# THE DATASHEET OF

# WM8960CGEFL/RV

www.win-source.net 0086-755-83957316

# SiT8209

Ultra-Performance Oscillator

## Features

- Any frequency between 80.000001 and 220 MHz accurate to 6 decimal places
- 100% pin-to-pin drop-in replacement to quartz-based oscillators
- Ultra-low phase jitter: 0.5 ps (12 kHz to 20 MHz)
- Frequency stability as low as ±10 PPM
- Industrial or extended commercial temperature range
- LVCMOS/LVTTL compatible output
- Standard 4-pin packages: 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 mm x mm
- Outstanding silicon reliability of 2 FIT or 500 million hour MTBF
- Pb-free, RoHS and REACH compliant
- Ultra-short lead time

## Applications

- SATA, SAS, Ethernet, 10-Gigabit Ethernet, SONET, PCI Express, video, Wireless
- Computing, storage, networking, telecom, industrial control

### Table 1. Electrical Characteristics[1]

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| **Output Frequency Range** | f | 80.000001 | – | 220 | MHz | |
| **Frequency Stability** | F_stab | -10 | – | +10 | PPM | Inclusive of Initial tolerance at 25 °C, and variations over operating temperature, rated power supply voltage and load |
| | | -20 | – | +20 | PPM | |
| | | -25 | – | +25 | PPM | |
| | | -50 | – | +50 | PPM | |
| **Operating Temperature Range** | T_use | -20 | – | +70 | °C | Extended Commercial |
| | | -40 | – | +85 | °C | Industrial |
| **Supply Voltage** | Vdd | 1.71 | 1.8 | 1.89 | V | Supply voltages between 2.5V and 3.3V can be supported. Contact SiTime for guaranteed performance specs for supply voltages not specified in this table. |
| | | 2.25 | 2.5 | 2.75 | V | |
| | | 2.52 | 2.8 | 3.08 | V | |
| | | 2.97 | 3.3 | 3.63 | V | |
| **Current Consumption** | Idd | – | 34 | 36 | mA | No load condition, f = 100 MHz, Vdd = 2.5V, 2.8V or 3.3V |
| | | – | 30 | 33 | mA | No load condition, f = 100 MHz, Vdd = 1.8V |
| **OE Disable Current** | I_OD | – | – | 31 | mA | Vdd = 2.5V, 2.8V or 3.3V, OE = GND, output is Weakly Pulled Down |
| | | – | – | 30 | mA | Vdd = 1.8 V. OE = GND, output is Weakly Pulled Down |
| **Standby Current** | I_std | – | – | 70 | µA | Vdd = 2.5V, 2.8V or 3.3V, $\overline{ST}$ = GND, output is Weakly Pulled Down |
| | | – | – | 10 | µA | Vdd = 1.8 V. $\overline{ST}$ = GND, output is Weakly Pulled Down |
| **Duty Cycle** | DC | 45 | – | 55 | % | f <= 165 MHz, all Vdds. |
| | | 40 | – | 60 | % | f > 165 MHz, all Vdds. |
| **Rise/Fall Time** | Tr, Tf | – | 1.2 | 2 | ns | 15 pF load, 10% - 90% Vdd |
| **Output Voltage High** | VOH | 90% | – | – | Vdd | IOH = -6 mA, IOL = 6 mA, (Vdd = 3.3V, 2.8V, 2.5V)<br>IOH = -3 mA, IOL = 3 mA, (Vdd = 1.8V) |
| **Output Voltage Low** | VOL | – | – | 10% | Vdd | |
| **Input Voltage High** | VIH | 70% | – | – | Vdd | Pin 1, OE or $\overline{ST}$ |
| **Input Voltage Low** | VIL | – | – | 30% | Vdd | Pin 1, OE or $\overline{ST}$ |
| **Input Pull-up Impedance** | Z_in | – | 100 | 250 | kΩ | Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high |
| | | 2 | – | – | MΩ | Pin 1, $\overline{ST}$ logic low |
| **Startup Time** | T_start | – | 7 | 10 | ms | Measured from the time Vdd reaches its rated minimum value |
| **OE Enable/Disable Time** | T_oe | – | – | 115 | ns | f = 80 MHz, For other frequencies, T_oe = 100 ns + 3 cycles |
| **Resume Time** | T_resume | – | – | 10 | ms | In standby mode, measured from the time $\overline{ST}$ pin crosses 50% threshold. Refer to Figure 5. |
| **RMS Period Jitter** | T_jitt | – | 1.5 | 2 | ps | f = 156.25 MHz, Vdd = 2.5V, 2.8V or 3.3V |
| | | – | 2 | 3 | ps | f = 156.25 MHz, Vdd = 1.8V |
| **RMS Phase Jitter (random)** | T_phj | – | 0.5 | 1 | ps | f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz |
| **First year Aging** | F_aging | -1.5 | – | +1.5 | PPM | 25°C |
| **10-year Aging** | | -5 | – | +5 | PPM | 25°C |

**Note:**

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

## Table 2. Pin Configuration

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

**Top View**

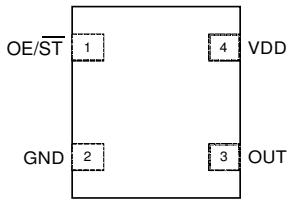



**Figure 1. Pin Assignments**

**Notes:**

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

## Table 3. 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 |

## Table 4. 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 |

## Table 5. 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** |

## Phase Noise Plot

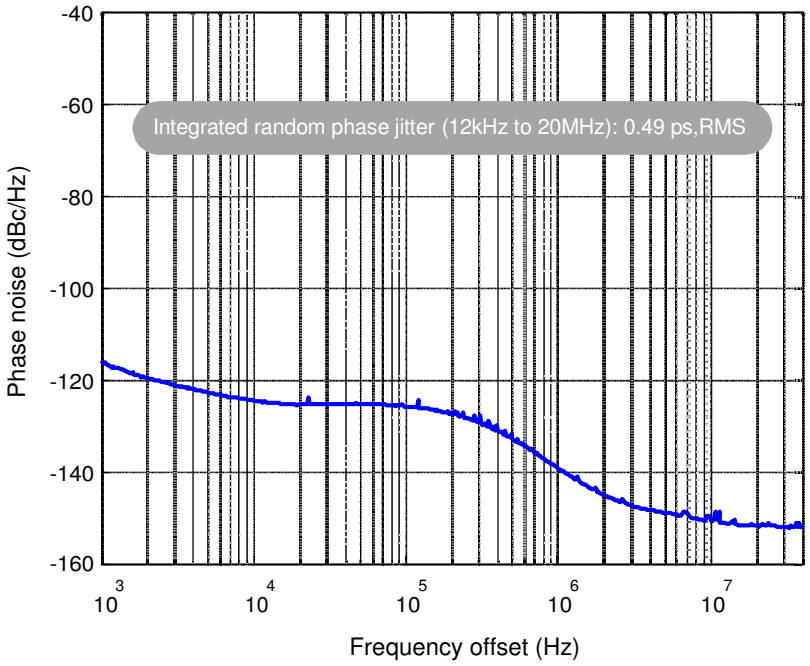



**Figure 2. Phase Noise, 156.25 MHz, 3.3V, LVCMOS Output**

## Test Circuit and Waveform[4]

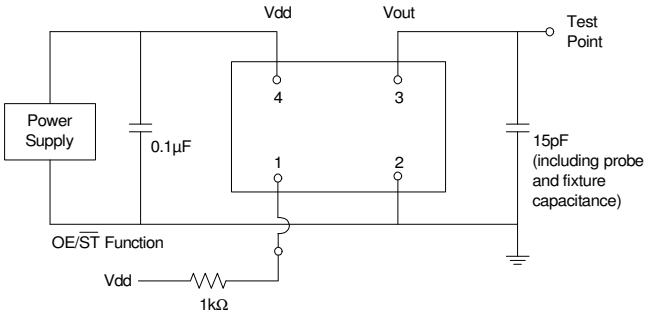



**Figure 3. Test Circuit**

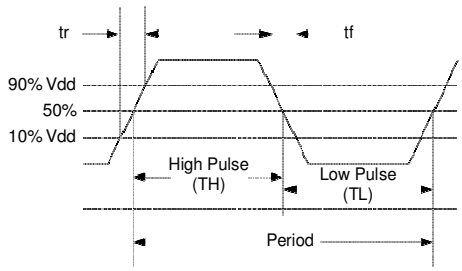



**Figure 4. Waveform**

**Notes:**

4. Duty Cycle is computed as Duty Cycle = TH/Period.
5. SiT8209 supports the configurable duty cycle feature. For custom duty cycle at any given frequency, contact SiTime.

## Timing Diagram

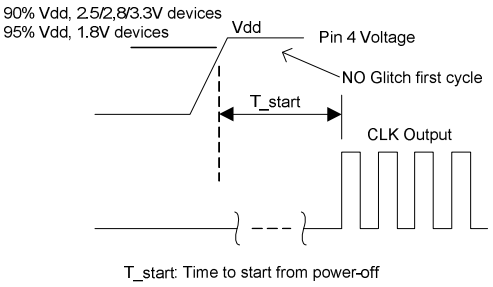



**Figure 5. Startup Timing (OE/$\overline{ST}$ Mode)**

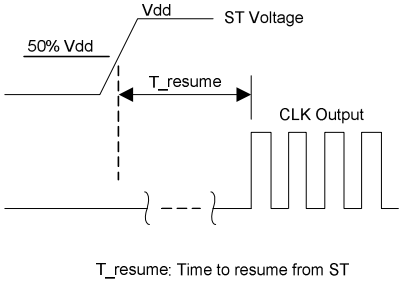



**Figure 6. Standby Resume Timing ($\overline{ST}$ Mode Only)**

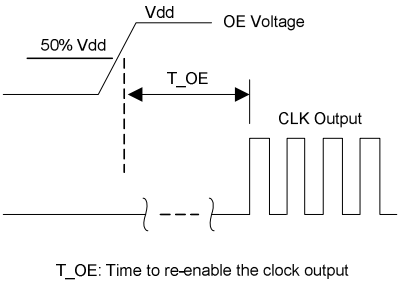



**Figure 6. OE Enable Timing (OE Mode Only)**

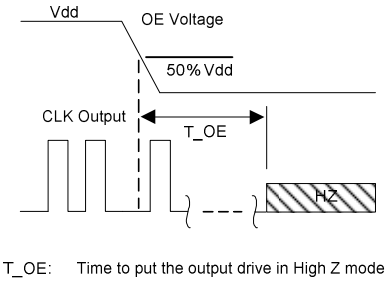



**Figure 7. OE Disable Timing (OE Mode Only)**

**Notes:**

6. SiT8209 supports NO RUNT pulses and No glitches during startup or resume.
7. SiT8209 supports gated output which is accurate within rated frequency stability from the first cycle.

## Performance Plots[8]

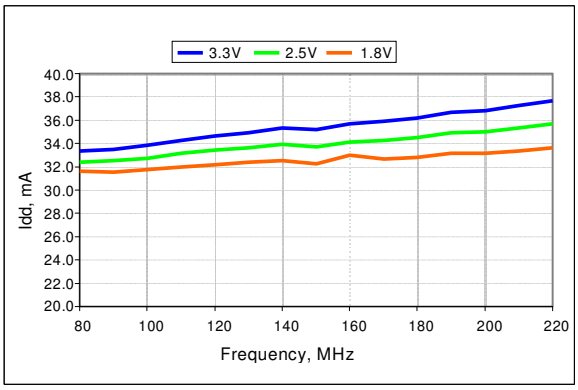



**Figure 8. Idd vs Frequency**

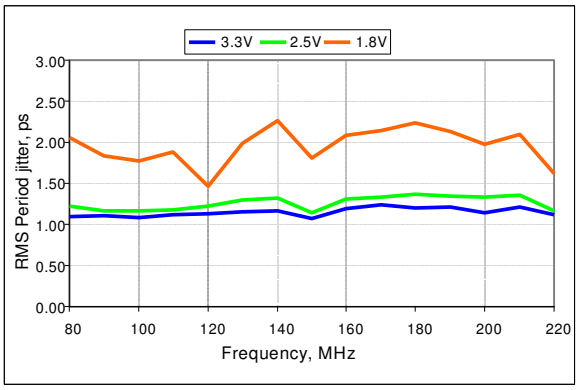



**Figure 9. RMS Period Jitter vs Frequency**

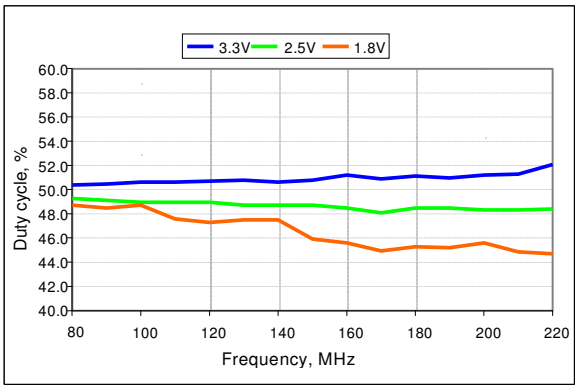



**Figure 10. Duty Cycle vs Frequency**

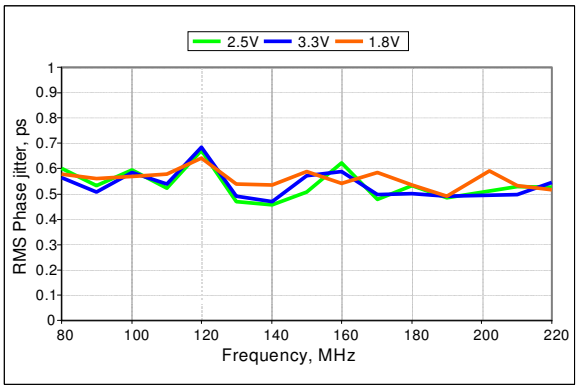



**Figure 11. RMS Phase Jitter vs Frequency**

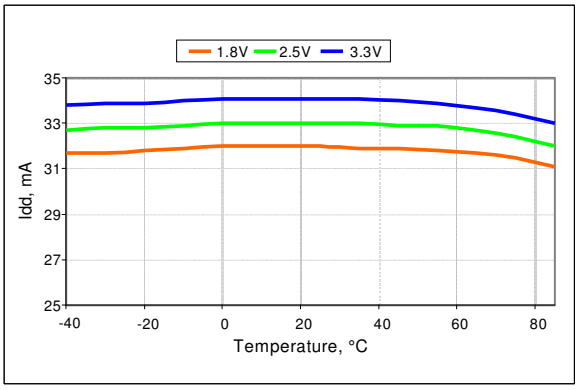



**Figure 12. Idd vs Temperature, 100 MHz Output**

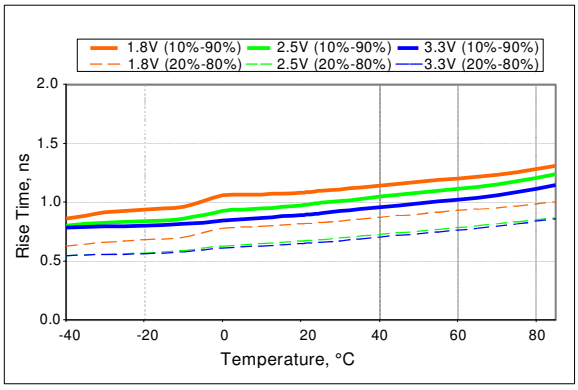



**Figure 13. Rise Time vs Temperature, 100 MHz Output**

**Note:**

8. All plots are measured with 15pF load at room temperature, unless otherwise stated.

## Programmable Drive Strength

The SiT8209 includes a programmable drive strength feature to provide a simple, flexible tool to optimize the clock rise/fall time for specific applications. Benefits from the programmable drive strength feature are:

- Improves system radiated electromagnetic interference (EMI) by slowing down the clock rise/fall time
- Improves the downstream clock receiver's (RX) jitter by decreasing (speeding up) the clock rise/fall time.
- Ability to drive large capacitive loads while maintaining full swing with sharp edge rates.

For more detailed information about rise/fall time control and drive strength selection, see the SiTime Applications Note section: http://www.sitime.com/support/application-notes.

### EMI Reduction by Slowing Rise/Fall Time

Figure 14 shows the harmonic power reduction as the rise/fall times are increased (slowed down). The rise/fall times are expressed as a ratio of the clock period. For the ratio of 0.05, the signal is very close to a square wave. For the ratio of 0.45, the rise/fall times are very close to near-triangular waveform. These results, for example, show that the 11th clock harmonic can be reduced by 35 dB if the rise/fall edge is increased from 5% of the period to 45% of the period.

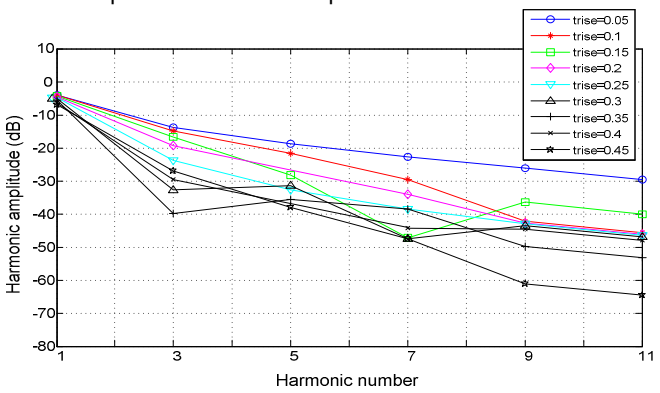



**Figure 15. Harmonic EMI reduction as a Function of Slower Rise/Fall Time**

### Jitter Reduction with Faster Rise/Fall Time

Power supply noise can be a source of jitter for the downstream chipset. One way to reduce this jitter is to increase rise/fall time (edge rate) of the input clock. Some chipsets would require faster rise/fall time in order to reduce their sensitivity to this type of jitter. The SiT8209 provides up to 3 additional high drive strength settings for very fast rise/fall time. Refer to the Rise/Fall Time Tables to determine the proper drive strength.

### High Output Load Capability

The rise/fall time of the input clock varies as a function of the actual capacitive load the clock drives. At any given drive strength, the rise/fall time becomes slower as the output load increases. As an example, for a 3.3V SiT8209 device with default drive strength setting, the typical rise/fall time is 1.15ns for 15 pF output load. The typical rise/fall time slows down to 2.72ns when the output load increases to 45 pF.

One can choose to speed up the rise/fall time to 1.41ns by then increasing the drive strength setting on the SiT8209.

The SiT8209 can support up to 60 pF or higher in maximum capacitive loads with up to 3 additional drive strength settings. Refer to the Rise/Tall Time Tables to determine the proper drive strength for the desired combination of output load vs. rise/fall time

### SiT8209 Drive Strength Selection

Tables 6 through 9 define the rise/fall time for a given capacitive load and supply voltage.Select the table that matches the SiT8208 nominal supply voltage (1.8V, 2.5V, 2.8V, 3.0V, 3.3V).

1. Select the table that matches the SiT8209 nominal supply voltage (1.8V, 2.5V, 2.8V, 3.0V, 3.3V).
2. Select the capacitive load column that matches the application requirement (5 pF to 60 pF)
3. Under the capacitive load column, select the desired rise/fall times.
4. The left-most column represents the part number code for the corresponding drive strength.
5. Add the drive strength code to the part number for ordering purposes.

### Calculating Maximum Frequency

Based on the rise and fall time data given in Tables 6 through 9, the maximum frequency the oscillator can operate with guaranteed full swing of the output voltage over temperature as follows:

$$\text{Max Frequency} = \frac{1}{6 \times (T_{rise})}$$

#### Example 1

Calculate $f_{MAX}$ for the following condition:

- Vdd = 1.8V (Table 6)
- Capacitive Load: 30 pF
- Typical Tr/f time = 5 ns
  (rise/fall time part number code = G)

Part number for the above example:

SiT8209AI**G**G2-18E-55.500000

Drive strength code is inserted here. Default setting is "-"

## Rise/Fall Time (10% to 90%) vs $C_{LOAD}$ Tables

### Table 6. Vdd = 1.8V Rise/Fall Times for Specific $C_{LOAD}$

| Rise/Fall Time Typ (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength \ $C_{LOAD}$ | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 12.45 | 17.68 | 19.48 | 46.21 | 57.82 |
| A | 6.50 | 10.27 | 16.21 | 23.92 | 30.73 |
| R | 4.38 | 7.05 | 11.61 | 16.17 | 20.83 |
| B | 3.27 | 5.30 | 8.89 | 12.18 | 15.75 |
| S | 2.62 | 4.25 | 7.20 | 9.81 | 12.65 |
| D | 2.19 | 3.52 | 6.00 | 8.31 | 10.59 |
| T | 1.76 | 3.01 | 5.14 | 7.10 | 9.15 |
| E | 1.59 | 2.59 | 4.49 | 6.25 | 7.98 |
| U | 1.49 | 2.28 | 3.96 | 5.55 | 7.15 |
| F | 1.22 | 2.10 | 3.57 | 5.00 | 6.46 |
| W | 1.07 | 1.88 | 3.23 | 4.50 | 5.87 |
| G | 1.01 | 1.64 | 2.95 | 4.12 | 5.40 |
| X | 0.96 | 1.50 | 2.74 | 3.80 | 4.98 |
| K | 0.92 | 1.41 | 2.56 | 3.52 | 4.64 |
| Y | 0.88 | 1.34 | 2.39 | 3.25 | 4.32 |
| Q | 0.86 | 1.29 | 2.24 | 3.04 | 4.06 |
| Z or "-": Default | 0.82 | 1.24 | 2.07 | 2.89 | 3.82 |
| M | 0.77 | 1.20 | 1.94 | 2.72 | 3.61 |
| N | 0.66 | 1.15 | 1.84 | 2.58 | 3.41 |
| P | 0.51 | 1.09 | 1.76 | 2.45 | 3.24 |

### Table 7. Vdd = 2.5V Rise/Fall Times for Specific $C_{LOAD}$

| Rise/Fall Time Typ (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength \ $C_{LOAD}$ | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 8.68 | 13.59 | 18.36 | 32.70 | 42.06 |
| A | 4.42 | 7.18 | 11.93 | 16.60 | 21.38 |
| R | 2.93 | 4.78 | 8.15 | 11.19 | 14.59 |
| B | 2.21 | 3.57 | 6.19 | 8.55 | 11.04 |
| S | 1.67 | 2.87 | 4.94 | 6.85 | 8.80 |
| D | 1.50 | 2.33 | 4.11 | 5.68 | 7.33 |
| T | 1.06 | 2.04 | 3.50 | 4.84 | 6.26 |
| E | 0.98 | 1.69 | 3.03 | 4.20 | 5.51 |
| U | 0.93 | 1.48 | 2.69 | 3.73 | 4.92 |
| F | 0.90 | 1.37 | 2.44 | 3.34 | 4.42 |
| W | 0.87 | 1.29 | 2.21 | 3.04 | 4.02 |
| G or "-": Default | 0.67 | 1.20 | 2.00 | 2.79 | 3.69 |
| X | 0.44 | 1.10 | 1.86 | 2.56 | 3.43 |
| K | 0.38 | 0.99 | 1.76 | 2.37 | 3.18 |
| Y | 0.36 | 0.83 | 1.66 | 2.20 | 2.98 |
| Q | 0.34 | 0.71 | 1.58 | 2.07 | 2.80 |
| Z | 0.33 | 0.65 | 1.51 | 1.95 | 2.65 |
| M | 0.32 | 0.62 | 1.44 | 1.85 | 2.50 |
| N | 0.31 | 0.59 | 1.37 | 1.77 | 2.39 |
| P | 0.30 | 0.57 | 1.29 | 1.70 | 2.28 |

### Table 8. Vdd = 2.8V Rise/Fall Times for Specific $C_{LOAD}$

| Rise/Fall Time Typ (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength \ $C_{LOAD}$ | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 7.93 | 12.69 | 17.94 | 30.10 | 38.89 |
| A | 4.06 | 6.66 | 11.04 | 15.31 | 19.80 |
| R | 2.68 | 4.40 | 7.53 | 10.29 | 13.37 |
| B | 2.00 | 3.25 | 5.66 | 7.84 | 10.11 |
| S | 1.59 | 2.57 | 4.54 | 6.27 | 8.07 |
| D | 1.19 | 2.14 | 3.76 | 5.21 | 6.72 |
| T | 1.00 | 1.79 | 3.20 | 4.43 | 5.77 |
| E | 0.94 | 1.51 | 2.78 | 3.84 | 5.06 |
| U | 0.90 | 1.38 | 2.48 | 3.40 | 4.50 |
| F | 0.87 | 1.29 | 2.21 | 3.03 | 4.05 |
| W | 0.62 | 1.19 | 1.99 | 2.76 | 3.68 |
| G or "-": Default | 0.41 | 1.08 | 1.84 | 2.52 | 3.36 |
| X | 0.37 | 0.96 | 1.72 | 2.33 | 3.15 |
| K | 0.35 | 0.78 | 1.63 | 2.15 | 2.92 |
| Y | 0.33 | 0.67 | 1.54 | 2.00 | 2.75 |
| Q | 0.32 | 0.63 | 1.46 | 1.89 | 2.57 |
| Z | 0.31 | 0.60 | 1.39 | 1.80 | 2.43 |
| M | 0.30 | 0.57 | 1.31 | 1.72 | 2.30 |
| N | 0.30 | 0.56 | 1.22 | 1.63 | 2.22 |
| P | 0.29 | 0.54 | 1.13 | 1.55 | 2.13 |

### Table 9. Vdd = 3.3V Rise/Fall Times for Specific $C_{LOAD}$

| Rise/Fall Time Typ (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength \ $C_{LOAD}$ | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 7.18 | 11.59 | 17.24 | 27.57 | 35.57 |
| A | 3.61 | 6.02 | 10.19 | 13.98 | 18.10 |
| R | 2.31 | 3.95 | 6.88 | 9.42 | 12.24 |
| B | 1.65 | 2.92 | 5.12 | 7.10 | 9.17 |
| S | 1.43 | 2.26 | 4.09 | 5.66 | 7.34 |
| D | 1.01 | 1.91 | 3.38 | 4.69 | 6.14 |
| T | 0.94 | 1.51 | 2.86 | 3.97 | 5.25 |
| E | 0.90 | 1.36 | 2.50 | 3.46 | 4.58 |
| U | 0.86 | 1.25 | 2.21 | 3.03 | 4.07 |
| F or "-": Default | 0.48 | 1.15 | 1.95 | 2.72 | 3.65 |
| W | 0.38 | 1.04 | 1.77 | 2.47 | 3.31 |
| G | 0.36 | 0.87 | 1.66 | 2.23 | 3.03 |
| X | 0.34 | 0.70 | 1.56 | 2.04 | 2.80 |
| K | 0.33 | 0.63 | 1.48 | 1.89 | 2.61 |
| Y | 0.32 | 0.60 | 1.40 | 1.79 | 2.43 |
| Q | 0.32 | 0.58 | 1.31 | 1.69 | 2.28 |
| Z | 0.30 | 0.56 | 1.22 | 1.62 | 2.17 |
| M | 0.30 | 0.55 | 1.12 | 1.54 | 2.07 |
| N | 0.30 | 0.54 | 1.02 | 1.47 | 1.97 |
| P | 0.29 | 0.52 | 0.95 | 1.41 | 1.90 |

## Instant Samples with Time Machine and Field Programmable Oscillators

SiTime supports a field programmable version of the SiT8209 low power oscillator for fast prototyping and real time custom- ization of features. The field programmable devices (FP devices) are available for all five standard SiT8209 package sizes and can be configured to one's exact specification using the Time Machine II, an USB powered MEMS oscillator programmer.

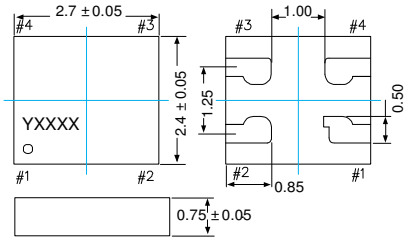
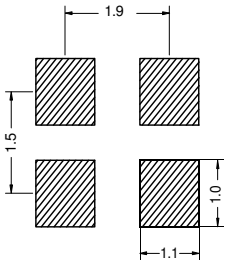
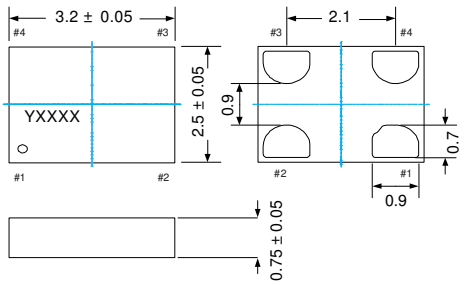
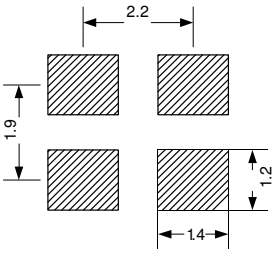
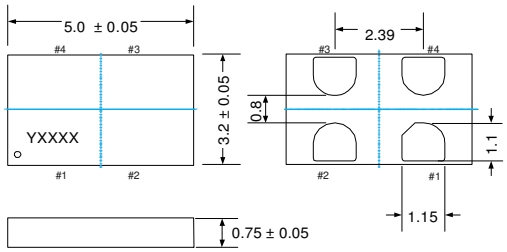
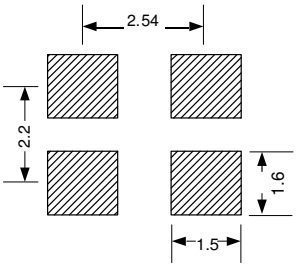
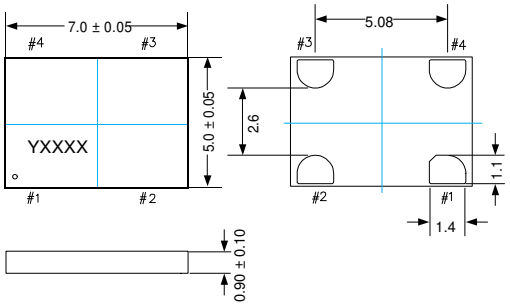
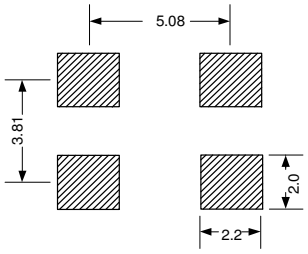
**Customizable Features of the SiT8209 FP Devices Include**

- Any frequency between 1 – 110 MHz
- Three frequency stability options, ±20 PPM, ±25 PPM, ±50 PPM
- Two operating temperatures, -20 to 70°C or -40 to 85°C
- Five supply voltage options, 1.8V, 2.5V, 2.8V, 3.0V, and 3.3V
- Output drive strength

For more information regarding SiTime's field programmable solutions, visit http://www.sitime.com/time-machine and http://www.sitime.com/fp-devices.

SiT8209 is typically factory-programmed per customer ordering codes for volume delivery.

## Dimensions and Patterns

| Package Size – Dimensions (Unit: mm)[9] | Recommended Land Pattern (Unit: mm)[10] |
|---|---|
| **2.7 x 2.4 x 0.75 mm (100% compatible with 2.5 x 2. 0 mm footprint)** | |
|  |  |
| **3.2 x 2.5 x 0.75 mm** | |
|  |  |
| **5.0 x 3.2 x 0.75 mm** | |
|  |  |
| **7.0 x 5.0 x 0.90 mm** | |
|  |  |

**Notes:**

9. 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.
10. A capacitor of value 0.1 µF between Vdd and GND is required.

## Ordering Information

**The Part No. Guide is for reference only. To customize and build an exact part number, use the SiTime Part Number Generator.**

SiT8209AC-23-25E-156.123456 T

**Part Family**
"SiT8209"

**Revision Letter**
"A" is the silicon revision

**Temperature Range**
"C" Ext. Commercial, -20 to 70ºC
"I" Industrial, -40 to 85ºC

**Output Drive Strength**
"–" Default (datasheet limits)
See Tables 6 to 9 for rise/fall times

| | | | | |
|---|---|---|---|---|
| "L" | "S" | "U" | "X" | "Z" |
| "A" | "D" | "F" | "K" | "M" |
| "R" | "T" | "W" | "Y" | "N" |
| "B" | "E" | "G" | "Q" | "P" |

**Package**
"G" 2.5 x 2.0
"2" 3.2 x 2.5
"3" 5.0 x 3.2
"8" 7.0 x 5.0

**Packaging**
"T": Tape & Reel, 3K reel
"Y": Tape & Reel, 1K reel
Blank for Bulk

**Frequency**
80.000001 to 220.000000 MHz

**Feature Pin**
"E" for Output Enable
"S" for Standby

**Voltage Supply**
"18" for 1.8V ±5%
"25" for 2.5V ±10%
"28" for 2.8V ±10%
"33" for 3.3V ±10%

**Frequency Tolerance**
"F" for ±10 PPM
"1" for ±20 PPM
"2" for ±25 PPM
"3" for ±50 PPM

## Table 10. Additional Information

| Document | Description | Download Link |
|---|---|---|
| **Time Machine II** | MEMS oscillator programmer | http://www.sitime.com/support/time-machine-oscillator-programmer |
| **Field Programmable Oscillators** | Devices that can be programmable in the field by Time Machine II | http://www.sitime.com/products/field-programmable-oscillators |
| **Manufacturing Notes** | Tape & Reel dimension, reflow profile and other manufacturing related info | http://www.sitime.com/component/docman/doc_download/243-manufacturing-notes-for-sitime-oscillators |
| **Qualification Reports** | RoHS report, reliability reports, composition reports | http://www.sitime.com/support/quality-and-reliability |
| **Performance Reports** | Additional performance data such as phase noise, current consumption and jitter for selected frequencies | http://www.sitime.com/support/performance-measurement-report |
| **Termination Techniques** | Termination design recommendations | http://www.sitime.com/support/application-notes |
| **Layout Techniques** | Layout recommendations | http://www.sitime.com/support/application-notes |

**SiTime Corporation**, 5451 Patrick Henry Drive, Santa Clara, CA 95054, USA | **Phone:** +1-408-328-4400 | **Fax:** +1-408-328-4439

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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 EpiSeal™ MEMS 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

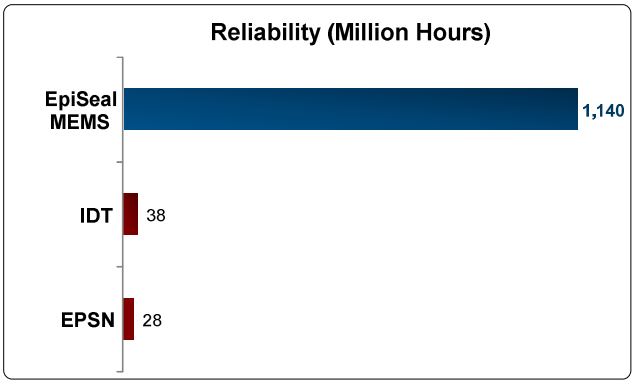


**Figure 1. Reliability Comparison[1]**

## 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 EpiSeal MEMS 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

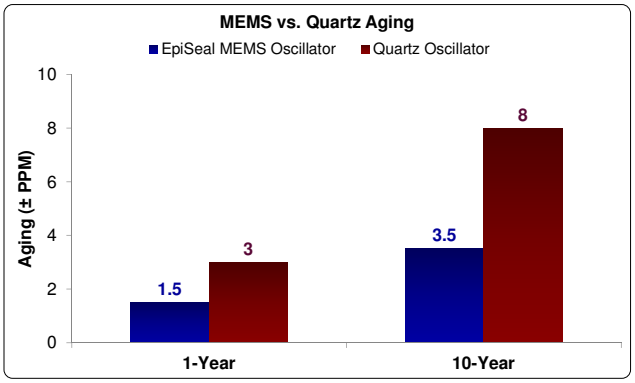


**Figure 2. Aging Comparison[2]**

## 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 EpiSeal MEMS Best in Class:

- Internal differential architecture for best common mode noise rejection
- Electrostatically driven MEMS resonator is more immune to EMS

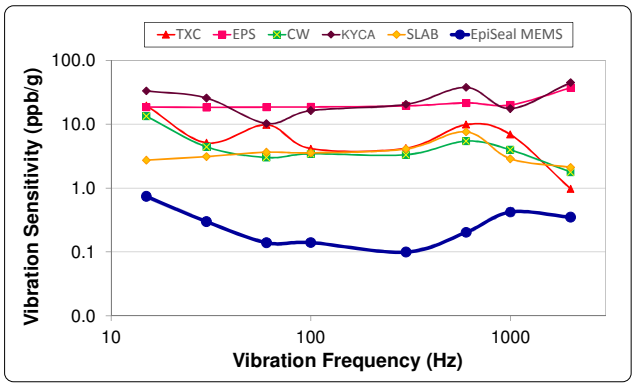


**Figure 3. Electro Magnetic Susceptibility (EMS)[3]**

## 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 EpiSeal MEMS Best in Class:

- On-chip regulators and internal differential architecture for common mode noise rejection
- MEMS resonator is paired with advanced analog CMOS IC

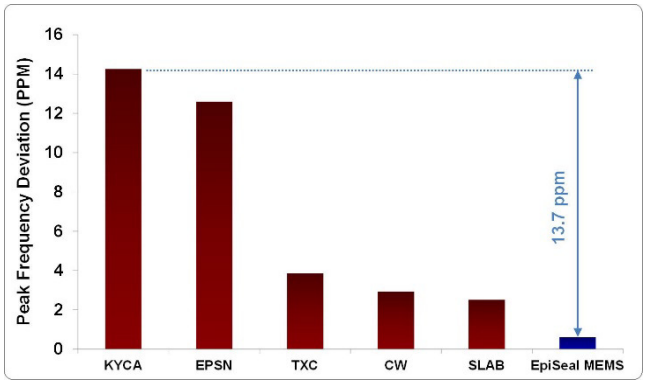


**Figure 4. Power Supply Noise Rejection[4]**

## 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 EpiSeal MEMS 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

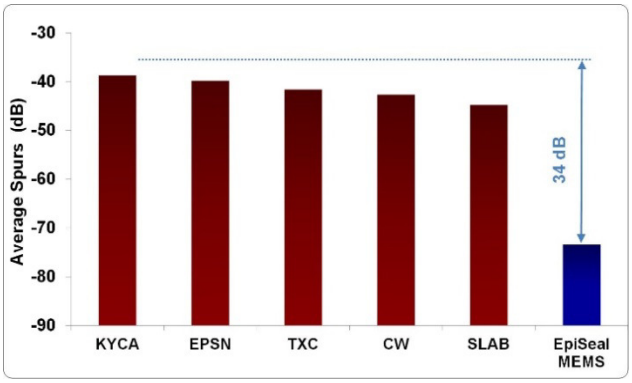


**Figure 5. Vibration Robustness[5]**

**Figure labels:**

- TXC = TXC
- Epson = EPSN
- Connor Winfield = CW
- Kyocera = KYCA
- SiLabs = SLAB
- SiTime = EpiSeal MEMS

## 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 EpiSeal MEMS 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

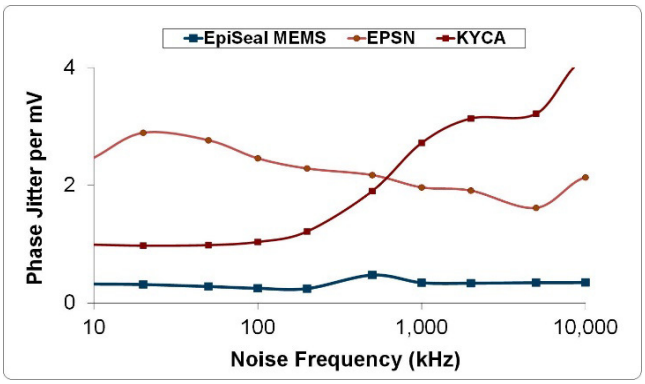


**Figure 6. Shock Robustness[6]**

**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:**

| Label | Manufacturer | Part Number | Technology |
|---|---|---|---|
| EpiSeal MEMS | SiTime | SiT9120AC-1D2-33E156.250000 | MEMS + PLL |
| EPSN | Epson | EG-2102CA156.2500M-PHPAL3 | Quartz, SAW |
| TXC | TXC | BB-156.250MBE-T | Quartz, 3rd Overtone |
| CW | Conner Winfield | P123-156.25M | Quartz, 3rd Overtone |
| KYCA | AVX Kyocera | KC7050T156.250P30E00 | Quartz, SAW |
| SLAB | SiLab | 590AB-BDG | Quartz, 3rd Overtone + PLL |

4. 50 mV pk-pk Sinusoidal voltage.

   **Devices used in this test:**

| Label | Manufacturer | Part Number | Technology |
|---|---|---|---|
| EpiSeal MEMS | SiTime | SiT8208AI-33-33E-25.000000 | MEMS + PLL |
| NDK | NDK | NZ2523SB-25.6M | Quartz |
| KYCA | AVX Kyocera | KC2016B25M0C1GE00 | Quartz |
| EPSN | Epson | SG-310SCF-25M0-MB3 | Quartz |

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 customer.

## Looking for pricing, stock, or lifecycle information?

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- View WM8960CGEFL/RV on WIN SOURCE
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