

# MC74HC175A

## Quad D Flip-Flop with Common Clock and Reset High-Performance Silicon-Gate CMOS

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

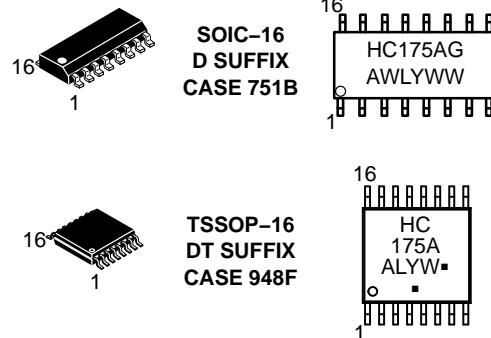
- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity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



ON Semiconductor®

<http://onsemi.com>

### MARKING DIAGRAMS



A = Assembly Location

L, WL = Wafer Lot

Y, YY = Year

W, WW = 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 2 of this data sheet.

# MC74HC175A

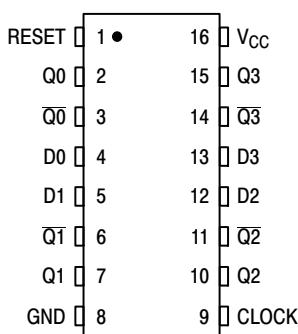


Figure 1. Pin Assignment

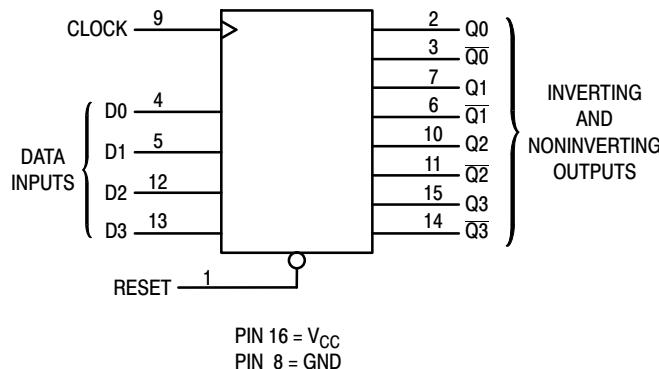


Figure 2. Logic Diagram

## FUNCTION TABLE

Inputs			Outputs	
Reset	Clock	D	Q	$\bar{Q}$
L	X	X	L	H
H	/	H	H	L
H	/	L	L	H
H	L	X	No Change	

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MC74HC175ADG	SOIC-16 (Pb-Free)	48 Units / Rail
MC74HC175ADR2G	SOIC-16 (Pb-Free)	2500 / Tape & Reel
MC74HC175ADTR2G	TSSOP-16 (Pb-Free)	2500 / Tape & Reel
NLV74HC175ADTR2G*	TSSOP-16 (Pb-Free)	2500 / 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.

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

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	– 0.5 to + 7.0	V
$V_{in}$	DC Input Voltage (Referenced to GND)	– 0.5 to $V_{CC}$ + 0.5	V
$V_{out}$	DC Output Voltage (Referenced to GND)	– 0.5 to $V_{CC}$ + 0.5	V
$I_{in}$	DC Input Current, per Pin	± 20	mA
$I_{out}$	DC Output Current, per Pin	± 25	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	± 50	mA
$P_D$	Power Dissipation in Still Air, SOIC Package TSSOP Package	500 450	mW
$T_{stg}$	Storage Temperature	– 65 to + 150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP, SOIC or TSSOP Package)	260	°C

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.

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.

†Derating — SOIC Package: – 7 mW/°C from 65° to 125°C  
TSSOP Package: – 6.1 mW/°C from 65° to 125°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit	
$V_{CC}$	DC Supply Voltage (Referenced to GND)	2.0	6.0	V	
$V_{in}, V_{out}$	DC Input Voltage, Output Voltage (Referenced to GND)	0	$V_{CC}$	V	
$T_A$	Operating Temperature, All Package Types	– 55	+ 125	°C	
$t_r, t_f$	Input Rise and Fall Time (Figure 1)	$V_{CC} = 2.0 \text{ V}$ $V_{CC} = 3.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$	0 0 0 0	1000 600 500 400	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.

# MC74HC175A

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

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 3.0 4.5 6.0	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	V
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 3.0 4.5 6.0	0.5 0.9 1.35 1.80	0.5 0.9 1.35 1.80	0.5 0.9 1.35 1.80	V
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 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		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 4.5 6.0	2.48 3.98 5.48	2.34 3.84 5.34	2.20 3.70 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 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		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 4.5 6.0	0.26 0.26 0.26	0.33 0.33 0.33	0.40 0.40 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 (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

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 1 and 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 $\bar{Q}$ (Figures 1 and 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 $\bar{Q}$ (Figures 2 and 4)	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 1 and 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			pF	
		35				

\* 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 + I<sub>CC</sub> V<sub>CC</sub>.

## TIMING REQUIREMENTS (Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

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 3)	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 3)	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 2)	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 1)	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 2)	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 1)	2.0	1000	1000	1000	ns
		3.0	800	800	800	
		4.5	500	500	500	
		6.0	400	400	400	

# MC74HC175A

## SWITCHING WAVEFORMS

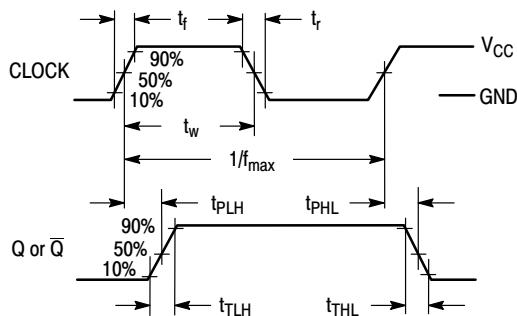


Figure 3.

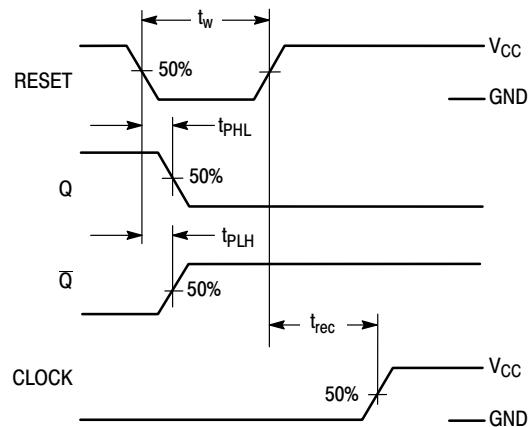


Figure 4.

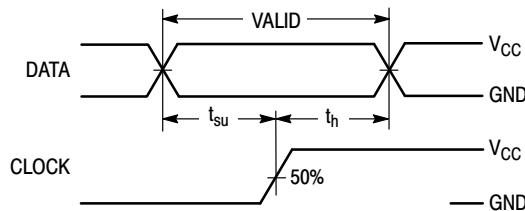
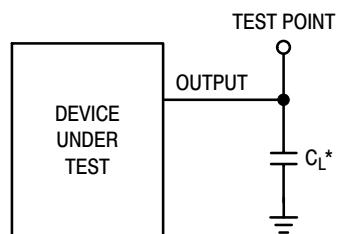


Figure 5.

## TEST CIRCUIT

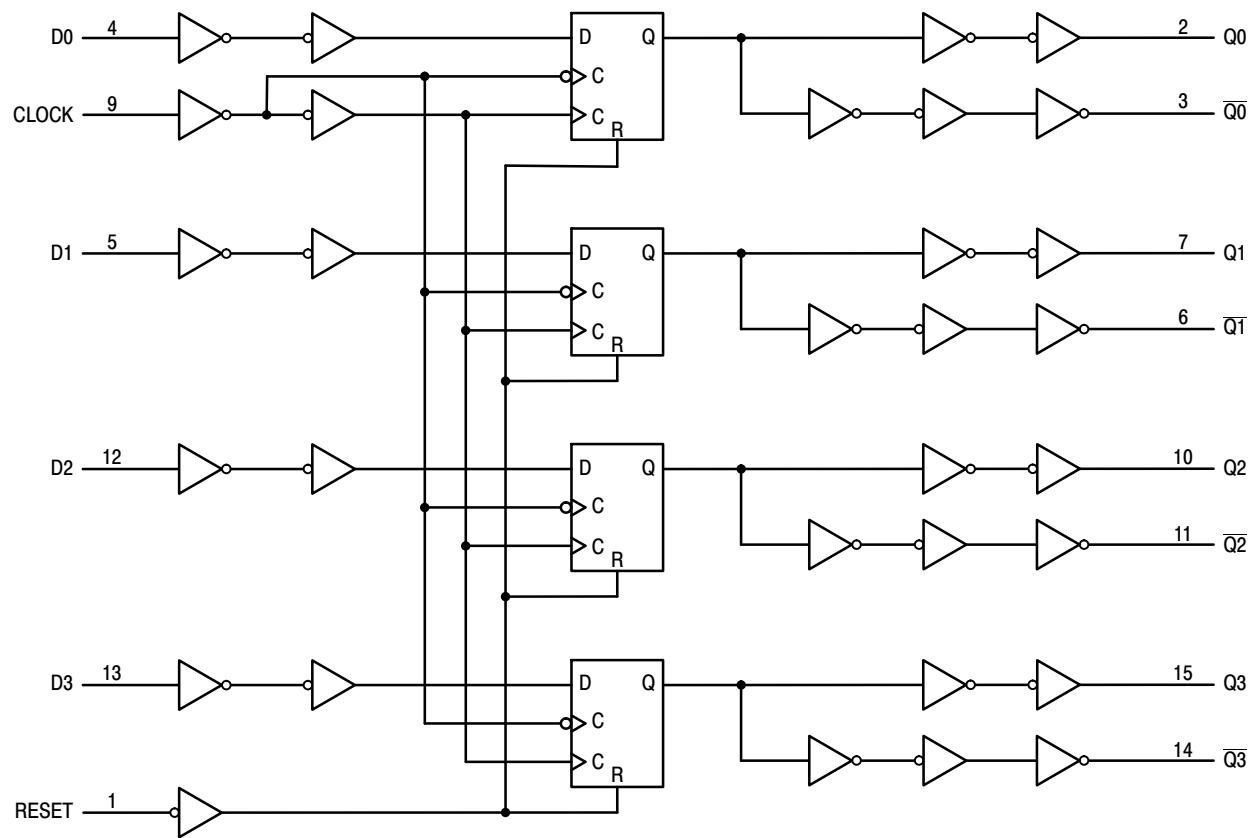


\*Includes all probe and jig capacitance

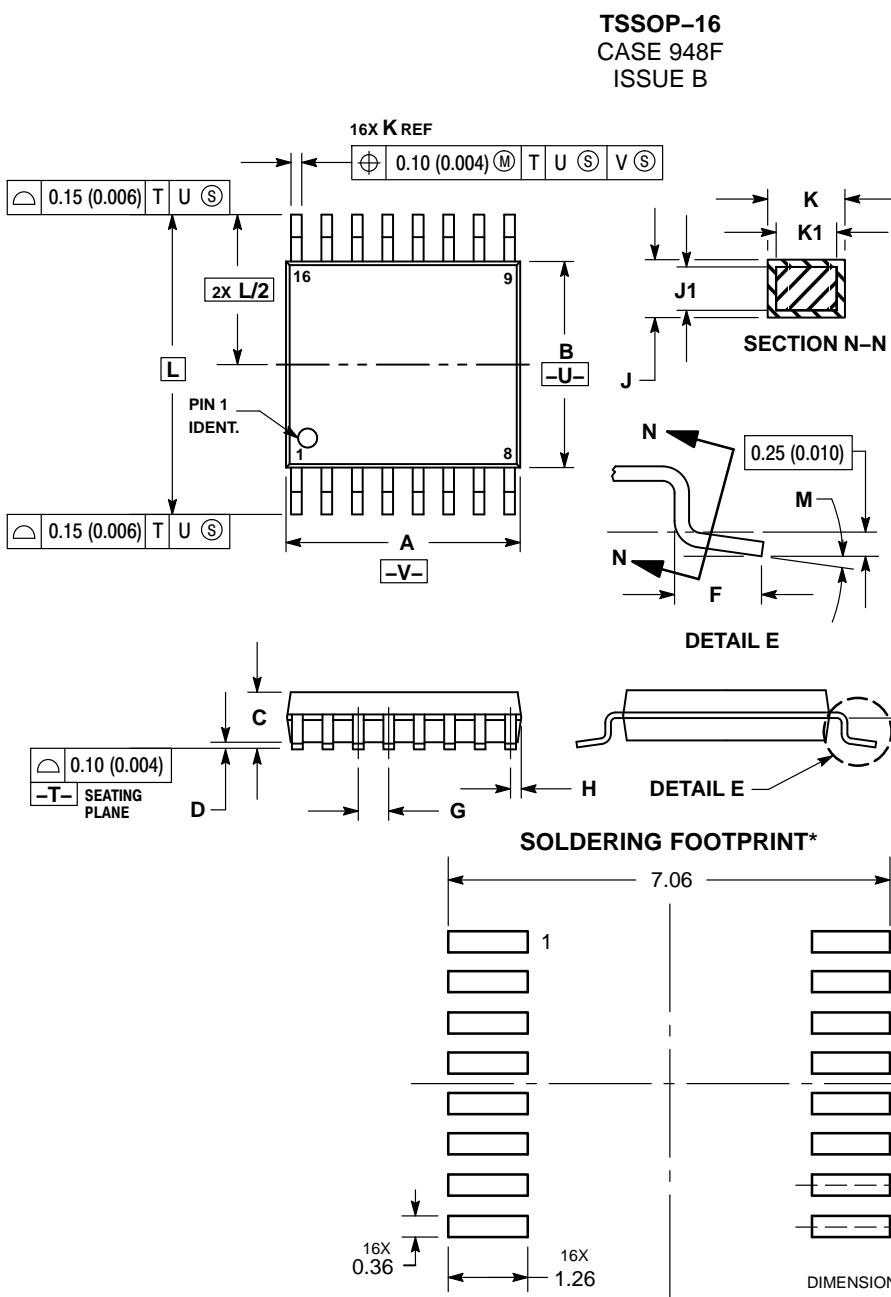
Figure 6.

# MC74HC175A

## EXPANDED LOGIC DIAGRAM



## PACKAGE DIMENSIONS

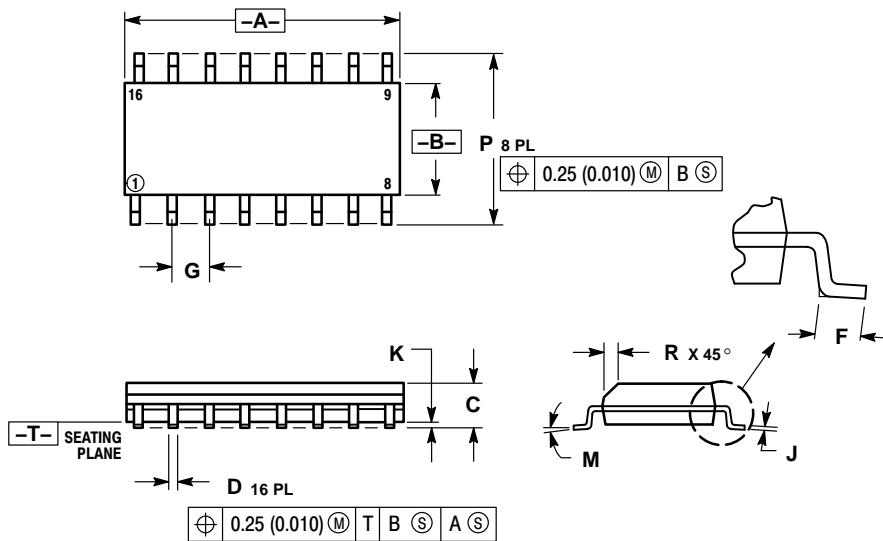


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74HC175A

## PACKAGE DIMENSIONS

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

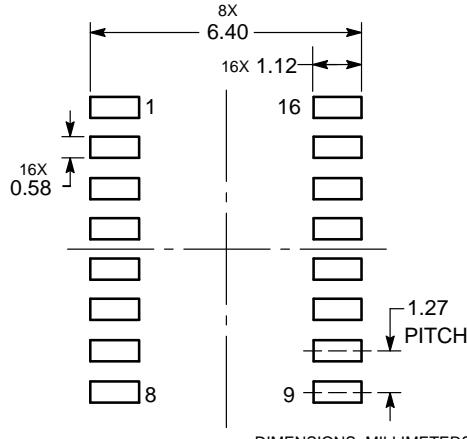


#### NOTES:

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

### SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

**ON Semiconductor** and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

### N. American Technical Support: 800-282-9855 Toll Free

USA/Canada

### Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910

### Japan Customer Focus Center

Phone: 81-3-5817-1050

### ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

### Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

## ON Semiconductor:

[MC74HC175AD](#) [MC74HC175ADG](#) [MC74HC175ADR2](#) [MC74HC175ADR2G](#) [MC74HC175ADTR2](#)  
[MC74HC175ADTR2G](#) [MC74HC175AFEL](#) [MC74HC175AFELG](#) [MC74HC175AN](#) [MC74HC175ANG](#)  
[NLV74HC175ADTR2G](#)