

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

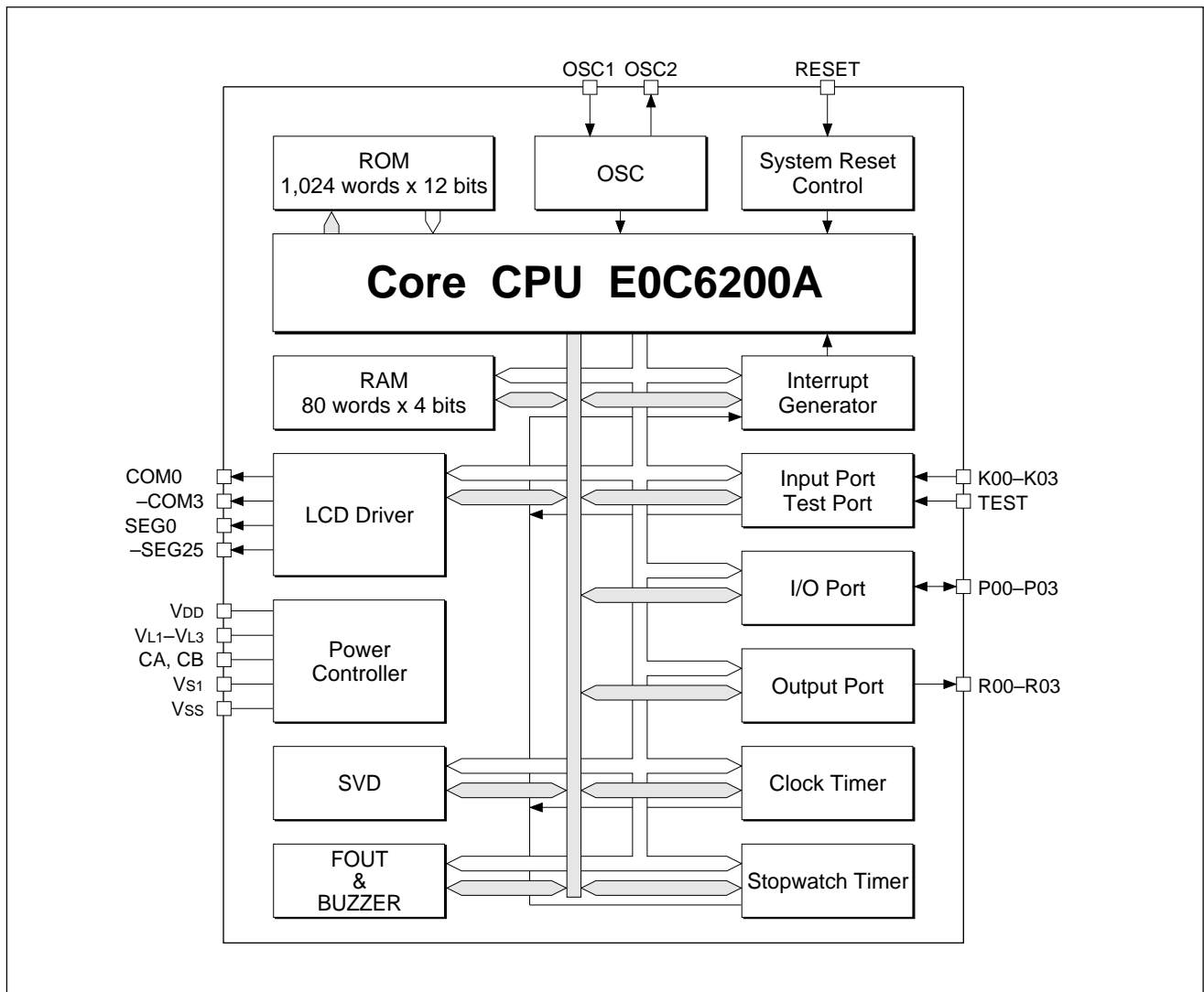
- CMOS LSI 4-bit parallel processing
- Clock 32.768kHz (Typ.)
CR or Crystal oscillation circuit selectable through mask option
- Instruction set 100 instructions
- Instruction execution time 153μsec, 214μsec or 366μsec (depending on instruction)
- ROM capacity 1,024 words × 12 bits
- RAM capacity 80 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

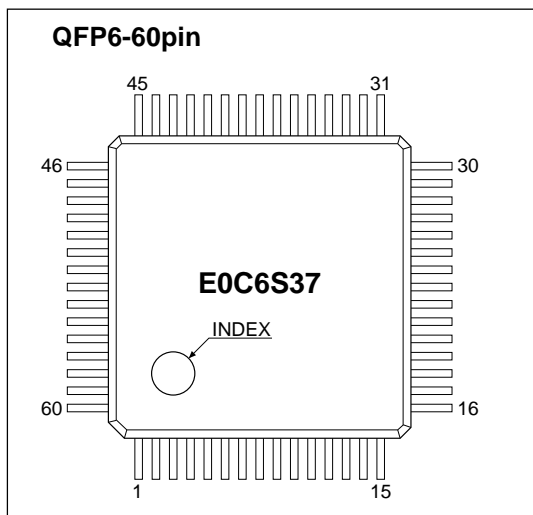
Model	Supply voltage	Clock (oscillation)
E0C6SL37	1.5V (0.9 to 2.0V)	32.768kHz Crystal or 65kHz CR oscillation (Typ.)
E0C6S37	3.0V (1.8 to 3.6V)	32.768kHz Crystal or 65kHz CR oscillation (Typ.)
E0C6SB37	3.0V (0.9 to 3.6V)	32.768kHz Crystal or 65kHz CR oscillation (Typ.)

E0C6S37

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



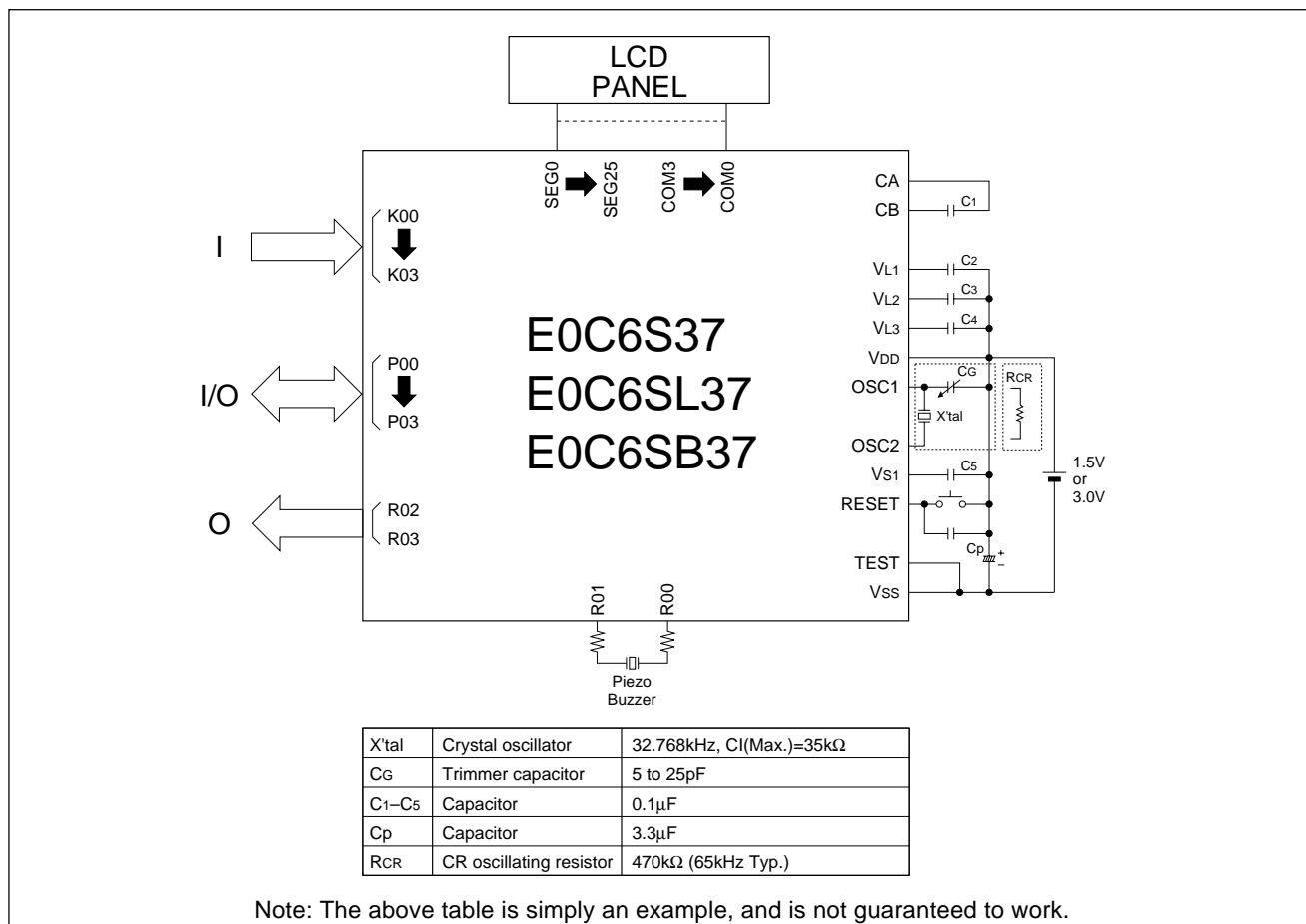
Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	OSC1	16	COM2	31	TEST	46	P01
2	OSC2	17	COM3	32	SEG13	47	P02
3	N.C.	18	SEG0	33	SEG14	48	P03
4	Vs1	19	SEG1	34	SEG15	49	RESET
5	N.C.	20	SEG2	35	SEG16	50	K00
6	CA	21	SEG3	36	SEG17	51	K01
7	CB	22	SEG4	37	SEG18	52	K02
8	N.C.	23	SEG5	38	SEG19	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 Ω

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 Ω

*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 Ω

*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

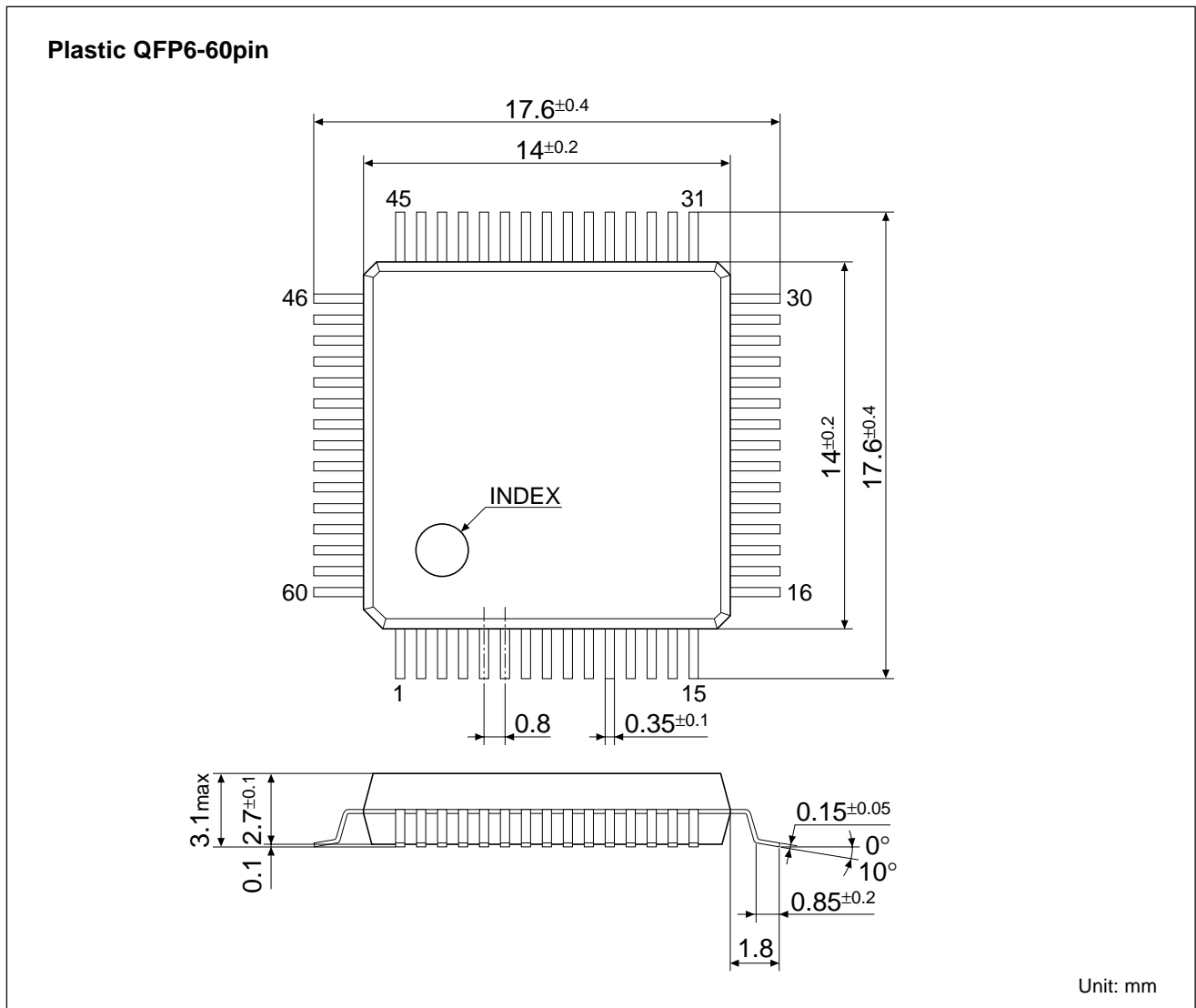
E0C6SB37 (CR)

(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



NOTICE:

No part of this material may be reproduced or duplicated in any form or by any means without the written permission of Seiko Epson. Seiko Epson reserves the right to make changes to this material without notice. Seiko Epson does not assume any liability of any kind arising out of any inaccuracies contained in this material or due to its application or use in any product or circuit and, further, there is no representation that this material is applicable to products requiring high level reliability, such as, medical products. Moreover, no license to any intellectual property rights is granted by implication or otherwise, and there is no representation or warranty that anything made in accordance with this material will be free from any patent or copyright infringement of a third party. This material or portions thereof may contain technology or the subject relating to strategic products under the control of the Foreign Exchange and Foreign Trade Control Law of Japan and may require an export license from the Ministry of International Trade and Industry or other approval from another government agency.

© Seiko Epson Corporation 1999 All right reserved.

SEIKO EPSON CORPORATION

ELECTRONIC DEVICES MARKETING DIVISION

IC Marketing & Engineering Group

ED International Marketing Department I (Europe & U.S.A.)

421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone : 042-587-5812 FAX : 042-587-5564

ED International Marketing Department II (Asia)

421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone : 042-587-5814 FAX : 042-587-5110

