

# SiT3821

## 1-220 MHz High Performance Differential VCXO



### Features

- Any frequency between 1 MHz and 220 MHz accurate to 6 decimal places
- Widest pull range options:  $\pm 25$ ,  $\pm 50$ ,  $\pm 100$ ,  $\pm 150$ ,  $\pm 200$ ,  $\pm 400$ ,  $\pm 800$ ,  $\pm 1600$  ppm
- Superior pull range linearity of  $\leq 1\%$ , 10 times better than quartz
- 0.6ps RMS phase jitter (random) over 12 kHz to 20 MHz bandwidth
- Industrial and extended commercial temperature ranges
- Industry-standard packages: 3.2 mm x 2.5 mm, 5.0 mm x 3.2 mm and 7.0 mm x 5.0 mm
- For frequencies higher than 220 MHz, refer to SiT3822 datasheet

### Applications

- Ideal for SONET, Video, Instrumentation, Satellite applications
- Telecom, networking, broadband



### Electrical Characteristics

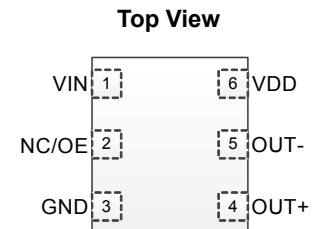
Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>LVPECL and LVDS, Common AC Characteristics</b>						
Output Frequency Range	f	1	–	220	MHz	
Frequency Stability	F <sub>stab</sub>	-10	–	+10	ppm	Inclusive of initial tolerance, operating temperature, rated power, supply voltage and load change
		-25	–	+25	ppm	
		-50	–	+50	ppm	
Operating Temperature Range	T <sub>use</sub>	-40	–	+85	°C	Industrial
		-20	–	+70	°C	Extended Commercial
Start-up Time	T <sub>start</sub>	–	–	10	ms	
Duty Cycle	DC	45	–	55	%	Contact SiTime for tighter duty cycle
Pull Range	PR	$\pm 25, \pm 50, \pm 100, \pm 150, \pm 200, \pm 400, \pm 800, \pm 1600$			ppm	See the last page for Absolute Pull Range, APR table
Upper Control Voltage	VC <sub>U</sub>	3.2	–	–	V	V <sub>dd</sub> = 3.3V, Voltage at which maximum deviation is guaranteed
		2.4	–	–	V	V <sub>dd</sub> = 2.5V, Voltage at which maximum deviation is guaranteed
Lower Control Voltage	VC <sub>L</sub>	–	–	0.1	V	Voltage at which maximum deviation is guaranteed
Linearity	Lin	–	–	1	%	
Frequency Change Polarity	–	Positive Slope			–	
Control Voltage Bandwidth (-3dB)	V <sub>BW</sub>	–	8	–	kHz	Contact SiTime for 16 kHz or other high bandwidth options
Vin Pin Input Impedance	Z <sub>vin</sub>	100	–	–	kΩ	Pin 1
First Year Aging		-2	–	+2	ppm	25°C
10-year Aging		-5	–	+5	ppm	25°C
<b>LVPECL, DC and AC Characteristics</b>						
Supply Voltage	V <sub>dd</sub>	2.97	3.3	3.63	V	
		2.25	2.5	2.75	V	
Current Consumption	I <sub>dd</sub>	–	61	69	mA	Excluding Load Termination Current, V <sub>dd</sub> = 3.3V or 2.5V
OE Disable Supply Current	I <sub>OE</sub>	–	–	35	mA	OE = Low
Output Disable Leakage Current	I <sub>leak</sub>	–	–	1	μA	OE = Low
Maximum Output Current	I <sub>driver</sub>	–	–	30	mA	Maximum average current drawn from OUT+ or OUT-
Output High Voltage	VOH	V <sub>dd</sub> -1.1	–	V <sub>dd</sub> -0.7	V	See Figure 1
Output Low Voltage	VOL	V <sub>dd</sub> -1.9	–	V <sub>dd</sub> -1.5	V	See Figure 1
Output Differential Voltage Swing	V <sub>Swing</sub>	1.2	1.6	2.0	V	See Figure 1
Rise/Fall Time	T <sub>r</sub> , T <sub>f</sub>	–	300	500	ps	20% to 80%
OE Enable/Disable Time	T <sub>oe</sub>	–	–	115	ns	f = 220 MHz - For other frequencies, T <sub>oe</sub> = 100ns + 3 period
RMS Period Jitter	T <sub>jitt</sub>	–	1.2	1.7	ps	f = 100 MHz, V <sub>dd</sub> = 3.3V or 2.5V
		–	1.2	1.7	ps	f = 156.25 MHz, V <sub>dd</sub> = 3.3V or 2.5V
		–	1.2	1.7	ps	f = 212.5 MHz, V <sub>dd</sub> = 3.3V or 2.5V
RMS Phase Jitter (random)	T <sub>phj</sub>	–	0.5	0.75	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V <sub>dds</sub>

### Electrical Characteristics

Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>LVDS, DC, and AC Characteristics</b>						
Supply Voltage	V <sub>dd</sub>	2.97	3.3	3.63	V	
		2.25	2.5	2.75	V	
Current Consumption	I <sub>dd</sub>	–	47	55	mA	Excluding Load Termination Current, V <sub>dd</sub> = 3.3V or 2.5V
OE Disable Current	I <sub>OE</sub>	–	–	35	mA	OE = Low
Output Disable Leakage Current	I <sub>leak</sub>	–	–	1	μA	OE = Low
Differential Output Voltage	V <sub>OD</sub>	200	350	500	mV	See Figure 4
V <sub>OD</sub> Magnitude Change	ΔV <sub>OD</sub>	–	–	50	mV	See Figure 4
Offset Voltage	V <sub>OS</sub>	1.125	1.2	1.375	V	See Figure 4
V <sub>OS</sub> Magnitude Change	ΔV <sub>OS</sub>	–	–	50	mV	See Figure 4
Rise/Fall Time	T <sub>r</sub> , T <sub>f</sub>	–	495	600	ps	20% to 80%
OE Enable/Disable Time	T <sub>oe</sub>	–	–	115	ns	f = 220 MHz - For other frequencies, T <sub>oe</sub> = 100ns + 3 period
RMS Period Jitter	T <sub>jitt</sub>	–	1.2	1.7	ps	f = 100 MHz, V <sub>dd</sub> = 3.3V or 2.5V
		–	1.2	1.7	ps	f = 156.25 MHz, V <sub>dd</sub> = 3.3V or 2.5V
		–	1.2	1.7	ps	f = 212.5 MHz, V <sub>dd</sub> = 3.3V or 2.5V
RMS Phase Jitter (random)	T <sub>phj</sub>	–	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V <sub>dds</sub>

### Pin Description

Pin	Map	Functionality	
1	VIN	Input	Control Voltage
2	NC	Input	No Connect (only for 3225 package)
	OE	Input	H or Open: specified frequency output L: output is high impedance (only for 7050 and 5032 packages)
3	GND	Power	VDD Power Supply Ground
4	OUT+	Output	Oscillator Output
5	OUT-	Output	Complementary Oscillator Output
6	VDD	Power	Power Supply Voltage



### Absolute Maximum

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
Storage Temperature	-65	150	°C
V <sub>DD</sub>	-0.5	4	V
Electrostatic Discharge	–	2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	–	260	°C

### Thermal Consideration

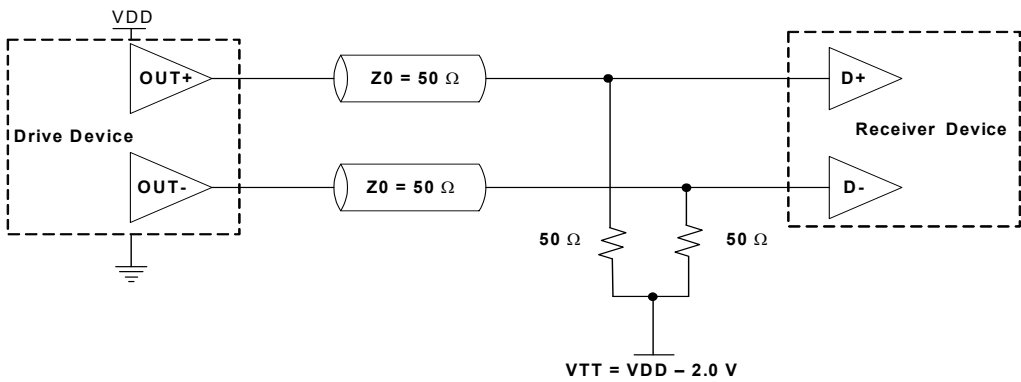
Package	θ <sub>JA</sub> , 4 Layer Board (°C/W)	θ <sub>JC</sub> , Bottom (°C/W)
7050, 6-pin	142	27
5032, 6-pin	97	20
3225, 6-pin	109	20

### Environmental Compliance

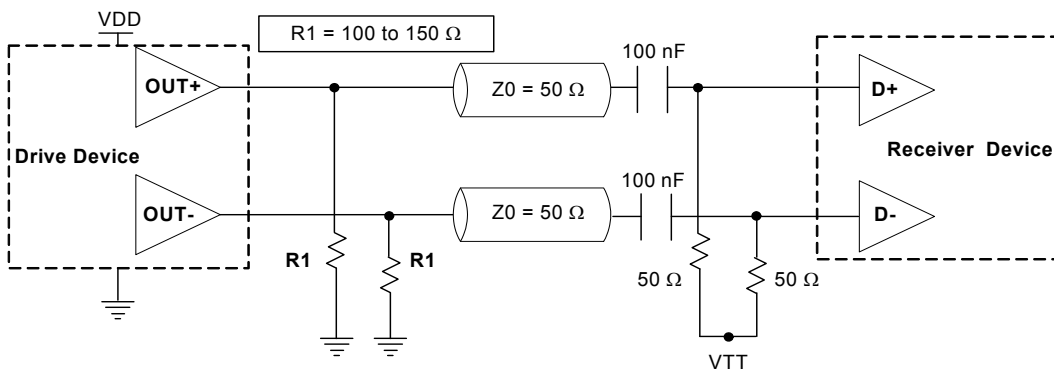
Parameter	Condition/Test Method
Mechanical Shock	MIL-STD-883F, Method 2002
Mechanical Vibration	MIL-STD-883F, Method 2007
Temperature Cycle	JESD22, Method A104
Solderability	MIL-STD-883F, Method 2003
Moisture Sensitivity Level	MSL1 @ 260°C

**Termination Diagrams**

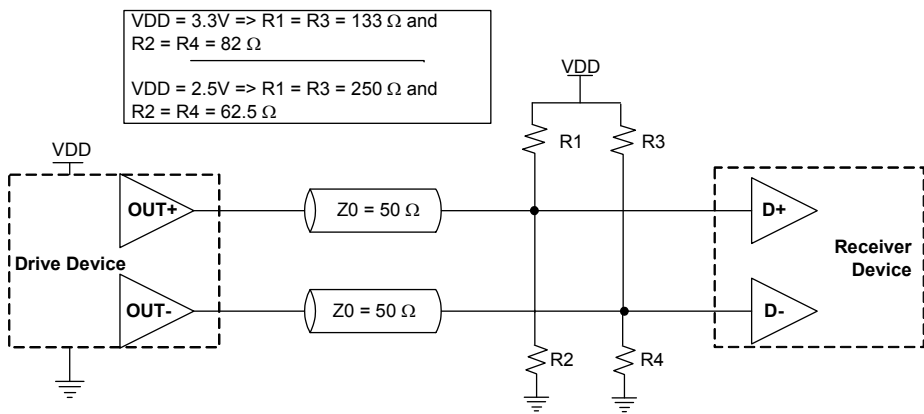
LVPECL:



**Figure 1. LVPECL Typical Termination**



**Figure 2. LVPECL AC Coupled Termination**



**Figure 3. LVPECL with Thevenin Typical Termination**

LVDS:

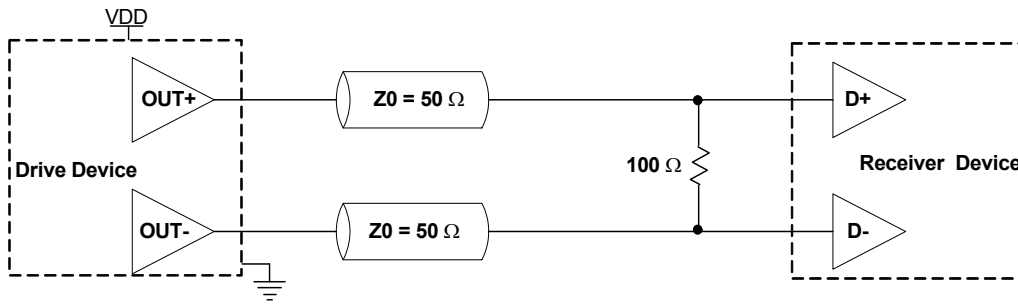
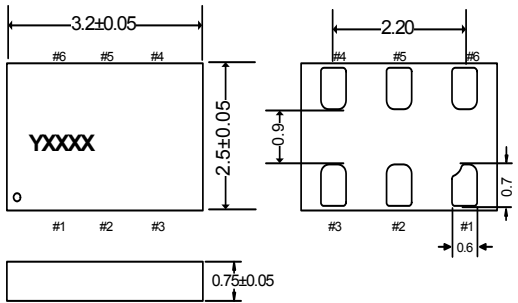
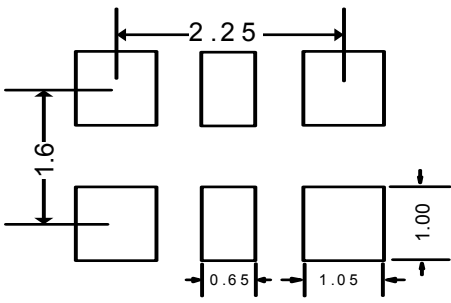
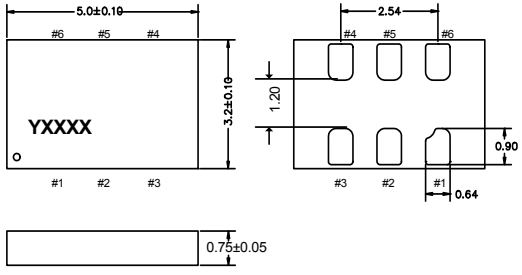
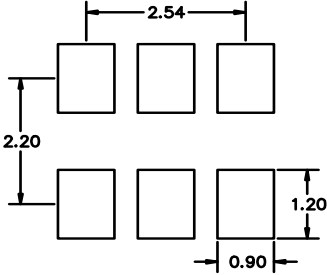
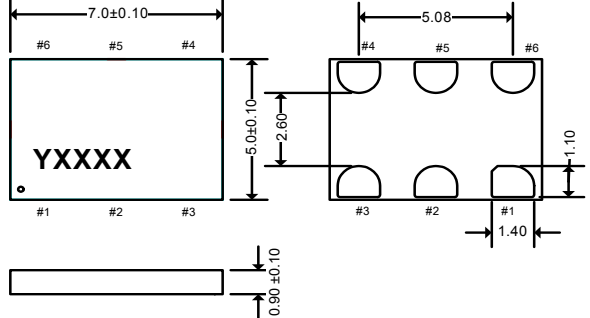
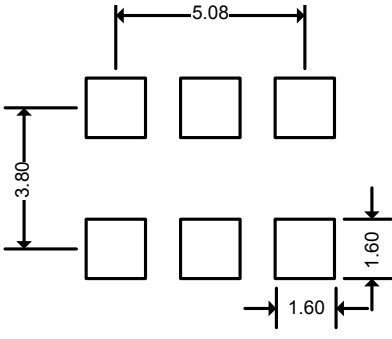


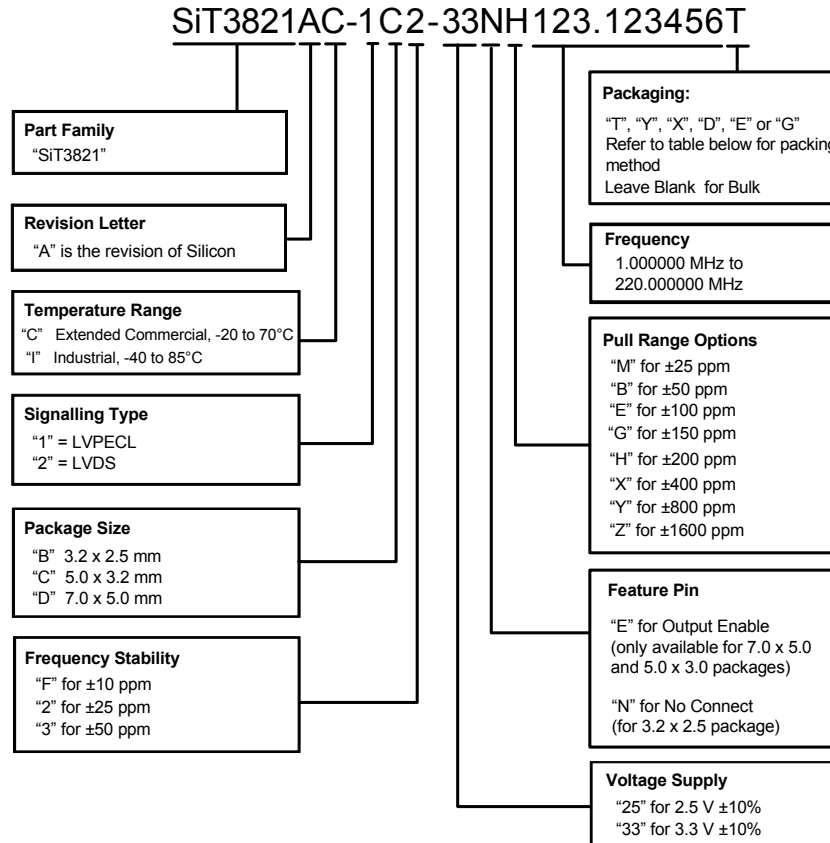
Figure 4. LVDS Single Termination (Load Terminated)

### Dimensions and Patterns

Package Size – Dimensions (Unit: mm) <sup>[1]</sup>	Recommended Land Pattern (Unit: mm) <sup>[2]</sup>
<p><b>3.2 x 2.5 x 0.75 mm</b></p>  <p>Top view shows a rectangular package with dimensions 3.2±0.05 mm by 2.5±0.05 mm. Markings #1-#6 are shown. The top marking is 'YXXXX'. The bottom view shows a 0.75±0.05 mm wide lead. The land pattern shows a 2.25 mm wide differential pair with 1.6 mm spacing and 0.65 mm/1.05 mm lead widths.</p>	 <p>Land pattern for a 2.25 mm wide differential pair. The spacing between the pair is 1.6 mm. The lead widths are 0.65 mm and 1.05 mm. The total width of the land pattern is 2.25 mm.</p>
<p><b>5.0 x 3.2 x 0.75 mm</b></p>  <p>Top view shows a rectangular package with dimensions 5.0±0.10 mm by 3.2±0.10 mm. Markings #1-#6 are shown. The top marking is 'YXXXX'. The bottom view shows a 0.75±0.05 mm wide lead. The land pattern shows a 2.54 mm wide differential pair with 2.20 mm spacing and 0.90 mm lead widths.</p>	 <p>Land pattern for a 2.54 mm wide differential pair. The spacing between the pair is 2.20 mm. The lead widths are 0.90 mm. The total width of the land pattern is 2.54 mm.</p>
<p><b>7.0 x 5.0 x 0.90 mm</b></p>  <p>Top view shows a rectangular package with dimensions 7.0±0.10 mm by 5.0±0.10 mm. Markings #1-#6 are shown. The top marking is 'YXXXX'. The bottom view shows a 0.90±0.10 mm wide lead. The land pattern shows a 5.08 mm wide differential pair with 3.80 mm spacing and 1.60 mm lead widths.</p>	 <p>Land pattern for a 5.08 mm wide differential pair. The spacing between the pair is 3.80 mm. The lead widths are 1.60 mm. The total width of the land pattern is 5.08 mm.</p>

1. 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.  
 2. A capacitor of value 0.1 μF between Vdd and GND is recommended.

### Ordering Information



### APR Definition

Absolute pull range (APR) = Nominal pull range (PR) - frequency stability (F\_stab) - Aging (F\_aging)

### APR Table

Nominal Pull Range	Frequency Stability		
	± 10	± 25	± 50
	APR (PPM)		
± 25	± 10	—	—
± 50	± 35	± 20	—
± 100	± 85	± 70	± 45
± 150	± 135	± 120	± 95
± 200	± 185	± 170	± 145
± 400	± 385	± 370	± 345
± 800	± 785	± 770	± 745
± 1600	± 1585	± 1570	± 1545

### Ordering Codes for Supported Tape & Reel Packing Method

Device Size	8 mm T&R (3ku)	8 mm T&R (1ku)	8 mm T&R (250u)	12 mm T&R (3ku)	12 mm T&R (1ku)	12 mm T&R (250u)	16 mm T&R (3ku)	16 mm T&R (1ku)	16 mm T&R (250u)
7.0 x 5.0 mm	—	—	—	—	—	—	T	Y	X
5.0 x 3.2 mm	—	—	—	T	Y	X	—	—	—
3.2 x 2.5 mm	D	E	G	T	Y	X	—	—	—

### Revision History

Version	Release Date	Change Summary
1.0	6/12/12	Original
1.1	6/6/14	Included 3225 package
1.2	10/6/14	Modified Thermal Consideration values

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