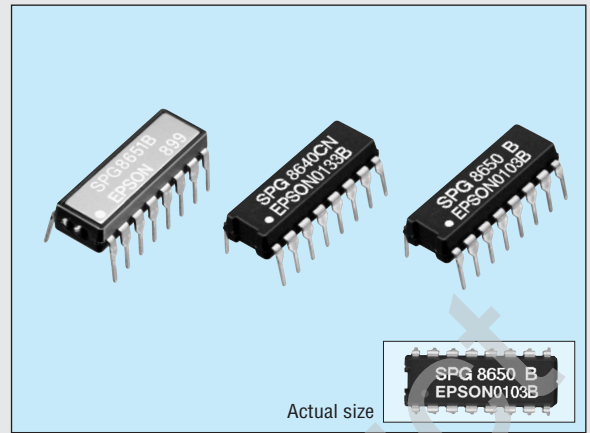


SELECTABLE-OUTPUT CRYSTAL OSCILLATOR

# SPG series

- Capable of selecting 57 varieties of frequency output.
- Low current consumption.
- Easy to mount DIP 16-pin package.



## Specifications (characteristics)

Item	Symbol	Specifications										Remarks	
Model name		8640AN	8640BN	8640CN	8650A	8650B	8650C	8650E	8651A	8651B	8651E		
Oscillation source frequency	$f_o$	600 kHz	1 MHz	768 kHz	60 kHz	100 kHz	96 kHz	32.768 kHz	60 kHz	100 kHz	32.768 kHz	For output frequency, refer to the table in the next page	
Power source voltage	Max. supply voltage	$V_{DD-GND}$										-0.3 V to +7.0 V	
	Operating voltage	$V_{DD}$										5.0 V $\pm$ 0.5 V	
Temperature range	Storage temperature	$T_{STG}$										-55 °C to +125 °C	-30 °C to +80 °C
	Operating temperature	$T_{OPR}$										-10 °C to +70 °C	-10 °C to +60 °C
Soldering condition (lead part)	$T_{SOL}$	Under +260 °C within 10 s										Package should be less than +150 °C	
Frequency tolerance	$\Delta f/f_o$	$\pm 100 \times 10^{-6}$			$\pm 50 \times 10^{-6}$			$\pm 5 \times 10^{-6} *1$			$V_{DD}=5 V, T_a=+25 °C$		
Frequency temperature characteristics		$+10/-120 \times 10^{-6}$										$V_{DD}=5 V$	
Frequency voltage characteristics		$\pm 20 \times 10^{-6}$	$\pm 10 \times 10^{-6}$	$\pm 20 \times 10^{-6}$	$\pm 10 \times 10^{-6}$			$\pm 5 \times 10^{-6}$			$V_{DD}=4.5$ to $5.5 V$		
Aging	$f_a$	$\pm 5 \times 10^{-6}/\text{year Max.}$							$\pm 3 \times 10^{-6}/\text{year Max.}$			$V_{DD}=5 V, T_a=+25 °C, \text{first year}$	
Current consumption	$I_{OP}$	1.0 mA Max.	2.0 mA Max.	1.5 mA Max.	0.5 mA Max.						No load condition		
Shock resistance	S.R.	$\pm 5 \times 10^{-8}$ Max.(From 500 mm)			$\pm 5 \times 10^{-8}$ Max.			$\pm 10 \times 10^{-8}$ Max.			Three drops on a hard wooden board form 750 mm		

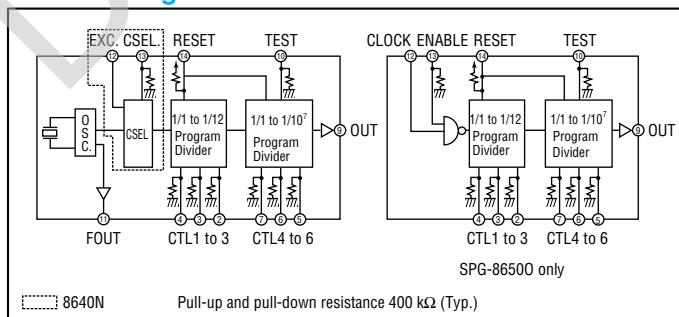
\*1 Frequency tolerance of 8651 system shows the value guaranteed at the time of shipment.

## Electric characteristics ( $V_{DD}=5 V \pm 0.5 V, T_a=-10$ to $+70 °C, C_L \leq 15 pF$ )

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
L. input voltage	$V_{IL}$	0		0.8	V	
H. input voltage	$V_{IH}$	$V_{DD}-1.0$		$V_{DD}$	V	
L. input current (Reset)	$I_{RL}$	-30		-5	$\mu A$	Reset=GND
H input current (Reset)	$I_{RH}$			0.5	$\mu A$	Reset= $V_{DD}$
L. input current (input terminal except for Reset)	$I_{IL}$	-0.5			$\mu A$	
H input current (input terminal except for Reset)	$I_{IH}$	5		30	$\mu A$	$I_{OH}=1.6 mA$
L. output voltage	$V_{OL}$			0.4	V	$I_{OH}=-40 \mu A$
H. output voltage	$V_{OH}$	$V_{DD}-1.0$			V	$V_{OL}=0.4 V$
L. output current	$I_{OL}$	1.6			mA	$V_{OH}=V_{DD}-1.0 V$
H. output current	$I_{OH}$			-40	$\mu A$	
Output rise time	$t_{rHL}$		30	60	ns	
Output fall time	$t_{rHL}$		25	50	ns	
Duty		40		60	%	Except in the case of 1/3 and 1/5
Min. reset pulse width	$t_{rw}$	1.0			$\mu s$	
Reset delay time	$t_r$			1.0	$\mu s$	
Reset release synchronous error	$t_E$	$t_w \times \frac{1}{2}$ to		$t_w \times 2$		
External signal input frequency	$F_{IN}$			1M	Hz	8640 N only
External signal input pulse width	$t_{IN}$	0.5			$\mu s$	
Oscillation start up time	$t_{OSC}$		0.2	1	s	* 3

\* 1  $t_o$ =oscillation source cycle. \* 2  $t_w=1/2$  cycle of preset frequency.  
 \* 3 For more than 1 ms until  $V_{DD}=0 \rightarrow 4.5 V$ . Time at 4.5 V is to be 0.

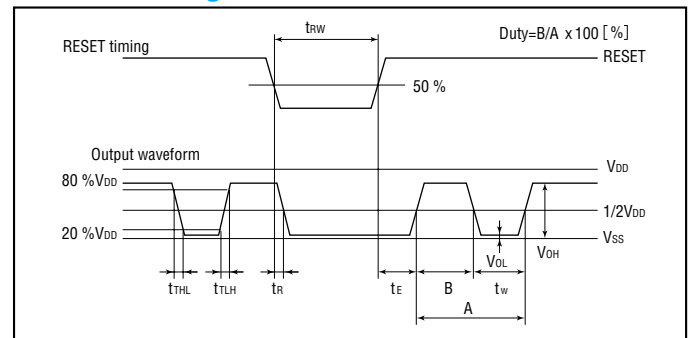
## Block diagram



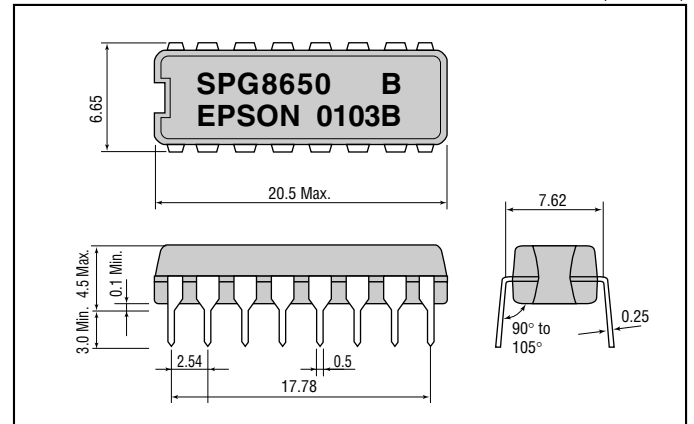
## Divider IC (without quartz crystal)

Item	Symbol	Specifications	Remarks
Model name		8650 O	
Input clock frequency		1 MHz max.	
Current consumption	$I_{OP}$	About 2 mA	No load condition

## RESET timing



## External dimensions



**Terminal connection**

No.	Pin terminal	No.	Pin terminal
1	NC	16	V <sub>DD</sub>
2	CTL 3	15	NC
3	CTL 2	14	RESET
4	CTL 1	13	NC (CSEL)
5	CTL 6	12	NC (EXC)
6	CTL 5	11	FOUT
7	CTL 4	10	TEST
8	GND	9	OUT

( ) shown 8640N only  
For 8650 O  
11. NC 12. CLOCK 13. ENABLE

NC: Do not connect to the external terminal.

**Explanation of terminal**

- (a) CTL 1 to 6 : Programs dividing ratio. (pull-down resistor incorporated.)
- (b) OUT : Output frequency preset by CTL1 to 6. (refer to the procedure for setting output frequency.)
- (c) FOUT : Constantly outputs the oscillation source frequency of builtin crystal unit.
- (d) RESET : Stops output at RESET= "L". (pull-up resistor incorporated.)
- (e) TEST : Used for the input terminal for testing. When CTL4 is H, output will be 1000 times larger than the preset value at TEST= "H". (pull-down resistor incorporated.)
- (f) EXC (8640N only) : Serves as input terminal when using an external clock by changing to the builtin oscillator. Effective only when CSEL is H.
- (g) CSEL (8640N only) : When this terminal is made H, the external clock is selected. (pull-down resistor incorporated.)

(Note) Treatment of empty terminals. When RESET terminal is not used, this should be connected to V<sub>DD</sub>, and when TEST terminal, CSEL terminal, and CTL 1 to 6 terminals are not used, to GND.

**Explanation of terminal (8650 O)**

- (a) CLOCK: Clock input (Max. 1 MHz)
- (b) ENABLE: Be sure to connect to V<sub>DD</sub>

**Setting of divider output**

CTL1	CTL2	CTL3	Dividing ratio	CTL4	CTL5	CTL6	Dividing ratio
0	0	0	1/1	0	0	0	1/1
0	0	1	1/10	0	0	1	1/10
0	1	0	1/2	0	1	0	1/10 <sup>2</sup>
0	1	1	1/3	0	1	1	1/10 <sup>3</sup>
1	0	0	1/4	1	0	0	1/10 <sup>4</sup>
1	0	1	1/5	1	0	1	1/10 <sup>5</sup>
1	1	0	1/6	1	1	0	1/10 <sup>6</sup>
1	1	1	1/12	1	1	1	1/10 <sup>7</sup>

0= "L" 1="H"

**Setting of output frequency**

**8640AN**

(Unit: Hz)

Set terminal	CTL4	CTL5	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	Output frequency	Baud rate output example (to/16)							
0	0	0	0	0	1	1	1	1	1	1	1	1	600k	60k	6k	600	60	6.0	0.6	0.06	0.006
0	0	1	0	0	1	1	0	0	1	1	1	1	60k	6k	600	60	6	0.6	0.06	0.006	0.0006
0	1	0	0	0	1	0	0	1	0	1	0	1	300k	30k	3k	300	30	3.0	0.3	0.03	0.003
0	1	1	0	0	1	0	1	0	1	0	1	0	200k	20k	2k	200	20	2.0	0.2	0.02	0.002
1	0	0	0	0	1	0	0	1	0	0	1	0	150k	15k	1.5k	150	15	1.5	0.15	0.015	0.0015
1	0	1	0	0	1	0	1	0	1	0	1	0	120k	12k	1.2k	120	12	1.2	0.12	0.012	0.0012
1	1	0	0	0	1	0	0	1	0	0	1	0	100k	10k	1k	100	10	1.0	0.1	0.01	0.001
1	1	1	0	0	1	0	1	0	1	0	1	0	50k	5k	500	50	5	0.5	0.05	0.005	0.0005

**8640BN**

Set terminal	CTL4	CTL5	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	Output frequency	Baud rate output example (to/16)							
0	0	0	0	0	1	1	1	1	1	1	1	1	1M	100k	10k	1k	100	10	1	1/10	1/10
0	0	1	0	0	1	1	0	0	1	1	1	1	100k	10k	1k	100	10	1	1/10	1/10	1/100
0	1	0	0	0	1	0	0	1	0	1	0	1	500k	50k	5k	500	50	5	1/2	1/20	1/20
0	1	1	0	0	1	0	1	0	1	0	1	0	333.3k	33.3k	3.3k	333.3	33.3	3.33	1/3	1/30	1/30
1	0	0	0	0	1	0	0	1	0	0	1	0	250k	25k	2.5k	250	25	2.5	1/4	1/40	1/40
1	0	1	0	0	1	0	1	0	1	0	1	0	200k	20k	2k	200	20	2	1/5	1/50	1/50
1	1	0	0	0	1	0	0	1	0	0	1	0	166.6k	16.6k	1.6k	166.6	16.6	1.6	1/6	1/60	1/60
1	1	1	0	0	1	0	1	0	1	0	1	0	83.3k	8.3k	833.3	83.3	8.3	0.83	1/12	1/120	1/120

**8650A 8651A**

Set terminal	CTL4	CTL5	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	Output frequency	Baud rate output example (to/16)							
0	0	0	0	0	1	1	1	1	1	1	1	1	60k	6.0k	600	60	6.0	0.6	0.06	0.006	0.0006
0	0	1	0	0	1	1	0	0	1	1	0	1	6k	600	60	6	0.6	0.06	0.006	0.0006	0.0006
0	1	0	0	0	1	0	0	1	0	1	0	1	30k	3.0k	300	30	3.0	0.3	0.03	0.003	0.0003
0	1	1	0	0	1	0	1	0	1	0	1	0	20k	2.0k	200	20	2.0	0.2	0.02	0.002	0.0002
1	0	0	0	0	1	0	0	1	0	0	1	0	15k	1.5k	150	15	1.5	0.15	0.015	0.0015	0.00015
1	0	1	0	0	1	0	1	0	1	0	1	0	12k	1.2k	120	12	1.2	0.12	0.012	0.0012	0.00012
1	1	0	0	0	1	0	0	1	0	0	1	0	10k	1.0k	100	10	1.0	0.1	0.01	0.001	0.0001
1	1	1	0	0	1	0	1	0	1	0	1	0	5k	500	50	5	0.5	0.05	0.005	0.0005	0.00005

**8650B 8651B**

Set terminal	CTL4	CTL5	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	Output frequency	Baud rate output example (to/16)							
0	0	0	0	0	1	1	1	1	1	1	1	1	100k	10k	1k	100	10	1	1/10	1/100	1/100
0	0	1	0	0	1	1	0	0	1	1	0	1	10k	1k	100	10	1	1/10	1/100	1/1000	1/1000
0	1	0	0	0	1	0	0	1	0	1	0	1	50k	5k	500	50	5	1/2	1/20	1/200	1/200
0	1	1	0	0	1	0	1	0	1	0	1	0	33.3k	3.3k	333.3	33.3	3.33	1/3	1/30	1/300	1/300
1	0	0	0	0	1	0	0	1	0	0	1	0	25k	2.5k	250	25	2.5	1/4	1/40	1/400	1/400
1	0	1	0	0	1	0	1	0	1	0	1	0	20k	2k	200	20	2	1/5	1/50	1/500	1/500
1	1	0	0	0	1	0	0	1	0	0	1	0	16.6k	1.6k	166.6	16.6	1.6	1/6	1/60	1/600	1/600
1	1	1	0	0	1	0	1	0	1	0	1	0	8.3k	833.3	83.3	8.3	0.83	1/12	1/120	1/1200	1/1200

**8650E 8651E**

Set terminal	CTL4	CTL5	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	CTL1	CTL2	CTL3	CTL6	Output frequency	Baud rate output example (to/16)							
0	0	0	0	0	1	1	1	1	1	1	1	1	32768	3276.8	327.68	32.768	3.276	0.3276	0.03276	0.003276	0.0003276
0	0	1	0	0	1	1	0	0	1	1	0	1	3276.8	327.68	32.768	3.276	0.327	0.0327	0.00327	0.000327	0.0000327
0	1	0	0	0	1	0	0	1	0	1	0	1	16384	1638.4	163.84	16.384	1.638	0.1638	0.01638	0.001638	0.0001638
0	1	1	0	0	1	0	1	0	1	0	1	0	10922.6	1092.26	109.226	10.922	1.092	0.1092	0.01092	0.001092	0.0001092
1	0	0	0	0	1	0	0	1	0	0	1	0	8192	819.2	81.92	8.192	0.819	0.0819	0.00819	0.000819	0.0000819
1	0	1	0	0	1	0	1	0	1	0	1	0	6553.6	655.36	65.536	6.553	0.655	0.0655	0.00655	0.000655	0.0000655
1	1	0	0	0	1	0	0	1	0	0	1	0	5461.3	546.13	54.613	5.461	0.546	0.0546	0.00546	0.000546	0.0000546
1	1	1	0	0	1	0	1	0	1	0	1	0	2730.6	273.06	27.306	2.730	0.273	0.0273	0.00273	0.000273	0.0000273

Note: Lower digits are omitted.

**Baud rate generator**

**8640CN**

CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	Output frequency	Baud rate output example (to/16)
0	0	0	0	0	0	768 kHz	48000 bits/s
1	0	0	1	0	0	153.6	9600
0	0	1	0	0	0	76.8	4800
0	1	0	0	0	1	38.4	2400
1	0	0	0	0	1	19.2	1200

**8650C**

CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	Output frequency	Baud rate output example (to/16)
0	0	0	0	0	0	96.0 kHz	6000 bits/s
1	0	0	1	0	0	19.2	1200
0	0	1	0	0	0	9.6	600
0	1	0	0	0	1	4.8	300
0	1	1	0	0	1	3.2	200
1	0	0	0	0	1	2.4	150
1	1	0	0	0	1	1.6	100
1	1	1	0	0	1	0.8	50