

0.4-Ω, Low Voltage, Dual SPST Analog Switch

DESCRIPTION

The DG2747, DG2748, and DG2749 are high performance, low on-resistance analog switches of dual SPST configuration.

Built on Vishay Siliconix's sub-micro CMOS technology, the DG2747/2748/2749 achieve switch on-resistance of 0.4 Ω at 2.7 V V₊ and 0.3 Ω at 4.3 V V₊. It provides 0.1 Ω flatness at 2.7 V V₊, and total harmonic distortion to 0.03 % (frequency range 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.

It can switch signals with amplitudes of up to V_{CC} to be transmitted in either direction.

The select pins of the control logic can tolerate voltages above V₊. Logic high is 1.4 V to make 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 DG2747/2748/2749 are ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG2747/2748/2749 come in a small miniQFN8-lead package (1.4 x 1.4 x 0.55 mm). As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations and is 100 % RoHS compliant.

FEATURES

- Wide operation voltage range: 1.6 V to 4.3 V
- Low on-resistance: 0.4 Ω typ. at 2.7 V
- Low voltage logic threshold:
V_{th(high)} = 1.4 V at V₊ = 3 V
- - 100 dB crosstalk
- > 250 mA latch up current per JESD78
- Switch exceeds 7 kV ESD/HBM


RoHS
COMPLIANT

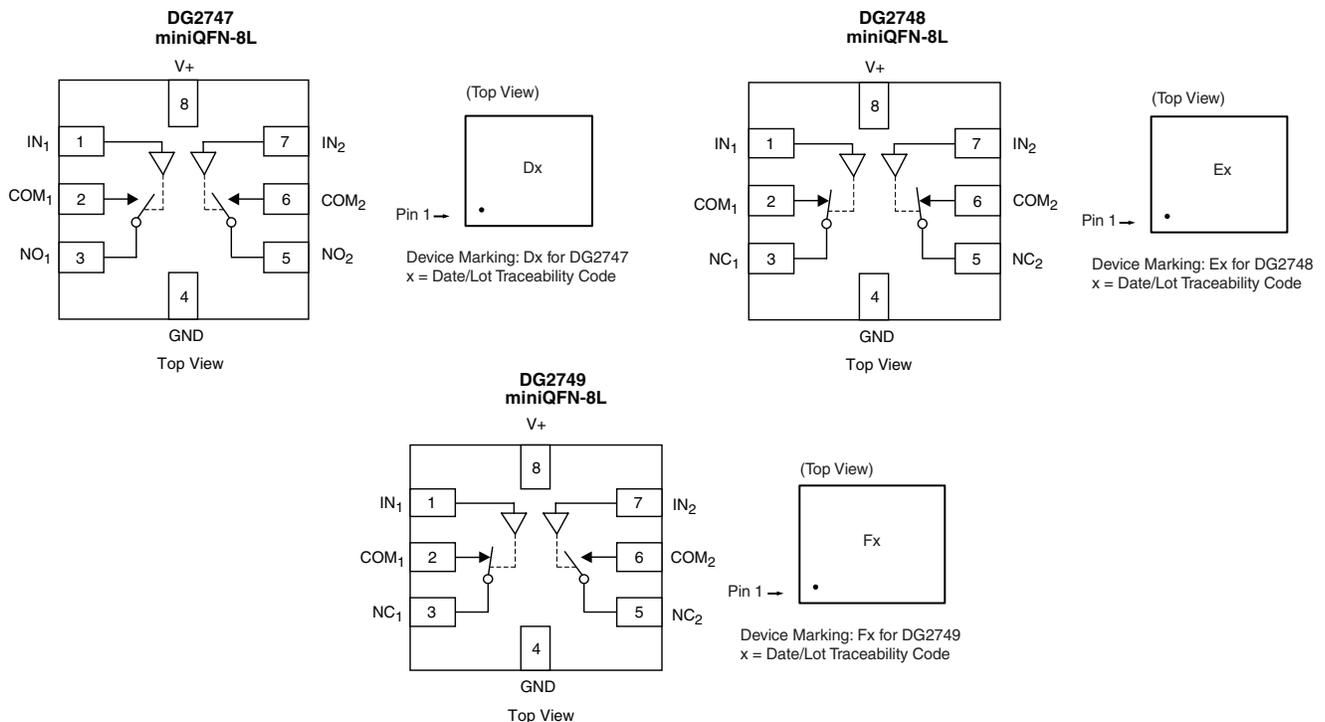
BENEFITS

- Ultra small miniQFN8 package of 1.4 x 1.4 x 0.55 mm
- High fidelity audio switch
- Reed relay replacement
- Low power consumption

APPLICATIONS

- Cellular phones
- Portable media player
- GPS
- PCMCIA cards
- Medical and test equipment

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION





| TRUTH TABLE | | | | | | |
|-------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| Logic | DG2747 | | DG2748 | | DG2749 | |
| | COM ₁ and NO ₁ | COM ₂ and NO ₂ | COM ₁ and NC ₁ | COM ₂ and NC ₂ | COM ₁ and NC ₁ | COM ₂ and NO 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 | DG2747DN-T1-E4 DG2748DN-T1-E4 DG2749DN-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, COM, NC, NO ^a | - 0.3 to (V+ + 0.3) | |
| Current (Any terminal except NO, NC or COM) | | 30 | mA |
| Continuous Current (NO, NC, or COM) | | ± 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 NC, NO, or COM 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.



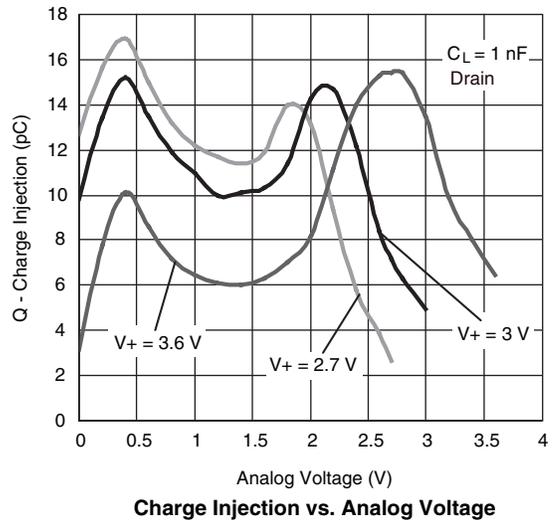
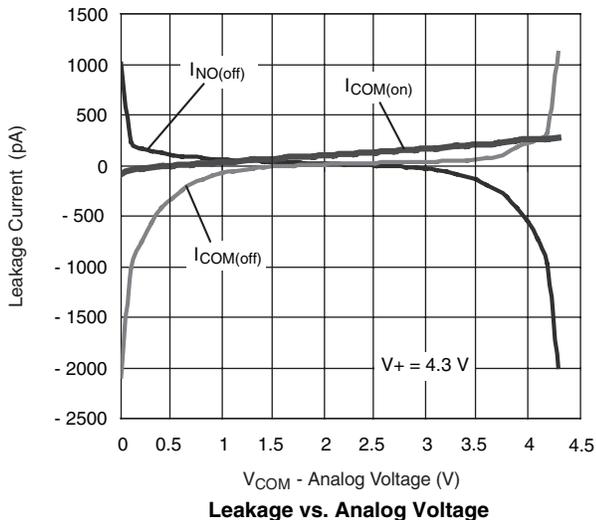
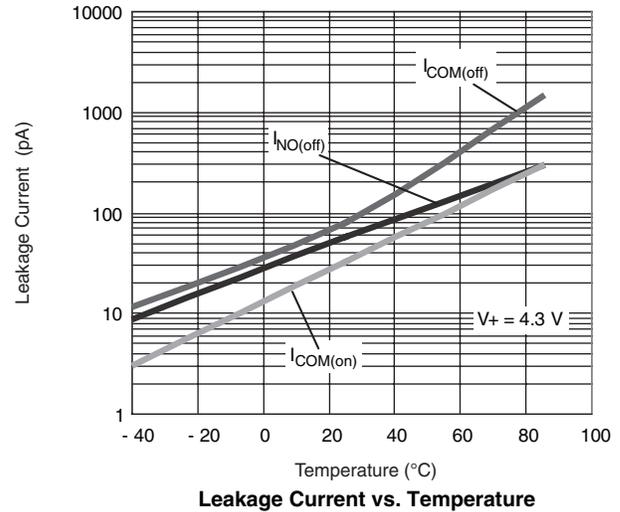
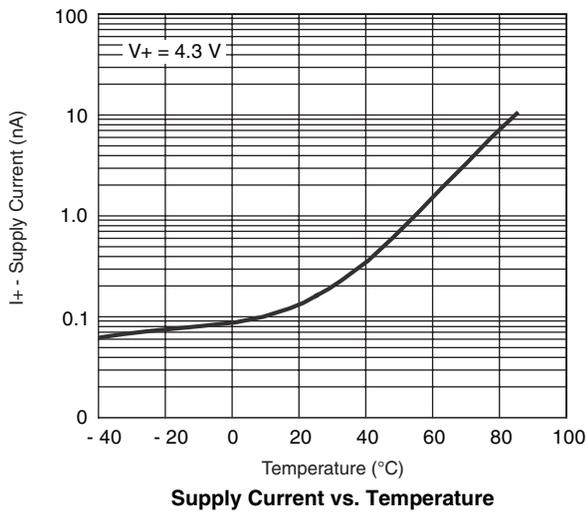
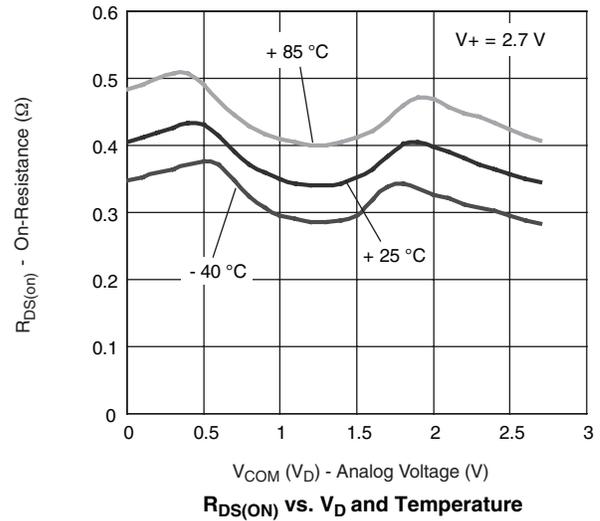
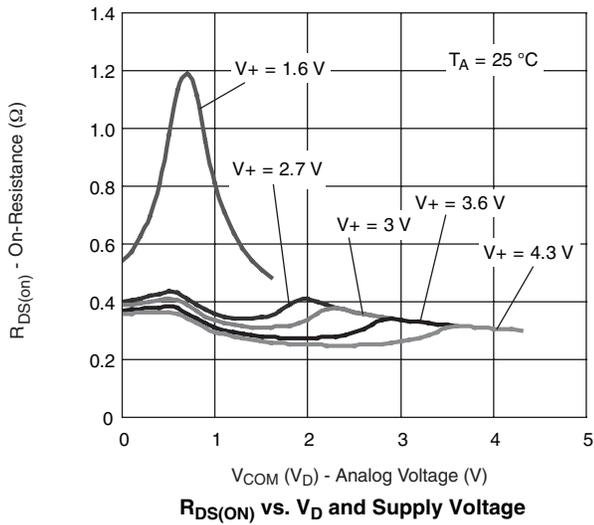
| SPECIFICATIONS $V_+ = 3\text{ V}$ | | | | | | | | | |
|--|--------------------------------------|---|--|-------------------------|-------------------|-------------------|---------------|---|----|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_+ = 3\text{ V}, \pm 10\%, V_{IN} = 0.4\text{ V}$ or 1.4 V^e | Temp. ^a | Limits - 40 to 85 °C | | | Unit | | |
| | | | | Min. ^b | Typ. ^c | Max. ^b | | | |
| Analog Switch | | | | | | | | | |
| Analog Signal Range ^d | V_{analog} | $R_{\text{DS(on)}}$ | Full | 0 | | V_+ | V | | |
| On-Resistance | $R_{\text{DS(on)}}$ | $V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}$ | Room | | 0.4 | 0.6 | Ω | | |
| | | $V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 1.5\text{ V}$ | | | | | | | |
| | | $V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}$ | Full | | | 0.7 | | | |
| | | $V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 1.5\text{ V}$ | | | | | | | |
| R_{ON} Match ^d | ΔR_{ON} | $V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}, 1.5\text{ V}$ | Room | | | 0.03 | | | |
| R_{ON} Resistance Flatness ^d | R_{ON} flatness | $V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}, 1.5\text{ V}$ | Room | | 0.1 | 0.2 | | | |
| Switch Off Leakage Current | $I_{\text{NO/NC(off)}}$ | $V_+ = 4.3\text{ V}, V_{\text{NO/NC}} = 1.0\text{ V}/3.3\text{ V}, V_{\text{COM}} = 3.3\text{ V}/1.0\text{ V}$ | Room | - 2 | | 2 | nA | | |
| | | | Full | - 10 | | 10 | | | |
| | Room | | - 2 | | 2 | | | | |
| | Full | | - 10 | | 10 | | | | |
| Channel-On Leakage Current | $I_{\text{COM(on)}}$ | $V_+ = 4.3\text{ V}, V_{\text{NO/NC}} = V_{\text{COM}} = 3.3\text{ V}/1.0\text{ V}$ | Room | - 2 | | 2 | | | |
| | | | Full | - 10 | | 10 | | | |
| Digital Control | | | | | | | | | |
| Input High Voltage | V_{INH} | | | Full | 1.4 | | | V | |
| Input Low Voltage | V_{INL} | | Full | | | 0.4 | | | |
| Input Current | I_{INL} or I_{INH} | $V_{\text{IN}} = 0$ or V_+ | Full | - 1 | | 1 | μA | | |
| Dynamic Characteristics | | | | | | | | | |
| Turn-On Time ^e | t_{ON} | $V_+ = 2.7\text{ V}$ to $3.6\text{ V}, V_{\text{NO}}$ or $V_{\text{NC}} = 1.5\text{ V}, R_L = 50\ \Omega, C_L = 35\text{ pF}$ | Room | | 14 | 25 | ns | | |
| | | | Full | | | 27 | | | |
| Turn-Off Time ^e | t_{OFF} | | Room | | 12 | 25 | | | |
| | | | Full | | | 27 | | | |
| Charge Injection ^d | Q | | $C_L = 1\text{ nF}, R_{\text{GEN}} = 0\ \Omega, V_{\text{GEN}} = 0\text{ V}$ | Room | | 10 | | | pC |
| Off-Isolation ^d | O_{IRR} | | $R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 1\text{ MHz}$ | Room | | - 52 | | | dB |
| | | $R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 100\text{ kHz}$ | | | - 72 | | | | |
| Crosstalk ^d | X_{TALK} | $R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 1\text{ MHz}$ | | | - 80 | | | | |
| | | $R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 100\text{ kHz}$ | | | - 100 | | | | |
| 3 dB bandwidth ^d | | $R_L = 50\ \Omega, C_L = 5\text{ pF}$ | Room | | 78 | | MHz | | |
| Source Off Capacitance ^d | $C_{\text{NX(off)}}$ | $f = 1\text{ MHz}, V_{\text{NX}} = 0\text{ V}$ | Room | | 75 | | pF | | |
| Drain Off Capacitance ^d | $C_{\text{COM(off)}}$ | $f = 1\text{ MHz}, V_{\text{COM}} = 0\text{ V}$ | Room | | 55 | | | | |
| Drain On Capacitance ^d | $C_{\text{COM(on)}}$ | $f = 1\text{ MHz}, V_{\text{COM}} = V_{\text{NX}} = 0\text{ V}$ | Room | | 100 | | | | |
| Total Harmonic Distortion ^d | THD | $V_+ = 2.7\text{ V}$ to $3.6\text{ V}, V_{\text{IN}} = 0.5\text{ Vp-p}$ $F = 20\text{ Hz}$ to 20 kHz | Room | | 0.03 | | % | | |
| Power Supply | | | | | | | | | |
| Power Supply Range | V_+ | | | 1.6 | | 4.3 | V | | |
| Power Supply Current | I_+ | $V_{\text{IN}} = 0$ or V_+ | Full | | | 1.0 | μA | | |

Notes:

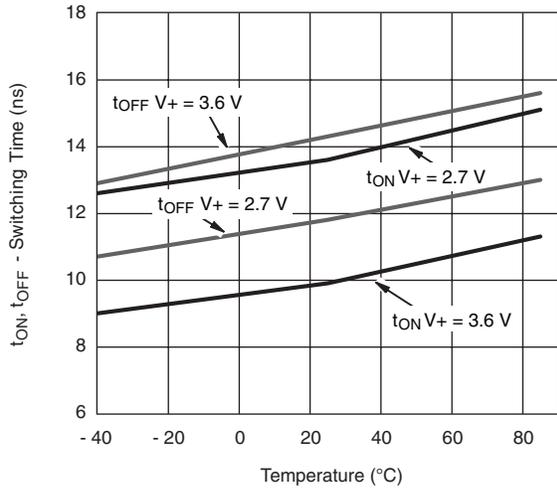
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d. 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.

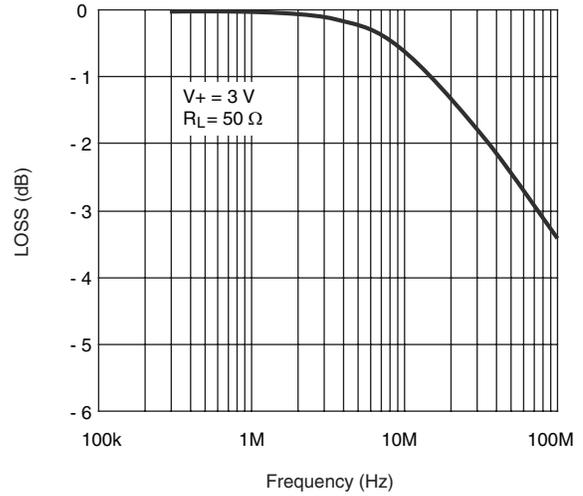
TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



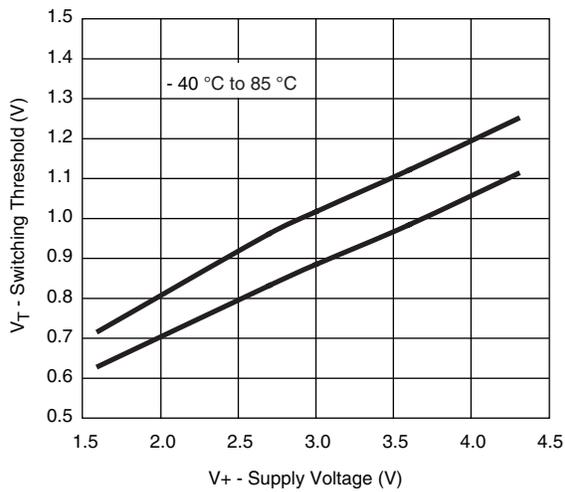
TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



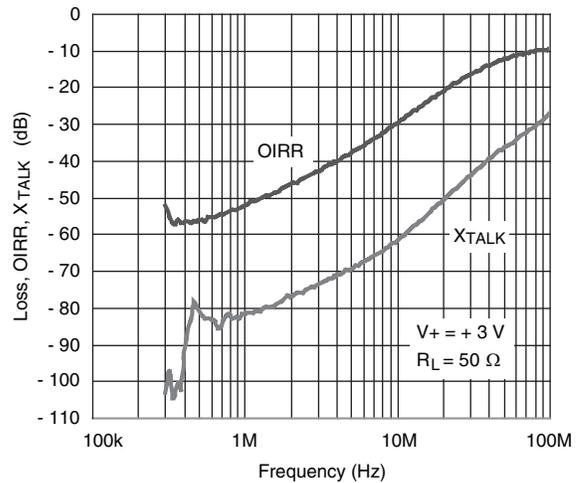
Switching Time vs. Temperature



Insertion Loss vs. Frequency

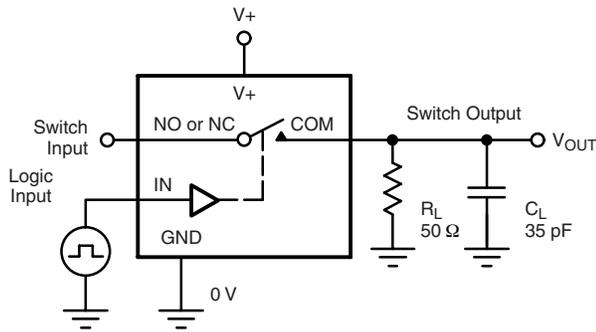


Switching Threshold vs. Supply Voltage



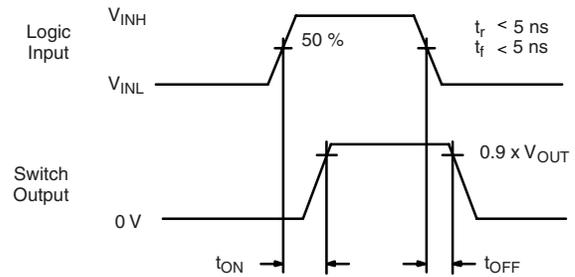
Off-Isolation and Crosstalk vs. Frequency

TEST CIRCUITS



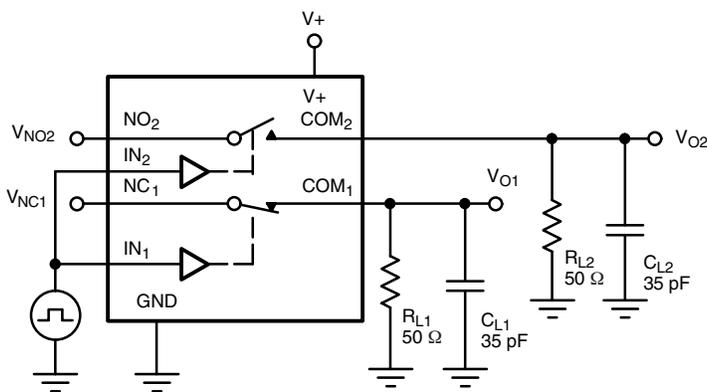
C_L (includes fixture and stray capacitance)

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



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)

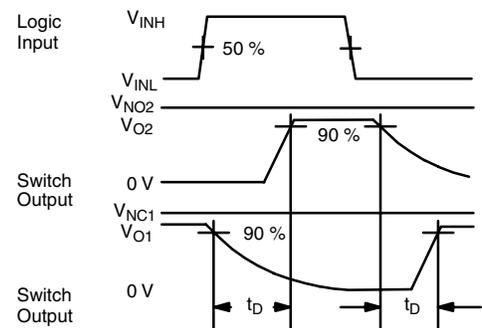


Figure 2. Break-Before-Make (DG2749)

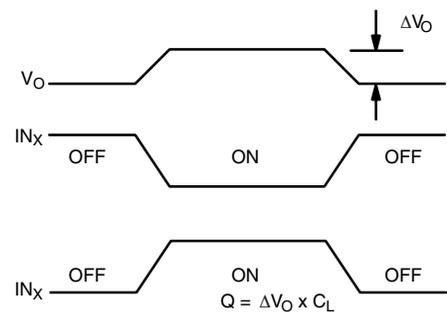
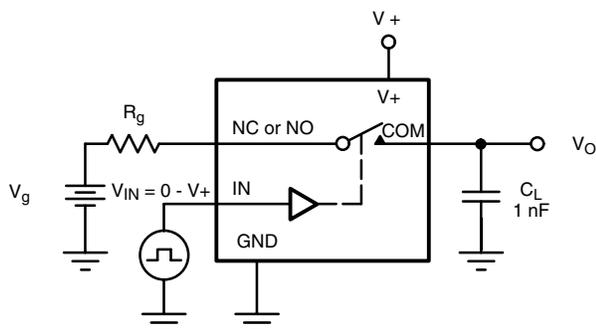


Figure 3. Charge Injection

TEST CIRCUITS

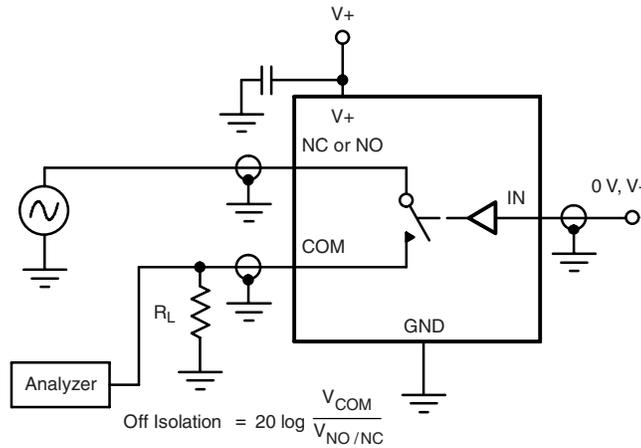


Figure 4. Off-Isolation

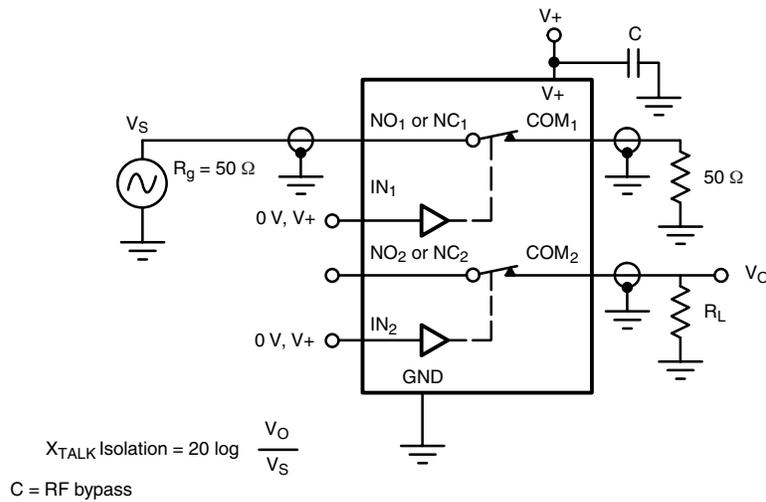


Figure 5. Crosstalk

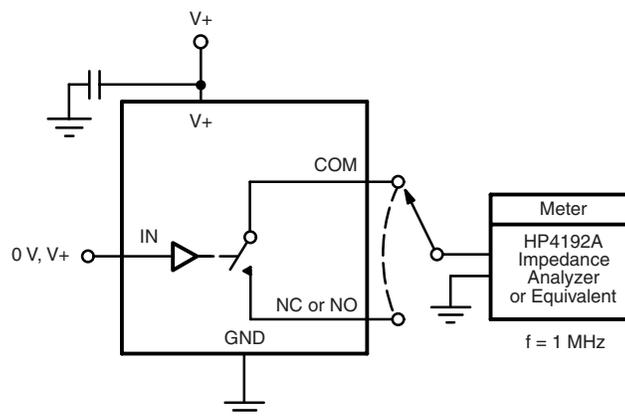


Figure 6. Channel Off/On Capacitance

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