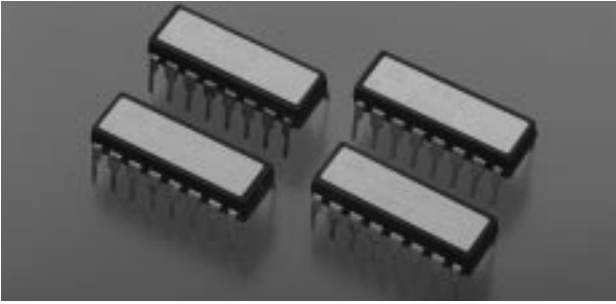


# Crystal Oscillators - Programmable - Seiko Epson

## SPG Series



## Features

- Capable of selecting 57 varieties of frequency output
- Use of CMOS IC enables low current consumption
- Easy-to-mount DIP 16 pin type
- Most types held ex-stock

## Specifications

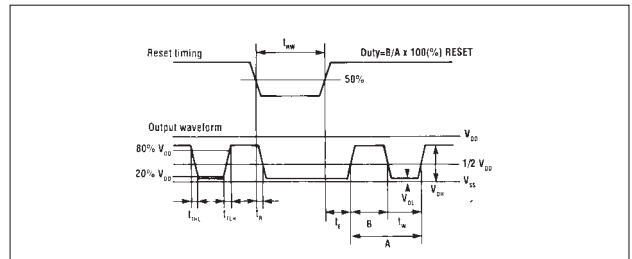
Item	Symbol	Specifications	Remarks
Model name		8640AN 8640BN 8640CN 8650A 8650B 8650C 8650D 8650E 8651A 8651B 8651E	For output frequency, refer to the table on the next page
Oscillation source frequency	$f_o$	600kHz 1MHz 769kHz 60kHz 100kHz 96kHz 153.6kHz 32.768kHz	
Power source	Max. supply voltage	$V_{DD}\cdot GND$	-0/3V ~ +7.0V
	Operating voltage	$V_{DD}$	5.0V $\pm$ 0.5V
Temperature range	Storage temp.	$T_{STG}$	-55°C ~ +125°C
	Operating temp.	$T_{OPR}$	-10°C ~ +70°C
Soldering condition (lead part)	$T_{SOL}$		Under 260°C within 10 sec. Package should be less than 150°C
Frequency tolerance	$\Delta f/f$	$\pm 100ppm$	$\pm 50ppm$ $\pm 5ppm$ (1*) $V_{DD}=5V, T_a=25^\circ C$
Frequency/temp. characteristics			$\pm 10/-120ppm$ $V_{DD}=5V, T_a=10 \sim 70^\circ C$
Frequency Voltage characteristics		$\pm 20ppm$ $\pm 10ppm$ $\pm 20ppm$	$\pm 10ppm$ $\pm 5ppm$ $V_{DD}=4.5 \sim 5.5V$
Aging	$f_a$	$\pm 5ppm/year$ max.	$\pm 3ppm/year$ max $V_{DD}=5V, T_a=25^\circ C$
Current consumption	lop	1.0mA 2.0mA 1.5mA	0.5mA Max. No load condition

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

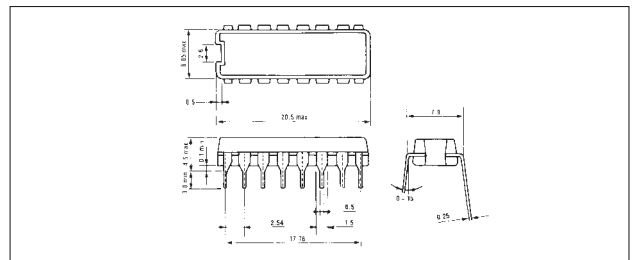
## Electrical Characteristics $V_{DD}=5V \pm 0.5V, T_a=-10 \sim 70^\circ C, C_L \leq 15pF$ Reset Timing

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= $V_{SS}$
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	$\mu A$	
L output voltage	$V_{OL}$			0.4	V	$I_{OL}=1.6mA$
H output voltage	$V_{OH}$	$V_{DD}-1.0$			V	$I_{OH}=40\mu A$
L output current	$I_{OL}$	1.6			mA	$V_{OL}=0.4V$
H output current	$I_{OH}$			-40	$\mu A$	$V_{OH}=V_{DD}-1.0V$
Output rise time	$t_{TLH}$		30	60	nS	
Output fall time	$t_{THL}$		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	$t_E$	$t_w-1/2$ to (*1) $t_w$ (*2)				
External signal input frequency	$F_{IN}$			1M	Hz	8640N only
External signal input plus width	$t_{IN}$	0.5			$\mu S$	8640N only
Oscillation startup time	$t_{OSC}$		0.2	1	sec.	(*3)

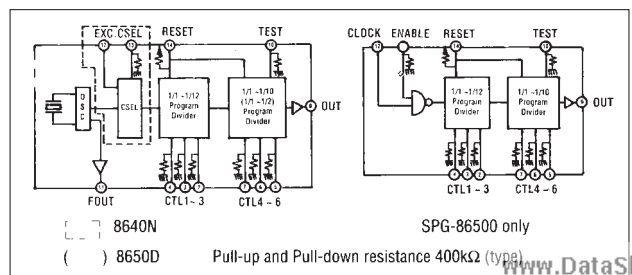
(\*1) to-oscillation source cycle. (\*2)  $t_w=1/2$  cycle of preset frequency  
 (\*3) for more than 1ms until  $V_{DD}=0.45V$ . Time at 4.5V is to be zero



## Dimensions (mm)



## Block Diagram



## Divider IC (without quartz crystal)

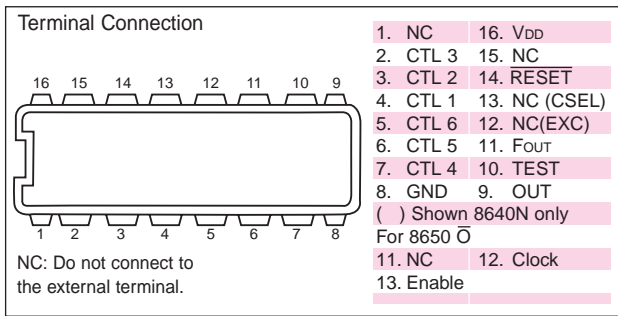
Item	Symbol	Specifications	Remarks
Model name		8650 ?	
Input clock frequency		1MHz MAX	
Current consumption	lop	about 2mA	No load condition



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# Crystal Oscillators - Programmable - Seiko Epson

## SPG Series



## Explanation of Terminals

Terminal Name	Function
CTL1 to 6	Programs dividing ratio. (pull-down resistor incorporated)
OUT	Output frequency preset by CTL1-6. (Refer to the setting procedure of output frequency)
FOUT	Constantly outputs the oscillation source frequency of built-in quartz crystal.
RESET	Stops output at RESET="L". (Pull up resistor incorporated)
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)
EXC (8640N only)	Serves as input terminal when using an external clock by changing to the built-in oscillator. Effective only when CSEL is H.
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 VDD, when TEST terminal, CSEL terminal, and CTL1 to 6 terminals are not used, to GND.

**Additional explanation of terminals for 8650D series**

Clock	Clock input (max. 1MHz)
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 (1 <sup>0</sup> )
0	0	1	1/10	0	0	1	1/10 (10 <sup>1</sup> )
0	1	0	1/2	0	1	0	1/10 <sup>2</sup> (10 <sup>2</sup> )
0	1	1	1/3	0	1	1	1/10 <sup>3</sup> (10 <sup>3</sup> )
1	0	0	1/4	1	0	0	1/10 <sup>4</sup> (10 <sup>4</sup> )
1	0	1	1/5	1	0	1	1/10 <sup>5</sup> (10 <sup>5</sup> )
1	1	0	1/6	1	1	0	1/10 <sup>6</sup> (10 <sup>6</sup> )
1	1	1	1/12	1	1	1	1/10 <sup>7</sup> (10 <sup>7</sup> )

\*0 = L 1 = H (8650D)

## Setting of Output Frequency

**8640AN**

Set terminal	CTL4	CTL5	CTL3	CTL2	CTL1	Output frequency (kHz)	Baud rate (fo/16)(bits/sec)	output example (fo/16)(bits/sec)					
0	0	0	0	0	0	600K	60K	6K	600	6	0.6	0.06	
0	0	1	0	0	0	60K	6K	600	60	6	0.6	0.06	0.006
0	1	0	0	0	0	300K	30K	3K	300	30	3	0.3	0.03
0	1	1	0	0	0	200K	20K	2K	200	20	2	0.2	0.02
1	0	0	0	0	0	150K	15K	1.5K	150	15	1.5	0.15	0.015
1	0	1	0	0	0	120K	12K	1.2K	120	12	1.2	0.12	0.012
1	1	0	0	0	0	100K	10K	1K	100	10	1	0.1	0.01
1	1	1	0	0	0	50K	5K	500	50	5	0.5	0.05	0.005

**8640BN**

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

**8650A 8651A**

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

**8650B 8651B**

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

**8650E 8651E**

Set terminal	CTL4	CTL5	CTL3	CTL2	CTL1	Output frequency (kHz)	Baud rate (fo/16)(bits/sec)	output example (fo/16)(bits/sec)					
0	0	0	0	0	0	32768	3276.8	327.68	32768	3276.8	0.32768	0.03276	0.00327
0	0	1	0	0	0	3276.8	327.68	32.768	3.276	0.327	0.0327	0.00327	0.00032
0	1	0	0	0	0	16384	1638.4	163.84	16384	1638.4	1.6384	0.16384	0.01638
0	1	1	0	0	0	10922.6	1092.26	109.226	10.922	1.092	0.1092	0.01092	0.00109
1	0	0	0	0	0	8192	819.2	81.92	8192	819.2	0.819	0.0819	0.00819
1	0	1	0	0	0	6553.6	655.36	65.536	6.553	0.655	0.0655	0.00655	0.00065
1	1	0	0	0	0	5461.3	546.13	54.613	5.461	0.546	0.0546	0.00546	0.00054
1	1	1	0	0	0	2730.6	273.06	27.306	2.730	0.273	0.0273	0.00273	0.00027

## Baud Rate Generator

**8640CN**

CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	Output frequency (kHz)	Baud rate output example (fo/16)(bits/sec)
0	0	0	0	0	0	768K	48000
1	0	1	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 (kHz)	Baud rate output example (fo/16)(bits/sec)
0	0	0	0	0	0	96.0	6000
1	0	1	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

**8650D**

CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	Output frequency (kHz)	Baud rate output example (fo/16)(bits/sec)
0	0	0	0	0	0	153.6	9600
0	0	0	0	0	1	76.8	4800
0	0	0	0	1	0	38.4	2400
0	0	0	0	1	1	19.2	1200
0	0	0	1	0	1	4.8	300
0	1	1	1	0	0	3.2	200
0	0	0	1	1	0	2.4	150
1	1	0	1	0	0	1.6	100
0	0	0	1	1	1	1.2	75
1	1	1	1	0	0	0.8	50

Note: Lower digits are omitted



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