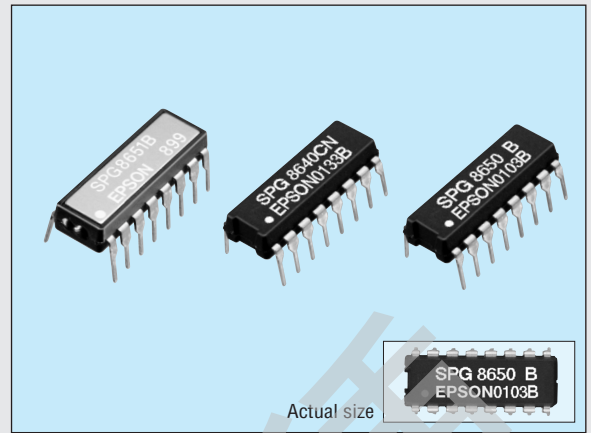


SELECTABLE-OUTPUT CRYSTAL OSCILLATOR

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		

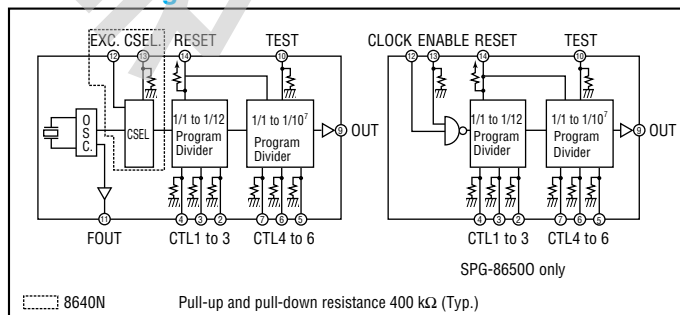
*1 Frequency tolerance of 8651 system shows the value guaranteed at the time of shipment.

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	μA	Reset=GND
H input current (Reset)	I_{RH}			0.5	μA	Reset= V_{DD}
L. input current (input terminal except for Reset)	I_{IL}	-0.5			μA	
H input current (input terminal except for Reset)	I_{IH}	5		30	μA	$I_{OL}=1.6 mA$
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	μA	
Output rise time	t_{LH}		30	60	ns	
Output fall time	t_{HL}		25	50	ns	
Duty		40		60	%	Except in the case of 1/3 and 1/5
Min. reset pulse width	t_{RW}	1.0			μs	
Reset delay time	t_R			1.0	μs	
Reset release synchronous error	t_E	$t_w \times \frac{1}{2} t_o$		t_w^2		
External signal input frequency	F_{IN}			1M	Hz	8640 N only
External signal input pulse width	t_{IN}	0.5			μs	
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.

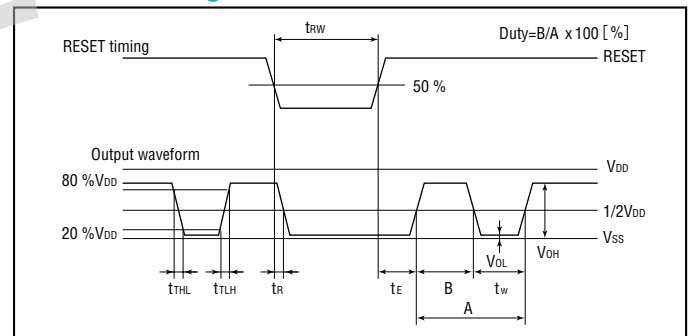
Block diagram



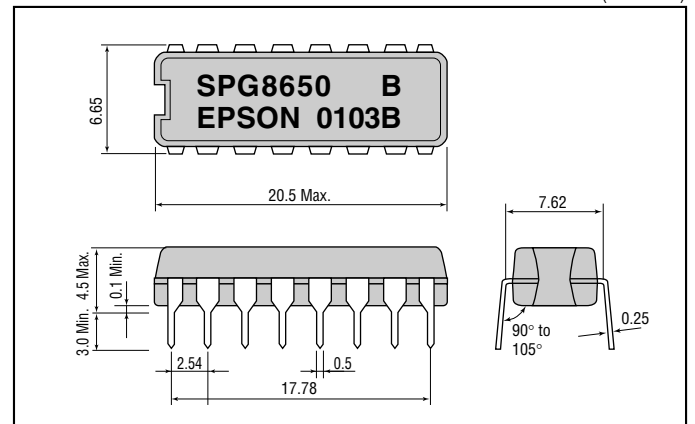
Divider IC (without quartz crystal)

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 _{DD}
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_{DD}, 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_{DD}

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 ²
0	1	1	1/3	0	1	1	1/10 ³
1	0	0	1/4	1	0	0	1/10 ⁴
1	0	1	1/5	1	0	1	1/10 ⁵
1	1	0	1/6	1	1	0	1/10 ⁶
1	1	1	1/12	1	1	1	1/10 ⁷

0= "L" 1="H"

Setting of output frequency

8640AN (Unit: Hz)

Set terminal	CTL4	CTL5	CTL6	CTL3	CTL2	CTL1	Output frequency	Baud rate output example (to/16)
0 0 0	0	0	0	0	0	0	600k	48000
0 0 1	0	0	1	0	0	0	60k	9600
0 1 0	0	1	0	0	0	0	300k	9600
0 1 1	0	1	1	0	0	0	200k	4800
1 0 0	1	0	0	0	0	0	150k	3000
1 0 1	1	0	1	0	0	0	120k	2400
1 1 0	1	1	0	0	0	0	100k	1920
1 1 1	1	1	1	0	0	0	50k	960

8640BN

Set terminal	CTL4	CTL5	CTL6	CTL3	CTL2	CTL1	Output frequency	Baud rate output example (to/16)
0 0 0	0	0	0	0	0	0	1M	6000
0 0 1	0	0	1	0	0	0	100k	1200
0 1 0	0	1	0	0	0	0	500k	600
0 1 1	0	1	1	0	0	0	333.3k	300
1 0 0	1	0	0	0	0	0	250k	200
1 0 1	1	0	1	0	0	0	200k	150
1 1 0	1	1	0	0	0	0	166.6k	100
1 1 1	1	1	1	0	0	0	83.3k	50

8650A 8651A

Set terminal	CTL4	CTL5	CTL6	CTL3	CTL2	CTL1	Output frequency	Baud rate output example (to/16)
0 0 0	0	0	0	0	0	0	60k	48000
0 0 1	0	0	1	0	0	0	6k	9600
0 1 0	0	1	0	0	0	0	30k	9600
0 1 1	0	1	1	0	0	0	20k	4800
1 0 0	1	0	0	0	0	0	15k	3000
1 0 1	1	0	1	0	0	0	12k	2400
1 1 0	1	1	0	0	0	0	10k	1920
1 1 1	1	1	1	0	0	0	5k	960

8650B 8651B

Set terminal	CTL4	CTL5	CTL6	CTL3	CTL2	CTL1	Output frequency	Baud rate output example (to/16)
0 0 0	0	0	0	0	0	0	100k	6000
0 0 1	0	0	1	0	0	0	10k	1200
0 1 0	0	1	0	0	0	0	50k	600
0 1 1	0	1	1	0	0	0	33.3k	300
1 0 0	1	0	0	0	0	0	25k	200
1 0 1	1	0	1	0	0	0	20k	150
1 1 0	1	1	0	0	0	0	16.6k	100
1 1 1	1	1	1	0	0	0	8.3k	50

8650E 8651E

Set terminal	CTL4	CTL5	CTL6	CTL3	CTL2	CTL1	Output frequency	Baud rate output example (to/16)
0 0 0	0	0	0	0	0	0	32768	48000
0 0 1	0	0	1	0	0	0	3276.8	9600
0 1 0	0	1	0	0	0	0	16384	9600
0 1 1	0	1	1	0	0	0	10922.6	4800
1 0 0	1	0	0	0	0	0	8192	3000
1 0 1	1	0	1	0	0	0	6553.6	2400
1 1 0	1	1	0	0	0	0	5461.3	1920
1 1 1	1	1	1	0	0	0	2730.6	960

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
1	0	0	0	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
1	0	0	0	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