EPSON

E0C6S27

4-bit Single Chip Microcomputer

Low Voltage Operation Products
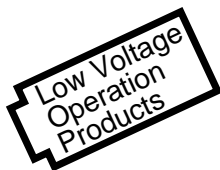
● Core CPU Architecture
● SVD Circuit
● High Quality Display LCD Driver
● Stepping-Motor Driver

■ **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
E0C6S27 (Normal type)	2.2 to 3.6V	32.768kHz Crystal or 65kHz CR (Typ.)
E0C6SA27 (High speed type)	2.2 to 3.6V	200kHz CR (Typ.)
E0C6SB27 (Wide voltage type)	0.9 to 3.6V	32.768kHz Crystal or 65kHz CR (Typ.)
E0C6SL27 (Low voltage type)	0.9 to 1.8V	32.768kHz Crystal

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■ **BLOCK DIAGRAM**

■ PIN CONFIGURATION

QFP6-60pin

E0C6S27

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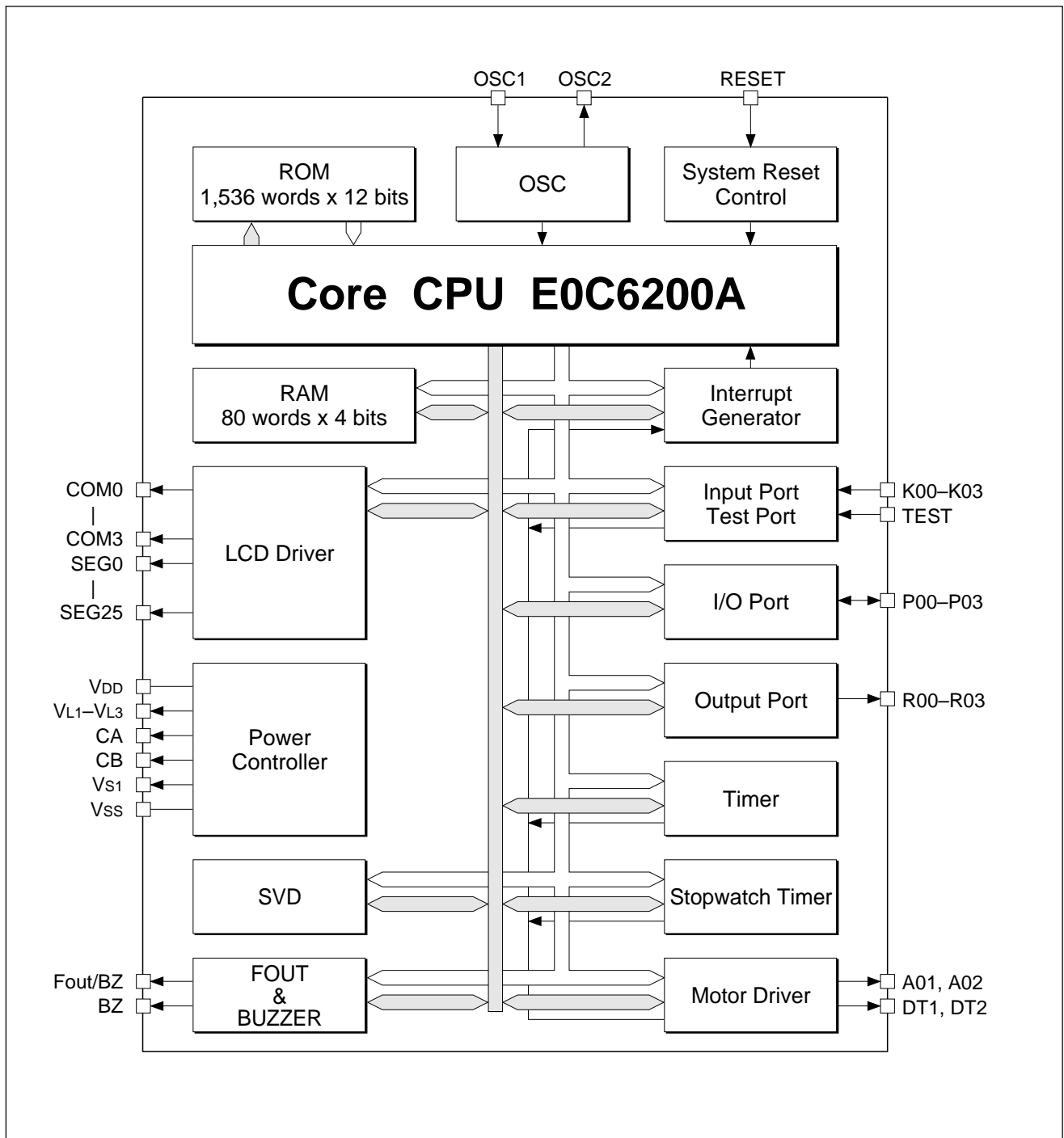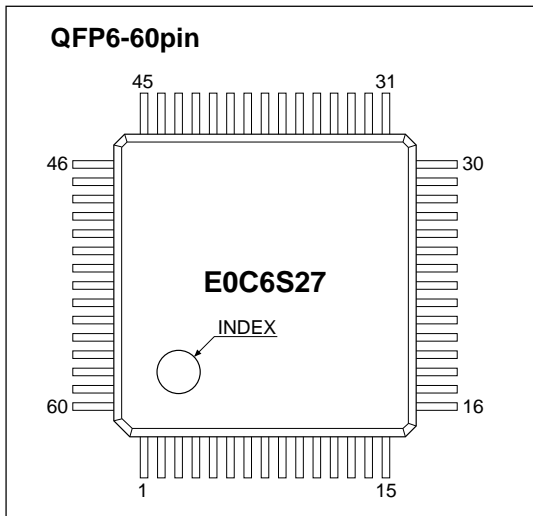
Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	OSC1	16	COM2	31	TEST	46	P01
2	OSC2	17	COM3	32	SEG13	47	P02
3	N.C.	18	SEG0	33	SEG14	48	P03
4	V$_{S1}$	19	SEG1	34	SEG15	49	RESET
5	CA	20	SEG2	35	SEG16	50	K00
6	CB	21	SEG3	36	SEG17	51	K01
7	V$_{L1}$	22	SEG4	37	SEG18	52	K02
8	V$_{L2}$	23	SEG5	38	SEG19	53	K03
9	V$_{L3}$	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	V$_{SS}$
15	COM1	30	SEG12	45	P00	60	V$_{DD}$

N.C. : No Connection

■ PIN DESCRIPTION

Pin name	Pin No.	I/O	Function
V$_{DD}$	60	(I)	Power supply pin (+)
V$_{SS}$	59	(I)	Power supply pin (–)
V$_{S1}$	4	O	Oscillation and internal logic system regulated voltage output pin
V$_{L1}$	7	O	LCD system regulated voltage output pin (-1.05V)
V$_{L2}$	8	O	LCD system booster voltage output pin (V$_{L1}\times$2)
V$_{L3}$	9	O	LCD system booster voltage output pin (V$_{L1}\times$3)
CA, CB	5, 6	—	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
DT1, DT2	10, 13	I/O	Test pin
A01, A02	11, 12	O	Motor driving port pin

■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(VDD=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_{IOSC}	V_{SS} - 0.3 to 0.5	V
Operating temperature	Topr	-20 to 70	°C
Storage temperature	Tstg	-65 to 150	°C
Soldering temperature / Time	Tsol	260°C, 10sec (lead section)	–
Permissible dissipation *1	P_D	250	mW

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

● Recommended Operating Conditions

E0C6S27

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V_{SS}	VDD=0V	-3.6	-3.0	-2.2	V
Oscillation frequency	f_{OSC}	Crystal oscillation		32.768		kHz
		CR oscillation, R=470kΩ		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

E0C6SA27

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V_{SS}	VDD=0V	-3.6	-3.0	-2.2	V
Oscillation frequency	f_{OSC}	CR oscillation, R=160kΩ		200	260	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

E0C6SL27

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V_{SS}	VDD=0V *3	-1.8	-1.5	-1.1	V
		VDD=0V, With software control *1	-1.8	-1.5	-0.9 *2	V
Oscillation frequency	f_{OSC}			32.768		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.

*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

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V_{SS}	VDD=0V *3	-3.6	-3.0	-1.1	V
		VDD=0V, With software control *1	-3.6	-3.0	-0.9 *2	V
Oscillation frequency	f_{OSC}	Crystal oscillation		32.768		kHz
		CR oscillation, R=470kΩ		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.

*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, Ta=25°C, V_{S1}/V_{L1}–V_{L3} are internal voltage, C1–C5=0.1μF)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}		K00–K03, P00–P03	0.2•V_{SS}		0	V
High level input voltage (2)	V_{IH2}		RESET, TEST	0.15•V_{SS}		0	V
Low level input voltage (1)	V_{IL1}		K00–K03, P00–P03	V_{SS}		0.8•V_{SS}	V
Low level input voltage (2)	V_{IL2}		RESET, TEST	V_{SS}		0.85•V_{SS}	V
High level input current (1)	I_{IH1}	V_{IH1}=0V, No pull down resistor	K00–K03, P00–P03	0		0.5	μA
High level input current (2)	I_{IH2}	V_{IH2}=0V, With pull down resistor	K00–K03	10		40	μA
High level input current (3)	I_{IH3}	V_{IH3}=0V, With pull down resistor	P00–P03 RESET, TEST	30		100	μA
Low level input current	I_{IL}	V_{IL}=V_{SS}	K00–K03, P00–P03 RESET, TEST	-0.5		0	μA
High level output current (1)	I_{OH1}	V_{OH1}=0.1•V_{SS}	R02, R03, P00–P03			-1.0	mA
High level output current (2)	I_{OH2}	V_{OH2}=0.1•V_{SS} (built-in protection resistance)	R00, R01			-1.0	mA
Low level output current (1)	I_{OL1}	V_{OL1}=0.9•V_{SS}	R02, R03, P00–P03	3.0			mA
Low level output current (2)	I_{OL2}	V_{OL2}=0.9•V_{SS} (built-in protection resistance)	R00, R01	3.0			mA
Common output current	I_{OH3}	V_{OH3}=-0.05V	COM0–COM3			-3	μA
	I_{OL3}	V_{OL3}=V_{L3}+0.05V		3			μA
Segment output current (during LCD output)	I_{OH4}	V_{OH4}=-0.05V	SEG0–SEG25			-3	μA
	I_{OL4}	V_{OL4}=V_{L3}+0.05V		3			μA
Segment output current (during DC output)	I_{OH5}	V_{OH5}=0.1•V_{SS}	SEG0–SEG25			-300	μA
	I_{OL5}	V_{OL5}=0.9•V_{SS}		300			μA

E0C6SL27

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=32.768kHz, Ta=25°C, V_{S1}/V_{L1}–V_{L3} are internal voltage, C1–C5=0.1μF)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}		K00–K03, P00–P03	0.2•V_{SS}		0	V
High level input voltage (2)	V_{IH2}		RESET, TEST	0.15•V_{SS}		0	V
Low level input voltage (1)	V_{IL1}		K00–K03, P00–P03	V_{SS}		0.8•V_{SS}	V
Low level input voltage (2)	V_{IL2}		RESET, TEST	V_{SS}		0.85•V_{SS}	V
High level input current (1)	I_{IH1}	V_{IH1}=0V, No pull down resistor	K00–K03, P00–P03	0		0.5	μA
High level input current (2)	I_{IH2}	V_{IH2}=0V, With pull down resistor	K00–K03	5		20	μA
High level input current (3)	I_{IH3}	V_{IH3}=0V, With pull down resistor	P00–P03 RESET, TEST	10		60	μA
Low level input current	I_{IL}	V_{IL}=V_{SS}	K00–K03, P00–P03 RESET, TEST	-0.5		0	μA
High level output current (1)	I_{OH1}	V_{OH1}=0.1•V_{SS}	R02, R03, P00–P03			-200	μA
High level output current (2)	I_{OH2}	V_{OH2}=0.1•V_{SS} (built-in protection resistance)	R00, R01			-200	μA
Low level output current (1)	I_{OL1}	V_{OL1}=0.9•V_{SS}	R02, R03, P00–P03	700			μA
Low level output current (2)	I_{OL2}	V_{OL2}=0.9•V_{SS} (built-in protection resistance)	R00, R01	700			μA
Common output current	I_{OH3}	V_{OH3}=-0.05V	COM0–COM3			-3	μA
	I_{OL3}	V_{OL3}=V_{L3}+0.05V		3			μA
Segment output current (during LCD output)	I_{OH4}	V_{OH4}=-0.05V	SEG0–SEG25			-3	μA
	I_{OL4}	V_{OL4}=V_{L3}+0.05V		3			μA
Segment output current (during DC output)	I_{OH5}	V_{OH5}=0.1•V_{SS}	SEG0–SEG25			-100	μA
	I_{OL5}	V_{OL5}=0.9•V_{SS}		130			μA

● **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, Ta=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)		$\frac{1}{2}$•V_{L2}-0.1		$\frac{1}{2}$•V_{L2}×0.9	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		-2.25	-2.10	-1.95	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		$\frac{3}{2}$•V_{L2}-0.1		$\frac{3}{2}$•V_{L2}×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	Without panel load		0.7	1.4	μA
		During execution *1			1.9	3.5	μA

∗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, Ta=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)		$\frac{1}{2}$•V_{L2}-0.1		$\frac{1}{2}$•V_{L2}×0.85	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		-2.25	-2.10	-1.95	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		$\frac{3}{2}$•V_{L2}-0.1		$\frac{3}{2}$•V_{L2}×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	Without panel load		5.0	15	μA
		During execution *1			6.5	19	μA

∗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, Ta=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	Without panel load		0.6	1.1	μA
		During execution *1			1.7	3.0	μA

∗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, Ta=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	Without panel load		1.2	2.2	μA
		During execution *1			3.4	6.0	μA

∗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, Ta=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)		$2{\bullet}V_{L1}$-0.1		$2{\bullet}V_{L1}{\times}0.9$	V
	V_{L3}	Connect 1MΩ 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	μS
Current consumption	I_{OP}	During HALT	Without panel load		0.7	1.4	μA
		During execution *1			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, Ta=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)		$2{\bullet}V_{L1}$-0.1		$2{\bullet}V_{L1}{\times}0.85$	V
	V_{L3}	Connect 1MΩ 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	μS
Current consumption	I_{OP}	During HALT	Without panel load		1.4	2.8	μA
		During execution *1			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}=470kΩ, Ta=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)		$\frac{1}{2}{\bullet}V_{L2}$-0.1		$\frac{1}{2}{\bullet}V_{L2}{\times}0.9$	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		-2.25	-2.10	-1.95	V
	V_{L3}	Connect 1MΩ 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	μS
Current consumption	I_{OP}	During HALT	Without panel load		6.5	14.0	μA
		During execution *1			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}=470kΩ, Ta=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)		$\frac{1}{2}{\bullet}V_{L2}$-0.1		$\frac{1}{2}{\bullet}V_{L2}{\times}0.85$	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		-2.25	-2.10	-1.95	V
	V_{L3}	Connect 1MΩ 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	μS
Current consumption	I_{OP}	During HALT	Without panel load		16.0	35.0	μA
		During execution *1			18.0	40.0	μA

∗1: The SVD circuit is turned off.

E0C6SA27 (CR, Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=200kHz, R_{CR}=160kΩ, Ta=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)		$\frac{1}{2}$•V_{L2}-0.1		$\frac{1}{2}$•V_{L2}×0.9	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		-2.25	-2.10	-1.95	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		$\frac{3}{2}$•V_{L2}-0.1		$\frac{3}{2}$•V_{L2}×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	Without panel load		60	110	μA
		During execution *1			70	130	μA

*1: The SVD circuit is turned off.

E0C6SA27 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=200kHz, R_{CR}=160kΩ, Ta=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)		$\frac{1}{2}$•V_{L2}-0.1		$\frac{1}{2}$•V_{L2}×0.85	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		-2.25	-2.10	-1.95	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		$\frac{3}{2}$•V_{L2}-0.1		$\frac{3}{2}$•V_{L2}×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	Without panel load		85	160	μA
		During execution *1			95	180	μA

*1: The SVD circuit is turned off.

E0C6SB27 (CR, Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=65kHz, R_{CR}=470kΩ, Ta=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	Without panel load		6.5	14.0	μA
		During execution *1			9.0	18.0	μA

*1: The SVD circuit is turned off.

E0C6SB27 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=65kHz, R_{CR}=470kΩ, Ta=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	Without panel load		15.0	35.0	μA
		During execution *1			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=35kΩ), C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec	(V_{SS})	-2.2			V
Oscillation stop voltage	Vstp	tstp≤10sec	(V_{SS})	-2.2			V
Built-in capacitance (drain)	C_D	Including the parasitic capacity inside the IC			20		pF
Frequency/voltage deviation	∂f/∂V	V_{SS}=-1.8 to -3.6V				5	ppm
Frequency/IC deviation	∂f/∂IC			-10		10	ppm
Frequency adjustment range	∂f/∂C_G	C_G=5 to 25pF		40			ppm
Harmonic oscillation start voltage	V_{hho}	C_G=5pF	(V_{SS})			-3.6	V
Permitted leak resistance	R_{leak}	Between OSC1 and V_{DD}, V_{SS}		200			MΩ

E0C6SL27 (Crystal)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, Crystal: C-002R (C_I=35kΩ), C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec	(V_{SS})	-1.1			V
Oscillation stop voltage	Vstp	tstp≤10sec	(V_{SS})	-1.1(-0.9)[*1]			V
Built-in capacitance (drain)	C_D	Including the parasitic capacity inside the IC			20		pF
Frequency/voltage deviation	∂f/∂V	V_{SS}=-1.1 to -1.8V (-0.9) [*1]				5	ppm
Frequency/IC deviation	∂f/∂IC			-10		10	ppm
Frequency adjustment range	∂f/∂C_G	C_G=5 to 25pF		40			ppm
Harmonic oscillation start voltage	V_{hho}	C_G=5pF	(V_{SS})			-1.8	V
Permitted leak resistance	R_{leak}	Between OSC1 and V_{DD}, V_{SS}		200			MΩ

*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=35kΩ), C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec	(V_{SS})	-1.1			V
Oscillation stop voltage	Vstp	tstp≤10sec	(V_{SS})	-1.1(-0.9)[*1]			V
Built-in capacitance (drain)	C_D	Including the parasitic capacity inside the IC			20		pF
Frequency/voltage deviation	∂f/∂V	V_{SS}=-1.1 to -3.6V (-0.9) [*1]				5	ppm
Frequency/IC deviation	∂f/∂IC			-10		10	ppm
Frequency adjustment range	∂f/∂C_G	C_G=5 to 25pF		40			ppm
Harmonic oscillation start voltage	V_{hho}	C_G=5pF	(V_{SS})			-3.6	V
Permitted leak resistance	R_{leak}	Between OSC1 and V_{DD}, V_{SS}		200			MΩ

*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}=470kΩ, Ta=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	fosc			-20	65kHz	20	%
Oscillation start voltage	Vsta		(V_{SS})	-2.2			V
Oscillation start time	tsta	V_{SS}=-2.2 to -3.6V			3		mS
Oscillation stop voltage	Vstp		(V_{SS})	-2.2			V

E0C6SA27 (CR)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, R_{CR}=160kΩ, Ta=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	fosc			-30	200kHz	30	%
Oscillation start voltage	Vsta		(V_{SS})	-2.2			V
Oscillation start time	tsta	V_{SS}=-2.2 to -3.6V			3		mS
Oscillation stop voltage	Vstp		(V_{SS})	-2.2			V

E0C6SB27 (CR)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, R_{CR}=470kΩ, Ta=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	fosc			-20	65kHz	20	%
Oscillation start voltage	Vsta		(V_{SS})	-1.1			V
Oscillation start time	tsta	V_{SS}=-1.1 to -3.6V			3		mS
Oscillation stop voltage	Vstp		(V_{SS})	-1.1			V

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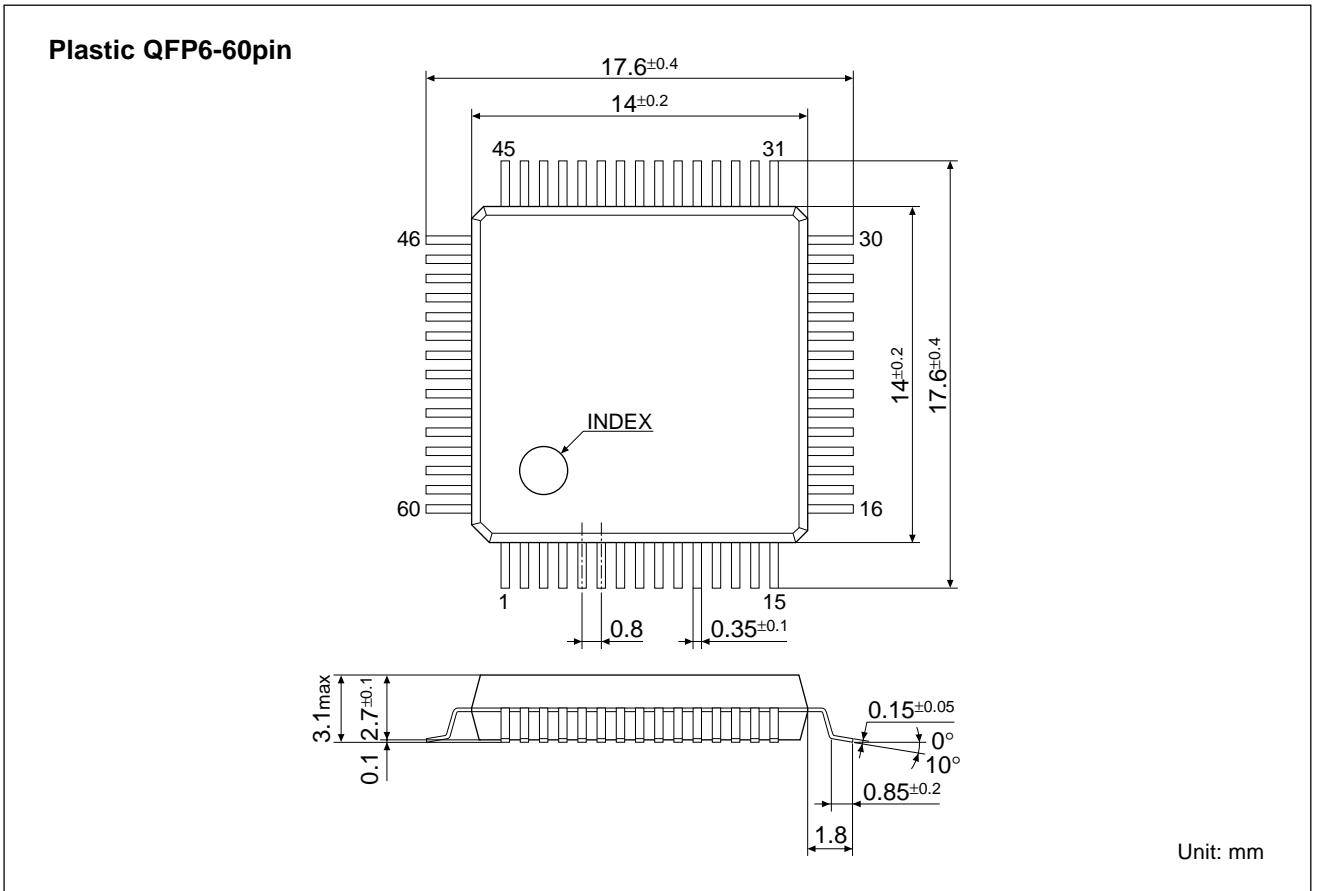● **Motor Driver Characteristics**

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

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			μA
Output driver leak (Pch)	I_{leak}				1	MΩ

■ **BASIC EXTERNAL CONNECTION DIAGRAM**

X'tal	Crystal oscillator	32.768kHz, CI(Max.)=35kΩ
C_G	Trimmer capacitor	5 to 25pF
C1–C5	Capacitor	0.1μF
Cp	Capacitor	3.3μF
R_{CR}	CR oscillating resistor	420kΩ (65kHz Typ.), 160kΩ (160kHz Typ.)

Note: The above table is simply an example, and is not guaranteed to work.

■ PACKAGE DIMENSIONS

Plastic QFP6-60pin

Unit: mm
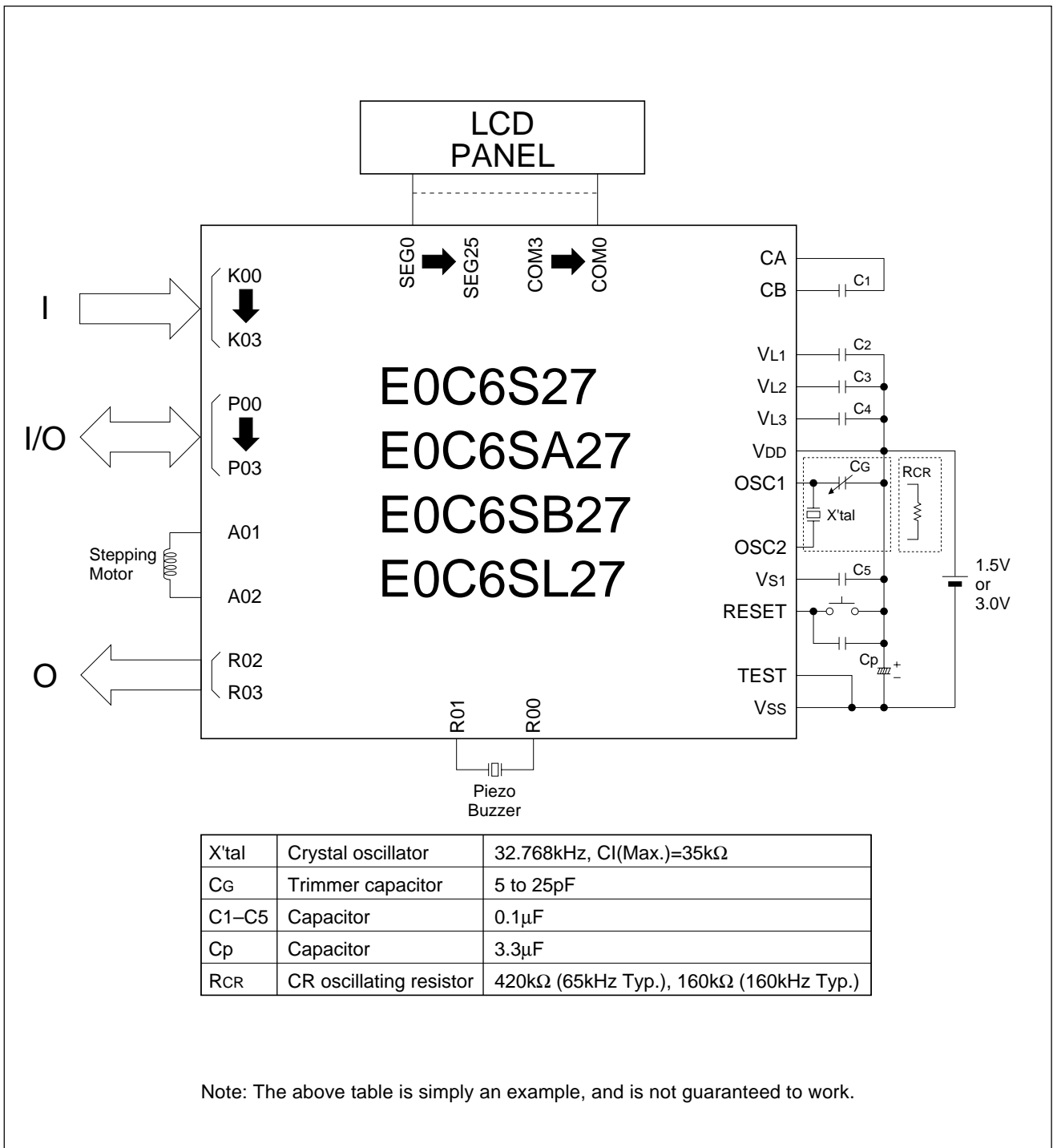
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