

## 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 ( $\pm 20$  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	—	$\pm 10$	—	ppm
	Temperature stability, 0 to +85 °C	—	$\pm 20$	—	ppm
	Total stability, 0 to +70 °C operation <sup>1</sup>	—	—	$\pm 150$	ppm
	Total stability, 0 to +85 °C operation <sup>2</sup>	—	—	$\pm 250$	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.  $V_{TT} = .45 \times V_{DD}$ .

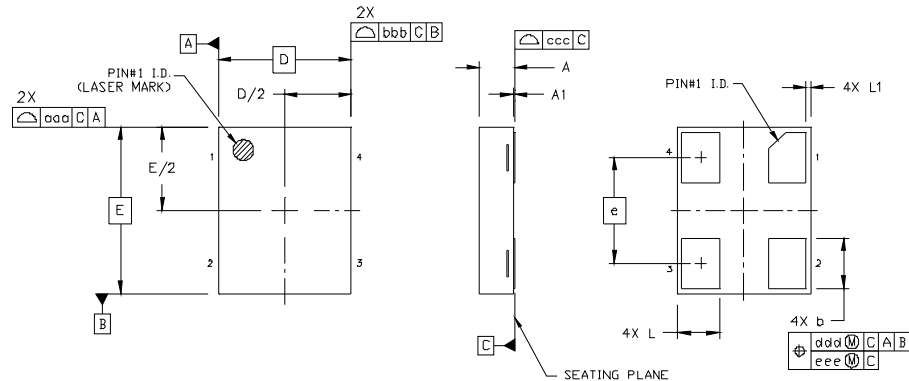
# Si500S

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	$0.5 \times V_{DD}$	$46 - 13 \text{ ns}/T_{CLK}$	—	$54 + 13 \text{ ns}/T_{CLK}$	%
Rise and Fall Times <sup>3</sup>	CMOS, $C_L = 15 \text{ pF}$ 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 <sup>4</sup>	$V_{OH}$	$V_{TT} + 0.375$	—	—	V
	$V_{OL}$	—	—	$V_{TT} - 0.375$	V
SSTL-2.5 Output Voltage <sup>4</sup>	$V_{OH}$	$V_{TT} + 0.48$	—	—	V
	$V_{OL}$	—	—	$V_{TT} - 0.48$	V
SSTL-3.3 Output Voltage <sup>5</sup>	$V_{OH}$	$V_{TT} + 0.48$	—	—	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		—	—	$12 + 3 \times T_{CLK}$	$\mu\text{s}$
Return from Powerdown Time		—	—	2	ms
Period Jitter (1-sigma)	SSTL <sup>3</sup>	—	1	2	ps RMS
Integrated Phase Jitter	1 MHz – $0.4 \times F_{OUT}$ , SSTL or CMOS and $C_L \leq 7 \text{ pF}$ , $F_{OUT} > 2.5 \text{ MHz}$	—	0.7	1.5	ps RMS

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

## 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

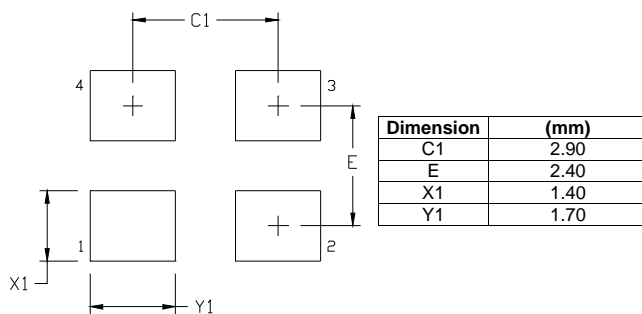
Dimension	Min	Nom	Max
L1	0.00	0.05	0.10
aaa			0.10
bbb			0.10
ccc			0.08
ddd			0.10
eee			0.05

**Table 2. Pad Connections**

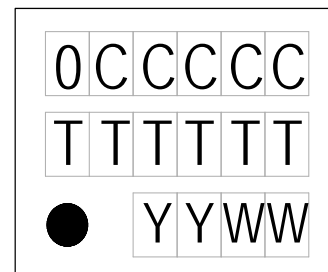
1	OE
2	GND
3	Output
4	VDD

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

	A	B	C	D	E	F
<b>Open</b>	Active	Active	Active	Active	Active	Active
<b>1 Level</b>	Active	Tri-State	Active	Power-down	Active	Driver Stopped
<b>0 Level</b>	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**

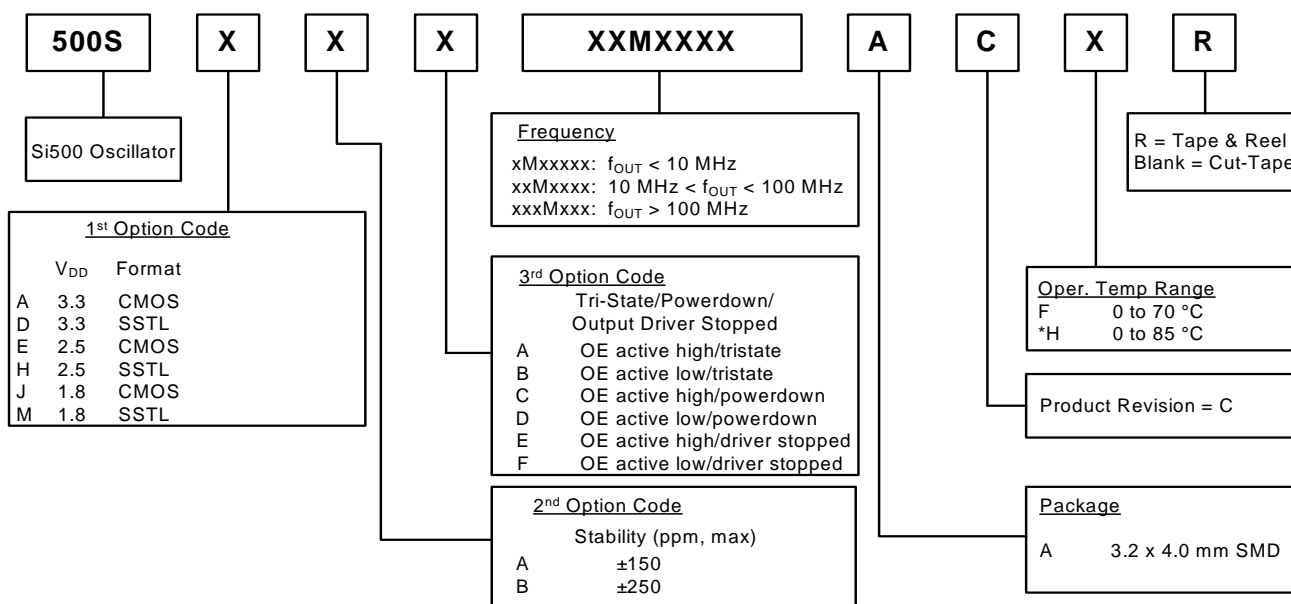
# Si500S

## 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](http://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  $\pm 250$  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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