

### Features

- Any frequency between 1 MHz and 110 MHz accurate to 6 decimal places
- Operating temperature from -40°C to 85°C. Refer to SiT8918 for higher temperature options
- Excellent total frequency stability as low as ±20 PPM
- Low power consumption of 3.6 mA typical
- Fast startup time of 5 ms
- LVC MOS/HCMOS compatible output
- 5-pin SOT23 package
- Pb-free, RoHS and REACH compliant

### Applications

- Ideal for DSC, DVC, DVR, IP CAM, Tablets, e-Books, SSD, GPON, EPON, etc
- Ideal for high-speed serial protocols such as: USB, SATA, SAS, Firewire, 100M / 1G / 10G Ethernet, etc.



### Electrical Characteristics<sup>[1, 2]</sup>

Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Frequency Range</b>						
Output Frequency Range	f	1	–	110	MHz	
<b>Frequency Stability and Aging</b>						
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.
		-25	–	+25	PPM	
		-50	–	+50	PPM	
<b>Operating Temperature Range</b>						
Operating Temperature Range	T_use	-20	–	+70	°C	Extended Commercial
		-40	–	+85	°C	Industrial
<b>Supply Voltage and Current Consumption</b>						
Supply Voltage	Vdd	1.62	1.8	1.98	V	Contact SiTime for 1.5V support
		2.25	2.5	2.75	V	
		2.52	2.8	3.08	V	
		2.7	3.0	3.3	V	
		2.97	3.3	3.63	V	
		2.25	–	3.63	V	
Current Consumption	Idd	–	3.8	4.5	mA	No load condition, f = 20 MHz, Vdd = 2.8V, 3.0V, 3.3V or 2.5-3.3V option
		–	3.6	4.2	mA	No load condition, f = 20 MHz, Vdd = 2.5V
		–	3.4	3.9	mA	No load condition, f = 20 MHz, Vdd = 1.8V
OE Disable Current	I_OD	–	–	4	mA	Vdd = 2.5V to 3.3V, OE = GND, output is Weakly Pulled Down
		–	–	3.8	mA	Vdd = 1.8V, OE = GND, output is Weakly Pulled Down
Standby Current	I_std	–	2.6	4.3	µA	$\overline{ST}$ = GND, Vdd = 2.8V to 3.3V, Output is Weakly Pulled Down
		–	1.4	2.5	µA	$\overline{ST}$ = GND, Vdd = 2.5V, Output is Weakly Pulled Down
		–	0.6	1.3	µA	$\overline{ST}$ = GND, Vdd = 1.8V, Output is Weakly Pulled Down
<b>LVC MOS Output Characteristics</b>						
Duty Cycle	DC	45	–	55	%	All Vdds
Rise/Fall Time	Tr, Tf	–	1	2	ns	Vdd = 2.5V, 2.8V, 3.0V or 3.3V, 20% - 80%
		–	1.3	2.5	ns	Vdd = 1.8V, 20% - 80%
		–	–	2	ns	Vdd = 2.25V - 3.63V, 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)
<b>Input Characteristics</b>						
Input High Voltage	VIH	70%	–	–	Vdd	Pin 1, OE or $\overline{ST}$
Input Low Voltage	VIL	–	–	30%	Vdd	Pin 1, OE or $\overline{ST}$
Input Pull-up Impedance	Z_in	–	87	100	kΩ	Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high
		2	–	–	MΩ	Pin 1, $\overline{ST}$ logic low

#### Notes:

- All electrical specifications in the above table are specified with 15 pF output load and for all Vdd(s) unless otherwise stated.
- Contact SiTime for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

Electrical Characteristics<sup>[1, 2]</sup> (continued)

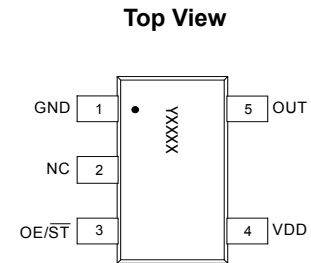
Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Startup and Resume Timing</b>						
Startup Time	T_start	–	–	5	ms	Measured from the time Vdd reaches its rated minimum value
Enable/Disable Time	T_oe	–	–	130	ns	f = 110 MHz. For other frequencies, T_oe = 100 ns + 3 * cycles
Resume Time	T_resume	–	–	5	ms	Measured from the time ST pin crosses 50% threshold
<b>Jitter</b>						
RMS Period Jitter	T_jitt	–	1.76	3	ps	f = 75 MHz, Vdd = 2.5V, 2.8V, 3.0V or 3.3V
		–	1.78	3	ps	f = 75 MHz, Vdd = 1.8V
RMS Phase Jitter (random)	T_phj	–	0.5	0.9	ps	f = 75 MHz, Integration bandwidth = 900 kHz to 7.5 MHz
		–	1.3	2	ps	f = 75 MHz, Integration bandwidth = 12 kHz to 20 MHz

## Notes:

- All electrical specifications in the above table are specified with 15 pF output load and for all Vdd(s) unless otherwise stated.
- Contact [SiTime](#) for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

## Pin Description

Pin	Symbol	Functionality	
1	GND	Power	Electrical ground <sup>[3]</sup>
2	NC	No Connect	No connect
3	OE/ $\overline{ST}$	Output Enable	H or Open <sup>[4]</sup> : specified frequency output L: output is high impedance. Only output driver is disabled.
		Standby	H or Open <sup>[4]</sup> : specified frequency output L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to I_std.
4	VDD	Power	Power supply voltage <sup>[3]</sup>
5	OUT	Output	Oscillator output



## Notes:

- A capacitor value of 0.1  $\mu$ F between Vdd and GND is recommended.
- A pull-up resistor of <10 k $\Omega$  between OE/  $\overline{ST}$  pin and Vdd is recommended in high noise environment.

## Absolute Maximum

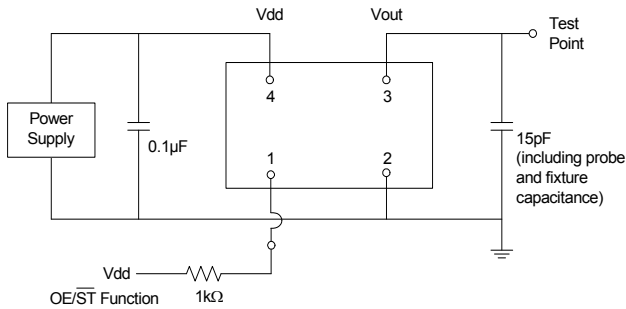
Attempted operation outside the absolute maximum ratings of the part may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

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	–	150	°C

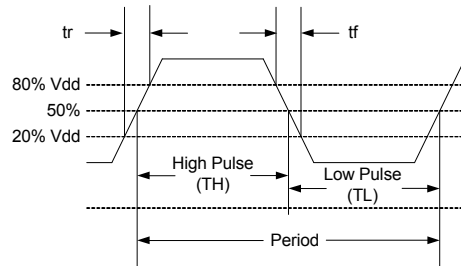
## Environmental Compliance

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<sup>[5]</sup>



**Figure 1. Test Circuit**

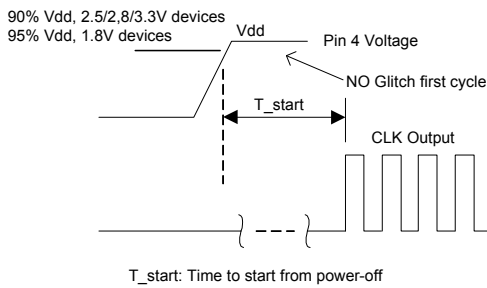


**Figure 2. Waveform**

**Note:**

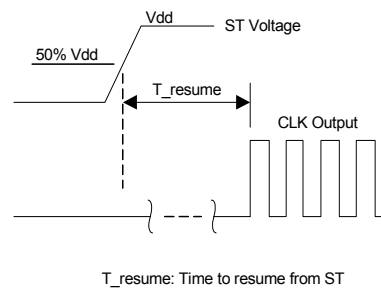
5. Duty Cycle is computed as  $Duty\ Cycle = TH/Period$ .

### Timing Diagrams



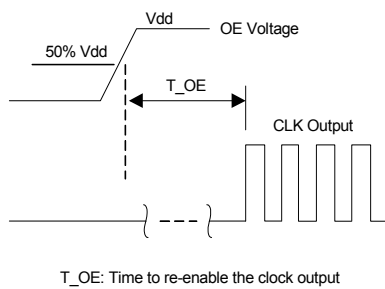
T\_start: Time to start from power-off

**Figure 3. Startup Timing (OE/ST Mode)**



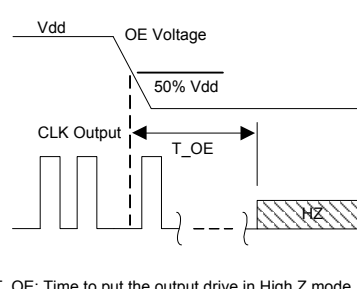
T\_resume: Time to resume from ST

**Figure 4. Standby Resume Timing (ST Mode Only)**



T\_OE: Time to re-enable the clock output

**Figure 5. OE Enable Timing (OE Mode Only)**



T\_OE: Time to put the output drive in High Z mode

**Figure 6. OE Disable Timing (OE Mode Only)**

**Notes:**

- 6. SiT9201 supports no runt pulses and no glitches during startup or resume.
- 7. SiT9201 supports gated output which is accurate within rated frequency stability from the first cycle.

## Performance Plots

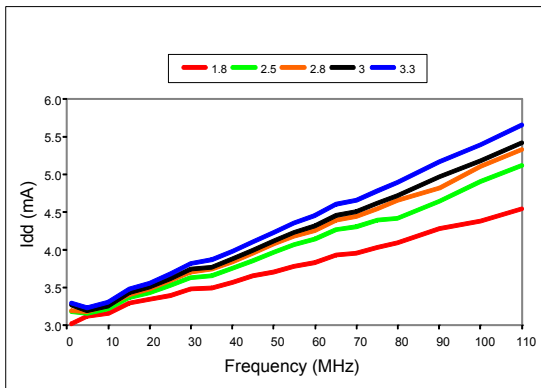


Figure 7. Idd vs Frequency

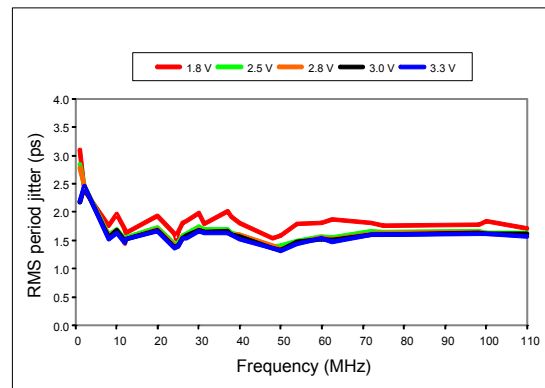


Figure 8. RMS Period Jitter vs Frequency

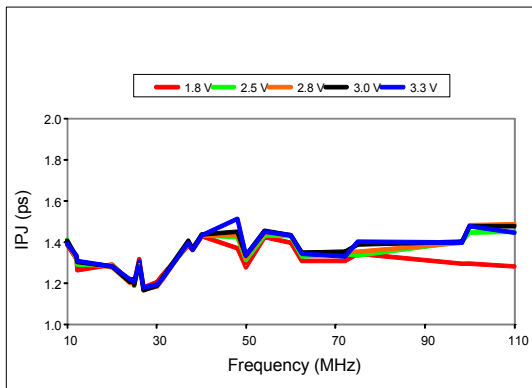


Figure 9. RMS Phase Jitter vs Frequency (12 kHz to 20 MHz Integration Bandwidth)

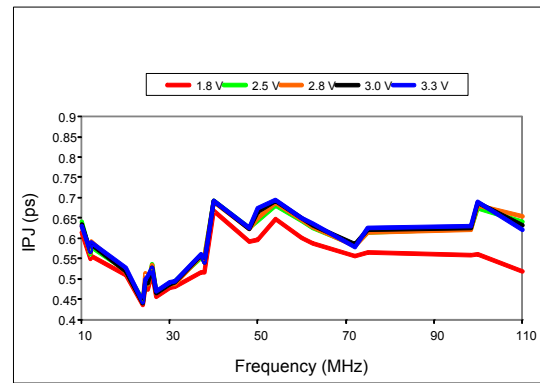


Figure 10. RMS Phase Jitter vs Frequency (900 kHz to 20 MHz Integration Bandwidth)

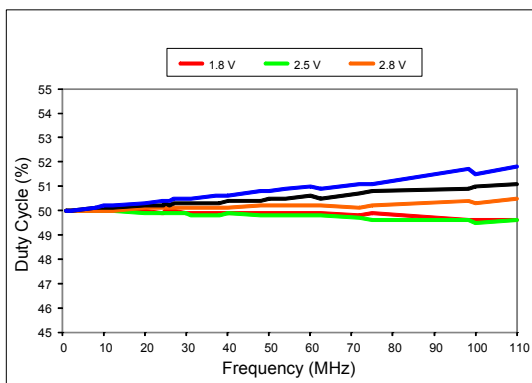


Figure 11. Duty Cycle vs Frequency

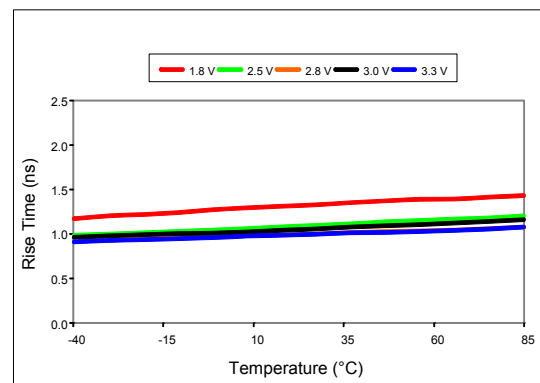


Figure 12. Rise Time vs Temperature, 20 MHz Output

**Note:**

8. All plots are measured with 15 pF load at room temperature, unless otherwise stated.

Rise/Fall Time (20% to 80%) vs  $C_{LOAD}$  Tables

Rise/Fall Time Typ (ns)					
Drive Strength \ $C_{LOAD}$	5 pF	15 pF	30 pF	45 pF	60 pF
L	6.16	11.61	22.00	31.27	39.91
A	3.19	6.35	11.00	16.01	21.52
R	2.11	4.31	7.65	10.77	14.47
B	1.65	3.23	5.79	8.18	11.08
T	0.93	1.91	3.32	4.66	6.48
E	0.78	1.66	2.94	4.09	5.74
U	0.70	1.48	2.64	3.68	5.09
F or "-": default	0.65	1.30	2.40	3.35	4.56

Table 1. Vdd = 1.8V Rise/Fall Times for Specific  $C_{LOAD}$ 

Rise/Fall Time Typ (ns)					
Drive Strength \ $C_{LOAD}$	5 pF	15 pF	30 pF	45 pF	60 pF
L	4.13	8.25	12.82	21.45	27.79
A	2.11	4.27	7.64	11.20	14.49
R	1.45	2.81	5.16	7.65	9.88
B	1.09	2.20	3.88	5.86	7.57
T	0.62	1.28	2.27	3.51	4.45
E or "-": default	0.54	1.00	2.01	3.10	4.01
U	0.43	0.96	1.81	2.79	3.65
F	0.34	0.88	1.64	2.54	3.32

Table 2. Vdd = 2.5V Rise/Fall Times for Specific  $C_{LOAD}$ 

Rise/Fall Time Typ (ns)					
Drive Strength \ $C_{LOAD}$	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.77	7.54	12.28	19.57	25.27
A	1.94	3.90	7.03	10.24	13.34
R	1.29	2.57	4.72	7.01	9.06
B	0.97	2.00	3.54	5.43	6.93
T	0.55	1.12	2.08	3.22	4.08
E or "-": default	0.44	1.00	1.83	2.82	3.67
U	0.34	0.88	1.64	2.52	3.30
F	0.29	0.81	1.48	2.29	2.99

Table 3. Vdd = 2.8V Rise/Fall Times for Specific  $C_{LOAD}$ 

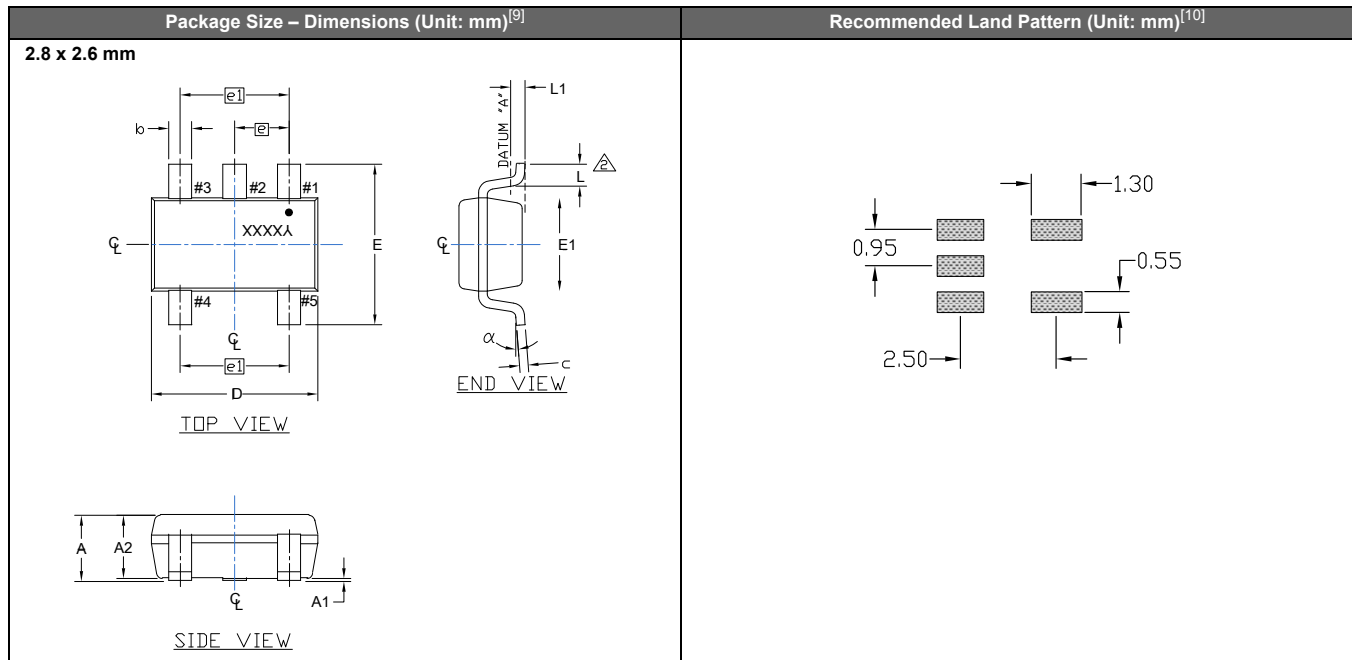
Rise/Fall Time Typ (ns)					
Drive Strength \ $C_{LOAD}$	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.60	7.21	11.97	18.74	24.30
A	1.84	3.71	6.72	9.86	12.68
R	1.22	2.46	4.54	6.76	8.62
B	0.89	1.92	3.39	5.20	6.64
T or "-": default	0.51	1.00	1.97	3.07	3.90
E	0.38	0.92	1.72	2.71	3.51
U	0.30	0.83	1.55	2.40	3.13
F	0.27	0.76	1.39	2.16	2.85

Table 4. Vdd = 3.0V Rise/Fall Times for Specific  $C_{LOAD}$ 

Rise/Fall Time Typ (ns)					
Drive Strength \ $C_{LOAD}$	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.39	6.88	11.63	17.56	23.59
A	1.74	3.50	6.38	8.98	12.19
R	1.16	2.33	4.29	6.04	8.34
B	0.81	1.82	3.22	4.52	6.33
T or "-": default	0.46	1.00	1.86	2.60	3.84
E	0.33	0.87	1.64	2.30	3.35
U	0.28	0.79	1.46	2.05	2.93
F	0.25	0.72	1.31	1.83	2.61

Table 5. Vdd = 3.3V Rise/Fall Times for Specific  $C_{LOAD}$

### Dimensions and Patterns



**Notes:**

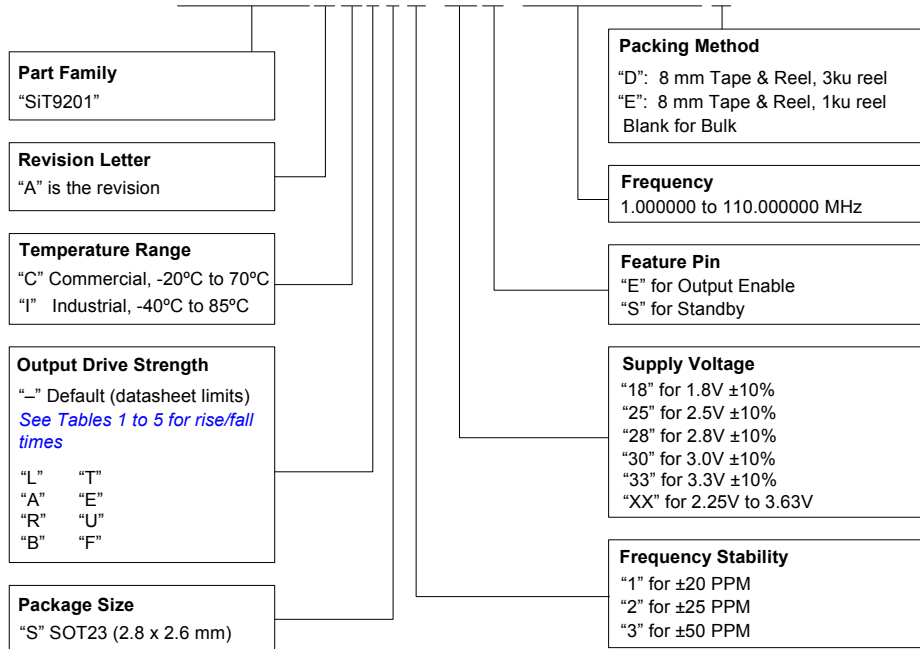
- 9. Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of "Y" will depend on the assembly location of the device.
- 10. A capacitor value of 0.1  $\mu$ F between Vdd and GND is recommended.

### Dimension Table

Symbol	Min.	Nom.	Max.
A	0.90	1.27	1.45
A1	0.00	0.07	0.15
A2	0.90	1.2	1.30
b	0.30	0.35	0.50
c	0.14	0.153	0.20
D	2.90		
E	2.80		
E1	1.60		
e	0.95		
e1	1.90		
L	0.30	0.38	0.55
L1	0.25		
a	0°	–	8°

### Ordering Information

SiT9201AC-S2-18E-25.000625D



**Note:**

10. Contact [SiTime](http://www.sitime.com) for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

**Additional Information**

Document	Description	Download Link
<b>Manufacturing Notes</b>	Tape & Reel dimension, reflow profile and other manufacturing related info	<a href="http://www.sitime.com/component/docman/doc_download/85-manufacturing-notes-for-sitime-oscillators">http://www.sitime.com/component/docman/doc_download/85-manufacturing-notes-for-sitime-oscillators</a>
<b>Qualification Reports</b>	RoHS report, reliability reports, composition reports	<a href="http://www.sitime.com/support/quality-and-reliability">http://www.sitime.com/support/quality-and-reliability</a>
<b>Performance Reports</b>	Additional performance data such as phase noise, current consumption and jitter for selected frequencies	<a href="http://www.sitime.com/support/performance-measurement-report">http://www.sitime.com/support/performance-measurement-report</a>
<b>Termination Techniques</b>	Termination design recommendations	<a href="http://www.sitime.com/support/application-notes">http://www.sitime.com/support/application-notes</a>
<b>Layout Techniques</b>	Layout recommendations	<a href="http://www.sitime.com/support/application-notes">http://www.sitime.com/support/application-notes</a>

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# Supplemental Information

The Supplemental Information section is not part of the datasheet and is for informational purposes only.

# 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 Epi-Seal™ process, which eliminates foreign particles and improves long term aging and reliability
- World-class MEMS and CMOS design expertise

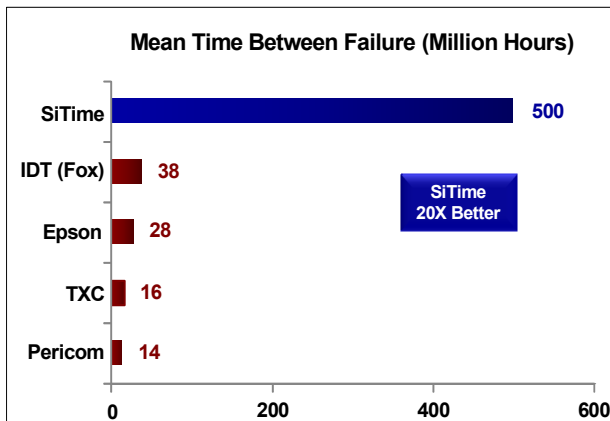


Figure 1. Reliability Comparison<sup>[1]</sup>

## 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 Epi-Seal™ process, which eliminates foreign particles and improves long term aging and reliability
- Inherently better immunity of electrostatically driven MEMS resonator

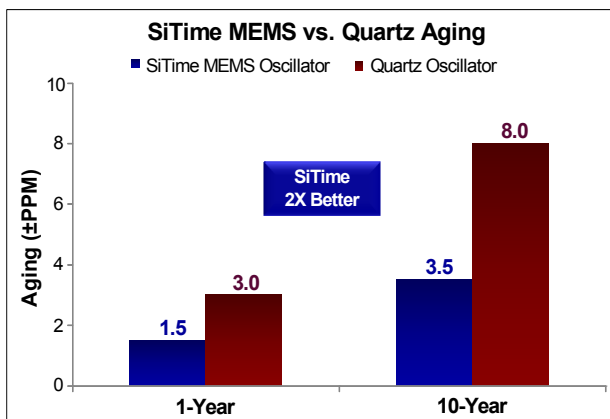


Figure 2. Aging Comparison<sup>[2]</sup>

## 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

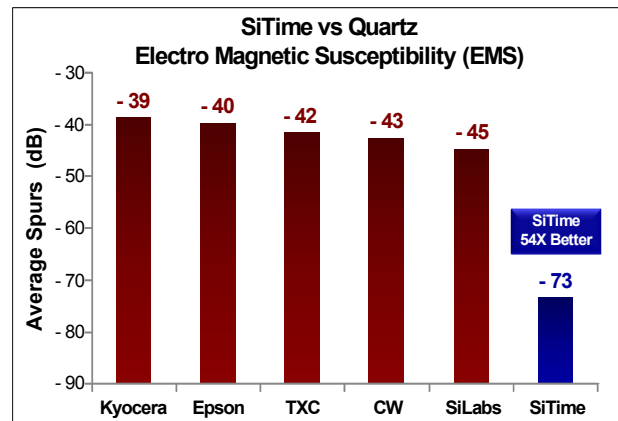


Figure 3. Electro Magnetic Susceptibility (EMS)<sup>[3]</sup>

## 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

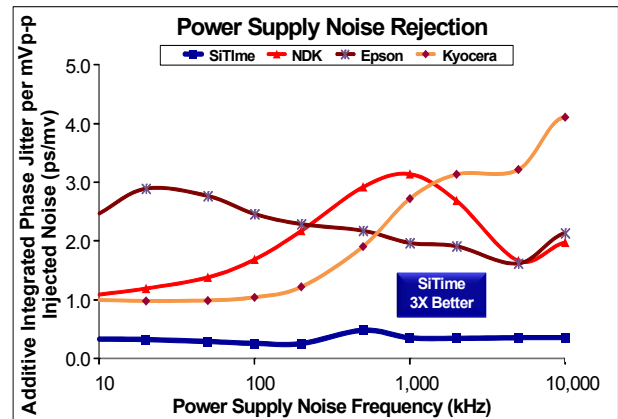


Figure 4. Power Supply Noise Rejection<sup>[4]</sup>

## 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

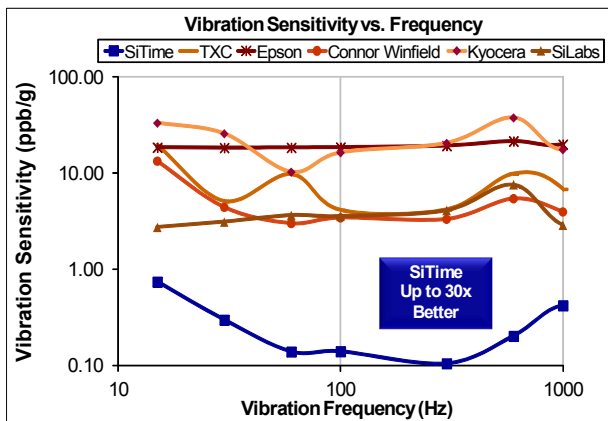


Figure 5. Vibration Robustness<sup>[5]</sup>

## 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

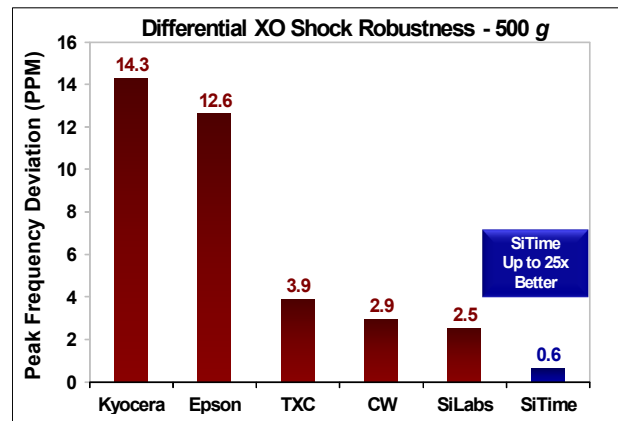


Figure 6. Shock Robustness<sup>[6]</sup>

### Notes:

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](mailto:productsupport@sitime.com).

# Document Feedback Form

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EMI  Termination recommendations  Shock and vibration performance  Other

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