

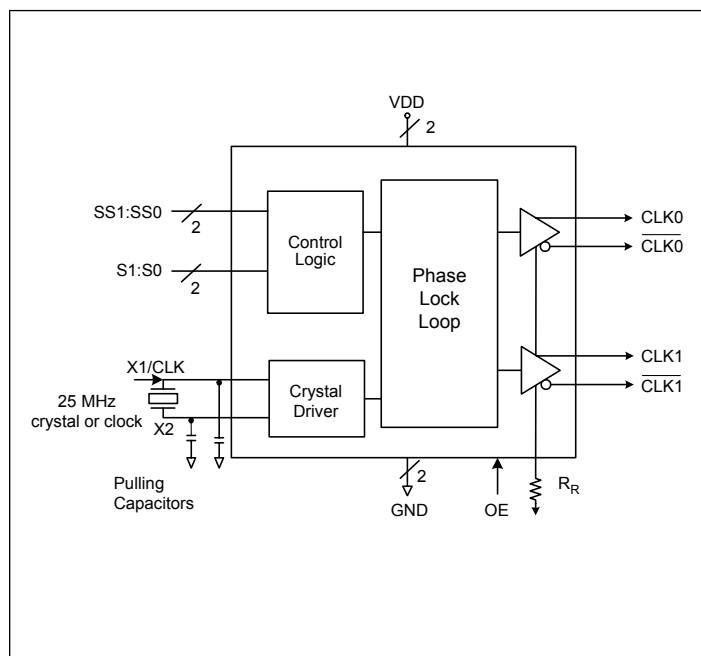
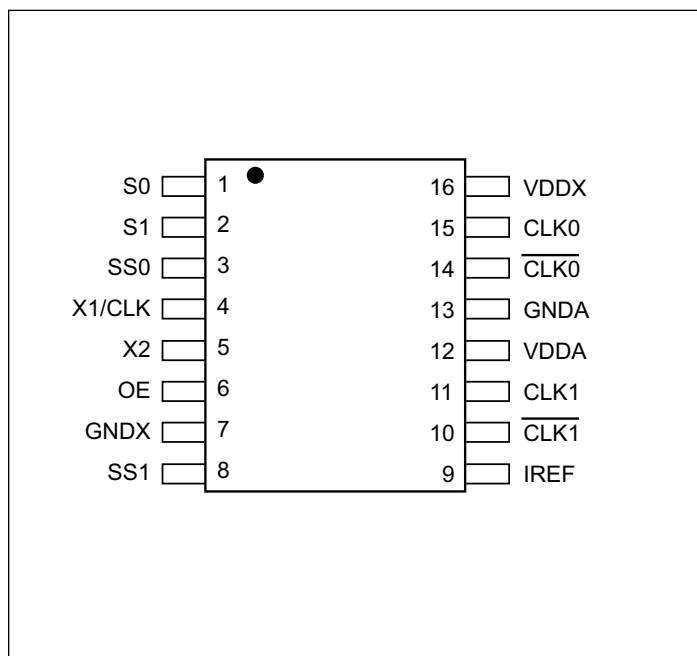
PI6C557-03A
PCIe 2.0 Clock Generator with 2 HCSL Outputs
Features

- PCIe® 2.0 compliant
 - Phase jitter - 2.1ps RMS (typ)
- LVDS compatible outputs
- Supply voltage of 3.3V ±10%
- 25MHz crystal or clock input frequency
- HCSL outputs, 0.8V Current mode differential pair
- Jitter 35ps cycle-to-cycle (typ)
- Spread of -0.5%, -0.75%, and no spread
- Industrial temperature range
- Spread Bypass option available
- Spread and frequency selection via external pins
- Packaging: (Pb-free and Green)
 - 16-pin TSSOP (L16)
 - 16-pin QSOP (Q16)

Description

The PI6C557-03A is a spread spectrum clock generator compliant to PCI Express® 2.0 and Ethernet requirements. The device is used for PC or embedded systems to substantially reduce Electro-magnetic Interference (EMI).

The PI6C557-03A provides two differential (HCSL) or LVDS spread spectrum outputs. The PI6C557-03A is configured to select spread and clock selection. Using Pericom's patented Phase-Locked Loop (PLL) techniques, the device takes a 25MHz crystal input and produces two pairs of differential outputs (HCSL) at 25MHz, 100MHz, 125MHz and 200MHz clock frequencies. It also provides spread selection of -0.5%, -0.75%, and no spread.

Block Diagram

Pin Configuration (16-Pin TSSOP)


Pin Description

| Pin # | Pin Name | I/O Type | Description |
|-------|----------|----------|---|
| 1 | S0 | Input | Select pin 0 (Internal pull-up resistor). See Table 1. |
| 2 | S1 | Input | Select pin 1 (Internal pull-up resistor). See Table 1. |
| 3 | SS0 | Input | Spread Select pin 0 (Internal pull-up resistor). See Table 2. |
| 4 | X1/CLK | Input | Crystal or clock input. Connect to a 25MHz crystal or single ended clock. |
| 5 | X2 | Output | Crystal connection. Leave unconnected for clock input. |
| 6 | OE | Input | Output enable. Internal pull-up resistor. |
| 7 | GNDX | Power | Crystal ground pin. |
| 8 | SS1 | Input | Spread Select pin 1 (Internal pull-up resistor). See Table 2. |
| 9 | IREF | Output | Precision resistor attached to this pin is connected to the internal current reference. |
| 10 | CLK1 | Output | HCSL compliment clock output |
| 11 | CLK1 | Output | HCSL clock output |
| 12 | VDDA | Power | Connect to a +3.3V source. |
| 13 | GND A | Power | Output and analog circuit ground. |
| 14 | CLK0 | Output | HCSL compliment clock output |
| 15 | CLK0 | Output | HCSL clock output |
| 16 | VDDX | Power | Connect to a +3.3V source. |

Table 1: Output Frequency Select Table

| S1 | S0 | CLK(MHz) |
|----|----|----------|
| 0 | 0 | 25 |
| 0 | 1 | 100 |
| 1 | 0 | 125 |
| 1 | 1 | 200 |

Table 2: Spread Selection Table

| SS1 | SS0 | Spread |
|-----|-----|------------|
| 0 | 0 | No Spread |
| 0 | 1 | Down -0.5 |
| 1 | 0 | Down -0.75 |
| 1 | 1 | No Spread |

Application Information

Decoupling Capacitors

Decoupling capacitors of 0.01μF should be connected between each V_{DD} pin and the ground plane and placed as close to the V_{DD} pin as possible.

Crystal

Use a 25MHz fundamental mode parallel resonant crystal with less than 300PPM of error across temperature.

Crystal Capacitors

C_L = Crystals's load capacitance in pF

Crystal Capacitors (pF) = $(C_L - 8) * 2$

For example, for a crystal with 16pF load caps, the external effective crystal cap would be 16 pF. $(16-8)*2=16$.

Current Source (IREF) Reference Resistor - R_R

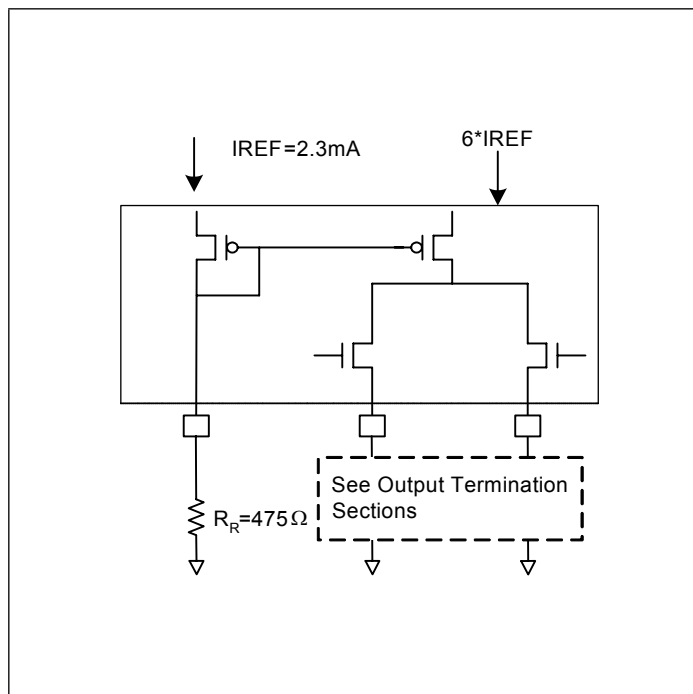
If board target trace impedance is 50Ω, then R_R = 475Ω providing an IREF of 2.32 mA. The output current (I_{OH}) is 6*IREF.

Output Termination

The PCI Express differential clock outputs of the PI6C557-03A are open source drivers and require an external series resistor and a resistor to ground. These resistor values and their allowable locations are shown in detail in the PCI Express Layout Guidelines section.

The PI6C557-03A can be configured for LVDS compatible voltage levels. See the LVDS Compatible Layout Guidelines section.

Output Structures



PI6C557-03A

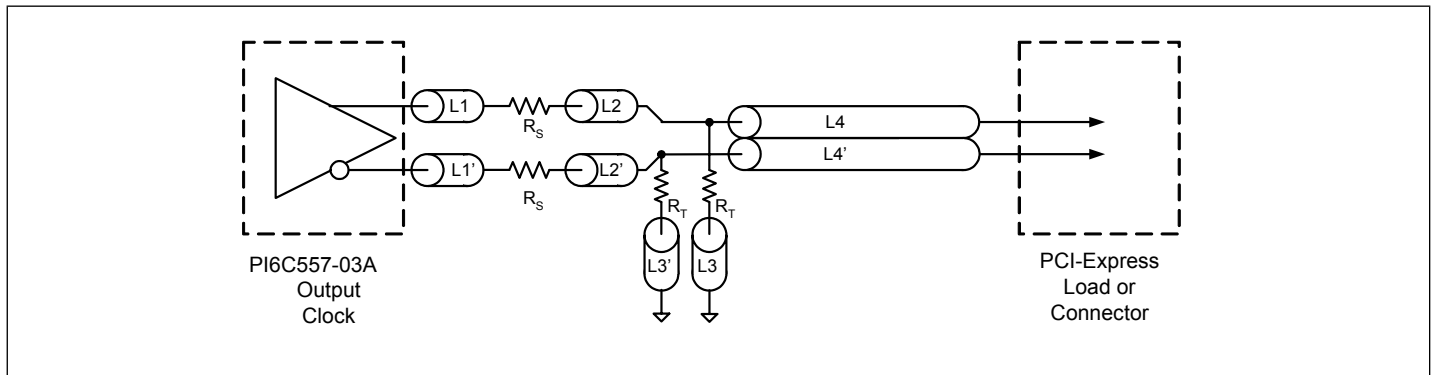
PCI Express Layout Guidelines

| Common Recommendations for Differential Routing | Dimension or Value | Unit |
|---|--------------------|------|
| L1 length, route as non-coupled 50Ω trace. | 0.5 max | inch |
| L2 length, route as non-coupled 50Ω trace. | 0.2 max | inch |
| L3 length, route as non-coupled 50Ω trace. | 0.2 max | inch |
| R_S | 33 | Ω |
| R_T | 49.9 | Ω |

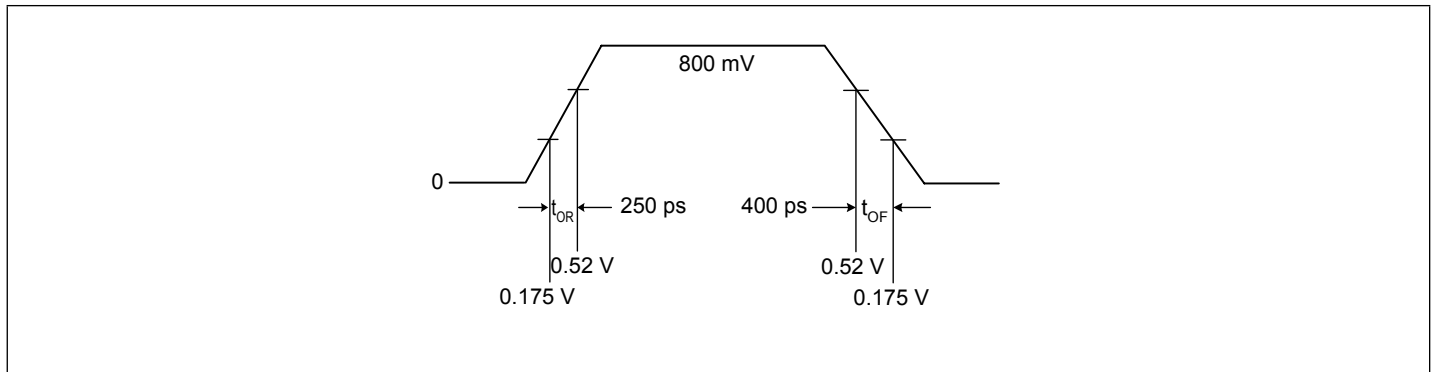
| Differential Routing on a Single PCB | Dimension or Value | Unit |
|---|---------------------|------|
| L4 length, route as coupled microstrip 100Ω differential trace. | 2 min to 16 max | inch |
| L4 length, route as coupled stripline 100Ω differential trace. | 1.8 min to 14.4 max | inch |

| Differential Routing to a PCI Express connector | Dimension or Value | Unit |
|---|-----------------------|------|
| L4 length, route as coupled microstrip 100Ω differential trace. | 0.25 min to 14 max | inch |
| L4 length, route as coupled stripline 100Ω differential trace. | 0.225 min to 12.6 max | inch |

PCI Express Device Routing



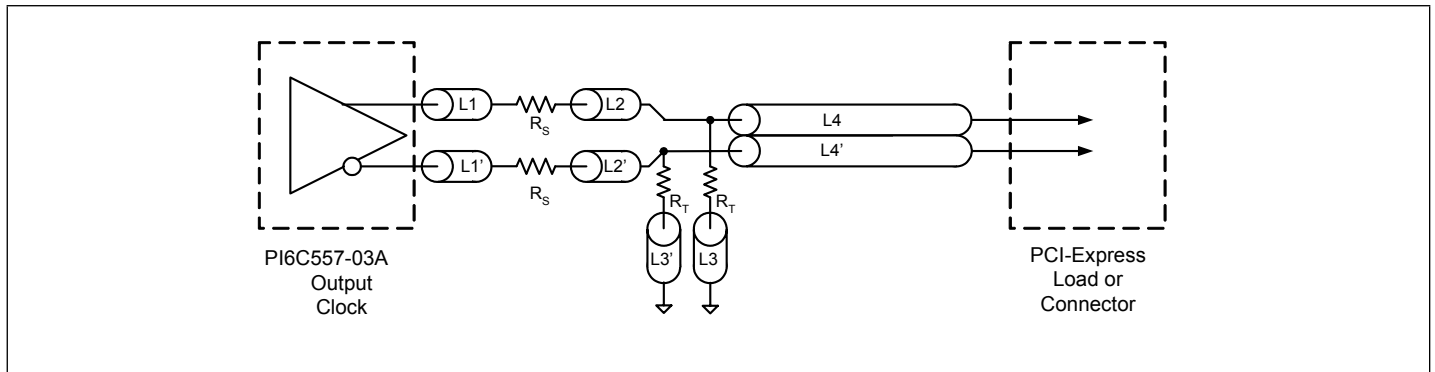
Typical PCI Express (HCSL) Waveform



Application Information

| LVDS Recommendations for Differential Routing | Dimension or Value | Unit |
|---|--------------------|------|
| L1 length, route as non-coupled 50Ω trace. | 0.5 max | inch |
| L2 length, route as non-coupled 50Ω trace. | 0.2 max | inch |
| RP | 100 | Ω |
| RQ | 100 | Ω |
| RT | 150 | Ω |
| L3 length, route as 100Ω differential trace. | | |
| L3 length, route as 100Ω differential trace. | | |

LVDS Device Routing



Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

| | |
|------------------------------------|------------------------|
| Supply Voltage to Ground Potential | 5.5V |
| All Inputs and Outputs | -0.5V to $V_{DD}+0.5V$ |
| Ambient Operating Temperature | -40 to +85°C |
| Storage Temperature | -65 to +150°C |
| Junction Temperature | 150°C |
| Soldering Temperature | 260°C |
| ESD Protection (Input) | 2000 V min (HBM) |

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.

Electrical Specifications

Recommended Operation Conditions

| Parameter | Min. | Typ. | Max. | Unit |
|---|------|------|------|------|
| Ambient Operating Temperature | -40 | | +85 | °C |
| Power Supply Voltage (measured in respect to GND) | +3.0 | | +3.6 | V |

DC Characteristics ($V_{DD} = 3.3V \pm 10\%$, $T_A = -40^{\circ}C$ to $+85^{\circ}C$)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------|-----------------------------------|--------------------------------|--------------------------------------|------|----------------|------------|
| V_{DD} | Supply Voltage | | 3.0 | 3.3 | 3.6 | V |
| V_{IH} | Input High Voltage ⁽¹⁾ | OE | 2.0 | | $V_{DD} + 0.3$ | V |
| V_{IL} | Input Low Voltage ⁽¹⁾ | OE | GND - 0.3 | | 0.8 | V |
| I_{IL} | Input Leakage Current | $0 < V_{in} < V_{DD}$ | With input pull-up and pull-downs | -20 | 20 | μA |
| | | | Without input pull-up and pull-downs | -5 | 5 | |
| I_{DD} | Operating Supply Current | $R_L = 50\Omega$, $C_L = 2pF$ | | | 95 | mA |
| I_{DDOE} | | OE = LOW | | | 50 | mA |
| C_{IN} | Input Capacitance | @ 55MHz | | | 7 | pF |
| C_{OUT} | Output Capacitance | @ 55MHz | | | 6 | pF |
| L_{PIN} | Pin Inductance | | | | 5 | nH |
| R_{OUT} | Output Resistance | CLK Outputs | 3.0 | | | k Ω |

Notes:

1. Single edge is monotonic when transitioning through region.

HCSL Output AC Characteristics ($V_{DD} = 3.3V \pm 10\%$, $T_A = -40^\circ C$ to $+85^\circ C$)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------|---|---------------------------------------|------|------|------|---------|
| F_{IN} | Input Frequency | | | 25 | | MHz |
| V_{OUT} | Output Frequency | | 25 | | 200 | MHz |
| V_{OH} | Output High Voltage ^(1,2) | 100 MHz HCSL output @ $V_{DD} = 3.3V$ | 660 | 800 | 900 | mV |
| V_{OL} | Output Low Voltage ^(1,2) | | -150 | 0 | | mV |
| V_{CPA} | Crossing Point Voltage ^(1,2) | Absolute | 250 | 350 | 550 | mV |
| V_{CN} | Crossing Point Voltage ^(1,2,4) | Variation over all edges | | | 140 | mV |
| J_{CC} | Jitter, Cycle-to-Cycle ^(1,3) | | | 35 | 60 | ps |
| J_{RMS} | PCIe RMS Jitter | PCIe 2.0 Test Method @ 100MHz Output | | | 3.1 | ps |
| MF | Modulation Frequency | Spread Spectrum | 30 | 31.5 | 33 | kHz |
| t_{OR} | Rise Time ^(1,2) | From 0.175V to 0.525V | 175 | | 500 | ps |
| t_{OF} | Fall Time ^(1,2) | From 0.525V to 0.175V | 175 | | 500 | ps |
| T_{SKEW} | Skew between outputs | At Crossing Point Voltage | | | 50 | ps |
| $T_{DUTY-CYCLE}$ | Duty Cycle ^(1,3) | | 45 | | 55 | % |
| T_{OE} | Output Enable Time ⁽⁵⁾ | All outputs | | | 10 | μs |
| T_{OT} | Output Disable Time ⁽⁵⁾ | All outputs | | | 10 | μs |
| t_{STABLE} | From power-up to $V_{DD}=3.3V$ | From Power-up $V_{DD}=3.3V$ | | 3.0 | | ms |
| t_{SPREAD} | Setting period after spread change | Setting period after spread change | | 3.0 | | ms |

Notes:

1. $R_L = 50\text{-}\Omega$ with $C_L = 2\text{ pF}$
2. Single-ended waveform
3. Differential waveform
4. Measured at the crossing point
5. CLK pins are tri-stated when OE is LOW

Thermal Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------|--|------------|------|------|------|--------------|
| θ_{JA} | Thermal Resistance Junction to Ambient | Still air | | | 90 | $^\circ C/W$ |
| θ_{JC} | Thermal Resistance Junction to Case | | | | 24 | $^\circ C/W$ |

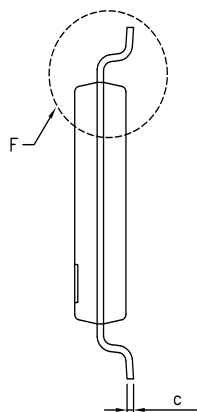
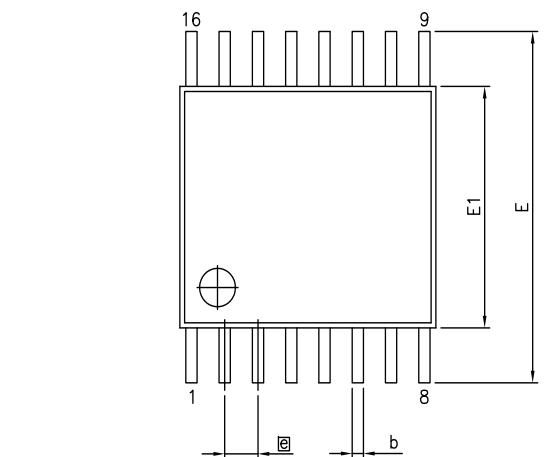
Recommended Crystal Specification

Pericom recommends:

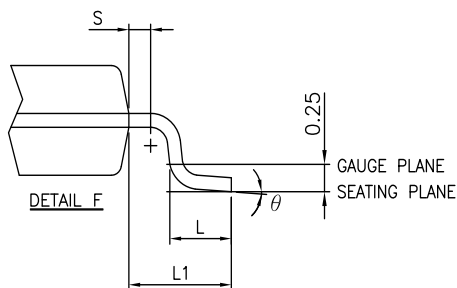
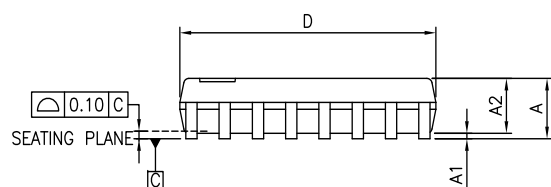
- a) GC2500003 XTAL 49S/SMD(4.0 mm), 25M, $CL=18\text{pF}$, $\pm 30\text{ppm}$
http://www.pericom.com/pdf/datasheets/se/GC_GF.pdf
- b) FY2500081, SMD 5x3.2(4P), 25M, $CL=18\text{pF}$, $\pm 30\text{ppm}$
http://www.pericom.com/pdf/datasheets/se/FY_F9.pdf
- c) FL2500047, SMD 3.2x2.5(4P), 25M, $CL=18\text{pF}$, $\pm 20\text{ppm}$
<http://www.pericom.com/pdf/datasheets/se/FL.pdf>

PI6C557-03A

Packaging Mechanical: 16-Pin TSSOP (L)



| SYMBOLS | MIN. | NOM. | MAX. |
|---------|----------|------|------|
| A | — | — | 1.20 |
| A1 | 0.05 | — | 0.15 |
| A2 | 0.80 | 1.00 | 1.05 |
| b | 0.19 | — | 0.30 |
| c | 0.09 | — | 0.20 |
| D | 4.90 | 5.00 | 5.10 |
| E1 | 4.30 | 4.40 | 4.50 |
| E | 6.20 | 6.40 | 6.60 |
| e | 0.65 BSC | | |
| L1 | 1.00 REF | | |
| L | 0.45 | 0.60 | 0.75 |
| S | 0.20 | — | — |
| θ | 0° | — | 8° |



NOTES:

1. ALL DIMENSIONS IN MILLIMETERS. ANGLES IN DEGREES.
2. JEDEC MO-153F
3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.



DATE: 03/24/16

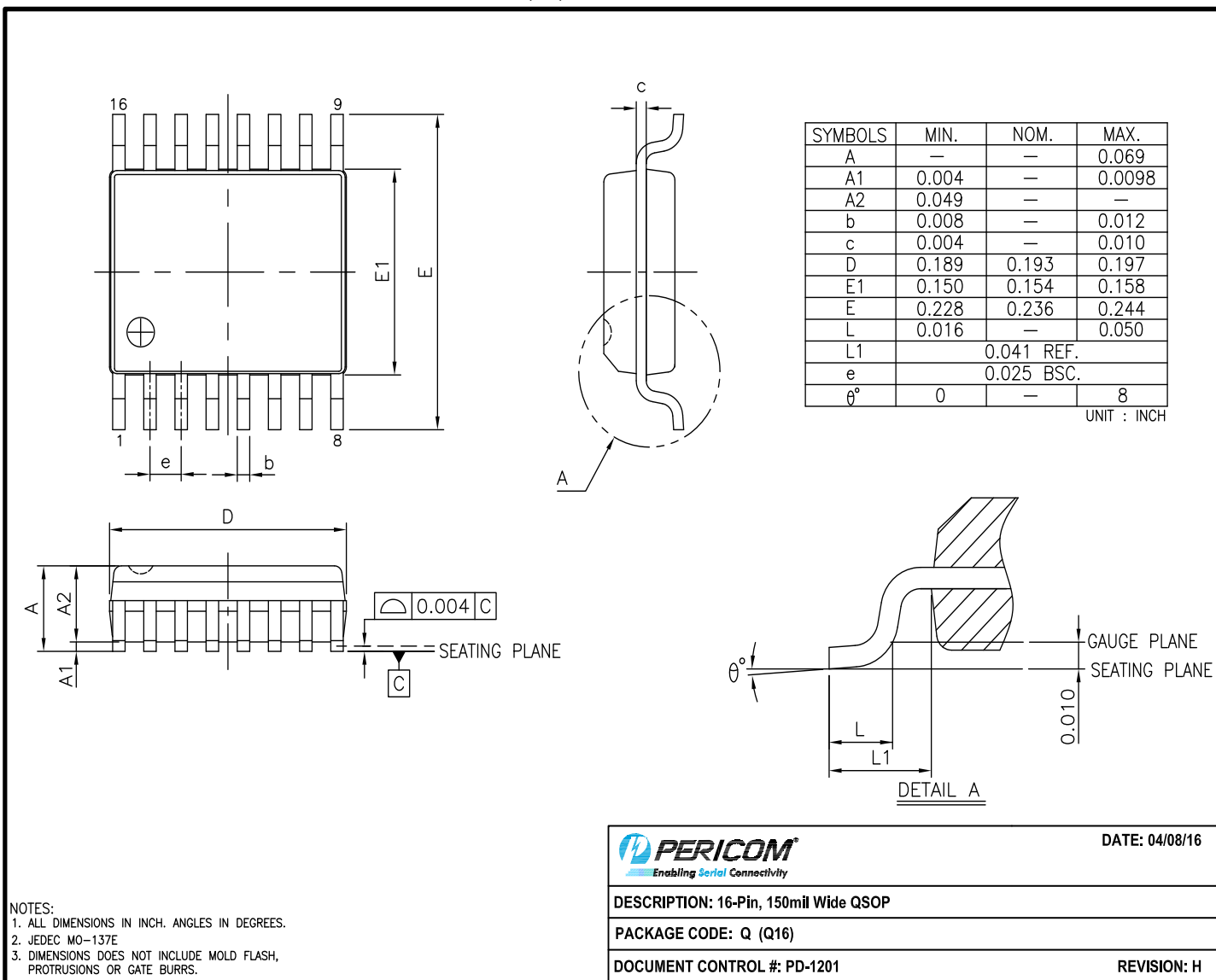
DESCRIPTION: 16-Pin, 173mil Wide TSSOP

PACKAGE CODE: L (L16)

DOCUMENT CONTROL #: PD-1310

REVISION: G

16-0061

PI6C557-03A
Packaging Mechanical: 16-Pin QSOP (Q)


16-0056

For latest package info.

 please check: <http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/>
Ordering Information

| Ordering Code | Package Code | Package Type |
|----------------|--------------|--|
| PI6C557-03ALE | L | 16-pin, 173mil Wide (TSSOP) |
| PI6C557-03ALEX | L | 16-pin, 173mil Wide (TSSOP), Tape & Reel |
| PI6C557-03AQE | Q | 16-pin, 150mil Wide (QSOP) |
| PI6C557-03AQEX | Q | 16-pin, 150mil Wide (QSOP), Tape & Reel |

Notes:

- Thermal characteristics can be found on the company web site at www.diodes.com/design/support/packaging/
- E = Pb-free and Green
- Adding an X suffix = Tape/Reel

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