

# MC74HC541A

## Octal 3-State Noninverting Buffer/Line Driver/Line Receiver

### High-Performance Silicon-Gate CMOS

The MC74HC541A is identical in pinout to the LS541. The device inputs are compatible with Standard CMOS outputs. External pull-up resistors make them compatible with LSTTL outputs.

The HC541A is an octal noninverting buffer/line driver/line receiver designed to be used with 3-state memory address drivers, clock drivers, and other bus-oriented systems. This device features inputs and outputs on opposite sides of the package and two ANDed active-low output enables.

The HC541A is similar in function to the HC540A, which has inverting outputs.

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2 to 6V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance With the JEDEC Standard No. 7A Requirements
- Chip Complexity: 134 FETs or 33.5 Equivalent Gates

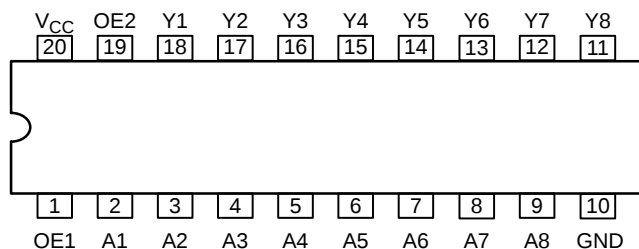


Figure 1. Pinout: 20-Lead Packages (Top View)

FUNCTION TABLE

| Inputs |     |   | Output Y |
|--------|-----|---|----------|
| OE1    | OE2 | A |          |
| L      | L   | L | L        |
| L      | L   | H | H        |
| H      | X   | X | Z        |
| X      | H   | X | Z        |

X = Don't Care

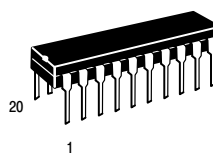
Z = High Impedance



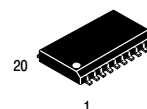
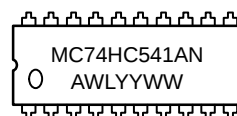
ON Semiconductor

<http://onsemi.com>

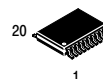
#### MARKING DIAGRAMS



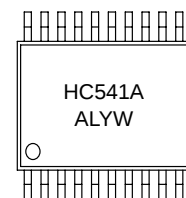
PDIP-20  
N SUFFIX  
CASE 783



SO-20  
DW SUFFIX  
CASE 751D



TSSOP-20  
DT SUFFIX  
CASE 948E



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

#### ORDERING INFORMATION

| Device         | Package   | Shipping  |
|----------------|-----------|-----------|
| MC74HC541AN    | PDIP-20   | 1440/Box  |
| MC74HC541ADW   | SOIC-WIDE | 38/Rail   |
| MC74HC541ADWR2 | SOIC-WIDE | 1000/Reel |
| MC74HC541ADT   | TSSOP-20  | 75/Rail   |
| MC74HC541ADTR2 | TSSOP-20  | 2500/Reel |

# MC74HC541A

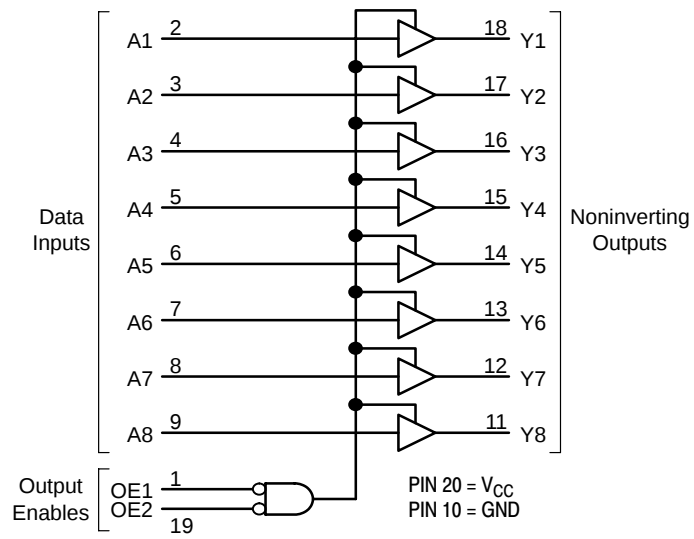


Figure 2. Logic Diagram

# MC74HC541A

## 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 ≤ V <sub>I</sub> ≤ + 0.5 | V    |
| V <sub>O</sub>        | DC Output Voltage (Note 2)                                                                                    | − 0.5 ≤ V <sub>O</sub> ≤ + 0.5 | V    |
| I <sub>IK</sub>       | DC Input Diode Current                                                                                        | ± 20                           | mA   |
| I <sub>OK</sub>       | DC Output Diode Current                                                                                       | ± 35                           | mA   |
| I <sub>O</sub>        | DC Output Sink Current                                                                                        | ± 35                           | mA   |
| I <sub>CC</sub>       | DC Supply Current per Supply Pin                                                                              | ± 75                           | mA   |
| I <sub>GND</sub>      | DC Ground Current per Ground Pin                                                                              | ± 75                           | 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<br>PDIP<br>SOIC<br>TSSOP                                                                   | 67<br>96<br>128                | °C/W |
| P <sub>D</sub>        | Power Dissipation in Still Air at 85°C<br>PDIP<br>SOIC<br>TSSOP                                               | 750<br>500<br>450              | 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 3)<br>Machine Model (Note 4)<br>Charged Device Model (Note 5) | > 4000<br>> 300<br>> 1000      | V    |
| I <sub>Latch–Up</sub> | Latch–Up Performance<br>Above V <sub>CC</sub> and Below GND at 85°C (Note 6)                                  | ± 300                          | 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. I<sub>O</sub> absolute maximum rating must be observed.
3. Tested to EIA/JESD22–A114–A.
4. Tested to EIA/JESD22–A115–A.
5. Tested to JESD22–C101–A.
6. Tested to EIA/JESD78.
7. For high frequency or heavy load considerations, see 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 Range, All Package Types                                                                   | − 55        | + 125              | °C   |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise/Fall Time (Figure 3)<br>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>0<br>0 | 1000<br>500<br>400 | ns   |

8. 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.

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## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Condition                                                                                                                           | V <sub>CC</sub><br>V     | Guaranteed Limit             |                              |                              | Unit |
|-----------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------|------------------------------|------------------------------|------|
|                 |                                                |                                                                                                                                     |                          | –55°C to 25°C                | ≤85°C                        | ≤125°C                       |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>OUT</sub> = 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                                                                             | 2.0<br>3.0<br>4.5<br>6.0 | 1.50<br>2.10<br>3.15<br>4.20 | 1.50<br>2.10<br>3.15<br>4.20 | 1.50<br>2.10<br>3.15<br>4.20 | V    |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>OUT</sub> = V <sub>CC</sub> – 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                                                           | 2.0<br>3.0<br>4.5<br>6.0 | 0.50<br>0.90<br>1.35<br>1.80 | 0.50<br>0.90<br>1.35<br>1.80 | 0.50<br>0.90<br>1.35<br>1.80 | V    |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>IN</sub> = V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                                                    | 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    |
|                 |                                                |                                                                                                                                     | 3.0<br>4.5<br>6.0        | 2.48<br>3.98<br>5.48         | 2.34<br>3.84<br>5.34         | 2.20<br>3.70<br>5.20         |      |
|                 |                                                |                                                                                                                                     |                          |                              |                              |                              |      |
|                 |                                                |                                                                                                                                     |                          |                              |                              |                              |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>IN</sub> = V <sub>IH</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                                                    | 2.0<br>4.5<br>6.0        | 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    |
|                 |                                                |                                                                                                                                     | 3.0<br>4.5<br>6.0        | 0.26<br>0.26<br>0.26         | 0.33<br>0.33<br>0.33         | 0.40<br>0.40<br>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>OZ</sub> | Maximum Three-State Leakage Current            | Output in High Impedance State<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>OUT</sub> = V <sub>CC</sub> or GND | 6.0                      | ±0.5                         | ±5.0                         | ±10.0                        | 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   |

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

## AC 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°C to 25°C         | ≤85°C                 | ≤125°C                |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input A to Output Y<br>(Figures 3 and 5)       | 2.0<br>3.0<br>4.5<br>6.0 | 80<br>30<br>18<br>15  | 100<br>40<br>23<br>20 | 120<br>55<br>28<br>25 | ns   |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 4 and 6) | 2.0<br>3.0<br>4.5<br>6.0 | 110<br>45<br>25<br>21 | 140<br>60<br>31<br>26 | 165<br>75<br>38<br>31 | ns   |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 4 and 6) | 2.0<br>3.0<br>4.5<br>6.0 | 110<br>45<br>25<br>21 | 140<br>60<br>31<br>26 | 165<br>75<br>38<br>31 | ns   |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 3 and 5)           | 2.0<br>3.0<br>4.5<br>6.0 | 60<br>22<br>12<br>10  | 75<br>28<br>15<br>13  | 90<br>34<br>18<br>15  | ns   |
| C <sub>IN</sub>                        | Maximum Input Capacitance                                                 |                          | 10                    | 10                    | 10                    | pF   |
| C <sub>OUT</sub>                       | Maximum Three-State Output Capacitance (High Impedance State Output)      |                          | 15                    | 15                    | 15                    | pF   |

10. For propagation delays with loads other than 50 pF, and information on typical parametric values, see the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Buffer) (Note 11) | Typical @ 25°C, V <sub>CC</sub> = 5.0 V, V <sub>EE</sub> = 0 V | pF |
|-----------------|------------------------------------------------------|----------------------------------------------------------------|----|
|                 |                                                      | 35                                                             |    |

11. 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 the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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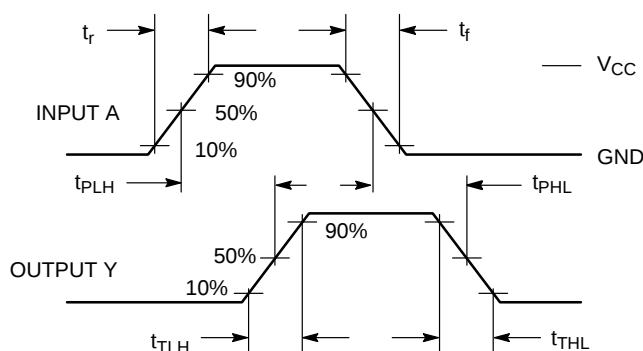


Figure 3. Switching Waveform

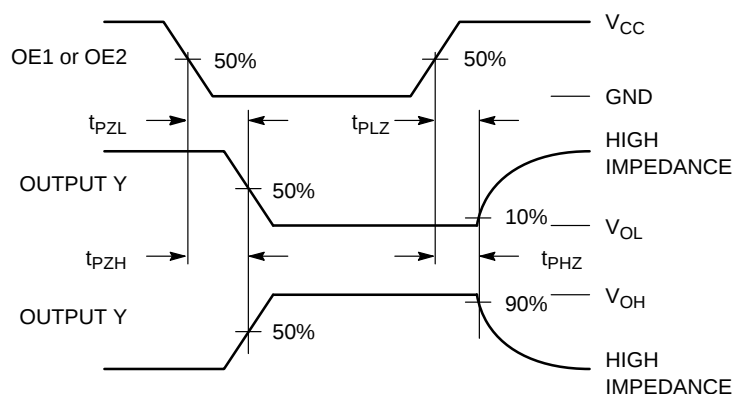
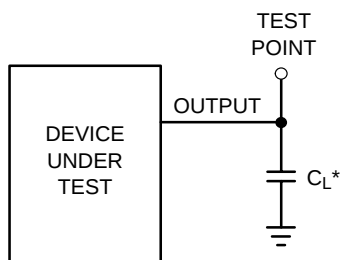
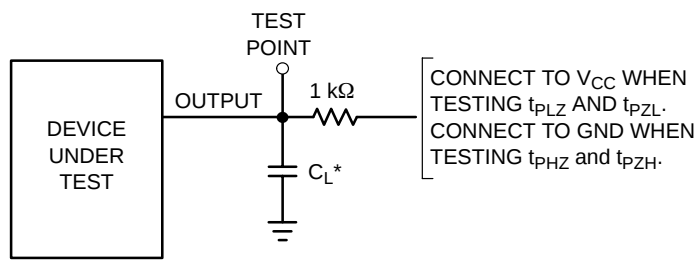


Figure 4. Switching Waveform



\*Includes all probe and jig capacitance

Figure 5. Test Circuit



\*Includes all probe and jig capacitance

Figure 6. Test Circuit

## PIN DESCRIPTIONS

### INPUTS

#### A1, A2, A3, A4, A5, A6, A7, A8 (PINS 2, 3, 4, 5, 6, 7, 8, 9)

Data input pins. Data on these pins appear in non-inverted form on the corresponding Y outputs, when the outputs are enabled.

### CONTROLS

#### OE1, OE2 (PINS 1, 19)

Output enables (active-low). When a low voltage is applied to both of these pins, the outputs are enabled and the

device functions as a non-inverting buffer. When a high voltage is applied to either input, the outputs assume the high impedance state.

### OUTPUTS

#### Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8 (PINS 18, 17, 16, 15, 14, 13, 12, 11)

Device outputs. Depending upon the state of the output enable pins, these outputs are either non-inverting outputs or high-impedance outputs.

# MC74HC541A

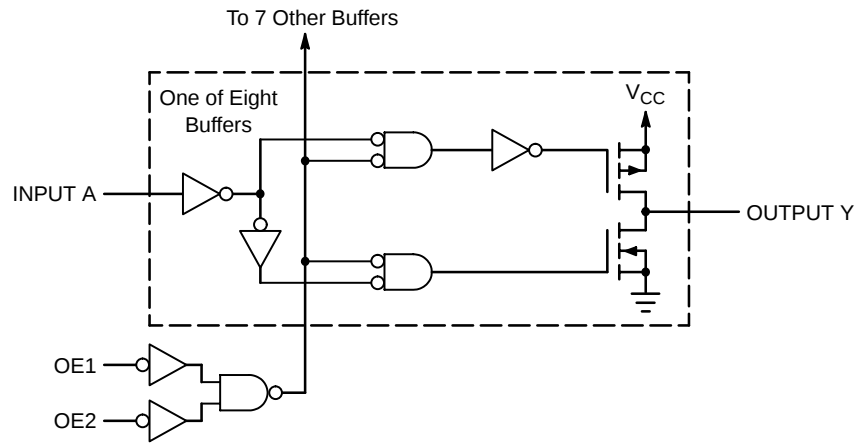
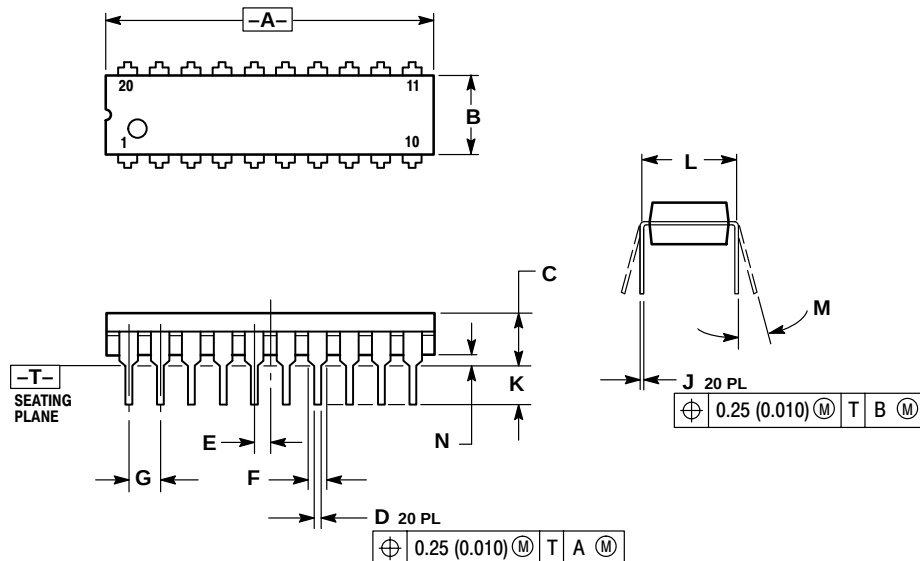


Figure 7. Logic Detail

# MC74HC541A

## PACKAGE DIMENSIONS

PDIP  
N SUFFIX  
PLASTIC DIP PACKAGE  
CASE 738-03  
ISSUE E

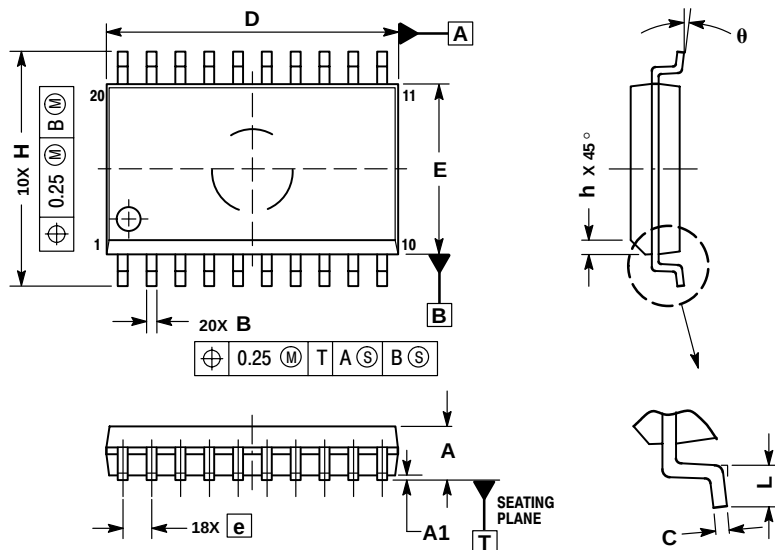


### NOTES:

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 B DOES NOT INCLUDE MOLD FLASH.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 1.010     | 1.070 | 25.66       | 27.17 |
| B   | 0.240     | 0.260 | 6.10        | 6.60  |
| C   | 0.150     | 0.180 | 3.81        | 4.57  |
| D   | 0.015     | 0.022 | 0.39        | 0.55  |
| E   | 0.050 BSC |       | 1.27 BSC    |       |
| F   | 0.050     | 0.070 | 1.27        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.140 | 2.80        | 3.55  |
| L   | 0.300 BSC |       | 7.62 BSC    |       |
| M   | 0°        | 15°   | 0°          | 15°   |
| N   | 0.020     | 0.040 | 0.51        | 1.01  |

SO-20  
DW SUFFIX  
CASE 751D-05  
ISSUE F



### NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 2.35        | 2.65  |
| A1  | 0.10        | 0.25  |
| B   | 0.35        | 0.49  |
| C   | 0.23        | 0.32  |
| D   | 12.65       | 12.95 |
| E   | 7.40        | 7.60  |
| e   | 1.27 BSC    |       |
| H   | 10.05       | 10.55 |
| h   | 0.25        | 0.75  |
| L   | 0.50        | 0.90  |
| θ   | 0°          | 7°    |

