

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

with LSTTL-Compatible Inputs

## MC74VHCT259A

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.

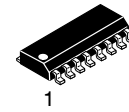
The VHC259 is designed for general purpose storage applications in digital systems. The device has four modes of operation as shown in the mode selection table. In the addressable latch mode, the signal on Data In is written into the addressed latch. The addressed latch follows the data input with all 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.

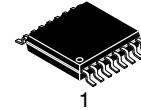
The VHCT259A input structures provide protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. The output structures also provide protection when  $V_{CC} = 0$  V. These input and output structures help prevent device destruction caused by supply voltage-input/output 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:  $I_{CC} = 2$   $\mu$ 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

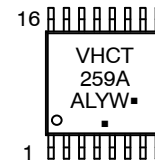
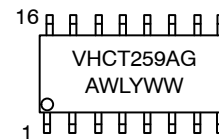


SOIC-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F

### 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.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 7.

# MC74VHCT259A

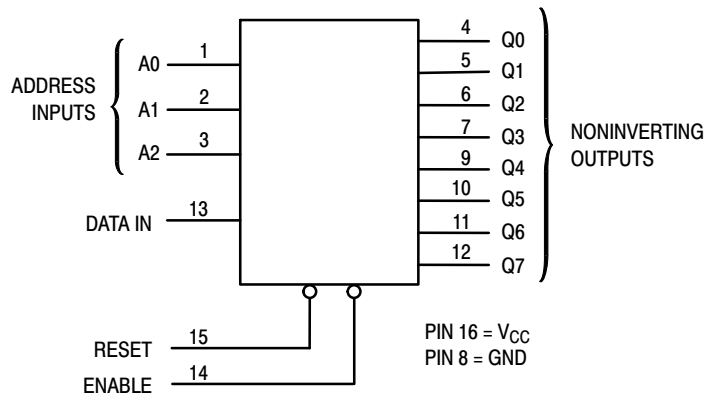


Figure 1. Logic Diagram

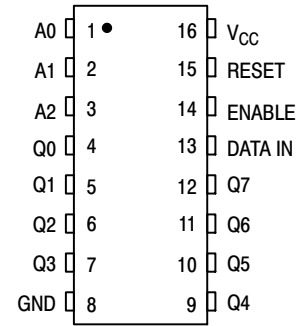


Figure 2. Pin Assignment

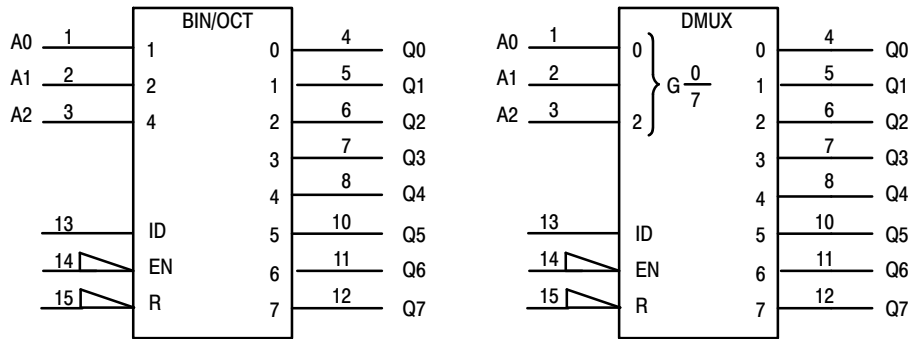


Figure 3. IEC Logic Symbol

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

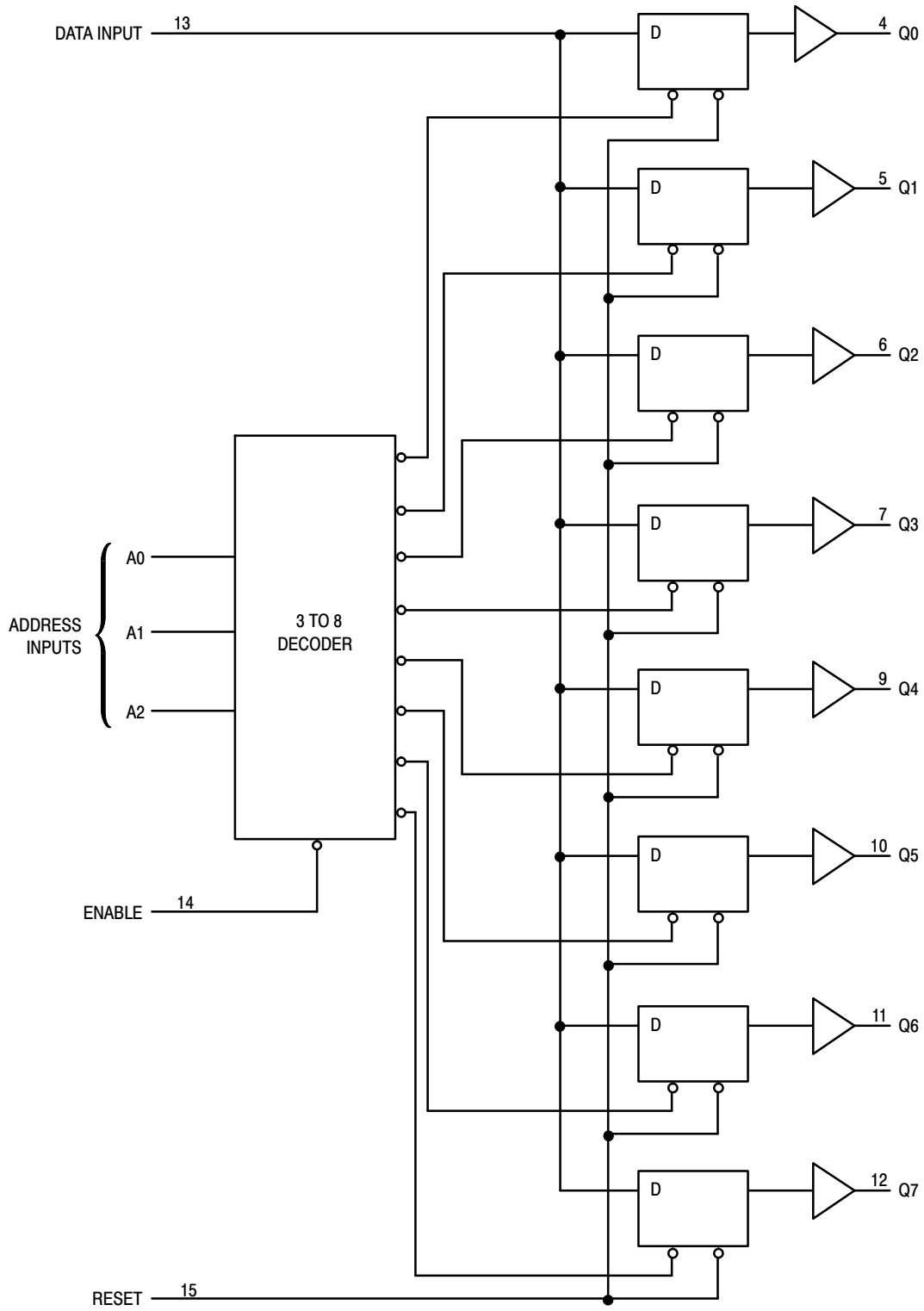


Figure 4. Expanded Logic Diagram

# 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	$\pm 20$	mA
$I_{OUT}$	DC Output Current, per Pin	$\pm 25$	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	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)	$\pm 300$	mA
$\theta_{JA}$	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

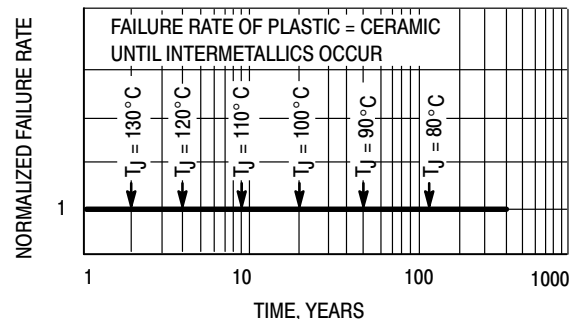


Figure 5. Failure Rate vs. Time Junction Temperature

# MC74VHCT259A

## DC CHARACTERISTICS (Voltages Referenced to GND)

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

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0ns)

Symbol	Parameter	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		-55°C ≤ T <sub>A</sub> ≤ 125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Data to Output (Figures 6 and 11)	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Address Select to Output (Figures 7 and 11)	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Enable to Output (Figures 8 and 11)	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>PHL</sub>	Maximum Propagation Delay, Reset to Output (Figures 9 and 11)	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF C <sub>L</sub> = 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 <sub>IN</sub>	Maximum Input Capacitance			6	10		10		10	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	Typical @ 25°C, V <sub>CC</sub> = 5.0V		pF
		30		

5. C<sub>PD</sub> 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# 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	

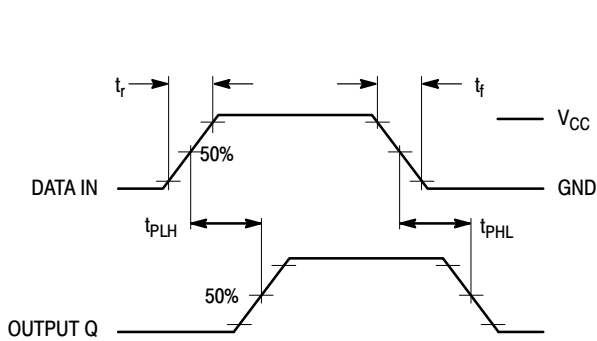


Figure 6. Switching Waveform

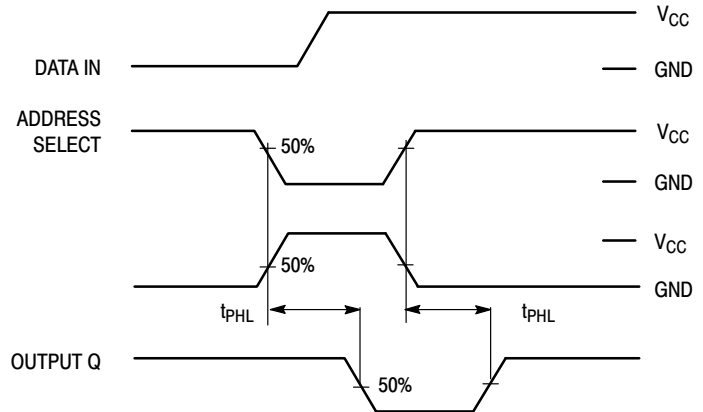


Figure 7. Switching Waveform

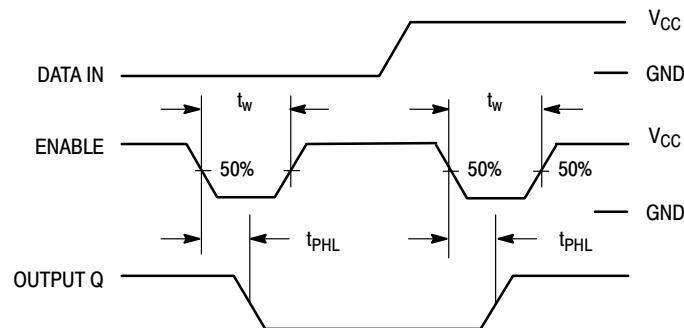


Figure 8. Switching Waveform

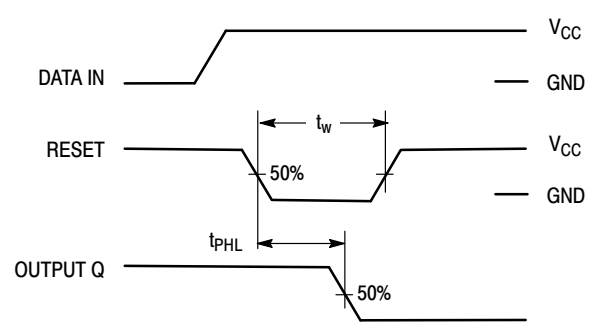


Figure 9. Switching Waveform

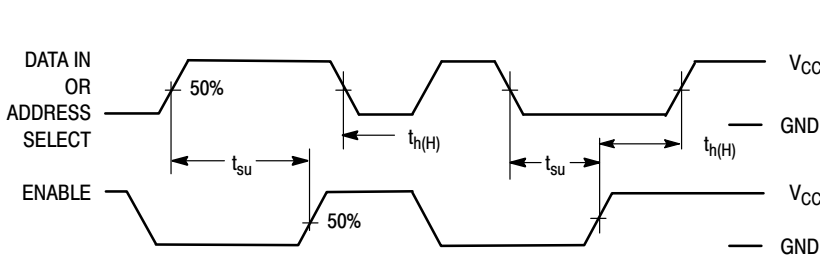
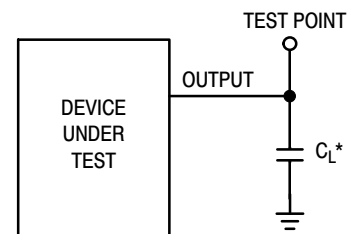


Figure 10. Switching Waveform



\*Includes all probe and jig capacitance

Figure 11. Test Circuit

# MC74VHCT259A

## ORDERING INFORMATION

Device	Package	Shipping†
MC74VHCT259ADR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel
MC74VHCT259ADTRG	TSSOP-16 (Pb-Free)	2500 Tape & Reel

## DISCONTINUED (Note 6)

MC74VHCT259ADG	SOIC-16 (Pb-Free)	48 Units / Rail
MC74VHCT259ADTG	TSSOP-16 (Pb-Free)	96 Units / Rail

†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](#).

6. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).

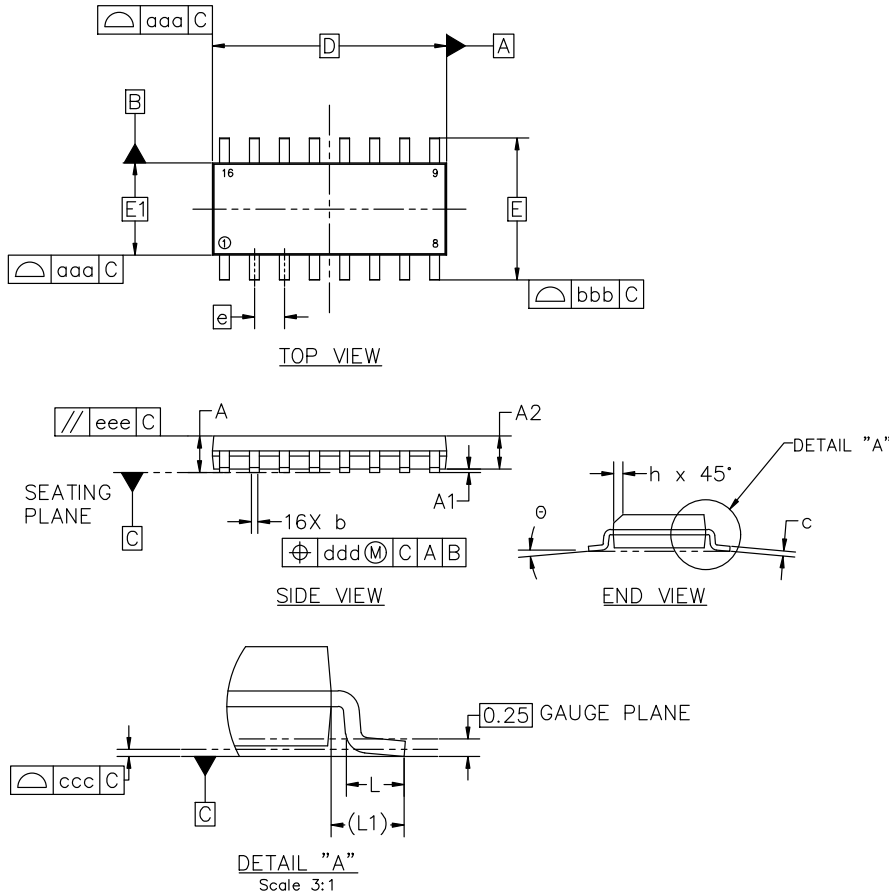


**SOIC-16 9.90x3.90x1.37 1.27P**  
**CASE 751B**  
**ISSUE M**

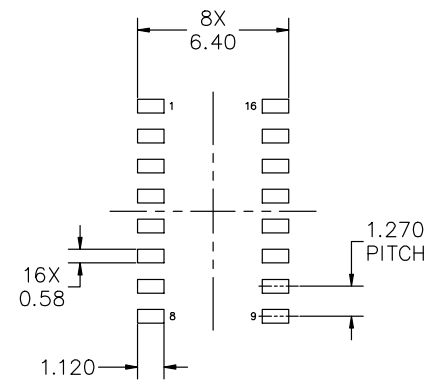
DATE 18 OCT 2024

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	0.10	0.18	0.25
A2	1.25	1.37	1.50
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, SOLDERM/D

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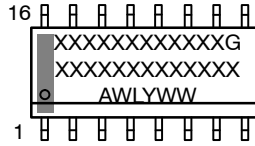
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SOIC-16 9.90x3.90x1.37 1.27P  
CASE 751B  
ISSUE M

DATE 18 OCT 2024

GENERIC  
MARKING DIAGRAM\*



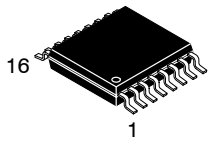
XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*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:  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:  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:  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:  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:  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:  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:  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>	

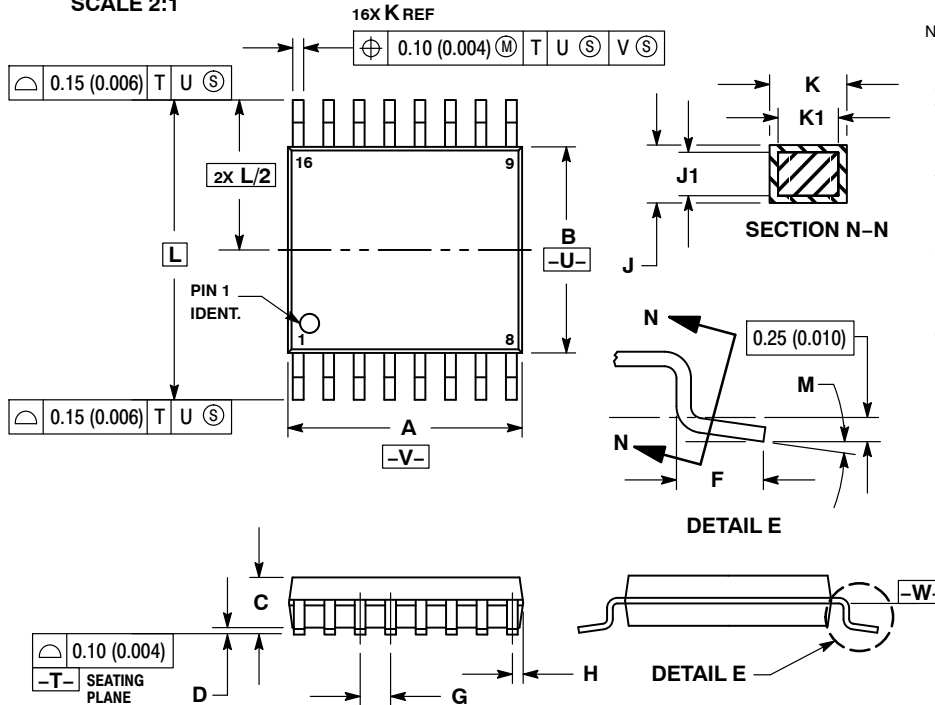
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DESCRIPTION:	SOIC-16 9.90X3.90X1.37 1.27P	PAGE 2 OF 2

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TSSOP-16 WB  
CASE 948F  
ISSUE B

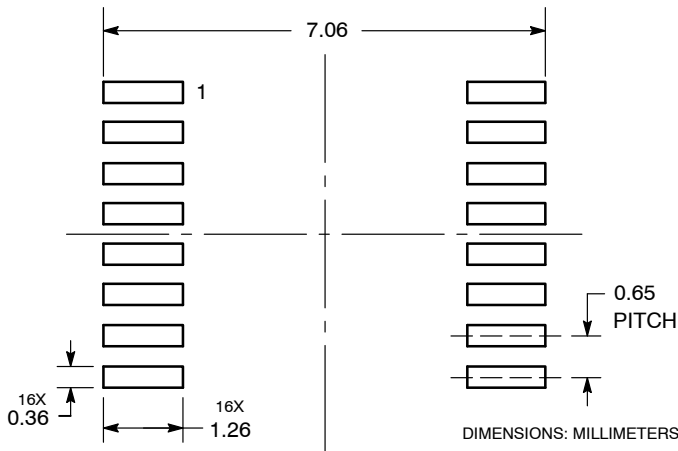
DATE 19 OCT 2006



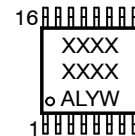
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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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DESCRIPTION:	TSSOP-16	PAGE 1 OF 1

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