

## Features

- Single LVCMOS output
- Supports 125MHz or 130MHz output frequencies
- RMS phase jitter @ 125MHz, using a 25MHz crystal (1.875MHz – 20MHz): 0.15ps (typical)
- RMS phase jitter @ 125MHz, using a 25MHz crystal (12kHz – 20MHz): 0.33ps (typical)
- Full 3.3V or 2.5V supply modes
- Industrial ambient operating temperature
- Available in lead-free package: 8-TSSOP

## Description

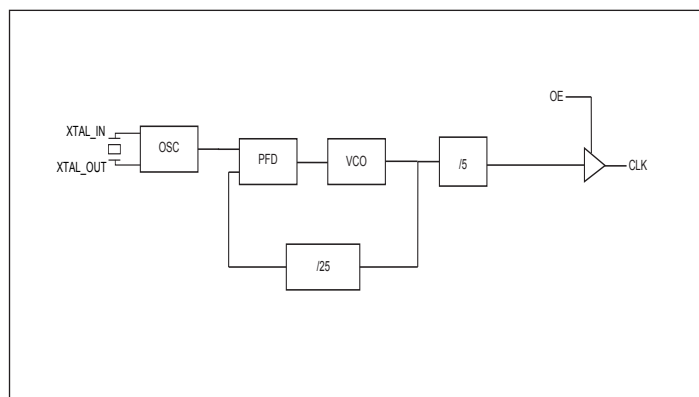
The PI6LC48C21 is a single LVCMOS output synthesizer optimized to generate Ethernet reference clock frequencies and is a member of Pericom's HiFlex family of high performance clock solutions. Using a 25MHz crystal, It can generate 125MHz with very low phase jitter.

It is ideal for Ethernet interface in all kind of systems.

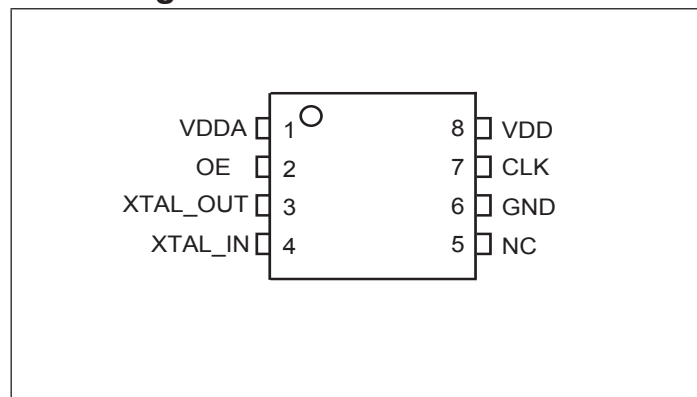
## Applications

- Networking systems

## Block Diagram



## Pin Configuration



## Pinout Table

| Pin No. | Pin Name             | I/O Type |         | Description                                      |
|---------|----------------------|----------|---------|--|
| 1       | VDDA                 | Power    |         | Analog Power Supply                              |
| 2       | OE                   | Input    | Pull-up | High: Output enabled; Low: Output high impedance |
| 3, 4    | XTAL_OUT,<br>XTAL_IN | Crystal  |         | Crystal Input and Output                         |
| 5       | NC                   |          |         | No Connect                                       |
| 6       | GND                  | Power    |         | Ground   |
| 7       | CLK                  | Output   |         | Output Clock                                     |
| 8       | VDD                  | Power    |         | Power Supply                                     |

## Typical Crystal Requirement

| Parameter                          | Minimum     | Typical | Maximum | Units    |
|------------------------------------|-------------|---------|---------|----------|
| Mode of Oscillation                | Fundamental |         |         |          |
| Frequency                          | 22.4        | 25      | 27.2    | MHz      |
| Equivalent Series Resistance (ESR) |             |         | 50      | $\Omega$ |
| Shunt Capacitance                  |             |         | 7       | pF       |
| Drive Level                        |             |         | 1       | mW       |

## Recommended Crystal Specification

Pericom recommends:

- a) FL2500047, SMD 3.2x2.5(4P), 25MHz, CL=18pF, +/-20ppm. <http://www.pericom.com/pdf/datasheets/se/FL.pdf>
- b) FY2500091, SMD 5x3.2(4P), 25MHz, CL=18pF, +/-30ppm. [http://www.pericom.com/pdf/datasheets/se/FY\\_F9.pdf](http://www.pericom.com/pdf/datasheets/se/FY_F9.pdf)
- c) FL2600018, SMD 3.2x2.5(4P), 26MHz, CL=18pF, +/-20ppm. <http://www.pericom.com/pdf/datasheets/se/FL.pdf>

## Output Frequency

| Crystal Frequency (MHz) | Output Frequency (MHz) |
|-------------------------|------------------------|
| 25                      | 125                    |
| 26                      | 130                    |

## Pin Characteristics

| Symbol       | Parameter         | Minimum | Typical | Maximum | Units      |
|--------------|-------------------|---------|---------|---------|------------|
| $C_{IN}$     | Input Capacitance |         | 4       |         | pF         |
| $R_{PULLUP}$ | Pull up resistor  |         | 51      |         | k $\Omega$ |
| $R_{OUT}$    | Output Impedance  |         | 15      |         | $\Omega$   |

## 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, ( $V_{DD} = V_{DDA}$ ,  $T_A = -40$  to  $85^\circ\text{C}$ )**

| Symbol            | Parameter                   | Condition | Min   | Typ | Max   | Units |
|-------------------|-----------------------------|-----------|-------|-----|-------|-------|
| $V_{DD}, V_{DDA}$ | Core, Analog Supply Voltage |           | 3.135 | 3.3 | 3.465 | V     |
| $V_{DD}, V_{DDA}$ | Core, Analog Supply Voltage |           | 2.375 | 2.5 | 2.625 | V     |
| $I_{DD}$          | Power Supply Current        |           |       |     | 45    | mA    |
| $I_{DDA}$         | Analog Supply Current       |           |       |     | 25    | mA    |

## DC Electrical Characteristics, ( $V_{DD} = V_{DDA}$ , $T_A = -40$ to $85^\circ\text{C}$ )

| Symbol   | Parameter           |    | Condition  | Min     | Typ | Max            | Units |
|----------|---------------------|----|--|---------|-----|----------------|-------|
| $V_{IH}$ | Input High Voltage  |    | $V_{DD} = 3.3V \pm 5\%$                          | 2       |     | $V_{DD} + 0.3$ | V     |
|          |                     |    | $V_{DD} = 2.5V \pm 5\%$                          | 1.7     |     | $V_{DD} + 0.3$ |       |
| $V_{IL}$ | Input Low Voltage   |    | $V_{DD} = 3.3V \pm 5\%$                          | -0.3    |     | 0.8            | V     |
|          |                     |    | $V_{DD} = 2.5V \pm 5\%$                          | -0.3    |     | 0.7            |       |
| $V_{OH}$ | Output High Voltage |    | $V_{DD} = 3.3V \pm 5\%$ , $I_{OH} = -8\text{mA}$ | 2.6     |     |                | V     |
|          |                     |    | $V_{DD} = 2.5V \pm 5\%$ , $I_{OH} = -4\text{mA}$ | 90% VDD |     |                |       |
| $V_{OL}$ | Output Low Voltage  |    | $V_{DD} = 3.3V \pm 5\%$ , $I_{OL} = 8\text{mA}$  |         |     | 0.4            | V     |
|          |                     |    | $V_{DD} = 2.5V \pm 5\%$ , $I_{OL} = 4\text{mA}$  |         |     | 10% VDD        |       |
| $I_{IH}$ | Input High Current  | OE | $V_{DD} = V_{IN} = 3.465V$                       |         |     | 5              | uA    |
| $I_{IL}$ | Input Low Current   | OE | $V_{DD} = 3.465V$ , $V_{IN} = 0V$                | -150    |     |                | uA    |

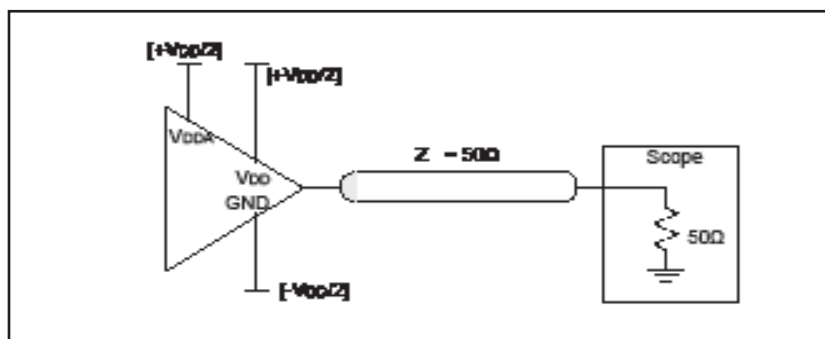
## AC Electrical Characteristics, ( $V_{DD} = V_{DDA}$ , $T_A = -40$ to $85^\circ\text{C}$ )

| Symbol               | Parameter                                 | Condition                     | Min. | Typ. | Max | Units |
|----------------------|---|-------------------------------|------|------|-----|-------|
| $f_{OUT}$            | Output Frequency                          |                               | 112  | 125  | 136 | MHz   |
| $t_{jit(\emptyset)}$ | RMS Phase Jitter, (Random) <sup>(1)</sup> | 125MHz,<br>(1.875MHz - 20MHz) |      | 0.15 |     | ps    |
|                      |   | 125MHz,<br>(12kHz - 20MHz)    |      | 0.33 |     | ps    |
| $t_R / t_F$          | Output Rise/Fall Time                     | 20% to 80%                    | 250  |      | 800 | ps    |
| $\phi_{DC}$          | Output Duty Cycle                         |                               | 47   |      | 53  | %     |

### Note:

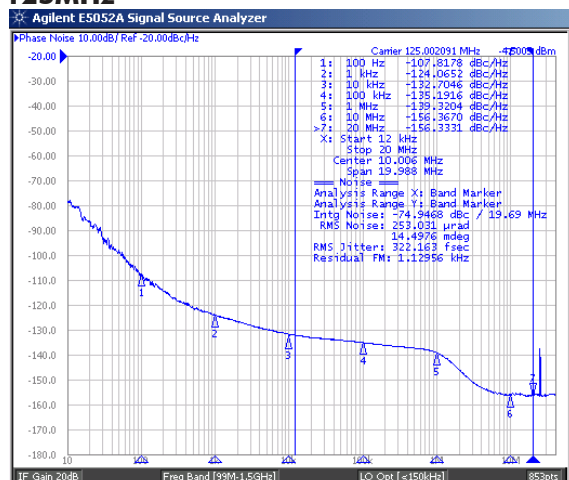
1. Please refer to the Phase Noise Plots.

## LVCMOS Test Circuit



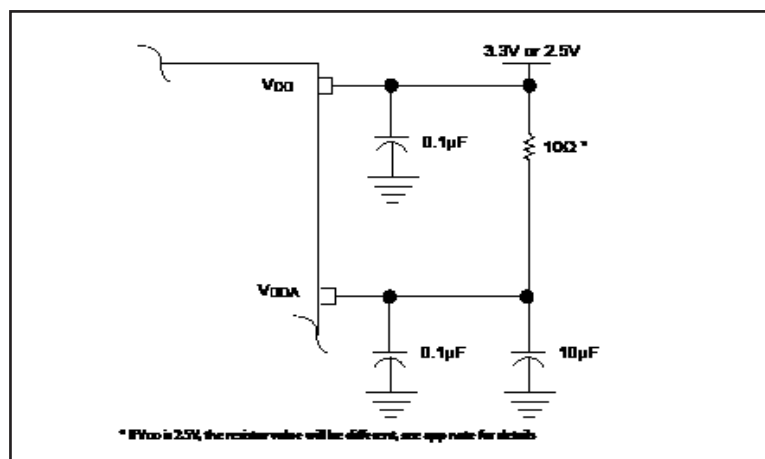
## Phase Noise Plot

### 125MHz



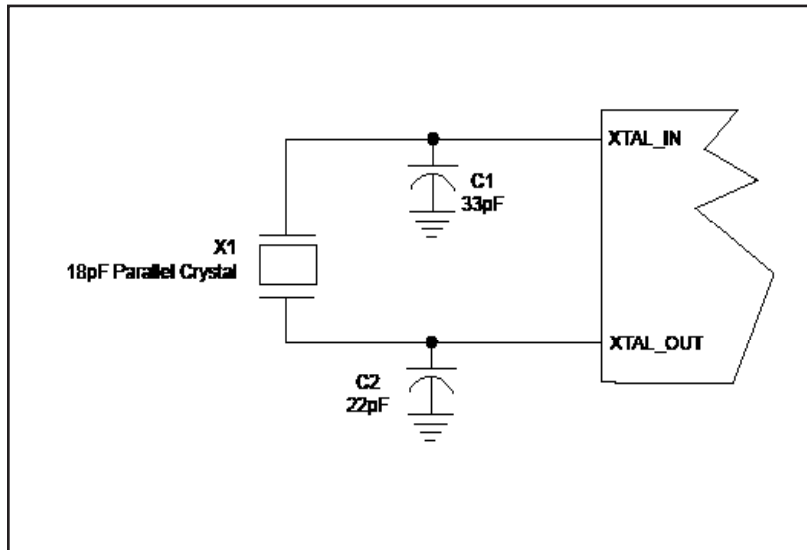
## Power Supply Filtering Techniques

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 PI6LC48C21 provides separate power supplies to isolate any high switching noise from the outputs to the internal PLL.  $V_{DD}$  and  $V_{DDA}$  should be individually connected to the power supply plane through vias, and 0.1 $\mu$ F 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 10 $\Omega$  resistor along with a 10 $\mu$ F bypass capacitor be connected to the  $V_{DDA}$  pin.



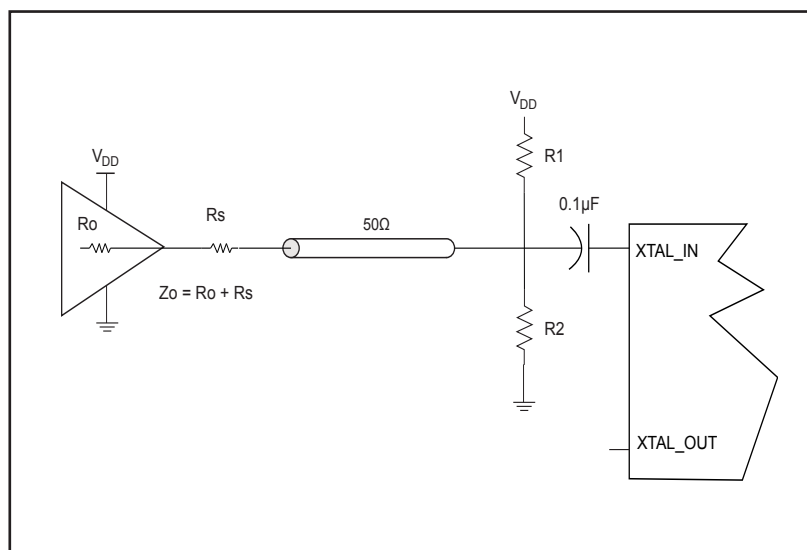
## Crystal Input Interface

The clock generator has been characterized with 18pF parallel resonant crystals. The capacitor values shown in the figure below were determined using a 25MHz, 18pF parallel resonant crystal and were chosen to minimize the ppm error.

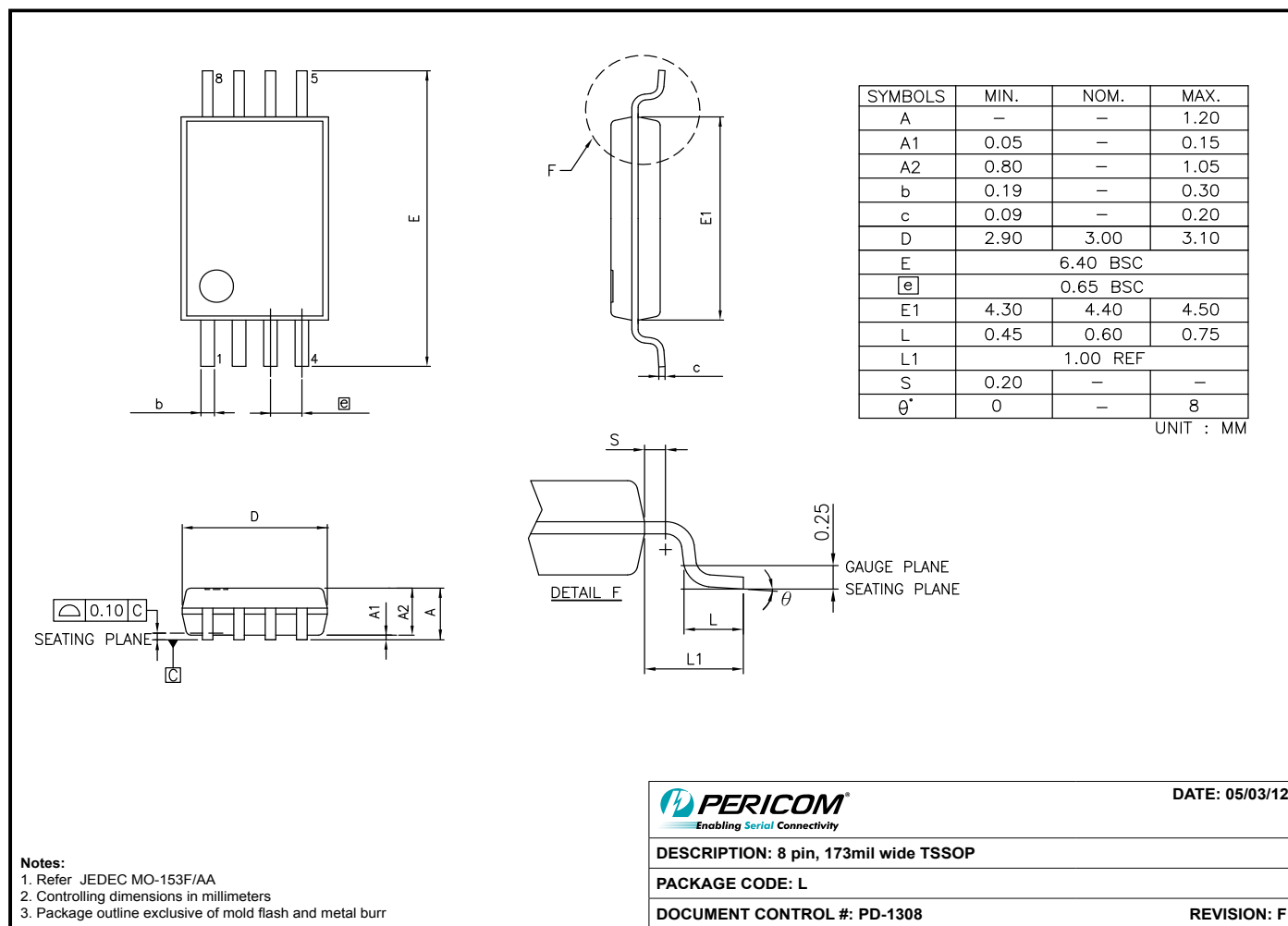


## LVCMOS to XTAL Interface

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 50Ω applications,  $R_1$  and  $R_2$  can be 100Ω. This can also be accomplished by removing  $R_1$  and making  $R_2$  50Ω. By overdriving the crystal oscillator, the device will be functional, but note, the device performance is guaranteed by using a quartz crystal.



## Packaging Mechanical: 8-Contact TSSOP (L)



12-0370

## Ordering Information

| Ordering Code  | Packaging Type | Package Description                       | Operating Temperature |
|----------------|----------------|---|-----------------------|
| PI6LC48C21LIE  | L              | Pb-free & Green, 8-pin TSSOP              | Industrial            |
| PI6LC48C21LIEX | L              | Pb-free & Green, 8-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