

## CMOS Quad 2-Input NAND Gate

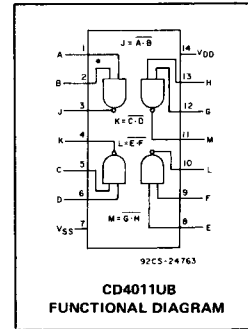
High-Voltage Types (20-Volt Rating)

■ CD4011UB quad 2-input NAND gate provides the system designer with direct implementation of the NAND function and supplements the existing family of CMOS gates.

The CD4011UB types are supplied in 14-lead hermetic dual-in-line ceramic packages (D and F suffixes), 14-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

**Features:**

- Propagation delay time = 30 ns (typ.) at  $C_L = 50$  pF,  $V_{DD} = 10$  V
- Standardized symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1  $\mu$ A at 18 V over full package temperature range; 100 nA at 18 V and 25°C
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"



**MAXIMUM RATINGS, Absolute-Maximum Values:**

DC SUPPLY-VOLTAGE RANGE, ( $V_{DD}$ )

Voltages referenced to  $V_{SS}$  Terminal ..... -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to  $V_{DD} + 0.5$ V

DC INPUT CURRENT, ANY ONE INPUT .....  $\pm 10$ mA

POWER DISSIPATION PER PACKAGE ( $P_D$ ):

For  $T_A = -55^\circ\text{C}$  to  $+100^\circ\text{C}$  ..... 500mW

For  $T_A = +100^\circ\text{C}$  to  $+125^\circ\text{C}$  ..... Derate Linearly at 12mW/ $^\circ\text{C}$  to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR  $T_A =$  FULL PACKAGE-TEMPERATURE RANGE (All Package Types) ..... 100mW

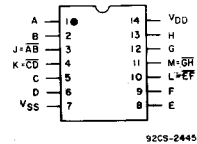
OPERATING-TEMPERATURE RANGE ( $T_A$ ) .....  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE ( $T_{stg}$ ) .....  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16  $\pm$  1/32 inch (1.59  $\pm$  0.79mm) from case for 10s max .....  $+265^\circ\text{C}$

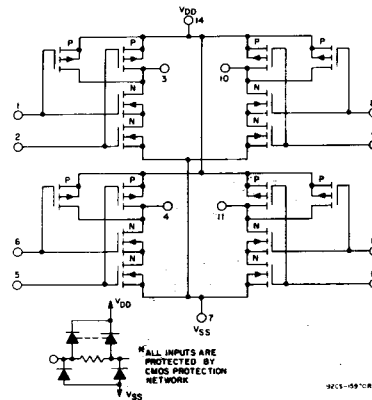
**TERMINAL ASSIGNMENT**



**RECOMMENDED OPERATING CONDITIONS**

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges.

| CHARACTERISTIC  | MIN. | MAX. | UNITS |
|---|------|------|-------|
| Supply Voltage Range (For $T_A =$ Full Package Temperature Range) | 3    | 18   | V     |



# CD4011UB Types

## STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                     | CONDITIONS         |                     |                     | LIMITS AT INDICATED TEMPERATURES (°C) |       |       |       |       |                   |      | UNITS |
|--|--------------------|---------------------|---------------------|---------------------------------------|-------|-------|-------|-------|-------------------|------|-------|
|  | V <sub>O</sub> (V) | V <sub>IN</sub> (V) | V <sub>DD</sub> (V) | -55                                   | -40   | +85   | +125  | +25   |                   |      |       |
|  |                    |                     |                     |                                       |       |       |       | Min.  | Typ.              | Max. |       |
| Quiescent Device Current, I <sub>DD</sub> Max.     | -                  | 0,5                 | 5                   | 0.25                                  | 0.25  | 7.5   | 7.5   | -     | 0.01              | 0.25 | μA    |
|  | -                  | 0,10                | 10                  | 0.5                                   | 0.5   | 15    | 15    | -     | 0.01              | 0.5  |       |
|  | -                  | 0,15                | 15                  | 1                                     | 1     | 30    | 30    | -     | 0.01              | 1    |       |
|  | -                  | 0,20                | 20                  | 5                                     | 5     | 150   | 150   | -     | 0.02              | 5    |       |
| Output Low (Sink) Current I <sub>OL</sub> Min.     | 0,4                | 0,5                 | 5                   | 0.64                                  | 0.61  | 0.42  | 0.36  | 0.51  | 1                 | -    | mA    |
|  | 0,5                | 0,10                | 10                  | 1.6                                   | 1.5   | 1.1   | 0.9   | 1.3   | 2.6               | -    |       |
|  | 1,5                | 0,15                | 15                  | 4.2                                   | 4     | 2.8   | 2.4   | 3.4   | 6.8               | -    |       |
| Output High (Source) Current, I <sub>OH</sub> Min. | 4,6                | 0,5                 | 5                   | -0.64                                 | -0.61 | -0.42 | -0.36 | -0.51 | -1                | -    | mA    |
|  | 2,5                | 0,5                 | 5                   | -2                                    | -1.8  | -1.3  | -1.15 | -1.6  | -3.2              | -    |       |
|  | 9,5                | 0,10                | 10                  | -1.6                                  | -1.5  | -1.1  | -0.9  | -1.3  | -2.6              | -    |       |
|  | 13,5               | 0,15                | 15                  | -4.2                                  | -4    | -2.8  | -2.4  | -3.4  | -6.8              | -    |       |
| Output Voltage: Low-Level, V <sub>OL</sub> Max.    | -                  | 0,5                 | 5                   | 0.05                                  |       |       |       | -     | 0                 | 0.05 | V     |
|  | -                  | 0,10                | 10                  | 0.05                                  |       |       |       | -     | 0                 | 0.05 |       |
|  | -                  | 0,15                | 15                  | 0.05                                  |       |       |       | -     | 0                 | 0.05 |       |
| Output Voltage: High-Level, V <sub>OH</sub> Min.   | -                  | 0,5                 | 5                   | 4.95                                  |       |       |       | 4.95  | 5                 | -    | V     |
|  | -                  | 0,10                | 10                  | 9.95                                  |       |       |       | 9.95  | 10                | -    |       |
|  | -                  | 0,15                | 15                  | 14.95                                 |       |       |       | 14.95 | 15                | -    |       |
| Input Low Voltage, V <sub>IL</sub> Max.            | 4,5                | -                   | 5                   | 1                                     |       |       |       | -     | -                 | 1    | V     |
|  | 9                  | -                   | 10                  | 2                                     |       |       |       | -     | -                 | 2    |       |
| Input High Voltage, V <sub>IH</sub> Min.           | 0,5,4,5            | -                   | 5                   | 2,5                                   |       |       |       | -     | -                 | 2,5  | V     |
|  | 1,9                | -                   | 10                  | 8                                     |       |       |       | 8     | -                 | -    |       |
|  | 1,5,13,5           | -                   | 15                  | 12,5                                  |       |       |       | 12,5  | -                 | -    |       |
| Input Current I <sub>IN</sub> Max.                 |                    | 0,18                | 18                  | ±0.1                                  | ±0.1  | ±1    | ±1    | -     | ±10 <sup>-5</sup> | ±0.1 | μA    |

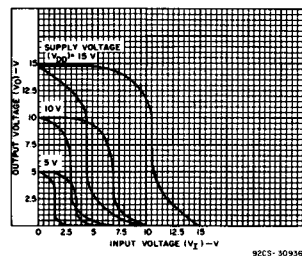


Fig. 2 - Minimum and maximum voltage transfer characteristics.

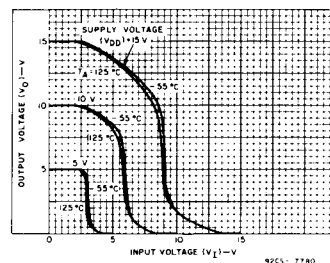


Fig. 3 - Typical voltage transfer characteristics as a function of temperature.

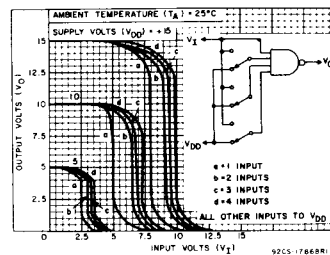


Fig. 4 - Typical multiple input switching transfer characteristics for CD4012UB.

## DYNAMIC ELECTRICAL CHARACTERISTICS

At  $T_A = 25^\circ\text{C}$ , Input  $t_r, t_f = 20\text{ ns}$ , and  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ k}\Omega$

| CHARACTERISTIC                             | TEST CONDITIONS | LIMITS                |      | UNITS |      |
|--|-----------------|-----------------------|------|-------|------|
|  |                 | V <sub>DD</sub> VOLTS | TYP. |       | MAX. |
| Propagation Delay Time, $t_{PHL}, t_{PLH}$ |                 | 5                     | 60   | 120   | ns   |
|  |                 | 10                    | 30   | 60    |      |
|  |                 | 15                    | 25   | 50    |      |
| Transition Time, $t_{THL}, t_{TLH}$        |                 | 5                     | 100  | 200   | ns   |
|  |                 | 10                    | 50   | 100   |      |
|  |                 | 15                    | 40   | 80    |      |
| Input Capacitance, C <sub>IN</sub>         | Any Input       |                       | 10   | 15    | pF   |

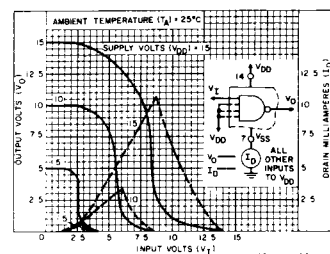


Fig. 5 - Typical current and voltage transfer characteristics.

3  
COMMERCIAL CMOS  
HIGH VOLTAGE ICs

# CD4011UB Types

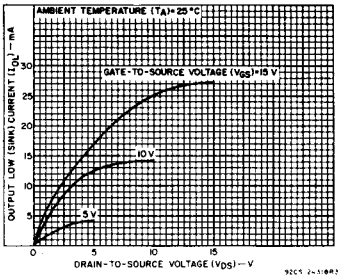


Fig. 6 - Typical output low (sink) current characteristics.

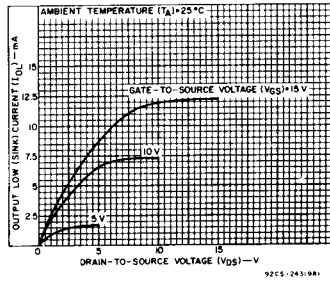


Fig. 7 - Minimum output low (sink) current characteristics.

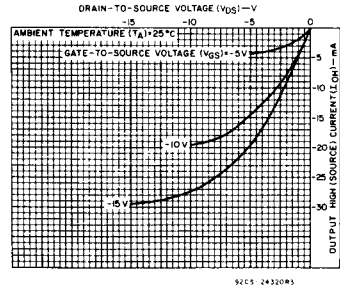


Fig. 8 - Typical output high (source) current characteristics.

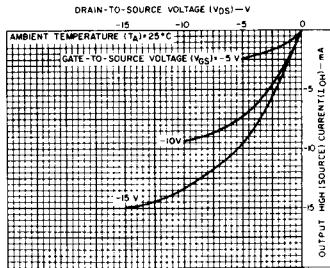


Fig. 9 - Minimum output high (source) current characteristics.

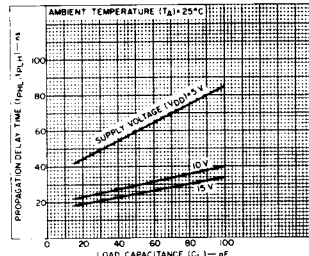


Fig. 10 - Typical propagation delay time vs. load capacitance.

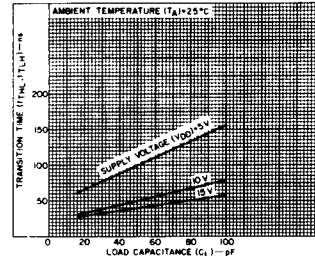


Fig. 11 - Typical transition time vs. load capacitance.

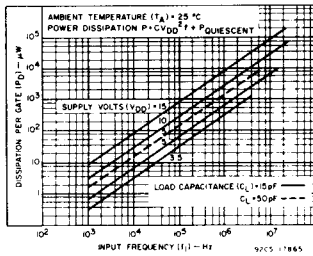


Fig. 12 - Typical power dissipation vs. frequency characteristics.

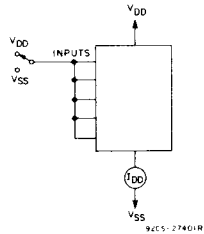


Fig. 13 - Quiescent device current test circuit.

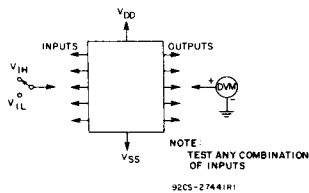


Fig. 14 - Input voltage test circuit.

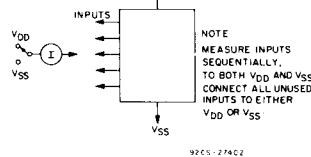
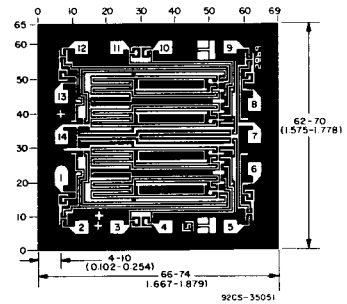


Fig. 15 - Input current test circuit.

## Chip Dimensions and Pad Layout

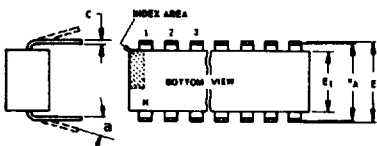
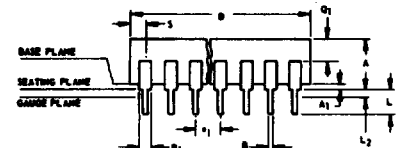


CD4011UBH

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils ( $10^{-3}$  inch).

## Dimensional Outlines

### Dual-In-Line Welded-Seal Ceramic Packages



- NOTES:**  
Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).
  - Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
  - e<sub>A</sub> applies in zone L<sub>2</sub> when unit installed.
  - a applies to spread leads prior to installation.
  - N is the maximum quantity of lead positions.
  - N<sub>1</sub> is the quantity of allowable missing leads.

(D) SUFFIX (JEDEC MO-001-AD)  
14-Lead Dual-In-Line Welded-Seal Ceramic Package

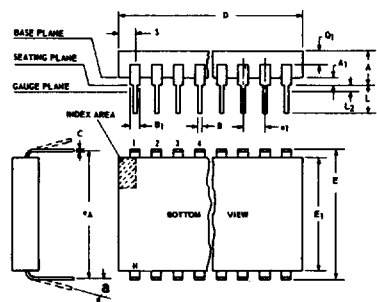
| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.120    | 0.160 |      | 3.05        | 4.06  |
| A <sub>1</sub> | 0.020    | 0.065 |      | 0.51        | 1.65  |
| B              | 0.014    | 0.020 |      | 0.356       | 0.508 |
| B <sub>1</sub> | 0.060    | 0.065 |      | 1.27        | 1.65  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 0.745    | 0.770 |      | 18.93       | 19.55 |
| E              | 0.300    | 0.325 |      | 7.62        | 8.25  |
| E <sub>1</sub> | 0.240    | 0.260 |      | 6.10        | 6.60  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.000       | 0.76  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 14       |       | 5    | 14          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.050    | 0.085 |      | 1.27        | 2.15  |
| S              | 0.065    | 0.090 |      | 1.66        | 2.28  |

92SS-4411R2

(D) SUFFIX (JEDEC MO-001-AE)  
16-Lead Dual-In-Line Welded-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.120    | 0.160 |      | 3.05        | 4.06  |
| A <sub>1</sub> | 0.020    | 0.065 |      | 0.51        | 1.65  |
| B              | 0.014    | 0.020 |      | 0.356       | 0.508 |
| B <sub>1</sub> | 0.035    | 0.065 |      | 0.89        | 1.65  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 0.745    | 0.785 |      | 18.93       | 19.93 |
| E              | 0.300    | 0.325 |      | 7.62        | 8.25  |
| E <sub>1</sub> | 0.240    | 0.260 |      | 6.10        | 6.60  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.000       | 0.76  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 16       |       | 5    | 16          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.050    | 0.085 |      | 1.27        | 2.15  |
| S              | 0.015    | 0.060 |      | 0.39        | 1.52  |

92SS-4266R5



- NOTES:**  
Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).
  - Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
  - e<sub>A</sub> applies in zone L<sub>2</sub> when unit installed.
  - a applies to spread leads prior to installation.
  - N is the maximum quantity of lead positions.
  - N<sub>1</sub> is the quantity of allowable missing leads.

(D) SUFFIX (JEDEC MO-015-AG)  
24-Lead Dual-In-Line Welded-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.090    | 0.200 |      | 2.29        | 5.08  |
| A <sub>1</sub> | 0.020    | 0.070 |      | 0.51        | 1.78  |
| B              | 0.015    | 0.020 |      | 0.381       | 0.508 |
| B <sub>1</sub> | 0.045    | 0.055 |      | 1.143       | 1.397 |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 1.15     | 1.22  |      | 29.21       | 30.98 |
| E              | 0.600    | 0.625 |      | 15.24       | 15.87 |
| E <sub>1</sub> | 0.480    | 0.520 |      | 12.20       | 13.20 |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.600 TP |       | 2, 3 | 15.24 TP    |       |
| L              | 0.100    | 0.180 |      | 2.54        | 4.57  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.00        | 0.76  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 24       |       | 5    | 24          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.020    | 0.080 |      | 0.51        | 2.03  |
| S              | 0.020    | 0.060 |      | 0.51        | 1.52  |

92CS-19948R4

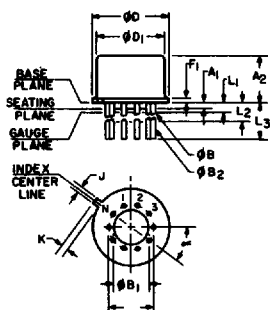
(D) SUFFIX (JEDEC MO-015-AH)  
28-Lead Dual-In-Line Welded-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.090    | 0.200 |      | 2.29        | 5     |
| A <sub>1</sub> | 0        | 0.070 | 2    | 0           | 1.77  |
| B              | 0.015    | 0.020 |      | 0.381       | 0.508 |
| B <sub>1</sub> | 0.015    | 0.065 |      | 0.39        | 1.39  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 1.380    | 1.420 |      | 35.06       | 36.06 |
| E              | 0.600    | 0.625 |      | 15.24       | 15.87 |
| E <sub>1</sub> | 0.485    | 0.515 |      | 12.32       | 13.08 |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.600 TP |       | 2, 3 | 15.24 TP    |       |
| L              | 0.100    | 0.200 |      | 2.6         | 5     |
| L <sub>2</sub> | 0        | 0.030 |      | 0           | 0.76  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 28       |       | 5    | 28          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.020    | 0.070 |      | 0.51        | 1.77  |
| S              | 0.040    | 0.070 |      | 1.02        | 1.77  |

92CM-20250R2

### TO-5 Style Package

(T) SUFFIX (JEDEC MO-006-AG)  
12-Lead Metal Package



92CS-19774

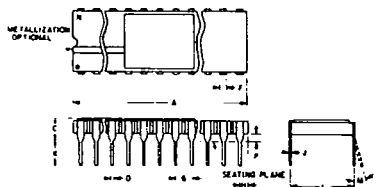
| SYMBOL          | INCHES |       | NOTE | MILLIMETERS |       |
|-----------------|--------|-------|------|-------------|-------|
|                 | MIN.   | MAX.  |      | MIN.        | MAX.  |
| a               | 0.230  |       | 2    | 5.84 TP     |       |
| A <sub>1</sub>  | 0      | 0     |      | 0           | 0     |
| A <sub>2</sub>  | 0.165  | 0.185 |      | 4.19        | 4.70  |
| φB              | 0.016  | 0.019 | 3    | 0.407       | 0.482 |
| φB <sub>1</sub> | 0      | 0     |      | 0           | 0     |
| φB <sub>2</sub> | 0.016  | 0.021 | 3    | 0.407       | 0.533 |
| φD              | 0.335  | 0.370 |      | 8.51        | 9.39  |
| φD <sub>1</sub> | 0.305  | 0.335 |      | 7.75        | 8.50  |
| F <sub>1</sub>  | 0.020  | 0.040 |      | 0.51        | 1.01  |
| j               | 0.028  | 0.034 |      | 0.712       | 0.863 |
| k               | 0.029  | 0.045 | 4    | 0.74        | 1.14  |
| L <sub>1</sub>  | 0.000  | 0.050 | 3    | 0.00        | 1.27  |
| L <sub>2</sub>  | 0.250  | 0.500 | 3    | 6.4         | 12.7  |
| L <sub>3</sub>  | 0.500  | 0.562 | 3    | 12.7        | 14.27 |
| a               | 30° TP |       |      | 30° TP      |       |
| N               | 12     |       | 6    | 12          |       |
| N <sub>1</sub>  | 1      |       | 5    | 1           |       |

**NOTES:**

- Refer to Rules for Dimensioning Axial Lead Product Outlines.
- Leads at gauge plane within 0.007" (0.178 mm) radius of True Position (TP) at maximum material condition.
- φB applies between L<sub>1</sub> and L<sub>2</sub>. φB<sub>2</sub> applies between L<sub>2</sub> and 0.500" (12.70 mm) from seating plane. Diameter is uncontrolled in L<sub>1</sub> and beyond 0.500" (12.70 mm).
- Measure from Max. φD.
- N<sub>1</sub> is the quantity of allowable missing leads.
- N is the maximum quantity of lead positions.

Dimensional Outlines (Cont'd)

DUAL-IN-LINE SIDE-BRAZED CERAMIC PACKAGES



(D) SUFFIX  
18-Lead Dual-In-Line  
Side-Brazed Ceramic Package

| SYMBOL | INCHES |       | NOTE | MILLIMETERS |        |
|--------|--------|-------|------|-------------|--------|
|        | MIN.   | MAX.  |      | MIN.        | MAX.   |
| A      | 0.890  | 0.915 |      | 22.606      | 23.241 |
| C      | —      | 0.200 |      | —           | 5.080  |
| D      | 0.015  | 0.021 |      | 0.381       | 0.533  |
| F      | 0.054  | REF.  | 1    | 1.371       | REF.   |
| G      | 0.100  | BSC   | 1    | 2.54        | BSC    |
| H      | 0.035  | 0.065 |      | 0.889       | 1.651  |
| J      | 0.008  | 0.012 | 3    | 0.203       | 0.304  |
| K      | 0.125  | 0.150 |      | 3.175       | 3.810  |
| L      | 0.290  | 0.310 | 2    | 7.366       | 7.874  |
| M      | —      | 15°   |      | 0°          | 15°    |
| P      | 0.025  | 0.045 |      | 0.635       | 1.143  |
| N      | 18     |       |      | 18          |        |

92CS-27231R1

(D) SUFFIX  
22-Lead Dual-In-Line  
Side-Brazed Ceramic Package

| SYMBOL | INCHES |       | NOTE | MILLIMETERS |       |
|--------|--------|-------|------|-------------|-------|
|        | MIN.   | MAX.  |      | MIN.        | MAX.  |
| A      | 1.065  | 1.100 |      | 27.05       | 27.94 |
| C      | 0.085  | 0.145 |      | 2.16        | 3.68  |
| D      | 0.017  | 0.023 |      | 0.43        | 0.58  |
| F      | 0.040  | REF.  | 1    | 1.02        | REF.  |
| G      | 0.100  | BSC   | 1    | 2.54        | BSC   |
| H      | 0.030  | 0.070 |      | 0.76        | 1.78  |
| J      | 0.008  | 0.012 | 3    | 0.20        | 0.30  |
| K      | 0.125  | 0.175 |      | 3.18        | 4.45  |
| L      | 0.380  | 0.420 | 2    | 9.65        | 10.67 |
| M      | —      | 7°    |      | —           | 7°    |
| P      | 0.025  | 0.050 |      | 0.64        | 1.27  |
| N      | 22     |       |      | 22          |       |

92CS-25186R2

NOTES:

- Leads within 0.005" (0.13 mm) radius of True Position at maximum material condition.
- Dimension "L" to center of leads when formed parallel.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).

(D) SUFFIX  
24-Lead Dual-In-Line  
Side-Brazed Ceramic Package

| SYMBOL | INCHES |       | NOTE | MILLIMETERS |       |
|--------|--------|-------|------|-------------|-------|
|        | MIN.   | MAX.  |      | MIN.        | MAX.  |
| A      | 1.180  | 1.220 |      | 29.98       | 30.98 |
| C      | 0.085  | 0.145 |      | 2.16        | 3.68  |
| D      | 0.015  | 0.023 |      | 0.39        | 0.58  |
| F      | 0.040  | REF.  |      | 1.02        | REF.  |
| G      | 0.100  | BSC   | 1    | 2.54        | BSC   |
| H      | 0.030  | 0.070 |      | 0.77        | 1.77  |
| J      | 0.008  | 0.012 | 3    | 0.21        | 0.30  |
| K      | 0.125  | 0.175 |      | 3.18        | 4.44  |
| L      | 0.580  | 0.620 | 2    | 14.74       | 15.74 |
| M      | —      | 7°    |      | —           | 7°    |
| P      | 0.025  | 0.050 |      | 0.64        | 1.27  |
| N      | 24     |       |      | 24          |       |

92CS-30968R1

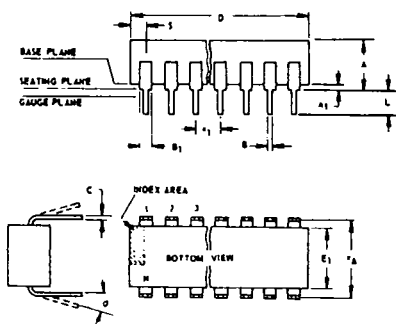
(D) SUFFIX  
40-Lead Dual-In-Line  
Side-Brazed Ceramic Package

| SYMBOL | INCHES |       | NOTE | MILLIMETERS |       |
|--------|--------|-------|------|-------------|-------|
|        | MIN.   | MAX.  |      | MIN.        | MAX.  |
| A      | 1.980  | 2.020 |      | 50.30       | 51.30 |
| C      | 0.095  | 0.155 |      | 2.43        | 3.93  |
| D      | 0.017  | 0.023 |      | 0.43        | 0.58  |
| F      | 0.050  | REF.  |      | 1.27        | REF.  |
| G      | 0.100  | BSC   | 1    | 2.54        | BSC   |
| H      | 0.030  | 0.070 |      | 0.76        | 1.78  |
| J      | 0.008  | 0.012 | 3    | 0.20        | 0.30  |
| K      | 0.125  | 0.175 |      | 3.18        | 4.45  |
| L      | 0.580  | 0.620 | 2    | 14.74       | 15.74 |
| M      | —      | 7°    |      | —           | 7°    |
| P      | 0.025  | 0.050 |      | 0.64        | 1.27  |
| N      | 40     |       |      | 40          |       |

92CM-27029R2

Dual-In-Line Plastic and Frit-Seal Ceramic Packages

(E) SUFFIX (JEDEC MO-001-AN)  
8-Lead Dual-In-Line Plastic  
(Mini-DIP) Package



| SYMBOL         | INCHES |       | NOTE | MILLIMETERS |       |
|----------------|--------|-------|------|-------------|-------|
|                | MIN.   | MAX.  |      | MIN.        | MAX.  |
| A              | 0.155  | 0.200 |      | 3.94        | 5.08  |
| A <sub>1</sub> | 0.020  | 0.050 |      | 0.508       | 1.27  |
| B              | 0.014  | 0.020 |      | 0.356       | 0.508 |
| B <sub>1</sub> | 0.035  | 0.065 |      | 0.889       | 1.65  |
| C              | 0.008  | 0.012 | 1    | 0.203       | 0.304 |
| D              | 0.370  | 0.400 |      | 9.40        | 10.16 |
| E              | 0.300  | 0.325 |      | 7.62        | 8.25  |
| E <sub>1</sub> | 0.240  | 0.260 |      | 6.10        | 6.60  |
| e <sub>1</sub> | 0.100  | TP    | 2    | 2.54        | TP    |
| e <sub>A</sub> | 0.300  | TP    | 2, 3 | 7.62        | TP    |
| L              | 0.125  | 0.150 |      | 3.18        | 3.81  |
| L <sub>2</sub> | 0.000  | 0.030 |      | 0.000       | 0.762 |
| a              | 0      | 15    | 4    | 0           | 15    |
| N              | 8      |       | 5    | 8           |       |
| N <sub>1</sub> | 0      |       | 6    | 0           |       |
| O <sub>1</sub> | 0.040  | 0.075 |      | 1.02        | 1.90  |
| S              | 0.015  | 0.060 |      | 0.381       | 1.52  |

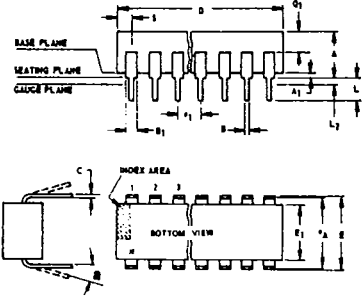
92CS-24026 R1

NOTES:

- Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013".
  - Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
  - e<sub>A</sub> applies in zone L<sub>2</sub> when unit installed.
  - a applies to spread leads prior to installation.
  - N is the maximum quantity of lead positions.
  - N<sub>1</sub> is the quantity of allowable missing leads.

Dimensional Outlines (Cont'd)

Dual-In-Line Plastic and Frit-Seal Ceramic Packages (Cont'd)



**NOTES:**  
 Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.  
 1. When this device is supplied solder dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).  
 2. Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.  
 3. eA applies in zone L2 when unit installed.  
 4. alpha applies to spread leads prior to installation.  
 5. N is the maximum quantity of lead positions.  
 6. N1 is the quantity of allowable missing leads.

(E) and (F) SUFFIXES (JEDEC MO-001-AB)  
 14-Lead Dual-In-Line Plastic or Frit-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.155    | 0.200 |      | 3.94        | 5.08  |
| A <sub>1</sub> | 0.020    | 0.050 |      | 0.51        | 1.27  |
| B              | 0.014    | 0.020 |      | 0.356       | 0.508 |
| B <sub>1</sub> | 0.050    | 0.065 |      | 1.27        | 1.65  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 0.745    | 0.770 |      | 18.93       | 19.55 |
| E              | 0.300    | 0.325 |      | 7.62        | 8.25  |
| E <sub>1</sub> | 0.240    | 0.260 |      | 6.10        | 6.60  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.000       | 0.76  |
| alpha          | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 14       |       | 5    | 14          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.040    | 0.075 |      | 1.02        | 1.90  |
| S              | 0.065    | 0.090 |      | 1.66        | 2.28  |

92SS-4296R3

(E) and (F) SUFFIXES (JEDEC MO-001-AC)  
 16-Lead Dual-In-Line Plastic or Frit-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.155    | 0.200 |      | 3.94        | 5.08  |
| A <sub>1</sub> | 0.020    | 0.050 |      | 0.51        | 1.27  |
| B              | 0.014    | 0.020 |      | 0.356       | 0.508 |
| B <sub>1</sub> | 0.035    | 0.065 |      | 0.89        | 1.65  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 0.745    | 0.785 |      | 18.93       | 19.93 |
| E              | 0.300    | 0.325 |      | 7.62        | 8.25  |
| E <sub>1</sub> | 0.240    | 0.260 |      | 6.10        | 6.60  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.000       | 0.76  |
| alpha          | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 16       |       | 5    | 16          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.040    | 0.075 |      | 1.02        | 1.90  |
| S              | 0.015    | 0.060 |      | 0.39        | 1.52  |

92CM-15967R4

(E) SUFFIX  
 18-Lead Dual-In-Line Plastic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.155    | 0.200 |      | 3.94        | 5.08  |
| A <sub>1</sub> | 0.020    | 0.050 |      | 0.508       | 1.27  |
| B              | 0.014    | 0.020 |      | 0.356       | 0.508 |
| B <sub>1</sub> | 0.035    | 0.065 |      | 0.89        | 1.65  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 0.845    | 0.885 |      | 21.47       | 22.47 |
| E <sub>1</sub> | 0.240    | 0.260 |      | 6.10        | 6.60  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| alpha          | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 18       |       | 5    | 18          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| S              | 0.015    | 0.060 |      | 0.39        | 1.52  |

92CS-30630

(E) SUFFIX  
 22-Lead Dual-In-Line Plastic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.155    | 0.200 |      | 3.94        | 5.08  |
| A <sub>1</sub> | 0.020    | 0.050 |      | 0.508       | 1.27  |
| B              | 0.015    | 0.020 |      | 0.381       | 0.508 |
| B <sub>1</sub> | 0.035    | 0.065 |      | 0.89        | 1.65  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              |          | 1.120 |      |             | 28.44 |
| E              | 0.390    | 0.420 |      | 9.91        | 10.66 |
| E <sub>1</sub> | 0.345    | 0.355 |      | 8.77        | 9.01  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.400 TP |       | 2, 3 | 10.16 TP    |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| L <sub>2</sub> | 0        | 0.030 |      | 0           | 0.762 |
| alpha          | 2°       | 15°   | 4    | 2°          | 15°   |
| N              | 22       |       | 5    | 22          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.055    | 0.085 |      | 1.40        | 2.15  |
| S              | 0.015    | 0.060 |      | 0.381       | 1.27  |

92CS-30830

(F) SUFFIX (JEDEC MO-001-AG)  
 16-Lead Dual-In-Line Frit-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.165    | 0.210 |      | 4.20        | 5.33  |
| A <sub>1</sub> | 0.015    | 0.045 |      | 0.381       | 1.14  |
| B              | 0.015    | 0.020 |      | 0.381       | 0.508 |
| B <sub>1</sub> | 0.045    | 0.070 |      | 1.15        | 1.77  |
| C              | 0.009    | 0.011 | 1    | 0.229       | 0.279 |
| D              | 0.750    | 0.795 |      | 19.05       | 20.19 |
| E              | 0.295    | 0.325 |      | 7.50        | 8.25  |
| E <sub>1</sub> | 0.245    | 0.300 |      | 6.23        | 7.62  |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.120    | 0.160 |      | 3.05        | 4.06  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.000       | 0.76  |
| alpha          | 2°       | 15°   | 4    | 2°          | 15°   |
| N              | 16       |       | 5    | 16          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.050    | 0.080 |      | 1.27        | 2.03  |
| S              | 0.010    | 0.060 |      | 0.254       | 1.52  |

92CM-22284R1

(E) and (F) SUFFIXES (JEDEC MO-015-AA)  
 24-Lead Dual-In-Line Plastic or Frit-Seal Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.120    | 0.250 |      | 3.10        | 6.30  |
| A <sub>1</sub> | 0.020    | 0.070 |      | 0.51        | 1.77  |
| B              | 0.016    | 0.020 |      | 0.407       | 0.508 |
| B <sub>1</sub> | 0.028    | 0.070 |      | 0.72        | 1.77  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 1.20     | 1.29  |      | 30.48       | 32.76 |
| E              | 0.600    | 0.625 |      | 15.24       | 15.87 |
| E <sub>1</sub> | 0.515    | 0.580 |      | 13.09       | 14.73 |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.600 TP |       | 2, 3 | 15.24 TP    |       |
| L              | 0.100    | 0.200 |      | 2.54        | 5.00  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.00        | 0.76  |
| alpha          | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 24       |       | 5    | 24          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.040    | 0.075 |      | 1.02        | 1.90  |
| S              | 0.040    | 0.100 |      | 1.02        | 2.54  |

92CS26938R2

(E) SUFFIX  
 40-Lead Dual-In-Line Plastic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.120    | 0.250 |      | 3.10        | 6.30  |
| A <sub>1</sub> | 0.020    | 0.070 |      | 0.51        | 1.77  |
| B              | 0.016    | 0.020 |      | 0.407       | 0.508 |
| B <sub>1</sub> | 0.028    | 0.070 |      | 0.72        | 1.77  |
| C              | 0.008    | 0.012 | 1    | 0.204       | 0.304 |
| D              | 2.000    | 2.090 |      | 50.80       | 53.09 |
| E <sub>1</sub> | 0.515    | 0.580 |      | 13.09       | 14.73 |
| e <sub>1</sub> | 0.100 TP |       | 2    | 2.54 TP     |       |
| e <sub>A</sub> | 0.600 TP |       | 2, 3 | 15.24 TP    |       |
| L              | 0.100    | 0.200 |      | 2.54        | 5.00  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.00        | 0.76  |
| alpha          | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 40       |       | 5    | 40          |       |
| N <sub>1</sub> | 0        |       | 6    | 0           |       |
| Q <sub>1</sub> | 0.065    | 0.095 |      | 1.66        | 2.41  |
| S              | 0.040    | 0.100 |      | 1.02        | 2.54  |

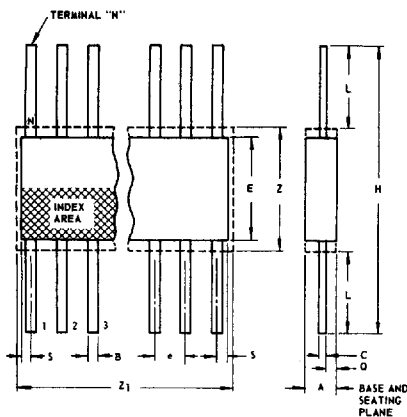
92CS-30959

T-90-20

**Dimensional Outlines (Cont'd)**

**Ceramic Flat Packs**

**(K) SUFFIX (JEDEC MO-004-AF)  
14-Lead**



| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.008    | 0.100 |      | 0.21        | 2.54  |
| B              | 0.015    | 0.019 | 1    | 0.381       | 0.482 |
| C              | 0.003    | 0.006 | 1    | 0.077       | 0.152 |
| e              | 0.050 TP |       | 2    | 1.27 TP     |       |
| E              | 0.200    | 0.300 |      | 5.1         | 7.6   |
| H              | 0.600    | 1.000 |      | 15.3        | 25.4  |
| L              | 0.150    | 0.350 |      | 3.9         | 8.8   |
| N              | 14       |       | 3    | 14          |       |
| Q              | 0.005    | 0.050 |      | 0.13        | 1.27  |
| S              | 0.000    | 0.050 |      | 0.00        | 1.27  |
| Z              | 0.300    |       | 4    | 7.62        |       |
| Z <sub>1</sub> | 0.400    |       | 4    | 10.16       |       |

92SS-4300R3

**NOTES:**

1. Refer to JEDEC Publication No. 95 for Rules for Dimensioning Peripheral Lead Outlines.
2. Leads within 0.005" (0.12 mm) radius of True Position (TP) at maximum material condition.
3. N is the maximum quantity of lead positions.
4. Z and Z<sub>1</sub> determine a zone within which all body and lead irregularities lie.

**(K) SUFFIX (JEDEC MO-004-AG)  
16-Lead**

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.008    | 0.100 |      | 0.21        | 2.54  |
| B              | 0.015    | 0.019 | 1    | 0.381       | 0.482 |
| C              | 0.003    | 0.006 | 1    | 0.077       | 0.152 |
| e              | 0.050 TP |       | 2    | 1.27 TP     |       |
| E              | 0.200    | 0.300 |      | 5.1         | 7.6   |
| H              | 0.600    | 1.000 |      | 15.3        | 25.4  |
| L              | 0.150    | 0.350 |      | 3.9         | 8.8   |
| N              | 16       |       | 3    | 16          |       |
| Q              | 0.005    | 0.050 |      | 0.13        | 1.27  |
| S              | 0.000    | 0.025 |      | 0.00        | 0.63  |
| Z              | 0.300    |       | 4    | 7.62        |       |
| Z <sub>1</sub> | 0.400    |       | 4    | 10.16       |       |

92CS-17271R3

**(K) SUFFIX  
24-Lead**

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.075    | 0.120 |      | 1.91        | 3.04  |
| B              | 0.018    | 0.022 | 1    | 0.458       | 0.558 |
| C              | 0.004    | 0.007 | 1    | 0.102       | 0.177 |
| e              | 0.050 TP |       | 2    | 1.27 TP     |       |
| E              | 0.600    | 0.700 |      | 15.24       | 17.78 |
| H              | 1.150    | 1.350 |      | 29.21       | 34.29 |
| L              | 0.225    | 0.325 |      | 5.72        | 8.25  |
| N              | 24       |       | 3    | 24          |       |
| Q              | 0.035    | 0.070 |      | 0.89        | 1.77  |
| S              | 0.060    | 0.110 | 1    | 1.53        | 2.79  |
| Z              | 0.700    |       | 4    | 17.78       |       |
| Z <sub>1</sub> | 0.750    |       | 4    | 19.05       |       |

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**(K) SUFFIX  
28-Lead**

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.075    | 0.120 |      | 1.91        | 3.04  |
| B              | 0.018    | 0.022 | 1    | 0.458       | 0.558 |
| C              | 0.004    | 0.007 | 1    | 0.102       | 0.177 |
| e              | 0.050 TP |       | 2    | 1.27 TP     |       |
| E              | 0.600    | 0.700 |      | 15.24       | 17.78 |
| H              | 1.150    | 1.350 |      | 29.21       | 34.29 |
| L              | 0.225    | 0.325 |      | 5.72        | 8.25  |
| N              | 28       |       | 3    | 28          |       |
| Q              | 0.035    | 0.070 |      | 0.89        | 1.77  |
| S              | 0        | 0.060 | 1    | 0           | 1.53  |
| Z              | 0.700    |       | 4    | 17.78       |       |
| Z <sub>1</sub> | 0.750    |       | 4    | 19.05       |       |

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