

## Features

- Maximum rated frequency: 133 MHz
- Low cycle-to-cycle jitter
- Input to output delay, less than 200ps
- Internal feedback allows outputs to be synchronized to the clock input
- Spread spectrum compatible
- Operates at 3.3V V<sub>DD</sub>
- Space-saving Package: (Pb-free & Green available)
  - 16-Pin TSSOP (L)
  - 16-Pin SOIC (W)

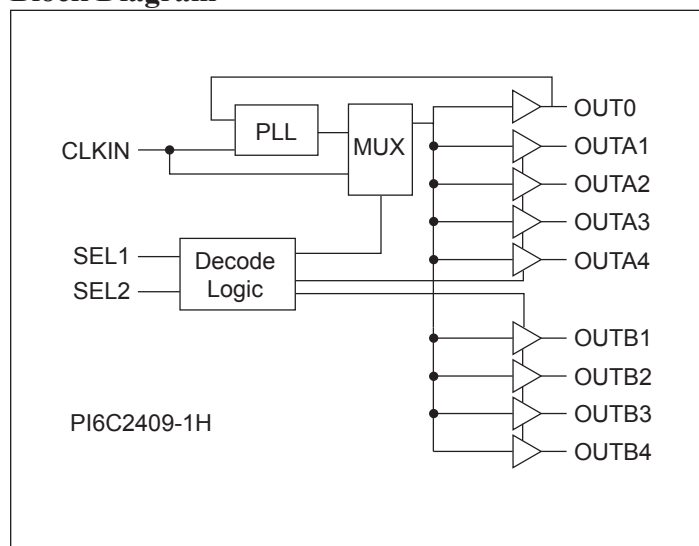
## Description

The PI6C2409-1H is a PLL based, zero-delay buffer, with the ability to distribute nine outputs of up to 133 MHz at 3.3V. All the outputs are distributed from a single clock input CLKIN and output OUT0 performs zero delay by connecting a feedback to PLL.

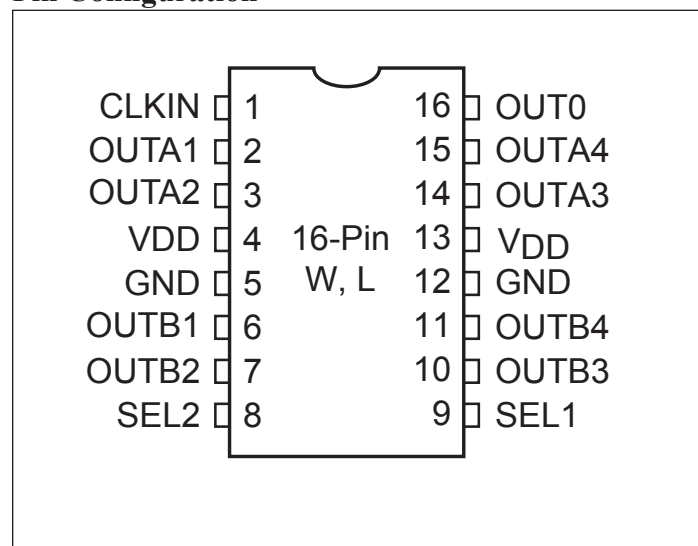
PI6C2409-1H has two banks of four outputs that can be controlled by the selection inputs, SEL1 & SEL2. It also has a power sparing feature: when input SEL1 is 0 and SEL2 is 1, PLL is turned off and all outputs are referenced from CLKIN. PI6C2409-1H is available in high drive and industrial environment versions.

An internal feedback on OUT0 is used to synchronize the outputs to the input; the relationship between loading of this signal and the outputs determines the input-output delay. PI6C2409-1H are characterized for both commercial and industrial operation

## Block Diagram



## Pin Configuration



## Input Select Decoding

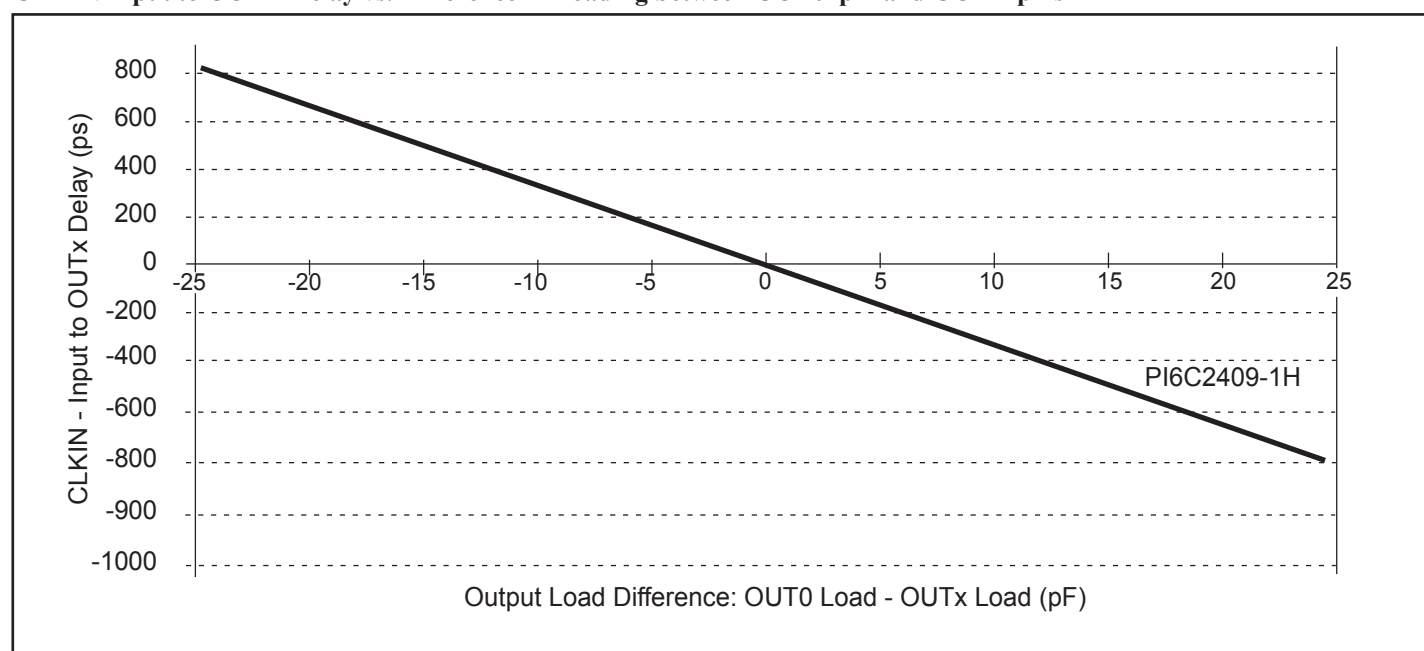
| SEL2 | SEL1 | OUTA [1-4] | OUTB [1-4] | Output Source (OUT0) | PLL |
|------|------|------------|------------|----------------------|-----|
| 0    | 0    | 3-State    | 3-State    | PLL                  | ON  |
| 0    | 1    | PLL        | 3-State    | PLL                  | ON  |
| 1    | 0    | CLKIN      | CLKIN      | CLKIN                | OFF |
| 1    | 1    | PLL        | PLL        | PLL                  | ON  |

## Pin Description

| Pin          | Signal    | Description                                      |
|--------------|-----------|--------------------------------------------------|
| 1            | CLKIN     | Input clock reference frequency (weak pull-down) |
| 2, 3, 14, 15 | OUTA[1-4] | Clock outputs, Bank A                            |
| 4, 13        | VDD       | 3.3V supply                                      |
| 5, 12        | GND       | Ground                                           |
| 6, 7, 10, 11 | OUTB[1-4] | Clock outputs, Bank B                            |
| 8            | SEL2      | Select input, bit 2 (weak pull-up)               |
| 9            | SEL1      | Select input, bit 1 (weak pull-up)               |
| 16           | OUT0      | Clock Output , internal PLL feedback             |

## Zero-Delay and Skew Control

CLKIN Input to OUTx Delay vs. Difference in Loading between OUT0 pin and OUTx pins



The relationship between loading of the OUT0 signal and other outputs determines the input-output delay. Zero delay is achieved when all outputs, including feedback, are loaded equally.

## Maximum Ratings

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

|                                         |                          |
|-----------------------------------------|--------------------------|
| Storage Temperature.....                | –65°C to +150°C          |
| Supply Voltage to Ground Potential..... | –0.5V to +4.6V           |
| DC Input Voltage .....                  | –0.5V to $V_{DD} + 0.5V$ |
| 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.

## Operating Conditions ( $V_{CC} = 3.3V \pm 0.3V$ )

| Parameter | Description                               | Min. | Max. | Units |
|-----------|-------------------------------------------|------|------|-------|
| $V_{DD}$  | Supply Voltage                            | 3.0  | 3.6  | V     |
| $T_A$     | Commercial Operating Temperature          | 0    | 70   | °C    |
|           | Industrial Operating Temperature          | –40  | 85   |       |
| $C_L$     | Load Capacitance, below 100 MHz           |      | 30   | pF    |
|           | Load Capacitance, from 100 MHz to 133 MHz | –    | 15   |       |
| $C_{IN}$  | Input Capacitance                         | –    | 7    |       |

## DC Electrical Characteristics for Industrial Temperature Devices

| Parameters | Description         | Test Conditions                                            | Min. | Max. | Units   |
|------------|---------------------|------------------------------------------------------------|------|------|---------|
| $V_{IL}$   | Input LOW Voltage   |                                                            |      | 0.8  | V       |
| $V_{IH}$   | Input HIGH Voltage  |                                                            | 2.0  |      |         |
| $I_{IL}$   | Input LOW Current   | $V_{IN} = 0V$                                              |      | 50.0 | $\mu A$ |
| $I_{IH}$   | Input HIGH Current  | $V_{IN} = V_{DD}$                                          |      | 125  |         |
| $V_{OL}$   | Output LOW Voltage  | $I_{OL} = 12mA$                                            |      | 0.4  | V       |
| $V_{OH}$   | Output HIGH Voltage | $I_{OH} = -12mA$                                           | 2.4  |      |         |
| $I_{DD}$   | Bypass, PLL OFF     | SEL1 = 0, SEL2 = 1                                         |      | 1.0  | mA      |
|            | Supply Current      | Unloaded outputs 100 MHz, Select inputs at $V_{DD}$ or GND |      | 62   |         |
|            |                     | Unloaded outputs 66 MHz, CLKIN                             |      | 44   |         |

### AC Electrical Characteristics for Industrial Temperature Devices

| Parameters         | Name                                                           | Test Conditions                                                 | Min. | Typ. | Max. | Units |
|--------------------|----------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|-------|
| F <sub>O</sub>     | Output Frequency                                               | 30pF load                                                       | 10.0 |      | 100  | MHz   |
|                    |                                                                | 10pF load                                                       |      |      | 133  |       |
| t <sub>DC</sub>    | Duty Cycle <sup>(1)</sup>                                      | Measured at V <sub>DD</sub> /2,<br>F <sub>OUT</sub> = 66.67 MHz | 40.0 | 50   | 60.0 | %     |
|                    | Duty Cycle <sup>(1)</sup>                                      | Measured at V <sub>DD</sub> /2V,<br>F <sub>OUT</sub> < 50MHz    | 45.0 |      | 55.0 |       |
| t <sub>R</sub>     | Rise Time <sup>(1)</sup>                                       | Measured between 0.8V and 2.0V                                  |      |      | 1.5  | ns    |
| t <sub>F</sub>     | Fall Time <sup>(1)</sup>                                       | Measured between 0.8V and 2.0V                                  |      |      | 1.5  |       |
| t <sub>SK(O)</sub> | Output to Output Skew <sup>(1)</sup>                           | All outputs equally loaded                                      |      |      | 250  | ps    |
| t <sub>0</sub>     | Delay, CLKIN Rising Edge<br>to OUT0 Rising Edge <sup>(1)</sup> | Measured at V <sub>DD</sub> /2                                  |      | 0    | ±350 |       |
| t <sub>SK(D)</sub> | Device-to-Device Skew <sup>(1)</sup>                           | Measured at V <sub>DD</sub> /2 on OUT0 pins<br>of devices       |      | 0    | 700  |       |
| t <sub>SLEW</sub>  | Output Slew Rate <sup>(1)</sup>                                | Measured between 0.8V & 2.0V<br>on -1H device using Test Crt #2 | 1    |      |      | V/ns  |
| t <sub>JIT</sub>   | Cycle-to-Cycle Jitter <sup>(1)</sup>                           | Measured at 66.67 MHz,<br>loaded 30pF load                      |      |      | 250  | ps    |
| t <sub>LOCK</sub>  | PLL Lock Time <sup>(1)</sup>                                   | Stable power supply, valid clocks<br>presented on CLKIN pin     |      |      | 1.0  | ms    |

**Note:**

1. See Switching Waveforms on page 6.

### DC Electrical Characteristics for Commercial Temperature Devices

| Parameters      | Description         | Test Conditions                                                         | Min. | Max. | Units |
|-----------------|---------------------|-------------------------------------------------------------------------|------|------|-------|
| V <sub>IL</sub> | Input LOW Voltage   | -                                                                       | -    | 0.8  | V     |
| V <sub>IH</sub> | Input HIGH Voltage  | -                                                                       | 2.0  | -    |       |
| I <sub>IL</sub> | Input LOW Current   | V <sub>IN</sub> = 0V                                                    | -    | 50   | μA    |
| I <sub>IH</sub> | Input HIGH Current  | V <sub>IN</sub> = V <sub>DD</sub>                                       | -    | 125  |       |
| V <sub>OL</sub> | Output LOW Voltage  | I <sub>OL</sub> = 12mA                                                  | -    | 0.4  | V     |
| V <sub>OH</sub> | Output HIGH Voltage | I <sub>OH</sub> = -12mA                                                 | 2.4  | -    |       |
| I <sub>DD</sub> | Bypass, PLL off     | SEL1 = 0 SEL2 = 1                                                       | -    | 1.0  | mA    |
|                 | Supply Current      | Unloaded outputs, 66.67 MHz,<br>Select inputs at V <sub>DD</sub> or GND | -    | 39   |       |
|                 |                     | Unloaded outputs 100 MHz<br>Select Inputs @ V <sub>DD</sub> or GND      | -    | 54   |       |

**AC Electrical Characteristics for Commercial Temperature Devices**

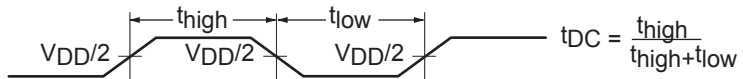
| Parameters         | Description                                                    | Test Conditions                                                 | Min. | Typ. | Max. | Units |
|--------------------|----------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|-------|
| F <sub>O</sub>     | Output Frequency                                               | 30pF load                                                       | 10.0 |      | 100  | MHz   |
|                    |                                                                | 10pF load                                                       |      |      | 133  |       |
| t <sub>DC</sub>    | Duty Cycle <sup>(1)</sup>                                      | Measured at V <sub>DD</sub> /2,<br>F <sub>O</sub> = 66.67 MHz   | 40.0 | 50   | 60.0 | %     |
|                    | Duty Cycle <sup>(1)</sup>                                      | Measured at V <sub>DD</sub> /2V,<br>F <sub>O</sub> < 50 MHz     | 45.0 |      | 55.0 |       |
| t <sub>R</sub>     | Rise Time <sup>(1)</sup>                                       | Measured between 0.8V and 2.0V                                  |      |      | 1.5  | ns    |
| t <sub>F</sub>     | Fall Time <sup>(1)</sup>                                       |                                                                 |      |      | 1.5  |       |
| t <sub>SK(O)</sub> | Output to Output Skew <sup>(1)</sup>                           | All outputs equally loaded                                      |      |      | 250  | ps    |
| t <sub>0</sub>     | Delay, CLKIN Rising Edge<br>to OUT0 Rising Edge <sup>(1)</sup> | Measured at V <sub>DD</sub> /2                                  |      | 0    | ±350 |       |
| t <sub>SK(D)</sub> | Device-to-Device Skew <sup>(1)</sup>                           | Measured at V <sub>DD</sub> /2 on OUT0 pins<br>of devices       |      | 0    | 700  |       |
| t <sub>SLEW</sub>  | Output Slew Rate <sup>(1)</sup>                                | Measured between 0.8V & 2.0V<br>on -1H device using Test Crt #2 | 1    |      |      | V/ns  |
| t <sub>JIT</sub>   | Cycle-to-Cycle Jitter <sup>(1)</sup>                           | Measured at 66.67 MHz,<br>loaded 30pF load                      |      |      | 200  | ps    |
| t <sub>LOCK</sub>  | PLL Lock Time <sup>(1)</sup>                                   | Stable power supply, valid clocks<br>presented on CLKIN pin     |      |      | 1.0  | ms    |

**Note:**

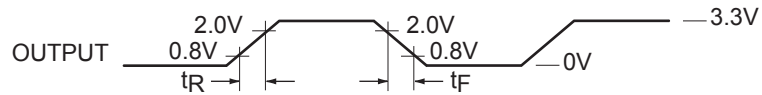
1. See Switching Waveforms on page 6.

## Switching Waveforms

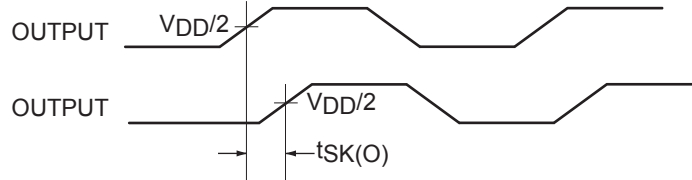
Duty Cycle Timing



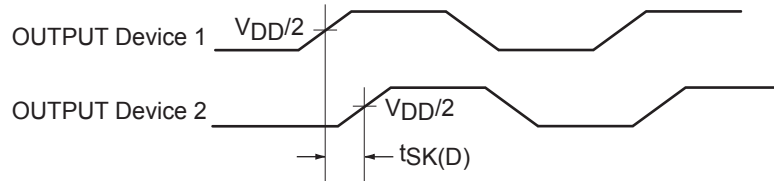
All Outputs Rise/Fall Time



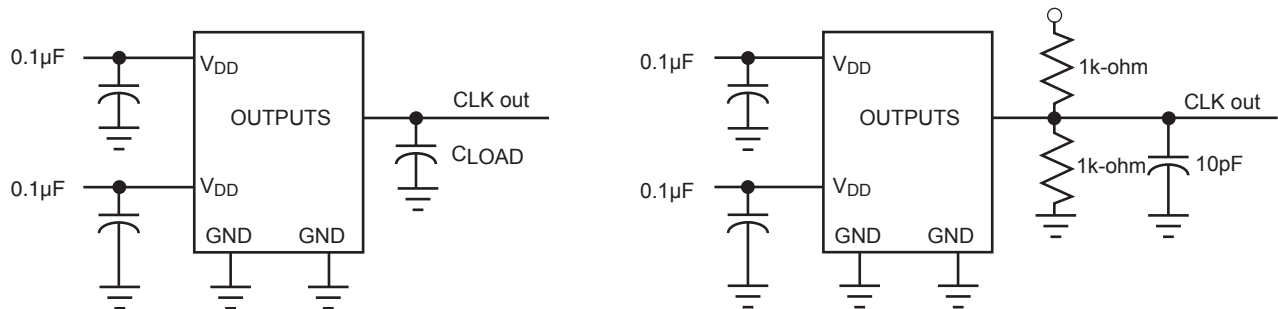
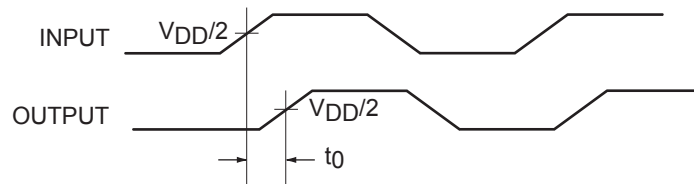
Output-Output Skew



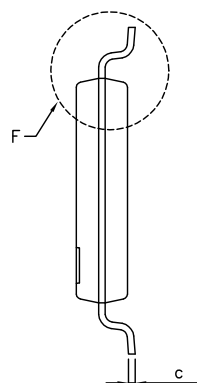
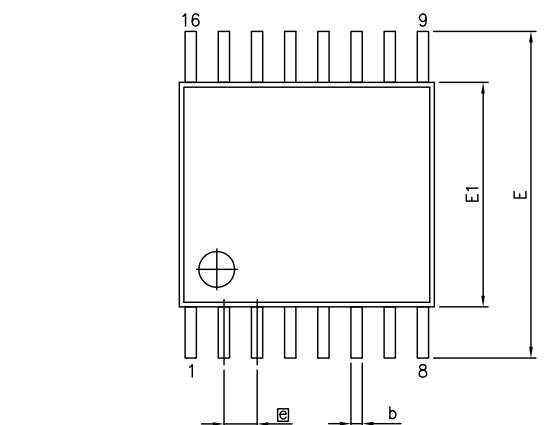
Device-Device Skew



Input-Output Propagation Delay

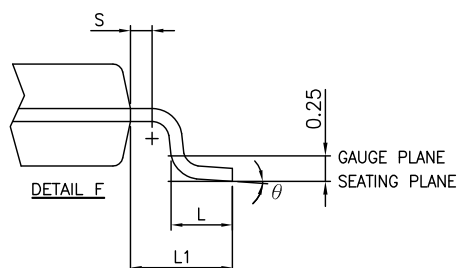
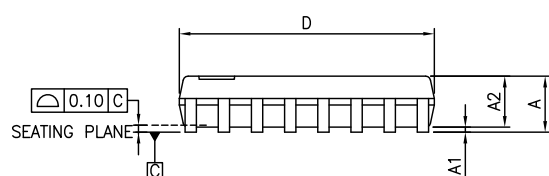


## Packaging Mechanical: 16-Pin TSSOP (L)



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

| SYMBOLS  | MIN.     | NOM. | MAX. |
|----------|----------|------|------|
| A        | —        | —    | 1.20 |
| A1       | 0.05     | —    | 0.15 |
| A2       | 0.80     | —    | 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        | 6.40 BSC |      |      |
| e        | 0.65 BSC |      |      |
| L1       | 1.00 REF |      |      |
| L        | 0.45     | 0.60 | 0.75 |
| S        | 0.20     | —    | —    |
| $\theta$ | 0°       | —    | 8°   |



### Notes:

1. Refer JEDEC MO-153F/AB
2. Controlling dimensions in millimeters
3. Package outline exclusive of mold flash and metal burr



DATE: 05/03/12

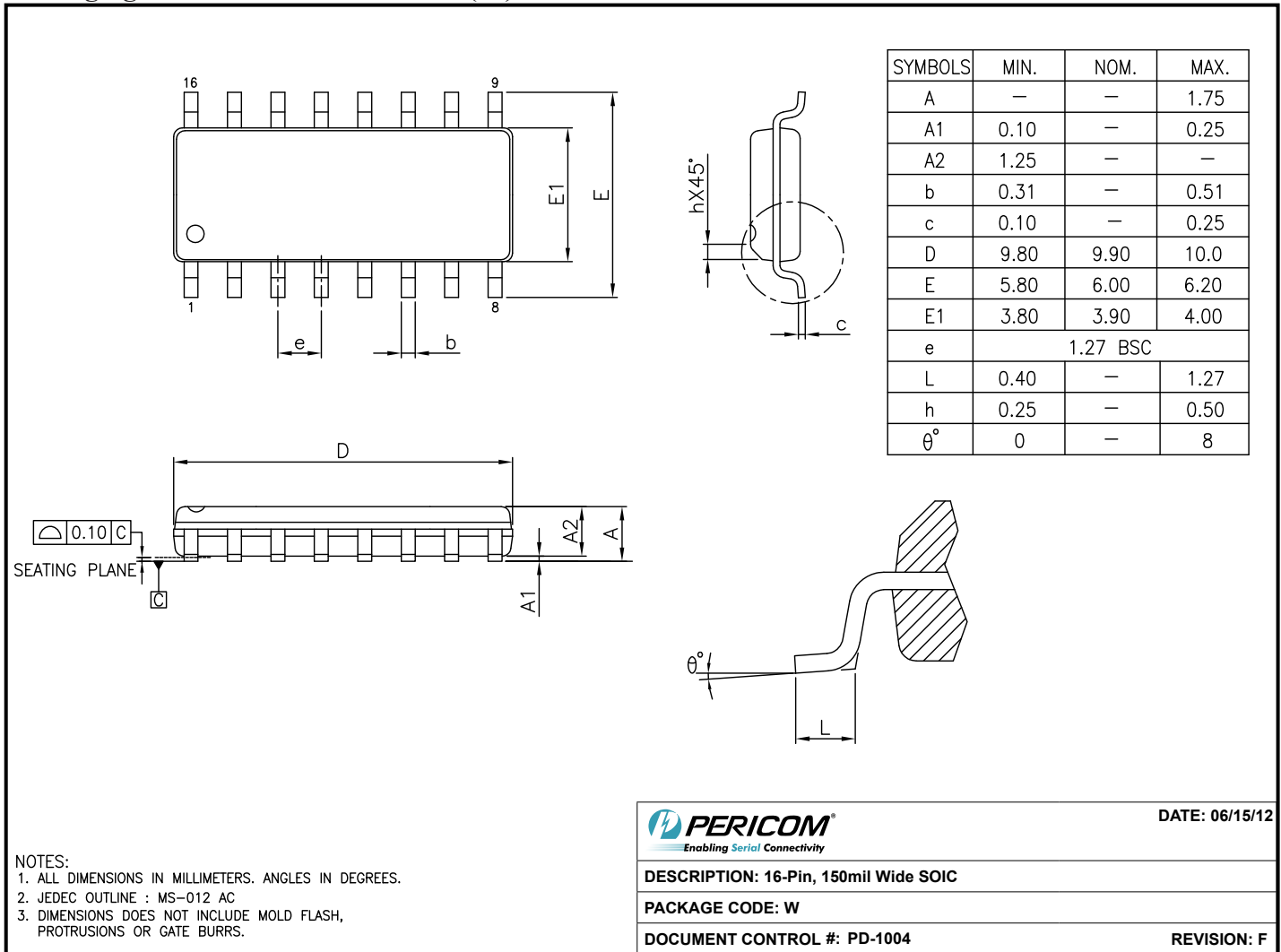
DESCRIPTION: 16-Pin, 173mil Wide TSSOP

PACKAGE CODE: L

DOCUMENT CONTROL #: PD-1310

REVISION: F

12-0372

**Packaging Mechanical: 16-Pin SOIC (W)**


2012-0398

**Ordering Information**

| Ordering Code   | Package Code | Package Description                       | Operating Range |
|-----------------|--------------|-------------------------------------------|-----------------|
| PI6C2409-1HLE   | L            | 16-pin, 173-mil Wide (TSSOP)              | Commercial      |
| PI6C2409-1HLEX  | L            | 16-pin, 173-mil Wide (TSSOP), Tape & Reel | Commercial      |
| PI6C2409-1HLIE  | L            | 16-pin, 173-mil Wide (TSSOP)              | Industrial      |
| PI6C2409-1HLIEX | L            | 16-pin, 173-mil Wide (TSSOP), Tape & Reel | Industrial      |
| PI6C2409-1HWE   | W            | 16-pin, 150-mil Wide (SOIC)               | Commercial      |
| PI6C2409-1HWEX  | W            | 16-pin, 150-mil Wide (SOIC), Tape & Reel  | Commercial      |
| PI6C2409-1HWIE  | W            | 16-pin, 150-mil Wide (SOIC)               | Industrial      |
| PI6C2409-1HWIEX | W            | 16-pin, 150-mil Wide (SOIC), 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 = Pb-free and Green
- Adding an X suffix = Tape/Reel