# Si500S

# SINGLE-ENDED OUTPUT SILICON OSCILLATOR

## Features

- Quartz-free, MEMS-free, and PLL-free all-silicon oscillator
- Any output frequencies from 0.9 to 200 MHz
- Short lead times
- Excellent temperature stability (±20 ppm)
- Highly reliable startup and operation
- High immunity to shock and vibration
- Low jitter: <1.5 ps rms
- 0 to 85 °C operation includes 10-year aging in hot environments
- Footprint compatible with industry-standard 3.2 x 5.0 mm XOs
- CMOS and SSTL versions available
- Driver stopped, tri-state, or powerdown operation
- RoHS compliant
- 1.8, 2.5, or 3.3 V options
- Low power
- More than 10x better fit rate than competing crystal solutions


## Specifications

| Parameters | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Frequency Range | | 0.9 | — | 200 | MHz |
| Frequency Stability | Temperature stability, 0 to +70 °C | — | ±10 | — | ppm |
| | Temperature stability, 0 to +85 °C | — | ±20 | — | ppm |
| | Total stability, 0 to +70 °C operation[1] | — | — | ±150 | ppm |
| | Total stability, 0 to +85 °C operation[2] | — | — | ±250 | ppm |
| Operating Temperature | Commercial | 0 | — | 70 | °C |
| | Extended commercial | 0 | — | 85 | °C |
| Storage Temperature | | –55 | — | +125 | °C |
| Supply Voltage | 1.8 V option | 1.71 | — | 1.98 | V |
| | 2.5 V option | 2.25 | — | 2.75 | V |
| | 3.3 V option | 2.97 | — | 3.63 | V |

**Notes:**

1. Inclusive of 25 °C initial frequency accuracy, operating temperature range, supply voltage change, output load change, first-year aging at 25 °C, shock, vibration, and one solder reflow.
2. Inclusive of 25 °C initial frequency accuracy, operating temperature range, supply voltage change, output load change, ten-year aging at 85 °C, shock, vibration, and one solder reflow.
3. See “AN409: Output Termination Options for the Si500S and Si500D Silicon Oscillators” for further details regarding output clock termination recommendations.
4. $V_{TT}$ = .5 x $V_{DD}$.
5. $V_{TT}$ = .45 x $V_{DD}$.

| Parameters | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Supply Current | 1.8 V option, 40 pF, 40 MHz, CMOS | — | 13.9 | 16 | mA |
| | 1.8 V option, 10 pF, 200 MHz, CMOS | — | 16.7 | 19 | mA |
| | 2.5 V option, 40 pF, 40 MHz, CMOS | — | 15.8 | 18 | mA |
| | 2.5 V option, 10 pF, 200 MHz, CMOS | — | 19.3 | 22 | mA |
| | 3.3 V option, 40 pF, 40 MHz, CMOS | — | 17.7 | 20 | mA |
| | 3.3 V option, 10 pF, 200 MHz, CMOS | — | 21.5 | 24 | mA |
| | SSTL-3.3, 200 MHz | — | 18.1 | 20.2 | mA |
| | SSTL-2.5, 200 MHz | — | 18.0 | 19.7 | mA |
| | SSTL-1.8, 200 MHz | — | 16.8 | 18.7 | mA |
| | Output Stopped, CMOS | — | 11.8 | 13.1 | mA |
| | Tri-State | — | 9.7 | 10.7 | mA |
| | Powerdown | — | 1.0 | 1.9 | mA |
| Output Symmetry | 0.5 x $V_{DD}$ | 46 – 13 ns/$T_{CLK}$ | — | 54 + 13 ns/$T_{CLK}$ | % |
| Rise and Fall Times[3] | CMOS, $C_L$ = 15 pF measured from 20 to 80% of $V_{DD}$ | — | 1.4 | 2.0 | ns |
| | SSTL | — | — | 0.6 | ns |
| CMOS Output Voltage | $V_{OH}$, sourcing 9 mA | $V_{DD}$ – 0.5 | — | — | V |
| | $V_{OL}$, sinking 9 mA | — | — | 0.5 | V |
| SSTL-1.8 Output Voltage[4] | $V_{OH}$ | $V_{TT}$ + 0.375 | — | — | V |
| | $V_{OL}$ | — | — | $V_{TT}$ – 0.375 | |
| SSTL-2.5 Output Voltage[4] | $V_{OH}$ | $V_{TT}$ + 0.48 | — | — | V |
| | $V_{OL}$ | — | — | $V_{TT}$ – 0.48 | |
| SSTL-3.3 Output Voltage[5] | $V_{OH}$ | $V_{TT}$ + 0.48 | — | — | V |
| | $V_{OL}$ | — | — | $V_{TT}$ – 0.48 | |
| Powerup Time | From time $V_{DD}$ crosses min spec supply | — | — | 2 | ms |
| OE Deassertion to Clk Stop | | — | — | 250 + 3 x $T_{CLK}$ | ns |
| Return from Output Driver Stopped Mode | | — | — | 250 + 3 x $T_{CLK}$ | ns |
| Return from Tri-State Time | | — | — | 12 + 3 x $T_{CLK}$ | µs |
| Return from Powerdown Time | | — | — | 2 | ms |
| Period Jitter (1-sigma) | SSTL[3] | — | 1 | 2 | ps RMS |
| Integrated Phase Jitter | 1 MHz – 0.4 x $F_{OUT}$, SSTL or CMOS and $C_L \leq 7$ pF, $F_{OUT} > 2.5$ MHz | — | 0.7 | 1.5 | ps RMS |

**Notes:**

1. Inclusive of 25 °C initial frequency accuracy, operating temperature range, supply voltage change, output load change, first-year aging at 25 °C, shock, vibration, and one solder reflow.
2. Inclusive of 25 °C initial frequency accuracy, operating temperature range, supply voltage change, output load change, ten-year aging at 85 °C, shock, vibration, and one solder reflow.
3. See “AN409: Output Termination Options for the Si500S and Si500D Silicon Oscillators” for further details regarding output clock termination recommendations.
4. $V_{TT}$ = .5 x $V_{DD}$.
5. $V_{TT}$ = .45 x $V_{DD}$.

## Package Specifications

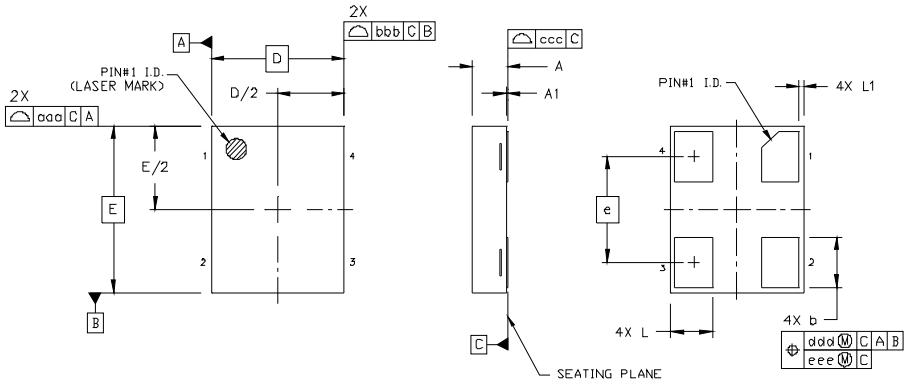



**Table 1. Package Diagram Dimensions (mm)**

| Dimension | Min | Nom | Max |
|---|---|---|---|
| A | 0.80 | 0.85 | 0.90 |
| A1 | 0.00 | 0.03 | 0.05 |
| b | 1.15 | 1.20 | 1.25 |
| D | 3.20 BSC | | |
| e | 2.54 BSC | | |
| E | 4.00 BSC | | |
| L | 0.95 | 1.00 | 1.05 |

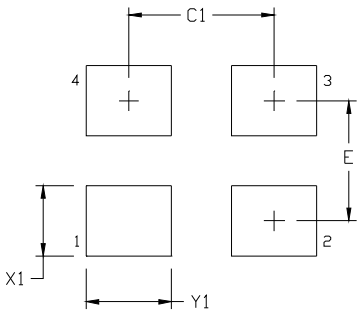
| Dimension | Min | Nom | Max |
|---|---|---|---|
| L1 | 0.00 | 0.05 | 0.10 |
| aaa | | | 0.10 |
| bbb | | | 0.10 |
| ccc | | | 0.08 |
| ddd | | | 0.10 |
| eee | | | 0.05 |

**Table 2. Pad Connections**

| | |
|---|---|
| 1 | OE |
| 2 | GND |
| 3 | Output |
| 4 | VDD |

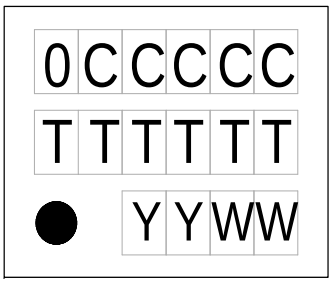
**Table 3. Tri-State/Powerdown/Driver Stopped Function on OE (3rd Option Code)**

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| **Open** | Active | Active | Active | Active | Active | Active |
| **1 Level** | Active | Tri-State | Active | Power-down | Active | Driver Stopped |
| **0 Level** | Tri-State | Active | Power-down | Active | Driver Stopped | Active |




| Dimension | (mm) |
|---|---|
| C1 | 2.90 |
| E | 2.40 |
| X1 | 1.40 |
| Y1 | 1.70 |

**Figure 1. Recommended Land Pattern**




0 = Si500
CCCCC = mark code
TTTTTT = assembly manufacturing code
YY = year
WW = work week

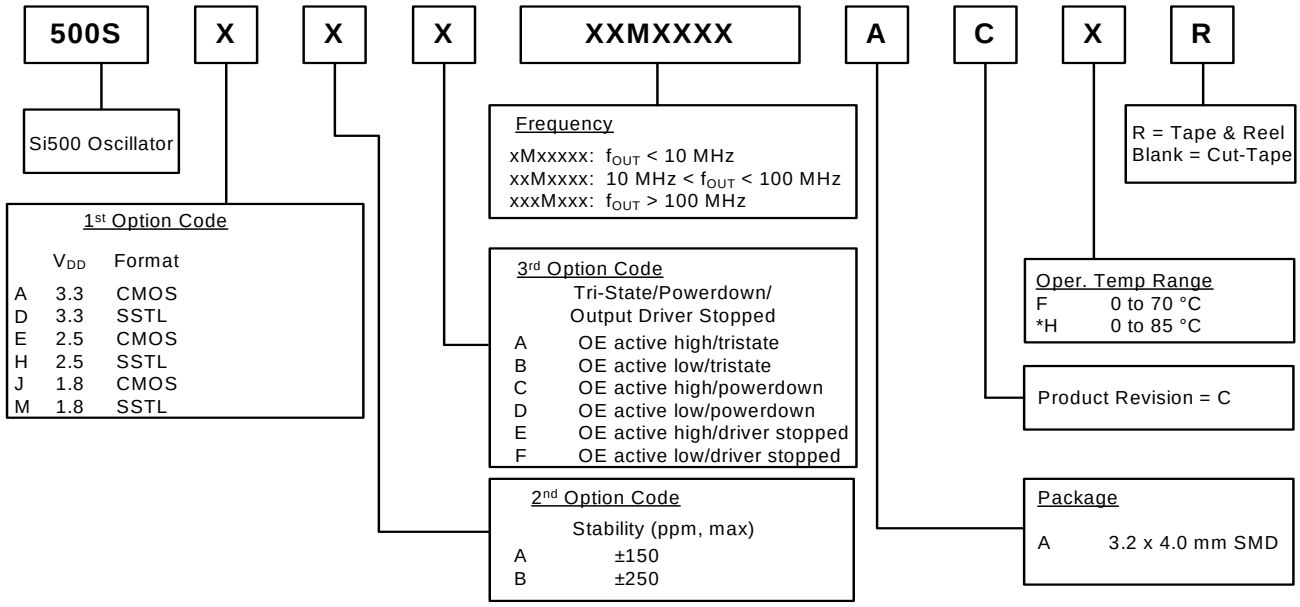
**Figure 2. Top Mark**

## Environmental Compliance

| Parameter | Conditions/Test Method |
|---|---|
| Mechanical Shock | MIL-STD-883, Method 2002.4 |
| Mechanical Vibration | MIL-STD-883, Method 2007.3 A |
| Resistance to Soldering Heat | MIL-STD-202, 260 C° for 8 seconds |
| Solderability | MIL-STD-883, Method 2003.8 |
| Damp Heat | IEC 68-2-3 |
| Moisture Sensitivity Level | J-STD-020, MSL 3 |

## Ordering Information

The Si500S supports a variety of options including frequency, output format, supply voltage, and tri-state/powerdown/output driver stopped mode. Specific device configurations are programmed into the Si500S at time of shipment. Configurations are specified using the figure below. Silicon Labs provides a web-based part number utility that can be used to simplify part number configuration. Refer to www.silabs.com/SiliconXOPartnumber to access this tool. The Si500S silicon oscillator is supplied in a ROHS-compliant, 4-pad, 3.2 x 4.0 mm package. Tape and reel packaging is available as an ordering option.




*Note: Only ±250 ppm is supported.

# Document Change List

## Revision 0.3 to Revision 0.4

- Revision B to Revision C updated in Ordering Information
- 0 to 85 C° Operating Temperature Range option added
- Multiple CMOS output format codes removed

## Revision 0.4 to Revision 1.0

- Clarified SSTL specifications.
- Revised CMOS supply current max values .

## Revision 1.0 to Revision 1.1

- Updated Ordering information for ±250 ppm from 0 to +85 °C.
- Updated jitter from 1.5 ps to 1.5 ps rms.
- Updated operating temperature to include extended commercial at 0 to +85 °C.

## ClockBuilder Pro

One-click access to Timing tools, documentation, software, source code libraries & more. Available for Windows and iOS (CBGo only).

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