

Micro MINI E0C6007

4-bit Single Chip Microcomputer



- E0C6200C Core CPU
- Low Voltage and Low Power
- Built-in LCD Driver

■ DESCRIPTION

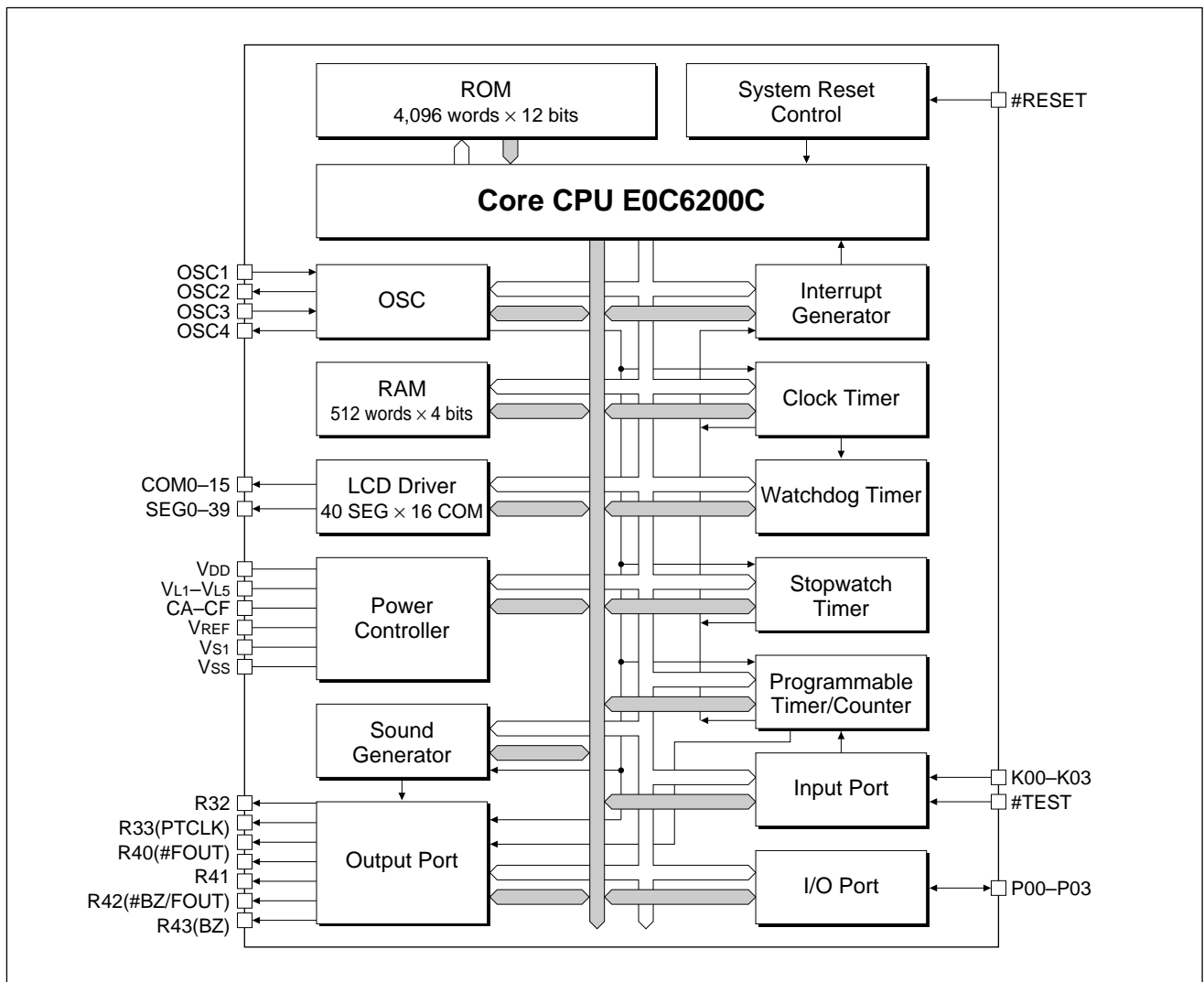
Micro MINI "E0C6007" is a single chip microcomputer for battery-driven products with dot-matrix LCD display. It achieves low cost performance, and is suitable for a product added some feature instead of standard IC. It consists that Seiko Epson's original core CPU E0C6200C, LCD driver (40 segments × 16 commons), 512 words RAM, 4K words ROM, sound generator, clock timer and so on.

■ FEATURES

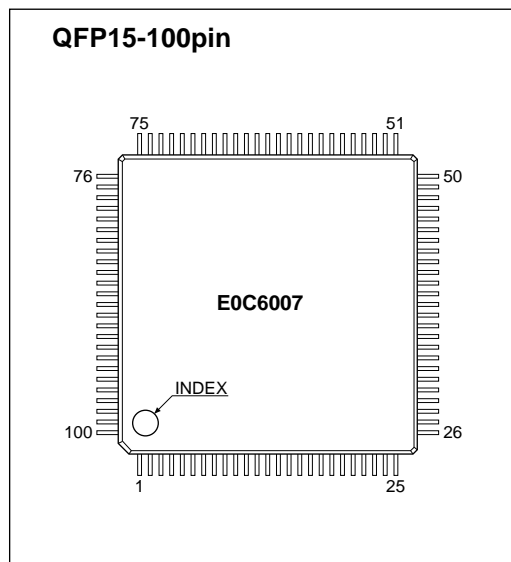
- CMOS LSI 4-bit parallel processing
- Clock 32.768kHz (X'tal or CR oscillation by mask option)
2MHz (CR or Ceramic oscillation by mask option)
- Instruction set 108 instructions
- ROM capacity 4K × 12 bits
- RAM capacity 512 × 4 bits (data memory)
160 × 4 bits (display memory)
- I/O port I: 4 bits (with pull-up resistor selectable by mask option)
O: 6 bits (buzzer and clock outputs are possible)
I/O: 4 bits
- Supply voltage detector (SVD) No support
- Time base counter Clock timer, stopwatch timer
- Programmable timer 8-bit timer × 1ch. with event counter and clock output function
- Watchdog timer Built-in
- Sound generator 8 programable sounds (8 type of frequency)
with envelope and 1-shot out function
- LCD driver 40 segments × 16 or 8 commons
- Interrupt External : Key interrupt 1 line
Internal : Clock timer interrupt 1 line
Stopwatch timer interrupt 1 line
Programmable timer interrupt 1 line
- Operation voltage 2.2 to 5.5V
(Min. 1.8V when the OSC3 oscillation circuit is not use)
- Power consumption 2.5μA (32.768kHz X'tal, 3.0V, HALT)
6.5μA (32.768kHz X'tal, 3.0V, RUN)
1.0mA (2MHz CR, 3.0V, RUN)
- Package Die form (pad pitch = 130μm) or QFP15-100pin

E0C6007

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



No.	Pin name	No.	Pin name	No.	Pin name	No.	Pin name	No.	Pin name
1	VL4	21	COM12	41	SEG25	61	SEG6	81	R41
2	VL5	22	COM13	42	SEG24	62	SEG5	82	R40
3	CF	23	COM14	43	SEG23	63	SEG4	83	R33
4	CE	24	COM15	44	SEG22	64	SEG3	84	R32
5	CD	25	N.C.	45	SEG21	65	SEG2	85	#RESET
6	CC	26	N.C.	46	SEG20	66	SEG1	86	#TEST
7	CB	27	SEG39	47	SEG19	67	SEG0	87	Vss
8	CA	28	SEG38	48	SEG18	68	K03	88	OSC4
9	COM0	29	SEG37	49	SEG17	69	K02	89	OSC3
10	COM1	30	SEG36	50	SEG16	70	K01	90	Vs1
11	COM2	31	SEG35	51	N.C.	71	K00	91	OSC2
12	COM3	32	SEG34	52	SEG15	72	P03	92	OSC1
13	COM4	33	SEG33	53	SEG14	73	P02	93	Vdd
14	COM5	34	SEG32	54	SEG13	74	P01	94	VREF
15	COM6	35	SEG31	55	SEG12	75	P00	95	VL1
16	COM7	36	SEG30	56	SEG11	76	N.C.	96	VL2
17	COM8	37	SEG29	57	SEG10	77	N.C.	97	VL3
18	COM9	38	SEG28	58	SEG9	78	N.C.	98	N.C.
19	COM10	39	SEG27	59	SEG8	79	R43	99	N.C.
20	COM11	40	SEG26	60	SEG7	80	R42	100	N.C.

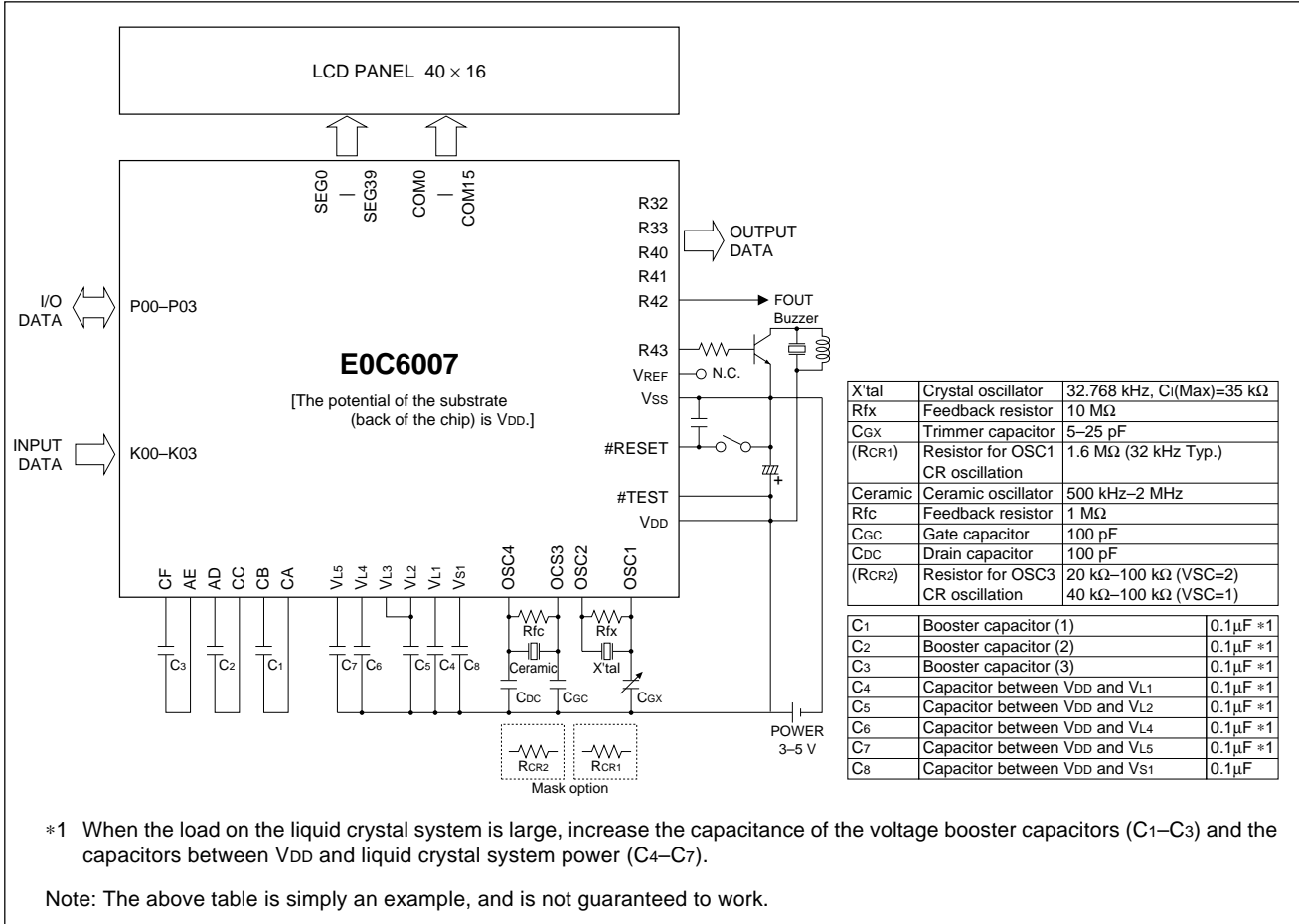
N.C. = No Connection

PIN DESCRIPTION

Pin name	Pin No.	I/O	Function
VDD	93	-	Power supply (+)
VSS	87	-	Power supply (-)
VS1	90	-	Internal logic system/oscillation system regulated voltage output
VL1-VL5	95-97, 1, 2	-	LCD system power supply 1/4 bias generated internally, 1/5 bias generated externally *1
VREF	94	O	LCD system power test pin *2
CA-CF	8-3	-	LCD system voltage booster condenser connecting pin
OSC1	92	I	Crystal or CR oscillator input *1
OSC2	91	O	Crystal or CR oscillator output *1, Cd buil-in
OSC3	89	I	CR or ceramic oscillator input *1
OSC4	88	O	CR or ceramic oscillator output *1
COM0-COM15	9-24	O	LCD common output (1/8 duty or 1/16 duty is selected on software)
SEG0-SEG39	67-52, 50-27	O	LCD segment output
K00-K03	71-68	I	Input port (pull up resistor is available by mask option) *1
P00-P03	75-72	I/O	I/O port
R32	84	O	Output port
R33	83	O	Output port or PTCLK output
R40	82	O	Output port or #FOUT output *1
R41	81	O	Output port
R42	80	O	Output port, #BZ output or FOUT output *1
R43	79	O	Output port or BZ output *1
#RESET	85	I	Initial reset input terminal
#TEST	86	I	Testing input terminal *3

- *1: Selected by mask option
- *2: Leave the VREF pin unconnected (N.C.).
- *3: The #TEST pin is used when the IC load is being detected. During ordinary operation be certain to connect this pin to VDD.

BASIC EXTERNAL CONNECTION DIAGRAM



■ 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}	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 drawn in).

*2: In case of plastic package (QFP15-100pin).

● Recommended Operating Conditions

(T_a=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	V _{SS}	V _{DD} =0V				
		VSC="0"	-3.8	-3.0	-1.8	V
		VSC="1"	-5.5	-3.0	-2.2	V
		VSC="2"	-5.5	-5.0	-3.5	V
Oscillation frequency (1)	f _{osc1}		20	32.768	50	kHz
Oscillation frequency (2)	f _{osc3}	VSC="1"	50	1,000	1,200	kHz
Oscillation frequency (3)	f _{osc3}	VSC="2"	50	2,000	2,300	kHz
Voltage booster capacitor (1)	C1			0.1		μF
Voltage booster capacitor (2)	C2			0.1		μF
Voltage booster capacitor (3)	C3			0.1		μF
Capacitor between V _{DD} and V _{L1}	C4			0.1		μF
Capacitor between V _{DD} and V _{L2}	C5			0.1		μF
Capacitor between V _{DD} and V _{L4}	C6			0.1		μF
Capacitor between V _{DD} and V _{L5}	C7			0.1		μF
Capacitor between V _{DD} and V _{S1}	C8			0.1		μF

● DC Characteristics

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, V_{L1}=-1.0V, V_{L2}=-2.0V, V_{L4}=-3.0V, V_{L5}=-4.0V, f_{osc1}=32.768kHz, f_{osc3}=1MHz, T_a=25°C, C₁-C₈=0.047μF)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High-level input voltage (1)	V _{IH1}	V _{SS} =-2.2 to -5.5V	K00-03, P00-03	0.2·V _{SS}	0	V
Low-level input voltage (1)	V _{IL1}	T _a =25°C		V _{SS}	0.8·V _{SS}	V
High-level input voltage (2)	V _{IH2}	V _{SS} =-2.2 to -5.5V	#RESET	-0.2	0	V
Low-level input voltage (2)	V _{IL2}	T _a =25°C		V _{SS}	V _{SS} +0.2	V
High-level input current	I _{IH}	V _{SS} =-3.0V, V _{IH} =0V	K00-03, P00-03, #RESET	0		0.5 μA
Low-level input current (1)	I _{IL1}	V _{SS} =-3.0V, V _{IL1} =V _{SS} With Pull-up resistor		-45		-15 μA
Low-level input current (2)	I _{IL2}	V _{SS} =-3.0V, V _{IL2} =V _{SS} No Pull-up resistor		-0.5		0 μA
High-level output current (1)	I _{OH1}	V _{SS} =-2.2V V _{OH1} =-0.5V	P00-03, R32, R33, R40, R41			-1.0 mA
Low-level output current (1)	I _{OL1}	V _{SS} =-2.2V, V _{OL1} =V _{SS} +0.5V		4.0		mA
High-level output current (2)	I _{OH2}	V _{SS} =-2.2V V _{OH2} =-0.5V	R42, R43			-2.0 mA
Low-level output current (2)	I _{OL2}	V _{SS} =-2.2V, V _{OL2} =V _{SS} +0.5V		8.0		mA
Common output current	I _{OH3}	V _{OH3} =-0.05V	COM0-15			-30 μA
	I _{OL3}	V _{OL3} =V _{L5} +0.05V		30		μA
Segment output current	I _{OH4}	V _{OH4} =-0.05V	SEG0-39			-10 μA
	I _{OL4}	V _{OL4} =V _{L5} +0.05V		10		μA

● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $V_{L1}=-1.0V$, $V_{L2}=-2.0V$, $V_{L4}=-3.0V$, $V_{L5}=-4.0V$, $f_{osc1}=32.768kHz$, $f_{osc3}=1MHz$, $T_a=25^{\circ}C$, $C_1-C_8=0.047\mu F$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit	
LCD drive voltage (Normal mode)	VL1	Connects a 1MΩ load resistance between VDD and VL1 (No panel load)	1/2·VL2 -0.1		1/2·VL2 ×0.95	V	
	VL2	Connects a 1MΩ load resistance between VDD and VL2 (No panel load)	LC="0"		-2.06	Typ. ×0.88	V
			LC="1"		-2.11		
			LC="2"		-2.17		
			LC="3"		-2.22		
			LC="4"		-2.27		
			LC="5"		-2.32		
			LC="6"		-2.38		
			LC="7"	Typ. ×1.12	-2.43		
			LC="8"		-2.48		
			LC="9"		-2.53		
			LC="10"		-2.59		
			LC="11"		-2.64		
			LC="12"		-2.69		
			LC="13"		-2.74		
LC="14"		-2.80					
LC="15"		-2.85					
VL4	Connects a 1MΩ load resistance between VDD and VL4 (No panel load)	3/2·VL2		3/2·VL2 ×0.95	V		
VL5	Connects a 1MΩ load resistance between VDD and VL5 (No panel load)	2·VL2		2·VL2 ×0.95	V		
LCD drive voltage (Heavy load protection mode)	VL1	Connects a 1MΩ load resistance between VDD and VL1 (No panel load)	LC="0"		-1.05	Typ. ×0.88	V
			LC="1"		-1.08		
			LC="2"		-1.11		
			LC="3"		-1.13		
			LC="4"		-1.16		
			LC="5"		-1.19		
			LC="6"		-1.21		
			LC="7"	Typ. ×1.12	-1.24		
			LC="8"		-1.26		
			LC="9"		-1.29		
			LC="10"		-1.32		
			LC="11"		-1.34		
			LC="12"		-1.37		
			LC="13"		-1.40		
	LC="14"		-1.42				
LC="15"		-1.45					
VL2	Connects a 1MΩ load resistance between VDD and VL2 (No panel load)	2·VL1		2·VL1 ×0.90	V		
VL4	Connects a 1MΩ load resistance between VDD and VL4 (No panel load)	3·VL1		3·VL1 ×0.90	V		
VL5	Connects a 1MΩ load resistance between VDD and VL5 (No panel load)	4·VL1		4·VL1 ×0.90	V		
Current consumption *1 (OSC1/crystal oscillation)	I _{hlt}	During HALT (VSC="0", OSCC="0")		2.5	5.0	μA	
	I _{EX1}	During operation at 32kHz (VSC="0", OSCC="0")		6.5	9.0	μA	
	I _{EX2}	During operation at 1MHz (VSC="1")		400	600	μA	
	I _{EX3}	During operation at 2MHz (VSC="2", VSS=-5.0V)		1,000	1,500	μA	
Current consumption *1 (OSC1/CR oscillation)	I _{hlt}	During HALT (VSC="0" or "1", OSCC="0")		20	70	μA	
	I _{EX1}	During operation at f _{osc1} (VSC="0" or "1", OSCC="0")		25	80	μA	
	I _{EX2}	During operation at 1MHz (VSC="1")		420	600	μA	
	I _{EX3}	During operation at 2MHz (VSC="2", VSS=-5.0V)		1,000	1,500	μA	

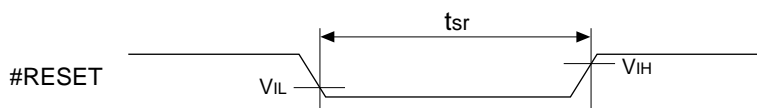
*1: No panel load.

● AC Characteristics

#RESET Input

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $f_{osc1}=32.768kHz$, $T_a=25^{\circ}C$, $V_{IH}=0.5V_{SS}$, $V_{IL}=0.9V_{SS}$)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
#RESET input time	t _{sr}	2.0			ms



● Oscillation Characteristics

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

OSC1 Crystal Oscillation

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, Crystal: C-002R($C_1=35k\Omega$), $C_{Gx}=25pF$, C_{Dx} =built-in, $R_{fx}=10M\Omega$, $T_a=25^\circ C$, $V_{SC}="0"$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start time	t_{sta}	$V_{SS}=-2.2$ to $-5.5V$			5	s
Built-in drain capacitance	C_D	Package as assembled		22		pF
		Bare chip		21		pF
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-2.2$ to $-5.5V$			5	ppm
Frequency/IC deviation	$\partial f/\partial IC$		-10		+10	ppm
Frequency adjustable range	$\partial f/\partial C_G$	$C_G=5$ to $25pF$	35	45		ppm
Harmonic oscillation start voltage	V_{hho}	$C_G=5pF$ (V_{SS})			-5.5	V
Permitted leak resistance	R_{leak}	Between OSC1 and V_{DD} , V_{S1}	200			$M\Omega$

OSC1 CR Oscillation

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $T_a=25^\circ C$, $V_{SC}="0"$ or $"1"$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{osc1}	$R_{CR1}=1.6M\Omega$	Typ. $\times 70\%$	32	Typ. $\times 130\%$	kHz
Oscillation start time	t_{sta}	$V_{SS}=-2.2$ to $-5.5V$			3	ms
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-2.2$ to $-5.5V$	-5		+5	%

OSC3 CR Oscillation 1

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $T_a=25^\circ C$, $V_{SC}="1"$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{osc3}	$R_{CR2}=40k\Omega$	Typ. $\times 70\%$	860	Typ. $\times 130\%$	kHz
Oscillation start time	t_{sta}	$V_{SS}=-2.2$ to $-5.5V$			3	ms
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-2.2$ to $-5.5V$	-5		+5	%

OSC3 CR Oscillation 2

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-5.0V$, $T_a=25^\circ C$, $V_{SC}="2"$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{osc3}	$R_{CR2}=20k\Omega$	Typ. $\times 70\%$	1.7	Typ. $\times 130\%$	MHz
Oscillation start time	t_{sta}	$V_{SS}=-3.5$ to $-5.5V$			3	ms
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-3.5$ to $-5.5V$	-5		+5	%

OSC3 Ceramic Oscillation 1

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-3.0V$, $T_a=25^\circ C$, $V_{SC}="1"$, Ceramic oscillator: CSB 1000J *1 (1MHz), $C_{GC}=C_{DC}=100pF$, $R_{fc}=1M\Omega$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start time	t_{sta}	$V_{SS}=-2.2$ to $-5.5V$			3	ms
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-2.2$ to $-5.5V$	-3		+3	%

*1: Made by Murata Mfg. Co.

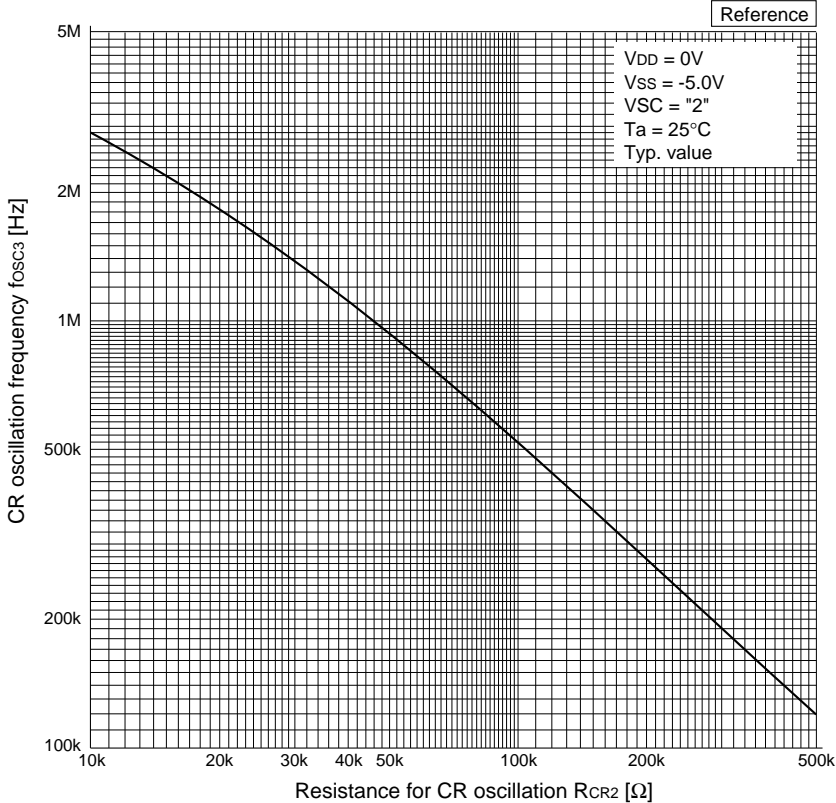
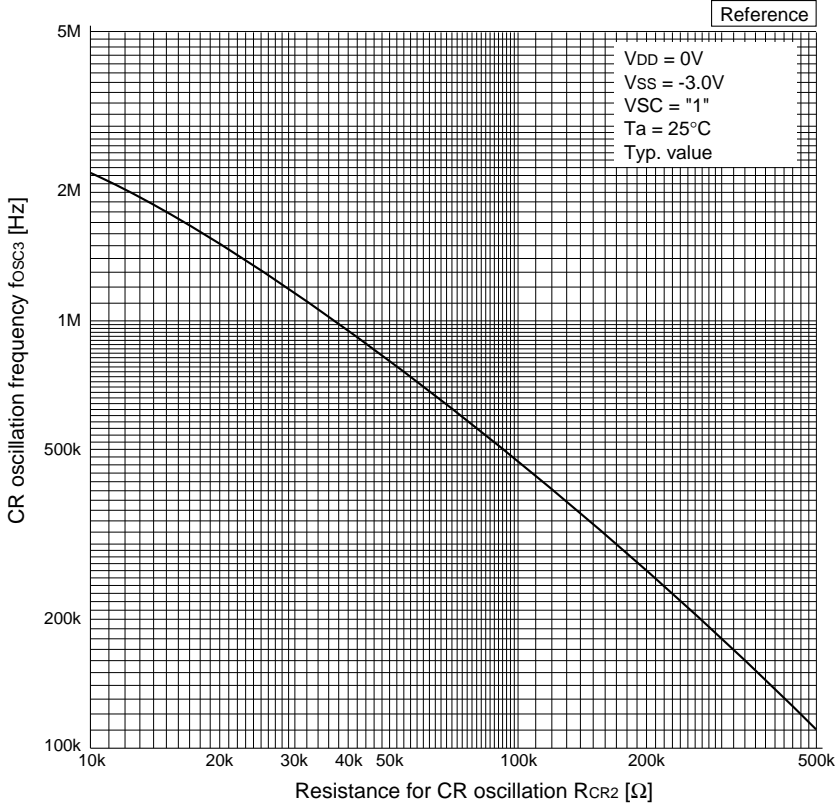
OSC3 Ceramic Oscillation 2

(Unless otherwise specified: $V_{DD}=0V$, $V_{SS}=-5.0V$, $T_a=25^\circ C$, $V_{SC}="2"$, Ceramic oscillator: CSA 2.00MG *1 (2MHz), $C_{GC}=C_{DC}=100pF$, $R_{fc}=1M\Omega$)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start time	t_{sta}	$V_{SS}=-3.5$ to $-5.5V$			3	ms
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-3.5$ to $-5.5V$	-3		+3	%

*1: Made by Murata Mfg. Co.

• OSC3 CR oscillation frequency - resistance characteristic



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