



# 4 x 4 REGISTER FILE WITH 3-STATE OUTPUTS

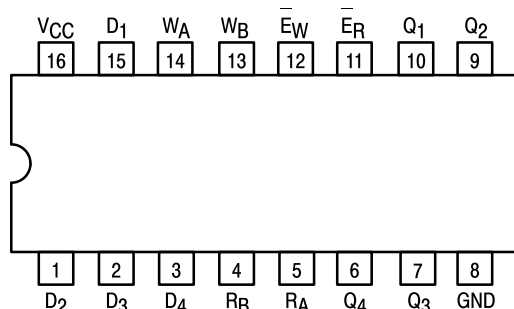
The TTL/MSI SN54/74LS670 is a high-speed, low-power 4 x 4 Register File organized as four words by four bits. Separate read and write inputs, both address and enable, allow simultaneous read and write operation.

The 3-state outputs make it possible to connect up to 128 outputs to increase the word capacity up to 512 words. Any number of these devices can be operated in parallel to generate an n-bit length.

The SN54/74LS170 provides a similar function to this device but it features open-collector outputs.

- Simultaneous Read/Write Operation
- Expandable to 512 Words by n-Bits
- Typical Access Time to 20 ns
- 3-State Outputs for Expansion
- Typical Power Dissipation of 125 mW

## CONNECTION DIAGRAM DIP (TOP VIEW)



NOTE:  
The Flatpak version  
has the same pinouts  
(Connection Diagram) as  
the Dual In-Line Package.

## PIN NAMES

|                                 |                                 |
|---------------------------------|---------------------------------|
| D <sub>1</sub> – D <sub>4</sub> | Data Inputs                     |
| W <sub>A</sub> , W <sub>B</sub> | Write Address Inputs            |
| E <sub>W</sub>                  | Write Enable (Active LOW) Input |
| R <sub>A</sub> , R <sub>B</sub> | Read Address Inputs             |
| E <sub>R</sub>                  | Read Enable (Active LOW) Input  |
| Q <sub>1</sub> – Q <sub>4</sub> | Outputs (Note b)                |

## LOADING (Note a)

|                                 | HIGH         | LOW           |
|---------------------------------|--------------|---------------|
| D <sub>1</sub> – D <sub>4</sub> | 0.5 U.L.     | 0.25 U.L.     |
| W <sub>A</sub> , W <sub>B</sub> | 0.5 U.L.     | 0.25 U.L.     |
| E <sub>W</sub>                  | 1.0 U.L.     | 0.5 U.L.      |
| R <sub>A</sub> , R <sub>B</sub> | 0.5 U.L.     | 0.25 U.L.     |
| E <sub>R</sub>                  | 1.5 U.L.     | 0.75 U.L.     |
| Q <sub>1</sub> – Q <sub>4</sub> | 65 (25) U.L. | 15 (7.5) U.L. |

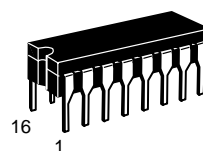
## NOTES:

- a) 1 TTL Unit Load (U.L.) = 40  $\mu$ A HIGH/1.6 mA LOW.  
b) The Output LOW drive factor is 7.5 U.L. for Military (54) and 15 U.L. for Commercial (74) Temperature Ranges. The Output HIGH drive factor is 25 U.L. for Military and 65 U.L. for Commercial Temperature Ranges.

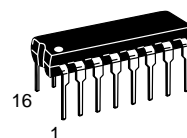
## SN54/74LS670

## 4 x 4 REGISTER FILE WITH 3-STATE OUTPUTS

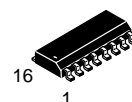
## LOW POWER SCHOTTKY



**J SUFFIX**  
CERAMIC  
CASE 620-09



**N SUFFIX**  
PLASTIC  
CASE 648-08

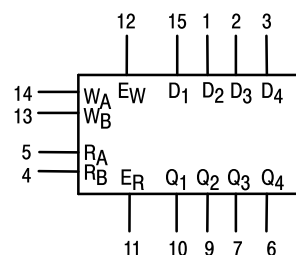


**D SUFFIX**  
SOIC  
CASE 751B-03

## ORDERING INFORMATION

|            |         |
|------------|---------|
| SN54LSXXXJ | Ceramic |
| SN74LSXXXN | Plastic |
| SN74LSXXXD | SOIC    |

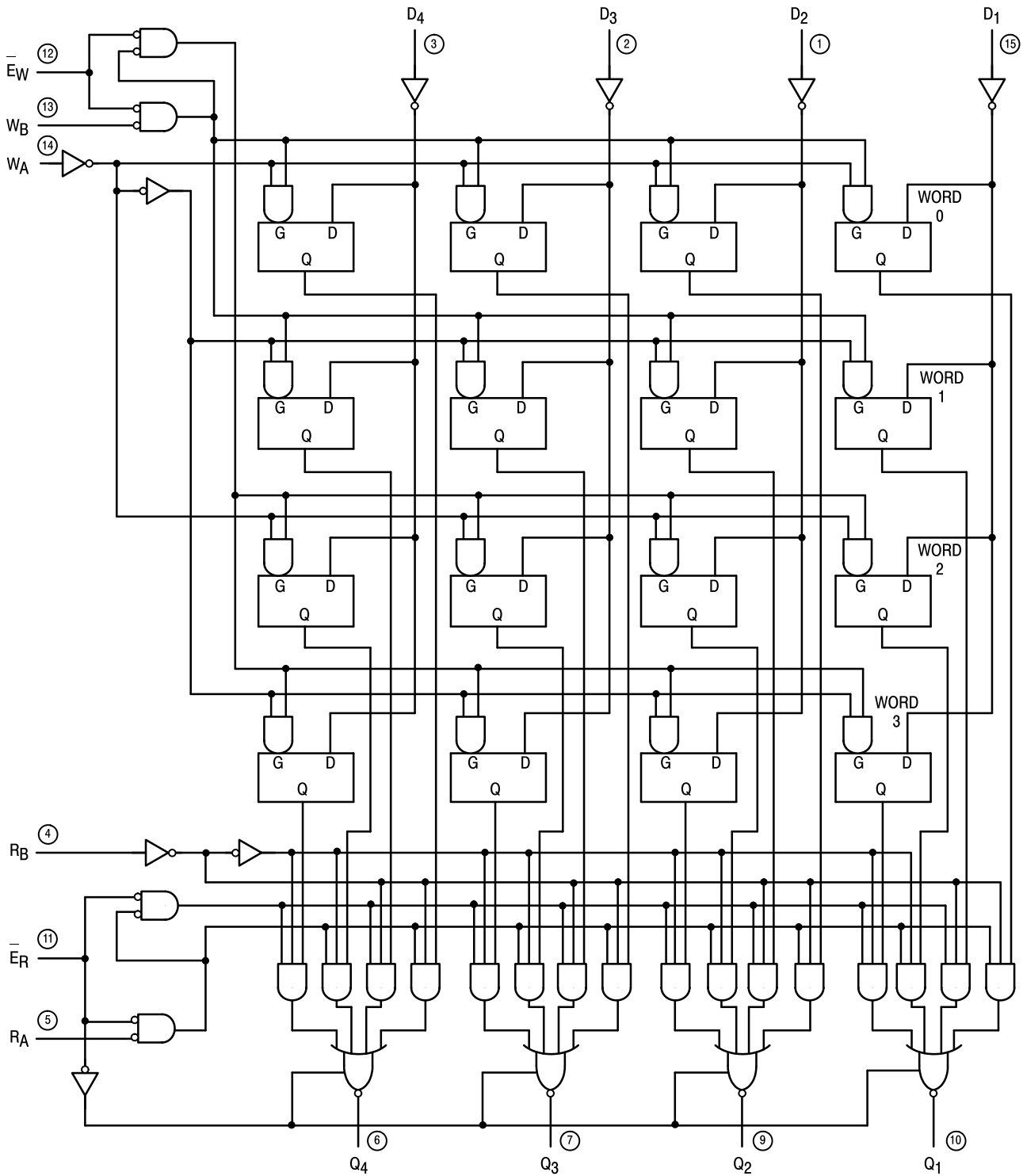
## LOGIC SYMBOL



V<sub>CC</sub> = PIN 16  
GND = PIN 8

# SN54/74LS670

## LOGIC DIAGRAM



VCC = PIN 16  
 GND = PIN 8  
 ○ = PIN NUMBERS

# SN54/74LS670

## GUARANTEED OPERATING RANGES

| Symbol          | Parameter                           |          | Min         | Typ        | Max          | Unit |
|-----------------|-------------------------------------|----------|-------------|------------|--------------|------|
| V <sub>CC</sub> | Supply Voltage                      | 54<br>74 | 4.5<br>4.75 | 5.0<br>5.0 | 5.5<br>5.25  | V    |
| T <sub>A</sub>  | Operating Ambient Temperature Range | 54<br>74 | −55<br>0    | 25<br>25   | 125<br>70    | °C   |
| I <sub>OH</sub> | Output Current — High               | 54<br>74 |             |            | −1.0<br>−2.6 | mA   |
| I <sub>OL</sub> | Output Current — Low                | 54<br>74 |             |            | 12<br>24     | mA   |

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

| Symbol           | Parameter                                                         |        | Limits |       |                      | Unit | Test Conditions                                                                                                    |
|------------------|-------------------------------------------------------------------|--------|--------|-------|----------------------|------|--------------------------------------------------------------------------------------------------------------------|
|                  |                                                                   |        | Min    | Typ   | Max                  |      |                                                                                                                    |
| V <sub>IH</sub>  | Input HIGH Voltage                                                |        | 2.0    |       |                      | V    | Guaranteed Input HIGH Voltage for All Inputs                                                                       |
| V <sub>IL</sub>  | Input LOW Voltage                                                 | 54     |        |       | 0.7                  | V    | Guaranteed Input LOW Voltage for All Inputs                                                                        |
|                  |                                                                   | 74     |        |       | 0.8                  |      |                                                                                                                    |
| V <sub>IK</sub>  | Input Clamp Diode Voltage                                         |        |        | −0.65 | −1.5                 | V    | V <sub>CC</sub> = MIN, I <sub>IN</sub> = −18 mA                                                                    |
| V <sub>OH</sub>  | Output HIGH Voltage                                               | 54     | 2.4    | 3.4   |                      | V    | V <sub>CC</sub> = MIN, I <sub>OH</sub> = MAX, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table |
|                  |                                                                   | 74     | 2.4    | 3.1   |                      | V    |                                                                                                                    |
| V <sub>OL</sub>  | Output LOW Voltage                                                | 54, 74 |        | 0.25  | 0.4                  | V    | I <sub>OL</sub> = 12 mA                                                                                            |
|                  |                                                                   | 74     |        | 0.35  | 0.5                  | V    | I <sub>OL</sub> = 24 mA                                                                                            |
| I <sub>OZH</sub> | Output Off Current HIGH                                           |        |        |       | 20                   | μA   | V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.7 V                                                                      |
| I <sub>OZL</sub> | Output Off Current LOW                                            |        |        |       | −20                  | μA   | V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.4 V                                                                      |
| I <sub>IH</sub>  | Input HIGH Current<br>D, R, W<br>E <sub>W</sub><br>E <sub>R</sub> |        |        |       | 20<br>40<br>60       | μA   | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V                                                                     |
|                  | D, R, W<br>E <sub>W</sub><br>E <sub>R</sub>                       |        |        |       | 0.1<br>0.2<br>0.3    | mA   | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V                                                                     |
| I <sub>IL</sub>  | Input LOW Current<br>D, R, W<br>E <sub>W</sub><br>E <sub>R</sub>  |        |        |       | −0.4<br>−0.8<br>−1.2 | mA   | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V                                                                     |
| I <sub>OS</sub>  | Short Circuit Current (Note 1)                                    |        | −30    |       | −130                 | mA   | V <sub>CC</sub> = MAX                                                                                              |
| I <sub>CC</sub>  | Power Supply Current                                              |        |        |       | 50                   | mA   | V <sub>CC</sub> = MAX                                                                                              |

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

# SN54/74LS670

## AC CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| Symbol                 | Parameter                                   | Limits |          |          | Unit | Test Conditions                                   |
|------------------------|---------------------------------------------|--------|----------|----------|------|---------------------------------------------------|
|                        |                                             | Min    | Typ      | Max      |      |                                                   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, $R_A$ or $R_B$ to Output |        | 23<br>25 | 40<br>45 | ns   | $V_{CC} = 5.0\text{ V}$ ,<br>$C_L = 45\text{ pF}$ |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, $E_W$ to Output          |        | 26<br>28 | 45<br>50 | ns   |                                                   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay, Data to Output           |        | 25<br>23 | 45<br>40 | ns   |                                                   |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time                          |        | 15<br>22 | 35<br>40 | ns   |                                                   |
| $t_{PLZ}$<br>$t_{PHZ}$ | Output Disable Time                         |        | 16<br>30 | 35<br>50 | ns   | $C_L = 5.0\text{ pF}$                             |

## AC SETUP REQUIREMENTS ( $T_A = 25^\circ\text{C}$ )

| Symbol    | Parameter       | Limits |     |     | Unit | Test Conditions         |
|-----------|-----------------|--------|-----|-----|------|-------------------------|
|           |                 | Min    | Typ | Max |      |                         |
| $t_W$     | Pulse Width     | 25     |     |     | ns   | $V_{CC} = 5.0\text{ V}$ |
| $t_s$     | Setup Time, (D) | 10     |     |     | ns   |                         |
| $t_s$     | Setup Time, (W) | 15     |     |     | ns   |                         |
| $t_h$     | Hold Time, (D)  | 15     |     |     | ns   |                         |
| $t_h$     | Hold Time, (W)  | 5.0    |     |     | ns   |                         |
| $t_{rec}$ | Recovery Time   | 25     |     |     | ns   |                         |

## AC WAVEFORMS

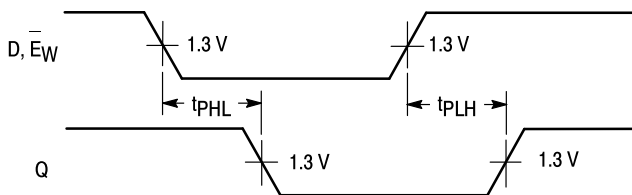


Figure 1

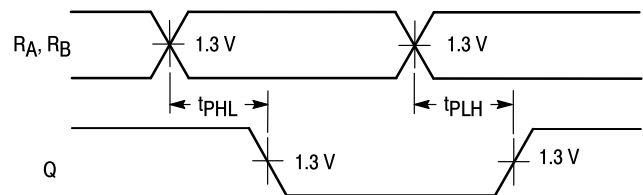


Figure 2

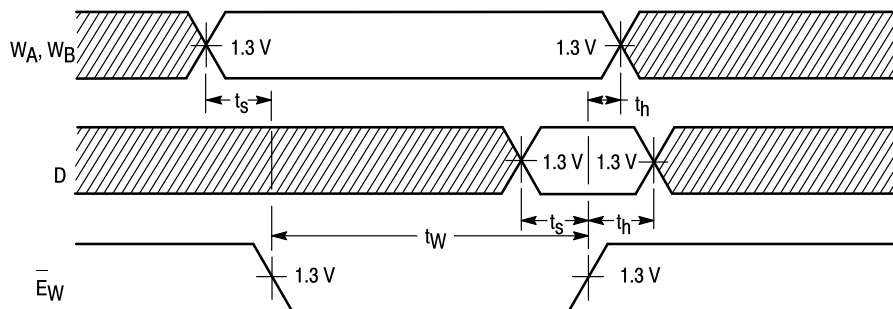
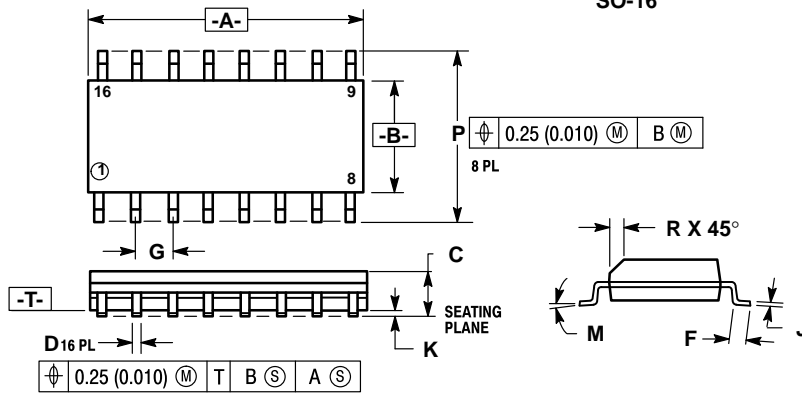


Figure 3

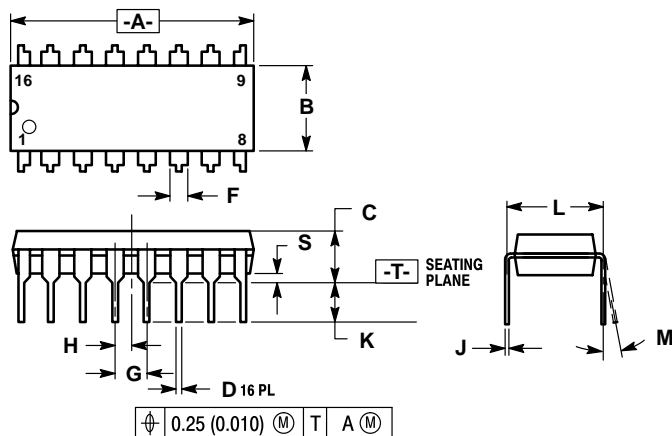
**Case 751B-03 D Suffix**  
**16-Pin Plastic**  
**SO-16**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. 751B-01 IS OBSOLETE, NEW STANDARD 751B-03.

| 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 |

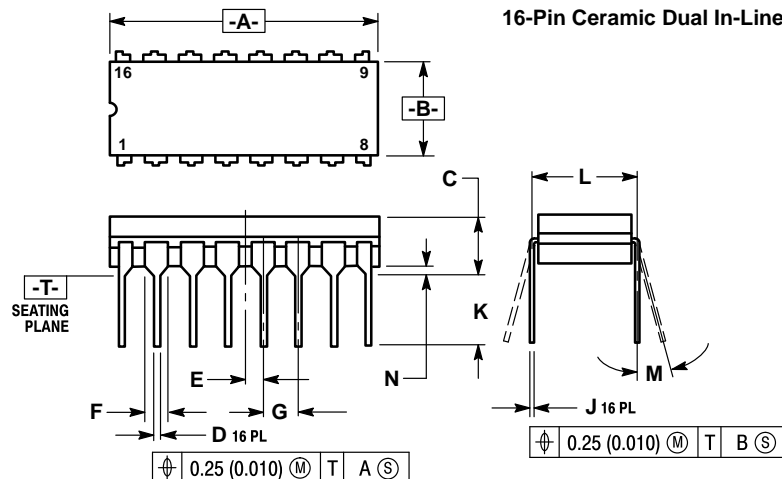
**Case 648-08 N Suffix**  
**16-Pin Plastic**



- 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.
  6. 648-01 THRU -07 OBSOLETE, NEW STANDARD 648-08.


| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 18.80       | 19.55 | 0.740     | 0.770 |
| B   | 6.35        | 6.85  | 0.250     | 0.270 |
| C   | 3.69        | 4.44  | 0.145     | 0.175 |
| D   | 0.39        | 0.53  | 0.015     | 0.021 |
| F   | 1.02        | 1.77  | 0.040     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| H   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.21        | 0.38  | 0.008     | 0.015 |
| K   | 2.80        | 3.30  | 0.110     | 0.130 |
| L   | 7.50        | 7.74  | 0.295     | 0.305 |
| M   | 0°          | 10°   | 0°        | 10°   |
| S   | 0.51        | 1.01  | 0.020     | 0.040 |

**Case 620-09 J Suffix**  
**16-Pin Ceramic Dual In-Line**



- 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. DIM F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.
  5. 620-01 THRU -08 OBSOLETE, NEW STANDARD 620-09.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 19.05       | 19.55 | 0.750     | 0.770 |
| B   | 6.10        | 7.36  | 0.240     | 0.290 |
| C   | —           | 4.19  | —         | 0.165 |
| D   | 0.39        | 0.53  | 0.015     | 0.021 |
| E   | 1.27 BSC    |       | 0.050 BSC |       |
| F   | 1.40        | 1.77  | 0.055     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| J   | 0.23        | 0.27  | 0.009     | 0.011 |
| K   | —           | 5.08  | —         | 0.200 |
| L   | 7.62 BSC    |       | 0.300 BSC |       |
| M   | 0°          | 15°   | 0°        | 15°   |
| N   | 0.39        | 0.88  | 0.015     | 0.035 |

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