

SiT9121 Preliminary

1-220 MHz High Performance Differential Oscillator



Features

- Any frequency between 1 MHz and 220 MHz accurate to 6 decimal places
- LVPECL and LVDS output signaling types
- 0.6ps RMS phase jitter (random) over 12 kHz to 20 MHz bandwidth
- Frequency stability as low as ± 10 ppm
- Industrial and extended commercial temperature ranges
- Industry-standard packages: 3.2x2.5, 5.0x3.2 and 7.0x5.0 mmxmm
- For frequencies higher than 220 MHz, refer to SiT9122 datasheet

Applications

- 10GB Ethernet, SONET, SATA, SAS, Fibre Channel, PCI-Express
- Telecom, networking, instrumentation, storage, servers



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Electrical Characteristics

| Parameter and Conditions | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---------------------------------|----------------------|------|----------------------|-----------------|--|
| LVPECL and LVDS, Common Electrical Characteristics | | | | | | |
| Supply Voltage | V _{dd} | 2.97 | 3.3 | 3.63 | V | |
| | | 2.25 | 2.5 | 2.75 | V | |
| | | 2.25 | – | 3.63 | V | Termination schemes in Figures 1 and 2 - XX ordering code |
| | | 1.71 | 1.8 | 1.89 | V | Only for LVDS output |
| Output Frequency Range | f | 1 | – | 220 | MHz | |
| Frequency Stability | F _{stab} | -10 | – | +10 | ppm | Inclusive of initial tolerance, operating temperature, rated power supply voltage, and load variations |
| | | -20 | – | +20 | ppm | |
| | | -25 | – | +25 | ppm | |
| | | -50 | – | +50 | ppm | |
| First Year Aging | F _{aging1} | -2 | – | +2 | ppm | 25°C |
| 10-year Aging | F _{aging10} | -5 | – | +5 | ppm | 25°C |
| Operating Temperature Range | T _{use} | -40 | – | +85 | °C | Industrial |
| | | -20 | – | +70 | °C | Extended Commercial |
| Input Voltage High | V _{IH} | 70% | – | – | V _{dd} | Pin 1, OE or \overline{ST} |
| Input Voltage Low | V _{IL} | – | – | 30% | V _{dd} | Pin 1, OE or \overline{ST} |
| Input Pull-up Impedance | Z _{in} | – | 100 | 250 | k Ω | Pin 1, OE logic high or logic low, or \overline{ST} logic high |
| | | 2 | – | – | M Ω | Pin 1, \overline{ST} logic low |
| Start-up Time | T _{start} | – | 6 | 10 | ms | Measured from the time V _{dd} reaches its rated minimum value. |
| Resume Time | T _{resume} | – | 6 | 10 | ms | In Standby mode, measured from the time \overline{ST} pin crosses 50% threshold. |
| Duty Cycle | DC | 45 | – | 55 | % | Contact SiTime for tighter duty cycle |
| LVPECL, DC and AC Characteristics | | | | | | |
| Current Consumption | I _{dd} | – | 61 | 69 | mA | Excluding Load Termination Current, V _{dd} = 3.3V or 2.5V |
| OE Disable Supply Current | I _{OE} | – | – | 35 | mA | OE = Low |
| Output Disable Leakage Current | I _{leak} | – | – | 1 | μ A | OE = Low |
| Standby Current | I _{std} | – | – | 100 | μ A | \overline{ST} = Low, for all V _{dds} |
| Maximum Output Current | I _{driver} | – | – | 30 | mA | Maximum average current drawn from OUT+ or OUT- |
| Output High Voltage | V _{OH} | V _{dd} -1.1 | – | V _{dd} -0.7 | V | See Figure 1(a) |
| Output Low Voltage | V _{OL} | V _{dd} -1.9 | – | V _{dd} -1.5 | V | See Figure 1(a) |
| Output Differential Voltage Swing | V _{Swing} | 1.2 | 1.6 | 2.0 | V | See Figure 1(b) |
| Rise/Fall Time | T _r , T _f | – | 300 | 500 | ps | 20% to 80%, see Figure 1(a) |
| OE Enable/Disable Time | T _{oe} | – | – | 115 | ns | f = 212.5 MHz - For other frequencies, T _{oe} = 100ns + 3 period |
| RMS Period Jitter | T _{jitt} | – | 1.2 | 1.7 | ps | f = 100 MHz, V _{DD} = 3.3V or 2.5V |
| | | – | 1.2 | 1.7 | ps | f = 156.25 MHz, V _{DD} = 3.3V or 2.5V |
| | | – | 1.2 | 1.7 | ps | f = 212.5 MHz, V _{DD} = 3.3V or 2.5V |
| RMS Phase Jitter (random) | T _{phj} | – | 0.6 | 0.85 | ps | f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dds} |
| LVDS, DC and AC Characteristics | | | | | | |
| Current Consumption | I _{dd} | – | 47 | 55 | mA | Excluding Load Termination Current, V _{dd} = 3.3V or 2.5V |
| OE Disable Supply Current | I _{OE} | – | – | 35 | mA | OE = Low |
| Differential Output Voltage | V _{OD} | 250 | 350 | 450 | mV | See Figure 2 |

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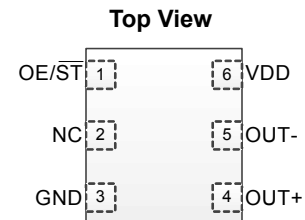


Electrical Characteristics (continued)

| Parameter and Conditions | Symbol | Min. | Typ. | Max. | Unit | Condition |
|--|---------------------------------|-------|------|-------|------|--|
| LVDS, DC and AC Characteristics (continued) | | | | | | |
| Output Disable Leakage Current | I _{leak} | – | – | 1 | μA | OE = Low |
| Standby Current | I _{std} | – | – | 100 | μA | \overline{ST} = Low, for all V _{dds} |
| VOD Magnitude Change | ΔVOD | – | – | 50 | mV | See Figure 2 |
| Offset Voltage | VOS | 1.125 | 1.2 | 1.375 | V | See Figure 2 |
| VOS Magnitude Change | ΔVOS | – | – | 50 | mV | See Figure 2 |
| Rise/Fall Time | T _r , T _f | – | 495 | 600 | ps | 20% to 80%, see Figure 2 |
| OE Enable/Disable Time | T _{oe} | – | – | 115 | ns | f = 212.5 MHz - For other frequencies, T _{oe} = 100ns + 3 period |
| RMS Period Jitter | T _{jitt} | – | 1.2 | 1.7 | ps | f = 100 MHz, VDD = 3.3V or 2.5V |
| | | – | 1.2 | 1.7 | ps | f = 156.25 MHz, VDD = 3.3V or 2.5V |
| | | – | 1.2 | 1.7 | ps | f = 212.5 MHz, VDD = 3.3V or 2.5V |
| RMS Phase Jitter (random) | T _{phj} | – | 0.6 | 0.85 | ps | f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all V _{dds} |

Pin Description

| Pin | Map | | Functionality |
|-----|-----------------|--------|---|
| 1 | OE | Input | H or Open: specified frequency output L: output is high impedance |
| | \overline{ST} | Input | H or Open: specified frequency output L: Device goes to sleep mode. Supply current reduces to I _{std} . |
| 2 | NC | NA | No Connect; Leave it floating or connect to GND for better heat dissipation |
| 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 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 (HBM) | – | 2000 | V |
| Soldering Temperature (follow standard Pb free soldering guidelines) | – | 260 | °C |

Thermal Consideration

| Package | θ _{JA} , 4 Layer Board (°C/W) | θ _{JC} , Bottom (°C/W) |
|-------------|--|---------------------------------|
| 7050, 6-pin | 38.1 | 26.9 |
| 5032, 6-pin | 68.1 | 17.5 |
| 3225, 6-pin | 97.4 | 15.2 |

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 |

Waveform Diagrams

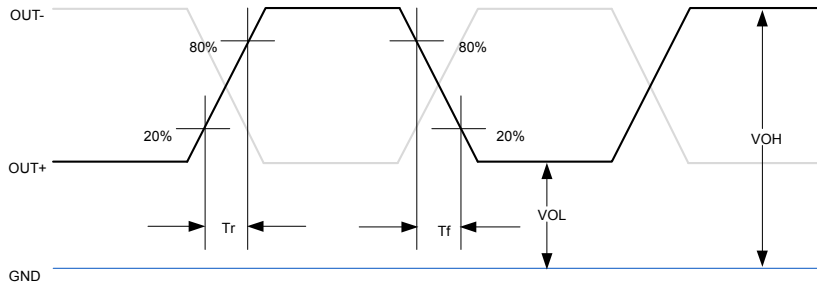


Figure 1(a). LVPECL Voltage Levels per Differential Pin (OUT+/OUT-)

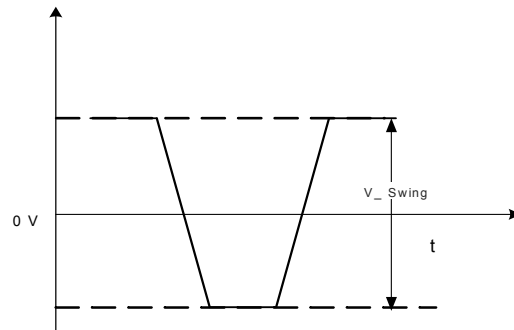


Figure 1(b). LVPECL Voltage Levels Across Differential Pair

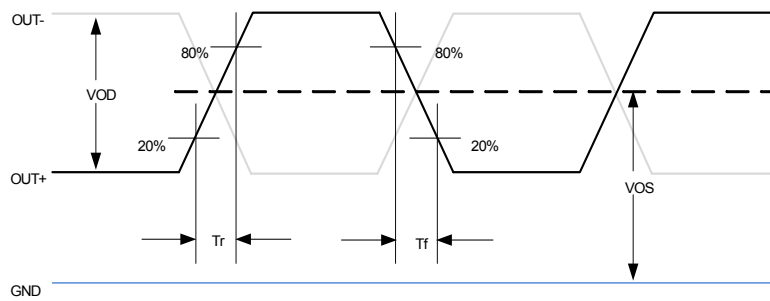


Figure 2. LVDS Voltage Levels per Differential Pin (OUT+/OUT-)

Termination Diagrams

LVPECL:

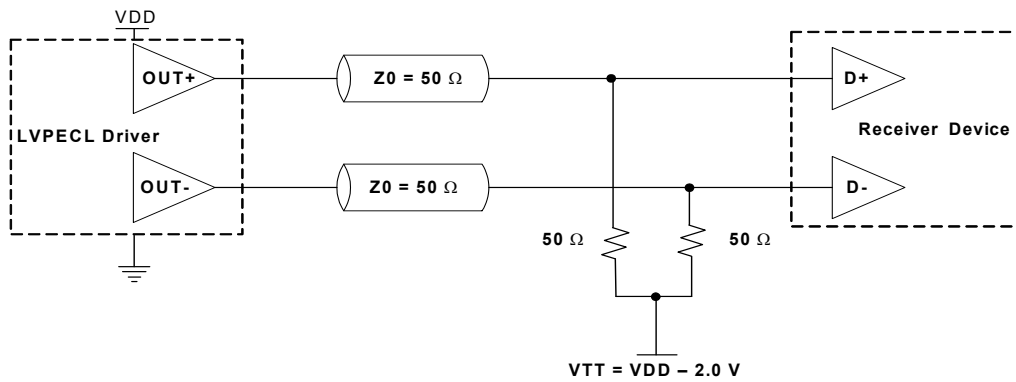


Figure 3. LVPECL Typical Termination

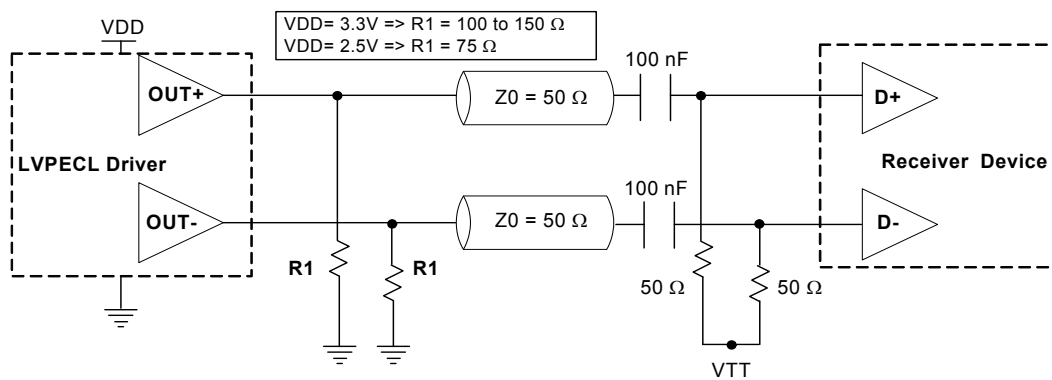


Figure 4. LVPECL AC Coupled Termination

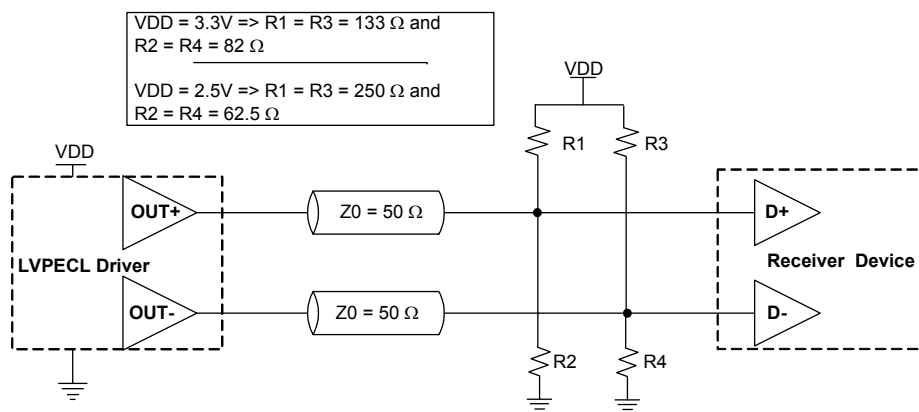


Figure 5. LVPECL with Thevenin Typical Termination

LVDS:

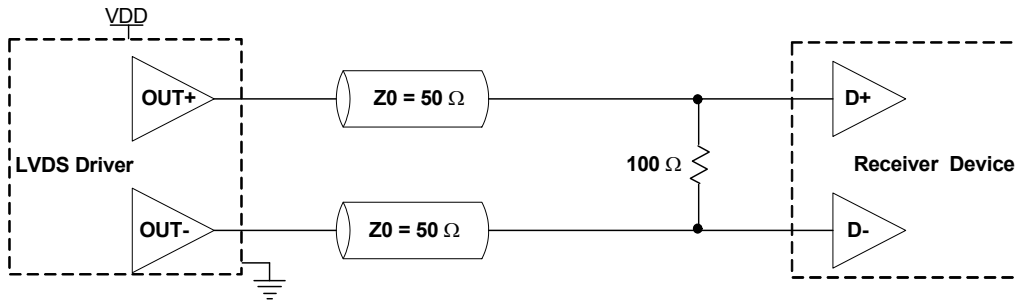
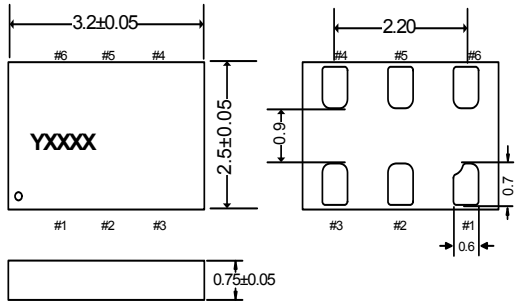
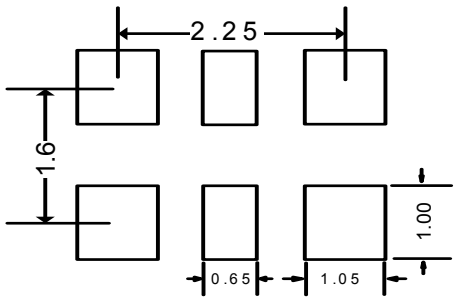
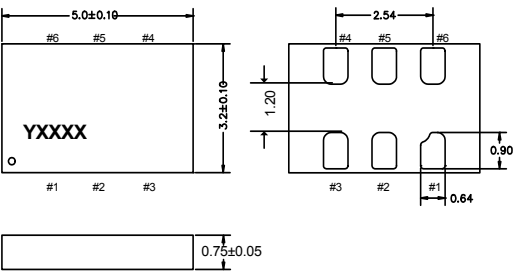
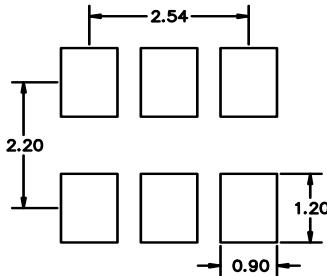
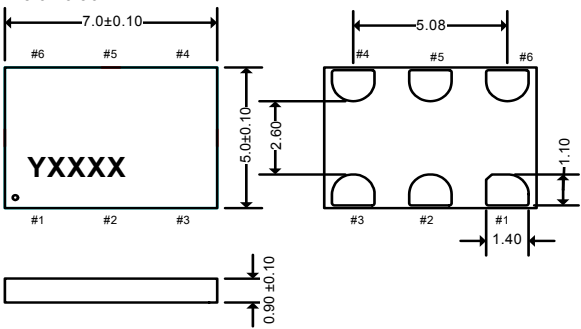
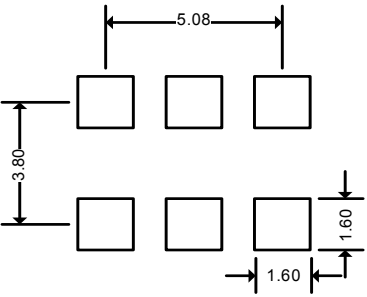


Figure 6. LVDS Single Termination (Load Terminated)

Dimensions and Patterns

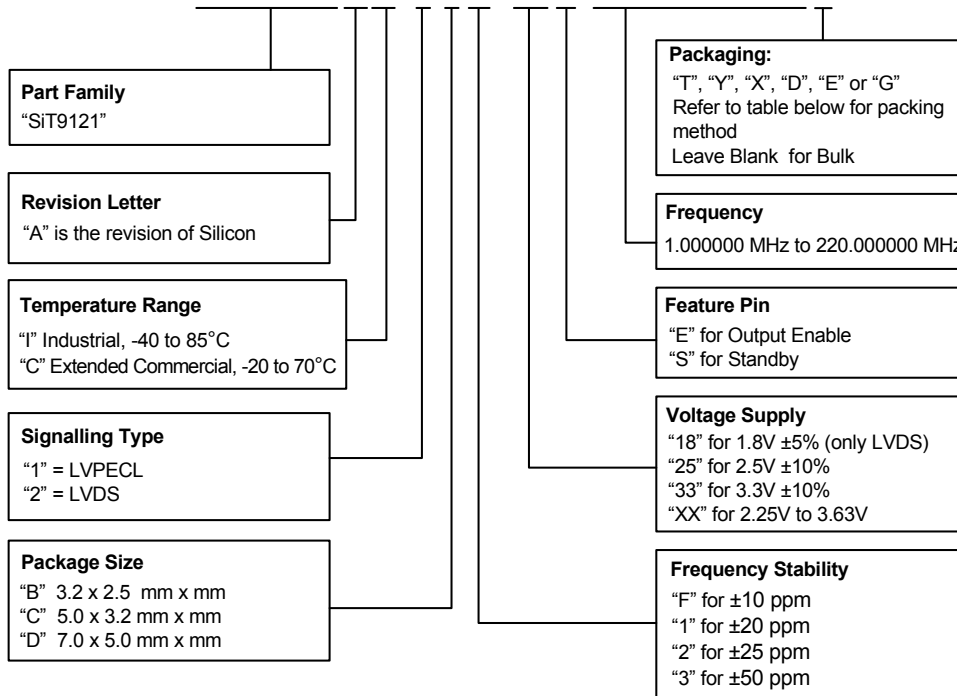
| Package Size – Dimensions (Unit: mm) ^[1] | Recommended Land Pattern (Unit: mm) ^[2] |
|--|--|
| <p>3.2 x 2.5x 0.75 mm</p>  |  |
| <p>5.0 x 3.2 x 0.75 mm</p>  |  |
| <p>7.0 x 5.0x 0.90 mm</p>  |  |

Notes:

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 μ F between Vdd and GND is recommended.

Ordering Information

SiT9121AC-1C2-33E125.000000T



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 | - | - | - |

Frequencies Not Supported

Range 1: From 209.000001 MHz to 210.999999 MHz

Revision History

| Version | Release Date | Change Summary |
|---------|--------------|--|
| 1.01 | 2/20/13 | Original |
| 1.02 | 12/3/13 | Added input specifications, LVPECL/LVDS waveforms, packaging T&R options |
| 1.03 | 2/6/14 | Added 8mm T&R option and ± 10 ppm |
| 1.04 | 4/8/14 | Included 1.8V option for LVDS output only |
| 1.05 | 7/23/14 | Included Thermal Consideration Table |

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