

MC74HC175A

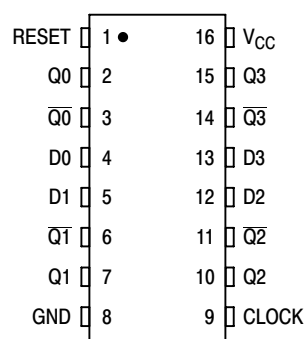


Figure 1. Pin Assignment

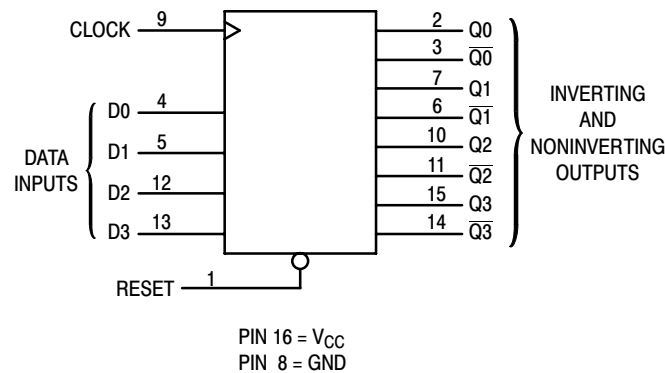


Figure 2. Logic Diagram

FUNCTION TABLE

| Inputs |       |   | Outputs   |   |
|--------|-------|---|-----------|---|
| Reset  | Clock | D | Q         | 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> |
|-----------------|---------------------|-----------------------|
| MC74HC175AN     | PDIP-16             | 500 Units / Rail      |
| MC74HC175AD     | SOIC-16             | 48 Units / Rail       |
| MC74HC175ADG    | SOIC-16 (Pb-Free)   | 48 Units / Rail       |
| MC74HC175ADR2   | SOIC-16             | 2500 Units / Reel     |
| MC74HC175ADR2G  | SOIC-16 (Pb-Free)   | 2500 Units / Reel     |
| MC74HC175ADTR2  | TSSOP-16*           | 2500 Units / Reel     |
| MC74HC175ADTR2G | TSSOP-16*           | 2500 Units / Reel     |
| MC74HC175AFEL   | SOEIAJ-16           | 2000 Units / Reel     |
| MC74HC175AFELG  | SOEIAJ-16 (Pb-Free) | 2000 Units / 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.

\*This package is inherently Pb-Free.

# MC74HC175A

## 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                                                               | $\pm 20$                | mA   |
| $I_{out}$ | DC Output Current, per Pin                                                              | $\pm 25$                | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                                                | $\pm 50$                | mA   |
| $P_D$     | Power Dissipation in Still Air,<br>Plastic DIP†<br>SOIC Package†<br>TSSOP Package†      | 750<br>500<br>450       | mW   |
| $T_{stg}$ | Storage Temperature                                                                     | – 65 to + 150           | °C   |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds<br>(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.

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

†Derating — Plastic DIP: – 10 mW/°C from 65° to 125°C

SOIC Package: – 7 mW/°C from 65° to 125°C

TSSOP Package: – 6.1 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter                                            | Min                                                                                                      | Max                            | Unit |
|------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------|------|
| V <sub>CC</sub>                    | DC Supply Voltage (Referenced to GND)                | 2.0                                                                                                      | 6.0                            | V    |
| V <sub>in</sub> , V <sub>out</sub> | DC Input Voltage, Output Voltage (Referenced to GND) | 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<br>(Figure 1)               | V <sub>CC</sub> = 2.0 V<br>V <sub>CC</sub> = 3.0 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6.0 V | 0<br>1000<br>600<br>500<br>400 | ns   |

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol   | Parameter                         | Test Conditions                                                                          | $V_{CC}$<br>V            | Guaranteed Limit           |                            |                            | Unit |
|----------|-----------------------------------|------------------------------------------------------------------------------------------|--------------------------|----------------------------|----------------------------|----------------------------|------|
|          |                                   |                                                                                          |                          | – 55 to<br>25°C            | ≤ 85°C                     | ≤ 125°C                    |      |
| $V_{IH}$ | Minimum High-Level Input Voltage  | $V_{out} = 0.1 \text{ V}$ or $V_{CC} - 0.1 \text{ V}$<br>$ I_{out}  \leq 20 \mu\text{A}$ | 2.0<br>3.0<br>4.5<br>6.0 | 1.5<br>2.1<br>3.15<br>4.2  | 1.5<br>2.1<br>3.15<br>4.2  | 1.5<br>2.1<br>3.15<br>4.2  | V    |
| $V_{IL}$ | Maximum Low-Level Input Voltage   | $V_{out} = 0.1 \text{ V}$ or $V_{CC} - 0.1 \text{ V}$<br>$ I_{out}  \leq 20 \mu\text{A}$ | 2.0<br>3.0<br>4.5<br>6.0 | 0.5<br>0.9<br>1.35<br>1.80 | 0.5<br>0.9<br>1.35<br>1.80 | 0.5<br>0.9<br>1.35<br>1.80 | V    |
| $V_{OH}$ | Minimum High-Level Output Voltage | $V_{in} = V_{IH}$ or $V_{IL}$<br>$ I_{out}  \leq 20 \mu\text{A}$                         | 2.0<br>4.5<br>6.0        | 1.9<br>4.4<br>5.9          | 1.9<br>4.4<br>5.9          | 1.9<br>4.4<br>5.9          | V    |
|          |                                   | $V_{in} = V_{IH}$ or $V_{IL}$ $ I_{out}  \leq 2.4 \text{ mA}$                            | 3.0                      | 2.48                       | 2.34                       | 2.20                       |      |
|          |                                   | $ I_{out}  \leq 4.0 \text{ mA}$                                                          | 4.5                      | 3.98                       | 3.84                       | 3.70                       |      |
|          |                                   | $ I_{out}  \leq 5.2 \text{ mA}$                                                          | 6.0                      | 5.48                       | 5.34                       | 5.20                       |      |

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## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Test Conditions                                                                                                                                      | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|-----------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|--------|---------|------|
|                 |                                                |                                                                                                                                                      |                      | – 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> 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><br> I <sub>out</sub>   ≤ 2.4 mA<br> I <sub>out</sub>   ≤ 4.0 mA<br> 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<br>I <sub>out</sub> = 0 μA                                                                                  | 6.0                  | 4                | 40     | 160     | μA   |

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## 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><br>V | Guaranteed Limit |        |         | Unit |
|----------------------------------------|-------------------------------------------------------------------------|----------------------|------------------|--------|---------|------|
|                                        |                                                                         |                      | – 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| f <sub>max</sub>                       | Maximum Clock Frequency (50% Duty Cycle)<br>(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> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Clock to Q or $\bar{Q}$<br>(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 $\bar{Q}$<br>(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> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(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   |

### NOTES:

1. For propagation delays with loads other than 50 pF, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).
2. Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

| 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>. For load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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## TIMING REQUIREMENTS (Input $t_r = t_f = 6$ ns)

| Symbol     | Parameter                                                    | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|------------|--------------------------------------------------------------|----------------------|------------------|--------|---------|------|
|            |                                                              |                      | – 55 to<br>25°C  | ≤ 85°C | ≤ 125°C |      |
| $t_{su}$   | Minimum Setup Time, Data to Clock<br>(Figure 3)              | 2.0                  | 100              | 125    | 150     | ns   |
|            |                                                              | 3.0                  | 45               | 65     | 85      |      |
|            |                                                              | 4.5                  | 20               | 25     | 30      |      |
|            |                                                              | 6.0                  | 17               | 21     | 26      |      |
| $t_h$      | Minimum Hold Time, Clock to Data<br>(Figure 3)               | 2.0                  | 5                | 5      | 5       | ns   |
|            |                                                              | 3.0                  | 3                | 3      | 3       |      |
|            |                                                              | 4.5                  | 3                | 3      | 3       |      |
|            |                                                              | 6.0                  | 3                | 3      | 3       |      |
| $t_{rec}$  | Minimum Recovery Time, Reset Inactive to Clock<br>(Figure 2) | 2.0                  | 100              | 125    | 150     | ns   |
|            |                                                              | 3.0                  | 45               | 65     | 85      |      |
|            |                                                              | 4.5                  | 20               | 25     | 30      |      |
|            |                                                              | 6.0                  | 17               | 21     | 26      |      |
| $t_w$      | Minimum Pulse Width, Clock<br>(Figure 1)                     | 2.0                  | 80               | 100    | 120     | ns   |
|            |                                                              | 3.0                  | 45               | 65     | 85      |      |
|            |                                                              | 4.5                  | 16               | 20     | 24      |      |
|            |                                                              | 6.0                  | 14               | 17     | 20      |      |
| $t_w$      | Minimum Pulse Width, Reset<br>(Figure 2)                     | 2.0                  | 80               | 100    | 120     | ns   |
|            |                                                              | 3.0                  | 45               | 65     | 85      |      |
|            |                                                              | 4.5                  | 16               | 20     | 24      |      |
|            |                                                              | 6.0                  | 14               | 17     | 20      |      |
| $t_r, t_f$ | Maximum Input Rise and Fall Times<br>(Figure 1)              | 2.0                  | 1000             | 1000   | 1000    | ns   |
|            |                                                              | 3.0                  | 800              | 800    | 800     |      |
|            |                                                              | 4.5                  | 500              | 500    | 500     |      |
|            |                                                              | 6.0                  | 400              | 400    | 400     |      |

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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## SWITCHING WAVEFORMS

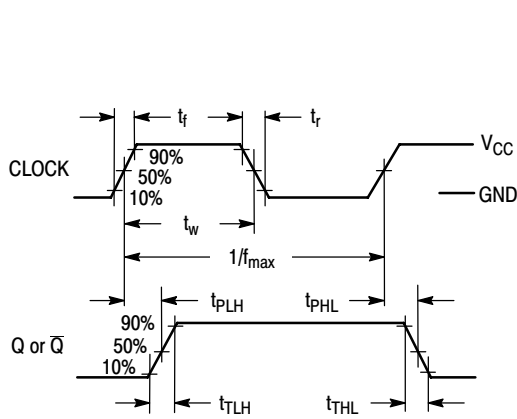


Figure 3.

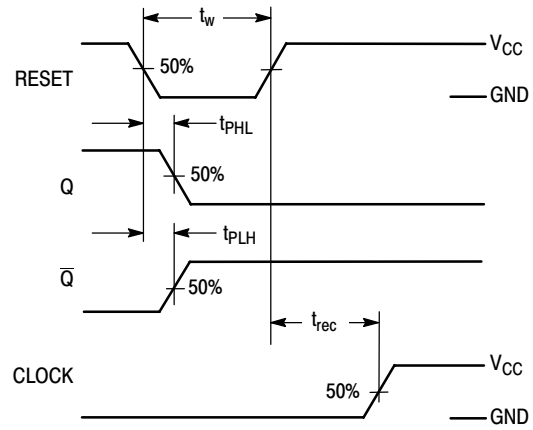


Figure 4.

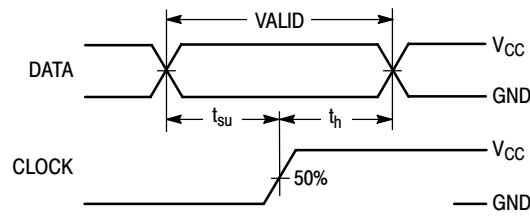
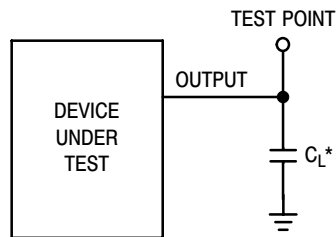


Figure 5.

## TEST CIRCUIT

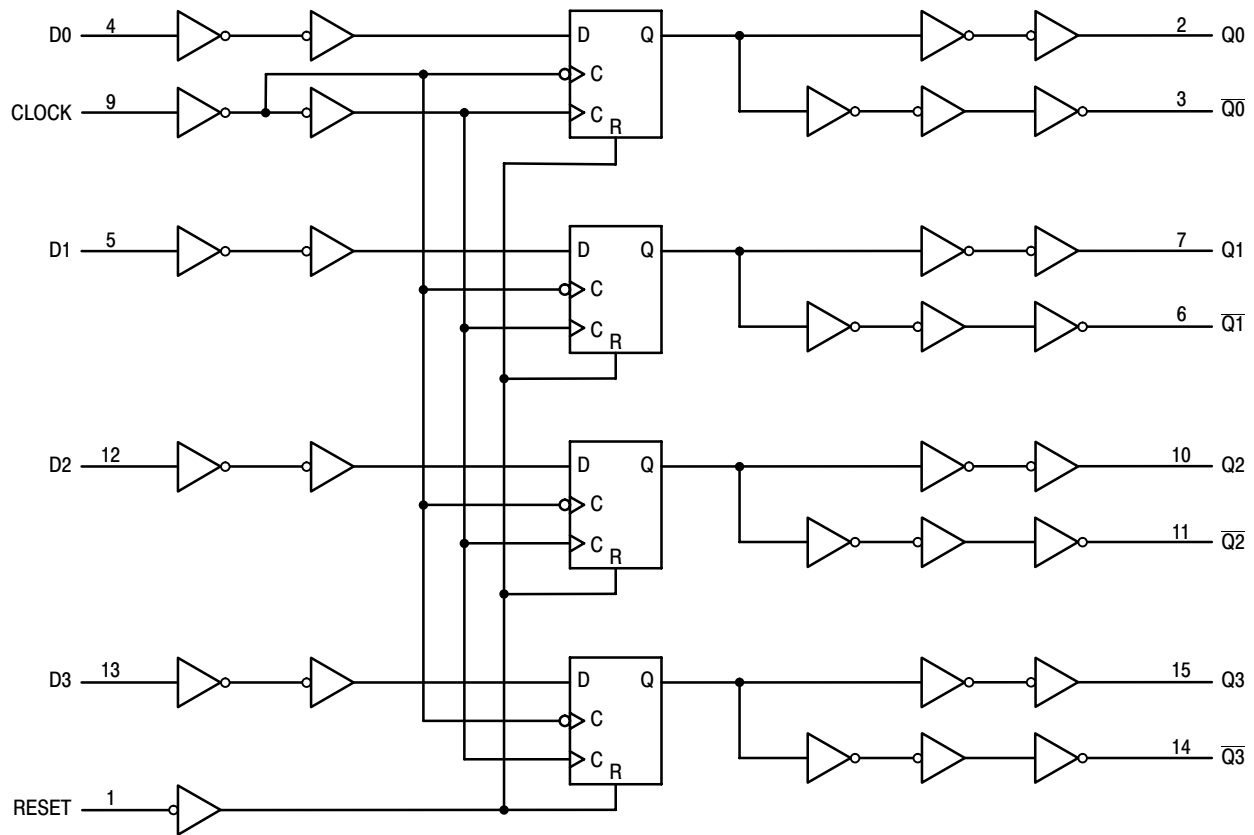


\*Includes all probe and jig capacitance

Figure 6.

# MC74HC175A

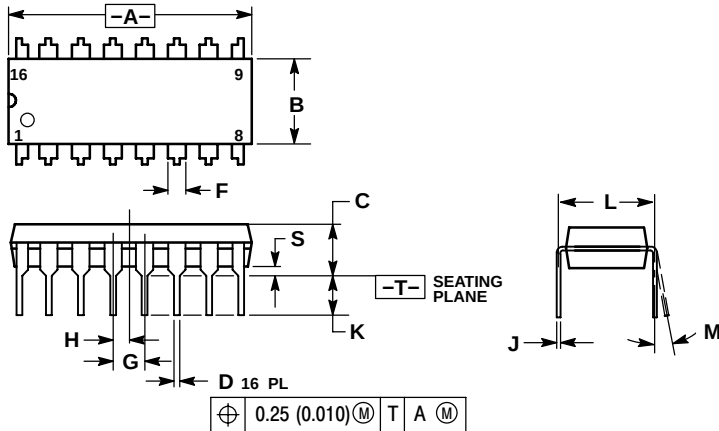
## EXPANDED LOGIC DIAGRAM



# MC74HC175A

## PACKAGE DIMENSIONS

PDIP-16  
N SUFFIX  
CASE 648-08  
ISSUE T

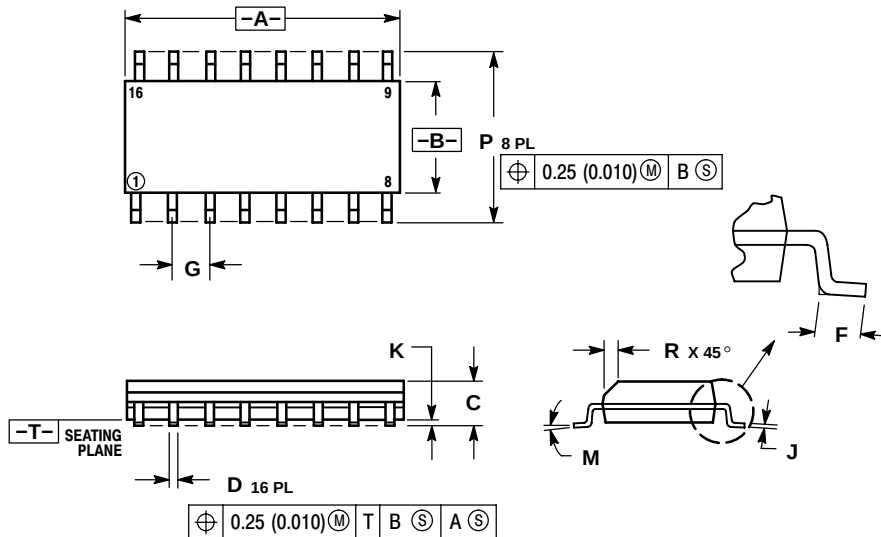


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.70  | 1.02        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.050 BSC |       | 1.27 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0°        | 10°   | 0°          | 10°   |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

SOIC-16  
D SUFFIX  
CASE 751B-05  
ISSUE J



### NOTES:

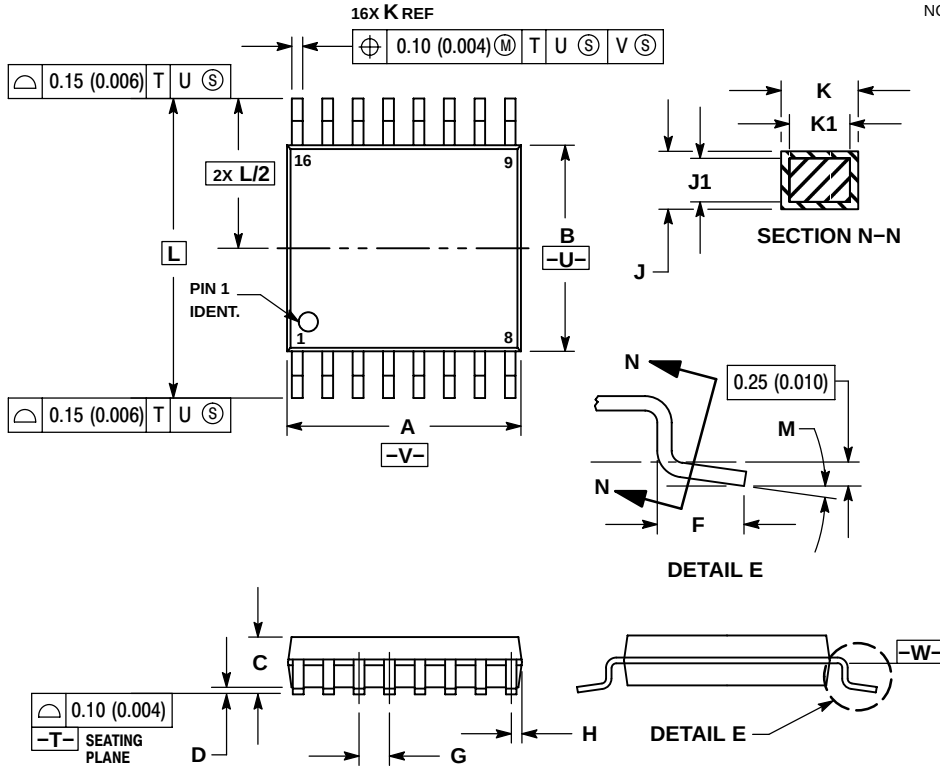
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL 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 |

# MC74HC175A

## PACKAGE DIMENSIONS

TSSOP-16  
DT SUFFIX  
CASE 948F-01  
ISSUE A



- 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-.

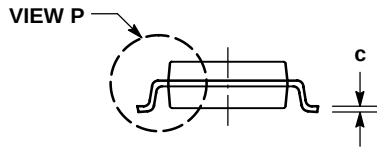
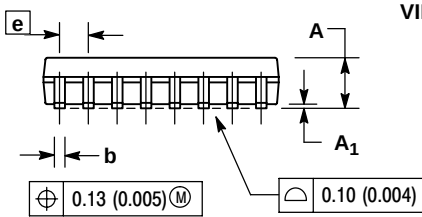
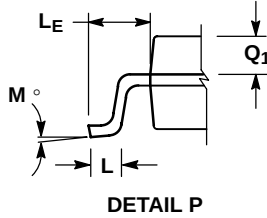
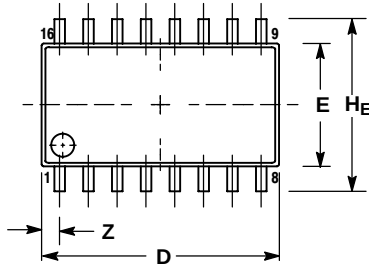
| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 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°    |



# MC74HC175A

## PACKAGE DIMENSIONS

SOEIAJ-16  
F SUFFIX  
CASE 966-01  
ISSUE O



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.18        | 0.27  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.78  | ---       | 0.031 |

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