

## Micro MINI E0C6006

### 4-bit Single Chip Microcomputer



- E0C6200B Core CPU
- Low Voltage and Low Power
- Built-in LCD Driver
- Ir Output

#### ■ DESCRIPTION

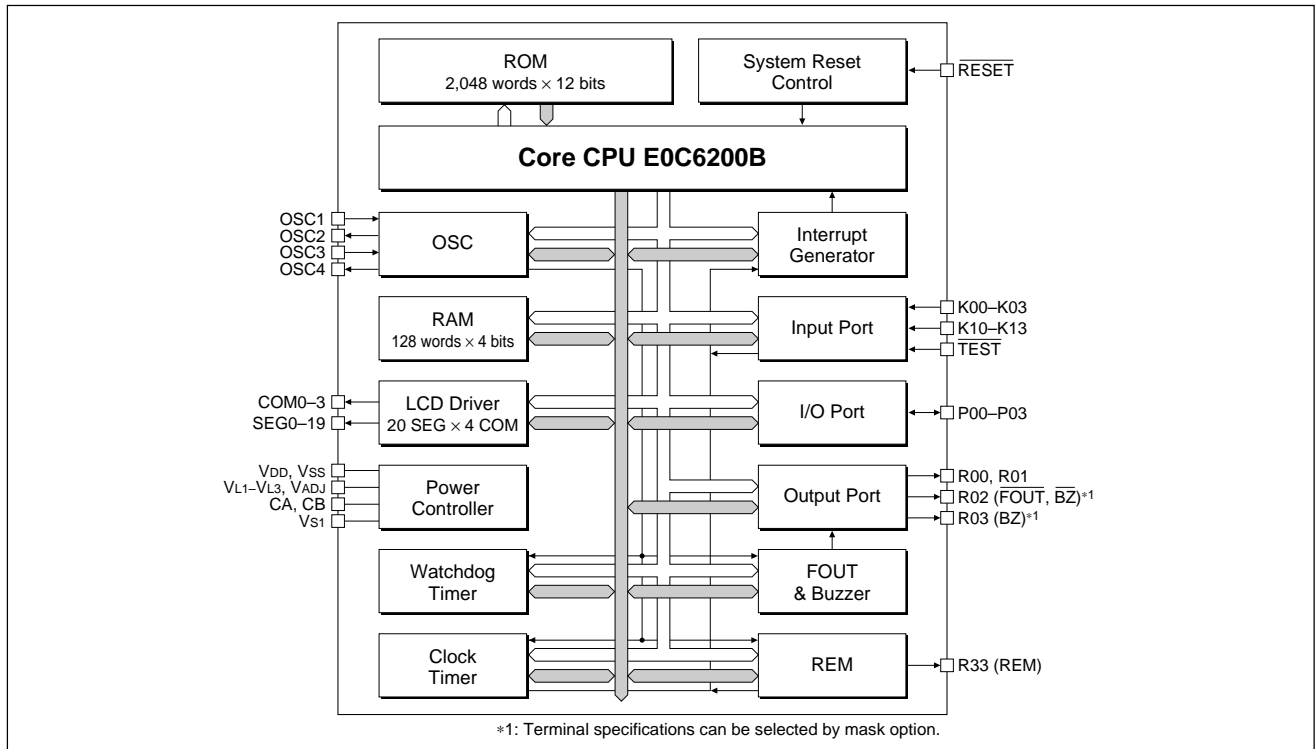
Micro MINI "E0C6006" is a single chip microcomputer for battery-driven products with 7-segment LCD display. It achieves low cost performance, and is suitable for a product added some feature instead of standard IC. It consists that Seiko Epson's original core CPU E0C6200B, LCD driver (20 segments × 4 commons), 128 words RAM, 2K words ROM, clock timer and so on.

#### ■ FEATURES

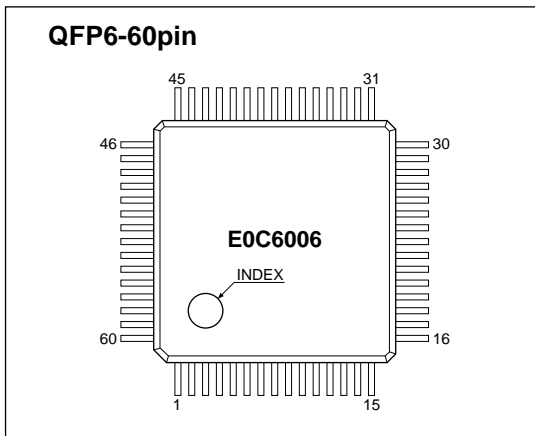
- CMOS LSI 4-bit parallel processing
- Clock ..... 32.768kHz/455kHz
- Instruction set ..... 100 instructions
- ROM capacity ..... 2K × 12 bits
- RAM capacity ..... 128 × 4 bits
- I/O port ..... I: 8 bits (with pull-down resistor selectable by mask option)  
O: 4 bits  
I/O: 4 bits
- Supply voltage detector (SVD) ..... No support
- Clock timer ..... 1ch.
- LCD driver ..... 20 segments × 4/3 commons
- Interrupt ..... External : 2 input interrupts  
Internal : 3 timer interrupts  
: 1 remote control output control interrupt
- Operation voltage ..... 2.2 to 3.5V
- Power consumption ..... 2.0μA (32.768kHz X'tal, 3.0V, HALT)  
9.0μA (32.768kHz X'tal, 3.0V, RUN)
- Package ..... Die form (pad pitch = 130μm), QFP6-60pin or QFP13-64pin

# E0C6006

## ■ BLOCK DIAGRAM

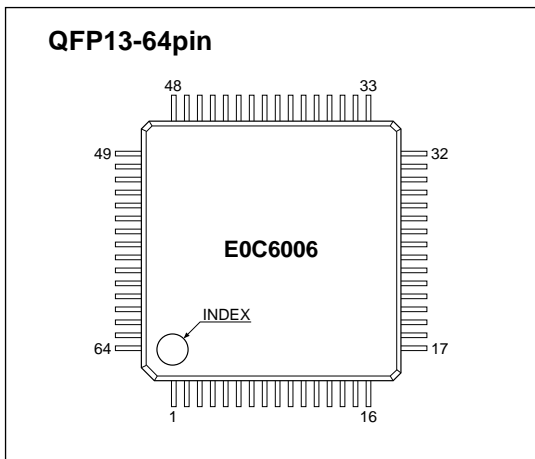


## ■ PIN CONFIGURATION



No.	Pin name	No.	Pin name	No.	Pin name	No.	Pin name
1	N.C.	16	R33(REM)	31	RESET	46	VL3
2	N.C.	17	SEG0	32	SEG12	47	VADJ
3	N.C.	18	SEG1	33	SEG13	48	CA
4	K00	19	SEG2	34	SEG14	49	CB
5	K01	20	SEG3	35	SEG15	50	VSS
6	K02	21	SEG4	36	SEG16	51	OSC4
7	K03	22	SEG5	37	SEG17	52	OSC3
8	K10	23	SEG6	38	SEG18	53	VS1
9	K11	24	SEG7	39	SEG19	54	OSC2
10	K12	25	SEG8	40	COM3	55	OSC1
11	K13	26	SEG9	41	COM2	56	VDD
12	R00	27	SEG10	42	COM1	57	P03
13	R01	28	N.C.	43	COM0	58	P02
14	R02	29	SEG11	44	VL1	59	P01
15	R03	30	TEST	45	VL2	60	P00

N.C. = No connection



No.	Pin name	No.	Pin name	No.	Pin name	No.	Pin name
1	N.C.	17	N.C.	33	RESET	49	N.C.
2	N.C.	18	R33(REM)	34	SEG12	50	VADJ
3	N.C.	19	SEG0	35	SEG13	51	CA
4	N.C.	20	SEG1	36	SEG14	52	CB
5	K00	21	SEG2	37	SEG15	53	VSS
6	K01	22	SEG3	38	SEG16	54	OSC4
7	K02	23	SEG4	39	SEG17	55	OSC3
8	K03	24	SEG5	40	SEG18	56	VS1
9	K10	25	SEG6	41	SEG19	57	OSC2
10	K11	26	SEG7	42	COM3	58	OSC1
11	K12	27	SEG8	43	COM2	59	VDD
12	K13	28	SEG9	44	COM1	60	P03
13	R00	29	SEG10	45	COM0	61	P02
14	R01	30	SEG11	46	VL1	62	P01
15	R02	31	N.C.	47	VL2	63	P00
16	R03	32	TEST	48	VL3	64	N.C.

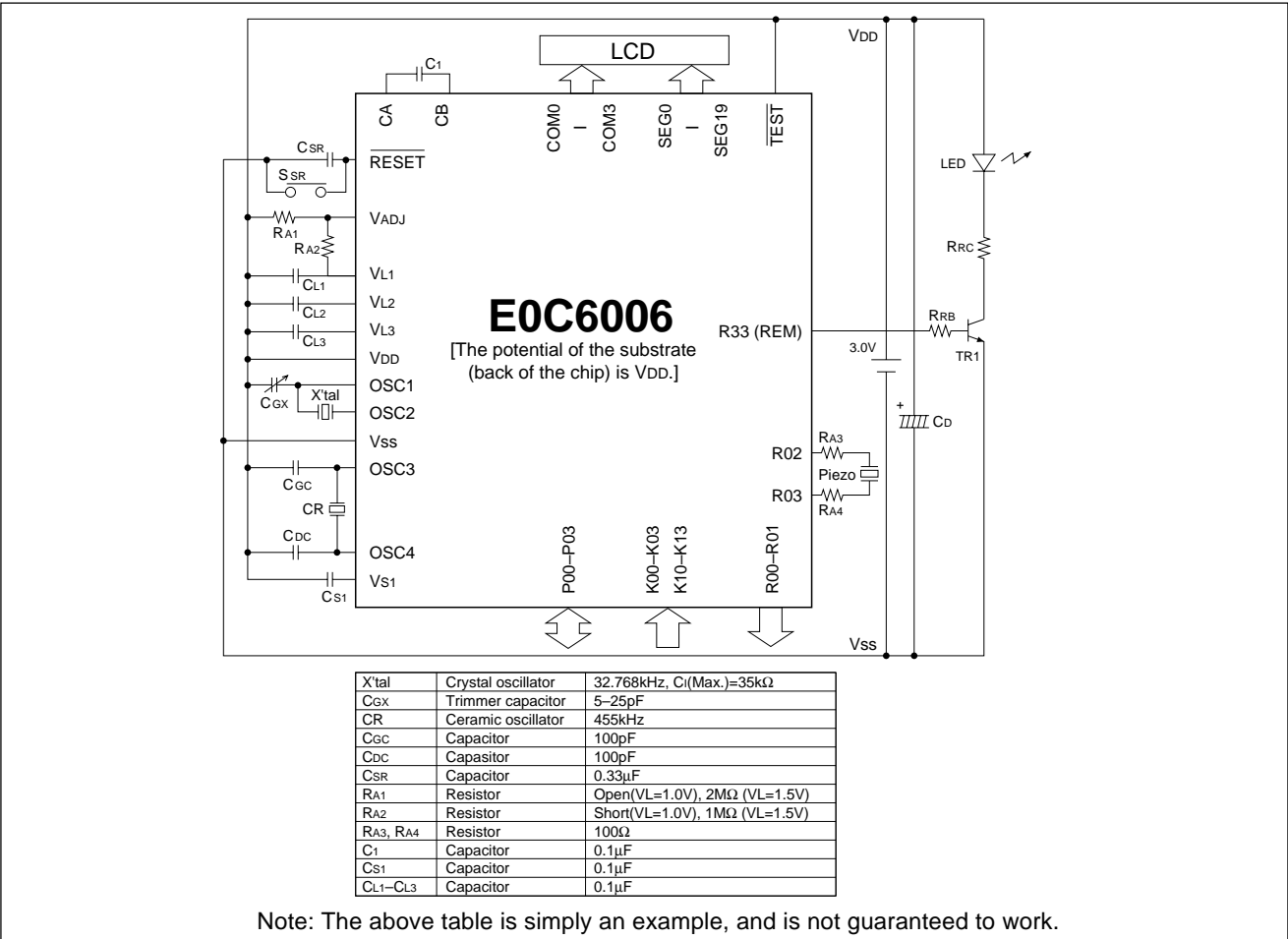
N.C. = No connection

## PIN DESCRIPTION

Pin name	Pin No.		In/Out	Function
	QFP6-60pin	QFP13-64pin		
VDD	56	59	(I)	Power supply pin (+)
VSS	50	53	(I)	Power supply pin (-)
Vs1	53	56	-	Oscillation and internal logic system voltage output pin
VL1	44	46	-	LCD drive voltage output pin
VL2	45	47	-	LCD drive voltage output pin
VL3	46	48	-	LCD drive voltage output pin
CA, CB	48, 49	51, 52	-	Boost capacitor connecting pin
VADJ	47	50	I	VL1 adjustment input pin
OSC1	55	58	I	Oscillation input pin (crystal)
OSC2	54	57	O	Oscillation output pin (crystal)
OSC3	52	55	I	Oscillation input pin (ceramic or CR *)
OSC4	51	54	O	Oscillation output pin (ceramic or CR *)
K00-K03	4-7	5-8	I	Input port pin
K10-K13	8-11	9-12	I	Input port pin
P00-P03	60-57	63-60	I/O	I/O port pin
R00, R01	12, 13	13, 14	O	Output port pin
R02	14	15	O	Output port pin, BZ or FOUT output pin *
R03	15	16	O	Output port pin or BZ output pin *
R33(REM)	16	18	O	Remote control carrier output port pin
SEG0-19	17-27, 29, 32-39	19-30, 34-41	O	LCD segment output pin or DC output pin *
COM0-3	43-40	45-42	O	LCD common output pin (1/3 duty or 1/4 duty are selectable *)
RESET	31	33	I	Initial reset input pin
TEST	30	32	I	Input pin for test

\* Can be selected by mask option

## BASIC EXTERNAL CONNECTION DIAGRAM



## ■ ELECTRICAL CHARACTERISTICS

### ● Absolute Maximum Ratings

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

Rating	Symbol	Value	Unit
Supply voltage	V <sub>SS</sub>	-5.2 to 0.5	V
Input voltage (1)	V <sub>I</sub>	V <sub>SS</sub> - 0.3 to 0.3	V
Input voltage (2)	V <sub>I</sub> OSC	V <sub>S1</sub> - 0.3 to 0.3	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)	—
Permissible dissipation *1	P <sub>D</sub>	250	mW

\*1: In case of plastic package (QFP6-60pin, QFP13-64pin).

### ● Recommended Operating Conditions

(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	-3.5	-3.0	-2.2	V
Oscillation frequency	f <sub>OSC1</sub>		—	32.768	—	kHz
	f <sub>OSC3</sub>	Duty: 50±5%	50	455	600	kHz
LCD drive voltage	V <sub>L1</sub>		-1.6	-1.03	—	V
CR oscillation external resistor	R <sub>CR</sub>		100	140	500	kΩ

### ● DC Characteristics

(Unless otherwise specified: V<sub>DD</sub>=0V, V<sub>SS</sub>=-2.2 to -3.5V, V<sub>L3</sub>=-3.0V, T<sub>a</sub>=-20 to 70°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage (1)	V <sub>IH1</sub>	K00-03, K10-13, P00-03	0.2·V <sub>SS</sub>		0	V
Low level input voltage (1)	V <sub>IL1</sub>	K00-03, K10-13, P00-03	V <sub>SS</sub>		0.8·V <sub>SS</sub>	V
High level input voltage (2)	V <sub>IH2</sub>	RESET	0.1·V <sub>SS</sub>		0	V
Low level input voltage (2)	V <sub>IL2</sub>	RESET	V <sub>SS</sub>		0.9·V <sub>SS</sub>	V
High level input current	I <sub>IH</sub>	V <sub>IH</sub> =V <sub>DD</sub>			1	μA
Low level input current	I <sub>IL1</sub>	V <sub>IL1</sub> =V <sub>SS</sub> K00-03, K10-13, No pull-up	-1			μA
	I <sub>IL2</sub>	V <sub>IL2</sub> =V <sub>SS</sub> K00-03, K10-13, Pull-up	-5		-0.35	μA
	I <sub>IL3</sub>	V <sub>IL3</sub> =V <sub>SS</sub> RESET	-5		-0.35	μA
	I <sub>IL4</sub>	V <sub>IL4</sub> =0.2·V <sub>SS</sub> K00-03, K10-13, Pull-up	-50			μA
	I <sub>IL5</sub>	V <sub>IL5</sub> =0.2·V <sub>SS</sub> RESET	-50			μA
	I <sub>IL6</sub>	V <sub>IL6</sub> =V <sub>SS</sub> P00-03 *1	-13		-2	μA
High level output current (1)	I <sub>OH1</sub>	V <sub>OH1</sub> =0.1·V <sub>SS</sub> R00-03			-250	μA
Low level output current (1)	I <sub>OL1</sub>	V <sub>OL1</sub> =0.9·V <sub>SS</sub> R00-03	1.0			mA
High level output current (2)	I <sub>OH2</sub>	V <sub>OH2</sub> =0.1·V <sub>SS</sub> P00-03			-250	μA
Low level output current (2)	I <sub>OL2</sub>	V <sub>OL2</sub> =0.9·V <sub>SS</sub> P00-03	1.0			mA
High level output current (3)	I <sub>OH3</sub>	V <sub>OH3</sub> =0.1·V <sub>SS</sub> R33(REM)			-1.8	mA
Low level output current (3)	I <sub>OL3</sub>	V <sub>OL3</sub> =0.9·V <sub>SS</sub> R33(REM)	1.0			mA
Common output current	I <sub>OH4</sub>	V <sub>OH4</sub> =-0.05V COM0-3			-3.0	μA
	I <sub>OL4</sub>	V <sub>OL4</sub> =V <sub>L3</sub> +0.05V	3.0			μA
Segment output current (during LCD output)	I <sub>OH5</sub>	V <sub>OH5</sub> =-0.05V SEG0-19			-3.0	μA
	I <sub>OL5</sub>	V <sub>OL5</sub> =V <sub>L3</sub> +0.05V	3.0			μA

\*1: Only at read cycle using internal program.

### ● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified: V<sub>DD</sub>=0V, V<sub>SS</sub>=-2.2 to -3.5V, T<sub>a</sub>=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	V <sub>L1</sub>	V <sub>ADJ</sub> =V <sub>L1</sub> , I <sub>L1</sub> =5μA	-1.11	-1.03	-0.95	V
	V <sub>L2</sub>	1 MΩ load connected between V <sub>DD</sub> and V <sub>L2</sub> (no panel load)	2·V <sub>L1</sub>		2·V <sub>L1</sub> +0.1	V
	V <sub>L3</sub>	1 MΩ load connected between V <sub>DD</sub> and V <sub>L3</sub> (no panel load)	3·V <sub>L1</sub>		3·V <sub>L1</sub> +0.3	V
Current consumption	I <sub>OP</sub>	HALT mode, OSCC=0		2	5	μA
		OSC1 mode, OSCC=0		9	18	μA
		OSC3 mode *1		130	250	μA

\*1: Ceramic oscillation (455 kHz) or CR oscillation (R<sub>CR</sub>=140 kΩ)

## ● 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 oscillator: 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 time	$t_{sta}$	$V_{SS}=-2.2$ to $-3.5V$	–	–	3	sec
Built-in capacitance (drain)	$C_D$	Package as assembled	–	20	–	pF
		Bare chip	–	19	–	pF
Frequency/voltage deviation	$\partial f/\partial V$	$V_{SS}=-2.2$ to $-3.5V$	–	–	5	ppm
Frequency/IC deviation	$\partial f/\partial IC$		-10	–	10	ppm
Frequency adjustment range	$\partial f/\partial C_G$	$C_G=5$ to $25pF$	40	–	–	ppm
Harmonic oscillation start voltage	$V_{hho}$	$C_G=5pF$ ( $V_{SS}$ )	–	–	-3.5	V
Permitted leak resistance	$R_{leak}$	Between OSC1 and other pins	200	–	–	$M\Omega$

### OSC3 (Ceramic Oscillation)

(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-3.0V$ , Ceramic oscillator: CSB455E\*1,  $C_{GC}=C_{DC}=100pF$ ,  $T_a=25^\circ C$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	$V_{sta}$	( $V_{DD}$ )	-2.2	–	–	V
Oscillation start time	$t_{sta}$	$V_{SS}=-2.2$ to $-3.5V$	–	3	–	mS
Oscillation stop voltage	$V_{stp}$	( $V_{DD}$ )	-2.2	–	–	V

\*1: CSB455E: made by Murata Mfg.Co.

### OSC3 (CR Oscillation)

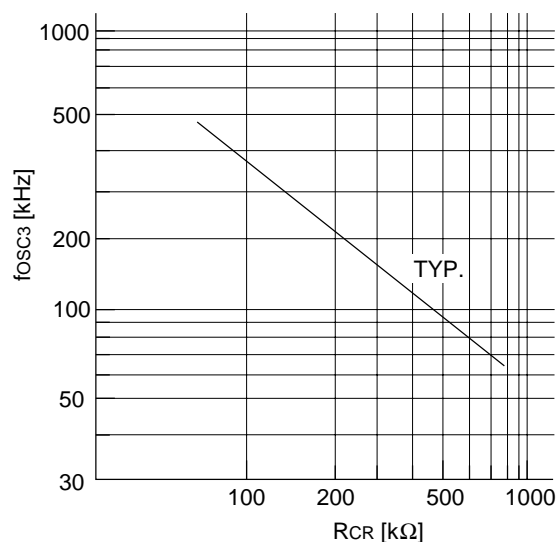
(Unless otherwise specified:  $V_{DD}=0V$ ,  $V_{SS}=-3.0V$ ,  $R_{CR}=140k\Omega$ ,  $T_a=25^\circ C$ )

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency	$f_{osc3}$		–	280	–	kHz
Oscillation start voltage	$V_{sta}$	( $V_{DD}$ )	-2.2	–	–	V
Oscillation start time	$t_{sta}$	$V_{SS}=-2.2$ to $-3.5V$	–	3	–	mS
Oscillation stop voltage	$V_{stp}$	( $V_{DD}$ )	-2.2	–	–	V

#### E0C6006 oscillation characteristics — $f_{osc3}$ vs RCR — (for reference)

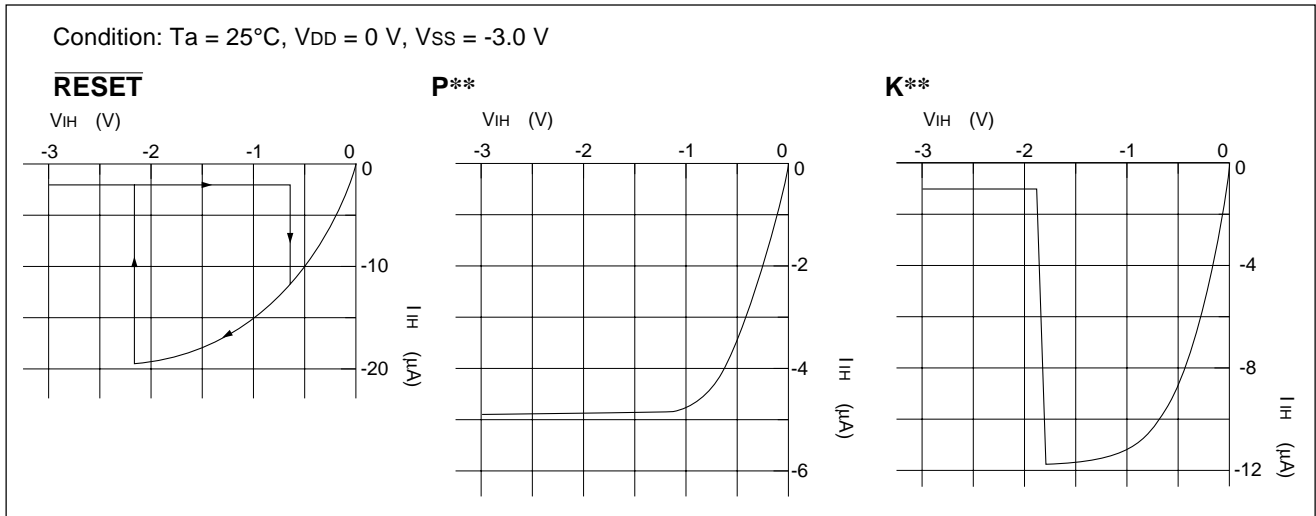
Condition:  $T_a = 25^\circ C$ ,  $V_{DD} = GND$ ,  $V_{SS} = -3.0 V$ ,  
Non board and package capacitance

Note: Oscillation characteristics are affected by various conditions (board pattern, parts used, etc.).

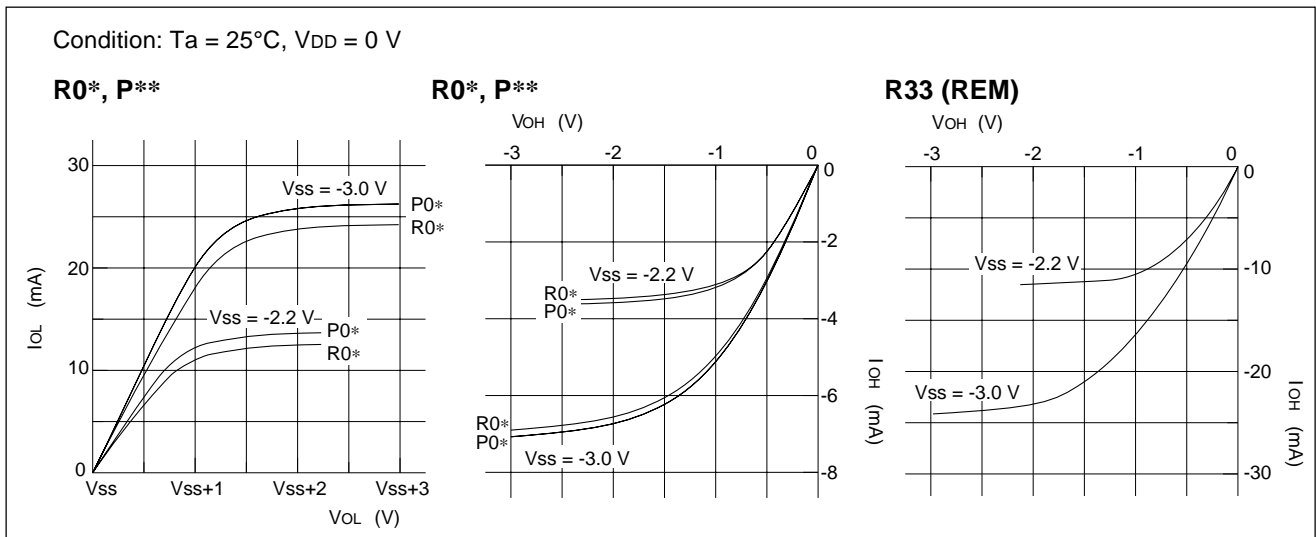


# E0C6006

## ● Input Current Characteristics (For Reference)



## ● Output Current Characteristics (For Reference)



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