EPSON

E0C6S37

4-bit Single Chip Microcomputer

Low Voltage Operation Products

- 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.

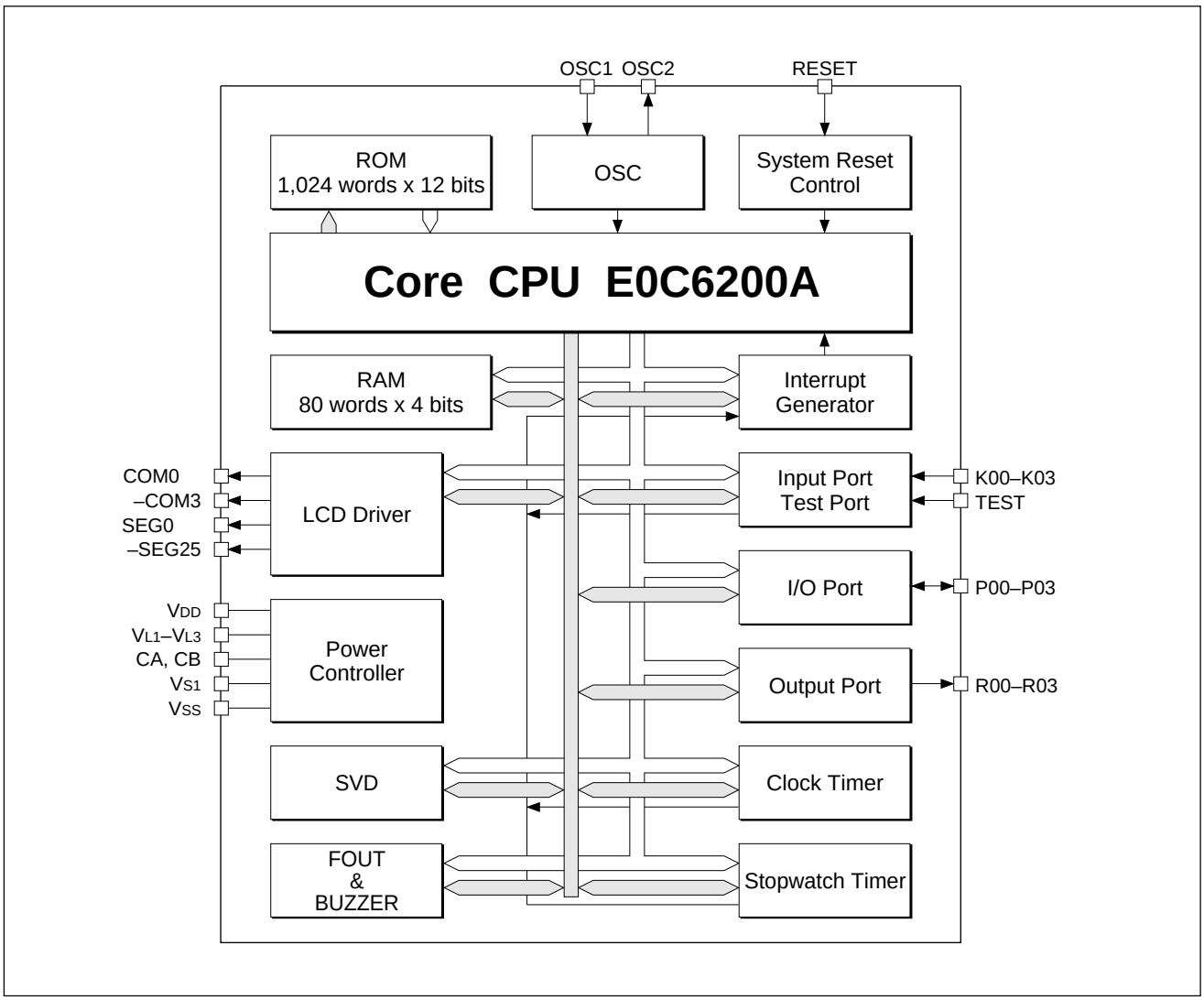
■ FEATURES

- 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/$\overline{BZ}$ 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

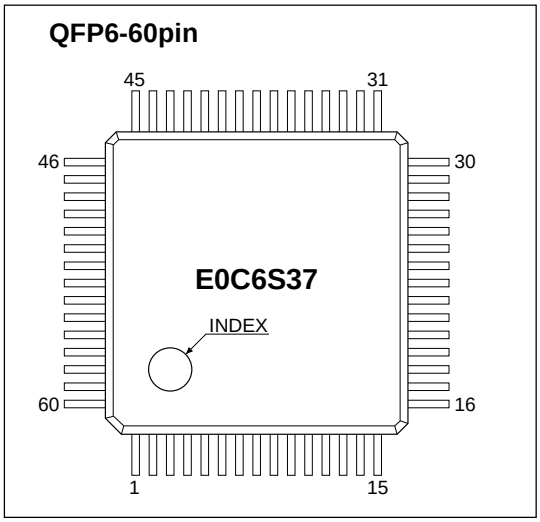
■ LINE UP

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.)

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



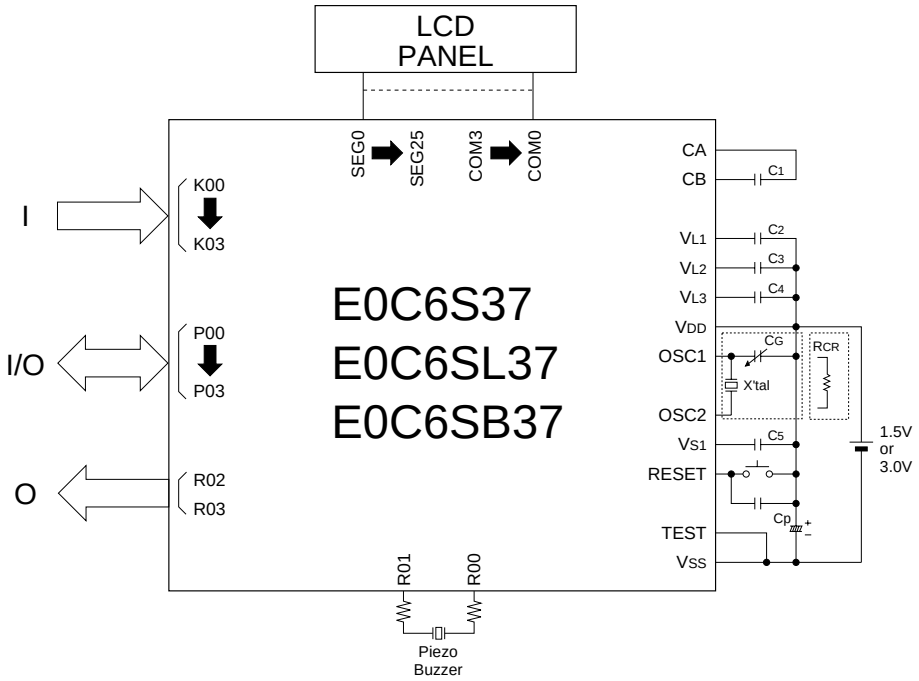
Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	OSC1	16	COM2	31	TEST	46	P01
2	OSC2	17	COM3	32	SEG13	47	P02
3	N.C.	18	SEG0	33	SEG14	48	P03
4	V_{S1}	19	SEG1	34	SEG15	49	RESET
5	N.C.	20	SEG2	35	SEG16	50	K00
6	CA	21	SEG3	36	SEG17	51	K01
7	CB	22	SEG4	37	SEG18	52	K02
8	N.C.	23	SEG5	38	SEG19	53	K03
9	N.C.	24	SEG6	39	SEG20	54	R00
10	N.C.	25	SEG7	40	SEG21	55	R01
11	V_{L1}	26	SEG8	41	SEG22	56	R02
12	V_{L2}	27	SEG9	42	SEG23	57	R03
13	V_{L3}	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}	11	O	LCD system regulated voltage output pin (-1.05V)
V_{L2}	12	O	LCD system booster voltage output pin (V_{L1}×2)
V_{L3}	13	O	LCD system booster voltage output pin (V_{L1}×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



X'tal	Crystal oscillator	32.768kHz, CI(Max.)=35kΩ
C_G	Trimmer capacitor	5 to 25pF
C_1–C_5	Capacitor	0.1µF
Cp	Capacitor	3.3µF
R_{CR}	CR oscillating resistor	470kΩ (65kHz Typ.)

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

■ 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_{IOSC}	V_{SS} - 0.3 to 0.5	V
Permissible total output current *1	ΣI_{VSS}	10	mA
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 *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

(Ta=-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	f_{OSC1}	Crystal oscillation		32.768		kHz
	f_{OSC2}	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

(Ta=-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	f_{OSC1}	Crystal oscillation		32.768		kHz
	f_{OSC2}	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

(Ta=-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	f_{OSC1}	Crystal oscillation		32.768		kHz
	f_{OSC2}	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, 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	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	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	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	I_{OH4}	V_{OH4}=-0.05V	SEG0–SEG25			-3	µA
(during LCD output)	I_{OL4}	V_{OL4}=V_{L3}+0.05V		3			µA
Segment output current	I_{OH5}	V_{OH5}=0.1•V_{SS}	SEG0–SEG25			-300	µA
(during DC output)	I_{OL5}	V_{OL5}=0.9•V_{SS}		300			µA

E0C6SL37

(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	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	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	5.0		20	µA
High level input current (3)	I_{IH3}	V_{IH3}=0V, With pull down resistor	P00–P03 RESET	9.0		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			-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	I_{OH4}	V_{OH4}=-0.05V	SEG0–SEG25			-3	µA
(during LCD output)	I_{OL4}	V_{OL4}=V_{L3}+0.05V		3			µA
Segment output current	I_{OH5}	V_{OH5}=0.1•V_{SS}	SEG0–SEG25			-100	µA
(during DC output)	I_{OL5}	V_{OL5}=0.9•V_{SS}		130			µA

● 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, 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		1.0	2.5	µA
		During execution *1			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, 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		2.0	5.5	µA
		During execution *1			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}=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)		$\frac{1}{2}$•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		8.0	15.0	µA
		During execution *1			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}=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)		$\frac{1}{2}$•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		16.0	30.0	µA
		During execution *1			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, 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		1.0	2.5	µA
		During execution *1			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, 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		2.0	5.5	µA
		During execution *1			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, 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		8.0	15.0	µA
		During execution *1			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, 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		16.0	30.0	µA
		During execution *1			30.0	40.0	µA

*1: The SVD circuit is turned off.

E0C6SB37 (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•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		1.0	2.5	µA
		During execution *1			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, 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		2.0	5.5	µA
		During execution *1			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, 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		8.0	15.0	µA
		During execution *1			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, 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		16.0	30.0	µA
		During execution *1			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=35kΩ), C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec (Vss)	-1.8			V
Oscillation stop voltage	Vstp	tstp≤10sec (Vss)	-1.8			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	Vhho	C_G=5pF (Vss)			-3.6	V
Permitted leak resistance	Rleak	Between OSC1 and V_{DD}	200			MΩ

E0C6SL37 (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 (Vss)	-1.1			V
Oscillation stop voltage	Vstp	tstp≤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	∂f/∂V	V_{SS}=-1.1 to -2.0V (-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	Vhho	C_G=5pF (Vss)			-2.0	V
Permitted leak resistance	Rleak	Between OSC1 and V_{DD}	200			MΩ

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

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec (Vss)	-1.1			V
Oscillation stop voltage	Vstp	tstp≤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	∂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	Vhho	C_G=5pF (Vss)			-3.6	V
Permitted leak resistance	Rleak	Between OSC1 and V_{DD}	200			MΩ

*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}=470kΩ, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	fosc		-20	65kHz	20	%
Oscillation start voltage	Vsta	(Vss)	-1.8			V
Oscillation start time	tsta	V_{SS}=-1.8 to -3.6V		3		mS
Oscillation stop voltage	Vstp	(Vss)	-1.8			V

E0C6SL37 (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	(Vss)	-1.1			V
Oscillation start time	tsta	V_{SS}=-1.1 to -2.0V		3		mS
Oscillation stop voltage	Vstp	(Vss)	-1.1			V

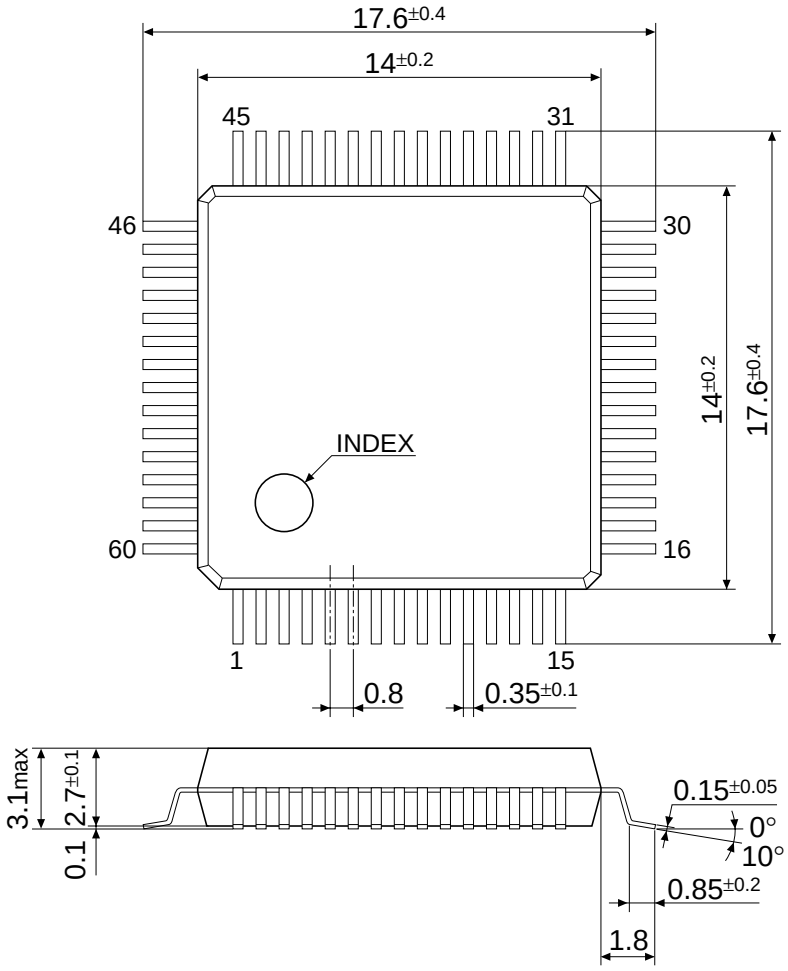
E0C6SB37 (CR)

(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	(Vss)	-1.1			V
Oscillation start time	tsta	V_{SS}=-1.1 to -3.6V		3		mS
Oscillation stop voltage	Vstp	(Vss)	-1.1			V

■ PACKAGE DIMENSIONS

Plastic QFP6-60pin



Unit: mm

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