

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

| 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} | — | — | $V_{TT} - 0.375$ | |
| 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 | | — | — | $250 + 3 \times T_{CLK}$ | 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:

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

| 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:

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

Package Specifications

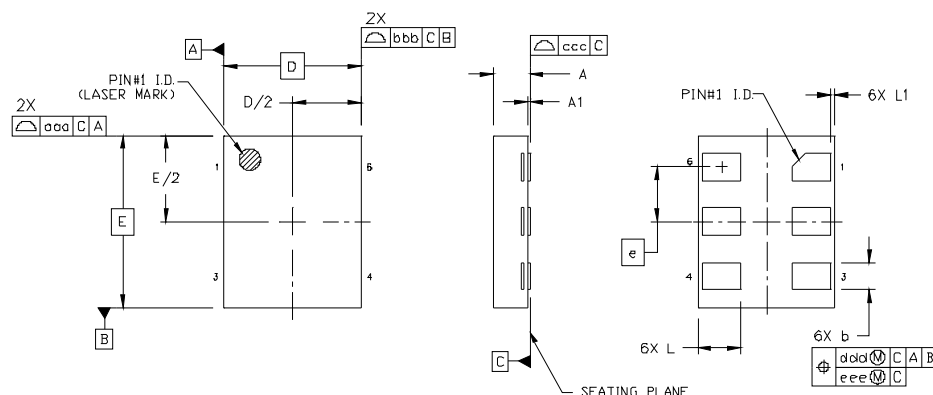


Table 1. Package Diagram Dimensions (mm)

| 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 |

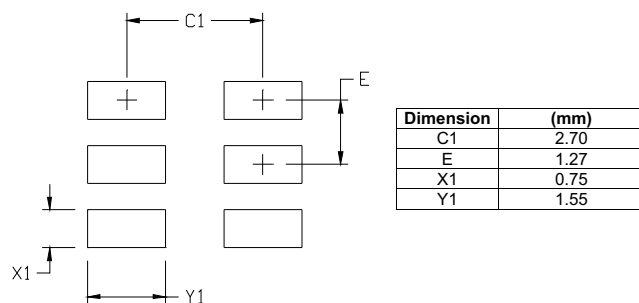
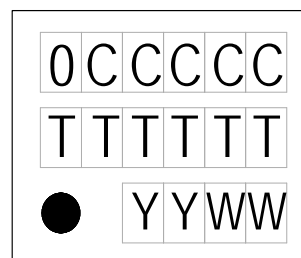


Figure 1. Recommended Land Pattern



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

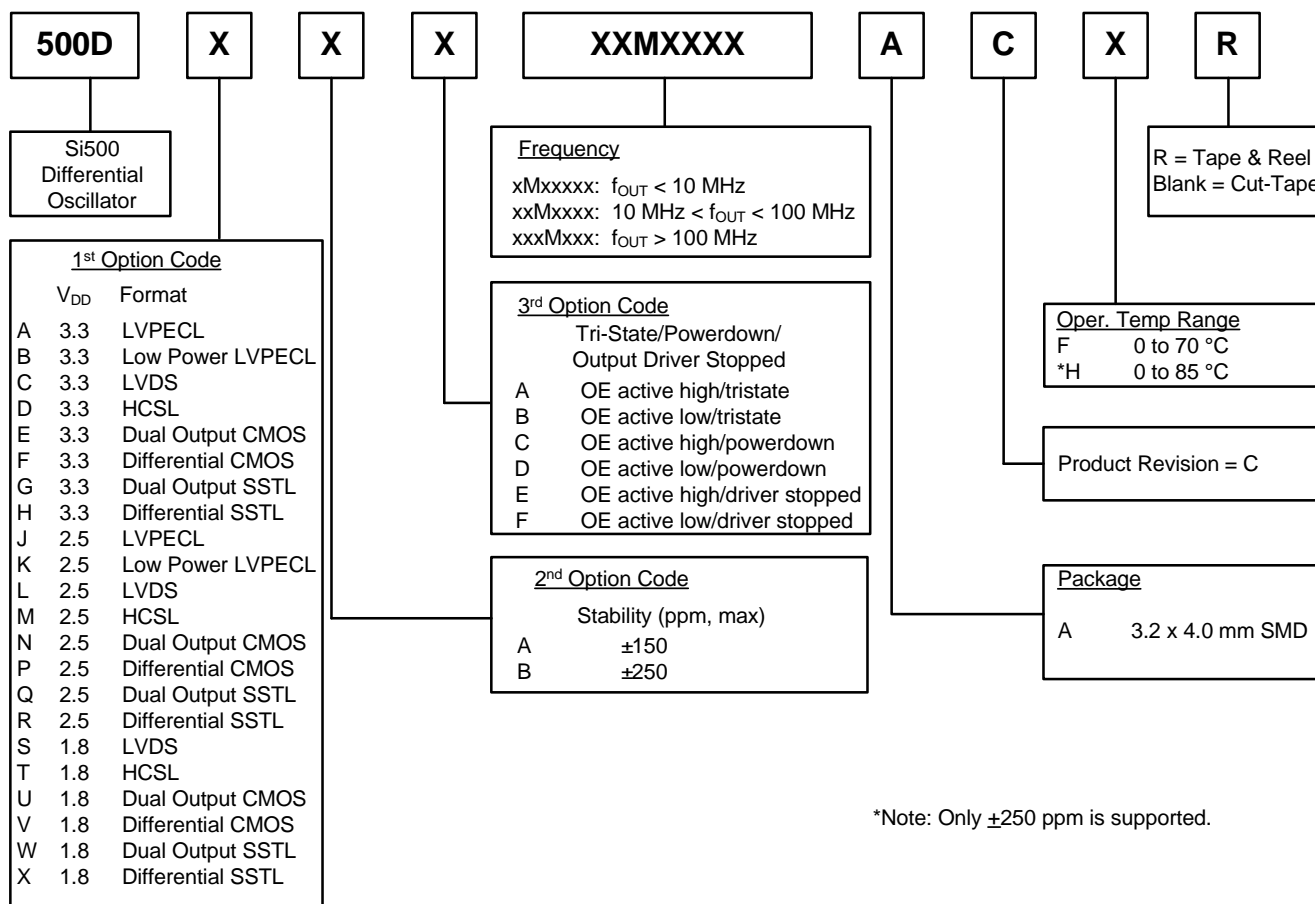
Figure 2. Top Mark

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.

NOTES:

CONTACT INFORMATION

Silicon Laboratories Inc.

400 West Cesar Chavez
Austin, TX 78701
Tel: 1+(512) 416-8500
Fax: 1+(512) 416-9669
Toll Free: 1+(877) 444-3032

Please visit the [Silicon Labs Technical Support](#) web page and register to submit a technical support request.

The information in this document is believed to be accurate in all respects at the time of publication but is subject to change without notice. Silicon Laboratories assumes no responsibility for errors and omissions, and disclaims responsibility for any consequences resulting from the use of information included herein. Additionally, Silicon Laboratories assumes no responsibility for the functioning of undescribed features or parameters. Silicon Laboratories reserves the right to make changes without further notice. Silicon Laboratories makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Silicon Laboratories assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Silicon Laboratories products are not designed, intended, or authorized for use in applications intended to support or sustain life, or for any other application in which the failure of the Silicon Laboratories product could create a situation where personal injury or death may occur. Should Buyer purchase or use Silicon Laboratories products for any such unintended or unauthorized application, Buyer shall indemnify and hold Silicon Laboratories harmless against all claims and damages.

Silicon Laboratories and Silicon Labs are trademarks of Silicon Laboratories Inc.
Other products or brandnames mentioned herein are trademarks or registered trademarks of their respective holders.