

## CMOS Analog Multiplexers

The DG508A is a CMOS Monolithic 8-Channel Analog Multiplexer, which can also be used as a demultiplexer. An enable input is provided. When the enable input is high, a channel is selected by the address inputs, and when low, all channels are off.

A channel in the ON state conducts current equally well in both directions. In the OFF state each channel blocks voltages up to the supply rails. The address inputs and the enable input are TTL and CMOS compatible over the full specified operating temperature range.

The DG508A is pinout compatible with the industry standard devices.

## Features

- Low Power Consumption
- TTL and CMOS-Compatible Address and Enable Inputs
- 44V Maximum Power Supply Rating
- High Latch-Up Immunity
- Break-Before-Make Switching
- Alternate Source

## Applications

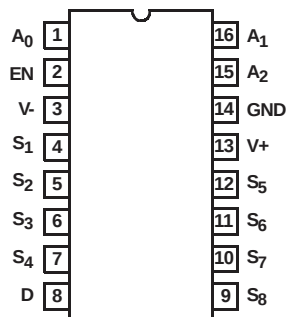
- Data Acquisition Systems
- Communication Systems
- Signal Multiplexing/Demultiplexing
- Audio Signal Multiplexing

## Ordering Information

| PART NUMBER | TEMP. RANGE (°C) | PACKAGE      | PKG. NO. |
|-------------|------------------|--------------|----------|
| DG508AAK    | -55 to 125       | 16 Ld Cerdip | F16.3    |
| DG508ABK    | -25 to 85        | 16 Ld Cerdip | F16.3    |
| DG508ACJ    | 0 to 70          | 16 Ld PDIP   | E16.3    |

## Pinout

**DG508A (PDIP, Cerdip)**  
TOP VIEW



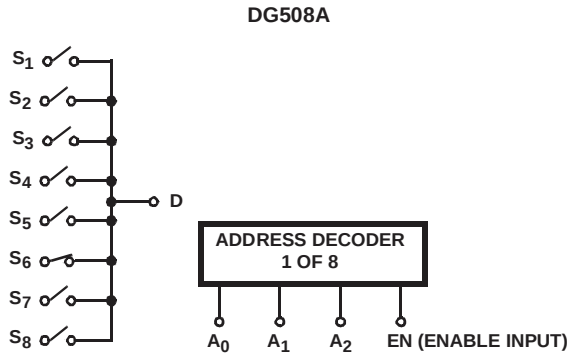
## Truth Table

| DG508A         |                |                |    |           |
|----------------|----------------|----------------|----|-----------|
| A <sub>2</sub> | A <sub>1</sub> | A <sub>0</sub> | EN | ON SWITCH |
| X              | X              | X              | 0  | None      |
| 0              | 0              | 0              | 1  | 1         |
| 0              | 0              | 1              | 1  | 2         |
| 0              | 1              | 0              | 1  | 3         |
| 0              | 1              | 1              | 1  | 4         |
| 1              | 0              | 0              | 1  | 5         |
| 1              | 0              | 1              | 1  | 6         |
| 1              | 1              | 0              | 1  | 7         |
| 1              | 1              | 1              | 1  | 8         |

A<sub>0</sub>, A<sub>1</sub>, A<sub>2</sub>, EN

Logic "1" = V<sub>AH</sub> ≥ 2.4V, Logic "0" = V<sub>AL</sub> ≤ 0.8V

## Functional Diagram

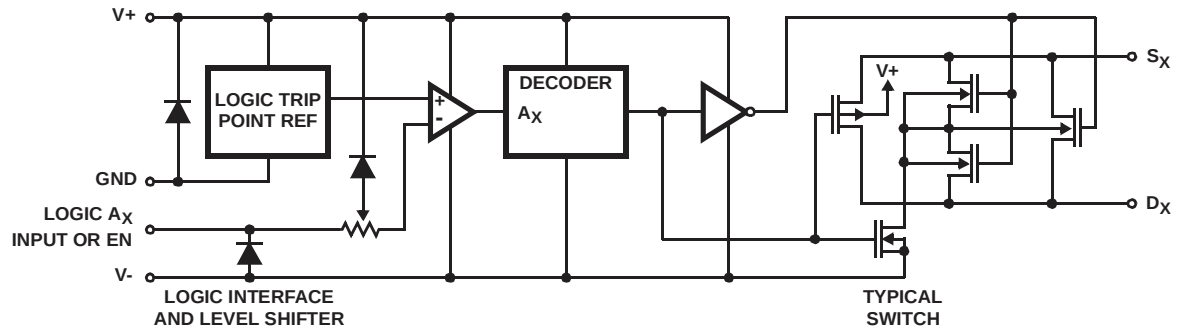


3 Line Binary Address Inputs

(1 0 1) and EN = 1

Above example shows channel 6 turned ON.

## Schematic Diagram



## Absolute Maximum Ratings

|                                                          |                      |
|----------------------------------------------------------|----------------------|
| V+ to V-                                                 | 44V                  |
| V- to Ground                                             | 25V                  |
| Digital Inputs, V <sub>S</sub> , V <sub>D</sub> (Note 1) | (V- -2V) To (V+ +2V) |
| Continuous Current, (Any Terminal Except S or D)         | 30mA                 |
| Continuous Current, (S or D)                             | 20mA                 |
| Peak Current, S or D (Pulsed 1ms, 10% Duty Cycle Max)    | 40mA                 |

## Operating Conditions

|                   |                |
|-------------------|----------------|
| Temperature Range |                |
| "A" Suffix        | -55°C to 125°C |
| "B" Suffix        | -25°C to 85°C  |
| "C" Suffix        | 0°C to 70°C    |

## Thermal Information

|                                          |                      |                      |
|------------------------------------------|----------------------|----------------------|
| Thermal Resistance (Typical, Note 2)     | $\theta_{JA}$ (°C/W) | $\theta_{JC}$ (°C/W) |
| 16 Ld CERDIP Package                     | 75                   | 20                   |
| 16 Ld PDIP Package                       | 90                   | N/A                  |
| Maximum Junction Temperature             |                      |                      |
| CERDIP Package                           | 175°C                |                      |
| PDIP Package                             | 150°C                |                      |
| Maximum Storage Temperature              |                      |                      |
| "A" and "B" Suffix                       | -65°C to 150°C       |                      |
| "C" Suffix                               | -65°C to 125°C       |                      |
| Maximum Lead Temperature (Soldering 10s) | 300°C                |                      |

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTES:

1. Signals on S<sub>X</sub>, D, E<sub>N</sub>, or A<sub>X</sub> exceeding V+ or V- are clamped by internal diodes. Limit diode current to maximum current ratings.
2.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications $T_A = 25^\circ\text{C}$ , V+ = +15V, V- = -15V, GND = 0V, V<sub>EN</sub> = 2.4V, Unless Otherwise Specified

| PARAMETER                                                  | TEST CONDITIONS                                                                                                             | “A” SUFFIX                                     |                 |                 | “B” AND “C” SUFFIX |                 |                 | UNITS |   |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------|-----------------|--------------------|-----------------|-----------------|-------|---|
|                                                            |                                                                                                                             | (NOTE 4)<br>MIN                                | (NOTE 3)<br>TYP | (NOTE 4)<br>MAX | (NOTE 4)<br>MIN    | (NOTE 3)<br>TYP | (NOTE 4)<br>MAX |       |   |
| DYNAMIC CHARACTERISTICS                                    |                                                                                                                             |                                                |                 |                 |                    |                 |                 |       |   |
| Switching Time of Multiplexer, t <sub>TRANSITION</sub>     | See Figure 1                                                                                                                | -                                              | 0.6             | 1               | -                  | 0.6             | -               | μs    |   |
| Break-Before-Make Interval, t <sub>OPEN</sub>              | See Figure 3                                                                                                                | -                                              | 0.2             | -               | -                  | 0.2             | -               | μs    |   |
| Enable Turn-ON Time, t <sub>ON(EN)</sub>                   | See Figure 2                                                                                                                | -                                              | 1               | 1.5             | -                  | 1               | -               | μs    |   |
| Enable Turn-OFF Time, t <sub>OFF(EN)</sub>                 | See Figure 2                                                                                                                | -                                              | 0.4             | 1.0             | -                  | 0.4             | -               | μs    |   |
| OFF Isolation, OIRR                                        | V <sub>EN</sub> = 0V, R <sub>L</sub> = 1kΩ, C <sub>L</sub> = 15pF, V <sub>S</sub> = 7V <sub>RMS</sub> , f = 500kHz (Note 5) | -                                              | 68              | -               | -                  | 68              | -               | dB    |   |
| Source OFF Capacitance, C <sub>S(OFF)</sub>                | V <sub>S</sub> = 0V, V <sub>EN</sub> = 0V, f = 140kHz                                                                       | -                                              | 5               | -               | -                  | 5               | -               | pF    |   |
| Drain OFF Capacitance, C <sub>D(OFF)</sub>                 | V <sub>D</sub> = 0V, V <sub>EN</sub> = 0V, f = 140kHz                                                                       | -                                              | 25              | -               | -                  | 25              | -               | pF    |   |
| Charge Injection, Q                                        | See Figure 4                                                                                                                | -                                              | 4               | -               | -                  | 4               | -               | pC    |   |
| DIGITAL INPUT CHARACTERISTICS                              |                                                                                                                             |                                                |                 |                 |                    |                 |                 |       |   |
| Address Input Current, Input Voltage High, I <sub>AH</sub> | V <sub>A</sub> = 2.4V                                                                                                       | -10                                            | -0.002          | -               | -10                | -0.002          | -               | μA    |   |
|                                                            | V <sub>A</sub> = 15V                                                                                                        | -                                              | 0.006           | 10              | -                  | 0.006           | 10              | μA    |   |
| Address Input Current Input Voltage Low, I <sub>AL</sub>   | V <sub>EN</sub> = 2.4V                                                                                                      | V <sub>A</sub> = 0V                            | -10             | -0.002          | -                  | -10             | -0.002          | μA    |   |
|                                                            | V <sub>EN</sub> = 0V                                                                                                        |                                                | -10             | -0.002          | -                  | -10             | -0.0002         | μA    |   |
| ANALOG SWITCH CHARACTERISTICS                              |                                                                                                                             |                                                |                 |                 |                    |                 |                 |       |   |
| Analog Signal Range, V <sub>ANALOG</sub>                   | (Note 7)                                                                                                                    | -15                                            | -               | +15             | -15                | -               | +15             | V     |   |
| Drain-Source ON Resistance, r <sub>DS(ON)</sub>            | Sequence Each Switch ON<br>V <sub>AL</sub> = 0.8V, V <sub>AH</sub> = 2.4V                                                   | I <sub>S</sub> = -200μA, V <sub>D</sub> = +10V | -               | 270             | 400                | -               | 270             | 450   | Ω |
|                                                            |                                                                                                                             | I <sub>S</sub> = -200μA, V <sub>D</sub> = -10V | -               | 230             | 400                | -               | 230             | 450   | Ω |
| r <sub>DS(ON)</sub> Matching Between Channels              | -10V ≤ V <sub>S</sub> ≤ +10V<br><br>Δr <sub>DS(ON)</sub> = $\frac{r_{DS(ON)MAX} - r_{DS(ON)MIN}}{r_{DS(ON)AVG}}$            |                                                | -               | 6               | -                  | -               | 6               | -     | % |

**Electrical Specifications**  $T_A = 25^{\circ}\text{C}$ ,  $V_+ = +15\text{V}$ ,  $V_- = -15\text{V}$ ,  $\text{GND} = 0\text{V}$ ,  $V_{\text{EN}} = 2.4\text{V}$ , Unless Otherwise Specified **(Continued)**

| PARAMETER                                       | TEST CONDITIONS                                                                          |                                              | “A” SUFFIX      |                 |                 | “B” AND “C” SUFFIX |                 |                 | UNITS |
|-------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------|-------|
|                                                 |                                                                                          |                                              | (NOTE 4)<br>MIN | (NOTE 3)<br>TYP | (NOTE 4)<br>MAX | (NOTE 4)<br>MIN    | (NOTE 3)<br>TYP | (NOTE 4)<br>MAX |       |
| Source OFF Leakage Current, I <sub>S(OFF)</sub> | V <sub>EN</sub> = 0V                                                                     | V <sub>S</sub> = +10V, V <sub>D</sub> = -10V | -1              | 0.002           | 1               | -5                 | 0.002           | 5               | nA    |
|                                                 |                                                                                          | V <sub>S</sub> = -10V, V <sub>D</sub> = +10V | -1              | -0.005          | 1               | -5                 | -0.005          | 5               | nA    |
| Drain OFF Leakage Current, I <sub>D(OFF)</sub>  | V <sub>EN</sub> = 0V                                                                     | V <sub>S</sub> = -10V, V <sub>D</sub> = +10V | -               | 0.01            | 10              | -                  | 0.01            | 20              | nA    |
|                                                 |                                                                                          | V <sub>S</sub> = +10V, V <sub>D</sub> = -10V | -10             | -0.015          | -               | -20                | -0.015          | -               | nA    |
| Drain ON Leakage Current, I <sub>D(ON)</sub>    | (Note 6)<br>Sequence Each Switch ON<br>V <sub>AL</sub> = 0.8V,<br>V <sub>AH</sub> = 2.4V | V <sub>D</sub> = V <sub>S(ALL)</sub> = +10V  | -               | 0.015           | 10              | -                  | 0.015           | 20              | nA    |
|                                                 |                                                                                          | V <sub>D</sub> = V <sub>S(ALL)</sub> = -10V  | -10             | -0.03           | -               | -20                | -0.03           | -               | nA    |
| POWER SUPPLY CHARACTERISTICS                    |                                                                                          |                                              |                 |                 |                 |                    |                 |                 |       |
| Positive Supply Current, I+                     | V <sub>EN</sub> = 5.0V (Enabled) or                                                      |                                              | -               | 1.3             | 2.4             | -                  | 1.3             | 2.4             | mA    |
| Negative Supply Current, I-                     | V <sub>EN</sub> = 0V (Standby), V <sub>A</sub> = 0V                                      |                                              | -1.5            | -0.7            | -               | -1.5               | -0.7            | -               | mA    |

**Electrical Specifications**  $T_A = \text{Over Operating Temperature Range}$ ,  $V_+ = +15\text{V}$ ,  $V_- = -15\text{V}$ ,  $\text{GND} = 0\text{V}$ ,  $V_{\text{EN}} = 2.4\text{V}$ , Unless Otherwise Specified

| PARAMETER                                                  | TEST CONDITIONS                                                                    |                                                | “A” SUFFIX |                 |     | UNITS |
|------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------|------------|-----------------|-----|-------|
|                                                            |                                                                                    |                                                | MIN        | (NOTE 3)<br>TYP | MAX |       |
| DIGITAL INPUT CHARACTERISTICS                              |                                                                                    |                                                |            |                 |     |       |
| Address Input Current, Input Voltage High, I <sub>AH</sub> | V <sub>A</sub> = 2.4V                                                              |                                                | -30        | -               | -   | μA    |
|                                                            | V <sub>A</sub> = 15V                                                               |                                                | -          | -               | 30  | μA    |
| Address Input Current Input Voltage Low, I <sub>AL</sub>   | V <sub>EN</sub> = 2.4V                                                             | V <sub>A</sub> = 0V                            | -30        | -               | -   | μA    |
|                                                            | V <sub>EN</sub> = 0V                                                               |                                                | -30        | -               | -   | μA    |
| ANALOG SWITCH CHARACTERISTICS                              |                                                                                    |                                                |            |                 |     |       |
| Analog Signal Range, V <sub>ANALOG</sub>                   | (Note 7)                                                                           |                                                | -15        | -               | +15 | V     |
| Drain-Source ON Resistance, r <sub>DS(ON)</sub>            | Sequence Each Switch ON<br>V <sub>AL</sub> = 0.8V, V <sub>AH</sub> = 2.4V          | I <sub>S</sub> = -200μA, V <sub>D</sub> = +10V | -          | -               | 500 | Ω     |
|                                                            |                                                                                    | I <sub>S</sub> = -200μA, V <sub>D</sub> = -10V | -          | -               | 500 | Ω     |
| Source OFF Leakage Current, I <sub>S(OFF)</sub>            | V <sub>EN</sub> = 0V                                                               | V <sub>S</sub> = +10V, V <sub>D</sub> = -10V   | -          | -               | 50  | nA    |
|                                                            |                                                                                    | V <sub>S</sub> = -10V, V <sub>D</sub> = +10V   | -50        | -               | -   | nA    |
| Drain OFF Leakage Current, I <sub>D(OFF)</sub>             | V <sub>EN</sub> = 0V                                                               | V <sub>S</sub> = -10V, V <sub>D</sub> = +10V   | -          | -               | 200 | nA    |
|                                                            |                                                                                    | V <sub>S</sub> = +10V, V <sub>D</sub> = -10V   | -200       | -               | -   | nA    |
| Drain ON Leakage Current, I <sub>D(ON)</sub>               | (Note 6) Sequence Each Switch ON<br>V <sub>AL</sub> = 0.8V, V <sub>AH</sub> = 2.4V | V <sub>D</sub> = V <sub>S(ALL)</sub> = +10V    | -          | -               | 200 | nA    |
|                                                            |                                                                                    | V <sub>D</sub> = V <sub>S(ALL)</sub> = -10V    | -200       | -               | -   | nA    |
| POWER SUPPLY CHARACTERISTICS                               |                                                                                    |                                                |            |                 |     |       |
| Positive Supply Current, I+                                | V <sub>EN</sub> = 5.0V, V <sub>A</sub> = 0V                                        |                                                | -3.2       | -               | 4.5 | mA    |
| Negative Supply Current, I-                                |                                                                                    |                                                | -3.2       | -               | 4.5 | mA    |
| Positive Standby Supply Current, I+                        | V <sub>EN</sub> = 0V, V <sub>A</sub> = 0V                                          |                                                | -3.2       | -               | 4.5 | mA    |
| Negative Standby Supply Current, I-                        |                                                                                    |                                                | -3.2       | -               | 4.5 | mA    |

**NOTES:**

- Typical values are for design aid only, not guaranteed and not subject to production testing.
- The algebraic convention whereby the most negative value is a minimum, and the most positive value is a maximum, is used in this data sheet.
- Off isolation =  $20\text{Log } |V_{\text{S}}|/|V_{\text{D}}|$ , where  $V_{\text{S}}$  = input to Off switch, and  $V_{\text{D}}$  = output due to  $V_{\text{S}}$ .
- $I_{\text{D(ON)}}$  is leakage from driver into “ON” switch.
- Parameter not tested. Parameter guaranteed by design or characterization.

## Test Circuits and Waveforms

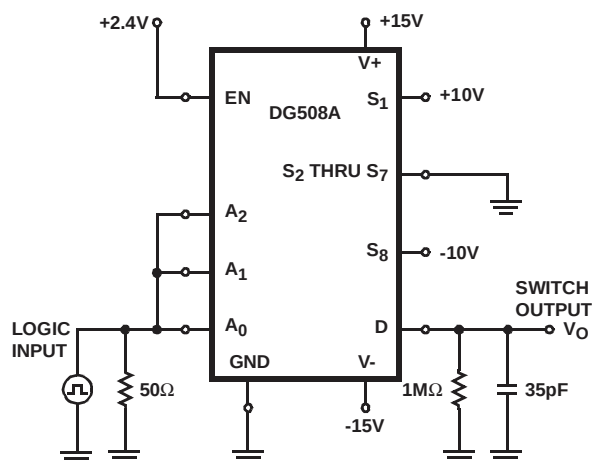


FIGURE 1A. TEST CIRCUIT

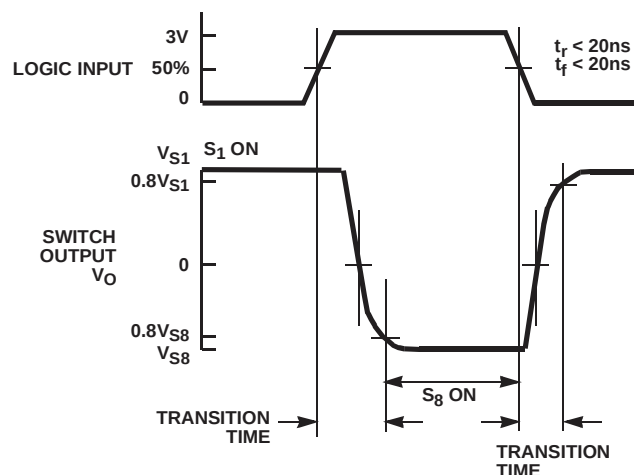


FIGURE 1B. MEASUREMENT POINTS

FIGURE 1. SWITCHING TIME

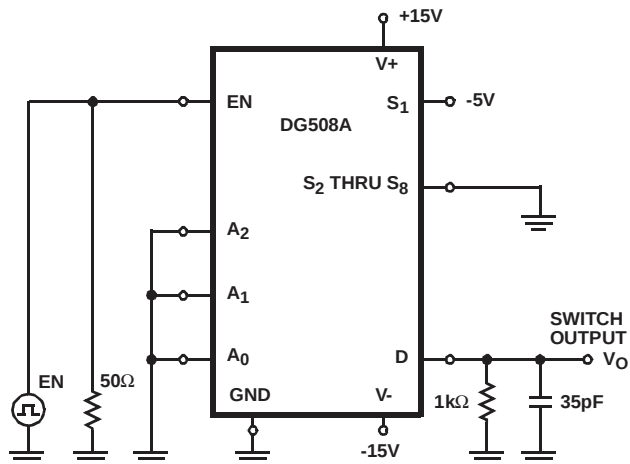


FIGURE 2A. TEST CIRCUIT

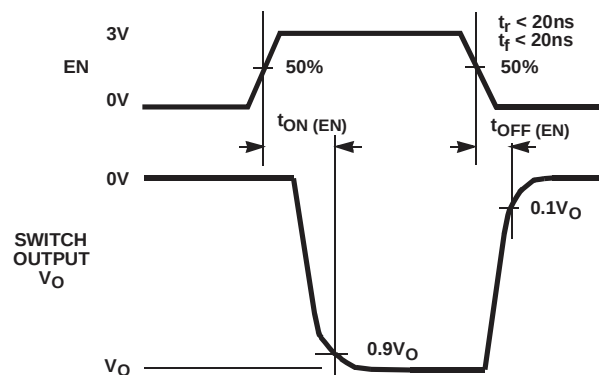


FIGURE 2B. MEASUREMENT POINTS

FIGURE 2. ENABLE TIMES

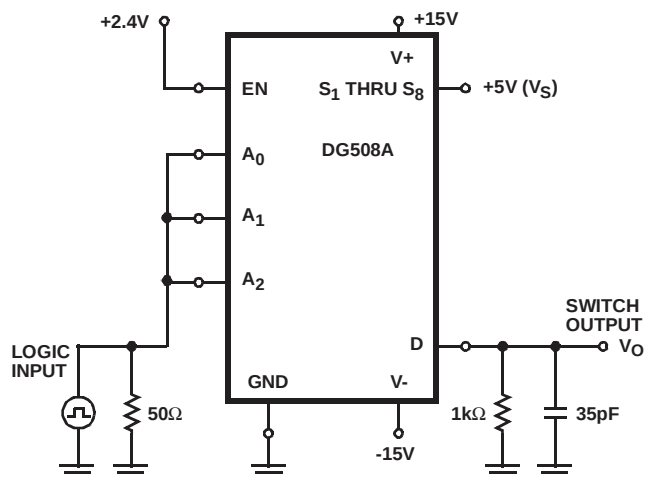


FIGURE 3A. TEST CIRCUIT

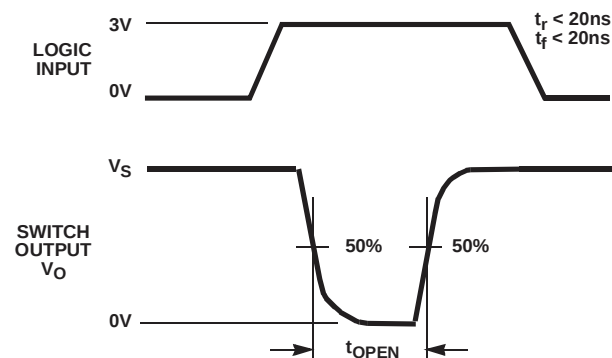


FIGURE 3B. MEASUREMENT POINTS

FIGURE 3. BREAK-BEFORE-MAKE INTERVAL

## Test Circuits and Waveforms (Continued)

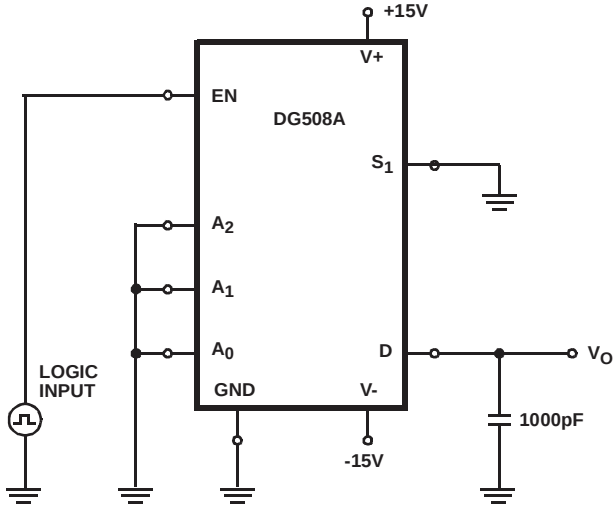
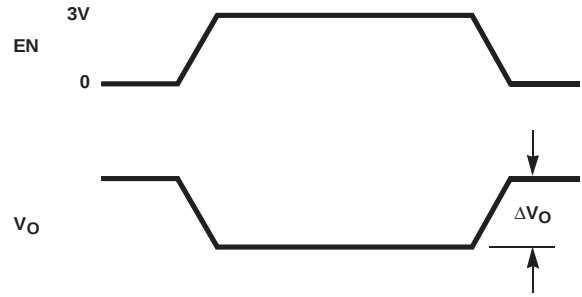


FIGURE 4A. TEST CIRCUIT



$\Delta V_O$  is the measured voltage error due to charge injection. The charge transfer error in Coulombs is  $Q = C_L \times \Delta V_O$ .

FIGURE 4B. CHARGE INJECTION WAVEFORMS

FIGURE 4. CHARGE INJECTION

## Typical Performance Curves

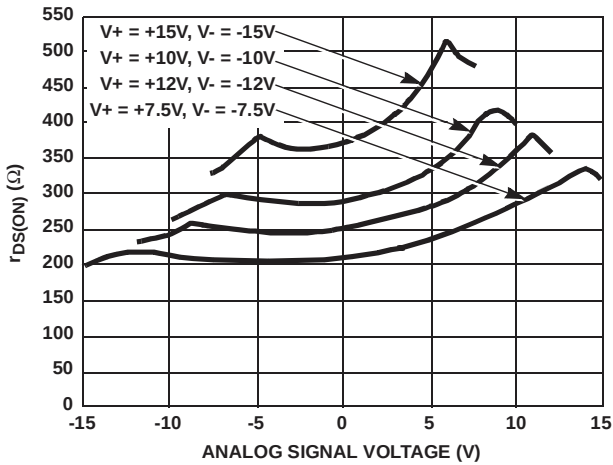


FIGURE 5.  $r_{DS(ON)}$  vs ANALOG SIGNAL VOLTAGE vs SUPPLY VOLTAGE

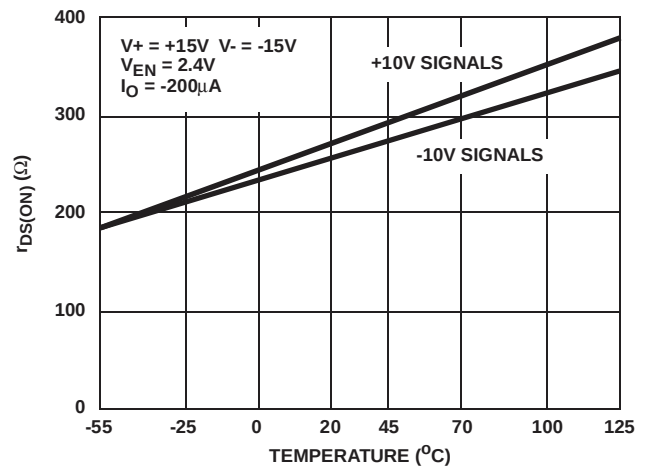


FIGURE 6. TYPICAL  $r_{DS(ON)}$  VARIATION WITH TEMPERATURE

## Die Characteristics

### DIE DIMENSIONS:

3100 $\mu$ m x 2083 $\mu$ m

### METALLIZATION:

Type: Al

Thickness: 10k $\text{\AA}$   $\pm$ 1k $\text{\AA}$

### PASSIVATION:

Type: PSG/Nitride

Thickness: PSG: 7k $\text{\AA}$   $\pm$ 1.4k $\text{\AA}$

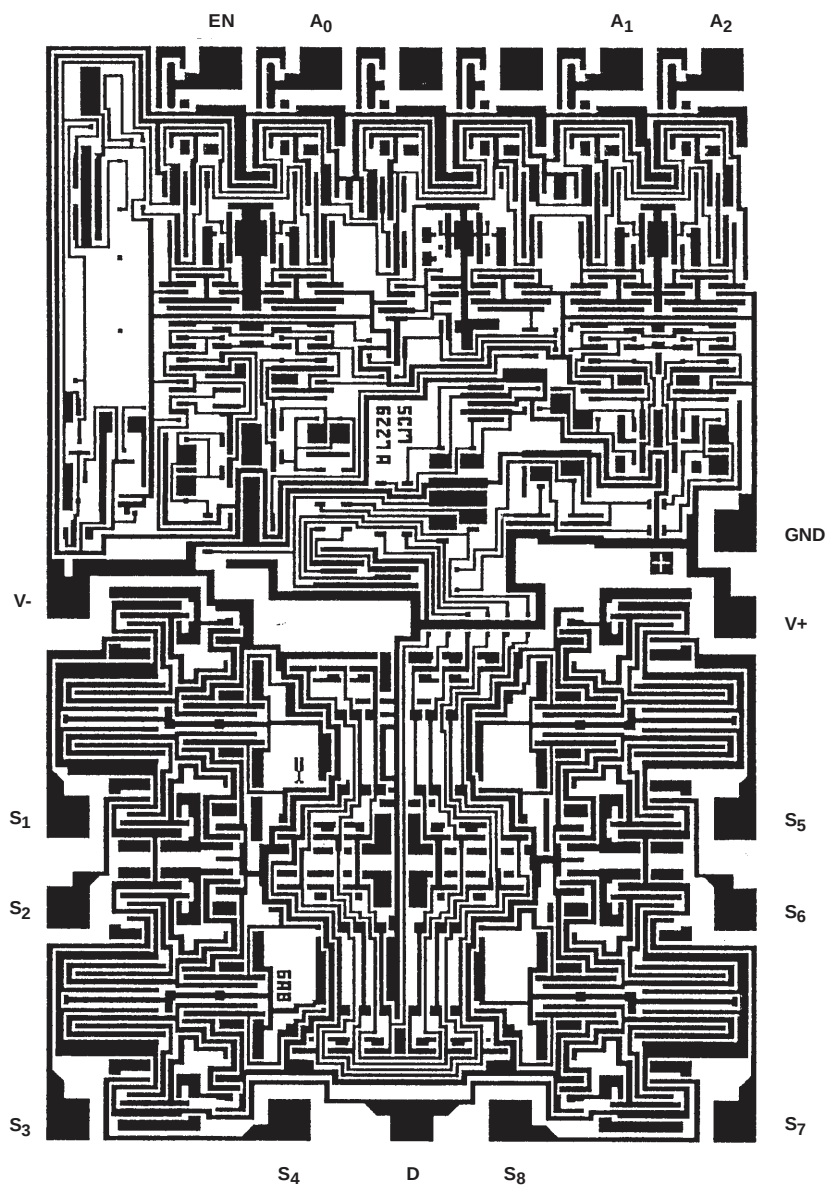
Nitride: 8k $\text{\AA}$   $\pm$ 1.2k $\text{\AA}$

### WORST CASE CURRENT DENSITY:

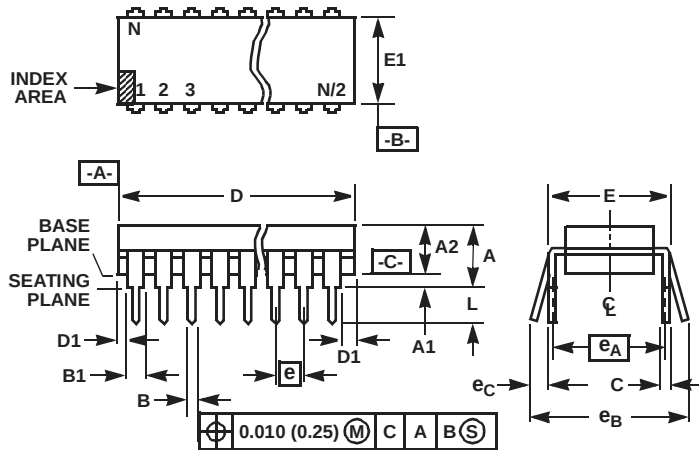
$9.1 \times 10^4$  A/cm<sup>2</sup>

## Metallization Mask Layout

DG508A



## Dual-In-Line Plastic Packages (PDIP)



### NOTES:

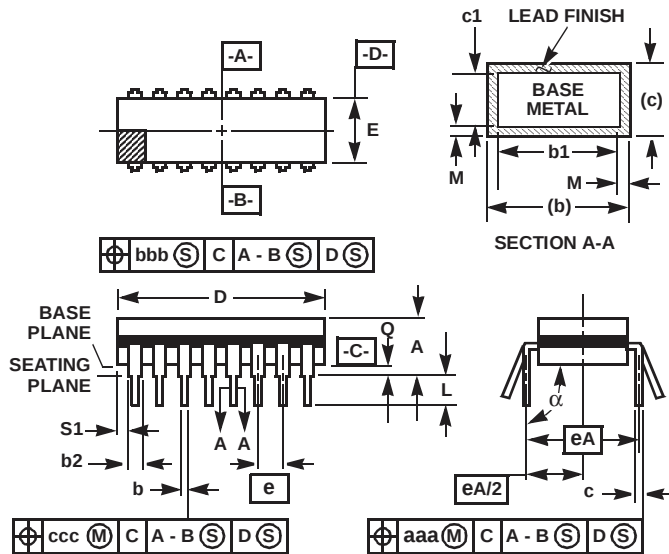
1. Controlling Dimensions: INCH. In case of conflict between English and Metric dimensions, the inch dimensions control.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Symbols are defined in the "MO Series Symbol List" in Section 2.2 of Publication No. 95.
4. Dimensions A, A1 and L are measured with the package seated in JEDEC seating plane gauge GS-3.
5. D, D1, and E1 dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.010 inch (0.25mm).
6. E and  $e_A$  are measured with the leads constrained to be perpendicular to datum -C-.
7.  $e_B$  and  $e_C$  are measured at the lead tips with the leads unconstrained.  $e_C$  must be zero or greater.
8. B1 maximum dimensions do not include dambar protrusions. Dambar protrusions shall not exceed 0.010 inch (0.25mm).
9. N is the maximum number of terminal positions.
10. Corner leads (1, N, N/2 and N/2 + 1) for E8.3, E16.3, E18.3, E28.3, E42.6 will have a B1 dimension of 0.030 - 0.045 inch (0.76 - 1.14mm).

### E16.3 (JEDEC MS-001-BB ISSUE D) 16 LEAD DUAL-IN-LINE PLASTIC PACKAGE

| SYMBOL | INCHES    |       | MILLIMETERS |       | NOTES |
|--------|-----------|-------|-------------|-------|-------|
|        | MIN       | MAX   | MIN         | MAX   |       |
| A      | -         | 0.210 | -           | 5.33  | 4     |
| A1     | 0.015     | -     | 0.39        | -     | 4     |
| A2     | 0.115     | 0.195 | 2.93        | 4.95  | -     |
| B      | 0.014     | 0.022 | 0.356       | 0.558 | -     |
| B1     | 0.045     | 0.070 | 1.15        | 1.77  | 8, 10 |
| C      | 0.008     | 0.014 | 0.204       | 0.355 | -     |
| D      | 0.735     | 0.775 | 18.66       | 19.68 | 5     |
| D1     | 0.005     | -     | 0.13        | -     | 5     |
| E      | 0.300     | 0.325 | 7.62        | 8.25  | 6     |
| E1     | 0.240     | 0.280 | 6.10        | 7.11  | 5     |
| e      | 0.100 BSC |       | 2.54 BSC    |       | -     |
| $e_A$  | 0.300 BSC |       | 7.62 BSC    |       | 6     |
| $e_B$  | -         | 0.430 | -           | 10.92 | 7     |
| L      | 0.115     | 0.150 | 2.93        | 3.81  | 4     |
| N      | 16        |       | 16          |       | 9     |

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## Ceramic Dual-In-Line Frit Seal Packages (CERDIP)



### NOTES:

- Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark.
- The maximum limits of lead dimensions b and c or M shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
- Dimensions b1 and c1 apply to lead base metal only. Dimension M applies to lead plating and finish thickness.
- Corner leads (1, N, N/2, and N/2+1) may be configured with a partial lead paddle. For this configuration dimension b3 replaces dimension b2.
- This dimension allows for off-center lid, meniscus, and glass overrun.
- Dimension Q shall be measured from the seating plane to the base plane.
- Measure dimension S1 at all four corners.
- N is the maximum number of terminal positions.
- Dimensioning and tolerancing per ANSI Y14.5M - 1982.
- Controlling dimension: INCH.

### F16.3 MIL-STD-1835 GDIP1-T16 (D-2, CONFIGURATION A) 16 LEAD CERAMIC DUAL-IN-LINE FRIT SEAL PACKAGE

| SYMBOL   | INCHES    |        | MILLIMETERS |       | NOTES |
|----------|-----------|--------|-------------|-------|-------|
|          | MIN       | MAX    | MIN         | MAX   |       |
| A        | -         | 0.200  | -           | 5.08  | -     |
| b        | 0.014     | 0.026  | 0.36        | 0.66  | 2     |
| b1       | 0.014     | 0.023  | 0.36        | 0.58  | 3     |
| b2       | 0.045     | 0.065  | 1.14        | 1.65  | -     |
| b3       | 0.023     | 0.045  | 0.58        | 1.14  | 4     |
| c        | 0.008     | 0.018  | 0.20        | 0.46  | 2     |
| c1       | 0.008     | 0.015  | 0.20        | 0.38  | 3     |
| D        | -         | 0.840  | -           | 21.34 | 5     |
| E        | 0.220     | 0.310  | 5.59        | 7.87  | 5     |
| e        | 0.100 BSC |        | 2.54 BSC    |       | -     |
| eA       | 0.300 BSC |        | 7.62 BSC    |       | -     |
| eA/2     | 0.150 BSC |        | 3.81 BSC    |       | -     |
| L        | 0.125     | 0.200  | 3.18        | 5.08  | -     |
| Q        | 0.015     | 0.060  | 0.38        | 1.52  | 6     |
| S1       | 0.005     | -      | 0.13        | -     | 7     |
| $\alpha$ | 90°       | 105°   | 90°         | 105°  | -     |
| aaa      | -         | 0.015  | -           | 0.38  | -     |
| bbb      | -         | 0.030  | -           | 0.76  | -     |
| ccc      | -         | 0.010  | -           | 0.25  | -     |
| M        | -         | 0.0015 | -           | 0.038 | 2, 3  |
| N        | 16        |        | 16          |       | 8     |

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