## SiT9122

# 220-625 MHz High Performance Differential Oscillator



#### **Features**

- Any frequency between 220 MHz and 625 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 ±10 PPM
- Industrial and extended commercial temperature ranges
- Industry-standard packages: 3.2x2.5, 5.0x3.2 and 7.0x5.0 mmxmm
- For frequencies lower than 220 MHz, refer to SiT9121 datasheet

#### **Applications**

- 10GB Ethernet, SONET, Synchronous Ethernet, SATA, SAS, Fibre Channel, PCI-Express
- Telecom, networking, broadband, instrumentation







#### **Electrical Characteristics**

Parameter and Conditions	Symbol	Min.	Тур.	Max.	Unit	Condition	
		VPECL a	nd LVDS	Commo	n AC Ch	aracteristics	
Output Frequency Range	f	220	_	625	MHz	For frequency coverage see last page	
	F_stab	-10	_	+10	PPM		
Frequency Stability	_	-20	_	+20	PPM	Inclusive of initial tolerance, operating temperature, rated power	
Trequency outsinty		-25	_	+25	PPM	supply voltage, and load variations	
		-50	_	+50	PPM	-	
First Year Aging	F aging1	-2	_	+2	PPM	25°C	
10-year Aging	F aging10	-5	_	+5	PPM	25°C	
	T use	-40	_	+85	°C	Industrial	
Operating Temperature Range	_	-20	_	+70	°C	Extended Commercial	
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 ST pin crosses 50% threshold.	
Duty Cycle	DC	45	_	55	%	f = 220 to 314 MHz and f = 528 to 625 MHz	
, ,		40	_	60	%	f = 423 to 502 MHz	
	1	I VE	PECL, DC	and AC	Characte	ristics	
	Vdd	2.97	3.3	3.63	V		
Supply Voltage	Vuu	2.25	2.5	2.75	V		
Supply Voltage		2.25		3.63	V	Termination schemes in Figures 1 and 2 - XX ordering code	
Current Consumption	ldd	2.20	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	μΑ	OE = Low	
Standby Current	I std	_	_	100	μΑ	ST = Low, for all Vdds	
Maximum Output Current	I driver	_	_	30	mΑ	Maximum average current drawn from OUT+ or OUT-	
Output High Voltage	VOH	Vdd-1.1	_	Vdd-0.7	V	See Figure 1	
Output Low Voltage	VOL	Vdd-1.9	_	Vdd-1.5	V	See Figure 1	
Output Differential Voltage Swing	V_Swing	1.2	1.6	2.0	V	See Figure 1	
Rise/Fall Time	Tr, Tf	-	300	500	ps	20% to 80%	
OE Enable/Disable Time	T_oe	_	_	105	ns	f = 625 MHz - For other frequencies, T oe = 100ns + 3 period	
RMS Period Jitter	T_jitt	_	1.2	1.7	ps	f = 266 MHz, VDD = 3.3V or 2.5V	
		-	1.2	1.7	ps	f = 312.5 MHz, VDD = 3.3V or 2.5V	
		_	1.2	1.7	ps	f = 622.08 MHz, VDD = 3.3V or 2.5V	
RMS Phase Jitter (random)	T_phj	-	0.6	0.85	ps	f = 312.5 MHz, Integration bandwidth = 12 kHz to 20 MHz, all	
		11	/DS, DC a	nd AC C	haraatar	Vdds	
						istics	
	Vdd	2.97	3.3	3.63	V	Contact SiTime for 1.8V option	
Supply Voltage		2.25	2.5	2.75	V	l var i i i	
0		2.25	-	3.63	V	XX ordering code	
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	
Output Disable Leakage Current	I_leak	-	-	1	μΑ	OE = Low	
Standby Current	I_std	-	-	100	μА	ST = Low, for all Vdds	
Differential Output Voltage	VOD	200	350	500	mV	See Figure 4	

Rev. 1.01 Revised Feb 20, 2013

## 220-625 MHz High Performance Differential Oscilla-

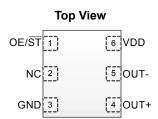


**Electrical Characteristics** (continued)

Parameter and Conditions	Symbol	Min.	Тур.	Max.	Unit	Condition		
VOD Magnitude Change	ΔVOD	_	-	50	mV	See Figure 4		
Offset Voltage	VOS	1.125	1.2	1.375	V	See Figure 4		
VOS Magnitude Change	ΔVOS	-	-	50	mV	See Figure 4		
Rise/Fall Time	Tr, Tf	-	495	600	ps	20% to 80%		
OE Enable/Disable Time	T_oe	I	_	105	ns	f = 625 MHz - For other frequencies, T_oe = 100ns + 3 period		
RMS Period Jitter	T_jitt	I	1.4	1.7	ps	f = 266 MHz, VDD = 3.3V or 2.5V		
		-	1.4	1.7	ps	f = 312.5 MHz, VDD = 3.3V or 2.5V		
		-	1.2	1.7	ps	f = 622.08 MHz, VDD = 3.3V or 2.5V		
RMS Phase Jitter (random)	T_phj	-	0.6	0.85	ps	f = 312.5 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds		

### **Pin Description**

Pin	Мар	Functionality			
	OE	Input	H or Open: specified frequency output L: output is high impedance		
1	ST	Input	H or Open: specified frequency output L: Device goes to sleep mode. Supply current reduces to I_std.		
2	NC	NA	Not 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 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 (HBM)	-	2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	-	260	°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

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### **Termination Diagrams**

#### LVPECL:

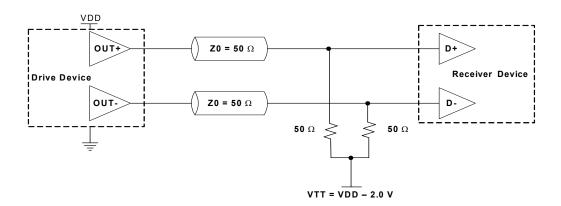


Figure 1. LVPECL Typical Termination

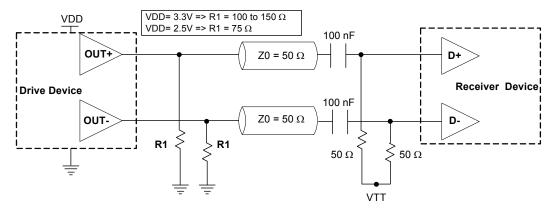


Figure 2. LVPECL AC Coupled Termination

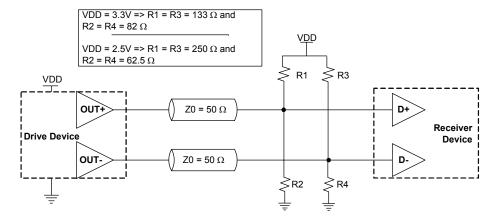


Figure 3. LVPECL with Thevenin Typical Termination

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LVDS:

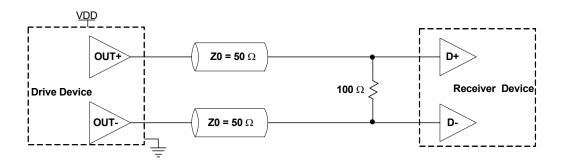


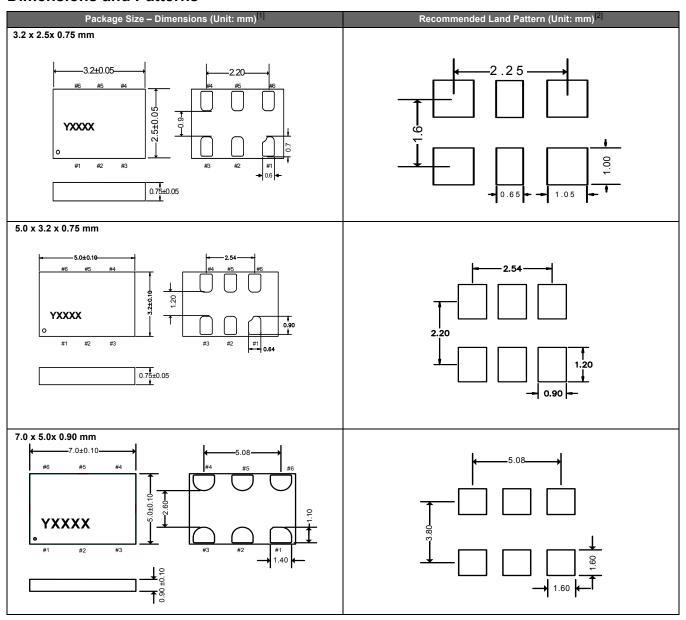
Figure 4. LVDS Single Termination (Load Terminated)

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## 220-625 MHz High Performance Differential Oscilla-



#### **Dimensions and Patterns**

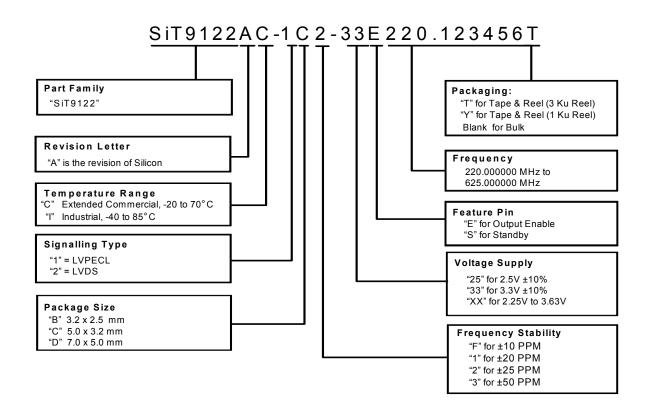


- 1. Top Marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of "Y" will depend on the assembly location of the device.
- 2. A capacitor of value 0.1  $\mu\text{F}$  between Vdd and GND is recommended.

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#### **Ordering Information**



#### **Frequencies Not Supported**

ĺ	Range 1: From 251.000001 MHz to 263.999999 MHz
ĺ	Range 2: From 314.000001 MHz to 422.999999 MHz
ĺ	Range 3: From 502.000001 MHz to 527.999999 MHz

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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**

## 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

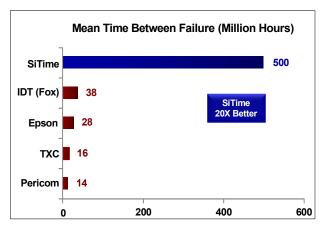


Figure 1. Reliability Comparison<sup>[1]</sup>

#### **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

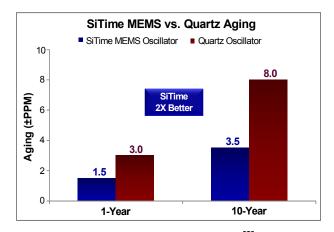


Figure 2. Aging Comparison<sup>[2]</sup>

#### **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

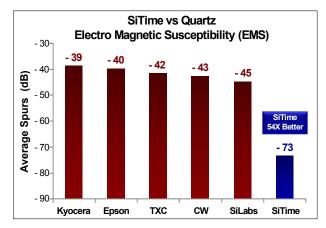


Figure 3. Electro Magnetic Susceptibility (EMS)[3]

#### **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

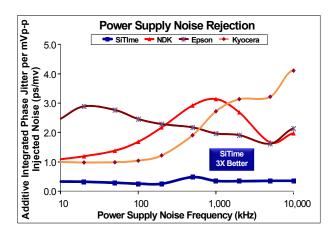


Figure 4. Power Supply Noise Rejection<sup>[4]</sup>

## Silicon MEMS Outperforms Quartz



#### **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

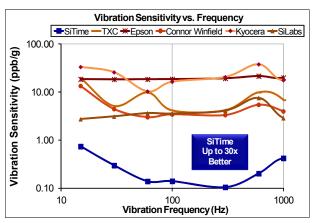


Figure 5. Vibration Robustness<sup>[5]</sup>

#### 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
  - $\bullet$  Continuous frequency measurement in 100  $\mu s$  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.

#### **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 guartz
- Center-anchored MEMS resonator is the most robust design

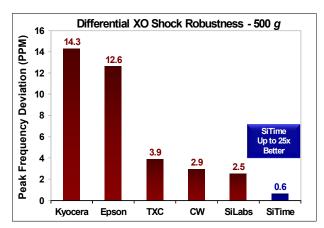


Figure 6. Shock Robustness<sup>[6]</sup>

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