

# Quad D Flip-Flop with Common Clock and Reset

## High-Performance Silicon-Gate CMOS

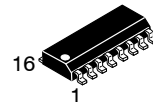
### MC74HC175A

The MC74HC175A is identical in pinout to the LS175. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

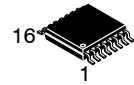
This device consists of four D flip-flops with common Reset and Clock inputs, and separate D inputs. Reset (active-low) is asynchronous and occurs when a low level is applied to the Reset input. Information at a D input is transferred to the corresponding Q output on the next positive going edge of the Clock input.

#### Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity 166 FETs or 41.5 Equivalent Gates
- -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

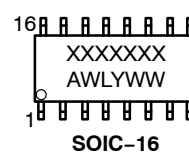


TSSOP-16  
DT SUFFIX  
CASE 948F

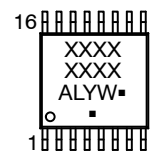


QFN16  
MN SUFFIX  
CASE 485AW

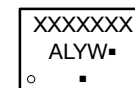
#### MARKING DIAGRAMS



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)

#### ORDERING INFORMATION

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

MC74HC175A

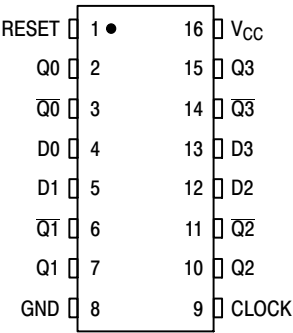


Figure 1. Pin Assignment

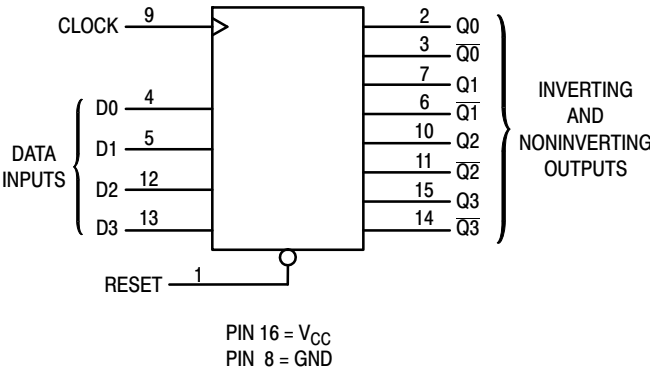


Figure 2. Logic Diagram

FUNCTION TABLE				
Inputs			Outputs	
Reset	Clock	D	Q	Q̄
L	X	X	L	H
H	⌈	H	H	L
H	⌈	L	L	H
H	L	X	No Change	

# MC74HC175A

## 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 Output 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 Seconds	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance (Note 1)	SOIC−16 QFN16 TSSOP−16	126 118 159
P <sub>D</sub>	Power Dissipation in Still Air at 25°C	SOIC−16 QFN16 TSSOP−16	995 1062 787
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	2000 N/A

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.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit	
V <sub>CC</sub>	DC Supply Voltage	2.0	6.0	V	
V <sub>in</sub> , V <sub>out</sub>	DC Input Voltage, Output Voltage (Note 3)	0	V <sub>CC</sub>	V	
T <sub>A</sub>	Operating Temperature, All Package Types	−55	+125	°C	
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time	V <sub>CC</sub> = 2.0 V	0	1000	ns
		V <sub>CC</sub> = 3.0 V	0	600	
		V <sub>CC</sub> = 4.5 V	0	500	
		V <sub>CC</sub> = 6.0 V	0	400	

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.

# MC74HC175A

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				– 55 to 25°C	≤ 85°C	≤ 125°C	
V <sub>IH</sub>	Minimum High–Level Input Voltage	V <sub>out</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V  I <sub>out</sub>   ≤ 20 µA	2.0	1.5	1.5	1.5	V
			3.0	2.1	2.1	2.1	
			4.5	3.15	3.15	3.15	
			6.0	4.2	4.2	4.2	
V <sub>IL</sub>	Maximum Low–Level Input Voltage	V <sub>out</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V  I <sub>out</sub>   ≤ 20 µA	2.0	0.5	0.5	0.5	V
			3.0	0.9	0.9	0.9	
			4.5	1.35	1.35	1.35	
			6.0	1.80	1.80	1.80	
V <sub>OH</sub>	Minimum High–Level Output Voltage	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 20 µA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
			6.0	5.9	5.9	5.9	
		V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 2.4 mA  I <sub>out</sub>   ≤ 4.0 mA  I <sub>out</sub>   ≤ 5.2 mA	3.0	2.48	2.34	2.20	
			4.5	3.98	3.84	3.70	
			6.0	5.48	5.34	5.20	
V <sub>OL</sub>	Maximum Low–Level Output Voltage	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 20 µA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
			6.0	0.1	0.1	0.1	
		V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 2.4 mA  I <sub>out</sub>   ≤ 4.0 mA  I <sub>out</sub>   ≤ 5.2 mA	3.0	0.26	0.33	0.40	
			4.5	0.26	0.33	0.40	
			6.0	0.26	0.33	0.40	
I <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = V <sub>CC</sub> or GND	6.0	± 0.1	± 1.0	± 1.0	µA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package)	V <sub>in</sub> = V <sub>CC</sub> or GND I <sub>out</sub> = 0 µA	6.0	4	40	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.

# MC74HC175A

## AC ELECTRICAL CHARACTERISTICS

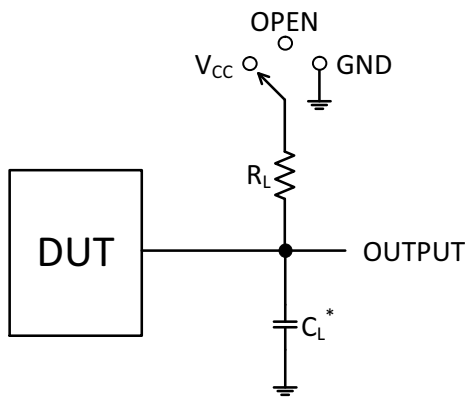
Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
f <sub>max</sub>	Maximum Clock Frequency (50% Duty Cycle) (Figures 3, 4)	2.0	6	4.8	4	MHz
		3.0	10	8.0	6	
		4.5	30	24	20	
		6.0	35	28	24	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Clock to Q or $\overline{Q}$ (Figures 3, 4)	2.0	150	190	225	ns
		3.0	75	90	110	
		4.5	26	32	38	
		6.0	22	28	33	
t <sub>PHL</sub>	Maximum Propagation Delay, Reset to Q or $\overline{Q}$ (Figures 3, 5)	2.0	125	155	190	ns
		3.0	70	85	110	
		4.5	22	27	34	
		6.0	19	24	30	
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 3, 4)	2.0	75	95	110	ns
		3.0	27	32	36	
		4.5	15	19	22	
		6.0	13	16	19	
C <sub>In</sub>	Maximum Input Capacitance	—	10	10	10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Per Flip–Flop)*	Typical @ 25°C, V <sub>CC</sub> = 5.0 V			35	pF

\* Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

## TIMING REQUIREMENTS

Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
t <sub>su</sub>	Minimum Setup Time, Data to Clock (Figure 6)	2.0	100	125	150	ns
		3.0	45	65	85	
		4.5	20	25	30	
		6.0	17	21	26	
t <sub>h</sub>	Minimum Hold Time, Clock to Data (Figure 6)	2.0	5	5	5	ns
		3.0	3	3	3	
		4.5	3	3	3	
		6.0	3	3	3	
t <sub>rec</sub>	Minimum Recovery Time, Reset Inactive to Clock (Figure 5)	2.0	100	125	150	ns
		3.0	45	65	85	
		4.5	20	25	30	
		6.0	17	21	26	
t <sub>w</sub>	Minimum Pulse Width, Clock (Figure 4)	2.0	80	100	120	ns
		3.0	45	65	85	
		4.5	16	20	24	
		6.0	14	17	20	
t <sub>w</sub>	Minimum Pulse Width, Reset (Figure 5)	2.0	80	100	120	ns
		3.0	45	65	85	
		4.5	16	20	24	
		6.0	14	17	20	
t <sub>r</sub> , t <sub>f</sub>	Maximum Input Rise and Fall Times (Figure 4)	2.0	1000	1000	1000	ns
		3.0	600	600	600	
		4.5	500	500	500	
		6.0	400	400	400	

# MC74HC175A

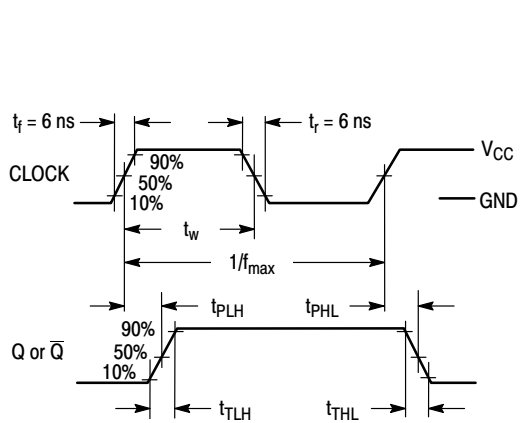


\*C<sub>L</sub> Includes probe and jig capacitance

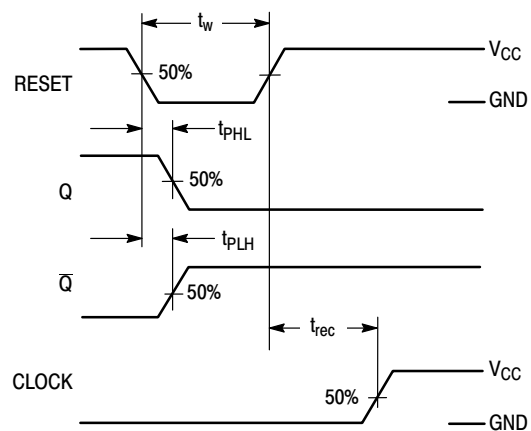
Test	Switch Position	C <sub>L</sub>	R <sub>L</sub>
t <sub>PLH</sub> / t <sub>PHL</sub>	Open	50 pF	1 kΩ
t <sub>PLZ</sub> / t <sub>PZL</sub>	V <sub>CC</sub>		
t <sub>PHZ</sub> / t <sub>PZH</sub>	GND		

### Figure 3. Test Circuit

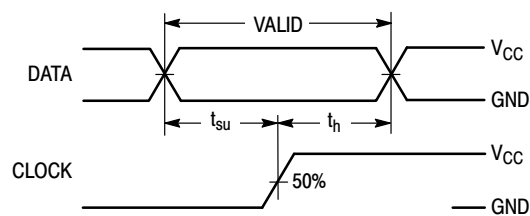
## SWITCHING WAVEFORMS



**Figure 4.**



**Figure 5.**



**Figure 6.**

# MC74HC175A

## EXPANDED LOGIC DIAGRAM

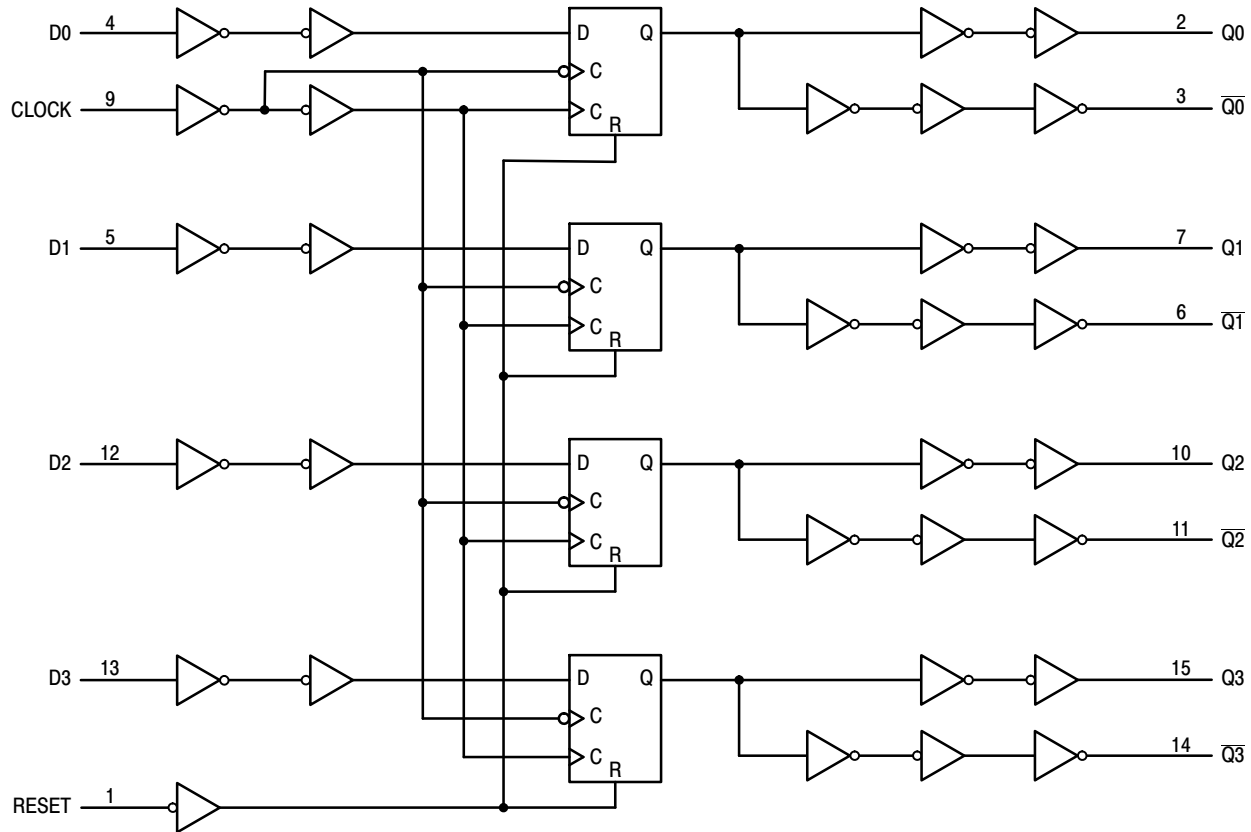


Figure 7.

## ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
MC74HC175ADG	HC175AG	SOIC-16	48 Units / Rail
MC74HC175ADR2G	HC175AG	SOIC-16	2500 Units / Tape & Reel
MC74HC175ADTR2G	HC 175A	TSSOP-16	2500 Units / Tape & Reel
MC74HC175ADTR2G-Q*	HC 175A	TSSOP-16	2500 Units / Tape & Reel

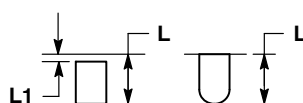
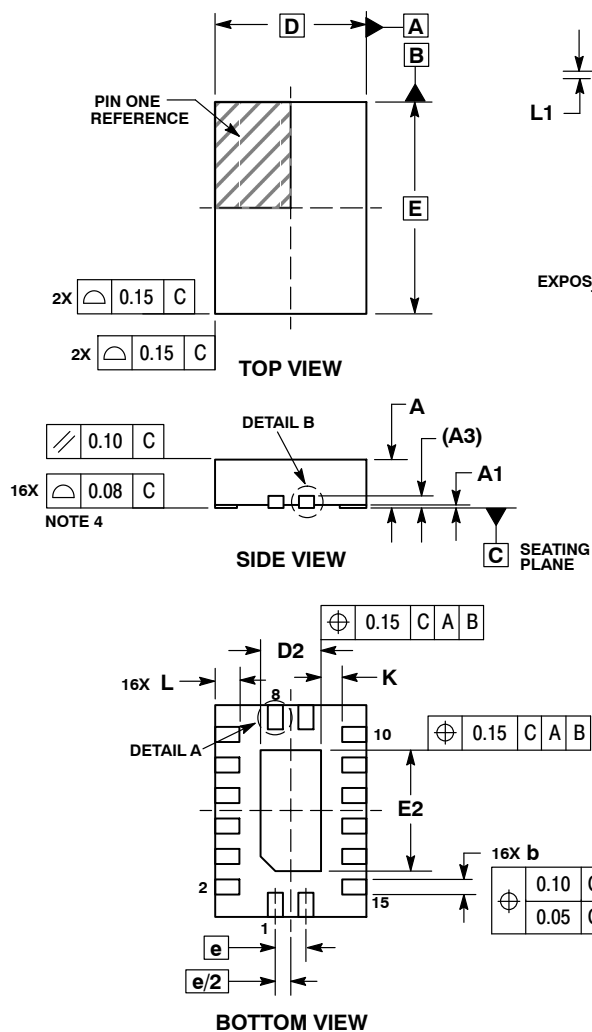
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

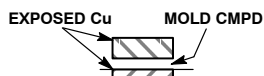
# MC74HC175A

## PACKAGE DIMENSIONS

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



**DETAIL A**  
ALTERNATE TERMINAL  
CONSTRUCTIONS



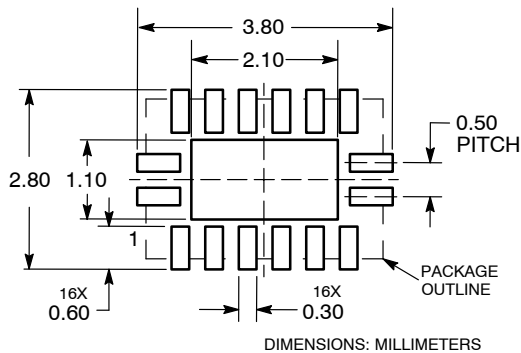
**DETAIL B**  
ALTERNATE  
CONSTRUCTIONS

### 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\*

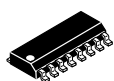


\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS



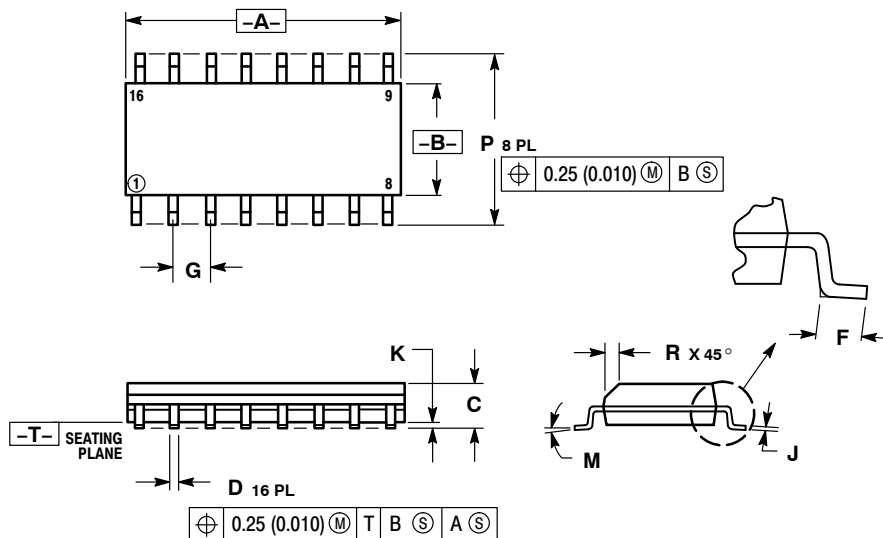
SCALE 1:1

### SOIC-16

#### CASE 751B-05

#### ISSUE K

DATE 29 DEC 2006



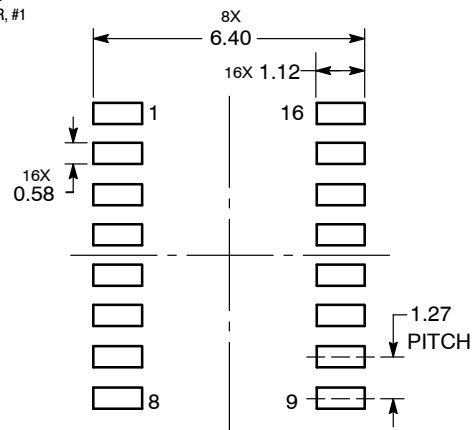
#### NOTES:

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: 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	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	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	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
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	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	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	

#### RECOMMENDED SOLDERING FOOTPRINT\*



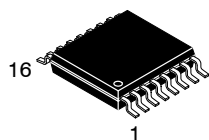
DIMENSIONS: MILLIMETERS

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

DOCUMENT NUMBER:	98ASB42566B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
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:

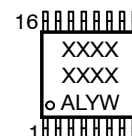
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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