

# Quad 2-Input Data Selector/Multiplexer

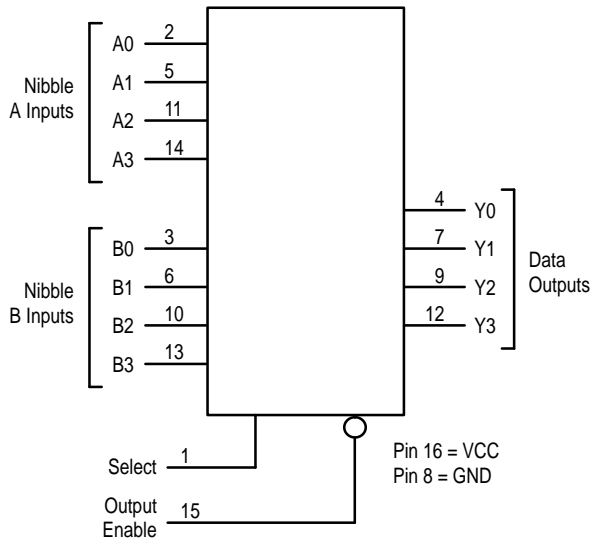
## High-Performance Silicon-Gate CMOS

The MC54/74HC158 is identical in pinout to the LS158. The device inputs are compatible with Standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

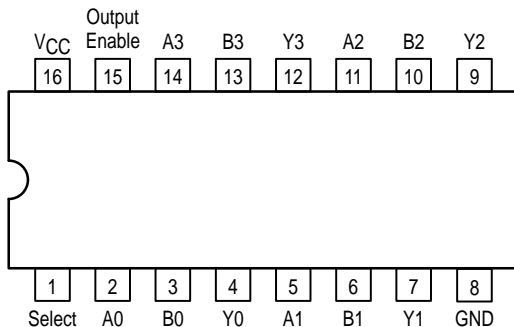
These devices route 2 nibbles (A or B) to a single port (Y) as determined by the Select input. The data is presented at the outputs in inverted form for the HC158. A high level on the Output Enable input sets all four Y outputs to a high level for the HC158.

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2 to 6V
- Low Input Current: 1µA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance With the JEDEC Standard No. 7A Requirements
- Chip Complexity: 74 FETs or 18.5 Equivalent Gates

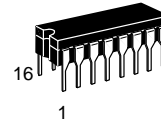
### LOGIC DIAGRAM



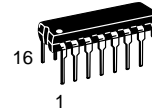
### Pinout: 16-Lead Plastic Package (Top View)



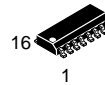
## MC54/74HC158



**J SUFFIX**  
CERAMIC PACKAGE  
CASE 620-10



**N SUFFIX**  
PLASTIC PACKAGE  
CASE 648-08



**D SUFFIX**  
SOIC PACKAGE  
CASE 751B-05

### ORDERING INFORMATION

|            |         |
|------------|---------|
| MC54HCXXXJ | Ceramic |
| MC74HCXXXN | Plastic |
| MC74HCXXXD | SOIC    |

### FUNCTION TABLE

| Inputs        |        | Outputs            |
|---------------|--------|--------------------|
| Output Enable | Select | Y0-Y3              |
| H             | X      | H                  |
| L             | L      | $\overline{A0-A3}$ |
| L             | H      | $\overline{B0-B3}$ |

X = Don't Care

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



**MAXIMUM RATINGS\***

| Symbol           | Parameter   | Value                          | Unit |
|------------------|---|--------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage (Referenced to GND)   | - 0.5 to + 7.0                 | V    |
| V <sub>in</sub>  | DC Input Voltage (Referenced to GND)  | - 1.5 to V <sub>CC</sub> + 1.5 | V    |
| V <sub>out</sub> | DC Output Voltage (Referenced to GND)   | - 0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>in</sub>  | DC Input Current, per Pin   | ± 20                           | mA   |
| I <sub>out</sub> | DC Output Current, per Pin  | ± 25                           | mA   |
| I <sub>CC</sub>  | DC Supply Current, V <sub>CC</sub> and GND Pins   | ± 50                           | mA   |
| P <sub>D</sub>   | Power Dissipation in Still Air, Plastic or Ceramic DIP†<br>SOIC Package†                          | 750<br>500                     | mW   |
| T <sub>stg</sub> | Storage Temperature   | - 65 to + 150                  | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds<br>(Plastic DIP or SOIC Package)<br>(Ceramic DIP) | 260<br>300                     | °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<sub>in</sub> and V<sub>out</sub> should be constrained to the range GND ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>CC</sub>. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

\* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

† Derating — Plastic DIP: - 10 mW/°C from 65° to 125°  
Ceramic DIP: - 10 mW/°C from 100° to 125°  
SOIC Package: - 7 mW/°C from 65° to 125°

For high frequency or heavy load considerations, see Chapter 2 of the Motorola 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 2)               | V <sub>CC</sub> = 2.0 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6.0 V | 0<br>1000<br>500<br>400 | ns   |

**DC CHARACTERISTICS** (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Condition  | V <sub>CC</sub><br>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> = 0.1V or V <sub>CC</sub> - 0.1V<br> I <sub>out</sub>   ≤ 20μA    | 2.0                  | 1.50             | 1.50       | 1.50       | V    |
|                 |  |  | 4.5                  | 3.15             | 3.15       | 3.15       |      |
|                 |  |  | 6.0                  | 4.20             | 4.20       | 4.20       |      |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>out</sub> = 0.1V or V <sub>CC</sub> - 0.1V<br> I <sub>out</sub>   ≤ 20μA    | 2.0                  | 0.3              | 0.3        | 0.3        | V    |
|                 |  |  | 4.5                  | 0.9              | 0.9        | 0.9        |      |
|                 |  |  | 6.0                  | 1.2              | 1.2        | 1.2        |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20μA | 2.0                  | 1.9              | 1.9        | 1.9        | V    |
|                 |  |  | 4.5<br>6.0           | 4.4<br>5.9       | 4.4<br>5.9 | 4.4<br>5.9 |      |
| 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>   ≤ 20μA | 2.0                  | 0.1              | 0.1        | 0.1        | V    |
|                 |  |  | 4.5<br>6.0           | 0.1<br>0.1       | 0.1<br>0.1 | 0.1<br>0.1 |      |
| I <sub>in</sub> | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND   | 4.5                  | 3.98             | 3.84       | 3.70       | μA   |
|                 |  |  | 6.0                  | 5.48             | 5.34       | 5.20       |      |
| 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> = 0μA                 | 4.5                  | 0.26             | 0.33       | 0.40       | μA   |
|                 |  |  | 6.0                  | 0.26             | 0.33       | 0.40       |      |

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

**AC CHARACTERISTICS** ( $C_L = 50$  pF, Input  $t_r = t_f = 6$  ns)

| Symbol                                 | Parameter   | V <sub>CC</sub><br>V | Guaranteed Limit |       |        | Unit |
|--|---|----------------------|------------------|-------|--------|------|
|  |   |                      | -55 to 25°C      | ≤85°C | ≤125°C |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input A or B to Output Y<br>(Figures 3 and 5)  | 2.0                  | 125              | 155   | 190    | ns   |
|  |   | 4.5                  | 25               | 31    | 38     |      |
|  |   | 6.0                  | 21               | 26    | 32     |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Select to Output Y<br>(Figures 3 and 5)        | 2.0                  | 125              | 155   | 190    | ns   |
|  |   | 4.5                  | 25               | 31    | 38     |      |
|  |   | 6.0                  | 21               | 26    | 32     |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 4 and 5) | 2.0                  | 115              | 145   | 175    | ns   |
|  |   | 4.5                  | 23               | 29    | 35     |      |
|  |   | 6.0                  | 20               | 25    | 30     |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 2 and 5)           | 2.0                  | 75               | 95    | 110    | ns   |
|  |   | 4.5                  | 15               | 19    | 22     |      |
|  |   | 6.0                  | 13               | 16    | 19     |      |
| C <sub>in</sub>                        | Maximum Input Capacitance   |                      | 10               | 10    | 10     | pF   |

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Package)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V |  | pF |
|-----------------|--|---|--|----|
|                 |  | 35                                      |  |    |
|                 |  |   |  |    |

\* Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ . For load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

**SWITCHING WAVEFORMS**

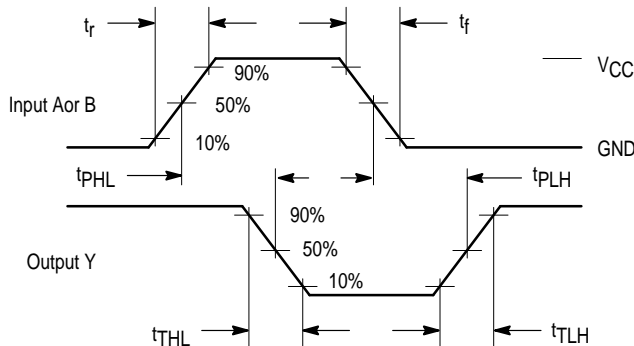


Figure 1.

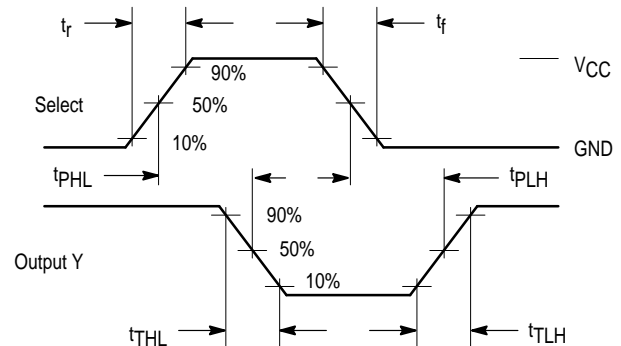


Figure 2. Y versus Select, Inverted

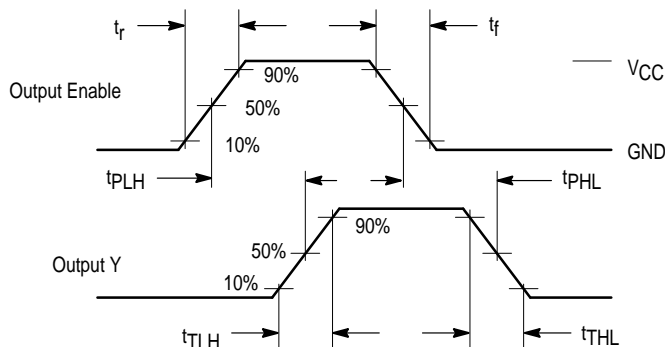
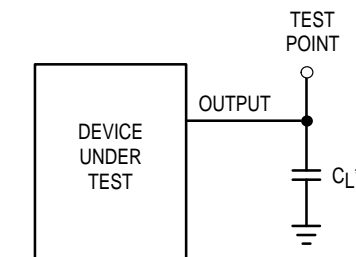


Figure 3.



\*Includes all probe and jig capacitance

Figure 4. Test Circuit

**PIN DESCRIPTIONS**

**INPUTS**

**A0–A3 (Pins 2,5,11,14)**

Nibble A inputs. The data present on these pins is transferred to the outputs when the Select input is at a low level and the Output Enable input is at a low level. The data is presented to the outputs in inverted form for the HC158.

**B0–B3 (Pins 3,6,10,13)**

Nibble B inputs. The data present on these pins is transferred to the outputs when the Select input is at a high level and the Output Enable input is at a low level. The data is presented to the outputs in inverted form for the HC158.

**OUTPUTS**

**Y0–Y3 (Pins 4,7,9,12)**

Data outputs. The selected input nibble is presented at these outputs when the Output Enable input is at a low level.

The data present on these pins is in its inverted form for the HC158. For the Output Enable input at a high level, the outputs are at a high level for the HC158.

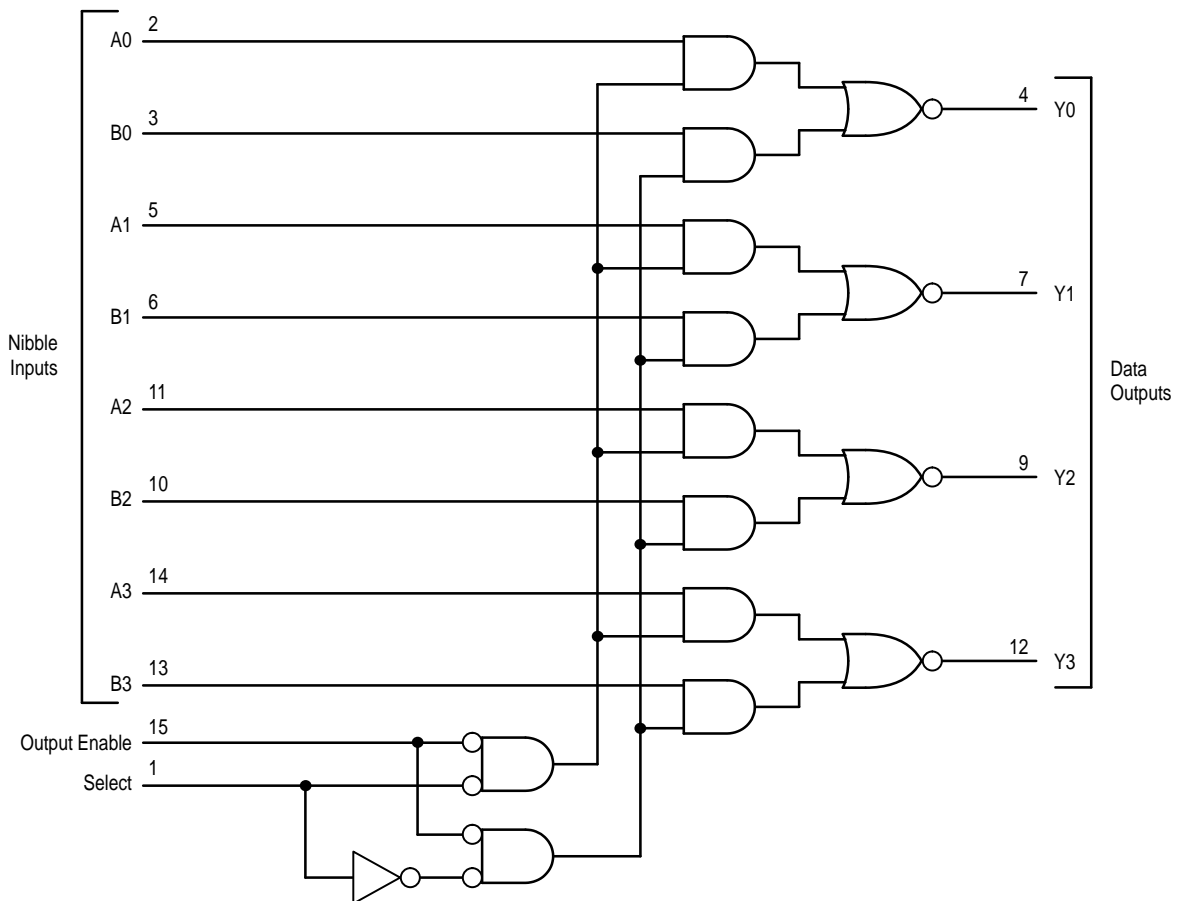
**CONTROL INPUTS**

**Select (Pin 1)**

Nibble select. This input determines the data word to be transferred to the outputs. A low level on this input selects the A inputs and a high level selects the B inputs.

**Output Enable (Pin 15)**

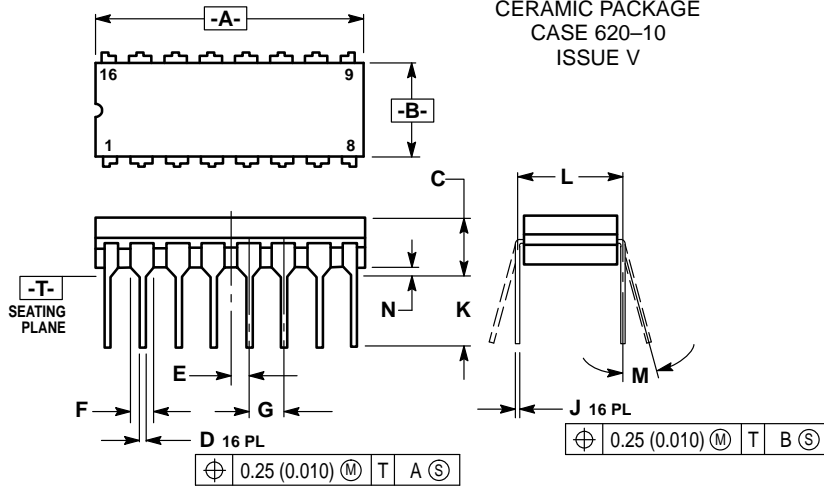
Output Enable input. A low level on this input allows the selected data to be presented at the outputs. A high level on this input sets all of the outputs to a high level for the HC158.



**Figure 5. Expanded Logic Diagram**

OUTLINE DIMENSIONS

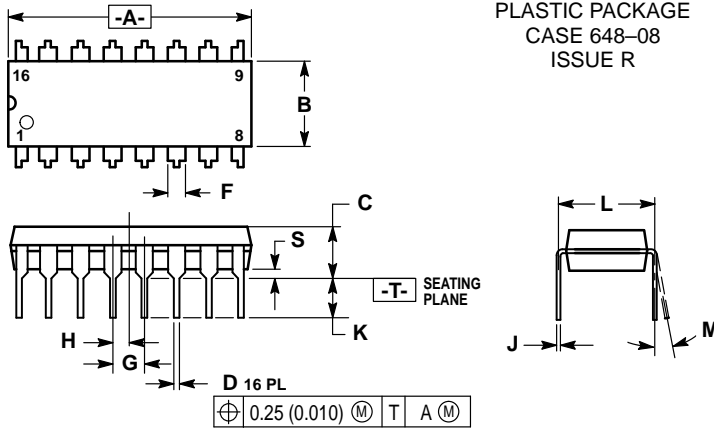
**J SUFFIX**  
CERAMIC PACKAGE  
CASE 620-10  
ISSUE V



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.750     | 0.785 | 19.05       | 19.93 |
| B   | 0.240     | 0.295 | 6.10        | 7.49  |
| C   | —         | 0.200 | —           | 5.08  |
| D   | 0.015     | 0.020 | 0.39        | 0.50  |
| E   | 0.050 BSC |       | 1.27 BSC    |       |
| F   | 0.055     | 0.065 | 1.40        | 1.65  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.125     | 0.170 | 3.18        | 4.31  |
| L   | 0.300 BSC |       | 7.62 BSC    |       |
| M   | 0°        | 15°   | 0°          | 15°   |
| N   | 0.020     | 0.040 | 0.51        | 1.01  |

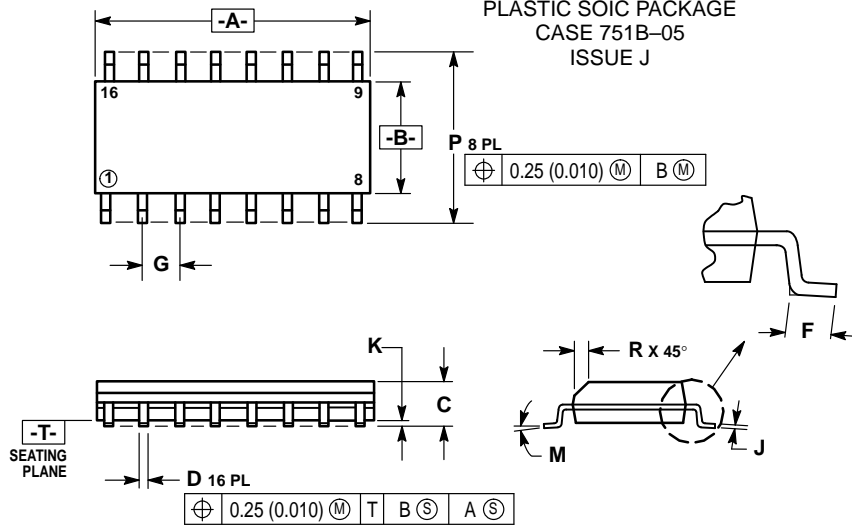
**N SUFFIX**  
PLASTIC PACKAGE  
CASE 648-08  
ISSUE R



- 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     | 0.070 | 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  |

**D SUFFIX**  
PLASTIC SOIC PACKAGE  
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 |

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