



# 74ACT32701

## 16-BIT D-TYPE LATCH PULS 16-BIT BUS BUFFER WITH 3-STATE OUTPUTS (NON INVERTED)

PRELIMINARY DATA

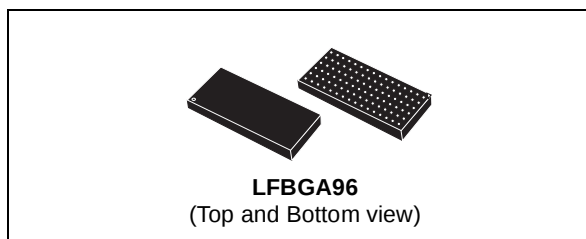
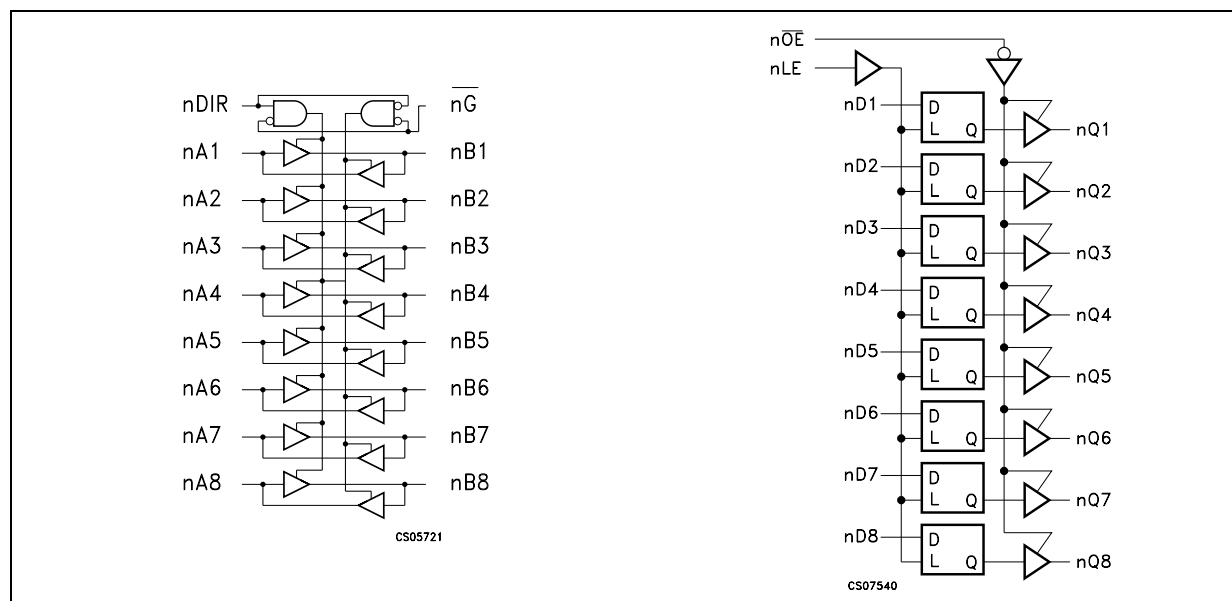
- HIGH SPEED:  $t_{PD} = 4.8ns$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 8\mu A$ (MAX.) at  $T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS  
 $V_{IH} = 2V$  (MIN.),  $V_{IL} = 0.8V$  (MAX.)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24mA$  (MIN) at  $V_{CC} = 4.5V$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 4.5V to 5.5V
- FUNCTION COMPATIBLE WITH SERIES 16373 AND 16245 (244)
- IMPROVED LATCH-UP IMMUNITY
- IMPROVED ESD IMMUNITY

### DESCRIPTION

The 74ACT16244 is a low voltage CMOS 16-BIT D-TYPE LATCH and 16 BIT BUS TRANSCEIVER with 3-STATE output non inverting fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

Both functions can be used as 16 bit or dual octal devices, so the 16 bit transceiver can be used as 8 bit bus buffer plus 8 bit transceiver, or only 16 bit buffer in select direction.

### LOGIC DIAGRAM



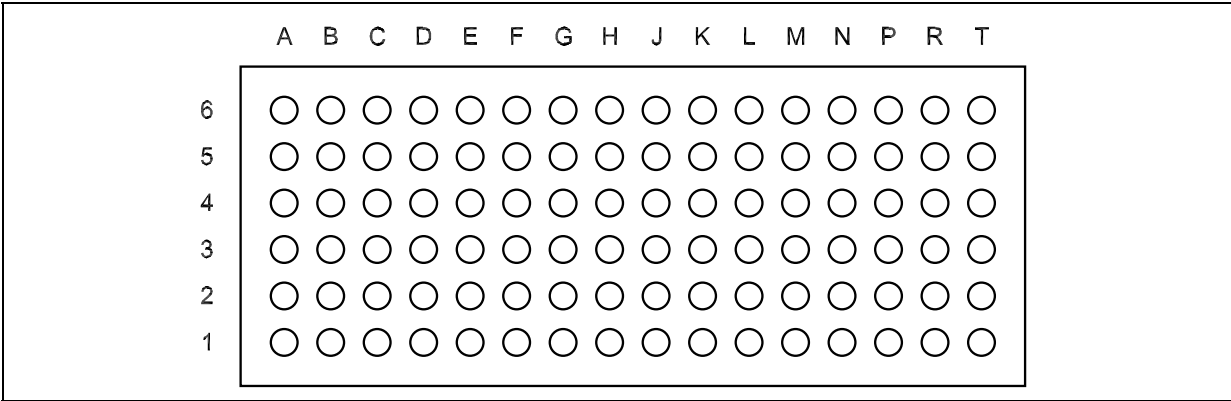
### ORDER CODES

| PACKAGE | TRAY         | T & R         |
|---------|--------------|---------------|
| LFBGA96 | 74ACT32701LB | 74ACT32701LBR |

This device can be used to integrate in one chip the internal logic component required to STV0701 to work as P.O.D. interface in Digital TV application. It is ideal for low power and high speed 4.5 to 5.5. applications.

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

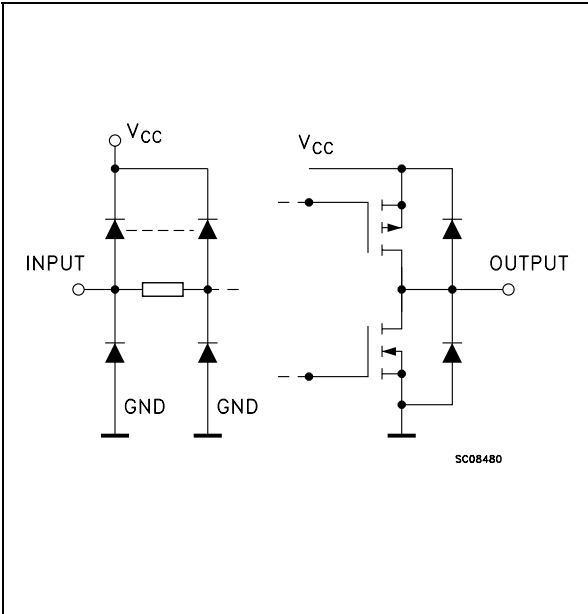
PIN CONNECTION (Top view)



TERMINAL ASSIGNMENT

|   | A   | B   | C               | D   | E   | F               | G   | H   | J    | K   | L               | M   | N   | P               | R   | T    |
|---|-----|-----|-----------------|-----|-----|-----------------|-----|-----|------|-----|-----------------|-----|-----|-----------------|-----|------|
| 6 | 1D2 | 1D4 | 1D6             | 1D8 | 2D2 | 2D4             | 2D6 | 2D7 | 3A2  | 3A4 | 3A6             | 3A8 | 4A2 | 4A4             | 4A6 | 4A7  |
| 5 | 1D1 | 1D3 | 1D5             | 1D7 | 2D1 | 2D3             | 2D5 | 2D8 | 3A1  | 3A3 | 3A5             | 3A7 | 4A1 | 4A3             | 4A5 | 4A8  |
| 4 | 1LE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 2LE | 3G   | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 4G   |
| 3 | 1OE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 2OE | 3DIR | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 4DIR |
| 2 | 1Q1 | 1Q3 | 1Q5             | 1Q7 | 2Q1 | 2Q3             | 2Q5 | 2B8 | 3B1  | 3B3 | 3B5             | 3B7 | 4B1 | 4B3             | 4B5 | 4B8  |
| 1 | 1Q2 | 1Q4 | 1Q6             | 1Q8 | 2Q2 | 2Q4             | 2Q6 | 2B7 | 3B2  | 3B4 | 3B6             | 3B8 | 4B2 | 4B4             | 4B6 | 4B7  |

INPUT AND OUTPUT EQUIVALENT CIRCUIT



TRUTH TABLE (each 8bit section of 16bit Latch)

| INPUTS |    |   | OUTPUT         |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

TRUTH TABLE (each 8bit section of 16bit Transceiver)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| G      | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

X : Don't Care  
Z : High Impedance

**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 SPECIFICATIONS

| 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 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 V <sub>CC</sub> -0.1V                                              |                       |       | 0.8   |             | 0.8  | V    |   |
|                  |                                       | 5.5                    |                                                                                              |                       |       | 0.8   |             | 0.8  |      |   |
| V <sub>OH</sub>  | High Level Output 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                                                                       | 3.86                  |       |       | 3.76        |      | V    |   |
|                  |                                       | 5.5                    | I <sub>O</sub> =-24 mA                                                                       | 4.86                  |       |       | 4.76        |      |      |   |
| 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>IIL</sub> 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                                                      |                       | 0.9   |       |             | 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                | 5.5                    | V <sub>OLD</sub> = 1.65 V max                                                                |                       |       |       |             | 75   | mA   |   |
| I <sub>OHD</sub> | (note 1, 2)                           |                        | 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 <sup>(*)</sup>     |  | 2.0                   | 3.3  | 5.0  | 2.0         | 6.0  | ns   |
| t <sub>PHL</sub> |                        |                        |  | 3.0                   | 4.8  | 6.5  | 3.0         | 8.0  |      |
| t <sub>PZL</sub> | Output Enable Time     | 5.0 <sup>(*)</sup>     |  | 4.0                   | 6.5  | 8.7  | 4.0         | 9.7  | ns   |
| t <sub>PZH</sub> |                        |                        |  | 3.0                   | 5.5  | 7.7  | 3.0         | 8.8  |      |
| t <sub>PLZ</sub> | Output Disable Time    | 5.0 <sup>(*)</sup>     |  | 4.0                   | 6.0  | 8.0  | 4.0         | 9.2  | ns   |
| t <sub>PHZ</sub> |                        |                        |  | 3.0                   | 4.6  | 6.4  | 3.0         | 7.3  |      |

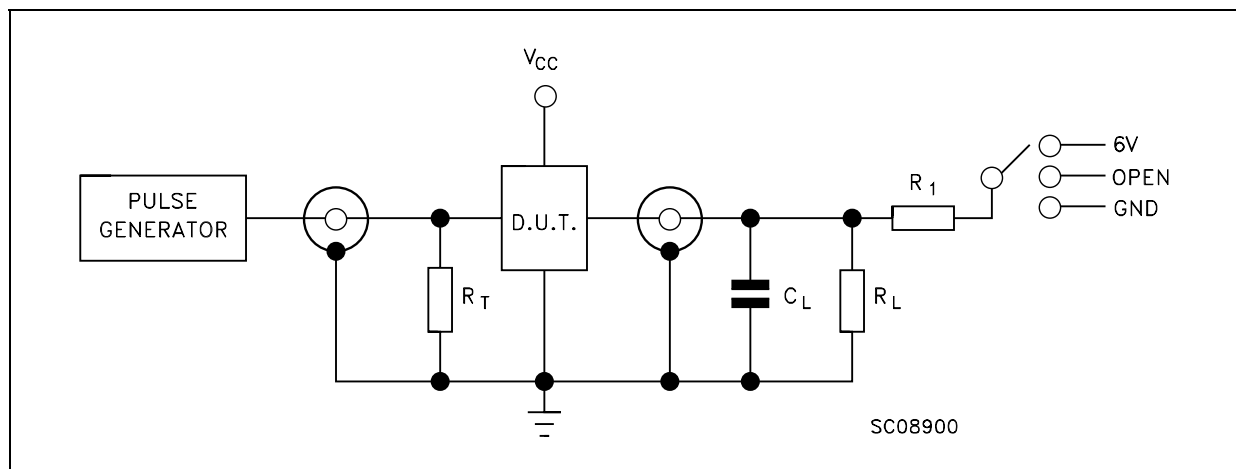
(\*) Voltage range is 5.0V ± 0.5V

## CAPACITIVE CHARACTERISTICS

| Symbol           | Parameter                              | Test Condition         |                         | Value                 |      |      |             |      | Unit |
|------------------|----------------------------------------|------------------------|-------------------------|-----------------------|------|------|-------------|------|------|
|                  |                                        | V <sub>CC</sub><br>(V) |                         | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      |      |
|                  |                                        |                        |                         | Min.                  | Typ. | Max. | Min.        | Max. |      |
| C <sub>IN</sub>  | Input Capacitance                      | 5.0                    |                         |                       | 3.6  |      |             |      | pF   |
| C <sub>OUT</sub> | Output Capacitance                     | 5.0                    |                         |                       | 11   |      |             |      | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance (note 1) | 5.0                    | f <sub>IN</sub> = 10MHz |                       | 42   |      |             |      | 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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/n$  (per circuit)

## TEST CIRCUIT

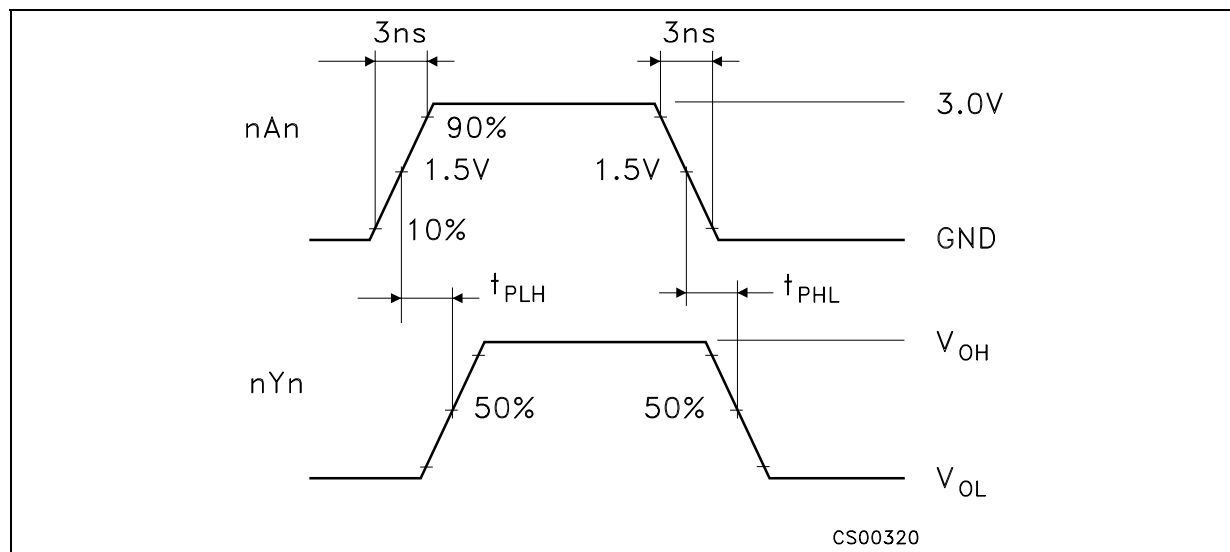
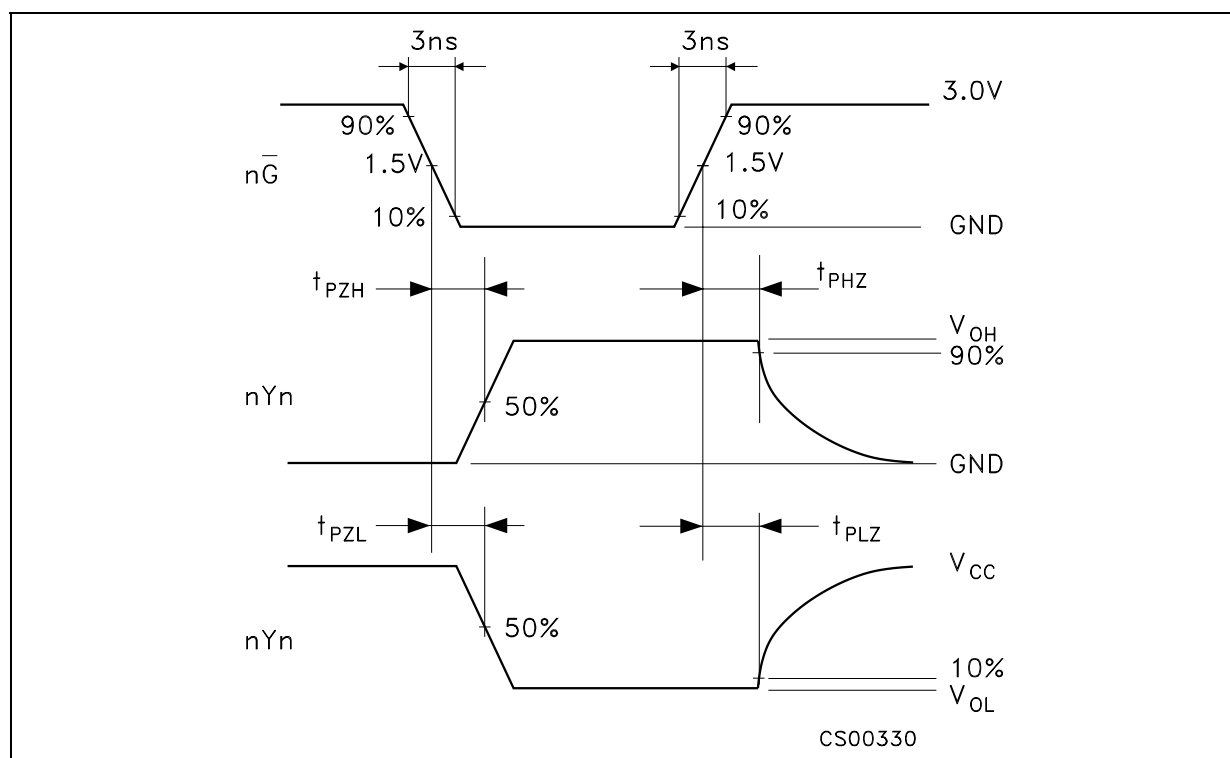


| Test                                | Switch           |
|-------------------------------------|------------------|
| t <sub>PLH</sub> , t <sub>PHL</sub> | Open             |
| t <sub>PZL</sub> , t <sub>PLZ</sub> | 2V <sub>CC</sub> |
| t <sub>PZH</sub> , t <sub>PHZ</sub> | GND              |

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

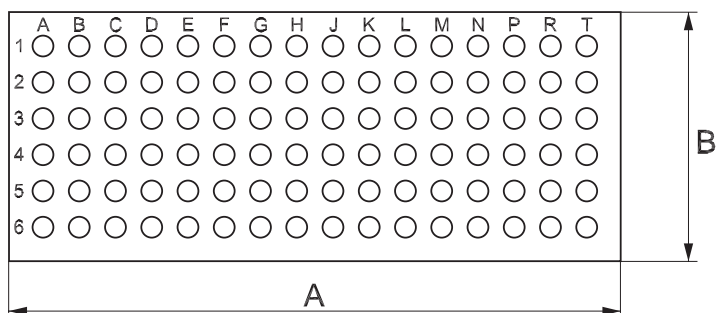
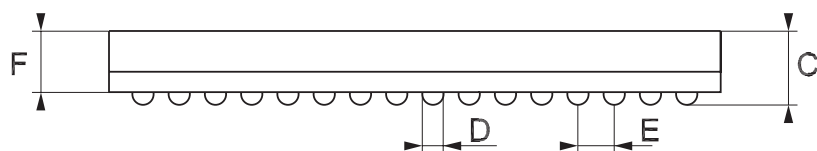
R<sub>L</sub> = R<sub>1</sub> = 500Ω or equivalent

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)

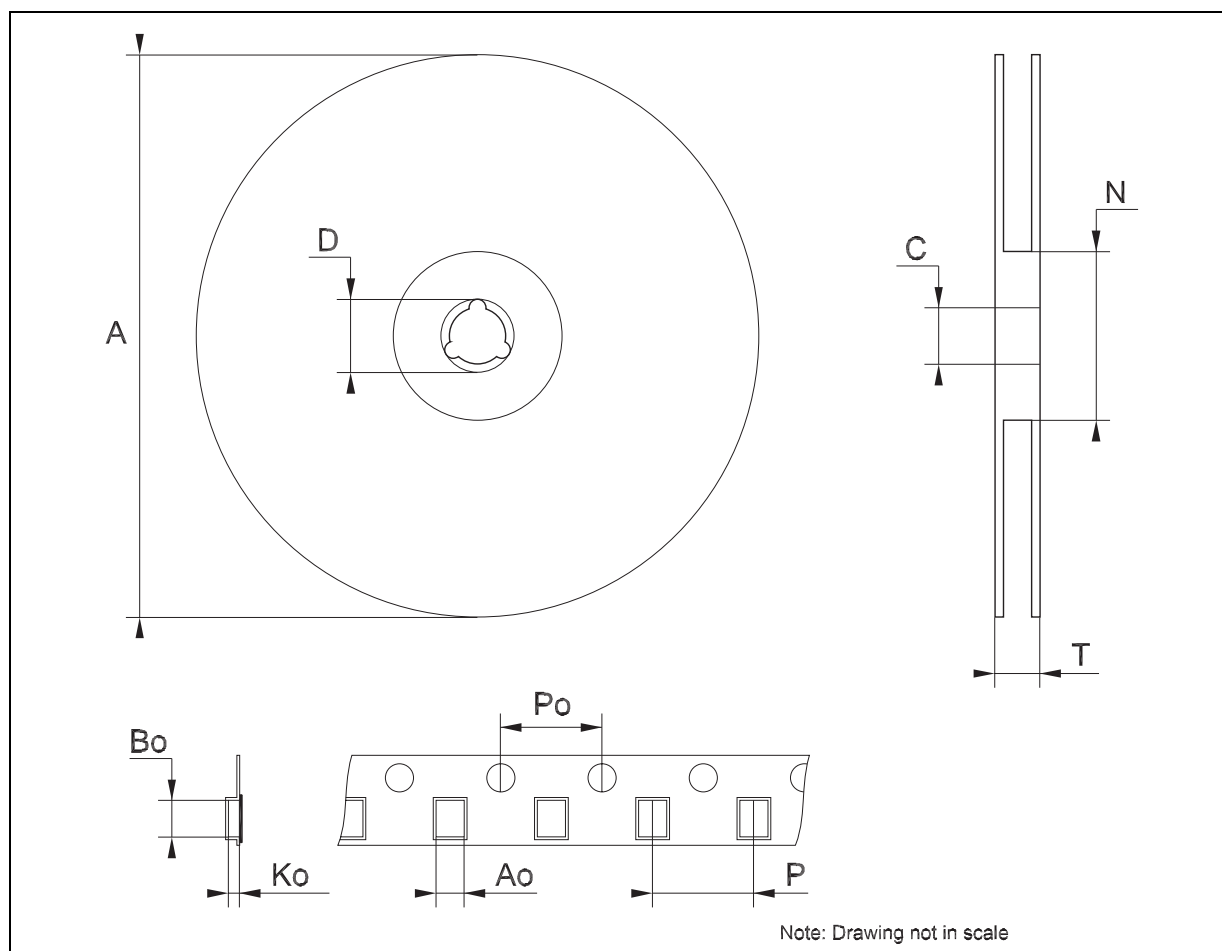
## LFBGA96 MECHANICAL DAT A

| DIM. | mm.   |     |       | mils  |      |       |
|------|-------|-----|-------|-------|------|-------|
|      | MIN.  | TYP | MAX.  | MIN.  | TYP. | MAX.  |
| A    | 13.40 |     | 13.60 | 527.5 |      | 535.4 |
| B    | 5.40  |     | 5.60  | 212.6 |      | 220.5 |
| C    |       |     | 1.6   |       |      | 63.0  |
| D    |       | 0.5 |       |       | 19.7 |       |
| E    |       | 0.8 |       |       | 31.5 |       |
| F    | 0.85  |     |       | 33.5  |      |       |



### Tape & Reel LFBGA96 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 |       |      | 1.196  |
| Ao   | 5.8  |     | 6.0  | 0.228 |      | 0.236  |
| Bo   | 13.8 |     | 14.0 | 0.543 |      | 0.551  |
| Ko   | 2.1  |     | 2.3  | 0.083 |      | 0.091  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |     | 8.1  | 0.311 |      | 0.319  |



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