

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 ±5 ppm. Contact SiTime for tighter stability options
- Industrial and extended commercial temperature ranges
- Industry-standard packages: 3.2 x 2.5, 5.0 x 3.2 and 7.0 x 5.0 mm
- For frequencies higher than 220 MHz, refer to SiT5022 datasheet

Applications

- SATA, SAS, 10GB Ethernet, Fibre Channel, PCI-Express
- Networking, broadband, instrumentation



Electrical Character	ISTICS					
Parameter and Conditions	Symbol	Min.	Тур.	Max.	Unit	Condition
	L	VPECL an	d LVDS, C	ommon E	lectrical C	haracteristics
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
Output Frequency Range	f	1	-	220	MHz	
Initial Tolerance	F_init	-2	-	2	ppm	At 25°C after two reflows
Stability Over Temperature	F_stab					Over operating temperature range at rated nominal power
		-5	-	+5	ppm	supply voltage and load.
A A A B						Contact SiTime for tighter stability options.
Supply Voltage	F_vdd	-	50	-	ppb	±10% Vdd
Output Load	F_load	-2.5	0.1	-	ppm	15 pF ±10% of load 25°C
First Year Aging	F_aging1		_	+2.5	ppm	
10-year Aging	F_aging10	-5 -40	_	+5 +85	°C	25°C Industrial
Operating Temperature Range	T_use	-40	-	+05	°C	Extended Commercial
Pull Range	PR			-	-	
Upper Control Voltage	VC_U	± Vdd-0.1	12.0, ±20, ±0		ppm V	All Vdds. Voltage at which maximum deviation is guaranteed.
Control Voltage Range	VC_U VC L	-	_	0.1	V	All vuus. voltage at which maximum deviation is guaranteed.
Control Voltage Input Impedance	Z vc	100		0.1	kΩ	
Frequency Change Polarity			Positive slope		-	
Control Voltage -3dB Bandwidth	V BW	-	-	8	kHz	
Input Voltage High	VIH	70%	_	_	Vdd	Pin 1, OE or ST
Input Voltage Low	VIL	_	_	30%	Vdd	Pin 1, OE or ST
Input Pull-up Impedance	Zin	_	100	250	kΩ	Pin 1, OE logic high or logic low, or ST logic high
input i un-up impedance	۰۰۰ ۲_۰۰	2	-	200	MΩ	Pin 1, ST logic low
Start un Tima	T atart	-	6	10		Measured from the time Vdd reaches its rated minimum value.
Start-up Time	T_start		6	10	ms	
Resume Time	T_resume	-	0	-	ms	In Standby mode, measured from the time ST pin crosses
Duty Cycle	DC	45		55	%	Contact SiTime for tighter duty cycle
		L		and AC C		
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 OE = Low
Output Disable Leakage Current	I_leak	-	_	1 100	μΑ	
Standby Current	I_std	-	_		μA	ST = Low, for all Vdds
Maximum Output Current	I_driver VOH	- Vdd-1.1	-	30 Vdd-0.7	mA V	Maximum average current drawn from OUT+ or OUT- See Figure 1(a)
Output High Voltage Output Low Voltage	VOH	Vdd-1.1 Vdd-1.9	_	Vdd-0.7 Vdd-1.5	V	See Figure 1(a)
Output Differential Voltage Swing	VOL V Swing	1.2	- 1.6	2.0	V	See Figure 1(b)
Rise/Fall Time	v_Swing Tr, Tf	1.2	300	2.0 500	v ps	20% to 80%, see Figure 1(a)
OE Enable/Disable Time	T_oe	_		115	ps ns	$f = 212.5 \text{ MHz} - \text{For other frequencies}, T_oe = 100 \text{ ns} + 3 \text{ period}$
RMS Period Jitter	_	_	1.2	1.7	-	f = 100 MHz, VDD = 3.3V or 2.5V
	T_jitt		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 ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all
	נייץ_י	-	0.0	0.00	ha	Vdds

Electrical Characteristics



Electrical Characteristics (continued)

Parameter and Conditions	Symbol	Min.	Тур.	Max.	Unit	Condition
		I	LVDS, DC	and AC Cl	naracteris	tics
Current Consumption	ldd	-	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
Output Disable Leakage Current	l_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	600	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	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

Pin Description

Pin	Мар		Functionality	
		V Control	Voltage control	
1	VC/OE/ST	Output Enable	H or Open: specified frequency output L: output is high impedance	Top View
		Standby	H or Open: specified frequency output L: Device goes to sleep mode. Supply current reduces to I_std.	VC/OE/ST 1 6 VDD
2	NC	NA	No Connect; Leave it floating or connect to GND for better heat dissipation	NC 2 5 OUT-
3	GND	Power	VDD Power Supply Ground	NC 2 5 OUT-
4	OUT+	Output	Oscillator output	GND 3 4 OUT+
5	5 OUT- Output		Complementary oscillator output	GND 3 4 OUT+
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

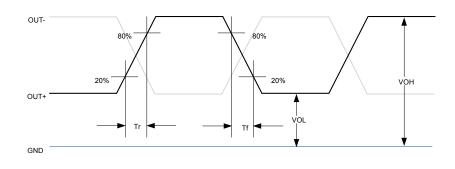


Figure 1(a). LVPECL Voltage Levels per Differential Pin (OUT+/OUT-)

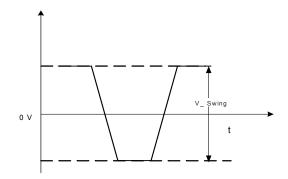


Figure 1(b). LVPECL Voltage Levels Across Differential Pair

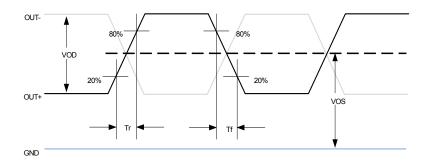


Figure 2. LVDS Voltage Levels per Differential Pin (OUT+/OUT-)



Termination Diagrams

LVPECL:

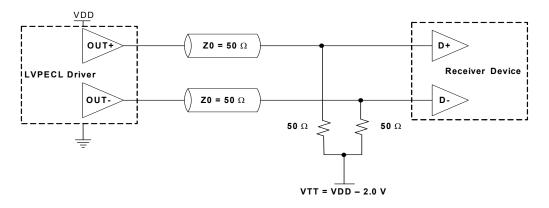


Figure 3. LVPECL Typical Termination

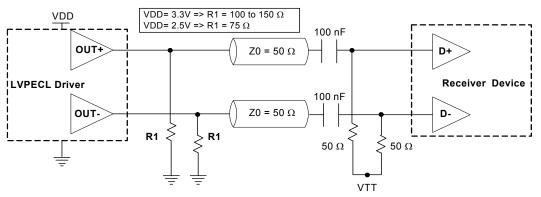


Figure 4. LVPECL AC Coupled Termination

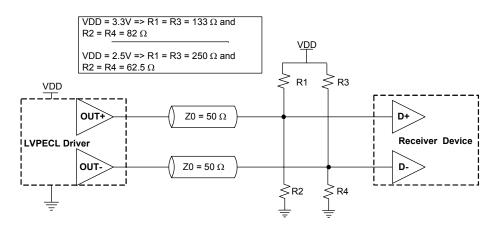


Figure 5. LVPECL with Thevenin Typical Termination



LVDS:

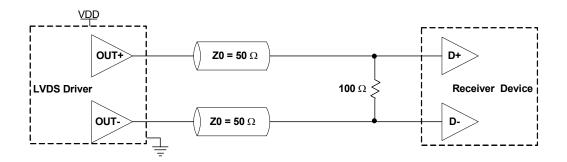
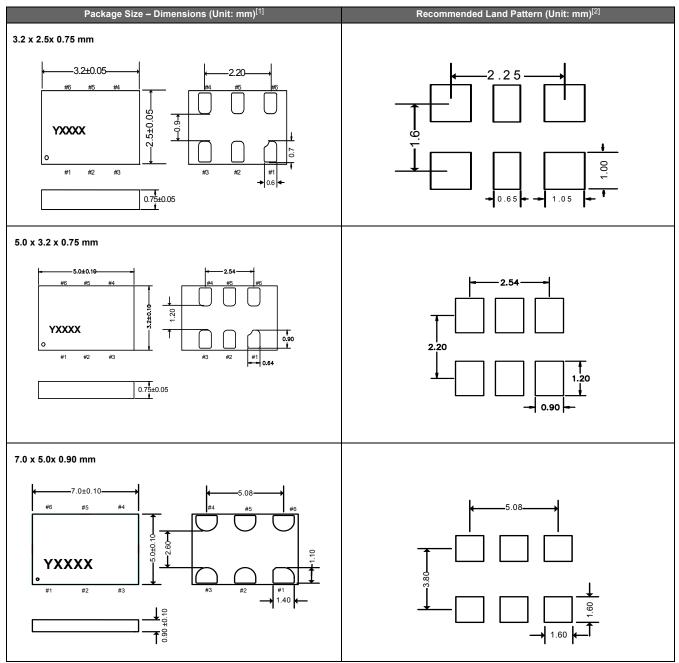


Figure 6. LVDS Single Termination (Load Terminated)



Dimensions and Patterns



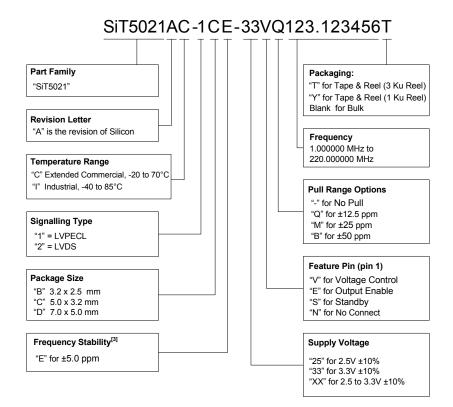
Notes:

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 μF between Vdd and GND is recommended.



Ordering Information



Note:

3. Contact SiTime for tighter stability options.

Ordering Codes for Supported Tape & Reel Packing Method

Device Size	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	-	-	-	Ţ	Y	Х
5.0 x 3.2 mm	Т	Y	Х	-	-	-
3.2 x 2.5 mm	Т	Y	Х	-	-	-

Frequencies Not Supported

Range 1: From 209.000001 MHz to 210.999999 MHz



Revision History

Version	Release Date	Change Summary
1.2	8/20/13	Original
1.3	12/16/13	Added input specifications, LVPECL/LVDS waveforms, packaging T&R options
1.4	12/11/14	Modified Thermal Consideration values and Pin Configuration table (pin 1) and drawing
1.5	11/12/15	 Revised stability over temperature and first year aging values in the electrical characteristics table Revised frequency stability and supply voltage options

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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

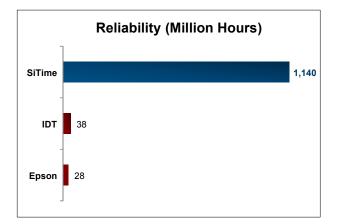


Best Reliability

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 EpiSeal[™] process, which eliminates foreign particles and improves long term aging and reliability
- · World-class MEMS and CMOS design expertise





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

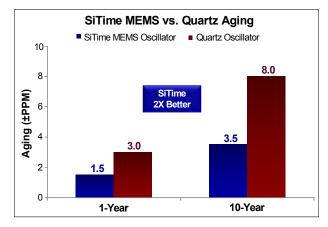


Figure 2. Aging Comparison^[2]

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

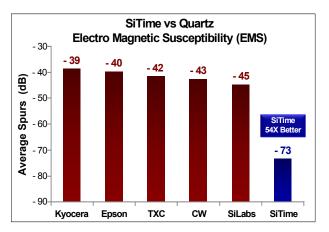


Figure 3. Electro Magnetic Susceptibility (EMS)^[3]

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

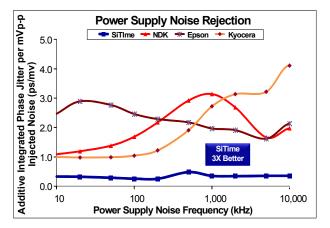


Figure 4. Power Supply Noise Rejection^[4]



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

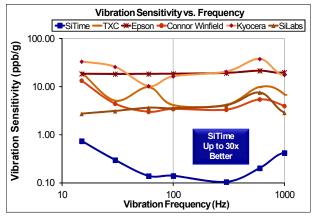


Figure 5. Vibration Robustness^[5]

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: 20//m
 - 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 - guartz 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.

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

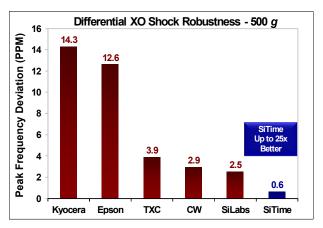


Figure 6. Shock Robustness^[6]

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3. Is there any application specific information that you would like to see in this document? (Check all that apply) EMI Termination recommendations Shock and vibration performance Other If "Other," please specify:
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