

E0C63B07

4-bit Single Chip Microcomputer



- 4-bit Low Cycle / Inst. Core CPU
- Built-in 7 Segment Type LCD Driver
- Low Voltage Operation (0.9V Min.)
- Built-in Gate Array

■ DESCRIPTION

The E0C63B07 is a CMOS 4-bit microcomputer composed of a CMOS 4-bit core CPU, ROM, RAM, 7 segment type LCD driver, 10000 gates of gate array and counters. And the E0C63B07 can be operated by single Manganese battery with LCD display. So that the E0C63B07 is best suited for systems such as numeric pager.

■ FEATURES

- CMOS LSI 4-bit parallel processing
- OSC1 oscillation circuit 32.768/76.8/153.6kHz (Typ.) Crystal oscillation circuit (*1)
- OSC3 oscillation circuit 400kHz (Max.) CR oscillation circuit, Operatable in 0.9V
- Instruction set Basic instruction : 46 types (411 instructions with all)
Addressing mode : 8 types
- Instruction execution time

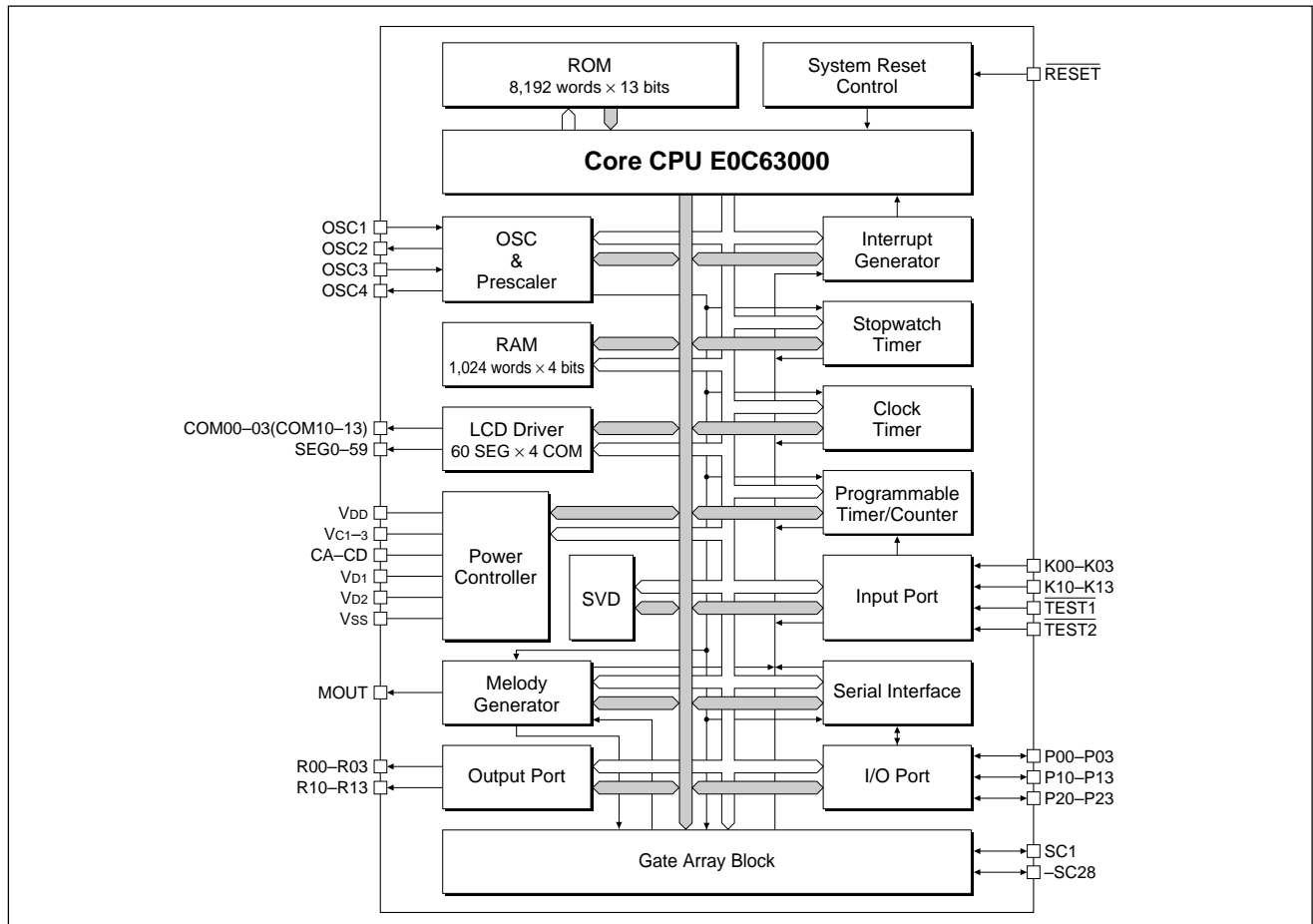
During operation at 32.768kHz :	61μsec	122μsec	183μsec
During operation at 76.8kHz :	26μsec	52μsec	78μsec
During operation at 153.6kHz :	13μsec	26μsec	39μsec
During operation at 400kHz :	5μsec	10μsec	15μsec
- ROM capacity Code ROM: 8,192 words × 13 bits
- RAM capacity Data memory : 1,024 words × 4 bits
Display memory : 60 words × 4 bits
- Input port 8 bits (Pull-up resistors may be supplemented *1)
- Output port 8 bits (It is possible to switch the 2 bits to special output *2)
- I/O port 12 bits (It is possible to switch the 4 bits to serial input/output *2)
- Serial interface 1 port (8-bit clock synchronous system)
- LCD driver 60 segments × 4, 3 or 2 commons (*2) 1/3 or 1/2 bias drive (*1)
- Time base counter 2 systems (Clock timer, stopwatch timer)
- Programmable timer Built-in, 2 inputs × 8 bits, with event counter function
- Watchdog timer Built-in
- Gate array SOG : 10,000 gates
Number of terminals : 28 bits
CPU interface : Bus interface
- Melody generator Equivalent to SVM7100M Series
Maximum 16 melodies
Melody ROM capacity : 495 words
(words can be optionally arranged for each melody)
Address control ROM : 80 words
(words can be optionally arranged for each melody)
Play output waveform : Single sound square wave
- Supply voltage detection (SVD) circuit .. 16 values, programmable (1.05V to 2.60V)
- External interrupt Input port interrupt : 2 systems

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- Internal interrupt Clock timer interrupt : 4 systems
 Stopwatch timer interrupt : 2 systems
 Programmable timer interrupt : 2 systems
 Serial interface interrupt : 1 system
 Gate array interrupt : 4 systems
 Melody interrupt : 1 system
- Power supply voltage 0.9V to 3.6V
- Operating temperature range -20°C to 70°C
- Current consumption (Typ.) Single clock:
 - During HALT (32kHz)
 - 1.5V (normal mode, LCD power OFF) 1.2μA
 - 1.5V (normal mode, LCD power ON) 2.0μA
 - 3.0V (halver mode, LCD power ON) 1.5μA
 - During operation (32kHz)
 - 1.5V (normal mode, LCD power ON) 6.0μA
 - 3.0V (halver mode, LCD power ON) 3.5μA
 - Twin clock:
 - During operation (400kHz)
 - 3.0V (normal mode, LCD power ON) 85μA
- Package QFP8-160pin (plastic) or chip

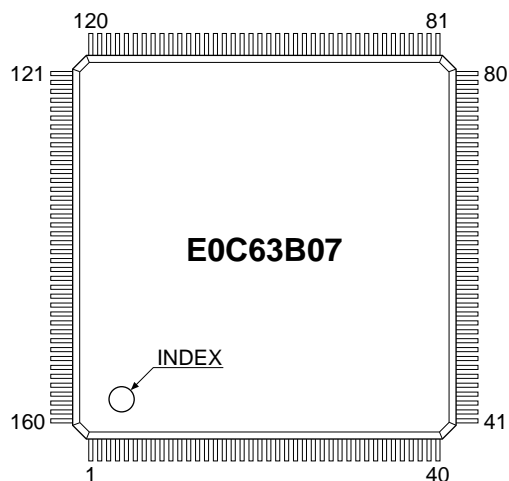
*1: Can be selected with mask option *2: Can be selected with software

■ BLOCK DIAGRAM



■ PIN CONFIGURATION

QFP8-160pin



No.	Name	No.	Name	No.	Name	No.	Name
1	K10	41	P03	81	R01	121	N.C.
2	N.C.	42	P02	82	R02	122	N.C.
3	K03	43	P01	83	R03	123	N.C.
4	K02	44	P00	84	R10	124	SEG29
5	K01	45	COM13	85	R11	125	SEG28
6	K00	46	COM12	86	R12	126	SEG27
7	N.C.	47	COM11	87	R13	127	SEG26
8	N.C.	48	COM10	88	SC1	128	SEG25
9	N.C.	49	SEG30	89	SC2	129	SEG24
10	N.C.	50	SEG31	90	SC3	130	SEG23
11	N.C.	51	SEG32	91	SC4	131	SEG22
12	CA	52	SEG33	92	SC5	132	SEG21
13	CB	53	SEG34	93	SC6	133	SEG20
14	CC	54	SEG35	94	SC7	134	SEG19
15	CD	55	SEG36	95	SC8	135	SEG18
16	Vc3	56	SEG37	96	SC9	136	SEG17
17	Vc2	57	SEG38	97	SC10	137	SEG16
18	Vc1	58	SEG39	98	SC11	138	SEG15
19	Vd2	59	SEG40	99	SC12	139	SEG14
20	Vss	60	SEG41	100	SC13	140	SEG13
21	OSC1	61	SEG42	101	SC14	141	SEG12
22	OSC2	62	SEG43	102	SC15	142	SEG11
23	Vd1	63	SEG44	103	SC16	143	SEG10
24	OSC3	64	SEG45	104	SC17	144	SEG9
25	OSC4	65	SEG46	105	SC18	145	SEG8
26	VDD	66	SEG47	106	SC19	146	SEG7
27	RESET	67	SEG48	107	SC20	147	SEG6
28	TEST2	68	SEG49	108	SC21	148	SEG5
29	TEST1	69	SEG50	109	SC22	149	SEG4
30	MOUT	70	SEG51	110	SC23	150	SEG3
31	P23	71	SEG52	111	SC24	151	SEG2
32	P22	72	SEG53	112	SC25	152	SEG1
33	P21	73	SEG54	113	SC26	153	SEG0
34	P20	74	SEG55	114	SC27	154	COM03
35	P13	75	SEG56	115	SC28	155	COM02
36	P12	76	SEG57	116	N.C.	156	COM01
37	P11	77	SEG58	117	N.C.	157	COM00
38	P10	78	SEG59	118	N.C.	158	K13
39	N.C.	79	N.C.	119	N.C.	159	K12
40	N.C.	80	R00	120	N.C.	160	K11

N.C. : No Connection

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■ PIN DESCRIPTION

Signal name	Pin No.	In/Out	Function
V _{DD}	26	–	Power (+) supply
V _{SS}	20	–	Power (–) supply
V _{D1}	23	–	Oscillation/internal logic system regulated voltage output
V _{D2}	19	–	Supply voltage doubler/halver output
V _{C1} –V _{C3}	18–16	–	LCD system power supply 1/3 or 1/2 bias (selected by mask option)
CA, CB	12, 13	–	LCD system boosting/reducing capacitor connecting
CC, CD	14, 15	–	Supply voltage doubling/halving capacitor connecting
OSC1	21	I	Crystal oscillation input
OSC2	22	O	Crystal oscillation output
OSC3	24	I	CR oscillation input
OSC4	25	O	CR oscillation output
K00–K03	6–3	I	Input port
K10–K13	1, 160–158	I	Input port
P00–P03	44–41	I/O	I/O port
P10–P13	38–35	I/O	I/O port (switching to serial I/F input/output is possible by software)
P20–P23	34–31	I/O	I/O port
R00	80	O	Output port
R01	81	O	Output port
R02	82	O	Output port (switching to TOUT output is possible by software)
R03	83	O	Output port (switching to FOUT output is possible by software)
R10–R13	84–87	O	Output port
COM00–COM03 COM10–COM13	157–154 48–45	O	LCD common output (1/4, 1/3, 1/2 duty can be selected by software)
SEG0–SEG59	153–124, 49–78	O	LCD segment output
MOUT	30	O	Melody output
SC1–SC28	88–115	I, O, I/O	G/A input/output
RESET	27	I	Initial reset input
TEST1	29	I	Testing input
TEST2	28	I	Testing input

■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(V_{SS}=0V)

Rating	Symbol	Value	Unit
Supply voltage	V _{DD}	-0.5 to 7.0	V
Input voltage (1)	V _I	-0.5 to V _{DD} + 0.3	V
Input voltage (2)	V _I osc	-0.5 to V _{D1} + 0.3	V
Permissible total output current *1	ΣI _{VDD}	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 (QFP8-160pin).

● Recommended Operating Conditions

(T_a=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit	
Supply voltage	V _{DD}	V _{SS} =0V	Doubler mode (OSC3 OFF)	0.9	1.1	1.25	V
			Doubler mode (OSC3 ON)	0.9	1.1	2.2	V
			Normal mode (OSC3 OFF)	1.25	3.0	3.6	V
			Normal mode (OSC3 ON)	2.2	3.0	3.6	V
			Halver mode (OSC3 OFF)	2.5	3.0	3.6	V
Oscillation frequency	fosc1	Any one is selected	–	32.768	–	kHz	
			–	76.8	–	kHz	
			–	153.6	–	kHz	
	fosc3	Duty 50±5%, VDC="1"	50	–	400	kHz	

● DC Characteristics

(Unless otherwise specified: $V_{DD}=1.5V$, $V_{SS}=0V$, $f_{osc1}=32.768kHz$, $T_a=25^{\circ}C$, $V_{D1}/V_{C1}/V_{C2}/V_{C3}$ are internal voltage, $C_1-C_5=0.2\mu F$, $C_6-C_7=0.4\mu F$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}	K00-03, K10-13 P00-03, P10-13, P20-23	$0.8 \cdot V_{DD}$		V_{DD}	V
High level input voltage (2)	V_{IH2}	RESET, TEST1, TEST2	$0.9 \cdot V_{DD}$		V_{DD}	V
Low level input voltage (1)	V_{IL1}	K00-03, K10-13 P00-03, P10-13, P20-23	0		$0.2 \cdot V_{DD}$	V
Low level input voltage (2)	V_{IL2}	RESET, TEST1, TEST2	0		$0.1 \cdot V_{DD}$	V
High level input current	I_{IH}	$V_{IH}=1.5V$ K00-03, K10-13 P00-03, P10-13, P20-23 RESET, TEST1, TEST2	0		0.5	μA
Low level input current (1)	I_{IL1}	$V_{IL1}=V_{SS}$ No pull-up K00-03, K10-13 P00-03, P10-13, P20-23 RESET, TEST1, TEST2	-0.5		0	μA
Low level input current (2)	I_{IL2}	$V_{IL2}=V_{SS}$ With pull-up K00-03, K10-13 P00-03, P10-13, P20-23 RESET, TEST1, TEST2	-8	-5	-3	μA
High level output current (1)	I_{OH1}	$V_{OH1}=0.9 \cdot V_{DD}$ R00-03, R10-13 P00-03, P10-13, P20-23			-0.3	mA
High level output current (2)	I_{OH2}	$V_{OH2}=0.9 \cdot V_{DD}$ MOUT			-0.3	mA
Low level output current (1)	I_{OL1}	$V_{OL1}=0.1 \cdot V_{DD}$ R00-03, R10-13 P00-03, P10-13, P20-23	0.7			mA
Low level output current (2)	I_{OL2}	$V_{OL2}=0.1 \cdot V_{DD}$ BZ	0.7			mA
Common output current	I_{OH3}	$V_{OH3}=V_{C3}-0.05V$ COM0-COM3(10-13)			-10	μA
	I_{OL3}	$V_{OL3}=V_{SS}+0.05V$	10			μA
Segment output current (during LCD output)	I_{OH4}	$V_{OH4}=V_{C3}-0.05V$ SEG0-SEG59			-10	μA
	I_{OL4}	$V_{OL4}=V_{SS}+0.05V$	10			μA
Segment output current (during DC output)	I_{OH5}	$V_{OH5}=0.9 \cdot V_{DD}$ SEG0-SEG59			-100	μA
	I_{OL5}	$V_{OL5}=0.1 \cdot V_{DD}$	100			μA

(Unless otherwise specified: $V_{DD}=3.0V$, $V_{SS}=0V$, $f_{osc1}=32.768kHz$, $T_a=25^{\circ}C$, $V_{D1}/V_{C1}/V_{C2}/V_{C3}$ are internal voltage, $C_1-C_5=0.2\mu F$, $C_6-C_7=0.4\mu F$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}	K00-03, K10-13 P00-03, P10-13, P20-23	$0.8 \cdot V_{DD}$		V_{DD}	V
High level input voltage (2)	V_{IH2}	RESET, TEST1, TEST2	$0.9 \cdot V_{DD}$		V_{DD}	V
Low level input voltage (1)	V_{IL1}	K00-03, K10-13 P00-03, P10-13, P20-23	0		$0.2 \cdot V_{DD}$	V
Low level input voltage (2)	V_{IL2}	RESET, TEST1, TEST2	0		$0.1 \cdot V_{DD}$	V
High level input current	I_{IH}	$V_{IH}=3.0V$ K00-03, K10-13 P00-03, P10-13, P20-23 RESET, TEST1, TEST2	0		0.5	μA
Low level input current (1)	I_{IL1}	$V_{IL1}=V_{SS}$ No pull-up K00-03, K10-13 P00-03, P10-13, P20-23 RESET, TEST1, TEST2	-0.5		0	μA
Low level input current (2)	I_{IL2}	$V_{IL2}=V_{SS}$ With pull-up K00-03, K10-13 P00-03, P10-13, P20-23 RESET, TEST1, TEST2	-16	-5	-6	μA
High level output current (1)	I_{OH1}	$V_{OH1}=0.9 \cdot V_{DD}$ R00-03, R10-13 P00-03, P10-13, P20-23			-1.5	mA
High level output current (2)	I_{OH2}	$V_{OH2}=0.9 \cdot V_{DD}$ MOUT			-1.5	mA
Low level output current (1)	I_{OL1}	$V_{OL1}=0.1 \cdot V_{DD}$ R00-03, R10-13 P00-03, P10-13, P20-23	6			mA
Low level output current (2)	I_{OL2}	$V_{OL2}=0.1 \cdot V_{DD}$ BZ	6			mA
Common output current	I_{OH3}	$V_{OH3}=V_{C3}-0.05V$ COM0-COM3(10-13)			-10	μA
	I_{OL3}	$V_{OL3}=V_{SS}+0.05V$	10			μA
Segment output current (during LCD output)	I_{OH4}	$V_{OH4}=V_{C3}-0.05V$ SEG0-SEG59			-10	μA
	I_{OL4}	$V_{OL4}=V_{SS}+0.05V$	10			μA
Segment output current (during DC output)	I_{OH5}	$V_{OH5}=0.9 \cdot V_{DD}$ SEG0-SEG59			-300	μA
	I_{OL5}	$V_{OL5}=0.1 \cdot V_{DD}$	300			μA

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● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified: $V_{DD}=3.0V$, $V_{SS}=0V$, $f_{OSC1}=32.768kHz$, $C_G=25pF$, $T_a=25^{\circ}C$, $V_{D1}/V_{C1}-V_{C3}$ are internal voltage, $C_1-C_5=0.2\mu F$, $C_6-C_7=0.4\mu F$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit	
LCD drive voltage	V_{C1}	Connect $1M\Omega$ load resistor between V_{SS} and V_{C1} (No panel load)	0.95	1.05	1.15	V	
	V_{C2}	Connect $1M\Omega$ load resistor between V_{SS} and V_{C2} (No panel load)	$2 \cdot V_{C1}$ $\times 0.9$		$2 \cdot V_{C1}$ $+0.1$	V	
	V_{C3}	Connect $1M\Omega$ load resistor between V_{SS} and V_{C3} (No panel load)	$3 \cdot V_{C1}$ $\times 0.9$		$3 \cdot V_{C1}$ $+0.1$	V	
SVD voltage	V_{SVD}	SVDS0-3="0"	0.95	1.05	1.15	V	
		SVDS0-3="1"	1.05	1.10	1.15	V	
		SVDS0-3="2"	1.10	1.15	1.20	V	
		SVDS0-3="3"	1.15	1.20	1.25	V	
		SVDS0-3="4"	1.20	1.25	1.30	V	
		SVDS0-3="5"	1.25	1.30	1.35	V	
		SVDS0-3="6"	1.35	1.40	1.45	V	
		SVDS0-3="7"	1.55	1.60	1.65	V	
		SVDS0-3="8"	1.90	1.95	2.00	V	
		SVDS0-3="9"	1.95	2.00	2.05	V	
		SVDS0-3="10"	2.00	2.05	2.10	V	
		SVDS0-3="11"	2.05	2.10	2.15	V	
		SVDS0-3="12"	2.15	2.20	2.25	V	
		SVDS0-3="13"	2.25	2.30	2.35	V	
		SVDS0-3="14"	2.45	2.50	2.55	V	
SVDS0-3="15"	2.55	2.60	2.65	V			
SVD circuit response time	t_{SVD}				100	μS	
Current consumption	IOP	During HALT	32.768kHz		1.2	2.3	μA
		Normal mode	76.8kHz		1.8	3.0	μA
		LCD power OFF	153.6kHz		3.4	6.0	μA
		During HALT	32.768kHz		2.0	3.5	μA
		Normal mode *1	76.8kHz		2.7	4.5	μA
		LCD power ON	153.6kHz		4.3	7.5	μA
		During HALT	32.768kHz		4.8	8.0	μA
		Doubler mode ($V_{DD}=1.2V$) *1	76.8kHz		6.0	10.0	μA
		LCD power ON	153.6kHz		10.0	17.0	μA
		During HALT	32.768kHz		1.5	2.4	μA
		Halver mode ($V_{DD}=3.0V$) *1	76.8kHz		1.8	3.0	μA
		LCD power ON	153.6kHz		2.5	4.5	μA
		During execution	32.768kHz		6.0	10.0	μA
		Normal mode *1	76.8kHz		12.0	20.0	μA
		LCD power ON	153.6kHz		23.0	35.0	μA
			400kHz (CR oscillation)		85.0	130.0	μA
		During execution	32.768kHz		13.0	20.0	μA
		Doubler mode ($V_{DD}=1.2V$) *1	76.8kHz		25.0	40.0	μA
		LCD power ON	153.6kHz		45.0	70.0	μA
			400kHz (CR oscillation)		170.0	260.0	μA
		During execution	32.768kHz		3.5	6.0	μA
Halver mode ($V_{DD}=3.0V$) *1	76.8kHz		7.0	10.0	μA		
LCD power ON	153.6kHz		12.0	18.0	μA		

*1: No panel load. The SVD circuit is OFF.

● Oscillation Characteristics

The oscillation characteristics change depending on the conditions (components used, board pattern, etc.). Use the following characteristics as reference values.

OSC1 crystal oscillation circuit

(Unless otherwise specified: $V_{DD}=3.0V$, $V_{SS}=0V$, $f_{osc1}=32.768kHz$, $C_G=25pF$, $C_D=$ built-in, $T_a=25^\circ C$)

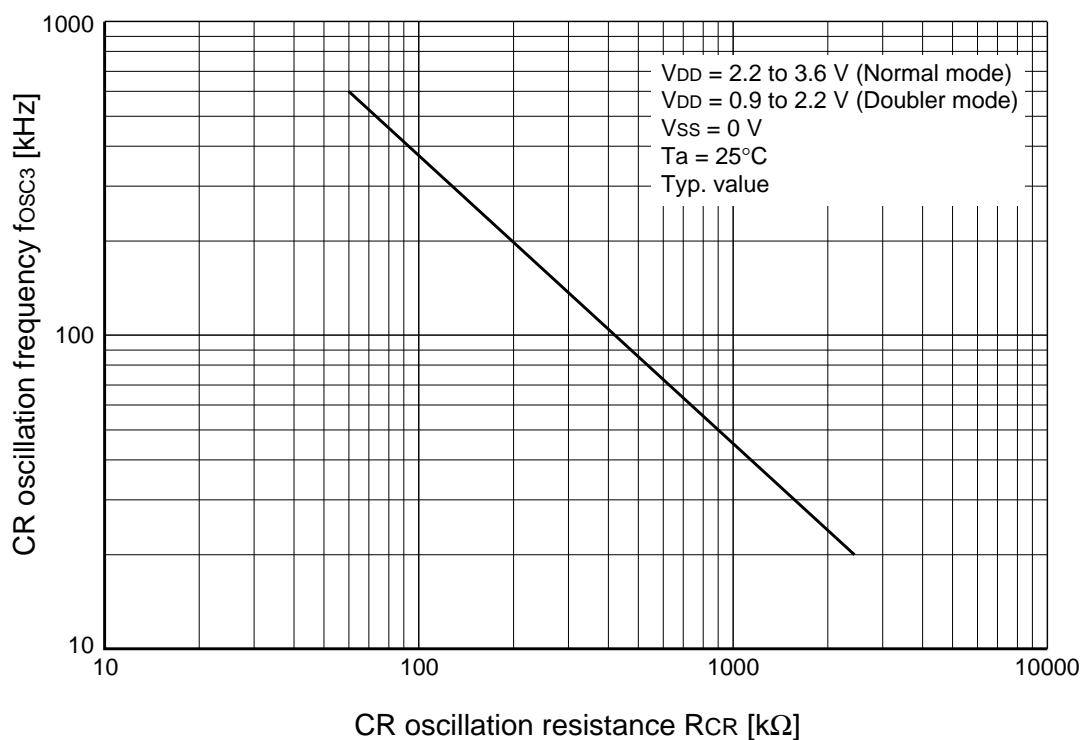
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	V_{sta}	$t_{sta} \leq 3sec (V_{DD})$	1.1			V
Oscillation stop voltage	V_{stp}	$t_{stp} \leq 10sec (V_{DD})$	Normal mode	1.1		V
			Doubler mode	0.9		V
Built-in capacitance (drain)	C_D	Including the parasitic capacity inside the IC (in chip)		14		pF
Frequency/voltage deviation	$\partial f/\partial V$	$V_{DD}=0.9$ to $3.6V$	with VDC switching		10	ppm
			without VDC switching		5	ppm
Frequency/IC deviation	$\partial f/\partial IC$		-10		10	ppm
Frequency adjustment range	$\partial f/\partial C_G$	$C_G=5$ to $25pF$	32.768kHz	30	40	ppm
			76.8kHz	20	25	ppm
			153.6kHz	8	10	ppm
Harmonic oscillation start voltage	V_{hho}	$C_G=5pF (V_{DD})$	3.6			V
Permitted leak resistance	R_{leak}	Between OSC1 and V_{DD} , V_{SS}	200			$M\Omega$

OSC3 CR oscillation circuit

(Unless otherwise specified: $V_{DD}=3.0V$, $V_{SS}=0V$, $R_{CR}=120k\Omega$, $T_a=25^\circ C$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	f_{osc3}		-30	310kHz	30	%
Oscillation start voltage	V_{sta}	Normal mode (V_{DD})	2.2			V
		Doubler mode (V_{DD})	0.9			V
Oscillation start time	t_{sta}	$V_{DD}=2.2$ to $3.6V$ (Doubler mode: $V_{DD}=0.9$ to $2.2V$)			3	mS
Oscillation stop voltage	V_{stp}	Normal mode (V_{DD})	2.2			V
		Doubler mode (V_{DD})	0.9			V

CR oscillation frequency-resistance characteristics



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● Serial Interface AC Characteristics

Clock synchronous master mode (during 32 kHz operation)

(Condition: $V_{DD}=1.5V$, $V_{SS}=0V$, $T_a=25^\circ C$, $V_{IH1}=0.8V_{DD}$, $V_{IL1}=0.2V_{DD}$, $V_{OH}=0.8V_{DD}$, $V_{OL}=0.2V_{DD}$)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Transmitting data output delay time	t_{smd}			5	μS
Receiving data input set-up time	t_{sms}	10			μS
Receiving data input hold time	t_{smh}	5			μS

Clock synchronous master mode (during 400 kHz operation)

(Condition: $V_{DD}=3.0V$, $V_{SS}=0V$, $T_a=25^\circ C$, $V_{IH1}=0.8V_{DD}$, $V_{IL1}=0.2V_{DD}$, $V_{OH}=0.8V_{DD}$, $V_{OL}=0.2V_{DD}$)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Transmitting data output delay time	t_{smd}			200	nS
Receiving data input set-up time	t_{sms}	400			nS
Receiving data input hold time	t_{smh}	200			nS

Clock synchronous slave mode (during 32 kHz operation)

(Condition: $V_{DD}=1.5V$, $V_{SS}=0V$, $T_a=25^\circ C$, $V_{IH1}=0.8V_{DD}$, $V_{IL1}=0.2V_{DD}$, $V_{OH}=0.8V_{DD}$, $V_{OL}=0.2V_{DD}$)

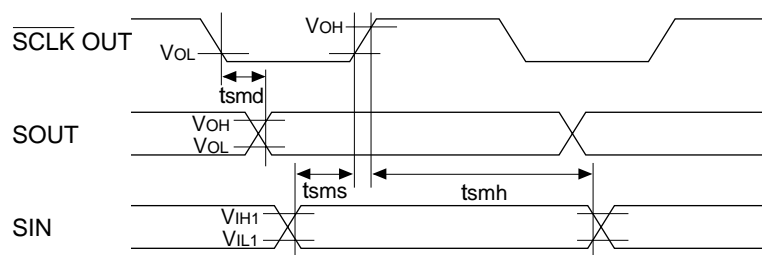
Characteristic	Symbol	Min.	Typ.	Max.	Unit
Transmitting data output delay time	t_{ssd}			10	μS
Receiving data input set-up time	t_{sss}	10			μS
Receiving data input hold time	t_{ssh}	5			μS

Clock synchronous slave mode (during 400 kHz operation)

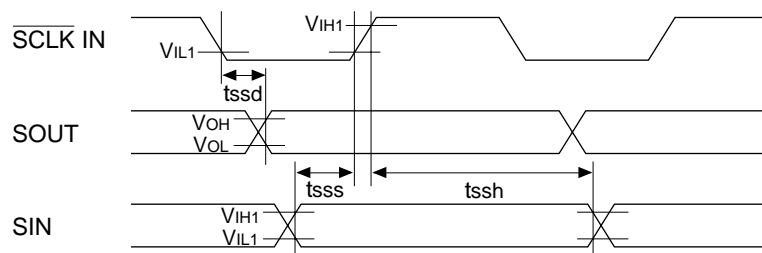
(Condition: $V_{DD}=3.0V$, $V_{SS}=0V$, $T_a=25^\circ C$, $V_{IH1}=0.8V_{DD}$, $V_{IL1}=0.2V_{DD}$, $V_{OH}=0.8V_{DD}$, $V_{OL}=0.2V_{DD}$)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Transmitting data output delay time	t_{ssd}			500	nS
Receiving data input set-up time	t_{sss}	400			nS
Receiving data input hold time	t_{ssh}	200			nS

Master mode



Slave mode



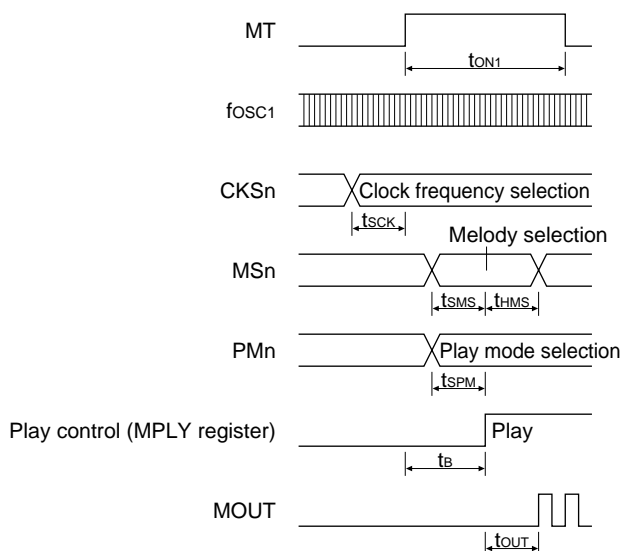
● Melody Generator AC Characteristics

(Unless otherwise specified: V_{DD}=3.0V, V_{SS}=0V, T_a=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Play start MT minimum pulse width	t _{ON1}		27.4 *1			mS
Frequency selection data set-up time	t _{SCK}		10			μS
Melody selection data set-up time	t _{SMS}		10			μS
Melody selection data hold time	t _{HMS}	"Melody change during play is impossible" option	10			μS
Play mode selection data set-up time	t _{SPM}		10			μS
Play start delay time	t _B				31.25 *1	mS
Output inverting time	t _{OUT}	f _{OSC1} =76.8, 153.6 kHz			1.68	mS
		f _{OSC1} =32.768 kHz			1.96	mS
Play suspension time (1)	t _{E1}		0.0039		♪ 1 beat	Sec
Play suspension time (2)	t _{E2}		♪ 1 beat		♪ 2 beats	Sec
MT=0 minimum pulse width	t _{OFF}		♪ 1 beat			Sec
MT=1 minimum pulse width	t _{ON2}		♪ 1 beat			Sec
Melody changing time during play	t _{MC}	"Melody change during play is possible" option	0		Note length at change	

*1 The quantization error becomes smaller than the standard value about by synchronization with the external clock. Therefore, actual time t is as follows: (Standard value - external clock 1 cycle) < t < standard value

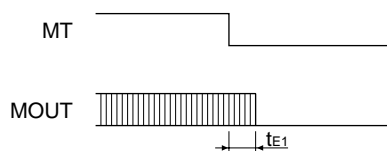
Play start timing



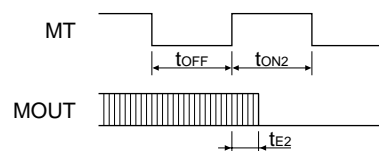
Melody and play mode selections should be done before starting the play (before setting the MT register to "1"), though it is no problem if the set-up time can be maintained.

Play stop timing

• Level hold play and One-shot C play

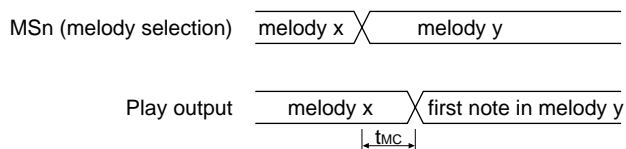


• Start/stop control by MT



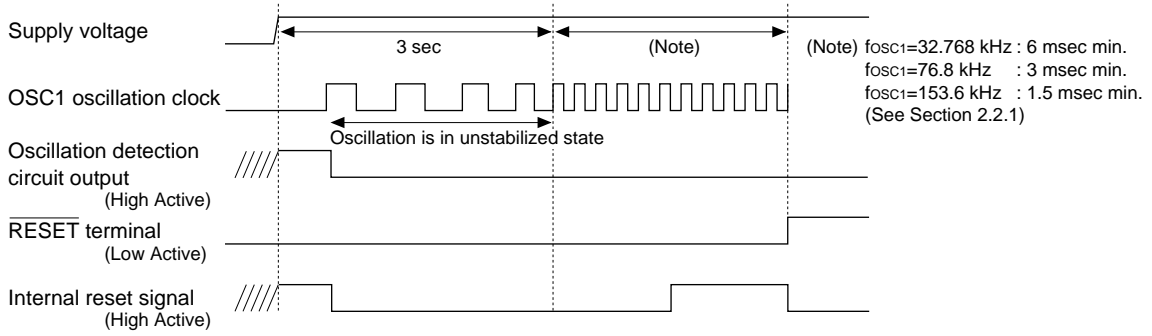
Change of melody during playing

• When the mask option "possible to change" is selected

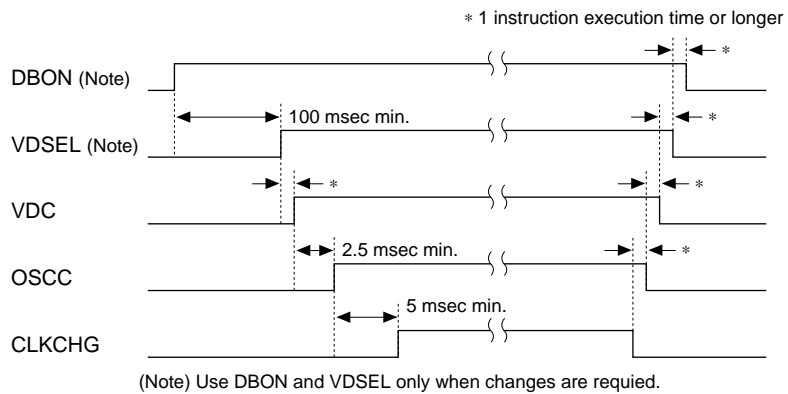


● Timing Chart

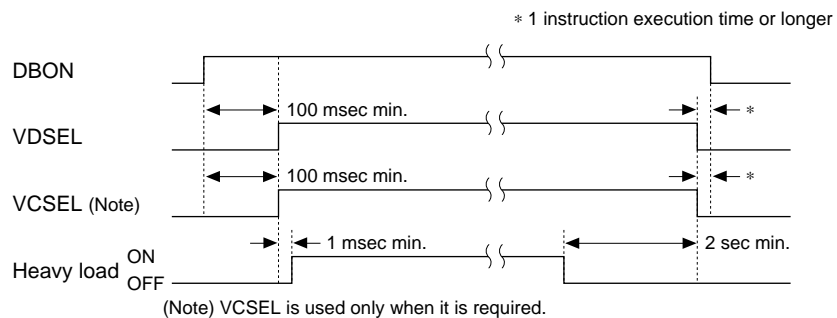
Initial reset



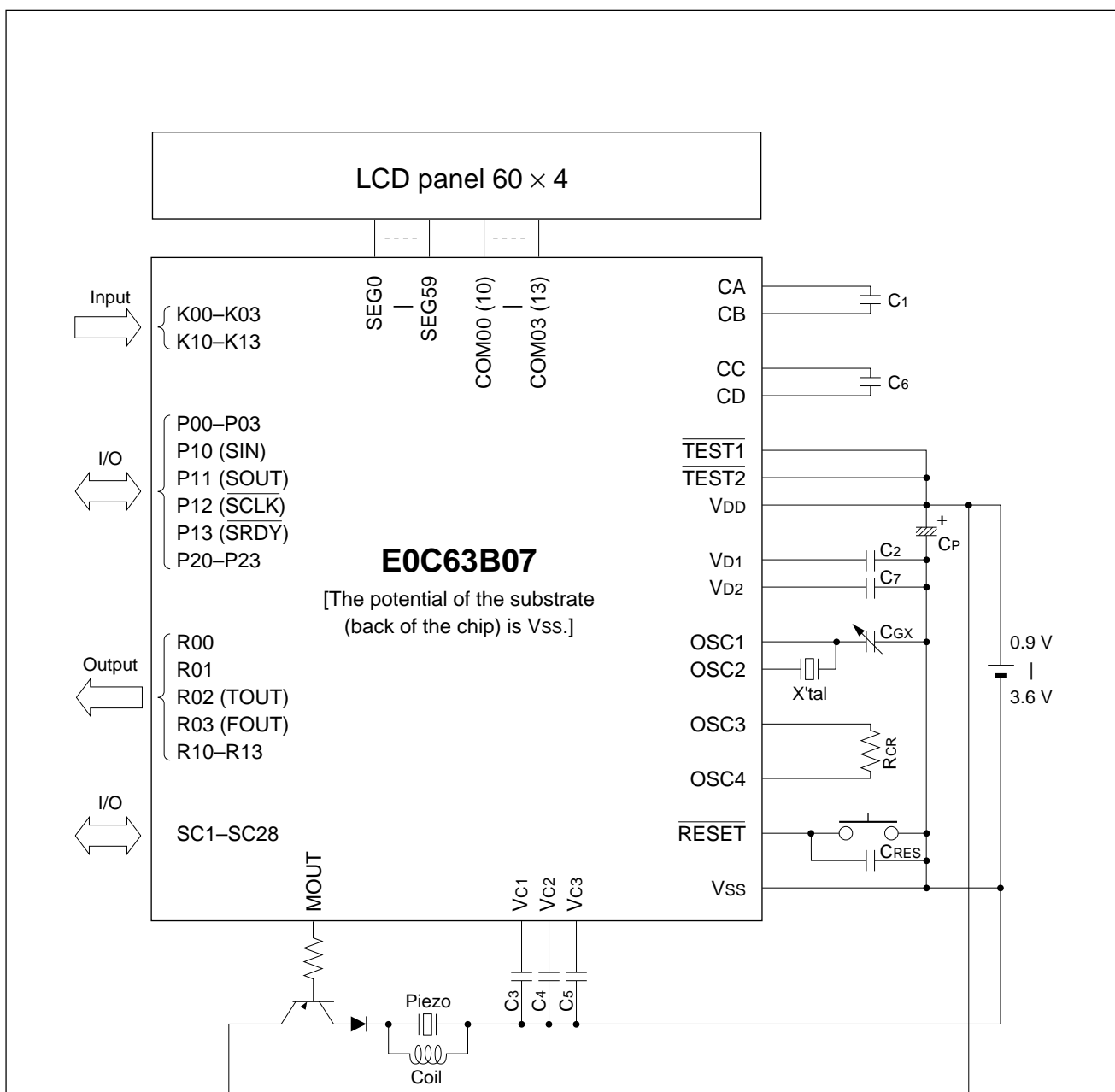
System clock switching



Supply voltage doubler control during heavy load driving



■ BASIC EXTERNAL CONNECTION DIAGRAM



X'tal	Crystal oscillator	32.768 kHz/76.8 kHz/153.6 kHz, C1 (Max.) = 34 kΩ
CGX	Trimmer capacitor	5–25 pF
RCR	Resistor for CR oscillation	120 kΩ (Max. 400 kHz)
C1–C5	Capacitor	0.2 μF
C6, C7	Capacitor	0.4 μF
CP	Capacitor	3.3 μF

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

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