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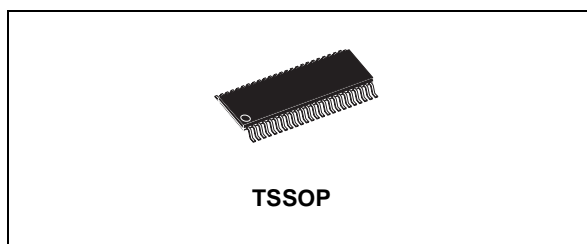
[sales@integrated-circuit.com](mailto:sales@integrated-circuit.com)



# 74AC16373

## 16-BIT D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS (NON INVERTED)

- **HIGH SPEED:**  
 $t_{PD} = 5.0 \text{ ns (TYP.) at } V_{CC} = 5V$
- **LOW POWER DISSIPATION:**  
 $I_{CC} = 8\mu A(\text{MAX.}) \text{ at } T_A=25^\circ C$
- **HIGH NOISE IMMUNITY:**  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- **50Ω TRANSMISSION LINE DRIVING CAPABILITY**
- **SYMMETRICAL OUTPUT IMPEDANCE:**  
 $|I_{OH}| = I_{OL} = 24mA \text{ (MIN)}$
- **OPERATING VOLTAGE RANGE:**  
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- **IMPROVED LATCH-UP IMMUNITY**



### ORDER CODES

| PACKAGE | TUBE | T & R        |
|---------|------|--------------|
| TSSOP   |      | 74AC16373TTR |

### DESCRIPTION

The 74AC16373 CMOS 16 BIT D-TYPE LATCH with 3 STATE OUTPUTS NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

These 16 bit D-TYPE latches are byte controlled by two latch enable inputs (nLE) and two output enable inputs(nOE).

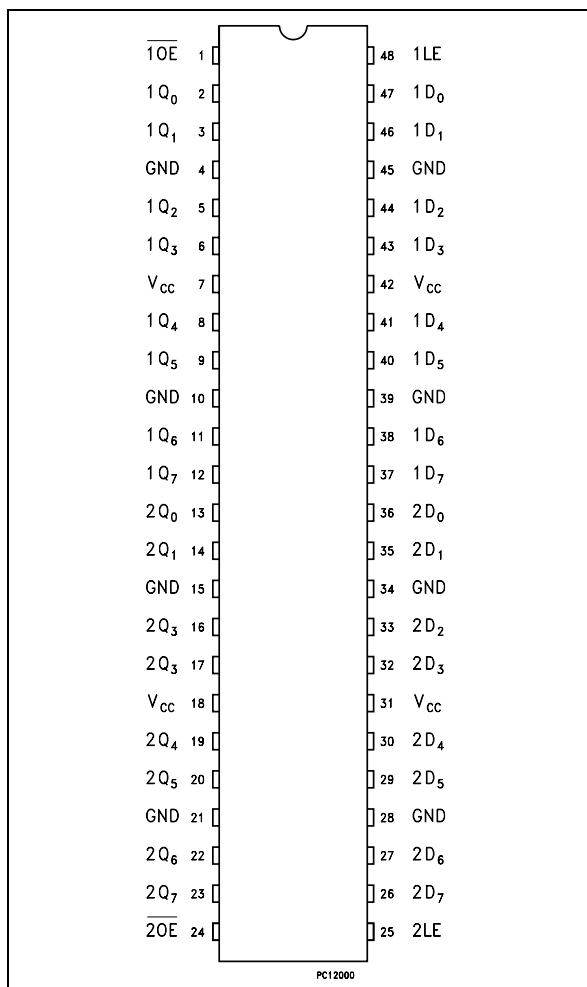
While the nLE input is held at a high level, the nQ outputs will follow the data (D) inputs.

When the nLE is taken LOW, the nQ outputs will be latched at the logic level of D data inputs.

When the (nOE) input is low, the nQ outputs will be in a normal logic state (high or low logic level); when nOE is at high level ,the outputs will be in a high impedance state.

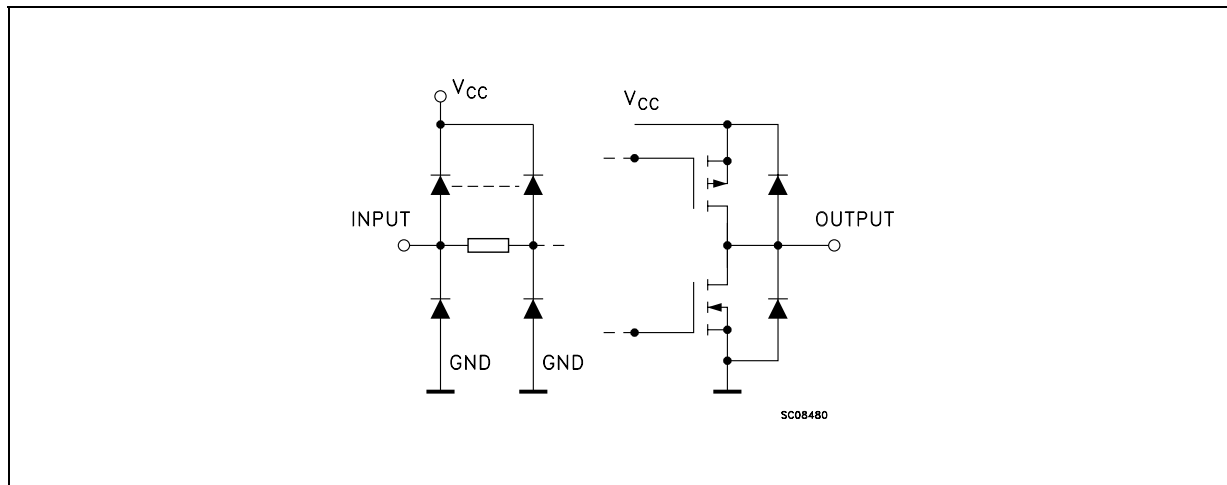
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION



## 74AC16373

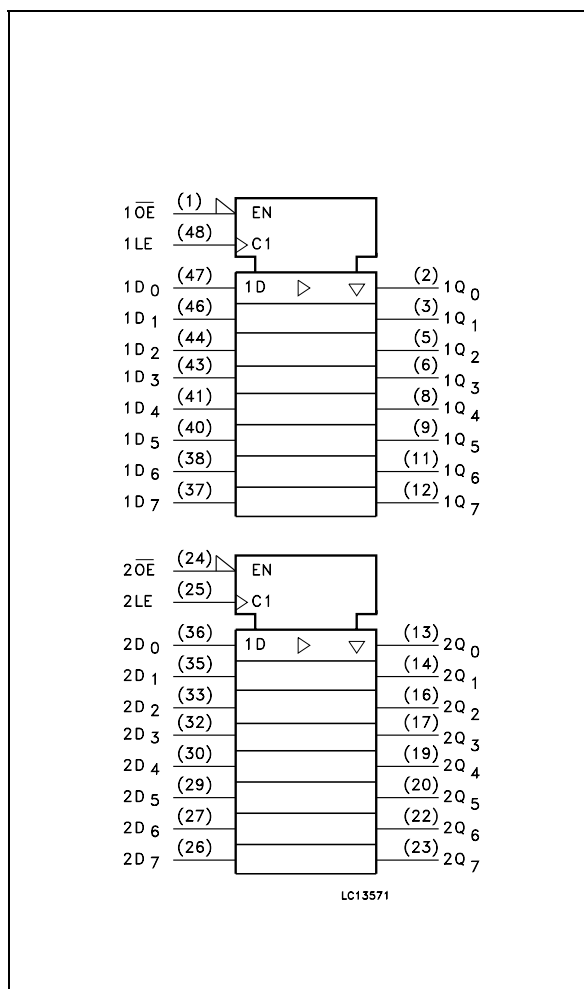
### INPUT AND OUTPUT EQUIVALENT CIRCUIT



### PIN DESCRIPTION

| PIN No                         | SYMBOL          | NAME AND FUNCTION                        |
|--------------------------------|-----------------|--|
| 1                              | 1OE             | 3 State Output Enable Input (Active LOW) |
| 2, 3, 5, 6, 8, 9, 11, 12       | 1Q0 to 1Q7      | 3-State Outputs                          |
| 13, 14, 16, 17, 19, 20, 22, 23 | 2Q0 to 2Q7      | 3-State Outputs                          |
| 24                             | 2OE             | 3 State Output Enable Input (Active LOW) |
| 25                             | 2LE             | Latch Enable Input                       |
| 36, 35, 33, 32, 30, 29, 27, 26 | 2D0 to 2D7      | Data Inputs                              |
| 47, 46, 44, 43, 41, 40, 38, 37 | 1D0 to 1D7      | Data Inputs                              |
| 48                             | 1LE             | Latch Enable Input                       |
| 4, 10, 15, 21, 28, 34, 39, 45  | GND             | Ground (0V)                              |
| 7, 18, 31, 42                  | V <sub>CC</sub> | Positive Supply Voltage                  |

### IEC LOGIC SYMBOLS



### TRUTH TABLE

| INPUTS          |    |   | OUTPUT      |
|-----------------|----|---|-------------|
| $\overline{OE}$ | LE | D | Q           |
| H               | X  | X | Z           |
| L               | L  | X | NO CHANGE * |
| L               | H  | L | L           |
| L               | H  | H | H           |

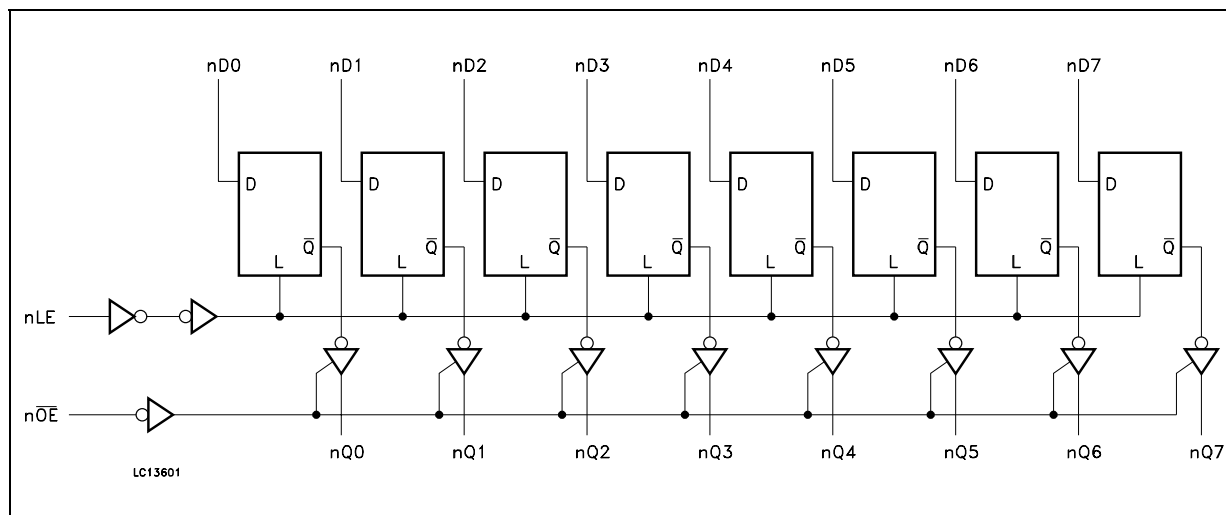
X : Don't Care

Z : High Impedance

\* : Q outputs are latched at the time when the LE input is taken low logic level.

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### LOGIC DIAGRAM



This logic diagram has not to be used to estimate propagation delays

### 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            | $^{\circ}C$ |
| $T_L$                 | Lead Temperature (10 sec)     | 300                    | $^{\circ}C$ |

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    | $^{\circ}C$ |
| dt/dv    | Input Rise and Fall Time $V_{CC} = 3.0, 4.5$ or $5.5V$ (note 1) | 8             | ns/V        |

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

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### 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 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 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 |      |
|                  |                                       | 5.5                    | 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   |
| I <sub>OLD</sub> | Dynamic Output Current (note 1, 2)    | 5.5                    | V <sub>OLD</sub> = 1.65 V max  |                        |       |       |             | 75   |              | 75   | mA   |
| I <sub>OHD</sub> |                                       |                        | V <sub>OHD</sub> = 3.85 V min  |                        |       |       |             | -75  |              | -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

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### AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , $R_L = 500 \Omega$ , Input $t_r = t_f = 3\text{ns}$ )

| Symbol              | Parameter                          | Test Condition  |  | Value                    |      |      |                                    |      |                                     | Unit |      |
|---------------------|------------------------------------|-----------------|--|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|                     |                                    | $V_{CC}$<br>(V) |  | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|                     |                                    |                 |  | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time<br>LE to Q  | 3.3(*)          |  |                          | 8.0  | 10.0 |                                    | 15.6 |                                     | 15.6 | ns   |
|                     |                                    | 5.0(**)         |  |                          | 6.0  | 8.0  |                                    | 11.9 |                                     | 11.9 |      |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time<br>D to Q   | 3.3(*)          |  |                          | 8.3  | 11.0 |                                    | 15.1 |                                     | 15.1 | ns   |
|                     |                                    | 5.0(**)         |  |                          | 6.0  | 9.1  |                                    | 10.1 |                                     | 10.1 |      |
| $t_{PZL}$ $t_{PZH}$ | Output Enable Time                 | 3.3(*)          |  |                          | 11.8 | 19.8 |                                    | 22.3 |                                     | 22.3 | ns   |
|                     |                                    | 5.0(**)         |  |                          | 7.4  | 11.3 |                                    | 12.8 |                                     | 12.8 |      |
| $t_{PLZ}$ $t_{PHZ}$ | Output Disable Time                | 3.3(*)          |  |                          | 7.1  | 9.5  |                                    | 10.2 |                                     | 10.2 | ns   |
|                     |                                    | 5.0(**)         |  |                          | 5.9  | 8.0  |                                    | 8.8  |                                     | 8.8  |      |
| $t_W$               | LE Pulse Width<br>HIGH             | 3.3(*)          |  |                          | 4.0  |      |                                    | 4.0  |                                     | 4.0  | ns   |
|                     |                                    | 5.0(**)         |  |                          | 5.0  |      |                                    | 5.0  |                                     | 5.0  |      |
| $t_s$               | Setup Time D to<br>LE, HIGH or LOW | 3.3(*)          |  |                          | 1.5  |      |                                    | 1.5  |                                     | 1.5  | ns   |
|                     |                                    | 5.0(**)         |  |                          | 1.5  |      |                                    | 1.5  |                                     | 1.5  |      |
| $t_h$               | Hold Time D to LE,<br>HIGH or LOW  | 3.3(*)          |  |                          | 3    |      |                                    | 3    |                                     | 3    | ns   |
|                     |                                    | 5.0(**)         |  |                          | 2.5  |      |                                    | 2.5  |                                     | 2.5  |      |

(\*) Voltage range is  $3.3\text{V} \pm 0.3\text{V}$

(\*\*) Voltage range is  $5.0\text{V} \pm 0.5\text{V}$

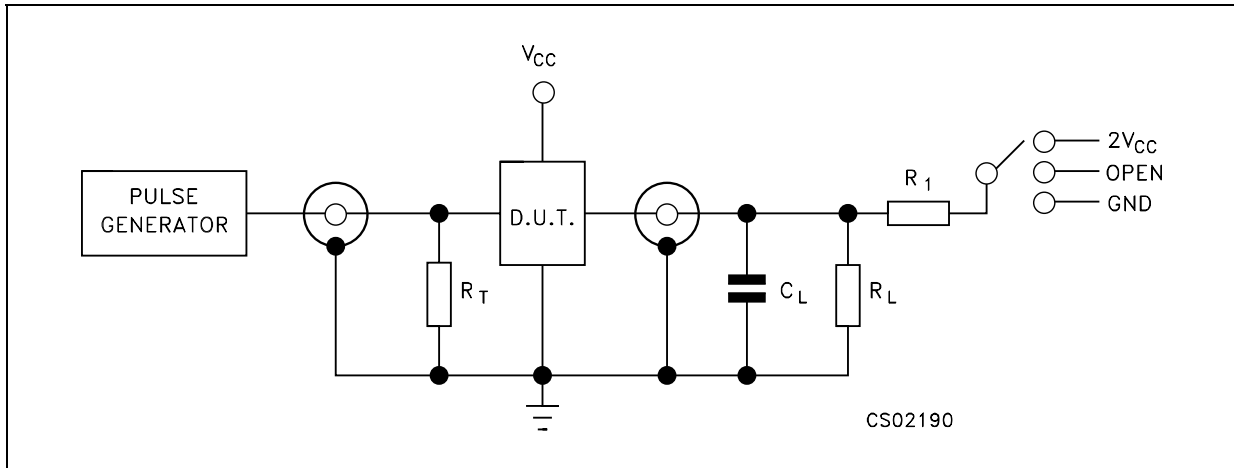
### CAPACITIVE CHARACTERISTICS

| Symbol    | Parameter                              | Test Condition  |                       | Value                    |      |      |                                    |      |                                     | Unit |      |
|-----------|--|-----------------|-----------------------|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|           |  | $V_{CC}$<br>(V) |                       | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|           |  |                 |                       | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $C_{IN}$  | Input Capacitance                      | 5.0             |                       |                          | 3.5  |      |                                    |      |                                     |      | pF   |
| $C_{OUT}$ | Output Capacitance                     | 5.0             |                       |                          | 15   |      |                                    |      |                                     |      | pF   |
| $C_{PD}$  | Power Dissipation Capacitance (note 1) | 5.0             | $f_{IN}=10\text{MHz}$ |                          | 25   |      |                                    |      |                                     |      | pF   |

1)  $C_{PD}$  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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/16$  (per circuit)

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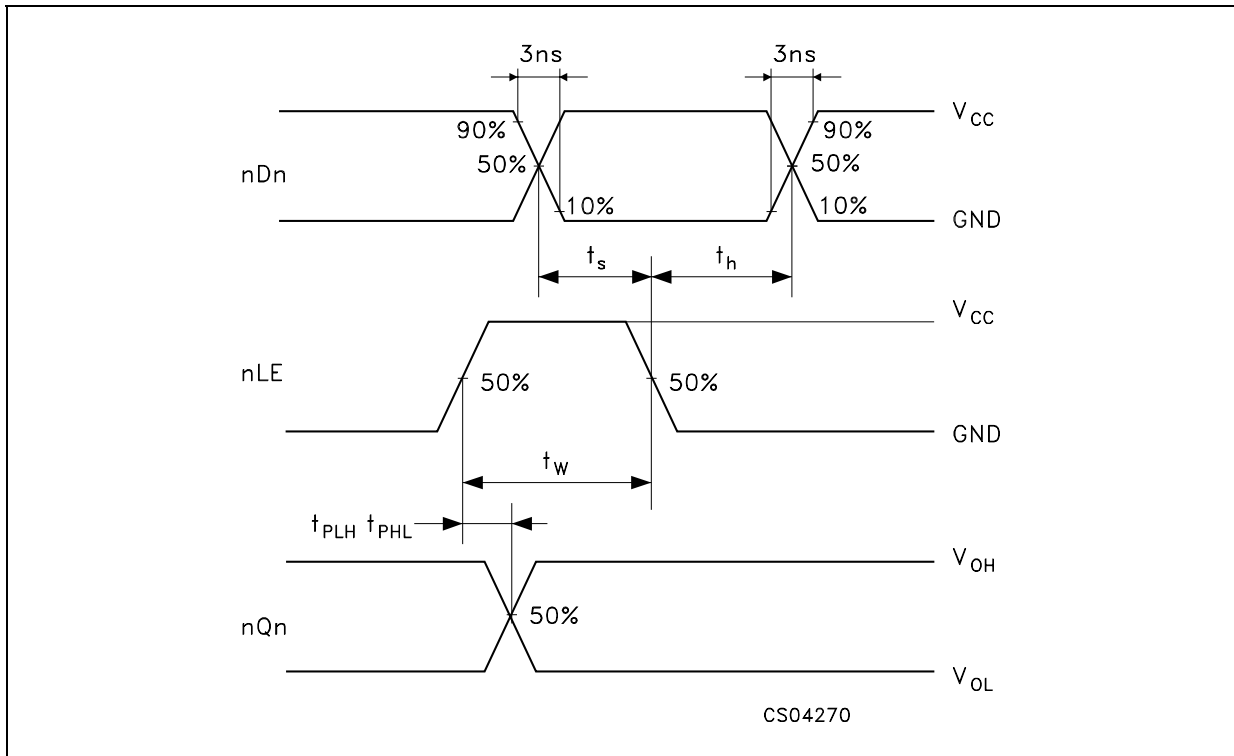
**TEST CIRCUIT**



| Test                  | Switch    |
|-----------------------|-----------|
| $t_{PLH}$ , $t_{PHL}$ | Open      |
| $t_{PZL}$ , $t_{PLZ}$ | $2V_{CC}$ |
| $t_{PZH}$ , $t_{PHZ}$ | GND       |

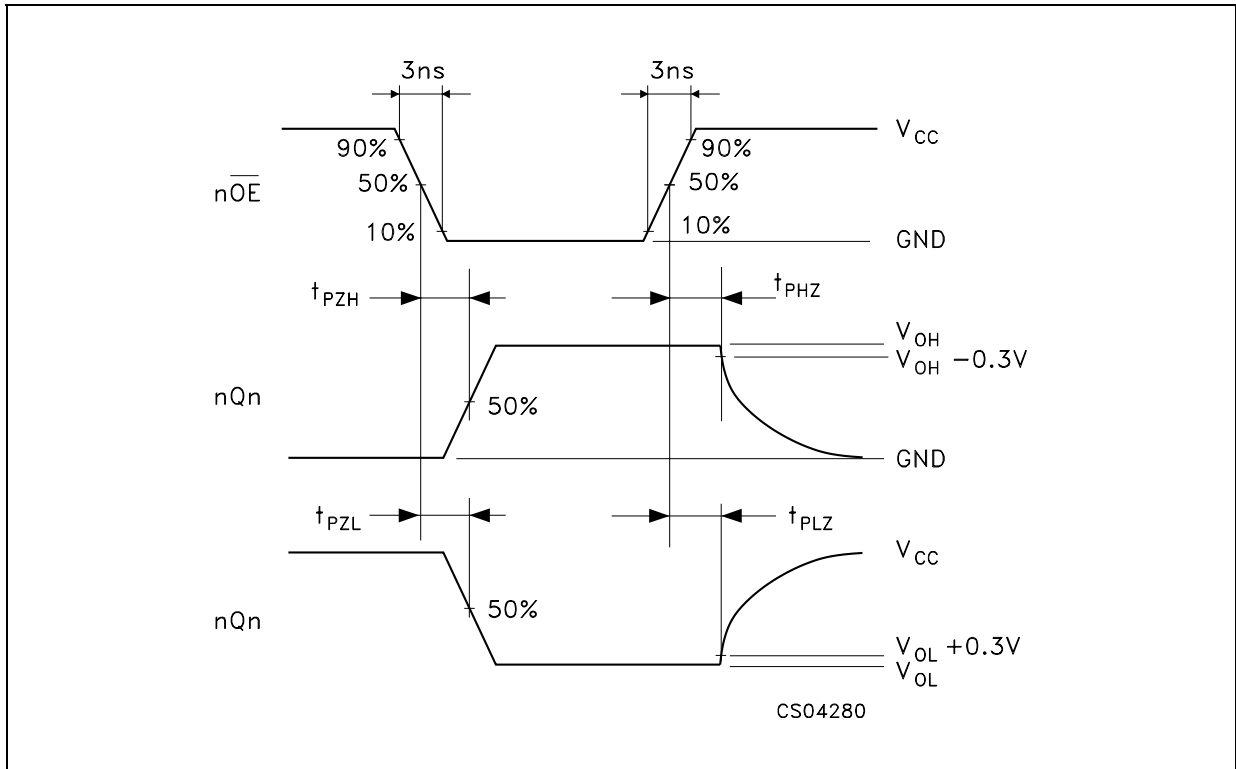
$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 500\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

**WAVEFORM 1 : LE TO Qn PROPAGATION DELAYS, LE MINIMUM PULSE WIDTH, Dn TO LE SETUP AND HOLD TIMES (f=1MHz; 50% duty cycle)**

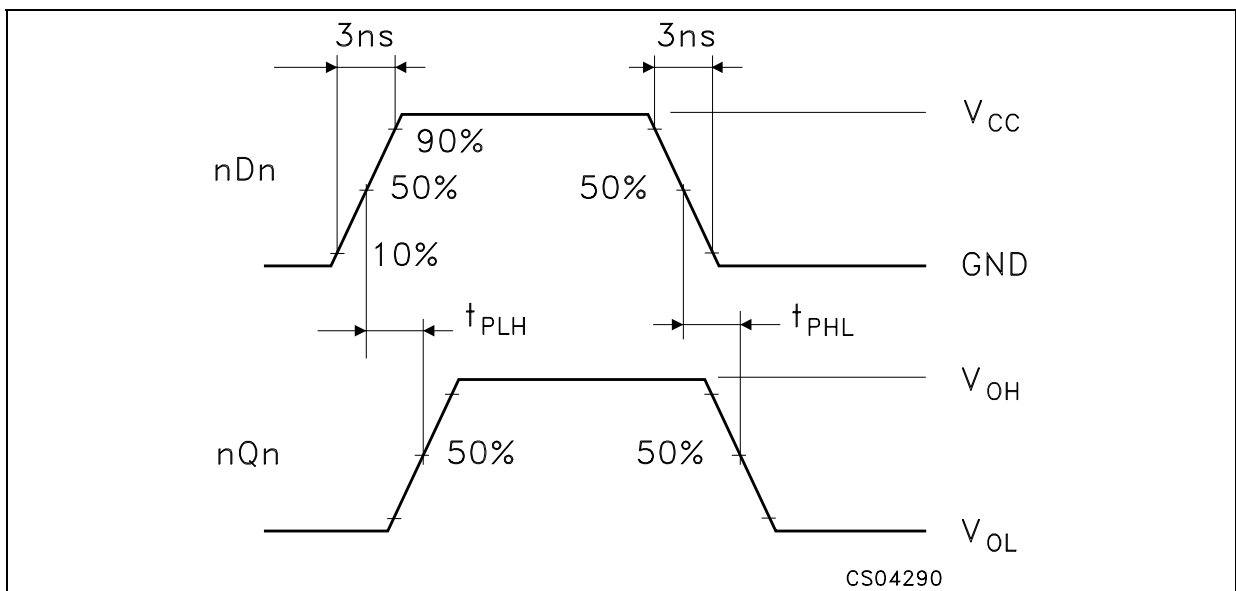


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**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME (f=1MHz; 50% duty cycle)**



**WAVEFORM 3 : PROPAGATION DELAY TIME (f=1MHz; 50% duty cycle)**

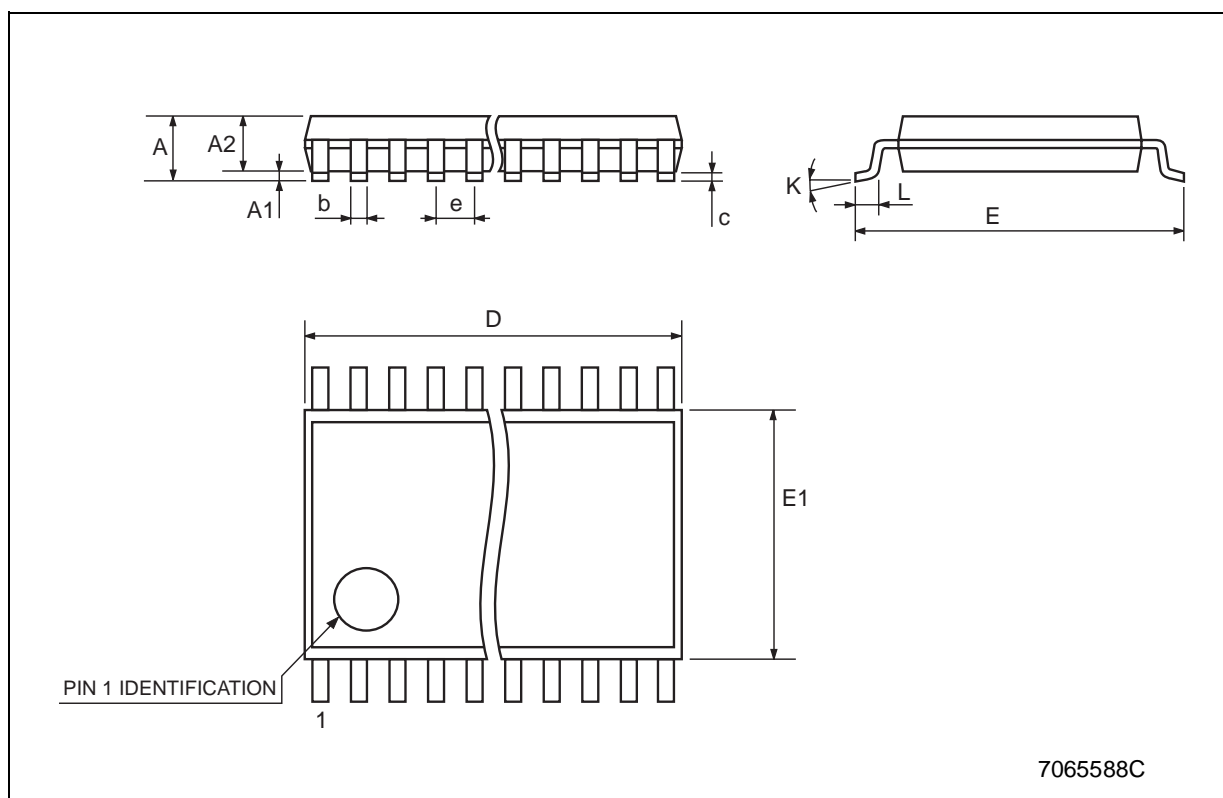




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**TSSOP48 MECHANICAL DATA**

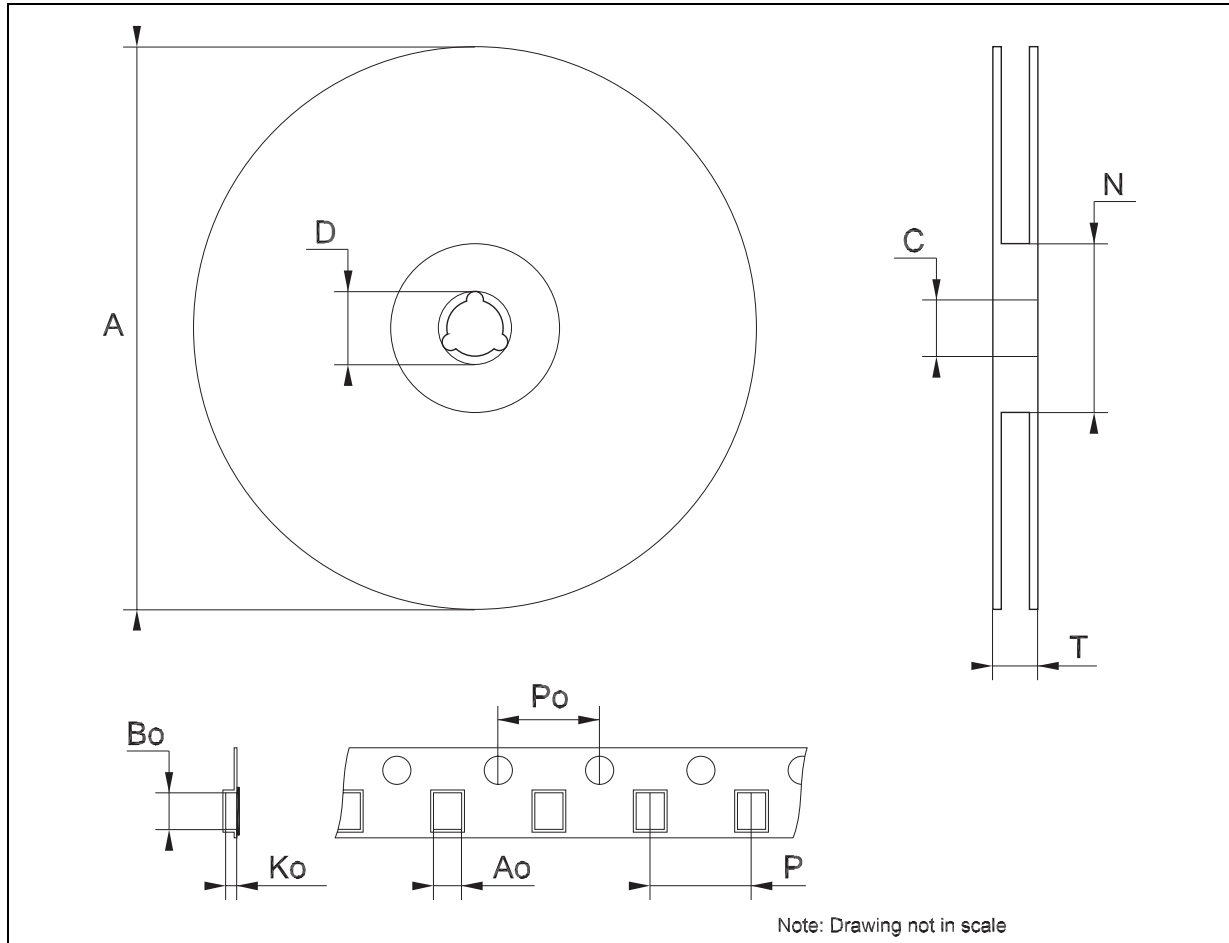
| DIM. | mm.  |         |      | inch   |            |        |
|------|------|---------|------|--------|------------|--------|
|      | MIN. | TYP     | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |         | 1.2  |        |            | 0.047  |
| A1   | 0.05 |         | 0.15 | 0.002  |            | 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  |



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**Tape & 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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