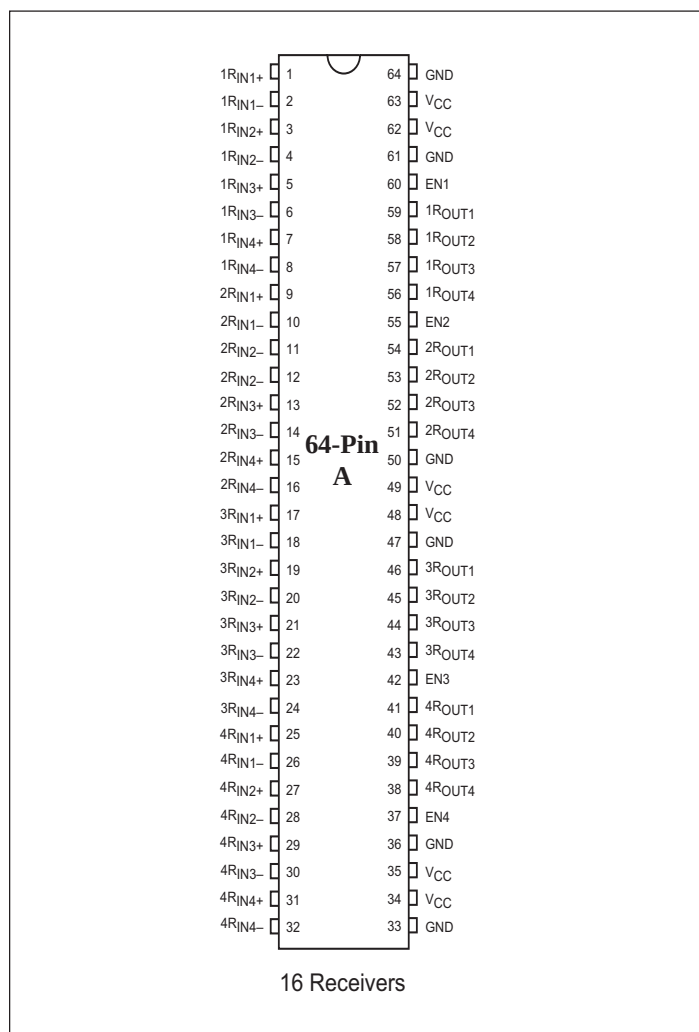


## Features

- Sixteen line receivers meet or exceed the requirements of the ANSI TIA/EIA-644-1995 Standard
- Designed for signaling rates up to 660 Mbps
- 0V to 3V common-mode input voltage range
- Operates from a single 3.3V supply
- Typical propagation delay time: 2.6ns
- Output skew 100ps (typical)
- Part-to-part skew is less than 1ns
- Integrated 110-Ohm termination on PI90LVT386
- Low Voltage TTL (LVTTTL) levels are 5V tolerant
- Open-circuit fail safe
- Flow-through pin out
- Packaging (Pb-free & Green available):  
- 64-Pin Thin Shrink Small Output TSSOP (A)

## Pin Configuration



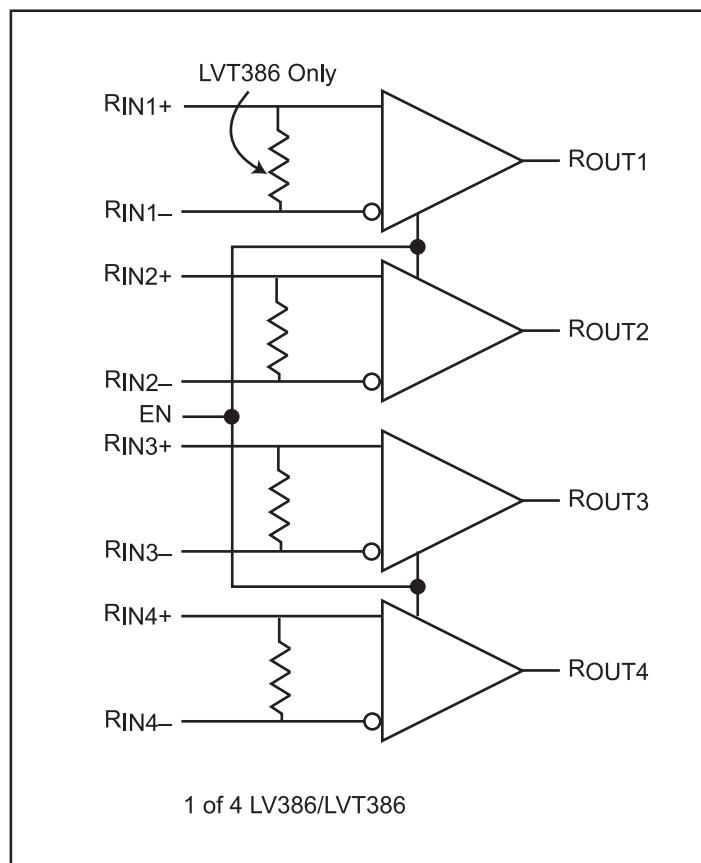
## Description

The PI90LVx386 family consists of sixteen differential line receivers with 3-state outputs that implement Low-Voltage Differential Signaling (LVDS). Any of the differential receivers will provide a valid logical output state with a  $\pm 100\text{mV}$  differential input voltage within the input common-mode voltage range that allows 0 to 3V of ground potential difference between two LVDS nodes. The independent EN pins can be used to place the outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In high-impedance state, outputs neither load nor drive the bus lines.

The intended application of these devices, and their signaling techniques, is for point-to-point baseband data transmission over controlled impedance media of approximately 100-ohms with a 100-Ohm termination resistor. The PI90LVT386 integrates the terminating resistors while the PI90LV386 requires external resistors. The transmission media may be printed circuit board traces, backplanes, or cables. The PI90LV386's 16 receivers integrated into the same substrate allow precise timing alignment.

These parts are characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

## Block Diagram



### Absolute Maximum Ratings Over Operating Free-Air Temperature

(unless otherwise noted)<sup>†</sup>

|                                          |                           |
|------------------------------------------|---------------------------|
| Supply Voltage Range, $V_{DD}^{(1)}$     | –0.5V to 4V               |
| Voltage Range: Enables or $R_{OUT}$      | –0.5V to $V_{DD} + 2V$    |
| $R_{IN+}$ or $R_{IN-}$                   | –0.5V to 4V               |
| Electrostatic Discharge <sup>(2)</sup> : |                           |
| $R_{IN+}$ , $R_{IN-}$ , and GND          | Class 3, A: 10kV, B: 700V |
| All Pins                                 | Class 3, A: 8kV, B: 600V  |
| Storage Temperature Range                | –65°C to 150°C            |
| Lead Temperature 1,6mm (1/16 inch)       |                           |
| from case for 10 seconds                 | 260°C                     |

<sup>†</sup> Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to Absolute-Maximum-Rated conditions for extended periods may affect device reliability.

#### Notes:

1. All voltage values, except differential I/O bus voltages, are with respect to ground terminal.
2. Tested in accordance with MIL-STD-883C Method 3015.7

### Function Table

| Differential Input           | Enables | Output     |
|------------------------------|---------|------------|
| $R_{IN\pm}$                  | EN      | $R_{OUT}$  |
| $V_{ID} \geq 100mV$          | H       | H          |
| $-100mV < V_{ID} \leq 100mV$ | H       | ?          |
| $V_{ID} \leq -100mV$         | H       | L          |
| X                            | L       | Z          |
| Open                         | H       | H          |
| X                            | H       | $R_{OUT0}$ |

#### Notes:

H = high level, L = low level, X = irrelevant  
Z = high impedance (off), ? = indeterminate

### Recommended Operating Conditions

|                                                    | Min.                 | Nom. | Max.                       | Units |
|----------------------------------------------------|----------------------|------|----------------------------|-------|
| Supply Voltage, $V_{CC}$                           | 3.0                  | 3.3  | 3.6                        | V     |
| High-Level Input Voltage, $V_{IH}$                 | 2.0                  |      |                            |       |
| Low-Level Input Voltage, $V_{IL}$                  |                      |      | 0.8                        |       |
| Magnitude of Differential Input Voltage $ V_{ID} $ | 0.1                  |      | 0.6                        |       |
| Common-Mode input Voltage, $V_{IC}$                | $\frac{ V_{ID} }{2}$ |      | $2.4 - \frac{ V_{ID} }{2}$ |       |
|                                                    |                      |      | $V_{CC} - 0.8$             |       |
| Operating free-air temperature, $T_A$              | –40                  |      | 85                         | °C    |

**Electrical Characteristics Over Recommended Operating Conditions** (unless otherwise noted)

| Symbol              | Parameter                                                              |     | Test Conditions                             | Min. | Typ. <sup>(1)</sup> | Max. | Units |
|---------------------|------------------------------------------------------------------------|-----|---------------------------------------------|------|---------------------|------|-------|
| V <sub>ITH+</sub>   | Positive-going differential input voltage threshold                    |     |                                             |      |                     | 100  | mV    |
| V <sub>ITH-</sub>   | Negative-going differential input voltage threshold                    |     |                                             | -100 |                     |      |       |
| V <sub>OH</sub>     | High-level output voltage                                              |     | I <sub>OH</sub> = -8mA                      | 2.4  | 3.1                 |      | V     |
| V <sub>OL</sub>     | Low-level output voltage                                               |     | I <sub>OL</sub> = 8mA                       |      | 0.3                 | 0.45 |       |
| I <sub>CC</sub>     | Supply Current                                                         |     | Enabled, No load                            |      | 40                  | 56   | mA    |
|                     |                                                                        |     | Disabled                                    |      |                     | 3    |       |
| I <sub>I</sub>      | Input Current<br>(R <sub>IN+</sub> or R <sub>IN-</sub> inputs)         | LV  | V <sub>I</sub> = 0V                         |      |                     | -20  | μA    |
|                     |                                                                        |     | V <sub>I</sub> = 2.4V                       | -1.2 |                     |      |       |
|                     |                                                                        | LVT | V <sub>I</sub> = 0V, other input open       |      |                     | -40  |       |
|                     |                                                                        |     | V <sub>I</sub> = 2.4V, other input open     | -2.4 |                     |      |       |
| I <sub>I(OFF)</sub> | Power-off input current (R <sub>IN+</sub> or R <sub>IN-</sub> inputs)  |     | V <sub>CC</sub> = 0V, V <sub>I</sub> = 2.4V |      | 12                  | ±20  |       |
| I <sub>IH</sub>     | High-level input current (enables)                                     |     | V <sub>IH</sub> = 2V                        |      |                     | 10   |       |
| I <sub>IL</sub>     | Low-level input current (enables)                                      |     | V <sub>IL</sub> = 0.8V                      |      |                     |      |       |
| I <sub>OZ</sub>     | High-impedance output current                                          |     | V <sub>O</sub> = 0V                         |      |                     | ±1   |       |
|                     |                                                                        |     | V <sub>O</sub> = 3.6V                       |      |                     | 10   |       |
| C <sub>IN</sub>     | Input capacitance (R <sub>IN+</sub> or R <sub>IN-</sub> inputs to GND) |     | V <sub>ID</sub> = 0.4 sin 2.5E09 t V        |      | 6                   |      | pF    |
| Z <sub>(t)</sub>    | Termination Impedance (LVT)                                            |     |                                             | 88   | 110                 | 143  | Ohms  |

**Note:**

1. All typical values are at 25°C and with a 3.3V supply.

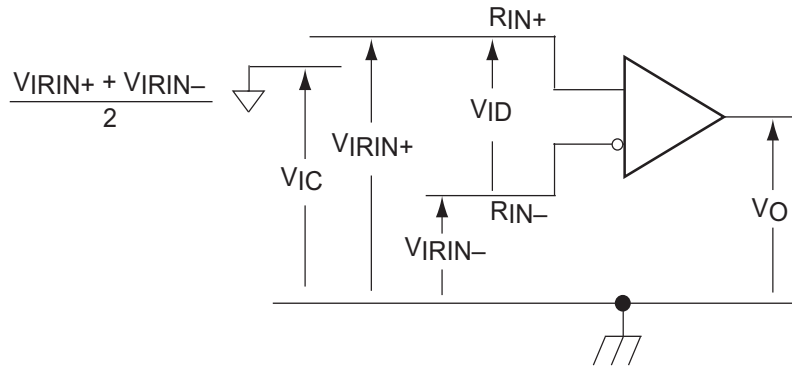
**Switching Characteristics Over Recommended Operating Conditions** (unless otherwise noted)

| Symbol              | Parameter                                                   | Test Conditions             | Min. | Typ. <sup>(1)</sup> | Max. | Units |
|---------------------|-------------------------------------------------------------|-----------------------------|------|---------------------|------|-------|
| t <sub>PLH</sub>    | Propagation delay time, low-to-high-level output            | See Figure 2                | 1    | 2.2                 | 3.1  | ns    |
| t <sub>PHL</sub>    | Propagation delay time, high-to-low-level output            |                             | 1    | 2.1                 | 3.1  |       |
| t <sub>r</sub>      | Differential output signal rise time                        |                             | 500  | 900                 | 1500 | ps    |
| t <sub>f</sub>      | Differential output signal fall time                        |                             | 500  | 820                 | 1200 |       |
| t <sub>sk(p)</sub>  | Pulse skew (t <sub>PHL</sub> – t <sub>PLH</sub> )           |                             |      | 120                 | 244  |       |
| t <sub>sk(o)</sub>  | Output skew <sup>(2)</sup>                                  |                             |      | 180                 | 320  |       |
| t <sub>sk(pp)</sub> | Part-to-part skew <sup>(3)</sup>                            |                             |      |                     | 1    |       |
| t <sub>PZH</sub>    | Propagation delay time, high-impedance-to-high-level output | See Figure 3 <sup>(4)</sup> |      | 2.5                 | 3.7  | ns    |
| t <sub>PZL</sub>    | Propagation delay time, high-impedance-to-low-level output  |                             |      | 4.8                 | 6.7  |       |
| t <sub>PHZ</sub>    | Propagation delay time, high-level-to-high-impedance output |                             |      | 3.7                 | 5.3  |       |
| t <sub>PLZ</sub>    | Propagation delay time, low-level-to-high-impedance output  |                             |      | 6.4                 | 8.7  |       |
| f <sub>MAX</sub>    | Maximum Clock frequency                                     |                             | 300  |                     |      | MHz   |

**Notes:**

1. All typical values are at 25°C and with a 3.3V supply
2. t<sub>sk(o)</sub> is the magnitude of the time difference between the t<sub>PLH</sub> or t<sub>PHL</sub> of all drivers of a single device with all of their inputs connected together.
3. t<sub>sk(pp)</sub> is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.
4. R<sub>OUT0</sub> disable time is 1 nanosecond greater.

## Parameter Measurement Information

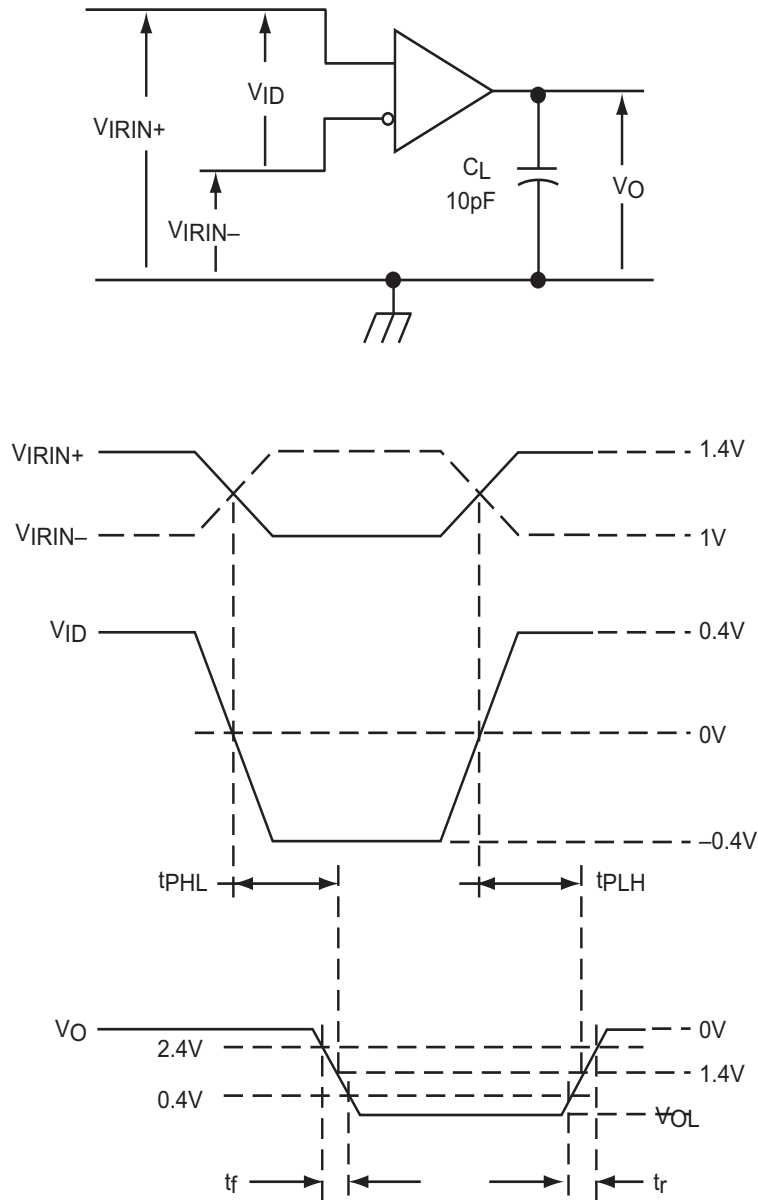


**Figure 1. Voltage Definitions**

**Table 1. Receiver Minimum and Maximum Input Threshold Test Voltages**

| Applied Voltages   |                    | Resulting Differential Input Voltage | Resulting Common-Mode Input Voltage |
|--------------------|--------------------|--------------------------------------|-------------------------------------|
| V <sub>IRIN+</sub> | V <sub>IRIN-</sub> | V <sub>ID</sub>                      | V <sub>IC</sub>                     |
| 1.25V              | 1.15V              | 100mV                                | 1.2V                                |
| 1.15V              | 1.25V              | -100mV                               | 1.2V                                |
| 2.4V               | 2.3V               | 100mV                                | 2.35V                               |
| 2.3V               | 2.4V               | -100mV                               | 2.35V                               |
| 0.1V               | 0V                 | 100mV                                | 0.05V                               |
| 0V                 | 0.1V               | -100mV                               | 0.05V                               |
| 1.5V               | 0.9V               | 600mV                                | 1.2V                                |
| 0.9V               | 1.5V               | -600mV                               | 1.2V                                |
| 2.4V               | 1.8V               | 600mV                                | 2.1V                                |
| 1.8V               | 2.4V               | -600mV                               | 2.1V                                |
| 0.6V               | 0V                 | 600mV                                | 0.3V                                |
| 0V                 | 0.6V               | -600mV                               | 0.3V                                |

## Parameter Measurement Information

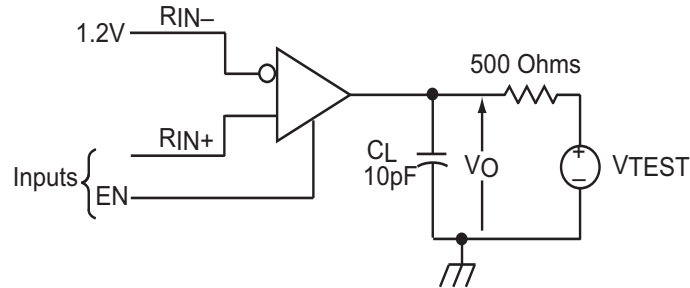


**Figure 2. Timing Test Circuit and Waveforms**

### Note:

1. All input pulses are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1\text{ns}$ , Pulse Repetition Rate (PRR) = 50 Mpps, Pulse width =  $10 \pm 0.2\text{ns}$ .  $C_L$  includes instrumentation and fixture capacitance within 0.06m of the D.U.T.

## Parameter Measurement Information



**Note:**

1. All input pulses are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1\text{ns}$ , Pulse Repetition Rate (PRR) = 0.5 Mpps, pulse width =  $500 \pm 10\text{ns}$ .  $C_L$  includes instrumentation and fixture capacitance within 0.06m of the D.U.T.

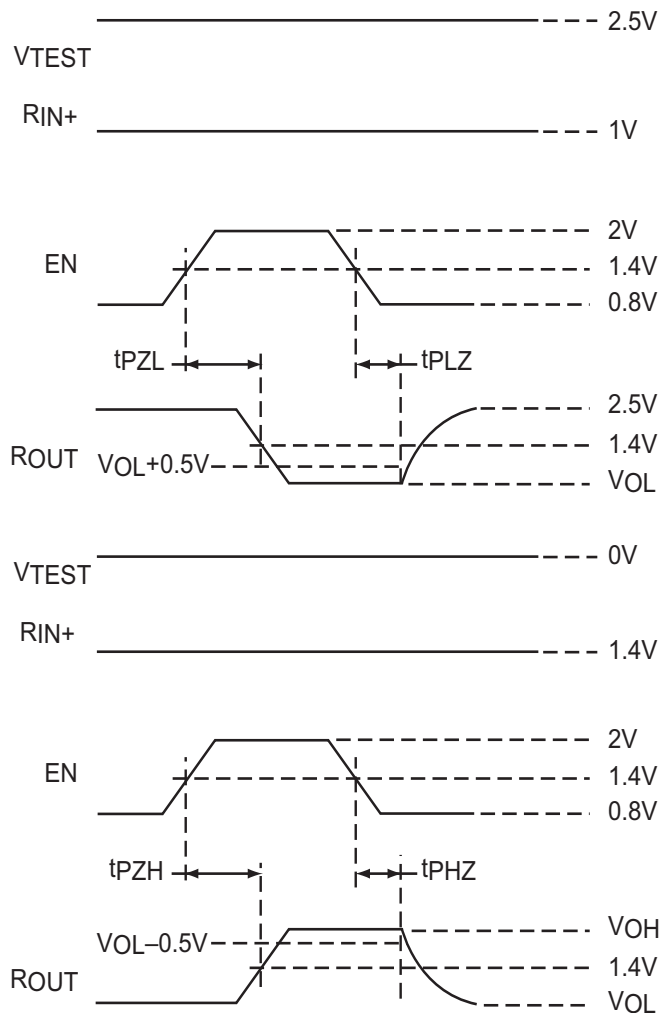
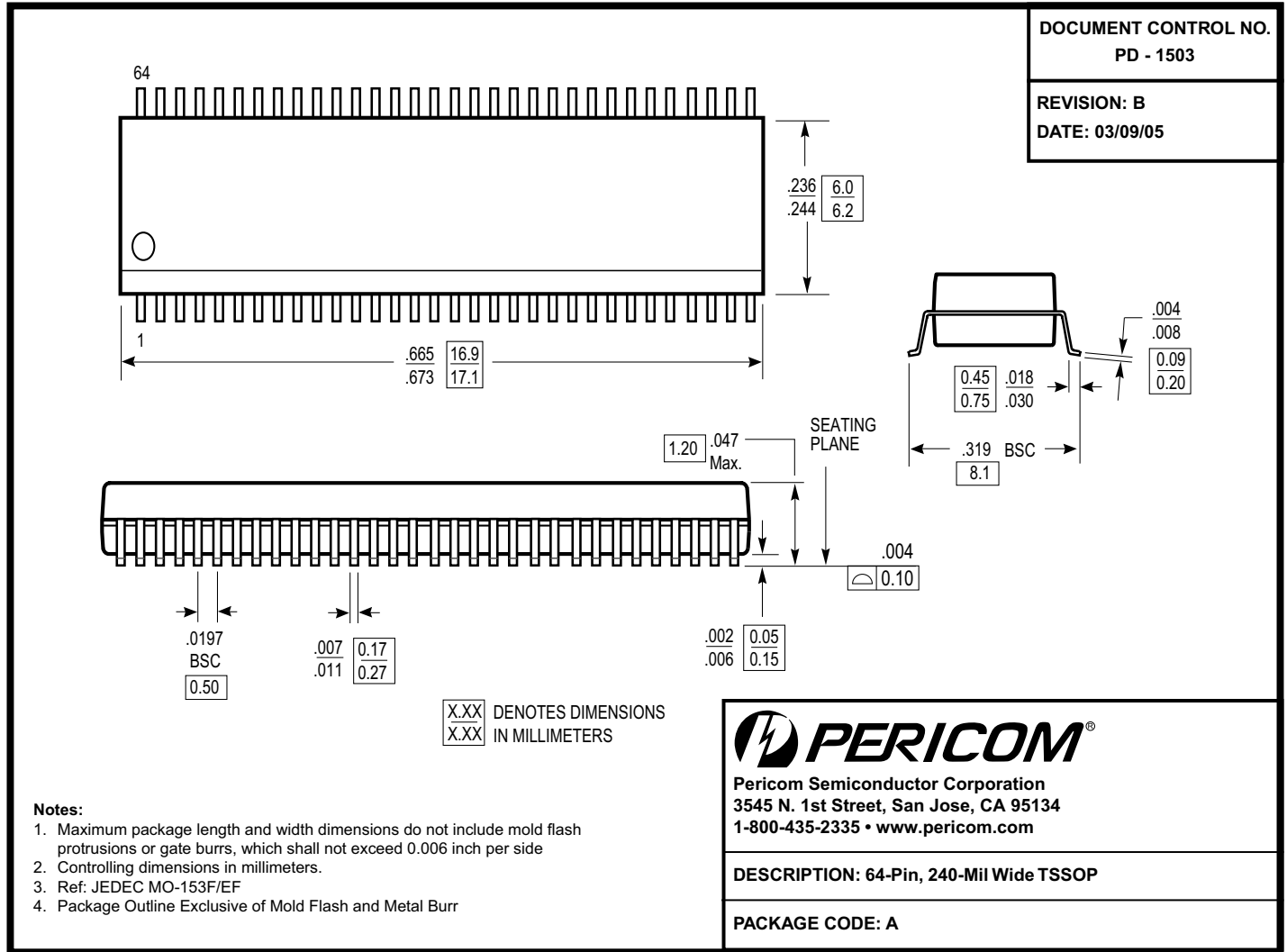


Figure 3. Enable/Disable Test Circuit and Waveforms

## Packaging Mechanical: 64-Pin TSSOP (A)



## Ordering Information

| Ordering Code | Package Code | Package Type                  |
|---------------|--------------|-------------------------------|
| PI90LV386AE   | A            | Pb-free & Green, 64-pin TSSOP |
| PI90LVT386AE  | A            | Pb-free & Green, 64-pin TSSOP |

### Notes:

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
- X = Tape and reel