

# MC74VHC157

## Quad 2-Channel Multiplexer

The MC74VHC157 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 ( $\bar{E}$ ) inputs. When  $\bar{E}$  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 internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

- High Speed:  $t_{PD} = 4.1 \text{ ns}$  (Typ) at  $V_{CC} = 5 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 4 \mu\text{A}$  (Max) at  $T_A = 25^\circ\text{C}$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise:  $V_{OLP} = 0.8 \text{ V}$  (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 82 FETs

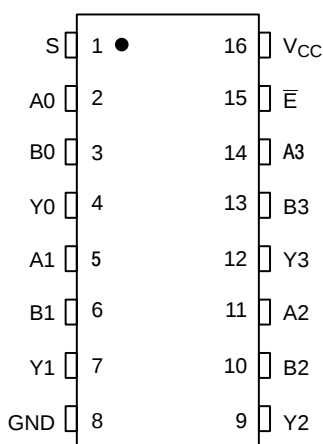


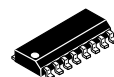
Figure 1. Pin Assignment



ON Semiconductor

<http://onsemi.com>

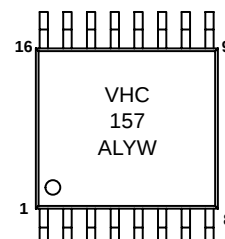
### MARKING DIAGRAMS



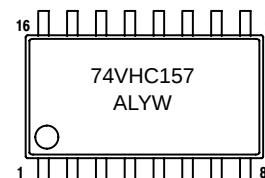
SOIC-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F



SOIC EIAJ-16  
M SUFFIX  
CASE 966



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week

### ORDERING INFORMATION

| Device         | Package      | Shipping        |
|----------------|--------------|-----------------|
| MC74VHC157D    | SOIC-16      | 48 Units/Rail   |
| MC74VHC157DR2  | SOIC-16      | 2500 Units/Reel |
| MC74VHC157DT   | TSSOP-16     | 96 Units/Rail   |
| MC74VHC157DTR2 | TSSOP-16     | 2500 Units/Reel |
| MC74VHC157M    | SOIC EIAJ-16 | 50 Units/Rail   |
| MC74VHC157MEL  | SOIC EIAJ-16 | 2000 Units/Reel |

## MC74VHC157

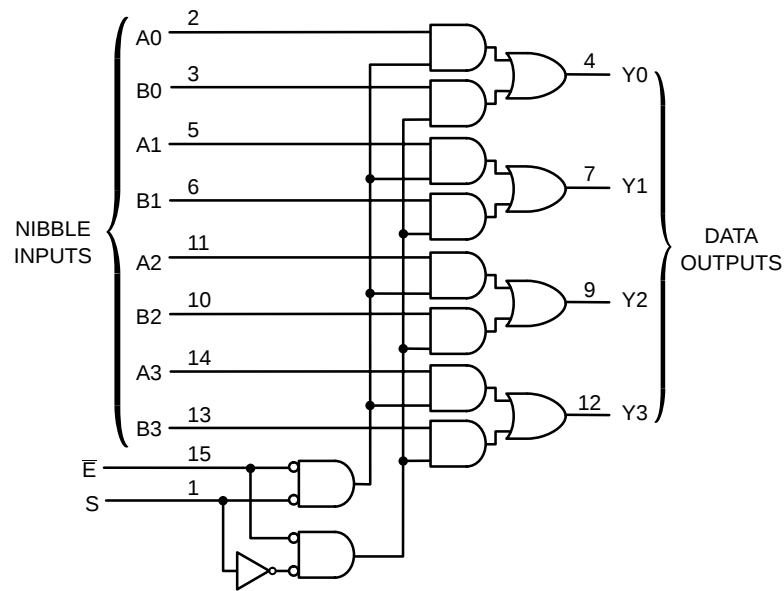


Figure 2. Expanded Logic Diagram

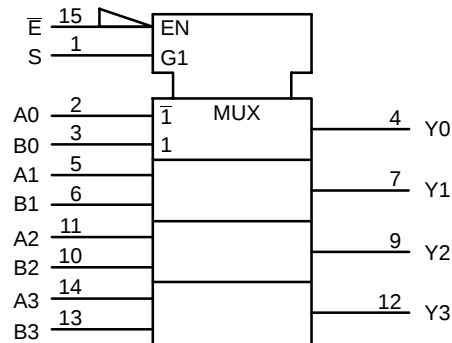


Figure 3. IEC Logic Symbol

### FUNCTION TABLE

| Inputs    |   | Outputs |
|-----------|---|---------|
| $\bar{E}$ | S | Y0 – Y3 |
| H         | X | L       |
| L         | L | A0–A3   |
| L         | H | B0–B3   |

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

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## MAXIMUM RATINGS (Note 1)

| Symbol                | Parameter                                                                                                     | Value                          | Unit |
|-----------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------|------|
| V <sub>CC</sub>       | DC Supply Voltage                                                                                             | − 0.5 to + 7.0                 | V    |
| V <sub>I</sub>        | DC Input Voltage                                                                                              | − 0.5 to V <sub>CC</sub> + 7.0 | V    |
| V <sub>O</sub>        | DC Output Voltage                                                                                             | − 0.5 to V <sub>CC</sub> + 7.0 | V    |
| I <sub>IK</sub>       | DC Input Diode Current<br>V <sub>I</sub> < GND                                                                | − 20                           | mA   |
| I <sub>OK</sub>       | DC Output Diode Current<br>V <sub>O</sub> < GND                                                               | ± 20                           | mA   |
| I <sub>O</sub>        | DC Output Sink Current                                                                                        | ± 25                           | mA   |
| I <sub>CC</sub>       | DC Supply Current per Supply Pin                                                                              | ± 100                          | 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                                                                                            | 250                            | °C/W |
| P <sub>D</sub>        | Power Dissipation in Still Air at 85°C                                                                        | 250                            | mW   |
| MSL                   | Moisture Sensitivity                                                                                          | Level 1                        |      |
| F <sub>R</sub>        | Flammability Rating<br>Oxygen Index: 30% – 35%                                                                | UL–94–VO (0.125 in)            |      |
| V <sub>ESD</sub>      | ESD Withstand Voltage<br>Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | >2000<br>>200<br>N/A           | V    |
| I <sub>Latch-Up</sub> | Latch-Up Performance<br>Above V <sub>CC</sub> and Below GND at 85°C (Note 5)                                  | ± 500                          | mA   |

1. Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Extended exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum-rated conditions is not implied.
2. Tested to EIA/JESD22–A114–A.
3. Tested to EIA/JESD22–A115–A.
4. Tested to JESD22–C101–A.
5. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Characteristics                                                                               | Min    | Max             | Unit |
|---------------------------------|-----------------------------------------------------------------------------------------------|--------|-----------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage                                                                             | 2.0    | 5.5             | V    |
| V <sub>IN</sub>                 | DC Input Voltage (Note 6)                                                                     | 0      | 5.5             | V    |
| V <sub>OUT</sub>                | DC Output Voltage                                                                             | 0      | V <sub>CC</sub> | 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<br>V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>0 | 100<br>20       | ns/V |

6. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

## 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         |

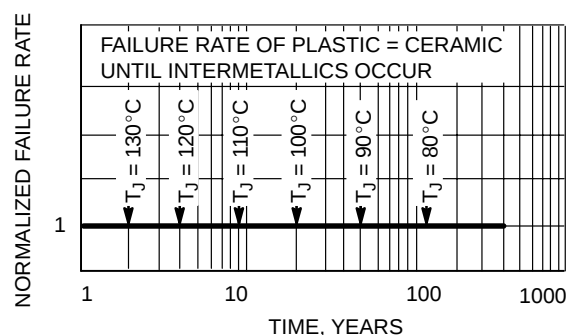


Figure 4. Failure Rate vs. Time Junction Temperature

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## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                 | Condition                                                                                                  | V <sub>CC</sub><br>(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> | High-Level Input Voltage  |                                                                                                            | 2.0<br>3.0 to 5.5      | 1.5<br>0.7 V <sub>CC</sub> |                   |                            | 1.5<br>0.7 V <sub>CC</sub> |                            | 1.5<br>0.7 V <sub>CC</sub>     |                            | V    |
| V <sub>IL</sub> | Low-Level Input Voltage   |                                                                                                            | 2.0<br>3.0 to 5.5      |                            |                   | 0.5<br>0.3 V <sub>CC</sub> |                            | 0.5<br>0.3 V <sub>CC</sub> |                                | 0.5<br>0.3 V <sub>CC</sub> | V    |
| V <sub>OH</sub> | High-Level Output Voltage | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = -50 μA                           | 2.0<br>3.0<br>4.5      | 1.9<br>2.9<br>4.4          | 2.0<br>3.0<br>4.5 |                            | 1.9<br>2.9<br>4.4          |                            | 1.9<br>2.9<br>4.4              |                            | V    |
|                 |                           | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = -4 mA<br>I <sub>OH</sub> = -8 mA | 3.0<br>4.5             | 2.58<br>3.94               |                   |                            | 2.48<br>3.8                |                            | 2.34<br>3.66                   |                            |      |
| V <sub>OL</sub> | Low-Level Output Voltage  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OL</sub> = 50 μA                            | 2.0<br>3.0<br>4.5      |                            | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1          |                            | 0.1<br>0.1<br>0.1          |                                | 0.1<br>0.1<br>0.1          | V    |
|                 |                           | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = 4 mA<br>I <sub>OH</sub> = 8 mA   | 3.0<br>4.5             |                            |                   | 0.36<br>0.36               |                            | 0.44<br>0.44               |                                | 0.52<br>0.52               |      |
| 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>CC</sub> | Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                   | 5.5                    |                            |                   | 4.0                        |                            | 40.0                       |                                | 40.0                       | μA   |

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns)

| Symbol                                 | Characteristic                         |                                                                                   | T <sub>A</sub> = 25°C |             |              | T <sub>A</sub> ≤ 85°C |              | -55°C ≤ T <sub>A</sub> ≤ 125°C |              | Unit |
|----------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------|-----------------------|-------------|--------------|-----------------------|--------------|--------------------------------|--------------|------|
|                                        |                                        | Test Conditions                                                                   | Min                   | Typ         | Max          | Typ                   | Max          | Typ                            | Max          |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay,<br>A to B to Y      | V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 6.2<br>8.7  | 9.7<br>13.2  | 1.0<br>1.0            | 11.5<br>15.0 | 1.0<br>1.0                     | 11.5<br>15.0 | ns   |
|                                        |                                        | V <sub>CC</sub> = 5.0 ± 0.5 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 4.1<br>5.6  | 6.4<br>8.4   | 1.0<br>1.0            | 7.5<br>9.5   | 1.0<br>1.0                     | 7.5<br>9.5   |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay,<br>S to Y           | V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 8.4<br>10.9 | 13.2<br>16.7 | 1.0<br>1.0            | 15.5<br>19.0 | 1.0<br>1.0                     | 15.5<br>19.0 | ns   |
|                                        |                                        | V <sub>CC</sub> = 5.0 ± 0.5 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 5.3<br>6.8  | 8.1<br>10.1  | 1.0<br>1.0            | 9.5<br>11.5  | 1.0<br>1.0                     | 9.5<br>11.5  |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay,<br>E to Y           | V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 8.7<br>11.2 | 13.6<br>17.1 | 1.0<br>1.0            | 16.0<br>19.5 | 1.0<br>1.0                     | 16.0<br>19.5 | ns   |
|                                        |                                        | V <sub>CC</sub> = 5.0 ± 0.5 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 5.6<br>7.1  | 8.6<br>10.6  | 1.0<br>1.0            | 10.0<br>12.0 | 1.0<br>1.0                     | 10.0<br>12.0 |      |
| C <sub>IN</sub>                        | Input Capacitance                      |                                                                                   |                       | 4           | 10           |                       | 10           |                                | 10           | pF   |
| C <sub>PD</sub>                        | Power Dissipation Capacitance (Note 7) | Typical @ 25°C, V <sub>CC</sub> = 5.0 V                                           |                       |             |              |                       |              |                                |              | pF   |
|                                        |                                        | 20                                                                                |                       |             |              |                       |              |                                |              |      |

7. 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>.

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**NOISE CHARACTERISTICS** (Input  $t_r = t_f = 3.0$  ns;  $C_L = 50$  pF;  $V_{CC} = 5.0$  V)

| Symbol    | Characteristic                           | $T_A = 25^\circ\text{C}$ |      | Unit |
|-----------|------------------------------------------|--------------------------|------|------|
|           |                                          | Typ                      | Max  |      |
| $V_{OLP}$ | Quiet Output Maximum Dynamic $V_{OL}$    | 0.3                      | 0.8  | V    |
| $V_{OLV}$ | Quiet Output Minimum Dynamic $V_{OL}$    | -0.3                     | -0.8 | V    |
| $V_{IHD}$ | Minimum High Level Dynamic Input Voltage |                          | 3.5  | V    |
| $V_{ILD}$ | Maximum Low Level Dynamic Input Voltage  |                          | 1.5  | V    |

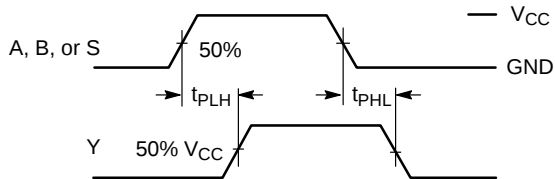


Figure 5. Switching Waveform

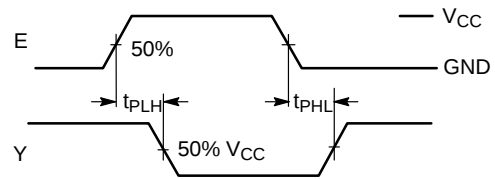
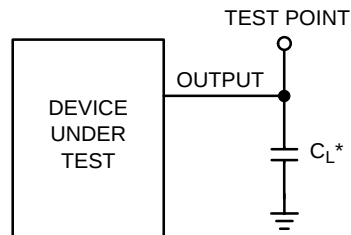


Figure 6. Inverting Switching



\*Includes all probe and jig capacitance.

Figure 7. Test Circuit

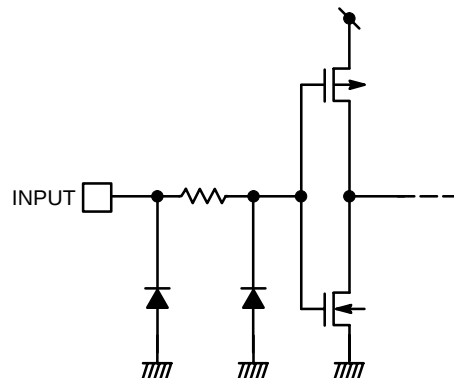
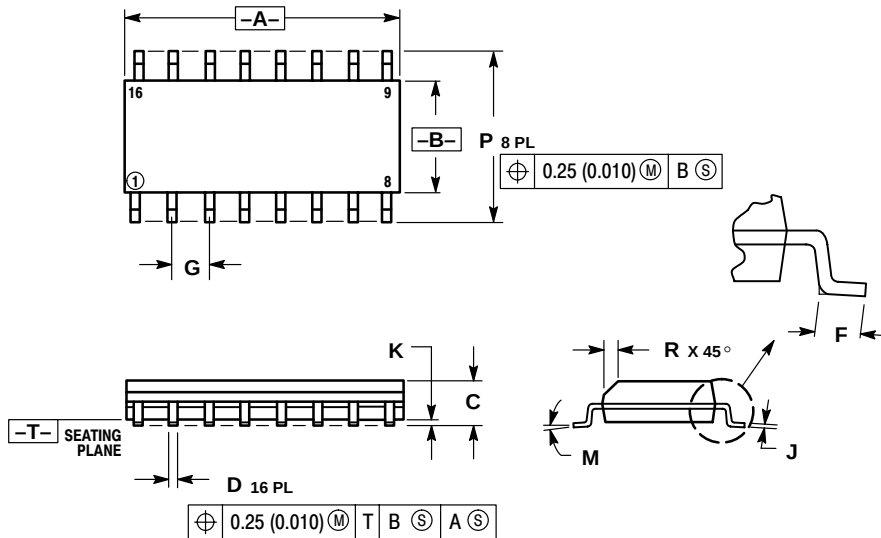


Figure 8. Input Equivalent Circuit

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## PACKAGE DIMENSIONS

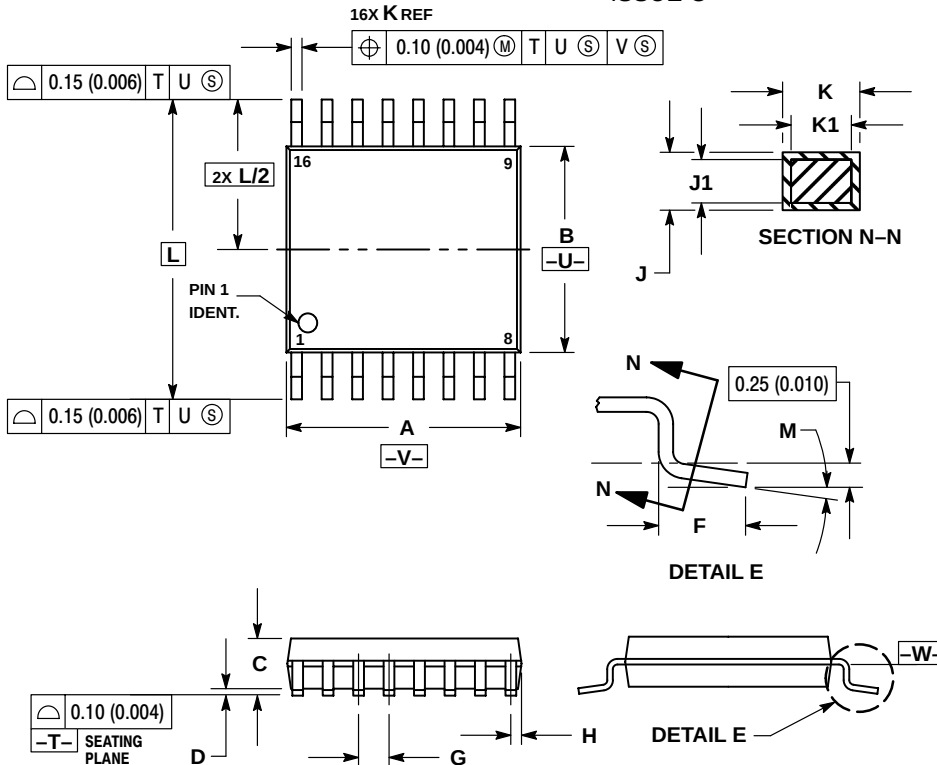
SOIC-16  
D SUFFIX  
CASE 751B-05  
ISSUE J



- 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 |

TSSOP  
DT SUFFIX  
CASE 948F-01  
ISSUE O



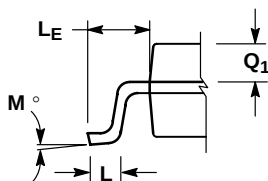
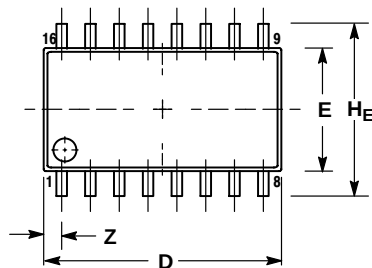
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.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

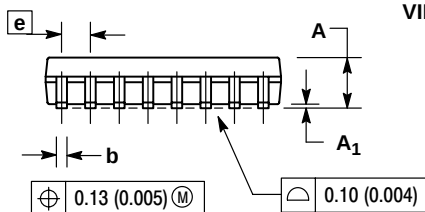
# MC74VHC157

## PACKAGE DIMENSIONS

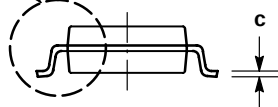
SOIC EIAJ-16  
M SUFFIX  
CASE 966-01  
ISSUE O



DETAIL P



VIEW P



### 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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