# 0.65-Ω, Low Voltage, Negative Swing Capable, Dual SPST Analog Switch

## DESCRIPTION

The DG2727, DG2728, and DG2729 are 0.6 Ω dual SPST analog switches. When Sx are used as signal input, these devices support AC-coupled audio signals with single rail power supply. Audio signals can swing below ground down to V+ - 4.3 V.

Built on Vishay Siliconix's sub-micro CMOS technology, the DG2747/2748/2749 achieve 0.6 Ω on-resistance and 0.2 Ω flatness at 2.7 V power supply. Its total harmonic distortion is 0.006 % (frequency ranges 20 Hz to 20 kHz).

It achieves - 72 dB off-isolation and - 100 dB crosstalk at 100 kHz. Its - 3 dB bandwidth is up to 78 MHz.

Select pin of control logic can tolerate voltage above power supply up to 4.3 V. It has guaranteed 1.2 V logic high for the power supply 2.7 V to 4.3 V range. This makes it compatible with many low voltage digital control circuits.

Combining wide operation voltage, low power, high speed, low on-resistance and small physical size, the DG2747, DG2748, DG2749 are ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG2747, DG2748, DG2749 come in a small miniQFN-8L package (1.4 mm x 1.4 mm x 0.55 mm) and operate over - 40 °C to + 85 °C extended temperature range.

## FEATURES

- **Halogen-free according to IEC 61249-2-21 definition**
- Wide operation voltage range: 1.6 V to 4.3 V
- Low 0.6 Ω (typical at 2.7 V) on-resistance
- Guaranteed logic high threshold: $V_{th(high)}$ = 1.2 V at V+ = 4.3 V
- - 82 dB crosstalk and - 76 dB off-isolation at 100 kHz
- 250 MHz, - 3 dB bandwidth
- 0.006 % total harmonic distortion
- > 250 mA latch up current per JESD78
- > 8 kV ESD/HBM per MIL-STD 883 (method 3015)
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE

## BENEFITS

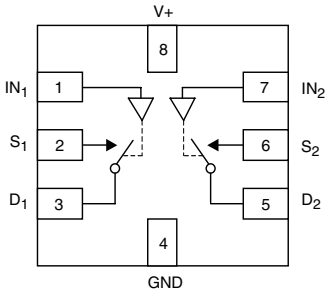
- Ultra small miniQFN-8L package of 1.4 mm x 1.4 mm x 0.55 mm
- High fidelity audio switch
- Reed relay replacement
- Low power consumption

## APPLICATIONS

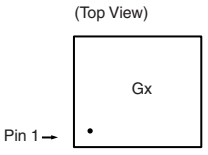
- Cellular phones
- GPS and portable media player
- Audio and video signal routing
- Modems
- Hard drives and computer peripherals
- Low voltage data-acquisition circuits
- Medical and test equipment

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

**DG2727**
**miniQFN-8L**

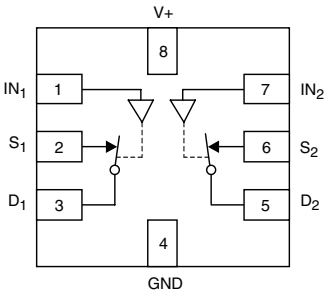



Top View

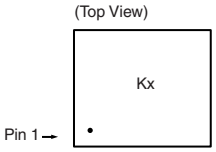



Device Marking: Gx for DG2727
x = Date/Lot Traceability Code

**DG2728**
**miniQFN-8L**

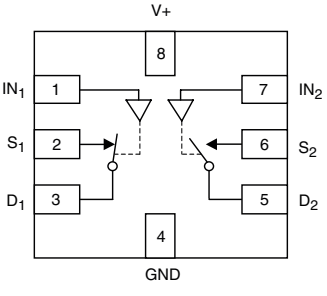



Top View

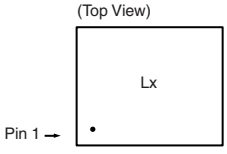



Device Marking: Kx for DG2728
x = Date/Lot Traceability Code

**DG2729**
**miniQFN-8L**




Top View




Device Marking: Lx for DG2729
x = Date/Lot Traceability Code

## TRUTH TABLE

| Logic | DG2727 | | DG2728 | | DG2729 | |
|---|---|---|---|---|---|---|
| | $S_1$ and $D_1$ | $S_2$ and $D_2$ | $S_1$ and $D_1$ | $D_2$ and $D_2$ | $S_1$ and $D_1$ | $S_2$ and $D_2$ |
| Low | OFF | OFF | ON | ON | ON | OFF |
| High | ON | ON | OFF | OFF | OFF | ON |

## ORDERING INFORMATION

| Temp. Range | Package | Part Number |
|---|---|---|
| - 40 °C to 85°C | miniQFN-8L | DG2727DN-T1-E4<br>DG2728DN-T1-E4<br>DG2729DN-T1-E4 |

## ABSOLUTE MAXIMUM RATINGS $T_A$ = 25 °C, unless otherwise noted

| Parameter | | Limit | Unit |
|---|---|---|---|
| Reference to GND | V+ | - 0.3 to 5.0 | V |
| | IN, D, S[a] | - 0.3 to (V+ + 0.3) | |
| Current (Any terminal except S or D) | | 30 | mA |
| Continuous Current (S or D) | | ± 300 | |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) | | ± 500 | |
| Storage Temperature (D Suffix) | | - 65 to 150 | °C |
| Power Dissipation (Packages)[b] | miniQFN-8L[c] | 190 | mW |

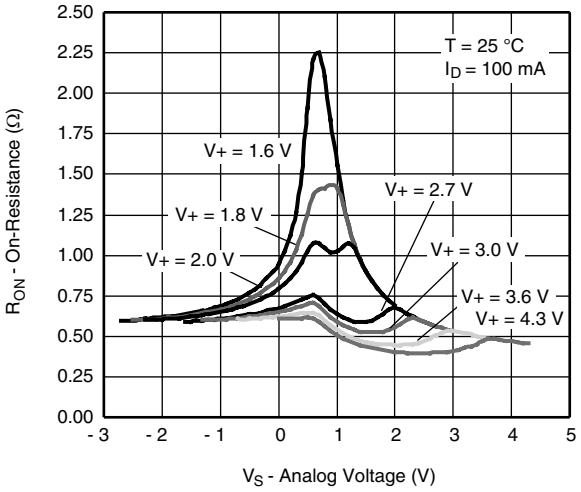
Notes:
a. Signals on S or D or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
b. All leads welded or soldered to PC board.
c. Derate 2.4 mW/°C above 70 °C.

| **SPECIFICATIONS** V+ = 3 V | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions Unless Otherwise Specified** V+ = 3 V, ± 10 %, $V_{IN}$ = 0.4 V or 1.2 V[e] | **Temp.[a]** | **Limits** - 40 °C to 85 °C **Min.[b]** | **Typ.[c]** | **Max.[b]** | **Unit** |
| **Analog Switch** | | | | | | | |
| Analog Signal Range[d] | $V_{analog}$ | | Full | V+ - 4.3 V | | V+ | V |
| On-Resistance | $R_{ON}$ | V+ = 2.7 V, $I_D$ = 100 mA, $V_S$ = - 1.6 V, - 1 V, 0 V, 2 V, 2.7 V | Room | | 0.65 | 1.0 | Ω |
| | | | Full | | | 1.15 | |
| $R_{ON}$ Match | $\Delta R_{ON}$ | V+ = 2.7 V, $I_D$ = 100 mA, $V_S$ = - 1.6 V, - 1 V, 0 V, 2 V, 2.7 V | Room | | | 0.1 | |
| $R_{ON}$ Resistance Flatness | $R_{ON}$ flatness | V+ = 2.7 V, $I_D$ = 100 mA, $V_S$ = - 1.6 V, - 1 V, 0 V, 2 V, 2.7 V | Room | | 0.2 | 0.3 | |
| Switch Off Leakage Current | $I_{S(off)}$ | V+ = 2.7 V, $V_S$ = - 1.8 V, 2.4 V $V_D$ = 0 V | Room | - 100 | | 100 | nA |
| | | | Full | - 500 | | 500 | |
| | $I_{D(off)}$ | | Room | - 100 | | 100 | |
| | | | Full | - 500 | | 500 | |
| Channel-On Leakage Current | $I_{D(on)}$ | V+ = 2.7 V, $V_S$ = $V_D$ = - 1.8 V, 2.4 V | Room | - 100 | | 100 | |
| | | | Full | - 500 | | 500 | |
| **Digital Control** | | | | | | | |
| High Level Input Voltage | $V_{INH}$ | V+ = 1.6 V to 2.6 V | Full | 1.0 | | | V |
| | | V+ = 2.7 V to 4.3 V | | 1.2 | | | |
| Low Level Input Voltage | $V_{INL}$ | V+ = 1.6 V to 2.6 V | | | | 0.3 | |
| | | V+ = 2.7 V to 4.3 V | | | | 0.4 | |
| Input Current | $I_{INL}$ or $I_{INH}$ | $V_{IN}$ = 0 or V+ | | - 1 | | 1 | µA |
| **Dynamic Characteristics** | | | | | | | |
| Turn-On Time | $t_{ON}$ | V+ = 1.6 V to 4.3 V, $V_S$ = 1.5 V, $R_L$ = 50 Ω, $C_L$ = 35 pF | Room | | 38 | 67 | ns |
| | | | Full | | | 72 | |
| Turn-Off Time | $t_{OFF}$ | | Room | | 14 | 40 | |
| | | | Full | | | 42 | |
| Break-Before-Make Time (DG2729 only) | $t_{BBM}$ | | Full | 2 | 14 | | ns |
| Charge Injection[d] | Q | $C_L$ = 1 nF, $R_{GEN}$ = 0 Ω, $V_{GEN}$ = 0 V | Room | | 1.2 | | pC |
| Off-Isolation[d] | $O_{IRR}$ | $R_L$ = 50 Ω, $C_L$ = 5 pF, f = 1 MHz | Room | | - 58 | | dB |
| | | $R_L$ = 50 Ω, $C_L$ = 5 pF, f = 100 kHz | | | - 76 | | |
| Crosstalk[d] | $X_{TALK}$ | $R_L$ = 50 Ω, $C_L$ = 5 pF, f = 1 MHz | | | - 64 | | |
| | | $R_L$ = 50 Ω, $C_L$ = 5 pF, f = 100 kHz | | | - 82 | | |
| 3 dB Bandwidth[d] | | $R_L$ = 50 Ω, $C_L$ = 5 pF | Room | | 252 | | MHz |
| Total Harmonic Distortion[d] | THD | $R_L$ = 600 Ω, 0.5 Vp-p, f = 20 Hz to 20 kHz | Room | | 0.006 | | % |
| Source Off Capacitance[d] | $C_{S(off)}$ | f = 1 MHz, $V_S$ = 0 V | Room | | 31 | | pF |
| Drain Off Capacitance[d] | $C_{D(off)}$ | f = 1 MHz, $V_D$ = 0 V | Room | | 31 | | |
| Drain On Capacitance[d] | $C_{D(on)}$ | f = 1 MHz, $V_D$ = $V_S$ = 0 V | Room | | 46 | | |
| **Power Supply** | | | | | | | |
| Power Supply Range | V+ | | | 1.6 | | 4.3 | V |
| Power Supply Current | I+ | $V_{IN}$ = 0 or V+ | Full | | | 1.0 | µA |

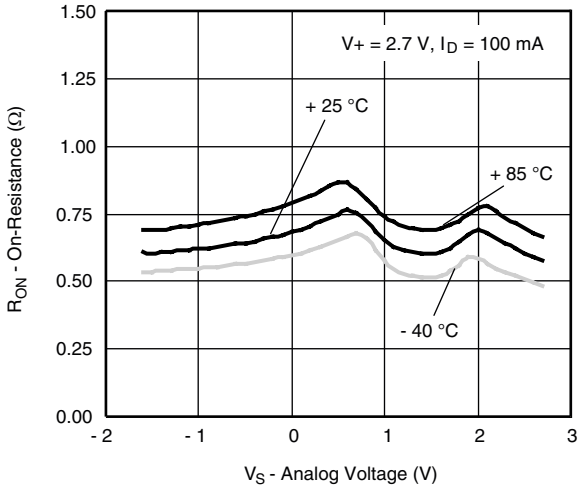
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee by design, not subjected to production test.
e. $V_{IN}$ = input voltage to perform proper function.

*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.*

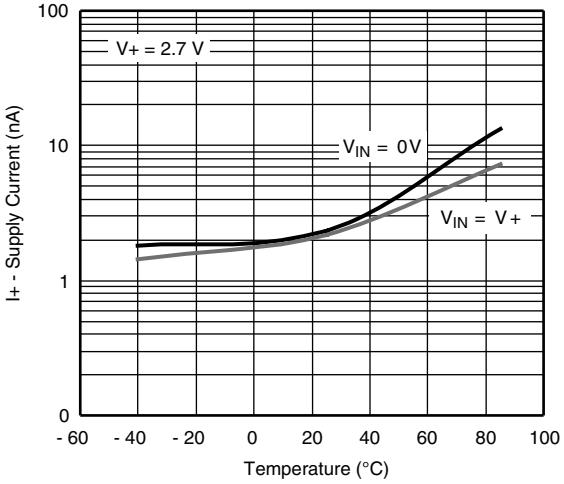
## TYPICAL CHARACTERISTICS $T_A$ = 25 °C, unless otherwise noted



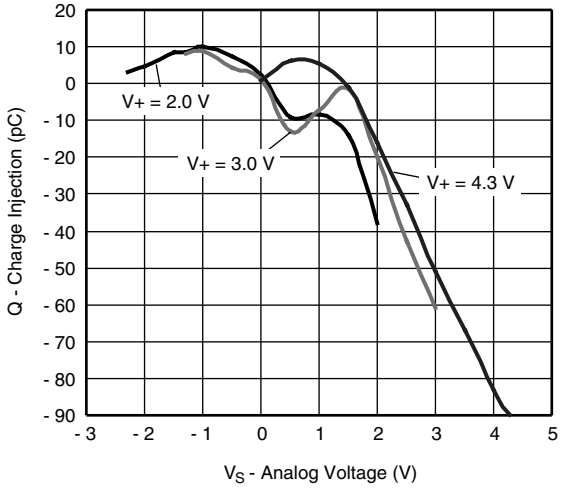

**$R_{DS(ON)}$ vs. Analog Voltage and Supply Voltage**



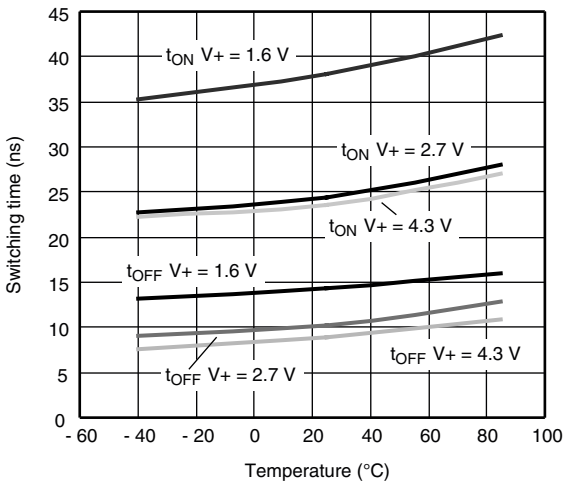

**$R_{DS(ON)}$ vs. Analog Voltage and Temperature**



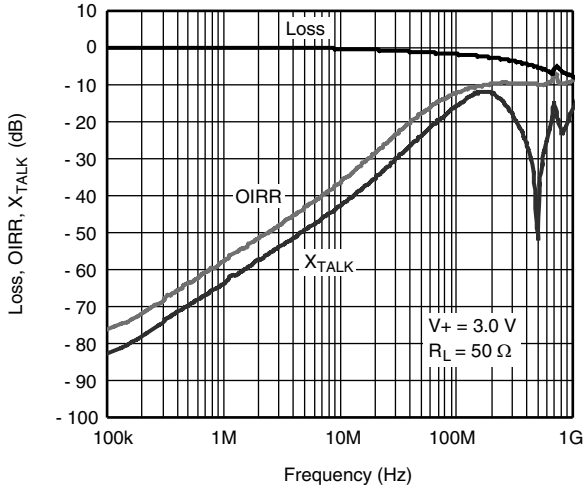

**Supply Current vs. Temperature**




**Charge Injection vs. Analog Voltage**

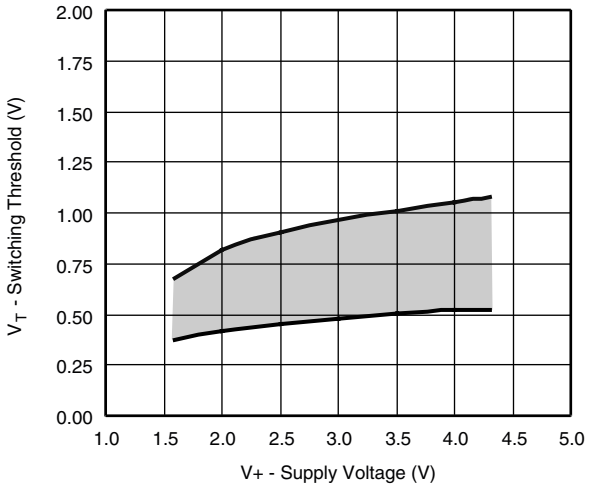



**Switching Time vs. Temperature**

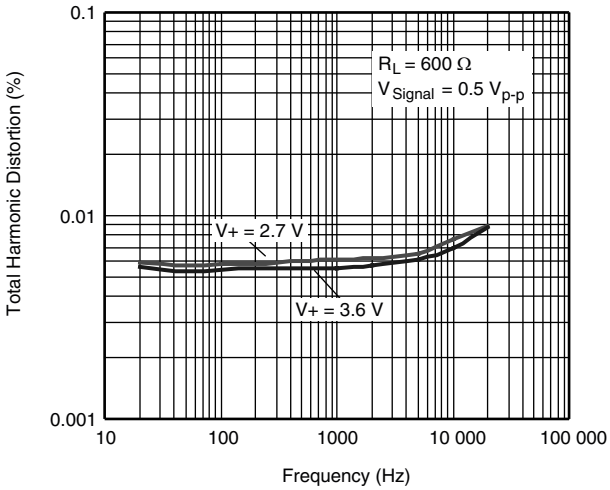



**Insertion Loss, Off-Isolation and Crosstalk vs. Frequency**

## TYPICAL CHARACTERISTICS $T_A$ = 25 °C, unless otherwise noted

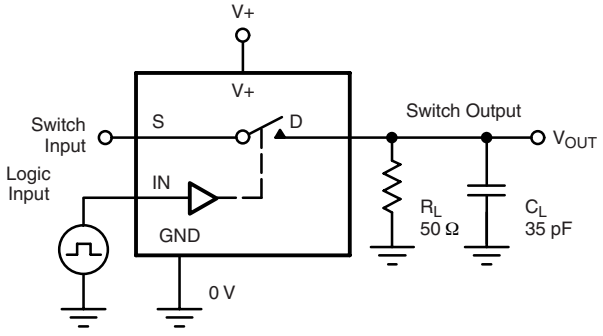



**Switching Threshold vs. Supply Voltage**



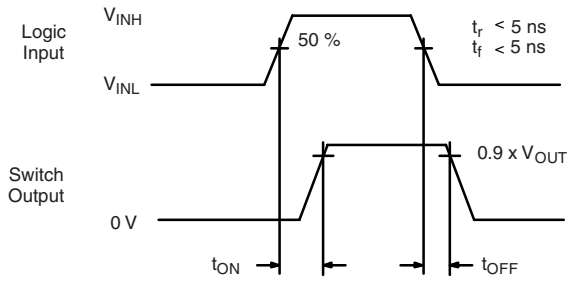

**Total Harmonic Distortion vs. Frequency**

## TEST CIRCUITS



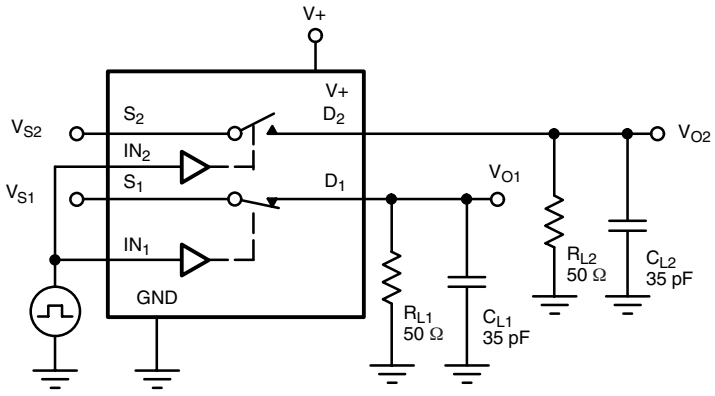

$C_L$ (includes fixture and stray capacitance)

$$V_{OUT} = V_D \left(\frac{R_L}{R_L + R_{ON}}\right)$$




Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

**Figure 1. Switching Time**




$C_L$ (includes fixture and stray capacitance)

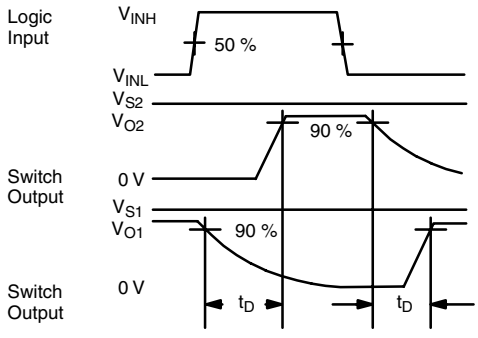



**Figure 2. Break-Before-Make (DG2729)**

## TEST CIRCUITS

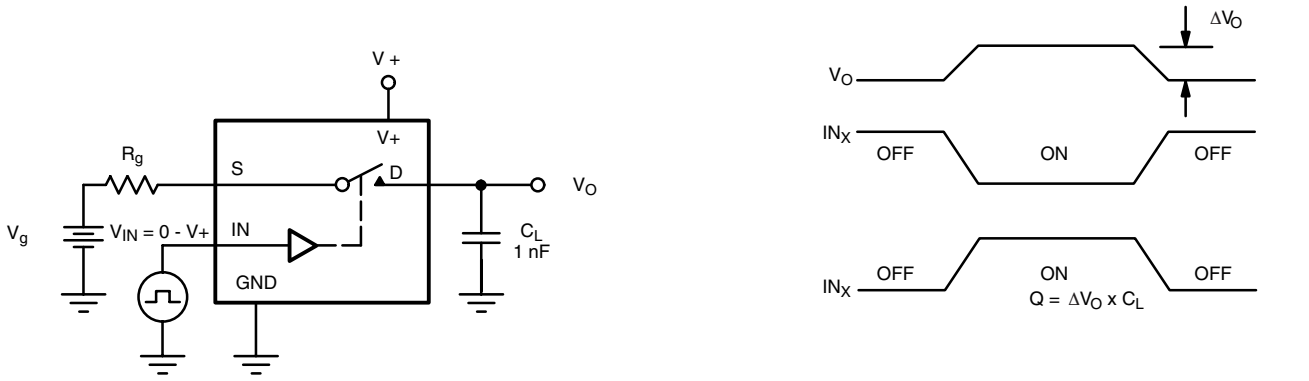



**Figure 3. Charge Injection**

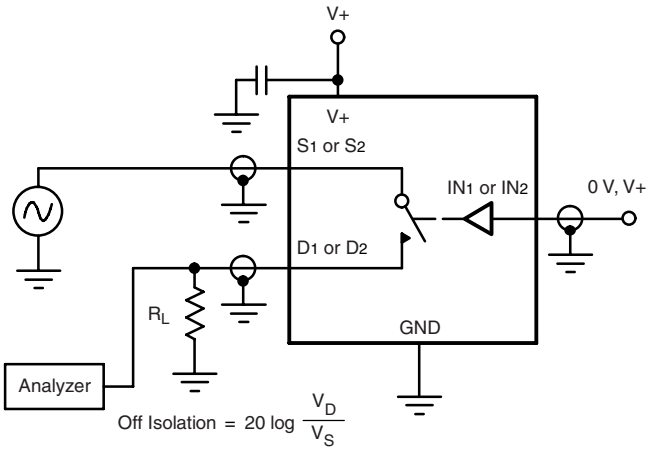



**Figure 4. Off-Isolation**

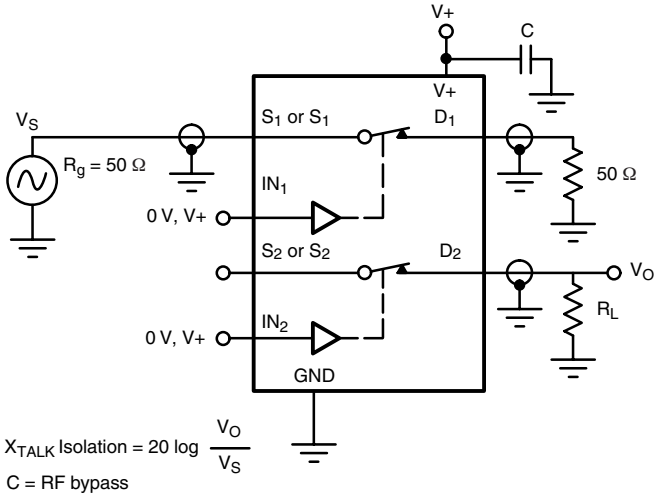



**Figure 5. Crosstalk**

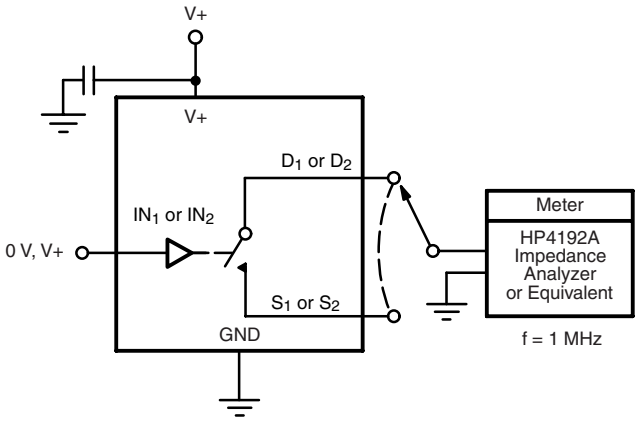
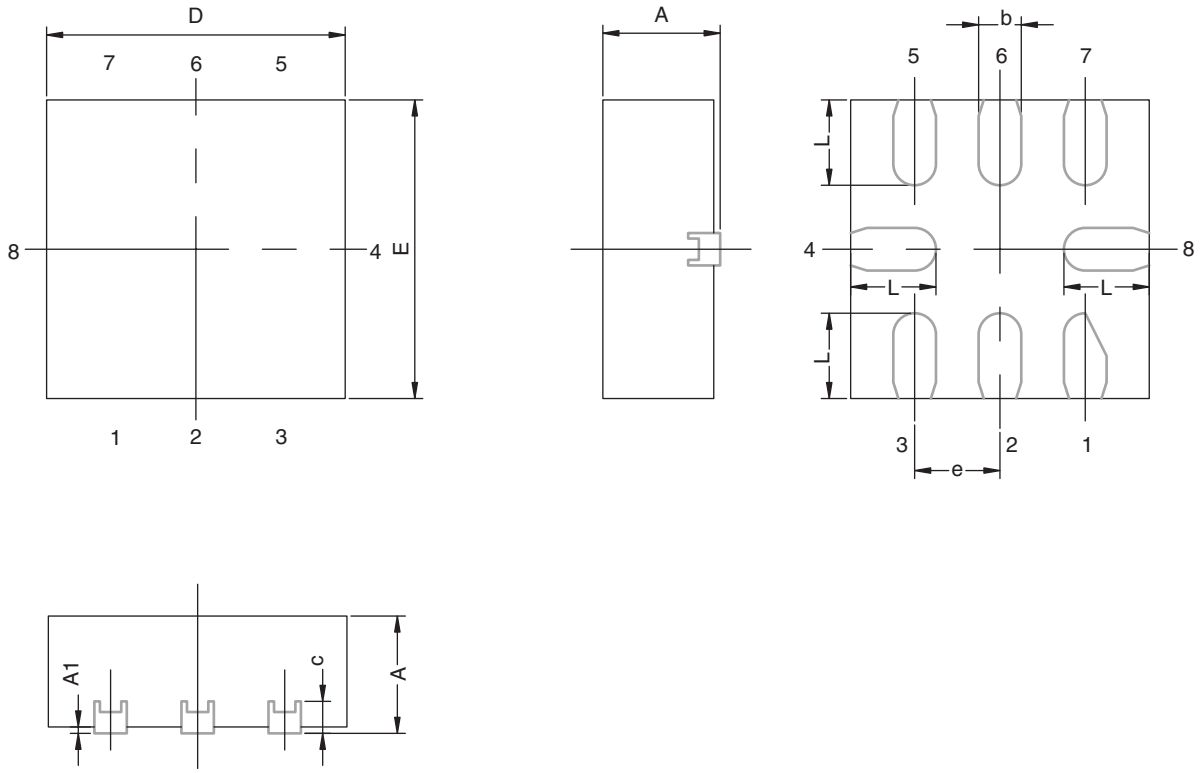



**Figure 6. Channel Off/On Capacitance**

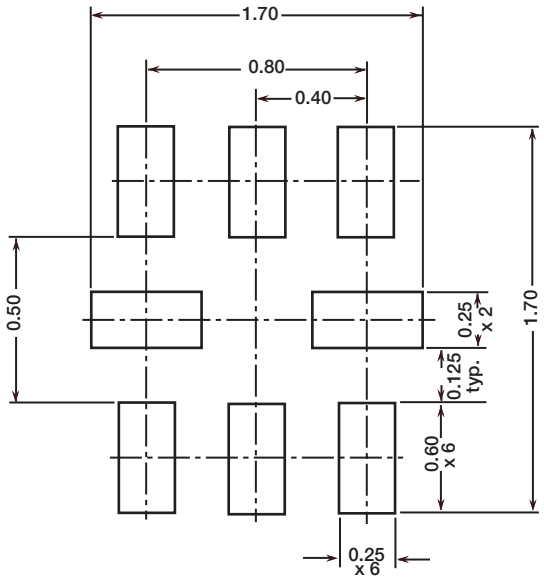
*Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?69049.*

## MINIQFN-8L CASE OUTLINE




| DIM | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.50 | 0.55 | 0.60 | 0.0197 | 0.0217 | 0.0236 |
| A1 | 0.00 | - | 0.05 | 0.000 | - | 0.002 |
| b | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| c | 0.15 REF | | | 0.006 REF | | |
| D | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| E | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| e | 0.40 BSC | | | 0.016 BSC | | |
| L | 0.35 | 0.40 | 0.45 | 0.014 | 0.016 | 0.018 |
| ECN: C-08336-Rev. A, 05-May-08<br>DWG: 5964 | | | | | | |

**RECOMMENDED MINIMUM PADS FOR MINI QFN 8L**




Suggested Minimum Pad
Dimensions in mm

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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**