EPSON

E0C6292

4-bit Single Chip Microcomputer

Wide Voltage Operation Products

- Core CPU Architecture
- SVD Circuit
- R/F Converter for Temperature Measurement
- High Quality LCD Driver

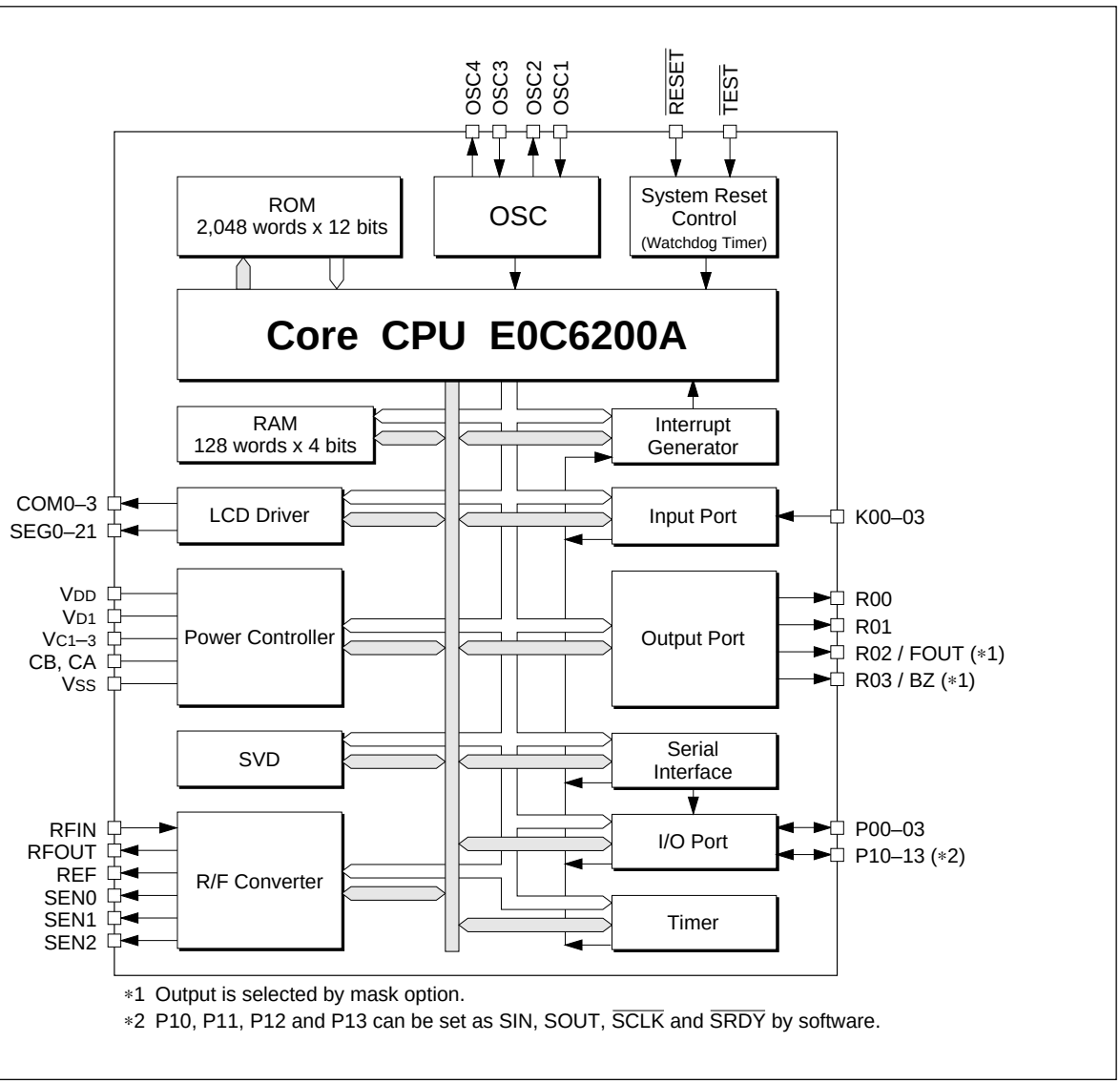
■ DESCRIPTION

The E0C6292 is a single-chip microcomputer composed of the 4-bit core CPU E0C6200A, ROM, RAM, R/F converter, SVD circuit, watchdog timer and time base counter. The E0C6292 is most suitable for controllers with temperature measurement functions, such as a heat control unit.

■ FEATURES

- CMOS LSI 4-bit parallel processing
- Twin clock ..... Crystal oscillation circuit (with built-in drain capacitance) 32.768kHz (Typ.)
  CR or Ceramic oscillation circuit (mask option) 1MHz (Typ.)
- Instruction set ..... 108 instructions
- Instruction execution time (depending on instruction) ..... During operation at 32.768kHz : 153µsec, 214µsec, 366µsec
  During operation at 1MHz : 5µsec, 7µsec, 12µsec
- ROM capacity ..... 2,048 words × 12 bits
- RAM capacity ..... 128 words × 4 bits
- Input port ..... 4 bits (pull up resistors may be supplemented by mask option)
- Output port ..... 4 bits (complementary output or Nch open drain output may be selected by mask option)
  Buzzer and clock outputs may be set by mask option
- I/O port ..... 8 bits (pull up during input mode is available by mask option)
- LCD driver ..... 22 segments × 2–4 commons
  1/2–1/4 duty dynamic drive may be selected by mask option
- Serial interface ..... 1 port (8-bit clock synchronous type)
- R/F converter ..... 1 reference resistance × 3 sensors, 16-bit counter
  DC bias sensor may be connected
- Time base counter ..... Clock timer 1 system
- Built-in watchdog timer
- Supply voltage detection (SVD) circuit .. 2.4, 2.5, 2.6 or 2.7V may be set by mask option
- Interrupt ..... External : Input port interrupt 1 system
  Internal : Timer interrupt 1 system
  R/F converter interrupt 1 system
  Serial interface interrupt 1 system
- Supply voltage ..... 2.2V to 5.5V
- Current consumption ..... HALT mode (3.0V) : 2.0µA (Typ.)
  OPERATING mode (32.768kHz/3.0V) : 5.0µA (Typ.)
  OPERATING mode (1MHz/3.0V) : 270µA (Typ.)
- Package ..... QFP6-64pin (plastic), QFP13-64pin (plastic)
  Die form

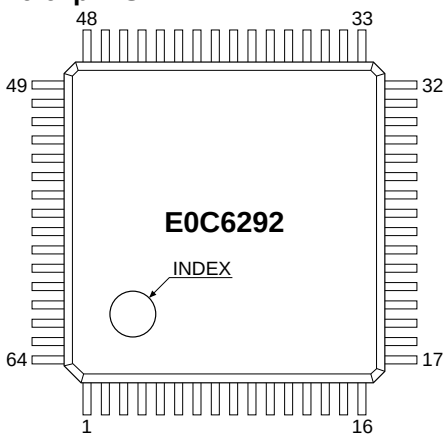
■ BLOCK DIAGRAM



*1 Output is selected by mask option.
*2 P10, P11, P12 and P13 can be set as SIN, SOUT, $\overline{SCLK}$ and $\overline{SRDY}$ by software.

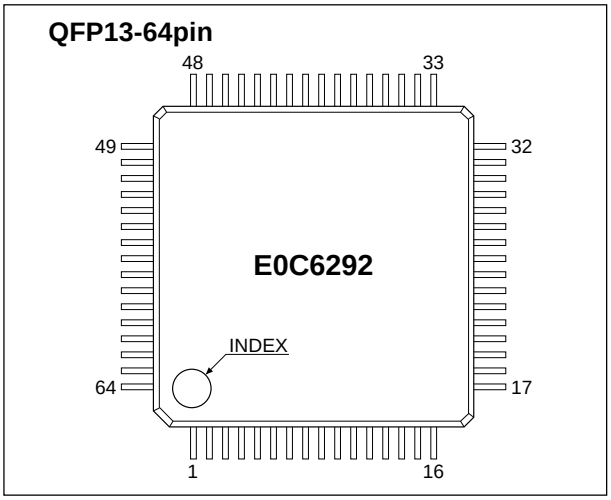
■ PIN CONFIGURATION

QFP6-64pin-S1



Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	R03	17	P13	33	V_{C2}	49	SEG6
2	R02	18	P12	34	V_{C1}	50	SEG7
3	R01	19	P11	35	V_{C3}	51	SEG8
4	R00	20	P10	36	CA	52	SEG9
5	K03	21	P03	37	CB	53	SEG10
6	K02	22	P02	38	COM3	54	SEG11
7	K01	23	P01	39	COM2	55	SEG12
8	K00	24	P00	40	COM1	56	SEG13
9	N.C.	25	$\overline{RESET}$	41	COM0	57	SEG14
10	REF	26	V_{SS}	42	SEG0	58	SEG15
11	SEN0	27	OSC1	43	SEG1	59	SEG16
12	SEN1	28	OSC2	44	SEG2	60	SEG17
13	SEN2	29	V_{DD}	45	SEG3	61	SEG18
14	RFIN	30	OSC4	46	SEG4	62	SEG19
15	RFOUT	31	OSC3	47	SEG5	63	SEG20
16	N.C.	32	V_{D1}	48	$\overline{TEST}$	64	SEG21

N.C. : No Connection



Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	R03	17	P13	33	V_{C2}	49	SEG6
2	R02	18	P12	34	V_{C1}	50	SEG7
3	R01	19	P11	35	V_{C3}	51	SEG8
4	R00	20	P10	36	CA	52	SEG9
5	K03	21	P03	37	CB	53	SEG10
6	K02	22	P02	38	COM3	54	SEG11
7	K01	23	P01	39	COM2	55	SEG12
8	K00	24	P00	40	COM1	56	SEG13
9	N.C.	25	$\overline{\text{RESET}}$	41	COM0	57	SEG14
10	REF	26	V_{SS}	42	SEG0	58	SEG15
11	SEN0	27	OSC1	43	SEG1	59	SEG16
12	SEN1	28	OSC2	44	SEG2	60	SEG17
13	SEN2	29	V_{DD}	45	SEG3	61	SEG18
14	RFIN	30	OSC4	46	SEG4	62	SEG19
15	RFOUT	31	OSC3	47	SEG5	63	SEG20
16	N.C.	32	V_{D1}	48	$\overline{\text{TEST}}$	64	SEG21

N.C. : No Connection

■ PIN DESCRIPTION

Pin name	Pin No.	I/O	Function
V_{DD}	29	(I)	Power supply pin (+)
V_{SS}	26	(I)	Power supply pin (–)
V_{D1}	32	O	Oscillation and internal logic system regulated voltage output pin
V_{C1}	34	O	LCD system reduced voltage output pin ($V_{C2} \times 1/2$)
V_{C2}	33	I	LCD system supply voltage input pin ($V_{C2} = V_{D1}$ or $V_{C2} = V_{DD}$)
V_{C3}	35	O	LCD system booster voltage output pin ($V_{C1} \times 3/2$)
CA, CB	36, 37	–	Voltage booster capacitor connecting pin
OSC1	27	I	Crystal oscillation input pin
OSC2	28	O	Crystal oscillation output pin
OSC3	31	I	Ceramic or CR oscillation input pin (selected by mask option)
OSC4	30	O	Ceramic or CR oscillation output pin (selected by mask option)
COM0–COM3	41–38	O	LCD common output pin (drive duty may be selected from 1/2–1/4 by mask option)
SEG0–SEG21	42–47, 49–64	O	LCD segment output pin (DC output may be selected by mask option)
K00–K03	8–5	I	Input port pin
P00–P03	24–21	I/O	I/O port pin
P10–P13	20–17	I/O	I/O port pin (serial I/O port may be selected by software)
R00, R01	4, 3	O	Output port pin
R02	2	O	Output port pin (DC or FOUT output may be selected by mask option)
R03	1	O	Output port pin (DC or BZ output may be selected by mask option)
REF	10	O	Reference resistance connecting pin for R/F converter
SEN0, SEN1, SEN2	11, 12, 13	O	Sensor connecting pin for R/F converter
RFIN	14	I	R/F converter CR oscillation input pin
RFOUT	15	O	R/F converter oscillation frequency output pin
$\overline{\text{RESET}}$	25	I	Initial reset input pin
$\overline{\text{TEST}}$	48	I	Testing input pin

■ 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}+0.5	V
Input voltage (2)	V_{IOSC}	-0.5 to V_{D1}+0.5	V
Permissible total output current *1	ΣI_{VDD}	10	mA
Operating temperature	Topr	-40 to 85	°C
Storage temperature	Tstg	-65 to 150	°C
Soldering temperature / Time	Tsol	260°C, 10sec (lead section)	–
Allowable 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 (QFP6-64pin, QFP13-64pin).

● Recommended Operating Conditions

(Ta=-40 to 85°C)

Condition	Symbol	Remark		Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	V_{SS} = 0V	When V_{C2} is connected to V_{D1}	2.2	3.0	5.5	V
			When V_{C2} is connected to V_{DD}	2.2	3.0	3.6	V
Oscillation frequency	f_{OSC1}			–	32.768	–	kHz
	f_{OSC3}	Duty 50±5%		300	1,000	1,300	kHz

● DC Characteristics

(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, f_{OSC1}=32.768kHz, Ta=25°C, V_{D1}/V_{C1}–V_{C3} are internal voltage, C1–C5=0.1µF)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Input threshold voltage	V_{INH}	L→H	K00–K03	1.80	2.25	2.70	V
	V_{INL}	H→L	K00–K03	0.35	0.60	0.85	V
High level input voltage (1)	V_{IH1}		P00–P03, P10–P13	0.8•V_{DD}		V_{DD}	V
High level input voltage (2)	V_{IH2}		$\overline{RESET}$, $\overline{TEST}$	0.9•V_{DD}		V_{DD}	V
Low level input voltage (1)	V_{IL1}		P00–P03, P10–P13	0		0.2•V_{DD}	V
Low level input voltage (2)	V_{IL2}		$\overline{RESET}$, $\overline{TEST}$	0		0.1•V_{DD}	V
High level input current (1)	I_{IH1}	V_{IH1}=3.0V	K00–K03	0		0.5	µA
High level input current (2)	I_{IH2}	V_{IH2}=3.0V	P00–P03, P10–P13 $\overline{RESET}$, $\overline{TEST}$	0		0.5	µA
Low level input current (1)	I_{IL1}	V_{IL1}=V_{SS}, no pull up resistor	K00–K03	-0.5		0	µA
Low level input current (2)	I_{IL2}	V_{IL2}=V_{SS}, no pull up resistor	P00–P03, P10–P13 $\overline{RESET}$, $\overline{TEST}$	-0.5		0	µA
Low level input current (3)	I_{IL3}	V_{IL3}=V_{SS}, with pull up resistor	K00–K03	-15	-8	-5	µA
Low level input current (4)	I_{IL4}	V_{IL4}=V_{SS}, with pull up resistor	P00–P03, P10–P13 $\overline{RESET}$, $\overline{TEST}$	-15	-8	-5	µA
High level output current (1)	I_{OH1}	V_{OH1}=0.9•V_{DD}	R00–R03			-4.0	mA
High level output current (2)	I_{OH2}	V_{OH2}=0.9•V_{DD}	P00–P03, P10–P13 RFOUT			-1.5	mA
Low level output current (1)	I_{OL1}	V_{OL1}=0.1•V_{DD}	R00–R03	6			mA
Low level output current (2)	I_{OL2}	V_{OL2}=0.1•V_{DD}	P00–P03, P10–P13 RFOUT	6			mA
Common output current	I_{OH3}	V_{OH3}=V_{DD}-0.05V	COM0–COM3			-3	µA
	I_{OL3}	V_{OL3}=V_{C3}+0.05V		3			µA
Segment output current (during LCD output)	I_{OH4}	V_{OH4}=V_{DD}-0.05V	SEG0–SEG21			-3	µA
	I_{OL4}	V_{OL4}=V_{C3}+0.05V		3			µA
Segment output current (during DC output)	I_{OH5}	V_{OH5}=0.9•V_{DD}	SEG0–SEG21			-200	µA
	I_{OL5}	V_{OL5}=0.1•V_{DD}		200			µA

● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, f_{OSC1}=32.768kHz, C_G=25pF, Ta=25°C, V_{D1}/V_{C1}–V_{C3} are internal voltage, C1–C5=0.1µF, C_{RF}=2,200pF, R_{REF}=50kΩ)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
LCD drive voltage	V_{C1}	V_{C2}=V_{DD}	Connect 1MΩ load resistor between	1/2 V_{DD}×0.9	1/2 V_{DD}	1/2 V_{DD}+0.1	V
		V_{C2}=V_{D1}	V_{SS} and V_{C1} (no panel load)	1/2 V_{D1}×0.9	1/2 V_{D1}	1/2 V_{D1}+0.1	V
	V_{C2}	V_{C2}=V_{DD}	Connect 1MΩ load resistor between		V_{DD}		V
		V_{C2}=V_{D1}	V_{SS} and V_{C2} (no panel load)	1.9	2.1	2.3	V
	V_{C3}	V_{C2}=V_{DD}	Connect 1MΩ load resistor between	3/2 V_{DD}×0.9	3/2 V_{DD}	3/2 V_{DD}+0.1	V
		V_{C2}=V_{D1}	V_{SS} and V_{C3} (no panel load)	3/2 V_{D1}×0.9	3/2 V_{D1}	3/2 V_{D1}+0.1	V
SVD voltage	V_{SVD}	2.4V (selected by mask option)		2.22	2.4	2.58	V
		2.5V (selected by mask option)		2.30	2.5	2.70	V
		2.6V (selected by mask option)		2.38	2.6	2.82	V
		2.7V (selected by mask option)		2.46	2.7	2.94	V
SVD circuit response time	t_{SVD}					100	µS
Power current consumption	I_{OP}	During HALT (32kHz)	no panel load		2	6	µA
		During execution (32kHz) *1			5	9	µA
		During execution (1MHz) *1			270	500	µA
		During execution (32kHz) *2			40	120	µA
		During execution (32kHz) *3			11	30	µA

*1 The R/F converter and SVD circuit are OFF status.
*2 The R/F converter is ON status. The SVD circuit is OFF status.
*3 The R/F converter is OFF status. The SVD circuit is ON status.

● 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_{SS}=0V, V_{DD}=3.0V, Crystal: C-002R (C_I=35kΩ), C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta ≤ 3sec	2.2			V
Oscillation stop voltage	Vstp	tstp ≤ 10sec	2.2			V
Built-in capacitance (drain)	C_D	Including the parasitic capacitance inside the IC		20		pF
Frequency/voltage deviation	∂f/∂V	V_{DD} = 2.2 to 5.5V			5	ppm
Frequency/IC deviation	∂f/∂IC		-10		10	ppm
Frequency adjustment range	∂f/∂C_G	C_G= 5 to 25pF	35			ppm
Harmonic oscillation start voltage	V_{hho}	C_G= 5pF			7	V
Permitted leak resistance	R_{leak}	Between OSC1 terminal and V_{DD}, V_{SS}	200			MΩ

OSC3 ceramic oscillation circuit

(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, Ceramic oscillator: 1MHz, C_{GC}=C_{DC}=100pF, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta		-2.2			V
Oscillation start time	tsta	V_{DD}=2.2 to 5.5V			3	mS
Oscillation stop voltage	Vstp		-2.2			V

OSC3 CR oscillation circuit

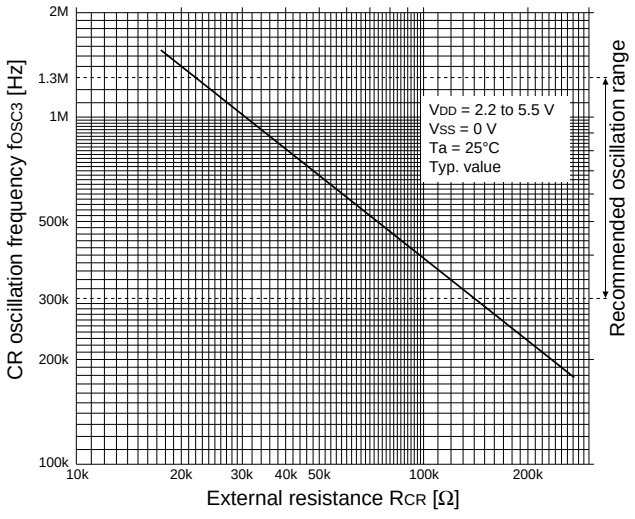
(Unless otherwise specified: V_{SS}=0V, V_{DD}=3.0V, R_{CR}=33kΩ, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	f_{OSC3}		-30	(1MHz)	30	%
Oscillation start voltage	Vsta		-2.2			V
Oscillation start time	tsta	V_{DD}=2.2 to 5.5V			3	mS
Oscillation stop voltage	Vstp		-2.2			V

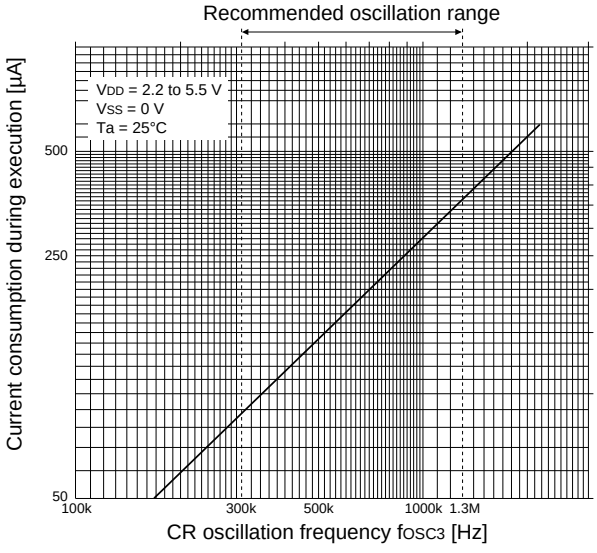
● Characteristic Curves

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

• CR oscillation frequency characteristic
- current consumption characteristic



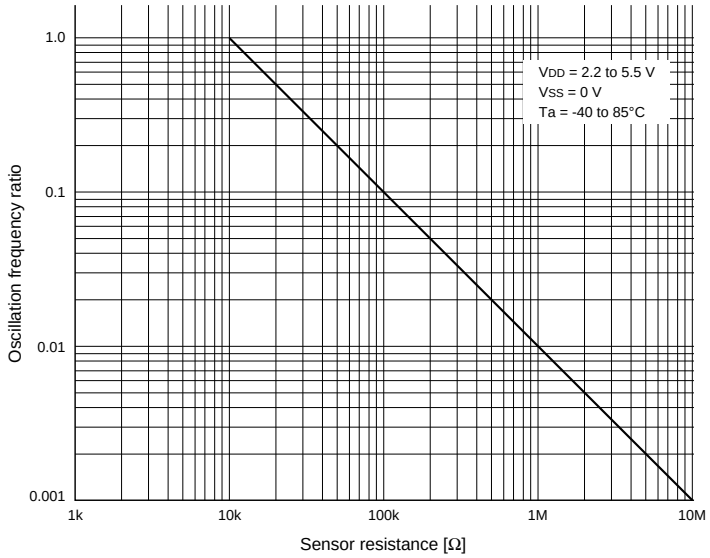
• CR oscillation frequency
- current consumption characteristic



• **R/F converter sensor resistance - oscillation frequency ratio characteristic**

The following figure shows the oscillation frequency ratio (ratio of oscillation frequency by the reference resistance to oscillation frequency by the sensor resistance) when the following elements are connected. (Typ.)
If the R/F conversion uses SEN0, SEN1 or SEN2, both characteristics will be the same.

Reference resistance (R_{REF}) 10kΩ
Sensor resistance (R_{SEN0}, R_{SEN1}, R_{SEN2}) ..... 10kΩ to 20MΩ
Oscillating capacitor (C_{RF}) 2,200pF

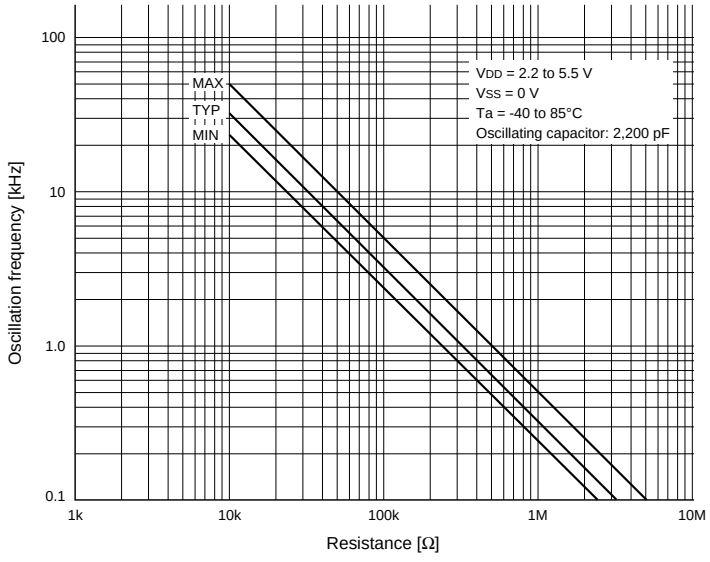


Oscillation frequency ratio - resistance curve

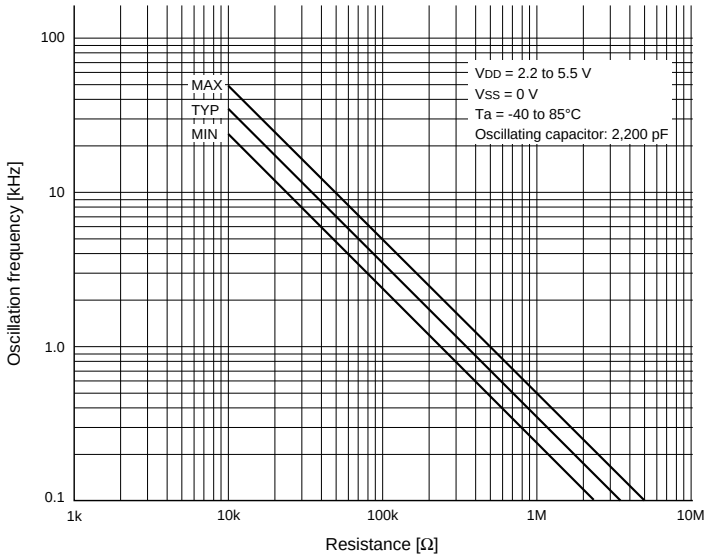
• **R/F converter resistance - oscillation frequency characteristic**

CR oscillation frequency of the R/F converter disperses in each sampling. Therefore, the initial setting value of the measurement counter should be decided after considering the fluctuation margin of the CR oscillation frequency by the reference resistance and sensor resistance to be used for the measurement.

Note: • The following curves are characteristic when the oscillating capacitor is 2,200pF.
• Typical oscillation frequency is characteristic when V_{DD} = 3.0V and Ta = 25°C.



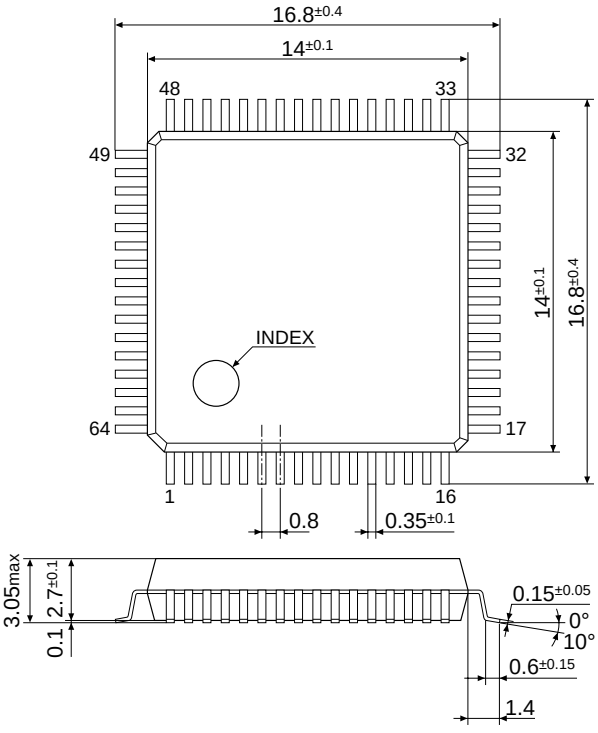
Resistance - oscillation frequency curve (REF)



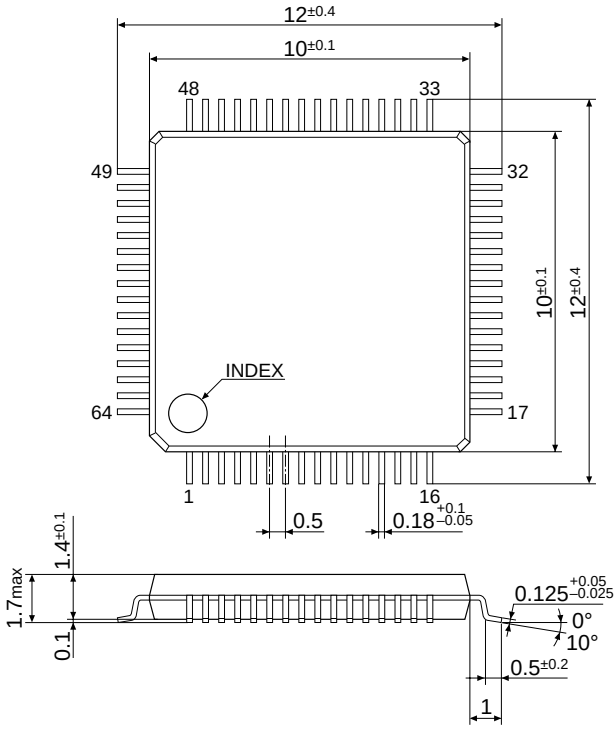
Resistance - oscillation frequency curve (SEN0, SEN1, SEN2)

■ PACKAGE DIMENSIONS

Plastic QFP6-64pin-S1

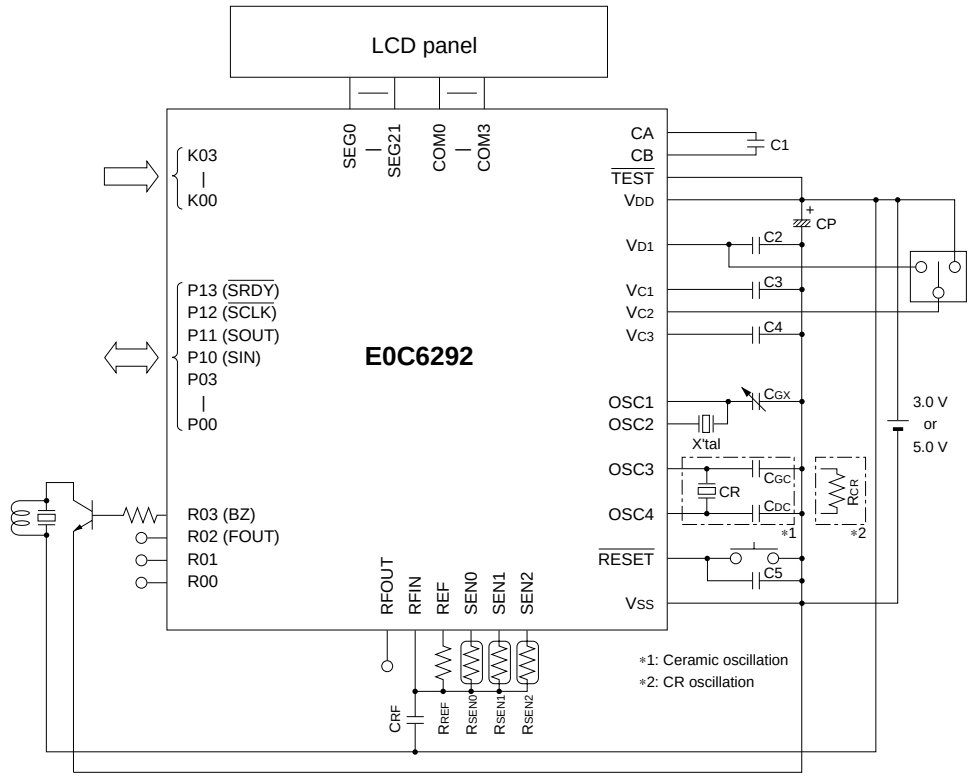


Plastic QFP13-64pin



Unit: mm

■ BASIC EXTERNAL CONNECTION DIAGRAM



X'tal	Crystal oscillator	32.768kHz, CI(Max.) = 35kΩ
CGX	Trimmer capacitor	5–25pF
CR	Ceramic oscillator	1MHz (Max.)
CGC	Gate capacitor	100pF
CDC	Drain capacitor	100pF
RCR	CR oscillating resistor	33kΩ (1,000kHz, Typ.)
RREF	Reference resistance for R/F conversion	49.9kΩ
RSEN0	Sensor 0 for R/F conversion (DC bias)	503AT-2 (Ishizuka Electronics Corporation)
RSEN1	Sensor 1 for R/F conversion (DC bias)	503AT-2 (Ishizuka Electronics Corporation)
RSEN2	Sensor 2 for R/F conversion (DC bias)	503AT-2 (Ishizuka Electronics Corporation)
CRF	Capacitor for R/F conversion	2,200pF
C1–C5	Capacitor	0.1µF
CP	Power capacitor	3.3µF

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

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

ENERGY SAVING EPSON