

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

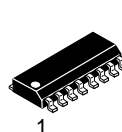
- High Speed: $t_{PD} = 7.6$ ns (Typ) at $V_{CC} = 5.0$ V
- Low Power Dissipation: $I_{CC} = 2$ μ A (Max) at $T_A = 25^\circ$ C
- TTL-Compatible Inputs: $V_{IL} = 0.8$ V; $V_{IH} = 2.0$ V
- Power Down Protection Provided on Inputs and Outputs
- Pin and Function Compatible with Other Standard Logic Families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



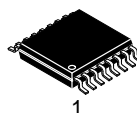
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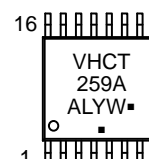
MARKING DIAGRAMS



SOIC-16
D SUFFIX
CASE 751B



TSSOP-16
DT SUFFIX
CASE 948F



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

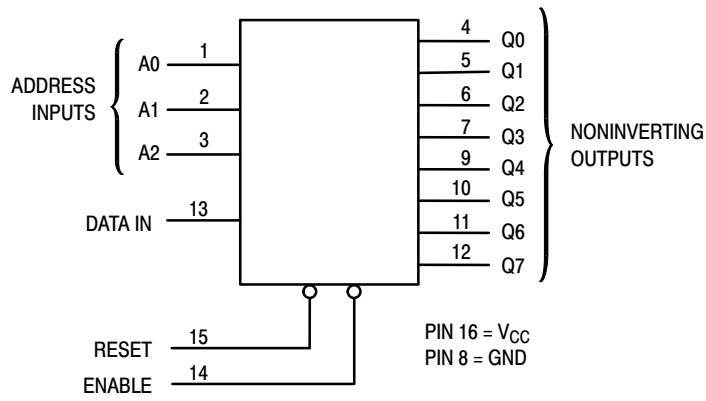


Figure 1. Logic Diagram

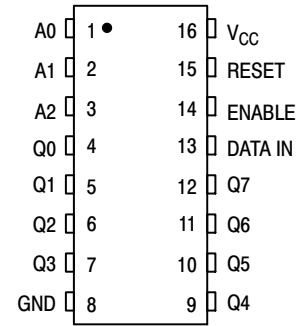


Figure 2. Pin Assignment

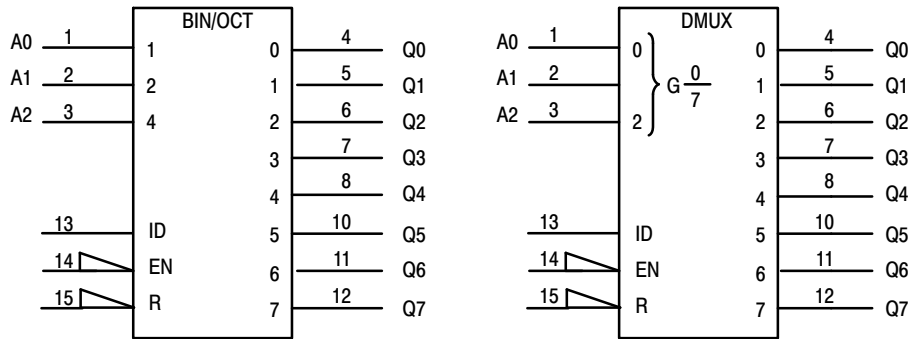


Figure 3. IEC Logic Symbol

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

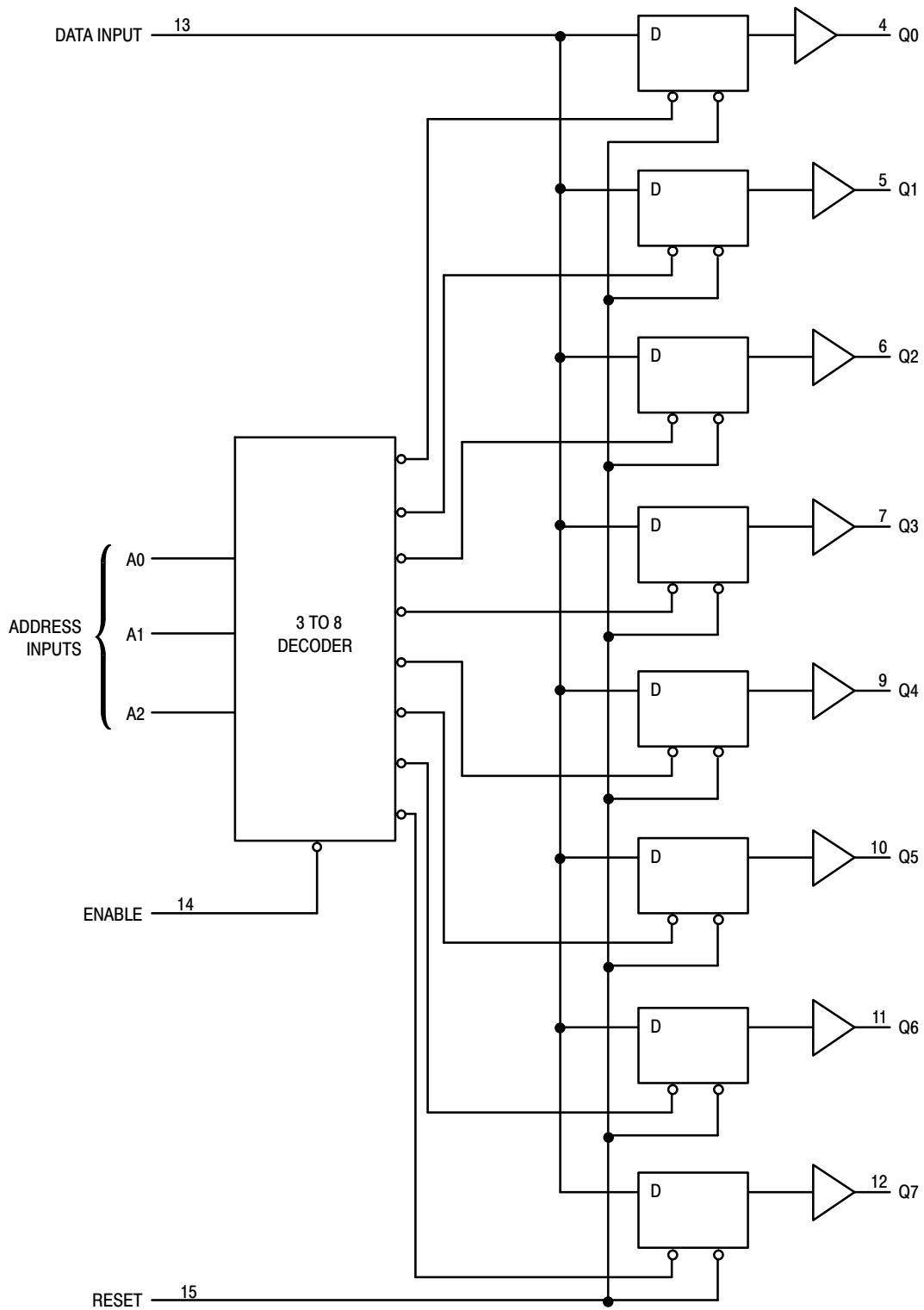


Figure 4. Expanded Logic Diagram

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 $V_{CC} + 0.5$ | V |
| 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 TSSOP | 200 180 | mW |
| T_{STG} | Storage Temperature Range | -65 to +150 | $^{\circ}C$ |
| V_{ESD} | ESD Withstand Voltage Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3) | >2000 >200 >2000 | V |
| $I_{LATCHUP}$ | Latchup Performance Above V_{CC} and Below GND at 125 $^{\circ}C$ (Note 4) | ± 300 | mA |
| θ_{JA} | Thermal Resistance, Junction-to-Ambient SOIC TSSOP | 143 164 | $^{\circ}C/W$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, 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 0 | 5.5 V_{CC} | V |
| T_A | Operating Temperature Range, all Package Types | -55 | 125 | $^{\circ}C$ |
| t_r, t_f | Input Rise or Fall Time $V_{CC} = 5.0 V \pm 0.5 V$ | 0 | 20 | ns/V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

| Junction Temperature $^{\circ}C$ | 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 |

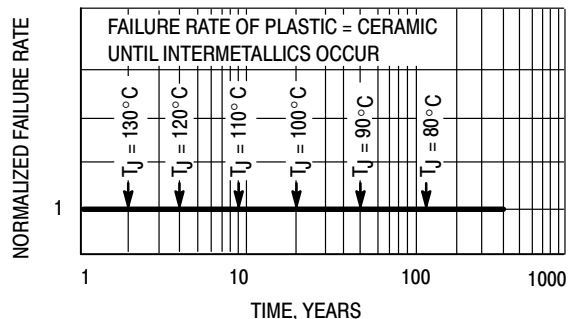


Figure 5. Failure Rate vs. Time Junction Temperature

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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 | |

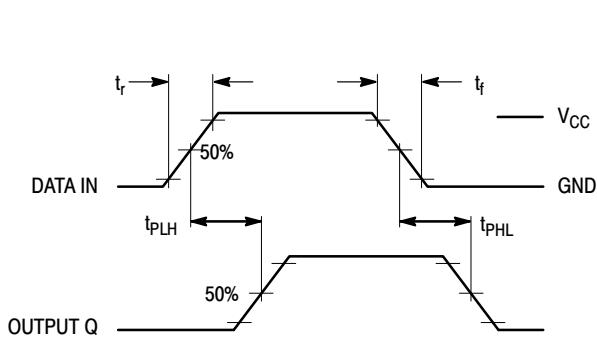


Figure 6. Switching Waveform

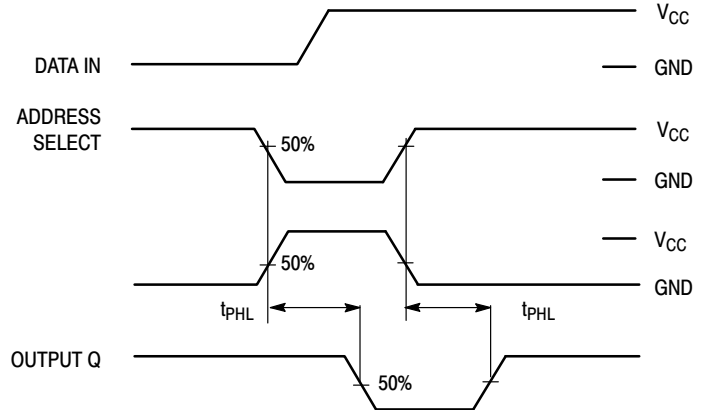


Figure 7. Switching Waveform

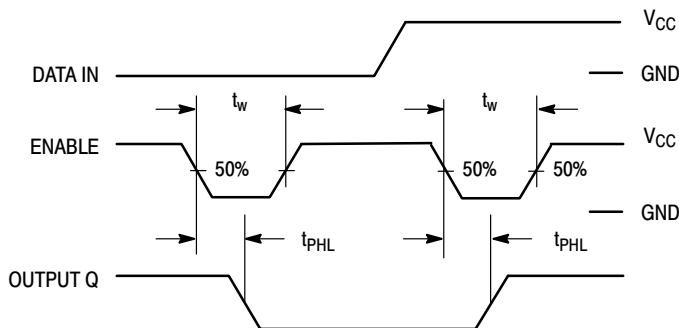


Figure 8. Switching Waveform

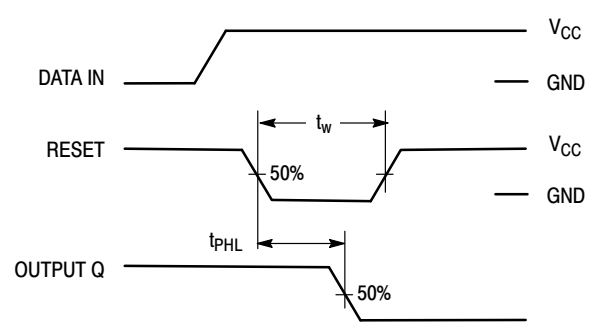


Figure 9. Switching Waveform

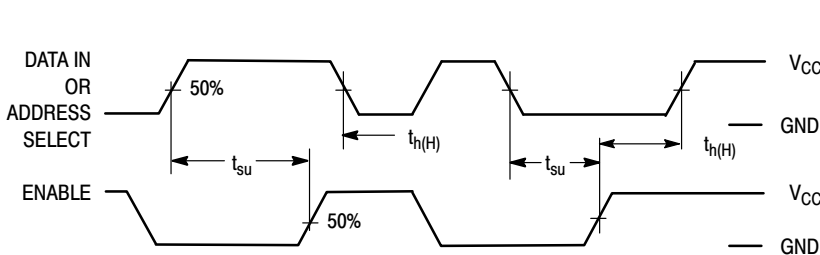
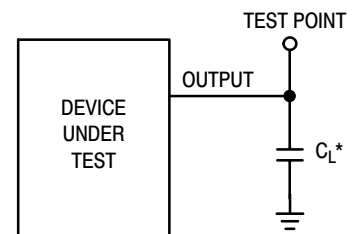


Figure 10. Switching Waveform



*Includes all probe and jig capacitance

Figure 11. Test Circuit

MC74VHCT259A

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------------|-----------------------|------------------|
| MC74VHCT259ADG | SOIC-16 (Pb-Free) | 48 Units / Rail |
| MC74VHCT259ADR2G | SOIC-16 (Pb-Free) | 2500 Tape & Reel |
| MC74VHCT259ADTG | TSSOP-16 (Pb-Free) | 96 Units / Rail |
| MC74VHCT259ADTRG | TSSOP-16 (Pb-Free) | 2500 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.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

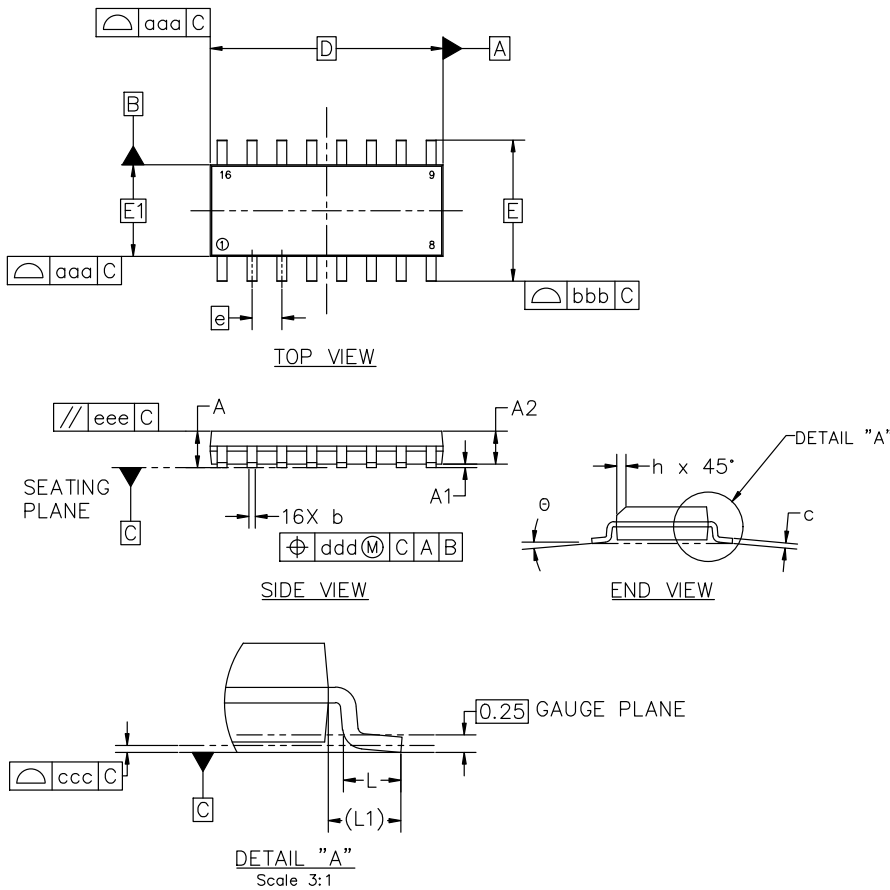


SOIC-16 9.90x3.90x1.50 1.27P
CASE 751B
ISSUE L

DATE 29 MAY 2024

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.



| MILLIMETERS | | | |
|--------------------------------|----------|------|------|
| DIM | MIN | NOM | MAX |
| A | 1.35 | 1.55 | 1.75 |
| A1 | 0.00 | 0.05 | 0.10 |
| A2 | 1.35 | 1.50 | 1.65 |
| b | 0.35 | 0.42 | 0.49 |
| c | 0.19 | 0.22 | 0.25 |
| D | 9.90 BSC | | |
| E | 6.00 BSC | | |
| E1 | 3.90 BSC | | |
| e | 1.27 BSC | | |
| h | 0.25 | --- | 0.50 |
| L | 0.40 | 0.83 | 1.25 |
| L1 | 1.05 REF | | |
| θ | 0° | --- | 7° |
| TOLERANCE OF FORM AND POSITION | | | |
| aaa | 0.10 | | |
| bbb | 0.20 | | |
| ccc | 0.10 | | |
| ddd | 0.25 | | |
| eee | 0.10 | | |



RECOMMENDED MOUNTING FOOTPRINT

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE onsemi SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D

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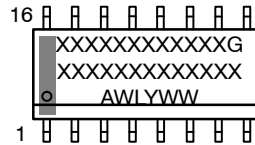
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



SOIC-16 9.90x3.90x1.50 1.27P
CASE 751B
ISSUE L

DATE 29 MAY 2024

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
 A = Assembly Location
 WL = Wafer Lot
 Y = Year
 WW = Work Week
 G = Pb-Free Package

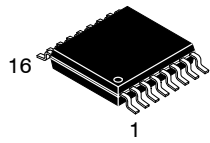
*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

| | | | |
|---|---|---|---|
| <p>STYLE 1:</p> <p>PIN 1. COLLECTOR 2. BASE 3. EMITTER 4. NO CONNECTION 5. EMITTER 6. BASE 7. COLLECTOR 8. COLLECTOR 9. BASE 10. EMITTER 11. NO CONNECTION 12. EMITTER 13. BASE 14. COLLECTOR 15. EMITTER 16. COLLECTOR</p> | <p>STYLE 2:</p> <p>PIN 1. CATHODE 2. ANODE 3. NO CONNECTION 4. CATHODE 5. CATHODE 6. NO CONNECTION 7. ANODE 8. CATHODE 9. CATHODE 10. ANODE 11. NO CONNECTION 12. CATHODE 13. CATHODE 14. NO CONNECTION 15. ANODE 16. CATHODE</p> | <p>STYLE 3:</p> <p>PIN 1. COLLECTOR, DYE #1 2. BASE, #1 3. EMITTER, #1 4. COLLECTOR, #1 5. COLLECTOR, #2 6. BASE, #2 7. EMITTER, #2 8. COLLECTOR, #2 9. COLLECTOR, #3 10. BASE, #3 11. EMITTER, #3 12. COLLECTOR, #3 13. COLLECTOR, #4 14. BASE, #4 15. EMITTER, #4 16. COLLECTOR, #4</p> | <p>STYLE 4:</p> <p>PIN 1. COLLECTOR, DYE #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. COLLECTOR, #3 6. COLLECTOR, #3 7. COLLECTOR, #4 8. COLLECTOR, #4 9. BASE, #4 10. EMITTER, #4 11. BASE, #3 12. EMITTER, #3 13. BASE, #2 14. EMITTER, #2 15. BASE, #1 16. EMITTER, #1</p> |
| <p>STYLE 5:</p> <p>PIN 1. DRAIN, DYE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. DRAIN, #3 6. DRAIN, #3 7. DRAIN, #4 8. DRAIN, #4 9. GATE, #4 10. SOURCE, #4 11. GATE, #3 12. SOURCE, #3 13. GATE, #2 14. SOURCE, #2 15. GATE, #1 16. SOURCE, #1</p> | <p>STYLE 6:</p> <p>PIN 1. CATHODE 2. CATHODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE 7. CATHODE 8. CATHODE 9. ANODE 10. ANODE 11. ANODE 12. ANODE 13. ANODE 14. ANODE 15. ANODE 16. ANODE</p> | <p>STYLE 7:</p> <p>PIN 1. SOURCE N-CH 2. COMMON DRAIN (OUTPUT) 3. COMMON DRAIN (OUTPUT) 4. GATE P-CH 5. COMMON DRAIN (OUTPUT) 6. COMMON DRAIN (OUTPUT) 7. COMMON DRAIN (OUTPUT) 8. SOURCE P-CH 9. SOURCE P-CH 10. COMMON DRAIN (OUTPUT) 11. COMMON DRAIN (OUTPUT) 12. COMMON DRAIN (OUTPUT) 13. GATE N-CH 14. COMMON DRAIN (OUTPUT) 15. COMMON DRAIN (OUTPUT) 16. SOURCE N-CH</p> | |

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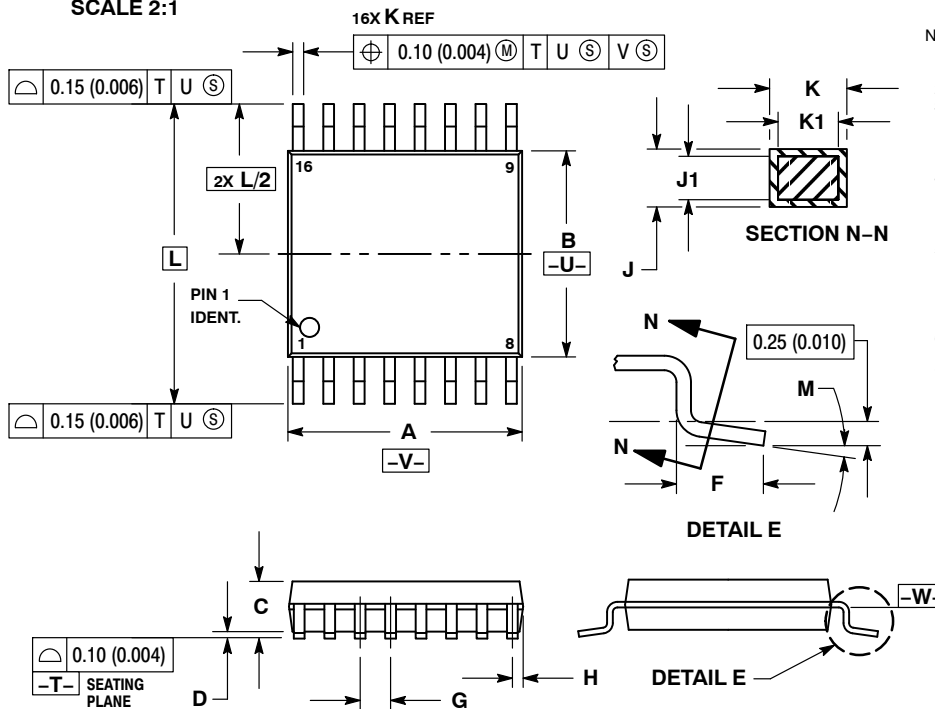
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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



TSSOP-16 WB
CASE 948F
ISSUE B

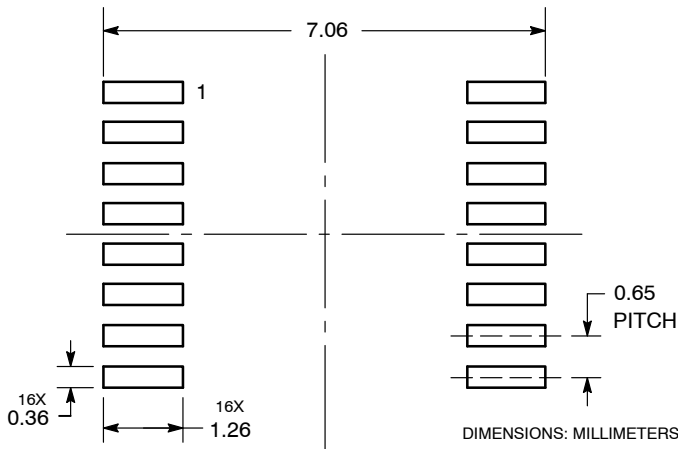
DATE 19 OCT 2006



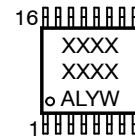
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
 4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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° |

RECOMMENDED SOLDERING FOOTPRINT*



GENERIC MARKING DIAGRAM*



- XXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- G or ■ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

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

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