

E0C6S37

4-bit Single Chip Microcomputer



- Core CPU Architecture
- SVD Circuit / Comparator
- Super Low Operating Voltage (0.9V)
- High Quality Display LCD Driver

DESCRIPTION

The E0C6S37 is an advanced single-chip CMOS 4-bit microcomputer consisting of the E0C6200A CMOS 4-bit core CPU. It also contains the ROM, RAM, LCD driver circuit, time base counter and stopwatch counter. The E0C6S37 provides an excellent solution for low-power consumption systems with clock functions.

FEATURES

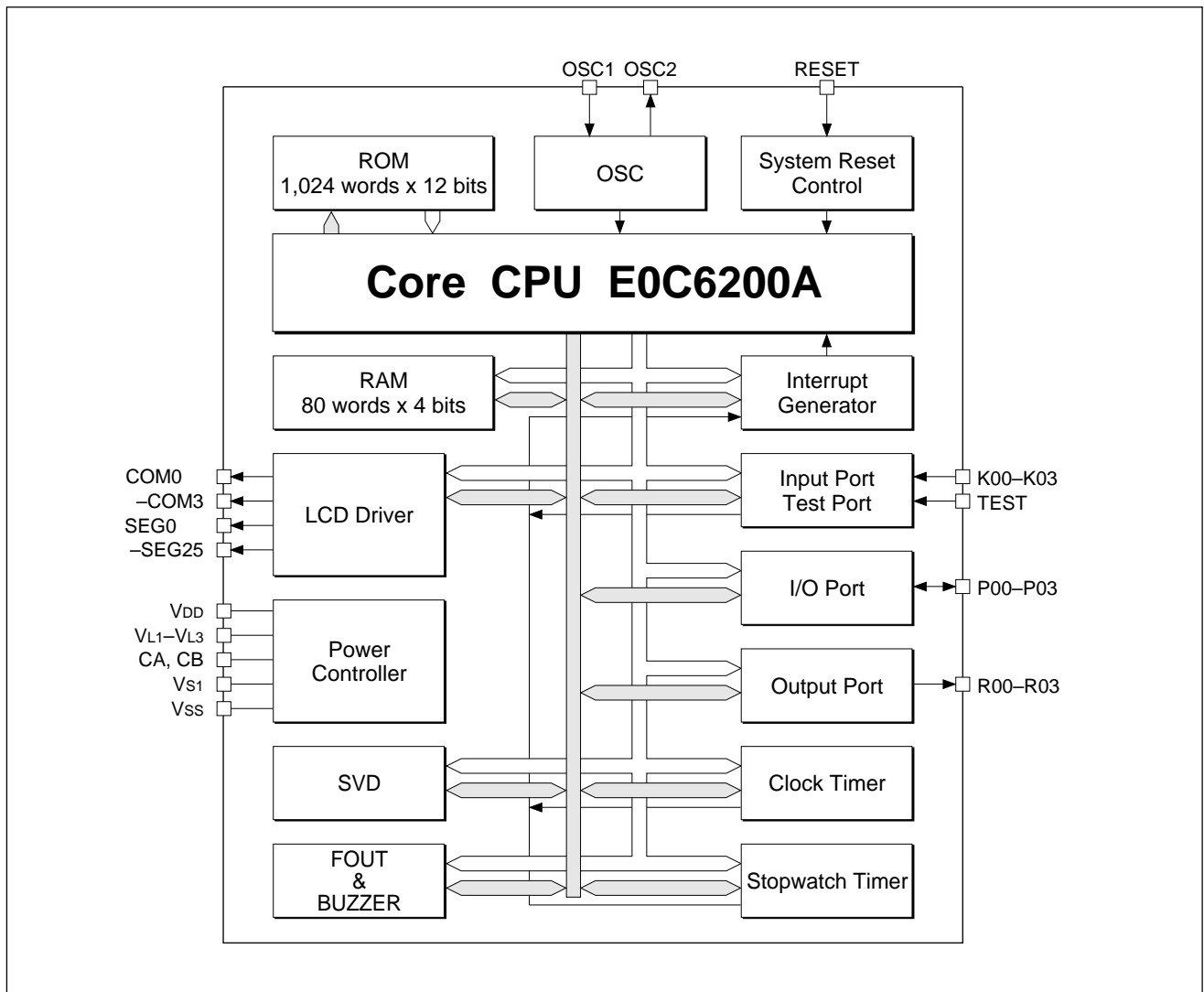
- CMOS LSI 4-bit parallel processing
- Clock 32.768kHz (Typ.)
CR or Crystal oscillation circuit selectable through mask option
- Instruction set 100 instructions
- Instruction execution time 153μsec, 214μsec or 366μsec (depending on instruction)
- ROM capacity 1,024 words × 12 bits
- RAM capacity 80 words × 4 bits
- Input port 4 bits (pull-down resistors are available by mask option)
- Output port 4 bits (general purpose port)
2 bits (for buzzer output) : BZ/B \bar{Z} 4kHz, 2kHz
1 bit (for clock output) : 16kHz, 8kHz, 4kHz, 2kHz
- I/O port 4 bits
- LCD driver 26 segments × 2 commons (1/2 duty), 3 commons (1/3 duty)
or 4 commons (1/4 duty)
- Built-in supply voltage detection (SVD) circuit
- Built-in stopwatch timer
- Interrupts External : Input interrupt 1 line
Internal : Timer interrupt 1 line
Stopwatch interrupt 1 line
- Supply voltage 1.5V/3.0V (Minimum operating voltage: 0.9V/1.8V)
- Current consumption HALT mode (32.768kHz/3.0V) : 1.0μA (Typ.)
OPERATING mode (32.768kHz/3.0V) : 2.5μA (Typ.)
- Package QFP6-60pin (plastic)
Die form

LINE UP

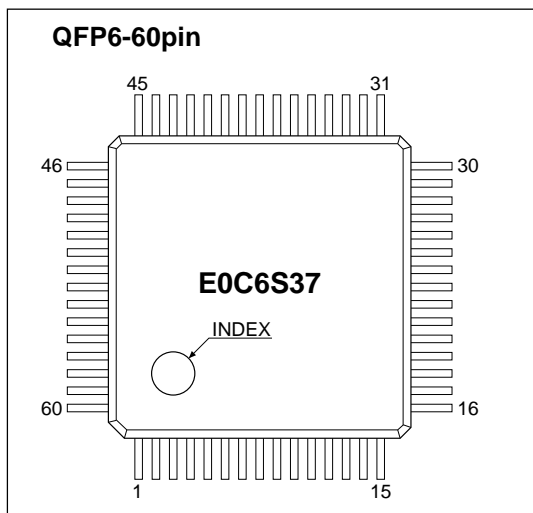
| Model | Supply voltage | Clock (oscillation) |
|-----------------|--------------------|--------------------------------------------------|
| E0C6SL37 | 1.5V (0.9 to 2.0V) | 32.768kHz Crystal or 65kHz CR oscillation (Typ.) |
| E0C6S37 | 3.0V (1.8 to 3.6V) | 32.768kHz Crystal or 65kHz CR oscillation (Typ.) |
| E0C6SB37 | 3.0V (0.9 to 3.6V) | 32.768kHz Crystal or 65kHz CR oscillation (Typ.) |

E0C6S37

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



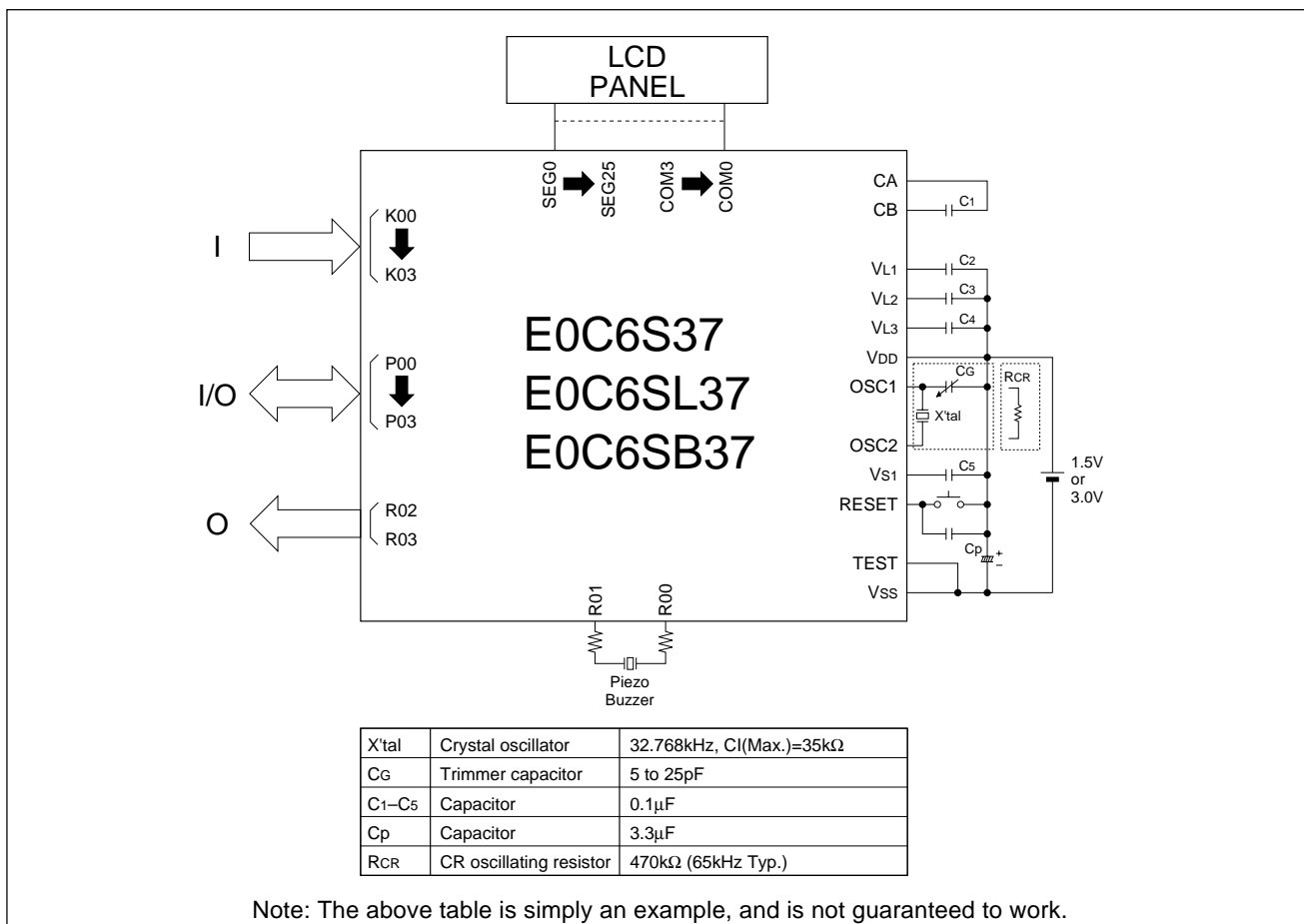
| Pin No. | Pin name | Pin No. | Pin name | Pin No. | Pin name | Pin No. | Pin name |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 1 | OSC1 | 16 | COM2 | 31 | TEST | 46 | P01 |
| 2 | OSC2 | 17 | COM3 | 32 | SEG13 | 47 | P02 |
| 3 | N.C. | 18 | SEG0 | 33 | SEG14 | 48 | P03 |
| 4 | Vs1 | 19 | SEG1 | 34 | SEG15 | 49 | RESET |
| 5 | N.C. | 20 | SEG2 | 35 | SEG16 | 50 | K00 |
| 6 | CA | 21 | SEG3 | 36 | SEG17 | 51 | K01 |
| 7 | CB | 22 | SEG4 | 37 | SEG18 | 52 | K02 |
| 8 | N.C. | 23 | SEG5 | 38 | SEG19 | 53 | K03 |
| 9 | N.C. | 24 | SEG6 | 39 | SEG20 | 54 | R00 |
| 10 | N.C. | 25 | SEG7 | 40 | SEG21 | 55 | R01 |
| 11 | VL1 | 26 | SEG8 | 41 | SEG22 | 56 | R02 |
| 12 | VL2 | 27 | SEG9 | 42 | SEG23 | 57 | R03 |
| 13 | VL3 | 28 | SEG10 | 43 | SEG24 | 58 | N.C. |
| 14 | COM0 | 29 | SEG11 | 44 | SEG25 | 59 | Vss |
| 15 | COM1 | 30 | SEG12 | 45 | P00 | 60 | VDD |

N.C. : No Connection

PIN DESCRIPTION

| Pin name | Pin No. | I/O | Function |
|------------|--------------|-----|--------------------------------------------------------------------|
| VDD | 60 | (I) | Power supply pin (+) |
| VSS | 59 | (I) | Power supply pin (-) |
| Vs1 | 4 | O | Oscillation and internal logic system regulated voltage output pin |
| VL1 | 11 | O | LCD system regulated voltage output pin (-1.05V) |
| VL2 | 12 | O | LCD system booster voltage output pin (VL1×2) |
| VL3 | 13 | O | LCD system booster voltage output pin (VL1×3) |
| CA, CB | 6, 7 | — | Voltage booster capacitor connecting pin |
| OSC1 | 1 | I | Crystal oscillation input pin |
| OSC2 | 2 | O | Crystal oscillation output pin |
| K00–K03 | 50–53 | I | Input port pin |
| P00–P03 | 45–48 | I/O | I/O port pin |
| R00–R03 | 54–57 | O | Output port pin |
| SEG0–SEG25 | 18–30, 32–44 | O | LCD segment output pin |
| COM0–COM3 | 14–17 | O | LCD common output pin |
| RESET | 49 | I | Initial reset input pin |
| TEST | 31 | I | Testing input pin |

BASIC EXTERNAL CONNECTION DIAGRAM



E0C6S37

■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(V_{DD}=0V)

| Rating | Symbol | Value | Unit |
|-------------------------------------|--------------------|------------------------------|------|
| Supply voltage | V _{SS} | -5.0 to 0.5 | V |
| Input voltage (1) | V _I | V _{SS} - 0.3 to 0.5 | V |
| Input voltage (2) | V _I osc | V _{SS} - 0.3 to 0.5 | V |
| Permissible total output current *1 | ΣI _{VSS} | 10 | mA |
| Operating temperature | T _{opr} | -20 to 70 | °C |
| Storage temperature | T _{stg} | -65 to 150 | °C |
| Soldering temperature / Time | T _{sol} | 260°C, 10sec (lead section) | — |
| Permissible dissipation *2 | P _D | 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 (QFP6-60pin).

● Recommended Operating Conditions

E0C6S37

(T_a=-20 to 70°C)

| Condition | Symbol | Remark | Min. | Typ. | Max. | Unit |
|-------------------------------------------------------|-----------------|-------------------------|------|--------|------|------|
| Supply voltage | V _{SS} | V _{DD} =0V | -3.6 | -3.0 | -1.8 | V |
| Oscillation frequency | fosc1 | Crystal oscillation | | 32.768 | | kHz |
| | fosc2 | CR oscillation, R=470kΩ | 50 | 65 | 80 | kHz |
| Booster capacitor | C1 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L1} | C2 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L2} | C3 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L3} | C4 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{S1} | C5 | | 0.1 | | | μF |

E0C6SL37

(T_a=-20 to 70°C)

| Condition | Symbol | Remark | Min. | Typ. | Max. | Unit |
|-------------------------------------------------------|-----------------|-----------------------------------------------|------|--------|---------|------|
| Supply voltage | V _{SS} | V _{DD} =0V *3 | -2.0 | -1.5 | -1.1 | V |
| | | V _{DD} =0V, With software control *1 | -2.0 | -1.5 | -0.9 *2 | V |
| Oscillation frequency | fosc1 | Crystal oscillation | | 32.768 | | kHz |
| | fosc2 | CR oscillation, R=470kΩ | 50 | 65 | 80 | kHz |
| Booster capacitor | C1 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L1} | C2 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L2} | C3 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L3} | C4 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{S1} | C5 | | 0.1 | | | μF |

*1: When the heavy load protection mode is set by software and the SVD circuit is turned off. Cannot be operated when the CR oscillation circuit is used.

*2: The voltage which can be displayed on the LCD panel will differ according to the characteristics of the LCD panel.

*3: When there is no software control during CR oscillation or crystal oscillation.

E0C6SB37

(T_a=-20 to 70°C)

| Condition | Symbol | Remark | Min. | Typ. | Max. | Unit |
|-------------------------------------------------------|-----------------|-----------------------------------------------|------|--------|---------|------|
| Supply voltage | V _{SS} | V _{DD} =0V *3 | -3.6 | -1.5 | -1.1 | V |
| | | V _{DD} =0V, With software control *1 | -3.6 | -1.5 | -0.9 *2 | V |
| Oscillation frequency | fosc1 | Crystal oscillation | | 32.768 | | kHz |
| | fosc2 | CR oscillation, R=470kΩ | 50 | 65 | 80 | kHz |
| Booster capacitor | C1 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L1} | C2 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L2} | C3 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{L3} | C4 | | 0.1 | | | μF |
| Capacitor between V _{DD} and V _{S1} | C5 | | 0.1 | | | μF |

*1: When the heavy load protection mode is set by software and the SVD circuit is turned off. Cannot be operated when the CR oscillation circuit is used.

*2: The voltage which can be displayed on the LCD panel will differ according to the characteristics of the LCD panel.

*3: When there is no software control during CR oscillation or crystal oscillation.

● DC Characteristics

E0C6S37/6SB37

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $f_{osc}=32.768kHz$, $T_a=25^{\circ}C$, $V_{S1}/V_{L1}-V_{L3}$ are internal voltage, $C1-C5=0.1\mu F$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------------------------|-----------|----------------------------------------------------------------|---------------------|------|---------------------|---------|
| High level input voltage (1) | V_{IH1} | | $0.2 \cdot V_{SS}$ | | 0 | V |
| High level input voltage (2) | V_{IH2} | | $0.15 \cdot V_{SS}$ | | 0 | V |
| Low level input voltage (1) | V_{IL1} | | V_{SS} | | $0.8 \cdot V_{SS}$ | V |
| Low level input voltage (2) | V_{IL2} | | V_{SS} | | $0.85 \cdot V_{SS}$ | V |
| High level input current (1) | I_{IH1} | $V_{IH1}=0V$, No pull down resistor | 0 | | 0.5 | μA |
| High level input current (2) | I_{IH2} | $V_{IH2}=0V$, With pull down resistor | 10 | | 40 | μA |
| High level input current (3) | I_{IH3} | $V_{IH3}=0V$, With pull down resistor | 30 | | 100 | μA |
| Low level input current | I_{IL} | $V_{IL}=V_{SS}$ | -0.5 | | 0 | μA |
| High level output current (1) | I_{OH1} | $V_{OH1}=0.1 \cdot V_{SS}$ | | | -1.0 | mA |
| High level output current (2) | I_{OH2} | $V_{OH2}=0.1 \cdot V_{SS}$ (built-in protection resistance) | | | -1.0 | mA |
| Low level output current (1) | I_{OL1} | $V_{OL1}=0.9 \cdot V_{SS}$ | 3.0 | | | mA |
| Low level output current (2) | I_{OL2} | $V_{OL2}=0.9 \cdot V_{SS}$ (built-in protection resistance) | 3.0 | | | mA |
| Common output current | I_{OH3} | $V_{OH3}=-0.05V$ | | | -3 | μA |
| | I_{OL3} | $V_{OL3}=V_{L3}+0.05V$ | 3 | | | μA |
| Segment output current (during LCD output) | I_{OH4} | $V_{OH4}=-0.05V$ | | | -3 | μA |
| | I_{OL4} | $V_{OL4}=V_{L3}+0.05V$ | 3 | | | μA |
| Segment output current (during DC output) | I_{OH5} | $V_{OH5}=0.1 \cdot V_{SS}$ | | | -300 | μA |
| | I_{OL5} | $V_{OL5}=0.9 \cdot V_{SS}$ | 300 | | | μA |

E0C6SL37

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-1.5V$, $f_{osc}=32.768kHz$, $T_a=25^{\circ}C$, $V_{S1}/V_{L1}-V_{L3}$ are internal voltage, $C1-C5=0.1\mu F$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------------------------|-----------|----------------------------------------------------------------|---------------------|------|---------------------|---------|
| High level input voltage (1) | V_{IH1} | | $0.2 \cdot V_{SS}$ | | 0 | V |
| High level input voltage (2) | V_{IH2} | | $0.15 \cdot V_{SS}$ | | 0 | V |
| Low level input voltage (1) | V_{IL1} | | V_{SS} | | $0.8 \cdot V_{SS}$ | V |
| Low level input voltage (2) | V_{IL2} | | V_{SS} | | $0.85 \cdot V_{SS}$ | V |
| High level input current (1) | I_{IH1} | $V_{IH1}=0V$, No pull down resistor | 0 | | 0.5 | μA |
| High level input current (2) | I_{IH2} | $V_{IH2}=0V$, With pull down resistor | 5.0 | | 20 | μA |
| High level input current (3) | I_{IH3} | $V_{IH3}=0V$, With pull down resistor | 9.0 | | 100 | μA |
| Low level input current | I_{IL} | $V_{IL}=V_{SS}$ | -0.5 | | 0 | μA |
| High level output current (1) | I_{OH1} | $V_{OH1}=0.1 \cdot V_{SS}$ | | | -200 | μA |
| High level output current (2) | I_{OH2} | $V_{OH2}=0.1 \cdot V_{SS}$ (built-in protection resistance) | | | -200 | μA |
| Low level output current (1) | I_{OL1} | $V_{OL1}=0.9 \cdot V_{SS}$ | 700 | | | μA |
| Low level output current (2) | I_{OL2} | $V_{OL2}=0.9 \cdot V_{SS}$ (built-in protection resistance) | 700 | | | μA |
| Common output current | I_{OH3} | $V_{OH3}=-0.05V$ | | | -3 | μA |
| | I_{OL3} | $V_{OL3}=V_{L3}+0.05V$ | 3 | | | μA |
| Segment output current (during LCD output) | I_{OH4} | $V_{OH4}=-0.05V$ | | | -3 | μA |
| | I_{OL4} | $V_{OL4}=V_{L3}+0.05V$ | 3 | | | μA |
| Segment output current (during DC output) | I_{OH5} | $V_{OH5}=0.1 \cdot V_{SS}$ | | | -100 | μA |
| | I_{OL5} | $V_{OL5}=0.9 \cdot V_{SS}$ | 130 | | | μA |

E0C6S37

● Analog Circuit Characteristics and Current Consumption

E0C6S37 (Crystal, Normal Operating Mode)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $f_{osc}=32.768kHz$, $T_a=25^{\circ}C$, $C_G=25pF$, $V_{S1}/V_{L1}-V_{L3}$ are internal voltage, $C1-C5=0.1\mu F$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|-----------|-------------------------------------------------------------------------------------|----------------------------------|-------|---------------------------------------|---------|
| Internal voltage | V_{L1} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L1} (without panel load) | $\frac{1}{2} \cdot V_{L2} - 0.1$ | | $\frac{1}{2} \cdot V_{L2} \times 0.9$ | V |
| | V_{L2} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L2} (without panel load) | -2.25 | -2.10 | -1.95 | V |
| | V_{L3} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L3} (without panel load) | $\frac{3}{2} \cdot V_{L2} - 0.1$ | | $\frac{3}{2} \cdot V_{L2} \times 0.9$ | V |
| SVD voltage | V_{SVD} | | -2.55 | -2.40 | -2.25 | V |
| SVD circuit response time | t_{SVD} | | | | 100 | μS |
| Current consumption | I_{OP} | During HALT | | 1.0 | 2.5 | μA |
| | | During execution *1 | Without panel load | 2.5 | 5.0 | μA |

*1: The SVD circuit is turned off.

E0C6S37 (Crystal, Heavy Load Protection Mode)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $f_{osc}=32.768kHz$, $T_a=25^{\circ}C$, $C_G=25pF$, $V_{S1}/V_{L1}-V_{L3}$ are internal voltage, $C1-C5=0.1\mu F$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|-----------|-------------------------------------------------------------------------------------|----------------------------------|-------|----------------------------------------|---------|
| Internal voltage | V_{L1} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L1} (without panel load) | $\frac{1}{2} \cdot V_{L2} - 0.1$ | | $\frac{1}{2} \cdot V_{L2} \times 0.85$ | V |
| | V_{L2} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L2} (without panel load) | -2.25 | -2.10 | -1.95 | V |
| | V_{L3} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L3} (without panel load) | $\frac{3}{2} \cdot V_{L2} - 0.1$ | | $\frac{3}{2} \cdot V_{L2} \times 0.85$ | V |
| SVD voltage | V_{SVD} | | -2.55 | -2.40 | -2.25 | V |
| SVD circuit response time | t_{SVD} | | | | 100 | μS |
| Current consumption | I_{OP} | During HALT | | 2.0 | 5.5 | μA |
| | | During execution *1 | Without panel load | 5.5 | 10.0 | μA |

*1: The SVD circuit is turned off.

E0C6S37 (CR, Normal Operating Mode)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $f_{osc}=65kHz$, $R_{CR}=470k\Omega$, $T_a=25^{\circ}C$, $V_{S1}/V_{L1}-V_{L3}$ are internal voltage, $C1-C5=0.1\mu F$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|-----------|-------------------------------------------------------------------------------------|----------------------------------|-------|---------------------------------------|---------|
| Internal voltage | V_{L1} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L1} (without panel load) | $\frac{1}{2} \cdot V_{L2} - 0.1$ | | $\frac{1}{2} \cdot V_{L2} \times 0.9$ | V |
| | V_{L2} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L2} (without panel load) | -2.25 | -2.10 | -1.95 | V |
| | V_{L3} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L3} (without panel load) | $\frac{3}{2} \cdot V_{L2} - 0.1$ | | $\frac{3}{2} \cdot V_{L2} \times 0.9$ | V |
| SVD voltage | V_{SVD} | | -2.55 | -2.40 | -2.25 | V |
| SVD circuit response time | t_{SVD} | | | | 100 | μS |
| Current consumption | I_{OP} | During HALT | | 8.0 | 15.0 | μA |
| | | During execution *1 | Without panel load | 15.0 | 20.0 | μA |

*1: The SVD circuit is turned off.

E0C6S37 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $f_{osc}=65kHz$, $R_{CR}=470k\Omega$, $T_a=25^{\circ}C$, $V_{S1}/V_{L1}-V_{L3}$ are internal voltage, $C1-C5=0.1\mu F$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|-----------|-------------------------------------------------------------------------------------|----------------------------------|-------|----------------------------------------|---------|
| Internal voltage | V_{L1} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L1} (without panel load) | $\frac{1}{2} \cdot V_{L2} - 0.1$ | | $\frac{1}{2} \cdot V_{L2} \times 0.85$ | V |
| | V_{L2} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L2} (without panel load) | -2.25 | -2.10 | -1.95 | V |
| | V_{L3} | Connect $1M\Omega$ load resistor between V_{DD} and V_{L3} (without panel load) | $\frac{3}{2} \cdot V_{L2} - 0.1$ | | $\frac{3}{2} \cdot V_{L2} \times 0.85$ | V |
| SVD voltage | V_{SVD} | | -2.55 | -2.40 | -2.25 | V |
| SVD circuit response time | t_{SVD} | | | | 100 | μS |
| Current consumption | I_{OP} | During HALT | | 16.0 | 30.0 | μA |
| | | During execution *1 | Without panel load | 30.0 | 40.0 | μA |

*1: The SVD circuit is turned off.

E0C6SL37 (Crystal, Normal Operating Mode)(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=32.768kHz, T_a=25°C, C_G=25pF, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.9 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.9 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 1.0 | 2.5 | μA |
| | | During execution *1 | Without panel load | 2.5 | 5.0 | μA |

*1: The SVD circuit is turned off.

E0C6SL37 (Crystal, Heavy Load Protection Mode)(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=32.768kHz, T_a=25°C, C_G=25pF, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|-------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.85 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.85 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 2.0 | 5.5 | μA |
| | | During execution *1 | Without panel load | 5.5 | 10.0 | μA |

*1: The SVD circuit is turned off.

E0C6SL37 (CR, Normal Operating Mode)(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=65kHz, R_{CR}=470kΩ, T_a=25°C, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.9 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.9 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 8.0 | 15.0 | μA |
| | | During execution *1 | Without panel load | 15.0 | 20.0 | μA |

*1: The SVD circuit is turned off.

E0C6SL37 (CR, Heavy Load Protection Mode)(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=65kHz, R_{CR}=470kΩ, T_a=25°C, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|-------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.85 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.85 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 16.0 | 30.0 | μA |
| | | During execution *1 | Without panel load | 30.0 | 40.0 | μA |

*1: The SVD circuit is turned off.

E0C6S37

E0C6SB37 (Crystal, Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{osc}=32.768kHz, T_a=25°C, C_G=25pF, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.9 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.9 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 1.0 | 2.5 | μA |
| | | During execution *1 | Without panel load | 2.5 | 5.0 | μA |

*1: The SVD circuit is turned off.

E0C6SB37 (Crystal, Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{osc}=32.768kHz, T_a=25°C, C_G=25pF, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|-------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.85 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.85 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 2.0 | 5.5 | μA |
| | | During execution *1 | Without panel load | 5.5 | 10.0 | μA |

*1: The SVD circuit is turned off.

E0C6SB37 (CR, Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{osc}=65kHz, R_{CR}=470kΩ, T_a=25°C, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.9 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.9 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 8.0 | 15.0 | μA |
| | | During execution *1 | Without panel load | 15.0 | 20.0 | μA |

*1: The SVD circuit is turned off.

E0C6SB37 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{osc}=65kHz, R_{CR}=470kΩ, T_a=25°C, V_{S1}/V_{L1}-V_{L3} are internal voltage, C₁-C₅=0.1μF)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|------------------|--------------------------------------------------------------------------------------------|------------------------|-------|-------------------------|------|
| Internal voltage | V _{L1} | Connect 1MΩ load resistor between V _{DD} and V _{L1} (without panel load) | -1.15 | -1.05 | -0.95 | V |
| | V _{L2} | Connect 1MΩ load resistor between V _{DD} and V _{L2} (without panel load) | 2•V _{L1} -0.1 | | 2•V _{L1} ×0.85 | V |
| | V _{L3} | Connect 1MΩ load resistor between V _{DD} and V _{L3} (without panel load) | 3•V _{L1} -0.1 | | 3•V _{L1} ×0.85 | V |
| SVD voltage | V _{SVD} | | -1.30 | -1.20 | -1.10 | V |
| SVD circuit response time | t _{SVD} | | | | 100 | μS |
| Current consumption | I _{OP} | During HALT | | 16.0 | 30.0 | μA |
| | | During execution *1 | Without panel load | 30.0 | 40.0 | μA |

*1: The SVD circuit is turned off.

● Oscillation Characteristics

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

E0C6S37 (Crystal)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, Crystal: C-002R ($C_I=35k\Omega$), $C_G=25pF$, C_D =built-in, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------------|------------------------------------------------|------|------|------|-----------|
| Oscillation start voltage | V_{sta} | $t_{sta} \leq 5sec$ (Vss) | -1.8 | | | V |
| Oscillation stop voltage | V_{stp} | $t_{stp} \leq 10sec$ (Vss) | -1.8 | | | V |
| Built-in capacitance (drain) | C_D | Including the parasitic capacity inside the IC | | 20 | | pF |
| Frequency/voltage deviation | $\partial f/\partial V$ | $V_{SS}=-1.8$ to $-3.6V$ | | | 5 | ppm |
| Frequency/IC deviation | $\partial f/\partial IC$ | | -10 | | 10 | ppm |
| Frequency adjustment range | $\partial f/\partial C_G$ | $C_G=5$ to $25pF$ | 40 | | | ppm |
| Harmonic oscillation start voltage | V_{hho} | $C_G=5pF$ (Vss) | | | -3.6 | V |
| Permitted leak resistance | R_{leak} | Between OSC1 and V_{DD} | 200 | | | $M\Omega$ |

E0C6SL37 (Crystal)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-1.5V$, Crystal: C-002R ($C_I=35k\Omega$), $C_G=25pF$, C_D =built-in, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------------|------------------------------------------------|--------------|------|------|-----------|
| Oscillation start voltage | V_{sta} | $t_{sta} \leq 5sec$ (Vss) | -1.1 | | | V |
| Oscillation stop voltage | V_{stp} | $t_{stp} \leq 10sec$ (Vss) | -1.1(-0.9)*1 | | | V |
| Built-in capacitance (drain) | C_D | Including the parasitic capacity inside the IC | | 20 | | pF |
| Frequency/voltage deviation | $\partial f/\partial V$ | $V_{SS}=-1.1$ to $-2.0V$ (-0.9) *1 | | | 5 | ppm |
| Frequency/IC deviation | $\partial f/\partial IC$ | | -10 | | 10 | ppm |
| Frequency adjustment range | $\partial f/\partial C_G$ | $C_G=5$ to $25pF$ | 40 | | | ppm |
| Harmonic oscillation start voltage | V_{hho} | $C_G=5pF$ (Vss) | | | -2.0 | V |
| Permitted leak resistance | R_{leak} | Between OSC1 and V_{DD} | 200 | | | $M\Omega$ |

*1: Items enclosed in parentheses () are those used when operating at heavy load protection mode.

E0C6SB37 (Crystal)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, Crystal: C-002R ($C_I=35k\Omega$), $C_G=25pF$, C_D =built-in, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------------|------------------------------------------------|--------------|------|------|-----------|
| Oscillation start voltage | V_{sta} | $t_{sta} \leq 5sec$ (Vss) | -1.1 | | | V |
| Oscillation stop voltage | V_{stp} | $t_{stp} \leq 10sec$ (Vss) | -1.1(-0.9)*1 | | | V |
| Built-in capacitance (drain) | C_D | Including the parasitic capacity inside the IC | | 20 | | pF |
| Frequency/voltage deviation | $\partial f/\partial V$ | $V_{SS}=-1.1$ to $-3.6V$ (-0.9) *1 | | | 5 | ppm |
| Frequency/IC deviation | $\partial f/\partial IC$ | | -10 | | 10 | ppm |
| Frequency adjustment range | $\partial f/\partial C_G$ | $C_G=5$ to $25pF$ | 40 | | | ppm |
| Harmonic oscillation start voltage | V_{hho} | $C_G=5pF$ (Vss) | | | -3.6 | V |
| Permitted leak resistance | R_{leak} | Between OSC1 and V_{DD} | 200 | | | $M\Omega$ |

*1: Items enclosed in parentheses () are those used when operating at heavy load protection mode.

E0C6S37 (CR)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $R_{CR}=470k\Omega$, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------------|-----------|--------------------------|------|-------|------|------|
| Oscillation frequency dispersion | f_{osc} | | -20 | 65kHz | 20 | % |
| Oscillation start voltage | V_{sta} | (Vss) | -1.8 | | | V |
| Oscillation start time | t_{sta} | $V_{SS}=-1.8$ to $-3.6V$ | | 3 | | mS |
| Oscillation stop voltage | V_{stp} | (Vss) | -1.8 | | | V |

E0C6SL37 (CR)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-1.5V$, $R_{CR}=470k\Omega$, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------------|-----------|--------------------------|------|-------|------|------|
| Oscillation frequency dispersion | f_{osc} | | -20 | 65kHz | 20 | % |
| Oscillation start voltage | V_{sta} | (Vss) | -1.1 | | | V |
| Oscillation start time | t_{sta} | $V_{SS}=-1.1$ to $-2.0V$ | | 3 | | mS |
| Oscillation stop voltage | V_{stp} | (Vss) | -1.1 | | | V |

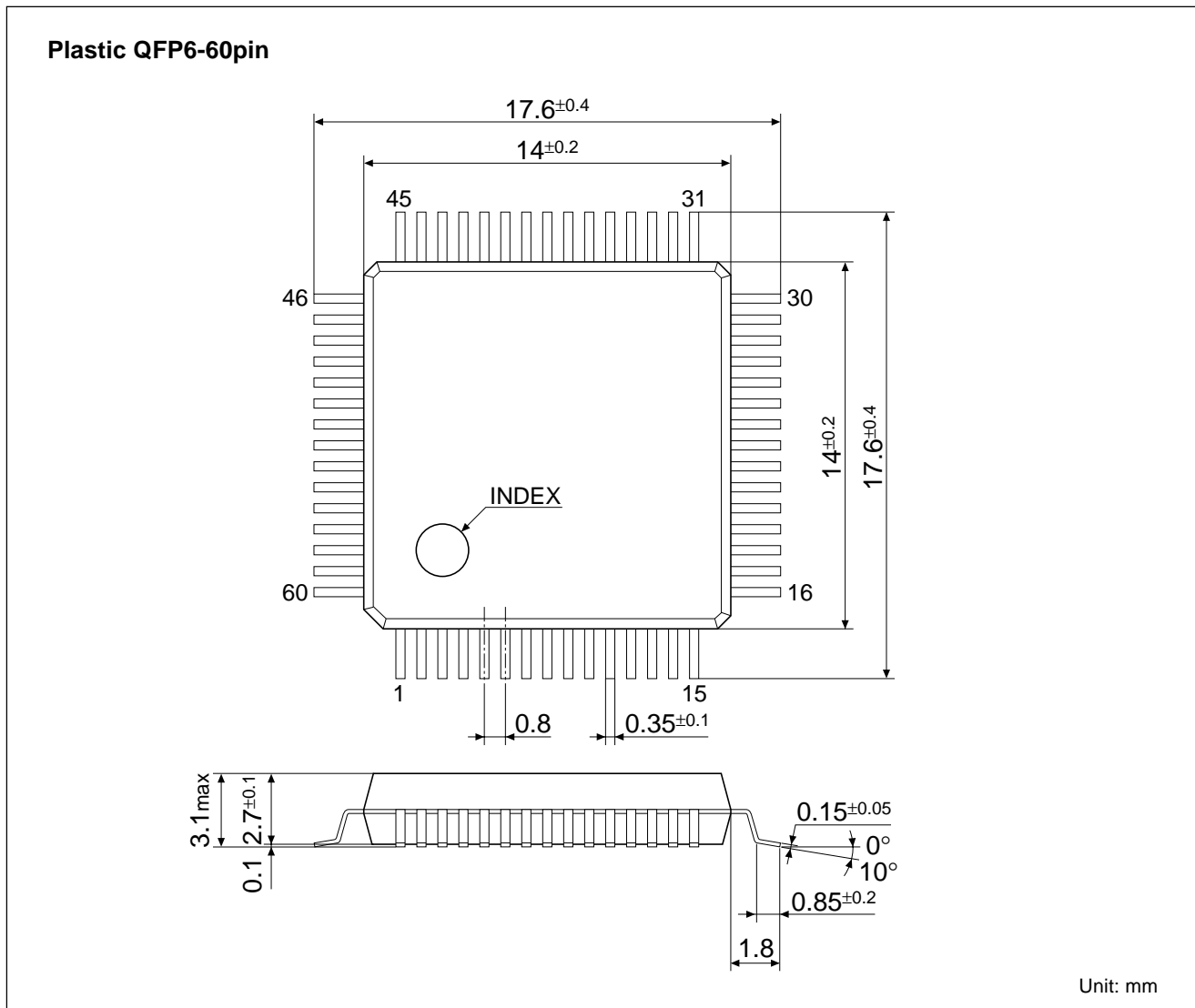
E0C6SB37 (CR)

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $R_{CR}=470k\Omega$, $T_a=25^\circ C$)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------------|-----------|--------------------------|------|-------|------|------|
| Oscillation frequency dispersion | f_{osc} | | -20 | 65kHz | 20 | % |
| Oscillation start voltage | V_{sta} | (Vss) | -1.1 | | | V |
| Oscillation start time | t_{sta} | $V_{SS}=-1.1$ to $-3.6V$ | | 3 | | mS |
| Oscillation stop voltage | V_{stp} | (Vss) | -1.1 | | | V |

E0C6S37

■ PACKAGE DIMENSIONS



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