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MC74VHCT259A

8-Bit Addressable Latch/1-of-8 Decoder CMOS Logic Level Shifter

with LSTTL-Compatible Inputs

The MC74VHCT259 is an 8-bit Addressable Latch fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output.

The VHCT259 is designed for general purpose storage applications in digital systems. The device has four modes of operation as shown in the mode selection table. In the addressable latch mode, the signal on Data In is written into the addressed latch. The addressed latch follows the data input with all non-addressed latches remaining in their previous states. In the memory mode, all latches remain in their previous state and are unaffected by the Data or Address inputs. In the one-of-eight decoding or demultiplexing mode, the addressed output follows the state of Data In with all other outputs in the LOW state. In the Reset mode, all outputs are LOW and unaffected by the address and data inputs. When operating the VHCT259 as an addressable latch, changing more than one bit of the address could impose a transient wrong address. Therefore, this should only be done while in the memory mode.

The VHCT inputs are compatible with TTL levels. This device can be used as a level converter for interfacing 3.3 V to 5.0 V because it has full 5.0 V CMOS level output swings.

The VHCT259A input structures provide protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. The output structures also provide protection when $V_{CC} = 0$ V. These input and output structures help prevent device destruction caused by supply voltage-input/output voltage mismatch, battery backup, hot insertion, etc.

Features

- High Speed: $t_{PD} = 7.6$ ns (Typ) at $V_{CC} = 5.0$ V
- Low Power Dissipation: $I_{CC} = 2$ μ A (Max) at $T_A = 25^\circ$ C
- TTL-Compatible Inputs: $V_{IL} = 0.8$ V; $V_{IH} = 2.0$ V
- Power Down Protection Provided on Inputs and Outputs
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V
- Pb-Free Packages are Available*

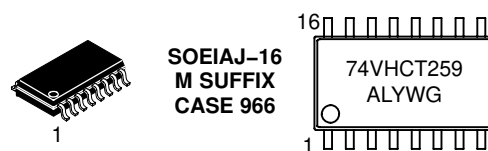
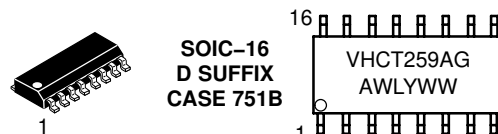
*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

<http://onsemi.com>

MARKING DIAGRAMS



A = Assembly Location
WL, L = Wafer Lot
Y = Year
WW, W = Work Week
G or ■ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

MC74VHCT259A

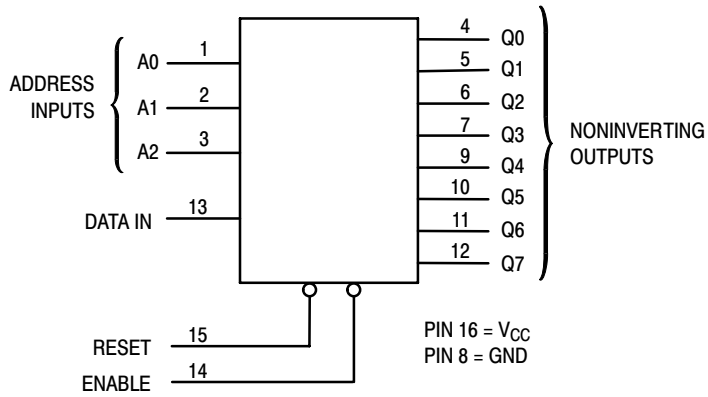


Figure 1. Logic Diagram

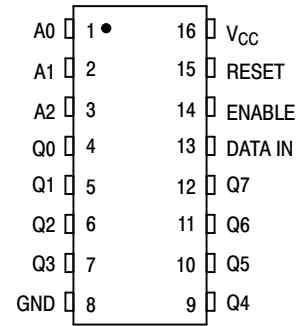


Figure 2. Pin Assignment

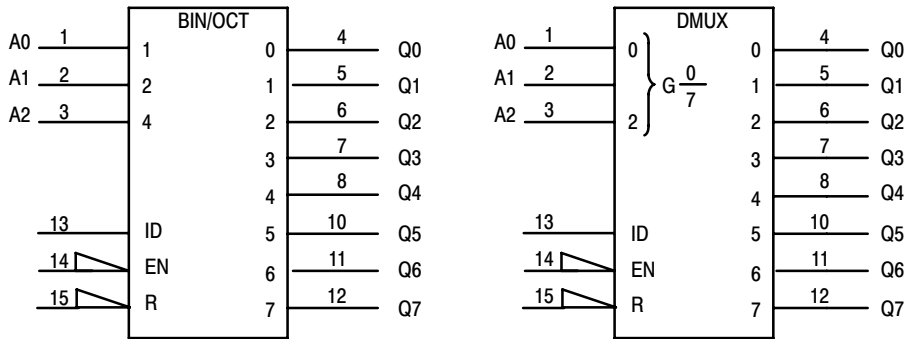


Figure 3. IEC Logic Symbol

MODE SELECTION TABLE

| Enable | Reset | Mode |
|--------|-------|----------------------|
| L | H | Addressable Latch |
| H | H | Memory |
| L | L | 8-Line Demultiplexer |
| H | L | Reset |

LATCH SELECTION TABLE

| Address Inputs | | | Latch Addressed |
|----------------|---|---|-----------------|
| C | B | A | |
| L | L | L | Q0 |
| L | L | H | Q1 |
| L | H | L | Q2 |
| L | H | H | Q3 |
| H | L | L | Q4 |
| H | L | H | Q5 |
| H | H | L | Q6 |
| H | H | H | Q7 |

MC74VHCT259A

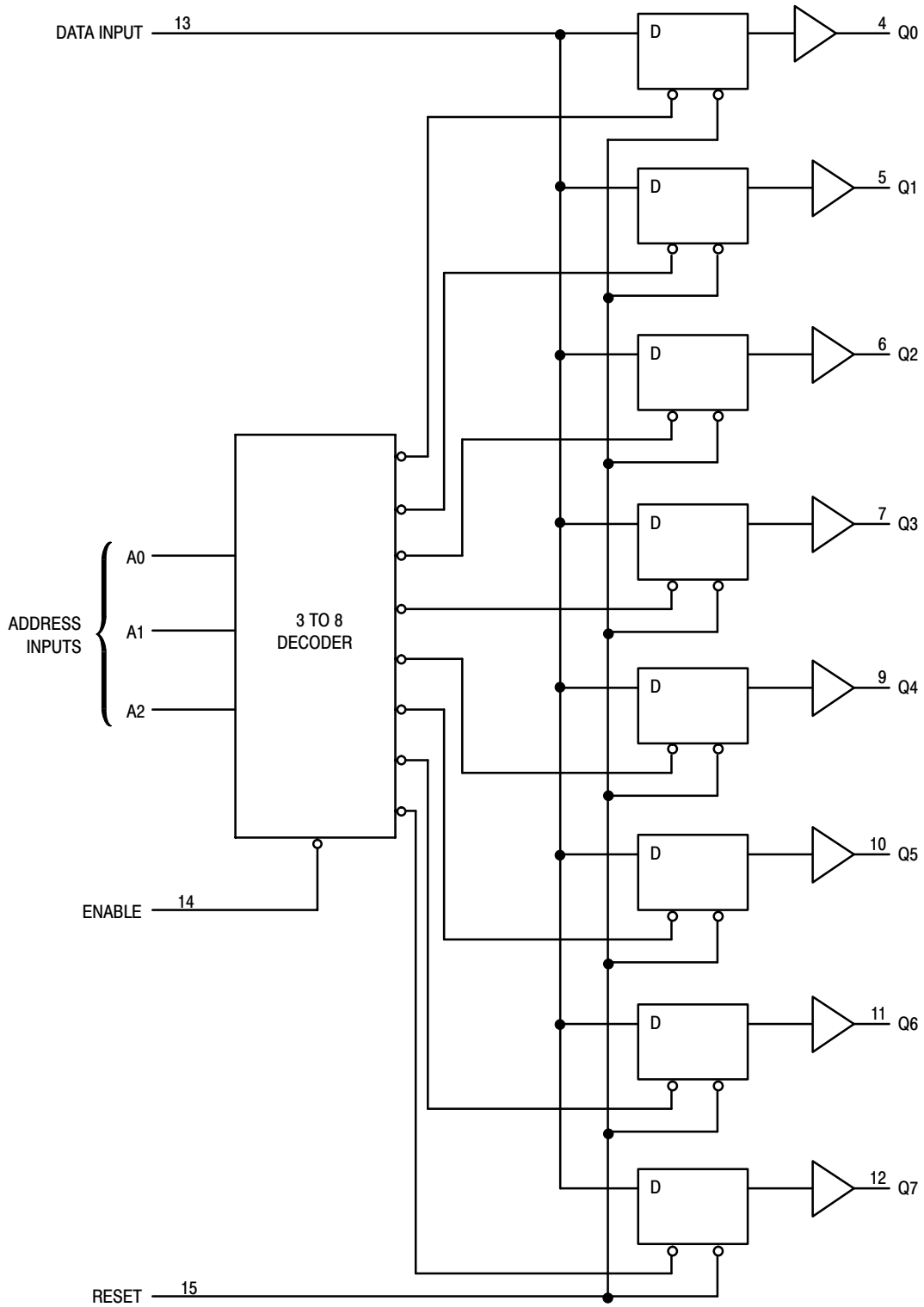


Figure 4. Expanded Logic Diagram

MC74VHCT259A

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------------|---|--|--|
| V _{CC} | Positive DC Supply Voltage | -0.5 to +7.0 | V |
| V _{IN} | Digital Input Voltage | -0.5 to +7.0 | V |
| V _{OUT} | DC Output Voltage | Output in 3-State High or Low State | -0.5 to +7.0 -0.5 to V _{CC} +0.5 |
| I _{IK} | Input Diode Current | -20 | mA |
| I _{OK} | Output Diode Current | ±20 | mA |
| I _{OUT} | DC Output Current, per Pin | ±25 | mA |
| I _{CC} | DC Supply Current, V _{CC} and GND Pins | ±75 | mA |
| P _D | Power Dissipation in Still Air | SOIC Package TSSOP | 200 180 |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |
| V _{ESD} | ESD Withstand Voltage | Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3) | >2000 >200 >2000 |
| I _{LATCHUP} | Latchup Performance | Above V _{CC} and Below GND at 125°C (Note 4) | ±300 |
| θ _{JA} | Thermal Resistance, Junction-to-Ambient | SOIC Package TSSOP | 143 164 |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Tested to EIA/JESD22-A114-A
2. Tested to EIA/JESD22-A115-A
3. Tested to JESD22-C101-A
4. Tested to EIA/JESD78

RECOMMENDED OPERATING CONDITIONS

| Symbol | Characteristics | Min | Max | Unit |
|---------------------------------|--|--|-----------------------------|------|
| V _{CC} | DC Supply Voltage | 4.5 | 5.5 | V |
| V _{IN} | DC Input Voltage | 0 | 5.5 | V |
| V _{OUT} | DC Output Voltage | Output in 3-State High or Low State | 0 5.5 V _{CC} | V |
| T _A | Operating Temperature Range, all Package Types | -55 | 125 | °C |
| t _r , t _f | Input Rise or Fall Time | V _{CC} = 5.0 V ± 0.5 V | 0 | 20 |

DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

| Junction Temperature °C | Time, Hours | Time, Years |
|-------------------------|-------------|-------------|
| 80 | 1,032,200 | 117.8 |
| 90 | 419,300 | 47.9 |
| 100 | 178,700 | 20.4 |
| 110 | 79,600 | 9.4 |
| 120 | 37,000 | 4.2 |
| 130 | 17,800 | 2.0 |
| 140 | 8,900 | 1.0 |

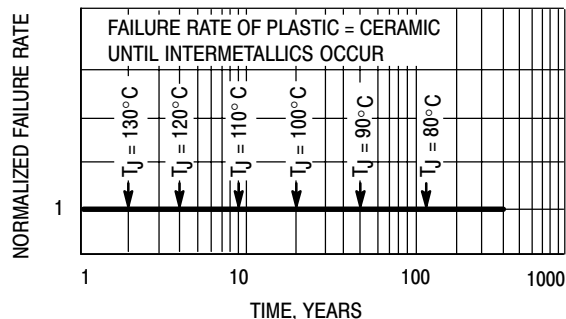


Figure 5. Failure Rate vs. Time Junction Temperature

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DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | T _A ≤ 85°C | | -55°C ≤ T _A ≤ 125°C | | Unit |
|------------------|---|--|------------------------|-----------------------|-----|------|-----------------------|------|--------------------------------|------|------|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| V _{IH} | Minimum High-Level Input Voltage | | 4.5 to 5.5 | 2 | | | 2 | | 2 | | V |
| V _{IL} | Maximum Low-Level Input Voltage | | 4.5 to 5.5 | | | 0.8 | | 0.8 | | 0.8 | V |
| V _{OH} | Maximum High-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} I _{OH} = -50 μA | 4.5 | 4.4 | 4.5 | | 4.4 | | 4.4 | | V |
| | | V _{IN} = V _{IH} or V _{IL} I _{OH} = -8 mA | 4.5 | 3.94 | | | 3.8 | | 3.66 | | V |
| V _{OL} | Maximum Low-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 μA | 4.5 | | 0 | 0.1 | | 0.1 | | 0.1 | V |
| | | V _{IN} = V _{IH} or V _{IL} I _{OH} = 8 mA | 4.5 | | | 0.36 | | 0.44 | | 0.52 | V |
| I _{IN} | Input Leakage Current | V _{IN} = 5.5 V or GND | 0 to 5.5 | | | ±0.1 | | ±1.0 | | ±1.0 | μA |
| I _{CC} | Maximum Quiescent Supply Current | V _{IN} = V _{CC} or GND | 5.5 | | | 4.0 | | 40.0 | | 40.0 | μA |
| I _{CCT} | Additional Quiescent Supply Current (per Pin) | Any one input: V _{IN} = 3.4 V All other inputs: V _{IN} = V _{CC} or GND | 5.5 | | | 1.35 | | 1.5 | | 1.5 | μA |
| I _{OPD} | Output Leakage Current | V _{OUT} = 5.5 V | 0 | | | 0.5 | | 5 | | 5 | μA |

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3.0ns)

| Symbol | Parameter | Test Conditions | T _A = 25°C | | | T _A ≤ 85°C | | -55°C ≤ T _A ≤ 125°C | | Unit |
|--|--|---|-----------------------|------------|--------------|-----------------------|--------------|--------------------------------|--------------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, Data to Output (Figures 6 and 11) | V _{CC} = 3.3 ± 0.3V C _L = 15pF C _L = 50pF | | 8.5 8.5 | 11.0 16.0 | 1.0 1.0 | 13.0 18.0 | 1.0 1.0 | 13.0 18.0 | ns |
| | | V _{CC} = 5.0 ± 0.5V C _L = 15pF C _L = 50pF | | 6.0 6.0 | 8.0 10.0 | 1.0 1.0 | 9.5 11.5 | 1.0 1.0 | 9.5 11.5 | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, Address Select to Output (Figures 7 and 11) | V _{CC} = 3.3 ± 0.3V C _L = 15pF C _L = 50pF | | 8.5 8.5 | 11.0 16.0 | 1.0 1.0 | 13.0 18.0 | 1.0 1.0 | 13.0 18.0 | ns |
| | | V _{CC} = 5.0 ± 0.5V C _L = 15pF C _L = 50pF | | 6.0 8.5 | 8.0 10.0 | 1.0 1.0 | 9.5 11.5 | 1.0 1.0 | 9.5 11.5 | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, Enable to Output (Figures 8 and 11) | V _{CC} = 3.3 ± 0.3V C _L = 15pF C _L = 50pF | | 8.5 8.5 | 11.0 16.0 | 1.0 1.0 | 13.0 18.0 | 1.0 1.0 | 13.0 18.0 | ns |
| | | V _{CC} = 5.0 ± 0.5V C _L = 15pF C _L = 50pF | | 6.0 8.5 | 8.0 10.0 | 1.0 1.0 | 9.5 11.5 | 1.0 1.0 | 9.5 11.5 | |
| t _{PHL} | Maximum Propagation Delay, Reset to Output (Figures 9 and 11) | V _{CC} = 3.3 ± 0.3V C _L = 15pF C _L = 50pF | | 8.5 8.5 | 11.0 16.0 | 1.0 1.0 | 13.0 18.0 | 1.0 1.0 | 13.0 18.0 | ns |
| | | V _{CC} = 5.0 ± 0.5V C _L = 15pF C _L = 50pF | | 6.0 8.5 | 8.0 10.0 | 1.0 1.0 | 9.5 11.5 | 1.0 1.0 | 9.5 11.5 | |
| C _{IN} | Maximum Input Capacitance | | | 6 | 10 | | 10 | | 10 | pF |

| | | | | | | | | | | |
|-----------------|--|--|--|--|--|--|--|--|--|----|
| C _{PD} | Power Dissipation Capacitance (Note 5) | Typical @ 25°C, V _{CC} = 5.0V | | | | | | | | pF |
| | | 30 | | | | | | | | |

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

MC74VHCT259A

TIMING REQUIREMENTS (Input $t_r = t_f = 3.0\text{ns}$)

| Symbol | Parameter | Test Conditions | $T_A = 25^\circ\text{C}$ | | | $T_A = \leq 85^\circ\text{C}$ | | $T_A = \leq 125^\circ\text{C}$ | | Unit |
|------------|---|--------------------------------|--------------------------|-----|-----|-------------------------------|-----|--------------------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t_w | Minimum Pulse Width, Reset or Enable (Figure 10) | $V_{CC} = 3.3 \pm 0.3\text{V}$ | 5.0 | | | 5.5 | | 5.5 | | ns |
| | | $V_{CC} = 5.0 \pm 0.5\text{V}$ | 5.0 | | | 5.5 | | 5.5 | | |
| t_{su} | Minimum Setup Time, Address or Data to Enable (Figure 10) | $V_{CC} = 3.3 \pm 0.3\text{V}$ | 4.5 | | | 4.5 | | 4.5 | | ns |
| | | $V_{CC} = 5.0 \pm 0.5\text{V}$ | 3.0 | | | 3.0 | | 3.0 | | |
| t_h | Minimum Hold Time, Enable to Address or Data (Figure 8 or 9) | $V_{CC} = 3.3 \pm 0.3\text{V}$ | 2.0 | | | 2.0 | | 2.0 | | ns |
| | | $V_{CC} = 5.0 \pm 0.5\text{V}$ | 2.0 | | | 2.0 | | 2.0 | | |
| t_r, t_f | Maximum Input, Rise and Fall Times (Figure 6) | $V_{CC} = 3.3 \pm 0.3\text{V}$ | | | 400 | | 300 | | 300 | ns |
| | | $V_{CC} = 5.0 \pm 0.5\text{V}$ | | | 200 | | 100 | | 100 | |

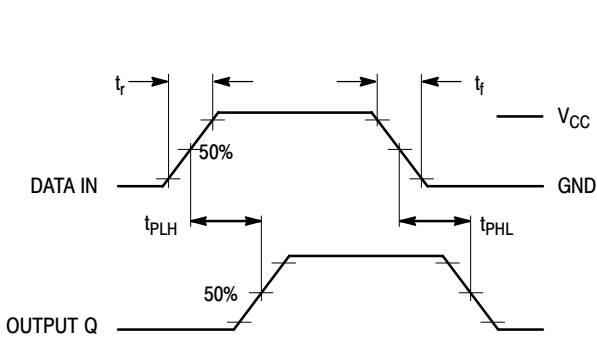


Figure 6. Switching Waveform

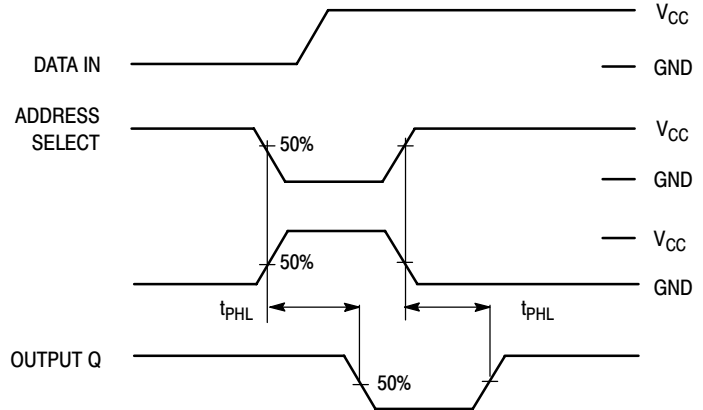


Figure 7. Switching Waveform

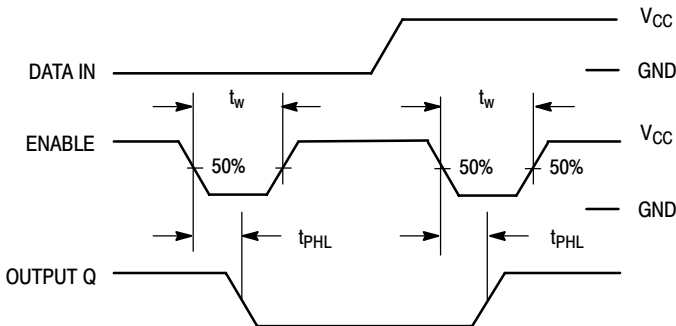


Figure 8. Switching Waveform

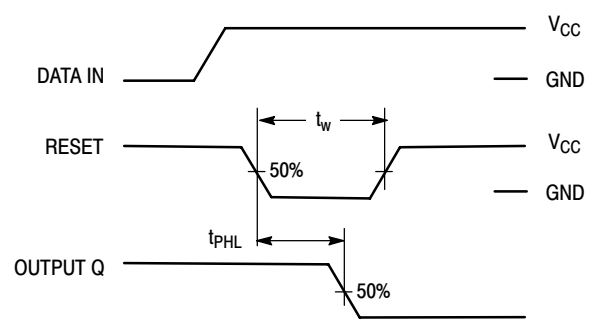


Figure 9. Switching Waveform

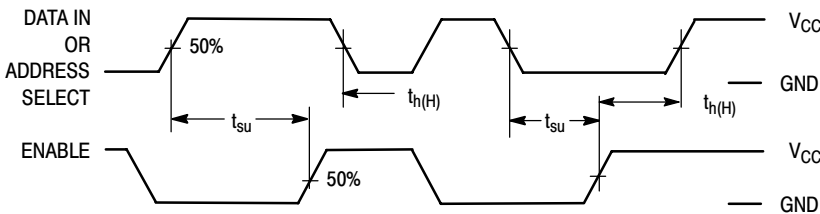
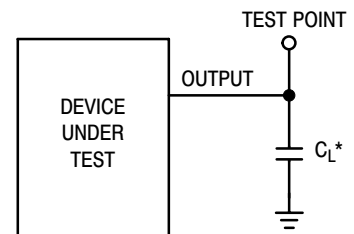


Figure 10. Switching Waveform



*Includes all probe and jig capacitance

Figure 11. Test Circuit

MC74VHCT259A

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------------|------------------------|------------------|
| MC74VHCT259AD | SOIC-16 | 48 Units / Rail |
| MC74VHCT259ADG | SOIC-16 (Pb-Free) | 48 Units / Rail |
| MC74VHCT259ADR2 | SOIC-16 | 2500 Tape & Reel |
| MC74VHCT259ADR2G | SOIC-16 (Pb-Free) | 2500 Tape & Reel |
| MC74VHCT259ADT | TSSOP-16* | 96 Units / Rail |
| MC74VHCT259ADTG | TSSOP-16* | 96 Units / Rail |
| MC74VHCT259ADTR2 | TSSOP-16* | 2500 Tape & Reel |
| MC74VHCT259ADTRG | TSSOP-16* | 2500 Tape & Reel |
| MC74VHCT259AM | SOEIAJ-16 | 50 Units / Rail |
| MC74VHCT259AMG | SOEIAJ-16 (Pb-Free) | 50 Units / Rail |
| MC74VHCT259AMEL | SOEIAJ-16 | 2000 Tape & Reel |
| MC74VHCT259AMELG | SOEIAJ-16 (Pb-Free) | 2000 Tape & Reel |

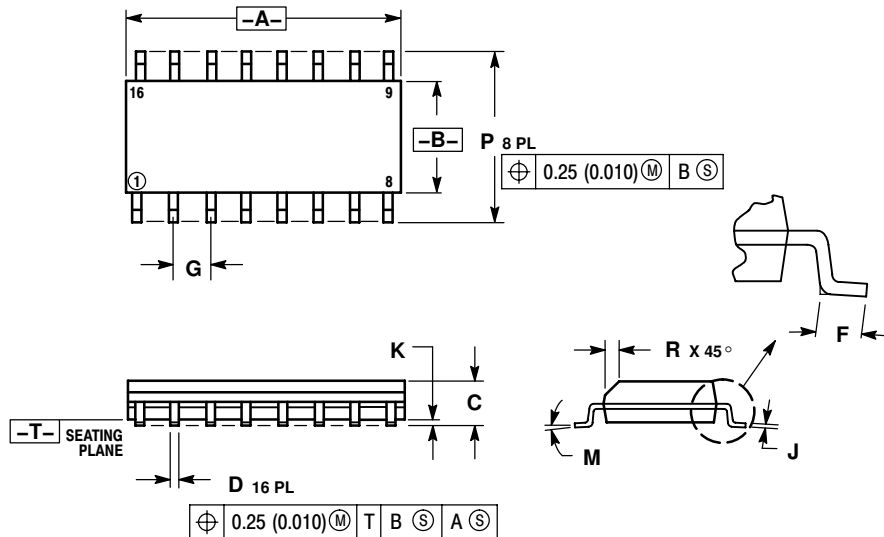
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*This package is inherently Pb-Free.

MC74VHCT259A

PACKAGE DIMENSIONS

SOIC-16
D SUFFIX
CASE 751B-05
ISSUE J

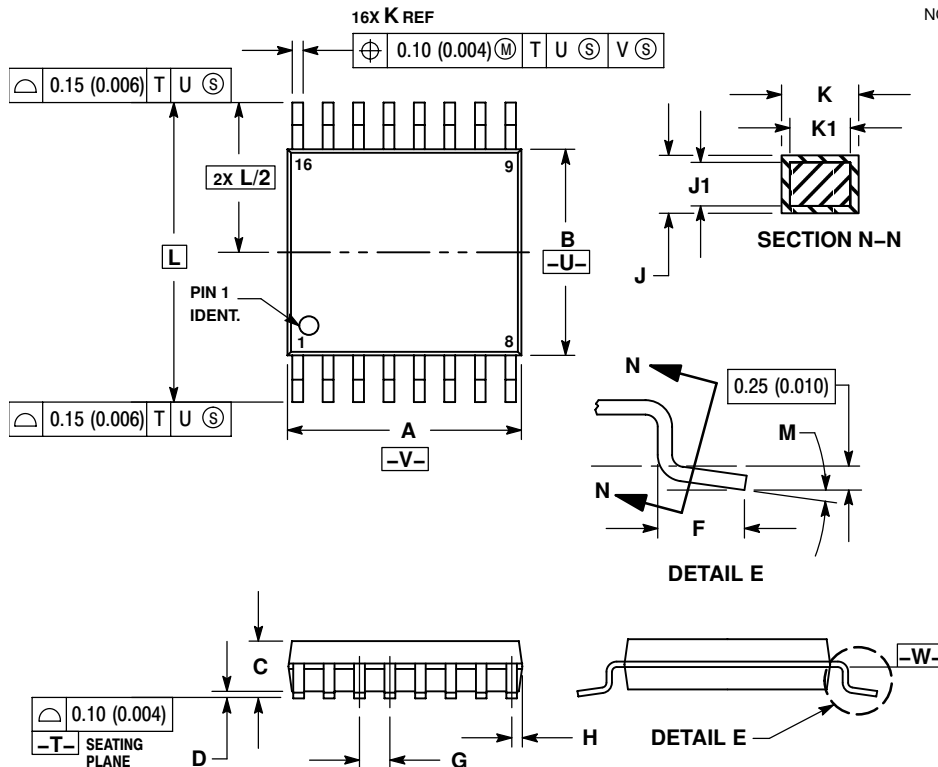


NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

TSSOP-16
DT SUFFIX
CASE 948F-01
ISSUE A



NOTES:

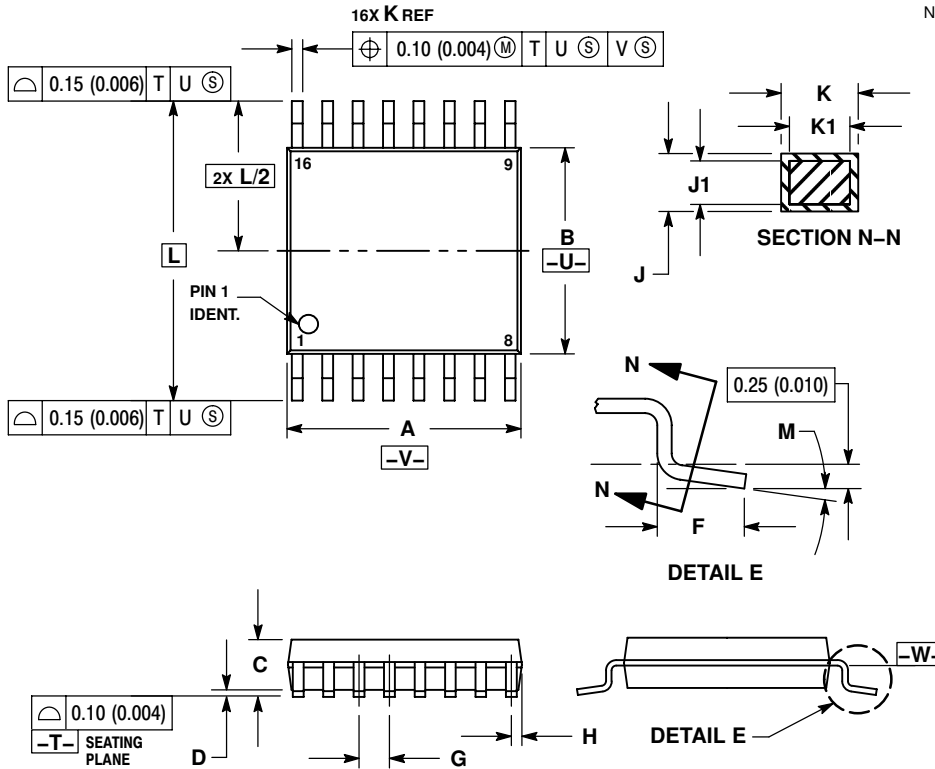
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.10 | 0.193 | 0.200 |
| B | 4.30 | 4.50 | 0.169 | 0.177 |
| C | --- | 1.20 | --- | 0.047 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.65 BSC | | 0.026 BSC | |
| H | 0.18 | 0.28 | 0.007 | 0.011 |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.19 | 0.30 | 0.007 | 0.012 |
| K1 | 0.19 | 0.25 | 0.007 | 0.010 |
| L | 6.40 BSC | | 0.252 BSC | |
| M | 0° | 8° | 0° | 8° |

MC74VHCT259A

PACKAGE DIMENSIONS

SOEIAJ-16
M SUFFIX
CASE 966-01
ISSUE A



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.10 | 0.193 | 0.200 |
| B | 4.30 | 4.50 | 0.169 | 0.177 |
| C | — | 1.20 | — | 0.047 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.65 BSC | | 0.026 BSC | |
| H | 0.18 | 0.28 | 0.007 | 0.011 |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.19 | 0.30 | 0.007 | 0.012 |
| K1 | 0.19 | 0.25 | 0.007 | 0.010 |
| L | 6.40 BSC | | 0.252 BSC | |
| M | 0° | 8° | 0° | 8° |

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