Features

- 27 standard frequencies between 10 MHz and 40 MHz
- 100% pin-to-pin drop-in replacement to quartz-based (VC)TCXO
- Frequency stability as low as ±1.5PPM. Contact SiTime for ±0.5 PPM and ±1 PPM options
- Low phase jitter: 0.5 ps (12 kHz to 20 MHz)
- LVCMOS compatible output with SoftEdge™ option for EMI reduction
- Voltage control, standby, output enable or no connect modes
- Standard 4-pin packages: 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 mm
- Outstanding silicon reliability of 2 FIT, 10 times better than quartz
- Pb-free, RoHs and REACH compliant

Applications

- WiFi, 3G, LTE, SDI, Ethernet, SONET, DSL
- Telecom, networking, smart meter, wireless, test instrumentation

EXPRESS SAMPLES   GREEN SOLUTIONS   QUARTZ FREE

Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	Refer to the frequency list (*page 6*)			MHz	27 standard frequencies between 10MHz and 40MHz
Initial Tolerance	F_init	-1	–	1	PPM	At 25°C
Stability Over Temperature	F_stab	-1.5	–	+1.5	PPM	Over operating temperature range at rated nominal power supply voltage and load. (*see ordering codes on page 6*)
		-2	–	+2	PPM	
		-2.5	–	+2.5	PPM	±1.5PPM is available in -20 to 70 °C temp. range only. **Contact SiTime for ±0.5 PPM and ±1 PPM options.**
		-5	–	+5	PPM	
Supply Voltage	F_vdd	–	50	–	PPB	±10% Vdd (±5% for Vdd = 1.8V)
Output Load	F_load	–	0.1	–	PPM	15 pF ±10% of load
First year Aging	F_aging	-1.5	–	+1.5	PPM	25°C
10-year Aging		-3.5	–	+3.5	PPM	25°C
Stability vs. Temperature Slope	F_slope	–	0.1	–	PPM/°C	
Operating Temperature Range	T_use	-20	–	+70	°C	Extended Commercial
		-40	–	+85	°C	Industrial
Supply Voltage	Vdd	1.71	1.8	1.89	V	Contact SiTime for any other supply voltage options.
		2.25	2.5	2.75	V	
		2.52	2.8	3.08	V	
		2.70	3.0	3.3	V	
		2.97	3.3	3.63	V	
Pull Range	PR		±12.5		PPM	
Upper Control Voltage	VC_U	Vdd-0.1	–	–	V	All Vdds. Voltage at which maximum deviation is guaranteed.
Control Voltage Range	VC_L	–	–	0.1	V	
Control Voltage Input Impedance	Z_vc	100	–	–	kΩ	
Frequency Change Polarity	–		Positive slope		–	
Control Voltage -3dB Bandwidth	V_BW	–	–	8	kHz	
Current Consumption	Idd	–	31	33	mA	No load condition, f = 20 MHz, Vdd = 2.5V, 2.8V or 3.3V.
		–	29	31	mA	No load condition, f = 20 MHz, Vdd = 1.8V.
OE Disable Current	I_OD	–	–	31	mA	Vdd = 2.5V, 2.8V or 3.3V, OE = GND, output is Weakly Pulled Down
		–	–	30	mA	Vdd = 1.8 V. OE = GND, output is Weakly Pulled Down
Standby Current	I_std	–	–	70	µA	Vdd = 2.5V, 2.8V or 3.3V, $\overline{ST}$ = GND, output is Weakly Pulled Down.
		–	–	10	µA	Vdd = 1.8V. $\overline{ST}$ = GND, output is Weakly Pulled Down.
Duty Cycle	DC	45	–	55	%	All Vdds
LVCMOS Rise/Fall Time	Tr, Tf	–	1.5	2	ns	LVCMOS option. Default rise/fall time, All Vdds, 10% - 90% Vdd.
SoftEdge™ Rise/Fall Time		SoftEdge™ Rise/Fall Time Table			ns	SoftEdge™ option. Frequency and supply voltage dependent.
Output Voltage High	VOH	90%	–	–	Vdd	OH = -7 mA, IOL = 7 mA, (Vdd = 3.3V, 3.0V)
Output Voltage Low	VOL	–	–	10%	Vdd	IOH = -4 mA, IOL = 4 mA, (Vdd = 2.8V, 2.5V) IOH = -2 mA, IOL = 2 mA, (Vdd = 1.8V)
Input Voltage High	VIH	70%	–	–	Vdd	Pin 1, OE or $\overline{ST}$
Input Voltage Low	VIL	–	–	30%	Vdd	Pin 1, OE or $\overline{ST}$
Input Pull-up Impedance	Z_in	–	100	250	kΩ	

Electrical Characteristics (continued)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Startup Time	T_start	–	–	10	ms	Measured from the time Vdd reaches its rated minimum value
OE Enable/Disable Time	T_oe	–	–	150	ns	f = 80 MHz. For other frequencies, T_oe = 100 ns + 3 cycles
Resume Time	T_resume	–	6	10	ms	Measured from the time ST pin crosses 50% threshold
RMS Period Jitter	T_jitt	–	1.7	2	ps	f = 10 MHz, Vdd = 2.5V, 2.8V or 3.3V
		–	1.7	2	ps	f = 10 MHz, Vdd = 1.8V
RMS Phase Jitter (random)	T_phj	–	0.5	1	ps	f = 10 MHz, Integration bandwidth = 12 kHz to 20 MHz, All Vdds

Note:
1. All electrical specifications in the above table are measured with 15pF output load, Contact SiTime for higher drive options.

Pin Configuration

Pin	Symbol		Functionality
1	VC/OE/$\overline{ST}$/NC	V control	Voltage control
		Output Enable	H or Open[2]: specified frequency output L: output is high impedance. Only output driver is disabled.
		Standby	H or Open[2]: specified frequency output L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to I_std.
		NC	No connect (input receiver off)
2	GND	Power	Electrical and case ground
3	CLK	Output	Oscillator output
4	VDD	Power	Power supply voltage

Top View
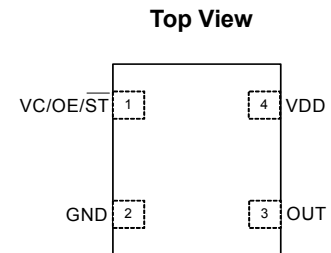
Note:
2. A pull-up resistor of <10 kΩ between OE/ $\overline{ST}$ pin and Vdd is recommended in high noise environment when the device operates in OE/$\overline{ST}$ mode.

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

Thermal Consideration

Package	θJA, 4 Layer Board (°C/W)	θJA, 2 Layer Board (°C/W)	θJC, Bottom (°C/W)
7050	191	263	27
5032	97	199	24
3225	109	212	27
2520	117	222	26

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

Timing Diagram

90% Vdd, 2.5/2,8/3.3V devices
95% Vdd, 1.8V devices

Vdd — Pin 4 Voltage

T_start

CLK Output
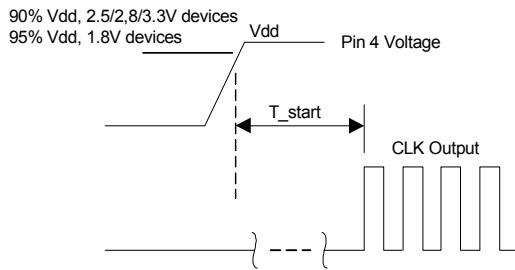
T_start: Time to start from power-off

(ST/OE Mode)

Vdd — ST Voltage

50% Vdd

T_resume

CLK Output
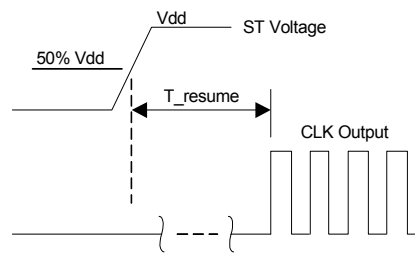
T_resume: Time to resume from ST

(ST Mode Only)

Phase Noise Plot

Phase Noise, 10MHz carrier, 3.3V, LVCMOS output, TCXO

Integrated random phase jitter (RMS, 12kHz-5MHz): 0.52ps

Phase Noise (dBc/Hz) vs Frequency Offset (Hz)
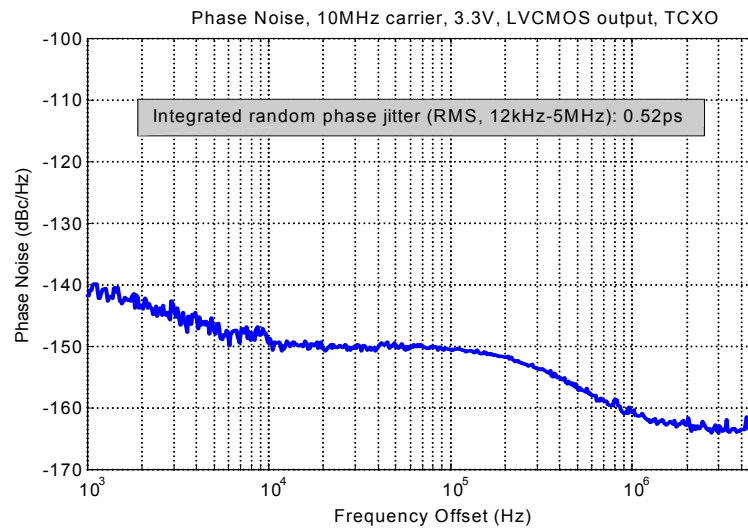
SoftEdge™ Option

The SoftEdge™ output is available as a standard option for the SiT500x family of MEMS (VC)TCXOs. It is typically used for EMI reduction similar to that of the clipped sinewave output common to many quartz based TCXOs.

In the SoftEdge™ mode, the slower rise/fall edges of the output waveform reduce the higher clock harmonics in a digital clock signal, minimizing EMI radiation at these harmonics. The table below show the actual rise/fall time in relation to the desired output frequency and the supply voltage with a 10 kΩ / 10pF load. Rail-to-rail swing of the output is maintained for these supported frequencies.

Rise/Fall Time for SoftEdge™ Option
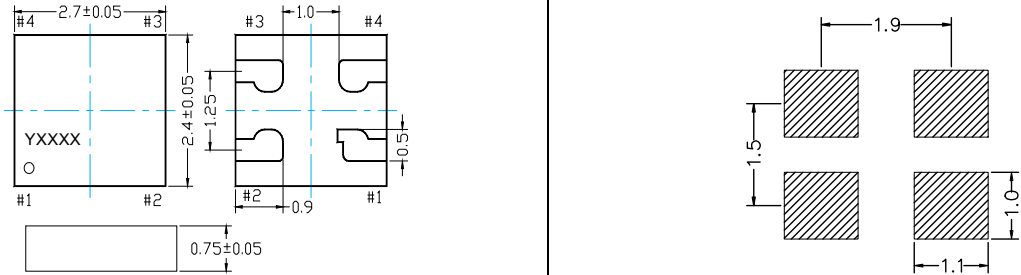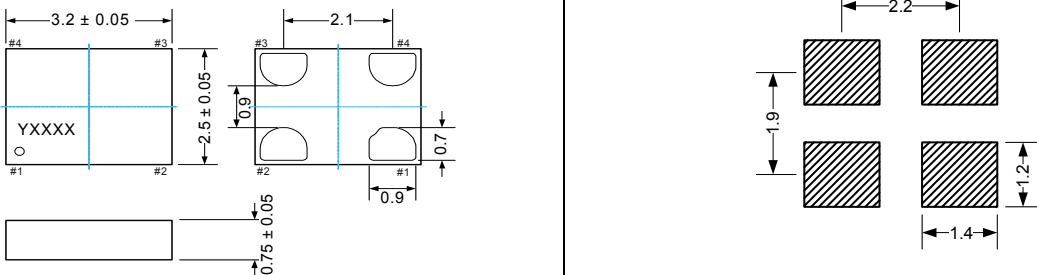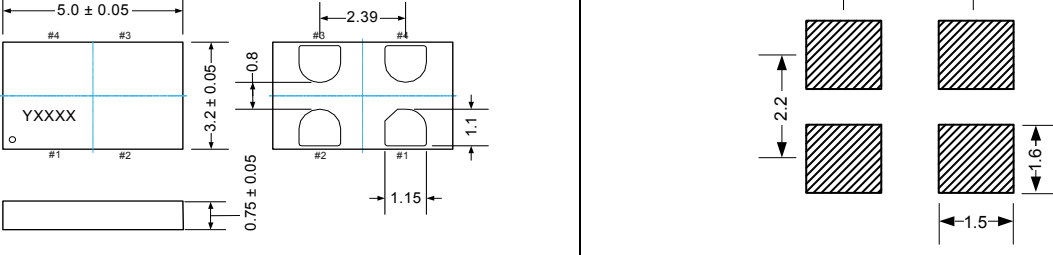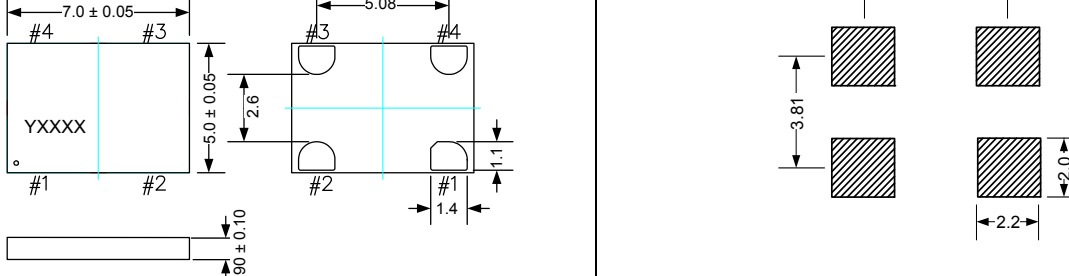
Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Rise/Fall Time	Tr, Tf	4.0	6.5	9.5	ns	1-26MHz, 1.8V, 3.0 and 3.3V, MHz 10k and 10 pF, 20%-80% Vd
		2.5	4.0	6.0	ns	1-26MHz, 2.5V and 2.8V, MHz 10k and 10 pF, 20%-80% Vdd
		1.5	3.5	5.0	ns	26-40MHz, 1.8V, 3.0V and 3.3V, MHz 10k and 10 pF, 20%-80% Vdd
		1.5	2.5	4.5	ns	26-40 MHz, 2.5V and 2.8V, MHz 10k and 10 pF, 20%-80% Vdd

SoftEdge™ Waveform Examples and Corresponding Harmonics Reduction

Figures below illustrate the harmonic power reduction as the rise/fall times are slowed from the standard squarewave output to that of the SoftEdge™ output. In general, the 1.8V device shows the lowest harmonics and provides best EMI performance comparing to devices with higher operating voltages.
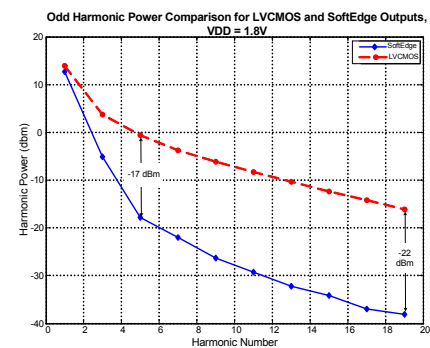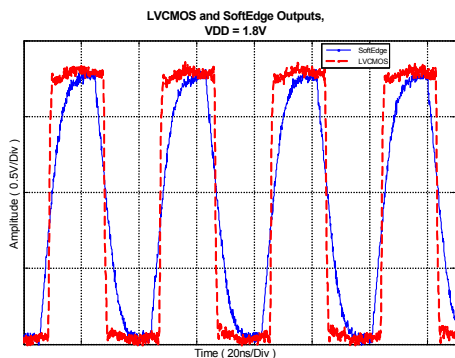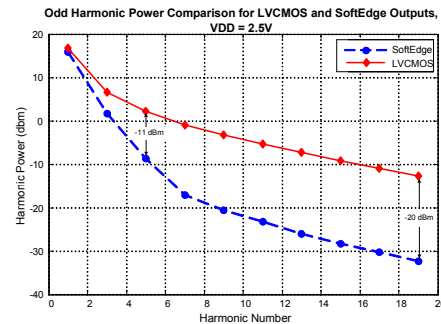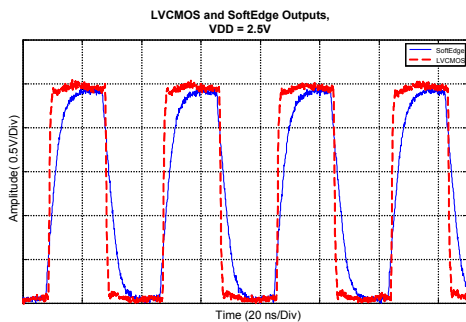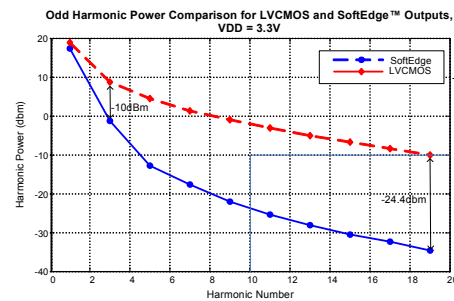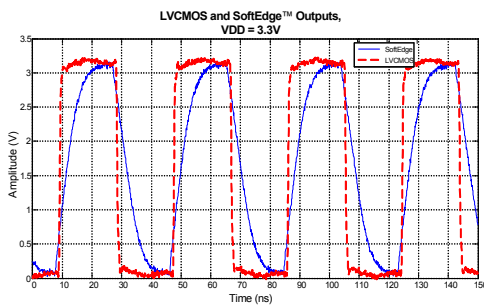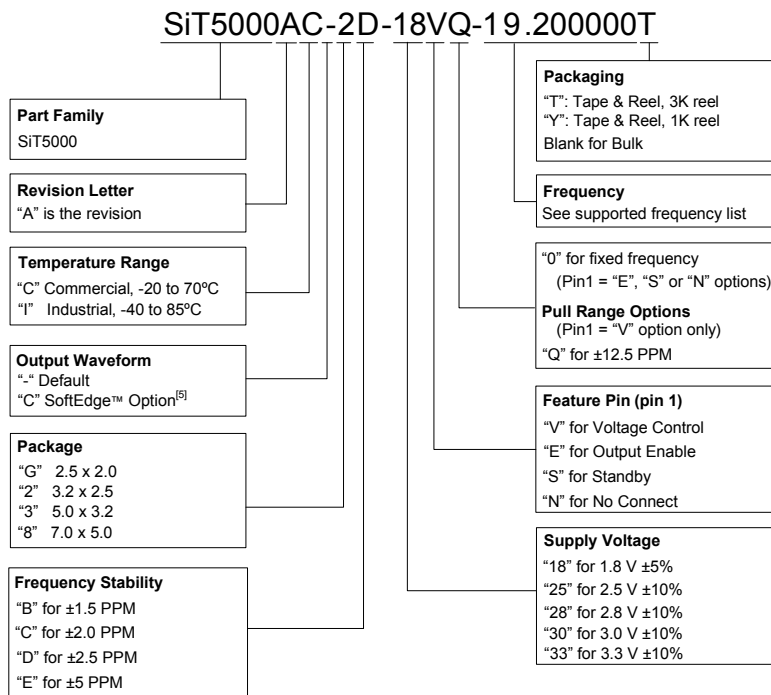
Dimensions and Patterns

Package Size – Dimensions (Unit: mm) [3]	Recommended Land Pattern (Unit: mm) [4]
2.7 x 2.4 x 0.75 mm (100% compatible with 2.5 x 2.0 mm footprint) 	
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:

3. 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.

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

SiT5000
Standard Frequency MEMS (VC)TCXO

The Smart Timing Choice™

Ordering Information

The Part No. Guide is for reference only. To customize and build an exact part number, use the SiTime Part Number Generator.

SiT5000AC-2D-18VQ-19.200000T

Packaging
"T": Tape & Reel, 3K reel
"Y": Tape & Reel, 1K reel
Blank for Bulk

Frequency
See supported frequency list

"0" for fixed frequency
   (Pin1 = "E", "S" or "N" options)
Pull Range Options
   (Pin1 = "V" option only)
"Q" for ±12.5 PPM

Feature Pin (pin 1)
"V" for Voltage Control
"E" for Output Enable
"S" for Standby
"N" for No Connect

Supply Voltage
"18" for 1.8 V ±5%
"25" for 2.5 V ±10%
"28" for 2.8 V ±10%
"30" for 3.0 V ±10%
"33" for 3.3 V ±10%

Part Family
SiT5000

Revision Letter
"A" is the revision

Temperature Range
"C" Commercial, -20 to 70ºC
"I" Industrial, -40 to 85ºC

Output Waveform
"-" Default
"C" SoftEdge™ Option[5]

Package
"G" 2.5 x 2.0
"2" 3.2 x 2.5
"3" 5.0 x 3.2
"8" 7.0 x 5.0

Frequency Stability
"B" for ±1.5 PPM
"C" for ±2.0 PPM
"D" for ±2.5 PPM
"E" for ±5 PPM

Note:
 5. SiTime's SoftEdge™ output waveform with 6 ns rise/fall time reduces EMI and is similar to clipped sine wave in functionality.

Supported Frequencies

10 MHz	12 MHz	12.288 MHz	12.8 MHz	13 MHz	14 MHz	14.4 MHz	14.7456 MHz	16 MHz
16.357 MHz	16.3676 MHz	16.367667 MHz	16.368 MHz	16.369 MHz	16.8 MHz	19.2 MHz	19.44 MHz	19.68 MHz
20 MHz	20.8 MHz	24 MHz	25 MHz	26 MHz	27.456 MHz	33.6 MHz	38.4 MHz	40 MHz

Frequency Stability vs. Temperature Range Options

Frequency Stability (PPM)	Temperature Range	
	C (-20 to +70°C)	I (-40 to +85°C)
±5	✓	✓
±2.5	✓	✓
±2	✓	✓
±1.5	✓	Contact SiTime
±1	Contact SiTime	Contact SiTime
±0.5	Contact SiTime	Contact SiTime

Additional Information

Document	Description	Download Link
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