

## Pin Description

| Pin # | Pin Name                 | I/O Type | Description  |
|-------|--------------------------|----------|--|
| 1     | VDDXD                    | Power    | Connect to a +3.3V source.   |
| 2     | S0                       | Input    | Spread Spectrum Select pin #0. See Spread Spectrum Selection table. Internal pull-up resistor.           |
| 3     | S1                       | Input    | Spread Spectrum Select pin #1. See Spread Spectrum Selection table. Internal pull-up resistor.           |
| 4     | S2                       | Input    | Spread Spectrum Select pin #2. See Spread Spectrum Selection table. Internal pull-up resistor.           |
| 5     | X1                       | Input    | Crystal connection.  |
| 6     | X2                       | Output   | Crystal connection.  |
| 7     | $\overline{\text{PD}}$   | Input    | Power down. Internal pull-up resistor.   |
| 8     | OE                       | Input    | Output enable. Tri-states output (High=enable outputs); Low=disable outputs). Internal pull-up resistor. |
| 9     | GND                      | Power    | Connect to digital circuit ground.   |
| 10    | IREF                     | Output   | Precision resistor attached to this pin is connected to the internal current reference.                  |
| 11    | $\overline{\text{CLK3}}$ | Output   | Selectable 100/200 MHz Spread Spectrum differential compliment output clock 3.                           |
| 12    | CLK3                     | Output   | Selectable 100/200 MHz Spread Spectrum differential true output clock 3.                                 |
| 13    | $\overline{\text{CLK2}}$ | Output   | Selectable 100/200 MHz Spread Spectrum differential compliment output clock 2.                           |
| 14    | CLK2                     | Output   | Selectable 100/200 MHz Spread Spectrum differential true output clock 2.                                 |
| 15    | VDDODA                   | Power    | Connect to a +3.3V analog source.  |
| 16    | GND                      | Power    | Output and Analog circuit ground   |
| 17    | $\overline{\text{CLK1}}$ | Output   | Selectable 100/200 MHz Spread Spectrum differential compliment output clock 1.                           |
| 18    | CLK1                     | Output   | Selectable 100/200 MHz Spread Spectrum differential true output clock 1.                                 |
| 19    | $\overline{\text{CLK0}}$ | Output   | Selectable 100/200 MHz Spread Spectrum differential compliment output clock 0.                           |
| 20    | CLK0                     | Output   | Selectable 100/200 MHz Spread Spectrum differential true output clock 0.                                 |

**Table 2: Spread Selection Table**

| S2 | S1 | S0 | Spread %  | Spread Type    | Output Frequency |
|----|----|----|-----------|----------------|------------------|
| 0  | 0  | 0  | -0.5      | Down           | 100              |
| 0  | 0  | 1  | -1.0      | Down           | 100              |
| 0  | 1  | 0  | -1.5      | Down           | 100              |
| 0  | 1  | 1  | No Spread | Not Applicable | 100              |
| 1  | 0  | 0  | -0.5      | Down           | 200              |
| 1  | 0  | 1  | -1.0      | Down           | 200              |
| 1  | 1  | 0  | -1.5      | Down           | 200              |
| 1  | 1  | 1  | No Spread | Not Applicable | 200              |

## Application Information

### Decoupling Capacitors

Decoupling capacitors of 0.01 $\mu$ F or 0.1 $\mu$ F must be connected between each VDD pin and the PCB ground plane and placed as close to the VDD pin as possible.

PI6C557-05Q must be isolated from system power supply noise to perform optimally.

### Crystal

Use a 25MHz fundamental mode parallel resonant crystal with less than 30PPM of error across temperature.

### Current Source (Iref) Reference Resistor - $R_R$

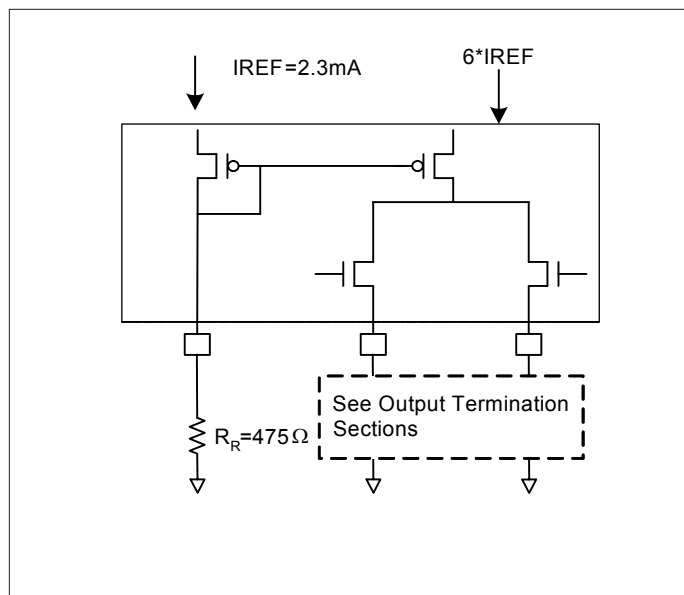
If board target trace impedance is 50-Ohm, then  $R_R = 475$ -Ohm providing an IREF of 2.32 mA. The output current (IOH) is 6\*IREF.

### Output Termination

The PCI-Express differential clock outputs of the PI6C557-05Q 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 PI6C557-05Q can be configured for LVDS compatible voltage levels. See the LVDS Compatible Layout Guidelines section.

## Output Structures



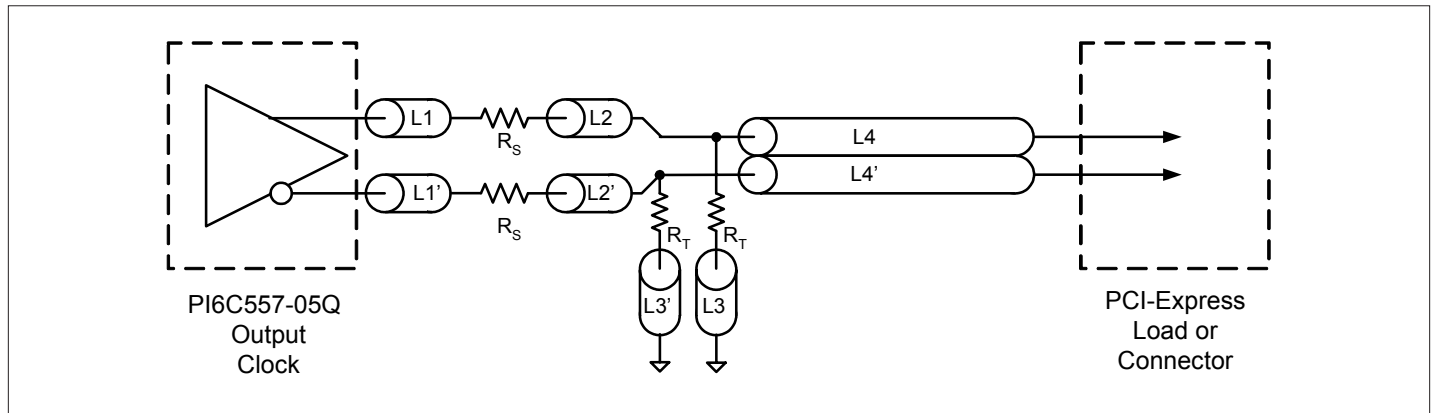
## PCI-Express Layout Guidelines

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

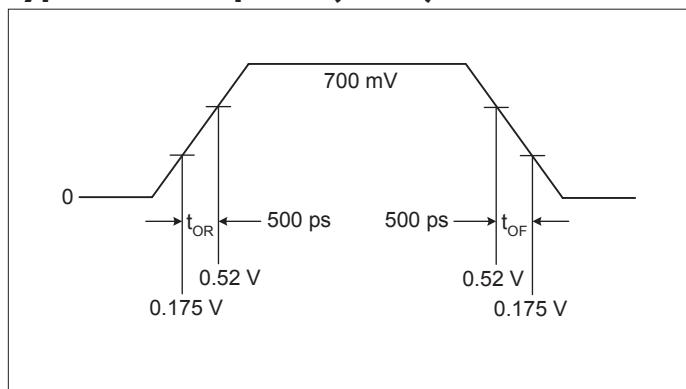
| Differential Routing on a Single PCB                               | Dimension or Value  | Unit |
|--|---------------------|------|
| L4 length, route as coupled microstrip 100-Ohm differential trace. | 2 min to 16 max     | inch |
| L4 length, route as coupled stripline 100-Ohm differential trace.  | 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 100-Ohm differential trace. | 0.25 min to 14 max    | inch |
| L4 length, route as coupled stripline 100-Ohm differential trace.  | 0.225 min to 12.6 max | inch |

## PCI-Express Device Routing



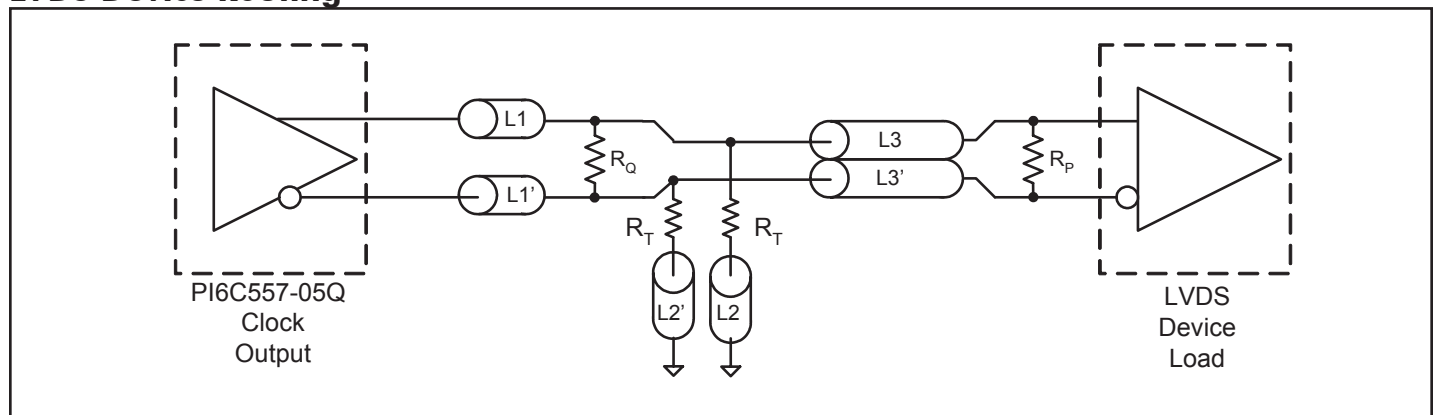
## Typical PCI-Express (HCSL) Waveform



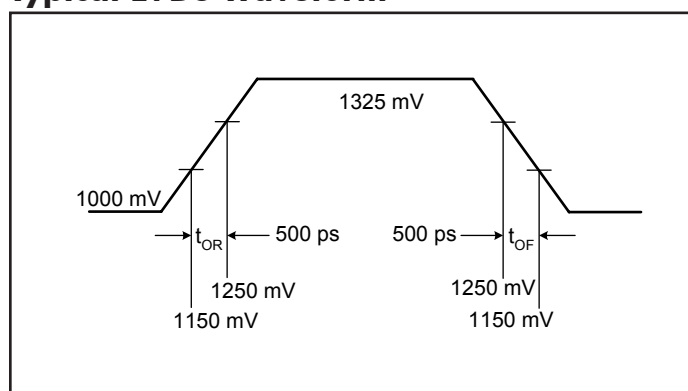
### Application Information

| LVDS Recommendations for Differential Routing | Dimension or Value | Unit |
|---|--------------------|------|
| L1 length, route as non-coupled 50-Ohm trace. | 0.5 max            | inch |
| L2 length, route as non-coupled 50-Ohm trace. | 0.2 max            | inch |
| $R_P$   | 100                | Ohm  |
| $R_Q$   | 100                | Ohm  |
| $R_T$   | 150                | Ohm  |
| L3 length, route as 100Ω differential trace.  |                    |      |
| L3 length, route as 100Ω differential trace.  |                    |      |

### LVDS Device Routing



### Typical LVDS Waveform



## Electrical Specifications

### Maximum Ratings

|   |                                |
|---|--------------------------------|
| Supply Voltage to Ground Potential..... | 5.5V                           |
| All Inputs and Outputs .....            | -0.5V to V <sub>DD</sub> +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.

### Recommended Operation Conditions

| Parameter   | Min.  | Typ. | Max.  | Unit |
|---|-------|------|-------|------|
| Ambient Operating Temperature                     | -40   |      | +85   | °C   |
| Power Supply Voltage (measured in respect to GND) | 3.135 |      | 3.465 | V    |

### DC Characteristics (V<sub>DD</sub> = 3.3V ±5%, T<sub>A</sub> = -40°C to +85°C)

| Symbol            | Parameter                         | Conditions   |                                      | Min.     | Typ. | Max.                 | Unit |
|-------------------|-----------------------------------|--|--------------------------------------|----------|------|----------------------|------|
| V <sub>DD</sub>   | Supply Voltage                    |  |                                      | 3.135    | 3.3  | 3.465                | V    |
| V <sub>IH</sub>   | Input High Voltage <sup>(1)</sup> |  |                                      | 2.0      |      | V <sub>DD</sub> +0.3 | V    |
| V <sub>IL</sub>   | Input Low Voltage <sup>(1)</sup>  |  |                                      | GND -0.3 |      | 0.8                  | V    |
| I <sub>IL</sub>   | Input Leakage Current             | 0 < V <sub>in</sub> < V <sub>DD</sub>              | Without input pull-up and pull-downs | -5       |      | 5                    | μA   |
| I <sub>DD</sub>   | Operating Supply Current          | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 2pF @100MHz |                                      |          | 105  | 120                  | mA   |
| I <sub>DDOE</sub> |                                   | OE = LOW   |                                      |          | 40   | 50                   | mA   |
| I <sub>DDPD</sub> |                                   | No load $\overline{\text{PD}}$ = LOW               |                                      |          | 60   | 100                  | μA   |
| C <sub>IN</sub>   | Input Capacitance                 | Input pin capacitance                              |                                      |          |      | 7                    | pF   |
| C <sub>OUT</sub>  | Output Capacitance                | Output pin capacitance                             |                                      |          |      | 6                    | pF   |
| L <sub>PIN</sub>  | Pin Inductance                    |  |                                      |          |      | 5                    | nH   |
| R <sub>OUT</sub>  | Output Resistance                 | CLK Outputs  |                                      | 3.0      |      |                      | kΩ   |

**Note:**

- Single edge is monotonic when transitioning through region.

### AC Characteristics (V<sub>DD</sub> = 3.3V ±5%, T<sub>A</sub> = -40°C to +85°C)

| Symbol                  | Parameter                                 | Conditions                          | Min. | Typ. | Max. | Unit |
|-------------------------|---|-------------------------------------|------|------|------|------|
| F <sub>IN</sub>         | Input Frequency                           |                                     |      | 25   |      | MHz  |
| V <sub>OUT</sub>        | Output Frequency                          | HCSL terminal                       |      |      | 200  | MHz  |
|                         |   | LVDS terminal                       |      |      | 100  |      |
| V <sub>OH</sub>         | Output High Voltage <sup>(1,2)</sup>      | @V <sub>DD</sub> = 3.3V             | 660  | 700  | 850  | mV   |
| V <sub>OL</sub>         | Output Low Voltage <sup>(1,2)</sup>       |                                     | -150 | 0    | 27   | mV   |
| V <sub>CPA</sub>        | Crossing Point Voltage <sup>(1,2)</sup>   | Absolute                            | 250  | 350  | 550  | mV   |
| V <sub>CN</sub>         | Crossing Point Voltage <sup>(1,2,4)</sup> | Variation over all edges            |      |      | 140  | mV   |
| J <sub>CC</sub>         | Jitter, Cycle-to-Cycle <sup>(1,3)</sup>   |                                     |      | 40   | 60   | ps   |
| J <sub>RMS</sub>        | RMS Jitter                                | PCIe Gen 2 High Band                |      | 2.1  | 3.1  | ps   |
|                         |   | PCIe Gen 2 Low Band                 |      | 0.6  | 3.0  |      |
| MF                      | Modulation Frequency                      | Spread Spectrum                     | 30   | 31.5 | 33   | kHz  |
| t <sub>OR</sub>         | Rise Time <sup>(1,2)</sup>                | From 0.175V to 0.525V               | 175  | 332  | 700  | ps   |
| t <sub>OF</sub>         | Fall Time <sup>(1,2)</sup>                | From 0.525V to 0.175V               | 175  | 344  | 700  | ps   |
| T <sub>SKEW</sub>       | Skew between outputs                      | At Crossing Point Voltage           |      |      | 50   | ps   |
| T <sub>DUTY-CYCLE</sub> | Duty Cycle <sup>(1,3)</sup>               |                                     | 45   |      | 55   | %    |
| T <sub>OE</sub>         | Output Enable Time <sup>(5)</sup>         | All outputs                         |      |      | 10   | μs   |
| T <sub>OT</sub>         | Output Disable Time <sup>(5)</sup>        | All outputs                         |      |      | 10   | μs   |
| t <sub>STABLE</sub>     | From power-up to V <sub>DD</sub> =3.3V    | From Power-up V <sub>DD</sub> =3.3V |      | 3.0  |      | ms   |

#### Notes:

1. R<sub>L</sub> = 50-Ohm with C<sub>L</sub> = 2 pF and R<sub>R</sub>
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 <sub>JA</sub> | Thermal Resistance Junction to Ambient | Still air  |      |      | 93   | °C/W |
| θ <sub>JC</sub> | Thermal Resistance Junction to Case    |            |      |      | 20   | °C/W |

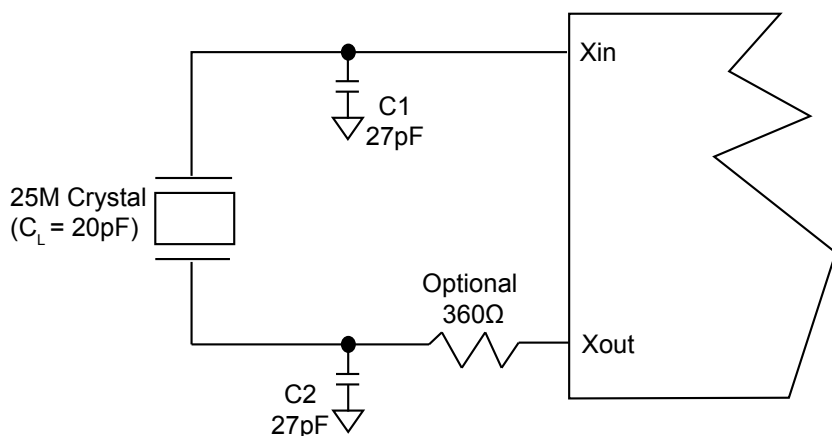
## Recommended Crystal Specification

Pericom recommends:

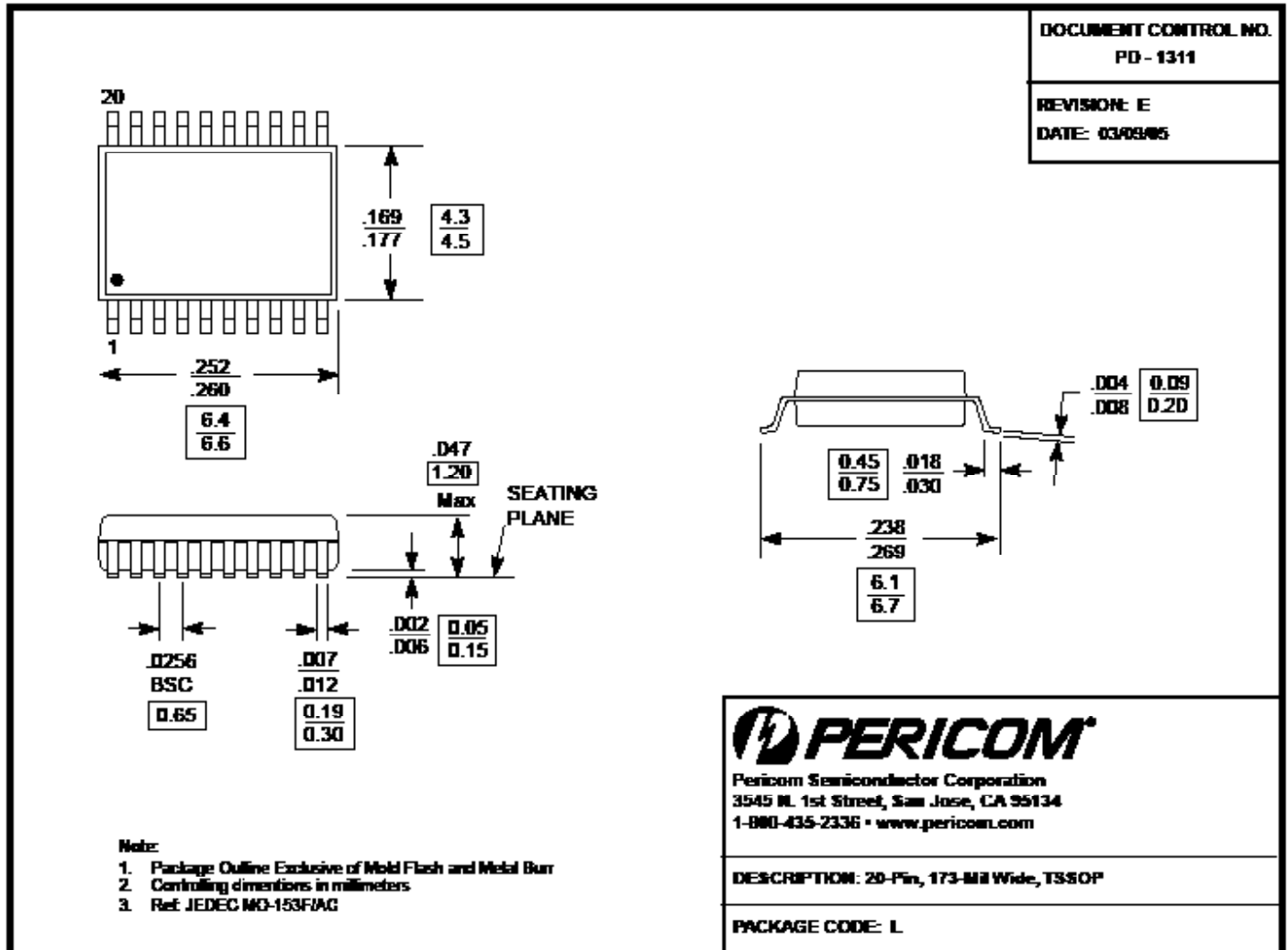
a) FL2500184Q, SMD 3.2x2.5(4P), 25M,  $C_L=20\text{pF}$ , Frequency Tolerance  $\pm 15\text{ppm}$ , Stability  $\pm 20\text{ppm}$   
(<http://www.pericom.com/pdf/datasheets/se/FL.pdf>)

## Recommended Crystal Circuit

The following diagram shows PI6C557-05Q crystal circuit connection with a parallel crystal. For the  $C_L=20\text{pF}$  parallel crystal, it is suggested to use  $C_1=27\text{pF}$ ,  $C_2=27\text{pF}$  in general.  $C_1$  and  $C_2$  can be adjusted to fine tune to the target ppm of crystal oscillation according to different board layouts.  $R_1=360\text{ohm}$  is recommended in layout for smaller size crystal drive level adjustment.



### Packaging Mechanical: 20-pin TSSOP (L)



### Ordering Information<sup>(1-3)</sup>

| Ordering Code | Package Code | Package Type                  |
|---------------|--------------|-------------------------------|
| PI6C557-05QLE | L            | Pb-free & Green, 20-Pin TSSOP |

Note:

- Thermal characteristics and package top marking information can be found at <http://www.pericom.com/packaging/>
- E = lead-free and green packaging
- Adding an X suffix = tape/reel