

DIFFERENTIAL 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, SSTL, LVPECL, LVDS, and HCSL 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. $V_{TT} = .5 \times V_{DD}$.
5. $V_{TT} = .45 \times V_{DD}$.

Si500D

| Parameters | Condition | Min | Typ | Max | Units |
|---|--|------------------------------|------|------------------------------|----------|
| Supply Current | LVPECL | — | 34.0 | 36.0 | mA |
| | Low Power LVPECL | — | 19.3 | 22.2 | mA |
| | LVDS | — | 14.9 | 16.5 | mA |
| | HCSL | — | 25.3 | 29.3 | mA |
| | Differential CMOS(3.3 V option, 10 pF on each output, 200 MHz) | — | 33 | 36 | mA |
| | Differential CMOS(3.3 V option, 1 pF on each output, 40 MHz) | — | 16 | — | mA |
| | Differential SSTL-3.3 | — | 24.5 | 27.7 | mA |
| | Differential SSTL-2.5 | — | 24.3 | 26.7 | mA |
| | Differential SSTL-1.8 | — | 22.2 | 25 | mA |
| | Tri-State | — | 9.7 | 10.7 | mA |
| Powerdown | — | 1.0 | 1.9 | mA | |
| Output Symmetry | $V_{DIFF} = 0$ | $46 - 13 \text{ ns}/T_{CLK}$ | — | $54 + 13 \text{ ns}/T_{CLK}$ | % |
| Rise and Fall Times (20/80%) ³ | LVPECL/LVDS | — | — | 460 | ps |
| | HCSL/Differential SSTL | — | — | 800 | ps |
| | Differential CMOS, 15 pF, ≥ 80 MHz | — | 1.1 | 1.6 | ns |
| LVPECL Output Option (DC coupling, 50 Ω to $V_{DD} - 2.0$ V) ³ | Mid-level | $V_{DD} - 1.5$ | — | $V_{DD} - 1.34$ | V |
| | Diff swing | .720 | — | .880 | V_{PK} |
| Low Power LVPECL Output Option (AC coupling, 100 Ω Differential Load) ³ | Mid-level | — | N/A | — | V |
| | Diff swing | .68 | — | .95 | V_{PK} |
| LVDS Output Option (2.5/3.3 V) ($R_{TERM} = 100 \Omega$ diff) ³ | Mid-level | 1.15 | — | 1.26 | V |
| | Diff swing | 0.25 | — | 0.45 | V_{PK} |
| LVDS Output Option (1.8 V) ($R_{TERM} = 100 \Omega$ diff) ³ | Mid-level | 0.85 | — | 0.96 | V |
| | Diff swing | 0.25 | — | 0.45 | V_{PK} |
| HCSL Output Option ³ | Mid-level | 0.35 | — | 0.425 | V |
| | Diff swing | 0.65 | — | 0.82 | V_{PK} |
| | DC termination per pad | 45 | — | 55 | Ω |
| CMOS Output Voltage ³ | V_{OH} , sourcing 9 mA | $V_{DD} - 0.6$ | — | — | V |
| | V_{OL} , sinking 9 mA | — | — | 0.6 | V |
| SSTL-1.8 Output Voltage ⁴ | V_{OH} | $V_{TT} + 0.375$ | — | — | V |
| | V_{OL} | — | — | $V_{TT} - 0.375$ | V |
| SSTL-2.5 Output Voltage ⁴ | V_{OH} | $V_{TT} + 0.48$ | — | — | V |
| | V_{OL} | — | — | $V_{TT} - 0.48$ | V |
| SSTL-3.3 Output Voltage ⁵ | V_{OH} | $V_{TT} + 0.48$ | — | — | V |
| | V_{OL} | — | — | $V_{TT} - 0.48$ | V |
| Powerup Time | From time V_{DD} crosses min spec supply | — | — | 2 | ms |
| OE Deassertion to Clk Stop | | — | — | $250 + 3 \times T_{CLK}$ | ns |
| Return from Output Driver Stopped Mode | | — | — | $250 + 3 \times T_{CLK}$ | ns |
| Return From Tri-State Time | | — | — | $12 + 3 \times T_{CLK}$ | μ s |

Notes:

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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. $V_{TT} = .5 \times V_{DD}$.
5. $V_{TT} = .45 \times V_{DD}$.

| Parameters | Condition | Min | Typ | Max | Units |
|----------------------------|---|-----|-----|-----|-----------|
| Return From Powerdown Time | | — | — | 2 | ms |
| Period Jitter (1-sigma) | Non-CMOS | — | 1 | 2 | ps RMS |
| | CMOS, $C_L = 7$ pF | — | 1 | 3 | ps RMS |
| Integrated Phase Jitter | 1.0 MHz – min(20 MHz, 0.4 x F_{OUT}), non-CMOS | — | 0.6 | 1 | ps RMS |
| | 1.0 MHz – min(20 MHz, 0.4 x F_{OUT}), CMOS format | — | 0.7 | 1.5 | ps RMS |

Notes:

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Si500D

Package Specifications

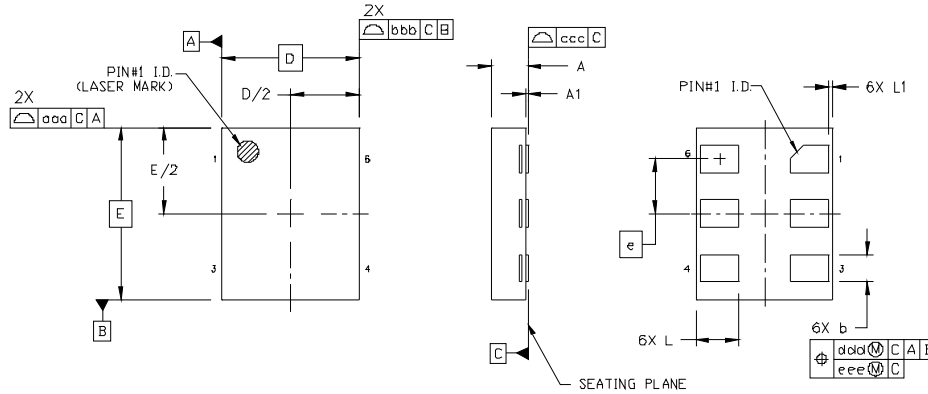


Table 1. Package Diagram Dimensions (mm)

| Dimension | Min | Nom | Max |
|-----------|-----------|------|------|
| A | 0.80 | 0.85 | 0.90 |
| A1 | 0.00 | 0.03 | 0.05 |
| b | 0.59 | 0.64 | 0.69 |
| D | 3.20 BSC. | | |
| e | 1.27 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 | NC—Make no external connection to this pin |
| 3 | GND |
| 4 | Output |
| 5 | Complementary Output |
| 6 | 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 |

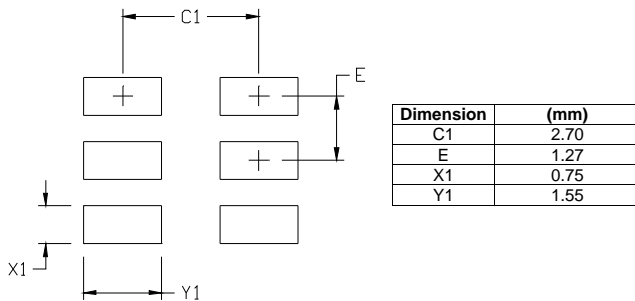
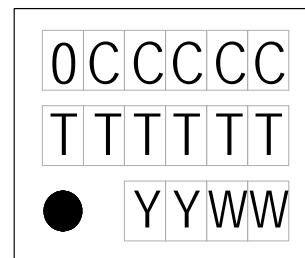


Figure 1. Recommended Land Pattern



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

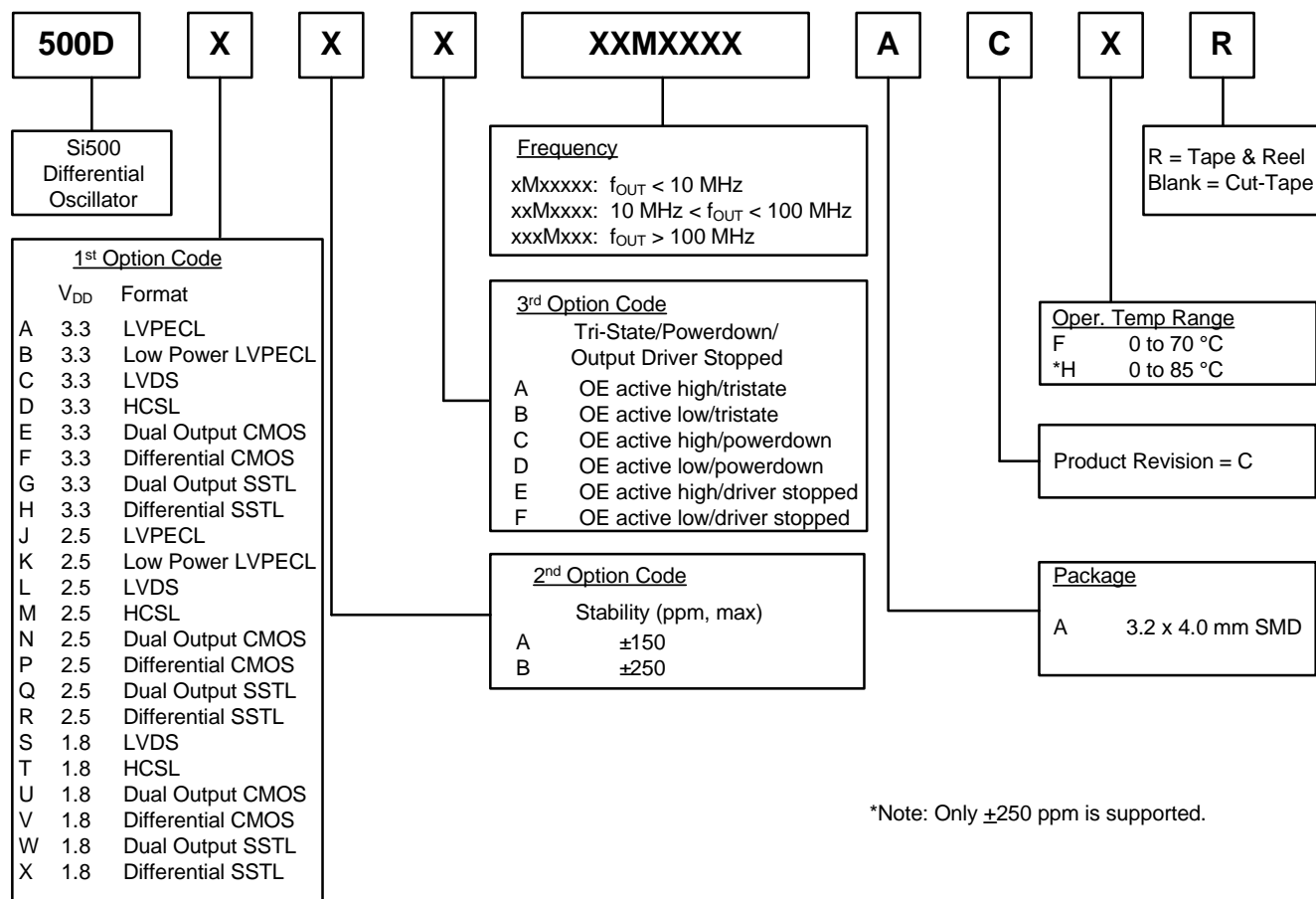
Figure 2. Top Mark

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 Si500D supports a variety of options including frequency, output format, supply voltage, and tri-state/powerdown. Specific device configurations are programmed into the Si500D 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 Si500D XO series is supplied in a ROHS-compliant, Pb-free, 6-pad, 3.2 x 4.0 mm package. Tape and reel packaging is available as an ordering option.



DOCUMENT CHANGE LIST

Revision 0.2 to Revision 0.3

- Revision B to Revision C updated in Ordering Information
- 0 to 85 °C Operating Temperature Range option added

Revision 0.3 to Revision 1.0

- Clarified SSTL specifications.
- Revised Differential CMOS supply current values.
- Clarified Differential CMOS supply current loading conditions.

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.
- Updated features to include LVPECL, LVDS, and HCSL.



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