

QUAD 2 CHANNEL MULTIPLEXER (3-STATE)

- HIGH SPEED: $t_{PD} = 4.8 \text{ ns}$ (TYP.) at $V_{CC} = 5V$
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A}$ (MAX.) at $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:
 $V_{IH} = 2V$ (MIN.), $V_{IL} = 0.8V$ (MAX)
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 8 \text{ mA}$ (MIN)
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC}(\text{OPR}) = 4.5V \text{ to } 5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 257
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE: $V_{OLP} = 0.8V$ (MAX.)

DESCRIPTION

The 74VHCT257A is an advanced high-speed CMOS QUAD 2-CHANNEL MULTIPLEXER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. It is composed of four independent 2-channel multiplexers with common SELECT and ENABLE INPUT(OE). The VHCT257A is a non-inverting multiplexer. When the ENABLE INPUT is held "High", all outputs become high impedance state.



Table 1: Order Codes

| PACKAGE | T & R |
|---------|---------------|
| SOP | 74VHCT257AMTR |
| TSSOP | 74VHCT257ATTR |

If SELECT INPUT is held "Low", "A" data is selected, when SELECT INPUT is "High", "B" data is chosen.

Power down protection is provided on all inputs and outputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V since all inputs are equipped with TTL threshold.

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

Figure 1: Pin Connection And IEC Logic Symbols

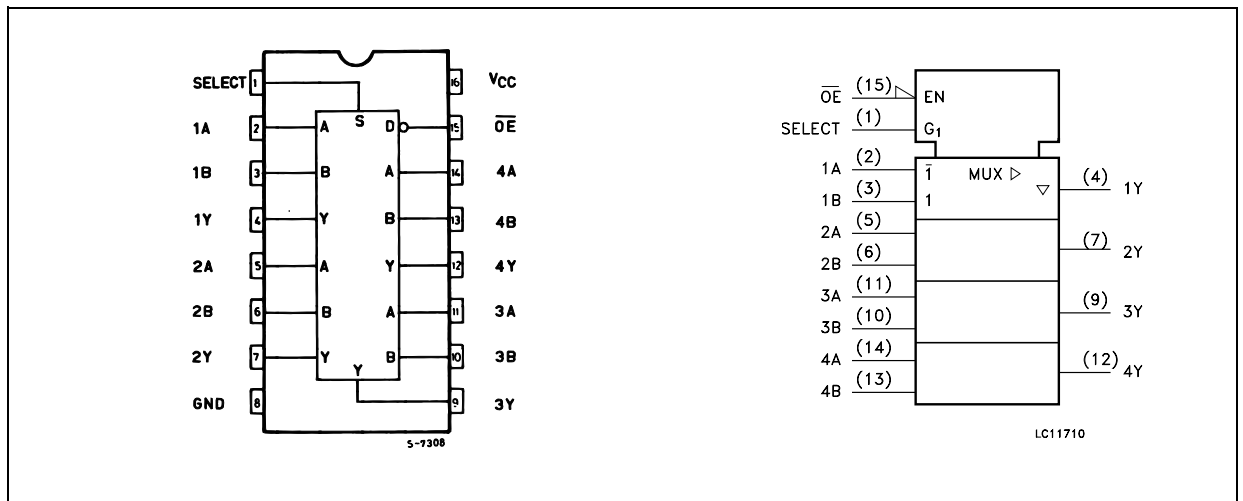


Figure 2: Input Equivalent Circuit

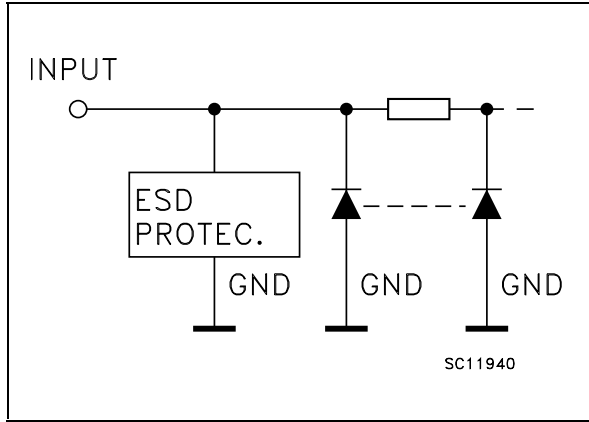


Table 2: Pin Description

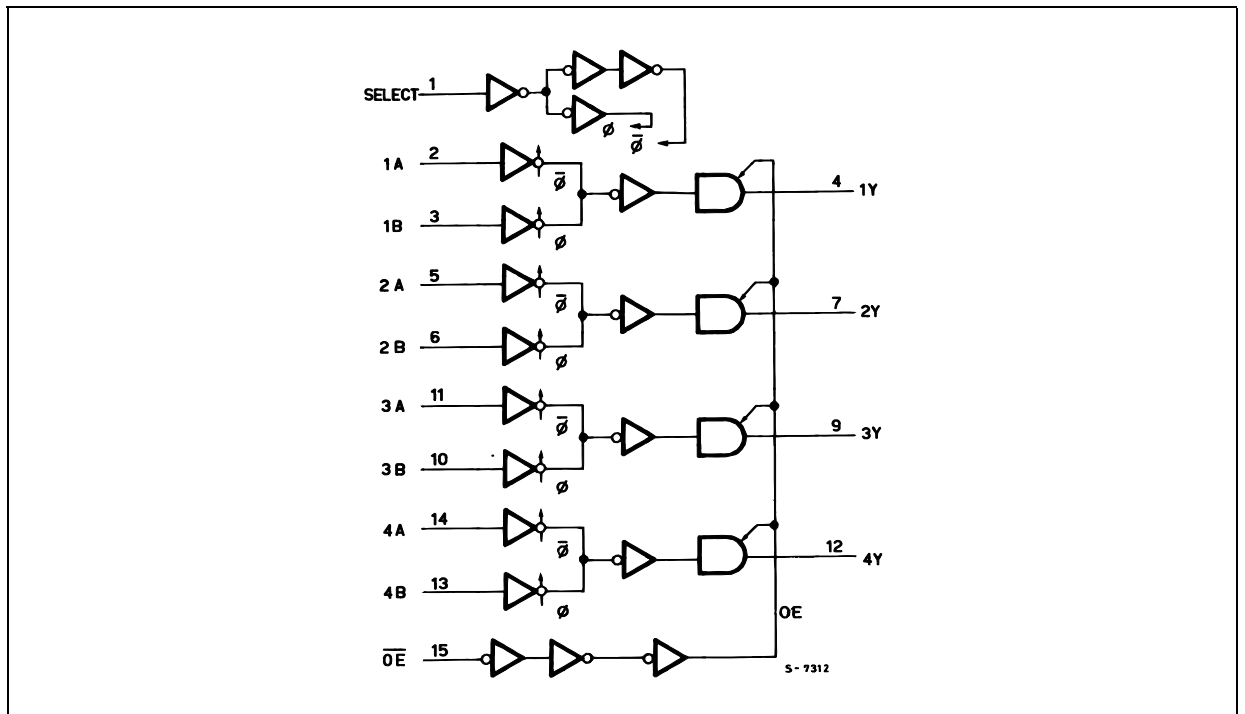
| PIN N° | SYMBOL | NAME AND FUNCTION |
|--------------|-----------------|-------------------------------------------|
| 1 | SELECT | Common Data Select Inputs |
| 2, 5, 11, 14 | 1A to 4A | Data Inputs From Source A |
| 3, 6, 10, 13 | 1B to 4B | Data Inputs From Source B |
| 4, 7, 9, 12 | 1Y to 4Y | 3 State Multiplexer Outputs |
| 15 | OE | 3 State Output Enable Inputs (Active LOW) |
| 8 | GND | Ground (0V) |
| 16 | V _{CC} | Positive Supply Voltage |

Table 3: Truth Table

| INPUTS | | | | OUTPUT |
|--------|--------|---|---|--------|
| OE | SELECT | A | B | Y |
| H | X | X | X | Z |
| L | L | L | X | L |
| L | L | H | X | H |
| L | H | X | L | L |
| L | H | X | H | H |

X: Don't Care
Z: High Impedance

Figure 3: Logic Diagram



This logic diagram has not been used to estimate propagation delays

Table 4: 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 (see note 1) | -0.5 to +7.0 | V |
| V_O | DC Output Voltage (see note 2) | -0.5 to $V_{CC} + 0.5$ | V |
| I_{IK} | DC Input Diode Current | - 20 | mA |
| I_{OK} | DC Output Diode Current | ± 20 | mA |
| I_O | DC Output Current | ± 25 | mA |
| I_{CC} or I_{GND} | DC V_{CC} or Ground Current | ± 50 | mA |
| T_{stg} | Storage Temperature | -65 to +150 | $^{\circ}\text{C}$ |
| T_L | Lead Temperature (10 sec) | 300 | $^{\circ}\text{C}$ |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

- 1) Output in OFF State
- 2) High or Low State

Table 5: Recommended Operating Conditions

| Symbol | Parameter | Value | Unit |
|----------|--------------------------------------------------------------------------|---------------|--------------------|
| V_{CC} | Supply Voltage | 4.5 to 5.5 | V |
| V_I | Input Voltage | 0 to 5.5 | V |
| V_O | Output Voltage (see note 1) | 0 to 5.5 | V |
| V_O | Output Voltage (see note 2) | 0 to V_{CC} | V |
| T_{op} | Operating Temperature | -55 to 125 | $^{\circ}\text{C}$ |
| dt/dv | Input Rise and Fall Time (see note 3) ($V_{CC} = 5.0 \pm 0.5\text{V}$) | 0 to 20 | ns/V |

- 1) Output in OFF State
- 2) High or Low State
- 3) V_{IN} from 0.8V to 2V

Table 6: DC Specifications

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|------------------|---------------------------------------|------------------------|------------------------------------------------------------------------------------|-----------------------|------|-------|-------------|-------|--------------|-------|------|
| | | V _{CC} (V) | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| V _{IH} | High Level Input Voltage | 4.5 to 5.5 | | 2 | | | 2 | | 2 | | V |
| V _{IL} | Low Level Input Voltage | 4.5 to 5.5 | | | | 0.8 | | 0.8 | | 0.8 | V |
| V _{OH} | High Level Output Voltage | 4.5 | I _O =-50 μA | 4.4 | 4.5 | | 4.4 | | 4.4 | | V |
| | | 4.5 | I _O =-8 mA | 3.94 | | | 3.8 | | 3.7 | | |
| V _{OL} | Low Level Output Voltage | 4.5 | I _O =50 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | I _O =8 mA | | | 0.36 | | 0.44 | | 0.55 | |
| I _{OZ} | High Impedance Output Leakage Current | 5.5 | V _I = V _{IH} or V _{IL} V _O = 0V to 5.5V | | | ±0.25 | | ± 2.5 | | ± 2.5 | μA |
| I _I | Input Leakage Current | 0 to 5.5 | V _I = 5.5V or GND | | | ± 0.1 | | ± 1.0 | | ± 1.0 | μA |
| I _{CC} | Quiescent Supply Current | 5.5 | V _I = V _{CC} or GND | | | 4 | | 40 | | 40 | μA |
| +I _{CC} | Additional Worst Case Supply Current | 5.5 | One Input at 3.4V, other input at V _{CC} or GND | | | 1.35 | | 1.5 | | 1.5 | mA |
| I _{OPD} | Output Leakage Current | 0 | V _{OUT} = 5.5V | | | 0.5 | | 5.0 | | 5.0 | μA |

Table 7: AC Electrical Characteristics (Input t_r = t_f = 3ns)

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|--------------------------------------|------------------------------------|----------------------------|------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
| | | V _{CC} (*) (V) | C _L (pF) | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t _{PLH} t _{PHL} | Propagation Delay Time A, B, to Y | 5.0 | 15 | | 4.8 | 7.0 | 1.0 | 8.0 | 1.0 | 8.0 | ns |
| | | 5.0 | 50 | | 5.5 | 8.0 | 1.0 | 9.0 | 1.0 | 9.0 | |
| t _{PLH} t _{PHL} | Propagation Delay Time SELECT to Y | 5.0 | 15 | | 6.0 | 6.8 | 1.0 | 8.0 | 1.0 | 8.0 | ns |
| | | 5.0 | 50 | | 7.0 | 8.8 | 1.0 | 10.0 | 1.0 | 10.0 | |
| t _{PZL} t _{PZH} | Output Enable Time | 5.0 | 15 | | 5.8 | 6.8 | 1.0 | 8.0 | 1.0 | 8.0 | ns |
| | | 5.0 | 50 | | 6.5 | 8.8 | 1.0 | 10.0 | 1.0 | 10.0 | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 5.0 | 50 | | 5.7 | 7.9 | 1.0 | 9.0 | 1.0 | 9.0 | ns |

(*) Voltage range is 5.0V ± 0.5V

Table 8: Capacitive Characteristics

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|------------------|----------------------------------------|----------------|----|-----------------------|------|------|-------------|------|--------------|------|------|
| | | | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| C _{IN} | Input Capacitance | | 4 | 10 | | 10 | | 10 | pF | | |
| C _{OUT} | Output Capacitance | | 6 | | | | | | pF | | |
| C _{PD} | Power Dissipation Capacitance (note 1) | | 23 | | | | | | 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. $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per Channel)

Table 9: Dynamic Switching Characteristics

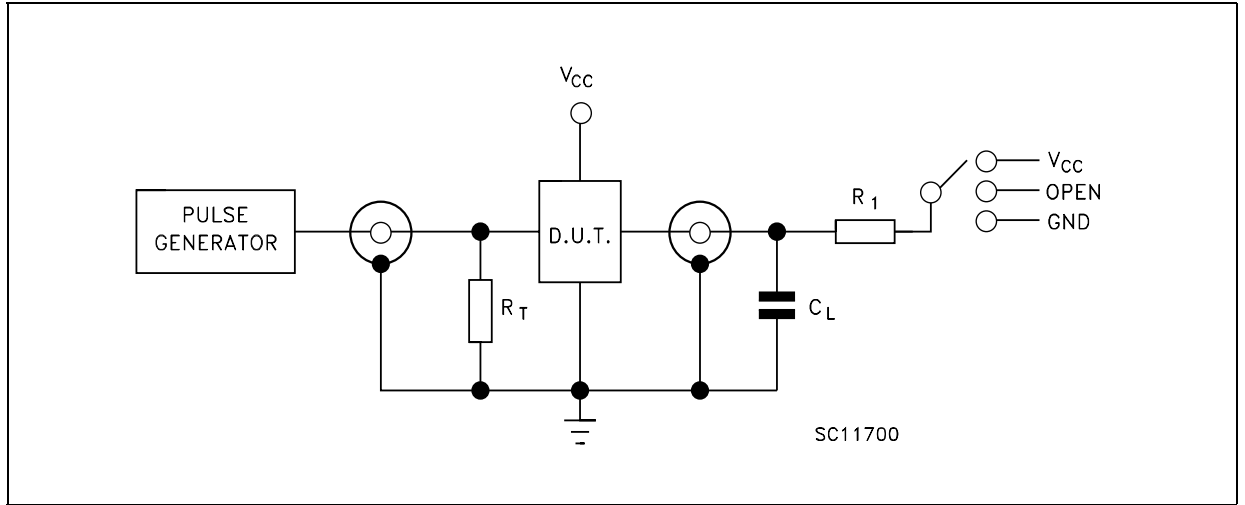
| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | | |
|------------------|----------------------------------------------|----------------|------------------------|---------------------|-----------------------|------|------|-------------|------|------|--------------|------|
| | | | | V _{CC} (V) | T _A = 25°C | | | -40 to 85°C | | | -55 to 125°C | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | | Min. | Max. |
| V _{OLP} | Dynamic Low Voltage Quiet Output (note 1, 2) | 5.0 | C _L = 50 pF | | 0.3 | 0.8 | | | | | V | |
| V _{OLV} | | | | -0.8 | -0.3 | | | | | | | |
| V _{IHD} | Dynamic High Voltage Input (note 1, 3) | | | 2.0 | | | | | | | | |
| V _{ILD} | Dynamic Low Voltage Input (note 1, 3) | | | | | 0.8 | | | | | | |

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.0V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f=1MHz.

Figure 4: Test Circuit



| TEST | SWITCH |
|--------------------|----------|
| t_{PLH}, t_{PHL} | Open |
| t_{PZL}, t_{PLZ} | V_{CC} |
| t_{PZH}, t_{PHZ} | GND |

$C_L = 15/50\text{pF}$ or equivalent (includes jig and probe capacitance)

$R_L = R_1 = 1\text{K}\Omega$ or equivalent

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

Figure 5: Waveform - Propagation Delays For Inverting Conditions ($f=1\text{MHz}; 50\%$ duty cycle)

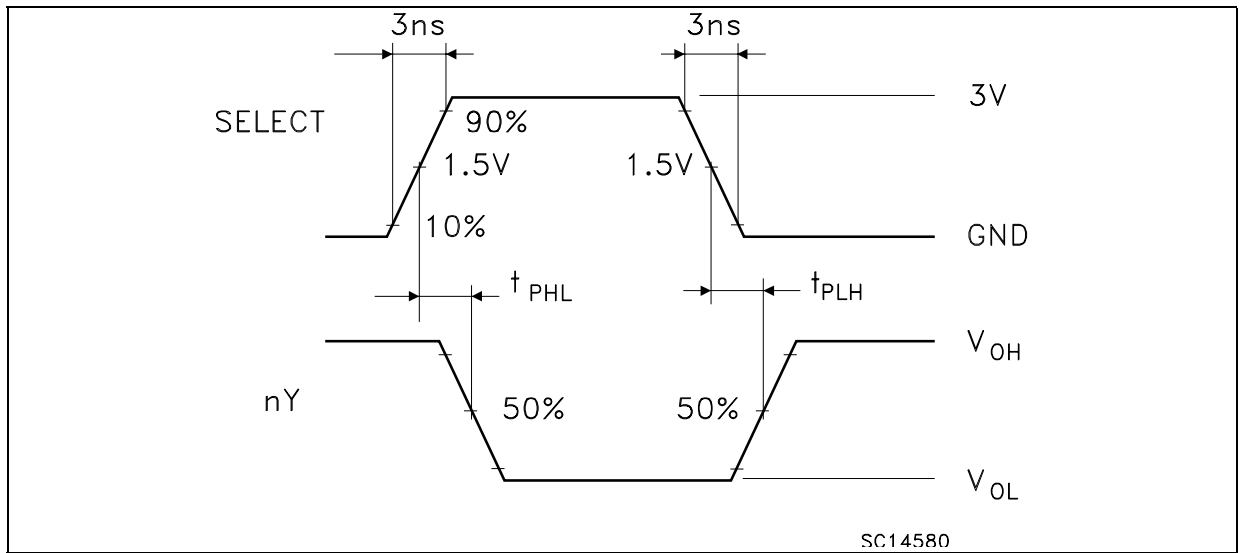


Figure 6: Waveform - Propagation Delays For Non-inverting Conditions (f=1MHz; 50% duty cycle)

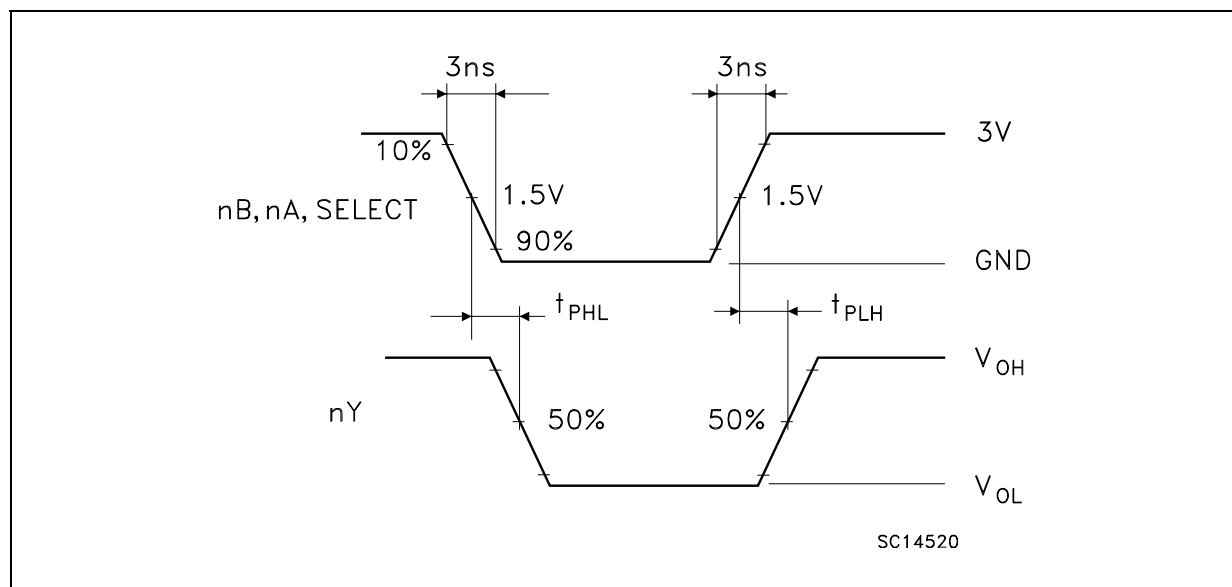
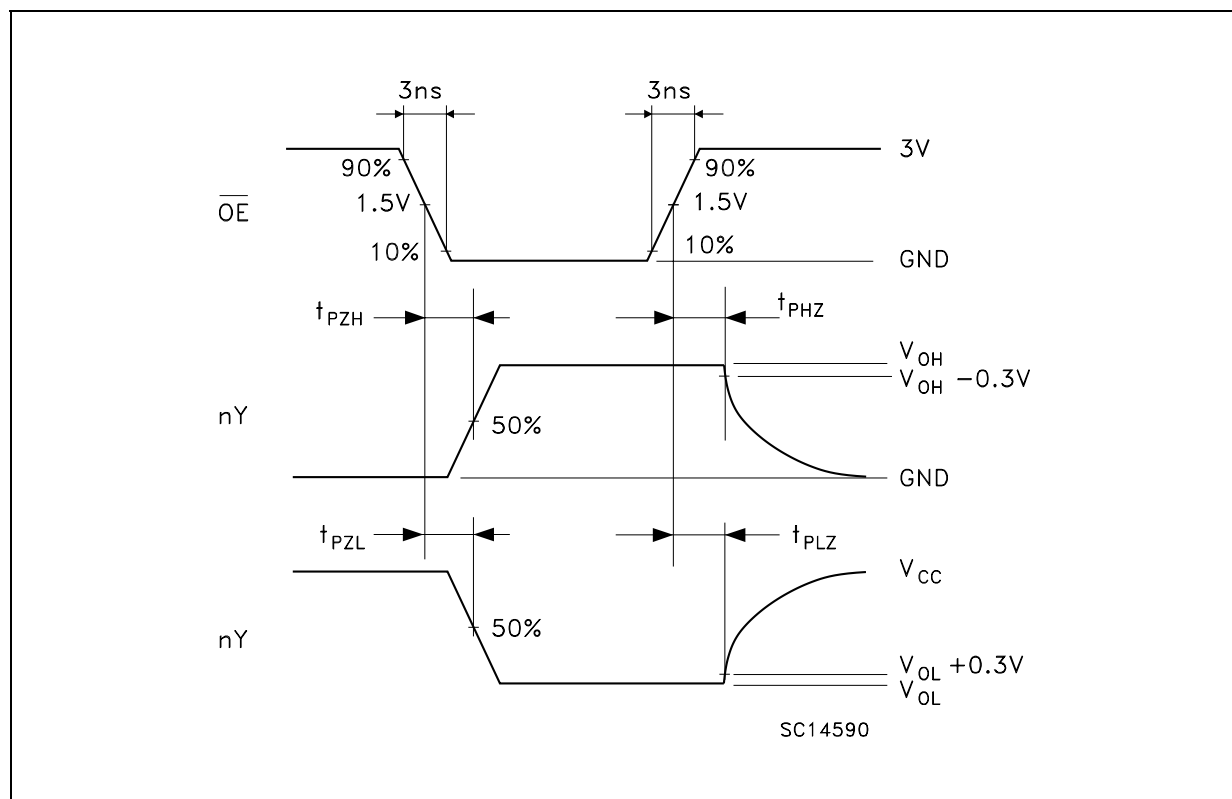
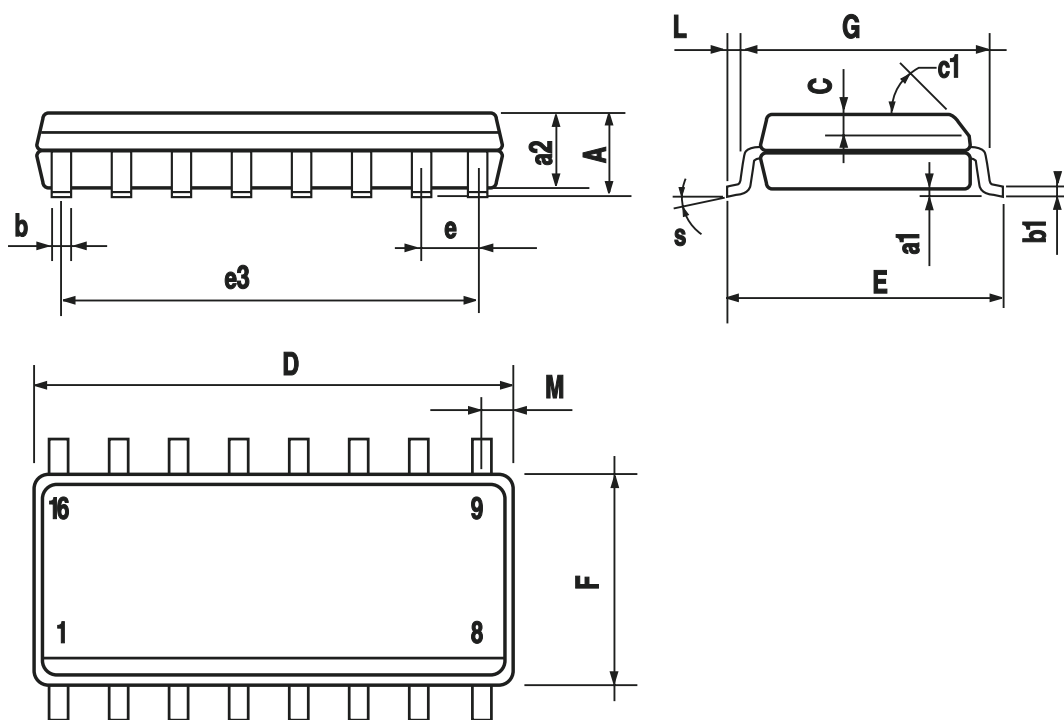


Figure 7: Waveform - Output Enable And Disable Time (f=1MHz; 50% duty cycle)



SO-16 MECHANICAL DATA

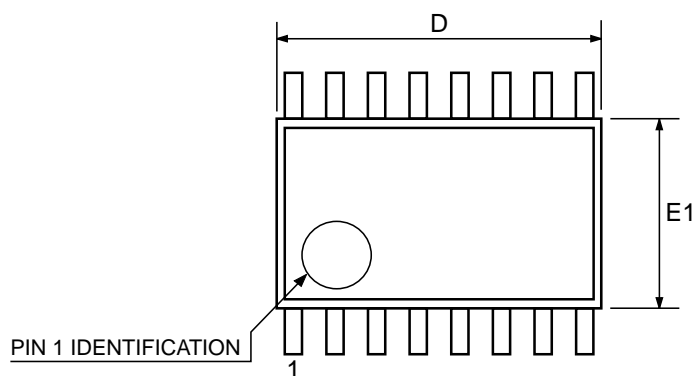
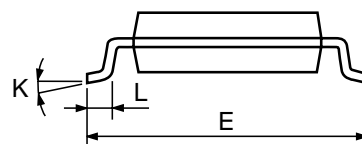
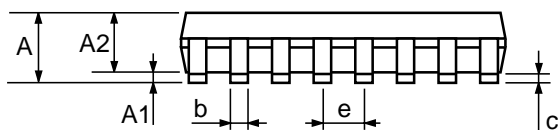
| DIM. | mm. | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.64 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



0016020D

TSSOP16 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|----------|------|-------|------------|--------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.2 | | | 0.047 |
| A1 | 0.05 | | 0.15 | 0.002 | 0.004 | 0.006 |
| A2 | 0.8 | 1 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 |
| c | 0.09 | | 0.20 | 0.004 | | 0.0079 |
| D | 4.9 | 5 | 5.1 | 0.193 | 0.197 | 0.201 |
| E | 6.2 | 6.4 | 6.6 | 0.244 | 0.252 | 0.260 |
| E1 | 4.3 | 4.4 | 4.48 | 0.169 | 0.173 | 0.176 |
| e | | 0.65 BSC | | | 0.0256 BSC | |
| K | 0° | | 8° | 0° | | 8° |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |



0080338D

Tape & Reel SO-16 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 | | | 22.4 | | | 0.882 |
| Ao | 6.45 | | 6.65 | 0.254 | | 0.262 |
| Bo | 10.3 | | 10.5 | 0.406 | | 0.414 |
| Ko | 2.1 | | 2.3 | 0.082 | | 0.090 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |



Tape & Reel TSSOP16 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 | | | 22.4 | | | 0.882 |
| Ao | 6.7 | | 6.9 | 0.264 | | 0.272 |
| Bo | 5.3 | | 5.5 | 0.209 | | 0.217 |
| Ko | 1.6 | | 1.8 | 0.063 | | 0.071 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |



Table 10: Revision History

| Date | Revision | Description of Changes |
|-------------|-----------------|--------------------------------|
| 16-Dec-2004 | 3 | Order Codes Revision - pag. 1. |

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