

## Features

- Any frequency between 1 MHz and 220 MHz accurate to 6 decimal places
- LVPECL and LVDS output signaling types
- 0.6ps RMS phase jitter (random) over 12 kHz to 20 MHz bandwidth
- Frequency stability as low as  $\pm 10$  ppm
- Industrial and extended commercial temperature ranges
- Industry-standard packages: 3.2x2.5, 5.0x3.2 and 7.0x5.0 mmxmm
- For frequencies higher than 220 MHz, refer to SiT9122 datasheet

## Applications

- 10GB Ethernet, SONET, SATA, SAS, Fibre Channel, PCI-Express
- Telecom, networking, instrumentation, storage, servers

INSTANT  
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## Electrical Characteristics

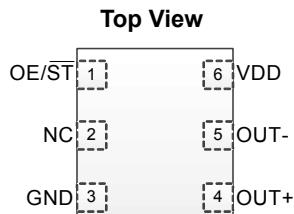
Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>LVPECL and LVDS, Common Electrical Characteristics</b>						
Supply Voltage	Vdd	2.97	3.3	3.63	V	
		2.25	2.5	2.75	V	
		2.25	—	3.63	V	Termination schemes in Figures 1 and 2 - XX ordering code
		1.71	1.8	1.89	V	Only for LVDS output
Output Frequency Range	f	1	—	220	MHz	
Frequency Stability	F_stab	-10	—	+10	ppm	Inclusive of initial tolerance, operating temperature, rated power supply voltage, and load variations
		-20	—	+20	ppm	
		-25	—	+25	ppm	
		-50	—	+50	ppm	
First Year Aging	F_aging1	-2	—	+2	ppm	25°C
10-year Aging	F_aging10	-5	—	+5	ppm	25°C
Operating Temperature Range	T_use	-40	—	+85	°C	Industrial
		-20	—	+70	°C	Extended Commercial
Input Voltage High	VIH	70%	—	—	Vdd	Pin 1, OE or $\overline{ST}$
Input Voltage Low	VIL	—	—	30%	Vdd	Pin 1, OE or $\overline{ST}$
Input Pull-up Impedance	Z_in	—	100	250	kΩ	Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high
		2	—	—	MΩ	Pin 1, $\overline{ST}$ logic low
Start-up Time	T_start	—	6	10	ms	Measured from the time Vdd reaches its rated minimum value.
Resume Time	T_resume	—	6	10	ms	In Standby mode, measured from the time $\overline{ST}$ pin crosses 50% threshold.
Duty Cycle	DC	45	—	55	%	Contact SiTime for tighter duty cycle
<b>LVPECL, DC and AC Characteristics</b>						
Current Consumption	Idd	—	61	69	mA	Excluding Load Termination Current, Vdd = 3.3V or 2.5V
OE Disable Supply Current	I_OE	—	—	35	mA	OE = Low
Output Disable Leakage Current	I_leak	—	—	1	µA	OE = Low
Standby Current	I_std	—	—	100	µA	$\overline{ST}$ = Low, for all Vdds
Maximum Output Current	I_driver	—	—	30	mA	Maximum average current drawn from OUT+ or OUT-
Output High Voltage	VOH	Vdd-1.1	—	Vdd-0.7	V	See Figure 1(a)
Output Low Voltage	VOL	Vdd-1.9	—	Vdd-1.5	V	See Figure 1(a)
Output Differential Voltage Swing	V_Swing	1.2	1.6	2.0	V	See Figure 1(b)
Rise/Fall Time	Tr, Tf	—	300	700	ps	20% to 80%, see Figure 1(a)
OE Enable/Disable Time	T_oe	—	—	115	ns	$f = 212.5$ MHz - For other frequencies, $T_{oe} = 100$ ns + 3 period
RMS Period Jitter	T_jitt	—	1.2	1.7	ps	$f = 100$ MHz, VDD = 3.3V or 2.5V
		—	1.2	1.7	ps	$f = 156.25$ MHz, VDD = 3.3V or 2.5V
		—	1.2	1.7	ps	$f = 212.5$ MHz, VDD = 3.3V or 2.5V
RMS Phase Jitter (random)	T_phj	—	0.6	0.85	ps	$f = 156.25$ MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
<b>LVDS, DC and AC Characteristics</b>						
Current Consumption	Idd	—	47	55	mA	Excluding Load Termination Current, Vdd = 3.3V or 2.5V
OE Disable Supply Current	I_OE	—	—	35	mA	OE = Low
Differential Output Voltage	VOD	250	350	450	mV	See Figure 2

## Electrical Characteristics (continued)

Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>LVDS, DC and AC Characteristics (continued)</b>						
Output Disable Leakage Current	I_leak	—	—	1	µA	OE = Low
Standby Current	I_std	—	—	100	µA	ST = Low, for all Vdds
VOD Magnitude Change	ΔVOD	—	—	50	mV	See Figure 2
Offset Voltage	VOS	1.125	1.2	1.375	V	See Figure 2
VOS Magnitude Change	ΔVOS	—	—	50	mV	See Figure 2
Rise/Fall Time	Tr, Tf	—	495	700	ps	20% to 80%, see Figure 2
OE Enable/Disable Time	T_oe	—	—	115	ns	f = 212.5 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	—	1.2	1.7	ps	f = 100 MHz, VDD = 3.3V or 2.5V
	—	1.2	1.7	ps	ps	f = 156.25 MHz, VDD = 3.3V or 2.5V
	—	1.2	1.7	ps	ps	f = 212.5 MHz, VDD = 3.3V or 2.5V
RMS Phase Jitter (random)	T_phj	—	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds

## Pin Description

Pin	Map	Functionality	
1	OE	Input	H or Open: specified frequency output L: output is high impedance
	ST	Input	H or Open: specified frequency output L: Device goes to sleep mode. Supply current reduces to I_std.
2	NC	NA	No Connect; Leave it floating or connect to GND for better heat dissipation
3	GND	Power	VDD Power Supply Ground
4	OUT+	Output	Oscillator output
5	OUT-	Output	Complementary oscillator output
6	VDD	Power	Power supply voltage



## Absolute Maximum

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 (HBM)	—	2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	—	260	°C

## Thermal Consideration

Package	θJA, 4 Layer Board (°C/W)	θJC, Bottom (°C/W)
7050, 6-pin	142	27
5032, 6-pin	97	20
3225, 6-pin	109	20

## 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

## Waveform Diagrams

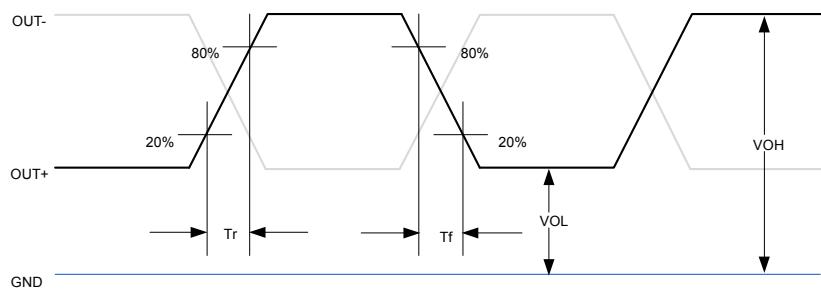


Figure 1(a). LVPECL Voltage Levels per Differential Pin (OUT+/OUT-)

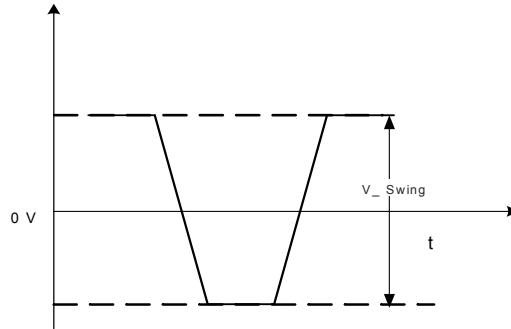


Figure 1(b). LVPECL Voltage Levels Across Differential Pair

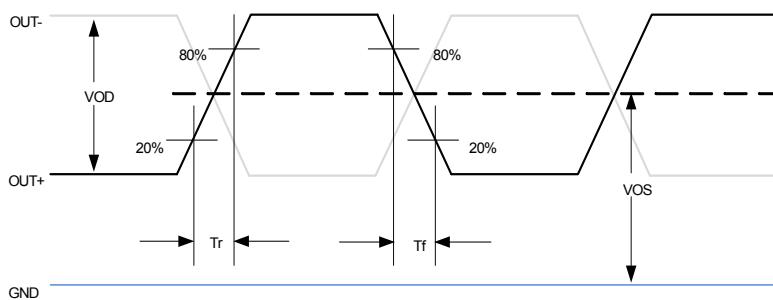


Figure 2. LVDS Voltage Levels per Differential Pin (OUT+/OUT-)

## Termination Diagrams

LVPECL:

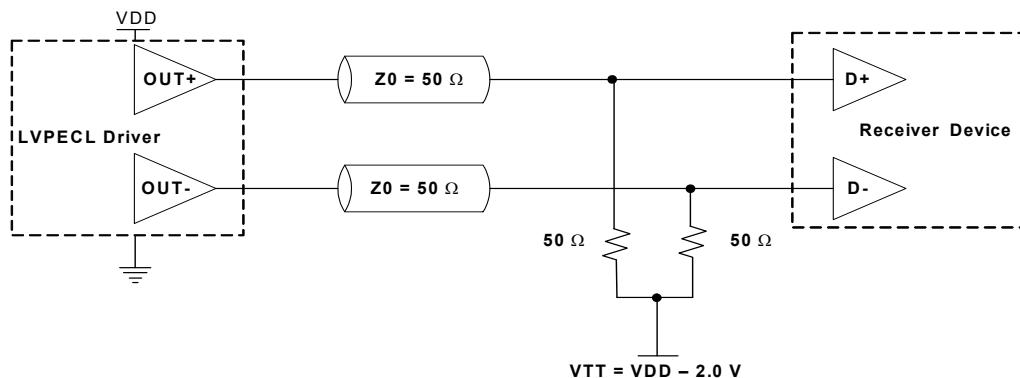


Figure 3. LVPECL Typical Termination

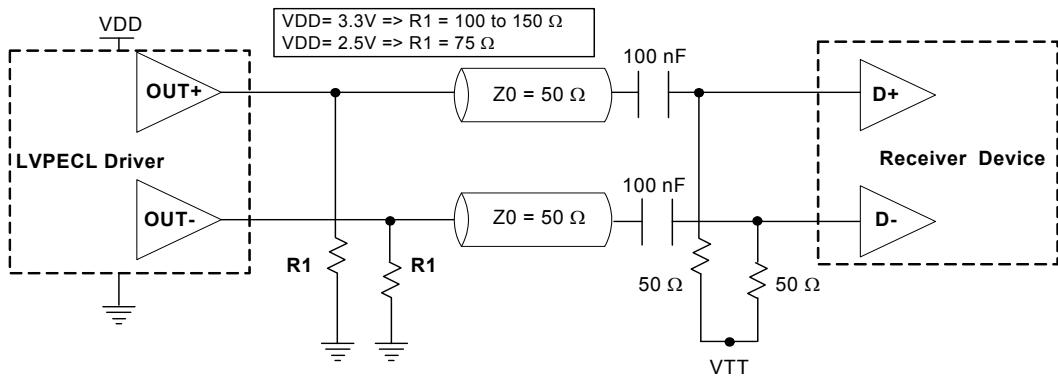


Figure 4. LVPECL AC Coupled Termination

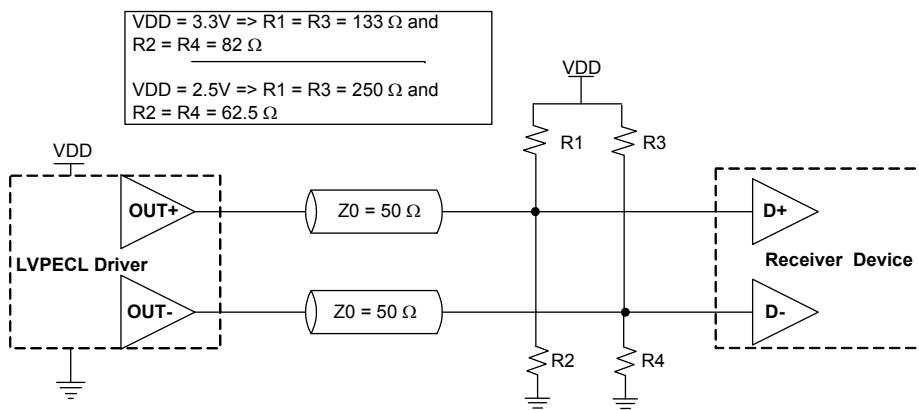
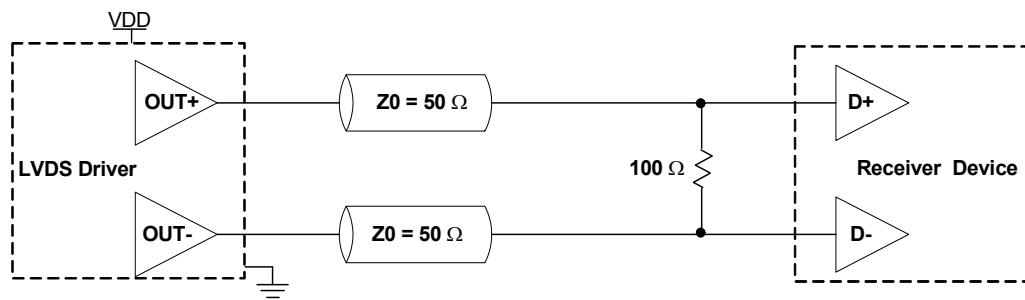


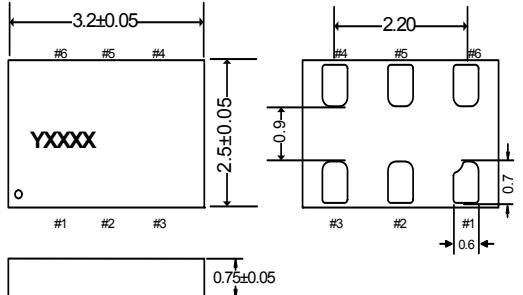
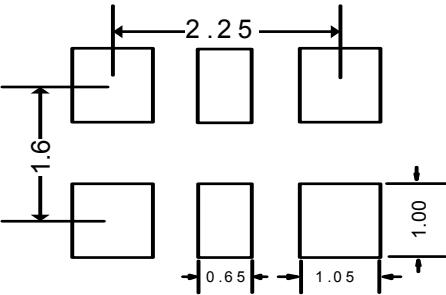
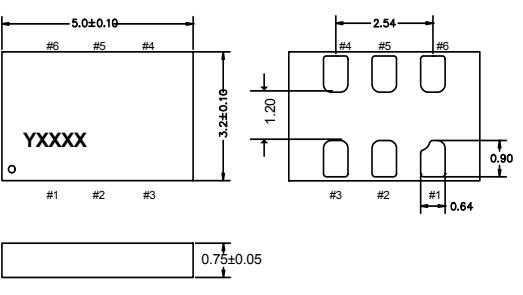
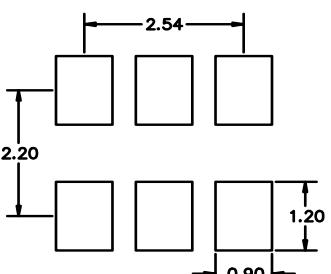
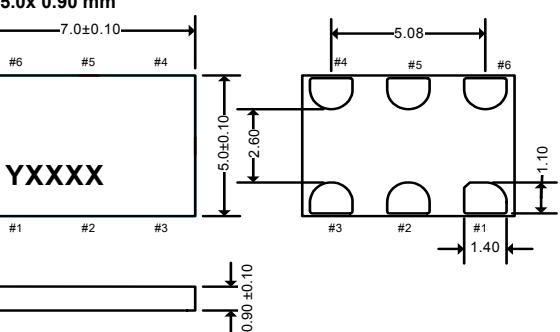
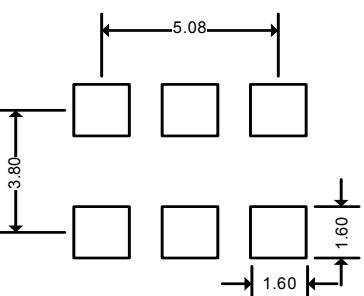
Figure 5. LVPECL with Thevenin Typical Termination

LVDS:



**Figure 6. LVDS Single Termination (Load Terminated)**

## Dimensions and Patterns

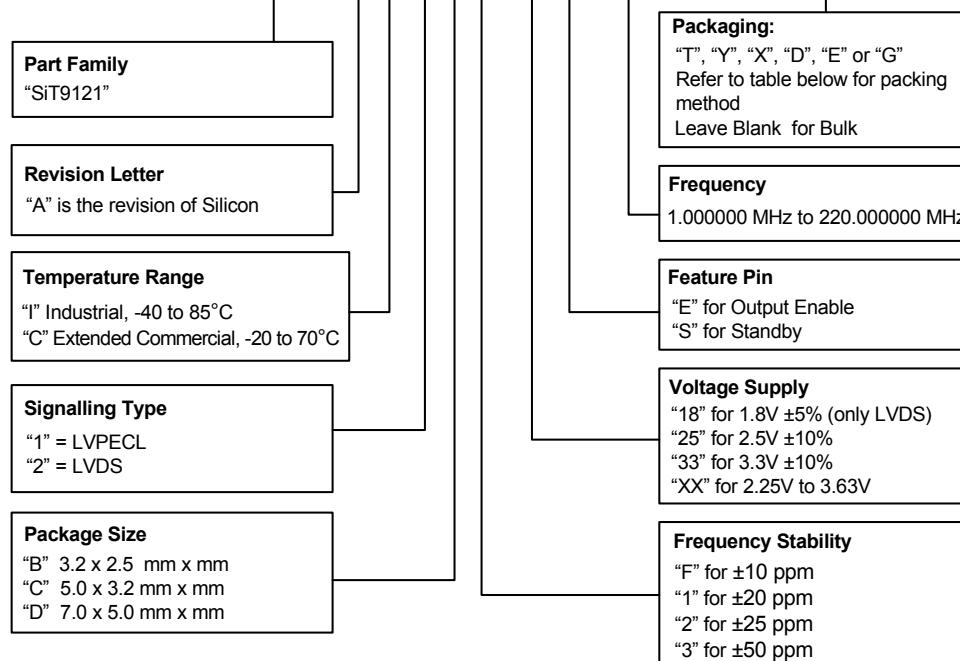
Package Size – Dimensions (Unit: mm) <sup>[1]</sup>	Recommended Land Pattern (Unit: mm) <sup>[2]</sup>
<b>3.2 x 2.5x 0.75 mm</b>  <p>YXXXX</p> <p>Dimensions: 3.2±0.05 mm, 2.5±0.05 mm, 0.9 mm, 0.7 mm, 0.6 mm, 0.65 mm, 1.05 mm, 1.00 mm, 0.75±0.05 mm.</p>	 <p>Dimensions: 2.25 mm, 1.6 mm, 0.65 mm, 1.05 mm, 1.00 mm.</p>
<b>5.0 x 3.2 x 0.75 mm</b>  <p>YXXXX</p> <p>Dimensions: 5.0±0.10 mm, 3.2±0.10 mm, 1.20 mm, 2.54 mm, 0.90 mm, 0.64 mm, 0.75±0.05 mm.</p>	 <p>Dimensions: 2.54 mm, 2.20 mm, 1.20 mm, 0.90 mm.</p>
<b>7.0 x 5.0x 0.90 mm</b>  <p>YXXXX</p> <p>Dimensions: 7.0±0.10 mm, 5.0±0.10 mm, 2.60 mm, 5.08 mm, 1.10 mm, 1.40 mm, 0.90±0.10 mm.</p>	 <p>Dimensions: 5.08 mm, 3.80 mm, 1.60 mm.</p>

### Notes:

1. 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.
2. A capacitor of value 0.1  $\mu$ F between Vdd and GND is recommended.

## Ordering Information

### SiT9121AC-1C2-33E125.000000T



## Ordering Codes for Supported Tape & Reel Packing Method

Device Size	8 mm T&R (3ku)	8 mm T&R (1ku)	8 mm T&R (250u)	12 mm T&R (3ku)	12 mm T&R (1ku)	12 mm T&R (250u)	16 mm T&R (3ku)	16 mm T&R (1ku)	16 mm T&R (250u)
7.0 x 5.0 mm	—	—	—	—	—	—	T	Y	X
5.0 x 3.2 mm	—	—	—	T	Y	X	—	—	—
3.2 x 2.5 mm	D	E	G	T	Y	X	—	—	—

## Frequencies Not Supported

Range 1: From 209.000001 MHz to 210.999999 MHz

### Revision History

Version	Release Date	Change Summary
1.01	2/20/13	Original
1.02	12/3/13	Added input specifications, LVPECL/LVDS waveforms, packaging T&R options
1.03	2/6/14	Added 8mm T&R option and ±10 ppm
1.04	4/8/14	Included 1.8V option for LVDS output only
1.05	7/30/14	Included Thermal Consideration table
1.06	10/20/14	Modified Thermal Consideration values. Preliminary removed from the title

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# Supplemental Information

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# Silicon MEMS Outperforms Quartz

# Silicon MEMS Outperforms Quartz

## Best Reliability

Silicon is inherently more reliable than quartz. Unlike quartz suppliers, SiTime has in-house MEMS and analog CMOS expertise, which allows SiTime to develop the most reliable products. Figure 1 shows a comparison with quartz technology.

### Why is SiTime Best in Class:

- SiTime's MEMS resonators are vacuum sealed using an advanced EpiSeal™ process, which eliminates foreign particles and improves long term aging and reliability
- World-class MEMS and CMOS design expertise

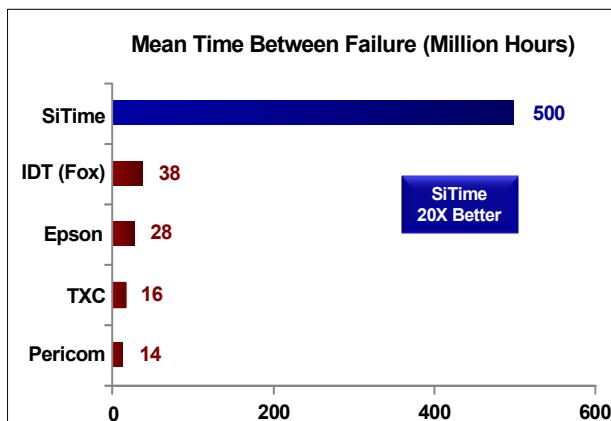


Figure 1. Reliability Comparison<sup>[1]</sup>

## Best Aging

Unlike quartz, MEMS oscillators have excellent long term aging performance which is why every new SiTime product specifies 10-year aging. A comparison is shown in Figure 2.

### Why is SiTime Best in Class:

- SiTime's MEMS resonators are vacuum sealed using an advanced EpiSeal process, which eliminates foreign particles and improves long term aging and reliability
- Inherently better immunity of electrostatically driven MEMS resonator

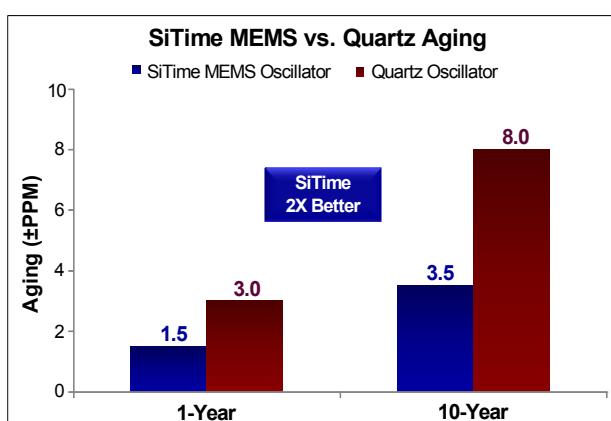


Figure 2. Aging Comparison<sup>[2]</sup>

## Best Electro Magnetic Susceptibility (EMS)

SiTime's oscillators in plastic packages are up to 54 times more immune to external electromagnetic fields than quartz oscillators as shown in Figure 3.

### Why is SiTime Best in Class:

- Internal differential architecture for best common mode noise rejection
- Electrostatically driven MEMS resonator is more immune to EMS

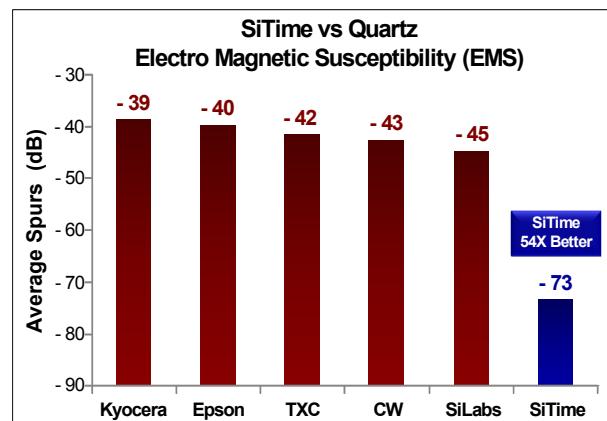


Figure 3. Electro Magnetic Susceptibility (EMS)<sup>[3]</sup>

## Best Power Supply Noise Rejection

SiTime's MEMS oscillators are more resilient against noise on the power supply. A comparison is shown in Figure 4.

### Why is SiTime Best in Class:

- On-chip regulators and internal differential architecture for common mode noise rejection
- Best analog CMOS design expertise

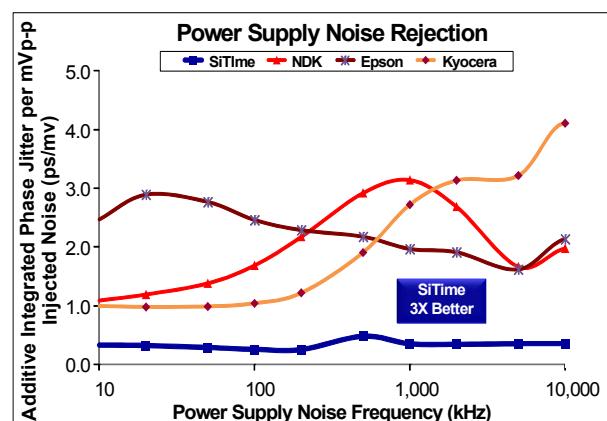


Figure 4. Power Supply Noise Rejection<sup>[4]</sup>

## 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

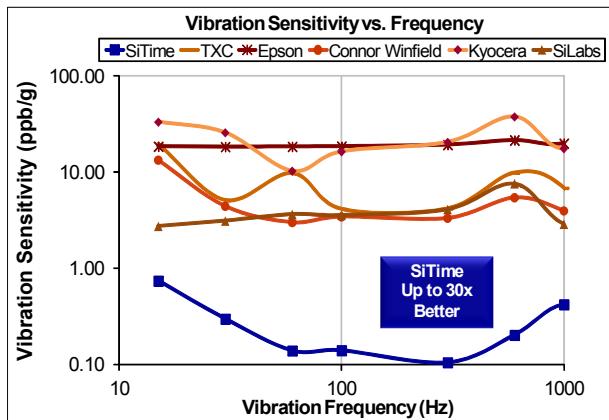


Figure 5. Vibration Robustness<sup>[5]</sup>

## 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.

### 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

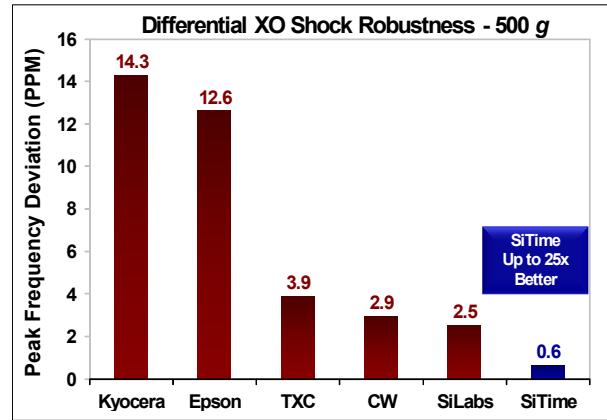


Figure 6. Shock Robustness<sup>[6]</sup>

### Notes:

- Data Source: Reliability documents of named companies.
- Data source: SiTime and quartz oscillator devices datasheets.
- 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
- 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
- Devices used in this test:** same as EMS test stated in Note 3.
- 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
- Additional data, including setup and detailed results, is available upon request to qualified customers. Please contact [productsupport@sitime.com](mailto:productsupport@sitime.com).

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