

## Micro MINI E0C6009

### 4-bit Single Chip Microcomputer



- E0C6200B Core CPU
- Low Voltage and Low Power
- Built-in LCD Driver
- Low Cost Performance

#### ■ DESCRIPTION

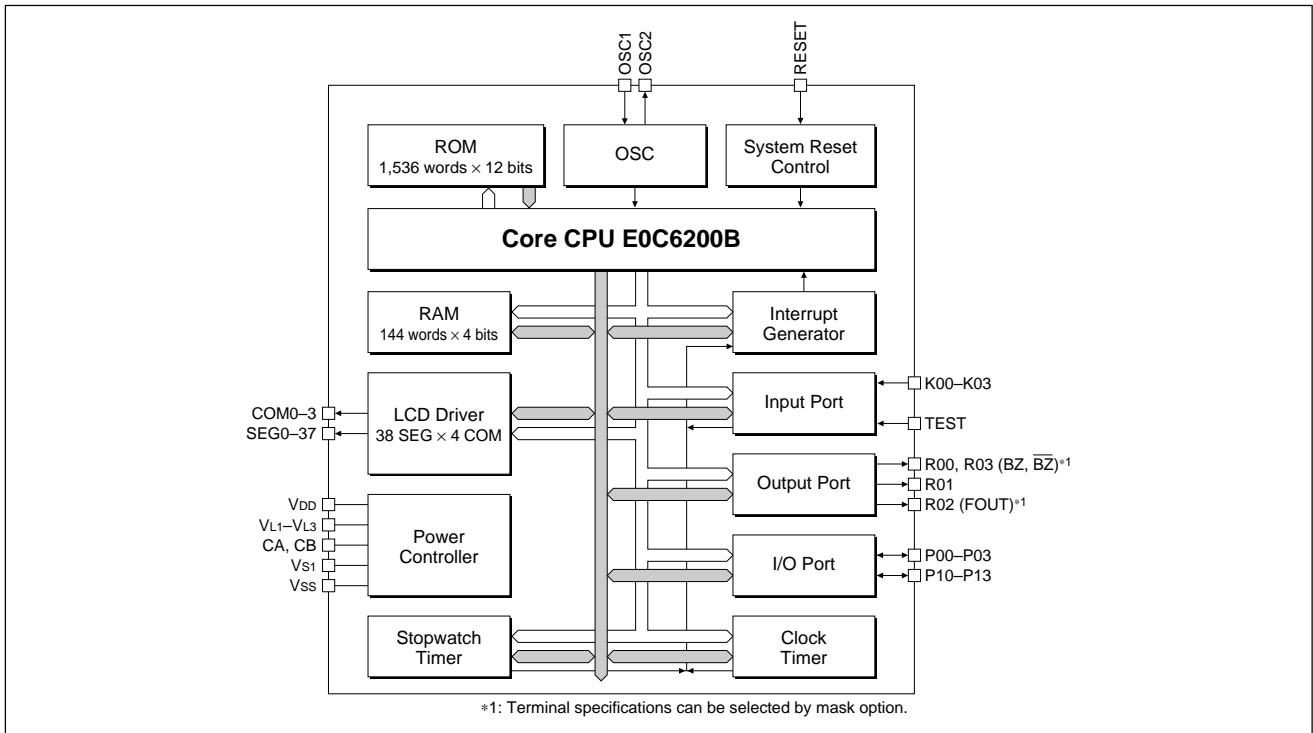
Micro MINI "E0C6009" is a single chip microcomputer for battery-driven products with 7-segment LCD display. It achieves low cost performance, and is suitable for a product added some feature instead of standard IC. It consists that Seiko Epson's original core CPU E0C6200B, LCD driver (38 segments × 4 commons), 144 words RAM, 1.5K words ROM, clock timer and so on.

#### ■ FEATURES

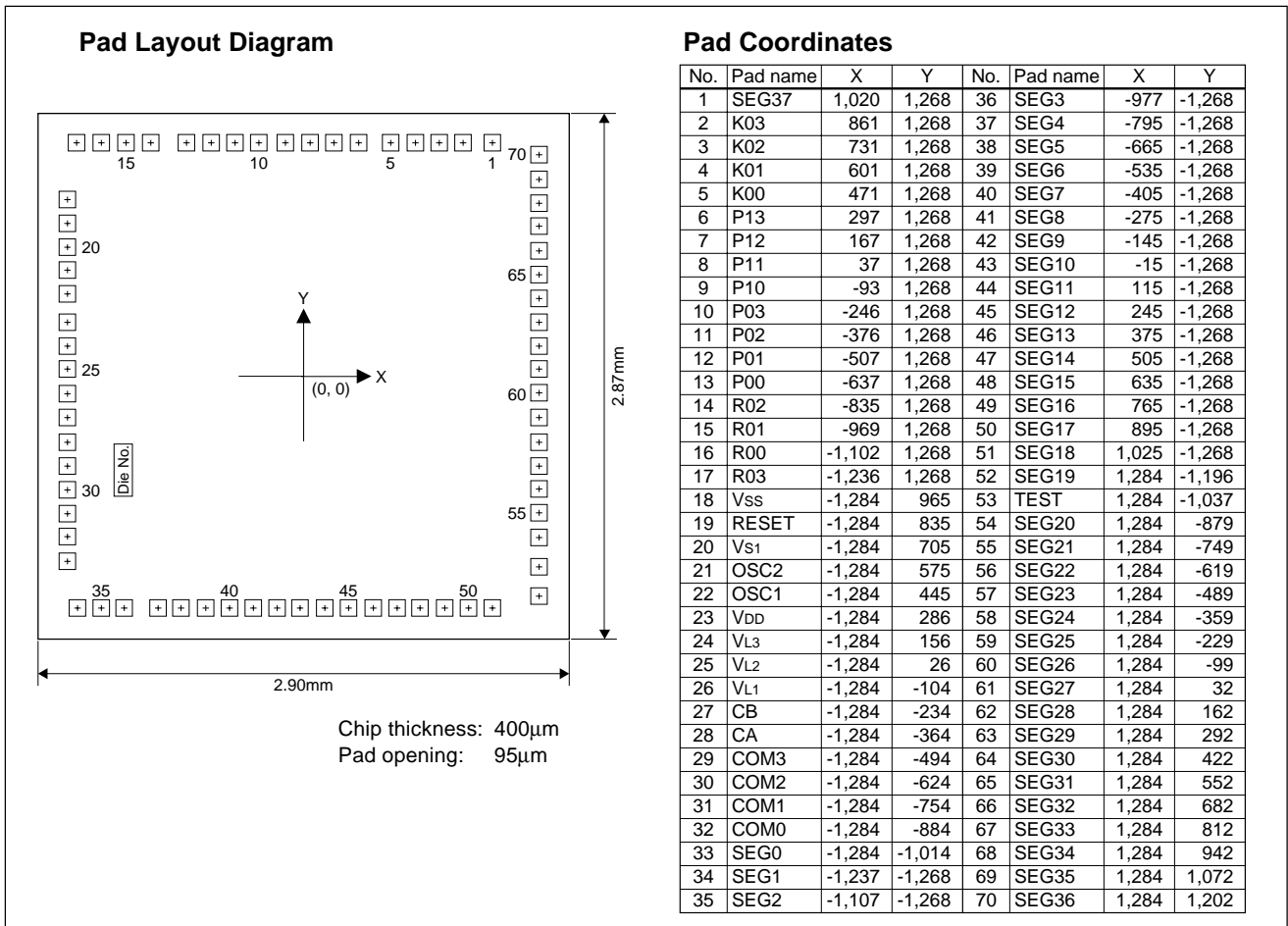
- CMOS LSI 4-bit parallel processing
- Clock ..... Crystal 32.768kHz (Typ.) or CR oscillation 65kHz (Typ.)
- Instruction set ..... 100 instructions
- ROM capacity ..... 1,536 × 12 bits
- RAM capacity ..... 144 × 4 bits
- I/O port ..... I: 4 bits (with pull-down resistor selectable by mask option)  
O: 4 bits (clock and buzzer outputs possible by mask option)  
I/O: 8 bits
- Supply voltage detector (SVD) ..... No support
- Clock timer ..... 1ch.
- Stopwatch timer ..... 1ch.
- LCD driver ..... 38 segments × 4/3/2 commons
- Interrupt ..... External : Key interrupt 1 line  
Internal : Timer interrupt 2 lines
- Operation voltage ..... 1.2 to 1.8V (E0C60L09)  
2.6 to 3.6V (E0C6009)
- Power consumption ..... 1.0μA (32.768kHz X'tal, 3.0V, HALT)  
2.5μA (32.768kHz X'tal, 3.0V, RUN)
- Package ..... Die form (pad pitch = 130μm)

# E0C6009

## ■ BLOCK DIAGRAM



## ■ PAD LAYOUT

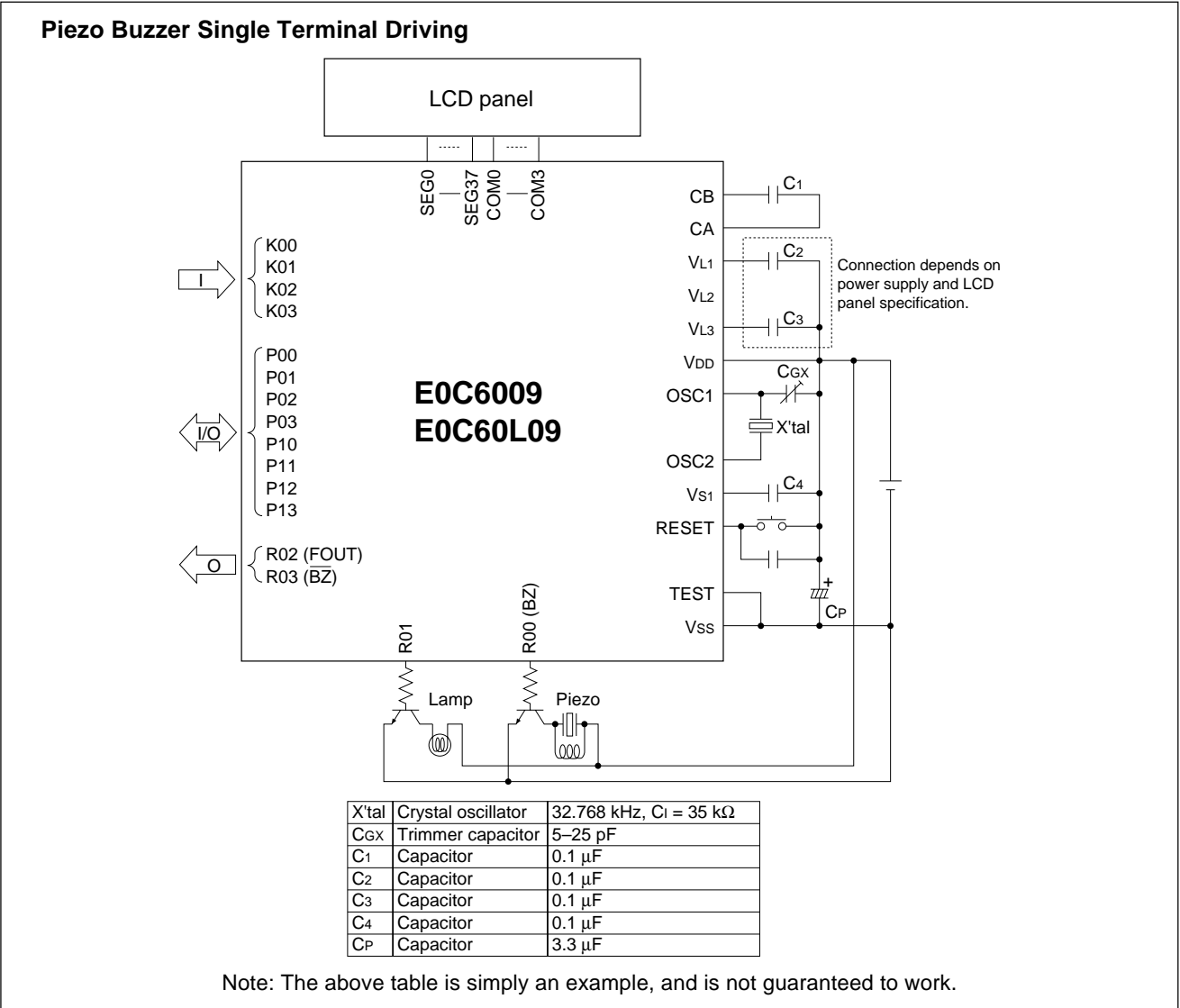


■ PAD DESCRIPTION

Pad name	Pad No.	I/O	Function
V <sub>DD</sub>	23	(I)	Power supply terminal (+)
V <sub>SS</sub>	18	(I)	Power supply terminal (-)
V <sub>S1</sub>	20	-	Constant voltage output terminal
V <sub>L1-3</sub>	26-24	-	Power source for LCD
CA, CB	28, 27	-	Booster capacitor connecting terminal
OSC1	22	I	Crystal or CR oscillation input terminal *
OSC2	21	O	Crystal or CR oscillation output terminal *
K00-03	5-2	I	Input port terminal
P00-03	13-10	I/O	I/O port terminal
P10-13	9-6	I/O	I/O port terminal
R00	16	O	Output port terminal (BZ output is selectable *)
R03	17	O	Output port terminal (BZ output is selectable *)
R01	15	O	Output port terminal
R02	14	O	Output port terminal (FOUT output is selectable *)
SEG0-37	33-52, 54-70, 1	O	LCD segment output (DC output is selectable *)
COM0-3	32-29	O	LCD common output terminal (1/4, 1/3 or 1/2 duty are selectable *)
RESET	19	I	Initial reset input terminal
TEST	53	I	Test input terminal

\* Can be selected by mask option

■ BASIC EXTERNAL CONNECTION DIAGRAM



# E0C6009

## ■ ELECTRICAL CHARACTERISTICS

### ● Absolute Maximum Ratings

#### E0C6009

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

Rating	Symbol	Value	Unit
Supply voltage	V <sub>SS</sub>	-5.5 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>S1</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)	—

#### E0C60L09

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

Rating	Symbol	Value	Unit
Supply voltage	V <sub>SS</sub>	-2.0 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>S1</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)	—

### ● Recommended Operating Conditions

#### E0C6009

(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	-2.6	V
Oscillation frequency	f <sub>osc</sub>	Crystal oscillation		32.768		kHz
		CR oscillation, R <sub>CR</sub> =475kΩ		65	80	kHz
Booster capacitor	C <sub>1</sub>		0.1			μF
Capacitor between V <sub>DD</sub> and V <sub>S1</sub>	C <sub>3</sub> or C <sub>4</sub> *1		0.1			μF

\*1: Depends on the LCD specification.

#### E0C60L09

(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	-1.8	-1.5	-1.2	V
Oscillation frequency	f <sub>osc</sub>	Crystal oscillation		32.768		kHz
		CR oscillation, R <sub>CR</sub> =475kΩ		65	80	kHz
Booster capacitor	C <sub>1</sub>		0.1			μF
Capacitor between V <sub>DD</sub> and V <sub>S1</sub>	C <sub>3</sub> or C <sub>4</sub> *1		0.1			μF

\*1: Depends on the LCD specification.

## ● DC Characteristics

### E0C6009

(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,  $C_1-C_4=0.1\mu F$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage (1)	$V_{IH1}$	K00-03, P00-03, P10-13	$0.2 \cdot V_{SS}$		0	V
High level input voltage (2)	$V_{IH2}$	RESET, TEST	$0.1 \cdot V_{SS}$		0	V
Low level input voltage (1)	$V_{IL1}$	K00-03, P00-03, P10-13	$V_{SS}$		$0.8 \cdot V_{SS}$	V
Low level input voltage (2)	$V_{IL2}$	RESET, TEST	$V_{SS}$		$0.9 \cdot V_{SS}$	V
High level input current (1)	$I_{IH1}$	$V_{IH1}=0V$ , No pull-down	0		0.5	$\mu A$
High level input current (2)	$I_{IH2}$	$V_{IH2}=0V$ , Pull-down	4		40	$\mu A$
High level input current (3)	$I_{IH3}$	$V_{IH3}=0V$ , Pull-down	50		200	$\mu A$
Low level input current	$I_{IL}$	$V_{IL}=V_{SS}$	-0.5		0	$\mu A$
High level output current (1)	$I_{OH1}$	$V_{OH1}=0.1 \cdot V_{SS}$			-1.8	mA
High level output current (2)	$I_{OH2}$	$V_{OH2}=0.1 \cdot V_{SS}$			-0.9	mA
Low level output current (1)	$I_{OL1}$	$V_{OL1}=0.9 \cdot V_{SS}$	4.0			mA
Low level output current (2)	$I_{OL2}$	$V_{OL2}=0.9 \cdot V_{SS}$	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)	$I_{OH5}$	$V_{OH5}=0.1 \cdot V_{SS}$			-200	$\mu A$
	$I_{OL5}$	$V_{OL5}=0.9 \cdot V_{SS}$	200			$\mu A$

### E0C60L09

(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,  $C_1-C_4=0.1\mu F$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage (1)	$V_{IH1}$	K00-03, P00-03, P10-13	$0.2 \cdot V_{SS}$		0	V
High level input voltage (2)	$V_{IH2}$	RESET, TEST	$0.1 \cdot V_{SS}$		0	V
Low level input voltage (1)	$V_{IL1}$	K00-03, P00-03, P10-13	$V_{SS}$		$0.8 \cdot V_{SS}$	V
Low level input voltage (2)	$V_{IL2}$	RESET, TEST	$V_{SS}$		$0.9 \cdot V_{SS}$	V
High level input current (1)	$I_{IH1}$	$V_{IH1}=0V$ , No pull-down	0		0.5	$\mu A$
High level input current (2)	$I_{IH2}$	$V_{IH2}=0V$ , Pull-down	2		16	$\mu A$
High level input current (3)	$I_{IH3}$	$V_{IH3}=0V$ , Pull-down	25		100	$\mu A$
Low level input current	$I_{IL}$	$V_{IL}=V_{SS}$	-0.5		0	$\mu A$
High level output current (1)	$I_{OH1}$	$V_{OH1}=0.1 \cdot V_{SS}$			-300	$\mu A$
High level output current (2)	$I_{OH2}$	$V_{OH2}=0.1 \cdot V_{SS}$			-150	$\mu A$
Low level output current (1)	$I_{OL1}$	$V_{OL1}=0.9 \cdot V_{SS}$	1400			$\mu A$
Low level output current (2)	$I_{OL2}$	$V_{OL2}=0.9 \cdot V_{SS}$	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	$\mu A$
	$I_{OL5}$	$V_{OL5}=0.9 \cdot V_{SS}$	100			$\mu A$

# E0C6009

## ● Analog Circuit Characteristics and Current Consumption

### E0C6009 (Crystal Oscillation)

- 4.5 V LCD panel, 1/4, 1/3, 1/2 duty, 1/3 bias (VL2 is shorted to VSS inside the IC)

#### <Normal mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=32.768kHz, Ta=25°C, CG=25pF, Vs1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL2 - 0.1		1/2·VL2 ×0.9	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		VSS		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3/2·VL2 - 0.1		3/2·VL2 ×0.9	V
Current consumption	IOP	During HALT		1.0	2.5	μA
		During execution	Without panel load	2.5	5.0	μA

#### <Heavy load protection mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=32.768kHz, Ta=25°C, CG=25pF, Vs1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL2 - 0.1		1/2·VL2 ×0.85	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		VSS		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3/2·VL2 - 0.1		3/2·VL2 ×0.85	V
Current consumption	IOP	During HALT		2.0	5.5	μA
		During execution	Without panel load	5.5	10.0	μA

- 3 V LCD panel, 1/4, 1/3, 1/2 duty, 1/2 bias (VL3 is shorted to VSS inside the IC and VL1 is shorted to VL2 outside the IC)

#### <Normal mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=32.768kHz, Ta=25°C, CG=25pF, Vs1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.9	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.9	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)		VSS		V
Current consumption	IOP	During HALT		1.0	2.5	μA
		During execution	Without panel load	2.5	5.0	μA

#### <Heavy load protection mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=32.768kHz, Ta=25°C, CG=25pF, Vs1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.85	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.85	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)		VSS		V
Current consumption	IOP	During HALT		2.0	5.5	μA
		During execution	Without panel load	5.5	10.0	μA

**E0C60L09 (Crystal Oscillation)**

- **4.5 V LCD panel, 1/4, 1/3, 1/2 duty, 1/3 bias** (VL1 is shorted to Vss inside the IC)

**<Normal mode>**

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=32.768kHz, Ta=25°C, CG=25pF, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.9	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3·VL1 - 0.1		3·VL1 ×0.9	V
Current consumption	IOP	During HALT	Without panel load	1.0	2.5	μA
		During execution	panel load	2.5	5.0	μA

**<Heavy load protection mode>**

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=32.768kHz, Ta=25°C, CG=25pF, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.85	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3·VL1 - 0.1		3·VL1 ×0.85	V
Current consumption	IOP	During HALT	Without panel load	2.0	5.5	μA
		During execution	panel load	5.5	10.0	μA

- **3 V LCD panel, 1/4, 1/3, 1/2 duty, 1/2 bias** (VL1 is shorted to Vss inside the IC and VL1 is shorted to VL2 outside the IC)

**<Normal mode>**

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=32.768kHz, Ta=25°C, CG=25pF, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		Vss		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.9	V
Current consumption	IOP	During HALT	Without panel load	1.0	2.5	μA
		During execution	panel load	2.5	5.0	μA

**<Heavy load protection mode>**

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=32.768kHz, Ta=25°C, CG=25pF, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		Vss		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.85	V
Current consumption	IOP	During HALT	Without panel load	2.0	5.5	μA
		During execution	panel load	5.5	10.0	μA

# E0C6009

## E0C6009 (CR Oscillation)

- 4.5 V LCD panel, 1/4, 1/3, 1/2 duty, 1/3 bias (VL2 is shorted to VSS inside the IC)

### <Normal mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL2 - 0.1		1/2·VL2 ×0.9	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		VSS		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3/2·VL2 - 0.1		3/2·VL2 ×0.9	V
Current consumption	IOP	During HALT	Without panel load	8.0	15.0	μA
		During execution		15.0	20.0	μA

### <Heavy load protection mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL2 - 0.1		1/2·VL2 ×0.85	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		VSS		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3/2·VL2 - 0.1		3/2·VL2 ×0.85	V
Current consumption	IOP	During HALT	Without panel load	16.0	30.0	μA
		During execution		30.0	40.0	μA

- 3 V LCD panel, 1/4, 1/3, 1/2 duty, 1/2 bias (VL3 is shorted to VSS inside the IC and VL1 is shorted to VL2 outside the IC)

### <Normal mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C3=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.9	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.9	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)		VSS		V
Current consumption	IOP	During HALT	Without panel load	8.0	15.0	μA
		During execution		15.0	20.0	μA

### <Heavy load protection mode>

(Unless otherwise specified: VDD=0V, VSS=-3.0V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C3=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.85	V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	1/2·VL3 - 0.1		1/2·VL3 ×0.85	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)		VSS		V
Current consumption	IOP	During HALT	Without panel load	16.0	30.0	μA
		During execution		30.0	40.0	μA



## E0C60L09 (CR Oscillation)

- 4.5 V LCD panel, 1/4, 1/3, 1/2 duty, 1/3 bias (VL1 is shorted to Vss inside the IC)

## &lt;Normal mode&gt;

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.9	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3·VL1 - 0.1		3·VL1 ×0.9	V
Current consumption	IOP	During HALT	Without panel load	8.0	15.0	μA
		During execution	panel load	15.0	20.0	μA

## &lt;Heavy load protection mode&gt;

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C4=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.85	V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	3·VL1 - 0.1		3·VL1 ×0.85	V
Current consumption	IOP	During HALT	Without panel load	16.0	30.0	μA
		During execution	panel load	30.0	40.0	μA

- 3 V LCD panel, 1/4, 1/3, 1/2 duty, 1/2 bias (VL1 is shorted to Vss inside the IC and VL1 is shorted to VL2 outside the IC)

## &lt;Normal mode&gt;

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C3=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		Vss		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.9	V
Current consumption	IOP	During HALT	Without panel load	8.0	15.0	μA
		During execution	panel load	15.0	20.0	μA

## &lt;Heavy load protection mode&gt;

(Unless otherwise specified: VDD=0V, VSS=-1.5V, fosc=65kHz, Ta=25°C, VS1/VL1-VL3 are internal voltage, C1-C3=0.1μF, RCR=475kΩ)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1 MΩ load resistor between VDD and VL1 (without panel load)		Vss		V
	VL2	Connect 1 MΩ load resistor between VDD and VL2 (without panel load)		Vss		V
	VL3	Connect 1 MΩ load resistor between VDD and VL3 (without panel load)	2·VL1 - 0.1		2·VL1 ×0.85	V
Current consumption	IOP	During HALT	Without panel load	16.0	30.0	μA
		During execution	panel load	30.0	40.0	μA

# E0C6009

## ● Oscillation Characteristics

Oscillation characteristics will vary according to different conditions (elements used, board pattern). Use the following characteristics as reference values.

### E0C6009 Crystal Oscillation

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-3.0V$ ,  $f_{osc}=32.768kHz$ , 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	Vsta	$t_{sta} \leq 5sec (V_{SS})$	-2.6			V
Oscillation stop voltage	Vstp	$t_{stp} \leq 10sec (V_{SS})$	-2.6			V
Built-in capacitance (drain)	$C_D$	Including the parasitic capacitance inside the chip		20		pF
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-2.6$ 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 $25pF$	35	45		ppm
Harmonic oscillation start voltage	Vhho	( $V_{SS}$ )			-3.6	V
Permitted leak resistance	Rleak	Between OSC1 and $V_{DD}$ , $V_{SS}$	200			M $\Omega$

### E0C60L09 Crystal Oscillation

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-1.5V$ ,  $f_{osc}=32.768kHz$ , 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	Vsta	$t_{sta} \leq 5sec (V_{SS})$	-1.2			V
Oscillation stop voltage	Vstp	$t_{stp} \leq 10sec (V_{SS})$	-1.2			V
Built-in capacitance (drain)	$C_D$	Including the parasitic capacitance inside the chip		20		pF
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-1.2$ to $-1.8V$			5	ppm
Frequency/IC deviation	$\partial f/\partial IC$		-10		10	ppm
Frequency adjustment range	$\partial f/\partial C_G$	$C_G=5$ to $25pF$	35	45		ppm
Harmonic oscillation start voltage	Vhho	( $V_{SS}$ )			-1.8	V
Permitted leak resistance	Rleak	Between OSC1 and $V_{DD}$ , $V_{SS}$	200			M $\Omega$

### E0C6009 CR Oscillation

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-3.0V$ ,  $R_{CR}=475k\Omega$ ,  $T_a=25^\circ C$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	fosc		45.5	65	84.5	kHz
Oscillation start time	tsta	$V_{SS}=-2.6$ to $-3.6V$			3	mS

### E0C60L09 CR Oscillation

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-1.5V$ ,  $R_{CR}=475k\Omega$ ,  $T_a=25^\circ C$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	fosc		45.5	65	84.5	kHz
Oscillation start time	tsta	$V_{SS}=-1.2$ to $-1.8V$			3	mS

#### 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

