

DIFFERENTIAL OUTPUT PROGRAMMABLE OSCILLATORS AND CLOCK GENERATORS

SiTime offers a range of differential output programmable oscillators and clock generators that operate at frequencies from 1 to 800 MHz and can support LVPECL, LVDS, CML and HCSL signaling. These products incorporate SiTime's high-performance programmable PLL technology to offer very low jitter (<1ps), making them ideal for high performance communications, networking, computing and consumer applications such as 10 Gigabit Ethernet, Gigabit Ethernet, PCI Express, Fibre Channel, USB3.0, DDR memories, Quick Path Interconnect, etc.

The SiT9102 and SiT9002 are available in industry standard footprints of 7.0 x 5.0 mm and 5.0 x 3.2 mm, with heights lower than 0.9 mm, enabling customers to easily replace existing products in their systems. For space-constrained applications, a 3.2 x 2.5 mm package can also be made available on customer request.

Device	Product Description	Key Features
SiT9102	Differential Output Programmable Oscillator	<ul style="list-style-type: none"> Up to 800 MHz LVPECL, LVDS, CML or HCSL signaling Operating voltage of 1.8 V, 2.5 V, and 3.3 V Available in ± 10 PPM frequency tolerance
SiT9103	3-PLL, 3-Output Differential Programmable Clock Generator	<ul style="list-style-type: none"> Up to 800 MHz LVPECL, LVDS, CML or HCSL signaling Operating voltage of 1.8 V, 2.5 V, and 3.3 V Any Voltage, Any Output Center or Down Spread
SiT9002	Differential Output Programmable Spread Spectrum Oscillator	<ul style="list-style-type: none"> Reduces EMI up to 12 dB Center or Down Spread Up to 800 MHz LVPECL, LVDS, CML or HCSL signaling Operating voltage of 1.8 V, 2.5 V, and 3.3 V

All SiTime programmable timing products utilize proven MEMS technology that offers 10 times better robustness and reliability than existing, quartz-based solutions, supporting longer-life electronics. In addition, all SiTime products can be programmed and shipped in 24 hours for sample quantities and 2 weeks for production quantities. The unmatched flexibility offered by SiTime products ensures tremendous supply chain cost savings for OEMs and ODMs as it allows them to eliminate multiple suppliers, consolidate part numbers and inventory, and also shorten production lead time.

■ ■ ■ HIGH PERFORMANCE PROGRAMMABLE OSCILLATORS

SiTime's high performance programmable oscillators use an industry-leading, highly reliable MEMS resonator and advanced analog circuits to provide a wide range of programmable frequencies with very low jitter. The programmable features of SiTime's products such as frequency (as high as 800 MHz), operating voltage (1.8 V, 2.5 V, 2.8 V and 3.3 V), frequency tolerance (± 10 PPM, ± 20 PPM, ± 25 PPM, ± 50 PPM and ± 100 PPM) and output signaling types (LVPECL, LVDS, CML or HCSL) enable unparalleled flexibility and fast customization with very short lead times (samples in 24 hours and production quantities in two weeks). These all-silicon devices are available in industry-standard footprints and packages for direct drop-in replacements of quartz oscillators (XO and SPXO).

Device	Product Description	Key Features
SiT9102	Differential Output Programmable Oscillator	LVPECL, LVDS, CML or HCSL signaling Available in ± 10 PPM frequency tolerance Up to 800 MHz
SiT8102	Ultra stable, High Performance Programmable Oscillator	1-200 MHz Available in ± 10 PPM frequency tolerance Industry's lowest jitter
SiT8103	Lower Jitter, High Performance Programmable Oscillator Optimized for Sub-100MHz applications	1-110 MHz Available in ± 20 PPM frequency tolerance Excellent jitter performance
SiT8002	Programmable Oscillator	1-125 MHz Available in $+125^{\circ}\text{C}$ auto temperature range (SiT8002AA) Significant value over fixed and programmable quartz oscillators

SiTime's high performance programmable oscillators offer unique features that simplify system design:

- The SiT9102 differential output programmable oscillator can operate at frequencies up to 800 MHz, and provide ± 10 PPM frequency tolerance with sub-picosecond phase jitter. The SiT9102 supports four programmable differential output signaling levels – LVPECL, LVDS, CML and HCSL. These devices are designed for high performance networking, computing, and consumer applications.
- The SiT8102 single-ended programmable oscillator provides ultra low frequency tolerance of ± 10 PPM and sub-picosecond phase jitter, ideal for a wide range of >100 MHz applications. These all-silicon devices can replace fixed-frequency and programmable quartz oscillators (XO). It is an ideal choice for high performance computing, networking and other applications including 10 gigabyte Ethernet, Fibre Channel, GPON/EPON, profession video, etc.

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- The SiT8103 single-ended programmable oscillator is the latest addition to the SiTime high performance oscillator family, with lower power consumption and ± 20 PPM frequency tolerance. It is optimized for a wide range of sub-100MHz applications in networking, computing, consumer, industrial and medical. It is ideal for high speed serial protocols such as SATA, SAS, Firewire, USB, etc.
 - The SiT8002 programmable oscillator is a highly reliable timing device that is offered in four industry-standard packages with multiple power supply options, thus providing significant value over fixed quartz oscillators.

All SiTime programmable oscillators utilize proven MEMS technology that offers 10 times better robustness and reliability than existing, quartz-based solutions, supporting longer-life electronics. The unmatched flexibility offered by SiTime products ensures tremendous supply chain cost savings for OEMs and ODMs as it allows them to eliminate multiple suppliers, consolidate part numbers and inventory, and also shorten production lead time.

LOW POWER PROGRAMMABLE OSCILLATORS

SiTime's low power programmable MEMS oscillator family uses industry-leading, proven, and highly reliable MEMS and analog technologies to deliver the lowest power consumption and fastest start-up time. These devices are highly programmable – frequency, voltage and tolerance can be configured easily – enabling shipment of customized samples in 24 hours and production quantities in two weeks. Additionally, these all-silicon oscillators are offered in industry standard footprints and packages for direct drop-in replacements of quartz oscillators (XO and SPXO).

Device	Product Description	Key Features
SiT8003	Low Power Programmable Oscillator	1-110 MHz <3.5 mA typical IDD 3 ms start-up time ±25 PPM Frequency Tolerance
SiT8003XT	0.25 mm Thin Programmable Oscillator	1-110 MHz <3.5 mA typical IDD 3.5 mm x 3.0 mm x 0.25 mm package ±100 PPM Frequency Tolerance
SiT8033	2-Frequency Programmable Oscillator	1-110 MHz F ₀ or F ₀ /2, 3, 4 or 8 <3.5 mA typical IDD Frequency Select pin V _{in}

SiTime's low power all-silicon programmable oscillators offer a very fast start-up time of 3 ms, with active and standby IDD of 3.5 mA and 10 µA respectively. The fast start-up time enhances battery life by allowing electronic devices to quickly transition between standby and active modes.

- The [SiT8003](#) is available in standard four-pad package footprints of 2.5 x 2.0 mm, 3.2 x 2.5 mm, 5.0 x 3.2 mm and 7.0 x 5.0 mm. Designers can reduce the number of suppliers and parts on their AVL by replacing multiple fixed frequency crystal oscillators with the SiT8003. The device also offers frequency tolerance of ±25 PPM, allowing more timing margin for high performance applications such as video.
- The [SiT8003XT](#) offers the world's thinnest package at 0.25 mm, making this ultra thin clock oscillator ideal for smart cards, high capacity SIM cards and smaller, thinner consumer electronics.
- The [SiT8033](#) enables the user to select one of two related frequencies from the same device. With this unique feature, the same device can be used in different applications, simplifying procurement and reduces inventory cost.

PROGRAMMABLE SPREAD SPECTRUM OSCILLATORS

SiTime's programmable spread spectrum oscillators incorporate an industry-leading, highly reliable MEMS resonator and advanced analog circuits to provide EMI reduction of up to 12 dB with the lowest cycle-to-cycle jitter in the industry. Every programmable spread spectrum device, whether single-ended or differential, is available in industry standard footprints and packages. This feature allows easy replacement of conventional oscillators in systems without costly layout or design changes, ensuring that product delivery schedule is met and time to revenue is short.

Programmable features of SiTime's spread-spectrum products include amount of down spreading or center spreading, frequency (as high as 800 MHz), operating voltage (1.8 V, 2.5 V, 2.8 V and 3.3 V), frequency tolerance when spread is off (± 25 PPM, ± 50 PPM and ± 100 PPM) and output signaling types (LVPECL, LVDS, CML or HCSL). These programmable features enable unparalleled flexibility and fast customization with very short lead times (samples in 24 hours and production quantities in two weeks).

SiTime offers the following programmable spread spectrum oscillator products.

Device	Product Description	Key Features
SIT9001	Programmable Spread Spectrum Oscillator	<p>1-200 MHz Reduces EMI up to 12 dB Replaces any standard oscillator Center or Down Spread</p> <p>Consumer and computing applications: eg. Desktop PCs, printers, PCIe add-in cards</p>
SIT9002	Differential Output Programmable Spread Spectrum Oscillator	<p>1-220 MHz (Any), 220-800 MHz (Selected) Reduces EMI up to 12 dB LVPECL, LVDS, CML or HCSL signaling Center or Down Spread</p> <p>Consumer and computing applications: eg. PCs, printers, servers, RAID, storage, memory clocking, PCIe add-in cards</p>
SIT9003	Low Power Programmable Spread Spectrum Oscillator	<p>1-110 MHz Reduces EMI up to 12 dB Typical $I_{DD} < 3.5$ mA Center or Down Spread</p> <p>Portable and low power computing applications: eg. Notebooks, printers, storage</p>

All SiTime programmable oscillators utilize proven MEMS technology that offers 10 times better robustness and reliability than existing, quartz-based solutions, supporting longer-life electronics. The unmatched flexibility offered by SiTime products ensures tremendous supply chain cost savings for OEMs and ODMs as it allows them to eliminate multiple suppliers, consolidate part numbers and inventory, and also shorten production lead time.



PROGRAMMABLE CLOCK GENERATORS

SiTime's multi-PLL, multi-output programmable clock generators are the first in the industry to include embedded resonators, thus eliminating the need for external crystals and other clock sources. SiTime's programmable clock generators offer less than 1 ps of phase jitter, output frequencies of up to 800 MHz, and a variety of differential and single-ended outputs to address various standards.

In addition, SiTime's programmable clock generators are offered in extremely tiny packages, making them ideal for space-constrained applications. These multi-PLL devices integrate multiple oscillators and clock generators on a board, saving board space, reducing BOM cost, and offer supply chain benefits by eliminating multiple part numbers or suppliers from an Approved Vendor List (AVL).

Unique features such as independent voltage rails for the outputs and configurable output signaling type minimize the need for external components such as level translators and enable the board designer to reduce system complexity, cost, and power consumption. All of SiTime's clock generators are easily customizable to meet customer requirements with very short lead times.

Device	Product Description	Key Programmable Features
SiT9103	3-PLL, 3-Output Differential Programmable Clock Generator	Up to 800 MHz LVPECL, LVDS, CML or HCSL signaling Operating voltage of 1.8 V, 2.5 V or 3.3 V Any Voltage, Any Output Center or Down Spread
SiT9104	3-PLL, 6-Output Programmable Clock Generator	Any frequency up to 220 MHz Industry's smallest clock generator Operating voltage of 1.8 V, 2.5 V or 3.3 V Any Voltage, Any PLL 2 outputs from each PLL

All of SiTime's programmable silicon timing solutions utilize proven MEMS technology that offers 10 times better robustness and reliability than existing, quartz-based solutions, supporting longer-life electronics. In addition, all SiTime products can be programmed and shipped in 24 hours for sample quantities and 2 weeks for production quantities. The unmatched flexibility offered by SiTime products ensures tremendous supply chain cost savings for OEMs and ODMs as it allows them to eliminate multiple suppliers, consolidate part numbers and inventory, and also shorten production lead time.



VOLTAGE-CONTROLLED MEMS OSCILLATORS

SiTime's programmable voltage-controlled MEMS oscillator (VCMO) combines a highly robust and reliable MEMS resonator with advance analog circuits to provide the most flexible and programmable solution for clock synchronization applications. The device's extensive programmability enables delivery of customized samples in 24 hours and production quantities in 2 weeks with any combination of features including frequency, voltage, tolerance and package sizes. The ability to support factory-programmable pull range options from ± 30 PPM to ± 240 PPM in a single device is a unique SiTime feature not available in traditional voltage controlled crystal oscillators (VCXO).

In contrast with quartz based VCXO, the SiTime VCMO generates frequency variation by modulating the internal Fractional-N PLL as opposed to "pulling" of the crystal resonator. This results in industry-leading 0.5% linear pull range, representing significant improvement over the 5%-10% linearity offered by VCXOs. This enhancement allows system designers to simplify the clock synchronization algorithm, improve system lock time and provide better system stability.

SiTime's all-silicon VCMOs offer best-in-class 2 FIT (500M Hours MTBF) performance which significantly improves system reliability and is an order of magnitude better than quartz-based oscillators. The broad flexibility that is offered by SiTime's devices ensures tremendous supply chain cost savings for OEMs and ODMs by allowing them to eliminate multiple suppliers, consolidate part numbers and inventory, and also shorten production lead time.



EMBEDDED RESONATORS

SiTime's all-silicon, high performance MEMS resonators enable integration of the clock reference into our customer's ICs. SiTime offers a wide range of embedded resonator timing solutions that encompass ultra low power applications (Real Time Clock, Sleep Mode), high-frequency (MHz) clocks for microprocessor and serial applications, and high frequency RF solutions. SiTime's embedded resonators eliminate the need for external quartz crystals (XO) or other clocking components, ensuring that space- and height-constrained systems are the smallest, thinnest, most robust and reliable in the industry.

SiTime's MEMS resonators are produced in SiTime's patented MEMS-FIRST™ process which enables high Q, highly reliable, low drift and low cost resonators. These devices are extremely small and thin, resulting in easy integration into commonly used IC packages, using technology such as flip-chip, chip-stack, wire bonding and plastic over-molding.

Resonators are delivered to the customer as Known Good Die (KGD) which are 100% tested at the wafer level. To enable successful first-time-right design and easy integration, the customer also receives the drive circuit (oscillator) and associated IP in the form that they desire.