

## 1 pC Charge Injection, 100 pA Leakage, Quad SPST Switches

### DESCRIPTION

The DG611A, DG612A and DG613A contain four independently selectable SPST switches. They offer improved performance over the industry standard DG611 series. The DG611A and DG612A have all switches normally closed and normally open respectively, while the DG613A has 2 normally open and 2 normally closed switches.

They are designed to operate from a 2.7 V to 12 V single supply or from  $\pm 2.7$  V to  $\pm 5$  V dual supplies and are fully specified at +3 V, +5 V and  $\pm 5$  V. All control logic inputs have guaranteed 2 V logic high limits when operating from +5 V or  $\pm 5$  V supplies and 1.4 V when operating from a +3 V supply. The DG611A, DG612A and DG613A switches conduct equally well in both directions and offer rail to rail analog signal handling.

1 pC low charge injection, coupled with very low switch capacitance: 2 pF, fast switching speed:  $t_{on}/t_{off}$  27 ns/16 ns and excellent 3 dB bandwidth: 720 MHz, make these products ideal for precision instrumentation, high-end data acquisition, automated test equipment and high speed communication applications.

Operation temperature is specified from -40 °C to +125 °C.

The DG611A, DG612A and DG613A are available in 16 lead SOIC, TSSOP and the space saving 1.8 mm x 2.6 mm miniQFN packages.

### FEATURES

- Halogen-free according to IEC 61249-2-21 Definition
- Low charge injection (1 pC typ.)
- Leakage current < 0.25 nA at 85 °C
- Low switch capacitance ( $C_{soff}$  2 pF typ.)
- Low  $R_{DS(on)}$  - 115  $\Omega$  max.
- Fully specified with single supply operation at 3 V, 5 V and dual supplies at  $\pm 5$  V
- Low voltage, 2.5 V CMOS/TTL compatible
- 720 MHz, 3 dB bandwidth
- Excellent isolation performance (62 dB at 10 MHz)
- Excellent crosstalk performance (90 dB at 10 MHz)
- Fully specified from -40 °C to +85 °C and -40 °C to +125 °C
- 16 lead SOIC, TSSOP and miniQFN package (1.8 mm x 2.6 mm)
- Compliant to RoHS Directive 2002/95/EC

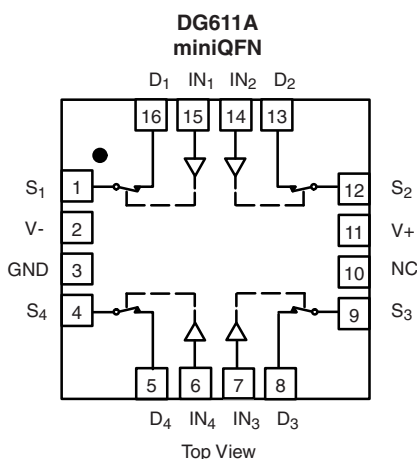
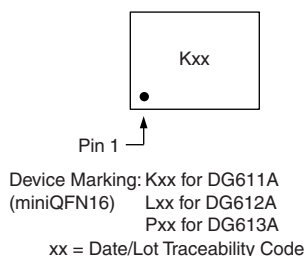
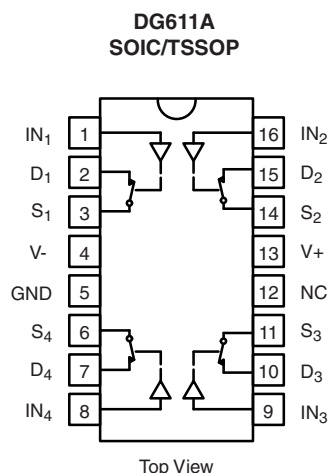


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Precision instrumentation
- Medical instrumentation
- Automated test equipment
- High speed communications applications
- High-end data acquisition
- Sample and hold applications
- Sample and hold systems

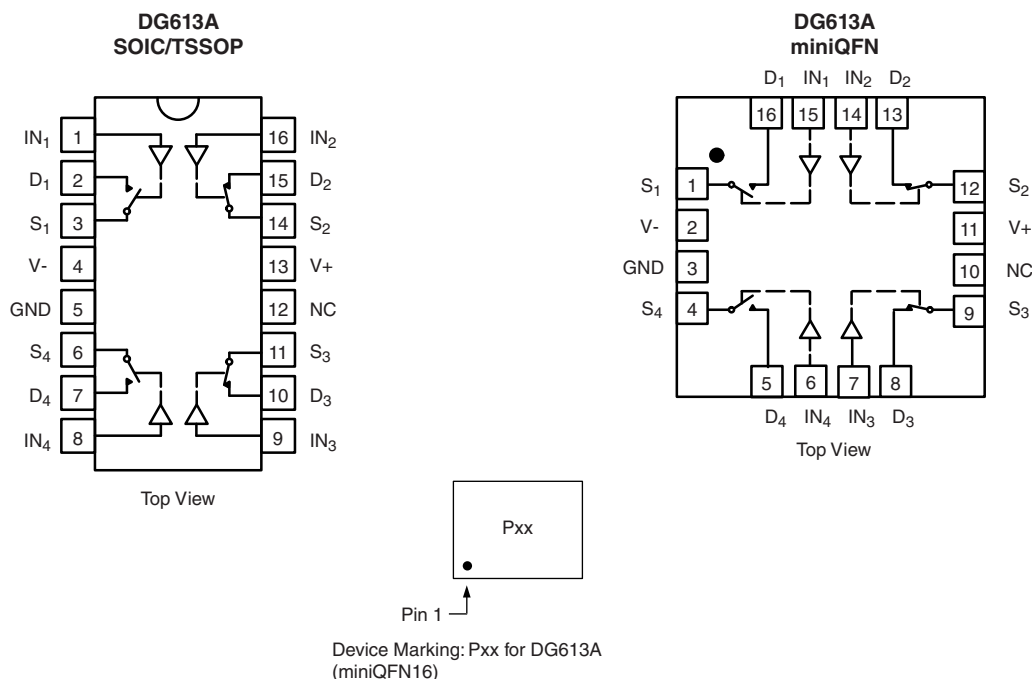
### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



### TRUTH TABLE

| Logic | DG611A | DG612A |
|-------|--------|--------|
| 0     | On     | Off    |
| 1     | Off    | On     |

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



### TRUTH TABLE

| Logic | SW <sub>1</sub> , SW <sub>4</sub> | SW <sub>2</sub> , SW <sub>3</sub> |
|-------|-----------------------------------|-----------------------------------|
| 0     | Off                               | On                                |
| 1     | On                                | Off                               |

### ORDERING INFORMATION

| Temp. Range                    | Package            | Part Number                                        |
|--------------------------------|--------------------|----------------------------------------------------|
| <b>DG611A, DG612A, DG613A</b>  |                    |                                                    |
| - 40 °C to 125 °C <sup>a</sup> | 16-pin TSSOP       | DG611AEQ-T1-E3<br>DG612AEQ-T1-E3<br>DG613AEQ-T1-E3 |
|                                | 16-pin Narrow SOIC | DG611AEY-T1-E3<br>DG612AEY-T1-E3<br>DG613AEY-T1-E3 |
|                                | 16-pin miniQFN     | DG611AEN-T1-E4<br>DG612AEN-T1-E4<br>DG613AEN-T1-E4 |

Notes:

a. - 40 °C to 85 °C datasheet limits apply.



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted) |                                 |                                                                    |                             |
|------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------|-----------------------------|
| Parameter                                                                                      |                                 | Limit                                                              | Unit                        |
| V + to V -                                                                                     |                                 | 14                                                                 | V                           |
| GND to V -                                                                                     |                                 | 7                                                                  |                             |
| Digital Inputs <sup>a</sup> , $V_S$ , $V_D$                                                    |                                 | (V -) - 0.3 V to (V +) + 0.3 V<br>or 30 mA, whichever occurs first |                             |
| Continuous Current (Any Terminal)                                                              |                                 | 30                                                                 | mA                          |
| Peak Current, S or D (Pulsed 1 ms, 10 % Duty Cycle)                                            |                                 | 100                                                                |                             |
| Storage Temperature                                                                            |                                 | - 65 to 150                                                        | $^{\circ}\text{C}$          |
| Power Dissipation (Package) <sup>b</sup>                                                       | 16-pin TSSOP <sup>c</sup>       | 450                                                                | mW                          |
|                                                                                                | 16-pin miniQFN <sup>d</sup>     | 525                                                                |                             |
|                                                                                                | 16-pin Narrow SOIC <sup>e</sup> | 640                                                                |                             |
| Thermal Resistance (Package) <sup>b</sup>                                                      | 16-pin TSSOP                    | 178                                                                | $^{\circ}\text{C}/\text{W}$ |
|                                                                                                | 16-pin miniQFN                  | 152                                                                |                             |
|                                                                                                | 16-pin Narrow SOIC              | 125                                                                |                             |

## Notes:

- Signals on SX, DX, or INX exceeding V + or V - will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads welded or soldered to PC Board.
- Derate 5.6 mW/ $^{\circ}\text{C}$  above 70  $^{\circ}\text{C}$ .
- Derate 6.6 mW/ $^{\circ}\text{C}$  above 70  $^{\circ}\text{C}$ .
- Derate 8 mW/ $^{\circ}\text{C}$  above 70  $^{\circ}\text{C}$ .
- Manual soldering with iron is not recommended for leadless components. The miniQFN-16 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

| SPECIFICATIONS FOR DUAL SUPPLIES (V + = + 5 V, V - = - 5 V) |                       |                                                                                                                        |                    |                   |                   |                   |                   |                   |      |
|-------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
| Parameter                                                   | Symbol                | Test Conditions<br>Unless Otherwise Specified<br>V + = + 5 V, V - = - 5 V<br>V <sub>IN</sub> = 2 V, 0.8 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|                                                             |                       |                                                                                                                        |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Analog Switch                                               |                       |                                                                                                                        |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup>                            | V <sub>ANALOG</sub>   |                                                                                                                        | Full               |                   | - 5               | 5                 | - 5               | 5                 | V    |
| On-Resistance                                               | R <sub>ON</sub>       | I <sub>S</sub> = 1 mA, V <sub>D</sub> = - 3 V, 0 V, + 3 V                                                              | Room Full          | 72                |                   | 115<br>160        |                   | 115<br>140        | Ω    |
| On-Resistance Match                                         | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V                                                                          | Room Full          | 0.7               |                   | 4<br>6.5          |                   | 4<br>5.5          |      |
| On-Resistance Flatness                                      | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = - 3 V, 0 V, + 3 V                                                              | Room Full          | 25                |                   | 40<br>60          |                   | 40<br>55          |      |
| Switch Off Leakage Current                                  | I <sub>S(off)</sub>   | V + = 5.5 V, V - = - 5.5 V<br>V <sub>D</sub> = + 4.5 V/- 4.5 V<br>V <sub>S</sub> = - 4.5 V/+ 4.5 V                     | Room Full          | ± 0.02            | - 0.1<br>- 2      | 0.1<br>2          | - 0.1<br>- 0.25   | 0.1<br>0.25       | nA   |
|                                                             | I <sub>D(off)</sub>   |                                                                                                                        | Room Full          | ± 0.02            | - 0.1<br>- 2      | 0.1<br>2          | - 0.1<br>- 0.25   | 0.1<br>0.25       |      |
| Switch On Leakage Current                                   | I <sub>D(on)</sub>    | V + = 5.5 V, V - = - 5.5 V<br>V <sub>D</sub> = V <sub>S</sub> = ± 4.5 V                                                | Room Full          | ± 0.02            | - 0.1<br>- 6      | 0.1<br>6          | - 0.1<br>- 0.25   | 0.1<br>0.25       |      |
| Digital Control                                             |                       |                                                                                                                        |                    |                   |                   |                   |                   |                   |      |
| Input Current, V <sub>IN</sub> Low                          | I <sub>IL</sub>       | V <sub>IN</sub> Under Test = 0.8 V                                                                                     | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               | μA   |
| Input Current, V <sub>IN</sub> High                         | I <sub>IH</sub>       | V <sub>IN</sub> Under Test = 2 V                                                                                       | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               |      |
| Input Capacitance <sup>e</sup>                              | C <sub>IN</sub>       | f = 1 MHz                                                                                                              | Room               | 2                 |                   |                   |                   |                   | pF   |
| Dynamic Characteristics                                     |                       |                                                                                                                        |                    |                   |                   |                   |                   |                   |      |
| Turn-On Time                                                | t <sub>ON</sub>       | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>V <sub>S</sub> = ± 3 V, see figure 1                                 | Room Full          | 27                |                   | 55<br>90          |                   | 55<br>75          | ns   |
| Turn-Off Time                                               | t <sub>OFF</sub>      |                                                                                                                        | Room Full          | 16                |                   | 35<br>50          |                   | 35<br>45          |      |
| Break-Before-Make Time Delay                                | t <sub>BBM</sub>      | DG613A only, V <sub>S</sub> = 3 V<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF                                    | Room Full          | 15                | 2                 |                   | 2                 |                   |      |
| Charge Injection <sup>e</sup>                               | Q                     | V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF                                                      | Room               | 1                 |                   |                   |                   |                   | pC   |
| Off Isolation <sup>e</sup>                                  | OIRR                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF<br>f = 10 MHz                                                             | Room               | - 62              |                   |                   |                   |                   | dB   |
| Channel-to-Channel Crosstalk <sup>e</sup>                   | X <sub>TALK</sub>     |                                                                                                                        | Room               | - 90              |                   |                   |                   |                   |      |
| 3 dB Bandwidth <sup>e</sup>                                 | BW                    | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF                                                                           | Room               | 720               |                   |                   |                   |                   | MHz  |
| Source Off Capacitance <sup>e</sup>                         | C <sub>S(off)</sub>   | f = 1 MHz; V <sub>S</sub> = 0 V                                                                                        | Room               | 2                 |                   |                   |                   |                   | pF   |
| Drain Off Capacitance <sup>e</sup>                          | C <sub>D(off)</sub>   |                                                                                                                        | Room               | 3                 |                   |                   |                   |                   |      |
| Drain On Capacitance <sup>e</sup>                           | C <sub>D(on)</sub>    | f = 1 MHz; V <sub>S</sub> = V <sub>D</sub> = 0 V                                                                       | Room               | 9                 |                   |                   |                   |                   |      |
| Total Harmonic Distortion <sup>e</sup>                      | THD                   | Signal = 1 V <sub>RMS</sub> , 20 Hz to 20 kHz,<br>R <sub>L</sub> = 600 Ω                                               | Room               | 0.01              |                   |                   |                   |                   | %    |
| Power Supplies                                              |                       |                                                                                                                        |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current                                        | I+                    | V + = + 5 V, V - = - 5 V<br>V <sub>IN</sub> = 0 V or 5 V                                                               | Room Full          | 0.001             |                   | 0.1<br>1          |                   | 0.1<br>1          | μA   |
| Negative Supply Current                                     | I-                    |                                                                                                                        | Room Full          | - 0.001           | - 0.1<br>- 1      |                   | - 0.1<br>- 1      |                   |      |
| Ground Current                                              | I <sub>GND</sub>      |                                                                                                                        | Room Full          | - 0.001           | - 0.1<br>- 1      |                   | - 0.1<br>- 1      |                   |      |

**SPECIFICATIONS FOR UNIPOLAR SUPPLIES ( $V_+ = +5\text{ V}$ ,  $V_- = 0\text{ V}$ )**

| Parameter                                    | Symbol                | Test Conditions<br>Unless Otherwise Specified<br>V + = + 5 V, V - = 0 V<br>V <sub>IN</sub> = 2 V, 0.8 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|----------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                                              |                       |                                                                                                                      |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Analog Switch                                |                       |                                                                                                                      |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup>             | V <sub>ANALOG</sub>   |                                                                                                                      | Full               |                   | 0                 | 5                 | 0                 | 5                 | V    |
| On-Resistance                                | R <sub>ON</sub>       | V + = + 5 V, V - = 0 V<br>I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 3.5 V                                            | Room<br>Full       | 139               |                   | 180<br>235        |                   | 180<br>215        | Ω    |
| On-Resistance Match                          | ΔR <sub>ON</sub>      | V + = + 5 V, V - = 0 V,<br>I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 3.5 V                                           | Room<br>Full       | 1                 |                   | 6<br>10           |                   | 6<br>9            |      |
| On-Resistance Flatness                       | R <sub>FLATNESS</sub> | V + = + 5 V, V - = 0 V,<br>I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, + 3.5 V                                      | Room<br>Full       | 56                |                   | 80<br>120         |                   | 80<br>110         |      |
| Switch Off<br>Leakage Current                | I <sub>S(off)</sub>   | V + = 5.5 V, V - = 0 V<br>V <sub>D</sub> = 4.5 V/1 V<br>V <sub>S</sub> = 1 V/4.5 V                                   | Room<br>Full       | ± 0.02            | - 0.1<br>- 2      | 0.1<br>2          | - 0.1<br>- 0.25   | 0.1<br>0.25       | nA   |
|                                              | I <sub>D(off)</sub>   |                                                                                                                      | Room<br>Full       | ± 0.02            | - 0.1<br>- 2      | 0.1<br>2          | - 0.1<br>- 0.25   | 0.1<br>0.25       |      |
| Switch On<br>Leakage Current                 | I <sub>D(on)</sub>    | V + = 5.5 V, V - = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 1 V/4.5 V                                                | Room<br>Full       | ± 0.02            | - 0.1<br>- 6      | 0.1<br>6          | - 0.1<br>- 0.25   | 0.1<br>0.25       |      |
| Digital Control                              |                       |                                                                                                                      |                    |                   |                   |                   |                   |                   |      |
| Input Current, V <sub>IN</sub> Low           | I <sub>IL</sub>       | V <sub>IN</sub> Under Test = 0.8 V                                                                                   | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               | μA   |
| Input Current, V <sub>IN</sub> High          | I <sub>IH</sub>       | V <sub>IN</sub> Under Test = 2 V                                                                                     | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               |      |
| Input Capacitance <sup>e</sup>               | C <sub>IN</sub>       | f = 1 MHz                                                                                                            | Room               | 2                 |                   |                   |                   |                   | pF   |
| Dynamic Characteristics                      |                       |                                                                                                                      |                    |                   |                   |                   |                   |                   |      |
| Turn-On Time <sup>e</sup>                    | t <sub>ON</sub>       | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>V <sub>S</sub> = 3 V, see figure 1                                 | Room<br>Full       | 33                |                   | 60<br>100         |                   | 60<br>90          | ns   |
| Turn-Off Time <sup>e</sup>                   | t <sub>OFF</sub>      |                                                                                                                      | Room<br>Full       | 16                |                   | 35<br>50          |                   | 35<br>45          |      |
| Break-Before-Make <sup>e</sup><br>Time Delay | t <sub>BBM</sub>      | DG613A only, V <sub>S</sub> = 3 V<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF                                  | Room<br>Full       | 19                | 2                 |                   | 2                 |                   |      |
| Charge Injection <sup>e</sup>                | Q                     | V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF                                                    | Full               | 2.3               |                   |                   |                   |                   | pC   |
| Off Isolation <sup>e</sup>                   | OIRR                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF<br>f = 10 MHz                                                           | Room               | - 61              |                   |                   |                   |                   | dB   |
| Channel-to-Channel<br>Crosstalk <sup>e</sup> | X <sub>TALK</sub>     |                                                                                                                      | Room               | - 90              |                   |                   |                   |                   |      |
| 3 dB Bandwidth <sup>e</sup>                  | BW                    | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF                                                                         | Room               | 675               |                   |                   |                   |                   | MHz  |
| Source Off Capacitance <sup>e</sup>          | C <sub>S(off)</sub>   | f = 1 MHz; V <sub>S</sub> = 0 V                                                                                      | Room               | 3                 |                   |                   |                   |                   | pF   |
| Drain Off Capacitance <sup>e</sup>           | C <sub>D(off)</sub>   |                                                                                                                      | Room               | 5                 |                   |                   |                   |                   |      |
| Drain On Capacitance <sup>e</sup>            | C <sub>D(on)</sub>    | f = 1 MHz; V <sub>S</sub> = V <sub>D</sub> = 0 V                                                                     | Room               | 9                 |                   |                   |                   |                   |      |
| Power Supplies                               |                       |                                                                                                                      |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current                         | I+                    | V <sub>IN</sub> = 0 V or 5 V                                                                                         | Room<br>Full       | 0.001             |                   | 0.1<br>1          |                   | 0.1<br>1          | μA   |
| Negative Supply Current                      | I-                    |                                                                                                                      | Room<br>Full       | - 0.001           | - 0.1<br>- 1      |                   | - 0.1<br>- 1      |                   |      |
| Ground Current                               | I <sub>GND</sub>      |                                                                                                                      | Room<br>Full       | - 0.001           | - 0.1<br>- 1      |                   | - 0.1<br>- 1      |                   |      |

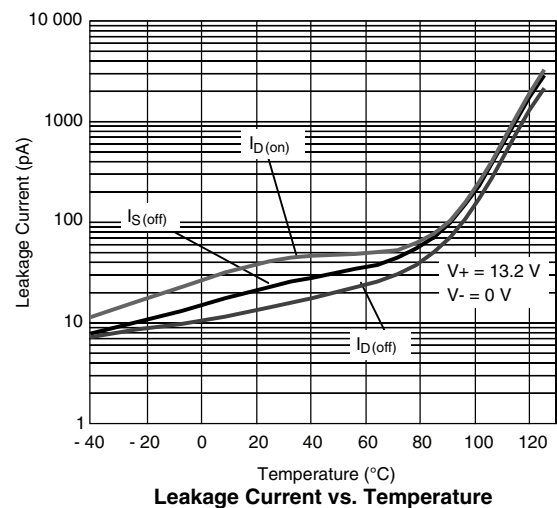
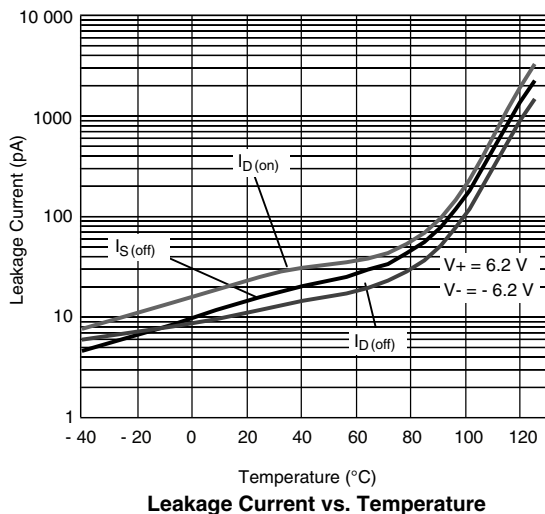
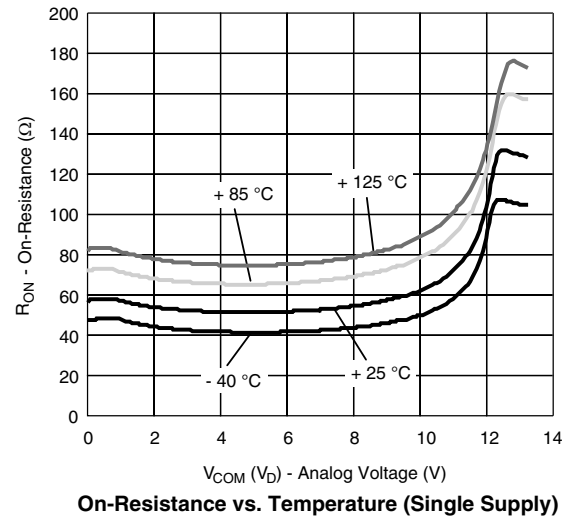
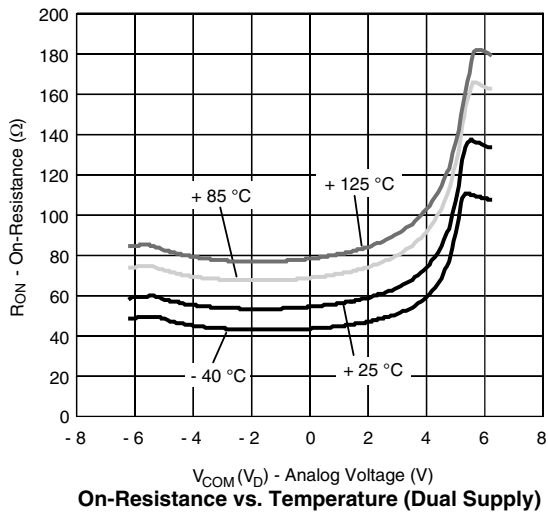
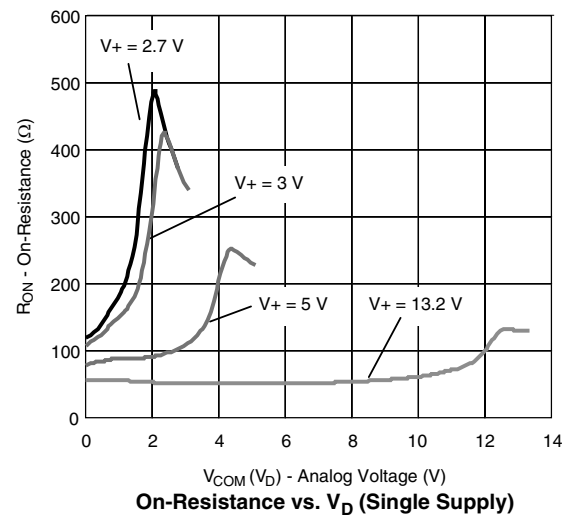
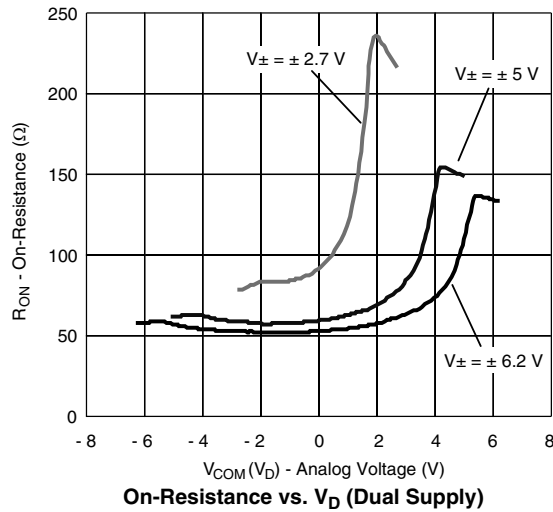
| SPECIFICATIONS FOR UNIPOLAR SUPPLIES (V + = + 3 V, V - = 0 V) |                     |                                                                                                          |                    |                   |                   |                   |                   |                   |      |
|---------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
| Parameter                                                     | Symbol              | Test Conditions<br>Unless Otherwise Specified<br>V+ = + 3 V, V- = 0 V<br>VIN = 1.4 V, 0.6 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|                                                               |                     |                                                                                                          |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Analog Switch                                                 |                     |                                                                                                          |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup>                              | V <sub>ANALOG</sub> |                                                                                                          | Full               |                   | 0                 | 3                 | 0                 | 3                 | V    |
| On-Resistance                                                 | R <sub>ON</sub>     | I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 1.5 V                                                          | Room Full          | 195               |                   | 235<br>300        |                   | 235<br>280        | Ω    |
| Switch Off Leakage Current                                    | I <sub>S(off)</sub> | V + = 3.3 V, V- = 0 V<br>V <sub>D</sub> = 3 V/0.3 V<br>V <sub>S</sub> = 0.3 V/3 V                        | Room Full          | ± 0.02            | - 0.1<br>- 2      | 0.1<br>2          | - 0.1<br>- 0.25   | 0.1<br>0.25       | nA   |
|                                                               | I <sub>D(off)</sub> |                                                                                                          | Room Full          | ± 0.02            | - 0.1<br>- 2      | 0.1<br>2          | - 0.1<br>- 0.25   | 0.1<br>0.25       |      |
| Switch On Leakage Current                                     | I <sub>D(on)</sub>  | V + = 3.3 V, V- = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 0.3 V/3 V                                     | Room Full          | ± 0.02            | - 0.1<br>- 6      | 0.1<br>6          | - 0.1<br>- 0.25   | 0.1<br>0.25       |      |
| Digital Control                                               |                     |                                                                                                          |                    |                   |                   |                   |                   |                   |      |
| Input Current, V <sub>IN</sub> Low                            | I <sub>IL</sub>     | V <sub>IN</sub> Under Test = 0.6 V                                                                       | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               | μA   |
| Input Current, V <sub>IN</sub> High                           | I <sub>IH</sub>     | V <sub>IN</sub> Under Test = 1.4 V                                                                       | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               |      |
| Input Capacitance <sup>e</sup>                                | C <sub>IN</sub>     | f = 1 MHz                                                                                                | Room               | 2                 |                   |                   |                   |                   | pF   |
| Dynamic Characteristics                                       |                     |                                                                                                          |                    |                   |                   |                   |                   |                   |      |
| Turn-On Time                                                  | t <sub>ON</sub>     | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>V <sub>S</sub> = 2 V, see figure 1                     | Room Full          | 87                |                   | 125<br>180        |                   | 125<br>170        | ns   |
| Turn-Off Time                                                 | t <sub>OFF</sub>    |                                                                                                          | Room Full          | 33                |                   | 55<br>65          |                   | 55<br>60          |      |
| Break-Before-Make Time Delay                                  | t <sub>BBM</sub>    | DG613 only, V <sub>S</sub> = 2 V<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF                       | Room Full          | 60                | 10                |                   | 10                |                   |      |
| Charge Injection <sup>e</sup>                                 | Q                   | V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF                                        | Room               | 2.3               |                   |                   |                   |                   | pC   |
| Off Isolation <sup>e</sup>                                    | OIRR                | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF<br>f = 10 MHz                                               | Room               | - 60              |                   |                   |                   |                   | dB   |
| Channel-to-Channel Crosstalk <sup>e</sup>                     | X <sub>TALK</sub>   |                                                                                                          | Room               | - 90              |                   |                   |                   |                   |      |
| 3 dB Bandwidth <sup>e</sup>                                   | BW                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF                                                             | Room               | 550               |                   |                   |                   |                   | MHz  |
| Source Off Capacitance <sup>e</sup>                           | C <sub>S(off)</sub> | f = 1 MHz; V <sub>S</sub> = 0 V                                                                          | Room               | 5                 |                   |                   |                   |                   | pF   |
| Drain Off Capacitance <sup>e</sup>                            | C <sub>D(off)</sub> |                                                                                                          | Room               | 6                 |                   |                   |                   |                   |      |
| Drain On Capacitance <sup>e</sup>                             | C <sub>D(on)</sub>  | f = 1 MHz; V <sub>S</sub> = V <sub>D</sub> = 0 V                                                         | Room               | 9                 |                   |                   |                   |                   |      |
| Power Supplies                                                |                     |                                                                                                          |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current                                          | I+                  | V <sub>IN</sub> = 0 V or 3 V                                                                             | Room Full          | 0.001             |                   | 0.1<br>1          |                   | 0.1<br>1          | μA   |
| Negative Supply Current                                       | I-                  |                                                                                                          | Room Full          | - 0.001           | - 0.1<br>- 1      |                   | - 0.1<br>- 1      |                   |      |
| Ground Current                                                | I <sub>GND</sub>    |                                                                                                          | Room Full          | - 0.001           | - 0.1<br>- 1      |                   | - 0.1<br>- 1      |                   |      |

### Notes:

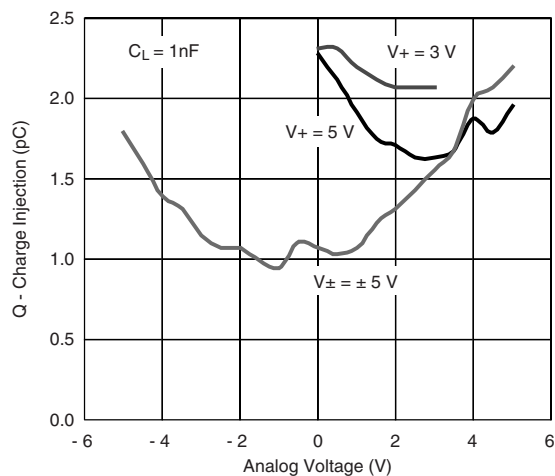
- V<sub>IN</sub> = input voltage to perform proper function.
- Room = 25 °C, Full = as determined by the operating temperature suffix.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guaranteed by design, not subject to production test.

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.

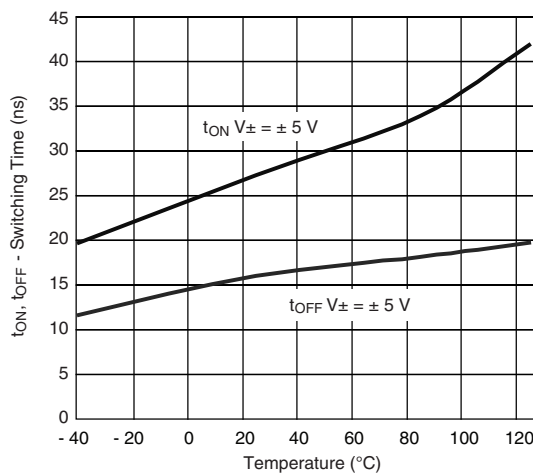
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



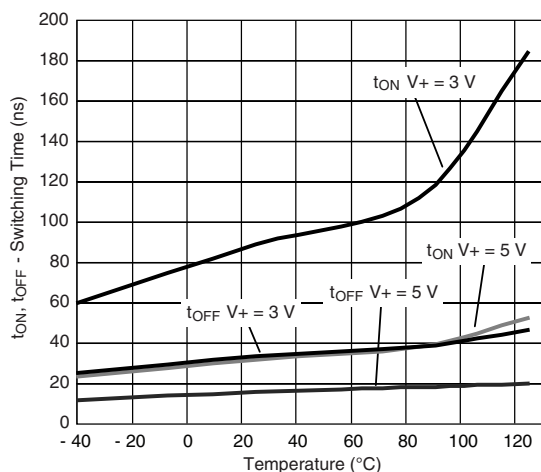
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



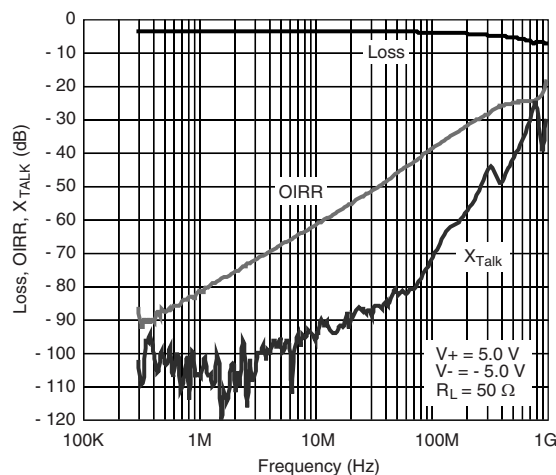
Charge Injection vs. Analog Voltage



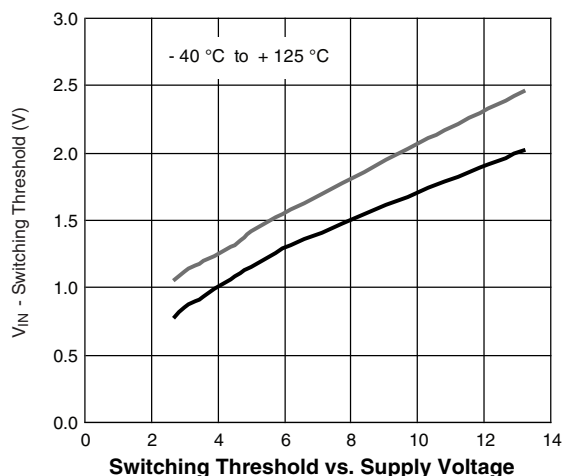
Switching Time vs. Temperature (Dual Supply)



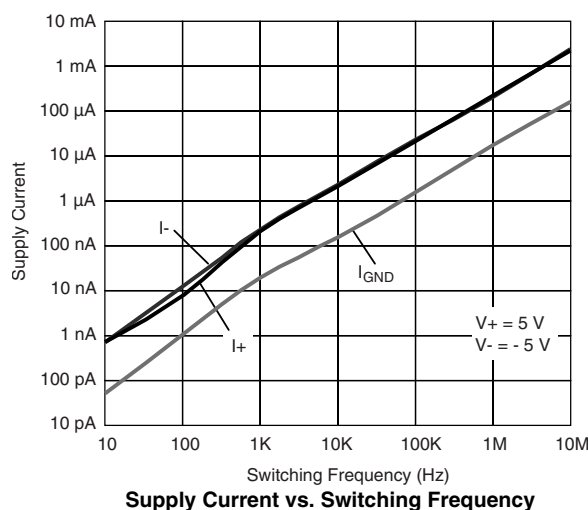
Switching Time vs. Temperature (Single Supply)



Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



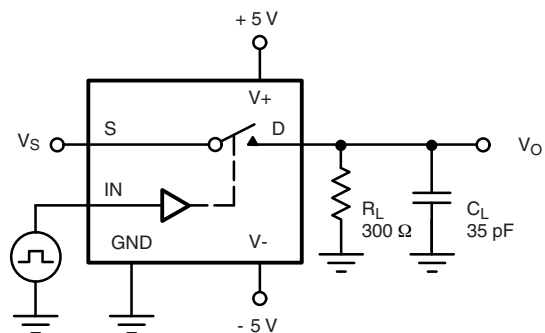
Switching Threshold vs. Supply Voltage



Supply Current vs. Switching Frequency

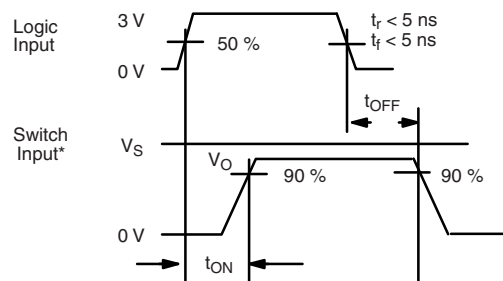


## TEST CIRCUITS



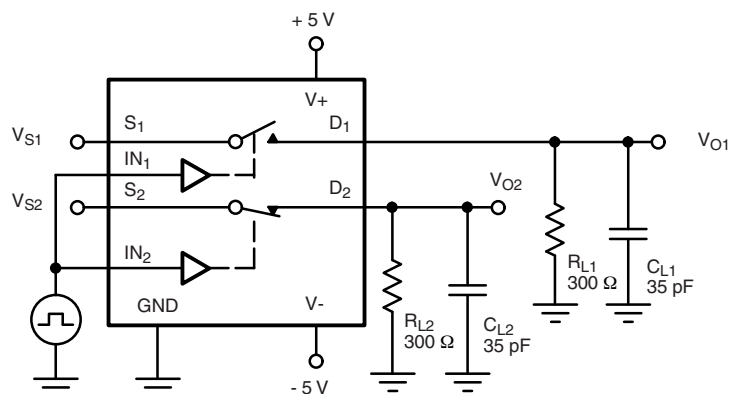
$C_L$  (includes fixture and stray capacitance)

$$V_O = V_S \frac{R_L}{R_L + r_{DS(on)}}$$



Note: Logic input waveform is inverted for switches that have the opposite logic sense control

Figure 1. Switching Time



$C_L$  (includes fixture and stray capacitance)

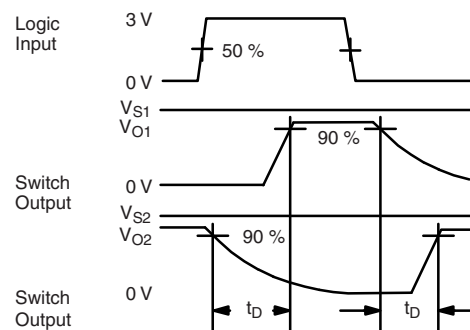


Figure 2. Break-Before-Make (DG613A)

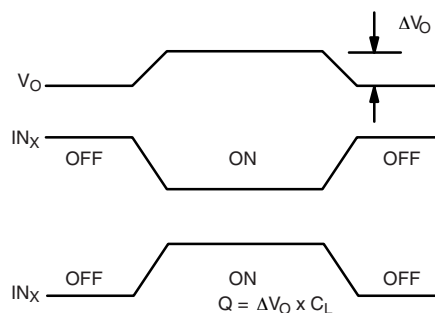
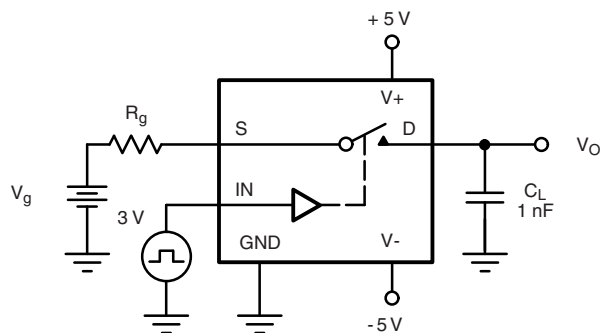


Figure 3. Charge Injection

## TEST CIRCUITS

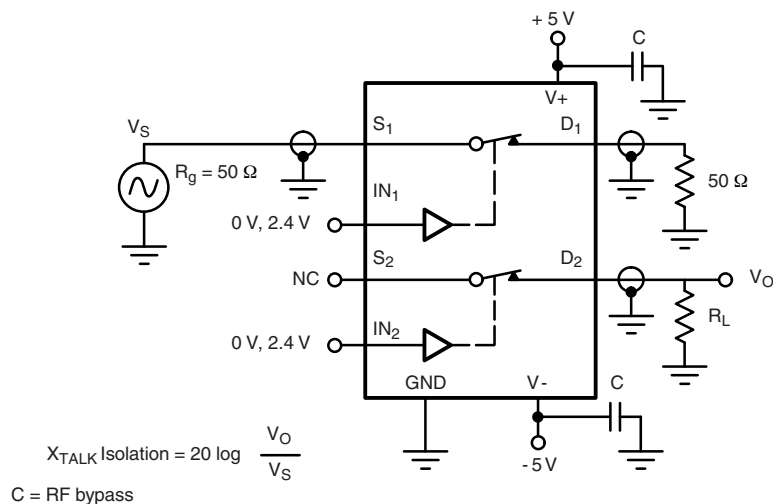


Figure 4. Crosstalk

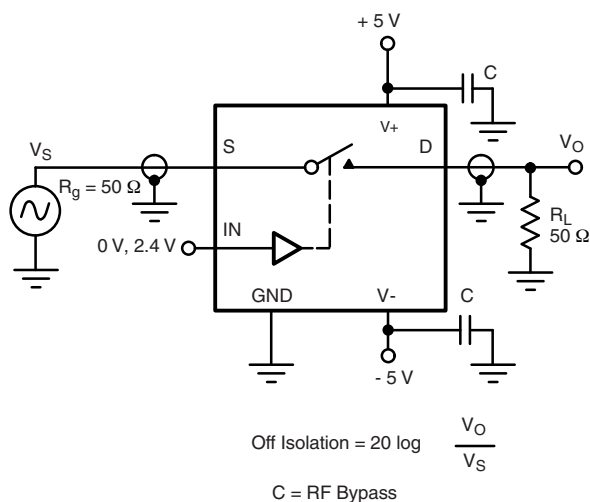


Figure 5. Off-Isolation

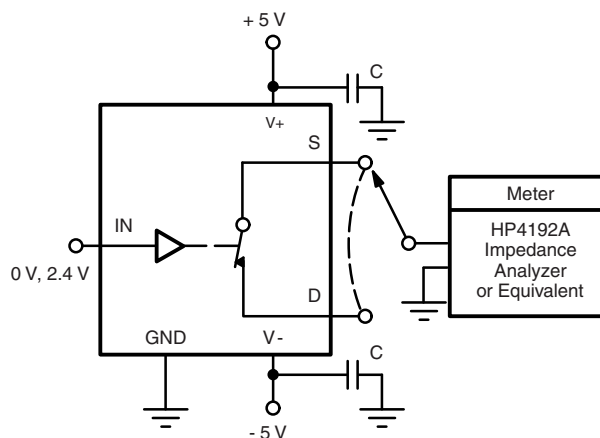
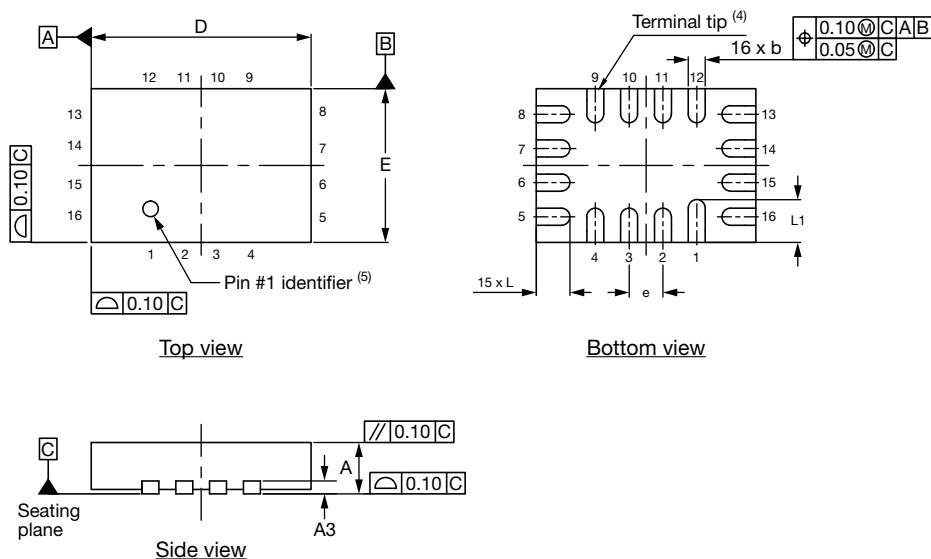


Figure 6. Source/Drain Capacitances

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?69904](http://www.vishay.com/ppg?69904).

## Thin miniQFN16 Case Outline



| DIMENSIONS        | MILLIMETERS <sup>(1)</sup> |      |      | INCHES     |       |       |
|-------------------|----------------------------|------|------|------------|-------|-------|
|                   | MIN.                       | NOM. | MAX. | MIN.       | NOM.  | MAX.  |
| A                 | 0.50                       | 0.55 | 0.60 | 0.020      | 0.022 | 0.024 |
| A1                | 0                          | -    | 0.05 | 0          | -     | 0.002 |
| A3                | 0.15 ref.                  |      |      | 0.006 ref. |       |       |
| b                 | 0.15                       | 0.20 | 0.25 | 0.006      | 0.008 | 0.010 |
| D                 | 2.50                       | 2.60 | 2.70 | 0.098      | 0.102 | 0.106 |
| e                 | 0.40 BSC                   |      |      | 0.016 BSC  |       |       |
| E                 | 1.70                       | 1.80 | 1.90 | 0.067      | 0.071 | 0.075 |
| L                 | 0.35                       | 0.40 | 0.45 | 0.014      | 0.016 | 0.018 |
| L1                | 0.45                       | 0.50 | 0.55 | 0.018      | 0.020 | 0.022 |
| N <sup>(3)</sup>  | 16                         |      |      | 16         |       |       |
| Nd <sup>(3)</sup> | 4                          |      |      | 4          |       |       |
| Ne <sup>(3)</sup> | 4                          |      |      | 4          |       |       |

### Notes

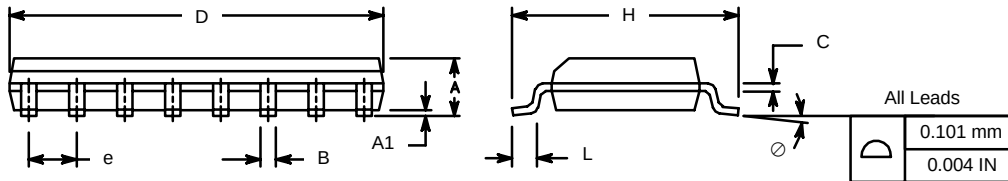
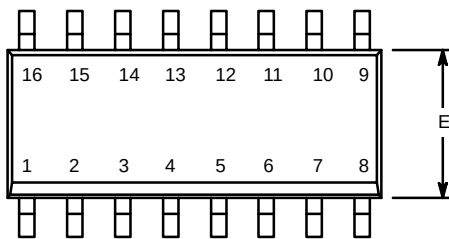
- (1) Use millimeters as the primary measurement.
- (2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
- (3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
- (4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
- (5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
- (6) Package warpage max. 0.05 mm.

ECN: T16-0226-Rev. B, 09-May-16  
DWG: 6023



### SOIC (NARROW): 16-LEAD

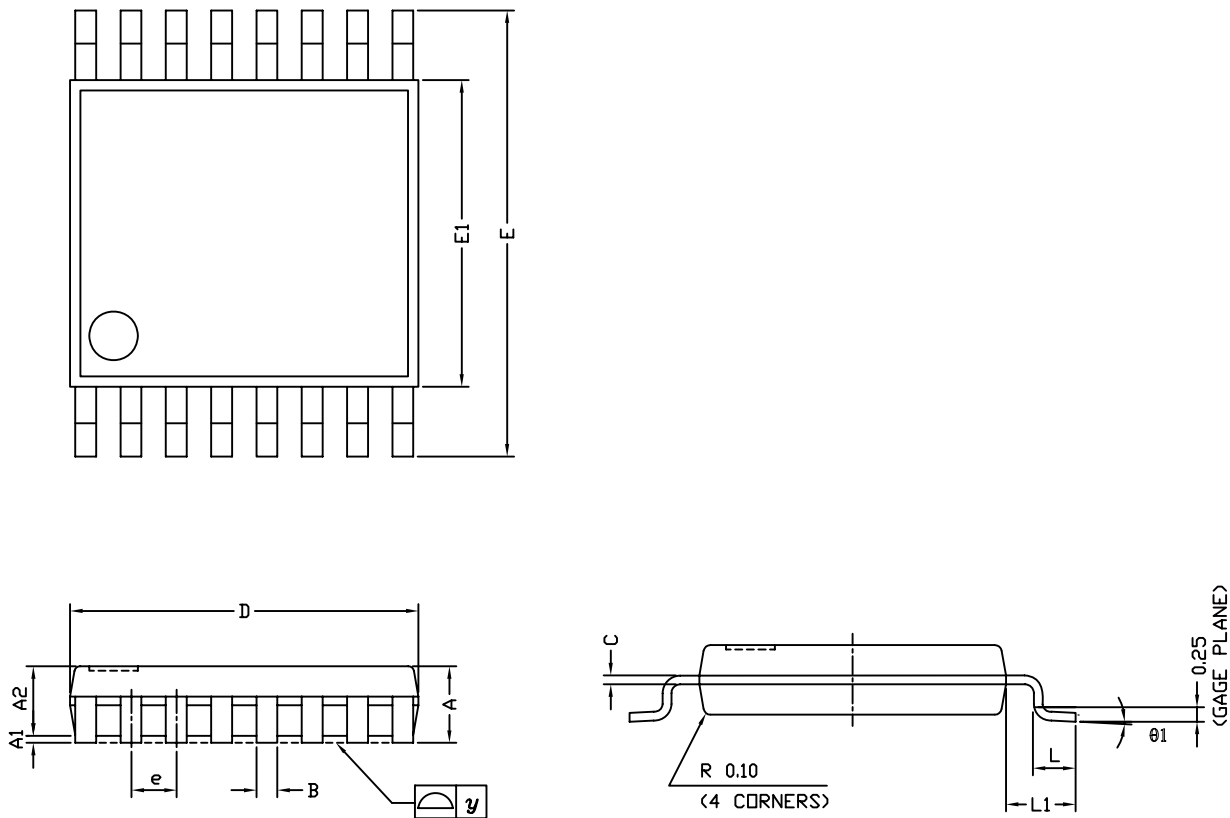
JEDEC Part Number: MS-012



| 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

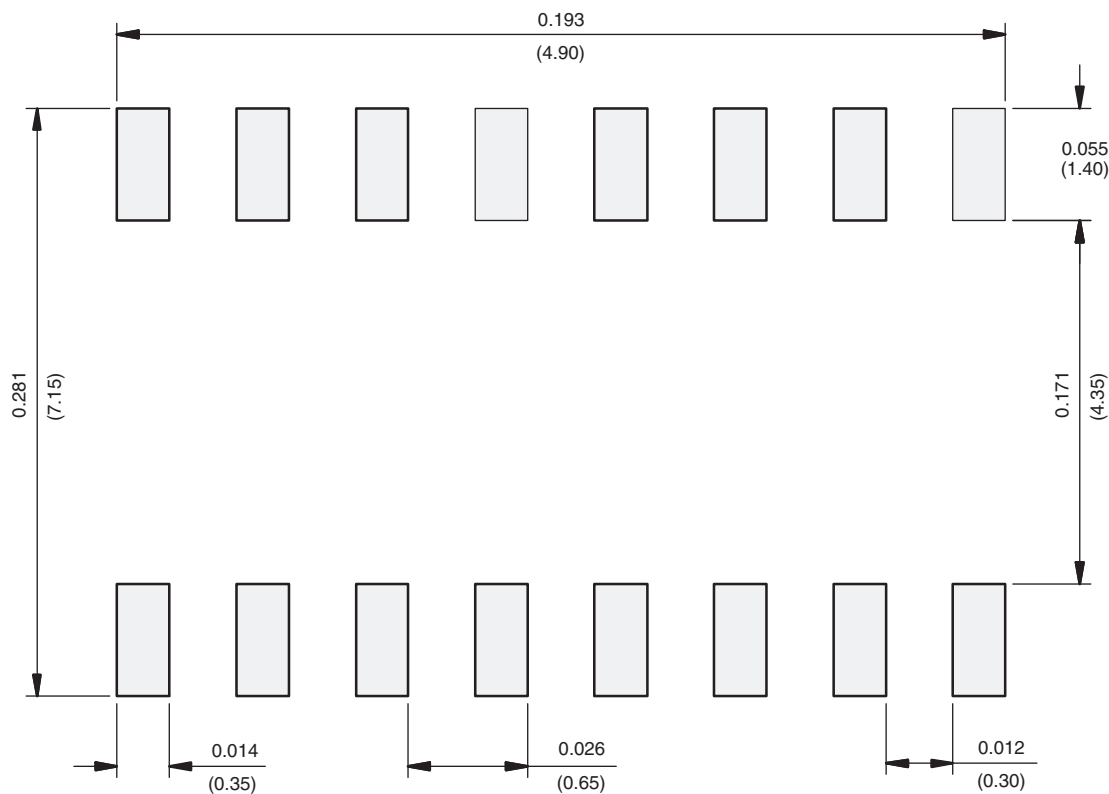
## TSSOP: 16-LEAD



| 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                      |                           |       |      |

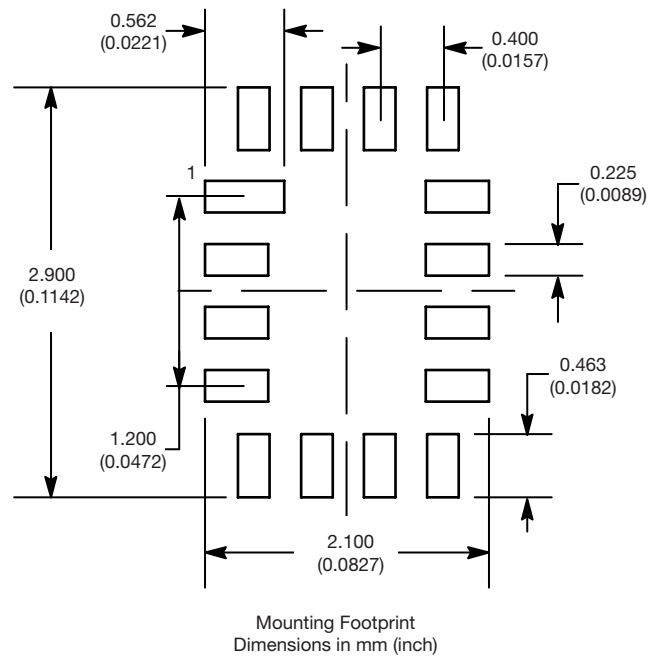


## RECOMMENDED MINIMUM PAD FOR TSSOP-16

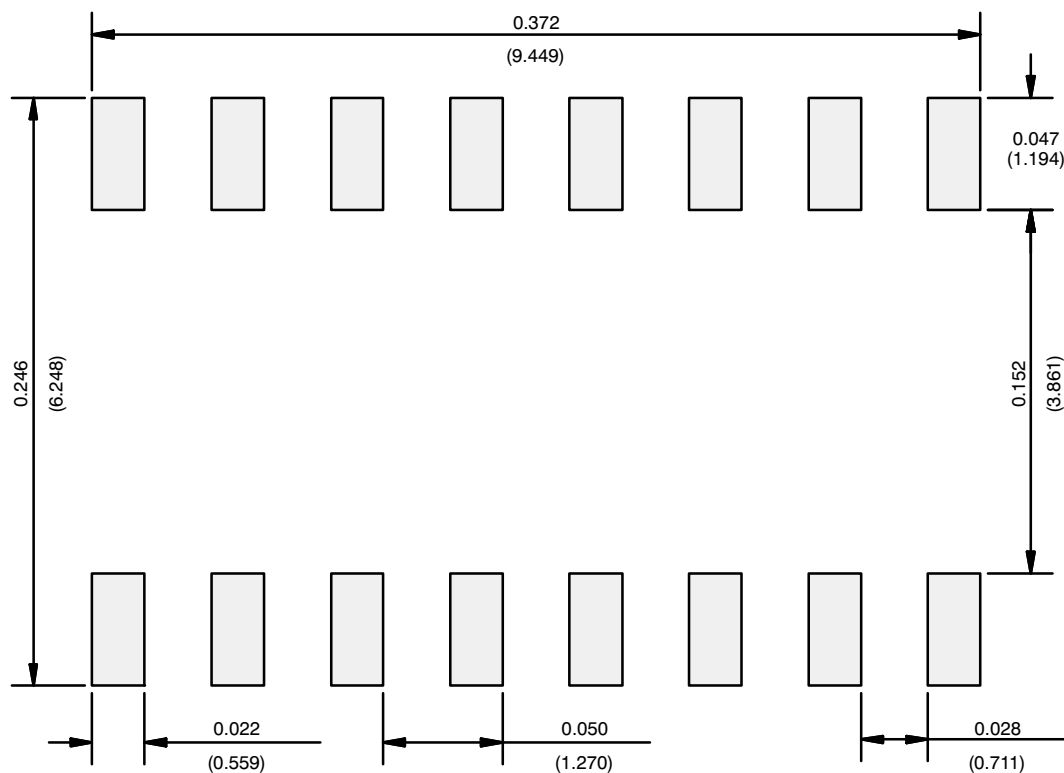


Recommended Minimum Pads  
Dimensions in inches (mm)

## RECOMMENDED MINIMUM PADS FOR MINI QFN 16L



## RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads  
Dimensions in Inches/(mm)

[Return to Index](#)





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