



74LCX16541

LOW VOLTAGE CMOS 16-BIT BUS BUFFER (3-STATE) WITH 5V TOLERANT INPUTS/OUTPUTS (NON INVERTED)

- 5V TOLERANT INPUTS AND OUTPUTS
- HIGH SPEED:
 $t_{PD} = 4.1 \text{ ns (MAX.) at } V_{CC} = 5V$
- LOW POWER DISSIPATION:
 $I_{CC} = 2 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- POWER DOWN PROTECTION ON INPUTS AND OUPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 24 \text{ mA (MIN)}$
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC(OPR)} = 2V \text{ to } 3.6V \text{ (1.5V Data Retention)}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 16541
- IMPROVED LATCH-UP IMMUNITY
- ESD PERFORMANCE:
 $HBM > 2000V \text{ (MIL STD 883 method 3015);}$
 $MM > 200V$

DESCRIPTION

The 74LCX16541 is an advanced high-speed CMOS 16-BIT BUS BUFFER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology.

This is composed of two 8-bit sections with separate output-enable signals. For either 8-bit buffers section, the 3 STATE control gate operates as a two input AND such that if either $\overline{nG1}$ and $\overline{nG2}$ are high, all outputs are in the high impedance state. This device is designed to be used with 3 state memory address driveres, etc.

It has same speed performance at 3.3V than 5V AC/ACT family, combined with a lower power consumption.

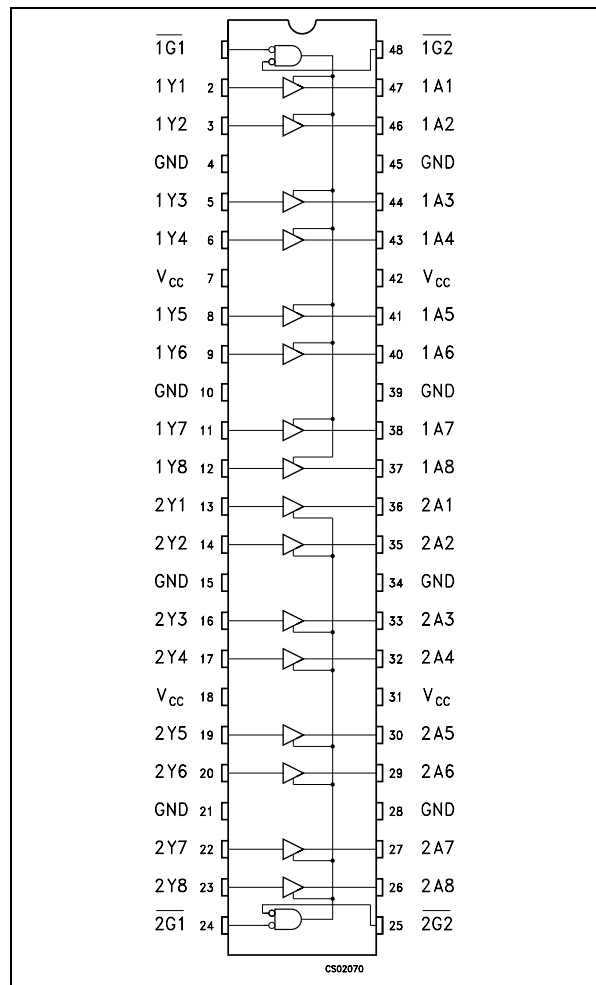
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.



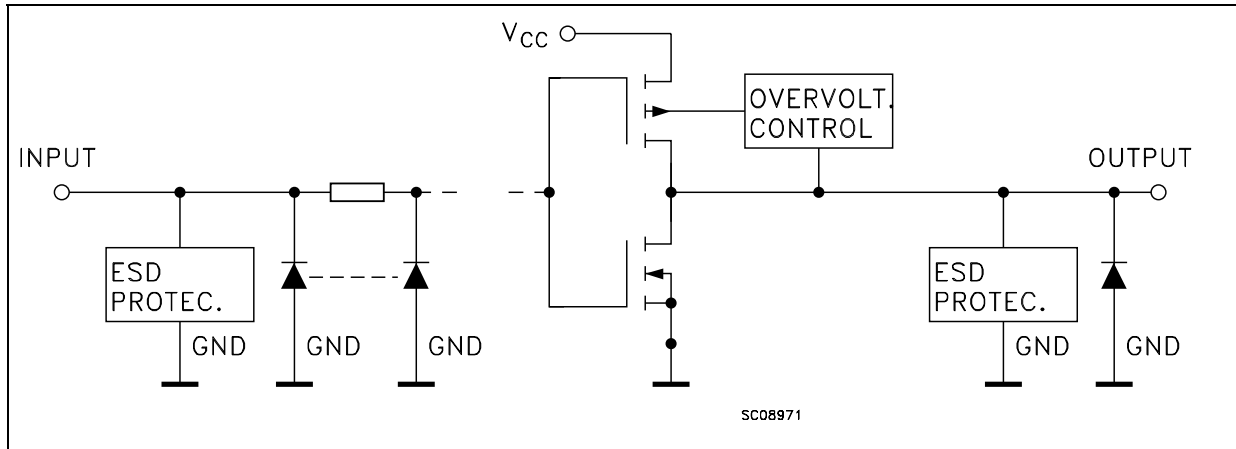
ORDER CODES

| PACKAGE | TUBE | T & R |
|---------|------|---------------|
| TSSOP | | 74LCX16541TTR |

PIN CONNECTION



INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

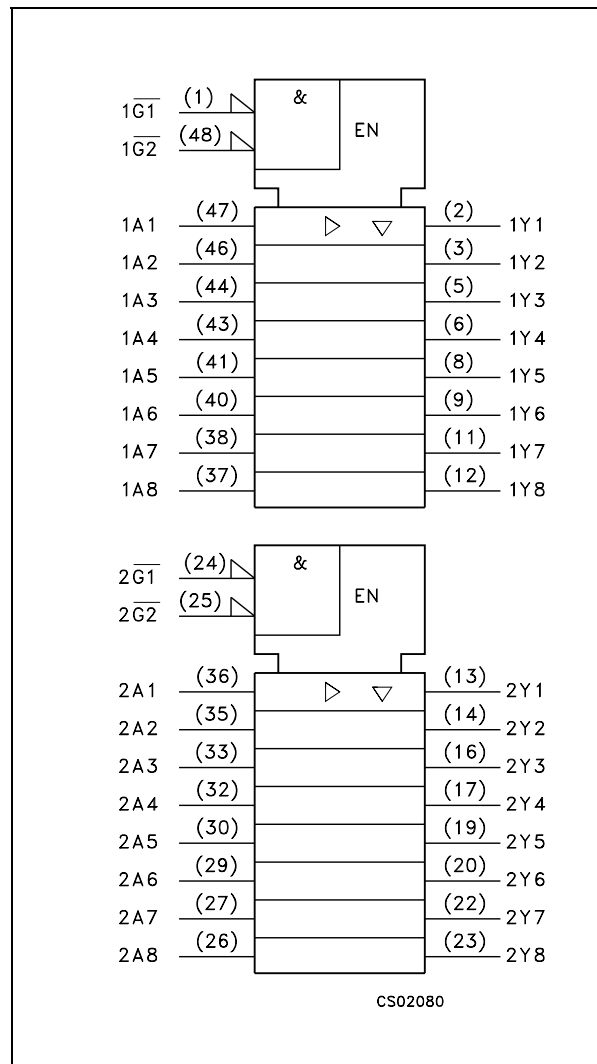
| PIN No | SYMBOL | NAME AND FUNCTION |
|--------------------------------|-----------------|-------------------------|
| 1, 48 | 1G1, 1G2 | Output Enable Inputs |
| 2, 3, 5, 6, 8, 9, 11, 12 | 1Y1 to 1Y8 | Data Outputs |
| 13, 14, 16, 17, 19, 20, 22, 23 | 2Y1 to 2Y8 | Data Outputs |
| 24, 25 | 2G1, 2G2 | Output Enable Inputs |
| 36, 35, 33, 32, 30, 29, 27, 26 | 2A1 to 2A8 | Data Outputs |
| 47, 46, 44, 43, 41, 40, 38, 37 | 1A1 to 1A8 | Data Outputs |
| 4, 10, 15, 21, 28, 34, 39, 45 | GND | Ground (0V) |
| 7, 18, 31, 42 | V _{CC} | Positive Supply Voltage |

TRUTH TABLE

| INPUTS | | | OUTPUT |
|-----------------|-----------------|----------------|----------------|
| $\overline{G1}$ | $\overline{G2}$ | A _n | Y _n |
| H | X | X | Z |
| X | H | X | Z |
| L | L | H | H |
| L | L | L | L |

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 +7.0 | V |
| V_O | DC Output Voltage (High or Low State) (note 1) | -0.5 to $V_{CC}+0.5$ | V |
| I_{IK} | DC Input Diode Current | -50 | mA |
| I_{OK} | DC Output Diode Current (note 2) | -50 | mA |
| I_O | DC Output Current | +50 | mA |
| I_{CC} or I_{GND} | DC V_{CC} or Ground Current | ± 100 | 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

1) I_O absolute maximum rating must be observed

2) $V_O < GND$

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|------------------|---|---------------|-------------|
| V_{CC} | Supply Voltage (note 1) | 2 to 3.6 | V |
| V_I | Input Voltage | 0 to 5.5 | V |
| V_O | Output Voltage (OFF State) | 0 to 5.5 | V |
| V_O | Output Voltage (High or Low State) | 0 to V_{CC} | V |
| T_{op} | Operating Temperature | -55 to 125 | $^{\circ}C$ |
| I_{OH}, I_{OL} | High or Low Level Output Current ($V_{CC} = 3.0$ to $3.6V$) | ± 24 | mA |
| I_{OH}, I_{OL} | High or Low Level Output Current ($V_{CC} = 2.7V$) | ± 12 | mA |
| dt/dv | Input Rise and Fall Time (note 2) | 0 to 10 | ns/V |

1) Truth Table guaranteed: 1.5V to 3.6V

2) V_{IN} from 0.8V to 2V at $V_{CC}=3.0V$

DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | Value | | | | Unit |
|------------------|---------------------------------------|------------------------|---|----------------------|------|----------------------|------|------|
| | | V _{CC} (V) | | -40 to 85 °C | | -55 to 125 °C | | |
| | | | | Min. | Max. | Min. | Max. | |
| V _{IH} | High Level Input Voltage | 2.7 to 3.6 | | 2.0 | | 2.0 | | V |
| V _{IL} | Low Level Input Voltage | | | | | 0.8 | | 0.8 |
| V _{OH} | High Level Output Voltage | 2.7 to 3.6 | I _O =-100 μA | V _{CC} -0.2 | | V _{CC} -0.2 | | V |
| | | 2.7 | I _O =-12 mA | 2.2 | | 2.2 | | |
| | | 3.0 | I _O =-12 mA | 2.4 | | 2.4 | | |
| | | 3.0 | I _O =-24 mA | 2.2 | | 2.2 | | |
| V _{OL} | Low Level Output Voltage | 2.7 to 3.6 | I _O =100 μA | | 0.2 | | 0.2 | V |
| | | 2.7 | I _O =12 mA | | 0.4 | | 0.4 | |
| | | 3.0 | I _O =24 mA | | 0.55 | | 0.55 | |
| I _{OZ} | High Impedance Output Leakage Current | 2.7 to 3.6 | V _I = 0 to 5.5V | | ± 5 | | ± 5 | μA |
| I _I | Input Leakage Current | 2.7 to 3.6 | V _I = 0 to 5.5V | | ± 5 | | ± 5 | μA |
| I _{off} | Power Off Leakage Current | 0 | V _I or V _O = 5.5V | | 10 | | 10 | μA |
| I _{CC} | Quiescent Supply Current | 2.7 to 3.6 | V _I = V _{CC} or GND | | 20 | | 20 | μA |

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, R_L = 500 Ω, Input t_r = t_f = 2.5ns)

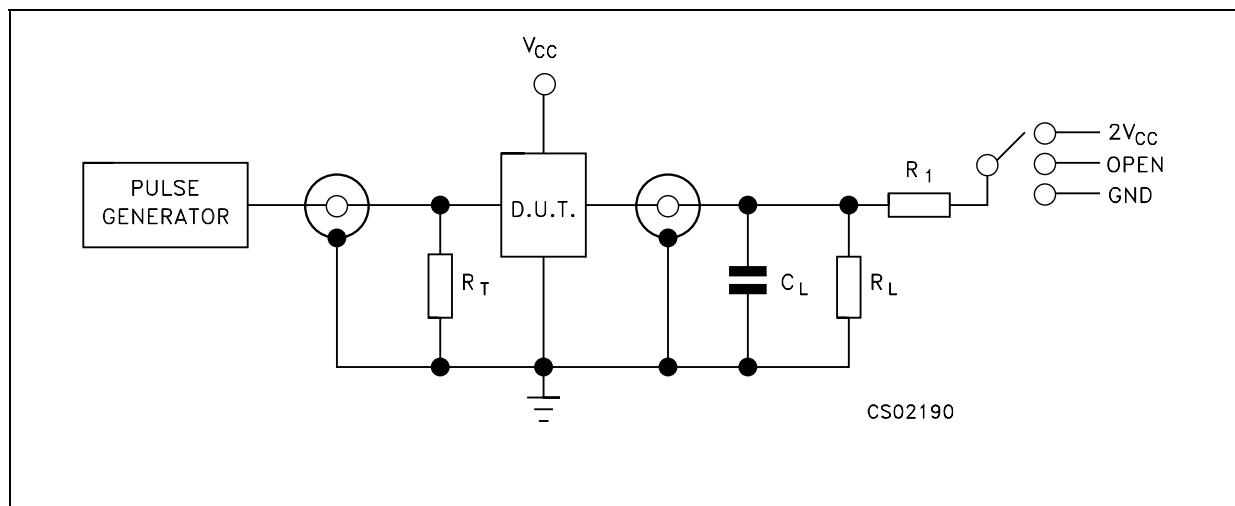
| Symbol | Parameter | Test Condition | | Value | | | | Unit |
|-----------------------------------|----------------------------------|------------------------|------------------------|--------------|------|---------------|------|------|
| | | V _{CC} (V) | C _L (pF) | -40 to 85 °C | | -55 to 125 °C | | |
| | | | | Min. | Max. | Min. | Max. | |
| t _{PLH} t _{PHL} | Propagation Delay Time A to Y | 2.7 | | 1.5 | 4.7 | 1.5 | 4.7 | ns |
| | | 3.0 to 3.6 | | 1.5 | 4.1 | 1.5 | 4.1 | |
| t _{PZL} t _{PZH} | Output Enable Time | 2.7 | | 1.5 | 5.8 | 1.5 | 5.8 | ns |
| | | 3.0 to 3.6 | | 1.5 | 4.6 | 1.5 | 4.6 | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 2.7 | | 1.5 | 6.2 | 1.5 | 6.2 | ns |
| | | 3.0 to 3.6 | | 1.5 | 5.8 | 1.5 | 5.8 | |

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | | Value | | | Unit |
|------------------|---|------------------------|--|------------------------|------|------|------|
| | | V _{CC} (V) | | T _A = 25 °C | | | |
| | | | | Min. | Typ. | Max. | |
| C _{IN} | Input Capacitance | 3.3 | V _I = 0V or V _{CC} | | 4 | | pF |
| C _{OUT} | Output Capacitance | 3.3 | V _I = 0V or V _{CC} | | 10 | | pF |
| C _{PD} | Power Dissipation Capacitance (note 1) Output enabled | 2.5 | f _{IN} = 10MHz | | 45 | | pF |
| | | 3.3 | V _I = 0V or V _{CC} | | 50 | | |
| | Power Dissipation Capacitance (note 1) Output disabled | 2.5 | f _{IN} = 10MHz | | 3 | | pF |
| | | 3.3 | V _I = 0V or V _{CC} | | 4 | | |

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

TEST CIRCUIT



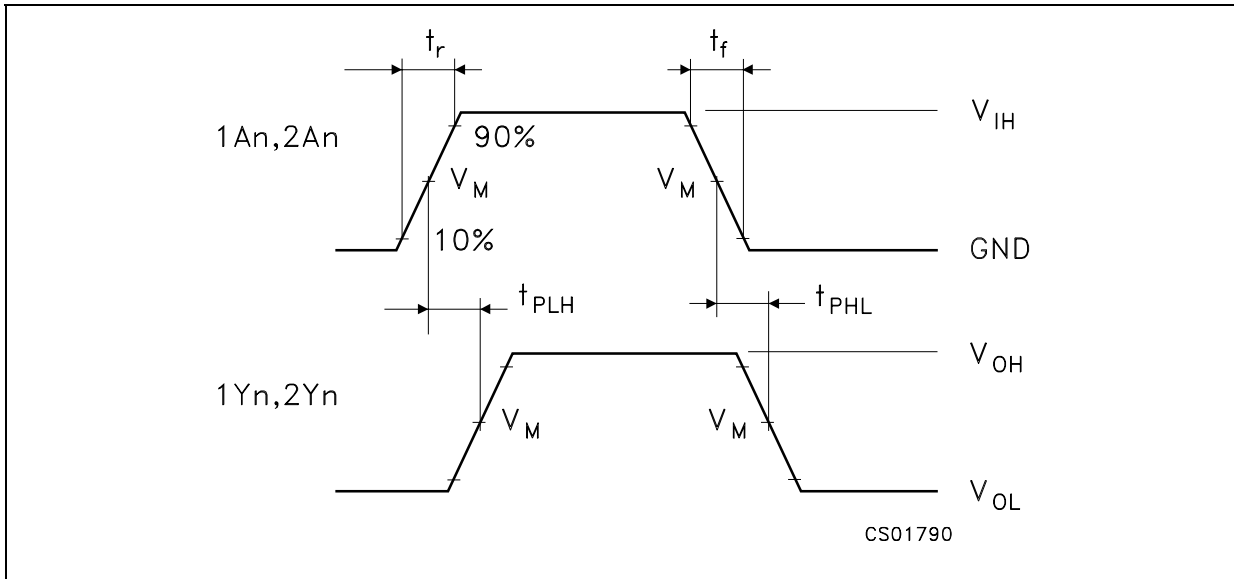
| TEST | SWITCH |
|-------------------------------------|------------------|
| t _{PLH} , t _{PHL} | Open |
| t _{PZL} , t _{PLZ} | 2V _{CC} |
| t _{PZH} , t _{PHZ} | GND |

C_L = 50 pF or equivalent (includes jig and probe capacitance)

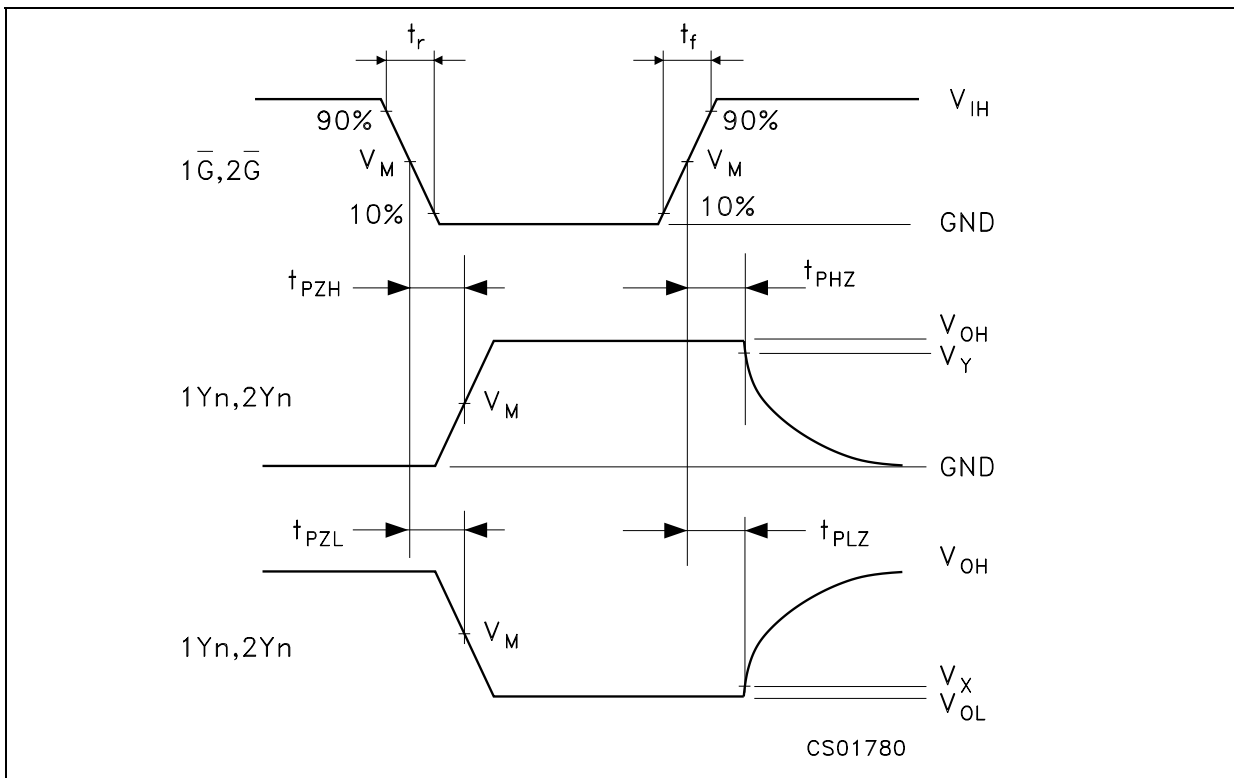
R_L = R₁ = 500 Ω or equivalent

R_T = Z_{OUT} of pulse generator (typically 50Ω)

WAVEFORM 1: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)

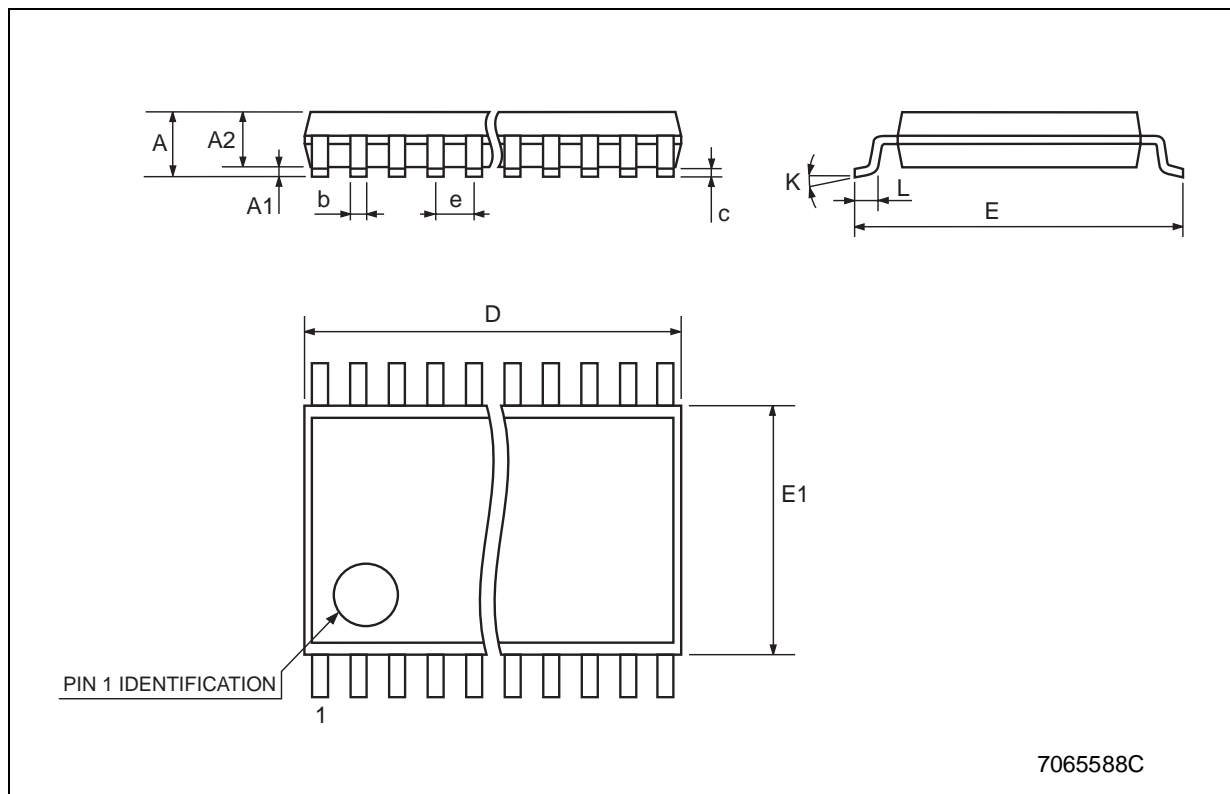


WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME (f=1MHz; 50% duty cycle; $V_Y = V_{OH} - 0.3V$, $V_X = V_{OL} + 0.3V$)



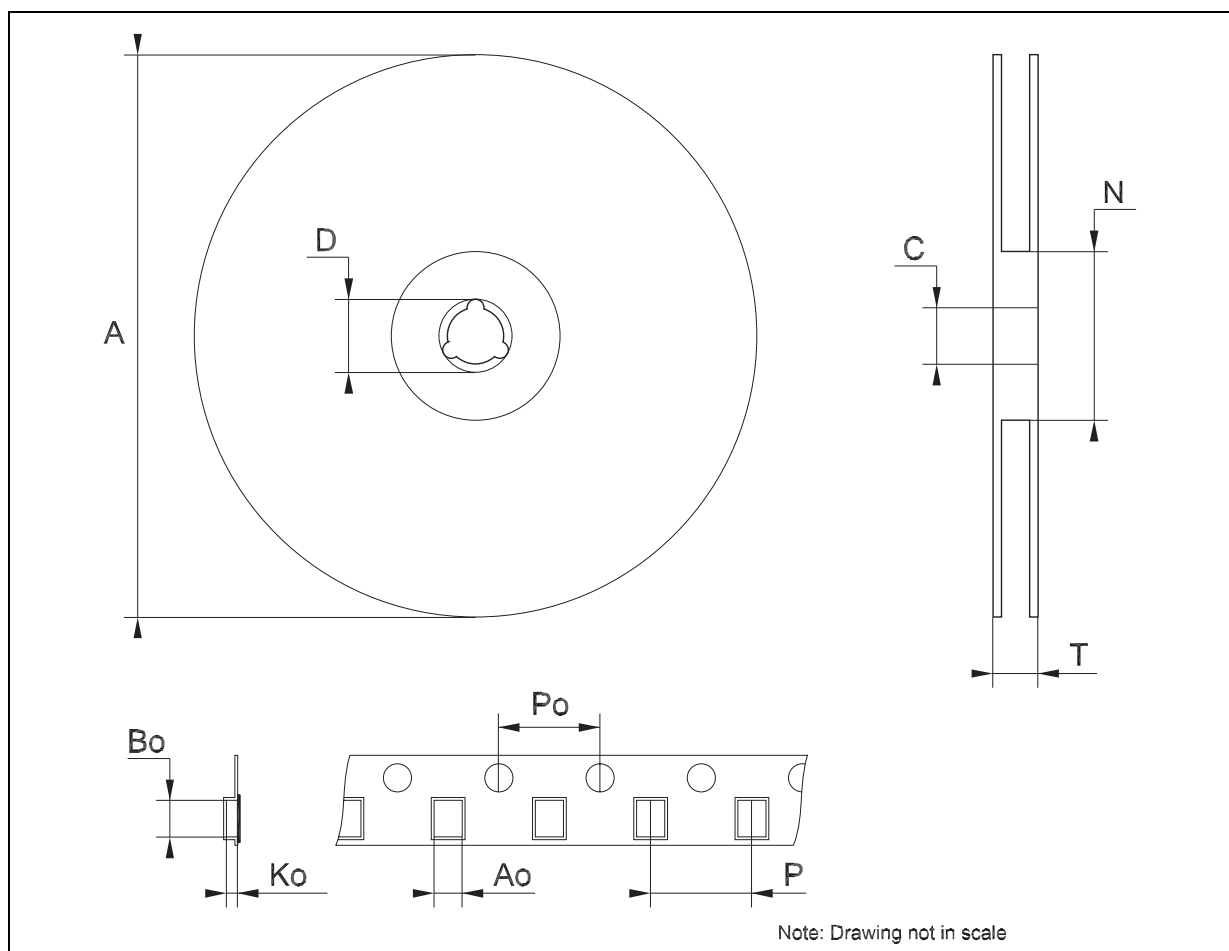
TSSOP48 MECHANICAL DATA

| 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 & 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 |



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2003 STMicroelectronics - Printed in Italy - All Rights Reserved
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>

