SiT2025B

High Frequency, Automotive AEC-Q100 SOT23 Oscillator

Features

INSTANT SAMPLES SEARCH INVENTORY GREEN SOLUTIONS LIFETIME WARRANTY

- AEC-Q100 with extended temperature range (-55°C to 125°C)
- Frequencies between 115.2 MHz and 137 MHz accurate to 6 decimal points
- 100% pin-to-pin drop-in replacement to quartz-based XO
- Excellent total frequency stability as low as ±20 ppm
- Industry best G-sensitivity of 0.1 PPB/G
- LVCMOS/LVTTL compatible output
- 5-pin SOT23-5 package: 2.9 x 2.8 mm x mm
- RoHS and REACH compliant, Pb-free, Halogen-free and Antimony-free

Applications

- Automotive, extreme temperature and other high-rel electronics
- Infotainment systems, collision detection devices, and in-vehicle networking
- Powertrain control

Electrical Characteristics

All Min and Max limits are specified over temperature and rated operating voltage with 15 pF output load unless otherwise stated. Typical values are at 25°C and nominal supply voltage.

Table 1. Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition
Frequency Range						
Output Frequency Range	f	115.20	–	137	MHz	Refer to Table 14 and Table 15 for the exact list of supported frequencies
Frequency Stability and Aging						
Frequency Stability	F_stab	-20	–	+20	ppm	Inclusive of Initial tolerance at 25°C, 1st year aging at 25°C, and variations over operating temperature, rated power supply voltage and load (15 pF ± 10%).
		-25	–	+25	ppm	
		-30	–	+30	ppm	
		-50	–	+50	ppm	
Operating Temperature Range						
Operating Temperature Range (ambient)v	T_use	-40	–	+85	°C	Industrial, AEC-Q100 Grade 3
		-40	–	+105	°C	Extended Industrial, AEC-Q100 Grade 2
		-40	–	+125	°C	Automotive, AEC-Q100 Grade 1
		-55	–	+125	°C	Extended Temperature, AEC-Q100
Supply Voltage and Current Consumption						
Supply Voltage	Vdd	1.62	1.8	1.98	V	All voltages between 2.25V and 3.63V including 2.5V, 2.8V, 3.0V and 3.3V are supported. Contact SiTime for 1.5V support
		2.25	–	3.63	V	
Current Consumption	Idd	–	6	8	mA	No load condition, f = 125 MHz, Vdd = 2.25V to 3.63V
		–	4.9	6	mA	No load condition, f = 125 MHz, Vdd = 1.62V to 1.98V
LVCMOS Output Characteristics						
Duty Cycle	DC	45	–	55	%	
Rise/Fall Time	Tr, Tf	–	1.5	3	ns	Vdd = 2.25V - 3.63V, 20% - 80%
		–	1.5	2.5	ns	Vdd = 1.8V, 20% - 80%
Output High Voltage	VOH	90%	–	–	Vdd	IOH = -4 mA (Vdd = 3.0V or 3.3V) IOH = -3 mA (Vdd = 2.8V and Vdd = 2.5V) IOH = -2 mA (Vdd = 1.8V)
Output Low Voltage	VOL	–	–	10%	Vdd	IOL = 4 mA (Vdd = 3.0V or 3.3V) IOL = 3 mA (Vdd = 2.8V and Vdd = 2.5V) IOL = 2 mA (Vdd = 1.8V)
Input Characteristics						
Input High Voltage	VIH	70%	–	–	Vdd	Pin 1, OE
Input Low Voltage	VIL	–	–	30%	Vdd	Pin 1, OE
Input Pull-up Impedence	Z_in	–	100	–	kΩ	Pin 1, OE logic high or logic low
Startup and Resume Timing						
Startup Time	T_start	–	–	5	ms	Measured from the time Vdd reaches its rated minimum value
Enable/Disable Time	T_oe	–	–	130	ns	f = 115.20 MHz. For other frequencies, T_oe = 100 ns + 3 * cycles
Jitter						
RMS Period Jitter	T_jitt	–	1.6	2.5	ps	f = 125 MHz, 2.25V to 3.63V
		–	1.8	3	ps	f = 125 MHz, 1.8V
RMS Phase Jitter (random)	T_phj	–	0.7	–	ps	f = 125 MHz, Integration bandwidth = 900 kHz to 7.5 MHz
		–	1.5	–	ps	f = 125 MHz, Integration bandwidth = 12 kHz to 20 MHz

Table 2. Pin Description

Pin	Symbol		Functionality
1	GND	Power	Electrical ground[1]
2	NC	No Connect	No connect
3	OE/NC	Output Enable	H[2]: specified frequency output L: output is high impedance. Only output driver is disabled.
		No Connect	Any voltage between 0 and Vdd or Open[2]: Specified frequency output. Pin 3 has no function.
4	VDD	Power	Power supply voltage[1]
5	OUT	Output	Oscillator output

Top View

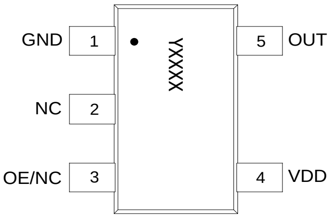


Figure 1. Pin Assignments

Notes:

1. A capacitor of value 0.1 µF or higher between Vdd and GND is required.
2. In OE or ST mode, a pull-up resistor of 10 kΩ or less is recommended if pin 3 is not externally driven. If pin 3 needs to be left floating, use the NC option.

Table 3. Absolute Maximum Limits

Attempted operation outside the absolute maximum ratings may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

Parameter	Min.	Max.	Unit
Storage Temperature	-65	150	°C
Vdd	-0.5	4	V
Electrostatic Discharge	–	2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	–	260	°C
Junction Temperature[3]	–	150	°C

Note:

3. Exceeding this temperature for extended period of time may damage the device.

Table 4. Thermal Consideration[4]

Package	θJA, 4 Layer Board (°C/W)	θJC, Bottom (°C/W)
SOT23-5	421	175

Note:

4. Refer to JESD51 for θJA and θJC definitions, and reference layout used to determine the θJA and θJC values in the above table.

Table 5. Maximum Operating Junction Temperature[5]

Max Operating Temperature (ambient)	Maximum Operating Junction Temperature
85°C	95°C
105°C	115°C
125°C	135°C

Note:

5. Datasheet specifications are not guaranteed if junction temperature exceeds the maximum operating junction temperature.

Table 6. Environmental Compliance

Parameter	Condition/Test Method
Mechanical Shock	**MIL-STD-883F, Method 2002**
Mechanical Vibration	**MIL-STD-883F, Method 2007**
Temperature Cycle	**JESD22, Method A104**
Solderability	**MIL-STD-883F, Method 2003**
Moisture Sensitivity Level	**MSL1 @ 260°C**

Test Circuit and Waveform[6]

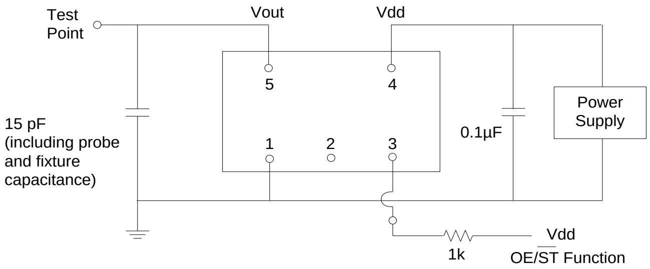


Figure 2. Test Circuit

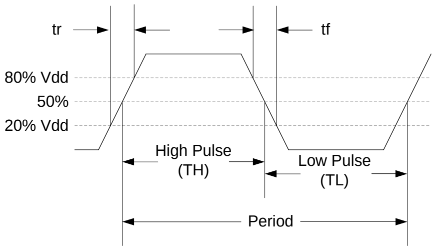
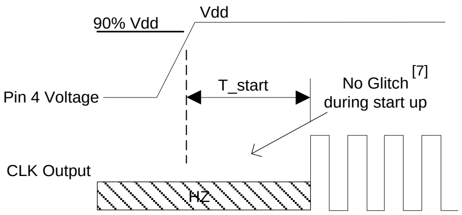


Figure 3. Waveform

Note:

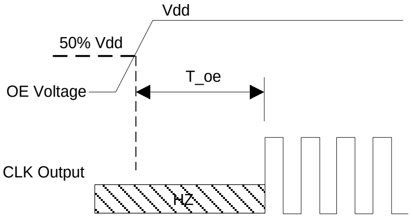
6. SiT2025 has “no runt” pulses and “no glitch” output during startup or resume.

Timing Diagrams



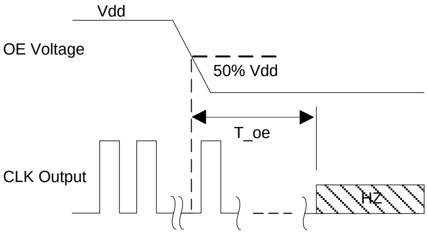
T_start: Time to start from power-off

Figure 4. Startup Timing (OE Mode)



T_oe: Time to re-enable the clock output

Figure 5. OE Enable Timing (OE Mode Only)



T_oe: Time to put the output in High Z mode

Figure 6. OE Disable Timing (OE Mode Only)

Note:

7. SiT2025 has “no runt” pulses and “no glitch” output during startup or resume.

Performance Plots[8]

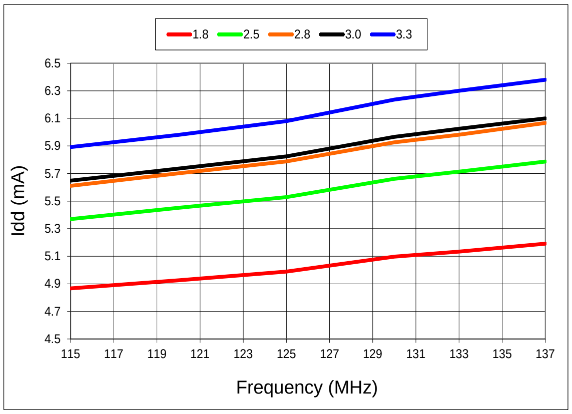


Figure 7. Idd vs Frequency

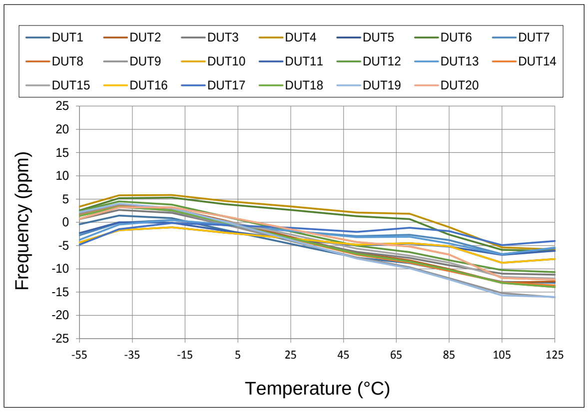


Figure 8. Frequency vs Temperature

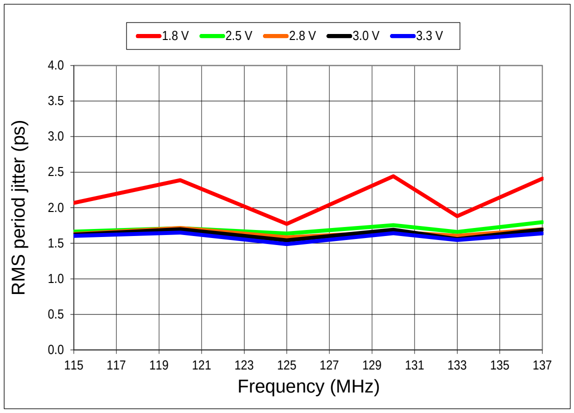


Figure 9. RMS Period Jitter vs Frequency

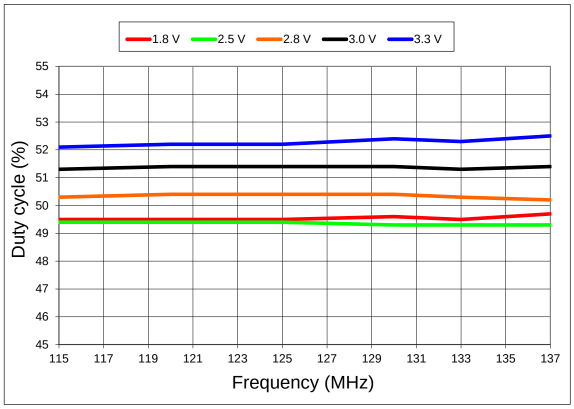


Figure 10. Duty Cycle vs Frequency

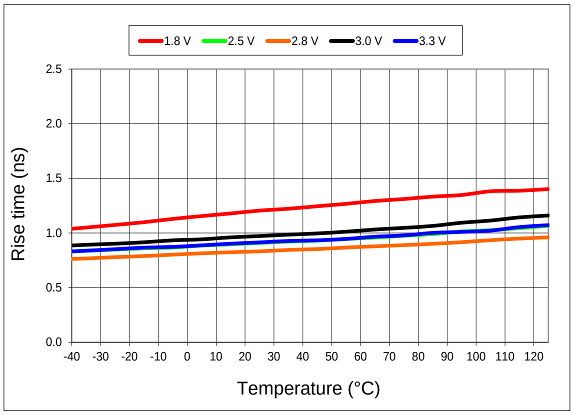


Figure 11. 20%-80% Rise Time vs Temperature

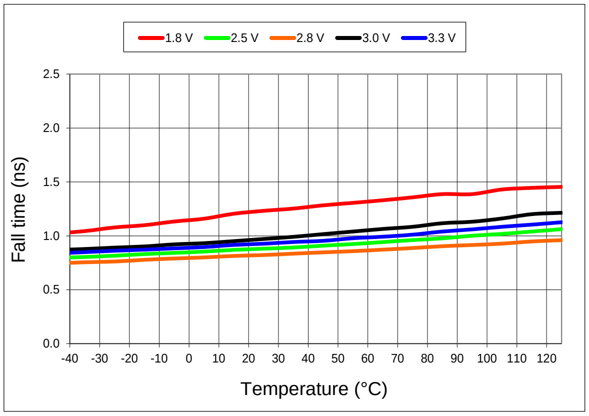
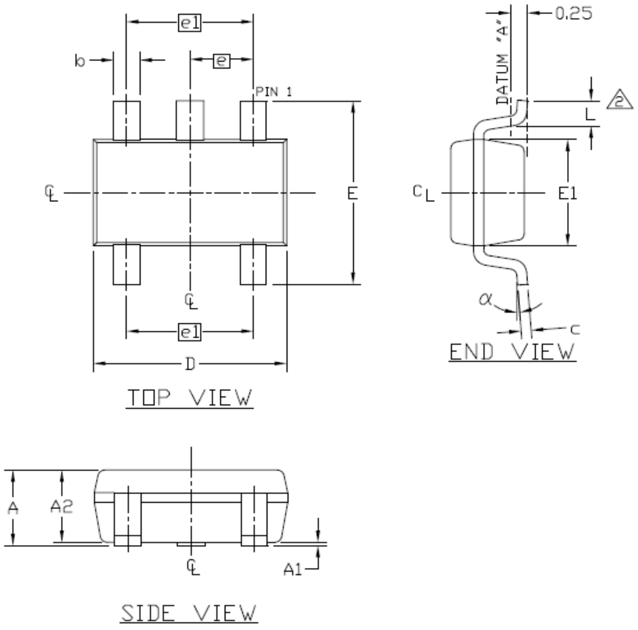
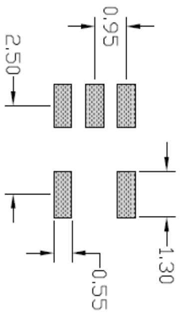


Figure 12. 20%-80% Fall Time vs Temperature

Dimensions and Patterns

Package Size – Dimensions (Unit: mm)[11]	Recommended Land Pattern (Unit: mm)[12]
2.90 x 2.80 mm SOT23-5	





Notes:

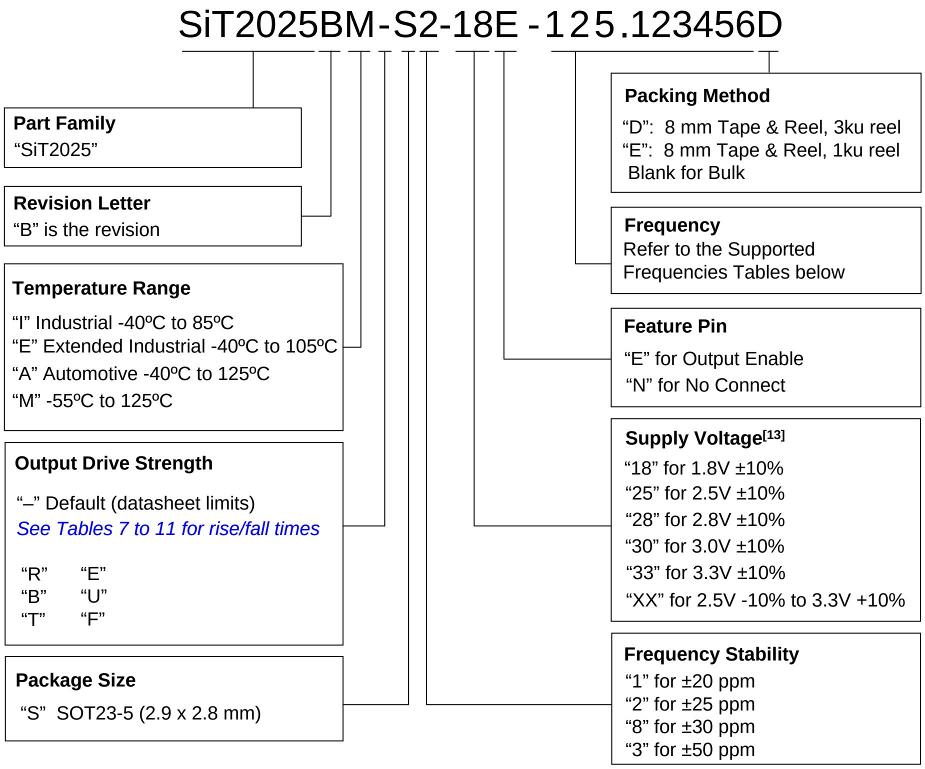
11. Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of “Y” will depend on the assembly location of the device.
12. A capacitor value of 0.1 µF between Vdd and GND is required.

Table 13. Dimension Table

Symbol	Min.	Nom.	Max.
A	0.90	1.27	1.45
A1	0.00	0.07	0.15
A2	0.90	1.20	1.30
b	0.30	0.35	0.50
c	0.14	0.15	0.20
D	2.75	2.90	3.05
E	2.60	2.80	3.00
E1	1.45	1.60	1.75
L	0.30	0.38	0.55
L1	0.25 REF		
e	0.95 BSC.		
e1	1.90 BSC.		
α	0°	–	8°

Ordering Information

The Part No. Guide is for reference only. To customize and build an exact part number, use the SiTime Part Number Generator.



SiT2025BM-S2-18E-125.123456D

Part Family
"SiT2025"

Revision Letter
"B" is the revision

Temperature Range
"I" Industrial -40ºC to 85ºC
"E" Extended Industrial -40ºC to 105ºC
"A" Automotive -40ºC to 125ºC
"M" -55ºC to 125ºC

Output Drive Strength
"–" Default (datasheet limits)
See Tables 7 to 11 for rise/fall times
"R" "E"
"B" "U"
"T" "F"

Package Size
"S" SOT23-5 (2.9 x 2.8 mm)

Packing Method
"D": 8 mm Tape & Reel, 3ku reel
"E": 8 mm Tape & Reel, 1ku reel
Blank for Bulk

Frequency
Refer to the Supported Frequencies Tables below

Feature Pin
"E" for Output Enable
"N" for No Connect

Supply Voltage[13]
"18" for 1.8V ±10%
"25" for 2.5V ±10%
"28" for 2.8V ±10%
"30" for 3.0V ±10%
"33" for 3.3V ±10%
"XX" for 2.5V -10% to 3.3V +10%

Frequency Stability
"1" for ±20 ppm
"2" for ±25 ppm
"8" for ±30 ppm
"3" for ±50 ppm

Note:

[13] The voltage portion of the SiT2025 part number consists of two characters that denote the specific supply voltage of the device. The SiT2025 supports either 1.8V ±10% or any voltage between 2.25V and 3.62V. In the 1.8V mode, one can simply insert 18 in the part number. In the 2.5V to 3.3V mode, two digits such as 18, 25 or 33 can be used in the part number to reflect the desired voltage. Alternatively, "XX" can be used to indicate the entire operating voltage range from 2.25V to 3.63V.

Table 14. Supported Frequencies (-40°C to +85°C)[14]

Frequency Range	
Min.	Max.
115.200000 MHz	137.000000 MHz

Table 15. Supported Frequencies (-40°C to +105°C or -40°C to +125°C)[14, 15]

Frequency Range	
Min.	Max.
115.194001 MHz	117.810999 MHz
118.038001 MHz	118.593999 MHz
118.743001 MHz	122.141999 MHz
122.705001 MHz	123.021999 MHz
123.348001 MHz	137.000000 MHz

Table 16. Supported Frequencies (-55°C to +125°C)[14, 15]

Frequency Range	
Min.	Max.
119.342001 MHz	120.238999 MHz
120.262001 MHz	121.169999 MHz
121.243001 MHz	121.600999 MHz
123.948001 MHz	137.000000 MHz

Notes:

[14] Any frequency within the min and max values in the above table are supported with 6 decimal places of accuracy.

[15] Please contact SiTime for frequencies that are not listed in the tables above.

Best Vibration Robustness

High-vibration environments are all around us. All electronics, from handheld devices to enterprise servers and storage systems are subject to vibration. Figure 5 shows a comparison of vibration robustness.

Why is SiTime Best in Class:

- The moving mass of SiTime's MEMS resonators is up to 3000 times smaller than quartz
- Center-anchored MEMS resonator is the most robust design

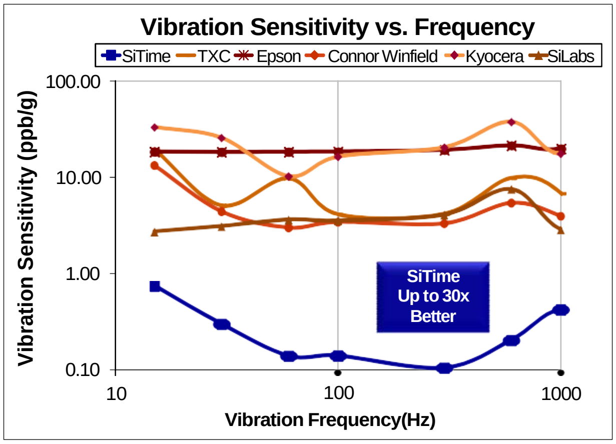


Figure 5. Vibration Robustness[5]

Best Shock Robustness

SiTime's oscillators can withstand at least 50,000 *g* shock. They all maintain their electrical performance in operation during shock events. A comparison with quartz devices is shown in Figure 6.

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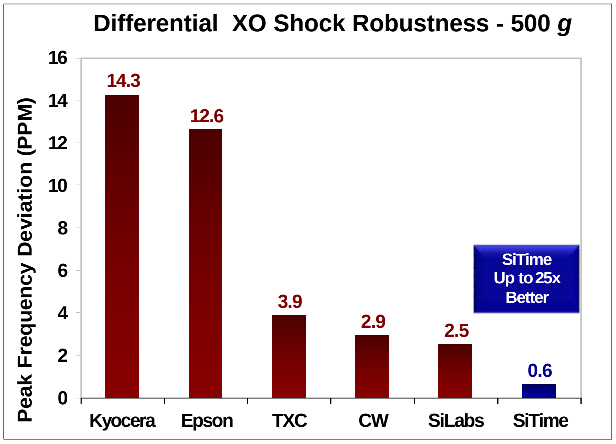

Figure 6. Shock Robustness[6]

Notes:

1. Data Source: Reliability documents of named companies.
2. Data source: SiTime and quartz oscillator devices datasheets.
3. Test conditions for Electro Magnetic Susceptibility (EMS):
   - According to IEC EN61000-4.3 (Electromagnetic compatibility standard)
   - Field strength: 3V/m
   - Radiated signal modulation: AM 1 kHz at 80% depth
   - Carrier frequency scan: 80 MHz – 1 GHz in 1% steps
   - Antenna polarization: Vertical
   - DUT position: Center aligned to antenna

   Devices used in this test:
   - SiTime, SiT9120AC-1D2-33E156.250000 - MEMS based - 156.25 MHz
   - Epson, EG-2102CA 156.2500M-PHPAL3 - SAW based - 156.25 MHz
   - TXC, BB-156.250MBE-T - 3rd Overtone quartz based - 156.25 MHz
   - Kyocera, KC7050T156.250P30E00 - SAW based - 156.25 MHz
   - Connor Winfield (CW), P123-156.25M - 3rd overtone quartz based - 156.25 MHz
   - SiLabs, Si590AB-BDG - 3rd overtone quartz based - 156.25 MHz
4. 50 mV pk-pk Sinusoidal voltage.

   Devices used in this test:
   - SiTime, SiT8208AI-33-33E-25.000000, MEMS based - 25 MHz
   - NDK, NZ2523SB-25.6M - quartz based - 25.6 MHz
   - Kyocera, KC2016B25M0C1GE00 - quartz based - 25 MHz
   - Epson, SG-310SCF-25M0-MB3 - quartz based - 25 MHz
5. Devices used in this test:

   same as EMS test stated in Note 3
6. Test conditions for shock test:
   - MIL-STD-883F Method 2002
   - Condition A: half sine wave shock pulse, 500-g, 1ms
   - Continuous frequency measurement in 100 µs gate time for 10 seconds

   Devices used in this test:

   same as EMS test stated in Note 3
7. Additional data, including setup and detailed results, is available upon request to qualified customers. Please contact productsupport@sitime.com.