

SiT3373

220 MHz to 725 MHz Ultra-low Jitter Differential VCXO



Features

- Any frequency between 220.000001 MHz and 725 MHz accurate to 6 decimal places
- Widest pull range options: ± 25 , ± 50 , ± 80 , ± 100 , ± 150 , ± 200 , ± 400 , ± 800 , ± 1600 , ± 3200 ppm
- 0.235 ps RMS phase jitter (typ) over 12 kHz to 20 MHz bandwidth
- Wide temperature range support from -40°C to 105°C
- Industry-standard packages: 7.0 x 5.0 mm, 5.0 x 3.2 mm, 3.2 x 2.5 mm packages
- For frequencies 1 MHz to 220 MHz, refer to [SiT3372](#)

Applications

- Cable Modem Termination System (CMTS), Video, Broadcasting System, Audio, Industrial Sensors, Remote Radio Head (RRH)
- SATA, SAS, 10GB Ethernet, Fibre Channel, PCI-Express
- Optical Transport Network (OTN)



Electrical Characteristics

Table 1. Electrical Characteristics – Common to LVPECL, LVDS and HCSL

All Min and Max limits in the Electrical Characteristics tables are specified over temperature and rated operating voltage with standard output termination show in the termination diagrams. Typical values are at 25°C and nominal supply voltage.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Frequency Range						
Output Frequency Range	f	220.000001	–	725	MHz	Accurate to 6 decimal places
Frequency Stability						
Frequency Stability	F_stab	-15	–	+15	ppm	Inclusive of initial tolerance, operating temperature, rated power supply voltage, load variations, and first year aging at 25°C . Contact SiTime for ± 15 ppm.
		-25	–	+25	ppm	Inclusive of initial tolerance, operating temperature, rated power supply voltage, load variations, and first year aging at 25°C .
		-35	–	+35	ppm	
		-50	–	+50	ppm	
Temperature Range						
Operating Temperature Range	T_use	-20	–	+70	$^{\circ}\text{C}$	Extended Commercial
		-40	–	+85	$^{\circ}\text{C}$	Industrial.
		-40	–	+95	$^{\circ}\text{C}$	
		-40	–	+105	$^{\circ}\text{C}$	Extended Industrial
Supply Voltage						
Supply Voltage	Vdd	2.97	3.30	3.63	V	
		2.70	3.00	3.30	V	
		2.52	2.80	3.08	V	
		2.25	2.50	2.75	V	
Voltage Control Characteristics						
Pull Range	PR	± 25 , ± 50 , ± 80 , ± 100 , ± 150 , ± 200 , ± 400 , ± 800 , ± 1600 , ± 3200 ppm			ppm	See the APR (Absolute Pull Range) Table 11 . Contact SiTime for custom pull range options.
Upper Control Voltage	VC_U	90%	–	–	Vdd	Voltage at which maximum frequency deviation is guaranteed
Lower Control Voltage	VC_L	–	–	10%	Vdd	Voltage at which minimum frequency deviation is guaranteed
Control Voltage Input Impedance	VC_z	–	10	–	M Ω	
Control Voltage Input Bandwidth	V_c	–	10	–	kHz	Contact SiTime for other input bandwidth options
Pull Range Linearity	Lin	–	–	1.0	%	
Frequency Change Polarity	–	Positive Slope			–	
Input Characteristics						
Input Voltage High	VIH	70%	–	–	Vdd	Pin 2, OE
Input Voltage Low	VIL	–	–	30%	Vdd	Pin 2, OE
Input Pull-up Impedance	Z_in	–	100	–	k Ω	Pin 2, OE logic high or logic low
Output Characteristics						
Duty Cycle	DC	45	–	55	%	
Startup and OE Timing						
Start-up Time	T_start	–	–	3.0	ms	Measured from the time Vdd reaches its rated minimum value.
OE Enable/Disable Time	T_oe	–	–	3.8	μs	f = 322.265625 MHz. Measured from the time OE pin reaches rated VIH and VIL to the time clock pins reach 90% of swing and high-Z. See Figure 7 and Figure 8

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Table 2. Electrical Characteristics – LVPECL Specific

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Current Consumption						
Current Consumption	I _{dd}	–	–	97	mA	Excluding Load Termination Current, V _{dd} = 3.3V or 2.5V
OE Disable Supply Current	I _{OE}	–	–	63	mA	OE = Low
Output Disable Leakage Current	I _{leak}	–	0.15	–	μA	OE = Low
Maximum Output Current	I _{driver}	–	–	32	mA	Maximum average current drawn from OUT+ or OUT-
Output Characteristics						
Output High Voltage	VOH	V _{dd} -1.15	–	V _{dd} -0.7	V	See Figure 3
Output Low Voltage	VOL	V _{dd} -1.9	–	V _{dd} -1.5	V	See Figure 3
Output Differential Voltage Swing	V _{Swing}	1.2	1.6	2.0	V	See Figure 4
Rise/Fall Time	T _r , T _f	–	225	290	ps	20% to 80%, see Figure 4
Jitter – 7.0 x 5.0 mm Package						
RMS Period Jitter^[1]	T _{jitt}	–	1.0	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3V or 2.5V, Pull Range = 100 ppm.
RMS Phase Jitter (random)	T _{phj}	–	0.220	0.270	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -20 to 70°C and -40 to 85°C.
		–	0.220	0.300	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -40 to 95 °C and -40 to 105°C
		–	0.1	–	ps	f = 156.25 or 322.265625 MHz, IEEE802.3-2005 10GbE jitter mask integration bandwidth = 1.875 MHz to 20 MHz, all V _{dd} levels.
Jitter – 5.0 x 3.2 mm and 3.2 x 2.5 mm Packages						
RMS Period Jitter^[1]	T _{jitt}	–	1.0	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3V or 2.5V, Pull Range = 100 ppm.
RMS Phase Jitter (random)	T _{phj}	–	0.225	0.282	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -20 to 70°C and -40 to 85°C.
		–	0.225	0.315	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -40 to 95 °C and -40 to 105°C
		–	0.1	–	ps	f = 156.25 or 322.265625 MHz, IEEE802.3-2005 10GbE jitter mask integration bandwidth = 1.875 MHz to 20 MHz, all V _{dd} levels.

Notes:

1. Measured according to JESD65B

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Table 3. Electrical Characteristics – LVDS Specific

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Current Consumption						
Current Consumption	I _{dd}	–	–	89	mA	Excluding Load Termination Current, V _{dd} = 3.3V or 2.5V
OE Disable Supply Current	I _{OE}	–	–	67	mA	OE = Low
Output Disable Leakage Current	I _{leak}	–	0.15	–	μA	OE = Low
Output Characteristics						
Differential Output Voltage	VOD	250	–	450	mV	See Figure 5
VOD Magnitude Change	ΔVOD	–	–	50	mV	See Figure 5
Offset Voltage	VOS	1.125	–	1.375	V	See Figure 5
VOS Magnitude Change	ΔVOS	–	–	50	mV	See Figure 5
Rise/Fall Time	T _r , T _f	–	370	470	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%, see Figure 6
Jitter – 7.0 x 5.0 mm package						
RMS Period Jitter^[2]	T _{jitt}	–	0.92	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3V or 2.5V, Pull Range = 100 ppm.
RMS Phase Jitter (random)	T _{phj}	–	0.215	0.265	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -20 to 70°C and -40 to 85°C.
		–	0.215	0.280	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -40 to 95 °C and -40 to 105°C
		–	0.1	–	ps	f = 156.25 or 322.265625 MHz, IEEE802.3-2005 10GbE jitter mask integration bandwidth = 1.875 MHz to 20 MHz, includes spurs, all V _{dd} levels.
Jitter – 5.0 x 3.2 mm and 3.2 x 2.5 mm packages						
RMS Period Jitter^[2]	T _{jitt}	–	0.92	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3V or 2.5V, Pull Range = 100 ppm.
RMS Phase Jitter (random)	T _{phj}	–	0.235	0.282	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -20 to 70°C and -40 to 85°C.
		–	0.235	0.310	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -40 to 95 °C and -40 to 105°C
		–	0.1	–	ps	f = 156.25 or 322.265625 MHz, IEEE802.3-2005 10GbE jitter mask integration bandwidth = 1.875 MHz to 20 MHz, includes spurs, all V _{dd} levels.

Notes:

- Measured according to JESD65B

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Table 4. Electrical Characteristics – HCSL – Specific

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Current Consumption						
Current Consumption	I _{dd}	–	–	102	mA	Excluding Load Termination Current, V _{dd} = 3.3V or 2.5V
OE Disable Supply Current	I _{OE}	–	–	67	mA	OE = Low
Output Disable Leakage Current	I _{leak}	–	0.15	–	μA	OE = Low
Maximum Output Current	I _{driver}	–	–	36	mA	Maximum average current drawn from OUT+ or OUT-
Output Characteristics						
Output High Voltage	VOH	0.6	–	0.90	V	See Figure 3
Output Low Voltage	VOL	-0.05	–	0.08	V	See Figure 3
Output Differential Voltage Swing	V _{Swing}	1.2	1.4	1.8	V	See Figure 4
Rise/Fall Time	Tr, Tf	–	360	470	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%, see Figure 4
Jitter – 7.0 x 5.0 mm package						
RMS Period Jitter^[3]	T _{jitt}	–	1.0	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3V or 2.5V, Pull Range = 100 ppm.
RMS Phase Jitter (random)	T _{phj}	–	0.215	0.265	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, Pull Range = 100 ppm.
		–	0.215	0.282	ps	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -20 to 70°C and -40 to 85°C.
		–	0.1	–	ps	f = 156.25 or 322.265625 MHz, IEEE802.3-2005 10GbE jitter mask integration bandwidth = 1.875 MHz to 20 MHz, includes spurs, all V _{dd} levels.
Jitter – 5.0 x 3.2 mm and 3.2 x 2.5 mm packages						
RMS Period Jitter^[3]	T _{jitt}	–	1.0	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3V or 2.5V, Pull Range = 100 ppm.
RMS Phase Jitter (random)	T _{phj}		0.235	0.282	0.215	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -20 to 70°C and -40 to 85°C.
			0.235	0.305	0.215	f = 322.265625 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dd} levels, includes spurs, pull range = 100 ppm. Temperature ranges -40 to 95 °C and -40 to 105°C
			0.1	–	0.1	f = 156.25 or 322.265625 MHz, IEEE802.3-2005 10GbE jitter mask integration bandwidth = 1.875 MHz to 20 MHz, includes spurs, all V _{dd} levels.

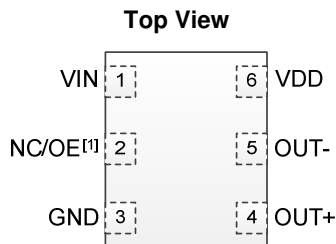
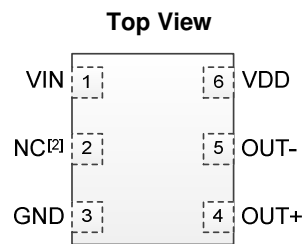
Notes:

- Measure according to JESD65B.

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Table 5. Pin Description

Pin	Symbol	Functionality	
1	VIN	Input	Control Voltage
2	NC/OE	No Connect (NC)	No Connect: Leave floating or connect to GND for better heat dissipation. NC for all 3.2 x 2.5 mm package options.
		Output Enable (OE)	H ^[4,5] : specified frequency output L: output is high impedance. Only output driver is disabled. OE function only available on 7050 package. Pin 2 on 3225 package is NC.
3	GND	Power	Vdd Power Supply Ground
4	OUT+	Output	Oscillator output
5	OUT-	Output	Complementary oscillator output
6	Vdd	Power	Power supply voltage ^[6]


**Figure 1. Pin Assignments
(7.0 x 5.0 mm and
5.0 x 3.2 mm packages)**

**Figure 2. Pin Assignments
(3.2 x 2.5 mm package)**
Notes:

4. A pull-up resistor of 10 k Ω or less is recommended if pin 1 is not externally driven.
5. OE mode is only available in the 7050 and 5032 packages. 3225 package is NC.
6. A capacitor of value 0.1 μ F or higher between Vdd and GND is required. An additional 10 μ F capacitor between Vdd and GND is required for the best phase jitter performance.

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Table 6. Absolute Maximum Ratings

Attempted operation outside the absolute maximum ratings 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
Vdd	-0.5	4.0	V
VIH		Vdd + 0.3V	V
VIL	-0.3		V
Storage Temperature	-65	150	°C
Maximum Junction Temperature		130	°C
Soldering Temperature (follow standard Pb-free soldering guidelines)		260	°C

Table 7. Thermal Considerations^[7]

Package	θ_{JA} , 4 Layer Board (°C/W)	θ_{JC} , Bottom (°C/W)
3225, 6-pin	80	30
5032, 6-pin	TBD	TBD
7050, 6-pin	52	19

Notes:

7. Refer to JESD51 for θ_{JA} and θ_{JC} definitions, and reference layout used to determine the θ_{JA} and θ_{JC} values in the above table.

Table 8. Maximum Operating Junction Temperature^[8]

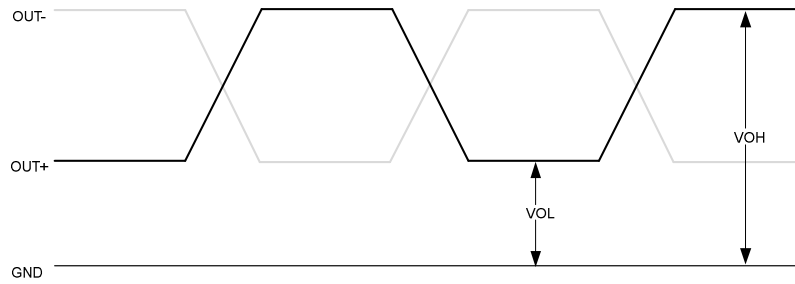
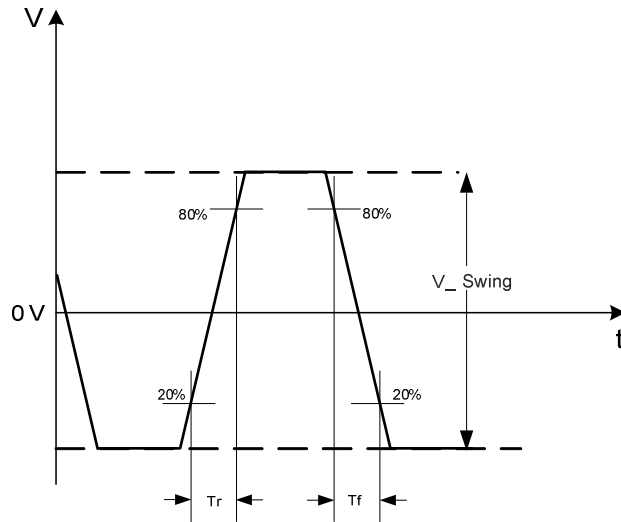
Max Operating Temperature (ambient)	Maximum Operating Junction Temperature
70°C	95°C
85°C	110°C
95°C	120°C
105°C	130°C

Notes:

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

Table 9. Environmental Compliance

Parameter	Test Conditions	Value	Unit
Mechanical Shock Resistance	MIL-STD-883F, Method 2002	10,000	<i>g</i>
Mechanical Vibration Resistance	MIL-STD-883F, Method 2007	70	<i>g</i>
Soldering Temperature (follow standard Pb free soldering guidelines)	MIL-STD-883F, Method 2003	260	°C
Moisture Sensitivity Level	MSL1 @ 260°C		
Electrostatic Discharge (HBM)	HBM, JESD22-A114	2,000	V
Charge-Device Model ESD Protection	JESD220C101	750	V
Latch-up Tolerance	JESD78 Compliant		

SiT3373 220 MHz to 725 MHz Ultra-low Jitter Differential VCXO**Waveform Diagrams****Figure 3. LVPECL/HCSL Voltage Levels per Differential Pin (OUT+/OUT-)****Figure 4. LVPECL/HCSL Voltage Levels across Differential Pair**

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Waveform Diagrams (continued)

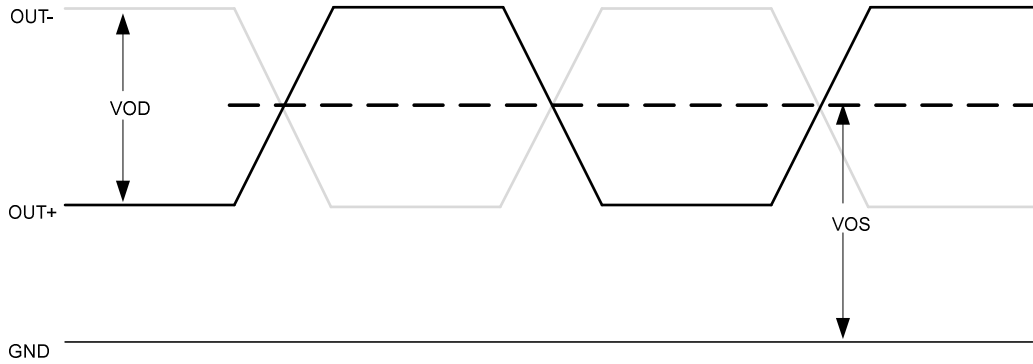


Figure 5. LVDS Voltage Levels per Differential Pin (OUT+/OUT-)

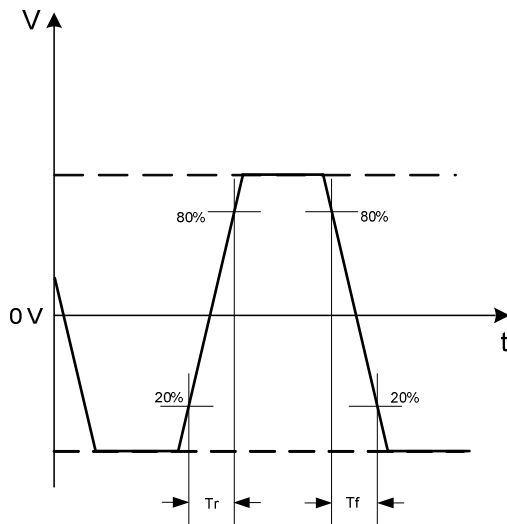


Figure 6. LVDS Differential Waveform

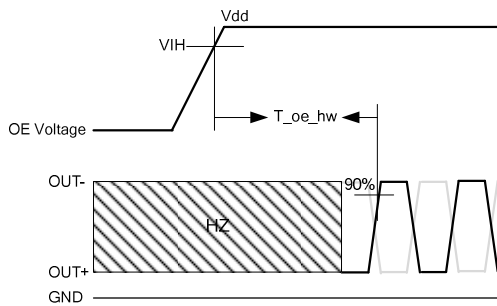


Figure 7. Hardware OE Enable Timing

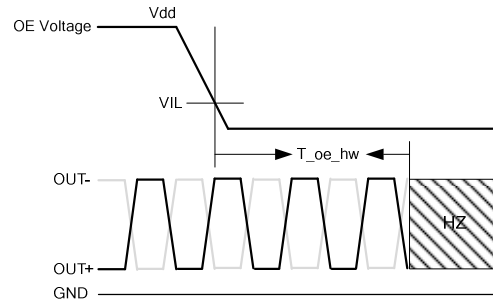


Figure 8. Hardware OE Disable Timing

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Termination Diagrams

LVPECL:

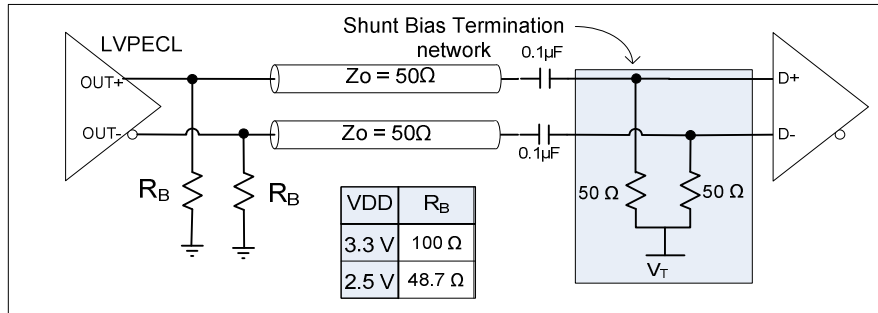


Figure 9. LVPECL with AC-coupled termination

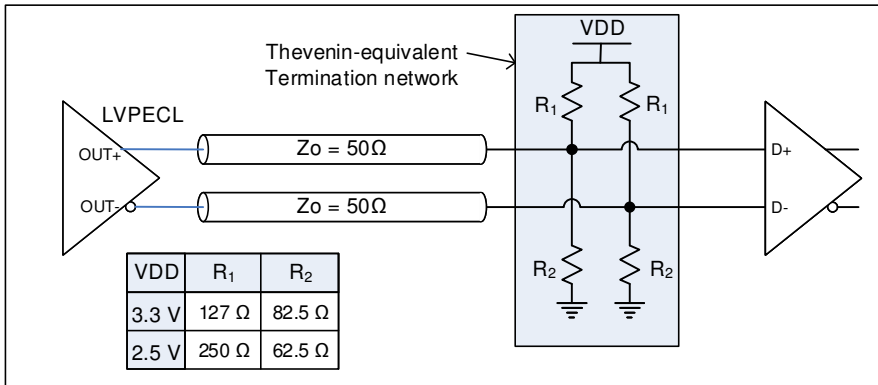


Figure 10. LVPECL DC-coupled load termination with Thevenin equivalent network

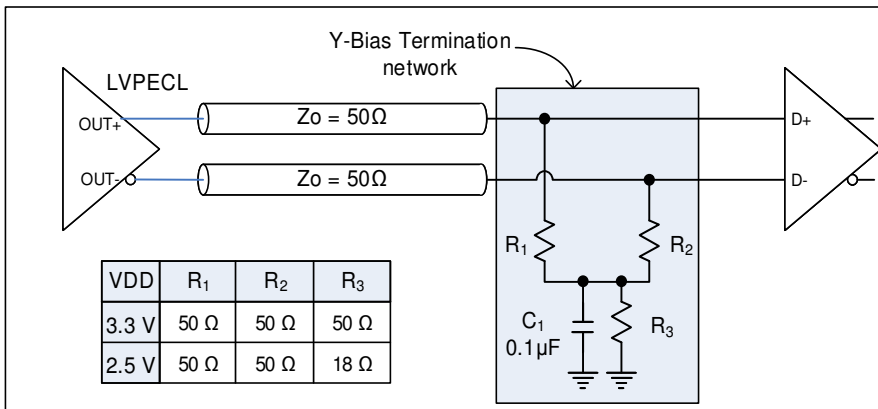
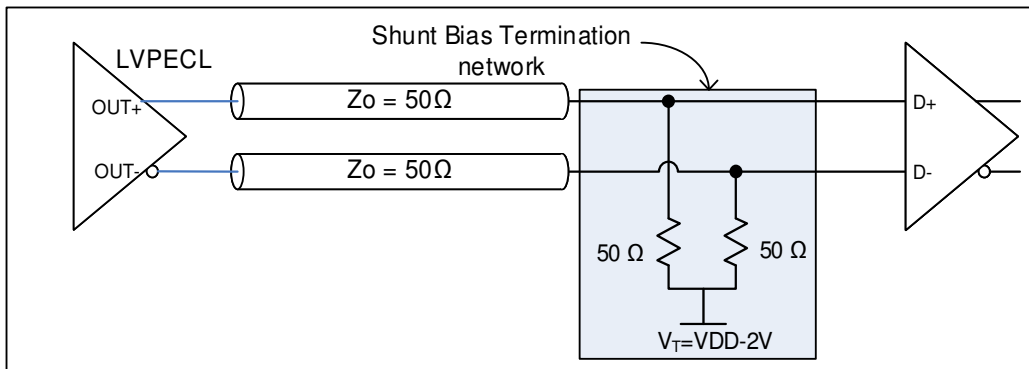
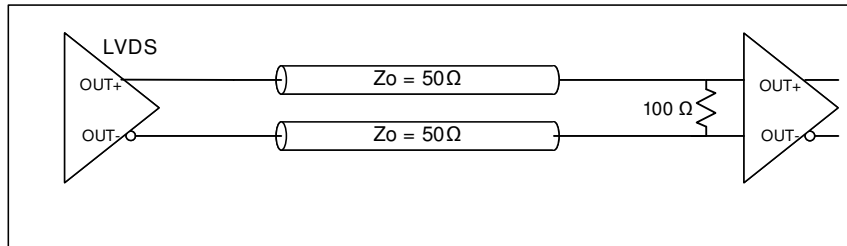
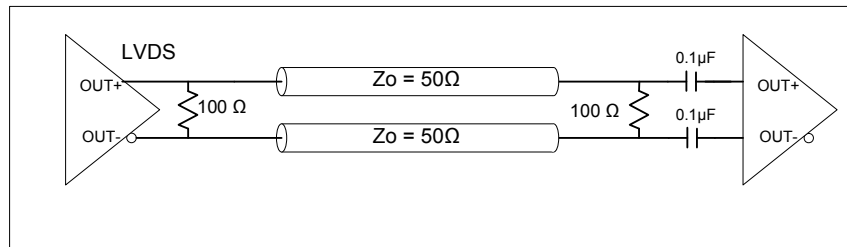
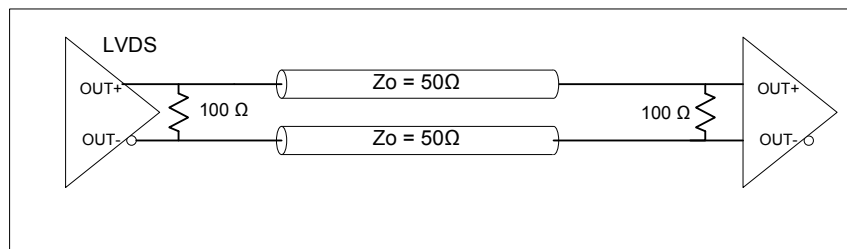


Figure 11. LVPECL with Y-Bias termination

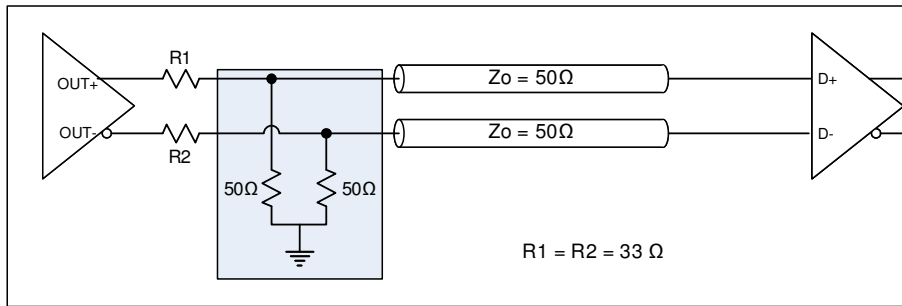
SiT3373 220 MHz to 725 MHz Ultra-low Jitter Differential VCXO**Termination Diagrams (continued)****Figure 12. LVPECL with DC-coupled parallel shunt load termination**

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Termination Diagrams (continued)
LVDS:

Figure 13. LVDS single DC termination at the load

Figure 14. LVDS double AC termination with capacitor close to the load

Figure 15. LVDS double DC termination

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HCSL:

**Figure 16. HCSL interface termination**

SiT3373 220 MHz to 725 MHz Ultra-low Jitter Differential VCXO

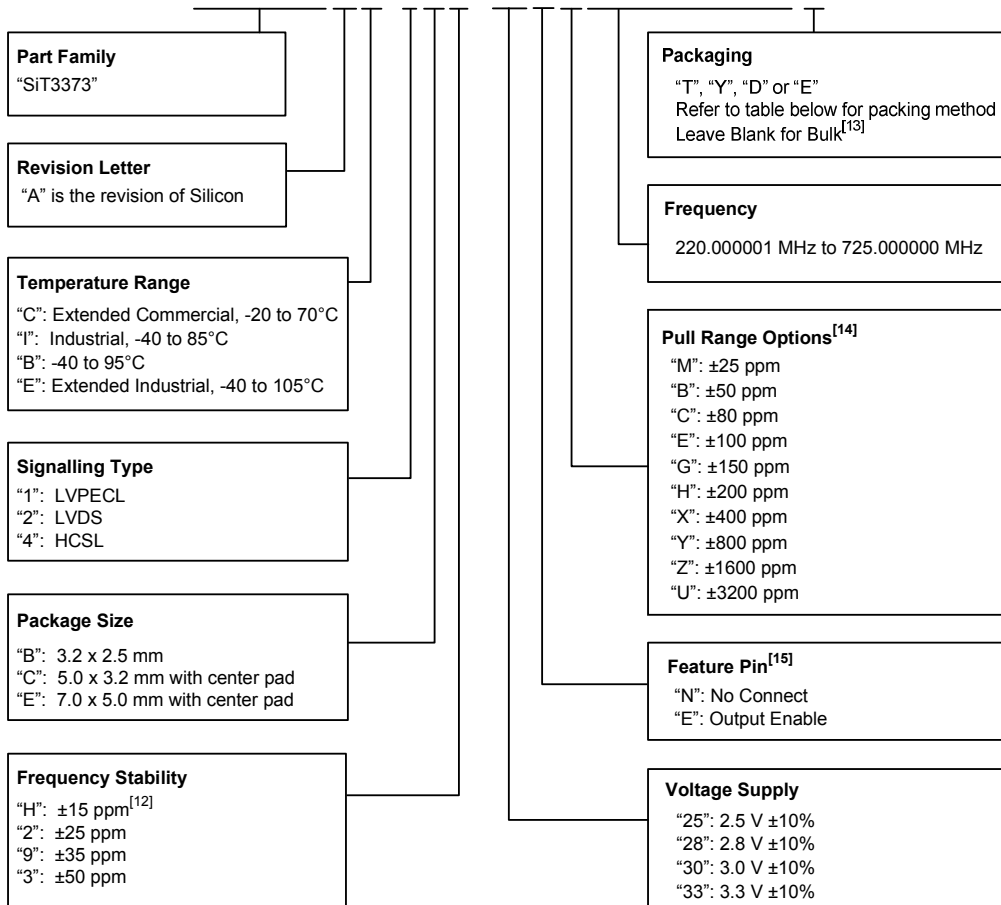
Dimensions and Patterns

Package Size – Dimensions (Unit: mm) ^[9]	Recommended Land Pattern (Unit: mm) ^[10]																																																					
<p>3.2 x 2.5 x 0.85 mm</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Dimension Table</caption> <thead> <tr> <th></th> <th>Symbol</th> <th>Min</th> <th>Nom</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>TOTAL THICKNESS</td> <td>A</td> <td>0.800</td> <td>0.850</td> <td>0.900</td> </tr> <tr> <td rowspan="2">BODY SIZE</td> <td>X</td> <td>D</td> <td>2.400</td> <td>2.500</td> <td>2.600</td> </tr> <tr> <td>Y</td> <td>E</td> <td>3.200</td> <td>3.200</td> <td>3.300</td> </tr> <tr> <td>LEAD PITCH</td> <td>e</td> <td colspan="3">1.100 BSC</td> </tr> <tr> <td>LEAD LENGTH</td> <td>L</td> <td>0.650</td> <td>0.700</td> <td>0.750</td> </tr> <tr> <td>LEAD WIDTH</td> <td>W</td> <td>0.550</td> <td>0.600</td> <td>0.650</td> </tr> </tbody> </table> <div style="text-align: right; margin-top: 10px;"> <table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">6L QFN</td> <td style="padding: 2px;">Package Outline</td> </tr> <tr> <td style="padding: 2px;">2.5 x 3.2 x 0.85 mm</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">POD-38 Rev A</td> <td></td> </tr> </table> </div>		Symbol	Min	Nom	Max	TOTAL THICKNESS	A	0.800	0.850	0.900	BODY SIZE	X	D	2.400	2.500	2.600	Y	E	3.200	3.200	3.300	LEAD PITCH	e	1.100 BSC			LEAD LENGTH	L	0.650	0.700	0.750	LEAD WIDTH	W	0.550	0.600	0.650	6L QFN	Package Outline	2.5 x 3.2 x 0.85 mm		POD-38 Rev A		<p>3.2 x 2.5 x 0.85 mm</p>											
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Notes:

9. 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.
10. A capacitor of value 0.1 μ F or higher between Vdd and GND is required. An additional 10 μ F capacitor between Vdd and GND is required for the best phase jitter performance
11. The center pad has no electrical function. Soldering down the center pad to the GND is recommended for best thermal dissipation, but is optional.

SiT3373 220 MHz to 725 MHz Ultra-low Jitter Differential VCXO

Ordering Information
SiT3373AC-1B2-33NH220.123456T

Notes:

12. Contact [SiTime](#) for ±15 ppm
13. Bulk is available for sampling only
14. Contact [SiTime](#) for custom pull range options
15. "E": Output Enable function is only available in 7.0 x 5.0 mm and 5.0 x 3.2 mm packages

Table 10. Ordering Codes for Supported Tape & Reel Packing Method

Device Size (mm x mm)	8 mm T&R (3ku)	8 mm T&R (1ku)	12 mm T&R (3ku)	12 mm T&R (1ku)	16 mm T&R (3ku)	16 mm T&R (1ku)
7.0 x 5.0	—	—	—	—	T	Y
5.0 x 3.2	—	—	T	Y	—	—
3.2 x 2.5	D	E	T	Y	—	—

SiT3373 220 MHz to 725 MHz Ultra-low Jitter Differential VCXO

Table 11. APR Table

Absolute pull range (APR) = Nominal pull range (PR) - frequency stability (F_stab) - aging ^[16]

Nominal Pull Range	Frequency Stability			
	± 15	± 25	± 35	±50
	APR (ppm)			
± 25	± 5	—	—	—
± 50	± 30	± 20	± 10	—
± 80	± 60	± 50	± 40	± 25
± 100	± 80	± 70	± 60	± 45
± 150	± 130	± 120	± 110	± 95
± 200	± 180	± 170	± 160	± 145
± 400	± 380	± 370	± 360	± 345
± 800	± 780	± 770	± 760	± 745
± 1600	± 1580	± 1570	± 1560	± 1545
± 3200	± 3180	± 3170	± 3160	± 3145

Note:

16. Aging includes solder down shift and 20-year aging.

Table 12. Additional Information

Document	Description	Download Link
ECCN #: EAR99	Five character designation used on the commerce Control List (CCL) to identify dual use items for export control purposes.	—
Part number Generator	Tool used to create the part number based on desired features.	—
Manufacturing Notes	Tape & Reel dimension, reflow profile and other manufacturing related info	http://www.sitime.com/manufacturing-notes
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

SiT3373 220 MHz to 725 MHz Ultra-low Jitter Differential VCXO

Table 13. Revision History

Revision	Release Date	Change Summary
1.0	10/13/2017	Initial release
1.01	02/02/2018	Corrected ppm ordering codes. Corrected minor formatting errors. Added Additional Information table. Added Extended Industrial temperature range (-40 °C – 95°C and -40 °C – 105°C)
1.03	05/10/2018	Updated the Part Ordering info with added 5.0 x 3.2 mm package

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