



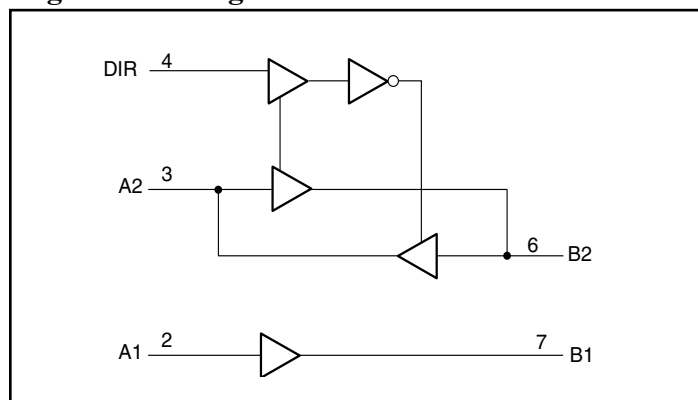
PI74STX2G4245

## 2-Bit Level Shifting Buffer/Transceiver with Configurable Dual Supply Voltage

### Product Features

- Operation Voltage:  $1.65V \leq V_{CCA} \leq 3.6V$   
 $2.3V \leq V_{CCB} \leq 5.5V$   
 $V_{CCA} \leq V_{CCB}$
- High Speed:  $t_{pd} = 5ns$  typical into  $30pF$  @  $3V V_{CC}$
- Power down high-impedance inputs and outputs
- High output drive:  $\pm 12mA$  at  $3V V_{CCA}/V_{CCB}$   
 $\pm 24mA$  at  $5V V_{CCB}$
- Industrial operation at  $-40^{\circ}C$  to  $+85^{\circ}C$
- Packaging:
  - 8-pin MSOP (U)
  - 12-pin TDFN (ZE)

### Logic Block Diagram



### Function Table

| Input |      | Output |
|-------|------|--------|
| DIR   | DATA |        |
| L     | B2   | A2     |
| H     | A2   | B2     |
| X     | A1   | B1     |

### Pin Description

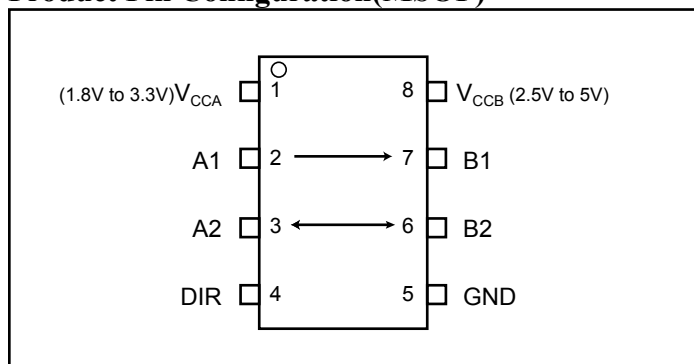
| Pin Name                            | Description       |
|-------------------------------------|-------------------|
| DIR                                 | Direction Control |
| A1                                  | Data Input        |
| B1                                  | Data Output       |
| A2, B2                              | Data Input/Output |
| V <sub>CCA</sub> , V <sub>CCB</sub> | Power Supply      |

### Product Description

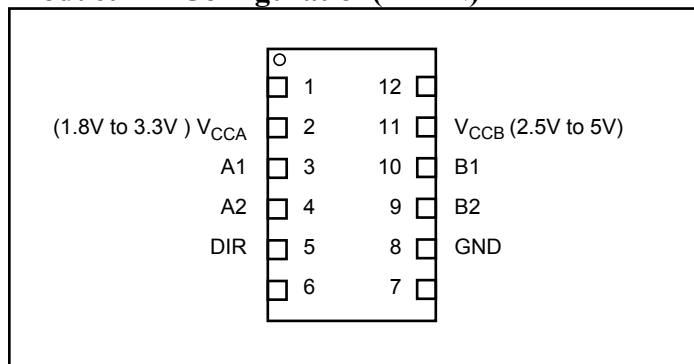
Pericom Semiconductor's STX series of logic circuits are produced using the Company's advanced CMOS technology, achieving industry leading performance.

Pericom Semiconductor's PI74STX2G4245, a 2-bit noninverting buffer/transceiver, contains two separate supply rails: A port (V<sub>CCA</sub>), set to operate from 1.8V to 3.3V; B port (V<sub>CCB</sub>), set to operate from 2.5V to 5V. The A1 to B1 translation is configured as an unidirectional buffer; the translation between A2 and B2 is bidirectional and its direction is controlled by the DIR pin.

### Product Pin Configuration(MSOP)



### Product Pin Configuration(TDFN)



**Maximum Ratings**

(Absolute maximum ratings over operating free-air temperature range from  $V_{CCB}$  at 2.5V &  $V_{CCA}$  at 1.2V, unless otherwise noted)

|                                       |                            |                                                      |                |
|---------------------------------------|----------------------------|------------------------------------------------------|----------------|
| Supply voltage range: $V_{CCA}$ ..... | -0.5V to +6V               | DC Input Diode Current, $I_{IK}$ ( $V_O < 0$ ).....  | -50mA          |
| $V_{CCB}$ .....                       | -0.5V to +6V               | DC Output Diode Current, $I_{OK}$ ( $V_O < 0$ )..... | -50mA          |
| Input Voltage Range, $V_I$ :          |                            | DC Output Current, ( $I_{OUT}$ ) .....               | $\pm 50$ mA    |
| Input A1 <sup>(1)</sup> .....         | -0.5V to +6V               | DC $V_{CC}$ or GND Current ( $I_{CC}/I_{GND}$ )..... | $\pm 100$ mA   |
| I/O A2 <sup>(1,2)</sup> .....         | -0.5V to $V_{CCA}+0.5$ V   | Storage temperature range, $T_{STG}$ .....           | -65°C to 150°C |
| I/O B2 <sup>(1,2)</sup> .....         | -0.5V to $V_{CCB}+0.5$ V   | Junction Lead Temperature ( $I_{OS}$ ) .....         | 260°C          |
| Output Voltage Range, $V_O$           |                            | Power Dissipation: MSOP .....                        | 200mW          |
| Output B1 <sup>(1,2)</sup> ..         | -0.5V to $V_{CCB} + 0.5$ V |                                                      |                |

**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.

1. The input negative voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. This value is limited to 6V.

**Recommended Operating Conditions for A Port ( $V_{CCA}$ )<sup>(1)</sup>**

| Parameter           | Description                        | Test Conditions             | Min.                 | Max.                 | Units |
|---------------------|------------------------------------|-----------------------------|----------------------|----------------------|-------|
| $V_{CCA}$           | Supply Voltage                     |                             | 1.65                 | 3.6                  | V     |
| $V_{IH}$            | High-level input voltage           | $V_{CCA} = 1.65$ V to 1.95V | $0.7 \times V_{CCA}$ |                      |       |
|                     |                                    | $V_{CCA} = 2.3$ V to 3.6V   | $0.7 \times V_{CCA}$ |                      |       |
| $V_{IL}$            | Low-level input voltage            | $V_{CCA} = 1.65$ to 1.95V   |                      | $0.3 \times V_{CCA}$ |       |
|                     |                                    | $V_{CCA} = 2.3$ V to 3.6V   |                      | $0.3 \times V_{CCA}$ |       |
| $V_{IA}$            | Input Voltage                      |                             | 0                    | $V_{CCA}$            |       |
| $V_{OA}$            | Output Votage                      |                             | 0                    | $V_{CCA}$            | mA    |
| $I_{OH}$            | High-level Output Current          | $V_{CCA} = 1.65$ V to 1.95V |                      | -4                   |       |
|                     |                                    | $V_{CCA} = 2.3$ V to 2.7V   |                      | -8                   |       |
|                     |                                    | $V_{CCA} = 3$ V to 3.6V     |                      | -12                  |       |
| $I_{OL}$            | Low-level Output Current           | $V_{CCA} = 1.65$ V to 1.95V |                      | 4                    |       |
|                     |                                    | $V_{CCA} = 2.3$ V to 2.7V   |                      | 8                    |       |
|                     |                                    | $V_{CCA} = 3$ V to 3.6V     |                      | 12                   |       |
| $\Delta t/\Delta V$ | Input transition rise or fall rate | $V_{CCA} = 1.65$ V to 1.95V |                      | 20                   | ns/V  |
|                     |                                    | $V_{CCA} = 2.3$ V to 3.6V   |                      | 10                   |       |
| $T_A$               | Operation free-air temperature     |                             | -40                  | 85                   | °C    |

**Note:**

1. To ensure proper device operation, all unused inputs must be held at  $V_{CCA}$  or GND.

**Recommended Operating Conditions for B Port (  $V_{CCB}$  )<sup>(1)</sup>**

| Parameters          | Description                        | Test Conditions            | Min.                 | Max.                 | Units |
|---------------------|------------------------------------|----------------------------|----------------------|----------------------|-------|
| $V_{CCB}$           | Supply Voltage                     |                            | 2.3                  | 5.5                  | V     |
| $V_{IH}$            | High-level input voltage           | $V_{CCB} = 2.3V$ to $5.5V$ | $0.7 \times V_{CCB}$ |                      |       |
| $V_{IL}$            | Low-level input voltage            | $V_{CCB} = 2.3V$ to $5.5V$ |                      | $0.3 \times V_{CCB}$ |       |
| $V_{IB}$            | Input Voltage                      |                            | 0                    | $V_{CCB}$            |       |
| $V_{OB}$            | Output Voltage                     |                            | 0                    | $V_{CCB}$            |       |
| $I_{OH}$            | High-level Output Current          | $V_{CCB} = 2.3V$ to $2.7V$ |                      | -8                   | mA    |
|                     |                                    | $V_{CCB} = 3V$ to $3.6V$   |                      | -12                  |       |
|                     |                                    | $V_{CCB} = 4.5V$ to $5.5V$ |                      | -24                  |       |
| $I_{OL}$            | Low-level Output Current           | $V_{CCB} = 2.3V$ to $2.7V$ |                      | 8                    |       |
|                     |                                    | $V_{CCB} = 3V$ to $3.6V$   |                      | 12                   |       |
|                     |                                    | $V_{CCB} = 4.5V$ to $5.5V$ |                      | 24                   |       |
| $\Delta t/\Delta V$ | Input transition rise or fall rate | $V_{CCB} = 2.3V$ to $5.5V$ |                      | 10                   | m/V   |
| $T_A$               | Operation free-air temperature     |                            | -40                  | 85                   | °C    |

**Note:**

1. To ensure proper device operation, all unused inputs must be held at  $V_{CCB}$  or GND.

**Electrical Characteristics** (Over recommended operating free-air temperature range)

| Parameters            |         | Test Conditions                         | $V_{CCA}^{(1)}$                                           | $V_{CCB}^{(1)}$                                          | Min.          | Typ. <sup>(2)</sup> | Max.     | Units   |
|-----------------------|---------|-----------------------------------------|-----------------------------------------------------------|----------------------------------------------------------|---------------|---------------------|----------|---------|
| $V_{OHA}$<br>(B to A) |         | $I_{OH} = -100\mu A$                    | 1.65V to 3.6V                                             | $2.3V \leq V_{CCB} \leq 5.5V$ and $V_{CCB} \geq V_{CCA}$ | $V_{CCB}-0.1$ |                     |          | V       |
|                       |         | $I_{OH} = -4mA$                         | 1.65V                                                     |                                                          | 1.3           |                     |          |         |
|                       |         | $I_{OH} = -8mA$                         | 2.3V                                                      |                                                          | 1.8           |                     |          |         |
|                       |         | $I_{OH} = -12mA$                        | 3.0V                                                      |                                                          | 2.4           |                     |          |         |
| $V_{OLA}$<br>(B to A) |         | $I_{OH} = 100\mu A$                     | 1.65V to 3.6V                                             |                                                          |               |                     | 0.1      |         |
|                       |         | $I_{OH} = 4mA$                          | 1.65V                                                     |                                                          |               |                     | 0.24     |         |
|                       |         | $I_{OH} = 8mA$                          | 2.3V                                                      |                                                          |               |                     | 0.3      |         |
|                       |         | $I_{OH} = 12mA$                         | 3.0V                                                      |                                                          |               |                     | 0.4      |         |
| $V_{OHB}$<br>(A to B) |         | $I_{OH} = -100\mu A$                    | $1.65V \leq V_{CCA} \leq 3.6V$ and $V_{CCB} \geq V_{CCA}$ | 2.3V to 5.5V                                             | $V_{CCB}-0.1$ |                     |          |         |
|                       |         | $I_{OH} = -8mA$                         |                                                           | 2.3V                                                     | 1.8           |                     |          |         |
|                       |         | $I_{OH} = -12mA$                        |                                                           | 3.0V                                                     | 2.4           |                     |          |         |
|                       |         | $I_{OH} = -24mA$                        |                                                           | 4.5V                                                     | 3.8           |                     |          |         |
| $V_{OLB}$<br>(A to B) |         | $I_{OH} = 100\mu A$                     |                                                           | 2.3V to 5.5V                                             |               |                     | 0.1      |         |
|                       |         | $I_{OH} = 8mA$                          |                                                           | 2.3V                                                     |               |                     | 0.3      |         |
|                       |         | $I_{OH} = 12mA$                         |                                                           | 3.0V                                                     |               |                     | 0.4      |         |
|                       |         | $I_{OH} = 24mA$                         |                                                           | 4.5V                                                     |               |                     | 0.55     |         |
| $I_I^{(3)}$           |         | $V_I = V_{CCA}/V_{CCB}$ or GND          | 1.65V to 3.6V and $V_{CCB} \geq V_{CCA}$                  | 2.3V to 5.5V and $V_{CCB} \geq V_{CCA}$                  |               |                     | $\pm 5$  | $\mu A$ |
| $I_{OFF}$             |         | $V_I$ or $V_O = V_{CCB}$ or GND         | 0V                                                        | 0 to 5.5V                                                |               |                     | $\pm 10$ |         |
|                       |         | $V_I$ or $V_O = V_{CCA}$ or GND         | 0 to 3.6V                                                 | 0V                                                       |               |                     | $\pm 10$ |         |
| $I_{CCA}$             |         | $V_I = V_{CCA}$ or GND, $I_O = 0$       | 1.65V to 3.6V and $V_{CCB} \geq V_{CCA}$                  | 2.3 to 5.5V and $V_{CCB} \geq V_{CCA}$                   |               |                     | 10       |         |
| $I_{CCB}$             |         | $V_I = V_{CCB}$ or GND, $I_O = 0$       |                                                           |                                                          |               |                     | 10       |         |
| $C_I$                 | A1, DIR | $V_I = V_{CCA}$ or GND                  | 1.8V                                                      | 3.3V                                                     |               | 4.5                 |          | pF      |
| $C_O$                 | B1      | $V_O = V_{CCB}$ or GND                  | 1.8V                                                      | 3.3V                                                     |               | 4.5                 |          |         |
| $C_{IO}$              | A2, B2  | $V_I$ or $V_O = V_{CCA}/V_{CCB}$ or GND | 1.8V                                                      | 3.3V                                                     |               | 6.0                 |          |         |

**Notes:**

- When  $1.65 \leq V_{CCA} \leq 1.95V$ ,  $V_{CCB}$  can not be greater than 3.6V
- All Typical values are at  $T_A = 25^\circ C$
- For I/O ports, the parameter  $I_I$  includes the output leakage current.

**Switching Characteristics for  $V_{CCA} = 1.8V \pm 0.15V$** 

(Over recommended operating free-air temperature range, see figure 1)

| Parameter          | From<br>(Input) | To<br>(Output) | V <sub>CCB</sub> = 2.5V ±0.2V |      | V <sub>CCB</sub> = 3.3V ±0.3V |      | Units |
|--------------------|-----------------|----------------|-------------------------------|------|-------------------------------|------|-------|
|                    |                 |                | Min.                          | Max. | Min.                          | Max. |       |
| t <sub>PHL</sub>   | A               | B              | 1.0                           | 8    | 1.0                           | 8    | ns    |
| t <sub>PLH</sub>   |                 |                | 1.0                           | 8    | 1.0                           | 8    |       |
| t <sub>PHL</sub>   | B               | A              | 1.0                           | 7    | 1.0                           | 7    |       |
| t <sub>PLH</sub>   |                 |                | 1.0                           | 7    | 1.0                           | 7    |       |
| t <sub>SK(O)</sub> |                 |                |                               | 1.5  |                               | 1    |       |

**Switching Characteristics for  $V_{CCA} = 2.5V \pm 0.2V$** 

(Over recommended operating free-air temperature range, see figure 1)

| Parameter          | From<br>(Input) | To<br>(Output) | V <sub>CCB</sub> = 2.5V ±0.2V |      | V <sub>CCB</sub> = 3.3V ±0.3V |      | V <sub>CCB</sub> = 5V ±0.5V |      | Units |
|--------------------|-----------------|----------------|-------------------------------|------|-------------------------------|------|-----------------------------|------|-------|
|                    |                 |                | Min.                          | Max. | Min.                          | Max. | Min.                        | Max. |       |
| t <sub>PHL</sub>   | A               | B              | 1.0                           | 7    | 1.0                           | 6.5  | 1.0                         | 6    | ns    |
| t <sub>PLH</sub>   |                 |                | 1.0                           | 7    | 1.0                           | 6.5  | 1.0                         | 6    |       |
| t <sub>PHL</sub>   | B               | A              | 1.0                           | 6    | 1.0                           | 6    | 1.0                         | 5    |       |
| t <sub>PLH</sub>   |                 |                | 1.0                           | 6    | 1.0                           | 6    | 1.0                         | 5    |       |
| t <sub>SK(O)</sub> |                 |                |                               | 1.5  |                               | 1    |                             | 1    |       |

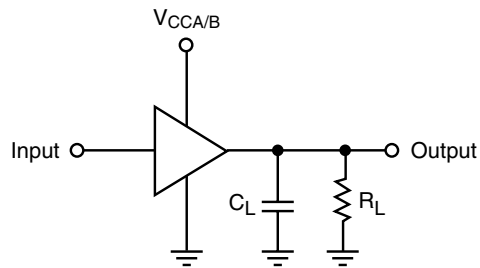
**Switching Characteristics for  $V_{CCA} = 3.3V \pm 0.3V$** 

(Over recommended operating free-air temperature range, see figure 1)

| Parameter          | From<br>(Input) | To<br>(Output) | V <sub>CCB</sub> = 3.3V ±0.3V |      | V <sub>CCB</sub> = 5V ±0.5V |      | Units |
|--------------------|-----------------|----------------|-------------------------------|------|-----------------------------|------|-------|
|                    |                 |                | Min.                          | Max. | Min.                        | Max. |       |
| t <sub>PHL</sub>   | A               | B              | 1.0                           | 5    | 1.0                         | 5    | ns    |
| t <sub>PLH</sub>   |                 |                | 1.0                           | 5    | 1.0                         | 5    |       |
| t <sub>PHL</sub>   | B               | A              | 1.0                           | 5    | 1.0                         | 5    |       |
| t <sub>PLH</sub>   |                 |                | 1.0                           | 5    | 1.0                         | 5    |       |
| t <sub>SK(O)</sub> |                 |                |                               | 1    |                             | 1    |       |

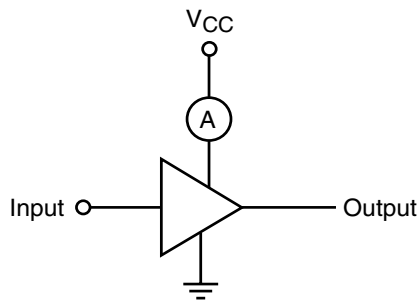
## AC Loading and Waveforms

| $V_{CCA/B}$     | $C_L$ | $R_L$        |
|-----------------|-------|--------------|
| $1.8 \pm 0.15V$ | 15pF  | 1K $\Omega$  |
| $2.5V \pm 0.2V$ | 15pF  | 500 $\Omega$ |
| 3.0V to 3.6V    | 30pF  | 500 $\Omega$ |
| $5V \pm 0.5V$   | 50pF  | 500 $\Omega$ |



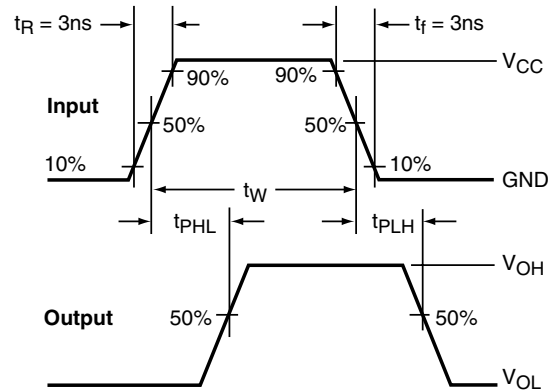
$C_L$  includes load and stray capacitance  
Input PRR = 1.0 MHz;  $t_W$  = 500ns

**Figure 1. AC Test Circuit**



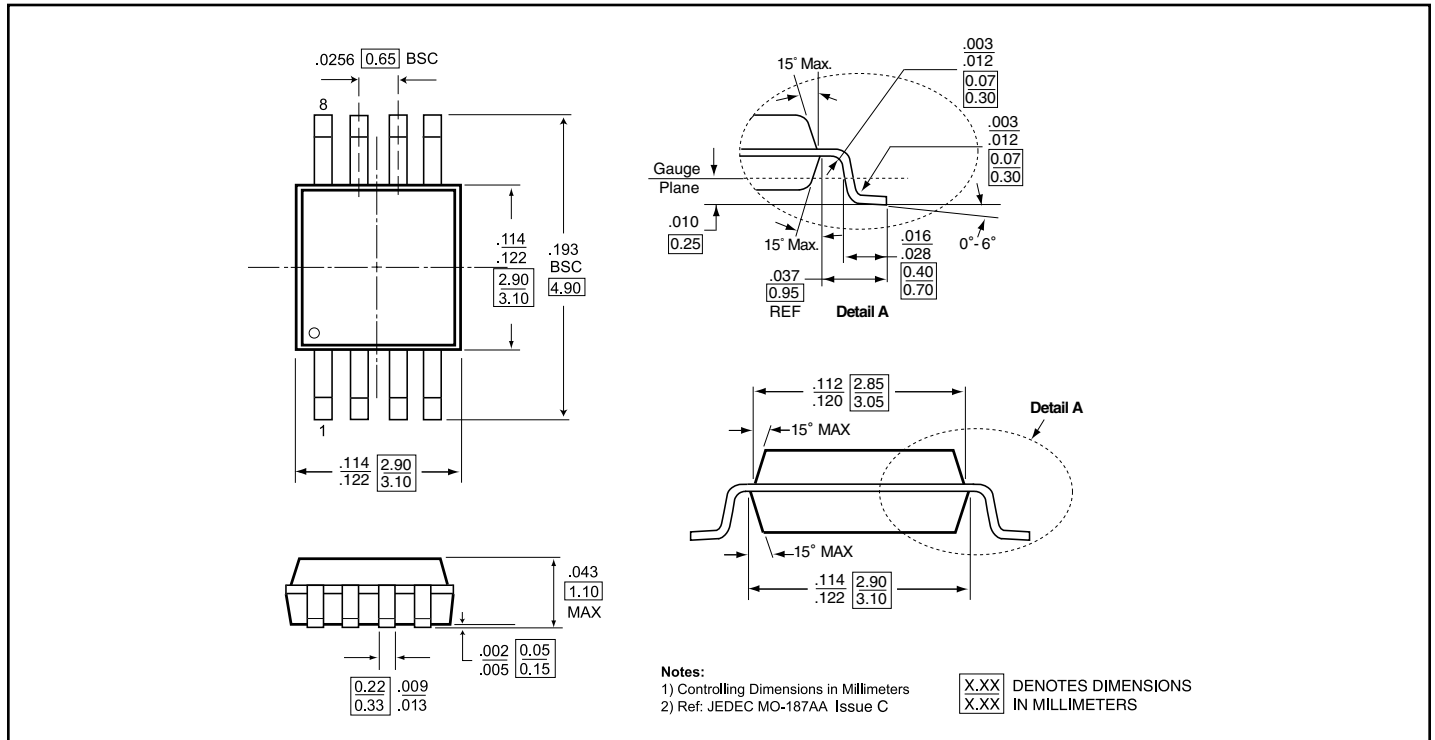
Input = AC Waveform;  $t_r = t_f = 1.8ns$ ;  
PRR = 10 MHz; Duty Cycle = 50%

**Figure 2.  $I_{CCD}$  Test Circuit**

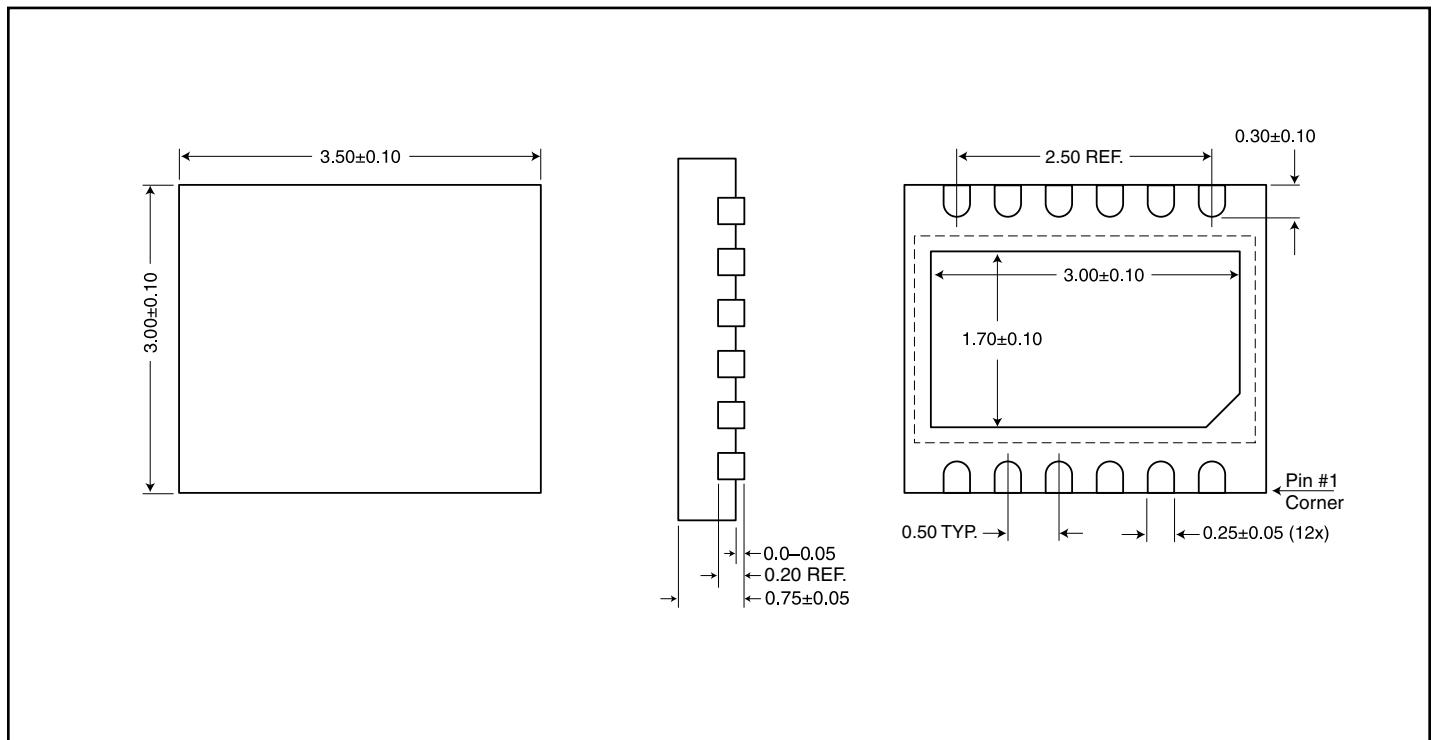


**Figure 3. AC Waveforms**

**Packaging Mechanical: 8-Pin MSOP (U)**



**Packaging Mechanical: 12-pin TDFN (ZE)**



**Ordering Information**

| Ordering Code     | Package Code | Package Type                | Package Top Marking |
|-------------------|--------------|-----------------------------|---------------------|
| PI74STX2G4245UX   | U            | 8-pin MSOP                  | STX2G,4245          |
| PI74STX2G4245ZEEX | ZE           | Pb-free & Green, 12-pinTDFN | DE                  |

**Notes:**

1. Thermal Characteristics can be found on the web: <http://www.pericom.com/packaging/>
2. X = Tape and Reel
3. Number of Transistors = TBD