

# 8-Input Data Selector/ Multiplexer with 3-State Outputs

## High-Performance Silicon-Gate CMOS

### MC74HC251A

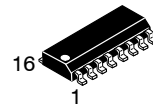
The MC74HC251 is identical in pinout to the LS251. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

This device selects one of the eight binary Data Inputs, as determined by the Address Inputs. The Output Enable pin must be a low level for the selected data to appear at the outputs. If Output Enable is high, both the Y and the  $\bar{Y}$  outputs are in the high-impedance state. This 3-state feature allows the HC251 to be used in bus-oriented systems.

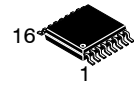
The HC251 is similar in function to the HC251 which does not have 3-state outputs.

#### Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- -Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



SOIC-16  
D SUFFIX  
CASE 751B

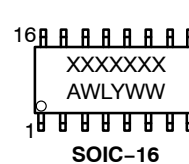


TSSOP-16  
DT SUFFIX  
CASE 948F

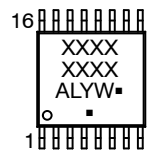


QFN16  
MN SUFFIX  
CASE 485AW

#### MARKING DIAGRAMS



SOIC-16



TSSOP-16



QFN16

XXXXXXX = Specific Device Code

A = Assembly Location

WL, L = Wafer Lot

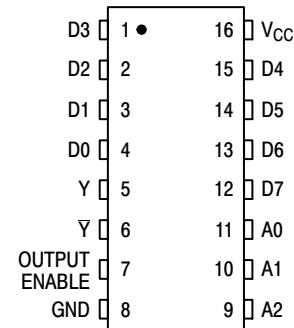
Y = Year

WW, W = Work Week

G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

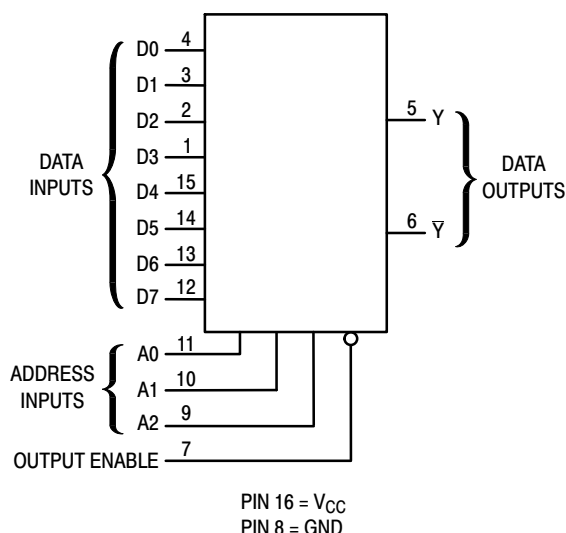
#### PIN ASSIGNMENT



#### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

# MC74HC251A



**Figure 1. Logic Diagram**

## FUNCTION TABLE

Inputs				Outputs	
A2	A1	A0	Output Enabled	Y	$\bar{Y}$
X	X	X	H	Z	$\bar{Z}$
L	L	L	L	D0	$\bar{D0}$
L	L	H	L	D1	$\bar{D1}$
L	H	L	L	D2	$\bar{D2}$
L	H	H	L	D3	$\bar{D3}$
H	L	L	L	D4	$\bar{D4}$
H	L	H	L	D5	$\bar{D5}$
H	H	L	L	D6	$\bar{D6}$
H	H	H	L	D7	$\bar{D7}$

Z = high impedance

D0, D1, ..., D7 = the level of the respective D input.

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	−0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage	−0.5 to V <sub>CC</sub> +0.5	V
V <sub>OUT</sub>	DC Output Voltage	−0.5 to V <sub>CC</sub> +0.5	V
I <sub>IN</sub>	DC Input Diode Current, per Pin	±20	mA
I <sub>OUT</sub>	DC Input Diode Current, Per Pin	±25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins	±50	mA
I <sub>IK</sub>	Input Clamp Current (V <sub>IN</sub> < 0 or V <sub>IN</sub> > V <sub>CC</sub> )	±20	mA
I <sub>OK</sub>	Output Clamp Current (V <sub>OUT</sub> < 0 or V <sub>OUT</sub> > V <sub>CC</sub> )	±20	mA
T <sub>STG</sub>	Storage Temperature Range	−65 to +150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 secs	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance (Note 1) <div>SOIC−16 QFN16 TSSOP−16</div>	<div>126 118 159</div>	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 25°C <div>SOIC−16 QFN16 TSSOP−16</div>	<div>995 1062 787</div>	mW
MSL	Moisture Sensitivity	Level 1	–
F <sub>R</sub>	Flammability Rating Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	–
V <sub>ESD</sub>	ESD Withstand Voltage (Note 2) Human Body Model Charged Device Model	<div>2000 N/A</div>	V

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. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
2. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

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## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	DC Supply Voltage	2.0	6.0	V
$V_{in}, V_{out}$	DC Input Voltage, Output Voltage (Note 3)	0	$V_{CC}$	V
$T_A$	Operating Temperature, All Package Types	-55	+125	°C
$t_r, t_f$	Input Rise and Fall Time $V_{CC} = 2.0\text{ V}$ $V_{CC} = 4.5\text{ V}$ $V_{CC} = 6.0\text{ V}$	0 0 0	1000 500 400	ns

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.

3. 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.

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	$V_{CC}$ V	Guaranteed Limit			Unit
				- 55 to 25°C	≤ 85°C	≤ 125°C	
$V_{IH}$	Minimum High-Level Input Voltage	$V_{out} = 0.1\text{ V}$ or $V_{CC} - 0.1\text{ V}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
$V_{IL}$	Maximum Low-Level Input Voltage	$V_{out} = 0.1\text{ V}$ or $V_{CC} - 0.1\text{ V}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 4.5 6.0	0.3 0.9 1.2	0.3 0.9 1.2	0.3 0.9 1.2	V
$V_{OH}$	Minimum High-Level Output Voltage	$V_{in} = V_{IH}$ or $V_{IL}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		$V_{in} = V_{IH}$ or $V_{IL}$ $ I_{out}  \leq 4.0\text{ mA}$ $ I_{out}  \leq 5.2\text{ mA}$	4.5 6.0	3.98 5.48	3.84 5.34	3.70 5.20	
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IH}$ or $V_{IL}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		$V_{in} = V_{IH}$ or $V_{IL}$ $ I_{out}  \leq 4.0\text{ mA}$ $ I_{out}  \leq 5.2\text{ mA}$	4.5 6.0	0.26 0.26	0.33 0.33	0.40 0.40	
$I_{in}$	Maximum Input Leakage Current	$V_{in} = V_{CC}$ or GND	6.0	± 0.1	± 1.0	± 1.0	μA
$I_{OZ}$	Maximum Three-State Leakage Current	Output in High-Impedance State $V_{in} = V_{IL}$ or $V_{IH}$ $V_{out} = V_{CC}$ or GND	6.0	± 0.5	± 5.0	± 10	μA
$I_{CC}$	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}$ or GND $I_{out} = 0\text{ }\mu\text{A}$	6.0	8	80	160	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

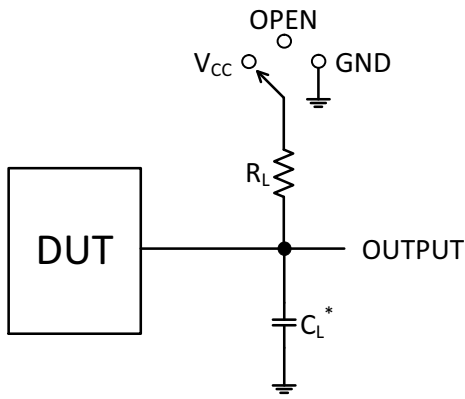
# MC74HC251A

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input D to Output Y or $\bar{Y}$ (Figures 2, 3, 4)	2.0 4.5 6.0	185 37 31	230 46 39	280 56 48	ns
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A to Output Y or $\bar{Y}$ (Figures 2, 5)	2.0 4.5 6.0	205 41 35	255 51 43	310 62 53	ns
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to Output Y (Figures 5, 7)	2.0 4.5 6.0	195 39 33	245 49 42	295 59 50	ns
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Propagation Delay, Output Enable to Output Y (Figures 2, 6)	2.0 4.5 6.0	145 29 25	180 36 31	220 44 38	ns
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to Output $\bar{Y}$ (Figures 2, 6)	2.0 4.5 6.0	220 44 37	275 55 47	330 66 56	ns
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Propagation Delay, Output Enable to Output $\bar{Y}$ (Figures 2, 6)	2.0 4.5 6.0	150 30 26	190 38 33	225 45 38	ns
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 2, 3, 4)	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C <sub>in</sub>	Maximum Input Capacitance	–	10	10	10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance (Output in High-Impedance State)	–	15	15	15	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Per Package)	Typical @ 25°C, V <sub>CC</sub> = 5.0 V	pF
		36	

# MC74HC251A



\*C<sub>L</sub> Includes probe and jig capacitance

Test	Switch Position	C <sub>L</sub>	R <sub>L</sub>
t <sub>PLH</sub> / t <sub>PHL</sub>	Open	50 pF	1 kΩ
t <sub>PLZ</sub> / t <sub>PZL</sub>	V <sub>CC</sub>		
t <sub>PHZ</sub> / t <sub>PZH</sub>	GND		

Figure 2. Test Circuit

## SWITCHING WAVEFORMS

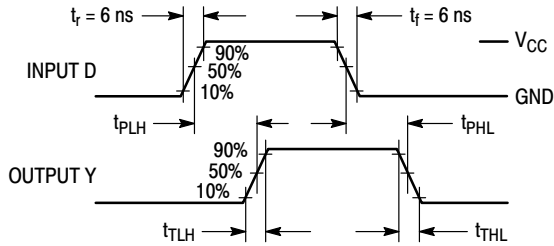


Figure 3.

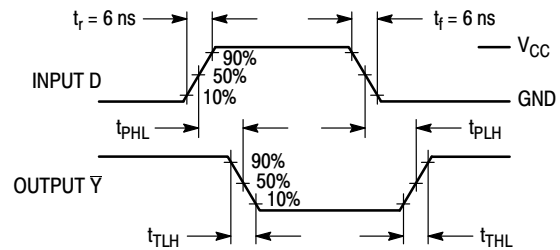


Figure 4.

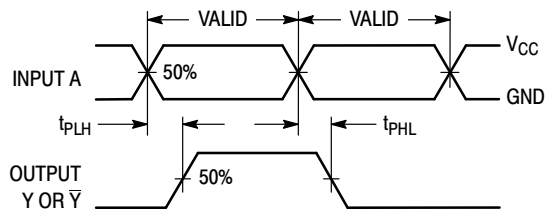


Figure 5.

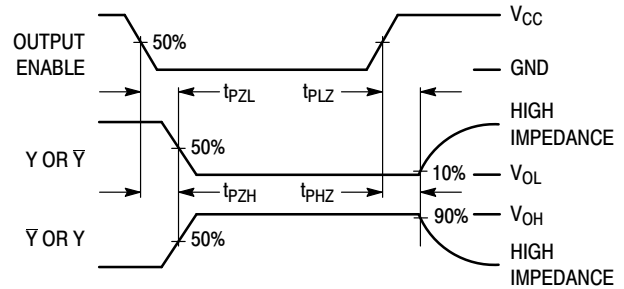


Figure 6.

# MC74HC251A

## PIN DESCRIPTIONS

### ADDRESS INPUTS

**A0, A1, A2 (Pins 1, 2, 3)**

Address inputs. These inputs, when the chip is selected, determine which of the eight outputs is active-low.

### CONTROL INPUTS

**CS1, CS2, CS3 (Pins 6, 4, 5)**

Chip select inputs. For CS1 at a high level and CS2, CS3 at a low level, the chip is selected and the outputs follow the

Address inputs. For any other combination of CS1, CS2, and CS3, the outputs are at a logic low.

### OUTPUTS

**Y0 – Y7 (Pins 15, 14, 13, 12, 11, 10, 9, 7)**

Active-high Decoded outputs. These outputs assume a high level when addressed and the chip is selected. These outputs remain low when not addressed or the chip is not selected.

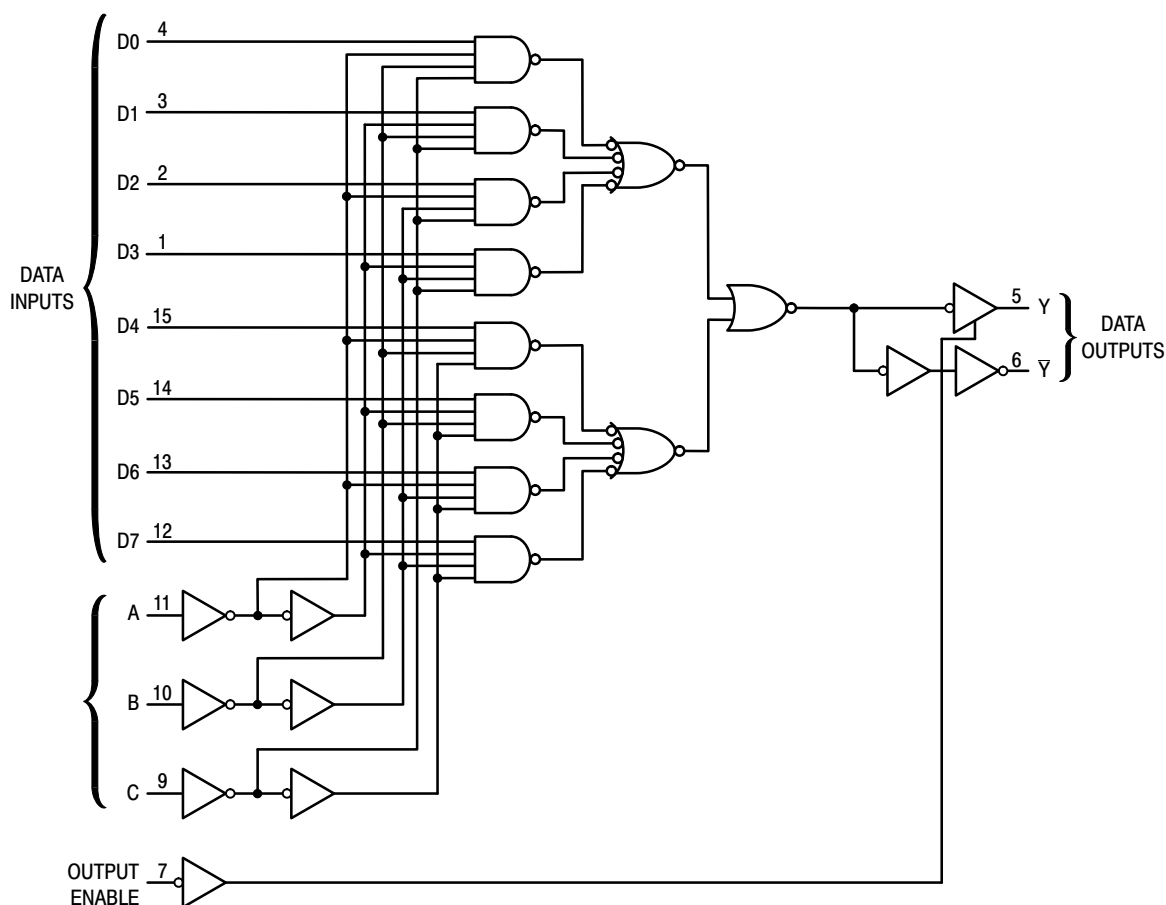


Figure 7. Expanded Logic Diagram

## ORDERING INFORMATION

Device	Marking	Package	Shipping†
MC74HC251ADG	HC251AG	SOIC-16	48 Units / Rail
MC74HC251ADR2G	HC251AG	SOIC-16	2500 Units / Tape & Reel
MC74HC251ADR2G-Q*	HC251AG	SOIC-16	2500 Units / Tape & Reel
MC74HC251ADTG	HC 251A	TSSOP-16	96 Units / Rail
MC74HC251ADTR2G	HC 251A	TSSOP-16	2500 Units / Tape & Reel

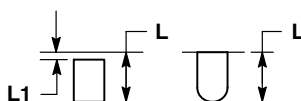
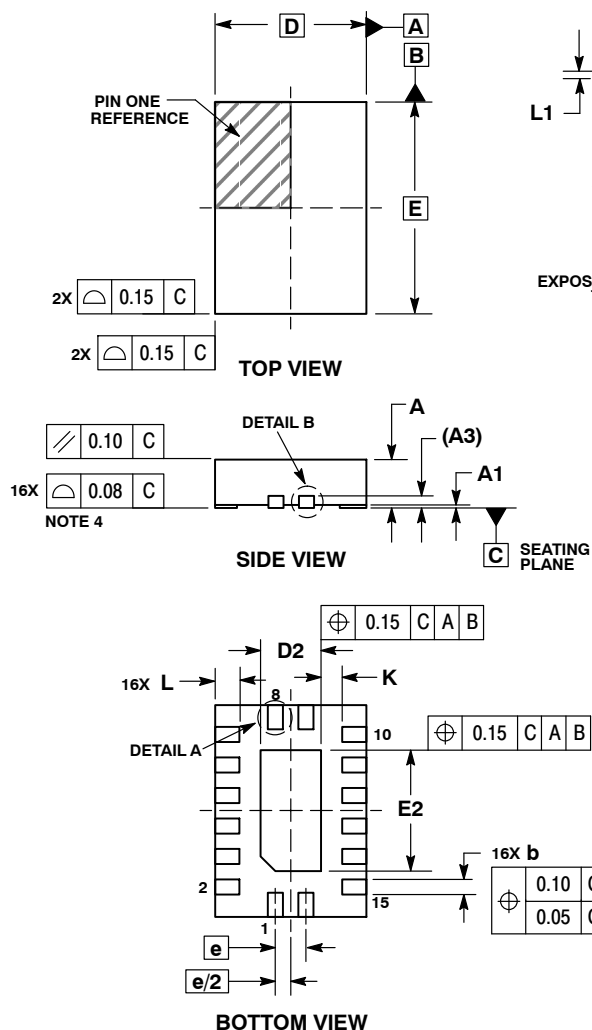
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

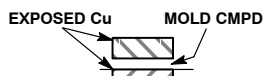
# MC74HC251A

## PACKAGE DIMENSIONS

QFN16, 2.5x3.5, 0.5P  
CASE 485AW  
ISSUE O



**DETAIL A**  
ALTERNATE TERMINAL  
CONSTRUCTIONS



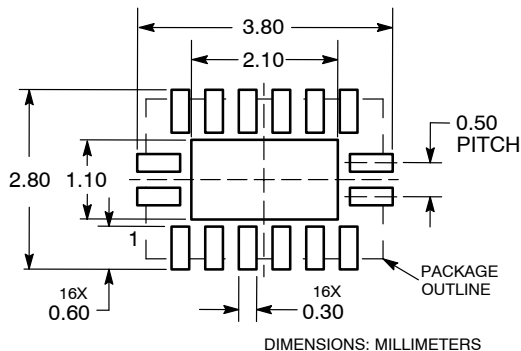
**DETAIL B**  
ALTERNATE  
CONSTRUCTIONS

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

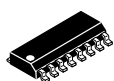
DIM	MILLIMETERS	
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20	REF
b	0.20	0.30
D	2.50	BSC
D2	0.85	1.15
E	3.50	BSC
E2	1.85	2.15
e	0.50	BSC
K	0.20	---
L	0.35	0.45
L1	---	0.15

### RECOMMENDED SOLDERING FOOTPRINT\*



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

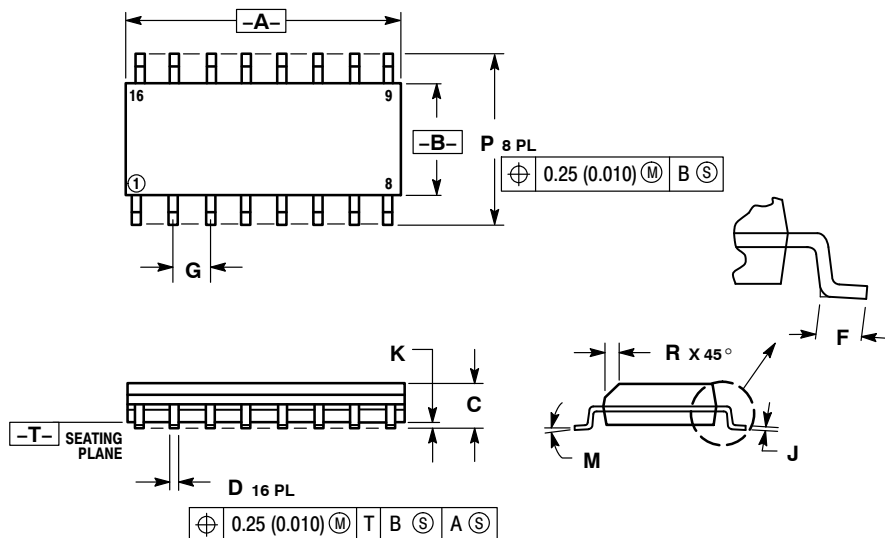
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

## SOIC-16 CASE 751B-05 ISSUE K

DATE 29 DEC 2006



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. 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.

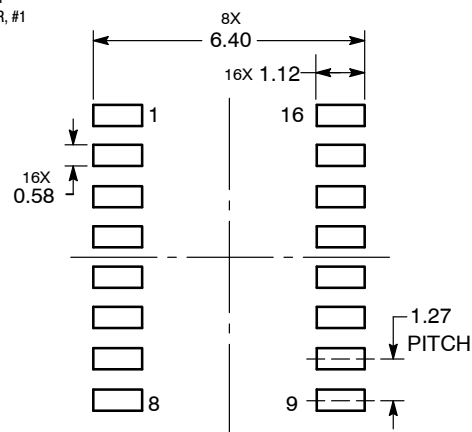
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

STYLE 1:	STYLE 2:	STYLE 3:	STYLE 4:
PIN 1. COLLECTOR	PIN 1. CATHODE	PIN 1. COLLECTOR, DYE #1	PIN 1. COLLECTOR, DYE #1
2. BASE	2. ANODE	2. BASE, #1	2. COLLECTOR, #1
3. EMITTER	3. NO CONNECTION	3. EMITTER, #1	3. COLLECTOR, #2
4. NO CONNECTION	4. CATHODE	4. COLLECTOR, #1	4. COLLECTOR, #2
5. EMITTER	5. CATHODE	5. COLLECTOR, #2	5. COLLECTOR, #3
6. BASE	6. NO CONNECTION	6. BASE, #2	6. COLLECTOR, #3
7. COLLECTOR	7. ANODE	7. EMITTER, #2	7. COLLECTOR, #4
8. COLLECTOR	8. CATHODE	8. COLLECTOR, #2	8. COLLECTOR, #4
9. BASE	9. CATHODE	9. COLLECTOR, #3	9. BASE, #4
10. EMITTER	10. ANODE	10. BASE, #3	10. EMITTER, #4
11. NO CONNECTION	11. NO CONNECTION	11. EMITTER, #3	11. BASE, #3
12. EMITTER	12. CATHODE	12. COLLECTOR, #3	12. EMITTER, #3
13. BASE	13. CATHODE	13. COLLECTOR, #4	13. BASE, #2
14. COLLECTOR	14. NO CONNECTION	14. BASE, #4	14. EMITTER, #2
15. EMITTER	15. ANODE	15. EMITTER, #4	15. BASE, #1
16. COLLECTOR	16. CATHODE	16. COLLECTOR, #4	16. EMITTER, #1

STYLE 5:	STYLE 6:	STYLE 7:
PIN 1. DRAIN, DYE #1	PIN 1. CATHODE	PIN 1. SOURCE N-CH
2. DRAIN, #1	2. CATHODE	2. COMMON DRAIN (OUTPUT)
3. DRAIN, #2	3. CATHODE	3. COMMON DRAIN (OUTPUT)
4. DRAIN, #2	4. CATHODE	4. GATE P-CH
5. DRAIN, #3	5. CATHODE	5. COMMON DRAIN (OUTPUT)
6. DRAIN, #3	6. CATHODE	6. COMMON DRAIN (OUTPUT)
7. DRAIN, #4	7. CATHODE	7. COMMON DRAIN (OUTPUT)
8. DRAIN, #4	8. CATHODE	8. SOURCE P-CH
9. GATE, #4	9. ANODE	9. SOURCE P-CH
10. SOURCE, #4	10. ANODE	10. COMMON DRAIN (OUTPUT)
11. GATE, #3	11. ANODE	11. COMMON DRAIN (OUTPUT)
12. SOURCE, #3	12. ANODE	12. COMMON DRAIN (OUTPUT)
13. GATE, #2	13. ANODE	13. GATE N-CH
14. SOURCE, #2	14. ANODE	14. COMMON DRAIN (OUTPUT)
15. GATE, #1	15. ANODE	15. COMMON DRAIN (OUTPUT)
16. SOURCE, #1	16. ANODE	16. SOURCE N-CH

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

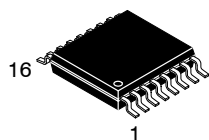
\*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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DESCRIPTION:	SOIC-16	PAGE 1 OF 1

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



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

DATE 19 OCT 2006



## NOTES:

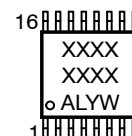
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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