

## 20-BIT TWO PORT BUS SWITCH

### PRELIMINARY DATA

- HIGH SPEED:  $t_{pD} = 0.25ns$  (MAX.) at  $V_{CC} = 4.5V$   $T_A=85^\circ C$
- ON RESISTANCE BETWEEN TWO PORT:  $5\Omega$  (TYP) at  $V_{CC} = 5.0V$   $T_A=25^\circ C$
- LOW POWER DISSIPATION:  $I_{CC} = 1\mu A$ (MAX.) at  $T_A=25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS:  $V_{IH}=2V$ (MIN),  $V_{IL}=0.8V$ (MAX)
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- OPERATING VOLTAGE RANGE:  $V_{CC}(OPR) = 4V$  to  $5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 16861
- IMPROVED LATCH-UP IMMUNITY
- ESD PERFORMANCE: HBM > 2000V (MIL STD 883 method 3015); MM > 200V

### DESCRIPTION

The B5S16861 is an advanced high-speed CMOS 20-BIT TWO PORT BUS SWITCH fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

It is ideal for 4V to 5.5V  $V_{CC}$  operations and ultra-low power and low noise applications, typically notebook and docking station.

Any  $\overline{nG}$  output control governs two 10-bit BUS SWITCHES. Output Enable inputs ( $\overline{nG}$ ) tied together gives full 20-bit operations. When  $\overline{nG}$  is LOW, the switches are on. When  $\overline{nG}$  is HIGH, the switches are in high impedance state.

It has ultra high-speed performance at 5V near zero delay with low ON resistance.

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

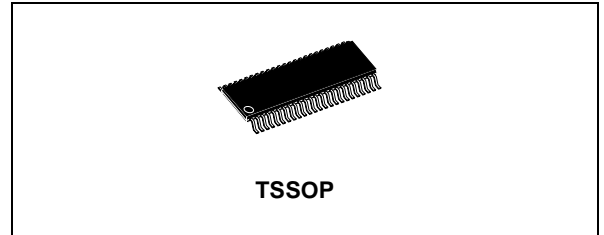


Table 1: Order Codes

| PACKAGE | T & R      |
|---------|------------|
| TSSOP48 | B5S16861TR |

Figure 1: Pin Connection

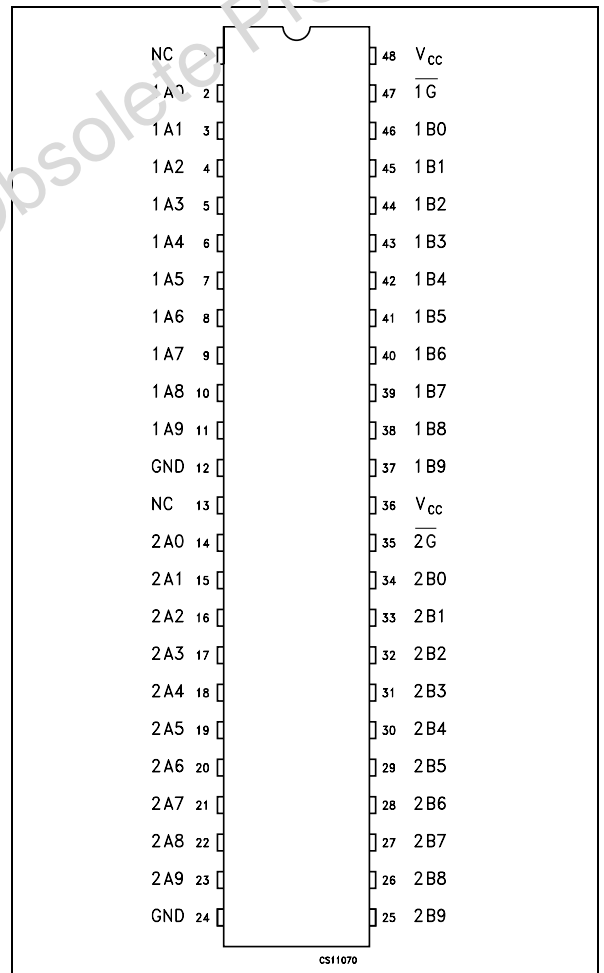


Figure 2: Input Equivalent Circuit

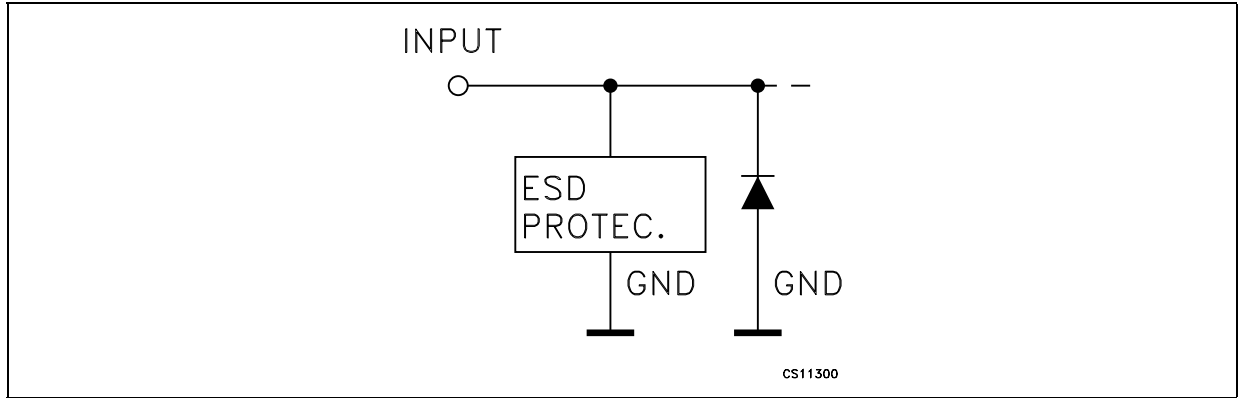


Table 2: Pin Description

| PIN N°                                 | SYMBOL                            | NAME QND FUNCTION             |
|--|-----------------------------------|-------------------------------|
| 1, 13                                  | NC                                | Not Connected                 |
| 2, 3, 4, 5, 6, 7, 8, 9, 10, 11         | 1A0 to 1A9                        | Data Inputs                   |
| 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 | 2A0 to 2A9                        | Data Inputs                   |
| 34, 33, 32, 31, 30, 29, 28, 27, 26, 25 | 2B0 to 2B9                        | Data Outputs                  |
| 46, 45, 44, 43, 42, 41, 40, 39, 38, 37 | 1B0 to 1B9                        | Data Outputs                  |
| 47, 35                                 | $\overline{1G}$ , $\overline{2G}$ | Bus Enable Input (Active Low) |
| 12, 24                                 | GND                               | Ground (0V)                   |
| 36, 48                                 | V <sub>CC</sub>                   | Positive Supply Voltage       |

Figure 3: Schematic Diagram

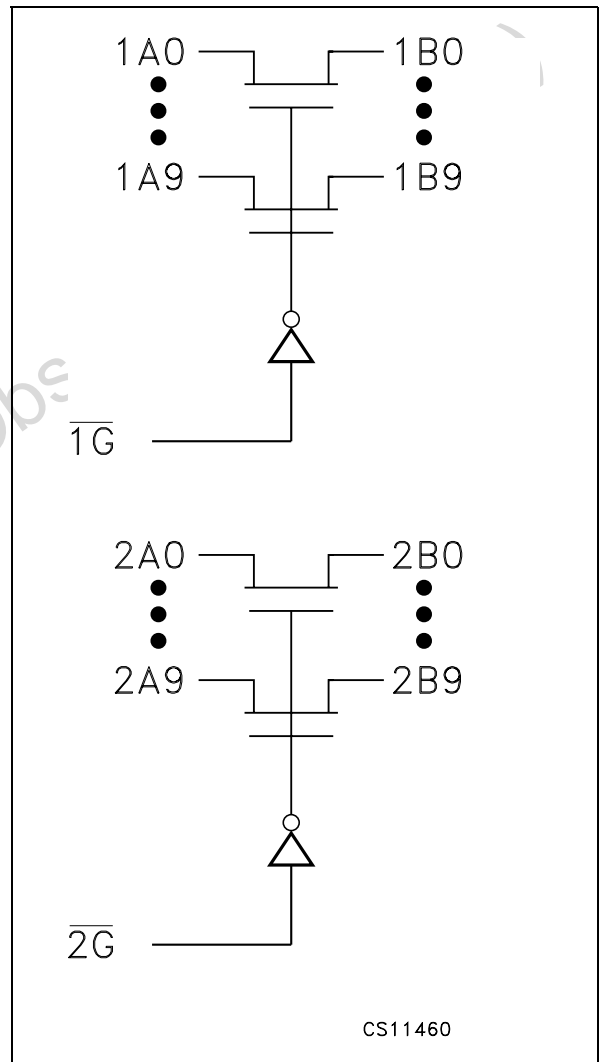


Table 3: Truth Table

| INPUT           |          | OUTPUT   |
|-----------------|----------|----------|
| $\overline{nG}$ | 1An, 2An | 1Bn, 2Bn |
| L               | X        | Bus ON   |
| H               | X        | Z        |

n: 0 to 9  
 X: "H" or "L"  
 Z: High Impedance

**Table 4: Absolute Maximum Ratings**

| Symbol                | Parameter                                    | Value        | Unit        |
|-----------------------|--|--------------|-------------|
| $V_{CC}$              | Supply Voltage                               | -0.5 to +7.0 | V           |
| $V_I$                 | DC Switch and Control Pin Voltage            | -0.5 to +7.0 | V           |
| $V_O$                 | DC Output Voltage ( $V_{CC} = 0V$ ) (note 1) | -0.5 to +7.0 | V           |
| $V_O$                 | DC Output Voltage ( $V_{IO} = Gnd$ )         | -0.5 to +7.0 | V           |
| $I_{IK}$              | DC Input Diode Current ( $V_{IO} < 0V$ )     | - 50         | mA          |
| $I_{OK}$              | DC Output Diode Current (note 2)             | - 50         | mA          |
| $I_O$                 | DC Output Current (note 3)                   | 128          | mA          |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current per Supply Pin | $\pm 100$    | mA          |
| $T_{stg}$             | Storage Temperature                          | -65 to +150  | $^{\circ}C$ |
| $T_L$                 | Lead Temperature (10 sec)                    | 300          | $^{\circ}C$ |

Absolute Maximum Rating are those value beyond which damage to the device may occur. Functional operation under these condition is not implied

1)  $I_O$  absolute maximum rating must be observed

2)  $V_O < GND$

3) Not more than one output should be tested at one time. Duration of the test should not exceed one second.

**Table 5: Recommended Operating Conditions**

| Symbol   | Parameter                                 | Value      | Unit        |
|----------|---|------------|-------------|
| $V_{CC}$ | Supply Voltage                            | 4 to 5.5   | V           |
| $V_I$    | Input Voltage                             | 0 to 5.5   | V           |
| $V_O$    | Output Voltage ( $V_{CC} = 0V$ )          | 0 to 5.5   | V           |
| $V_O$    | Output Voltage                            | 0 to 5.5   | V           |
| $T_{op}$ | Operating Temperature                     | -55 to 125 | $^{\circ}C$ |
| dt/dv    | Switch Input Rise and Fall Time           | 0 to DC    | ns/V        |
| dt/dv    | Control Input Rise and Fall Time (note 1) | 0 to 10    | ns/V        |

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

Table 6: DC Specification

| 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                     | 4 to 5.5               |  | 2                      |      |      | 2            |      | 2             |      | V    |            |
| V <sub>IL</sub>  | Low Level Input Voltage                      | 4 to 5.5               |  |                        |      | 0.8  |              | 0.8  |               | 0.8  | V    |            |
| V <sub>H</sub>   | Input Hysteresis at Control pin              | 4.5 to 5.5             |  |                        | 150  |      |              |      |               |      | mV   |            |
| R <sub>ON</sub>  | Switch ON Resistance                         | 4.5                    | I <sub>ON</sub> =64 mA<br>V <sub>I</sub> =0V   |                        |      |      |              | 7    |               |      | Ω    |            |
|                  |  | 4.5                    | I <sub>ON</sub> =48 mA<br>V <sub>I</sub> =0V   |                        |      | 5    |              | 7    |               |      |      |            |
|                  |  | 4.5                    | I <sub>ON</sub> =15 mA<br>V <sub>I</sub> =2.4V                                       |                        |      | 10   |              | 15   |               |      |      |            |
|                  |  | 4.0                    | I <sub>ON</sub> =15 mA<br>V <sub>I</sub> =2.4V                                       |                        |      | 14   |              | 22   |               |      |      |            |
| I <sub>I</sub>   | Input Leakage Current                        | 0 to 5.5               | V <sub>I</sub> = 5.5V or GND   |                        |      | ±0.1 |              | ±1.0 |               | ±2.0 | μA   |            |
| I <sub>OZ</sub>  | High Impedance Leakage Current               | 4.5 to 5.5             | V <sub>I/O</sub> = 5.5V to GND   |                        |      |      |              | ±1.0 |               | ±2.0 | μA   |            |
| V <sub>IK</sub>  | Clamp Diode Voltage                          | 4.0 to 5.5             | I <sub>I</sub> = -18mA   |                        |      | -0.7 |              | -1.2 |               | -1.2 | V    |            |
| I <sub>CC</sub>  | Quiescent Supply Current                     | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND  |                        |      | 0.1  | 1.0          |      | 3.0           |      | 10.0 | μA         |
| I <sub>CCD</sub> | Supply Current per Control Input per MHz (1) | 5.5                    | V <sub>I/O</sub> = Open<br>nG=GND;<br>Control Input<br>Toggling<br>50% Duty<br>Cycle |                        |      |      |              |      | 0.25          |      |      | mA/<br>MHz |
| ΔI <sub>CC</sub> | I <sub>CC</sub> incr. per Input              | 5.5                    | V <sub>IC</sub> =V <sub>CC</sub> -2.1 V  |                        |      |      |              |      | 2.5           |      |      | mA         |

1) This current applies to the control inputs only and represent the current required to switch internal capacitance at the specified frequency. The 1An and 2An inputs generate no significant AC or DC currents as they transition. This parameter is not tested, but is guaranteed by design.

Table 7: AC Electrical Characteristics

| Symbol                            | Parameter   | Test Condition         |                        |                       |   | Value        |      |               |      | Unit |
|-----------------------------------|---|------------------------|------------------------|-----------------------|---|--------------|------|---------------|------|------|
|                                   |   | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) | R <sub>L</sub><br>(Ω) | t <sub>s</sub> = t <sub>r</sub><br>(ns) | -40 to 85 °C |      | -55 to 125 °C |      |      |
|                                   |   |                        |                        |                       |   | Min.         | Max. | Min.          | Max. |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time (1)<br>xAn to xBn, xBn to xAn(2) | 4.5 to 5.5             | 50                     | 500                   | 2.5                                     |              | 0.25 |               |      | ns   |
| t <sub>PZL</sub> t <sub>PZH</sub> | Output Enable Time                                      |                        | 50                     | 500                   | 2.5                                     | 1.5          | 5.5  |               |      | ns   |
| t <sub>PLZ</sub> t <sub>PHZ</sub> | Output Disable Time                                     |                        | 50                     | 500                   | 2.5                                     | 1.5          | 5.5  |               |      | ns   |

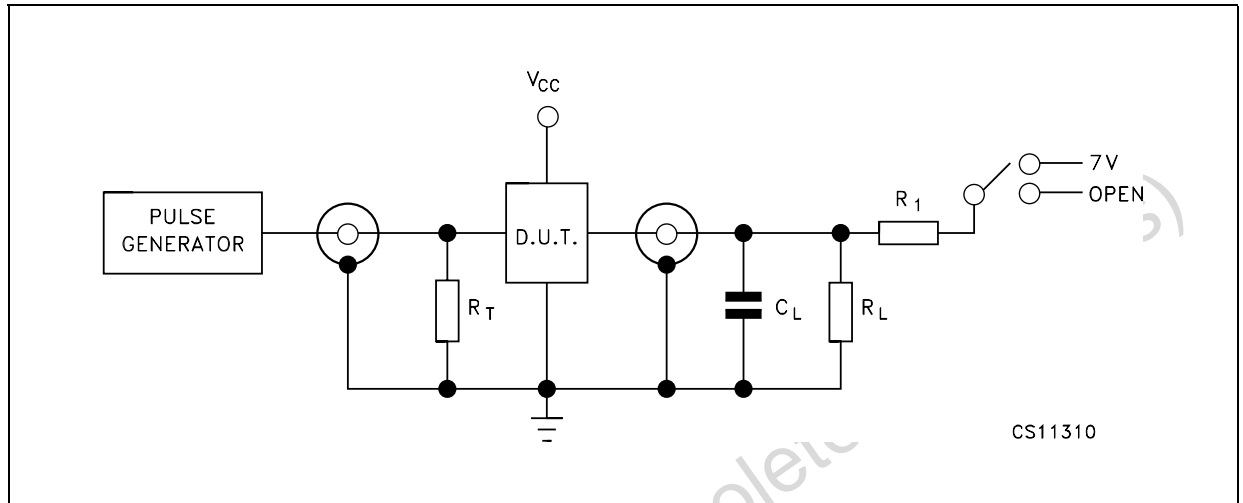
1) Parameter guaranteed by design

2) X=1,2; n=0..9.

Table 8: Capacitance Characteristics

| Symbol    | Parameter                        | Test Condition  |             | Value                            |      |      | Unit |
|-----------|----------------------------------|-----------------|-------------|----------------------------------|------|------|------|
|           |                                  | $V_{CC}$<br>(V) |             | $T_A = 25\text{ }^\circ\text{C}$ |      |      |      |
|           |                                  |                 |             | Min.                             | Typ. | Max. |      |
| $C_{IN}$  | Input Capacitance at Control Pin |                 |             |                                  | 4    |      | pF   |
| $C_{I/O}$ | Input Capacitance at I/O Pin     | 5.0             | $nG=V_{CC}$ |                                  | 5.5  |      | pF   |

Figure 4: Test Circuit



| TEST                  | SWITCH |
|-----------------------|--------|
| $t_{PLH}$ , $t_{PHL}$ | Open   |
| $t_{PZL}$ , $t_{PLZ}$ | 7V     |
| $t_{PZH}$ , $t_{PHZ}$ | Open   |

$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)

$R_L = R_1 = 500\Omega$  or equivalent

$R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

Figure 5: Waveform - Propagation Delay (f=1MHz; 50% duty cycle)

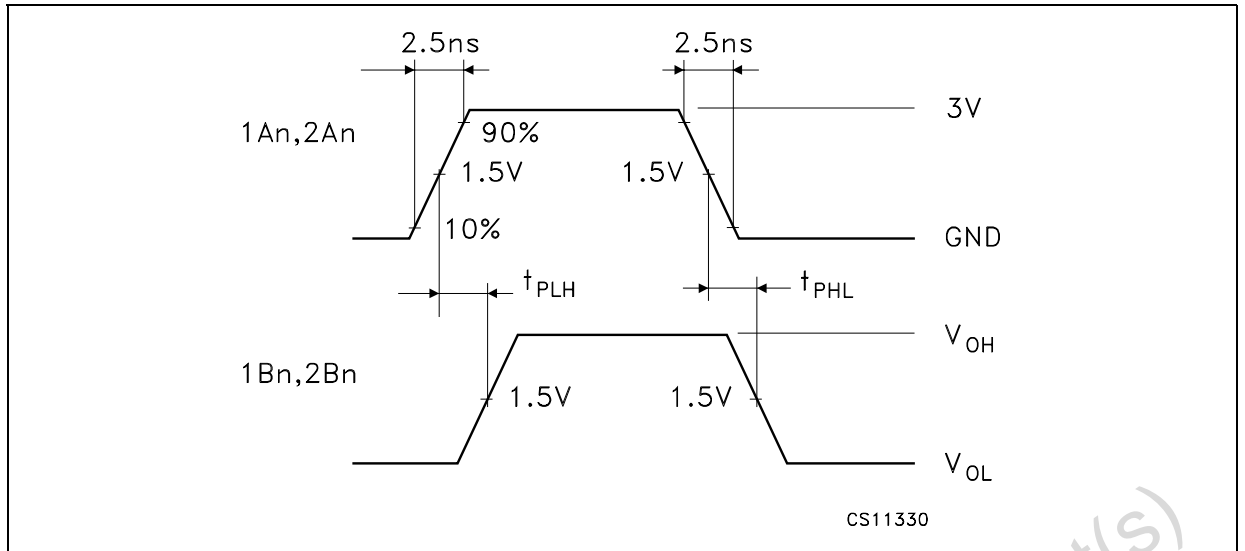
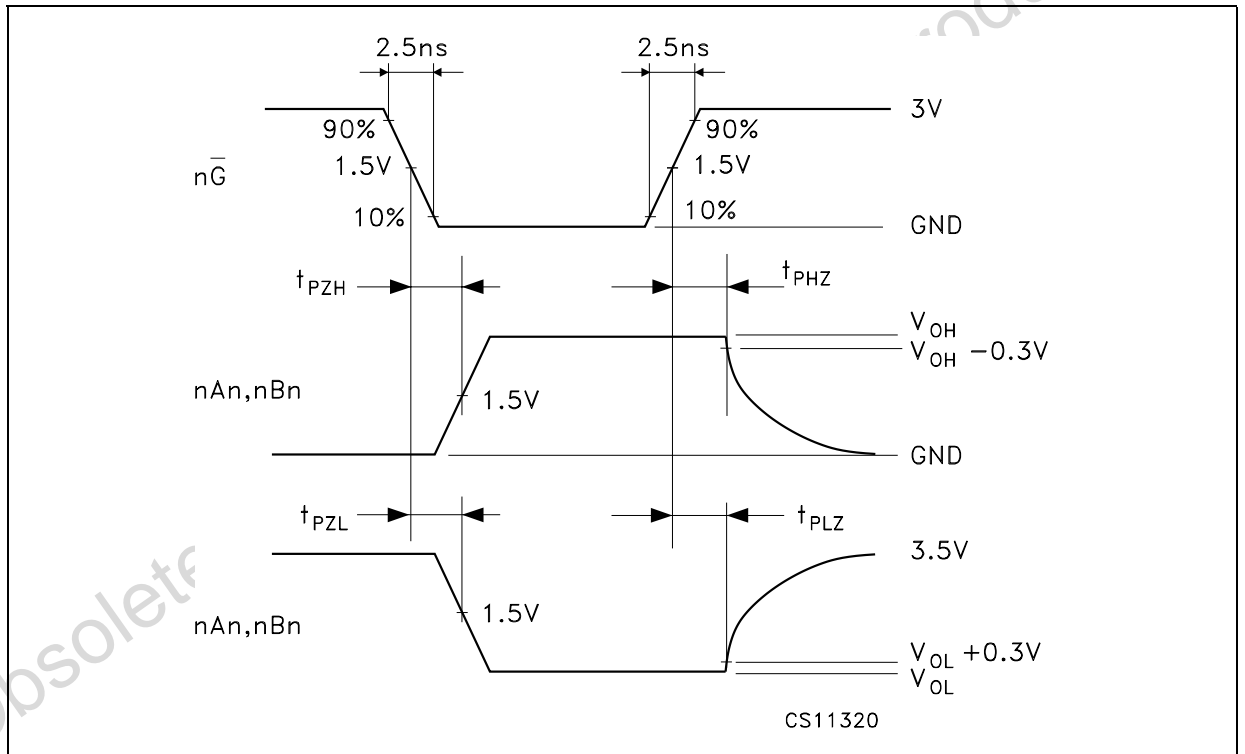
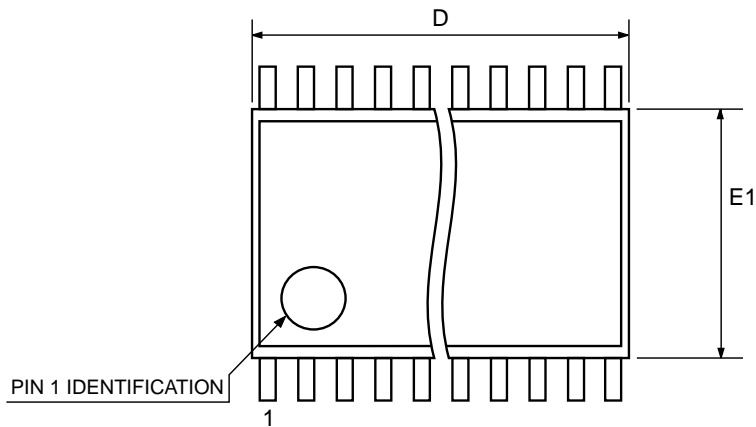
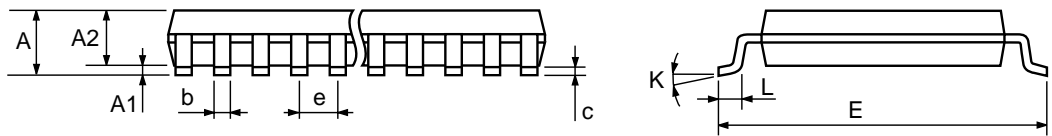


Figure 6: Waveform - Output Enable And Disable Time (f=1MHz; 50% duty cycle)



## TSSOP48 MECHANICAL DATA

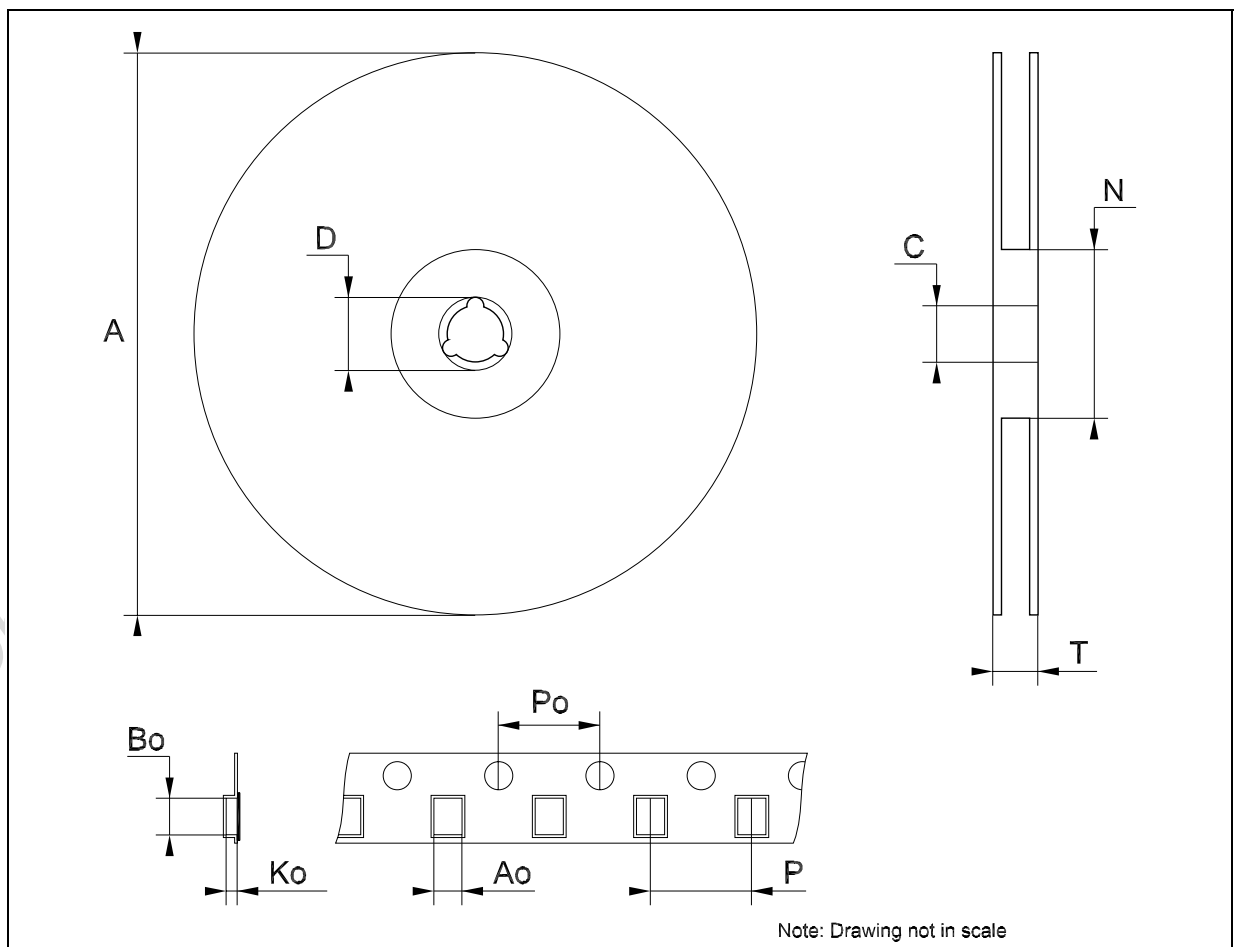
| DIM. | mm.  |         |      | inch   |            |        |
|------|------|---------|------|--------|------------|--------|
|      | MIN. | TYP     | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |         | 1.2  |        |            | 0.047  |
| A1   | 0.05 |         | 0.15 | 0.002  |            | 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    | 0.45 |         | 0.75 | 0.018  |            | 0.030  |



7065588D

## 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  |





**Table 9: Revision History**

| Date        | Revision | Description of Changes |
|-------------|----------|------------------------|
| 01-Oct-2004 | 1        | First Release.         |

Obsolete Product(s) - Obsolete Product(s)

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