

## 3-Output LVPECL Networking Clock Generator

### Features

- Three differential LVPECL output pairs
- Selectable crystal oscillator interface or LVCMOS/LVTTL single-ended clock input
- Supports the following output frequencies: 125MHz, 156.25MHz, 312.5MHz, 625MHz
- RMS phase jitter @ 156.25MHz, using a 31.25MHz or 26.041666MHz crystal (12kHz – 20MHz): 0.3ps (typical)
- Full 3.3V or 2.5V supply modes
- Commercial and industrial ambient operating temperature
- Available in lead-free package: 24-TSSOP

### Description

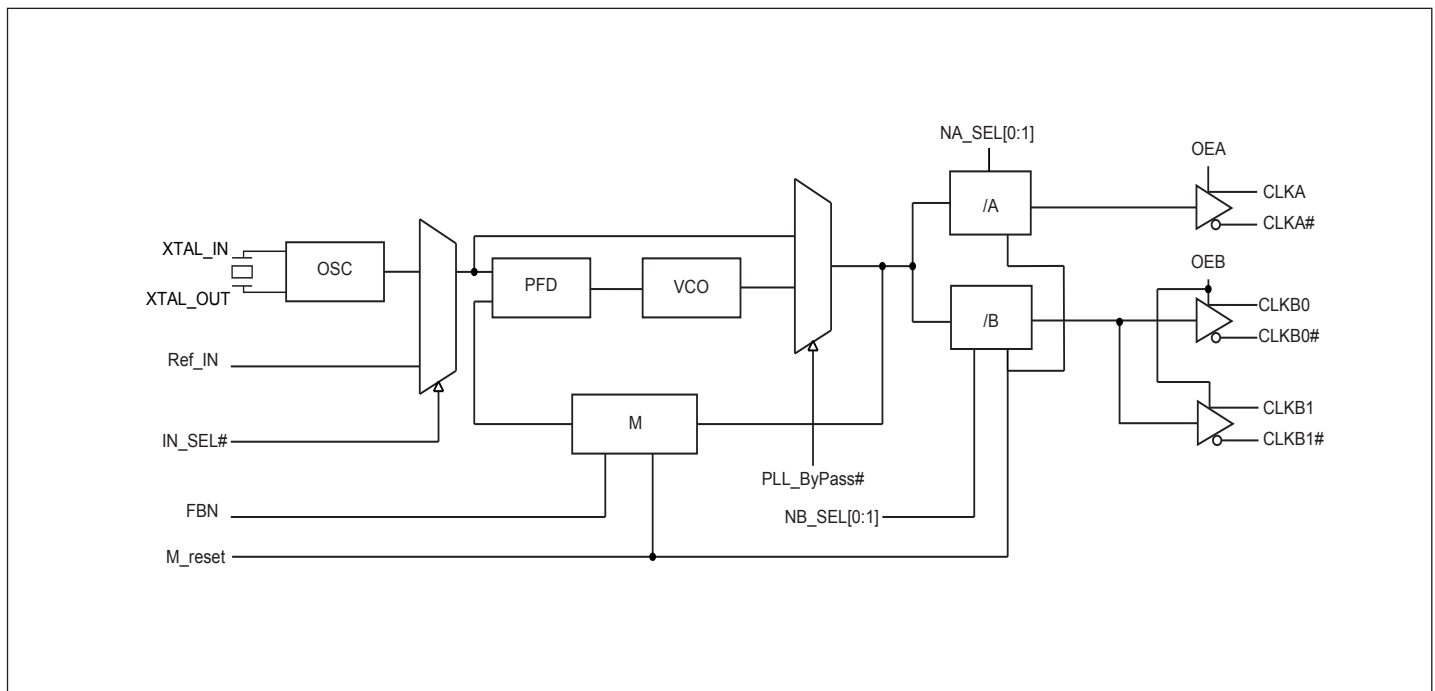
The PI6LC48P03 is a 3-output LVPECL synthesizer optimized to generate Ethernet reference clock frequencies and is a member of Pericom's HiFlex family of high performance clock solutions. Using a 31.25MHz or 26.041666MHz crystal, the most popular Ethernet frequencies can be generated based on the settings of 4 frequency select pins.

The PI6LC48P03 uses Pericom's proprietary low phase noise PLL technology to achieve ultra low phase jitter, so it is ideal for Ethernet interface in all kind of systems.

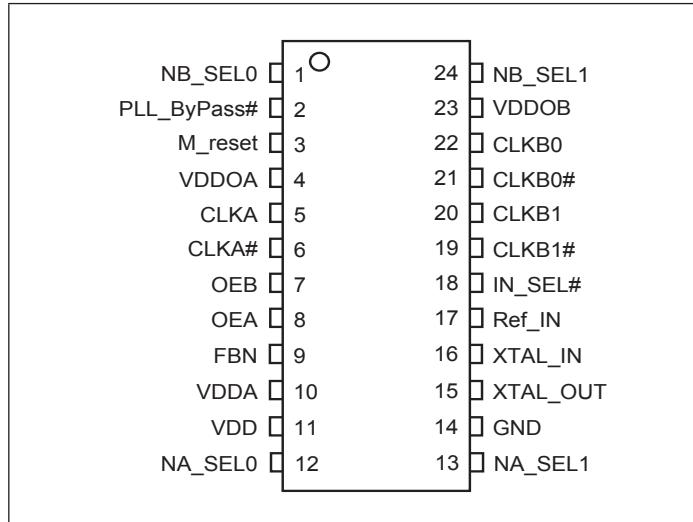
### Applications

- Networking systems

### Block Diagram



### Pin Configuration



### Pinout Table

Pin No.	Pin Name	I/O Type		Description
1	NB_SEL0	Input	Pull-down	Bank B Output Divider Select
2	PLL_ByPass#	Input	Pull-up	Active Low PLL Bypass
3	M_reset	Input	Pull-down	Master Reset. When HIGH, CLKx goes to “low” and CLKx# goes to “high”; When LOW outputs are enabled.
4	VDDOA	Power		Bank A Output Power Supply
5, 6	CLKA, CLKA#	Output		Bank A LVPECL Output Clock
7	OEB	Input	Pull-up	Bank B Output Enable. When LOW, output is differential low.
8	OEA	Input	Pull-up	Bank A Output Enable. When LOW, output is differential low.
9	FBN	Input	Pull-down	Feedback Divider Select
10	VDDA	Power		Analog Power Supply
11	VDD	Power		Core Power Supply
12	NA_SEL0	Input	Pull-up	Bank A Output Divider Select
13	NA_SEL1	Input	Pull-down	Bank A Output Divider Select
14	GND	Ground		Ground
15, 16	XTAL_OUT, XTAL_IN	Crystal		Crystal Input and Output
17	Ref_IN	Input	Pull-down	CMOS Reference Clock Input
18	IN_SEL#	Input	Pull-up	When HIGH, Crystal is selected; When LOW, reference input is selected.
19, 20	CLKB1#, CLKB1	Output		Bank B LVPECL Output Clock 1
21, 22	CLKB0#, CLKB0	Output		Bank B LVPECL Output Clock 0
23	VDDOB	Power		Bank B Output Power Supply
24	NB_SEL1	Input	Pull-up	Bank B Output Divider Select

**Output Frequency Selection Table**

Xtal Frequency (MHz)	NA_SEL1 / NB_SEL1	NA_SEL0 / NB_SEL0	FBN	Output Frequency (MHz)
31.25	0	0	0	625
31.25	0	1	0	312.5 (Bank A Default)
31.25	1	0	0	156.25 (Bank B Default)
31.25	1	1	0	125
26.041666	0	0	1	625
26.041666	0	1	1	312.5 (Bank A Default)
26.041666	1	0	1	156.25 (Bank B Default)
26.041666	1	1	1	125

**Typical Crystal Requirement**

Parameter	Minimum	Typical	Maximum	Units	
Mode of Oscillation	Fundamental				
Frequency	FBN = 0	28	31.25	35	MHz
	FBN = 1	23.33	26.04166	29.167	MHz
Equivalent Series Resistance (ESR)			50	$\Omega$	
Shunt Capacitance			7	pF	
Drive Level			1	mW	

**Recommended Crystal Specification**

Pericom recommends:

- a) FY3120001, SMD 5x3.2(4P), 31.25MHz, CL=18pF, +/-20ppm  
[http://www.pericom.com/pdf/datasheets/se/FY\\_F9.pdf](http://www.pericom.com/pdf/datasheets/se/FY_F9.pdf)
- b) FL2600155, SMD 3.2x2.5(4P), 26.041666MHz, CL18pF, +/-20ppm  
<https://www.pericom.com/assets/Datasheets/FL.pdf>

**Maximum Ratings** (Over operating free-air temperature range)

Storage Temperature.....	-65°C to +155°C
Ambient Temperature with Power Applied.....	-40°C to +85°C
3.3V Analog Supply Voltage.....	-0.5 to +3.6V
ESD Protection (HBM) .....	2000V

**Note:**

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**DC Electrical Characteristics**
**Power Supply DC Characteristics, ( $T_A = -40$  to  $85^\circ\text{C}$ )**

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{DD}$	Core Supply Voltage		3.135	3.3	3.465	V
$V_{DDA}$	Analog Supply Voltage		3.135	3.3	3.465	V
$V_{DDO\_A}$ $V_{DDO\_B}$	Output Supply Voltage		3.135	3.3	3.465	V
$V_{DD}$	Core Supply Voltage		2.375	2.5	2.625	V
$V_{DDA}$	Analog Supply Voltage		2.375	2.5	2.625	V
$V_{DDO\_A}$ $V_{DDO\_B}$	Output Supply Voltage		2.375	2.5	2.625	V
$I_{GND}$	Power Supply Current				132	mA
$I_{DDA}$	Analog Supply Current				30	mA

**LVCMOS/LVTTL DC Characteristics, ( $T_A = -40$  to  $85^\circ\text{C}$ )**

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{IH}$	Input High Voltage	$V_{DD} = 3.3\text{ V} \pm 5\%$	2		$V_{DD} + 0.3$	V
		$V_{DD} = 2.5\text{ V} \pm 5\%$	1.7		$V_{DD} + 0.3$	
$V_{IL}$	Input Low Voltage	$V_{DD} = 3.3\text{ V} \pm 5\%$	-0.3		0.8	V
		$V_{DD} = 2.5\text{ V} \pm 5\%$	-0.3		0.7	V
$I_{IH}$	Input High Current	Ref_IN, FBN, M_reset, NA_SEL1, NB_SEL0 $V_{DD} = V_{IN} = 3.465\text{V}$			100	$\mu\text{A}$
		OEA, OEB, PLL_By- pass#, IN_SEL#, NB_ SEL1, NA_SEL0 $V_{DD} = V_{IN} = 3.465\text{V}$			5	$\mu\text{A}$
$I_{IL}$	Input Low Current	Ref_IN, FBN, M_reset, NA_SEL1, NB_SEL0 $V_{DD} = 3.465\text{V}$ , $V_{IN} = 0\text{V}$	-5			$\mu\text{A}$
		OEA, OEB, PLL_By- pass#, IN_SEL#, NB_ SEL1, NA_SEL0 $V_{DD} = 3.465\text{V}$ , $V_{IN} = 0\text{V}$	-100			$\mu\text{A}$

**LVPECL DC Characteristics, ( $T_A = -40$  to  $85^\circ\text{C}$ )**

Symbol	Parameter	Condition	Min	Typ	Max	Units
V <sub>OH</sub>	Output High Voltage <sup>(1)</sup>	V <sub>DD</sub> = 3.3V	1.9		2.4	V
		V <sub>DD</sub> = 2.5V	1.1		1.6	
V <sub>OL</sub>	Output Low Voltage <sup>(1)</sup>	V <sub>DD</sub> = 3.3V	1.2		1.6	V
		V <sub>DD</sub> = 2.5V	0.4		0.8	

Note: 1. LVPECL Termination: Source 150ohm to GND and 100ohm across CLK and CLK#.

**AC Electrical Characteristics ( $T_A = -40$  to  $85^\circ\text{C}$ )**

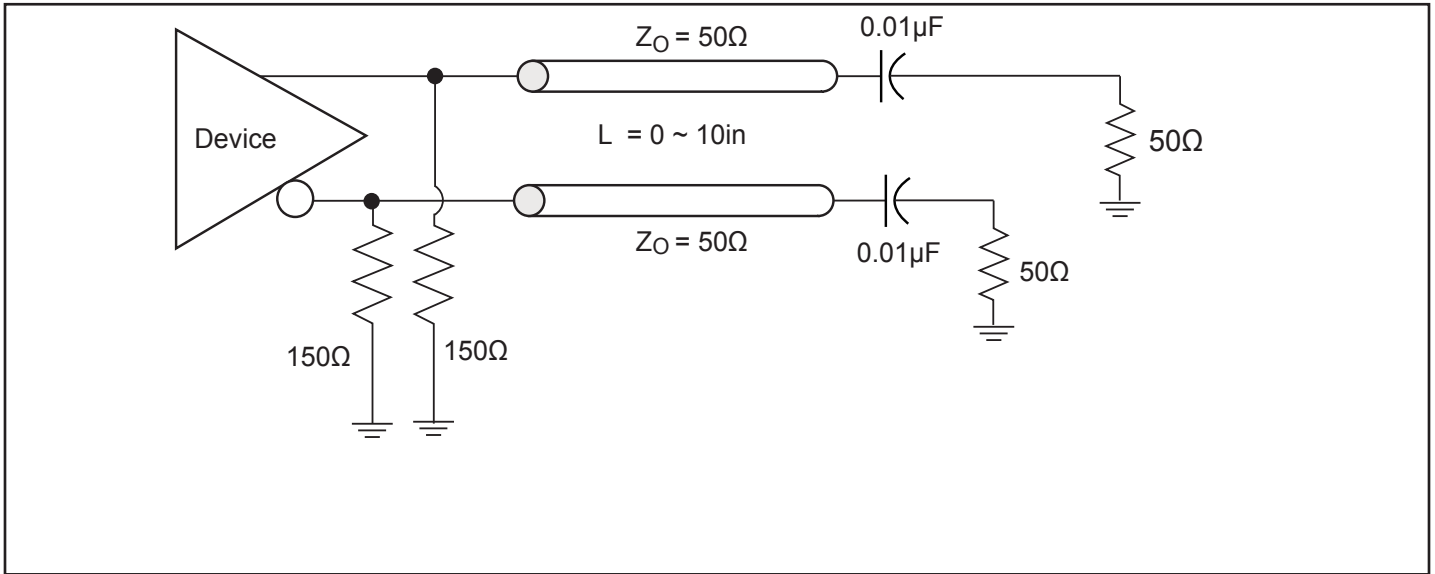
LVPECL Termination: Source 150ohm to GND and using 0.01uF ac-coupled to 50ohm to GND

Symbol	Parameter	Condition	Min.	Typ.	Max	Units
f <sub>OUT</sub>	Output Frequency	NA_SEL[1:0] / NB_SEL[1:0] = 00	560		700	MHz
		NA_SEL[1:0] / NB_SEL[1:0] = 01	280		350	MHz
		NA_SEL[1:0] / NB_SEL[1:0] = 10	140		175	MHz
		NA_SEL[1:0] / NB_SEL[1:0] = 11	112		140	MHz
t <sub>sk(B)</sub>	Output Skew <sup>(1)</sup>	Output with same VDD and load			30	ps
t <sub>sk(o)</sub>	Output Skew <sup>(2,4)</sup>	Output @ Same Frequencies			120	ps
		Output @ Different Frequencies			150	ps
t <sub>jit(Ø)</sub>	RMS Phase Jitter, (Random) <sup>(3)</sup>	625MHz, (1.875MHz - 20MHz)		0.15		ps
		625MHz, (12kHz - 20MHz)		0.3		ps
		312.5MHz, (1.875MHz - 20MHz)		0.15		ps
		312.5MHz, (12kHz - 20MHz)		0.3		ps
		156.25MHz, (1.875MHz - 20MHz)		0.15		ps
		156.25MHz, (12kHz - 20MHz)		0.3		ps
		125MHz, Freq Select 110, (1.875MHz - 20MHz)		0.15		ps
		125MHz, Freq Select 110, (12kHz - 20MHz)		0.3		ps
t <sub>R</sub> / t <sub>F</sub>	Output Rise/Fall Time	20% to 80%			400	ps
o <sub>DC</sub>	Output Duty Cycle <sup>(5)</sup>		48		52	%

**Note:**

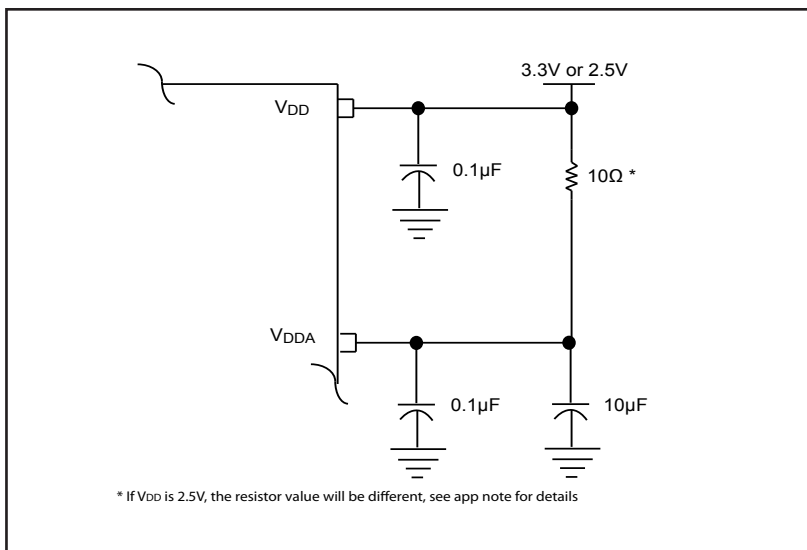
1. Defined as skew within a bank of outputs at the same supply voltage and with equal load conditions.
2. Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at the differential cross points.
3. Please refer to the Phase Noise Plots.
4. This parameter is defined in accordance with JEDEC Standard 65. Measured at the differential cross points.
5. Measured at the differential cross points.

**LVPECL Test Circuit**



**Power Supply Filtering Techniques**

As in any high speed analog circuitry, the power supply pins are vulnerable to random noise. To achieve optimum jitter performance, power supply isolation is required. The PI6LC48P03 provides separate power supplies to isolate any high switching noise from the outputs to the internal PLL.  $V_{DD}$ ,  $V_{DDA}$  and  $V_{DDO}$  should be individually connected to the power supply plane through vias, and 0.1μF bypass capacitors should be used for each pin. Figure below illustrates this for a generic  $V_{DD}$  pin and also shows that  $V_{DDA}$  requires that an additional 10Ω resistor along with a 10μF bypass capacitor be connected to the  $V_{DDA}$  pin.



## Recommendations for Unused Input and Output Pins

### Inputs:

#### Crystal Inputs:

For applications not requiring the use of the crystal oscillator input, both XTAL\_IN and XTAL\_OUT can be left floating. A 1k $\Omega$  resistor can be tied from XTAL\_IN to ground for additional protection.

#### Ref\_IN Input:

For applications not requiring the use of the clock, it can be left floating. A 1k $\Omega$  resistor tied from the Ref\_IN to ground can provide additional protection.

#### LVC MOS Control Pins:

All control pins have internal pulldowns/pullups; A 1k $\Omega$  resistor tied from internal pulldown control pins to ground, and a 4.7k $\Omega$  tied from internal pullup control pins to power supply can provide additional protection.

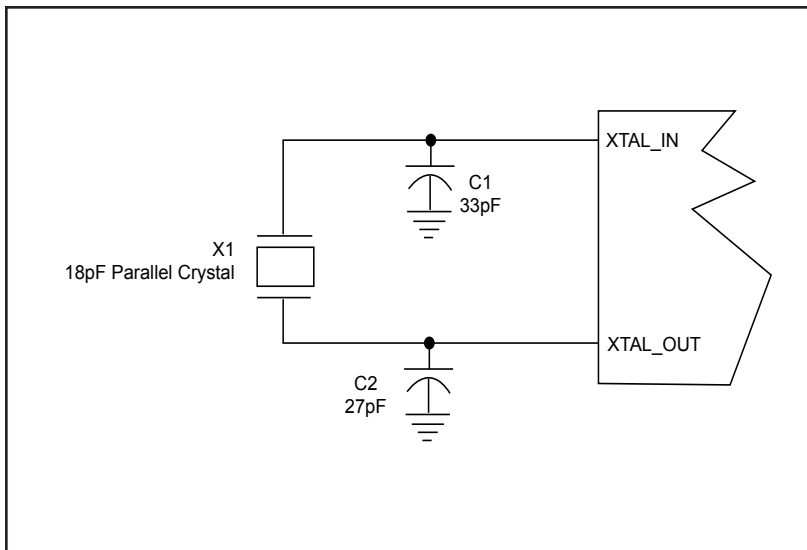
### Outputs:

#### LVPECL Outputs:

All unused LVPECL outputs can be left floating.

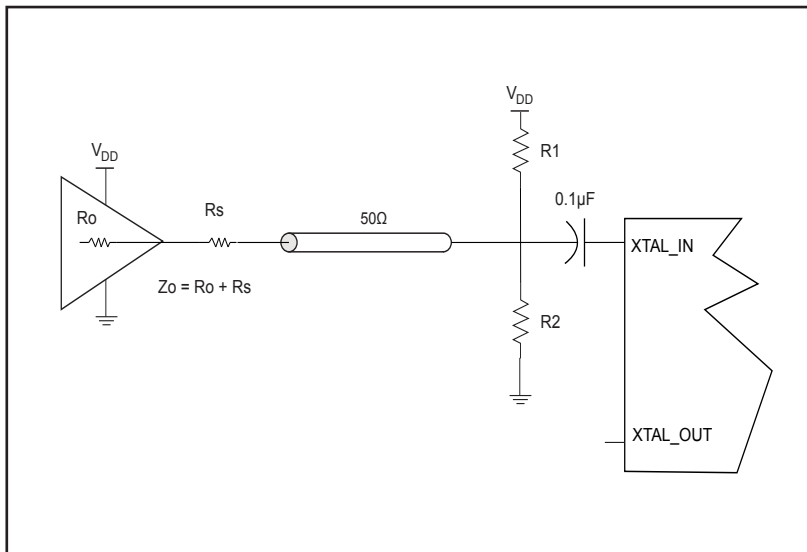
## Crystal Input Interface

The clock generator has been characterized with 18pF parallel resonant crystals. The capacitor values shown in the figure below were determined using a 31.25MHz or 26.041666MHz, 18pF parallel resonant crystal and were chosen to minimize the ppm error.



**LVCMOS to XTAL Interface**

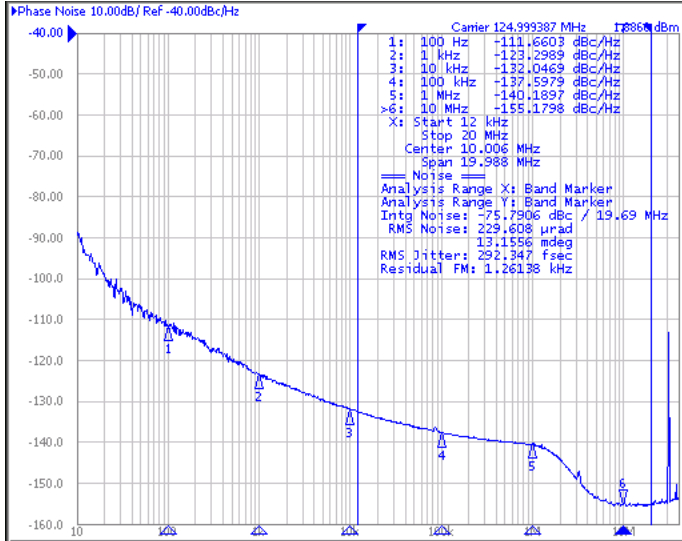
The XTAL\_IN input can accept a single-ended LVCMOS signal through an AC coupling capacitor. A general interface diagram is shown in the figure below. The XTAL\_OUT pin can be left floating. The input edge rate can be as slow as 10ns. For LVCMOS signals, it is recommended that the amplitude be reduced from full swing to half swing in order to prevent signal interference with the power rail and to reduce noise. This configuration requires that the output impedance of the driver ( $R_o$ ) plus the series resistance ( $R_s$ ) equals the transmission line impedance. In addition, matched termination at the crystal input will attenuate the signal in half. This can be done in one of the two ways. First,  $R_1$  and  $R_2$  in parallel should equal the transmission line impedance. For most  $50\Omega$  applications,  $R_1$  and  $R_2$  can be  $100\Omega$ . This can also be accomplished by removing  $R_1$  and making  $R_2$   $50\Omega$ . By overdriving the crystal oscillator, the device will be functional, but note, the device performance is guaranteed by using a quartz crystal.



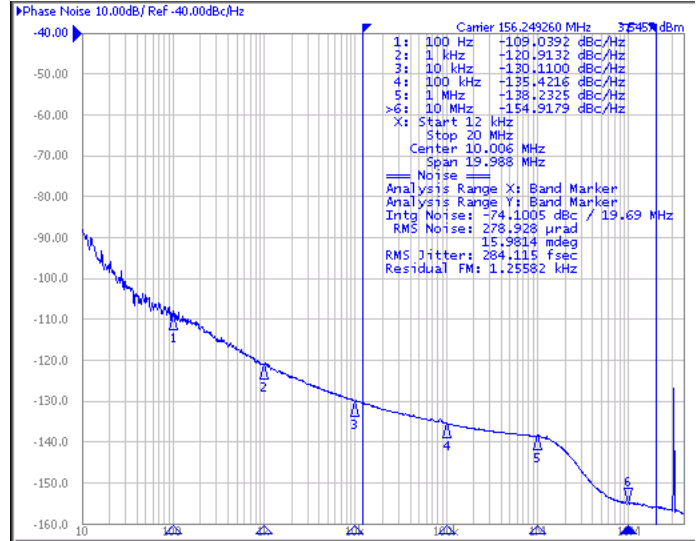


**Phase Noise Plots**

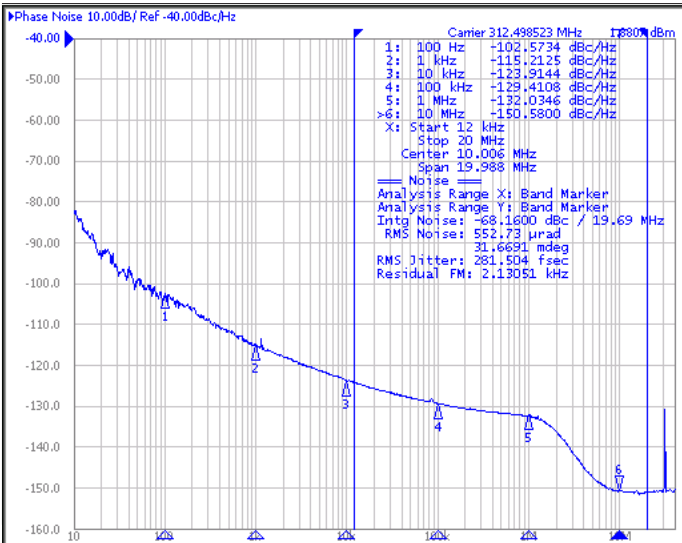
**125MHz**



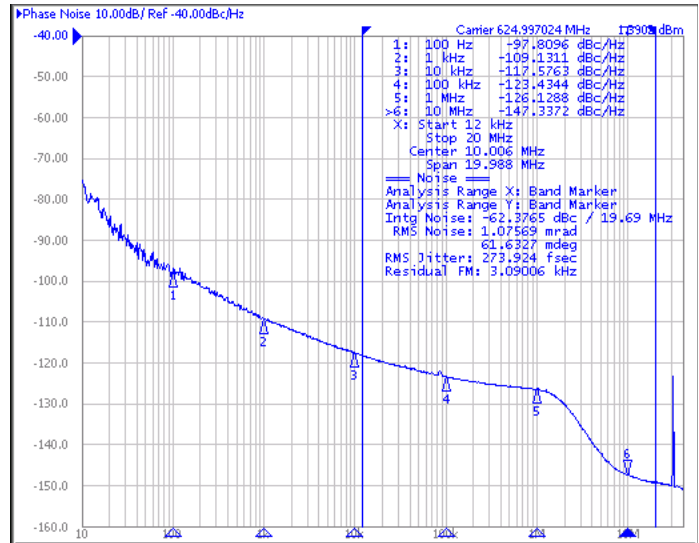
**156.25MHz**



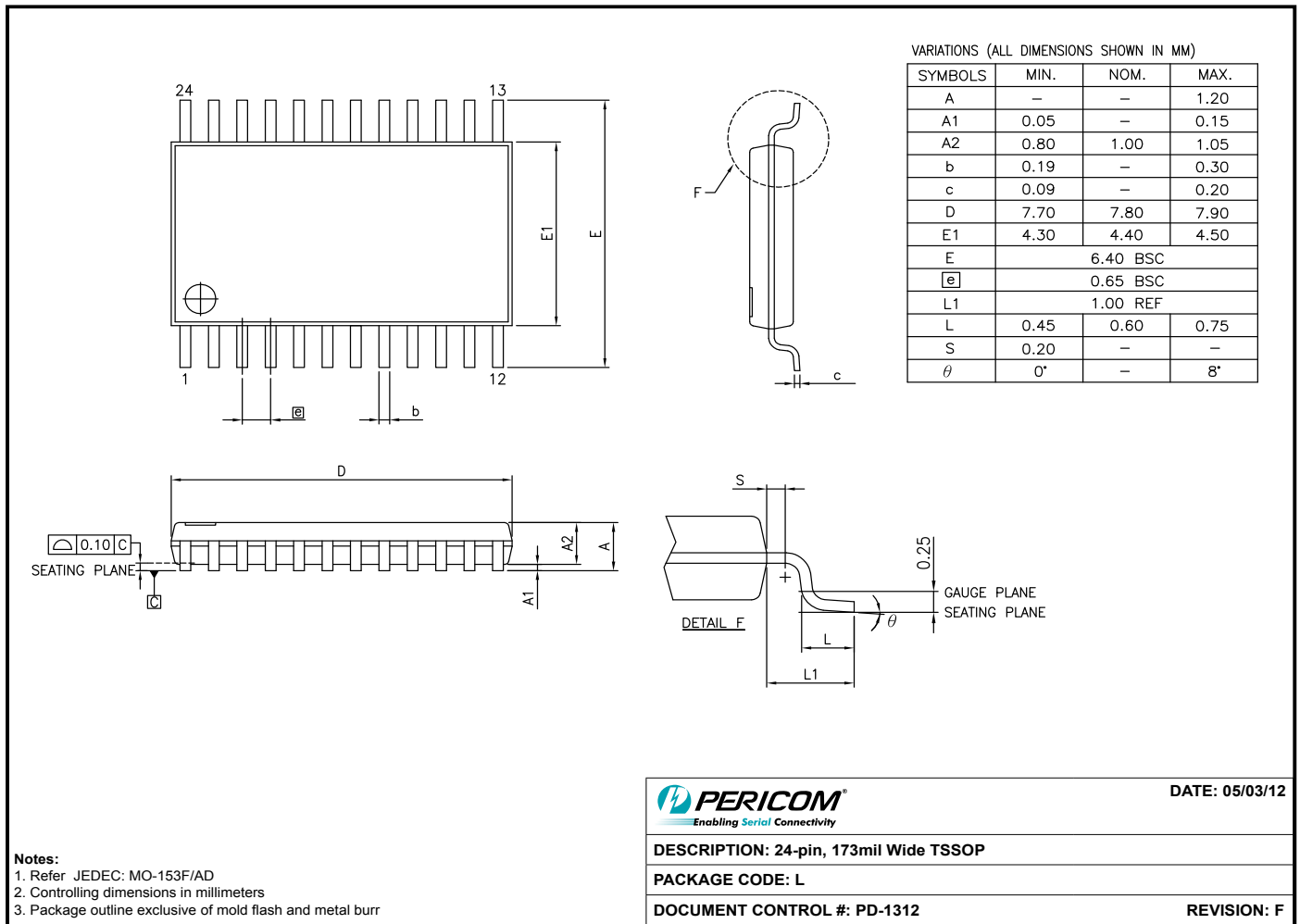
**312.5MHz**



**625MHz**



### Packaging Mechanical: 24-Contact TSSOP (L)



12-0374

### Ordering Information

Ordering Code	Packaging Type	Package Description	Operating Temperature
PI6LC48P03LE	L	Pb-free & Green, 24-pin TSSOP	Commercial
PI6LC48P03LEX	L	Pb-free & Green, 24-pin TSSOP, Tape & reel	Commercial
PI6LC48P03LIE	L	Pb-free & Green, 24-pin TSSOP	Industrial
PI6LC48P03LIEX	L	Pb-free & Green, 24-pin TSSOP, Tape & reel	Industrial

**Notes:**

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
- "E" denotes Pb-free and Green
- Adding an "X" at the end of the ordering code denotes tape and reel packaging