

SiT1625 AEC-Q100, Low Jitter and Low Power Oscillator

PRELIMINARY



Features

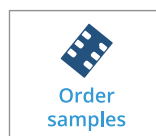
- AEC-Q100 Grade 1 temperature range
- 44 fixed frequencies between 4 MHz and 125 MHz
- Supply voltage of 1.5 V, 1.8 V, 2.5 V and 3.3 V
([Contact SiTime](#) for 1.2 V)
- Low power consumption of 2.5 mA typical at 1.8 V
- LVCMOS compatible output
- 1 μ A standby current
- 450 fs RMS phase jitter
- Industry-standard packages: 2.0 x 1.6, 2.5 x 2.0, 3.2 x 2.5 mm ([Contact SiTime](#) for 1.6 x 1.2 mm)
- RoHS and REACH compliant, Lead-free, Halogen-free and Antimony-free

Applications

- Automotive Camera and Sensors, Smart Mirrors
- Advanced Driver Assistance Systems
- Automotive Infotainment Systems
- In-vehicle networking and SerDes
- Industrial sensors

Related products for [automotive applications](#)

For aerospace and defense applications SiTime recommends using only [Endura™ ruggedized products](#)



Electrical Specifications

Table 1. Electrical Characteristics

All Min and Max limits are specified over temperature for all supply voltages with 15 pF output load unless otherwise stated. Typical values are specified at 25°C and at the nominal value of the highest voltage option for that parameter.

Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition	
Frequency Range							
Fixed Frequency Options	f	5, 10, 20, 25, 31.25, 33.333333, 50, 62.5, 78.125, 100, 125			MHz	SiT1625A	
		4, 4.096, 6, 8, 8.192, 9, 12, 16, 18, 18.432, 19.2, 24, 24.576, 30.72, 32, 32.768, 36, 38.4, 48, 61.44, 64, 72, 76.8, 96, 122.88				SiT1625B	
		7, 13, 21, 27, 39, 63, 91, 117				SiT1625C	
Frequency Stability and Aging							
Frequency Stability	F_stab	-50	–	+50	ppm	Inclusive of Initial tolerance at 25°C, 1st year aging at 25°C, and variations over operating temperature -40°C to 125°C, rated power supply voltage and load (15 pF \pm 10%)	
		-30	–	+30			Supported for -40°C to 105°C
		-25	–	+25			Supported for -40°C to 85°C
Operating Temperature Range							
Operating Temperature Range	T_use	-40	–	+125	°C	AEC-Q100 Grade 1	
		-40	–	+105	°C	AEC-Q100 Grade 2	
		-40	–	+85	°C	AEC-Q100 Grade 3	
Supply Voltage							
Supply Voltage	Vdd_1.5	1.35	1.5	1.65	V	Contact SiTime for 1.2 V and 5 V options (\pm 5%)	
	Vdd_1.8	1.62	1.8	1.98			
	Vdd_2.5	2.25	2.5	2.75			
	Vdd_3.3	2.97	3.3	3.63			
	Vdd_YY	1.62	–	3.63			

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Table 1. Electrical Characteristics (continued)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition
Current Consumption						
Current Consumption	I _{dd}	–	2.5	–	mA	f = 27 MHz, no load, V _{dd} _1.5
		–	2.5	–	mA	f = 27 MHz, no load, V _{dd} _1.8
		–	2.6	–	mA	f = 27 MHz, no load, V _{dd} _2.5
		–	2.7	–	mA	f = 27 MHz, no load, V _{dd} _3.3
		–	2.7	–	mA	f = 27 MHz, no load, V _{dd} _YY, tested at V _{dd} _3.3
Standby Current	I _{std}	–	0.15	–	μA	Up to 125°C, $\overline{ST} = 0$
		–	0.15	–	μA	Up to 105°C, $\overline{ST} = 0$
Mid-Standby Current	I _{midstd}	–	0.33	–	mA	Up to 125°C, $\overline{MS} = 0$
		–	0.33	–	mA	Up to 105°C, $\overline{MS} = 0$
LVC MOS Output Characteristics						
Duty Cycle	DC	45	–	55	%	All V _{dd} levels
Rise/Fall Time	Tr, Tf	–	–	2.3	ns	V _{dd} = 1.62 V – 3.63 V, 20% - 80%, 15 pF Load, f = 27 MHz
		–	–	2.5	ns	V _{dd} = 1.35 V – 1.65 V, 20% - 80%, 15 pF Load, f = 27 MHz
Output High Voltage	VOH	90%	–	–	V _{dd}	IOH = -4 mA (V _{dd} = 3.0 V or 3.3 V) IOH = -3 mA (V _{dd} = 2.8 V and V _{dd} = 2.5 V) IOH = -2 mA (V _{dd} = 1.8 V) IOH = -1.5 mA (V _{dd} = 1.5 V)
Output Low Voltage	VOL	–	–	10%	V _{dd}	IOL = 4 mA (V _{dd} = 3.0 V or 3.3 V) IOL = 3 mA (V _{dd} = 2.8 V and V _{dd} = 2.5 V) IOL = 2 mA (V _{dd} = 1.8 V) IOL = 1.5 mA (V _{dd} = 1.5 V)
Input Characteristics						
Input High Voltage	V _{IH}	70%	–	–	V _{dd}	Pin 1, OE or \overline{ST} or \overline{MS}
Input Low Voltage	V _{IL}	–	–	30%	V _{dd}	Pin 1, OE or \overline{ST} or \overline{MS}
Input Pull-down Impedance	Z _{in}	2	–	–	MΩ	Pin 1, OE or \overline{ST} or \overline{MS} or NC
Startup and Resume Timing						
Startup Time	T _{start}	–	0.7	1	ms	Measured from the time V _{dd} reaches its rated minimum value
Enable/Disable Time	T _{oe}	–	–	210	ns	f = 27 MHz. For other frequencies, T _{oe} = 100 ns + 3*cycles
Resume Time (Standby)	T _{resume}	–	0.7	1	ms	
Resume Time (Mid-Standby)		–	0.1	–	ms	
Jitter and Phase Noise						
RMS Period Jitter^[1]	T _{jitt}	–	1	–	ps	f = 27 MHz, measured based on 10k cycles
RMS Phase Jitter (random)^[2]	T _{phj_fc_2}	–	0.45	–	ps	f = 27 MHz, 12 kHz – 20 MHz integration bandwidth, phase noise measured 12 kHz – 10 MHz and extended flat above 10 MHz
	T _{phj_5}	–	0.33	–	ps	f = 27 MHz, 12 kHz – 5 MHz integration bandwidth, phase noise measured 12 kHz – 5 MHz
	T _{phj_fc48}	–	0.42	–	ps	f = 48 MHz, 12 kHz – 20 MHz integration bandwidth, phase noise measured 12 kHz – 20 MHz
Phase Noise	PN	–	-145	–	dBc/Hz	f = 27 MHz, f _{offset} = 100 kHz
Spurious Phase Noise	T _{spsn}	–	-85	–	dBc	f = 27 MHz, 1.8 V, 12 kHz – 5 MHz offset frequency range
Power Supply-Induced Jitter Sensitivity	PSJS	–	0.4	–	ps/mV	50 mV peak-peak on V _{dd} = 3.3 V

Note:

1. Appropriate when driving digital logic for use in setup and hold time equations.
2. Appropriate when driving phase locked loops in high-speed SerDes applications.

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Table 2. Absolute Maximum Limits

Operation outside the absolute maximum ratings may cause permanent damage to the part.
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
Supply Voltage (Vdd)	-0.5	4	V
Electrostatic Discharge (HBM)	–	2000	V
Electrostatic Discharge (CDM)	–	750	V
Soldering Temperature (follow standard Pb free soldering guidelines) ^[3]	–	260	°C
Junction Temperature ^[4]	–	150	°C

Note:

- Please refer to [SiTime Manufacturing Notes](#).
- Exceeding this temperature for extended period of time may damage the device.

Table 3. Thermal Considerations^[5]

Package	θ_{JA} (°C/W)	θ_{JB} (°C/W)	θ_{JC} (°C/W)	Ψ_{JT} (°C/W)
3225	208	76	134	15.7
2520	187	78	133	16.4
2016	190	75	167	14.9
1612	TBD	TBD	TBD	TBD

Note:

- θ_{JA} , Ψ_{JT} , θ_{JB} and θ_{JC} are provided according to JEDEC standards 51-2A, 51-7, 51-8, and 51-12.01 with a 25°C ambient and 36.3 mW power consumption. The conduction thermal resistances θ_{JB} and θ_{JC} are obtained with the assumption that all heat flows from the junction to a heat sink through either the solder pads (θ_{JB}) or the top of the package (θ_{JC}). The values of θ_{JA} and Ψ_{JT} are strongly application dependent, and we report values based on the JEDEC thermal environment of 2s2p board and still air. θ_{JA} is the thermal resistance to ambient on a JEDEC PCB - it is a conservative estimate, since the JEDEC board does not have vias to PCB planes in the vicinity of the package. Ψ_{JT} can be used to estimate the junction temperature from accurate measurements of the temperature at the top of the package if the thermal environment is similar to the JEDEC environment.

Table 4. Maximum Operating Junction Temperature^[6]

Max Operating Temperature (ambient)	Maximum Operating Junction Temperature
85°C	95°C
105°C	115°C
125°C	135°C

Note:

- Datasheet specifications are not guaranteed if junction temperature exceeds the maximum operating junction temperature.

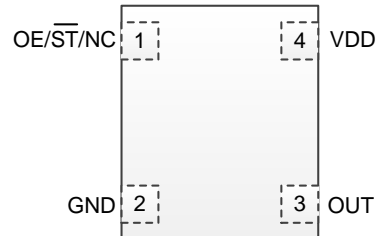
Table 5. Environmental Compliance

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

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Pin Description


Figure 1. Pin Assignments (Top View)
Table 6. Pin Description

Pin	Symbol		Function
1	OE/ \overline{ST} / \overline{MS} / NC	Output Enable (OE)	H ^[7] : specified frequency output L: output is high impedance. Only output driver is disabled
		Standby (\overline{ST})	H ^[7] : specified frequency output L: output is low (weak pull down). Device goes to sleep mode
		Mid-Standby (\overline{MS})	H ^[7] : specified frequency output L: output is low (weak pull down). Device goes to mid-standby mode
		No Connect (NC)	Any voltage between GND and Vdd or Open ^[8] . Specified frequency output. Pin 1 has no function.
2	GND	Power	Electrical ground ^[8]
3	OUT	Output	Oscillator output
4	VDD	Power	Power supply voltage ^[8]

Notes:

- In OE or \overline{MS} or \overline{ST} mode, a pull-up resistor of 10 k Ω or less is recommended if pin 1 is not externally driven. If pin 1 needs to be left floating, use the NC option.
- A capacitor of value 0.1 μ F between VDD and GND is required.

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Test Circuit and Waveform

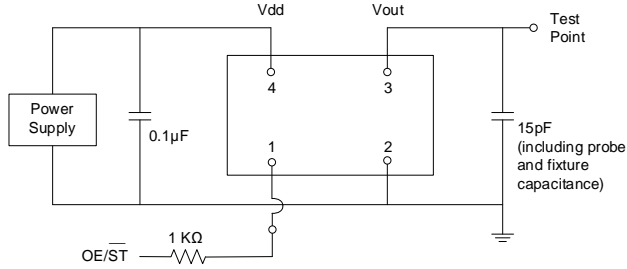


Figure 2. Test Circuit^[9]

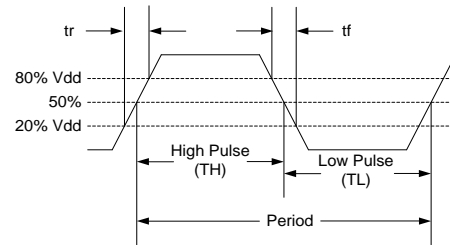


Figure 3. Waveform^[9]

Note:

9. Duty Cycle is computed as $Duty\ Cycle = TH/Period$.

Timing Diagrams

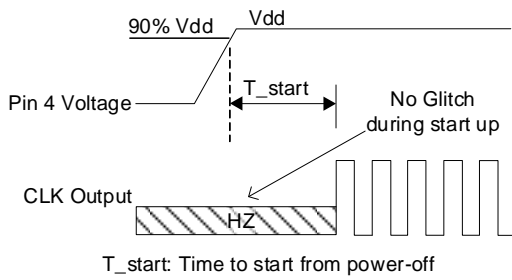


Figure 4. Startup Timing (OE/ST Mode)^[10]

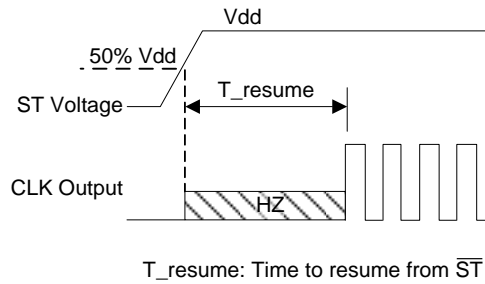


Figure 5. Standby Resume Timing (ST Mode Only)^[10]

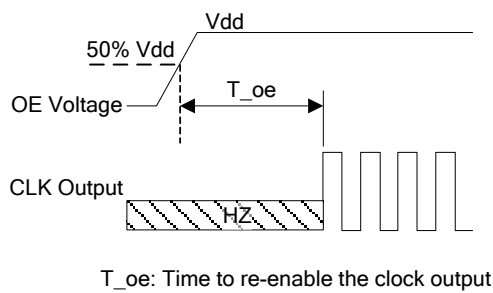


Figure 6. OE Enable Timing (OE Mode Only)

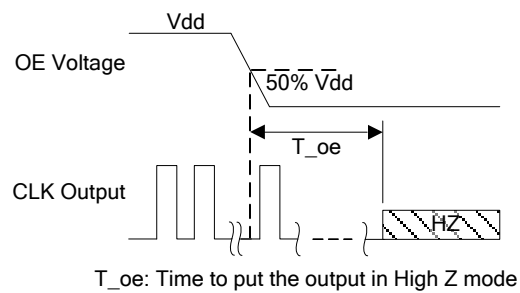


Figure 7. OE Disable Timing (OE Mode Only)

Note:

10. SiT1625 has "no runt" pulses and "no glitch" output during startup or resume.

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Programmable Drive Strength

The SiT1625 includes a programmable drive strength feature to provide a simple, flexible tool to optimize the clock rise/fall time for specific applications. Benefits from the programmable drive strength feature are:

- Improves system radiated electromagnetic interference (EMI) by slowing down the clock rise/fall time.
- Improves the downstream clock receiver's (RX) jitter by decreasing (speeding up) the clock rise/fall time.
- Ability to drive large capacitive loads while maintaining full swing with sharp edge rates.

[Table 1](#) reflects the default drive strength which is optimized for fastest rise/fall times.

For more detailed information about rise/fall time control and drive strength selection, [contact SiTime](#).

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Dimensions and Patterns

Package Size – Dimensions (Unit: mm)^[11]

1.6 x 1.2 x 0.75 mm

	SYMBOL	MIN	NOM	MAX	
TOTAL THICKNESS	A	0.700	0.750	0.800	
STAND OFF LEAD	A1	0.000	0.020	0.050	
THICKNESS	A3	0.203 REF			
BODY SIZE	X	D	1.180	1.230	1.280
	Y	E	1.610	1.660	1.710
LEAD WIDTH	b	0.150	0.200	0.250	
	b1	0.300	0.350	0.400	
LEAD LENGTH	L	0.480	0.580	0.680	
LEAD PITCH PACKAGE	e	0.850 BSC			
TOLERANCE MOLD	aaa	0.150			
FLATNESS	bbb	0.100			
COPLANARITY	ccc	0.080			
LEAD DISTANCE	K	0.50 REF			
NOTE					
1. ALL DIMENSIONS IN MM					
PKG INFO		DRAWING NO.			
4L PQFN 1.230x1.660x0.750 mm		POD-096-PQFN-004-G01216			
DATE		REV			
13-Apr-2023		A00			

Package Size – Dimensions (Unit: mm)^[11]

2.0 x 1.6 x 0.75 mm

	SYMBOL	MIN	NOM	MAX
PACKAGE THICKNESS	A	0.700	0.750	0.800
STAND OFF	A1	0.000	0.020	0.050
BODY SIZE	X	D	1.600	BSC
	Y	E	2.000	BSC
LEAD WIDTH	b	0.430	0.480	0.530
	b1	0.230	0.280	0.330
LEAD LENGTH	L	0.580	0.680	0.780
	L1	0.100 REF		
LEAD PITCH	e	0.930 BSC		
RADIUS	F	0.100 REF		
PACKAGE TOLERANCE	aaa	0.050		
MOLD FLATNESS	bbb	0.100		
COPLANARITY	ccc	0.080		
NOTES				
1. Dimensioning and tolerance conform to ASME Y14.5-2009				
2. All dimensions are in millimeters.				
TITLE		DWG NO.		
4L PQFN		POD-PQFN-004-X01620-026		
1.60x2.00x0.75 mm		REV. SHEET		
DATE		A02		
01-APR-2019		1 OF 2		

Recommended Land Pattern (Unit: mm)^[12]

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Dimensions and Patterns (continued)

Package Size – Dimensions (Unit: mm) ^[11]	Recommended Land Pattern (Unit: mm) ^[12]																																																																
<p>2.5 x 2.0 x 0.75 mm</p> <p>(TOP VIEW) (BOTTOM VIEW) (SIDE VIEW)</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>SYMBOL</th> <th>MIN</th> <th>NOM</th> <th>MAX</th> </tr> </thead> <tbody> <tr> <td>PACKAGE THICKNESS</td> <td>A</td> <td>0.700</td> <td>0.750</td> <td>0.800</td> </tr> <tr> <td>THICKNESS</td> <td>A1</td> <td>0.000</td> <td>0.020</td> <td>0.050</td> </tr> <tr> <td rowspan="2">BODY SIZE</td> <td>X</td> <td colspan="3">D 2.000 BSC</td> </tr> <tr> <td>Y</td> <td colspan="3">E 2.500 BSC</td> </tr> <tr> <td>LEAD WIDTH</td> <td>b</td> <td>0.300</td> <td>0.350</td> <td>0.400</td> </tr> <tr> <td>LEAD LENGTH</td> <td>L</td> <td>0.650</td> <td>0.750</td> <td>0.850</td> </tr> <tr> <td>LEAD PITCH</td> <td>e</td> <td colspan="3">1.250 BSC</td> </tr> <tr> <td>PACKAGE TOLERANCE</td> <td>aaa</td> <td colspan="3">0.050</td> </tr> <tr> <td>MOLD FLATNESS</td> <td>bbb</td> <td colspan="3">0.100</td> </tr> <tr> <td>COPLANARITY</td> <td>ccc</td> <td colspan="3">0.080</td> </tr> </tbody> </table> <p>NOTES 1. Dimensioning and tolerance conform to ASME Y14.5-2009 2. All dimensions are in millimeters.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>TITLE: 4L PQFN DWG NO.: POD-PQFN-004-X02025-010 2.00x2.50x0.75 mm REV.: SHEET DATE: 01-APR-2019 A02 1 OF 2</p> </div> <div style="width: 45%; text-align: center;"> </div> </div>		SYMBOL	MIN	NOM	MAX	PACKAGE THICKNESS	A	0.700	0.750	0.800	THICKNESS	A1	0.000	0.020	0.050	BODY SIZE	X	D 2.000 BSC			Y	E 2.500 BSC			LEAD WIDTH	b	0.300	0.350	0.400	LEAD LENGTH	L	0.650	0.750	0.850	LEAD PITCH	e	1.250 BSC			PACKAGE TOLERANCE	aaa	0.050			MOLD FLATNESS	bbb	0.100			COPLANARITY	ccc	0.080													
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- Notes:**
11. 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.
 12. A capacitor of value 0.1 pF or higher between VDD and GND is required.

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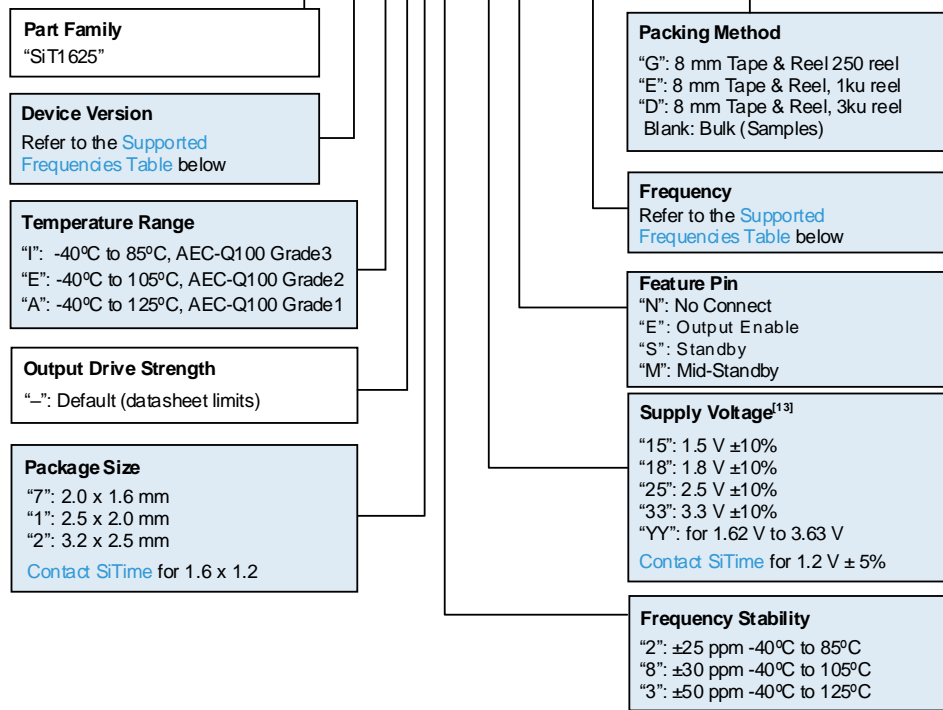


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Ordering Information

The part number guide illustrated below is for reference only, in which boxes identify order codes having more than one option. To customize and build an exact part number, use the SiTime [Part Number Generator](#). To validate the part number, use the SiTime [Part Number Decoder](#).

SiT1625CA-13-18N-27.00000D



Note:

13. The voltage portion of the SiT1625 part number consists of a two-digit number that denotes the specific supply voltage of the device. Alternatively, "YY" can be used to indicate the entire operating voltage range from 1.62 V to 3.63 V.

Table 7. Part Number and Supported Frequencies^[14,15]

Frequency Range (MHz)							
SiT1625A		SiT1625B				SiT1625C	
5.000000	50.000000	4.000000	16.000000	32.000000	72.000000	7.000000	39.000000
10.000000	62.500000	4.096000	18.000000	32.768000	76.800000	13.000000	63.000000
20.000000	78.125000	6.000000	18.432000	36.000000	96.000000	21.000000	91.000000
25.000000	100.000000	8.000000	19.200000	38.400000	122.880000	27.000000	117.000000
31.250000	125.000000	8.192000	24.000000	48.000000	-	-	-
33.333333	-	9.000000	24.576000	61.440000	-	-	-
-	-	12.000000	30.720000	64.000000	-	-	-

Notes:

- 14. Any frequency the table above is supported with 6 decimal places of accuracy.
- 15. Please [contact SiTime](#) for frequencies that are not listed in the tables above.

Table 8. Ordering Codes for Supported Tape & Reel Packing Method

Device Size (mm ²)	8 mm T&R (3ku)	8 mm T&R (1ku)	8 mm T&R (250u)
1.6 x 1.2	D	E	G
2.0 x 1.6	D	E	G
2.5 x 2.0	D	E	G
3.2 x 2.5	D	E	G

SiT1625 AEC-Q100, Low Jitter and Low Power Oscillator

PRELIMINARY



Instant Samples with Time Machine and Field Programmable Oscillator

SiTime supports a field programmable version of the SiT1625 for fast prototyping and real time customization of features. The field programmable devices (FP devices) are available for all standard SiT1625 package sizes and can be configured to one's exact specification using the Time Machine II.

For more information regarding SiTime's field programmable solutions, see [Time Machine II](#) and [Field Programmable devices](#).

SiT1625 is typically factory-programmed per customer ordering codes for volume delivery.

SiT1625 AEC-Q100, Low Jitter and Low Power Oscillator

PRELIMINARY



Additional Information

Table 9. Additional Information

Document	Description	Download Link
Time Machine II	Asterix programmer for engineering samples	https://www.sitime.com/time-machine-oscillator-and-active-resonator-programmer
Field Programmable Oscillators	Devices that can be programmable in the field by Time Machine II	https://www.sitime.com/support/resource-library/datasheets/field-programmable-oscillators-and-active-resonators-datasheet
Manufacturing Notes	Tape & Reel dimension, reflow profile and other manufacturing related info	https://www.sitime.com/sites/default/files/gated/Manufacturing-Notes-for-SiTime-Products.pdf
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

Revision History

Table 10. Revision History

Version	Release Date	Change Summary
0.1	3-Feb-2022	Initial release
0.22	15-Aug-2022	General Updates
0.23	21-Sep-2022	Additional updates on typos
0.24	30-Oct-2022	Formatting updates
0.25	6-Nov-2022	Adjusted frequency and package options Updated jitter and phase noise specifications
0.26	11-Feb-2023	Added clarifying notes to jitter and phase noise specifications
0.5	11-Feb-2023	Updated Features and Applications, Electrical Characteristics, Pin Descriptions, Ordering Information
0.51	22-Feb-2023	Updated Electrical Characteristics
0.52	19-Apr-2023	Added 1612 package option
0.6	27-Jul-2023	Expanded Supported Frequencies, Updated Table 1 specs, Added Programmable Drive Strength Section, Reorganized Sections, Typo corrections, Updated Ordering Information, Updated ESD spec
0.7	23-Jan-2024	Electrical Characteristics, Features, Pinout Updated

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