SiT8009 Preliminary

High Frequency, Low Power Oscillator



Features

- Any frequency between 115 MHz and 137 MHz accurate to 6 decimal places
- Operating temperature from -40°C to 85°C. Contact SiTime for high temperature options.
- Excellent total frequency stability as low as ±20 PPM
- Low power consumption of 7.0 mA typical
- Output enable or standby mode
- LVCMOS/HCMOS compatible output
- Industry-standard packages: 2.0 x 1.6, 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2,
- Pb-free, RoHS and REACH compliant

Applications

- Ideal for GPON/GPON, network switches, routers. servers, embedded systems
- Ideal for Ethernet, PCI-E, DDR, etc.







Electrical Characteristics[1, 2]

Parameter and Conditions	Symbol	Min.	Тур.	Max.	Unit	Condition	
			F	requency R	ange		
Output Frequency Range	f	115	_	137	MHz		
	•		Freque	ncy Stability	and Aging	1	
Frequency Stability	F_stab	-20	-	+20	PPM	Inclusive of Initial tolerance at 25°C, and variations over	
		-25	_	+25	PPM	operating temperature, rated power supply voltage and load.	
		-50	_	+50	PPM		
Aging	Ag	-1.5	_	1.5	PPM	1st year at 25°C	
			Operati	ng Tempera	ture Range	9	
Operating Temperature Range	T_use	-20	_	+70	°C	Extended Commercial	
		-40	_	+85	°C	Industrial	
		Sı	upply Voltag	ge and Curr	ent Consun	nption	
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	ldd	ı	7.5	9.0	mA	No load condition, f = 125 MHz, Vdd = 2.5V, 2.8V, 3.0V or 3.3V	
		ı	5.5	7.0	mA	No load condition, f = 125 MHz, Vdd = 1.8V	
Standby Current	I_std	ı	2.5	5	μΑ	ST = GND, Vdd = 3.0V or 3.3V, Output is Weakly Pulled Down	
		ı	2.5	5	μΑ	ST = GND, Vdd = 2.5V or 2.8V, Output is Weakly Pulled Down	
		ı	1	1.2	μΑ	ST = GND, Vdd = 1.8V, Output is Weakly Pulled Down	
			LVCMOS	Output Ch	aracteristic	es	
Duty Cycle	DC	45	-	55	%	All Vdds	
Rise/Fall Time	Tr, Tf	-	1.2	2	ns	Vdd = 2.5V, 2.8V, 3.0V or 3.3V, 20% - 80%	
		-	1.5	3	ns	Vdd =1.8V, 20% - 80%	
		ı	1.5	3	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)	
			Inp	ut Characte	eristics	•	
Input High Voltage	VIH	70%	_	_	Vdd	Pin 1, OE or ST	
Input Low Voltage	VIL	_	_	30%	Vdd	Pin 1, OE or ST	
Input Pull-up Impedence	Z_in	_	100	250	kΩ	Pin 1, OE logic high or logic low, or ST logic high	
		2	_	_	ΜΩ	Pin 1, ST logic low	

Rev. 0.92 Revised January 13, 2012

^{1.} All electrical specifications in the above table are specified with 15 pF output load and for all Vdd(s) unless otherwise stated.

^{2.} Contact SiTime for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

High Frequency, Low Power Oscillator



The Smart Timing Choice

Electrical Characteristics^[1, 2] (continued)

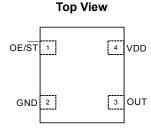
Parameter and Conditions	Symbol	Min.	Тур.	Max.	Unit	Condition			
Startup and Resume Timing									
Startup Time T_start - 5 ms Measured from the time Vdd reaches its rated minimum value									
Enable/Disable Time	T_oe	-	-	150	ns				
Resume Time	T_resume	-	-	5	ms	Measured from the time ST pin crosses 50% threshold			
				Jitter					
RMS Period Jitter	T_jitt	-	2	3	ps	f = 20 MHz, Vdd = 2.5V, 2.8V, 3.0V or 3.3V			
		-	2	4	ps	f = 20 MHz, Vdd = 1.8V			
RMS Phase Jitter (random)	T_phj	-	0.5	0.9	ps	Integration bandwidth = 900 kHz to 7.5 MHz			
		_	1.5	2	ps	Integration bandwidth = 12 kHz to 20 MHz			

Notes:

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

Pin Description

Pin	Symbol	Functionality		
	OE/ ST	Output Enable	H or Open ^[3] : specified frequency output L: output is high impedance. Only output driver is disabled.	
1		Standby	H or Open ^[3] : specified frequency output L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to I_std.	
2	GND	Power	Electrical ground ^[4]	
3	OUT	Output	Oscillator output	
4	VDD	Power	Power supply voltage ^[4]	



Notes:

- 3. A pull-up resistor of <10 k Ω between OE/ \overline{ST} pin and Vdd is recommended in high noise environment.
- 4. A capacitor value of 0.1 μF between Vdd and GND is recommended.

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

Thermal Consideration

Package	θJA, 4 Layer Board (°C/W)	θJA, 2 Layer Board (°C/W)	θJC, Bottom (°C/W)
7050	191	263	30
5032	97	199	24
3225	109	212	27
2520	117	222	26
2016	124	227	26

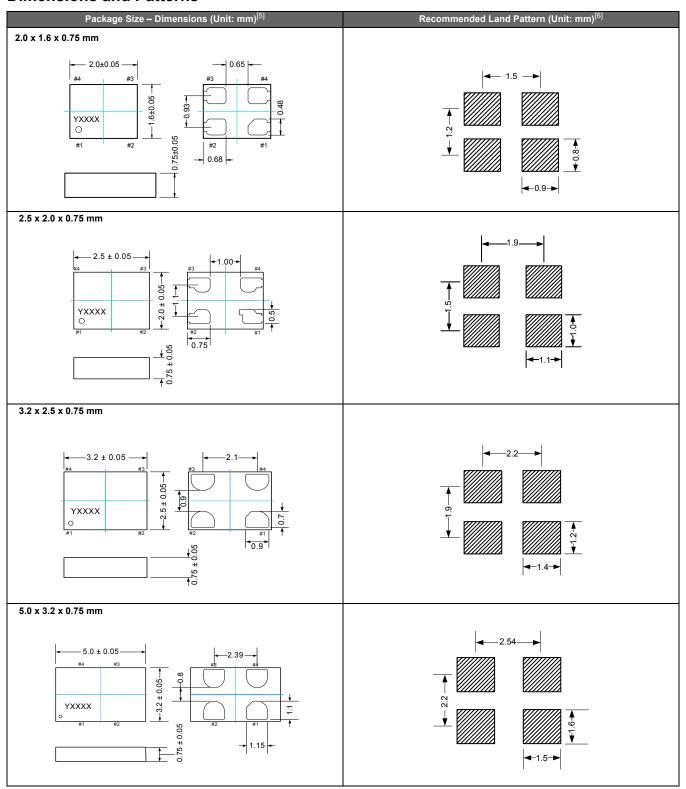
Environmental Compliance

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

High Frequency, Low Power Oscillator



Dimensions and Patterns

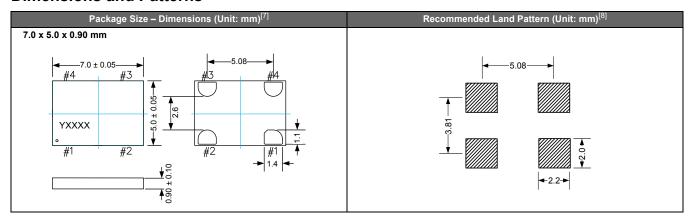


- 5. Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of "Y" will depend on the assembly location of the device.
 6. A capacitor of value 0.1 µF between Vdd and GND is recommended.

High Frequency, Low Power Oscillator



Dimensions and Patterns



Notes:

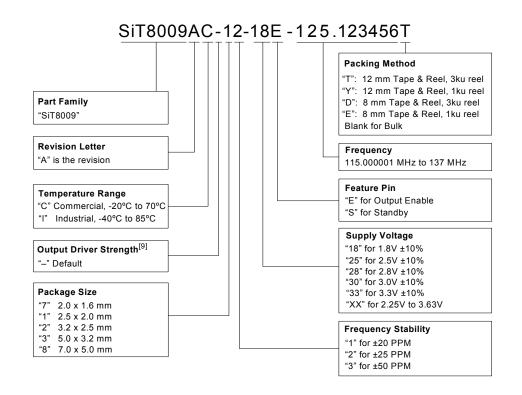
- 7. Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of "Y" will depend on the assembly location of the device.

 8. A capacitor of value 0.1 µF between Vdd and GND is recommended.

High Frequency, Low Power Oscillator



Ordering Information



Note:

9. Contact SiTime for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

Ordering Codes for Supported Tape & Reel Packing Methods[10]

Device Size	12 mm T&R (3ku)	12 mm T&R (1ku)	8 mm T&R (3ku)	8 mm T&R (1ku)
2.0 x 1.6 mm	-	-	D	E
2.5 x 2.0 mm	-	-	D	E
3.2 x 2.5 mm	-	_	D	E
5.0 x 3.2 mm	Т	Y	_	_
7.0 x 5.0 mm	Т	Y	-	-

Note:

10. For "-", contact SiTime for availability.

© SiTime Corporation 2013. The information contained herein is subject to change at any time without notice. SiTime assumes no responsibility or liability for any loss, damage or defect of a Product which is caused in whole or in part by (i) use of any circuitry other than circuitry embodied in a SiTime product, (ii) misuse or abuse including static discharge, neglect or accident, (iii) unauthorized modification or repairs which have been soldered or altered during assembly and are not capable of being tested by SiTime under its normal test conditions, or (iv) improper installation, storage, handling, warehousing or transportation, or (v) being subjected to unusual physical, thermal, or electrical stress.

Disclaimer: SiTime makes no warranty of any kind, express or implied, with regard to this material, and specifically disclaims any and all express or implied warranties, either in fact or by operation of law, statutory or otherwise, including the implied warranties of merchantability and fitness for use or a particular purpose, and any implied warranty arising from course of dealing or usage of trade, as well as any common-law duties relating to accuracy or lack of negligence, with respect to this material, any SiTime product and any product documentation. Products sold by SiTime are not suitable or intended to be used in a life support application or component, to operate nuclear facilities, or in other mission critical applications where human life may be involved or at stake. All sales are made conditioned upon compliance with the critical uses policy set forth below.

CRITICAL USE EXCLUSION POLICY

BUYER AGREES NOT TO USE SITIME'S PRODUCTS FOR ANY APPLICATION OR IN ANY COMPONENTS USED IN LIFE SUPPORT DEVICES OR TO OPERATE NUCLEAR FACILITIES OR FOR USE IN OTHER MISSION-CRITICAL APPLICATIONS OR COMPONENTS WHERE HUMAN LIFE OR PROPERTY MAY BE AT STAKE.

SiTime owns all rights, title and interest to the intellectual property related to SiTime's products, including any software, firmware, copyright, patent, or trademark. The sale of SiTime products does not convey or imply any license under patent or other rights. SiTime retains the copyright and trademark rights in all documents, catalogs and plans supplied pursuant to or ancillary to the sale of products or services by SiTime. Unless otherwise agreed to in writing by SiTime, any reproduction, modification, translation, compilation, or representation of this material shall be strictly prohibited.



Supplemental Information

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

SiTime Corporation 990 Almanor Avenue Sunnyvale, CA 94085 (408) 328-4400 www.sitime.com



Supplemental Information

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

SiTime Corporation 990 Almanor Avenue Sunnyvale, CA 94085 (408) 328-4400 www.sitime.com



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

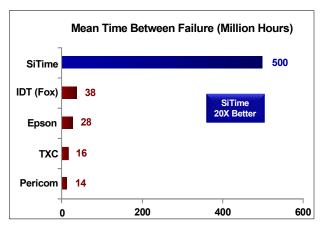


Figure 1. Reliability Comparison^[1]

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

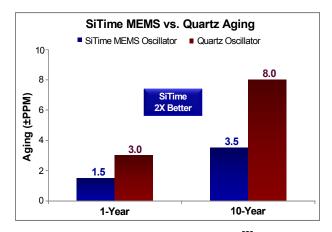


Figure 2. Aging Comparison^[2]

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

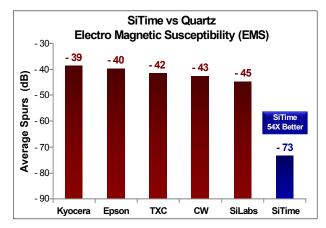


Figure 3. Electro Magnetic Susceptibility (EMS)[3]

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

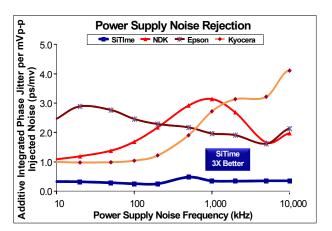


Figure 4. Power Supply Noise Rejection^[4]

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

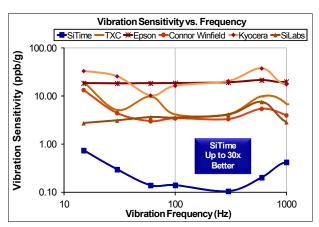


Figure 5. Vibration Robustness^[5]

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: 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 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 guartz
- Center-anchored MEMS resonator is the most robust design

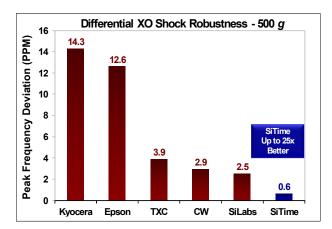


Figure 6. Shock Robustness^[6]

Document Feedback Form



SiTime values your input in improving our documentation. Click <u>here</u> for our online feedback form or fill out and email the form below to <u>productsupport@sitime.com</u>.

1. Does the Electrical (Characteristics table provide complete inf	Yes	No		
If No, what parameters	s are missing?				
2. Is the organization of	of this document easy to follow?		Yes	No	
If "No," please suggest	t improvements that we can make:				
3. Is there any applicat	tion specific information that you would lik	ke to see in this o	document? (Ch	eck all that appl	y)
EMI	Termination recommendations	Shock an	d vibration perf	ormance	Other
If "Other," please spec	ify:				
4. Are there any errors	in this document?	Yes	No		
If "Yes", please specify	(what and where):				
5. Do you have additio	nal recommendations for this document?	,			
Name					
T:41-					
Company					
Address					
City / State or Province	e / Postal Code / Country				
Telephone					
Application					
Would you like a reply	? Yes No				

Thank you for your feedback. Please click the email icon in your Adobe Reader tool bar and send to productsupport@sitime.com. Or you may use our online-feedback form.

Feedback Form Rev. 1.0 www.sitime.com