# CS00069

## Low Power 48MHz Oscillator for Intel Bay Trail Platform

SiTime™
The Smart Timing Choice™

## Features

- Frequency: 48MHz
- Stability: 50 PPM
- Supply voltage: 3.3V
- Operating temperature range: I-temp (-40°C to 85°C)
- LVCMOS/HCMOS compatible output
- Packages: SOT23, 2.5x2.0mmxmm, 5.0x3.2mmxmm, 7.0x5.0mmxmm
- 100% pin-to-pin drop-in replacement to quartz-based XO
- Pb-free, RoHS and REACH compliant

## Applications

- Oscillator for Intel Bay Trail Super IO IC

EXPRESS SAMPLES | GREEN SOLUTIONS | QUARTZ FREE

## Electrical Characteristics[1]

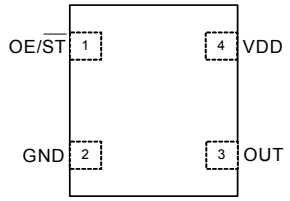
| Parameter and Conditions | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| **Frequency Range** | | | | | | |
| **Output Frequency Range** | f | | 48 | | MHz | |
| **Frequency Stability and Aging** | | | | | | |
| **Frequency Stability** | F_stab | -50 | – | +50 | PPM | Inclusive of Initial tolerance at 25°C, 1st year aging at 25°C, and variations over operating temperature, rated power supply |
| **Operating Temperature Range** | | | | | | |
| **Operating Temperature Range** | T_use | -40 | – | +85 | °C | Extended Commercial |
| **Supply Voltage and Current Consumption** | | | | | | |
| **Supply Voltage** | Vdd | 2.97 | 3.3 | 3.63 | V | |
| **Current Consumption** | Idd | – | 4.3 | 5.0 | mA | No load condition |
| **OE Disable Current** | I_OD | – | – | 4 | mA | OE = GND, output is Weakly Pulled Down |
| **Standby Current** | I_std | – | 2.6 | 4.3 | µA | ST = GND, Output is Weakly Pulled Down |
| **LVCMOS Output Characteristics** | | | | | | |
| **Duty Cycle** | DC | 45 | – | 55 | % | |
| **Rise/Fall Time** | Tr, Tf | – | – | 2 | ns | 20% - 80% |
| **Output High Voltage** | VOH | 90% | – | – | Vdd | IOH = -4 mA |
| **Output Low Voltage** | VOL | – | – | 10% | Vdd | IOL = 4 mA |
| **Input Characteristics** | | | | | | |
| **Input High Voltage** | VIH | 70% | – | – | Vdd | Pin 1, OE or $\overline{ST}$ |
| **Input Low Voltage** | VIL | – | – | 30% | Vdd | Pin 1, OE or $\overline{ST}$ |
| **Input Pull-up Impedence** | Z_in | – | 87 | 100 | kΩ | Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high |
| | | 2 | – | – | MΩ | Pin 1, $\overline{ST}$ logic low |
| **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 | – | – | 130 | ns | |
| **Resume Time** | T_resume | – | – | 5 | ms | Measured from the time ST pin crosses 50% threshold |
| **Jitter** | | | | | | |
| **RMS Period Jitter** | T_jitt | – | 1.76 | 3 | ps | |
| **RMS Phase Jitter (random)** | T_phj | – | 0.5 | 0.9 | ps | Integration bandwidth = 900 kHz to 7.5 MHz |

**Note:**
1. All electrical specifications in the above table are specified with 15 pF output load, 3.3V VDD and 48MHz output frequency unless otherwise stated.

## Pin Description (4-Pin Devices)

| 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] |

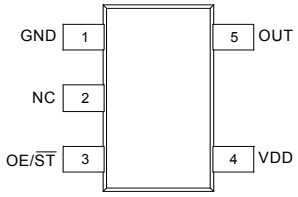
**Top View**




## Pin Description (5-Pin SOT23 Device)

| Pin | Symbol | | Functionality |
|---|---|---|---|
| 1 | GND | Power | Electrical ground[3] |
| 2 | NC | No Connect | No connect |
| 3 | 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[4]: specified frequency output<br>L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to I_std. |
| 4 | VDD | Power | Power supply voltage[3] |
| 5 | OUT | Output | Oscillator output |

**Top View**




**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 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) | θJC, Bottom (°C/W) |
|---|---|---|
| **SOT23** | 420 | 174 |
| **2520** | 117 | 26 |
| **3225** | 109 | 27 |
| **5032** | 97 | 24 |
| **7050** | 191 | 30 |

## 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** |

## Test Circuit and Waveform[4]

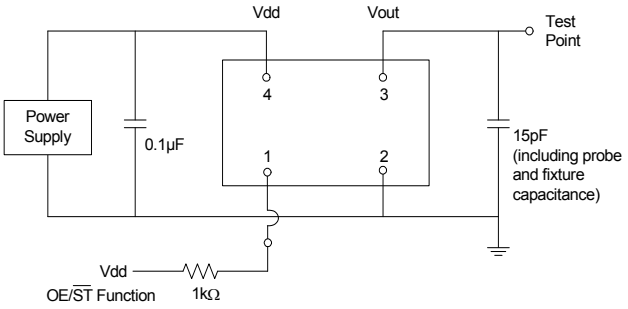



**Figure 1. Test Circuit**

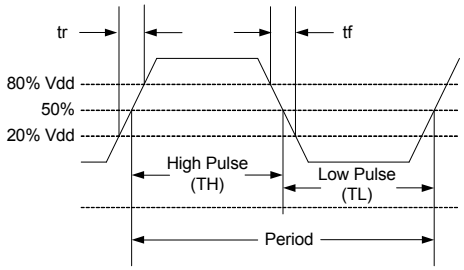



**Figure 2. Waveform**

**Note:**

4. Duty Cycle is computed as Duty Cycle = TH/Period.

## Timing Diagram

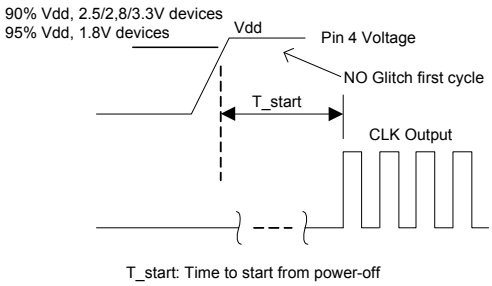



**Figure 3. Startup Timing (OE/$\overline{ST}$ Mode)**

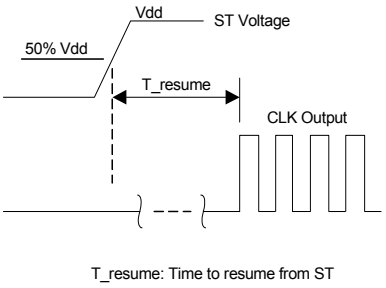



**Figure 4. Standby Resume Timing ($\overline{ST}$ Mode Only)**

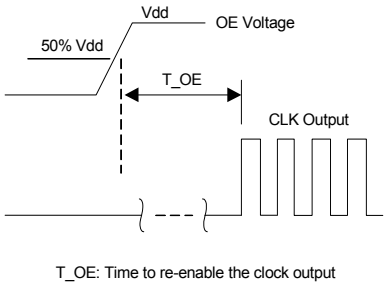



**Figure 5. OE Enable Timing (OE Mode Only)**

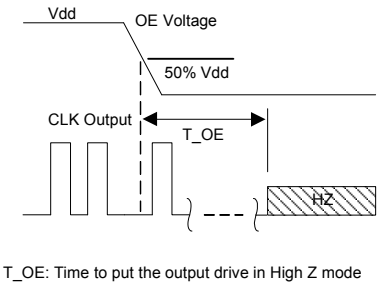
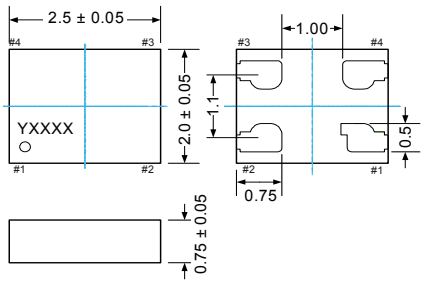
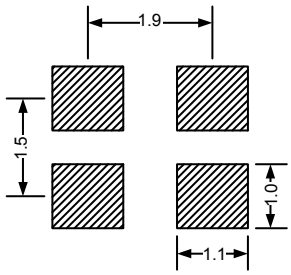
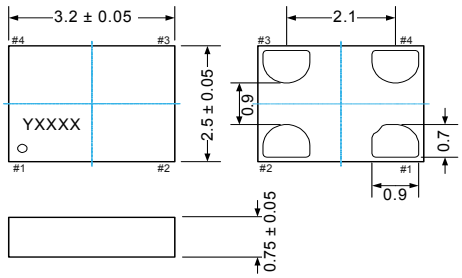
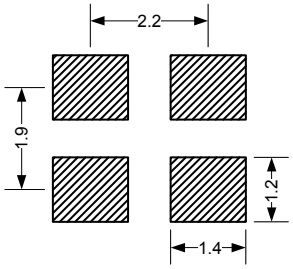
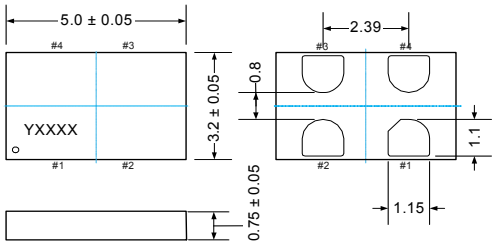
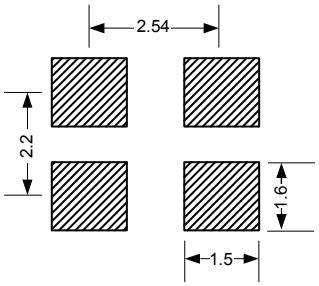
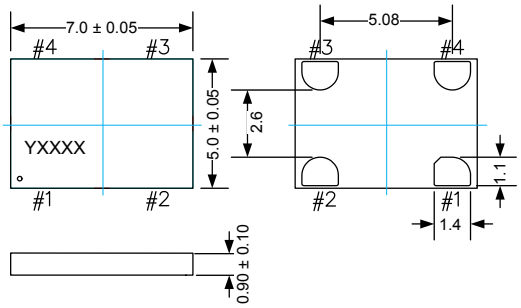
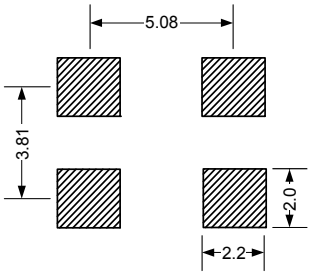



**Figure 5. OE Disable Timing (OE Mode Only)**

**Notes:**

5. SiT1602 supports no runt pulses and no glitches during startup or resume.
6. SiT1602 supports gated output which is accurate within rated frequency stability from the first cycle.

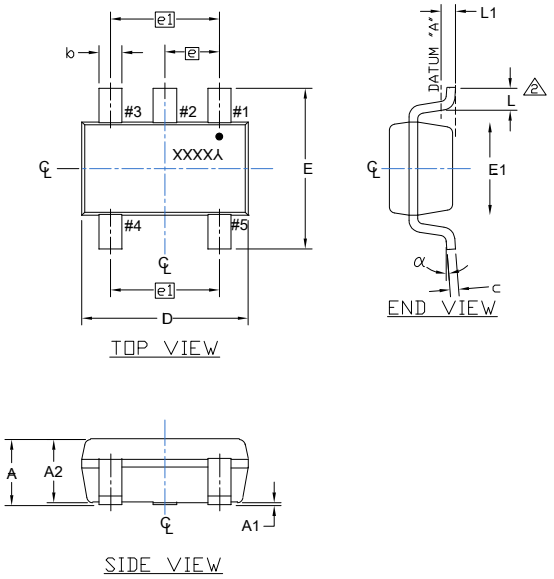
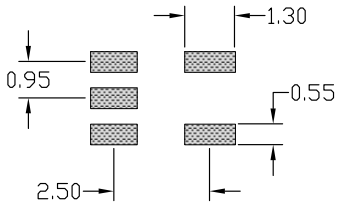
## Dimensions and Patterns

| Package Size – Dimensions (Unit: mm)[7] | Recommended Land Pattern (Unit: mm)[8] |
|---|---|
| **2.5 x 2.0 x 0.75 mm**   |   |
| **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:**

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.

## Dimensions and Patterns

| Package Size – Dimensions (Unit: mm)[9] | Recommended Land Pattern (Unit: mm)[10] |
|---|---|
| **2.9 x 2.8 mm (SOT23)**  |  |



**Notes:**

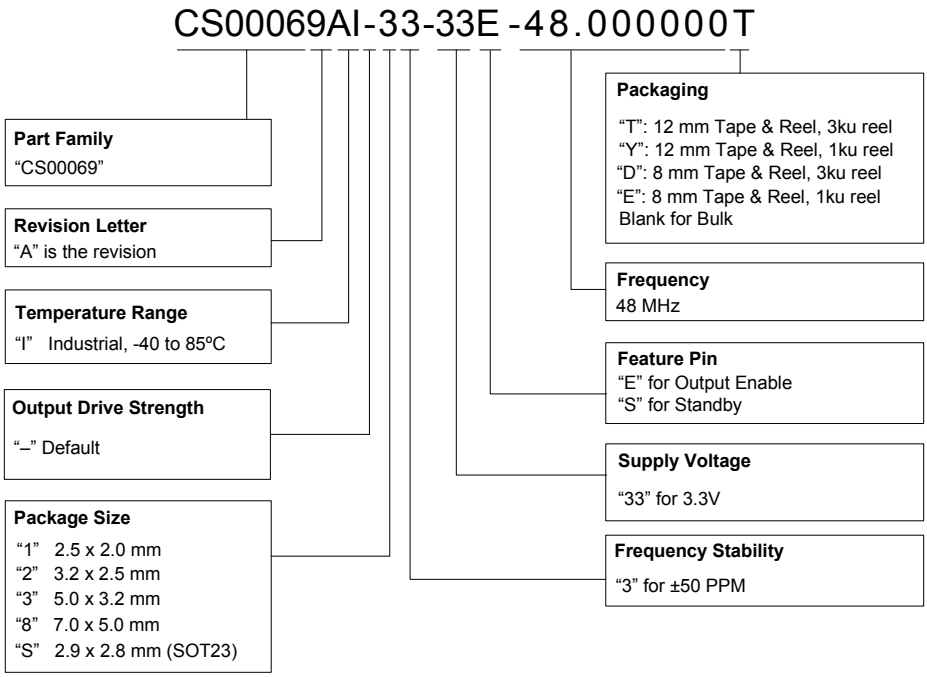
9.Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of "Y" will depend on the assembly location of the device.

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

### Dimension Table (SOT23)

| Symbol | Min. | Nom. | Max. |
|---|---|---|---|
| A | 0.90 | 1.27 | 1.45 |
| A1 | 0.00 | 0.07 | 0.15 |
| A2 | 0.90 | 1.2 | 1.30 |
| b | 0.30 | 0.35 | 0.50 |
| c | 0.14 | 0.153 | 0.20 |
| D | | 2.90 | |
| E | | 2.80 | |
| E1 | | 1.60 | |
| e | | 0.95 | |
| e1 | | 1.90 | |
| L | 0.30 | 0.38 | 0.55 |
| L1 | | 0.25 | |
| a | 0° | – | 8° |

## Ordering Information




## Ordering Codes for Supported Tape & Reel Packing Method[11]

| Device Size | 8 mm T&R (3ku) | 8 mm T&R (1ku) | 12 mm T&R (3ku) | 12 mm T&R (1ku) |
|---|---|---|---|---|
| 2.5 x 2.0 mm | D | E | – | – |
| 3.2 x 2.5 mm | D | E | – | – |
| 5.0 x 3.2 mm | – | – | T | Y |
| 7.0 x 5.0 mm | – | – | – | – |
| 2.9 x 2.8 mm | D | E | – | – |

**Note:**
11. For "–", contact SiTime for availability.

## 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/85-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 |