



# 74ACT16245

## 16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS (NON INVERTED)

- HIGH SPEED:  $t_{PD} = 4.8ns$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 8\mu A$  (MAX.) at  $T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS  
 $V_{IH} = 2V$  (MIN.),  $V_{IL} = 0.8V$  (MAX.)
- $50\Omega$  TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24mA$  (MIN)
- OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 4.5V to 5.5V
- IMPROVED LATCH-UP IMMUNITY



### ORDER CODES

| PACKAGE | TUBE | T & R         |
|---------|------|---------------|
| TSSOP   |      | 74ACT16245TTR |

### DESCRIPTION

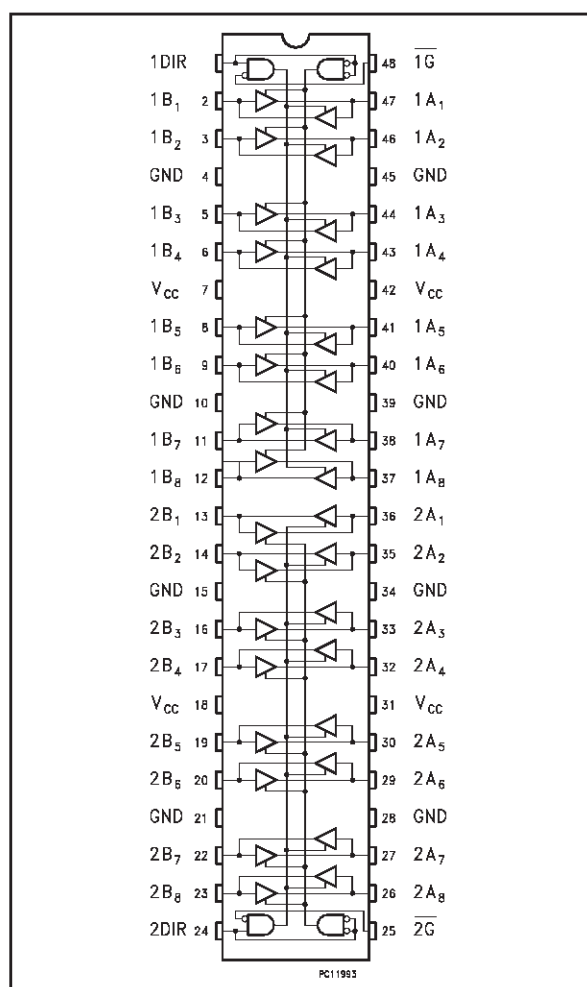
The ACT16245 is an advanced high-speed CMOS 16-BIT BUS TRANSCEIVER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

This IC is intended for two-way asynchronous communication between data buses and the direction of data transmission is determined by DIR input. The enable input  $\overline{G}$  can be used to disable the device so that the buses are effectively isolated.

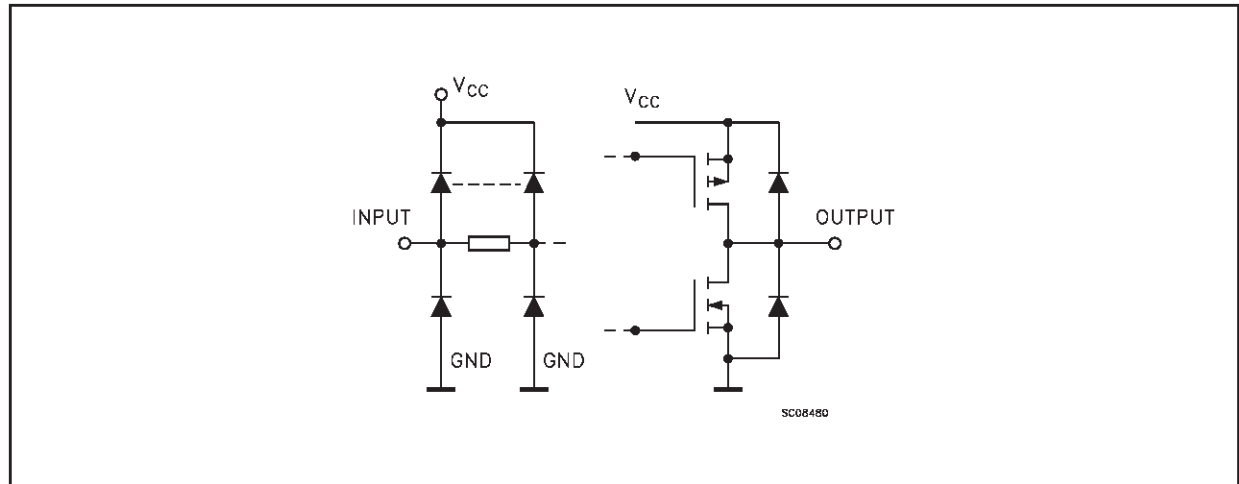
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

IT IS PROHIBITED TO APPLY A SIGNAL TO A TERMINAL WHEN IT IS IN OUTPUT MODE AND WHEN A BUS TERMINAL IS FLOATING (HIGH IMPEDANCE STATE). IT IS REQUIRED TO FIX THE INPUT LEVEL BY MEANS OF EXTERNAL PULL DOWN OR PULL UP RESISTOR.

### PIN CONNECTION



## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

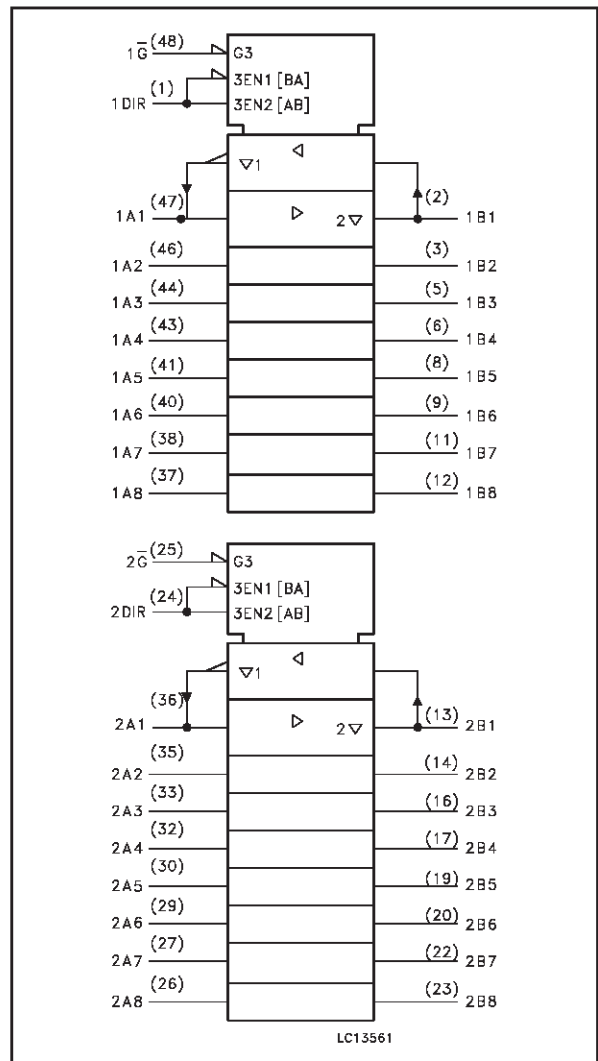
| PIN No                         | SYMBOL          | NAME AND FUNCTION       |
|--------------------------------|-----------------|-------------------------|
| 1                              | 1DIR            | Directional Control     |
| 2, 3, 5, 6, 8, 9, 11, 12       | 1B1 to 1B8      | Data Inputs/Outputs     |
| 13, 14, 16, 17, 19, 20, 22, 23 | 2B1 to 2B8      | Data Inputs/Outputs     |
| 24                             | 2DIR            | Directional Control     |
| 25                             | 2G              | Output Enable Input     |
| 36, 35, 33, 32, 30, 29, 27, 26 | 2A1 to 2A8      | Data Inputs/Outputs     |
| 47, 46, 44, 43, 41, 40, 38, 38 | 1A1 to 1A8      | Data Inputs/Outputs     |
| 48                             | 1G              | Output Enable Input     |
| 4, 10, 15, 21, 28, 34, 39, 45  | GND             | Ground (0V)             |
| 7, 18, 31, 42                  | V <sub>CC</sub> | Positive Supply Voltage |

## TRUTH TABLE

| INPUTS         |     | FUNCTION |        | OUTPUT         |
|----------------|-----|----------|--------|----------------|
| $\overline{G}$ | DIR | A BUS    | B BUS  | Y <sub>n</sub> |
| L              | L   | OUTPUT   | INPUT  | A = B          |
| L              | H   | INPUT    | OUTPUT | B = A          |
| H              | X   | Z        | Z      | Z              |

X: "H" or "L"  
Z: High Impedance

## IEC LOGIC SYMBOLS



**ABSOLUTE MAXIMUM RATINGS**

| Symbol                | Parameter                     | Value                  | Unit |
|-----------------------|-------------------------------|------------------------|------|
| $V_{CC}$              | Supply Voltage                | -0.5 to +7             | V    |
| $V_I$                 | DC Input Voltage              | -0.5 to $V_{CC} + 0.5$ | V    |
| $V_O$                 | DC Output Voltage             | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$              | DC Input Diode Current        | $\pm 20$               | mA   |
| $I_{OK}$              | DC Output Diode Current       | $\pm 20$               | mA   |
| $I_O$                 | DC Output Current             | $\pm 50$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | $\pm 400$              | mA   |
| $T_{stg}$             | Storage Temperature           | -65 to +150            | °C   |
| $T_L$                 | Lead Temperature (10 sec)     | 300                    | °C   |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol   | Parameter                                                  | Value         | Unit |
|----------|------------------------------------------------------------|---------------|------|
| $V_{CC}$ | Supply Voltage                                             | 4.5 to 5.5    | V    |
| $V_I$    | Input Voltage                                              | 0 to $V_{CC}$ | V    |
| $V_O$    | Output Voltage                                             | 0 to $V_{CC}$ | V    |
| $T_{op}$ | Operating Temperature                                      | -40 to 85     | °C   |
| dt/dv    | Input Rise and Fall Time $V_{CC} = 4.5$ to $5.5V$ (note 1) | 8             | ns/V |

1)  $V_{IN}$  from 0.8V to 2.0V

## DC SPECIFICATION

| Symbol           | Parameter                             | Test Condition         |                                                                                                | Value                  |       |       |              |      | Unit |
|------------------|---------------------------------------|------------------------|------------------------------------------------------------------------------------------------|------------------------|-------|-------|--------------|------|------|
|                  |                                       | V <sub>CC</sub><br>(V) |                                                                                                | T <sub>A</sub> = 25 °C |       |       | -40 to 85 °C |      |      |
|                  |                                       |                        |                                                                                                | Min.                   | Typ.  | Max.  | Min.         | Max. |      |
| V <sub>IH</sub>  | High Level Input Voltage              | 4.5                    | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> -0.1V                                             | 2.0                    |       |       | 2.0          |      | V    |
|                  |                                       | 5.5                    |                                                                                                | 2.0                    |       |       | 2.0          |      |      |
| V <sub>IL</sub>  | Low Level Input Voltage               | 4.5                    | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> -0.1V                                             |                        |       | 0.8   |              | 0.8  | V    |
|                  |                                       | 5.5                    |                                                                                                |                        |       | 0.8   |              | 0.8  |      |
| V <sub>OH</sub>  | High Level Ouput Voltage              | 4.5                    | I <sub>O</sub> =-50 μA                                                                         | 4.4                    | 4.49  |       | 4.4          |      | V    |
|                  |                                       | 5.5                    | I <sub>O</sub> =-50 μA                                                                         | 5.4                    | 5.49  |       | 5.4          |      |      |
|                  |                                       | 4.5                    | I <sub>O</sub> =-24 mA                                                                         | 3.94                   |       |       | 3.8          |      |      |
|                  |                                       | 5.5                    | I <sub>O</sub> =-24 mA                                                                         | 4.94                   |       |       | 4.8          |      |      |
| V <sub>OL</sub>  | Low Level Output Voltage              | 4.5                    | I <sub>O</sub> =50 μA                                                                          |                        | 0.001 | 0.1   |              | 0.1  | V    |
|                  |                                       | 5.5                    | I <sub>O</sub> =50 μA                                                                          |                        | 0.001 | 0.1   |              | 0.1  |      |
|                  |                                       | 4.5                    | I <sub>O</sub> =24 mA                                                                          |                        |       | 0.36  |              | 0.44 |      |
|                  |                                       | 5.5                    | I <sub>O</sub> =24 mA                                                                          |                        |       | 0.36  |              | 0.44 |      |
| I <sub>I</sub>   | Input Leakage Current                 | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                        |       | ± 0.1 |              | ± 1  | μA   |
| I <sub>OZ</sub>  | High Impedance Output Leakage Current | 5.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                        |       | ± 0.5 |              | ± 5  | μA   |
| I <sub>CCT</sub> | Max I <sub>CC</sub> /Input            | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> - 2.1V                                                        |                        |       | 0.5   |              | 1    | mA   |
| I <sub>CC</sub>  | Quiescent Supply Current              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                        |       | 8     |              | 80   | μA   |
| I <sub>OLD</sub> | Dynamic Output Current<br>(note 1, 2) | 5.5                    | V <sub>OLD</sub> = 1.65 V max                                                                  |                        |       |       |              | 75   | mA   |
| I <sub>OHD</sub> |                                       |                        | V <sub>OHD</sub> = 3.85 V min                                                                  |                        |       |       |              | -75  | mA   |

1) Maximum test duration 2ms, one output loaded at time

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50Ω

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, R<sub>L</sub> = 500 Ω, Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

| Symbol           | Parameter              | Test Condition         |  | Value                  |      |      |              |      | Unit |
|------------------|------------------------|------------------------|--|------------------------|------|------|--------------|------|------|
|                  |                        | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                  |                        |                        |  | Min.                   | Typ. | Max. | Min.         | Max. |      |
| t <sub>PLH</sub> | Propagation Delay Time | 5.0(*)                 |  |                        | 3.5  | 4.8  |              | 5.9  | ns   |
| t <sub>PHL</sub> |                        |                        |  |                        | 4.9  | 7.4  |              | 8.7  |      |
| t <sub>PZL</sub> | Output Enable Time     | 5.0(*)                 |  |                        | 6.1  | 9.2  |              | 11.1 | ns   |
| t <sub>PZH</sub> |                        |                        |  |                        | 5.5  | 8.0  |              | 9.6  |      |
| t <sub>PLZ</sub> | Output DisableTime     | 5.0(*)                 |  |                        | 5.6  | 8.3  |              | 9.9  | ns   |
| t <sub>PHZ</sub> |                        |                        |  |                        | 5.0  | 7.3  |              | 8.7  |      |

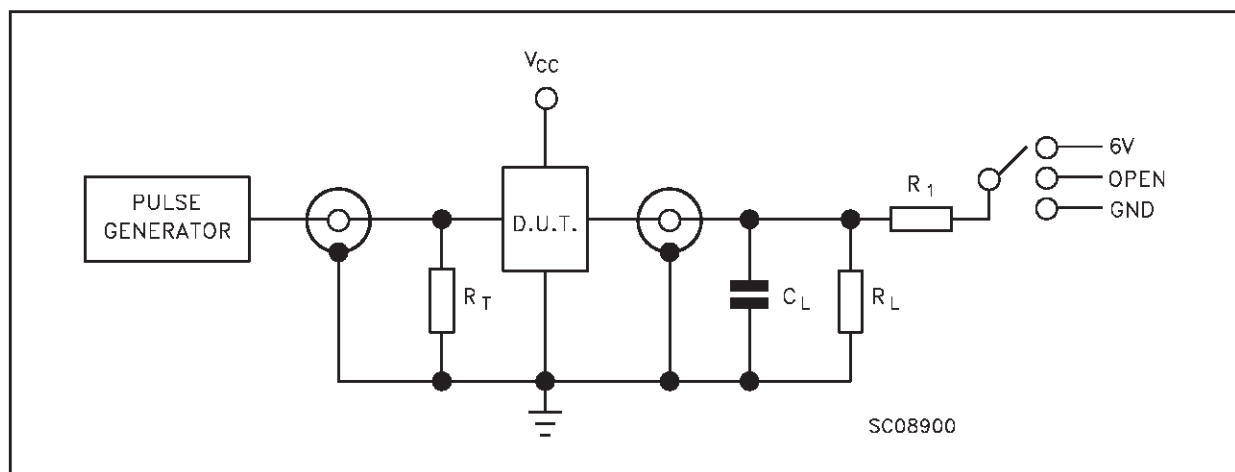
(\*) Voltage range is 5.0V ± 0.5V

## CAPACITANCE CHARACTERISTICS

| Symbol           | Parameter                              | Test Condition         |  | Value                  |      |      |              |      | Unit |
|------------------|----------------------------------------|------------------------|--|------------------------|------|------|--------------|------|------|
|                  |                                        | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                  |                                        |                        |  | Min.                   | Typ. | Max. | Min.         | Max. |      |
| C <sub>IN</sub>  | Input Capacitance                      | 5.0                    |  |                        | 6    |      |              |      | pF   |
| C <sub>I/O</sub> | I/O Capacitance                        | 5.0                    |  |                        | 14   |      |              |      | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance (note 1) | 5.0                    |  |                        | 24   |      |              |      | pF   |

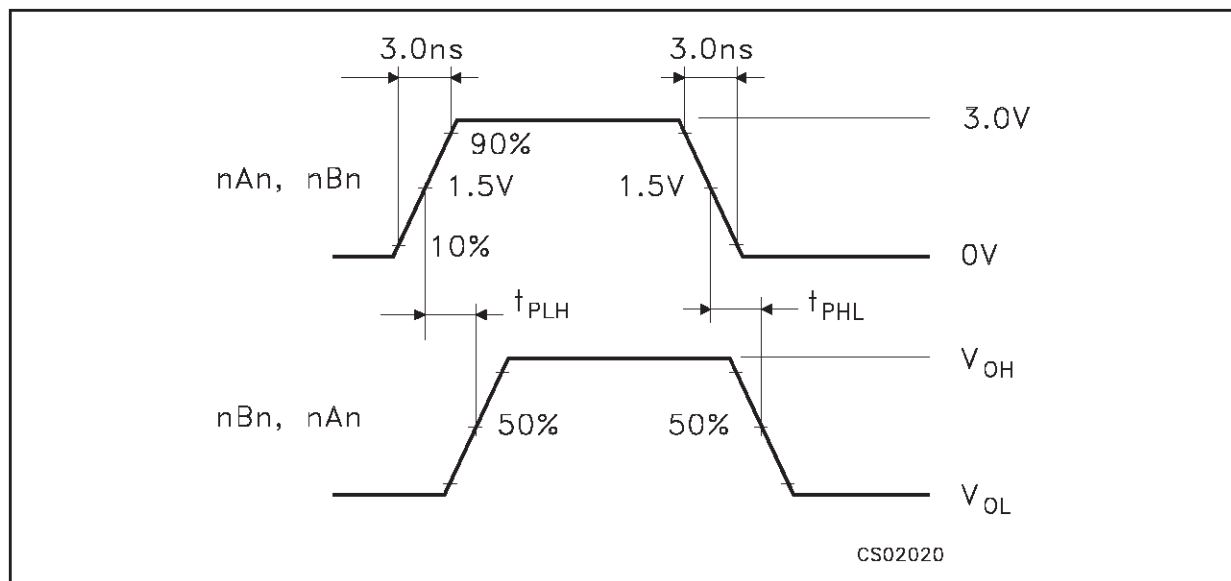
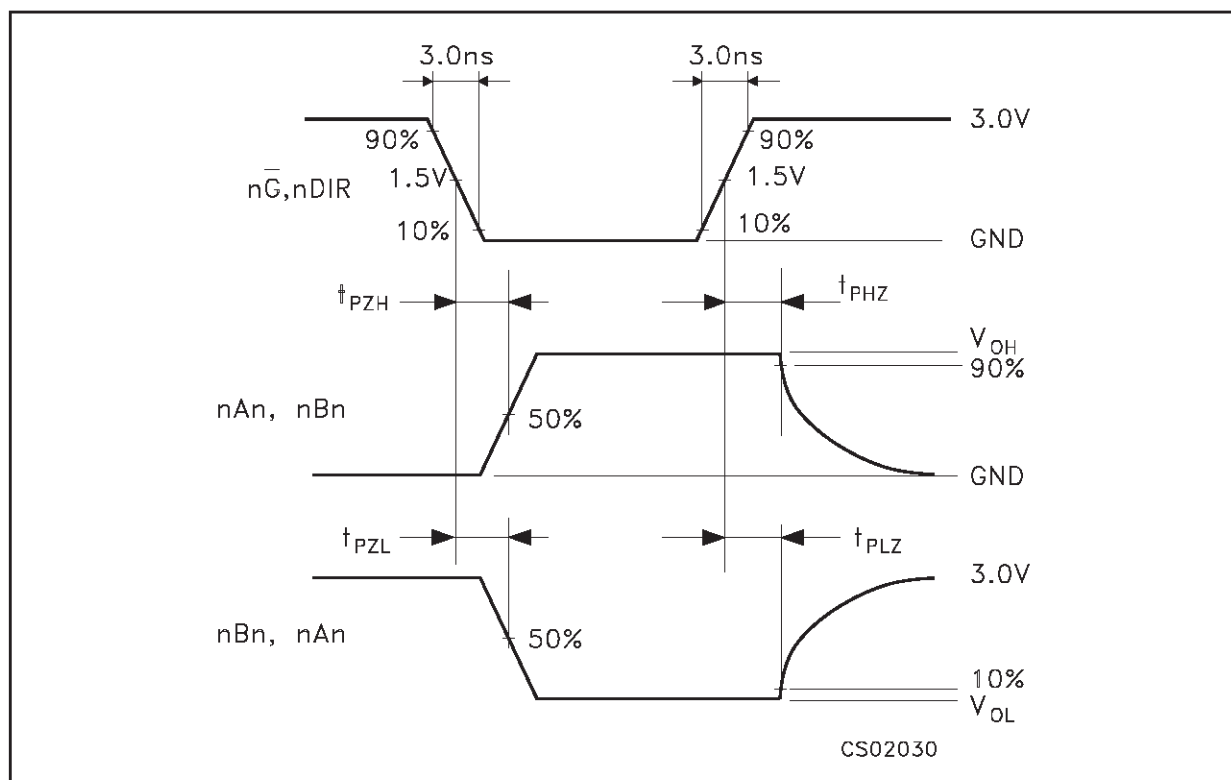
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/16$  (per circuit)

## TEST CIRCUIT



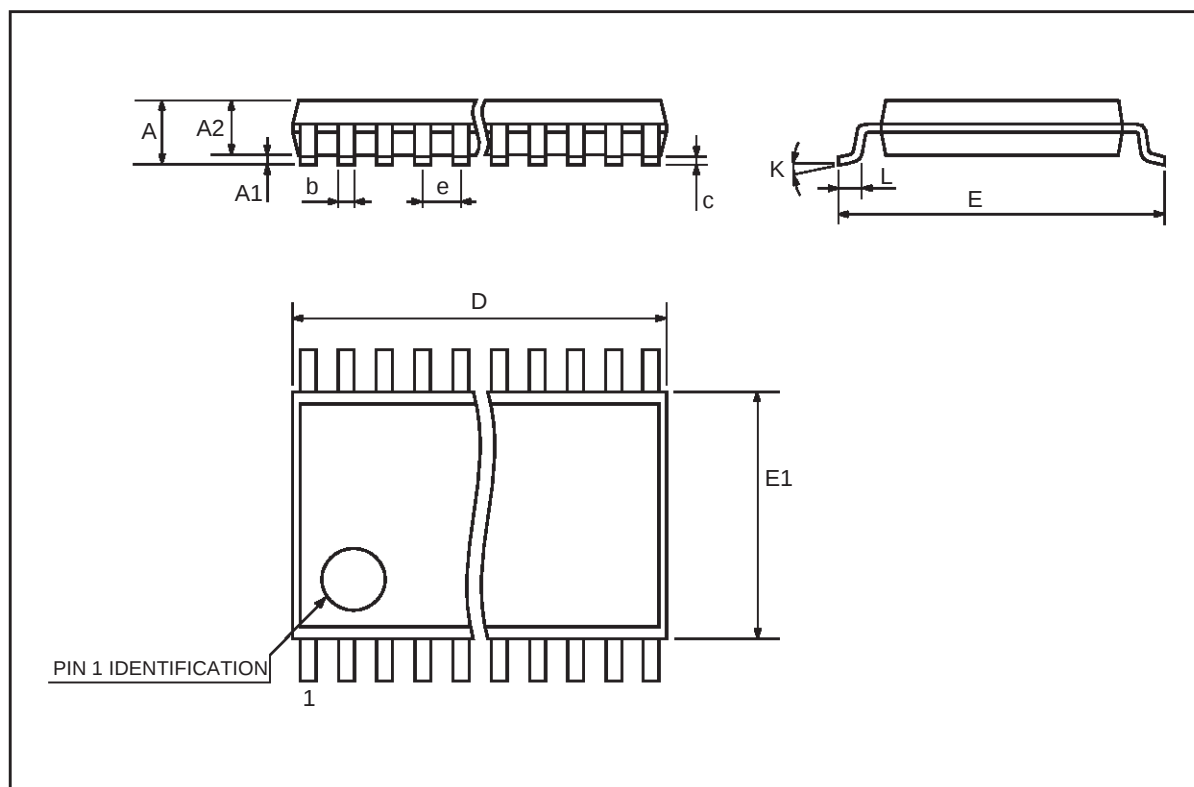
| Test                                | Switch           |
|-------------------------------------|------------------|
| t <sub>PLH</sub> , t <sub>PHL</sub> | Open             |
| t <sub>PZL</sub> , t <sub>PLZ</sub> | 2V <sub>CC</sub> |
| t <sub>PZH</sub> , t <sub>PHZ</sub> | GND              |

C<sub>L</sub> = 50pF or equivalent (includes jig and probe capacitance)  
R<sub>L</sub> = R<sub>1</sub> = 500Ω or equivalent  
R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

**WAVEFORM 1: PROPAGATION DELAYS** ( $f=1\text{MHz}$ ; 50% duty cycle)**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME** ( $f=1\text{MHz}$ ; 50% duty cycle)

## TSSOP48 MECHANICAL DATA

| DIM. | mm   |         |      | inch   |            |        |
|------|------|---------|------|--------|------------|--------|
|      | MIN. | TYP.    | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |         | 1.1  |        |            | 0.433  |
| A1   | 0.05 | 0.10    | 0.15 | 0.002  | 0.004      | 0.006  |
| A2   | 0.85 | 0.9     | 0.95 | 0.335  | 0.354      | 0.374  |
| b    | 0.17 |         | 0.27 | 0.0067 |            | 0.011  |
| c    | 0.09 |         | 0.20 | 0.0035 |            | 0.0079 |
| D    | 12.4 | 12.5    | 12.6 | 0.408  | 0.492      | 0.496  |
| E    | 7.95 | 8.1     | 8.25 | 0.313  | 0.319      | 0.325  |
| E1   | 6.0  | 6.1     | 6.2  | 0.236  | 0.240      | 0.244  |
| e    |      | 0.5 BSC |      |        | 0.0197 BSC |        |
| K    | 0°   | 4°      | 8°   | 0°     | 4°         | 8°     |
| L    | 0.50 | 0.60    | 0.70 | 0.020  | 0.024      | 0.028  |



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