

T-43-21

## CD4048A Types

CMOS Multi-Function  
Expandable 8-Input Gate

The RCA-CD4048A is an 8-input gate having four control inputs. Three binary control inputs — Ka, Kb, and Kc — provide the implementation of eight different logic functions. These functions are OR, NOR, AND, NAND, OR/AND, OR/NAND, AND/OR, and AND/NOR.

A fourth control input — Kd — provides the user with 3-state outputs. When control input Kd is high the output is either a logic 1 or a logic 0 depending on the input states. When control input Kd is low, the output is

an open circuit. This feature enables the user to connect this device to a common bus line.

In addition to the eight input lines, an EXPAND input is provided that permits the user to increase the number of inputs to one CD4048A, (see Fig. 6). For example, two CD4048A's can be cascaded to provide a 16-input multifunction gate. When the EXPAND input is not used, it should be connected to VSS.

## MAXIMUM RATINGS, Absolute-Maximum Values:

|                                                                       |                                        |
|-----------------------------------------------------------------------|----------------------------------------|
| STORAGE-TEMPERATURE RANGE ( $T_{stg}$ )                               | —65 to +150°C                          |
| OPERATING-TEMPERATURE RANGE ( $T_A$ ):                                |                                        |
| PACKAGE TYPES D, F, K, H                                              | —55 to +125°C                          |
| PACKAGE TYPE E                                                        | —40 to +85°C                           |
| DC SUPPLY-VOLTAGE RANGE, ( $V_{DD}$ )                                 |                                        |
| (Voltages referenced to $V_{SS}$ Terminal):                           | —0.5 to +15 V                          |
| POWER DISSIPATION PER PACKAGE ( $P_D$ )                               |                                        |
| FOR $T_A$ = —40 to +60°C (PACKAGE TYPE E)                             | .500 mW                                |
| FOR $T_A$ = +60 to +85°C (PACKAGE TYPE E)                             | .Derate Linearly at 12 mW/°C to 200 mW |
| FOR $T_A$ = —55 to +100°C (PACKAGE TYPES D, F, K)                     | .500 mW                                |
| FOR $T_A$ = +100 to +125°C (PACKAGE TYPES D, F, K)                    | .Derate Linearly at 12 mW/°C to 200 mW |
| DEVICE DISSIPATION PER OUTPUT TRANSISTOR                              |                                        |
| FOR $T_A$ = FULL PACKAGE-TEMPERATURE RANGE (ALL PACKAGE TYPES)        | .100 mW                                |
| INPUT VOLTAGE RANGE, ALL INPUTS                                       | —0.5 to $V_{DD} + 0.5$ V               |
| LEAD TEMPERATURE (DURING SOLDERING):                                  |                                        |
| At distance 1/16 ± 1/32 inch (1.69 ± 0.79 mm) from case for 10 s max. | +265°C                                 |

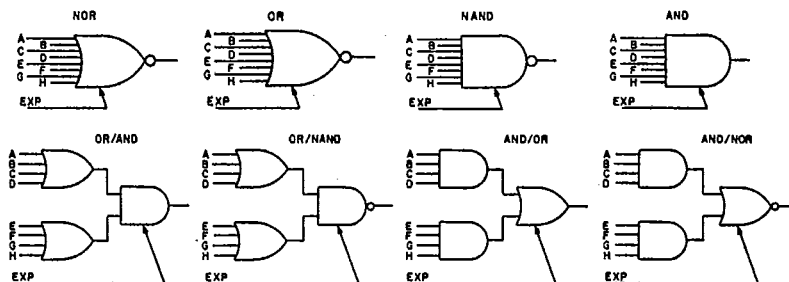


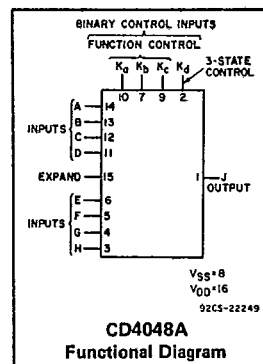
Fig. 1 — Basic logic configurations.

## RECOMMENDED OPERATING CONDITIONS

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

| CHARACTERISTIC                                                                | V <sub>DD</sub><br>(V) | LIMITS                 |      |              |      | UNITS |
|-------------------------------------------------------------------------------|------------------------|------------------------|------|--------------|------|-------|
|                                                                               |                        | D, F, K, H<br>Packages |      | E<br>Package |      |       |
|                                                                               |                        | Min.                   | Max. | Min.         | Max. |       |
| Supply-Voltage Range (For T <sub>A</sub> = Full<br>Package-Temperature Range) |                        | 3                      | 12   | 3            | 12   | V     |

These types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic package (E suffix), 16-lead ceramic flat package (K suffix), and in chip form (H suffix).



## Features:

- Medium-power TTL drive capability
- Three-state output
- High-current source and sink capability  
9 mA (typ.) @  $V_{DS} = 0.5$  V,  $V_{DD} = 10$  V
- Many logic functions available in one package
- Quiescent current specified to 15 V
- Maximum input leakage current of 1  $\mu$ A at 15 V (full package-temperature range)
- 1-V noise margin (full package-temperature range)

## Applications:

- Selection of up to 8 logic functions
- Digital control of logic
- General-purpose gating logic
  - Decoding
  - Encoding

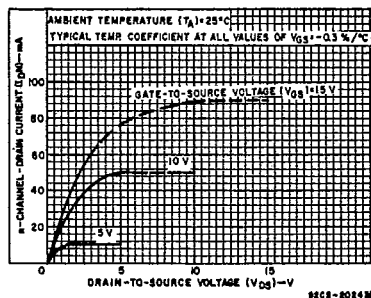


Fig. 2— Typical output n-channel drain characteristics.

CD4048A Types

STATIC ELECTRICAL CHARACTERISTICS

| Characteristic                                                   | Conditions               |                        |                        | Limits at Indicated Temperatures (°C) |       |      |      |           |      |       |      | Units |
|------------------------------------------------------------------|--------------------------|------------------------|------------------------|---------------------------------------|-------|------|------|-----------|------|-------|------|-------|
|                                                                  |                          |                        |                        | D, F, K, H Packages                   |       |      |      | E Package |      |       |      |       |
|                                                                  | V <sub>O</sub><br>(V)    | V <sub>IN</sub><br>(V) | V <sub>DD</sub><br>(V) | -55                                   | +25   |      | +125 | -40       | +25  |       | +85  |       |
| Quiescent Device Current I <sub>L</sub> Max.                     | —                        | —                      | 5                      | 1                                     | 0.005 | 1    | 60   | 10        | 0.01 | 10    | 140  | μA    |
|                                                                  | —                        | —                      | 10                     | 2                                     | 0.01  | 2    | 120  | 20        | 0.02 | 20    | 280  |       |
|                                                                  | —                        | —                      | 15                     | 25                                    | 0.5   | 25   | 1000 | 250       | 2.5  | 250   | 2500 |       |
| Output Voltage: Low Level, V <sub>OL</sub>                       | —                        | 5                      | 5                      | 0 Typ.; 0.05 Max.                     |       |      |      |           |      |       |      | V     |
|                                                                  | —                        | 10                     | 10                     | 0 Typ.; 0.05 Max.                     |       |      |      |           |      |       |      |       |
| High Level V <sub>OH</sub>                                       | —                        | 0                      | 5                      | 4.95 Min.; 5 Typ.                     |       |      |      |           |      |       |      | V     |
|                                                                  | —                        | 0                      | 10                     | 9.95 Min.; 10 Typ.                    |       |      |      |           |      |       |      |       |
| Noise Immunity: Inputs Low, V <sub>NL</sub>                      | 4.2                      | —                      | 5                      | 1.5 Min.; 2.25 Typ.                   |       |      |      |           |      |       |      | V     |
|                                                                  | 9                        | —                      | 10                     | 3 Min.; 4.5 Typ.                      |       |      |      |           |      |       |      |       |
| Inputs High V <sub>NH</sub>                                      | 0.8                      | —                      | 5                      | 1.5 Min.; 2.25 Typ.                   |       |      |      |           |      |       |      | V     |
|                                                                  | 1                        | —                      | 10                     | 3 Min.; 4.5 Typ.                      |       |      |      |           |      |       |      |       |
| Noise Margin: Inputs Low, V <sub>NML</sub>                       | 4.5                      | —                      | 5                      | 1 Min.                                |       |      |      |           |      |       |      | V     |
|                                                                  | 9                        | —                      | 10                     | 1 Min.                                |       |      |      |           |      |       |      |       |
| Inputs High, V <sub>NMH</sub>                                    | 0.5                      | —                      | 5                      | 1 Min.                                |       |      |      |           |      |       |      | V     |
|                                                                  | 1                        | —                      | 10                     | 1 Min.                                |       |      |      |           |      |       |      |       |
| Output Drive Current: n-Channel (Sink) I <sub>DN</sub> Min.      | 0.4                      | —                      | 4.5                    | 2                                     | 3.2   | 1.6  | 1.1  | 1.9       | 3.2  | 1.6   | 1.3  | mA    |
|                                                                  | 0.5                      | —                      | 10                     | 5.6                                   | 9     | 4.5  | 3.1  | 5.4       | 9    | 4.5   | 3.7  |       |
| p-channel (Source), I <sub>DP</sub> Min.                         | 4.6                      | —                      | 5                      | -2                                    | -3.2  | -1.6 | -1.1 | -1.9      | -3.2 | -1.6  | -1.3 | mA    |
|                                                                  | 9.5                      | —                      | 10                     | -5.6                                  | -9    | -4.5 | -3.1 | -3.8      | -9   | -3.15 | -2.6 |       |
| Input Leakage Current, I <sub>IL</sub> , I <sub>IH</sub>         | Any Input                |                        |                        | ±10 <sup>-5</sup> Typ., ±1 Max.       |       |      |      |           |      |       |      | μA    |
|                                                                  | —                        | —                      | 15                     |                                       |       |      |      |           |      |       |      |       |
| 3-State Output Leakage Current I <sub>OL</sub> , I <sub>OH</sub> | Forced (Output Disabled) |                        |                        | ±10 <sup>-4</sup> Typ., ±2 Max.       |       |      |      |           |      |       |      | μA    |
|                                                                  | —                        | —                      | 15                     |                                       |       |      |      |           |      |       |      |       |

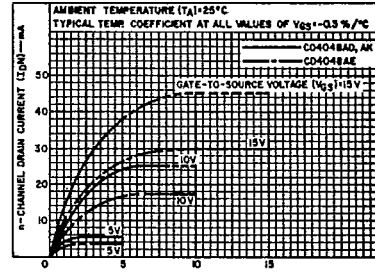


Fig. 3— Minimum output n-channel drain characteristics

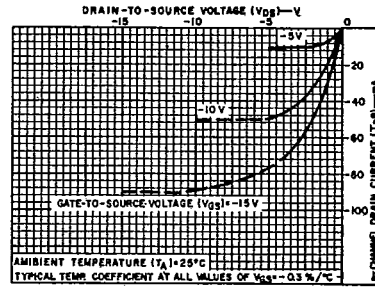


Fig. 4— Typical output p-channel drain characteristics.

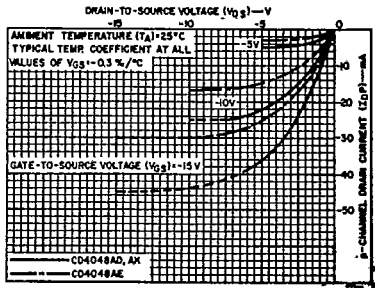


Fig. 5— Minimum output p-channel drain characteristics.

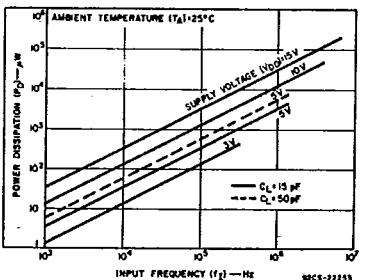


Fig. 6— Typical power dissipation as a function of input frequency.

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DYNAMIC ELECTRICAL CHARACTERISTICS at  $T_A = 25^\circ\text{C}$  and  $C_L = 15\text{ pF}$  and  $50\text{ pF}$ ,  
Typical Temperature Coefficient for all values of  $V_{DD} = 0.3\%/^\circ\text{C}$   $R_L = 200\text{ k}\Omega$

$C_L = 15\text{ pF}$

| CHARACTERISTIC                                  | TEST<br>CONDITIONS | LIMITS              |                               |       |                     |       | UNITS |
|-------------------------------------------------|--------------------|---------------------|-------------------------------|-------|---------------------|-------|-------|
|                                                 |                    | $V_{DD}$<br>(Volts) | <i>D, F, K, H</i><br>Packages |       | <i>E</i><br>Package |       |       |
|                                                 |                    |                     | TYP.                          | MAX.* | TYP.                | MAX.* |       |
| Propagation Delay Time<br>$t_{PHL}$             |                    | 5                   | 750                           | 1300  | 750                 | 1600  | ns    |
|                                                 |                    | 10                  | 225                           | 400   | 225                 | 500   |       |
| Transition Time:<br>High-to-Low Level $t_{THL}$ |                    | 5                   | 90                            | 140   | 90                  | 170   | ns    |
|                                                 |                    | 10                  | 30                            | 50    | 30                  | 65    |       |
| Low-to-High Level $t_{TLH}$                     |                    | 5                   | 130                           | 250   | 130                 | 300   | ns    |
|                                                 |                    | 10                  | 40                            | 60    | 40                  | 75    |       |
| Input Capacitance $C_i$                         | Any Input          |                     | 5                             | —     | 5                   | —     | pF    |

$C_L = 50\text{ pF}$

|                                                 |           |    |     |      |     |      |  |    |
|-------------------------------------------------|-----------|----|-----|------|-----|------|--|----|
| Propagation Delay Time<br>$t_{PLH}, t_{PHL}$    |           | 5  | 775 | 1350 | 775 | 1650 |  | ns |
|                                                 |           | 10 | 240 | 430  | 240 | 530  |  |    |
| Transition Time:<br>High-to-Low Level $t_{THL}$ |           | 5  | 105 | 170  | 105 | 200  |  | ns |
|                                                 |           | 10 | 40  | 70   | 40  | 85   |  |    |
| Low-to-High Level $t_{TLH}$                     |           | 5  | 145 | 280  | 145 | 330  |  | ns |
|                                                 |           | 10 | 50  | 80   | 50  | 95   |  |    |
| Input Capacitance $C_i$                         | Any Input |    | 5   | —    | 5   | —    |  | pF |

\* Max. Limits represent worst-case limits for worst-case modes of operation shown in Figs. 15, 16, and 17.

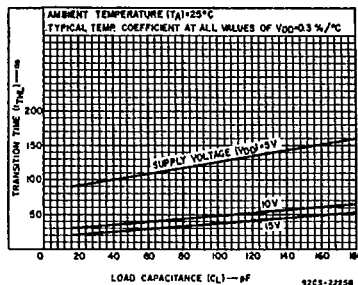


Fig. 9— Typical high-to-low level transition time as a function of load capacitance.

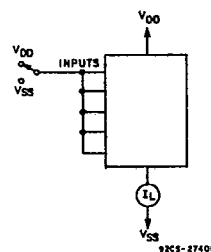


Fig. 10— Quiescent device current test circuit.

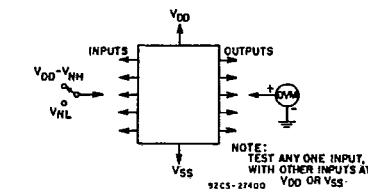


Fig. 11— Noise immunity test circuit.

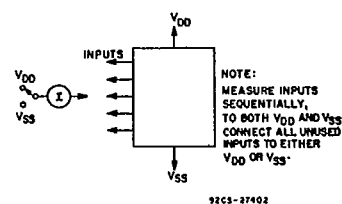


Fig. 12— Input leakage current test circuit.

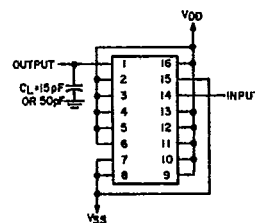


Fig. 13—  $t_{THL}$ ,  $t_{TLH}$  — AND/NOR.

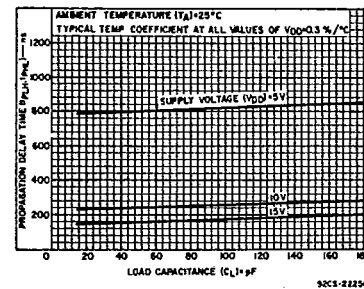


Fig. 7— Typical propagation delay time as a function of load capacitance.

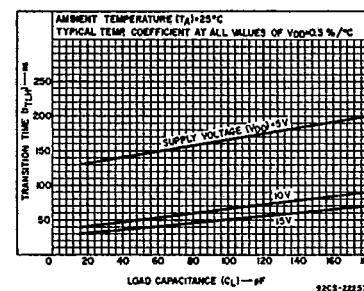
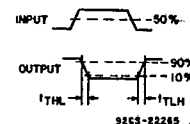


Fig. 8— Typical low-to-high level transition time as a function of load capacitance.



## CD4048A Types

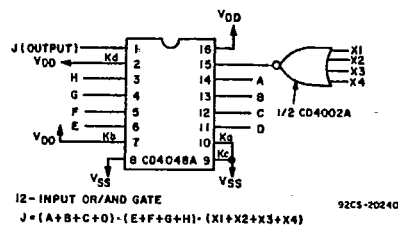
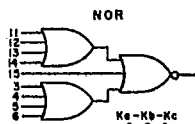


Fig. 14(a) - 12-input OR/AND gate.

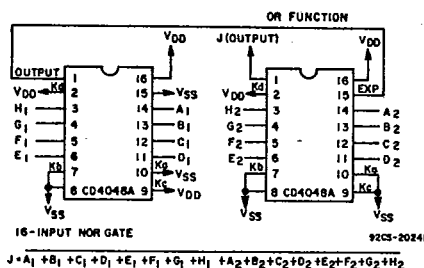
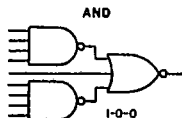
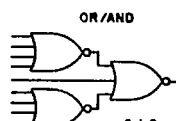
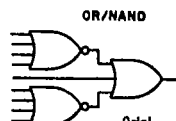
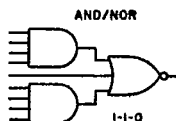
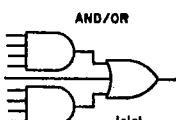
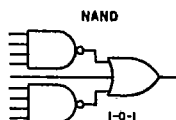
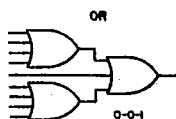
Fig. 14(b) 16-input NOR gate.  
Applications of Expand Input

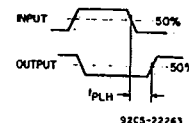
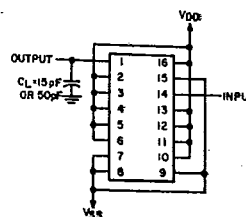
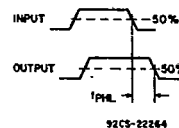
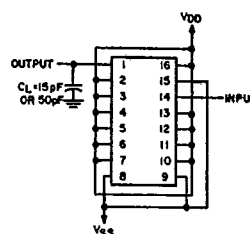
Fig. 14(c) Actual-circuit logic configurations.

## IMPLEMENTATION OF EXPAND INPUT FOR 9 OR MORE INPUTS

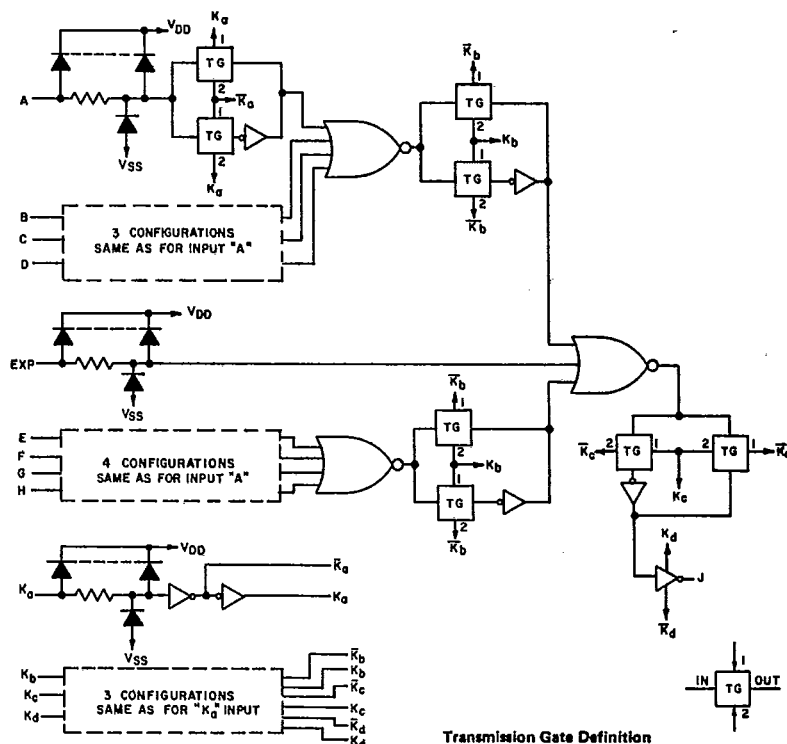
| OUTPUT FUNCTION | FUNCTION NEEDED AT EXPAND INPUT | OUTPUT BOOLEAN EXPRESSION                              |
|-----------------|---------------------------------|--------------------------------------------------------|
| NOR             | OR                              | $J = (A+B+C+D+E+F+G+H) + (EXP)$                        |
| OR              | OR                              | $J = (A+B+C+D+E+F+G+H) + (EXP)$                        |
| AND             | NAND                            | $J = (ABCDEF GH) \cdot (\overline{EXP})$               |
| NAND            | NAND                            | $J = (ABCDEF GH) \cdot (\overline{EXP})$               |
| OR/AND          | NOR                             | $J = (A+B+C+D) \cdot (E+F+G+H) \cdot (\overline{EXP})$ |
| OR/NAND         | NOR                             | $J = (A+B+C+D) \cdot (E+F+G+H) \cdot (\overline{EXP})$ |
| AND/NOR         | AND                             | $J = (ABCD) + (EFGH) + (EXP)$                          |
| AND/OR          | AND                             | $J = (ABCD) + (EFGH) + (EXP)$                          |

Note: (EXP) designates the EXPAND function (i.e.,  $X_1+X_2+\dots+X_N$ ).

Fig. 14-- Expansion logic and truth table.

Fig. 15-  $t_{PLH}$  - NAND.Fig. 16-  $t_{PHL}$  - AND.

## CD4048A Types



92CM-2225M1

FUNCTION TRUTH TABLE

| OUTPUT FUNCTION                | BOOLEAN EXPRESSION                                            | $K_a$ | $K_b$ | $K_c$ | UNUSED INPUT* |
|--------------------------------|---------------------------------------------------------------|-------|-------|-------|---------------|
| NOR                            | $J = A+B+C+D+E+F+G+H$                                         | 0     | 0     | 0     | $V_{SS}$      |
| OR                             | $J = A+B+C+D+E+F+G+H$                                         | 0     | 0     | 1     | $V_{SS}$      |
| OR/AND                         | $J = (A+B+C+D) \cdot (E+F+G+H)$                               | 0     | 1     | 0     | $V_{SS}$      |
| OR/NAND                        | $J = (A+B+C+D) \cdot (E+F+G+H)$                               | 0     | 1     | 1     | $V_{SS}$      |
| AND                            | $J = ABCDEFGH$                                                | 1     | 0     | 0     | $V_{DD}$      |
| NAND                           | $J = ABCDEFGH$                                                | 1     | 0     | 1     | $V_{DD}$      |
| AND/NOR                        | $J = \overline{A}\overline{B}\overline{C}\overline{D} + EFGH$ | 1     | 1     | 0     | $V_{DD}$      |
| AND/OR                         | $J = ABCD + EFGH$                                             | 1     | 1     | 1     | $V_{DD}$      |
| $K_d=1$ Normal Inverter Action |                                                               |       |       |       |               |
| $K_d=0$ High Impedance Output  |                                                               |       |       |       |               |

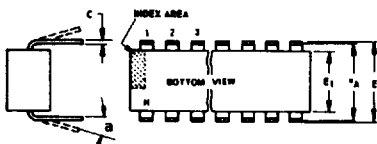
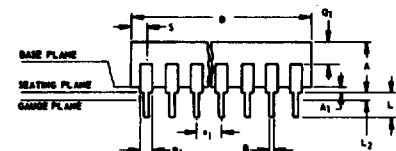
EXPAND Input=0

\*See Figs. 1 and 7.

Fig. 17— Logic diagram and truth table.

# 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.
- $e_A$  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

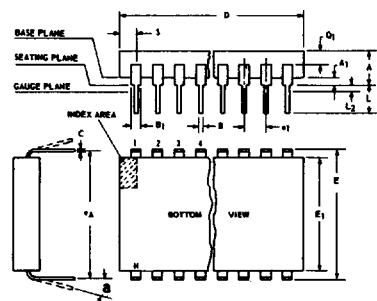
| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.120    | 0.160 |      | 3.05        | 4.06  |
| A <sub>1</sub> | 0.020    | 0.065 |      | 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.
- $e_A$  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

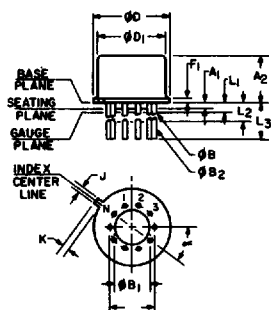
(D) SUFFIX (JEDEC MO-015-AH)  
28-Lead Dual-In-Line Welded-Seal  
Ceramic Package

| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.090    | 0.200 |      | 2.29        | 5.08  |
| A <sub>1</sub> | 0.020    | 0.070 | 2    | 0.51        | 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 |      | 2.54        | 5.08  |
| L <sub>2</sub> | 0.000    | 0.030 |      | 0.00        | 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

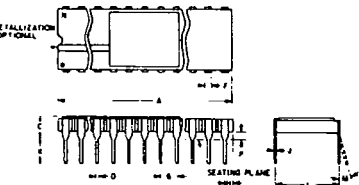
| SYMBOL          | INCHES |       | NOTE | MILLIMETERS |       |
|-----------------|--------|-------|------|-------------|-------|
|                 | MIN.   | MAX.  |      | MIN.        | MAX.  |
| a               | 0.230  |       | 2    | 5.84 TP     |       |
| A <sub>1</sub>  | 0      | 0     |      | 0           | 0     |
| A <sub>2</sub>  | 0.165  | 0.185 |      | 4.19        | 4.70  |
| øB              | 0.016  | 0.019 | 3    | 0.407       | 0.482 |
| øB <sub>1</sub> | 0      | 0     |      | 0           | 0     |
| øB <sub>2</sub> | 0.016  | 0.021 | 3    | 0.407       | 0.533 |
| øD              | 0.335  | 0.370 |      | 8.51        | 9.39  |
| øD <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.
- øB applies between L<sub>1</sub> and L<sub>2</sub>. øB<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. øD.
- 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



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

(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      | 0°     | 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

(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-30986R1

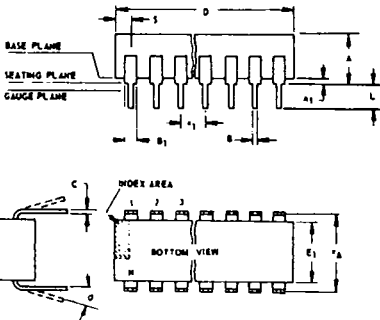
(D) SUFFIX  
40-Lead Dual-In-Line  
Side-Brazed Ceramic Package

| 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



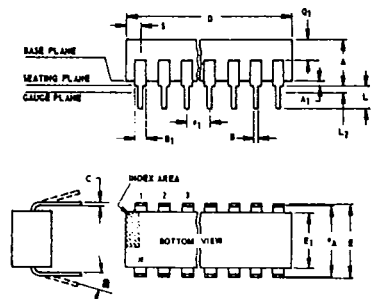
| SYMBOL         | INCHES |       | NOTE | MILLIMETERS |       |
|----------------|--------|-------|------|-------------|-------|
|                | MIN.   | MAX.  |      | MIN.        | MAX.  |
| A              | 0.155  | 0.200 |      | 3.94        | 5.08  |
| A <sub>1</sub> | 0.020  | 0.050 |      | 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.
- 1. When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013".
  - 2. Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
  - 3. e<sub>A</sub> applies in zone L<sub>2</sub> when unit installed.
  - 4. a applies to spread leads prior to installation.
  - 5. N is the maximum quantity of lead positions.
  - 6. 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.

- 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.
- $\phi A$  applies in zone L<sub>2</sub> when unit installed.
- $\phi$  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.

(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    | 0.060 |      | 0.51        | 1.27  |
| 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  |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 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          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| 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  |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 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          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| 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    | 0.060 |      | 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  |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 0.300 TP |       | 2, 3 | 7.62 TP     |       |
| L              | 0.125    | 0.150 |      | 3.18        | 3.81  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 18       | 5     |      | 18          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| 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  |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 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 |
| a              | 2°       | 15°   | 4    | 2°          | 15°   |
| N              | 22       | 5     |      | 22          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| Q <sub>1</sub> | 0.065    | 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  |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 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  |
| a              | 2°       | 15°   | 4    | 2°          | 15°   |
| N              | 16       | 5     |      | 16          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| 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 |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 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  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 24       | 5     |      | 24          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| 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

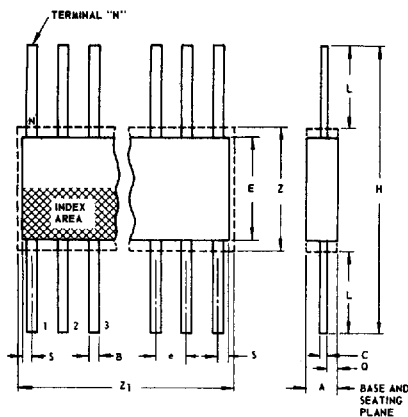
| SYMBOL         | INCHES   |       | NOTE | MILLIMETERS |       |
|----------------|----------|-------|------|-------------|-------|
|                | MIN.     | MAX.  |      | MIN.        | MAX.  |
| A              | 0.120    | 0.250 |      | 3.10        | 6.30  |
| A <sub>1</sub> | 0.020    | 0.070 |      | 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 |
| $\phi 1$       | 0.100 TP |       | 2    | 2.54 TP     |       |
| $\phi A$       | 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  |
| a              | 0°       | 15°   | 4    | 0°          | 15°   |
| N              | 40       | 5     |      | 40          | 5     |
| N <sub>1</sub> | 0        | 6     |      | 0           | 6     |
| 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       |       |

92S8-4300R3

## 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       |       |

92CS-19949R2

(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       |       |

92CS-20972