CRYSTAL OSCILLATOR (Programmable)
SPREAD SPECTRUM
OUTPUT: CMOS

For Automotive

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 ($\overline{ST}$)
- 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

Pb Free

RoHS Compliant

Product Number (please contact us)
X1G005281xxxx00

Specifications (characteristics)

Item		Symbol	Specifications				Conditions/Remarks	
Supply voltage		V_{CC}	1.80 V Typ.		2.50 V Typ.	3.30 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		
Output frequency range		f_O	0.67 MHz to 170 MHz					
Storage temperature		T_stg	-40 °C to +125 °C				Storage as single product.	
Operating temperature		T_use	-40 °C to +125 °C					
Frequency tolerance[*1]		f_tol	±100 × 10^{-6}				Average frequency of 1s gate time.	
Current consumption		I_{CC}	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	3.8 mA Max.	T_use = +125 °C	No load, f_O = 20 MHz
			3.4 mA Max.	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	T_use = +105 °C	
			2.9 mA Typ.		3.0 mA Typ.	3.2 mA Typ.	T_use = +25 °C	
			5.8 mA Max.	6.1 mA Max.	7.0 mA Max.	8.4 mA Max.	T_use = +125 °C	No load, f_O = 170 MHz
			5.7 mA Max.	6.0 mA Max.	6.9 mA Max.	8.3 mA Max.	T_use = +105 °C	
			4.9 mA Typ.		5.9 mA Typ.	7.0 mA Typ.	T_use = +25 °C	
Output disable current		I_dis	3.5 mA Max.	3.5 mA Max.	3.6 mA Max.	3.8 mA Max.	T_use = +125 °C	OE = GND, f_O = 170 MHz
			3.4 mA Max.	3.4 mA Max.	3.5 mA Max.	3.7 mA Max.	T_use = +105 °C	
Standby current		I_std	2.3 µA Max.	2.5 µA Max.	3.0 µA Max.	4.2 µA Max.	T_use = +125 °C	$\overline{ST}$ = GND
			0.9 µA Max.	1.0 µA Max.	1.5 µA Max.	2.5 µA Max.	T_use = +105 °C	
			0.3 µA Typ.	0.4 µA Typ.	0.5 µA Typ.	1.1 µA Typ.	T_use = +25 °C	
Symmetry		SYM	45 % to 55 %				50 % V_{CC} Level	
Output voltage (DC characteristics)		V_{OH}	90 % V_{CC} Min.				I_{OH}/I_{OL} Conditions	
		V_{OL}	10 % V_{CC} Max.					
Output load condition		L_CMOS	15 pF Max.					
Input voltage		V_{IH}	70 % V_{CC} Min.				OE or $\overline{ST}$	
		V_{IL}	30 % V_{CC} Max.					
Rise and Fall time	Default	tr/tf	3.0 ns Max.				f_O > 40 MHz	20 % - 80 % V_{CC}, L_CMOS = 15 pF
			6.0 ns Max.				f_O ≤ 40 MHz	
	Fast		3.0 ns Max.				f_O = 0.67 MHz to 170 MHz	
	Slow		10.0 ns Max.				f_O = 0.67 MHz to 20 MHz	
Disable Time		t_stp	1 µs Max.				Measured from the time OE or $\overline{ST}$ pin crosses 30 % V_{CC}	
Enable Time		t_sta	1 µs Max.				Measured from the time OE pin crosses 70 % V_{CC}	
Resume Time		t_res	3 ms Max.				Measured from the time $\overline{ST}$ pin crosses 70 % V_{CC}	
Start-up time		t_str	3 ms Max.				Measured from the time V_{CC} reaches its rated minimum value, 1.62 V	
Frequency aging		f_aging	This is included in frequency tolerance specification.				+25 °C, first year	

I_{OH}/I_{OL} Conditions [mA]

Rise/Fall time	Vcc	*A	*B	*C	*D
Default (f_O > 40 MHz), Fast	I_{OH}	-2.5	-3.5	-4.0	-5.0
	I_{OL}	2.5	3.5	4.0	5.0
Default (f_O ≤ 40 MHz)	I_{OH}	-1.5	-2.0	-2.5	-3.0
	I_{OL}	1.5	2.0	2.5	3.0
Slow	I_{OH}	-1.0	-1.5	-2.0	-2.5
	I_{OL}	1.0	1.5	2.0	2.5

*A : 1.62 V to 1.98 V, *B : 1.98 V to 2.20 V,
*C : 2.20 V to 2.80 V, *D : 2.70 V to 3.63 V

[*1] Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 ºC, 1 year).

Product Name

SG-9101CGA 170.000000MHz C 20 P J A A A
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

①Model, ②Package type, ③Frequency,

④Spread type, ⑤Spread percentage code,

⑥Function, ⑦Operating temperature,

⑧Modulation frequency, ⑨Modulation profile, ⑩Rise/Fall time

②Package Type
CG: 2.5 mm x 2.0 mm

④Spread type
C: Center spread
D: Down spread

⑥Function
P: Output enable
S: Standby

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

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

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

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

Spread spectrum configuration

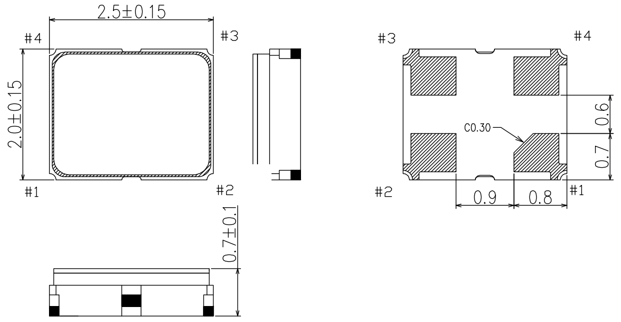
④	C: Center spread modulation	⑤Code	02	05	07	10	15	20
		Spread percentage	±0.25 %	±0.5 %	±0.75 %	±1.0 %	±1.5 %	±2.0 %
	D: Down spread modulation	⑤Code	05	10	15	20	30	40
		Spread percentage	-0.5 %	-1.0 %	-1.5 %	-2.0 %	-3.0 %	-4.0 %

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

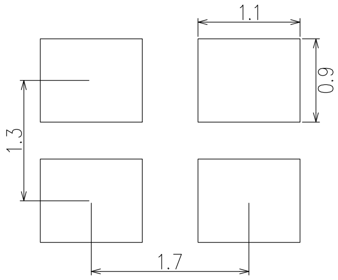
Pin description

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.
	$\overline{ST}$	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_std.
2	GND	Power	Ground		
3	OUT	Output	Clock output		
4	V_{CC}	Power	Power supply		

External dimensions (Unit: mm)



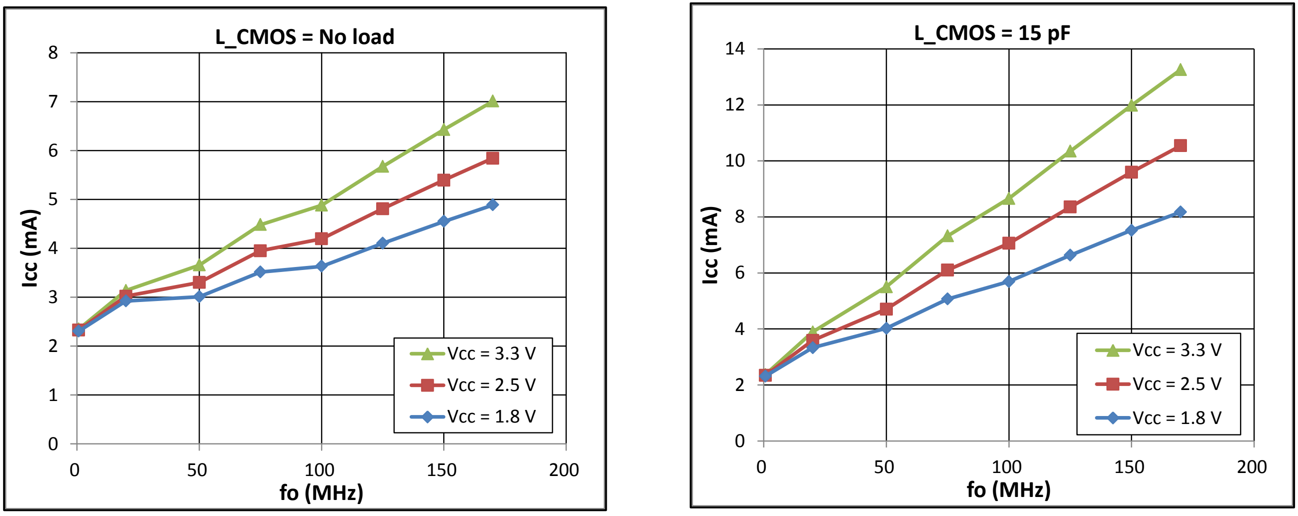
Footprint (Recommended) (Unit: mm)



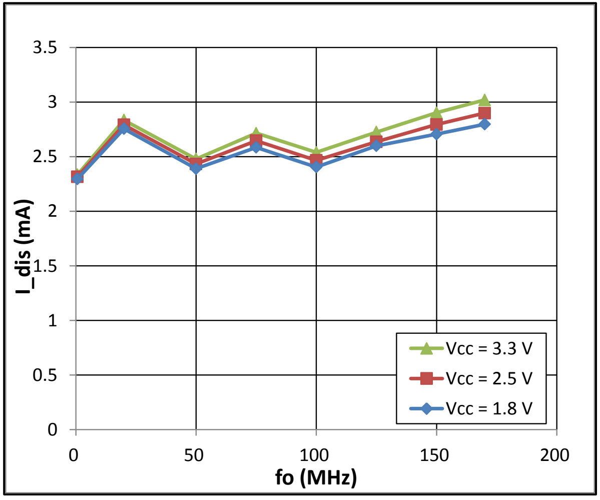
■Notes:
In order to achieve optimum jitter performance, the 0.1 µF capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.

Specification Graph (Typical supplemental specification. Unless otherwise specified T_use = 25 °C, L_CMOS = 15 pF)

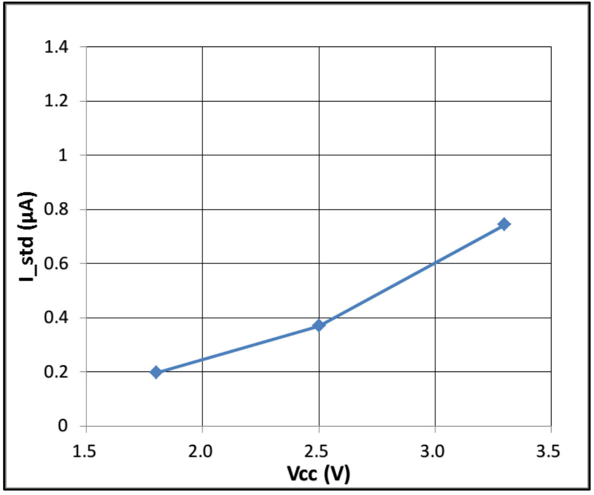
Current Consumption



Output disable current



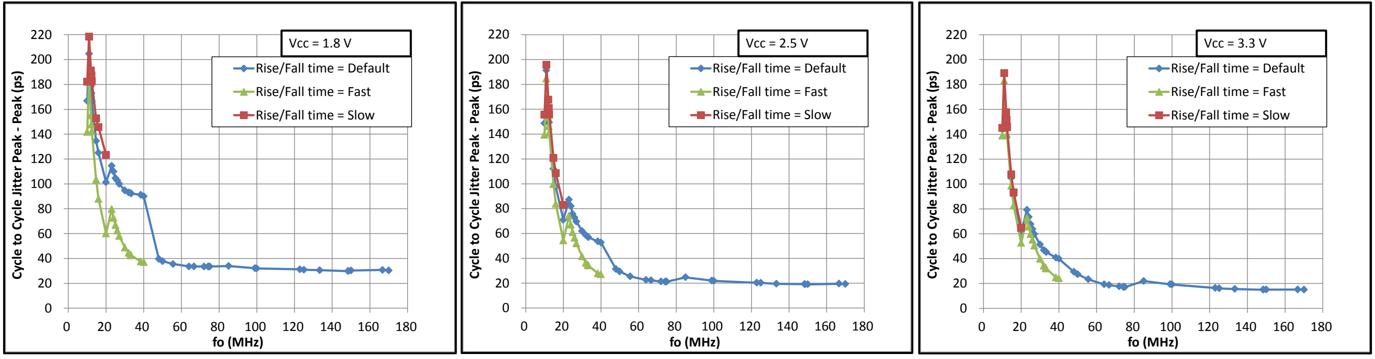
Standby current



■Notes:
Spread percentage : ±2.0 %, Modulation frequency : 25.4 kHz, Modulation profile : Hershey-kiss

Specification Graph (Typical supplemental specification. Unless otherwise specified T_use = 25 °C, L_CMOS = 15 pF)

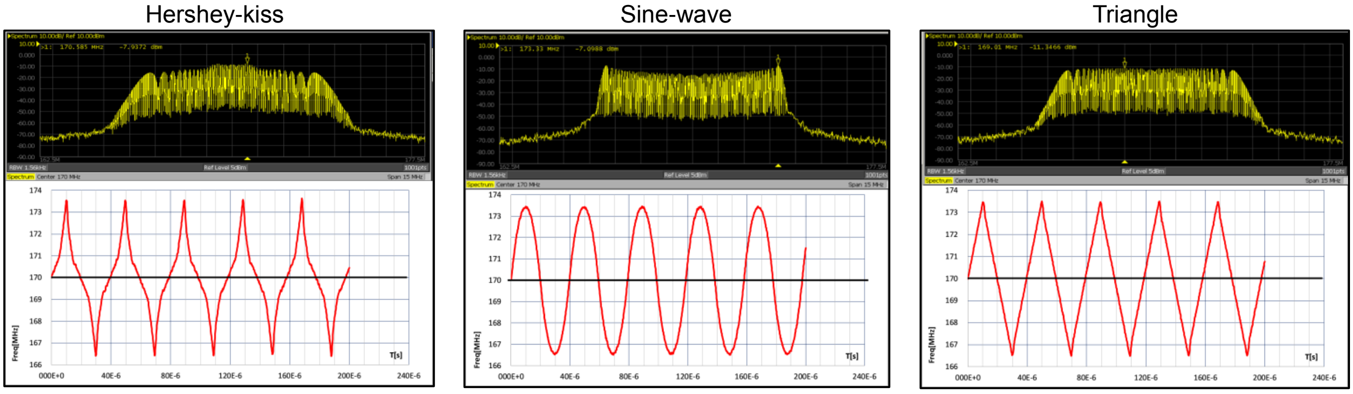
Cycle-to-Cycle Jitter Peak-Peak



■Notes:
Spread percentage : ±2.0 %, Modulation frequency : 25.4 kHz, Modulation profile : Hershey-kiss

Spread Spectrum Specification Graph

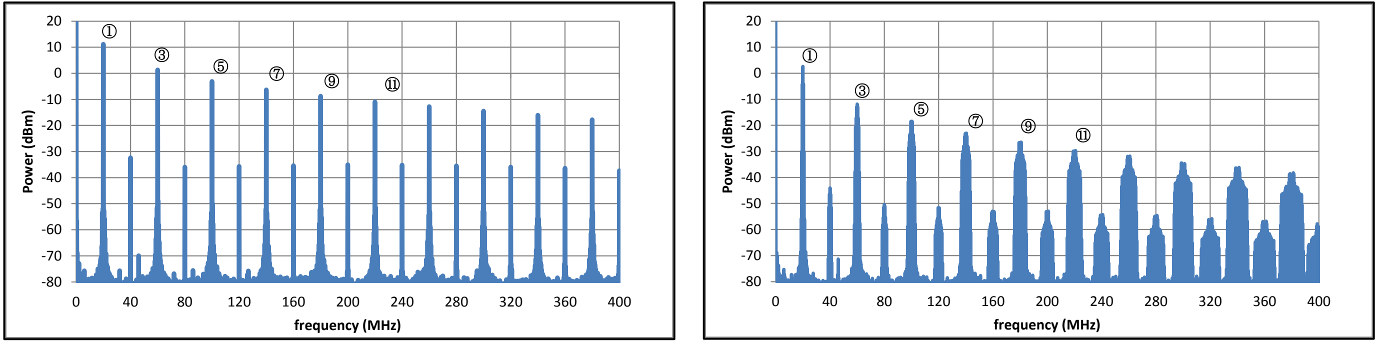
Spread Spectrum Profile fo : 170 MHz / Spread spectrum : ±2.0 % / Modulation frequency : 25.4 kHz


Hershey-kiss
Sine-wave
Triangle

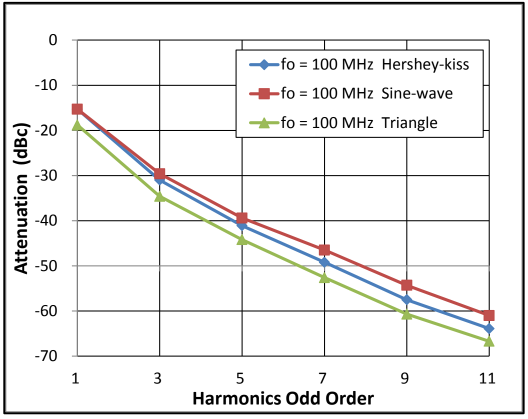
Harmonics Specification Graph

(Typical supplemental specification. Unless otherwise specified T_use = 25 ºC, L_CMOS = 15 pF, V_{CC} = 3.3 V)

Harmonics spectrum (fo = 20 MHz)

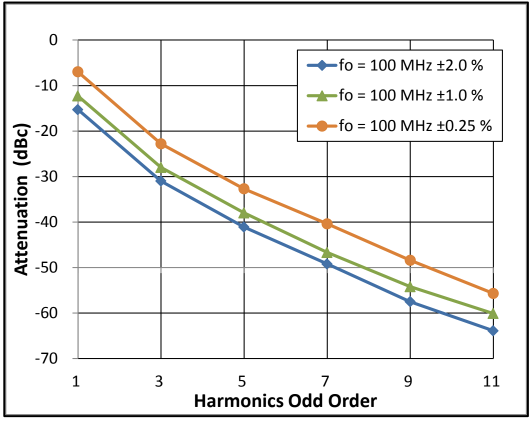

No spread spectrum
Center spread ±2.0 % , Hershey-kiss, 25.4 kHz

Modulation profile

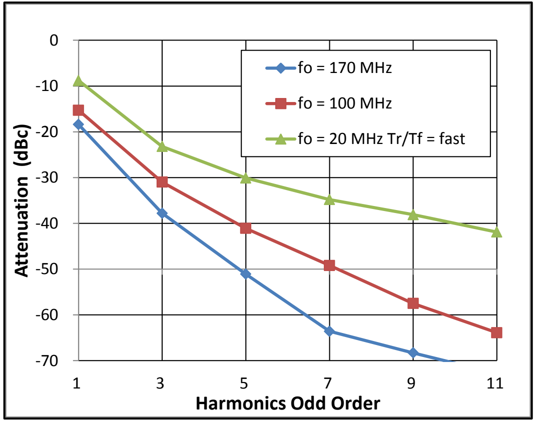


Modulation frequency

Spread percentage



Output frequency



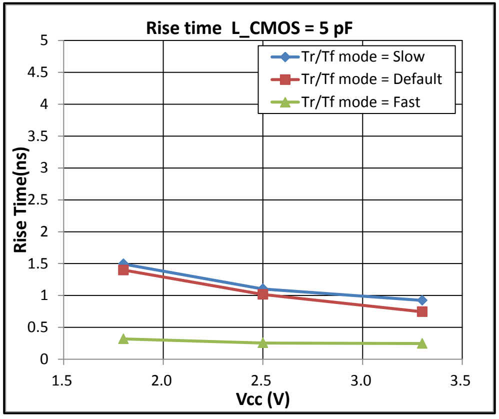
■Notes:

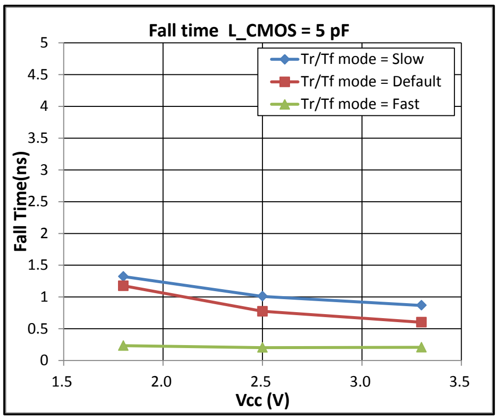
Harmonics order attenuation is normalizing to no-spread spectrum mode.

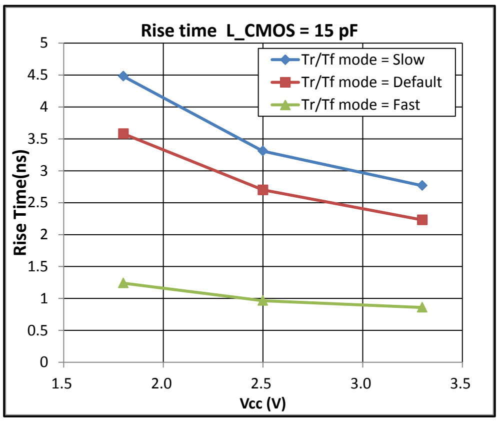
Specification Graph

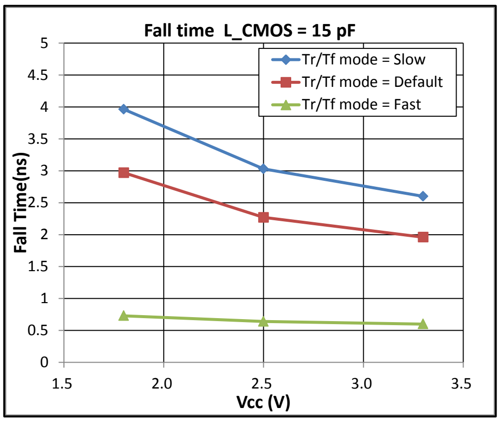
(Typical supplemental specification. Unless otherwise specified T_use = 25 °C, L_CMOS = 15 pF, V_{CC} = 3.3 V)

Rise/Fall Time (fo = 20 MHz)



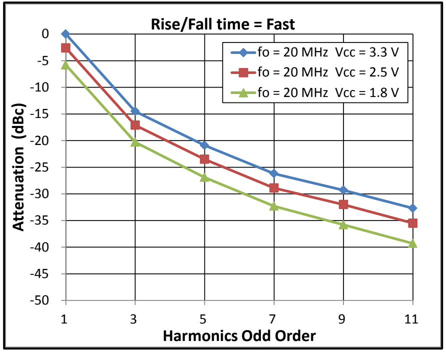




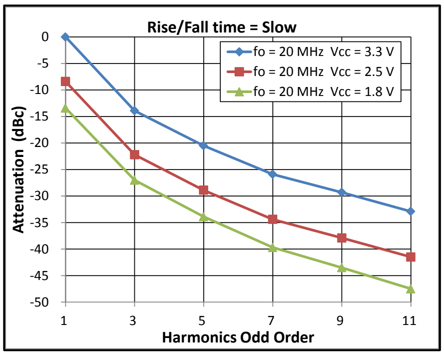


Harmonics comparison

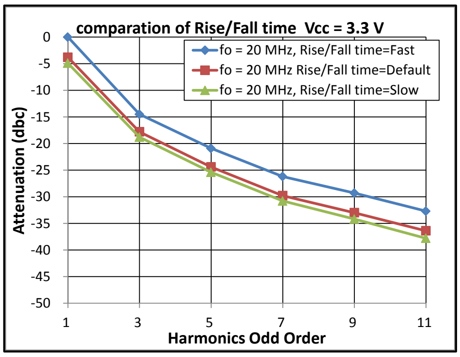
Center spread ±2.0 %, Hershey-kiss, 25.4 kHz



Normalize to V_{CC} = 3.3V.



Normalize to V_{CC} = 3.3V.



Normalize to Rise/Fall time = “Fast”.

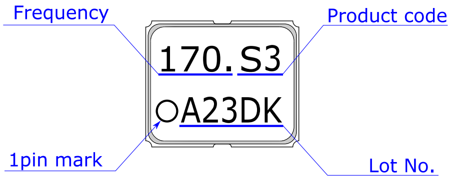
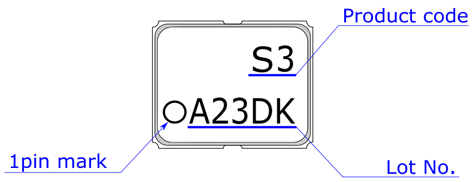
■Notes:

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)
	

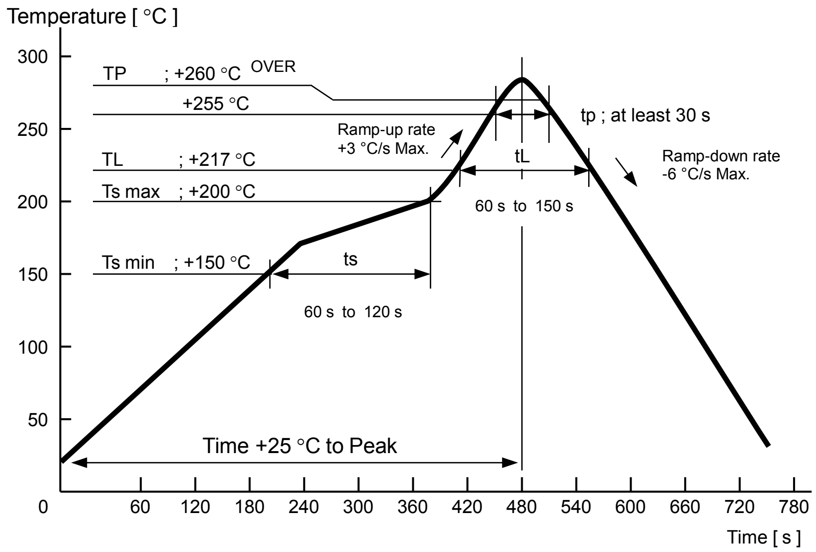
Simulation Model

- 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

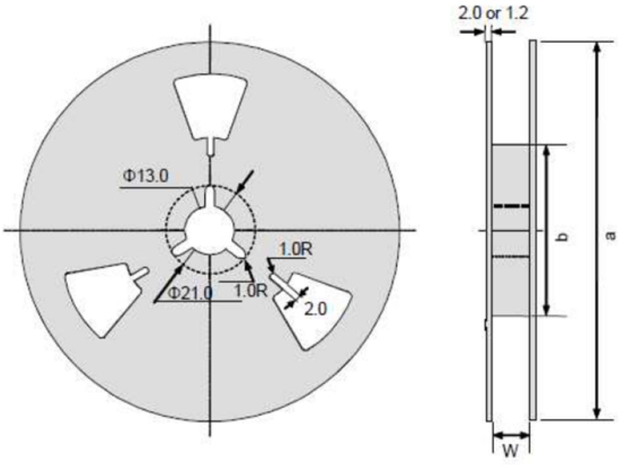
SMD products Reflow profile(example)
The availability of the heat resistance for reflow conditions of JEDEC-STD-020D.01 is judged individually. Please inquire.

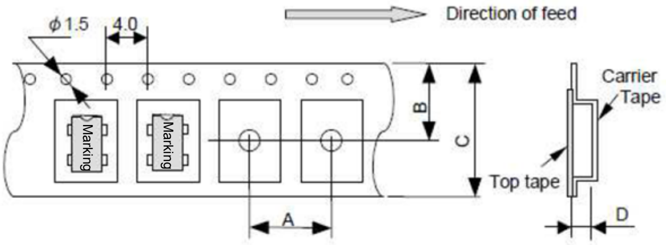


Pb Free	● Pb free.
RoHS Compliant	● Complies with EU RoHS directive. ➢ About the products without the Pb-free mark. Contains Pb in products exempted by EU RoHS directive. (Contains Pb in sealing glass, high melting temperature type solder or other.)

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 ISO/TS 16949 certification that is requested strongly by major automotive manufacturers as standard.

ISO/TS16949 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	►Pb free.
RoHS Compliant	►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.)
For Automotive	►Designed for automotive applications such as Car Multimedia, Body Electronics, Remote Keyless Entry etc.
Automotive Safety	►Designed for automotive applications related to driving safety (Engine Control Unit, Air Bag, ESC etc).

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