MEMS Timing Solutions for Communications & Enterprise

- Extensive portfolio for synchronization and wireless
- Environmental resilience for network densification
- Highest reliability and quality

The heartbeat of 5G™
MEMS Timing Solutions Empower 5G and Big Data

Full Product Portfolio for Every Network Node

Higher Performance, Environmentally Resilient, Smaller Size

- 4x higher precision under temp
- 20x better stability under vibration
- 2x more resistant to supply noise
- 3x lower power consumption
- 4x smaller size
- 30x better reliability

SiTime products are used in various network nodes:

- 5G RAN
- Microwave Backhaul
- Edge Server, DU
- GNSS Timing
- Carrier Grade Ethernet
- Optical Communications
- Hyperscale Servers
- Datacenter Switch
SiTime is the industry’s only pure play timing supplier with expertise in silicon MEMS, analog and packaging. We have shipped over 1.5 billions units of MEMS timing devices to over 10,000 customers. Our scalable, geographically diverse semiconductor supply chain ensures the most reliable delivery and highest quality.

**SILICON MEMS**
- Ultra small
- No aging
- No activity dips
- No fatigue
- Vibration resistant

**PROGRAMMABLE ANALOG**
- Ultra low jitter
- Most stable
- Resistant to board noise
- Low power
- Programmable

**SYSTEMS & PACKAGING**
- Industry standard package
- Semiconductor supply chain
- High volume manufacturing
- Highest reliability
- Best quality

**Elite Platform Architecture**

Environmentally resilient timing is imperative to deliver 130 ns time accuracy for 5G networks operating in uncontrolled environment. SiTime’s precision oscillators achieve 10 times better environmental resilience by leveraging our unique Elite Platform® DualMEMS® architecture with 30 µk temperature sensing accuracy and 40x faster tracking capability. Learn more
MEMS Oscillators Outperform Quartz

Better Stability

Ultra-Low Phase Noise, 156.25 MHz

Better Frequency Slope

Better Allan Deviation

Better Vibration Resistance
Jitter Cleaners, Network Synchronizers & Clock Generators
- Clock-SOC | Integrated MEMS, reduce BOM, simplify design
- Most resilient | Resistant to vibration, board bending, EMI, supply noise
- Best reliability | >1 billion hours MTBF, no quartz related failures
- Rich features | Up to 2.1 GHz, 4 clock domains, fast hitless switching

Stratum 3E OCXOs
- Resistant to airflow, thermal shock | ±0.05 ppb/°C
- Programmable | 1 to 60 MHz, ±5 to ±8 ppb
- Resistant to board noise | On-chip LDO, I₂C frequency tuning
- Smallest size | 9 x 7 mm²

Precision Super TCXOs
- Resistant to airflow, thermal shock | ±1 ppb/°C
- Most stable at high temp | ±100 ppb up to 105°C
- Resistant to vibration | 0.1 ppb/g
- No activity dips or micro-jumps

Ultra Low Jitter Oscillators
- Ultra-low phase noise | 70 fs jitter
- Best PSRN | 0.1 ps/mV, eliminates external LDOs
- Smallest size | Differential or LVCMOS in 2.0 x 1.6 mm²
- Most flexible | 1 to 725 MHz, up to 105°C, ±10 to ±50 ppm

I₂C/SPI Oscillator & VCXO
- In-system programmable | 1 to 725 MHz, up to ±3200 ppm pull
- Precise frequency steering | 0.005 ppb resolution
- Best pulling linearity | 0% (DCXO via I₂C or SPI), 1% (VCXO)
- Best stability at high temperature | ±10 ppm at 105°C
Enhance your system robustness and reduce your BOM with SiTime’s Cascade Platform™ SiT9514x Clock-SoCs with an integrated MEMS resonator that eliminates external quartz references and all quartz related issues.

Benefits

- Enhance system timing redundancy
  - Ultra fast hitless switching
  - Flexible, simultaneous monitoring of all inputs
  - Holdover support
- Deliver 10 times better vibration resistance
- Eliminate quartz issues
  - No inaccurate clock due to xtal capacitive mismatch
  - No jitter degradation due to noise coupling
  - No activity dips/frequency jumps inherent to xtal

Features

- Up to 4 independent clock domains
- Flexible input and output planning
- Programmable output signal types
- Synchronized, holdover, or free run
- Fastest 26-ps phase build-out in hitless switching
- Low loop bandwidth (1 mHz) for optimal wander
- DCO mode with 0.005 ppb frequency resolution
- Programmable output delay
- 125 fs typical rms phase jitter at 156.25 MHz

### Table

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Part Number</th>
<th># of Inputs</th>
<th># of Outputs</th>
<th>Max Output Frequency</th>
<th># of Clock Domains</th>
<th>Package (mm x mm)</th>
<th>EVB</th>
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</thead>
<tbody>
<tr>
<td>Clock Generator</td>
<td>SiT95141</td>
<td>4</td>
<td>10</td>
<td>2.1 GHz</td>
<td>1</td>
<td>9 x 9, 64-pin</td>
<td>SIT6503EB</td>
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<tr>
<td>SiT95143</td>
<td>4</td>
<td>11</td>
<td>2.1 GHz</td>
<td>2</td>
<td>4</td>
<td>9 x 9, 64-pin</td>
<td>SIT6503EB</td>
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<tr>
<td>Jitter Cleaner</td>
<td>SiT95145</td>
<td>4</td>
<td>10</td>
<td>2.1 GHz</td>
<td>1</td>
<td>9 x 9, 64-pin</td>
<td>SIT6503EB</td>
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<tr>
<td>Network Synchronizer</td>
<td>SiT95147</td>
<td>4</td>
<td>8</td>
<td>2.1 GHz</td>
<td>4</td>
<td>9 x 9, 64-pin</td>
<td>SIT6502EB</td>
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<tr>
<td>SiT95148</td>
<td>4</td>
<td>11</td>
<td>2.1 GHz</td>
<td>2</td>
<td>4</td>
<td>9 x 9, 64-pin</td>
<td>SIT6503EB</td>
</tr>
</tbody>
</table>

The heartbeat of 5G
Simplify your design and enhance environmental resilience with SiTime Emerald Platform™ OCXOs that deliver the most stable timing under environmental stressors such as under airflow, thermal shock, vibration, shock, and EMI.

**Benefits**

- Simplify board designs
  - No placement restrictions
  - No dedicated LDO required
- Enhance environmentally resilience
  - Resistant to airflow
  - Resistant to rapid temp change
  - Resistant to vibration, board bending
  - No activity dips or frequency jumps
- Deliver best reliability

**Features**

- Exceptional dynamic stability
  - ±0.05 ppb/°C frequency slope (dF/dT)
  - 1.5e-11 ADEV @ 10 sec under airflow
- Digital frequency pulling with I2C, 5 ppb resolution
  - Eliminate sensitivity to board noise
- Smallest size, 9 x 7 mm footprint
- 0.2 ps/mV PSNR, immune to power supply noise
- Any frequency from 1 to 220 MHz
- LVCMOS or clipped sinewave output

### Device Details

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Part Number</th>
<th>Output (MHz)</th>
<th>Stability (ppm)</th>
<th>Voltage (V)</th>
<th>Package (mm x mm)</th>
<th>Output Types</th>
<th>Feature</th>
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</thead>
<tbody>
<tr>
<td>OCXO</td>
<td>SiT5711</td>
<td>1 to 60</td>
<td>±5 ±8</td>
<td>3.3</td>
<td>9 x 7</td>
<td>LVCMOS, Clipped Sinewave</td>
<td>–</td>
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<tr>
<td>DCOCXO</td>
<td>SiT5721</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I2C Temp Redout</td>
<td></td>
</tr>
</tbody>
</table>

**Optical Transport**

- 1 PPS
- 8 kHz
- 8 kHz/19.44 MHz

**Video Serializer for IP Transport**

- SiT8009 XO
- SiT3372 VCXO
- Serial Data (SDI) In
- Serial Data (SDI) Out
- SDI Re-Clocker
- De-Serializer
- Video Processor
- Serializer
- SiT95145 Jitter Cleaner
- SiT5711 50 MHz OCXO

**Stratum 3E OCXOs**

The heartbeat of 5G
Improve time synchronization and IEEE1588 performance by replacing quartz OCXOs with SiTime Elite Platform Super-TCXOs® that deliver the best resilience under environmental stressors—airflow, thermal shock, vibration, shock, and EMI.

### Benefits
- Eliminate bulky, unreliable OCXOs
  - 4x smaller, 3x lower power vs. 9 x 7 mm OCXO
- Enhance environmentally resilience
  - Resistant to airflow
  - Resistant to rapid temperature change
  - Resistant to vibration, board bending
  - No activity dips or frequency jumps
- Simplify board designs
  - No placement restrictions
  - No dedicated LDO required

### Features
- Exceptional dynamic stability
  - ±1 ppb/°C dF/dT, 10°C/min ramp
  - 1.5e-11 ADEV @ 10, under airflow
- Up to 105°C operating temperature
- Digital frequency pulling with I²C, 5 ppb resolution
  - Eliminate external DAC, sensitivity to board noise
- No activity dips or micro-jumps
- 0.1 ppb/g vibration resistance
- 0.2 ps/mV PSNR, immune to power supply noise
- Any frequency from 1 to 220 MHz

### Time Synchronization for Servers

**SiT5356**
- **Device Type**: Elite Super-TCXO
- **Part Number**: SiT5358
- **Output Freq (MHz)**: 1 to 60
- **Stability (ppm)**: ±0.05
- **dF/dT (ppb/°C)**: ±1
- **Temp. (°C)**: -20 to +70
- **Package (mm x mm)**: 5.0 x 3.2
- **Output**: LVCMOS, Clipped Sinewave

**SiT5359**
- **Part Number**: SiT5359
- **Output Freq (MHz)**: 60 to 220
- **Stability (ppm)**: ±0.1 to ±0.25
- **Temp. (°C)**: -40 to +85
- **Package (mm x mm)**: 7.0 x 5.0

**SiT5356**
- **Part Number**: SiT5356
- **Output Freq (MHz)**: 1 to 60
- **Stability (ppm)**: ±0.1 to ±0.25
- **Temp. (°C)**: -40 to 105
- **Package (mm x mm)**: 5.0 x 3.2

**SiT5357**
- **Part Number**: SiT5357
- **Output Freq (MHz)**: 60 to 220
- **Stability (ppm)**: ±0.1 to ±0.25
- **Temp. (°C)**: -40 to 105
- **Package (mm x mm)**: 7.0 x 5.0

### IEEE 1588-Enabled Smart NIC

**SiT535x**
- **Device Type**: Elite Super-TCXO
- **Part Number**: SiT535x
- **Output Freq (MHz)**: 20 MHz
- **Stability (ppm)**: ±0.5 to ±2.5
- **dF/dT (ppb/°C)**: ±15
- **Temp. (°C)**: -20 to +70
- **Package (mm x mm)**: 3.2 x 2.5
- **Output**: LVPECL, LVDS

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The heartbeat of 5G
Accelerate your design and ensure supply continuity with SiTime’s complete portfolio of programmable oscillators, designed to improve reliability, shorten lead time, and solve unique timing problems such as EMI.

Benefits
• One-stop-shop for all oscillator needs
• Ultra small (2.0 x 1.6 mm) differential oscillator for small form factor designs (e.g. 400G/800G QSFP)
• Spread spectrum for EMI reduction
• Environmentally resilient
  – Resistant to airflow, thermal shock
  – Resistant to vibration, board bending
  – Immune to power supplier noise
• 48-hour availability, all configurations
• Instant samples with Time Machine II programmer

Features
• Any frequency from 1 to 725 MHz
• 3 jitter grades – 0.07 ps, 0.25 ps and 0.6 ps
• Frequency stability from ±10 to ±50 ppm
• Operating temperature up to 125°C
• PSNR as low as 0.05 ps/mV
• Programmable spread % for best EMI reduction
• FlexEdge™ configurable rise/fall time to reduce clock harmonics
• 10 standard footprints for drop-in replacement of quartz oscillators

Ultra Low Jitter Oscillators

800G PAM4 Optical Module

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Part Number</th>
<th>Output Freq (MHz)</th>
<th>Stability (ppm)</th>
<th>Jitter (ps)</th>
<th>Voltage (V)</th>
<th>Package (mm x mm)</th>
<th>Output Types</th>
<th>Features</th>
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</thead>
<tbody>
<tr>
<td>DE-XO</td>
<td>SIT9501 [1]</td>
<td>14 std freq</td>
<td>±20</td>
<td>0.07</td>
<td>1.8</td>
<td>2.5 to 3.3</td>
<td>LVPECL, LVDS, HCSL</td>
<td>FlexSwing, LP HCSL</td>
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<td></td>
<td>SIT9375</td>
<td>31 std</td>
<td>±20</td>
<td>0.17</td>
<td>2.5 to 3.3</td>
<td>2.0 x 1.6</td>
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<tr>
<td></td>
<td>SIT9366/67</td>
<td>1 to 725</td>
<td>±10</td>
<td>0.23</td>
<td>2.5 to 3.3</td>
<td>2.5 x 2.0</td>
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<td></td>
<td>SIT9120/21/22</td>
<td>1 to 625</td>
<td>±20</td>
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<td>5.0</td>
<td>3.2 x 2.5</td>
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<td></td>
<td>SIT8208/09</td>
<td>1 to 220</td>
<td>±25</td>
<td>0.5</td>
<td>1.8</td>
<td>7.0 x 5.0</td>
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<td></td>
<td>SIT8008/09</td>
<td>1 to 137</td>
<td>±50</td>
<td>1.3</td>
<td>2.5 to 3.3</td>
<td>5.0 x 3.2</td>
<td></td>
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<tr>
<td></td>
<td>SIT9005</td>
<td>1 to 141</td>
<td></td>
<td>1.3</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

[2] FlexSwing LVPECL enables non-standard LVPECL swing to reduce power. LP or lower power HCSL eliminates passives.
[3] 2.0 x 1.6 package is available for SIT9501, SIT9375, SIT8008, SIT8009, SIT9005.
Enable multiple video/audio standards and frequency margining with SiTime’s in-system programmable oscillators that allow designers to digitally reprogram output frequencies in real time. SiTime also offers a family of VCXOs in industry standard footprints.

**Benefits**
- Reduce clock design complexity by replacing multiple oscillators with a single I²C device
- Stress-test system by re-programming output frequency in real time
- Reduce sensitivity to board-level noise with digital programming interface
- Environmentally resilient
  - Resistant to airflow
  - Resistant to rapid temperature change
  - Resistant to vibration, board bending
  - Immune to power supply noise

**Features**
- 1 to 725 MHz, I²C/SPI programmable
- Digital frequency pulling (DCO) via I²C/SPI
  - 5 ppt (0.0005 ppb) pull resolution
  - Up to ±3200 ppm pull-range
  - 0% (perfect) pull linearity
- Analog pull (VCXO) with 0.1% linearity (typ)
- 0.21 ps typical RMS jitter under vibration
- Frequency stability from ±10 to ±50 ppm
- 0.05 ps/mV power supply noise rejection (PSNR)
- LVCMOS, LVPECL, LVDS, HCSL single types
- 9 industry standard packages

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**Video Broadcasting**

Data → FPGA → PFD → Phase Detector → Feedback Divider → DLP → 74.25 MHz → SIT3521 I²C Oscillator → PC

**G.Fast MDU**

SIT9366 XO-LVDS → G.Fast SOC → SIT3521 I²C/SPI Oscillator → PC

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<table>
<thead>
<tr>
<th>Device Type</th>
<th>Part Number</th>
<th>Output Freq (MHz)</th>
<th>Stability (ppm)</th>
<th>Voltage (V)</th>
<th>Temp. (°C)</th>
<th>Packages (mm x mm)</th>
<th>Output</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCXO</td>
<td>SIT3521</td>
<td>1 to 340</td>
<td>±10, ±20, ±25</td>
<td>2.5 to 3.3</td>
<td>-20 to 70</td>
<td>5.0 x 3.2</td>
<td>LVPECL, LVDS, HCSL</td>
<td>I²C programmable</td>
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<tr>
<td></td>
<td>SIT3522</td>
<td>340 to 725</td>
<td>±15, ±25, ±30</td>
<td>2.5 to 3.3</td>
<td>-40 to 85</td>
<td>3.2 x 2.5</td>
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<tr>
<td>VCXO</td>
<td>SIT3372</td>
<td>1 to 220</td>
<td>±15, ±25, ±30</td>
<td>2.5 to 3.3</td>
<td>-40 to 105</td>
<td>5.0 x 3.2</td>
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<td>SIT3373</td>
<td>220 to 725</td>
<td>±15, ±25, ±30</td>
<td>2.5 to 3.3</td>
<td>-40 to 85</td>
<td>7.0 x 5.0</td>
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</tbody>
</table>
Online Tools to Make Your Timing Design Simpler

Find the Right Part

PARAMETRIC SEARCH
Find products fast based on your search criteria

PART NUMBER GENERATOR
Configure your oscillator to your exact requirements

Program & Test the Part

TIME MACHINE II PROGRAMMER
Instantly program oscillator frequency, voltage, stability & more

EVALUATION BOARDS
Find the right evaluation board to reduce your design time

Get Performance Data

JITTER CALCULATOR & PLOTS
Convert phase noise to phase jitter (rms) and find phase noise plots

FREQUENCY SLOPE DF/DT CALCULATOR
Instantly calculate frequency slope by inputting your data

TIME ERROR SIMULATOR SOFTWARE
Quickly simulate and analyze the impact of the local oscillator

Find SiTime alternatives with SiTime’s Intellimatch™

Configure your oscillator to your exact requirements

Find the right evaluation board to reduce your design time

Instantly calculate frequency slope by inputting your data

Quickly simulate and analyze the impact of the local oscillator

Easily evaluate SiTime oscillators configured via I2C/SPI interfaces
App Notes and Papers - Technology and Industry Standards
SiTime's MEMS First™ and EpiSeal™ Processes
DualMEMS and TurboCompensation Temperature Sensing Technology
AN10052 IEEE 1588 Precision Time Protocol (PTP) in ITU-T Standards

App Notes and Papers - Performance and Reliability
AN10025 Reliability Calculations for SiTime Oscillators
AN10063 TCXO and OCXO Stability and System Impact Beyond Rated Temperature
Synchronization System Performance Benefits of Precision MEMS TCXOs under Environmental Stress Conditions

App Notes and Papers - Design and Measurement
AN10006 Best Design and Layout Practices
AN10039 TCXO Frequency Stability and Frequency Accuracy Budget
AN10041 Designing with the SiT39xx Family of DCXOs (Digitally Controlled Oscillators)
AN10050 I²C/SPI Programmable Oscillators
AN10062 Phase Noise Measurement Guide for Oscillators
AN10064 Improved System Performance with Digital Frequency Tuning in Precision Super-TCXOs
AN10066 LVDS Output with 600 mV to 1200 mV Swing
AN10067 Considerations for Measuring Phase Noise in Differential Oscillators
AN20003 SiT9514x Power Supply Noise Rejection
AN20011 SiT9514x Dynamic Control of Outputs
Adaptive Drift Compensation for Holdover Oscillators
Time Error Simulation - Software and Models

Application Briefs
5G New Radio (NR) – RRU, AAU, Massive MIMO
Fronthaul and IP RAN Switches
Microwave Outdoor Units (ODU)
Open RAN (ORAN) – Macro and Small Cells
Servers Load Balancing and IEEE1588 Support
Smart Network Interface Card (NIC) and IEEE1588

Videos
How to Design with SiTime TCXOs and OCXOs
SiTime Elite Super-TCXO Dynamic Performance vs. Quartz TCXO
Elite Super-TCXO Improves GNSS Robustness
SiTime MEMS Timing Solutions for 5G RRU
SiTime MEMS Timing Solutions for Open RAN
SiTime MEMS Timing Solutions for Optical Module
SiTime's Time Machine II - Part 1: How to Install Oscillator Programming Software
SiTime's Time Machine II - Part 2: How to Program Field Programmable Oscillators