1, *2                  | 10   | 19                                   | $\mu A$ |
|                                              |                  | During execution (60 kHz CR oscillation)                                           | LCD power ON *1, *2                  | 45   | 80                                   | $\mu A$ |
|                                              |                  | During execution (1,800 kHz CR oscillation)                                        | LCD power ON *1                      | 800  | 1,000                                | $\mu A$ |
|                                              |                  | During HALT (3.58 MHz ceramic oscillation)                                         | LCD power ON *1                      | 150  | 300                                  | $\mu A$ |
|                                              |                  | During execution (3.58 MHz ceramic oscillation)                                    | LCD power ON *1                      | 600  | 800                                  | $\mu A$ |
|                                              |                  | SVD circuit current (during supply voltage detection)<br>$V_{DD}=2.2$ to $5.5$ V   | 1                                    |      | 15                                   | $\mu A$ |
|                                              |                  | SVD circuit current (during external voltage detection)<br>$V_{DD}=2.2$ to $5.5$ V | 0.5                                  |      | 6                                    | $\mu A$ |
|                                              |                  |                                                                                    |                                      |      |                                      |         |

\*1: Without panel load. The SVD circuit is OFF.

\*2: OSCC = "0"

\*3: Please input the voltage, which is within the range between Vss and VDD, into the SVD terminal.

## ● Oscillation Characteristics

The oscillation characteristics change depending on the conditions (components used, board pattern, etc.). Use the following characteristics as reference values.

### OSC1 Crystal Oscillation Circuit

(Unless otherwise specified:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $f_{osc1}=32.768kHz$ ,  $C_G=25pF$ ,  $C_D=$ built-in,  $T_a=-20$  to  $70^{\circ}C$ )

| Characteristic                     | Symbol                | Condition                                                   | Min. | Typ. | Max. | Unit      |
|------------------------------------|-----------------------|-------------------------------------------------------------|------|------|------|-----------|
| Oscillation start voltage          | $V_{sta}$             | $t_{sta} \leq 3sec (V_{DD})$                                | 2.2  |      |      | V         |
| Oscillation stop voltage           | $V_{stp}$             | $t_{stp} \leq 10sec (V_{DD})$                               | 2.2  |      |      | V         |
| Built-in capacitance (drain)       | $C_D$                 | Including the parasitic capacitance inside the IC (in chip) |      | 14   |      | pF        |
| Frequency/voltage deviation        | $\Delta f/\Delta V$   | $V_{DD}=2.2$ to $5.5V$                                      |      |      | 10   | ppm       |
| Frequency/IC deviation             | $\Delta f/\Delta IC$  |                                                             | -10  |      | 10   | ppm       |
| Frequency adjustment range         | $\Delta f/\Delta C_G$ | $C_G=5$ to $25pF$                                           | 10   | 20   |      | ppm       |
| Harmonic oscillation start voltage | $V_{hho}$             | $C_G=5pF (V_{DD})$                                          | 5.5  |      |      | V         |
| Permitted leak resistance          | $R_{leak}$            | Between OSC1 and $V_{SS}$                                   | 200  |      |      | $M\Omega$ |

### OSC1 CR Oscillation Circuit

(Unless otherwise specified:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $R_{CR1}=600k\Omega$ ,  $T_a=-20$  to  $70^{\circ}C$ )

| Characteristic                   | Symbol     | Condition              | Min. | Typ.  | Max. | Unit |
|----------------------------------|------------|------------------------|------|-------|------|------|
| Oscillation frequency dispersion | $f_{osc1}$ |                        | -30  | 60kHz | 30   | %    |
| Oscillation start voltage        | $V_{sta}$  | $(V_{DD})$             | 2.2  |       |      | V    |
| Oscillation start time           | $t_{sta}$  | $V_{DD}=2.2$ to $5.5V$ |      |       | 3    | mS   |
| Oscillation stop voltage         | $V_{stp}$  | $(V_{DD})$             | 2.2  |       |      | V    |

### OSC3 Ceramic Oscillation Circuit

(Unless otherwise specified:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ , Ceramic oscillator:  $3.58MHz$ ,  $C_{GC}=C_{DC}=30pF$ ,  $T_a=-20$  to  $70^{\circ}C$ )

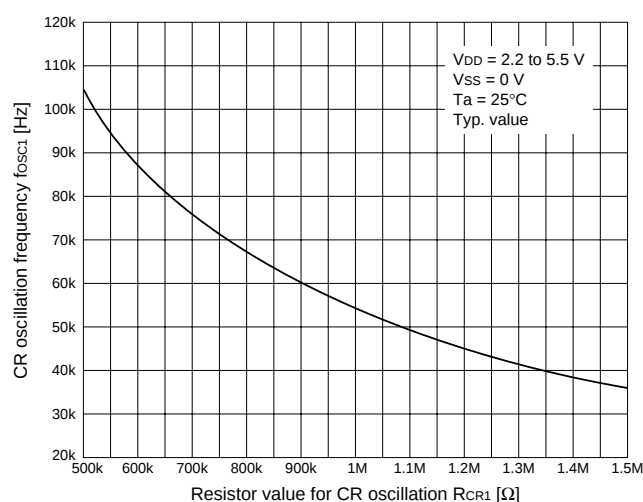
| Characteristic            | Symbol    | Condition              | Min. | Typ. | Max. | Unit |
|---------------------------|-----------|------------------------|------|------|------|------|
| Oscillation start voltage | $V_{sta}$ | $(V_{DD})$             | 2.2  |      |      | V    |
| Oscillation start time    | $t_{sta}$ | $V_{DD}=2.2$ to $5.5V$ |      |      | 5    | mS   |
| Oscillation stop voltage  | $V_{stp}$ | $(V_{DD})$             | 2.2  |      |      | V    |

### OSC3 CR Oscillation Circuit

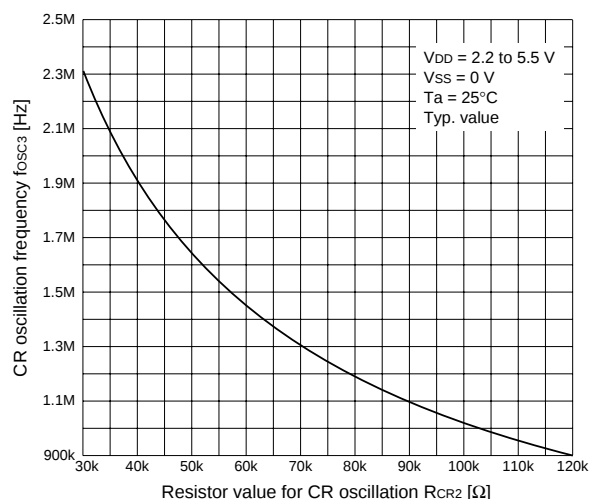
(Unless otherwise specified:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $R_{CR2}=47k\Omega$ ,  $T_a=-20$  to  $70^{\circ}C$ )

| Characteristic                   | Symbol     | Condition              | Min. | Typ.     | Max. | Unit |
|----------------------------------|------------|------------------------|------|----------|------|------|
| Oscillation frequency dispersion | $f_{osc3}$ |                        | -25  | 1,800kHz | 25   | %    |
| Oscillation start voltage        | $V_{sta}$  | $(V_{DD})$             | 2.2  |          |      | V    |
| Oscillation start time           | $t_{sta}$  | $V_{DD}=2.2$ to $5.5V$ |      |          | 3    | mS   |
| Oscillation stop voltage         | $V_{stp}$  | $(V_{DD})$             | 2.2  |          |      | V    |

#### • OSC1 CR oscillation frequency-resistance characteristic



#### • OSC3 CR oscillation frequency-resistance characteristic



## ● Serial Interface AC Characteristics

### Clock Synchronous Master Mode

#### • During 32 kHz operation

(Condition:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{IH1}=0.8V_{DD}$ ,  $V_{IL1}=0.2V_{DD}$ ,  $V_{OH}=0.8V_{DD}$ ,  $V_{OL}=0.2V_{DD}$ )

| Characteristic                      | Symbol    | Min. | Typ. | Max. | Unit    |
|-------------------------------------|-----------|------|------|------|---------|
| Transmitting data output delay time | $t_{smd}$ |      |      | 5    | $\mu S$ |
| Receiving data input set-up time    | $t_{sms}$ | 10   |      |      | $\mu S$ |
| Receiving data input hold time      | $t_{smh}$ | 5    |      |      | $\mu S$ |

#### • During 1 MHz operation

(Condition:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{IH1}=0.8V_{DD}$ ,  $V_{IL1}=0.2V_{DD}$ ,  $V_{OH}=0.8V_{DD}$ ,  $V_{OL}=0.2V_{DD}$ )

| Characteristic                      | Symbol    | Min. | Typ. | Max. | Unit |
|-------------------------------------|-----------|------|------|------|------|
| Transmitting data output delay time | $t_{smd}$ |      |      | 200  | nS   |
| Receiving data input set-up time    | $t_{sms}$ | 400  |      |      | nS   |
| Receiving data input hold time      | $t_{smh}$ | 200  |      |      | nS   |

Note that the maximum clock frequency is limited to 1 MHz.

### Clock Synchronous Slave Mode

#### • During 32 kHz operation

(Condition:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{IH1}=0.8V_{DD}$ ,  $V_{IL1}=0.2V_{DD}$ ,  $V_{OH}=0.8V_{DD}$ ,  $V_{OL}=0.2V_{DD}$ )

| Characteristic                      | Symbol    | Min. | Typ. | Max. | Unit    |
|-------------------------------------|-----------|------|------|------|---------|
| Transmitting data output delay time | $t_{ssd}$ |      |      | 10   | $\mu S$ |
| Receiving data input set-up time    | $t_{sss}$ | 10   |      |      | $\mu S$ |
| Receiving data input hold time      | $t_{ssh}$ | 5    |      |      | $\mu S$ |

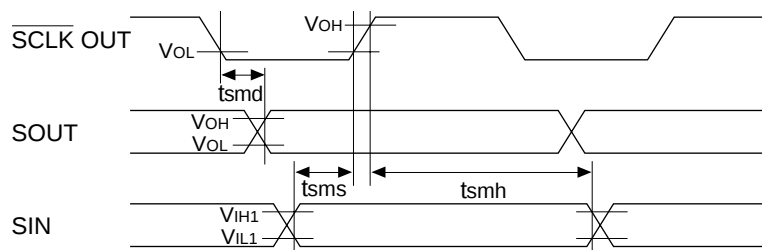
#### • During 1 MHz operation

(Condition:  $V_{DD}=3.0V$ ,  $V_{SS}=0V$ ,  $T_a=-20$  to  $70^{\circ}C$ ,  $V_{IH1}=0.8V_{DD}$ ,  $V_{IL1}=0.2V_{DD}$ ,  $V_{OH}=0.8V_{DD}$ ,  $V_{OL}=0.2V_{DD}$ )

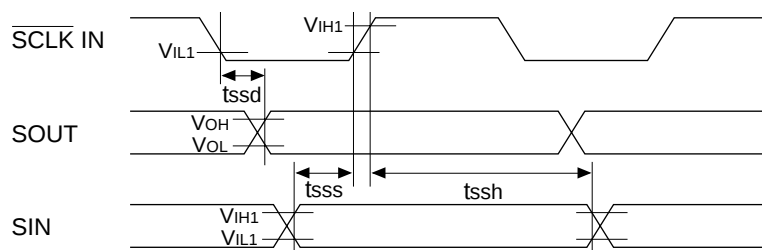
| Characteristic                      | Symbol    | Min. | Typ. | Max. | Unit |
|-------------------------------------|-----------|------|------|------|------|
| Transmitting data output delay time | $t_{ssd}$ |      |      | 500  | nS   |
| Receiving data input set-up time    | $t_{sss}$ | 400  |      |      | nS   |
| Receiving data input hold time      | $t_{ssh}$ | 200  |      |      | nS   |

Note that the maximum clock frequency is limited to 1 MHz.

#### <Master mode>



#### <Slave mode>

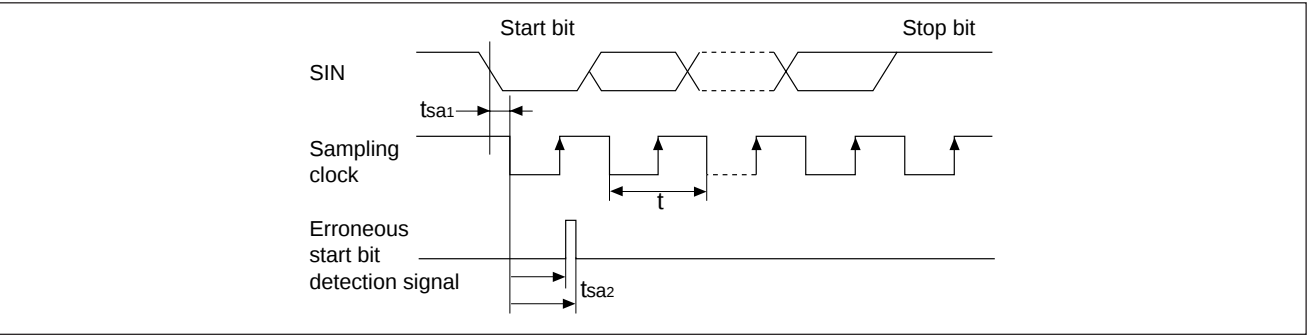


Asynchronous System

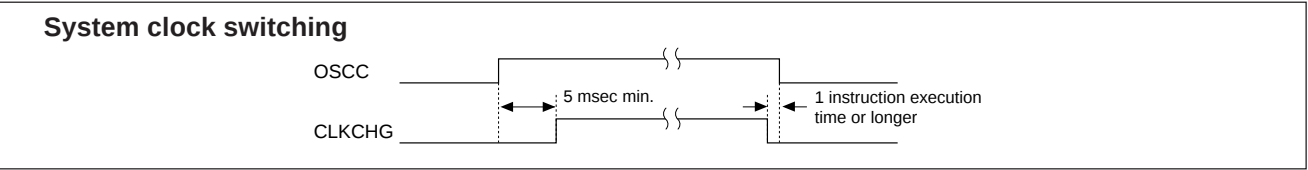
(Condition: VDD=2.2 to 5.5V, VSS=0V, Ta=-20 to 70°C)

| Characteristic                              | Symbol | Min.  | Typ. | Max.   | Unit |
|---------------------------------------------|--------|-------|------|--------|------|
| Start bit detection error time *1           | tsa1   | 0     |      | t/16   | S    |
| Erroneous start bit detection range time *2 | tsa2   | 9t/16 |      | 10t/16 | S    |

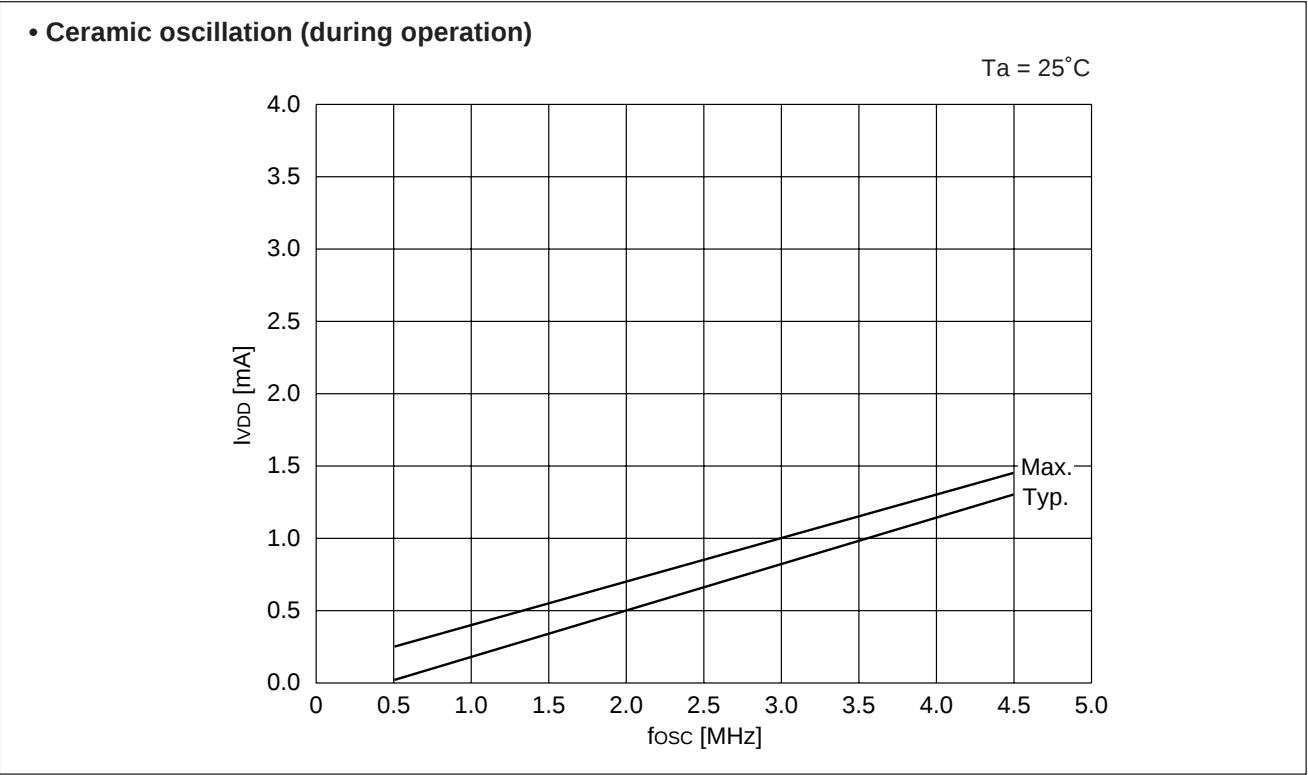
- \*1: Start bit detection error time is a logical delay time from inputting the start bit until internal sampling begins operating.  
(Time as far as AC is excluded.)
- \*2: Erroneous start bit detection range time is a logical range to detect whether a LOW level (start bit) has been input again after a start bit has been detected and the internal sampling clock has started. When a HIGH level is detected, the start bit detection circuit is reset and goes into a wait status until the next start bit. (Time as far as AC is excluded.)



● Timing Chart

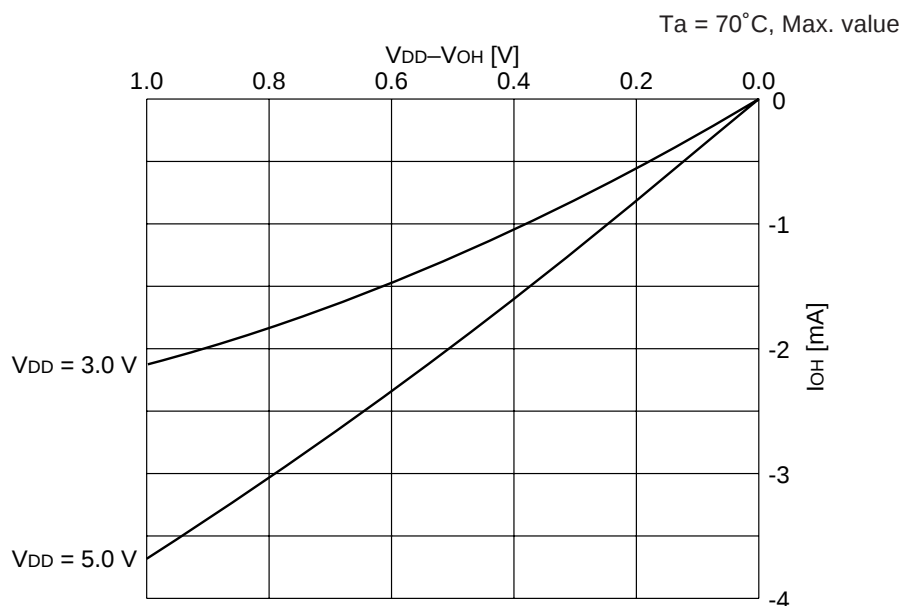


● Characteristic Curves (reference value)  
Power current - frequency characteristics

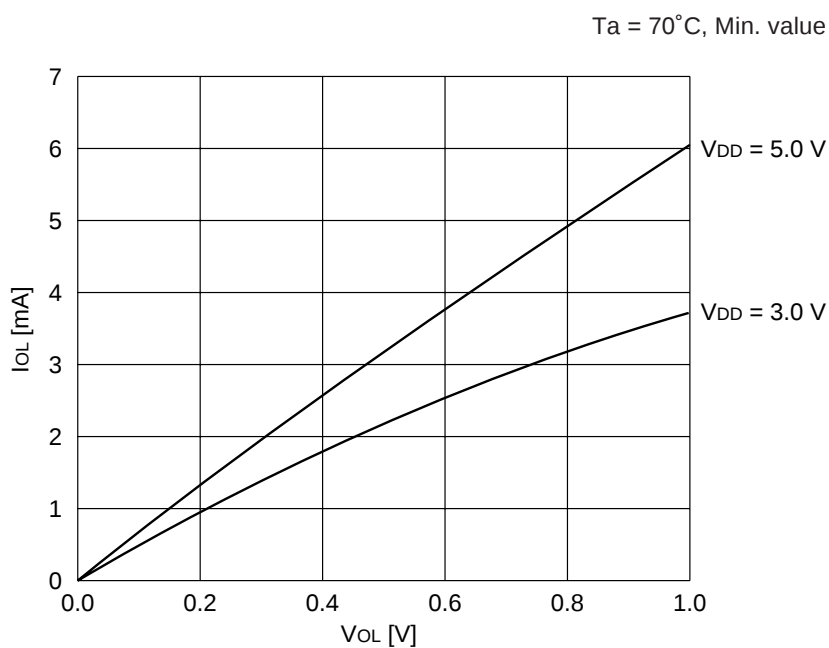


## Output current characteristics

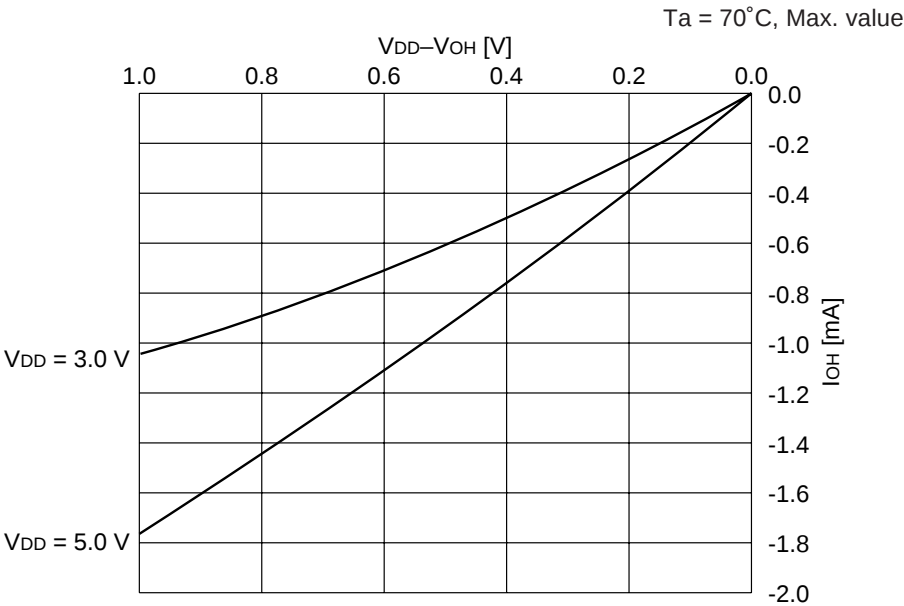
## • High level output current (Pxx, Rxx, BZ)



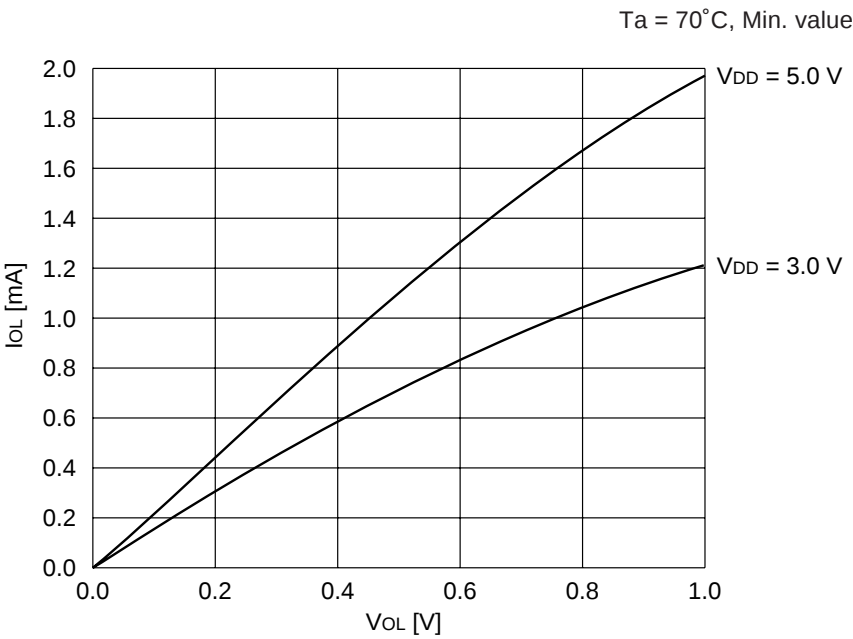
## • Low level output current (Pxx, Rxx, BZ)



• High level output current (SEGxx)

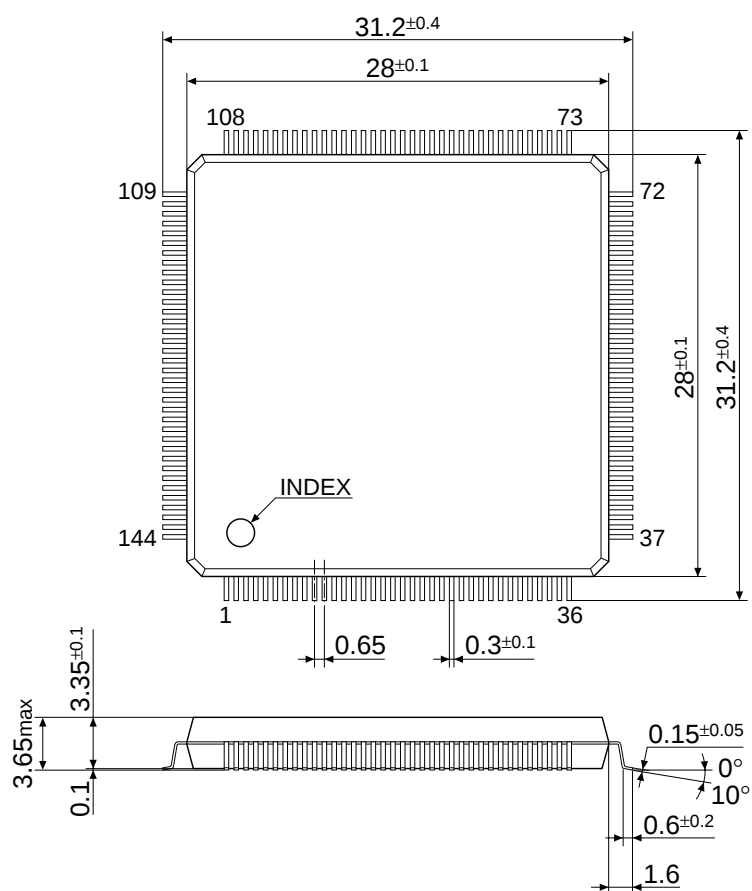


• Low level output current (SEGxx)



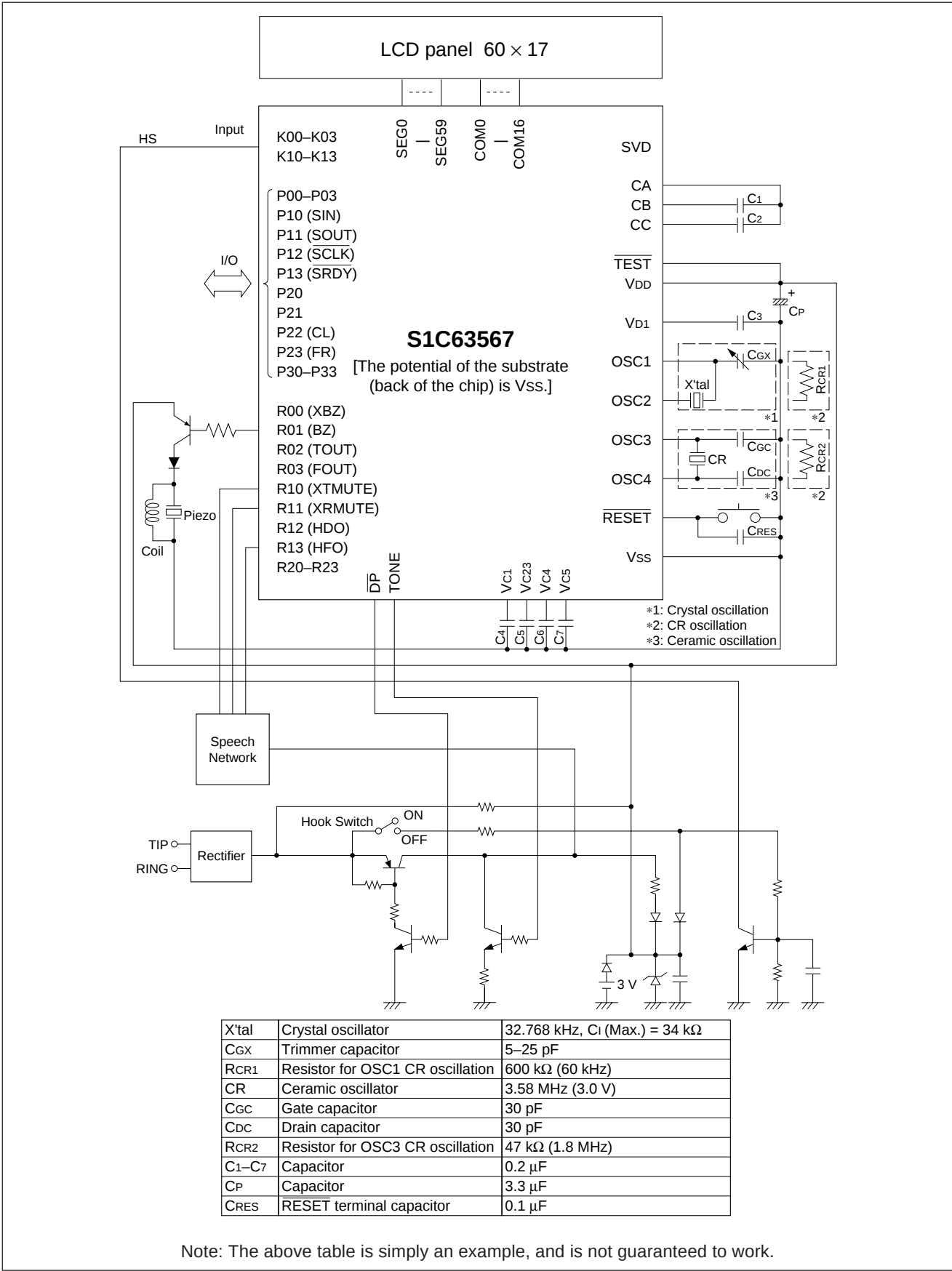
## ■ PACKAGE DIMENSIONS

### Plastic QFP8-144pin



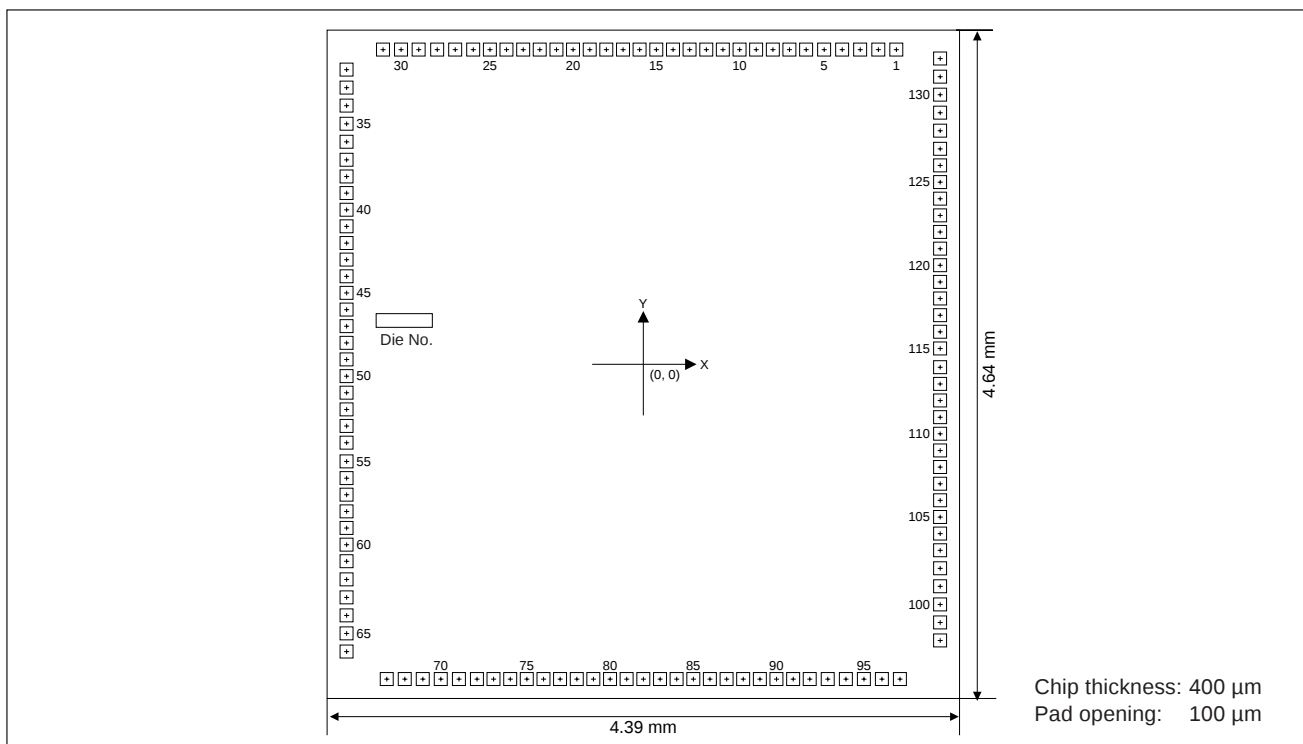
Unit: mm

■ BASIC EXTERNAL CONNECTION DIAGRAM



## ■ PAD LAYOUT

### ● Diagram of Pad Layout



### ● Pad Coordinates

Unit:  $\mu\text{m}$ 

| No. | Pad name | X     | Y    | No. | Pad name | X     | Y     | No. | Pad name | X     | Y     | No. | Pad name | X    | Y     |
|-----|----------|-------|------|-----|----------|-------|-------|-----|----------|-------|-------|-----|----------|------|-------|
| 1   | DP       | 1756  | 2185 | 32  | K11      | -2060 | 2046  | 67  | SEG47    | -1781 | -2185 | 98  | SEG16    | 2060 | -1917 |
| 2   | R23      | 1631  | 2185 | 33  | K10      | -2060 | 1921  | 68  | SEG46    | -1656 | -2185 | 99  | SEG15    | 2060 | -1792 |
| 3   | R22      | 1505  | 2185 | 34  | K03      | -2060 | 1796  | 69  | SEG45    | -1531 | -2185 | 100 | SEG14    | 2060 | -1667 |
| 4   | R21      | 1380  | 2185 | 35  | K02      | -2060 | 1670  | 70  | SEG44    | -1406 | -2185 | 101 | SEG13    | 2060 | -1541 |
| 5   | R20      | 1255  | 2185 | 36  | K01      | -2060 | 1545  | 71  | SEG43    | -1280 | -2185 | 102 | SEG12    | 2060 | -1416 |
| 6   | R13      | 1130  | 2185 | 37  | K00      | -2060 | 1420  | 72  | SEG42    | -1155 | -2185 | 103 | SEG11    | 2060 | -1291 |
| 7   | R12      | 1014  | 2185 | 38  | SVD      | -2060 | 1304  | 73  | SEG41    | -1040 | -2185 | 104 | SEG10    | 2060 | -1175 |
| 8   | R11      | 899   | 2185 | 39  | VC1      | -2060 | 1189  | 74  | SEG40    | -924  | -2185 | 105 | SEG09    | 2060 | -1060 |
| 9   | R10      | 783   | 2185 | 40  | VC23     | -2060 | 1073  | 75  | SEG39    | -809  | -2185 | 106 | SEG08    | 2060 | -944  |
| 10  | R03      | 668   | 2185 | 41  | VC4      | -2060 | 958   | 76  | SEG38    | -693  | -2185 | 107 | SEG07    | 2060 | -829  |
| 11  | R02      | 552   | 2185 | 42  | VC5      | -2060 | 842   | 77  | SEG37    | -578  | -2185 | 108 | SEG06    | 2060 | -713  |
| 12  | R01      | 437   | 2185 | 43  | CC       | -2060 | 727   | 78  | SEG36    | -462  | -2185 | 109 | SEG05    | 2060 | -598  |
| 13  | R00      | 321   | 2185 | 44  | CB       | -2060 | 611   | 79  | SEG35    | -347  | -2185 | 110 | SEG04    | 2060 | -482  |
| 14  | P33      | 206   | 2185 | 45  | CA       | -2060 | 496   | 80  | SEG34    | -231  | -2185 | 111 | SEG03    | 2060 | -367  |
| 15  | P32      | 90    | 2185 | 46  | COM8     | -2060 | 380   | 81  | SEG33    | -116  | -2185 | 112 | SEG02    | 2060 | -251  |
| 16  | P31      | -26   | 2185 | 47  | COM9     | -2060 | 265   | 82  | SEG32    | 0     | -2185 | 113 | SEG01    | 2060 | -136  |
| 17  | P30      | -141  | 2185 | 48  | COM10    | -2060 | 149   | 83  | SEG31    | 116   | -2185 | 114 | SEG00    | 2060 | -20   |
| 18  | P23      | -257  | 2185 | 49  | COM11    | -2060 | 34    | 84  | SEG30    | 231   | -2185 | 115 | COM7     | 2060 | 110   |
| 19  | P22      | -372  | 2185 | 50  | COM12    | -2060 | -82   | 85  | SEG29    | 347   | -2185 | 116 | COM6     | 2060 | 226   |
| 20  | P21      | -488  | 2185 | 51  | COM13    | -2060 | -197  | 86  | SEG28    | 462   | -2185 | 117 | COM5     | 2060 | 341   |
| 21  | P20      | -603  | 2185 | 52  | COM14    | -2060 | -313  | 87  | SEG27    | 578   | -2185 | 118 | COM4     | 2060 | 457   |
| 22  | P13      | -719  | 2185 | 53  | COM15    | -2060 | -428  | 88  | SEG26    | 693   | -2185 | 119 | COM3     | 2060 | 572   |
| 23  | P12      | -834  | 2185 | 54  | COM16    | -2060 | -544  | 89  | SEG25    | 809   | -2185 | 120 | COM2     | 2060 | 688   |
| 24  | P11      | -950  | 2185 | 55  | SEG59    | -2060 | -674  | 90  | SEG24    | 924   | -2185 | 121 | COM1     | 2060 | 803   |
| 25  | P10      | -1065 | 2185 | 56  | SEG58    | -2060 | -790  | 91  | SEG23    | 1040  | -2185 | 122 | COM0     | 2060 | 919   |
| 26  | P03      | -1181 | 2185 | 57  | SEG57    | -2060 | -905  | 92  | SEG22    | 1155  | -2185 | 123 | Vss      | 2060 | 1034  |
| 27  | P02      | -1306 | 2185 | 58  | SEG56    | -2060 | -1021 | 93  | SEG21    | 1280  | -2185 | 124 | OSC1     | 2060 | 1150  |
| 28  | P01      | -1431 | 2185 | 59  | SEG55    | -2060 | -1136 | 94  | SEG20    | 1406  | -2185 | 125 | OSC2     | 2060 | 1265  |
| 29  | P00      | -1556 | 2185 | 60  | SEG54    | -2060 | -1252 | 95  | SEG19    | 1531  | -2185 | 126 | Vd1      | 2060 | 1381  |
| 30  | K13      | -1682 | 2185 | 61  | SEG53    | -2060 | -1367 | 96  | SEG18    | 1656  | -2185 | 127 | OSC3     | 2060 | 1496  |
| 31  | K12      | -1807 | 2185 | 62  | SEG52    | -2060 | -1493 | 97  | SEG17    | 1781  | -2185 | 128 | OSC4     | 2060 | 1622  |
|     |          |       |      | 63  | SEG51    | -2060 | -1618 |     |          |       |       | 129 | Vdd      | 2060 | 1747  |
|     |          |       |      | 64  | SEG50    | -2060 | -1743 |     |          |       |       | 130 | RESET    | 2060 | 1872  |
|     |          |       |      | 65  | SEG49    | -2060 | -1868 |     |          |       |       | 131 | TEST     | 2060 | 1997  |
|     |          |       |      | 66  | SEG48    | -2060 | -1994 |     |          |       |       | 132 | TONE     | 2060 | 2123  |

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