

## 8-Channel, Triple 2-Channel Multiplexers

### DESCRIPTION

The DG9451, and DG9453 are high precision single and dual supply CMOS analog multiplexers. DG9451 is an 8-channel multiplexer, and the DG9453 is a triple 2-channel multiplexer or triple SPDT.

Designed to operate from a +2.7 V to +12 V single supply or from a  $\pm 2.5$  V to  $\pm 5$  V dual supplies, the DG9451, and DG9453 are fully specified at +12 V, +5 V and  $\pm 5$  V. All control logic inputs have guaranteed 1.4 V high limit when operating from +5 V or  $\pm 5$  V supplies and 1.65 V when operating from a +12 V supply.

The DG9451, and DG9453 are precision multiplexers of low leakage, low charge injection, and low parasitic capacitance. They conduct equally well in both directions, offer rail to rail analog signal handling and can be used both as multiplexers as well as de-multiplexers.

The DG9451, and DG9453 operating temperature is specified from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and are available in 16 pin TSSOP and the ultra compact 1.8 mm x 2.6 mm miniQFN16 packages.

### FEATURES

- +2.7 V to +12 V single supply operation
- $\pm 2.5$  V to  $\pm 5$  V dual supply operation
- Fully specified at +12 V, +5 V,  $\pm 5$  V
- Low charge injection ( $< 0.5$  pC typ.)
- High bandwidth: 270 MHz
- Low switch capacitance ( $C_{s(off)}$  1 pF typ.)
- Good isolation and crosstalk performance (typ. -44 dB at 100 MHz)
- MiniQFN16 package (1.8 mm x 2.6 mm)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

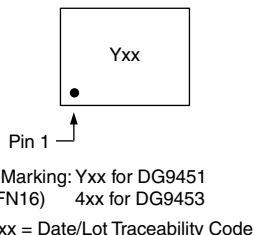
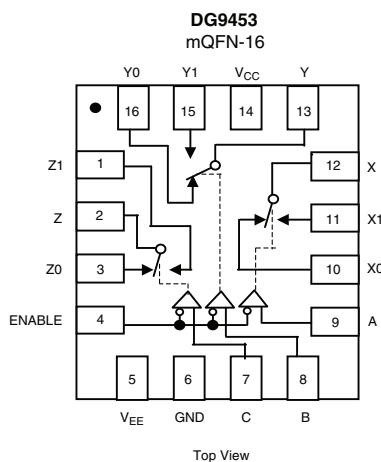
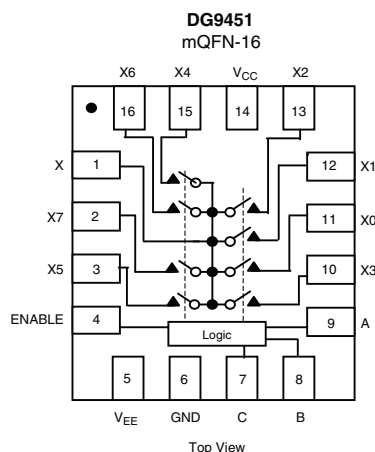


**RoHS**  
COMPLIANT  
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### APPLICATIONS

- Data acquisition
- Medical and healthcare devices
- Control and automation equipments
- Test instruments
- Touch panels
- Consumer

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION





| TRUTH TABLE  |               |   |   |                   |                           |
|--------------|---------------|---|---|-------------------|---------------------------|
| ENABLE INPUT | SELECT INPUTS |   |   | ON SWITCHES       |                           |
|              | C             | B | A | DG9451            | DG9453                    |
| H            | X             | X | X | All Switches Open | All Switches Open         |
| L            | L             | L | L | X to X0           | X to X0, Y to Y0, Z to Z0 |
| L            | L             | L | H | X to X1           | X to X1, Y to Y0, Z to Z0 |
| L            | L             | H | L | X to X2           | X to X0, Y to Y1, Z to Z0 |
| L            | L             | H | H | X to X3           | X to X1, Y to Y1, Z to Z0 |
| L            | H             | L | L | X to X4           | X to X0, Y to Y0, Z to Z1 |
| L            | H             | L | H | X to X5           | X to X1, Y to Y0, Z to Z1 |
| L            | H             | H | L | X to X6           | X to X0, Y to Y1, Z to Z1 |
| L            | H             | H | H | X to X7           | X to X1, Y to Y1, Z to Z1 |

| ORDERING INFORMATION           |                |                |
|--------------------------------|----------------|----------------|
| TEMP. RANGE                    | PACKAGE        | PART NUMBER    |
| DG9451, DG9453                 |                |                |
| -40 °C to +125 °C <sup>a</sup> | 16-Pin miniQFN | DG9451EN-T1-E4 |
|                                |                | DG9453EN-T1-E4 |

**Note**

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

| ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted) |                                |                                                                                      |      |
|---------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------|------|
| PARAMETER                                                                 |                                | LIMIT                                                                                | UNIT |
| V <sub>+</sub> to V <sub>-</sub>                                          |                                | 14                                                                                   | V    |
| GND to V <sub>-</sub>                                                     |                                | 7                                                                                    |      |
| Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>             |                                | (V <sub>-</sub> ) -0.3 to (V <sub>+</sub> ) +0.3<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                                                                          | °C   |
| Power Dissipation <sup>b</sup>                                            | 16-Pin miniQFN <sup>c, d</sup> | 525                                                                                  | mW   |
| Thermal Resistance <sup>b</sup>                                           | 16-Pin miniQFN <sup>d</sup>    | 152                                                                                  | °C/W |
| Latch-up (per JESD78)                                                     |                                | > 300                                                                                | mA   |

**Notes**

- Signals on SX, DX, or INX exceeding V<sub>+</sub> or V<sub>-</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads welded or soldered to PC board.
- Derate 6.6 mW/°C above 70 °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

| PARAMETER                                 | SYMBOL                | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V <sub>CC</sub> = +5 V, V <sub>EE</sub> = -5 V<br>V <sub>IN</sub> (A, B, C AND ENABLE) = 1.4 V, 0.3 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               | 66                | -                 | 100               | -                 | 100               | Ω    |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 125               | -                 | 118               |      |     |
| On-Resistance Match                       | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V                                                                                                                       |                                                                   | Room               | 3                 | -                 | 6                 | -                 | 6                 |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 10                | -                 | 8                 |      |     |
| On-Resistance Flatness                    | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, +3 V                                                                                                             |                                                                   | Room               | 10.2              | -                 | 16                | -                 | 16                |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 20                | -                 | 18                |      |     |
| Switch Off Leakage Current                | I <sub>S(off)</sub>   | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = -5.5 V,<br>V <sub>D</sub> = ± 4.5 V, V <sub>S</sub> = ∓ 4.5 V                                                              |                                                                   | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 | nA   |     |
|                                           | Full                  |                                                                                                                                                                     |                                                                   | -                  | -50               | 50                | -5                | 5                 |                   |      |     |
|                                           | I <sub>D(off)</sub>   |                                                                                                                                                                     |                                                                   | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -50               | 50                | -5                | 5                 |      |     |
| Channel On Leakage Current                | I <sub>D(on)</sub>    | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = -5.5 V,<br>V <sub>S</sub> = V <sub>D</sub> = ± 4.5 V                                                                       |                                                                   | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -50               | 50                | -5                | 5                 |      |     |
| Digital Control                           |                       |                                                                                                                                                                     |                                                                   |                    |                   |                   |                   |                   |                   |      |     |
| V <sub>IN</sub> (A, B, C and ENABLE) Low  | V <sub>IL</sub>       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 0.3               | -                 | 0.3               | V    |     |
| V <sub>IN</sub> (A, B, C and ENABLE) High | V <sub>IH</sub>       |                                                                                                                                                                     |                                                                   | Full               | -                 | 1.4               | -                 | 1.4               | -                 |      |     |
| Input Current, V <sub>IN</sub> Low        | I <sub>IL</sub>       | V <sub>IN</sub> (A, B, C and ENABLE) under test = 0.3 V                                                                                                             |                                                                   | Full               | 0.01              | -1                | 1                 | -1                | 1                 | μA   |     |
| Input Current, V <sub>IN</sub> High       | I <sub>IH</sub>       | V <sub>IN</sub> (A, B, C and ENABLE) under test = 1.4 V                                                                                                             |                                                                   | Full               | 0.01              | -1                | 1                 | -1                | 1                 |      |     |
| Input Capacitance <sup>e</sup>            | C <sub>IN</sub>       | f = 1 MHz                                                                                                                                                           |                                                                   | Room               | 3.4               | -                 | -                 | -                 | -                 | pF   |     |
| Dynamic Characteristics                   |                       |                                                                                                                                                                     |                                                                   |                    |                   |                   |                   |                   |                   |      |     |
| Transition Time                           | t <sub>TRANS</sub>    | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>see figure 1, 2, 3                                                                                                |                                                                   | Room               | 66                | -                 | 180               | -                 | 180               | ns   |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 218               | -                 | 207               |      |     |
| Enable Turn-On Time                       | t <sub>ON</sub>       |                                                                                                                                                                     |                                                                   | Room               | 152               | -                 | 250               | -                 | 250               |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 295               | -                 | 282               |      |     |
| Enable Turn-Off Time                      | t <sub>OFF</sub>      |                                                                                                                                                                     |                                                                   | Room               | 60                | -                 | 125               | -                 | 125               |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 136               | -                 | 131               |      |     |
| Break-Before-Make Time Delay              | t <sub>D</sub>        |                                                                                                                                                                     |                                                                   | Room               | 32                | -                 | -                 | -                 | -                 |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 13                | -                 | 13                |      |     |
| Off Isolation <sup>e</sup>                | OIRR                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 15 pF                                                                                                                       | f = 100 kHz                                                       | Room               | < -90             | -                 | -                 | -                 | -                 | dB   |     |
|                                           |                       |                                                                                                                                                                     | f = 10 MHz                                                        | Room               | -65               | -                 | -                 | -                 | -                 |      |     |
|                                           |                       |                                                                                                                                                                     | f = 100 MHz                                                       | Room               | -44               | -                 | -                 | -                 | -                 |      |     |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>     |                                                                                                                                                                     | f = 100 kHz                                                       | Room               | < -90             | -                 | -                 | -                 | -                 |      |     |
|                                           |                       |                                                                                                                                                                     | f = 10 MHz                                                        | Room               | -74               | -                 | -                 | -                 | -                 |      |     |
|                                           |                       |                                                                                                                                                                     | f = 100 MHz                                                       | Room               | -44               | -                 | -                 | -                 | -                 |      |     |
| Bandwidth, 3 dB                           | BW                    |                                                                                                                                                                     | R <sub>L</sub> = 50 Ω                                             | DG9451             | Room              | 270               | -                 | -                 | -                 | -    | MHz |
|                                           |                       |                                                                                                                                                                     | DG9453                                                            | Room               | 525               | -                 | -                 | -                 | -                 |      |     |
| 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              | 0.20              | -                 | -                 | -                 | -    | pC  |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub>   | f = 1 MHz                                                                                                                                                           | DG9451                                                            | Room               | 1                 | -                 | -                 | -                 | -                 | pF   |     |
|                                           |                       |                                                                                                                                                                     | DG9453                                                            | Room               | 1                 | -                 | -                 | -                 | -                 |      |     |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub>   | f = 1 MHz                                                                                                                                                           | DG9451                                                            | Room               | 10                | -                 | -                 | -                 | -                 |      |     |
|                                           |                       |                                                                                                                                                                     | DG9453                                                            | Room               | 3                 | -                 | -                 | -                 | -                 |      |     |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>    | f = 1 MHz                                                                                                                                                           | DG9451                                                            | Room               | 16                | -                 | -                 | -                 | -                 |      |     |
|                                           |                       |                                                                                                                                                                     | DG9453                                                            | Room               | 8                 | -                 | -                 | -                 | -                 |      |     |
| Total Harmonic Distortion <sup>e</sup>    | THD                   | Signal = 1 V <sub>RMS</sub> ,<br>20 Hz to 20 kHz, R <sub>L</sub> = 600 Ω                                                                                            |                                                                   | Room               | 0.01              | -                 | -                 | -                 | -                 | %    |     |
| Power Supplies                            |                       |                                                                                                                                                                     |                                                                   |                    |                   |                   |                   |                   |                   |      |     |
| Power Supply Current                      | I <sub>+</sub>        | V <sub>CC</sub> = +5 V, V <sub>EE</sub> = -5 V<br>V <sub>IN</sub> (A, B, C and ENABLE) = 0 V or 5 V                                                                 |                                                                   | Room               | 0.05              | -                 | 1                 | -                 | 1                 | μA   |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -                 | 10                | -                 | 10                |      |     |
| Negative Supply Current                   | I <sub>-</sub>        |                                                                                                                                                                     |                                                                   | Room               | -0.05             | -1                | -                 | -1                | -                 |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -10               | -                 | -10               | -                 |      |     |
| Ground Current                            | I <sub>GND</sub>      |                                                                                                                                                                     |                                                                   | Room               | -0.05             | -1                | -                 | -1                | -                 |      |     |
|                                           |                       |                                                                                                                                                                     |                                                                   | Full               | -                 | -10               | -                 | -10               | -                 |      |     |

**SPECIFICATIONS FOR UNIPOLAR SUPPLIES**

| PARAMETER                                 | SYMBOL                | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V <sub>CC</sub> = +5 V, V <sub>EE</sub> = 0 V<br>V <sub>IN(A, B, C AND ENABLE)</sub> = 1.4 V, 0.3 V <sup>a</sup> | TEMP. <sup>b</sup> | TYP. <sup>a</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>       | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, +3.5 V                                                                                                               | Room               | 105               | -                 | 165               | -                 | 165               | Ω    |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -                 | 205               | -                 | 194               |      |
| On-Resistance Match                       | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = +3.5 V                                                                                                                    | Room               | 3.2               | -                 | 8                 | -                 | 8                 |      |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -                 | 13                | -                 | 10                |      |
| On-Resistance Flatness                    | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, +3 V                                                                                                                 | Room               | 17                | -                 | 26                | -                 | 26                | nA   |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -                 | 30                | -                 | 28                |      |
| Switch Off Leakage Current                | I <sub>S(off)</sub>   | V <sub>+</sub> = +5.5 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 1 V/4.5 V, V <sub>S</sub> = 4.5 V/1 V                                                           | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -50               | 50                | -5                | 5                 |      |
|                                           | I <sub>D(off)</sub>   |                                                                                                                                                                   | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -50               | 50                | -5                | 5                 |      |
| Channel On Leakage Current                | I <sub>D(on)</sub>    | V <sub>+</sub> = +5.5 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 1 V/4.5 V                                                                      | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -50               | 50                | -5                | 5                 |      |
| Digital Control                           |                       |                                                                                                                                                                   |                    |                   |                   |                   |                   |                   |      |
| V <sub>IN(A, B, C and ENABLE)</sub> Low   | V <sub>IL</sub>       |                                                                                                                                                                   | Full               | -                 | -                 | 0.3               | -                 | 0.3               | V    |
| V <sub>IN(A, B, C and ENABLE)</sub> High  | V <sub>IH</sub>       |                                                                                                                                                                   | Full               | -                 | 1.4               | -                 | 1.4               |                   |      |
| Input Current, V <sub>IN</sub> Low        | I <sub>L</sub>        | V <sub>IN(A, B, C and ENABLE)</sub> under test = 0.3 V                                                                                                            | Full               | 0.01              | -1                | 1                 | -1                | 1                 | μA   |
| Input Current, V <sub>IN</sub> High       | I <sub>H</sub>        | V <sub>IN(A, B, C and ENABLE)</sub> under test = 1.4 V                                                                                                            | Full               | 0.01              | -1                | 1                 | -1                | 1                 |      |
| Dynamic Characteristics                   |                       |                                                                                                                                                                   |                    |                   |                   |                   |                   |                   |      |
| Transition Time                           | t <sub>TRANS</sub>    | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>See Figure 1, 2, 3                                                                                              | Room               | 79                | -                 | 205               | -                 | 205               | ns   |
| Enable Turn-On Time                       | t <sub>ON</sub>       |                                                                                                                                                                   | Full               | -                 | -                 | 295               | -                 | 285               |      |
|                                           |                       |                                                                                                                                                                   | Room               | 220               | -                 | 335               | -                 | 335               |      |
| Enable Turn-Off Time                      | t <sub>OFF</sub>      |                                                                                                                                                                   | Full               | -                 | -                 | 403               | -                 | 393               |      |
|                                           |                       |                                                                                                                                                                   | Room               | 93                | -                 | 150               | -                 | 150               |      |
| Break-Before-Make Time Delay              | t <sub>D</sub>        |                                                                                                                                                                   | Full               | -                 | -                 | 173               | -                 | 163               |      |
|                                           |                       | Room                                                                                                                                                              | 36                 | -                 | -                 | -                 | -                 |                   |      |
| 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               | 0.81              | -                 | -                 | -                 | -                 | pC   |
| Off Isolation <sup>e</sup>                | OIRR                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 15 pF<br>f = 100 kHz                                                                                                      | Room               | < -90             | -                 | -                 | -                 | -                 | dB   |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>     |                                                                                                                                                                   | Room               | < -90             | -                 | -                 | -                 | -                 |      |
| Dynamic Characteristics                   |                       |                                                                                                                                                                   |                    |                   |                   |                   |                   |                   |      |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub>   | f = 1 MHz                                                                                                                                                         | DG9451             | Room              | 1                 | -                 | -                 | -                 | pF   |
|                                           |                       |                                                                                                                                                                   | DG9453             | Room              | 1                 | -                 | -                 | -                 |      |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub>   | f = 1 MHz                                                                                                                                                         | DG9451             | Room              | 11                | -                 | -                 | -                 |      |
|                                           |                       |                                                                                                                                                                   | DG9453             | Room              | 3                 | -                 | -                 | -                 |      |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>    | f = 1 MHz                                                                                                                                                         | DG9451             | Room              | 17                | -                 | -                 | -                 |      |
|                                           |                       |                                                                                                                                                                   | DG9453             | Room              | 9                 | -                 | -                 | -                 |      |
| Power Supplies                            |                       |                                                                                                                                                                   |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current                      | I <sub>+</sub>        | V <sub>IN(A, B, C and ENABLE)</sub> = 0 V or 5 V                                                                                                                  | Room               | 0.05              | -                 | 1                 | -                 | 1                 | μA   |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -                 | 10                | -                 | 10                |      |
| Negative Supply Current                   | I <sub>-</sub>        |                                                                                                                                                                   | Room               | -0.05             | -1                | -                 | -1                | -                 |      |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -10               | -                 | -10               | -                 |      |
| Ground Current                            | I <sub>GND</sub>      |                                                                                                                                                                   | Room               | -0.05             | -1                | -                 | -1                | -                 |      |
|                                           |                       |                                                                                                                                                                   | Full               | -                 | -10               | -                 | -10               | -                 |      |

**SPECIFICATIONS FOR UNIPOLAR SUPPLIES**

| PARAMETER                                 | SYMBOL                | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V <sub>CC</sub> = +12 V, V <sub>EE</sub> = 0 V<br>V = 1.6 V, 0.5 V <sup>a</sup> | TEMP. <sup>b</sup> | TYP. <sup>c</sup> | -40 °C to +125 °C |                   | -40 °C to +85 °C  |                   | UNIT |
|-------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                                           |                       |                                                                                                                                  |                    |                   | MAX. <sup>d</sup> | MIN. <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                 | 12                | 0                 | 12                | V    |
| On-Resistance                             | R <sub>ON</sub>       | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0.7 V, 6 V, 11.3 V                                                                       | Room               | 68                | -                 | 105               | -                 | 105               | Ω    |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 143               | -                 | 137               |      |
| On-Resistance Match                       | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = +0.7 V                                                                                   | Room               | 4                 | -                 | 7                 | -                 | 7                 |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 10                | -                 | 8                 |      |
| On-Resistance Flatness                    | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0.7 V, +11.3 V                                                                           | Room               | 32                | -                 | 45                | -                 | 45                | nA   |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 49                | -                 | 47                |      |
| Switch Off Leakage Current                | I <sub>S(off)</sub>   | V <sub>+</sub> = +12 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 1 V/11 V, V <sub>S</sub> = 11 V/1 V                             | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -50               | 50                | -5                | 5                 |      |
|                                           | I <sub>D(off)</sub>   |                                                                                                                                  | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -50               | 50                | -5                | 5                 |      |
| Channel On Leakage Current                | I <sub>D(on)</sub>    | V <sub>+</sub> = +12 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 1 V/11 V                                       | Room               | ± 0.02            | -1                | 1                 | -1                | 1                 | nA   |
|                                           |                       |                                                                                                                                  | Full               | -                 | -50               | 50                | -5                | 5                 |      |
| Digital Control                           |                       |                                                                                                                                  |                    |                   |                   |                   |                   |                   |      |
| V <sub>IN(A, B, C and ENABLE)</sub> Low   | V <sub>IL</sub>       |                                                                                                                                  | Full               | -                 | -                 | 0.5               | -                 | 0.5               | V    |
| V <sub>IN(A, B, C and ENABLE)</sub> High  | V <sub>IH</sub>       |                                                                                                                                  | Full               | -                 | 1.6               | -                 | 1.6               | -                 |      |
| Input Current, V <sub>IN</sub> Low        | I <sub>L</sub>        | V <sub>IN(A, B, C and ENABLE)</sub> under test = 0.5 V                                                                           | Full               | 0.01              | -1                | 1                 | -1                | 1                 | μA   |
| Input Current, V <sub>IN</sub> High       | I <sub>H</sub>        | V <sub>IN(A, B, C and ENABLE)</sub> under test = 1.6 V                                                                           | Full               | 0.01              | -1                | 1                 | -1                | 1                 |      |
| Dynamic Characteristics                   |                       |                                                                                                                                  |                    |                   |                   |                   |                   |                   |      |
| Transition Time                           | t <sub>TRANS</sub>    | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>see figure 1, 2, 3                                                             | Room               | 55                | -                 | 135               | -                 | 135               | ns   |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 166               | -                 | 155               |      |
| Enable Turn-On Time                       | t <sub>ON</sub>       |                                                                                                                                  | Room               | 106               | -                 | 185               | -                 | 185               |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 219               | -                 | 205               |      |
| Enable Turn-Off Time                      | t <sub>OFF</sub>      |                                                                                                                                  | Room               | 65                | -                 | 130               | -                 | 130               |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 144               | -                 | 137               |      |
| Break-Before-Make Time Delay              | t <sub>D</sub>        |                                                                                                                                  | Room               | 30                | -                 | -                 | -                 | -                 |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 12                | -                 | 12                |      |
| 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               | 0.79              | -                 | -                 | -                 | -                 | pC   |
| Dynamic Characteristics                   |                       |                                                                                                                                  |                    |                   |                   |                   |                   |                   |      |
| Off Isolation <sup>e</sup>                | OIRR                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 15 pF<br>f = 100 kHz                                                                     | Room               | < -90             | -                 | -                 | -                 | -                 | dB   |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>     |                                                                                                                                  | Room               | < -90             | -                 | -                 | -                 | -                 |      |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub>   | f = 1 MHz                                                                                                                        | DG9451             | Room              | 1                 | -                 | -                 | -                 | pF   |
|                                           |                       |                                                                                                                                  | DG9453             | Room              | 1                 | -                 | -                 | -                 |      |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub>   | f = 1 MHz                                                                                                                        | DG9451             | Room              | 9                 | -                 | -                 | -                 |      |
|                                           |                       |                                                                                                                                  | DG9453             | Room              | 3                 | -                 | -                 | -                 |      |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>    | f = 1 MHz                                                                                                                        | DG9451             | Room              | 15                | -                 | -                 | -                 |      |
|                                           |                       |                                                                                                                                  | DG9453             | Room              | 8                 | -                 | -                 | -                 |      |
| Power Supplies                            |                       |                                                                                                                                  |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current                      | I <sub>+</sub>        | V <sub>IN(A, B, C and ENABLE)</sub> = 0 V or 12 V                                                                                | Room               | 0.05              | -                 | 1                 | -                 | 1                 | μA   |
|                                           |                       |                                                                                                                                  | Full               | -                 | -                 | 10                | -                 | 10                |      |
| Negative Supply Current                   | I <sub>-</sub>        |                                                                                                                                  | Room               | -0.05             | -1                | -                 | -1                | -                 |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -10               | -                 | -10               | -                 |      |
| Ground Current                            | I <sub>GND</sub>      |                                                                                                                                  | Room               | -0.05             | -1                | -                 | -1                | -                 |      |
|                                           |                       |                                                                                                                                  | Full               | -                 | -10               | -                 | -10               | -                 |      |

**Notes**a.  $V_{IN}$  = input voltage to perform proper function.

b. Room -25 °C, Full = as determined by the operating temperature suffix.

c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

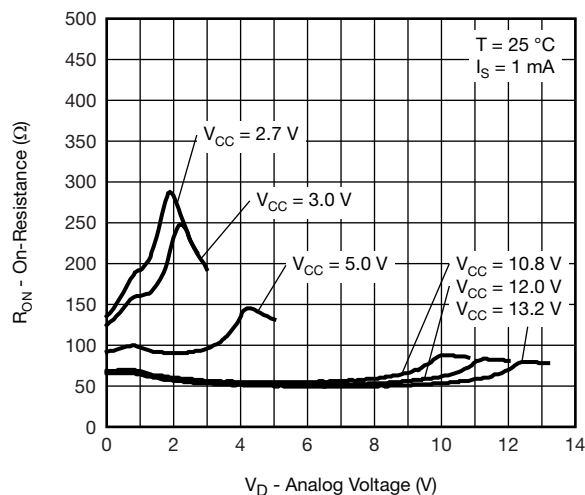
d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.

e. Guaranteed by design, not subject to production test.

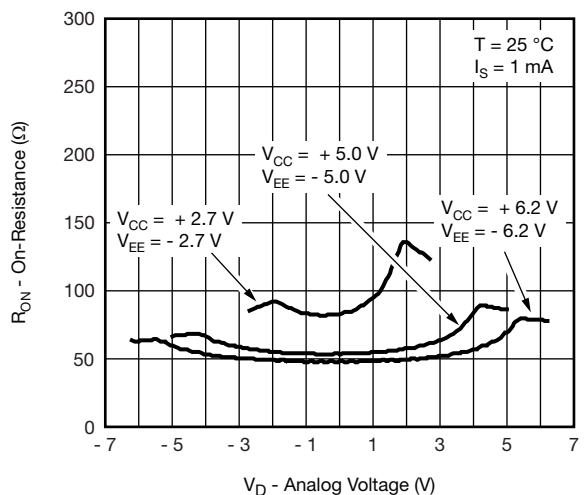
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



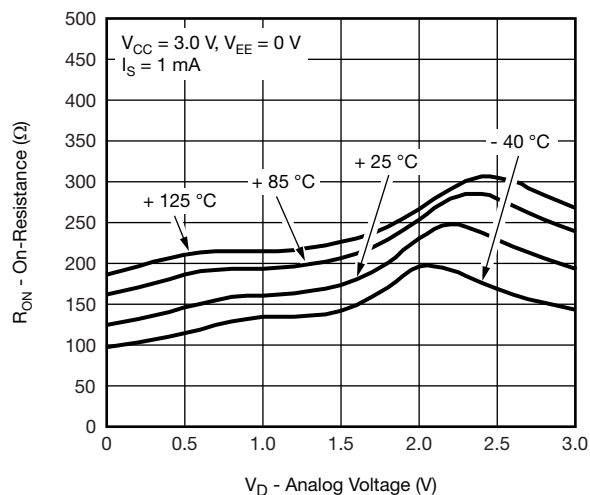
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



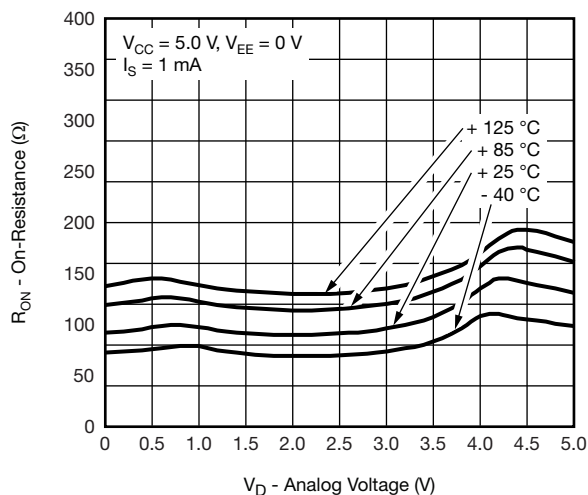
**On-Resistance vs.  $V_D$  and Signal Supply Voltage**



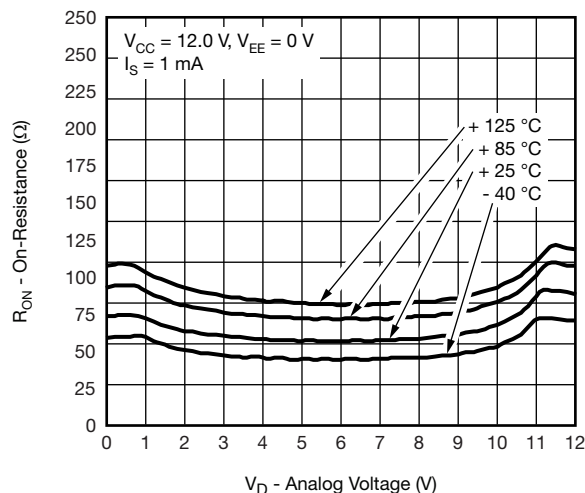
**On-Resistance vs. Analog Voltage and Temperature**



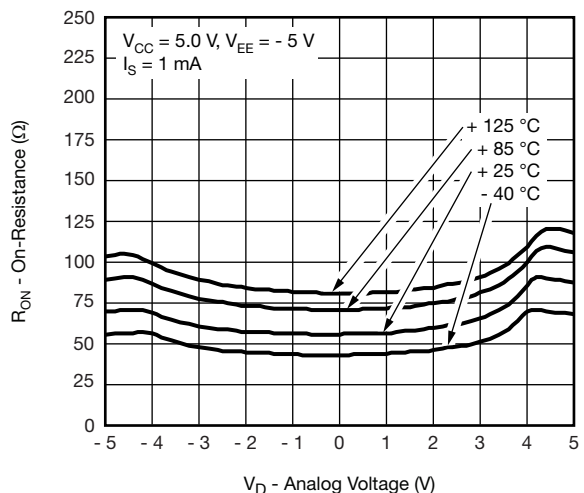
**On-Resistance vs. Analog Voltage and Temperature**



**On-Resistance vs. Analog Voltage and Temperature**



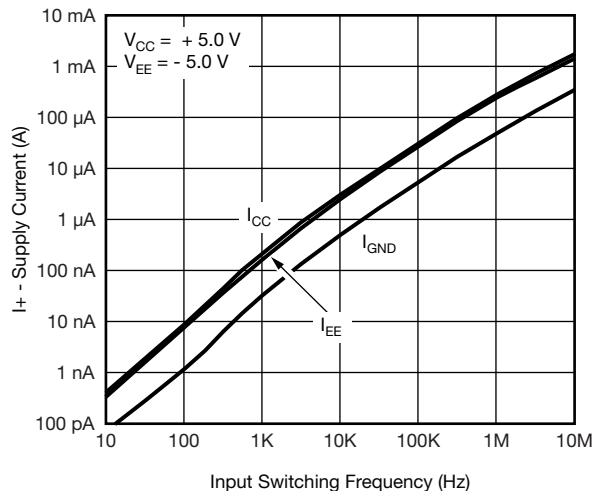
**On-Resistance vs. Analog Voltage and Temperature**



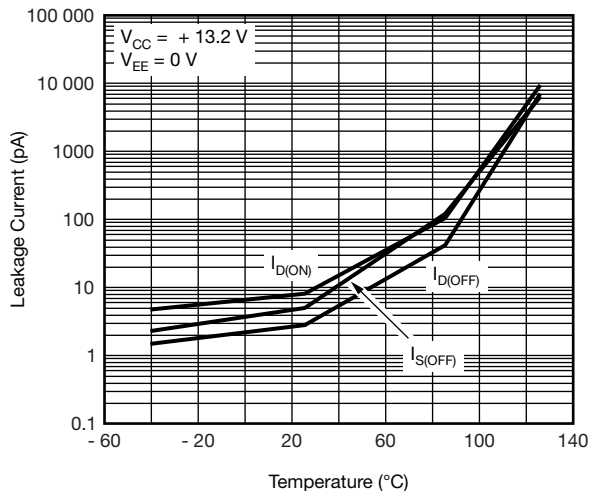
**On-Resistance vs. Analog Voltage and Temperature**



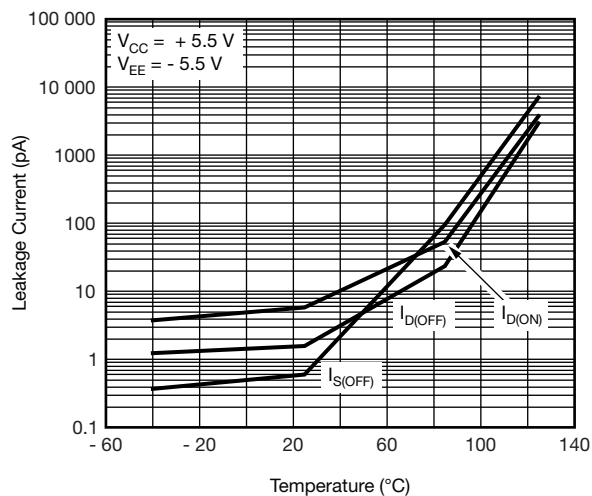
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



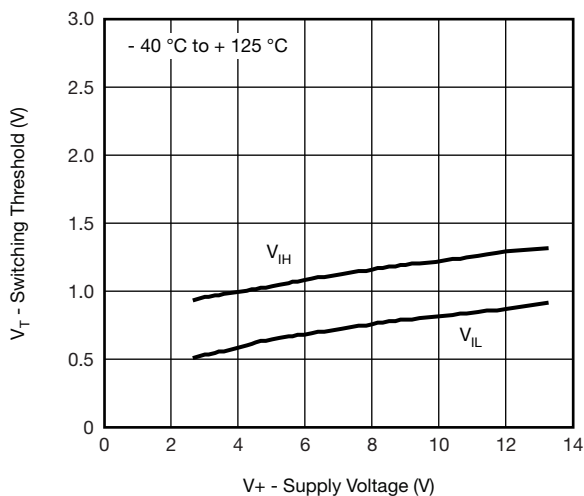
**Supply Current vs. Input Switching Frequency**



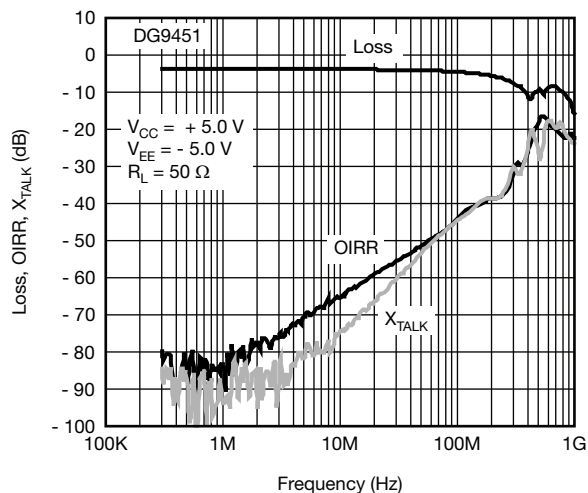
**Leakage Current vs. Temperature**



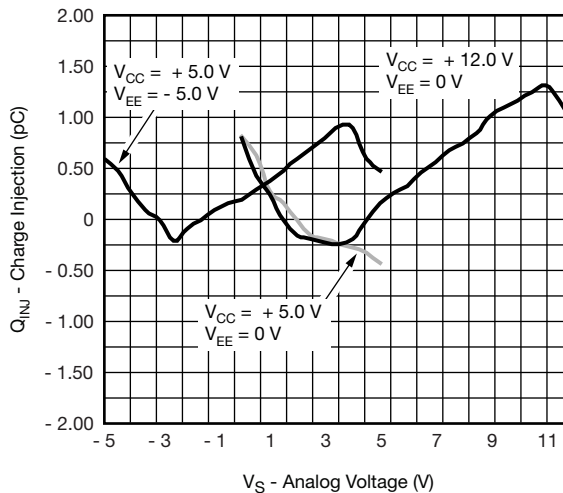
**Leakage Current vs. Temperature**



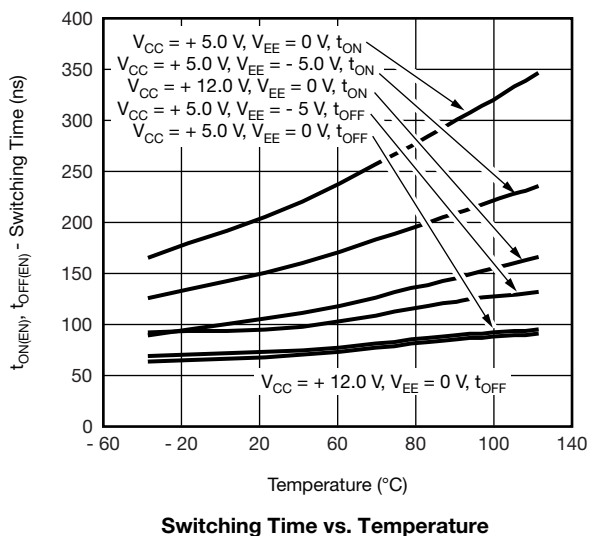
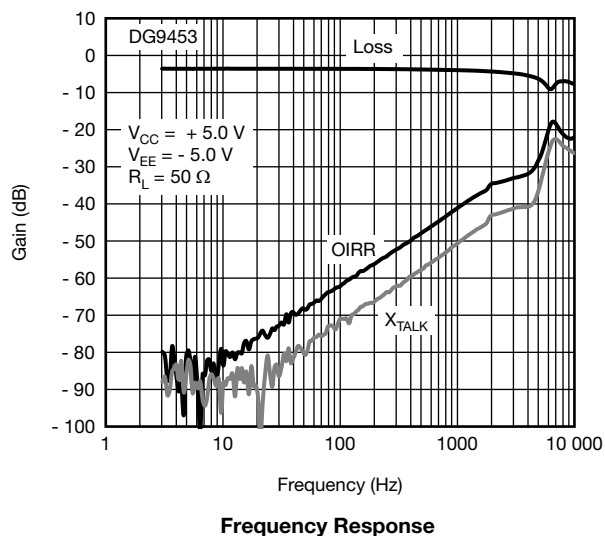
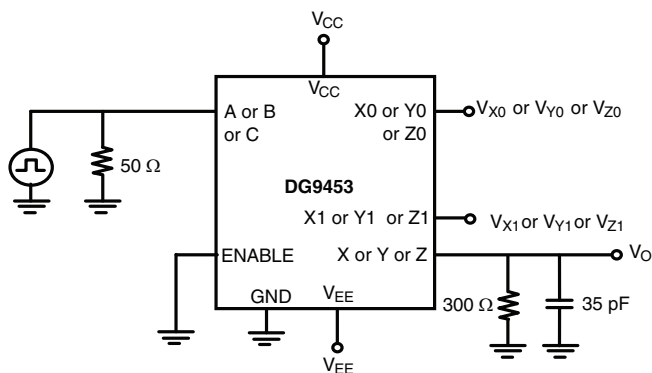
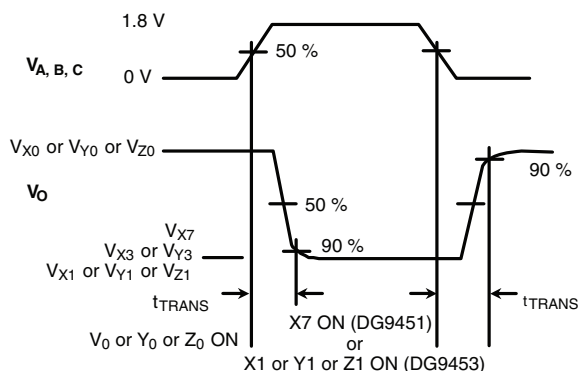
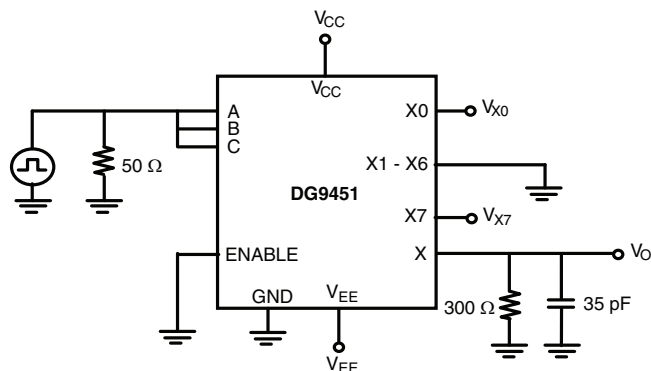
**Switching Threshold vs. Supply Voltage**

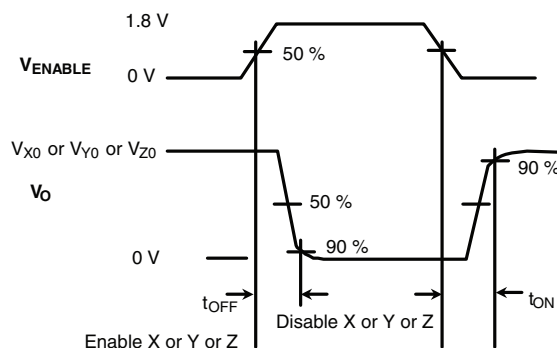
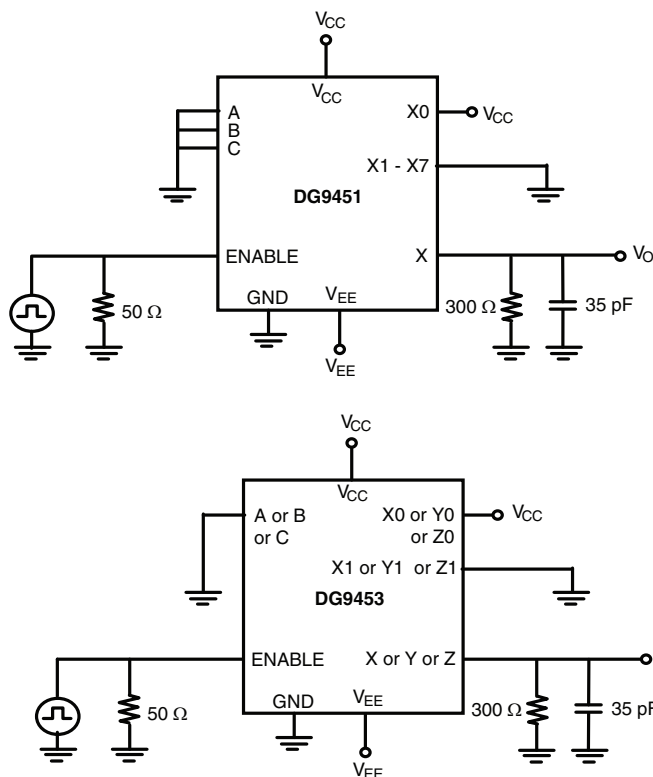
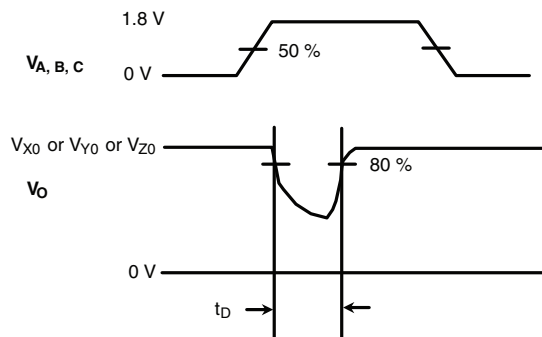
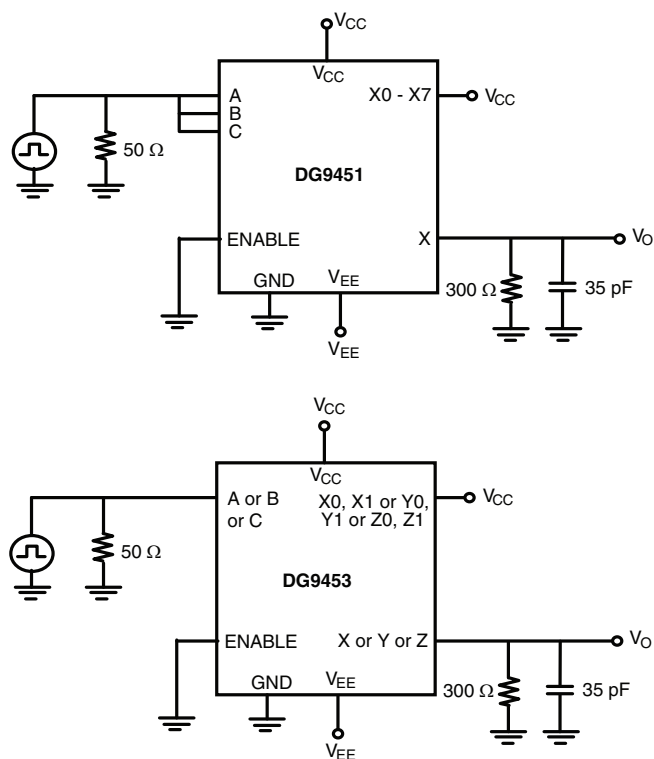


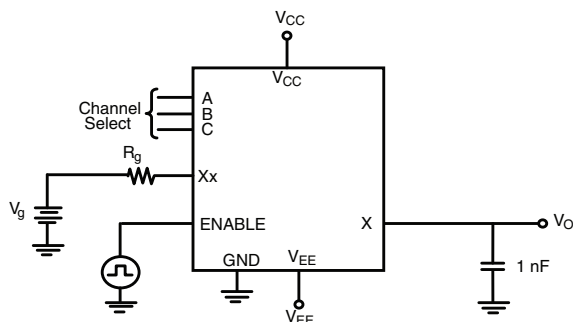
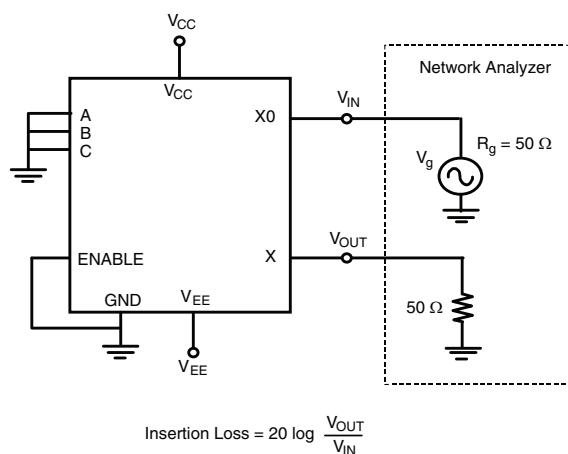
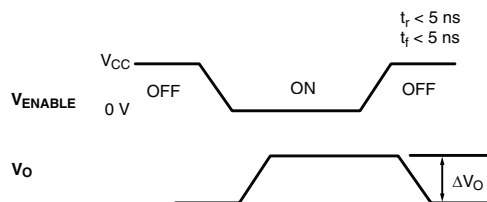
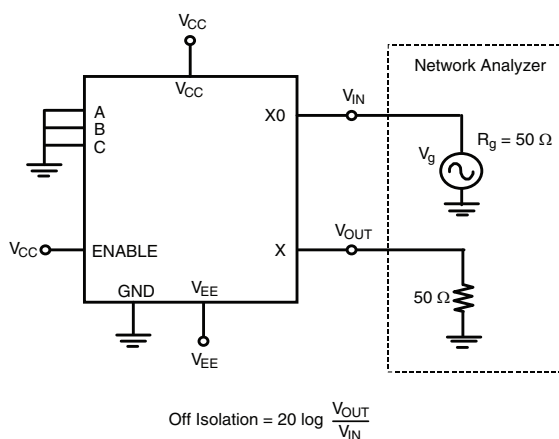
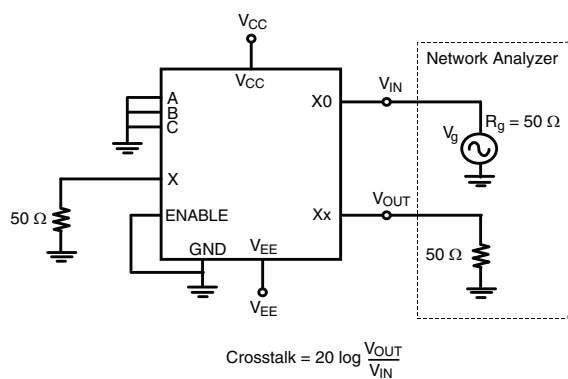
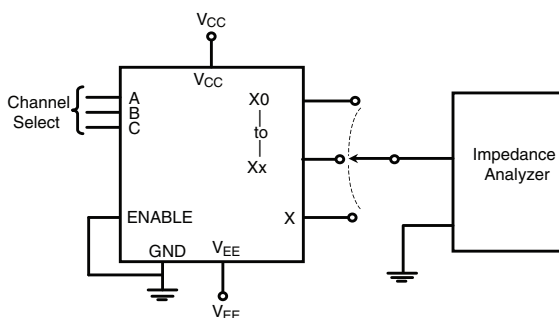
**DG9451 Insertion Loss, Off-Isolation, Crosstalk vs. Frequency**



**DG9451 Charge Injection vs. Analog Voltage**

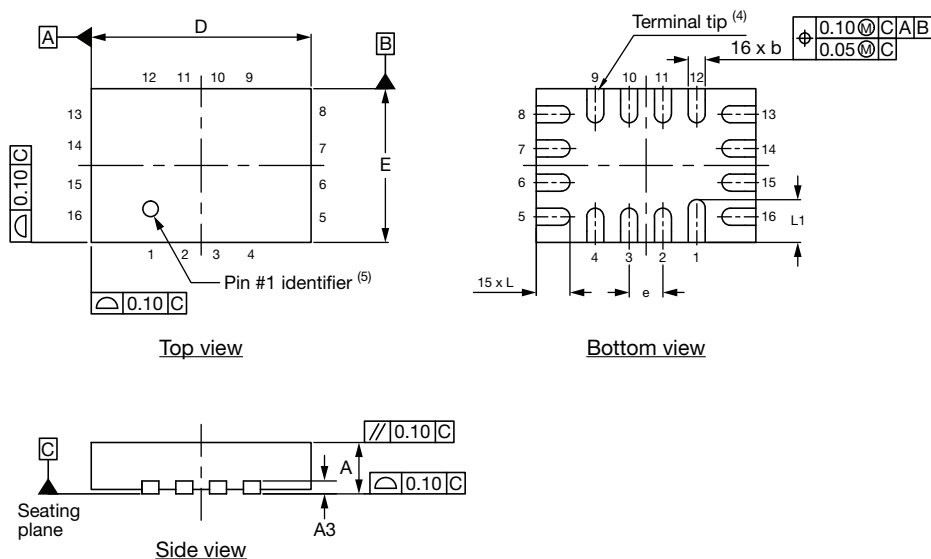
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**TEST CIRCUITS**

**Fig. 1 - Transition Time**

**TEST CIRCUITS**

**Fig. 2 - Enable Switching Time**

**Fig. 3 - Break-Before-Make**

**TEST CIRCUITS**

**Fig. 4 - Charge Injection**

**Fig. 5 - Insertion Loss**

**Fig. 7 - Off Isolation**

**Fig. 6 - Crosstalk**

**Fig. 8 - Source, Drain Capacitance**

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## Thin miniQFN16 Case Outline



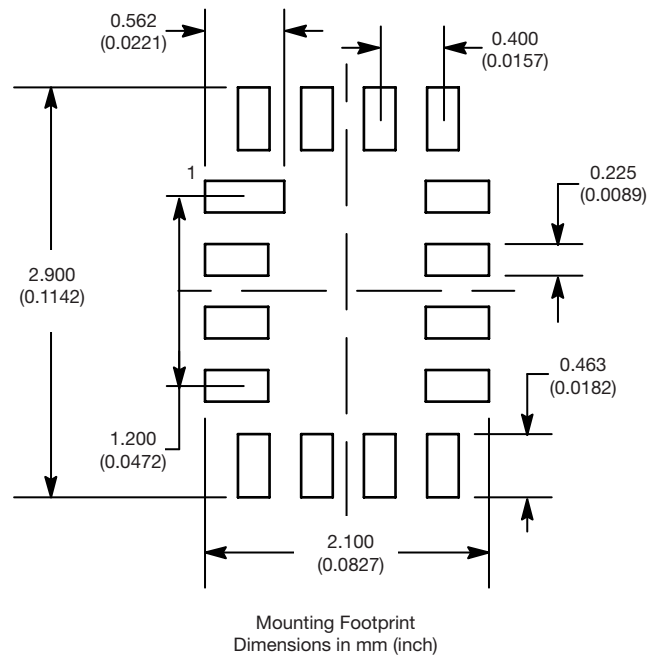
| DIMENSIONS        | MILLIMETERS <sup>(1)</sup> |      |      | INCHES     |       |       |
|-------------------|----------------------------|------|------|------------|-------|-------|
|                   | MIN.                       | NOM. | MAX. | MIN.       | NOM.  | MAX.  |
| A                 | 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

## RECOMMENDED MINIMUM PADS FOR MINI QFN 16L





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