



SiTime
Turbo
Webinars

SiTime University Turbo Seminar Series

Optimize System Design with
Low Power MEMS Oscillators



March 11-12, 2013

The Smart Timing Choice™

Turbo Webinars On the SiTime Web Site



The screenshot shows the SiTime website's support page. At the top, there is a navigation bar with links for 'register', 'login', 'part number generator', 'cross reference', 'blog', and a search box. Below this is a main navigation menu with 'Products', 'Applications', 'Support', 'Sales', 'News', and 'Company'. The 'Support' menu is expanded, showing a list of options: Overview, Product Selector, Request Samples, Application Notes, Tools and Models, Performance Reports, Quality and Reliability, Video Library, Channel Resources, FAQs, SiTime University, and Contact Us. The main content area features the 'SiTime University' header and a 'Turbo Webinars' section. This section describes 15-minute webinars and includes a link to the 'SiTime Turbo Webinar Series >>'. Below this is a 'Conference Presentations' section, featuring an 'ISSCC 2012 Tutorial' titled 'Getting In Touch with MEMS: The Electromechanical Interface'. A download link for a 1.55 Mb file is provided. The footer of the page shows the URL 'www.sitime.com/support/sitime-university'.

Agenda



- Introduction of the New Low Power MEMS Oscillator Family
- New Features and Enhancements that Enable Better System Designs and Supply Chain Management
- Advantages Over Quartz
- Product Selection Guide

Three Low Power MEMS Oscillators Enhance Industry's Broadest MEMS Timing Portfolio



Pin-Compatible	Pin-Compatible	Pin-Compatible	Pin-Compatible		Pin-Compatible	Pin-Compatible	
Low Jitter XO 0.3 to 0.5 ps Jitter 10 to 50 PPM	Low Power XO 10 to 50 PPM	High Temp XO up to +125°C 25 to 50 PPM	VCXO 0.5 ps Jitter	DCXO 0.5 ps Jitter	(VC) TCXO 0.5 ps Jitter	Spread Spectrum XO 50 to 100 PPM	Clock Generator 25 to 50 PPM
SiT8208/9 1-220 MHz	SiT1602 3.75-75 MHz Std Freq	SiT1618 7.3728-48 MHz Std Freq -40 to +125°C	SiT3807 1.5-45 MHz Std Freq	SiT3907 1-220 MHz	SiT5000 10-45 MHz 2-5 PPM	SiT9001 1-200 MHz	SiT9104 1-220 MHz
SiT9120^{Diff} 25-212.5 MHz	SiT8008 1-110 MHz 3.5-5 mA	SiT8918 1-110 MHz -40 to +125°C	SiT3808/9 1-220 MHz	SiT3921/2^{Diff} 1-625 MHz	SiT5001/2 1-220 MHz 1-5 PPM	SiT9003 Low Power 1-110 MHz	SiT9105 SE & Diff 1-800 MHz
SiT9121/2^{Diff} 1-625 MHz	SiT8009 115-137 MHz 5-7 mA	SiT8920 1-110 MHz -55 to +125°C	SiT3821/2^{Diff} 1-625 MHz		SiT5003/4 1-220 MHz 0.5 PPM	SiT9002^{Diff} 1-220 MHz	SiT9103^{Diff} 1-800 MHz
SiT9156^{Diff} 156.25 MHz 10/40 GbE	SiT8003XT 0.25mm thin 1-110 MHz				SiT5021/2^{Diff} 1-625 MHz 1-5 PPM		
	SiT8503 200-1000 kHz				SiT5023/4^{Diff} 1-625 MHz 0.5 PPM		

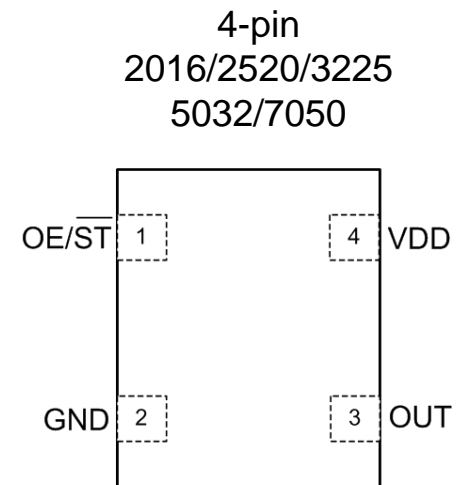
- LVCMOS Output
- Differential Output

New Generation of Low Power Oscillators With Enhanced Features and Performance

Low Power Oscillator Family Highlights



- **Wide frequency coverage with 6 decimal places of accuracy**
- **Excellent total frequency stability as low as ± 20 PPM**
- **Choice of industrial (-40 to 85°C) or commercial (-20 to 70°C)**
- **Flexible supply voltages, 1.8 V and 2.5 to 3.3 V**
- **Best power consumption at high frequency**
- **Rise/fall time control for best EMI**
- **Industrial standard footprint in 5 package sizes**



A Broad Range of Applications



SiT1602
50 Std Freq
3.57 to 77.76 MHz



SiT8008
Programmable
1 to 110 MHz



SiT8009
Programmable
115 to 137 MHz

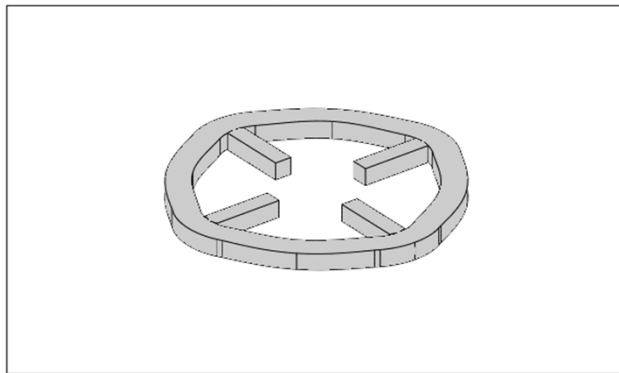


Better MEMS Timing Technology
More Features, Enhanced Performance
More Benefits to System ODM/OEM

Higher Performance MEMS Resonator Enhances Oscillator Performance

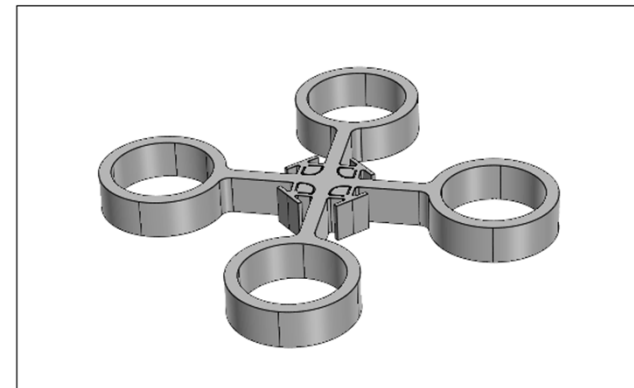


5 MHz Resonator
For SiT8003/8103



- First generation MEMS
- In production since 2007

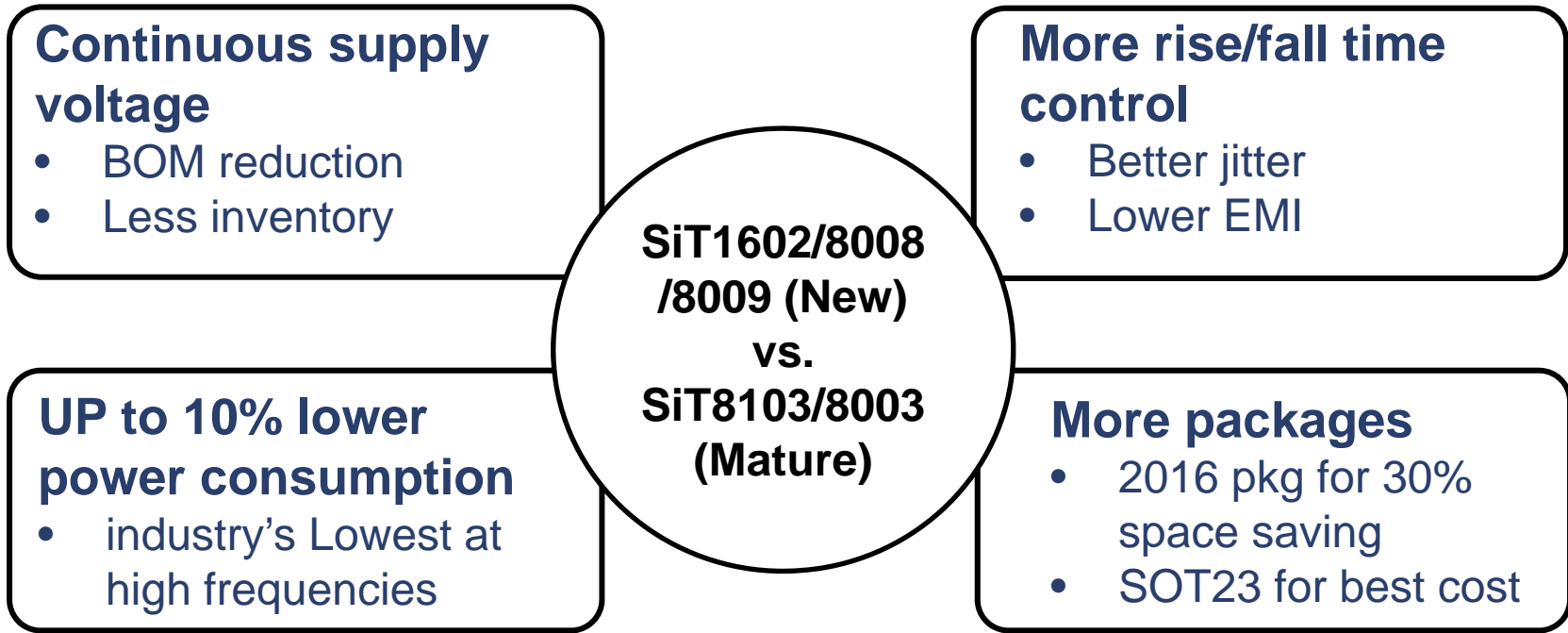
48 MHz Resonator
For SiT1602/8008/8009



- Second generation
- In production since 2011
- Enable better phase noise & jitter

- **CMOS enhancement enables more features and high performance**
 - Improved temperature compensation
 - Improved output driver
 - Improved regulator design

Feature Enhancements and Benefits



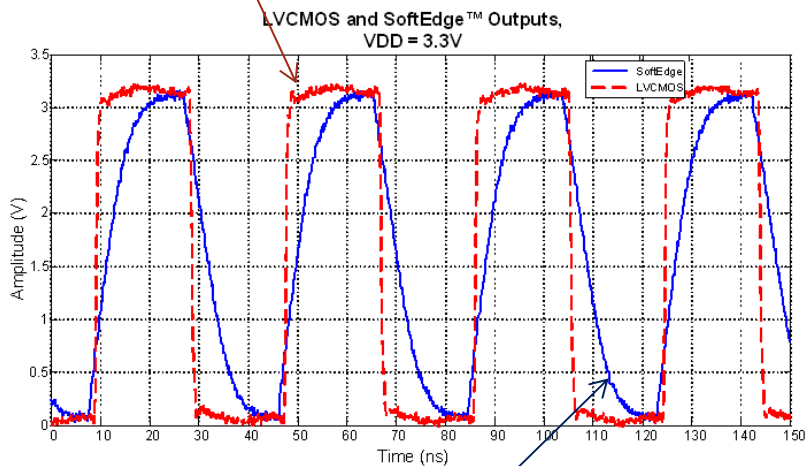
- **Other enhancements**
 - **Faster startup time**
 - **Better jitter for video**
 - **less aging**

- **More product details at <http://www.sitime.com/products/low-power-oscillators>**

SoftEdge™ Rise/Fall Time Control to Reduce EMI

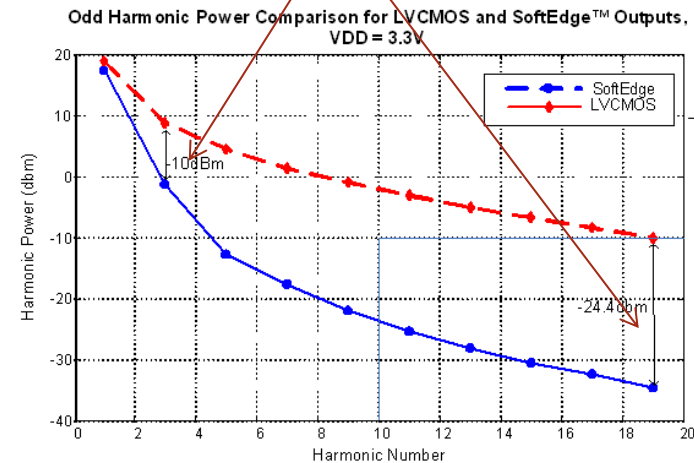


Standard Rise/fall time



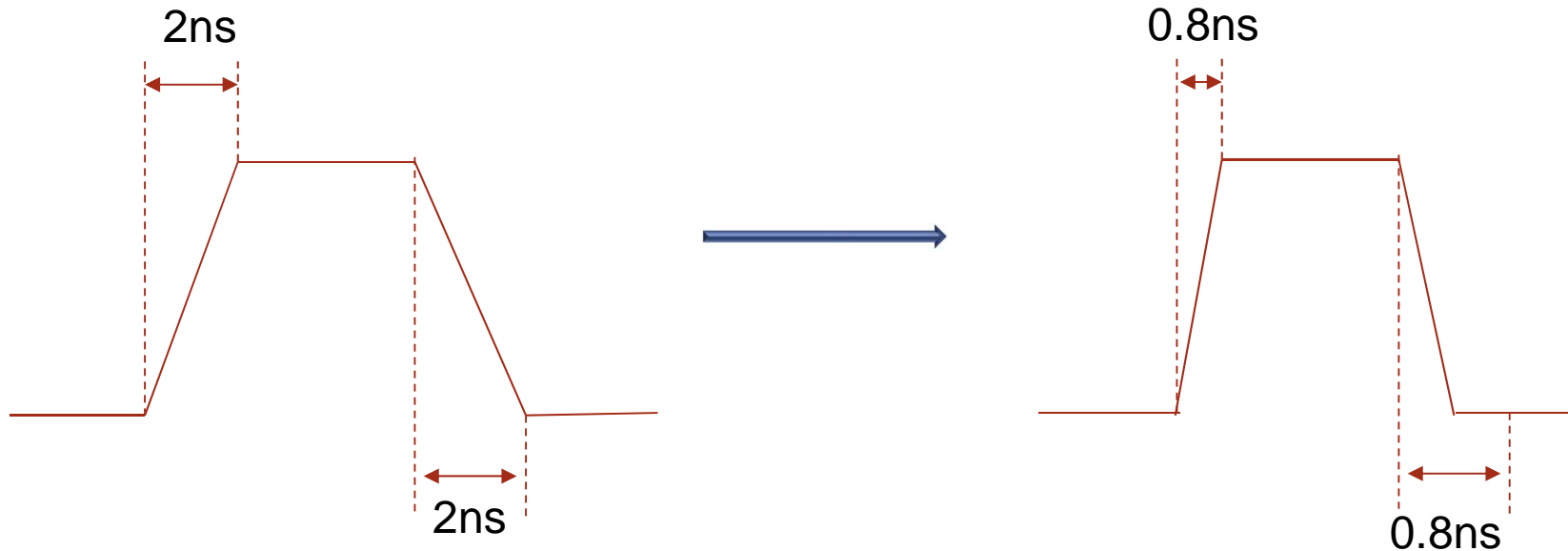
SoftEdge Rise/fall time

Up to 24 dBm EMI Reduction w SoftEdge™



- Multiple rise/fall time options are available on any given device
- Appnote: <http://www.sitime.com/support2/documents/AN10022-rise-and-fall-time-rev1.1.pdf>

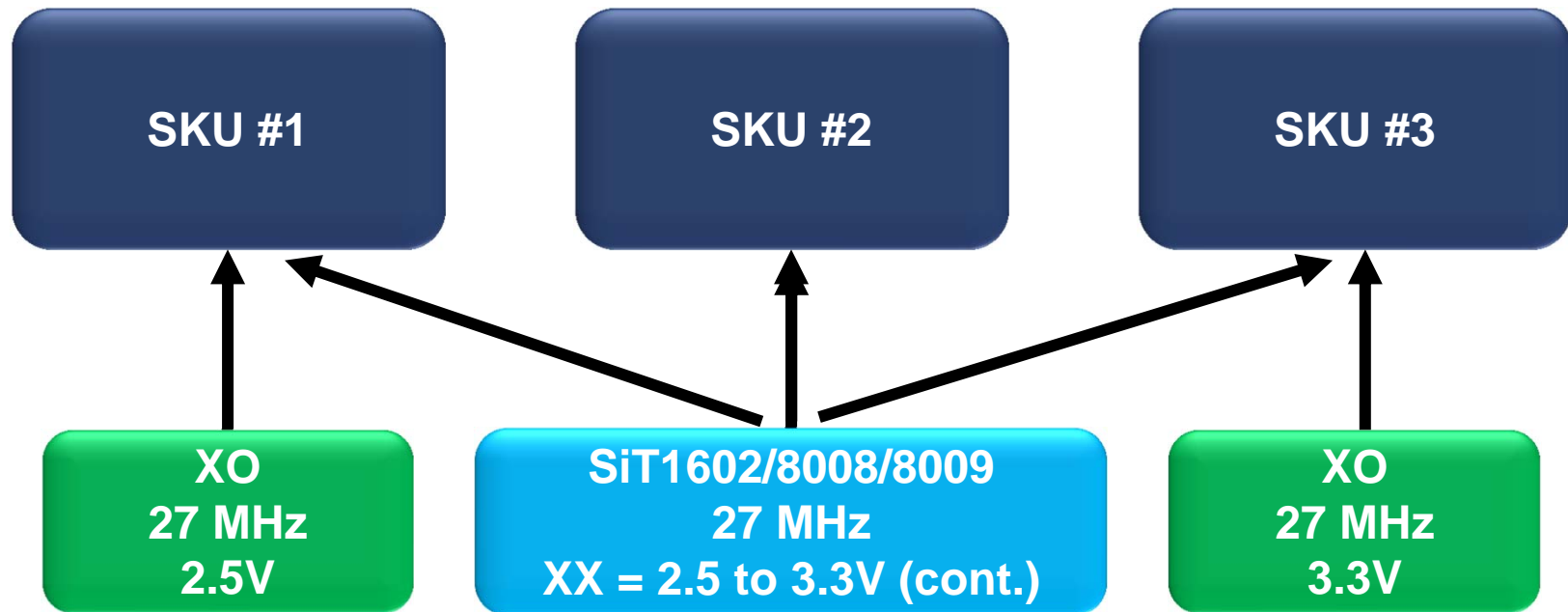
Faster Edge Rates Reduce System Jitter



- Typical rise/fall time
- Good EMI
- Larger jitter due to sensitivity to voltage

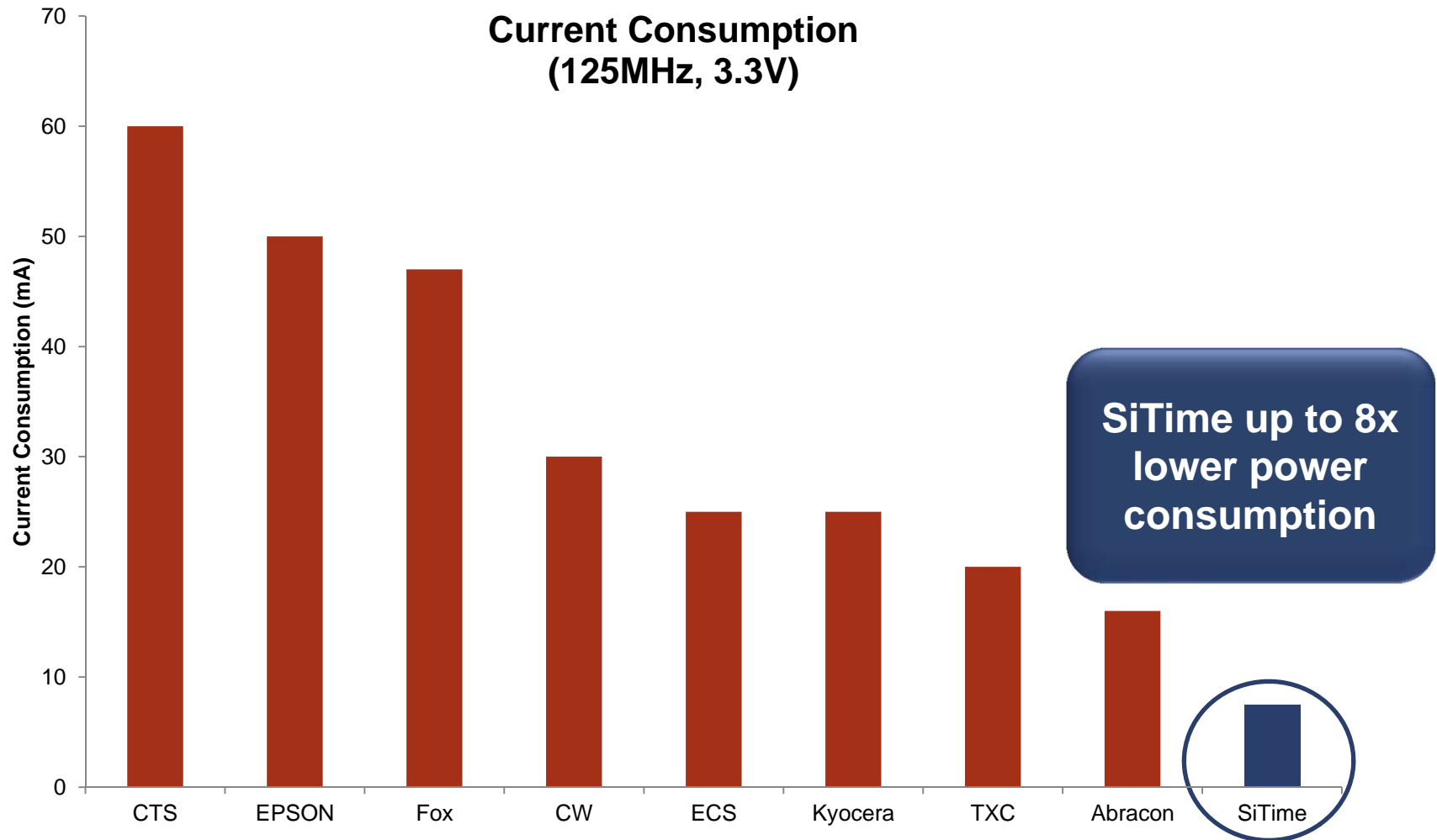
- Faster rise/fall time
- **Reduced jitter, less sensitive to voltage**
- Potential EMI Increase can be reduced with good design practice

Continuous Supply Voltage Simplifies Inventory Management



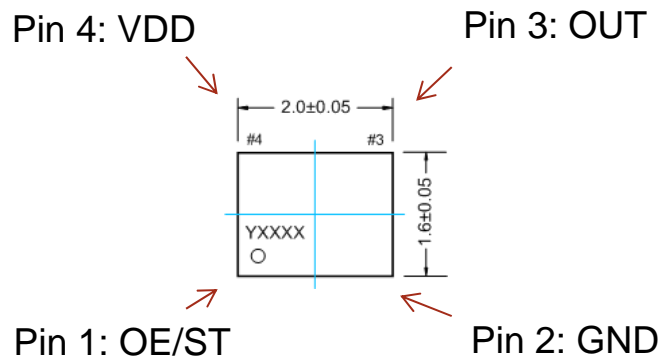
- Example: SiT1602AI-12-**xx**S-27.000000 where xx = 2.5 to 3.3V
- Result: Single SiTime device replaces 3 quartz oscillators
- Benefits: Fewer parts to manage, more flexibility in meeting demand

Lowest Power Consumption at High Frequency for Greener Electronics

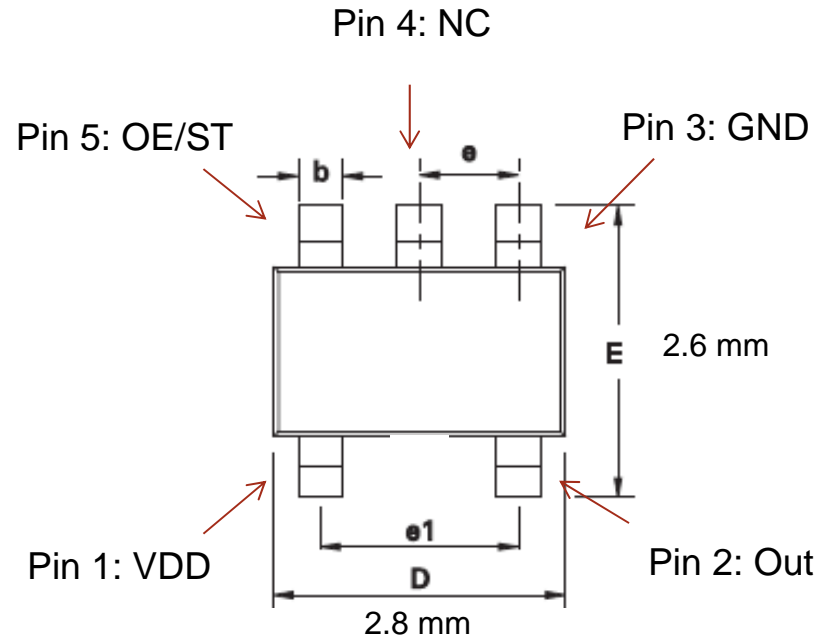


Source: DigiKey product search

More Package Options Increase Design Flexibility



- 36% smaller than 2520 package
- Compatible with quartz
- Available for any combination of freq, voltage and stability



- Industry's first Leaded package for oscillators
- Most cost effective
- Resistant to PCB flex
- Ideal for high temp apps

MEMS Advantages over Quartz Flexibility, Reliability, Quality

Silicon MEMS Delivers More Features and Better Reliability than Quartz



	SiTime MEMS XO	Quartz XO
Core technology	All-Silicon MEMS	Crystals
Product coverage	Any combination of voltage, frequency, package	Limited options for 1.8V, small package, stability
Frequency stability over-temp	±20 PPM	±25 PPM
Lower power consumption at High Frequency	6.4 mA @ 125 MHz	>10 mA @ 125 MHz
Rise/fall time control	1 – 6 ns	Not Available
Long term reliability (MTBF)	500 Million Hours	<50 Million Hours

Programmability Enables Optimal Clocks and Fastest Time-to-Market



Configure and request samples from SiTime

Summary Features & Benefits Part No. Generator Ordering Information Models Quality Docs

SiT8008 Part Number Generator

Frequency (MHz)

Frequency Stability (PPM) ±20 ±25 ±50

Temperature Range (°C) -20 to 70 -40 to 85

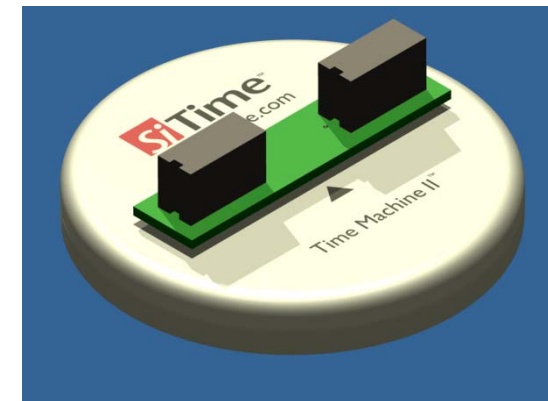
Supply Voltage (V) 3.3 3.0 2.8 2.5 1.8
 2.25V-3.63V(any voltage)

Package Size (mm) 2.0×1.6 2.5×2.0 3.2×2.5 5.0×3.2 7.0×5.0

Control Pin ST OE

Packaging Bulk 250U Reel 3KU 1KU

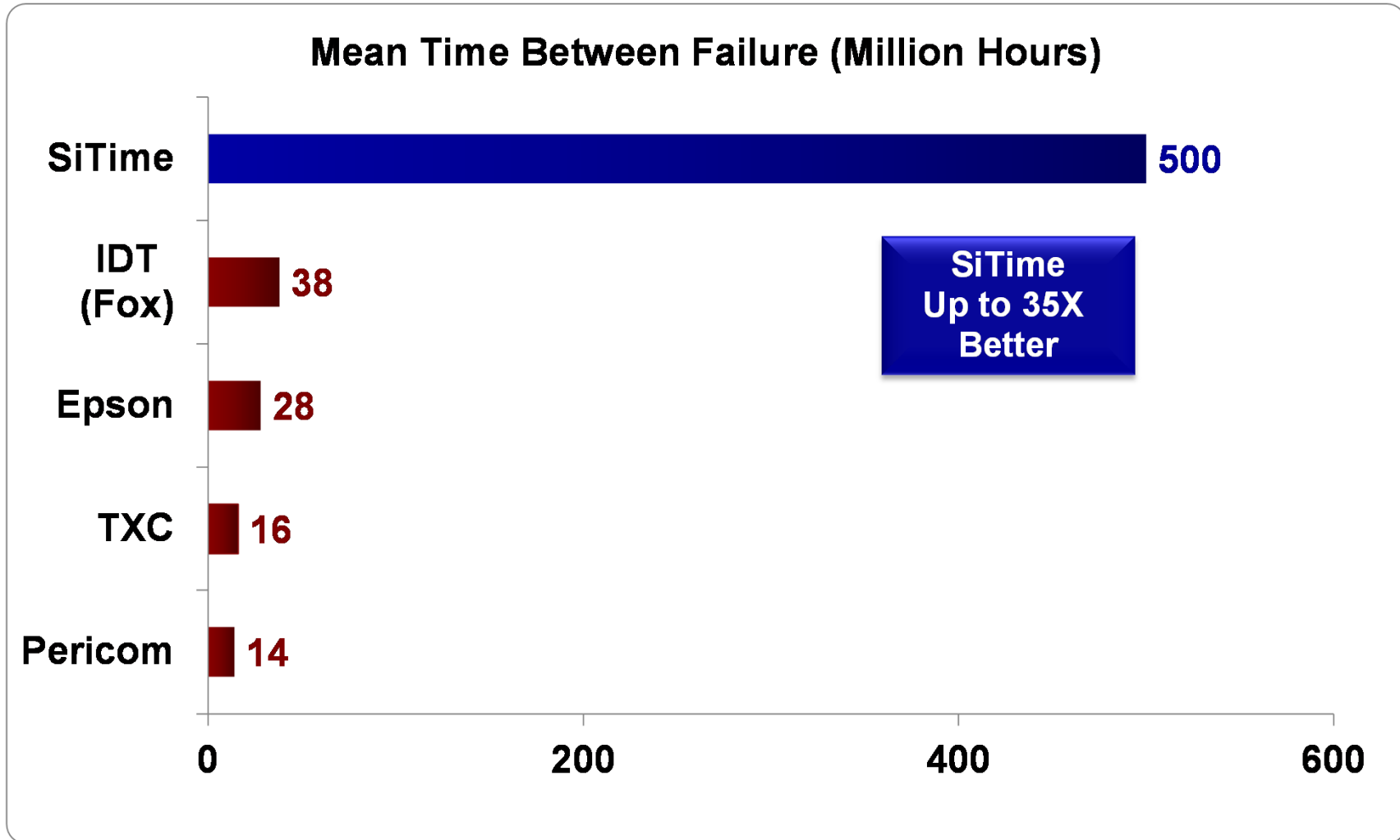
SiTime Part number is:



Or Program samples with Time Machine II

Express samples at <http://www.sitime.com/support/request-samples>

“Reliability is the New Power”



For more info, check out “Resilience and Reliability of Silicon MEMS” and “Reliability Calculations of SiTime Oscillators” at <http://www.sitime.com/support/application-notes>

Different MEMS Oscillator Family for Different Applications

Product Selection Guideline – Low Power MEMS Oscillators



- SiT1602/8008/8009 are Recommended for all new designs
- SiT8103/8003/8004 are NOT recommended for new designs
- SiT8103/8003/8004 will continue to be available in production volumes

Recommended Devices	Mature Devices
SiT1602 SiT8008	SiT8103 SiT8003
SiT8009	SiT8004

- More details at <http://www.sitime.com/products/low-power-oscillators>

Product Selection Guide – Low Power vs. Low Jitter



Pin-Compatible	Pin-Compatible	Pin-Compatible	Pin-Compatible		Pin-Compatible	Pin-Compatible	
Low Jitter XO 0.3 to 0.5 ps Jitter 10 to 50 PPM	Low Power XO 10 to 50 PPM	High Temp XO up to +125°C 25 to 50 PPM	VCXO 0.5 ps Jitter	DCXO 0.5 ps Jitter	(VC) TCXO 0.5 ps Jitter	Spread Spectrum XO 50 to 100 PPM	Clock Generator 25 to 50 PPM
SiT8208/9 1-220 MHz	SiT1602 3.75-75 MHz Std Freq	SiT1618 7.3728-48 MHz Std Freq -40 to +125°C	SiT3807 1.5-45 MHz Std Freq	SiT3907 1-220 MHz	SiT5000 10-45 MHz 2-5 PPM	SiT9001 1-200 MHz	SiT9104 1-220 MHz
SiT9120^{Diff} 25-212.5 MHz	SiT8008 1-110 MHz 3.5-5 mA	SiT8918 1-110 MHz -40 to +125°C	SiT3808/9 1-220 MHz	SiT3921/2^{Diff} 1-625 MHz	SiT5001/2 1-220 MHz 1-5 PPM	SiT9003 Low Power 1-110 MHz	SiT9105 SE & Diff 1-800 MHz
SiT9121/2^{Diff} 1-625 MHz	SiT8009 115-137 MHz 5-7 mA	SiT8920 1-110 MHz -55 to +125°C	SiT3821/2^{Diff} 1-625 MHz		SiT5003/4 1-220 MHz 0.5 PPM	SiT9002^{Diff} 1-220 MHz	SiT9103^{Diff} 1-800 MHz
SiT9156^{Diff} 156.25 MHz 10/40 GbE	SiT8003XT 0.25mm thin 1-110 MHz				SiT5021/2^{Diff} 1-625 MHz 1-5 PPM		
	SiT8503 200-1000 kHz				SiT5023/4^{Diff} 1-625 MHz 0.5 PPM		

LVCMOS Output

Differential Output

Different performance spec and frequency ranges for different applications

Product Selection Guide – Low Power vs. Low Jitter Continued..



- Key differences

	Low Jitter SiT8208/8209	Low Power SiT1602/8008/8009
Frequency	1-220 MHz	1 – 137 MHz
Jitter	0.5 ps	~1.3 ps
Target applications	Jitter sensitive Networking & Telecom	Portable device Low end networking Computing Consumer

- How to select--
 - Go with SiT1602/8008/8009 as the default for most applications
 - Go with SiT8208/8209 for high end applications in networking and telecom where jitter is important
- For more information, [visit http://www.sitime.com/support/product-selector](http://www.sitime.com/support/product-selector)

Summary



Lowest Power, Drop-in Replacement

Up to 8x lower than quartz, standard footprints

More Features, Most Flexibility

Rise/fall time control, Continuous voltage, 6 package options

Industry-Best Reliability

FIT Rate: 2, 500M Hours MTBF

Availability: Any Frequency, Supply Voltage, Package

Samples shipped within 48-hours, shortest production leadtime

Contact Information



- **For Questions, contact SiTime Technical Support**
Technicalsupport@sitime.com
- **For *Turbo Webinar* pdf Downloads on SiTime's Web Site**
www.sitime.com/support/sitime-u/turbo-webinars
 - All new webinars will be posted within 24-hours
- **For Low Power Oscillator datasheets and other info, visit**
<http://www.sitime.com/products/low-power-oscillators>

SiT1602 Standard Frequency, Low Power MEMS XO

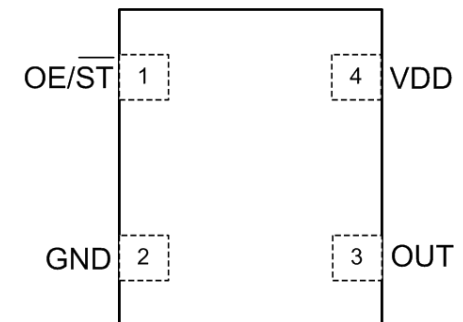


Frequency Range	Frequency Stability	Supply Voltage	Packages	Temp. Range	Active Current (typical)	Startup Time	Output Load	Signaling Type
3.75 to 77.6 MHz	± 20 PPM	1.8 V	2016	-40 to +85 C	3.4 mA (no load)	5 ms	15pF	LVCMOS
	± 25 PPM	2.5 to 3.3V	2520	-20 to +70 C				
	± 50 PPM		3225					
			5032					
			7050					

- 50 standard frequencies
- 100% drop-in replacement of quartz
- Package as small as 2016
- Excellent jitter for digital non-RF applications
- Excellent long term jitter (30ps over 10 μs interval) for video
- Faster startup time with gated output



4-pin
2016/2520/3225
5032/7050



SiT8008 Programmable, Low Power MEMS XO

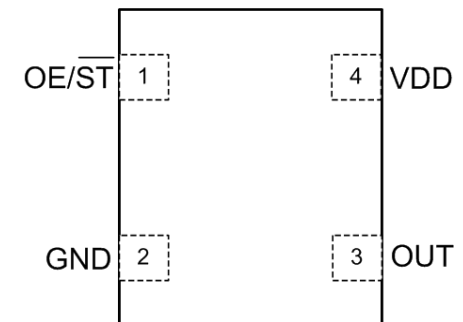


Frequency Range	Frequency Stability	Supply Voltage	Packages	Temp. Range	Active Current (typical)	Startup Time	Output Load	Signaling Type
1 to 110 MHz	± 20 PPM ± 25 PPM ± 50 PPM	1.8 V 2.5 to 3.3V	2016 2520 3225 5032 7050	-40 to +85 C -20 to +70 C	3.4 mA (no load)	5 ms	15pF	LVC MOS

- Any frequency between 1 to 110 MHz with 6 decimal places of accuracy
- 100% drop-in replacement of quartz
- Package as small as 2016
- Excellent jitter for digital non-RF applications
- Excellent long term jitter (30ps over 10 μs interval) for video
- Faster startup time with gated output



4-pin
2016/2520/3225
5032/7050



SiT8009 High Frequency, Low Power MEMS XO



Frequency Range	Frequency Stability	Supply Voltage	Packages	Temp. Range	Active Current (typical)	Startup Time	Output Load	Signaling Type
115 to 137 MHz	± 20 PPM ± 25 PPM ± 50 PPM	1.8 V 2.5 to 3.3V	2016 2520 3225 5032 7050	-40 to +85 C -20 to +70 C	3.4 mA (no load)	5 ms	15pF	LVC MOS

- Any frequency between 115 to 137 MHz with 6 decimal places of accuracy
- Lowest power consumption for high frequency oscillators
- 100% drop-in replacement of quartz
- Package as small as 2016
- Excellent jitter for Ethernet, PCIe and other digital non-RF applications



4-pin
2016/2520/3225
5032/7050

