

# E0C6S27

## 4-bit Single Chip Microcomputer



- Core CPU Architecture
- SVD Circuit
- High Quality Display LCD Driver
- Stepping-Motor Driver

### ■ DESCRIPTION

The E0C6S27 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, time base counter, stopwatch counter, and stepping-motor driver. The E0C6S27 provides an excellent solution for application as digital-analog-combinational watch.

### ■ FEATURES

- CMOS LSI 4-bit parallel processing
- Clock ..... 32.768kHz for Crystal or CR oscillation circuit
- Instruction set ..... 100 instructions
- Instruction execution time ..... 153μsec, 214μsec, 366μsec at 32.768kHz mode
- ROM size ..... 1,536 × 12 bits
- RAM size ..... 80 × 4 bits
- Input port ..... 4 bits (pull down resistors are available by mask option)
- Output port ..... 4 bits (general purpose)
- I/O port ..... 4 bits
- LCD driver ..... 26 segments × 2/3/4 commons
- Timer ..... Clock timer / Stopwatch timer
- Built-in stopwatch timer
- Supply voltage detection (SVD) circuit .. 1.2V / 2.4V
- Interrupts .....
 

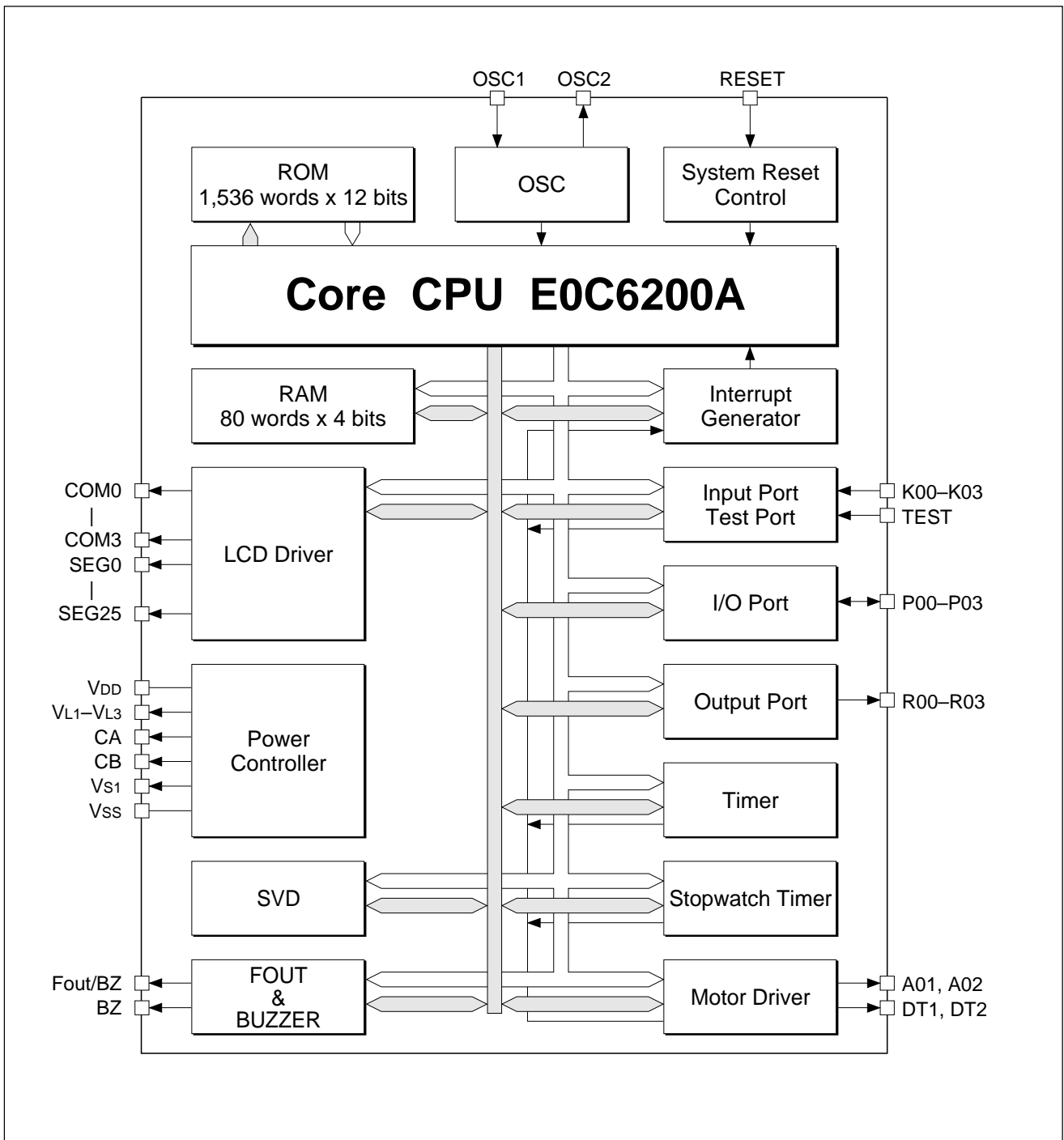
External : Input interrupt	1 system
Internal : Timer interrupt	2 systems
Motor driver interrupt	1 system
- Current consumption ..... HALT mode (32.768kHz/3.0V) : 1.0μA (Typ.)
- Package ..... QFP6-60pin (plastic)  
Die form

### ■ LINE UP

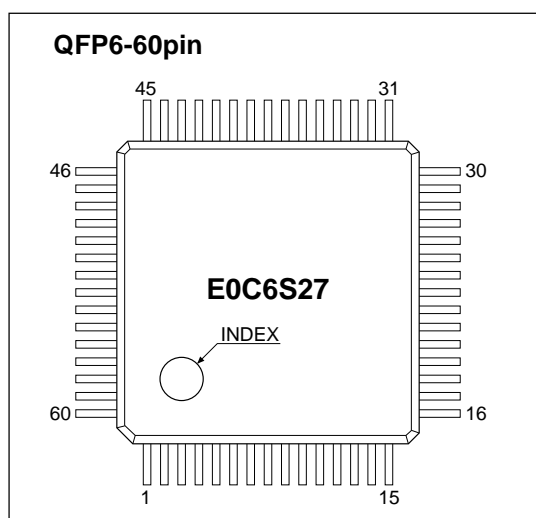
Model	Supply voltage	Oscillator
<b>E0C6S27</b> (Normal type)	2.2 to 3.6V	32.768kHz Crystal or 65kHz CR (Typ.)
<b>E0C6SA27</b> (High speed type)	2.2 to 3.6V	200kHz CR (Typ.)
<b>E0C6SB27</b> (Wide voltage type)	0.9 to 3.6V	32.768kHz Crystal or 65kHz CR (Typ.)
<b>E0C6SL27</b> (Low voltage type)	0.9 to 1.8V	32.768kHz Crystal

# E0C6S27

## ■ 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	CA	20	SEG2	35	SEG16	50	K00
6	CB	21	SEG3	36	SEG17	51	K01
7	VL1	22	SEG4	37	SEG18	52	K02
8	VL2	23	SEG5	38	SEG19	53	K03
9	VL3	24	SEG6	39	SEG20	54	R00
10	DT1	25	SEG7	40	SEG21	55	R01
11	A01	26	SEG8	41	SEG22	56	R02
12	A02	27	SEG9	42	SEG23	57	R03
13	DT2	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	7	O	LCD system regulated voltage output pin (-1.05V)
VL2	8	O	LCD system booster voltage output pin (VL1×2)
VL3	9	O	LCD system booster voltage output pin (VL1×3)
CA, CB	5, 6	—	Voltage booster capacitor connecting pin
OSC1	1	I	Crystal or CR oscillation input pin
OSC2	2	O	Crystal or CR 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
DT1, DT2	10, 13	I/O	Test pin
A01, A02	11, 12	O	Motor driving port pin

# E0C6S27

## ■ ELECTRICAL CHARACTERISTICS

### ● Absolute Maximum Ratings

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

Rating	Symbol	Value	Unit
Supply voltage	V <sub>SS</sub>	-5.0 to 0.5	V
Input voltage (1)	V <sub>I</sub>	V <sub>SS</sub> - 0.3 to 0.5	V
Input voltage (2)	V <sub>I</sub> osc	V <sub>SS</sub> - 0.3 to 0.5	V
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 *1	P <sub>D</sub>	250	mW

\*1: In case of plastic package (QFP6-60pin).

### ● Recommended Operating Conditions

#### E0C6S27

(T<sub>a</sub>=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>SS</sub>	V <sub>DD</sub> =0V	-3.6	-3.0	-2.2	V
Oscillation frequency	f <sub>osc</sub>	Crystal oscillation		32.768		kHz
		CR oscillation, R=470kΩ		65	80	kHz
Booster capacitor	C1		0.1			μF
Capacitor between V <sub>DD</sub> and VL1	C2		0.1			μF
Capacitor between V <sub>DD</sub> and VL2	C3		0.1			μF
Capacitor between V <sub>DD</sub> and VL3	C4		0.1			μF
Capacitor between V <sub>DD</sub> and VS1	C5		0.1			μF

#### E0C6SA27

(T<sub>a</sub>=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>SS</sub>	V <sub>DD</sub> =0V	-3.6	-3.0	-2.2	V
Oscillation frequency	f <sub>osc</sub>	CR oscillation, R=160kΩ		200	260	kHz
Booster capacitor	C1		0.1			μF
Capacitor between V <sub>DD</sub> and VL1	C2		0.1			μF
Capacitor between V <sub>DD</sub> and VL2	C3		0.1			μF
Capacitor between V <sub>DD</sub> and VL3	C4		0.1			μF
Capacitor between V <sub>DD</sub> and VS1	C5		0.1			μF

#### E0C6SL27

(T<sub>a</sub>=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>SS</sub>	V <sub>DD</sub> =0V *3	-1.8	-1.5	-1.1	V
		V <sub>DD</sub> =0V, With software control *1	-1.8	-1.5	-0.9 *2	V
Oscillation frequency	f <sub>osc</sub>			32.768		kHz
Booster capacitor	C1		0.1			μF
Capacitor between V <sub>DD</sub> and VL1	C2		0.1			μF
Capacitor between V <sub>DD</sub> and VL2	C3		0.1			μF
Capacitor between V <sub>DD</sub> and VL3	C4		0.1			μF
Capacitor between V <sub>DD</sub> and VS1	C5		0.1			μF

\*1: When the heavy load protection mode is set by software and the SVD circuit is turned off.

\*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.

#### E0C6SB27

(T<sub>a</sub>=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>SS</sub>	V <sub>DD</sub> =0V *3	-3.6	-3.0	-1.1	V
		V <sub>DD</sub> =0V, With software control *1	-3.6	-3.0	-0.9 *2	V
Oscillation frequency	f <sub>osc</sub>	Crystal oscillation		32.768		kHz
		CR oscillation, R=470kΩ		65	80	kHz
Booster capacitor	C1		0.1			μF
Capacitor between V <sub>DD</sub> and VL1	C2		0.1			μF
Capacitor between V <sub>DD</sub> and VL2	C3		0.1			μF
Capacitor between V <sub>DD</sub> and VL3	C4		0.1			μF
Capacitor between V <sub>DD</sub> and VS1	C5		0.1			μF

\*1: When the heavy load protection mode is set by software and the SVD circuit is turned off.

\*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

## E0C6S27/6SA27/6SB27

(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)	$V_{IH2}$	RESET, TEST	$0.15 \cdot V_{SS}$		0	V
Low level input voltage (1)	$V_{IL1}$		$V_{SS}$		$0.8 \cdot V_{SS}$	V
Low level input voltage (2)	$V_{IL2}$	RESET, TEST	$V_{SS}$		$0.85 \cdot V_{SS}$	V
High level input current (1)	$I_{IH1}$	$V_{IH1}=0V$ , No pull down resistor	0		0.5	$\mu A$
High level input current (2)	$I_{IH2}$	$V_{IH2}=0V$ , With pull down resistor	10		40	$\mu A$
High level input current (3)	$I_{IH3}$	$V_{IH3}=0V$ , With pull down resistor	30		100	$\mu A$
Low level input current	$I_{IL}$	$V_{IL}=V_{SS}$	-0.5		0	$\mu A$
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	$\mu A$
	$I_{OL3}$	$V_{OL3}=V_{L3}+0.05V$	3			$\mu A$
Segment output current (during LCD output)	$I_{OH4}$	$V_{OH4}=-0.05V$			-3	$\mu A$
	$I_{OL4}$	$V_{OL4}=V_{L3}+0.05V$	3			$\mu A$
Segment output current (during DC output)	$I_{OH5}$	$V_{OH5}=0.1 \cdot V_{SS}$			-300	$\mu A$
	$I_{OL5}$	$V_{OL5}=0.9 \cdot V_{SS}$	300			$\mu A$

## E0C6SL27

(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)	$V_{IH2}$	RESET, TEST	$0.15 \cdot V_{SS}$		0	V
Low level input voltage (1)	$V_{IL1}$		$V_{SS}$		$0.8 \cdot V_{SS}$	V
Low level input voltage (2)	$V_{IL2}$	RESET, TEST	$V_{SS}$		$0.85 \cdot V_{SS}$	V
High level input current (1)	$I_{IH1}$	$V_{IH1}=0V$ , No pull down resistor	0		0.5	$\mu A$
High level input current (2)	$I_{IH2}$	$V_{IH2}=0V$ , With pull down resistor	5		20	$\mu A$
High level input current (3)	$I_{IH3}$	$V_{IH3}=0V$ , With pull down resistor	10		60	$\mu A$
Low level input current	$I_{IL}$	$V_{IL}=V_{SS}$	-0.5		0	$\mu A$
High level output current (1)	$I_{OH1}$	$V_{OH1}=0.1 \cdot V_{SS}$			-200	$\mu A$
High level output current (2)	$I_{OH2}$	$V_{OH2}=0.1 \cdot V_{SS}$ (built-in protection resistance)			-200	$\mu A$
Low level output current (1)	$I_{OL1}$	$V_{OL1}=0.9 \cdot V_{SS}$	700			$\mu A$
Low level output current (2)	$I_{OL2}$	$V_{OL2}=0.9 \cdot V_{SS}$ (built-in protection resistance)	700			$\mu A$
Common output current	$I_{OH3}$	$V_{OH3}=-0.05V$			-3	$\mu A$
	$I_{OL3}$	$V_{OL3}=V_{L3}+0.05V$	3			$\mu A$
Segment output current (during LCD output)	$I_{OH4}$	$V_{OH4}=-0.05V$			-3	$\mu A$
	$I_{OL4}$	$V_{OL4}=V_{L3}+0.05V$	3			$\mu A$
Segment output current (during DC output)	$I_{OH5}$	$V_{OH5}=0.1 \cdot V_{SS}$			-100	$\mu A$
	$I_{OL5}$	$V_{OL5}=0.9 \cdot V_{SS}$	130			$\mu A$

# E0C6S27

## ● Analog Circuit Characteristics and Current Consumption

### E0C6S27 (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)	$\frac{1}{2} \bullet V_{L2}-0.1$		$\frac{1}{2} \bullet V_{L2} \times 0.9$	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)	$\frac{3}{2} \bullet V_{L2}-0.1$		$\frac{3}{2} \bullet V_{L2} \times 0.9$	V
SVD voltage	$V_{SVD}$		-2.55	-2.40	-2.25	V
SVD circuit response time	$t_{SVD}$				100	$\mu S$
Current consumption	$I_{OP}$	During HALT		0.7	1.4	$\mu A$
		During execution *1	Without panel load	1.9	3.5	$\mu A$

\*1: The SVD circuit is turned off.

### E0C6S27 (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)	$\frac{1}{2} \bullet V_{L2}-0.1$		$\frac{1}{2} \bullet V_{L2} \times 0.85$	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)	$\frac{3}{2} \bullet V_{L2}-0.1$		$\frac{3}{2} \bullet V_{L2} \times 0.85$	V
SVD voltage	$V_{SVD}$		-2.55	-2.40	-2.25	V
SVD circuit response time	$t_{SVD}$				100	$\mu S$
Current consumption	$I_{OP}$	During HALT		5.0	15	$\mu A$
		During execution *1	Without panel load	6.5	19	$\mu A$

\*1: The SVD circuit is turned off.

### E0C6SL27 (Crystal, Normal Operating Mode)

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-1.5V$ ,  $f_{osc}=32.768kHz$ ,  $T_a=25^{\circ}C$ ,  $C_G=25pF$ ,  $V_{S1}/V_{L1}-V_{L3}$  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)	-1.15	-1.05	-0.95	V
	$V_{L2}$	Connect $1M\Omega$ load resistor between $V_{DD}$ and $V_{L2}$ (without panel load)	$2 \bullet V_{L1}-0.1$		$2 \bullet V_{L1} \times 0.9$	V
	$V_{L3}$	Connect $1M\Omega$ load resistor between $V_{DD}$ and $V_{L3}$ (without panel load)	$3 \bullet V_{L1}-0.1$		$3 \bullet V_{L1} \times 0.9$	V
SVD voltage	$V_{SVD}$		-1.30	-1.20	-1.10	V
SVD circuit response time	$t_{SVD}$				100	$\mu S$
Current consumption	$I_{OP}$	During HALT		0.6	1.1	$\mu A$
		During execution *1	Without panel load	1.7	3.0	$\mu A$

\*1: The SVD circuit is turned off.

### E0C6SL27 (Crystal, Heavy Load Protection Mode)

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-1.5V$ ,  $f_{osc}=32.768kHz$ ,  $T_a=25^{\circ}C$ ,  $C_G=25pF$ ,  $V_{S1}/V_{L1}-V_{L3}$  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)	-1.15	-1.05	-0.95	V
	$V_{L2}$	Connect $1M\Omega$ load resistor between $V_{DD}$ and $V_{L2}$ (without panel load)	$2 \bullet V_{L1}-0.1$		$2 \bullet V_{L1} \times 0.85$	V
	$V_{L3}$	Connect $1M\Omega$ load resistor between $V_{DD}$ and $V_{L3}$ (without panel load)	$3 \bullet V_{L1}-0.1$		$3 \bullet V_{L1} \times 0.85$	V
SVD voltage	$V_{SVD}$		-1.30	-1.20	-1.10	V
SVD circuit response time	$t_{SVD}$				100	$\mu S$
Current consumption	$I_{OP}$	During HALT		1.2	2.2	$\mu A$
		During execution *1	Without panel load	3.4	6.0	$\mu A$

\*1: The SVD circuit is turned off.

**E0C6SB27 (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	VL1	Connect 1MΩ load resistor between VDD and VL1 (without panel load)	-1.15	-1.05	-0.95	V
	VL2	Connect 1MΩ load resistor between VDD and VL2 (without panel load)	$2 \cdot V_{L1} - 0.1$		$2 \cdot V_{L1} \times 0.9$	V
	VL3	Connect 1MΩ load resistor between VDD and VL3 (without panel load)	$3 \cdot V_{L1} - 0.1$		$3 \cdot V_{L1} \times 0.9$	V
SVD voltage	VSVD		-1.30	-1.20	-1.10	V
SVD circuit response time	tSVD				100	μS
Current consumption	IOP	During HALT		0.7	1.4	μA
		During execution *1	Without panel load	1.9	3.5	μA

\*1: The SVD circuit is turned off.

**E0C6SB27 (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	VL1	Connect 1MΩ load resistor between VDD and VL1 (without panel load)	-1.15	-1.05	-0.95	V
	VL2	Connect 1MΩ load resistor between VDD and VL2 (without panel load)	$2 \cdot V_{L1} - 0.1$		$2 \cdot V_{L1} \times 0.85$	V
	VL3	Connect 1MΩ load resistor between VDD and VL3 (without panel load)	$3 \cdot V_{L1} - 0.1$		$3 \cdot V_{L1} \times 0.85$	V
SVD voltage	VSVD		-1.30	-1.20	-1.10	V
SVD circuit response time	tSVD				100	μS
Current consumption	IOP	During HALT		1.4	2.8	μA
		During execution *1	Without panel load	3.8	7.0	μA

\*1: The SVD circuit is turned off.

**E0C6S27 (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	VL1	Connect 1MΩ load resistor between VDD and VL1 (without panel load)	$\frac{1}{2} \cdot V_{L2} - 0.1$		$\frac{1}{2} \cdot V_{L2} \times 0.9$	V
	VL2	Connect 1MΩ load resistor between VDD and VL2 (without panel load)	-2.25	-2.10	-1.95	V
	VL3	Connect 1MΩ load resistor between VDD and VL3 (without panel load)	$\frac{3}{2} \cdot V_{L2} - 0.1$		$\frac{3}{2} \cdot V_{L2} \times 0.9$	V
SVD voltage	VSVD		-2.55	-2.40	-2.25	V
SVD circuit response time	tSVD				100	μS
Current consumption	IOP	During HALT		6.5	14.0	μA
		During execution *1	Without panel load	9.0	18.0	μA

\*1: The SVD circuit is turned off.

**E0C6S27 (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	VL1	Connect 1MΩ load resistor between VDD and VL1 (without panel load)	$\frac{1}{2} \cdot V_{L2} - 0.1$		$\frac{1}{2} \cdot V_{L2} \times 0.85$	V
	VL2	Connect 1MΩ load resistor between VDD and VL2 (without panel load)	-2.25	-2.10	-1.95	V
	VL3	Connect 1MΩ load resistor between VDD and VL3 (without panel load)	$\frac{3}{2} \cdot V_{L2} - 0.1$		$\frac{3}{2} \cdot V_{L2} \times 0.85$	V
SVD voltage	VSVD		-2.55	-2.40	-2.25	V
SVD circuit response time	tSVD				100	μS
Current consumption	IOP	During HALT		16.0	35.0	μA
		During execution *1	Without panel load	18.0	40.0	μA

\*1: The SVD circuit is turned off.

# E0C6S27

## E0C6SA27 (CR, Normal Operating Mode)

(Unless otherwise specified: V<sub>DD</sub>=0V, V<sub>SS</sub>=-3.0V, f<sub>OSC</sub>=200kHz, R<sub>CR</sub>=160kΩ, T<sub>a</sub>=25°C, V<sub>S1</sub>/V<sub>L1</sub>-V<sub>L3</sub> are internal voltage, C1-C5=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Internal voltage	V <sub>L1</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L1</sub> (without panel load)	$\frac{1}{2} \bullet V_{L2} - 0.1$		$\frac{1}{2} \bullet V_{L2} \times 0.9$	V
	V <sub>L2</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L2</sub> (without panel load)	-2.25	-2.10	-1.95	V
	V <sub>L3</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L3</sub> (without panel load)	$\frac{3}{2} \bullet V_{L2} - 0.1$		$\frac{3}{2} \bullet V_{L2} \times 0.9$	V
SVD voltage	V <sub>SVD</sub>		-2.55	-2.40	-2.25	V
SVD circuit response time	t <sub>SVD</sub>				100	μS
Current consumption	I <sub>OP</sub>	During HALT		60	110	μA
		During execution *1	Without panel load	70	130	μA

\*1: The SVD circuit is turned off.

## E0C6SA27 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V<sub>DD</sub>=0V, V<sub>SS</sub>=-3.0V, f<sub>OSC</sub>=200kHz, R<sub>CR</sub>=160kΩ, T<sub>a</sub>=25°C, V<sub>S1</sub>/V<sub>L1</sub>-V<sub>L3</sub> are internal voltage, C1-C5=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Internal voltage	V <sub>L1</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L1</sub> (without panel load)	$\frac{1}{2} \bullet V_{L2} - 0.1$		$\frac{1}{2} \bullet V_{L2} \times 0.85$	V
	V <sub>L2</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L2</sub> (without panel load)	-2.25	-2.10	-1.95	V
	V <sub>L3</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L3</sub> (without panel load)	$\frac{3}{2} \bullet V_{L2} - 0.1$		$\frac{3}{2} \bullet V_{L2} \times 0.85$	V
SVD voltage	V <sub>SVD</sub>		-2.55	-2.40	-2.25	V
SVD circuit response time	t <sub>SVD</sub>				100	μS
Current consumption	I <sub>OP</sub>	During HALT		85	160	μA
		During execution *1	Without panel load	95	180	μA

\*1: The SVD circuit is turned off.

## E0C6SB27 (CR, Normal Operating Mode)

(Unless otherwise specified: V<sub>DD</sub>=0V, V<sub>SS</sub>=-3.0V, f<sub>OSC</sub>=65kHz, R<sub>CR</sub>=470kΩ, T<sub>a</sub>=25°C, V<sub>S1</sub>/V<sub>L1</sub>-V<sub>L3</sub> are internal voltage, C1-C5=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Internal voltage	V <sub>L1</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L1</sub> (without panel load)	-1.15	-1.05	-0.95	V
	V <sub>L2</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L2</sub> (without panel load)	$2 \bullet V_{L1} - 0.1$		$2 \bullet V_{L1} \times 0.9$	V
	V <sub>L3</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L3</sub> (without panel load)	$3 \bullet V_{L1} - 0.1$		$3 \bullet V_{L1} \times 0.9$	V
SVD voltage	V <sub>SVD</sub>		-1.30	-1.20	-1.10	V
SVD circuit response time	t <sub>SVD</sub>				100	μS
Current consumption	I <sub>OP</sub>	During HALT		6.5	14.0	μA
		During execution *1	Without panel load	9.0	18.0	μA

\*1: The SVD circuit is turned off.

## E0C6SB27 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V<sub>DD</sub>=0V, V<sub>SS</sub>=-3.0V, f<sub>OSC</sub>=65kHz, R<sub>CR</sub>=470kΩ, T<sub>a</sub>=25°C, V<sub>S1</sub>/V<sub>L1</sub>-V<sub>L3</sub> are internal voltage, C1-C5=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Internal voltage	V <sub>L1</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L1</sub> (without panel load)	-1.15	-1.05	-0.95	V
	V <sub>L2</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L2</sub> (without panel load)	$2 \bullet V_{L1} - 0.1$		$2 \bullet V_{L1} \times 0.85$	V
	V <sub>L3</sub>	Connect 1MΩ load resistor between V <sub>DD</sub> and V <sub>L3</sub> (without panel load)	$3 \bullet V_{L1} - 0.1$		$3 \bullet V_{L1} \times 0.85$	V
SVD voltage	V <sub>SVD</sub>		-1.30	-1.20	-1.10	V
SVD circuit response time	t <sub>SVD</sub>				100	μS
Current consumption	I <sub>OP</sub>	During HALT		15.0	35.0	μA
		During execution *1	Without panel load	18.0	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.

### E0C6S27 (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)	-2.2			V
Oscillation stop voltage	$V_{stp}$	$t_{stp} \leq 10sec$ (Vss)	-2.2			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 $V_{DD}$ , $V_{SS}$	200			$M\Omega$

### E0C6SL27 (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 $-1.8V$ (-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)			-1.8	V
Permitted leak resistance	$R_{leak}$	Between OSC1 and $V_{DD}$ , $V_{SS}$	200			$M\Omega$

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

### E0C6SB27 (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 $-3.6V$ (-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 $V_{DD}$ , $V_{SS}$	200			$M\Omega$

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

### E0C6S27 (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)	-2.2			V
Oscillation start time	$t_{sta}$	$V_{SS}=-2.2$ to $-3.6V$		3		mS
Oscillation stop voltage	$V_{stp}$	(Vss)	-2.2			V

### E0C6SA27 (CR)

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-3.0V$ ,  $R_{CR}=160k\Omega$ ,  $T_a=25^\circ C$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	$f_{osc}$		-30	200kHz	30	%
Oscillation start voltage	$V_{sta}$	(Vss)	-2.2			V
Oscillation start time	$t_{sta}$	$V_{SS}=-2.2$ to $-3.6V$		3		mS
Oscillation stop voltage	$V_{stp}$	(Vss)	-2.2			V

### E0C6SB27 (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 $-3.6V$		3		mS
Oscillation stop voltage	$V_{stp}$	(Vss)	-1.1			V

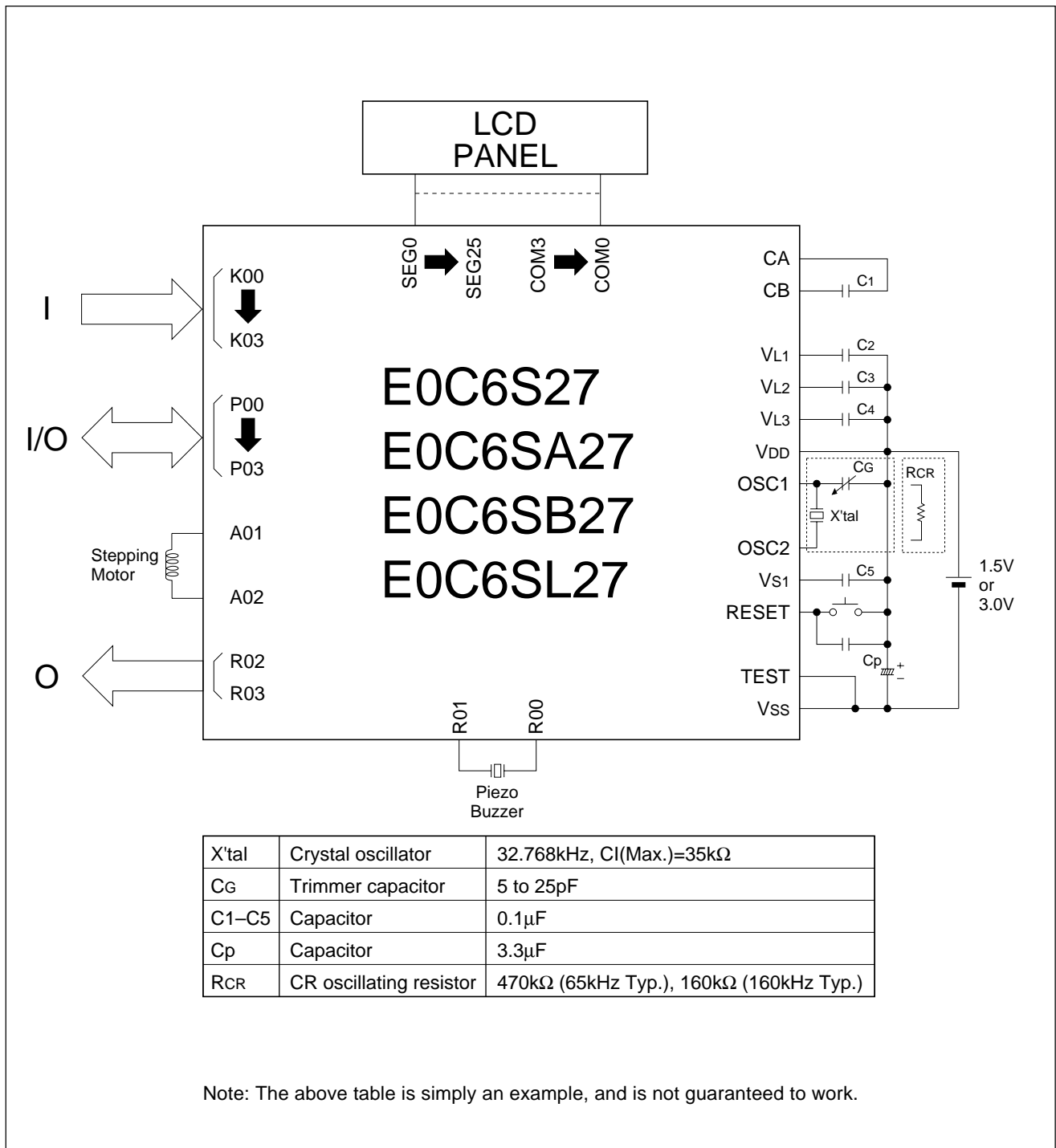
# E0C6S27

## ● Motor Driver Characteristics

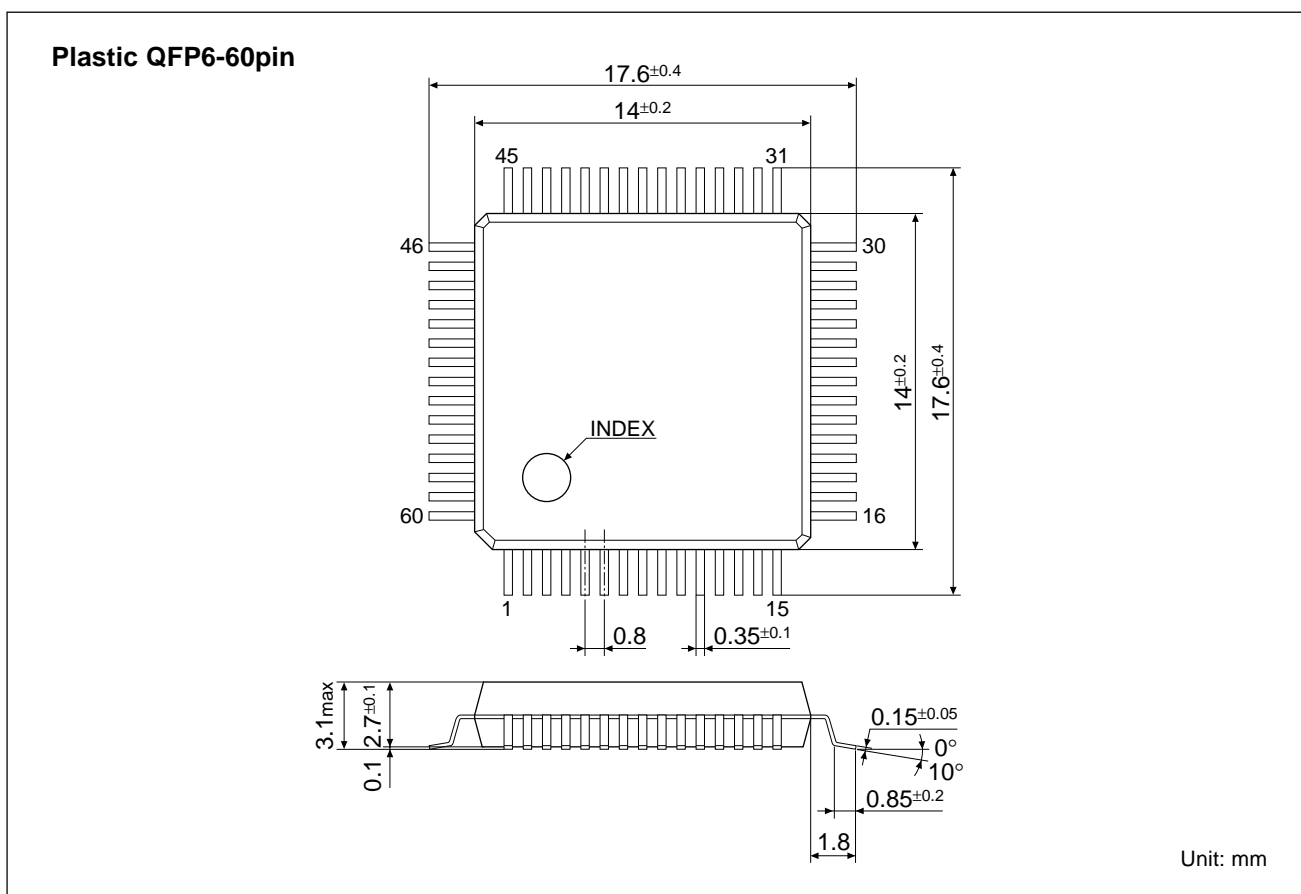
(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-1.58V$ , Crystal: C-002R ( $C_I=35k\Omega$ ),  $C_G=25pF$ ,  $C_D=$ built-in,  $T_a=25^\circ C$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	$V_{out}$	$V_{SS}=-1.35V$ $R_L=2k\Omega$	1.15			V
Diode characteristic	$I_D$	$V_n=0.6V$	10			$\mu A$
Output driver leak (Pch)	$I_{leak}$				1	$M\Omega$

## ■ BASIC EXTERNAL CONNECTION DIAGRAM



## ■ PACKAGE DIMENSIONS



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