



## Precision 8-Ch / Dual 4-Ch Low Voltage Analog Multiplexers

### DESCRIPTION

The DG408L, DG409L are low voltage pin-for-pin compatible companion devices to the industry standard DG408, DG409 with improved performance.

Using BiCMOS wafer fabrication technology allows the DG408L, DG409L to operate on single and dual supplies. Single supply voltage ranges from 3 V to 12 V while dual supply operation is recommended with  $\pm 3$  V to  $\pm 6$  V.

The DG408L is an 8 channel single-ended analog multiplexer designed to connect one of eight inputs to a common output as determined by a 3 bit binary address ( $A_0$ ,  $A_1$ ,  $A_2$ ). The DG409L is a dual 4 channel differential analog multiplexer designed to connect one of four differential inputs to a common dual output as determined by its 2 bit binary address ( $A_0$ ,  $A_1$ ). Break-before-make switching action to protect against momentary crosstalk between adjacent channels.

The DG408L, DG409L provides lower on-resistance, faster switching time, lower leakage, less power consumption, and higher off-isolation than the DG408, DG409.

### FEATURES

- Pin-for-pin compatibility with DG408, DG409
- 2.7 V to 12 V single supply or  $\pm 3$  V to  $\pm 6$  V dual supply operation
- Lower on-resistance:  $R_{DS(on)}$  - 17  $\Omega$  typ.
- Fast switching:  $t_{ON}$  - 38 ns,  $t_{OFF}$  - 18 ns
- Break-before-make guaranteed
- Low leakage:  $I_{S(OFF)}$  - 0.2 nA max.
- Low charge injection: 1 pC
- TTL, CMOS, LV logic (3 V) compatible
- 82 dB off-isolation at 1 MHz
- 2000 V ESD protection (HBM)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

#### Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.



### BENEFITS

- High accuracy
- Single and dual power rail capacity
- Wide operating voltage range
- Simple logic interface

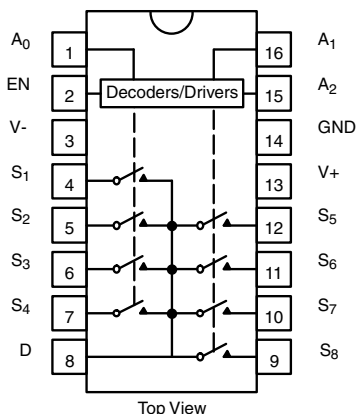
### APPLICATIONS

- Data acquisition systems
- Battery operated equipment
- Portable test equipment
- Sample and hold circuits
- Communication systems
- SDSL, DSLAM
- Audio and video signal routing

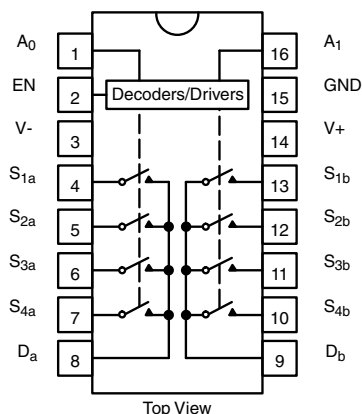
### FUNCTIONAL BLOCK DIAGRAMS AND PIN CONFIGURATIONS

**DG408L**

Dual-In- Line, SOIC, and TSSOP

**DG409L**

Dual-In- Line, SOIC, and TSSOP



**TRUTH TABLE (DG408L)**

| 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         |

**Note**

- For low and high voltage levels for V<sub>AX</sub> and V<sub>EN</sub> consult "Digital Control" parameters for specific V<sub>+</sub> operation.

**ORDERING INFORMATION (DG408L)**

| TEMP. RANGE      | PACKAGE      | PART NUMBER                                              |
|------------------|--------------|----------------------------------------------------------|
| -40 °C to +85 °C | 16-pin SOIC  | DG408LDY<br>DG408LDY-E3<br>DG408LDY-T1<br>DG408LDY-T1-E3 |
|                  | 16-pin TSSOP | DG408LDQ<br>DG408LDQ-E3<br>DG408LDQ-T1<br>DG408LDQ-T1-E3 |

**TRUTH TABLE (DG409L)**

| A <sub>1</sub> | A <sub>0</sub> | EN | ON SWITCH |
|----------------|----------------|----|-----------|
| X              | X              | 0  | None      |
| 0              | 0              | 1  | 1         |
| 0              | 1              | 1  | 2         |
| 1              | 0              | 1  | 3         |
| 1              | 1              | 1  | 4         |

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

X = do not care

**ORDERING INFORMATION (DG409L)**

| TEMP. RANGE      | PACKAGE      | PART NUMBER                                              |
|------------------|--------------|----------------------------------------------------------|
| -40 °C to +85 °C | 16-pin SOIC  | DG409LDY<br>DG409LDY-E3<br>DG409LDY-T1<br>DG409LDY-T1-E3 |
|                  | 16-pin TSSOP | DG409LDQ<br>DG409LDQ-E3<br>DG409LDQ-T1<br>DG409LDQ-T1-E3 |

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                                                     |                                   | LIMIT                   | UNIT |
|---------------------------------------------------------------|-----------------------------------|-------------------------|------|
| Voltage Referenced V+ to V- <sup>e</sup>                      |                                   | 14                      | V    |
| GND                                                           |                                   | 7                       |      |
| Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub> |                                   | (V-) - 0.3 to (V) + 0.3 |      |
| Current (any terminal)                                        |                                   | 30                      | mA   |
| Peak Current, S or D (pulsed at 1 ms, 10 % duty cycle max.)   |                                   | 100                     |      |
| Storage Temperature                                           | (A suffix)                        | -65 to +150             | °C   |
|                                                               | (D suffix)                        | -65 to +125             |      |
| Power Dissipation (package) <sup>b</sup>                      | 16-pin plastic TSSOP <sup>c</sup> | 650                     | mW   |
|                                                               | 16-pin narrow SOIC <sup>c</sup>   | 600                     |      |
|                                                               | 16-pin CerDIP <sup>d</sup>        | 900                     |      |
|                                                               | LCC-20 <sup>e</sup>               | 750                     |      |

**Notes**

- Signals on S<sub>X</sub>, D<sub>X</sub>, A<sub>X</sub>, or EN exceeding V<sub>+</sub> or V<sub>-</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads soldered or welded to PC board.
- Derate 7.6 mW/°C above 75 °C.
- Derate 12 mW/°C above 75 °C
- Derate 10 mW/°C above 75 °C



| SPECIFICATIONS (Single Supply 12 V)               |           |                                                                                                                      |                                      |                   |                               |                   |                              |                   |      |    |
|---------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------|-------------------------------|-------------------|------------------------------|-------------------|------|----|
| PARAMETER                                         | SYMBOL    | TEST CONDITIONS<br>UNLESS OTHERWISE<br>SPECIFIED<br>V+ = 12 V, ± 10 %, V- = 0 V<br>VEN = 0.8 V or 2.4 V <sup>f</sup> | TEMP. <sup>b</sup>                   | TYP. <sup>d</sup> | A SUFFIX<br>-55 °C to +125 °C |                   | D SUFFIX<br>-40 °C to +85 °C |                   | UNIT |    |
|                                                   |           |                                                                                                                      |                                      |                   | MIN. <sup>c</sup>             | MAX. <sup>c</sup> | MIN. <sup>c</sup>            | MAX. <sup>c</sup> |      |    |
| Analog Switch                                     |           |                                                                                                                      |                                      |                   |                               |                   |                              |                   |      |    |
| Analog Signal Range <sup>e</sup>                  | VANALOG   |                                                                                                                      | Full                                 | -                 | 0                             | 12                | 0                            | 12                | V    |    |
| Drain-Source<br>On-Resistance                     | RDS(on)   | VD = 10.8 V, VD = 2 V or 9 V,<br>IS = 10 mA,<br>sequence each switch on                                              | Room                                 | 17                | -                             | 29                | -                            | 29                | Ω    |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -                             | 38                | -                            | 35                |      |    |
| RpS(on) Matching<br>Between Channels <sup>g</sup> | ΔRDS      | VD = 10.8 V, VD = 2 V or 9 V,<br>IS = 10 mA,                                                                         | Room                                 | 1                 | -                             | 3                 | -                            | 3                 |      |    |
| On-Resistance Flatness <sup>i</sup>               | RFLAT(on) |                                                                                                                      | Room                                 | 3                 | -                             | 7                 |                              | 7                 |      |    |
| Switch Off Leakage<br>Current <sup>a</sup>        | IS(off)   | VEN = 0 V, VD = 11 V or 1 V,<br>VS = 1 V or 11 V                                                                     | Room                                 | -                 | -1                            | 1                 | -1                           | 1                 | nA   |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -15                           | 15                | -10                          | 10                |      |    |
|                                                   | ID(off)   |                                                                                                                      | Room                                 | -                 | -1                            | 1                 | -1                           | 1                 |      |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -15                           | 15                | -10                          | 10                |      |    |
| Channel On Leakage<br>Current <sup>a</sup>        | ID(on)    | VS = VD = 1 V or 11 V                                                                                                | Room                                 | -                 | -1                            | 1                 | -1                           | 1                 |      |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -15                           | 15                | -10                          | 10                |      |    |
| Digital Control                                   |           |                                                                                                                      |                                      |                   |                               |                   |                              |                   |      |    |
| Logic High Input Voltage                          | VINH      |                                                                                                                      | Full                                 | -                 | 2.4                           | -                 | 2.4                          | -                 | V    |    |
| Logic Low Input Voltage                           | VINL      |                                                                                                                      | Full                                 | -                 | -                             | 0.8               | -                            | 0.8               |      |    |
| Input Current                                     | IIN       | VAX = VEN = 2.4 V or 0.8 V                                                                                           | Full                                 | -                 | -1.5                          | 1.5               | -1                           | 1                 | μA   |    |
| Dynamic Characteristics                           |           |                                                                                                                      |                                      |                   |                               |                   |                              |                   |      |    |
| Transition Time                                   | tTRANS    | VS1 = 8 V, VS8 = 0 V, (DG408L)<br>VS1b = 8 V, VS4b = 0 V, (DG409L)<br>see figure 2                                   | Room                                 | 30                | -                             | 60                | -                            | 60                | ns   |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -                             | 68                | -                            | 65                |      |    |
| Break-Before-Make Time                            | tOPEN     | VS(all) = VDA = 5 V,<br>see figure 4                                                                                 | Room                                 | 11                | 1                             | -                 | 1                            | -                 |      |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -                             | -                 | -                            | -                 |      |    |
| Enable Turn-On Time                               | tON(EN)   | VAX = 0 V, VS1 = 5 V (DG408L)<br>VAX = 0 V, VS1b = 5 V (DG409L)<br>see figure 3                                      | Room                                 | 38                | -                             | 55                | -                            | 55                |      |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -                             | 60                | -                            | 60                |      |    |
| Enable Turn-Off Time                              | tOFF(EN)  |                                                                                                                      | Room                                 | 18                | -                             | 25                | -                            | 25                |      |    |
|                                                   |           |                                                                                                                      | Full                                 | -                 | -                             | 30                | -                            | 30                |      |    |
| Charge Injection <sup>e</sup>                     | Q         |                                                                                                                      | CL = 1 nF, VGEN = 0 V,<br>RGEN = 0 Ω | Room              | 1                             | -                 | 5                            | -                 | 5    | pC |
| Off Isolation <sup>e, h</sup>                     | OIRR      |                                                                                                                      | f = 100 kHz, RL = 1 kΩ               | Room              | -70                           | -                 | -                            | -                 | -    | dB |
| Crosstalk <sup>e</sup>                            | XTALK     | Room                                                                                                                 |                                      | -82               | -                             | -                 | -                            | -                 |      |    |
| Source Off Capacitance <sup>e</sup>               | CS(off)   | f = 1 MHz, VS = 0 V, VEN = 0 V                                                                                       | Room                                 | 7                 | -                             | -                 | -                            | -                 | pF   |    |
| Drain Off Capacitance <sup>e</sup>                | CD(off)   | f = 1 MHz, VD = 2.4 V, VEN = 0 V                                                                                     | Room                                 | 20                | -                             | -                 | -                            | -                 |      |    |
| Drain On Capacitance <sup>e</sup>                 | CD(on)    | f = 1 MHz, VD = 0 V, VEN = 2.4 V<br>(DG409L only)                                                                    | Room                                 | 31                | -                             | -                 | -                            | -                 |      |    |
| Power Supplies                                    |           |                                                                                                                      |                                      |                   |                               |                   |                              |                   |      |    |
| Power Supply Range                                | V+        |                                                                                                                      |                                      | -                 | 3                             | 12                | 3                            | 12                | V    |    |
| Power Supply Current                              | I+        | VEN = VA = 0 V or 5 V                                                                                                | Room                                 | 0.2               | -                             | 0.7               | -                            | 0.7               | μA   |    |

**Notes**

- a. Leakage parameters are guaranteed by worst case test condition and not subject to production test.  
b. Room = 25 °C, Full = as determined by the operating temperature suffix.  
c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.  
d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.  
e. Guaranteed by design, not subject to production test.  
f.  $V_{IN}$  = input voltage to perform proper function.  
g.  $\Delta R_{DS(on)} = R_{DS(on)} \text{ max.} - R_{DS(on)} \text{ min.}$   
h. Worst case isolation occurs on Channel 4 do to proximity to the drain pin.  
i.  $R_{DS(on)}$  flatness is measured as the difference between the minimum and maximum measured values across a defined Analog signal.



| SPECIFICATIONS (Dual Supply V+ = 5 V, V- = -5 V) |          |                                                                                                                      |                                |                   |                               |                   |                              |                   |      |    |
|--------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------|-------------------------------|-------------------|------------------------------|-------------------|------|----|
| PARAMETER                                        | SYMBOL   | TEST CONDITIONS<br>UNLESS OTHERWISE<br>SPECIFIED<br>V+ = 5 V, ± 10 %, V- = -5 V<br>VEN = 0.6 V or 2.4 V <sup>f</sup> | TEMP. <sup>b</sup>             | TYP. <sup>d</sup> | A SUFFIX<br>-55 °C to +125 °C |                   | D SUFFIX<br>-40 °C to +85 °C |                   | UNIT |    |
|                                                  |          |                                                                                                                      |                                |                   | MIN. <sup>c</sup>             | MAX. <sup>c</sup> | MIN. <sup>c</sup>            | MAX. <sup>c</sup> |      |    |
| Analog Switch                                    |          |                                                                                                                      |                                |                   |                               |                   |                              |                   |      |    |
| Analog Signal Range <sup>e</sup>                 | VANALOG  |                                                                                                                      | Full                           | -                 | -5                            | 5                 | -5                           | 5                 | V    |    |
| Drain-Source<br>On-Resistance                    | RDS(on)  | VD = ± 3.5 V, IS = 10 mA,<br>sequence each switch on                                                                 | Room                           | 20                | -                             | 40                | -                            | 40                | Ω    |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -                             | 50                | -                            | 50                |      |    |
| Switch Off Leakage<br>Current <sup>a</sup>       | IS(off)  | V+ = 5.5, V- = 5.5 V<br>VEN = 0 V, VD = ± 4.5 V,<br>VS = ± 4.5 V                                                     | Room                           | -                 | -1                            | 1                 | -1                           | 1                 | nA   |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -15                           | 15                | -10                          | 10                |      |    |
|                                                  | ID(off)  |                                                                                                                      | Room                           | -                 | -1                            | 1                 | -1                           | 1                 |      |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -15                           | 15                | -10                          | 10                |      |    |
| Channel On Leakage<br>Current <sup>a</sup>       | ID(on)   | Room                                                                                                                 | -                              | -1                | 1                             | -1                | 1                            |                   |      |    |
|                                                  |          | Full                                                                                                                 | -                              | -15               | 15                            | -10               | 10                           |                   |      |    |
| Digital Control                                  |          |                                                                                                                      |                                |                   |                               |                   |                              |                   |      |    |
| Logic High Input Voltage                         | VINH     |                                                                                                                      | Full                           | -                 | 2.4                           | -                 | 2.4                          | -                 | V    |    |
| Logic Low Input Voltage                          | VINL     |                                                                                                                      | Full                           | -                 | -                             | 0.6               | -                            | 0.6               |      |    |
| Input Current <sup>a</sup>                       | IIN      | VAX = VEN = 2.4 V or 0.6 V                                                                                           | Full                           | -                 | -1.5                          | 1.5               | -1                           | 1                 | μA   |    |
| Dynamic Characteristics                          |          |                                                                                                                      |                                |                   |                               |                   |                              |                   |      |    |
| Transition Time <sup>e</sup>                     | tTRANS   | VS1 = 3.5 V, VS8 = 0 V, (DG408L)<br>VS1b = 3.5 V, VS4b = 0 V, (DG409L)<br>see figure 2                               | Room                           | 30                | -                             | 60                | -                            | 60                | ns   |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -                             | 78                | -                            | 65                |      |    |
| Break-Before-Make Time <sup>e</sup>              | tOPEN    | VS(all) = VDA = 3.5 V,<br>see figure 4                                                                               | Room                           | 8                 | 1                             | -                 | 1                            | -                 |      |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -                             | -                 | -                            | -                 |      |    |
| Enable Turn-On Time <sup>e</sup>                 | tON(EN)  | VAX = 0 V, VS1 = 3.5 V (DG408L)<br>VAX = 0 V, VS1b = 3.5 V (DG409L)<br>see figure 3                                  | Room                           | 25                | -                             | 55                | -                            | 55                |      |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -                             | 68                | -                            | 60                |      |    |
| Enable Turn-Off Time <sup>e</sup>                | tOFF(EN) |                                                                                                                      | Room                           | 20                | -                             | 40                | -                            | 40                |      |    |
|                                                  |          |                                                                                                                      | Full                           | -                 | -                             | 50                | -                            | 45                |      |    |
| Source Off Capacitance <sup>e</sup>              | CS(off)  |                                                                                                                      | f = 1 MHz, VS = 0 V, VEN = 0 V | Room              | 6                             | -                 | -                            | -                 | -    | pF |
| Drain Off Capacitance <sup>e</sup>               | CD(off)  |                                                                                                                      | f = 1 MHz, VD = 0 V, VEN = 0 V | Room              | 15                            | -                 | -                            | -                 | -    |    |
| Drain On Capacitance <sup>e</sup>                | CD(on)   | f = 1 MHz, VD = 0 V, VEN = 2.4 V                                                                                     | Room                           | 29                | -                             | -                 | -                            | -                 |      |    |

**Notes**

- Leakage parameters are guaranteed by worst case test condition and not subject to production test.
- Room = 25 °C, full = as determined by the operating temperature suffix.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- Guaranteed by design, not subject to production test.
- $V_{IN}$  = input voltage to perform proper function.
- $\Delta R_{DS(on)} = R_{DS(on)} \text{ max.} - R_{DS(on)} \text{ min.}$
- Worst case isolation occurs on channel 4 do to proximity to the drain pin.
- $R_{DS(on)}$  flatness is measured as the difference between the minimum and maximum measured values across a defined Analog signal.



| SPECIFICATIONS (Single Supply 5 V)                |           |                                                                                                                     |                                      |                   |                               |                   |                              |                   |      |
|---------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------|-------------------------------|-------------------|------------------------------|-------------------|------|
| PARAMETER                                         | SYMBOL    | TEST CONDITIONS<br>UNLESS OTHERWISE<br>SPECIFIED<br>V+ = 5 V, ± 10 %, V- = 0 V<br>VEN = 0.6 V or 2.4 V <sup>f</sup> | TEMP. <sup>b</sup>                   | TYP. <sup>d</sup> | A SUFFIX<br>-55 °C to +125 °C |                   | D SUFFIX<br>-40 °C to +85 °C |                   | UNIT |
|                                                   |           |                                                                                                                     |                                      |                   | MIN. <sup>c</sup>             | MAX. <sup>c</sup> | MIN. <sup>c</sup>            | MAX. <sup>c</sup> |      |
| Analog Switch                                     |           |                                                                                                                     |                                      |                   |                               |                   |                              |                   |      |
| Analog Signal Range <sup>e</sup>                  | VANALOG   |                                                                                                                     | Full                                 | -                 | 0                             | 5                 | 0                            | 5                 | V    |
| Drain-Source<br>On-Resistance                     | RDS(on)   | V+ = 4.5 V, VD or VS = 1 V or 3.5 V,<br>IS = 5 mA                                                                   | Room                                 | 35                | -                             | 49                | -                            | 40                | Ω    |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -                             | 62                | -                            | 62                |      |
| RDS(on) Matching Between<br>Channels <sup>g</sup> | ΔRDS      | V+ = 4.5 V, VD = 1 V or 3.5 V,<br>IS = 5 mA                                                                         | Room                                 | 1.5               | -                             | 3                 | -                            | 3                 |      |
| On-Resistance Flatness <sup>i</sup>               | RFLAT(on) |                                                                                                                     | Room                                 | -                 | -                             | 4                 | -                            | 4                 |      |
| Switch Off Leakage<br>Current <sup>a</sup>        | IS(off)   | V+ = 5.5 V, VS = 1 V or 4 V,<br>VD = 4 V or 1 V                                                                     | Room                                 | -                 | -1                            | 1                 | -1                           | 1                 | nA   |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -15                           | 15                | -10                          | 10                |      |
|                                                   | ID(off)   |                                                                                                                     | Room                                 | -                 | -1                            | 1                 | -1                           | 1                 |      |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -15                           | 15                | -10                          | 10                |      |
| Channel On Leakage<br>Current <sup>a</sup>        | ID(on)    | V+ = 5.5 V, VD = VS = 1 V or 4 V,<br>sequence each switch on                                                        | Room                                 | -                 | -1                            | 1                 | -1                           | 1                 |      |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -15                           | 15                | -10                          | 10                |      |
| Digital Control                                   |           |                                                                                                                     |                                      |                   |                               |                   |                              |                   |      |
| Logic High Input Voltage                          | VINH      | V+ = 5 V                                                                                                            | Full                                 | -                 | 2.4                           | -                 | 2.4                          | -                 | V    |
| Logic Low Input Voltage                           | VINL      |                                                                                                                     | Full                                 | -                 | -                             | 0.6               | -                            | 0.6               |      |
| Input Current <sup>a</sup>                        | IIN       | VAX = VEN = 2.4 V or 0.6 V                                                                                          | Full                                 | -                 | -1.5                          | 1.5               | -1                           | 1                 | μA   |
| Dynamic Characteristics                           |           |                                                                                                                     |                                      |                   |                               |                   |                              |                   |      |
| Transition Time <sup>e</sup>                      | tTRANS    | VS1 = 3.5 V, VS8 = 0 V, (DG408L)<br>VS1b = 3.5 V, VS4b = 0 V, (DG409L)<br>see figure 2                              | Room                                 | 44                | -                             | 125               | -                            | 125               | ns   |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -                             | 138               | -                            | 135               |      |
| Break-Before-Make Time <sup>e</sup>               | tOPEN     | VS(all) = VDA = 3.5 V,<br>see figure 4                                                                              | Room                                 | 17                | 1                             | -                 | 1                            | -                 |      |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -                             | -                 | -                            | -                 |      |
| Enable Turn-On Time <sup>e</sup>                  | tON(EN)   | VAX = 0 V, VS1 = 3.5 V (DG408L)<br>VAX = 0 V, VS1b = 3.5 V (DG409L)<br>see figure 3                                 | Room                                 | 43                | -                             | 60                | -                            | 60                |      |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -                             | 70                | -                            | 65                |      |
| Enable Turn-Off Time <sup>e</sup>                 | tOFF(EN)  |                                                                                                                     | Room                                 | 26                | -                             | 45                | -                            | 45                |      |
|                                                   |           |                                                                                                                     | Full                                 | -                 | -                             | 60                | -                            | 50                |      |
| Charge Injection <sup>e</sup>                     | Q         |                                                                                                                     | CL = 1 nF, RGEN = 0 Ω,<br>VGEN = 0 V | Room              | -1                            | -                 | -                            | -                 | pC   |
| Off Isolation <sup>e, h</sup>                     | OIRR      |                                                                                                                     | f = 100 kHz, RL = 1 kΩ               | Room              | -70                           | -                 | -                            | -                 | -    |
| Crosstalk <sup>e</sup>                            | XTALK     | Room                                                                                                                |                                      | -80               | -                             | -                 | -                            | -                 |      |
| Source Off Capacitance <sup>e</sup>               | CS(off)   | f = 1 MHz, VS = 0 V, VEN = 0 V                                                                                      | Room                                 | 8                 | -                             | -                 | -                            | -                 | pF   |
| Drain Off Capacitance <sup>e</sup>                | CD(off)   | f = 1 MHz, VD = 0 V, VEN = 0 V                                                                                      | Room                                 | 21                | -                             | -                 | -                            | -                 |      |
| Drain On Capacitance <sup>e</sup>                 | CD(on)    | f = 1 MHz, VD = 0 V, VEN = 2.4 V                                                                                    | Room                                 | 32                | -                             | -                 | -                            | -                 |      |

**Notes**

- a. Leakage parameters are guaranteed by worst case test condition and not subject to production test.
- b. Room = 25 °C, full = as determined by the operating temperature suffix.
- c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- e. Guaranteed by design, not subject to production test.
- f.  $V_{IN}$  = input voltage to perform proper function.
- g.  $\Delta R_{DS(on)} = R_{DS(on)} \text{ max.} - R_{DS(on)} \text{ min.}$
- h. Worst case isolation occurs on channel 4 do to proximity to the drain pin.
- i.  $R_{DS(on)}$  flatness is measured as the difference between the minimum and maximum measured values across a defined Analog signal.



| SPECIFICATIONS (Single Supply 3 V)         |          |                                                                                                                   |                    |                   |                               |                   |                              |                   |      |
|--------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------------------|-------------------|------------------------------|-------------------|------|
| PARAMETER                                  | SYMBOL   | TEST CONDITIONS<br>UNLESS OTHERWISE<br>SPECIFIED<br>V+ = 3 V, ± 10 %, V- = 0 V<br>VEN = 0.4 V or 2 V <sup>f</sup> | TEMP. <sup>b</sup> | TYP. <sup>d</sup> | A SUFFIX<br>-55 °C to +125 °C |                   | D SUFFIX<br>-40 °C to +85 °C |                   | UNIT |
|                                            |          |                                                                                                                   |                    |                   | MIN. <sup>c</sup>             | MAX. <sup>c</sup> | MIN. <sup>c</sup>            | MAX. <sup>c</sup> |      |
| Analog Switch                              |          |                                                                                                                   |                    |                   |                               |                   |                              |                   |      |
| Analog Signal Range <sup>e</sup>           | VANALOG  |                                                                                                                   | Full               | -                 | 0                             | 3                 | 0                            | 3                 | V    |
| Drain-Source<br>On-Resistance              | RDS(on)  | V+ = 2.7 V, VD = 0.5 or 2.2 V,<br>IS = 5 mA                                                                       | Room               | 60                | -                             | 80                | -                            | 80                | Ω    |
|                                            |          |                                                                                                                   | Full               | -                 | -                             | 105               | -                            | 100               |      |
| Switch Off Leakage<br>Current <sup>a</sup> | IS(off)  | V+ = 3.3 V, VS = 2 or 1 V,<br>VD = 1 or 2 V                                                                       | Room               | -                 | -1                            | 1                 | -1                           | 1                 | nA   |
|                                            |          |                                                                                                                   | Full               | -                 | -15                           | 15                | -10                          | 10                |      |
|                                            | ID(off)  |                                                                                                                   | Room               | -                 | -1                            | 1                 | -1                           | 1                 |      |
|                                            |          |                                                                                                                   | Full               | -                 | -15                           | 15                | -10                          | 10                |      |
| Channel On Leakage<br>Current <sup>a</sup> | ID(on)   | V+ = 3.3 V, VD = VS = 1 V or 2 V,<br>sequence each switch on                                                      | Room               | -                 | -1                            | 1                 | -1                           | 1                 |      |
|                                            |          |                                                                                                                   | Full               | -                 | -15                           | 15                | -10                          | 10                |      |
| Digital Control                            |          |                                                                                                                   |                    |                   |                               |                   |                              |                   |      |
| Logic High Input Voltage                   | VINH     |                                                                                                                   | Full               | -                 | 2                             | -                 | 2                            | -                 | V    |
| Logic Low Input Voltage                    | VINL     |                                                                                                                   | Full               | -                 | -                             | 0.4               | -                            | 0.4               |      |
| Input Current <sup>a</sup>                 | IIN      | VAX = VEN = 2.4 V or 0.4 V                                                                                        | Full               | -                 | -1.5                          | 1.5               | -1                           | 1                 | μA   |
| Dynamic Characteristics                    |          |                                                                                                                   |                    |                   |                               |                   |                              |                   |      |
| Transition Time                            | tTRANS   | VS1 = 1.5 V, VS8 = 0 V, (DG408L)<br>VS1b = 1.5 V, VS4b = 0 V, (DG409L)<br>see figure 2                            | Room               | 75                | -                             | 150               | -                            | 150               | ns   |
|                                            |          |                                                                                                                   | Full               | -                 | -                             | 175               | -                            | 175               |      |
| Break-Before-Make Time                     | tOPEN    | VS(all) = VDA = 1.5 V,<br>see figure 4                                                                            | Room               | 32                | 1                             | -                 | 1                            | -                 |      |
|                                            |          |                                                                                                                   | Full               | -                 | -                             | -                 | -                            | -                 |      |
| Enable Turn-On Time                        | tON(EN)  | VAX = 0 V, VS1 = 1.5 V (DG408L)<br>VAX = 0 V, VS1b = 1.5 V (DG409L)<br>see figure 3                               | Room               | 70                | -                             | 95                | -                            | 95                |      |
|                                            |          |                                                                                                                   | Full               | -                 | -                             | 115               | -                            | 105               |      |
| Enable Turn-Off Time                       | tOFF(EN) |                                                                                                                   | Room               | 55                | -                             | 100               | -                            | 100               |      |
|                                            |          |                                                                                                                   | Full               | -                 | -                             | 115               | -                            | 105               |      |
| Charge Injection <sup>e</sup>              | Q        | CL = 1 nF, RGEN = 0 Ω,<br>VGEN = 1.5 V                                                                            | Room               | 0.4               | -                             | -                 | -                            | -                 | pC   |
| Off Isolation <sup>e, h</sup>              | OIRR     | f = 100 kHz, RL = 50 Ω                                                                                            | Room               | -70               | -                             | -                 | -                            | -                 | dB   |
| Crosstalk <sup>e</sup>                     | XTALK    |                                                                                                                   | Room               | -79               | -                             | -                 | -                            | -                 |      |
| Source Off Capacitance <sup>e</sup>        | CS(off)  | f = 1 MHz, VS = 0 V, VEN = 0 V                                                                                    | Room               | 8                 | -                             | -                 | -                            | -                 | pF   |
| Drain Off Capacitance <sup>e</sup>         | CD(off)  | f = 1 MHz, VD = 0 V, VEN = 0 V                                                                                    | Room               | 19                | -                             | -                 | -                            | -                 |      |
| Drain On Capacitance <sup>e</sup>          | CD(on)   | f = 1 MHz, VD = 0 V, VEN = 2 V<br>(DG409L only)                                                                   | Room               | 33                | -                             | -                 | -                            | -                 |      |

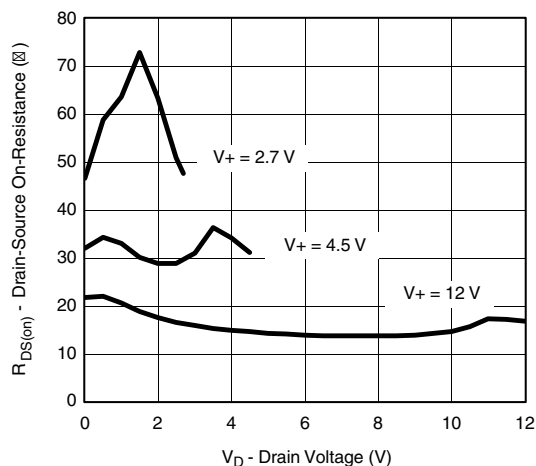
**Notes**

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- Guaranteed by design, not subject to production test.
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- $\Delta R_{DS(on)} = R_{DS(on)} \text{ max.} - R_{DS(on)} \text{ min.}$
- Worst case isolation occurs on channel 4 do to proximity to the drain pin.
- $R_{DS(on)}$  flatness is measured as the difference between the minimum and maximum measured values across a defined Analog signal.

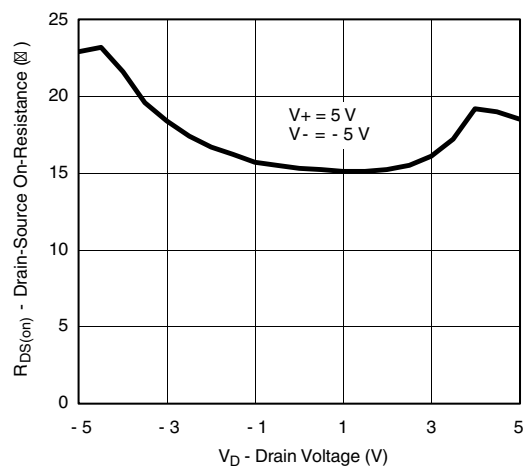
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



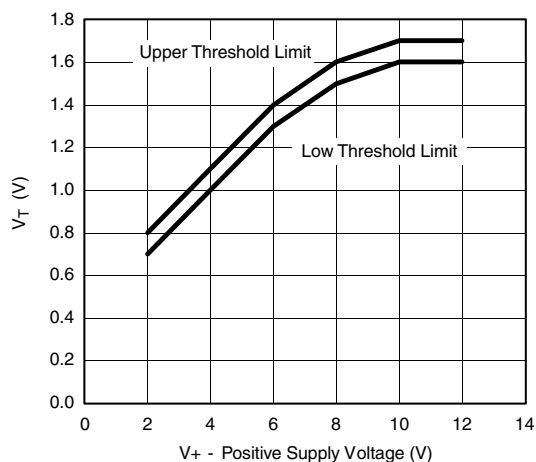
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



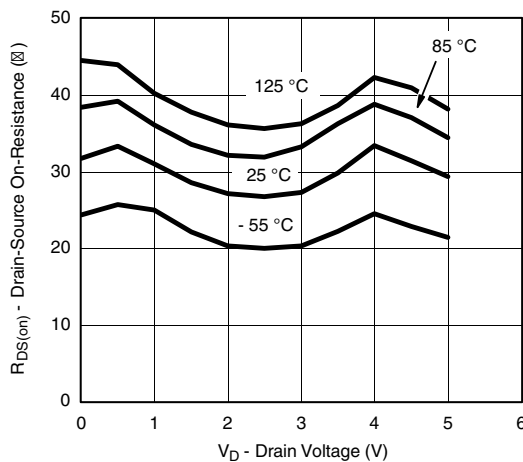
**R<sub>DS(on)</sub> vs. V<sub>D</sub> and Power Supply**



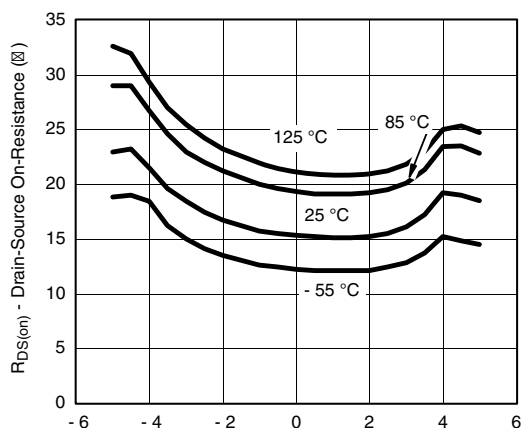
**R<sub>DS(on)</sub> vs. V<sub>D</sub> and Power Supply**



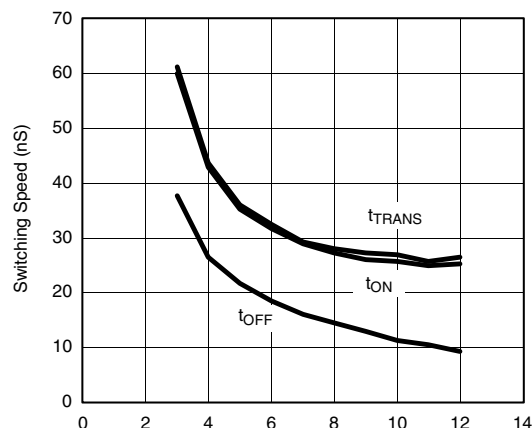
**Input Threshold vs. V<sub>+</sub> Supply Voltage**



**R<sub>DS(on)</sub> vs. V<sub>D</sub> and Temperature**



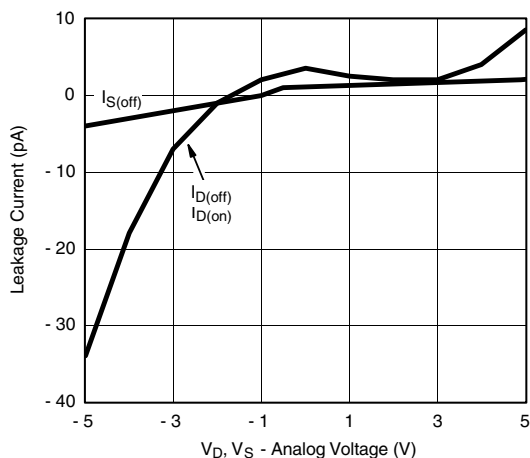
**R<sub>DS(on)</sub> vs. V<sub>D</sub> and Temperature**



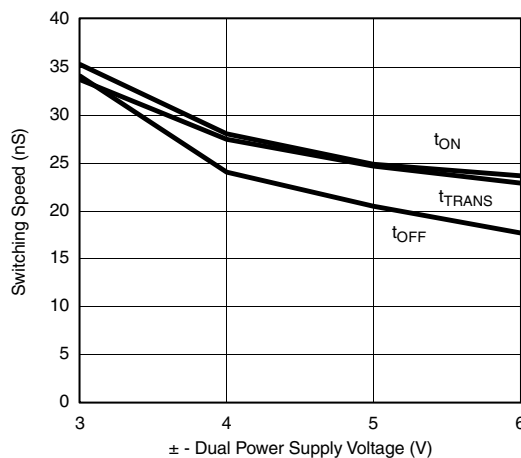
**Switching Time vs. Positive Supply Voltage**



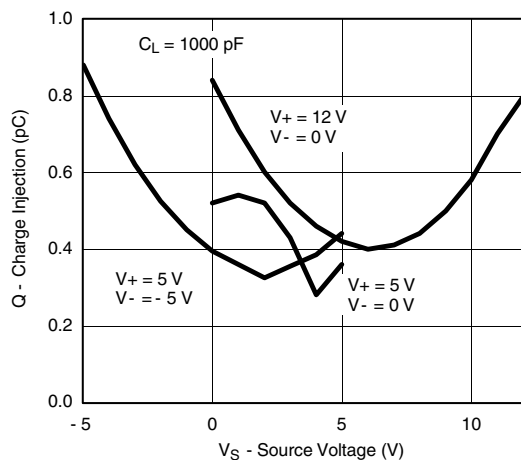
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



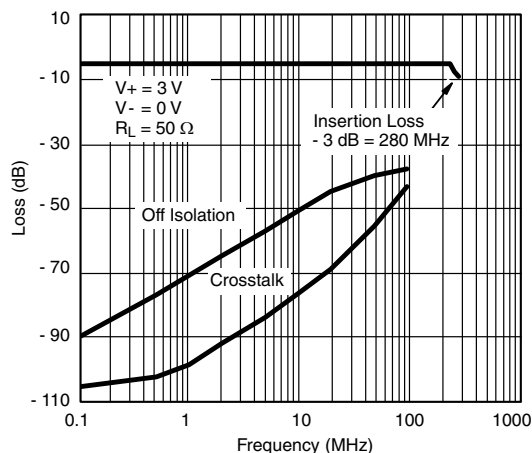
**Leakage Current vs. Analog Voltage**



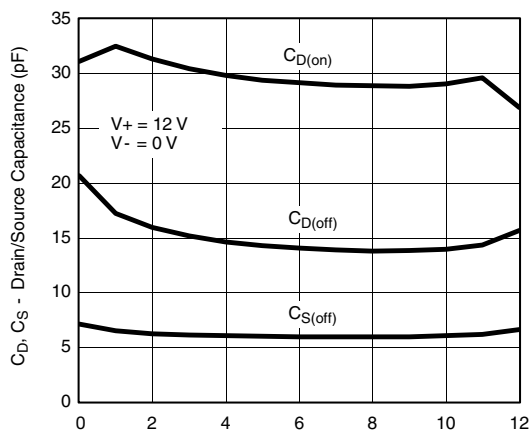
**Switching Time vs. Dual Power Supply Voltage**



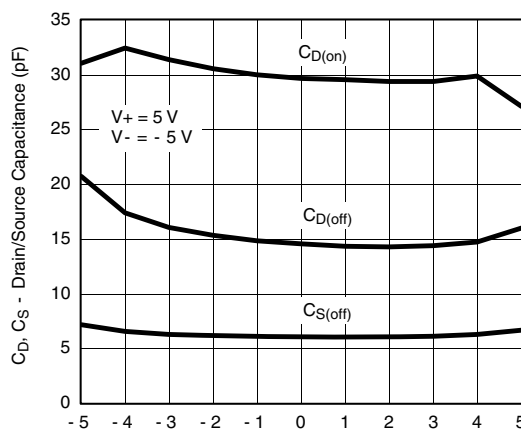
**Charge Injection vs. Analog Voltage**



**Insertion Loss, Off Isolation, and Crosstalk vs. Frequency (Single Supply)**

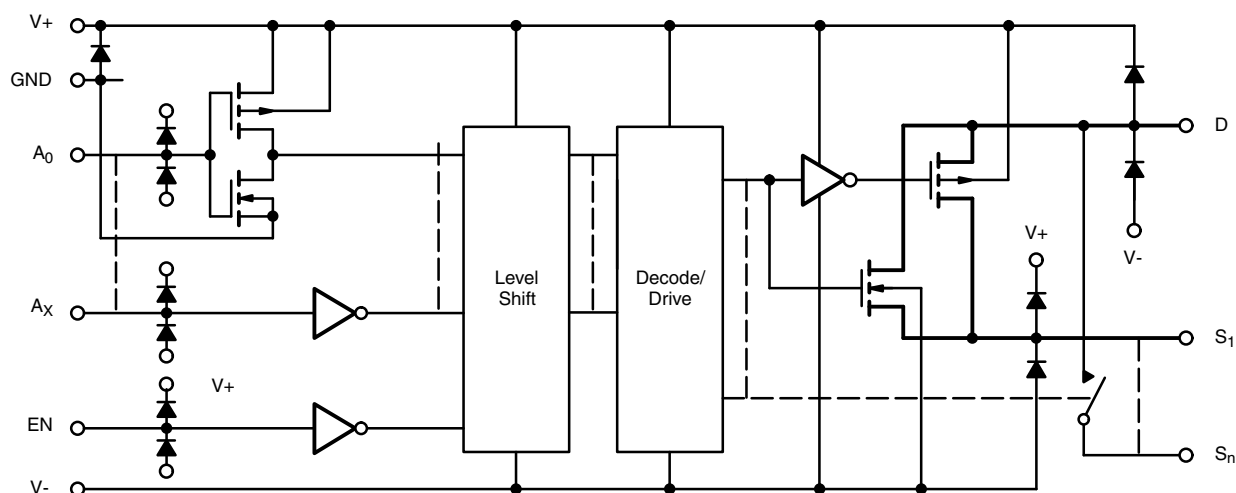
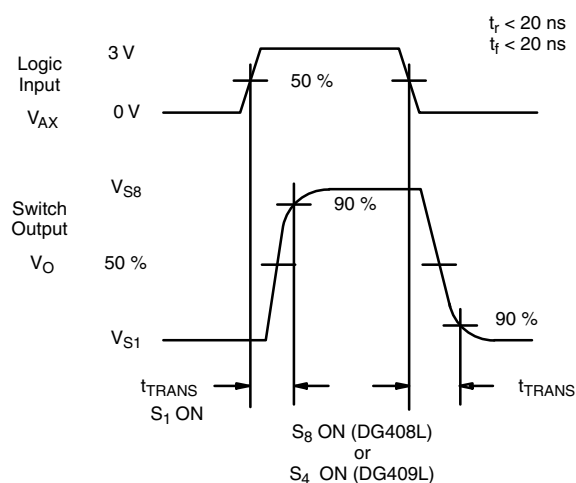
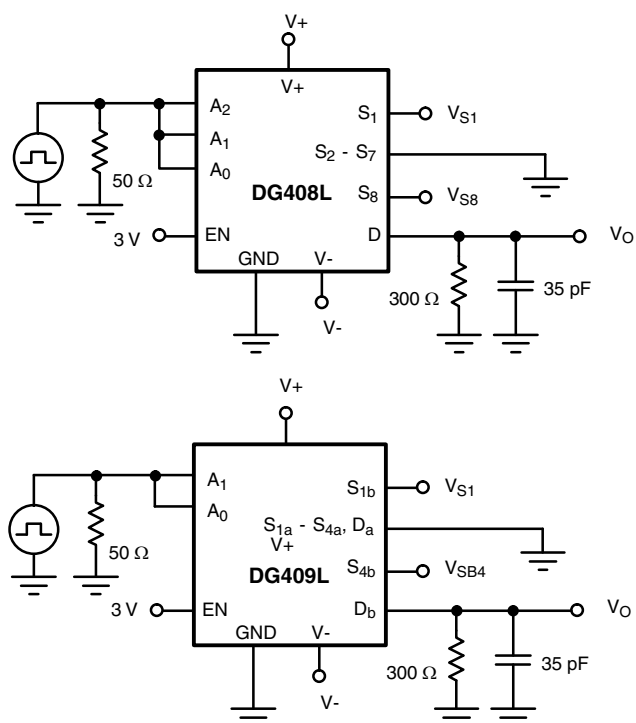


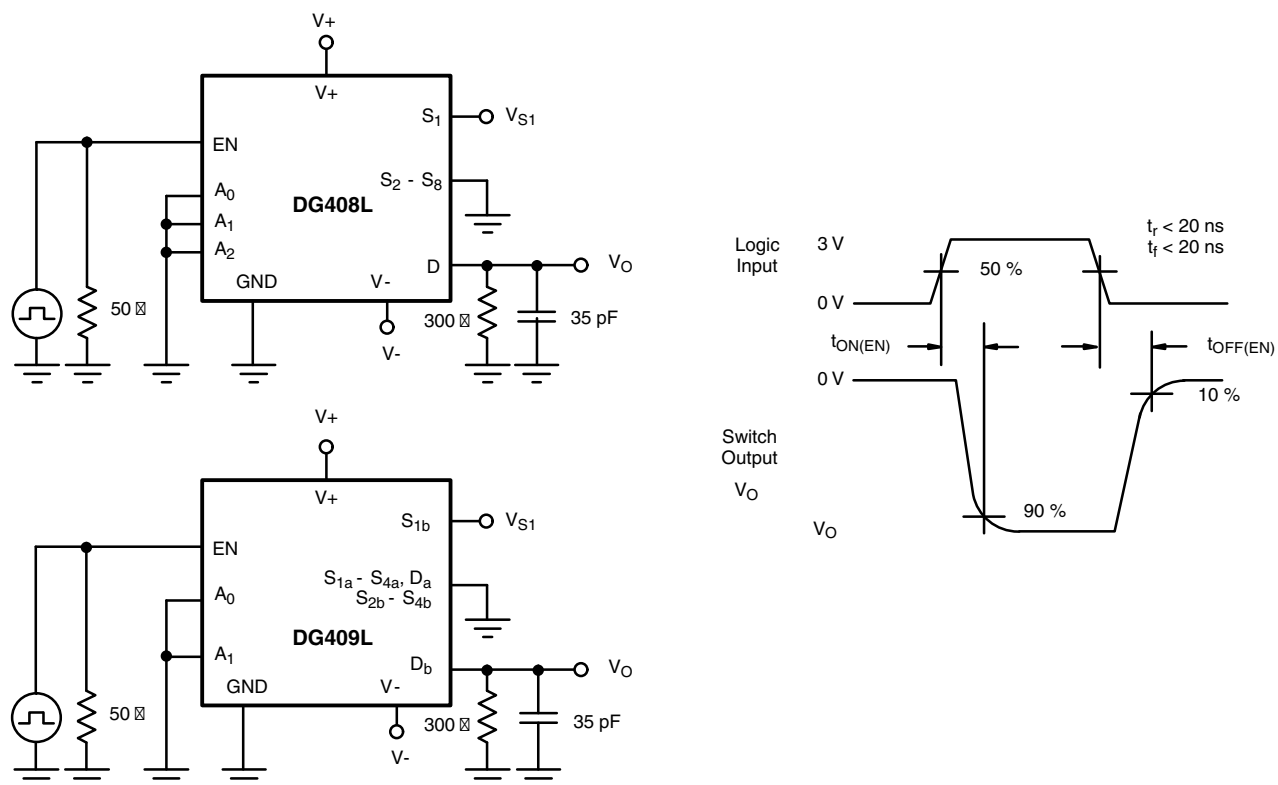
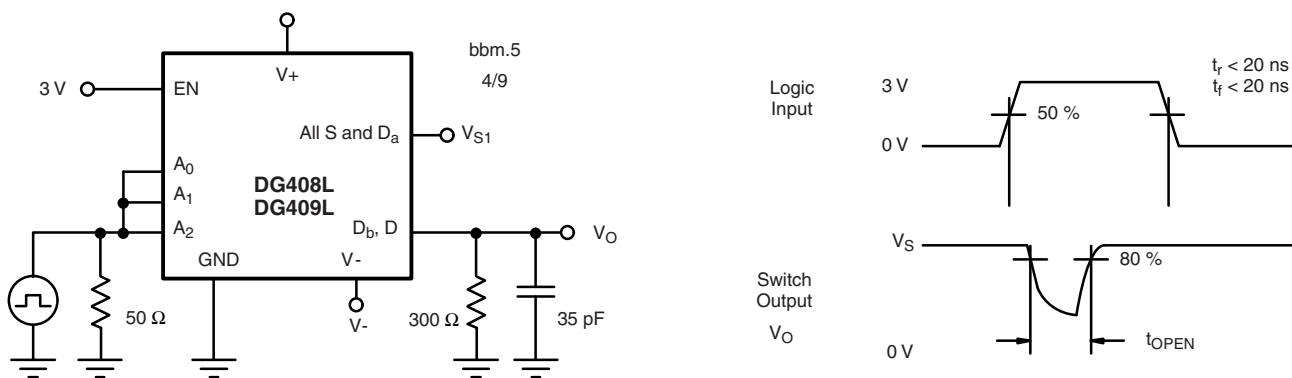
**Drain/Source Capacitance vs. Analog Voltage**

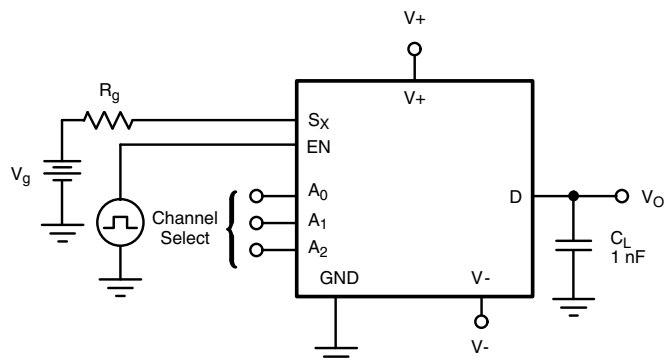
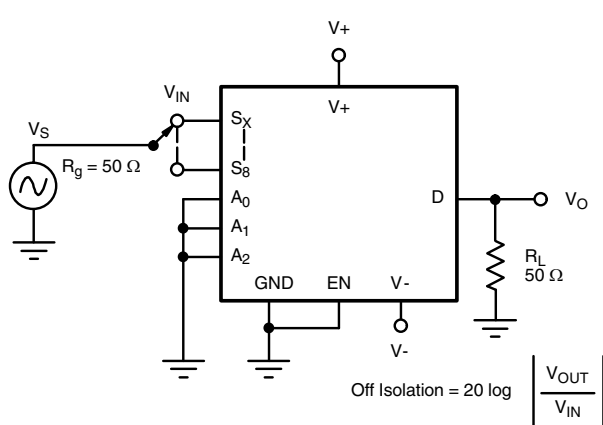
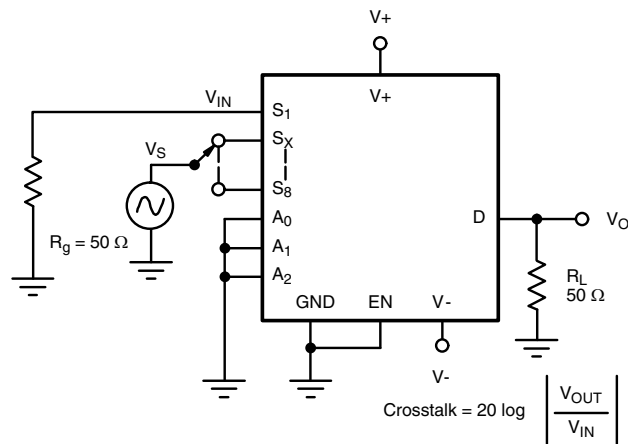
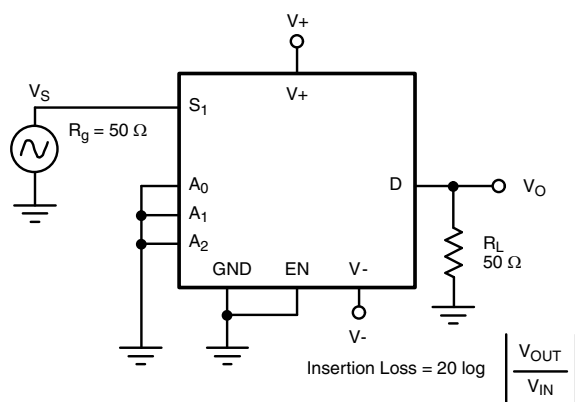
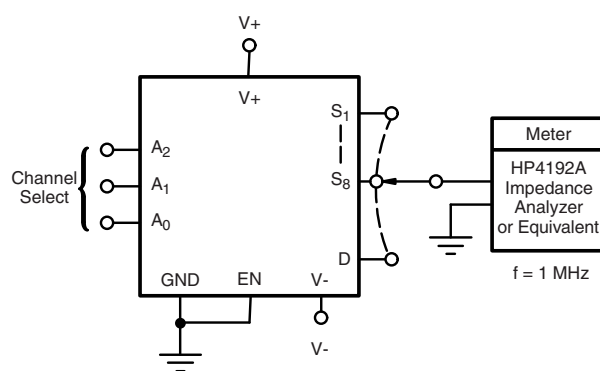


**Charge Injection vs. Analog Voltage**



**SCHEMATIC DIAGRAM** (Typical Channel)

**Fig. 1**
**TEST CIRCUITS**

**Fig. 2 - Transition Time**

**TEST CIRCUITS**

**Fig. 3 - Enable Switching Time**

**Fig. 4 - Break-Before-Make Interval**

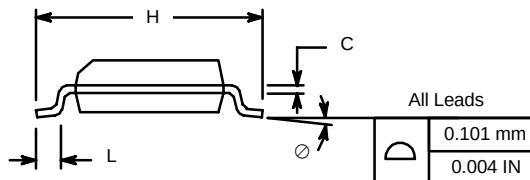
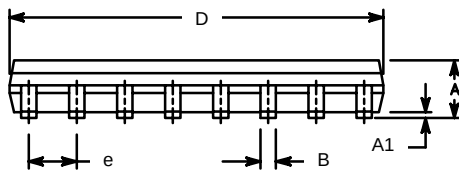
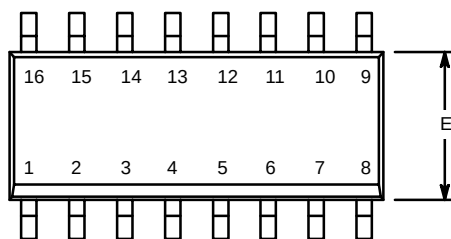
**TEST CIRCUITS**

**Fig. 5 - Charge Injection**

**Fig. 6 - Off Isolation**

**Fig. 7 - Crosstalk**

**Fig. 8 - Insertion Loss**

**Fig. 9 - Source Drain Capacitance**

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### SOIC (NARROW): 16-LEAD

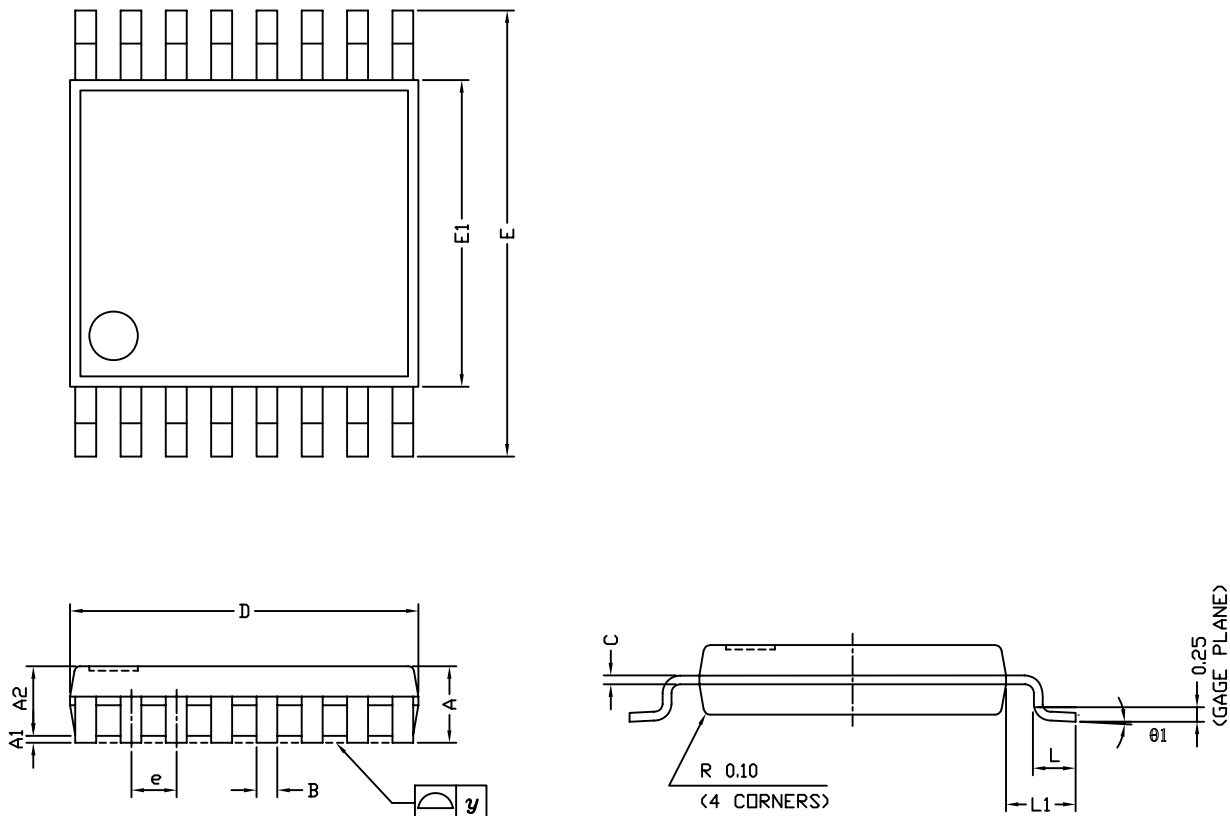
JEDEC Part Number: MS-012



| Dim            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | Min         | Max   | Min       | Max   |
| A              | 1.35        | 1.75  | 0.053     | 0.069 |
| A <sub>1</sub> | 0.10        | 0.20  | 0.004     | 0.008 |
| B              | 0.38        | 0.51  | 0.015     | 0.020 |
| C              | 0.18        | 0.23  | 0.007     | 0.009 |
| D              | 9.80        | 10.00 | 0.385     | 0.393 |
| E              | 3.80        | 4.00  | 0.149     | 0.157 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H              | 5.80        | 6.20  | 0.228     | 0.244 |
| L              | 0.50        | 0.93  | 0.020     | 0.037 |
| Ø              | 0°          | 8°    | 0°        | 8°    |

ECN: S-03946—Rev. F, 09-Jul-01  
DWG: 5300

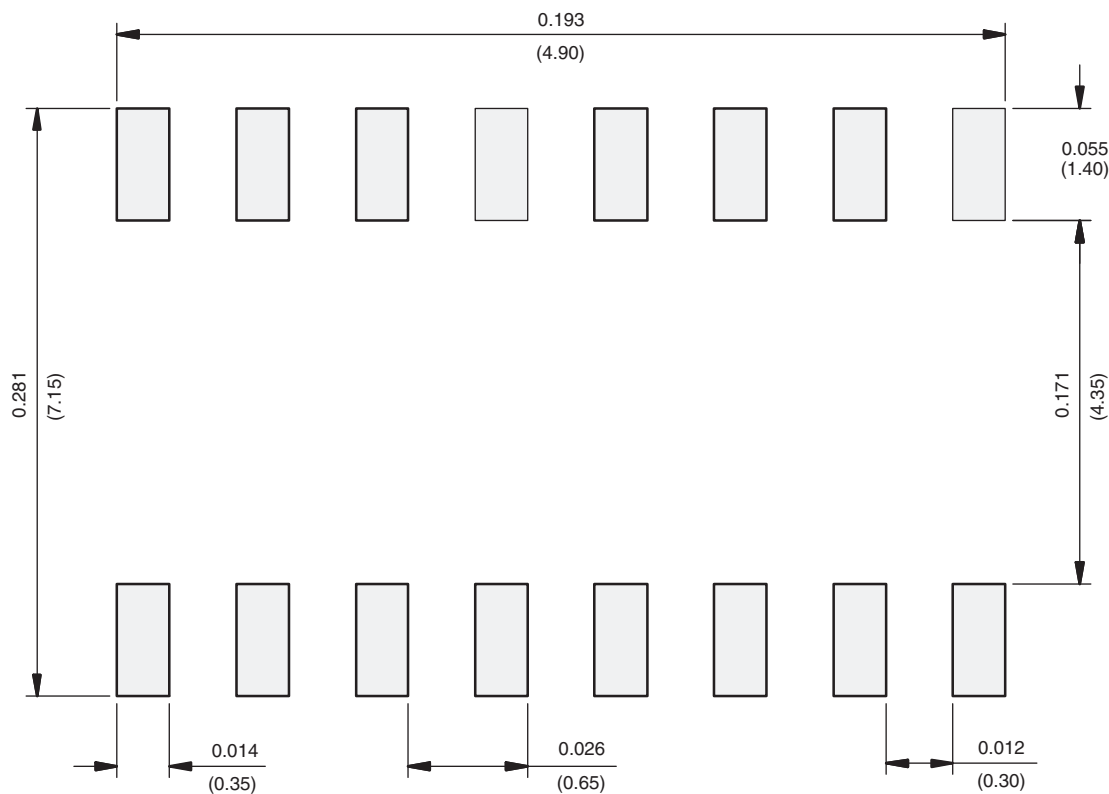
## TSSOP: 16-LEAD



| Symbols                        | DIMENSIONS IN MILLIMETERS |       |      |
|--------------------------------|---------------------------|-------|------|
|                                | Min                       | Nom   | Max  |
| A                              | -                         | 1.10  | 1.20 |
| A1                             | 0.05                      | 0.10  | 0.15 |
| A2                             | -                         | 1.00  | 1.05 |
| B                              | 0.22                      | 0.28  | 0.38 |
| C                              | -                         | 0.127 | -    |
| D                              | 4.90                      | 5.00  | 5.10 |
| E                              | 6.10                      | 6.40  | 6.70 |
| E1                             | 4.30                      | 4.40  | 4.50 |
| e                              | -                         | 0.65  | -    |
| L                              | 0.50                      | 0.60  | 0.70 |
| L1                             | 0.90                      | 1.00  | 1.10 |
| y                              | -                         | -     | 0.10 |
| θ1                             | 0°                        | 3°    | 6°   |
| ECN: S-61920-Rev. D, 23-Oct-06 |                           |       |      |
| DWG: 5624                      |                           |       |      |

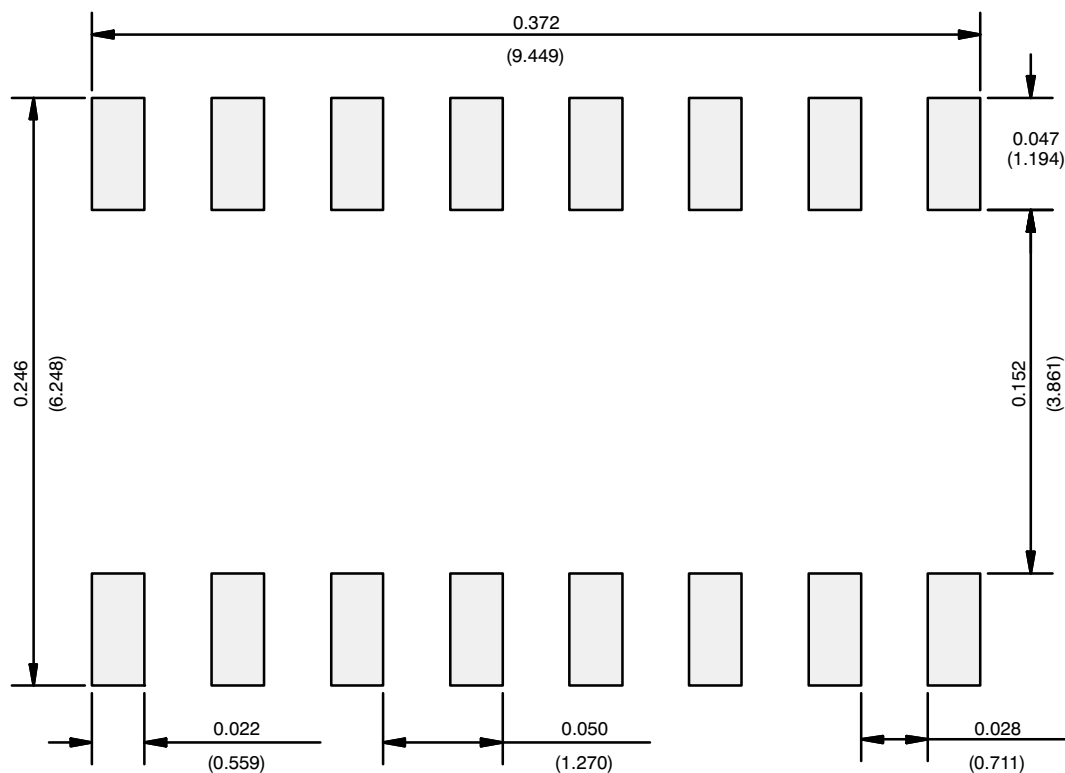


## RECOMMENDED MINIMUM PAD FOR TSSOP-16



Recommended Minimum Pads  
Dimensions in inches (mm)

## RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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