EPSON

Micro MINI **E0C6004**

4-bit Single Chip Microcomputer

Low Voltage Operation Products

● E0C6200B Core CPU
● Low Voltage and Low Power
● High Speed Operation (2MHz)
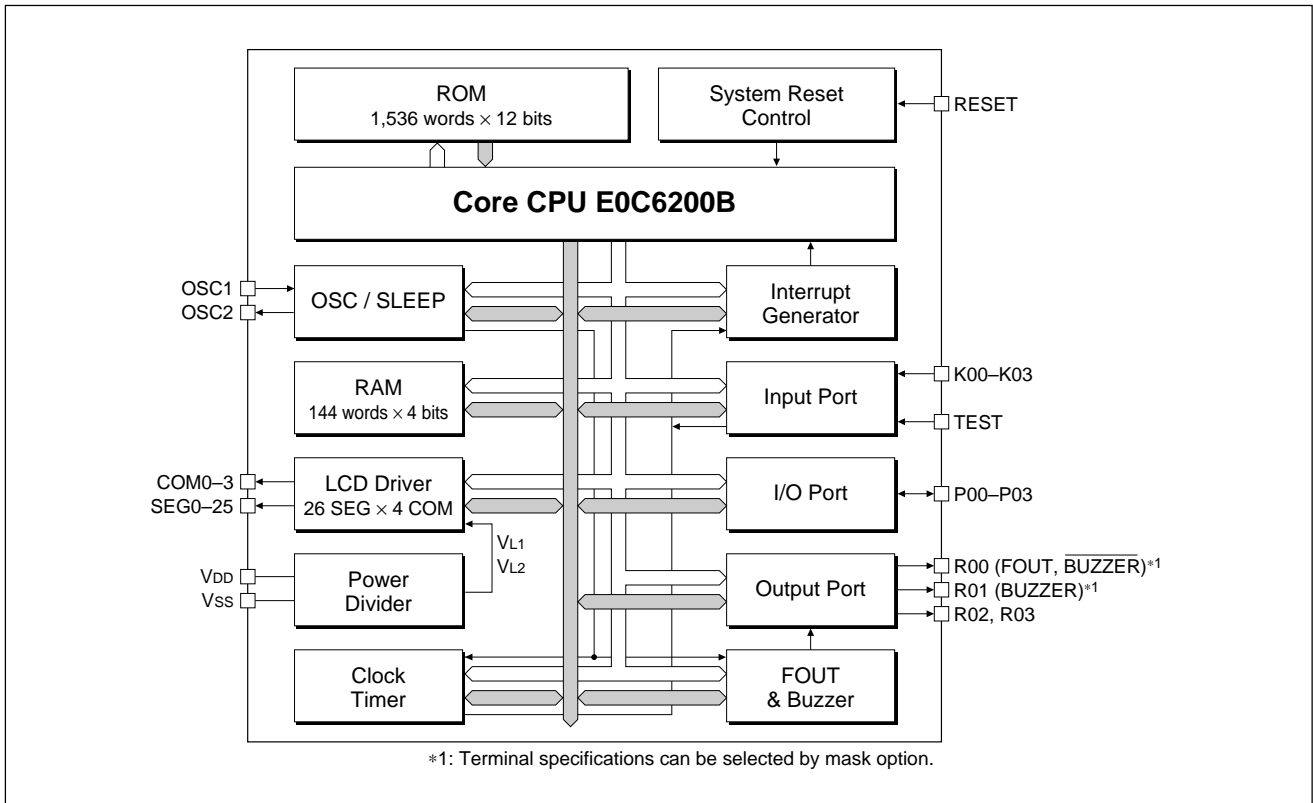● Low Cost Performance

■ DESCRIPTION

Micro MINI "E0C6004" 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 (26 segments × 4 commons), 144 words RAM, 1.5K words ROM, clock timer and so on.

■ FEATURES

● CMOS LSI 4-bit parallel processing

● Clock .... 2MHz (CR oscillation)

● Instruction set.. 100 instructions

● ROM capacity .... 1.5K × 12 bits

● RAM capacity .... 144 × 4 bits

● I/O port .... I: 4 bits (with pull-down resistor selectable by mask option)
                                                O: 4 bits (1 bit with 20mA drive)
                                                I/O: 4 bits

● LCD driver .... 26 segments × 4/3/2 commons

● Free running timer

● Interrupt .... External : Key interrupt   1 line
                                                 Internal : Timer interrupt   1 line

● Operation voltage .... 2.7 to 3.6V
                                                4.5 to 5.5V

● Power consumption .... 100nA (2MHz CR, 3.0V, SLEEP)
                                                100nA (2MHz CR, 5.0V, SLEEP)
                                                330µA (2MHz CR, 3.0V, HALT)
                                                1000µA (2MHz CR, 5.0V, HALT, LCDON)
                                                450µA (2MHz CR, 3.0V, RUN)
                                                1100µA (2MHz CR, 5.0V, RUN, LCDON)

● Package .... Die form (pad pitch = 130µm) or QFP12-48pin

■ BLOCK DIAGRAM

∗1: Terminal specifications can be selected by mask option.

■ PIN CONFIGURATION
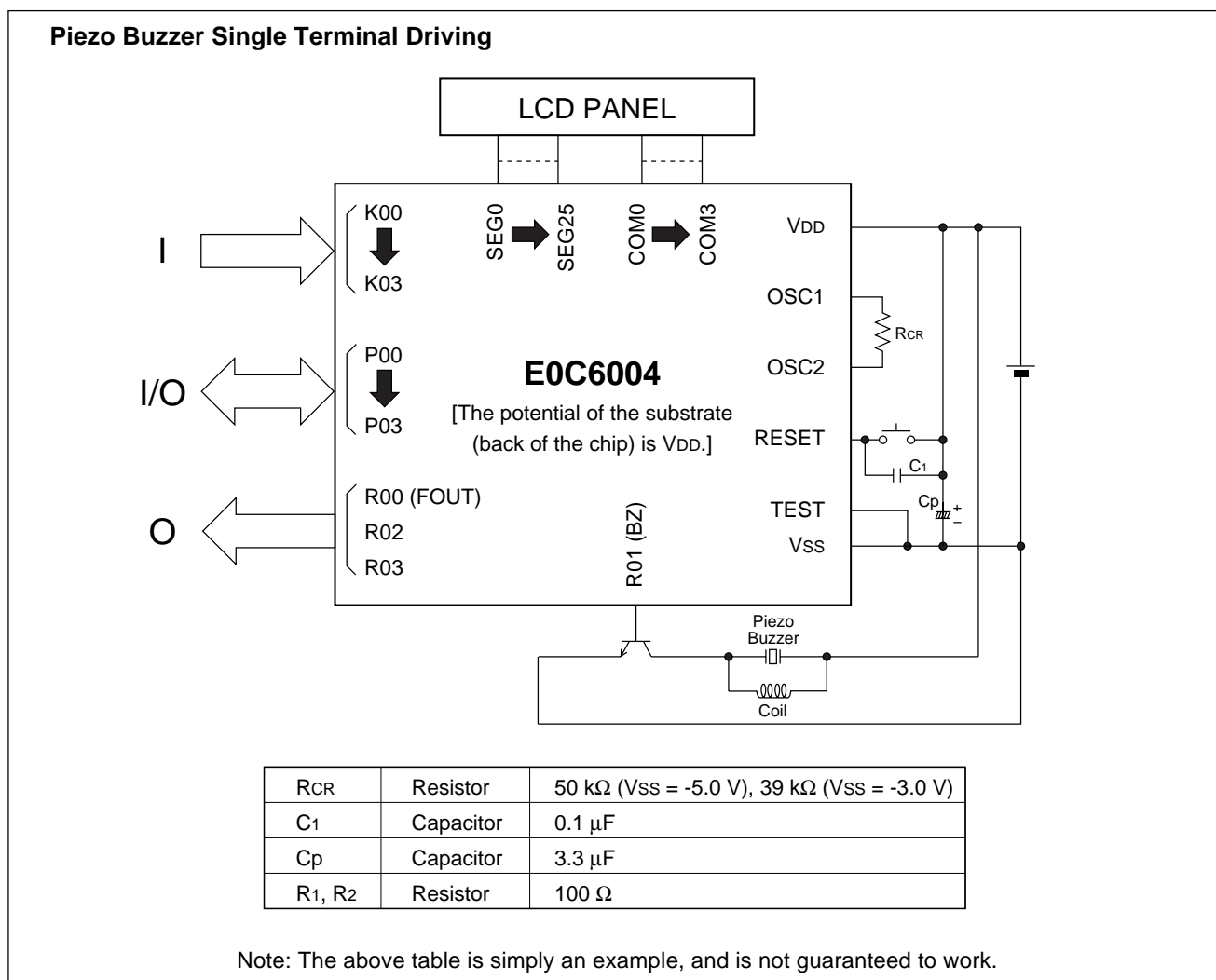
QFP12-48pin

E0C6004

INDEX
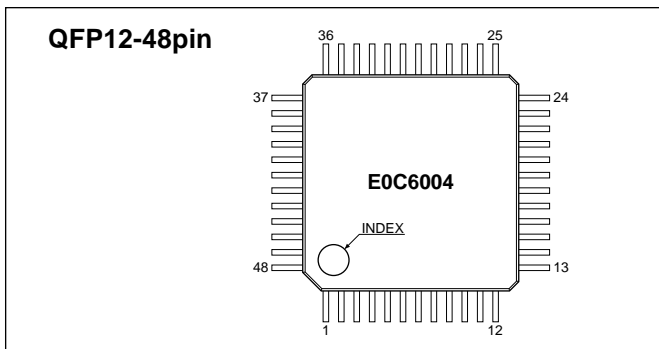
No.	Pin name	No.	Pin name	No.	Pin name	No.	Pin name
1	K02	13	SEG24	25	SEG12	37	SEG0
2	K01	14	SEG23	26	SEG11	38	COM0
3	K00	15	SEG22	27	SEG10	39	COM1
4	P03	16	SEG21	28	SEG9	40	COM2
5	P02	17	SEG20	29	SEG8	41	COM3
6	P01	18	SEG19	30	SEG7	42	TEST
7	P00	19	SEG18	31	SEG6	43	RESET
8	R03	20	SEG17	32	SEG5	44	V_{DD}
9	R02	21	SEG16	33	SEG4	45	OSC1
10	R01	22	SEG15	34	SEG3	46	OSC2
11	R00	23	SEG14	35	SEG2	47	V_{SS}
12	SEG25	24	SEG13	36	SEG1	48	K03

■ PIN DESCRIPTION

Pin name	Pin No.	I/O	Function
V_{DD}	44	(I)	Power supply pin (+)
V_{SS}	47	(I)	Power supply pin (-)
OSC1	45	I	CR oscillation input pin
OSC2	46	O	CR oscillation output pin
K00–K03	3–1, 48	I	Input port pin
P00–P03	7–4	I/O	I/O port pin
R00	11	O	Output port pin, $\overline{BUZZER}$ or FOUT output pin ∗
R01	10	O	Output port pin or BUZZER output pin ∗
R02, R03	9, 8	O	Output port pin
SEG0–25	37–12	O	LCD segment output pin or DC output pin ∗
COM0–3	38–41	O	LCD common output pin (1/4 duty, 1/3 or 1/2 duty are selectable ∗)
RESET	43	I	Initial reset input pin
TEST	42	I	Input pin for test

∗ Can be selected by mask option

EPSON

■ BASIC EXTERNAL CONNECTION DIAGRAM

Piezo Buzzer Single Terminal Driving

R_{CR}	Resistor	50 kΩ (V_{SS} = -5.0 V), 39 kΩ (V_{SS} = -3.0 V)
C_1	Capacitor	0.1 µF
C_p	Capacitor	3.3 µF
R_1, R_2	Resistor	100 Ω

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}	-7.0 to 0.5	V
Input voltage (1)	V_I	V_{SS} - 0.3 to 0.5	V
Input voltage (2)	V_{IOSC}	V_{S1} - 0.3 to 0.5	V
Permissible total output current *1	ΣI_{VSS}	40	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 (QFP12-48pin).

● Recommended Operating Conditions

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V_{SS}	3 V system, V_{DD}=0V	-3.6	-3.0	-2.7	V
		5 V system, V_{DD}=0V	-5.5	-5.0	-4.5	V
Oscillation frequency	f_{OSC}	CR oscillation, R_{CR}=50kΩ, V_{SS}=-5V		2		MHz

E0C6004

● DC Characteristics

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-5.0V$, $fosc=2MHz$, $Ta=25°C$)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}		K00–03, P00–03	$0.2 \cdot V_{SS}$		0	V
High level input voltage (2)	V_{IH2}		RESET	$0.1 \cdot V_{SS}$		0	V
Low level input voltage (1)	V_{IL1}		K00–03, P00–03	V_{SS}		$0.8 \cdot V_{SS}$	V
Low level input voltage (2)	V_{IL2}		RESET	V_{SS}		$0.9 \cdot V_{SS}$	V
High level input current (1)	I_{IH1}	$V_{IH1}=0V$, No pull-down	K00–03, P00–P03	0		0.5	μA
High level input current (2)	I_{IH2}	$V_{IH2}=0V$, Pull-down	K00–03	20	40	70	μA
High level input current (3)	I_{IH3}	$V_{IH3}=0V$, Pull-down	P00–03, RESET	50	100	150	μA
Low level input current	I_{IL}	$V_{IL}=V_{SS}$	K00–03, P00–03, RESET, TEST	-0.5		0	μA
High level output current (1)	I_{OH1}	$V_{OH1}=0.1 \cdot V_{SS}$	R02, R03, P00–03			-3.0	mA
High level output current (2)	I_{OH2}	$V_{OH2}=0.1 \cdot V_{SS}$ (with protection resistor)	R00, R01			-3.0	mA
High level output current (3)	I_{OH3}	$V_{OH3}=0.1 \cdot V_{SS}$, $V_{SS}=-4.5V$	R03			-15	mA
Low level output current (1)	I_{OL1}	$V_{OL1}=0.9 \cdot V_{SS}$	R02, R03, P00–03	3.0			mA
Low level output current (2)	I_{OL2}	$V_{OL2}=0.9 \cdot V_{SS}$ (with protection resistor)	R00, R01	3.0			mA
Common output current	I_{OH4}	$V_{OH4}=-0.05V$	COM0–3			-3	μA
	I_{OL4}	$V_{OL4}=V_{SS}+0.05V$		3			μA
Segment output current (during LCD output)	I_{OH5}	$V_{OH5}=-0.05V$	SEG0–25			-3	μA
	I_{OL5}	$V_{OL5}=V_{SS}+0.05V$		3			μA
Segment output current (during DC output)	I_{OH6}	$V_{OH6}=0.1 \cdot V_{SS}$	SEG0–25			-450	μA
	I_{OL6}	$V_{OL6}=0.9 \cdot V_{SS}$		450			μA

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $fosc=2MHz$, $Ta=25°C$)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}		K00–03, P00–03	$0.2 \cdot V_{SS}$		0	V
High level input voltage (2)	V_{IH2}		RESET	$0.1 \cdot V_{SS}$		0	V
Low level input voltage (1)	V_{IL1}		K00–03, P00–03	V_{SS}		$0.8 \cdot V_{SS}$	V
Low level input voltage (2)	V_{IL2}		RESET	V_{SS}		$0.9 \cdot V_{SS}$	V
High level input current (1)	I_{IH1}	$V_{IH1}=0V$, No pull-down	K00–03, P00–P03	0		0.5	μA
High level input current (2)	I_{IH2}	$V_{IH2}=0V$, Pull-down	K00–03	10	25	40	μA
High level input current (3)	I_{IH3}	$V_{IH3}=0V$, Pull-down	P00–03, RESET	30	60	100	μA
Low level input current	I_{IL}	$V_{IL}=V_{SS}$	K00–03, P00–03, RESET, TEST	-0.5		0	μA
High level output current (1)	I_{OH1}	$V_{OH1}=0.1 \cdot V_{SS}$	R02, R03, P00–03			-1.0	mA
High level output current (2)	I_{OH2}	$V_{OH2}=0.1 \cdot V_{SS}$ (with protection resistor)	R00, R01			-1.0	mA
High level output current (3)	I_{OH3}	$V_{OH3}=0.1 \cdot V_{SS}$, $V_{SS}=-2.7V$	R03			-5	mA
Low level output current (1)	I_{OL1}	$V_{OL1}=0.9 \cdot V_{SS}$	R02, R03, P00–03	3.0			mA
Low level output current (2)	I_{OL2}	$V_{OL2}=0.9 \cdot V_{SS}$ (with protection resistor)	R00, R01	3.0			mA
Common output current	I_{OH4}	$V_{OH4}=-0.05V$	COM0–3			-3	μA
	I_{OL4}	$V_{OL4}=V_{SS}+0.05V$		3			μA
Segment output current (during LCD output)	I_{OH5}	$V_{OH5}=-0.05V$	SEG0–25			-3	μA
	I_{OL5}	$V_{OL5}=V_{SS}+0.05V$		3			μA
Segment output current (during DC output)	I_{OH6}	$V_{OH6}=0.1 \cdot V_{SS}$	SEG0–25			-200	μA
	I_{OL6}	$V_{OL6}=0.9 \cdot V_{SS}$		200			μA

● Current Consumption

(Unless otherwise specified: $V_{DD}=0V$, $fosc=2MHz$, $Ta=25°C$)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Current consumption	I_{SLP2}	During SLEEP, LCD off	$V_{SS}=-3.0V$ no panel load $R_{CR}=39k\Omega$			100	nA
	I_{HALT2}	During HALT, LCD off			300	800	μA
	I_{HALT4}	During HALT, LCD on			330	800	μA
	I_{EXE2}	During operation, LCD off			420	1000	μA
	I_{EXE4}	During operation, LCD on			450	1000	μA
	I_{SLP1}	During SLEEP, LCD off	$V_{SS}=-5.0V$ no panel load $R_{CR}=50k\Omega$			100	nA
	I_{HALT1}	During HALT, LCD off			950	1500	μA
	I_{HALT3}	During HALT, LCD on			1000	1500	μA
	I_{EXE1}	During operation, LCD off			1050	1800	μA
	I_{EXE3}	During operation, LCD on			1100	1800	μA

EPSON

● **Oscillation Characteristics**

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

CR Oscillation

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-5.0V, R_{CR}=50kΩ, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Frequency voltage dispersion	$\Delta f/\Delta V_1$	V_{SS}=-4.5 to -5.5V			20	%
Frequency IC dispersion	$\Delta f/\Delta IC_1$	V_{SS}=-5V	-20	(2MHz)	20	%
Oscillation start time	t_{sta}	V_{SS}=-4.5 to -5.5V		3		mS

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, R_{CR}=39kΩ, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Frequency voltage dispersion	$\Delta f/\Delta V_1$	V_{SS}=-2.7 to -3.6V			30	%
Frequency IC dispersion	$\Delta f/\Delta IC_1$	V_{SS}=-3V	-20	(2MHz)	20	%
Oscillation start time	t_{sta}	V_{SS}=-2.7 to -3.6V		3		mS