

CRYSTAL OSCILLATOR (Programmable)  
SPREAD SPECTRUM  
OUTPUT: CMOS



Product Number  
X1G005281xxxx00

# SG-9101CGA

- Frequency range : 0.67 MHz to 170 MHz (1 ppm Step)
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Down or Center spread modulation
- Configurable spreading
  - 3 modulation profile (Hershey-kiss, Sine-wave, Triangle),
  - 4 modulation frequency, 6 spread percentage
- Package : 2.5 x 2.0 (mm)
- PLL technology to enable short lead time
- Conform to AEC-Q100



## Specifications (characteristics)

Item	Symbol	Specifications	Conditions/Remarks																																											
Supply voltage	V <sub>CC</sub>	1.80 V Typ. 1.62 V to 1.98 V   1.98 V to 2.20 V   2.20 V to 2.80 V   2.70 V to 3.63 V	2.50 V Typ. 2.70 V to 3.63 V																																											
Output frequency range	f <sub>o</sub>	0.67 MHz to 170 MHz																																												
Storage temperature	T <sub>stg</sub>	-40 °C to +125 °C																																												
Operating temperature	T <sub>use</sub>	-40 °C to +125 °C																																												
Frequency tolerance <sup>*1</sup>	f <sub>tol</sub>	±100 × 10 <sup>-6</sup>																																												
Current consumption	I <sub>CC</sub>	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	3.8 mA Max.	T <sub>use</sub> = +125 °C	Average frequency of 1s gate time.																																							
		3.4 mA Max.	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	T <sub>use</sub> = +105 °C																																								
		2.9 mA Typ.				3.0 mA Typ.		3.2 mA Typ.	T <sub>use</sub> = +25 °C																																					
		5.8 mA Max.	6.1 mA Max.	7.0 mA Max.	8.4 mA Max.	T <sub>use</sub> = +125 °C		No load, f <sub>o</sub> = 170 MHz																																						
		5.7 mA Max.	6.0 mA Max.	6.9 mA Max.	8.3 mA Max.	T <sub>use</sub> = +105 °C																																								
Output disable current	I <sub>dis</sub>	4.9 mA Typ.				5.9 mA Typ.	7.0 mA Typ.	T <sub>use</sub> = +25 °C																																						
		3.5 mA Max.	3.5 mA Max.	3.6 mA Max.	3.8 mA Max.	T <sub>use</sub> = +125 °C	OE = GND, f <sub>o</sub> = 170 MHz																																							
Standby current	I <sub>std</sub>	3.4 mA Max.	3.4 mA Max.	3.5 mA Max.	3.7 mA Max.	T <sub>use</sub> = +105 °C		ST = GND																																						
		2.3 µA Max.	2.5 µA Max.	3.0 µA Max.	4.2 µA Max.	T <sub>use</sub> = +125 °C																																								
		0.9 µA Max.	1.0 µA Max.	1.5 µA Max.	2.5 µA Max.	T <sub>use</sub> = +105 °C																																								
Symmetry	SYM	45 % to 55 %				50 % V <sub>CC</sub> Level																																								
						50 % V <sub>CC</sub> Level																																								
Output voltage (DC characteristics)	V <sub>OH</sub>	90 % V <sub>CC</sub> Min.				I <sub>OH</sub> /I <sub>OL</sub> Conditions (mA)																																								
						<table border="1"> <thead> <tr> <th>Rise/Fall time</th> <th>V<sub>CC</sub></th> <th>*A</th> <th>*B</th> <th>*C</th> <th>*D</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Default (f<sub>o</sub> &gt; 40 MHz), Fast</td> <td>I<sub>OH</sub></td> <td>-2.5</td> <td>-3.5</td> <td>-4.0</td> <td>-5.0</td> </tr> <tr> <td>I<sub>OL</sub></td> <td>2.5</td> <td>3.5</td> <td>4.0</td> <td>5.0</td> </tr> <tr> <td rowspan="2">Default (f<sub>o</sub> ≤ 40 MHz)</td> <td>I<sub>OH</sub></td> <td>-1.5</td> <td>-2.0</td> <td>-2.5</td> <td>-3.0</td> </tr> <tr> <td>I<sub>OL</sub></td> <td>1.5</td> <td>2.0</td> <td>2.5</td> <td>3.0</td> </tr> <tr> <td rowspan="2">Slow</td> <td>I<sub>OH</sub></td> <td>-1.0</td> <td>-1.5</td> <td>-2.0</td> <td>-2.5</td> </tr> <tr> <td>I<sub>OL</sub></td> <td>1.0</td> <td>1.5</td> <td>2.0</td> <td>2.5</td> </tr> </tbody> </table>				Rise/Fall time	V <sub>CC</sub>	*A	*B	*C	*D	Default (f <sub>o</sub> > 40 MHz), Fast	I <sub>OH</sub>	-2.5	-3.5	-4.0	-5.0	I <sub>OL</sub>	2.5	3.5	4.0	5.0	Default (f <sub>o</sub> ≤ 40 MHz)	I <sub>OH</sub>	-1.5	-2.0	-2.5	-3.0	I <sub>OL</sub>	1.5	2.0	2.5	3.0	Slow	I <sub>OH</sub>	-1.0	-1.5	-2.0	-2.5	I <sub>OL</sub>	1.0	1.5
Rise/Fall time	V <sub>CC</sub>	*A	*B	*C	*D																																									
Default (f <sub>o</sub> > 40 MHz), Fast	I <sub>OH</sub>	-2.5	-3.5	-4.0	-5.0																																									
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Slow	I <sub>OH</sub>	-1.0	-1.5	-2.0	-2.5																																									
	I <sub>OL</sub>	1.0	1.5	2.0	2.5																																									
Output load condition	L <sub>CMOS</sub>	15 pF Max.																																												
Input voltage	V <sub>IH</sub>	70 % V <sub>CC</sub> Min.				OE or ST																																								
	V <sub>IL</sub>	30 % V <sub>CC</sub> Max.																																												
Rise and Fall time	Default	tr/ff	3.0 ns Max.				f <sub>o</sub> > 40 MHz																																							
			6.0 ns Max.				f <sub>o</sub> ≤ 40 MHz																																							
			3.0 ns Max.				f <sub>o</sub> = 0.67 MHz to 170 MHz																																							
			10.0 ns Max.				f <sub>o</sub> = 0.67 MHz to 20 MHz																																							
Disable Time	t <sub>stp</sub>	1 µs Max.				Measured from the time OE or ST pin crosses 30 % V <sub>CC</sub>																																								
Enable Time	t <sub>sta</sub>	1 µs Max.				Measured from the time OE pin crosses 70 % V <sub>CC</sub>																																								
Resume Time	t <sub>res</sub>	3 ms Max.				Measured from the time ST pin crosses 70 % V <sub>CC</sub>																																								
Start-up time	t <sub>str</sub>	3 ms Max.				Measured from the time V <sub>CC</sub> reaches its rated minimum value, 1.62 V																																								
Frequency aging	f <sub>aging</sub>	This is included in frequency tolerance specification.				+25 °C, first year																																								

\*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 °C, 1 year).

## Product Name

SG-9101CGA170.000000MHz C 20 P J A A A  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

- ① Model, ② Package type, ③ Frequency,  
④ Spread type, ⑤ Spread percentage code,  
⑥ Function, ⑦ Operating temperature,  
⑧ Modulation frequency, ⑨ Modulation profile, ⑩ Rise/Fall time

④ Spread type  
C: Center spread  
D: Down spread

⑦ Operating temperature  
J: -40 °C to +125 °C

⑨ Modulation profile  
A: Hershey-kiss (default)  
B: Sine-wave  
C: Triangle

② Package Type  
CG: 2.5 mm x 2.0 mm

⑥ Function  
P: Output enable  
S: Standby

⑧ Modulation frequency  
A: 25.4 kHz (default)  
B: 12.7 kHz  
C: 8.5 kHz  
D: 6.3 kHz

⑩ Rise/Fall time  
A: Default  
B: Fast  
C: Slow

## Spread spectrum configuration

④	C: Center spread modulation	⑤ Code	02	05	07	10	15	20
		Spread percentage		±0.25 %	±0.5 %	±0.75 %	±1.0 %	±1.5 %
④	D: Down spread modulation	⑤ Code	05	10	15	20	30	40
		Spread percentage		-0.5 %	-1.0 %	-1.5 %	-2.0 %	-3.0 %

Modulation frequency: 25.4 kHz (default), 6.3 kHz, 8.5 kHz, 12.7 kHz  
Modulation profile: Hershey-kiss (default), Sine-wave, Triangle

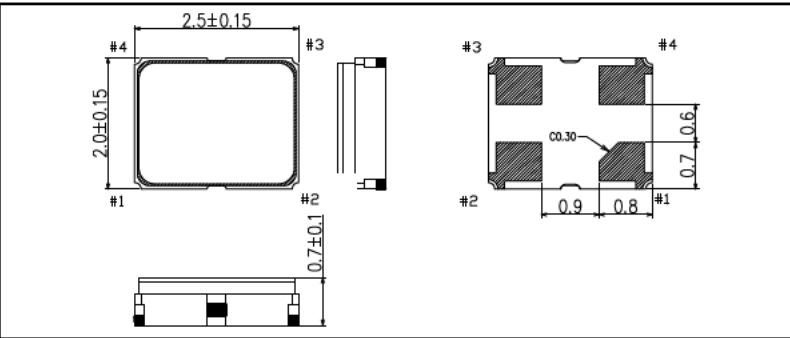


Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output enable	High: Specified frequency output from OUT pin Low: Out pin is low (weak pull down), only output driver is disabled.
	ST	Input	Standby	High: Specified frequency output from OUT pin Low: Out pin is low (weak pull down), Device goes to standby mode. Supply current reduces to the least as I <sub>std</sub> .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V <sub>CC</sub>	Power	Power supply	

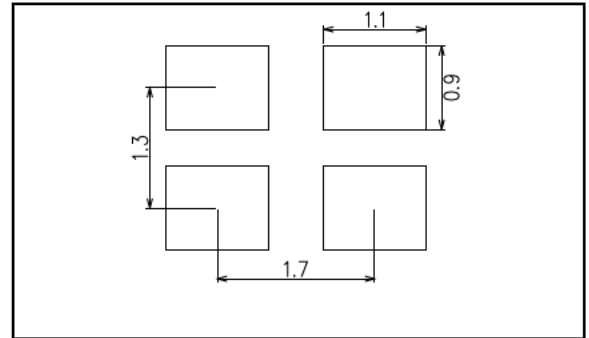
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)

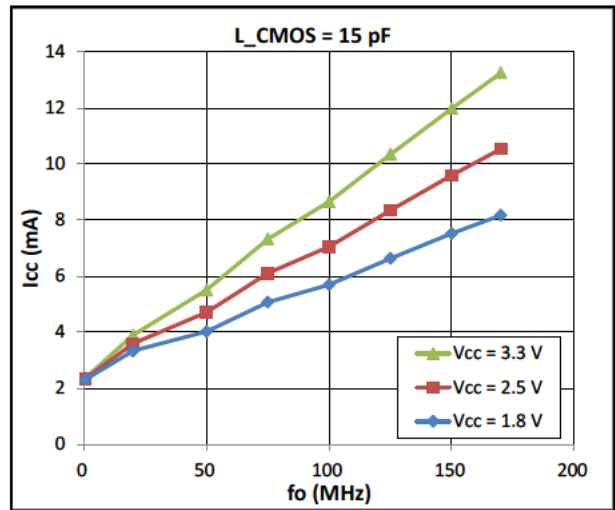
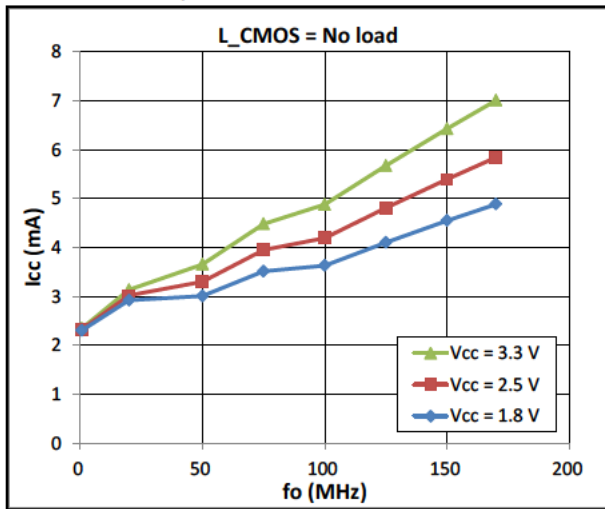


Notes:

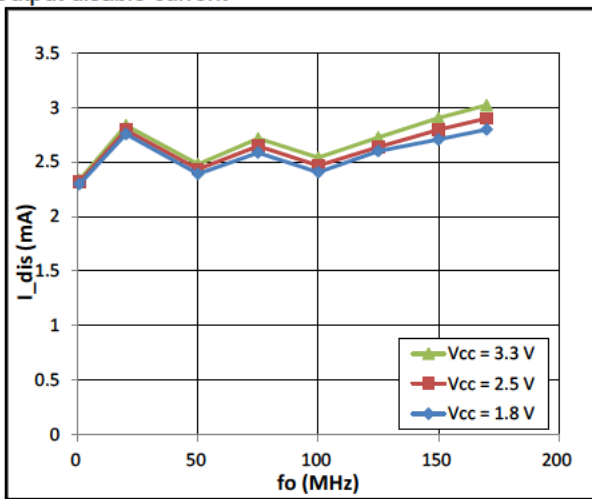
In order to achieve optimum jitter performance, the 0.1 μF capacitor between V<sub>CC</sub> and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.

Specification Graph (Typical supplemental specification. Unless otherwise specified  $T_{use} = 25\text{ }^{\circ}\text{C}$ ,  $L_{CMOS} = 15\text{ pF}$ )

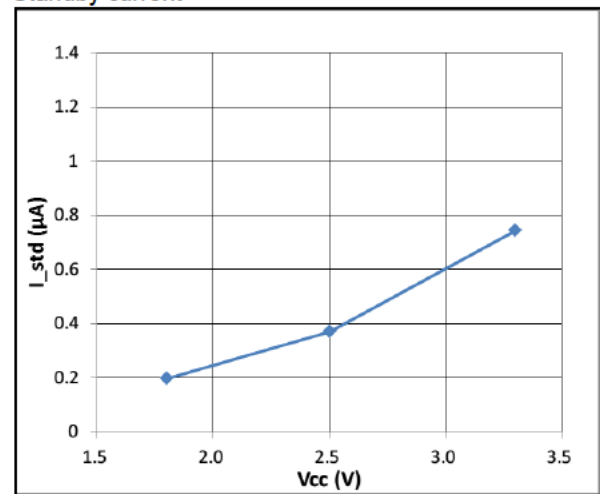
Current Consumption



Output disable current



Standby current

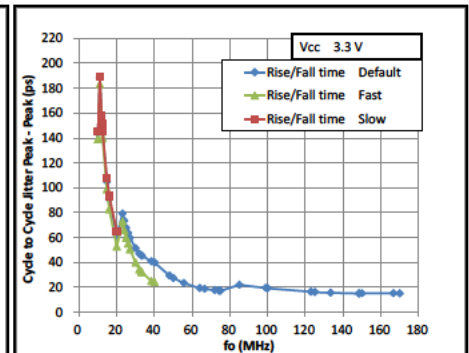
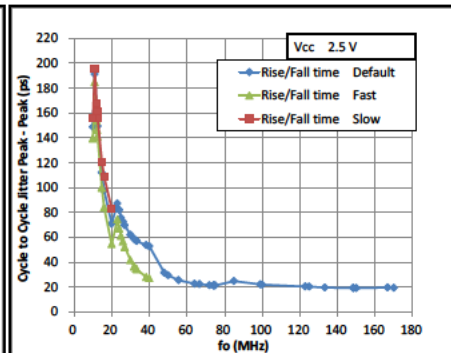
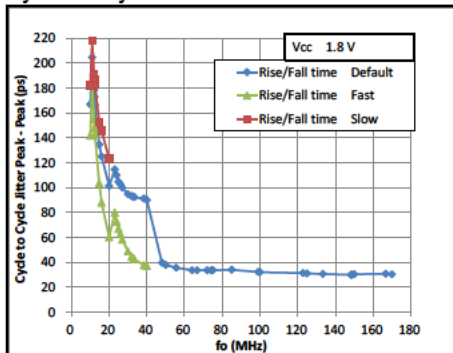


Notes:

Spread percentage :  $\pm 2.0\%$ , Modulation frequency : 25.4 kHz, Modulation profile : Hershey-kiss

Specification Graph (Typical supplemental specification. Unless otherwise specified  $T_{use} = 25\text{ }^{\circ}\text{C}$ ,  $L_{CMOS} = 15\text{ pF}$ )

Cycle-to-Cycle Jitter Peak-Peak



Notes:

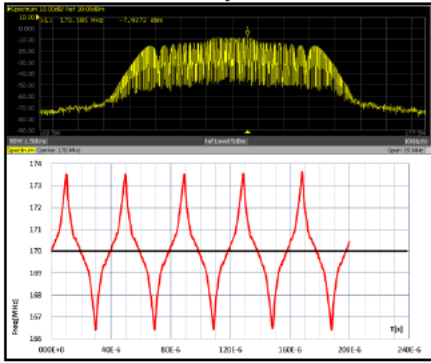
Spread percentage :  $\pm 2.0\%$ , Modulation frequency : 25.4 kHz, Modulation profile : Hershey-kiss



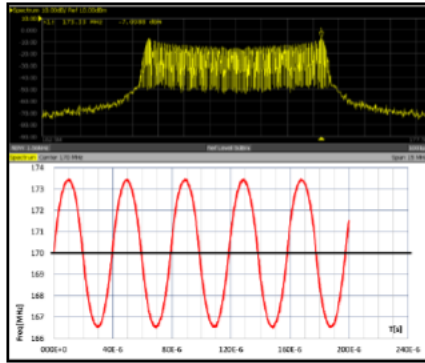
Spread Spectrum Specification Graph

Spread Spectrum Profile fo : 170 MHz / Spread spectrum : ±2.0 % / Modulation frequency : 25.4 kHz

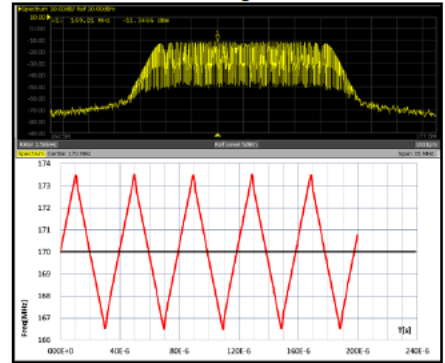
Hershey-kiss



Sine-wave



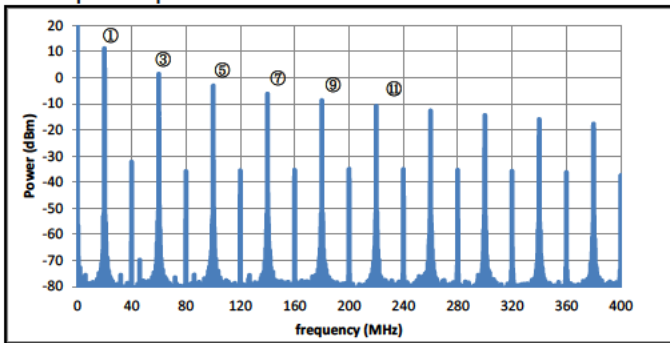
Triangle



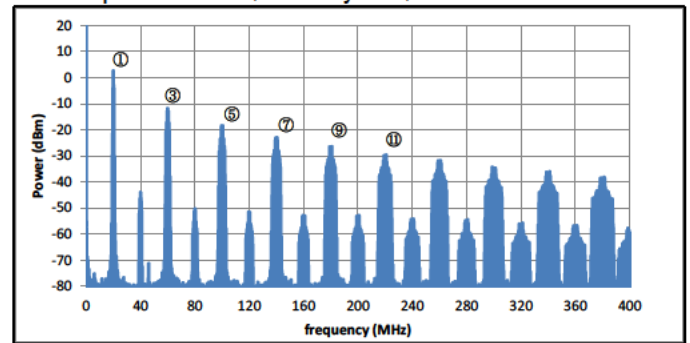
Harmonics Specification Graph

(Typical supplemental specification. Unless otherwise specified T\_use = 25 °C, L\_CMOS = 15 pF, VCC = 3.3 V)

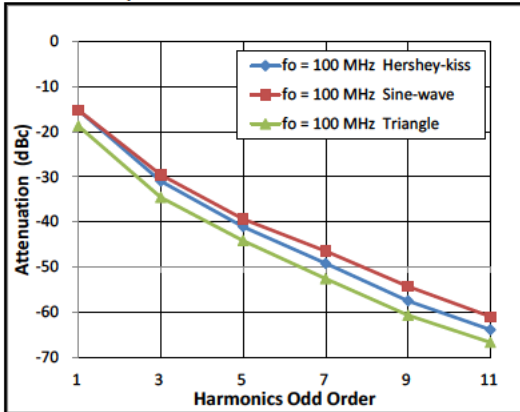
Harmonics spectrum (fo = 20 MHz) No spread spectrum



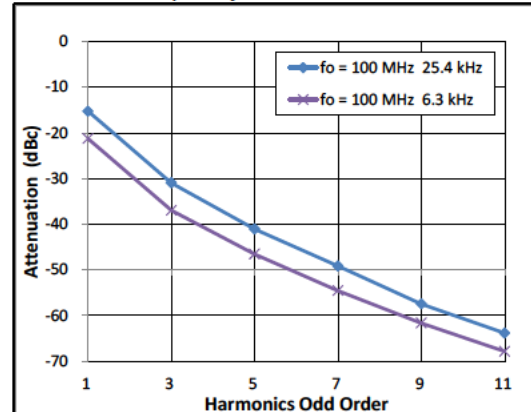
Center spread ±2.0 % , Hershey-kiss, 25.4 kHz



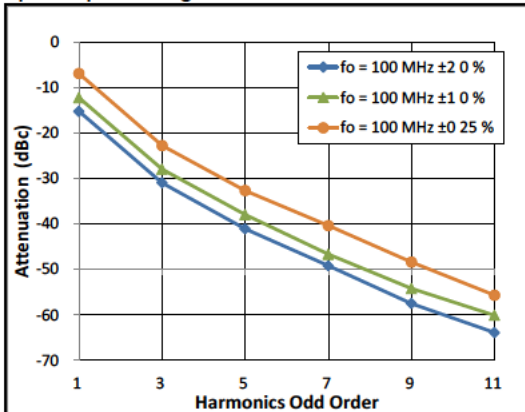
Modulation profile



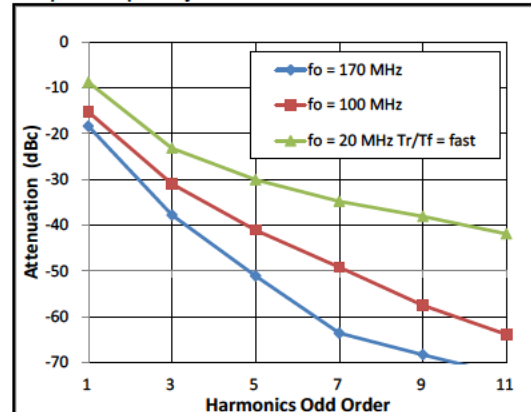
Modulation frequency



Spread percentage



Output frequency



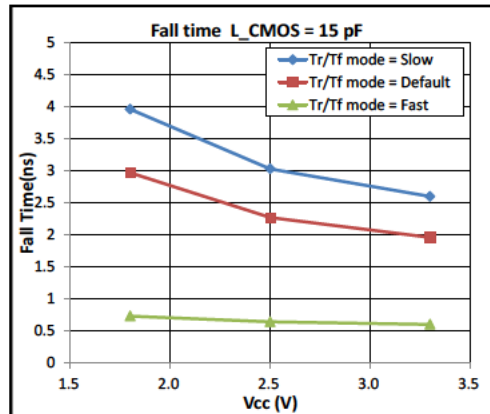
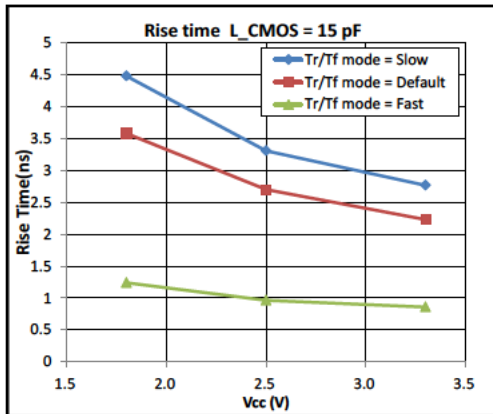
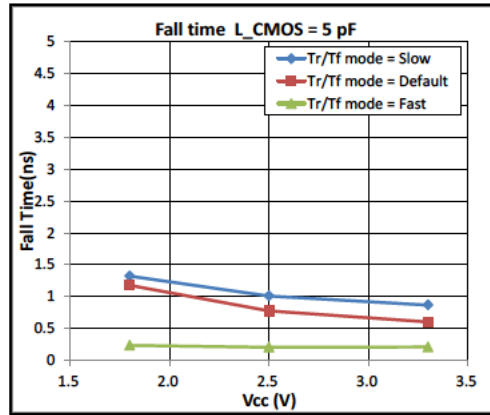
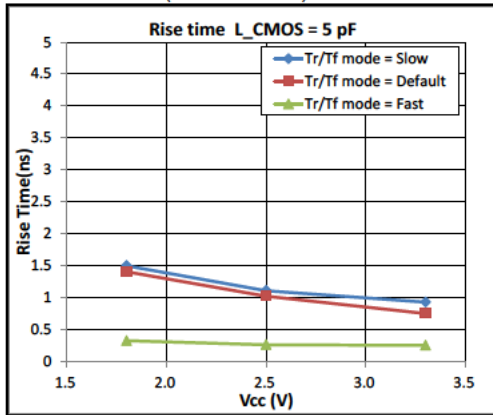
Notes:

Harmonics order attenuation is normalizing to no-spread spectrum mode.

Specification Graph

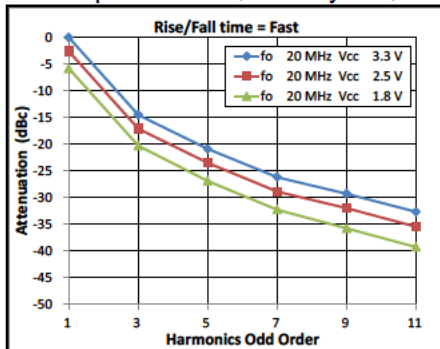
(Typical supplemental specification. Unless otherwise specified  $T_{use} = 25\text{ }^{\circ}\text{C}$ ,  $L_{CMOS} = 15\text{ pF}$ ,  $V_{CC} = 3.3\text{ V}$ )

Rise/Fall Time ( $f_o = 20\text{ MHz}$ )

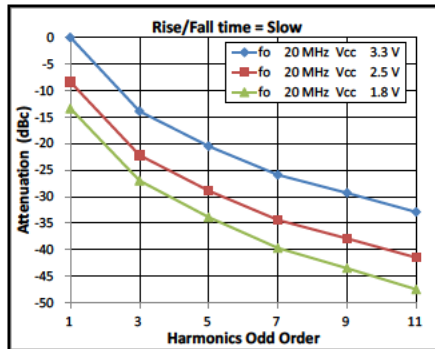


Harmonics comparison

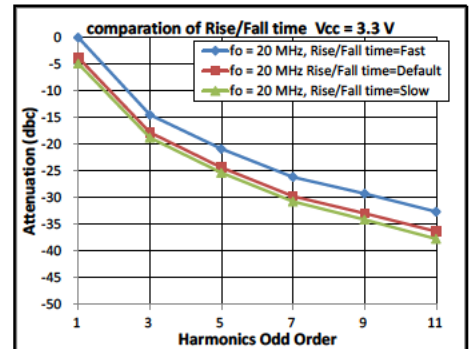
Center spread  $\pm 2.0\%$ , Hershey-kiss, 25.4 kHz



Normalize to  $V_{CC} = 3.3\text{ V}$ .



Normalize to  $V_{CC} = 3.3\text{ V}$ .



Normalize to Rise/Fall time = "Fast".

Notes:

frequency	slow	default	fast
0.67 M – 20 MHz	See Slow	See Default	See Fast
20 M – 40 MHz	-	See Default	See Fast
40 M – 170 MHz	-	See Fast	See Fast



ESD Rating

Test items	Breakdown voltage
Human Body Model (HBM)	2 000 V
Machine Model (MM)	250 V
Charged Device Model (CDM)	750 V

Device Marking (Standard specification)

Factory Programmed Part Marking	Field Programmable Part Marking (Blank Samples)

Simulation Model

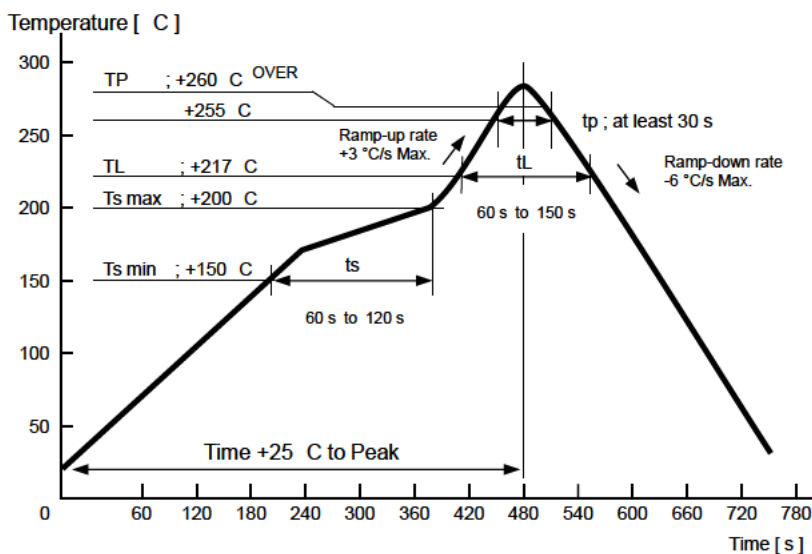
- IBIS Model is available upon request. Please contact us.  
Information Required: Oscillator operating condition (i.e. Power Supply, Rise/Fall Time, Temperature)

Device Material & Environmental Information

Package Dimensions	# of Pins	Reference Weight (Typ.)	Terminal Material	Terminal Plating	Complies With EU RoHS	Pb Free	MSL Rating	Peak Temp. (Max)
2.5 x 2.0 x 0.7 mm	4	13 mg	W	Au	Yes	Yes	1	260 °C

SMD products Reflow profile(example)

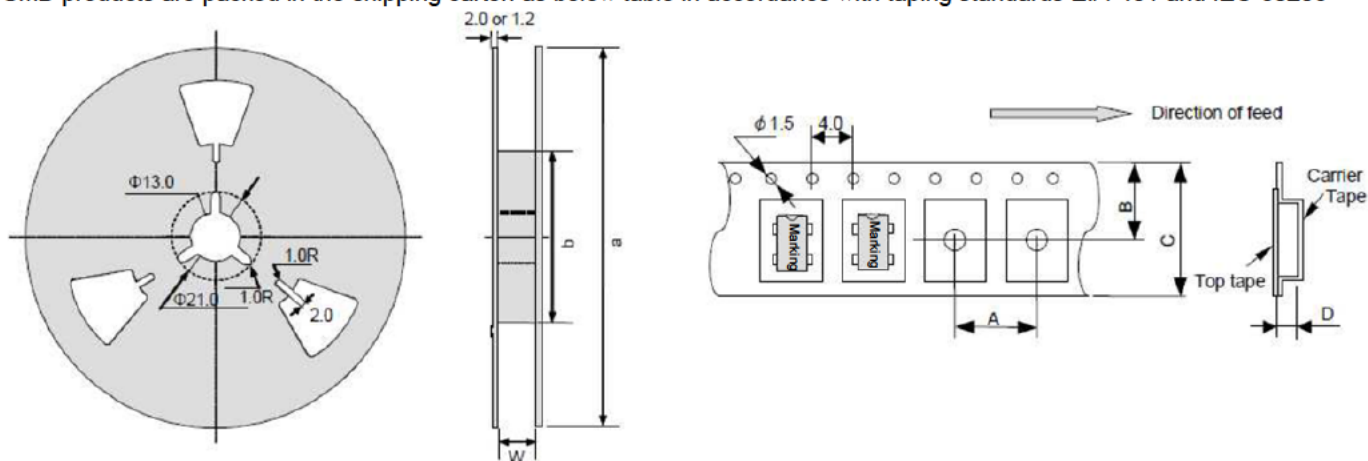
The availability of the heat resistance for reflow conditions of JEDEC-STD-020D.01 is judged individually. Please inquire.



	<ul style="list-style-type: none"> <li>Pb free.</li> </ul>
	<ul style="list-style-type: none"> <li>Complies with EU RoHS directive.                     <ul style="list-style-type: none"> <li>About the products without the Pb-free mark.</li> <li>Contains Pb in products exempted by EU RoHS directive.</li> <li>(Contains Pb in sealing glass, high melting temperature type solder or other.)</li> </ul> </li> </ul>

Standard Packing Specification

SMD products are packed in the shipping carton as below table in accordance with taping standards EIA-481 and IEC-60286



Standard Packing Quantity & Dimension(Unit mm)

Quantity (pcs/Reel)	Reel Dimension			Career Tape Dimension				Direction of Feed (L= Left Direction)
	a	b	W	A	B	C	D	
3000	Φ180	Φ60	9	4	5.25	8	1.15	L

## PROMOTION OF ENVIRONMENTAL MANAGEMENT SYSTEM CONFORMING TO INTERNATIONAL STANDARDS

At Seiko Epson, all environmental initiatives operate under the Plan-Do-Check-Action (PDCA) cycle designed to achieve continuous improvements. The environmental management system (EMS) operates under the ISO 14001 environmental management standard.

All of our major manufacturing and non-manufacturing sites, in Japan and overseas, completed the acquisition of ISO 14001 certification.





ISO 14000 is an international standard for environmental management that was established by the International Standards Organization in 1996 against the background of growing concern regarding global warming, destruction of the ozone layer, and global deforestation.

## WORKING FOR HIGH QUALITY

In order provide high quality and reliable products and services than meet customer needs, Seiko Epson made early efforts towards obtaining ISO9000 series certification and has acquired ISO9001 for all business establishments in Japan and abroad. We have also acquired IATF 16949 certification that is requested strongly by major automotive manufacturers as standard.

IATF 16949 is the international standard that added the sector-specific supplemental requirements for automotive industry based on ISO9001.

### ► Explanation of the mark that are using it for the catalog

	► Pb free.
	► Complies with EU RoHS directive. *About the products without the Pb-free mark. Contains Pb in products exempted by EU RoHS directive. (Contains Pb in sealing glass, high melting temperature type solder or other.)
	► Designed for automotive applications such as Car Multimedia, Body Electronics, Remote Keyless Entry etc.
	► Designed for automotive applications related to driving safety (Engine Control Unit, Air Bag, ESC etc ).

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