



## 74AC16244

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

- HIGH SPEED:  
 $t_{PD} = 4.5 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 8 \mu A$  (MAX.) at  $T_A = 25^\circ C$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- POWER DOWN PROTECTION ON INPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24 \text{ mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC(OPR)} = 2V$  to  $6V$
- PIN AND FUNCTION COMPATIBLE WITH  
74 SERIES 16244
- IMPROVED LATCH-UP IMMUNITY

#### DESCRIPTION

The 74AC16244 is an advanced high-speed CMOS 16-BIT BUS BUFFER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

Any  $\overline{nG}$  output control governs four BUS BUFFERS. Output Enable inputs ( $\overline{nG}$ ) tied together give full 16 bit operation.

When  $\overline{nG}$  is LOW, the outputs are enabled. When  $\overline{nG}$  is HIGH, the output are in high impedance state.

The device is designed to be used with 3-state memory address drivers, etc.

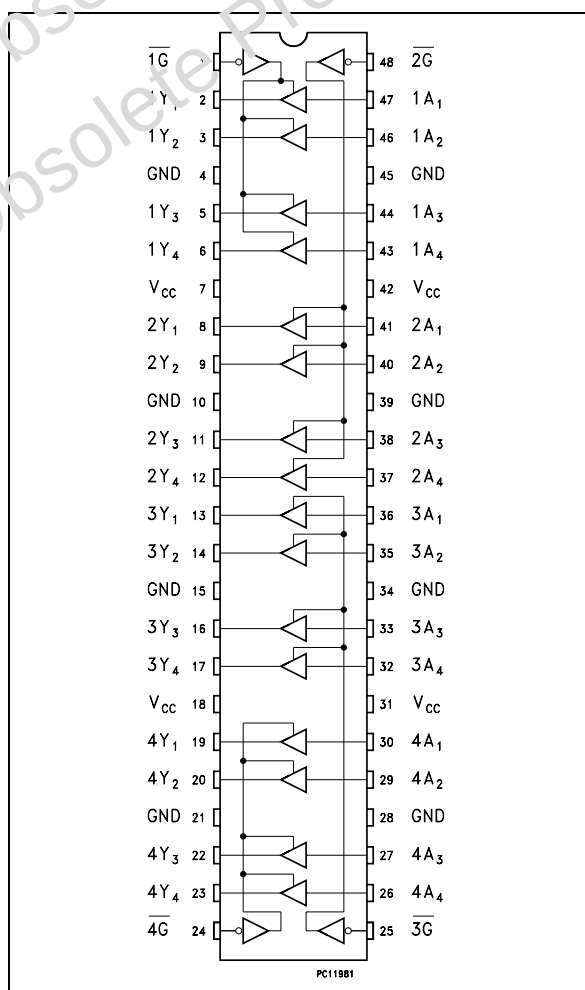


TSSOP

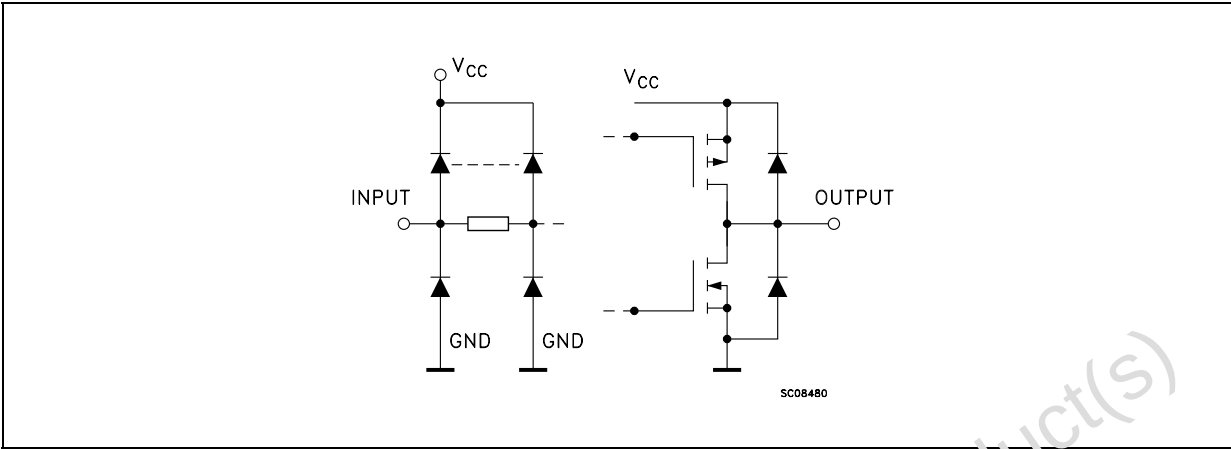
#### ORDER CODES

| PACKAGE | TUBE | T & P        |
|---------|------|--------------|
| TSSOP   |      | 74AC16244TTR |

#### PIN CONNECTION



INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

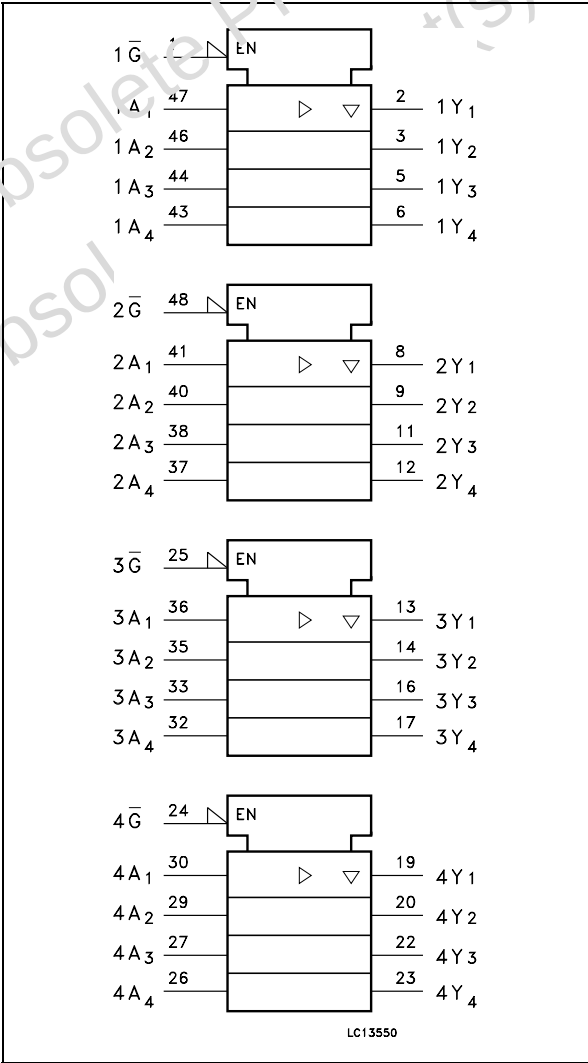
| PIN No                        | SYMBOL     | NAME AND FUNCTION       |
|-------------------------------|------------|-------------------------|
| 1                             | 1G         | Output Enable Input     |
| 2, 3, 5, 6                    | 1Y1 to 1Y4 | Data Outputs            |
| 8, 9, 11, 12                  | 2Y1 to 2Y4 | Data Outputs            |
| 13, 14, 16, 17                | 3Y1 to 3Y4 | Data Outputs            |
| 19, 20, 22, 23                | 4Y1 to 4Y4 | Data Outputs            |
| 24                            | 4G         | Output Enable Input     |
| 25                            | 3G         | Output Enable Input     |
| 30, 29, 27, 26                | 4A1 to 4A4 | Data Outputs            |
| 36, 35, 33, 32                | 3A1 to 3A4 | Data Outputs            |
| 41, 40, 38, 37                | 2A1 to 2A4 | Data Outputs            |
| 47, 46, 44, 43                | 1A1 to 1A4 | Data Outputs            |
| 48                            | 2G         | Output Enable Input     |
| 4, 10, 15, 21, 28, 34, 39, 45 | GND        | Ground (0V)             |
| 7, 18, 31, 42                 | VCC        | Positive Supply Voltage |

TRUTH TABLE

| INPUTS |    | OUTPUT |
|--------|----|--------|
| G      | An | Yn     |
| L      | L  | L      |
| L      | H  | H      |
| H      | X  | Z      |

X : Don't Care  
Z : High Impedance

IEC LOGIC SYMBOLS



**ABSOLUTE MAXIMUM RATINGS**

| Symbol                | Parameter                     | Value                  | Unit |
|-----------------------|-------------------------------|------------------------|------|
| $V_{CC}$              | Supply Voltage                | -0.5 to +7.0           | V    |
| $V_I$                 | DC Input Voltage              | -0.5 to +7.0           | 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       | $\pm 50$               | 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                                                 | 2 to 6        | V    |
| $V_I$    | Input Voltage                                                  | 0 to $V_{CC}$ | V    |
| $V_O$    | Output Voltage                                                 | 0 to $V_{CC}$ | V    |
| $T_{op}$ | Operating Temperature                                          | -55 to 125    | °C   |
| dt/dv    | Input Rise and Fall Time (note 1) $V_{CC} = 3.0, 4.5$ or $5.5$ | 0 to 8        | ns/V |

1)  $V_{IN}$  from 30% to 70% of  $V_{CC}$

## DC SPECIFICATIONS

| Symbol          | Parameter                             | Test Condition         |                                                                                                | Value                  |       |       |             |      |              |      | Unit |
|-----------------|---------------------------------------|------------------------|------------------------------------------------------------------------------------------------|------------------------|-------|-------|-------------|------|--------------|------|------|
|                 |                                       | V <sub>CC</sub><br>(V) |                                                                                                | T <sub>A</sub> = 25 °C |       |       | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                                       |                        |                                                                                                | Min.                   | Typ.  | Max.  | Min.        | Max. | Min.         | Max. |      |
| V <sub>IH</sub> | High Level Input Voltage              | 3.0                    | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> -0.1V                                             | 2.1                    | 1.5   |       | 2.1         |      | 2.1          |      | V    |
|                 |                                       | 4.5                    |                                                                                                | 3.15                   | 2.25  |       | 3.15        |      | 3.15         |      |      |
|                 |                                       | 5.5                    |                                                                                                | 3.85                   | 2.75  |       | 3.85        |      | 3.85         |      |      |
| V <sub>IL</sub> | Low Level Input Voltage               | 3.0                    | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> -0.1V                                             |                        | 1.5   | 0.9   |             | 0.9  |              | 0.9  | V    |
|                 |                                       | 4.5                    |                                                                                                |                        | 2.25  | 1.35  |             | 1.35 |              | 1.35 |      |
|                 |                                       | 5.5                    |                                                                                                |                        | 2.75  | 1.65  |             | 1.65 |              | 1.65 |      |
| V <sub>OH</sub> | High Level Output Voltage             | 3.0                    | I <sub>O</sub> =-50 μA                                                                         | 2.9                    | 2.99  |       | 2.9         |      | 2.9          |      | V    |
|                 |                                       | 4.5                    | I <sub>O</sub> =-50 μA                                                                         | 4.4                    | 4.49  |       | 4.4         |      | 4.4          |      |      |
|                 |                                       | 5.5                    | I <sub>O</sub> =-50 μA                                                                         | 5.4                    | 5.49  |       | 5.4         |      | 5.4          |      |      |
|                 |                                       | 3.0                    | I <sub>O</sub> =-12 mA                                                                         | 2.56                   |       |       | 2.46        |      | 2.46         |      |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =-24 mA                                                                         | 3.86                   |       |       | 3.76        |      | 3.76         |      |      |
|                 |                                       | 5.5                    | I <sub>O</sub> =-24 mA                                                                         | 4.86                   |       |       | 4.76        |      | 4.76         |      |      |
| V <sub>OL</sub> | Low Level Output Voltage              | 3.0                    | I <sub>O</sub> =50 μA                                                                          |                        | 0.002 | 0.1   |             | 0.1  |              | 0.1  | V    |
|                 |                                       | 4.5                    | I <sub>O</sub> =50 μA                                                                          |                        | 0.001 | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                                       | 5.5                    | I <sub>O</sub> =50 μA                                                                          |                        | 0.001 | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                                       | 3.0                    | I <sub>O</sub> =12 mA                                                                          |                        |       | 0.36  |             | 0.44 |              | 0.44 |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =24 mA                                                                          |                        |       | 0.36  |             | 0.44 |              | 0.44 |      |
| I <sub>I</sub>  | Input Leakage Current                 | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                        |       | ± 0.1 |             | ± 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  |              | ± 5  | μA   |
| I <sub>CC</sub> | Quiescent Supply Current              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                        |       | 8     |             | 80   |              | 80   | μA   |

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

| Symbol                            | Parameter                           | Test Condition         |                        |  | Value                 |      |      |             |      |              | Unit |      |
|-----------------------------------|-------------------------------------|------------------------|------------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                                   |                                     | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                                   |                                     |                        |                        |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay<br>Time<br>A to Y | 3.3 <sup>(*)</sup>     |                        |  | 6                     | 8.5  |      | 11.5        |      | 11.5         | ns   |      |
|                                   |                                     | 5.0 <sup>(**)</sup>    |                        |  | 4.5                   | 7.0  |      | 9.0         |      | 9.0          |      |      |
| t <sub>PZL</sub> t <sub>PZH</sub> | Output Enable<br>Time               | 3.3 <sup>(*)</sup>     |                        |  | 8                     | 10.5 |      | 14.0        |      | 14.0         | ns   |      |
|                                   |                                     | 5.0 <sup>(**)</sup>    |                        |  | 5.5                   | 8.0  |      | 10.0        |      | 10.0         |      |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub> | Output Disable<br>Time              | 3.3 <sup>(*)</sup>     |                        |  | 7.3                   | 9.0  |      | 11.5        |      | 11.5         | ns   |      |
|                                   |                                     | 5.0 <sup>(**)</sup>    |                        |  | 5.5                   | 8.0  |      | 14.0        |      | 14.0         |      |      |

(\*) Voltage range is 3.3V ± 0.3V

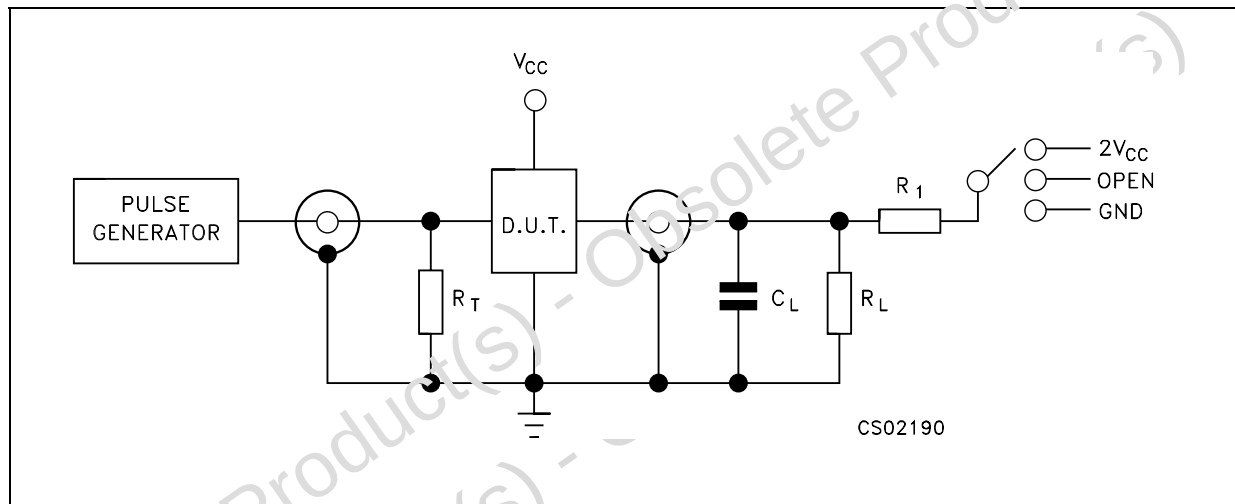
(\*\*) Voltage range is 5.0V ± 0.5V

## CAPACITIVE CHARACTERISTICS

| Symbol           | Parameter                              | Test Condition         |                         | Value                 |      |      |             |      |              | Unit |      |
|------------------|----------------------------------------|------------------------|-------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
|                  |                                        | V <sub>CC</sub><br>(V) |                         | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                  |                                        |                        |                         | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| C <sub>IN</sub>  | Input Capacitance                      |                        |                         |                       | 7    | 10   |             | 10   |              | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance                     |                        |                         |                       | 14   |      |             |      |              |      | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance (note 1) | 5.0                    | f <sub>IN</sub> = 10MHz |                       | 25   |      |             |      |              |      | 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 operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC(1)}$  (per Latch)

## TEST CIRCUIT

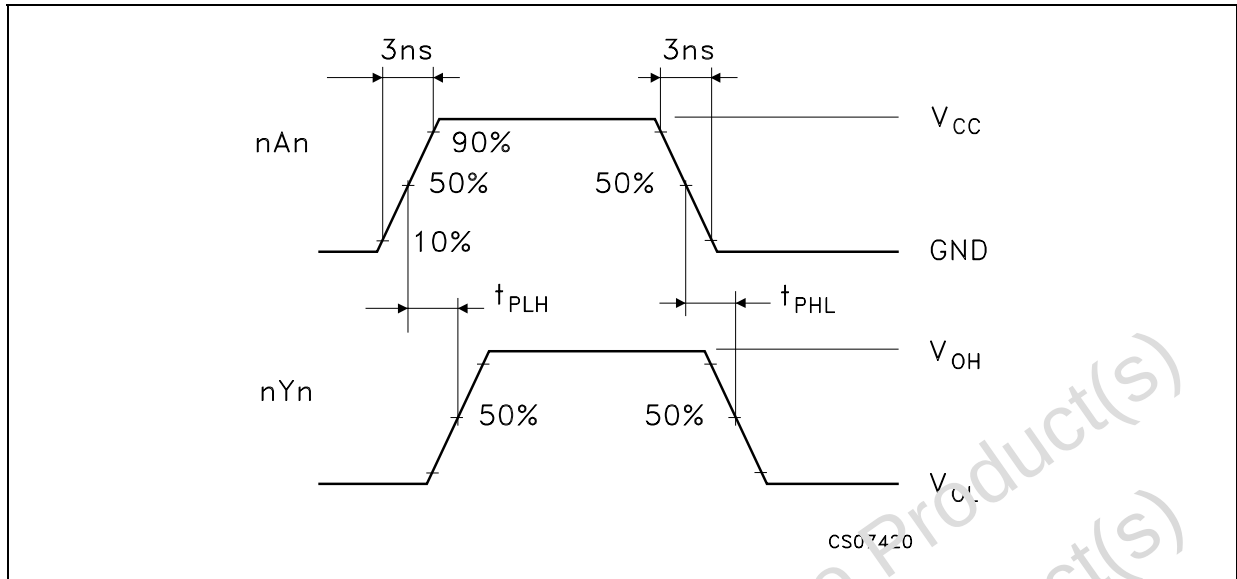
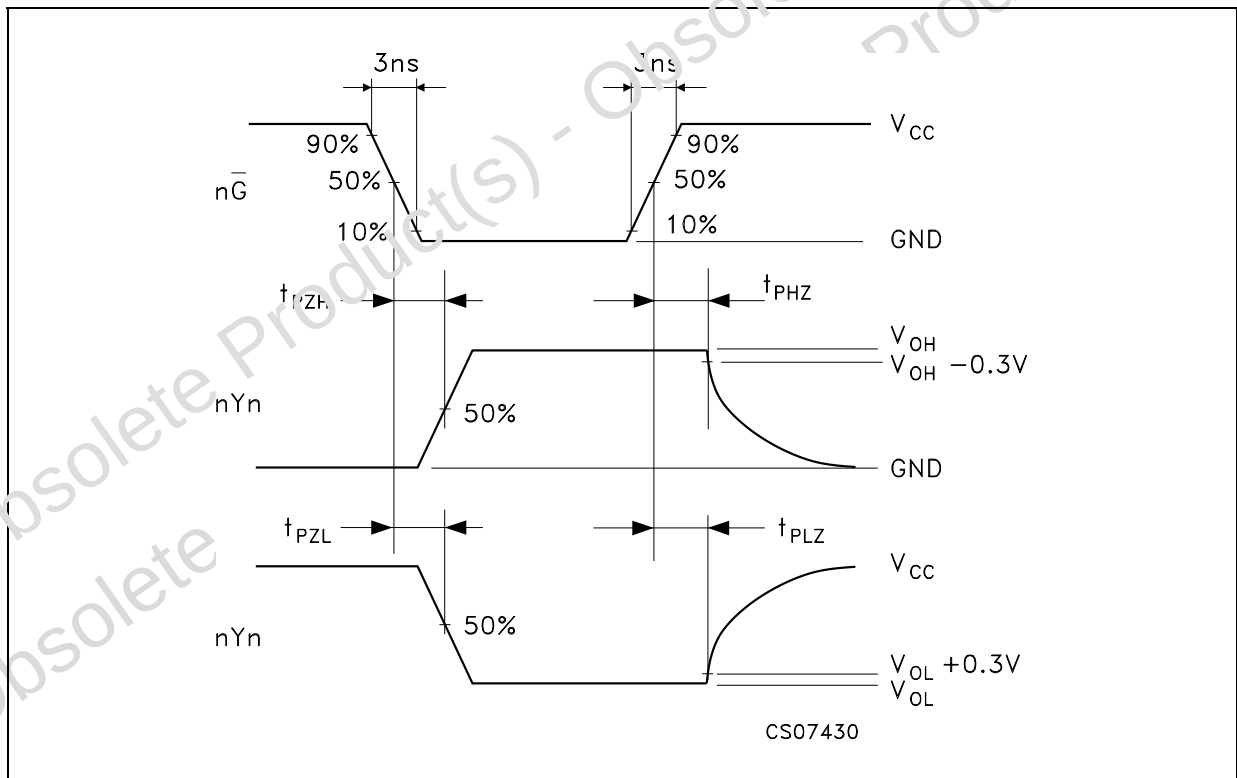


| TEST                                | SWITCH          |
|-------------------------------------|-----------------|
| t <sub>PLH</sub> , t <sub>PHL</sub> | Open            |
| t <sub>PZL</sub> , t <sub>PLZ</sub> | V <sub>CC</sub> |
| t <sub>PZH</sub> , t <sub>PHZ</sub> | GND             |

C<sub>L</sub> = 50 pF or equivalent (includes jig and probe capacitance)

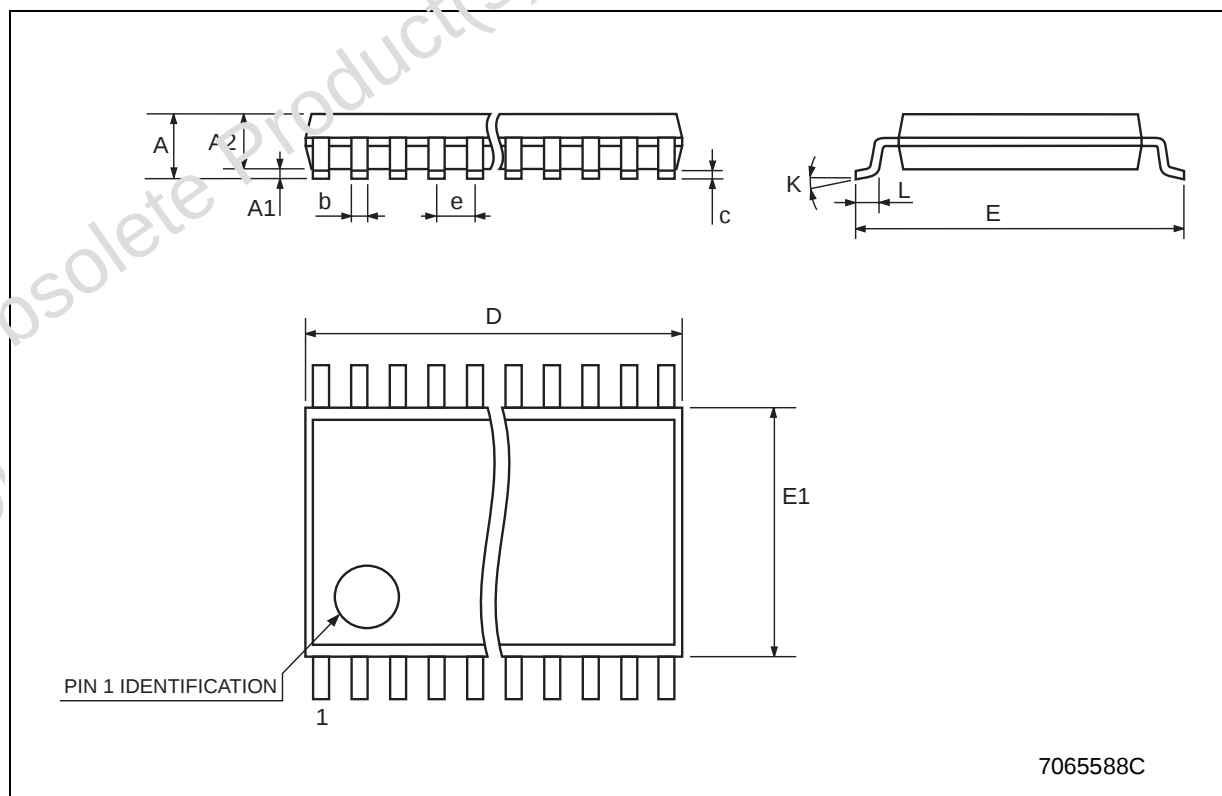
R<sub>L</sub> = R<sub>1</sub> = 500Ω or equivalent

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)

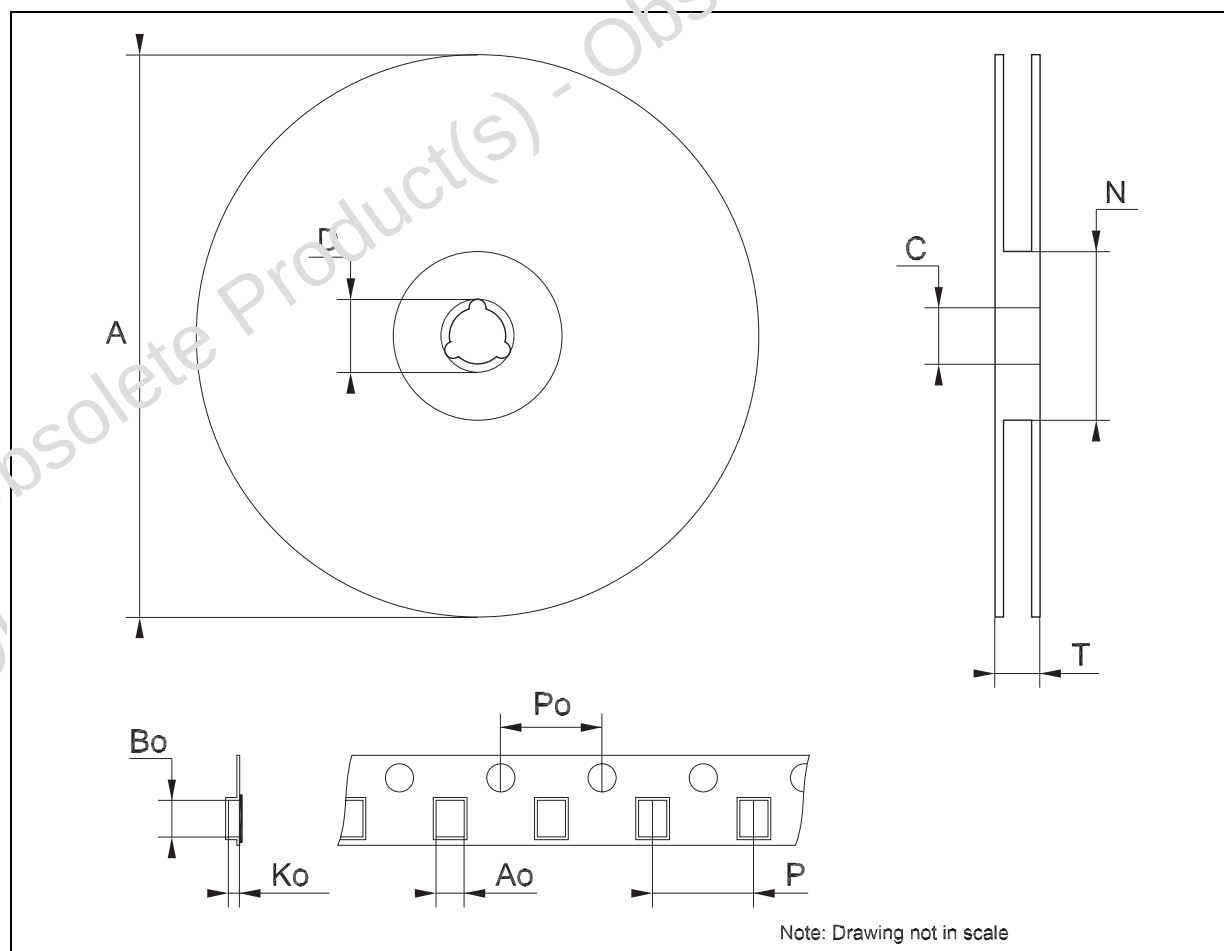
## TSSOP48 MECHANICAL DATA

| DIM. | mm.  |         |      | inch   |            |        |
|------|------|---------|------|--------|------------|--------|
|      | MIN. | TYP     | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |         | 1.2  |        |            | 0.047  |
| A1   | 0.05 |         | 0.15 | 0.002  |            | 0.006  |
| A2   |      | 0.9     |      |        | 0.035      |        |
| b    | 0.17 |         | 0.27 | 0.0067 |            | 0.011  |
| c    | 0.09 |         | 0.20 | 0.0035 |            | 0.0079 |
| D    | 12.4 |         | 12.6 | 0.488  |            | 0.496  |
| E    |      | 8.1 BSC |      |        | 0.318 BSC  |        |
| E1   | 6.0  |         | 6.2  | 0.236  |            | 0.244  |
| e    |      | 0.5 BSC |      |        | 0.0197 BSC |        |
| K    | 0°   |         | 8°   | 0°     |            | 8°     |
| L    | 0.50 |         | 0.75 | 0.020  |            | 0.030  |



## Tape &amp; Reel TSSOP48 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 30.4 |       |      | 1.197  |
| Ao   | 8.7  |     | 8.9  | 0.343 |      | 0.350  |
| Bo   | 13.1 |     | 13.3 | 0.516 |      | 0.524  |
| Ko   | 1.5  |     | 1.7  | 0.059 |      | 0.067  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |     | 12.1 | 0.468 |      | 0.476  |



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