

# MC74VHCT257A

## Quad 2-Channel Multiplexer with 3-State Outputs

The MC74VHCT257A is an advanced high speed CMOS quad 2-channel multiplexer fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

It consists of four 2-input digital multiplexers with common select (S) and enable ( $\overline{OE}$ ) inputs. When ( $\overline{OE}$ ) is held High, selection of data is inhibited and all the outputs go Low.

The select decoding determines whether the A or B inputs get routed to the corresponding Y outputs.

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 VHCT257A 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.

The internal circuit is composed of three stages, including a buffered output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

### Features

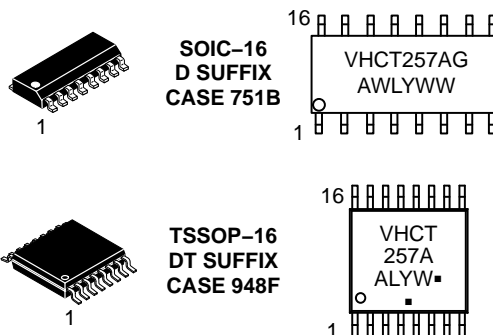
- High Speed:  $t_{PD} = 4.1$  ns (Typ) at  $V_{CC} = 5.0$  V
- Low Power Dissipation:  $I_{CC} = 4.0$   $\mu$ A (Max) at  $T_A = 25^\circ$ C
- TTL-Compatible Inputs:  $V_{IL} = 0.8$  V;  $V_{IH} = 2.0$  V
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Designed for 2.0 V to 5.5 V Operating Range
- Low Noise:  $V_{OLP} = 0.8$  V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance:
  - Human Body Model > 2000 V;
  - Machine Model > 200 V
- These Devices are Pb-Free and are RoHS Compliant



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### 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)

### FUNCTION TABLE

Inputs		Outputs Y0 – Y3
$\overline{OE}$	S	
H	X	Z
L	L	A0–A3
L	H	B0–B3

A0 – A3, B0 – B3 = the levels of the respective Data-Word Inputs.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# MC74VHCT257A

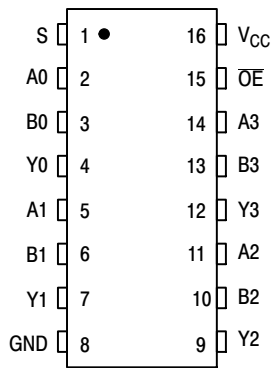


Figure 1. Pin Assignment

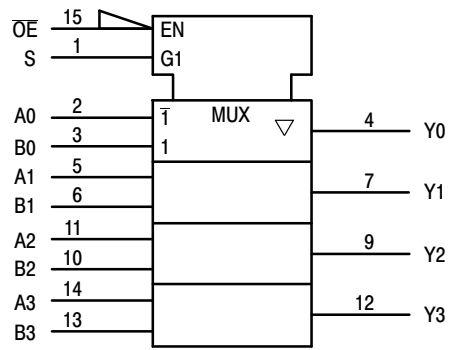


Figure 2. IEC Logic Symbol

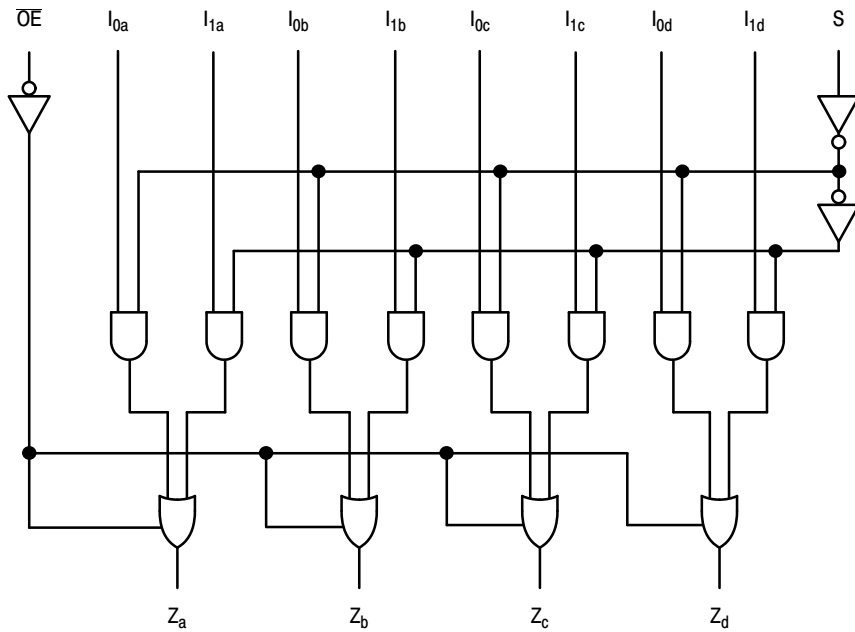


Figure 3. Expanded Logic Diagram

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

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## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	-0.5 to +7.0	V
V <sub>IN</sub>	Digital Input Voltage	-0.5 to +7.0	V
V <sub>OUT</sub>	DC Output Voltage	Output in 3-State High or Low State	V
I <sub>IK</sub>	Input Diode Current	-20	mA
I <sub>OK</sub>	Output Diode Current	± 20	mA
I <sub>OUT</sub>	DC Output Current, per Pin	± 25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins	± 75	mA
P <sub>D</sub>	Power Dissipation in Still Air	SOIC TSSOP	mW
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
V <sub>ESD</sub>	ESD Withstand Voltage	Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3)	V
I <sub>LATCHUP</sub>	Latchup Performance	Above V <sub>CC</sub> and Below GND at 125°C (Note 4)	mA
θ <sub>JA</sub>	Thermal Resistance, Junction-to-Ambient	SOIC TSSOP	°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 <sub>CC</sub>	DC Supply Voltage	4.5	5.5	V
V <sub>IN</sub>	DC Input Voltage	0	5.5	V
V <sub>OUT</sub>	DC Output Voltage	0	5.5	V
T <sub>A</sub>	Operating Temperature Range, all Package Types	-55	125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise or Fall Time	V <sub>CC</sub> = 5.0 V ± 0.5 V		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 °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

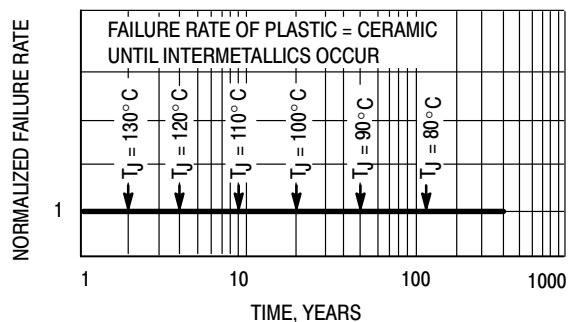


Figure 4. Failure Rate vs. Time Junction Temperature

# MC74VHCT257A

## 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	3.94			3.8		3.66		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>OZ</sub>	Maximum 3-State Leakage Current	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND	5.5			±0.2 5		±2.5		±2.5	μA
I <sub>CC1</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			1.35		1.5		1.65	mA
I <sub>CC</sub>	Additional Quiescent Supply Current (per pin)	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			4.0		40		40	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, A or B to Y	V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF C <sub>L</sub> = 50 pF		5.8 8.3	9.3 12.8	1.0 1.0	11.0 14.5	1.0 1.0	11.0 14.5	ns
		V <sub>CC</sub> = 5.0 ± 0.5 V C <sub>L</sub> = 15 pF C <sub>L</sub> = 50 pF		3.6 5.1	5.9 7.9	1.0 1.0	7.0 9.0	1.0 1.0	7.0 9.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, S to Y	V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF C <sub>L</sub> = 50 pF		7.0 9.5	11.0 14.5	1.0 1.0	13.0 16.5	1.0 1.0	13.0 16.5	ns
		V <sub>CC</sub> = 5.0 ± 0.5 V C <sub>L</sub> = 15 pF C <sub>L</sub> = 50 pF		4.0 5.5	6.8 8.8	1.0 1.0	8.0 10.0	1.0 1.0	8.0 10.0	
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Output Enable, Time, OE to Y	V <sub>CC</sub> = 3.3 ± 0.3 V R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF		6.7 9.2	10.5 14.0	1.0 1.0	12.5 16.0	1.0 1.0	12.5 16.0	ns
		V <sub>CC</sub> = 5.0 ± 0.5 V R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF		3.6 5.1	6.8 11.0	1.0 12.0	8.0 10.0	1.0 1.0	8.0 12.0	
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Output Disable, Time, $\overline{OE}$ to Y	V <sub>CC</sub> = 3.3 ± 0.3 V R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF		10.5	14.0	1.0	15.0	1.0	15.0	ns
		V <sub>CC</sub> = 5.0 ± 0.5 V R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF		9.5	12.0	1.0	13.0	1.0	13.0	
C <sub>IN</sub>	Maximum Input Capacitance			4	10		10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	Typical @ 25°C, V <sub>CC</sub> = 5.0 V								pF
		20								

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>.

## NOISE CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns, C<sub>L</sub> = 50 pF, V<sub>CC</sub> = 5.0 V)

Symbol	Characteristic	T <sub>A</sub> = 25°C		Unit
		Typ	Max	
V <sub>OLP</sub>	Quiet Output Maximum Dynamic V <sub>OL</sub>	0.3	0.8	V
V <sub>OLV</sub>	Quiet Output Minimum Dynamic V <sub>OL</sub>	-0.3	-0.8	V
V <sub>IHD</sub>	Minimum High Level Dynamic Input Voltage		2.0	V
V <sub>ILD</sub>	Maximum Low Level Dynamic Input Voltage		0.8	V



# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

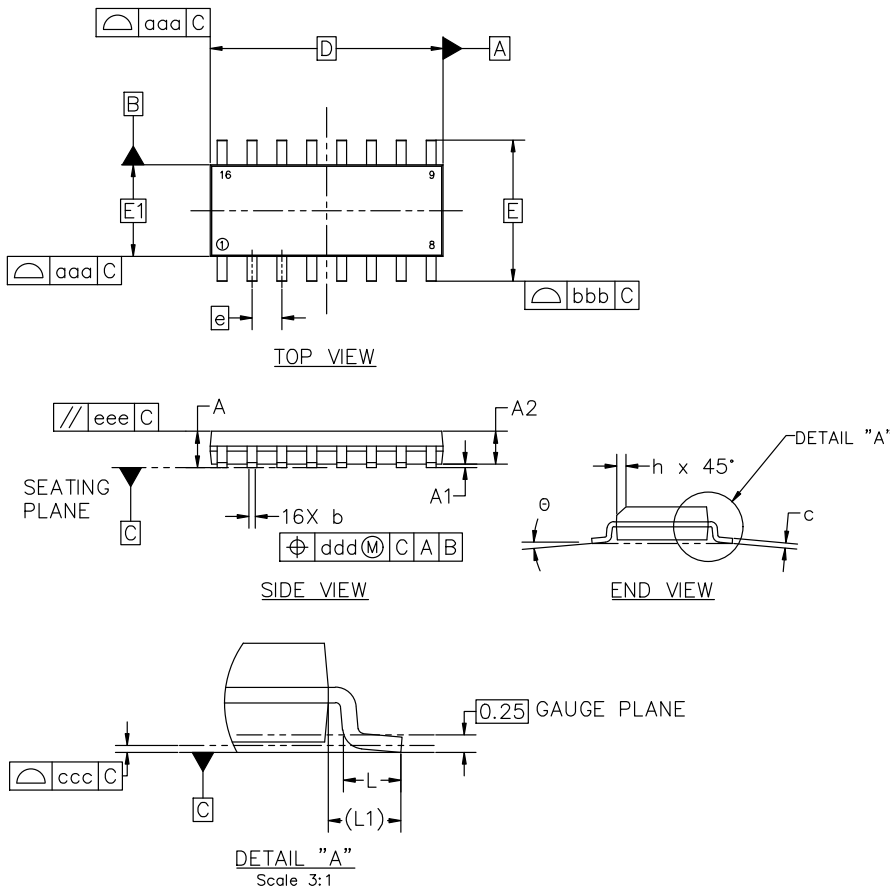


**SOIC-16 9.90x3.90x1.50 1.27P**  
**CASE 751B**  
**ISSUE L**

**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		
$\theta$	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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<b>DESCRIPTION:</b>	<b>SOIC-16 9.90X3.90X1.50 1.27P</b>	<b>PAGE 1 OF 2</b>

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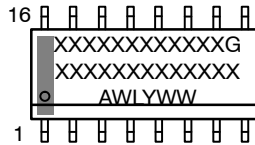
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**



**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

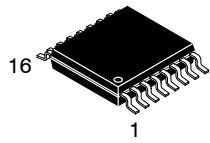
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

<p><b>STYLE 1:</b></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><b>STYLE 2:</b></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><b>STYLE 3:</b></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><b>STYLE 4:</b></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><b>STYLE 5:</b></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><b>STYLE 6:</b></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><b>STYLE 7:</b></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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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**TSSOP-16 WB**  
CASE 948F  
ISSUE B

DATE 19 OCT 2006

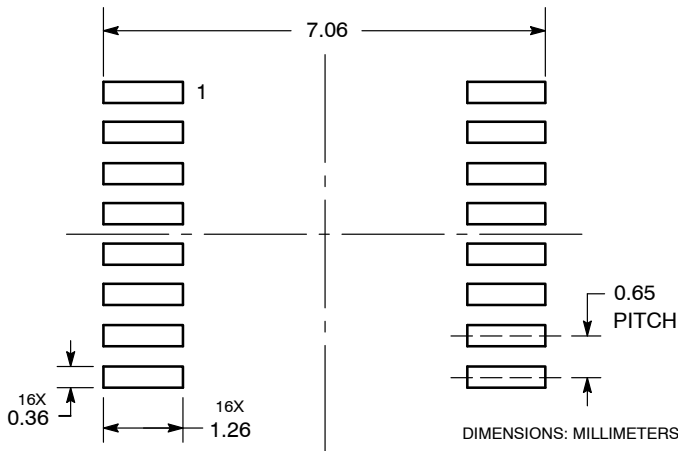


**NOTES:**

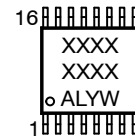
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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