

## 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, DG2748, DG2749 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 93 MHz.

It can switch signals with amplitudes of up to V<sub>CC</sub> 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, 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-8 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<sub>th(high)</sub> = 1.4 V at V+ = 3 V
- - 100 dB crosstalk at 100 kHz
- > 250 mA latch up current per JESD78
- Switch exceeds 7 kV ESD/HBM


**RoHS**  
COMPLIANT

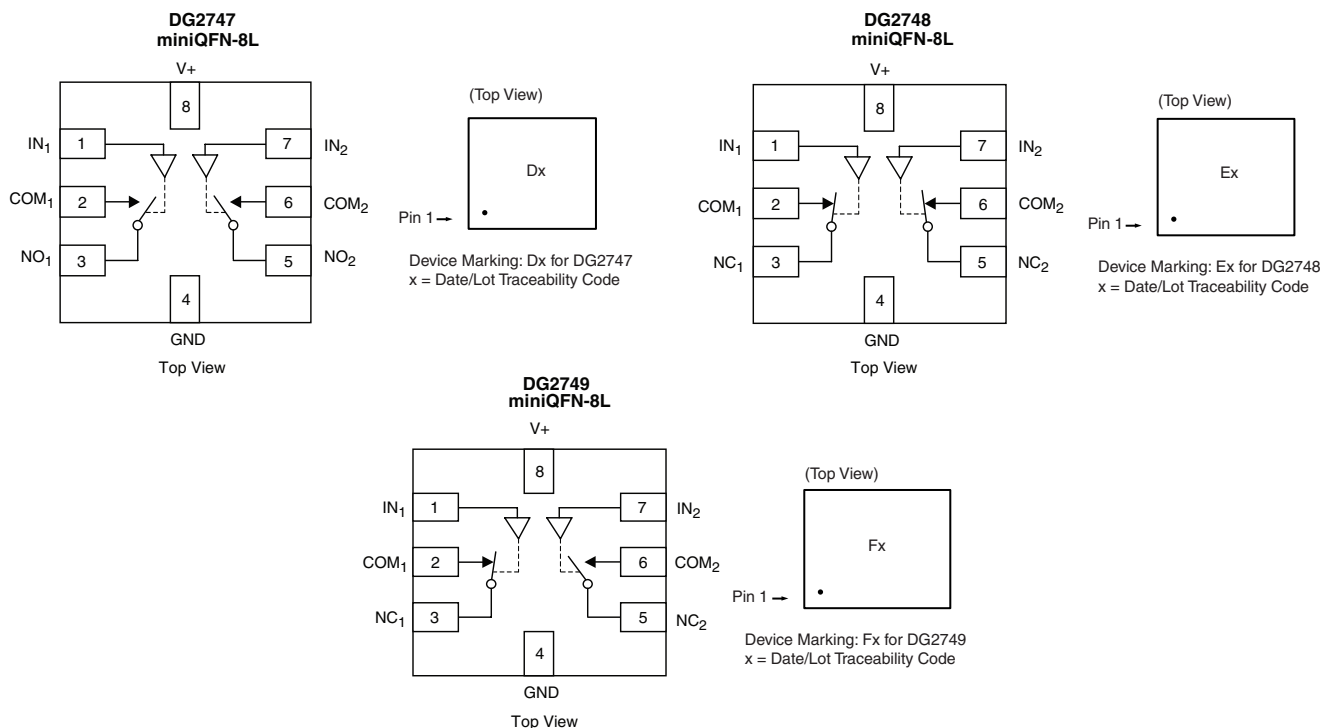
### BENEFITS

- 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 <sub>1</sub> and NO <sub>1</sub>	COM <sub>2</sub> and NO <sub>2</sub>	COM <sub>1</sub> and NC <sub>1</sub>	COM <sub>2</sub> and NC <sub>2</sub>	COM <sub>1</sub> and NC <sub>1</sub>	COM <sub>2</sub> and NO <sub>2</sub>
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 $T_A = 25\text{ °C}$ , unless otherwise noted			
Parameter		Limit	Unit
Reference to GND	V+	- 0.3 to 5.0	V
	IN, COM, NC, NO <sup>a</sup>	- 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) <sup>b</sup>	miniQFN-8L <sup>c</sup>	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.



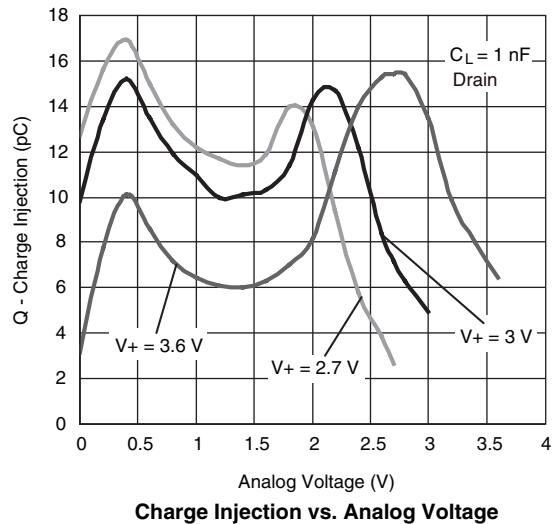
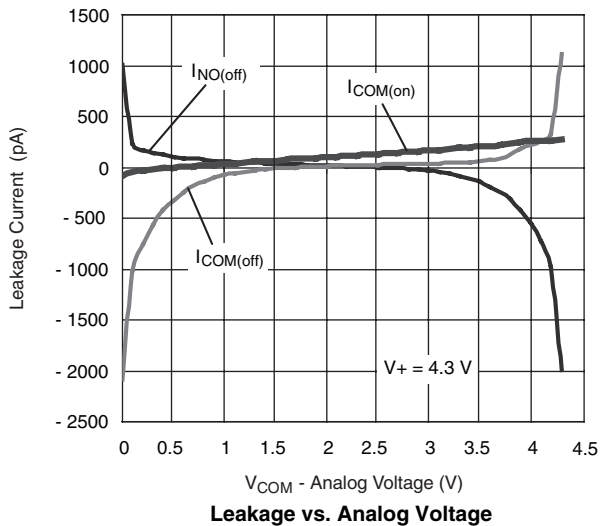
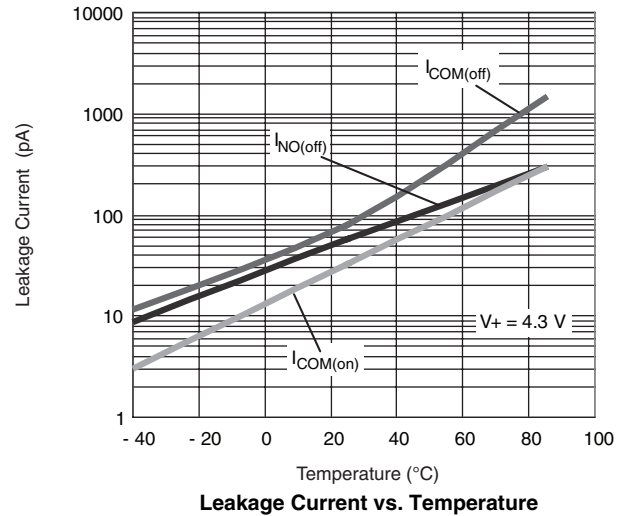
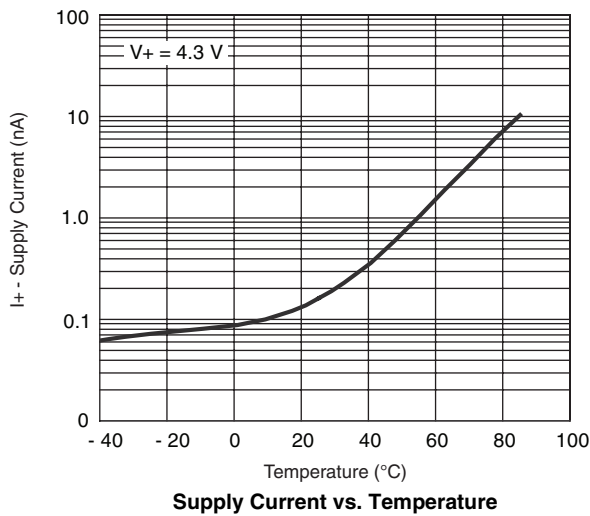
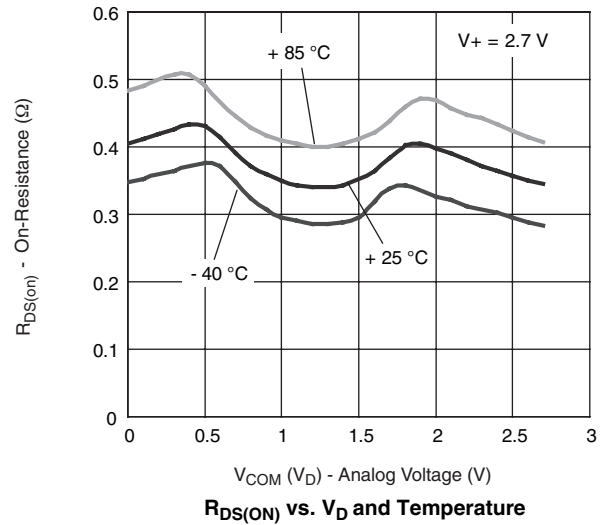
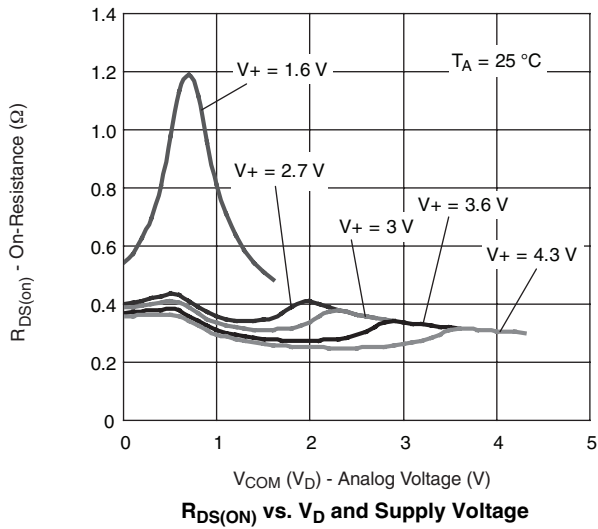
SPECIFICATIONS $V_+ = 3\text{ V}$									
Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 3\text{ V}, \pm 10\%, V_{IN} = 0.4\text{ V}$ or $1.4\text{ V}^e$	Temp. <sup>a</sup>	Limits - 40 °C to 85 °C			Unit		
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>			
<b>Analog Switch</b>									
Analog Signal Range <sup>d</sup>	$V_{\text{analog}}$	$R_{\text{DS(on)}}$	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	$\Omega$		
		$V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 1.5\text{ V}$							
		$V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}$	Full			0.7			
		$V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 1.5\text{ V}$							
$R_{\text{ON}}$ Match <sup>d</sup>	$\Delta R_{\text{ON}}$	$V_+ = 2.7\text{ V}, I_{\text{NO/NC}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}, 1.5\text{ V}$	Room			0.03			
$R_{\text{ON}}$ Resistance Flatness <sup>d</sup>	$R_{\text{ON}}$ 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			
<b>Digital Control</b>									
Input High Voltage	$V_{\text{INH}}$			Full	1.4			V	
Input Low Voltage	$V_{\text{INL}}$		Full			0.4			
Input Current	$I_{\text{INL}}$ or $I_{\text{INH}}$	$V_{\text{IN}} = 0$ or $V_+$	Full	- 1		1	$\mu\text{A}$		
<b>Dynamic Characteristics</b>									
Turn-On Time <sup>e</sup>	$t_{\text{ON}}$	$V_+ = 2.7\text{ V}$ 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 <sup>e</sup>	$t_{\text{OFF}}$		Room		12	25			
			Full			27			
Charge Injection <sup>d</sup>	Q		$C_L = 1\text{ nF}, R_{\text{GEN}} = 0\ \Omega, V_{\text{GEN}} = 0\text{ V}$	Room		10			pC
Off-Isolation <sup>d</sup>	$O_{\text{IRR}}$		$R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 1\text{ MHz}$	Room		- 52			dB
		$R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 100\text{ kHz}$			- 72				
Crosstalk <sup>d</sup>	$X_{\text{TALK}}$	$R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 1\text{ MHz}$			- 90				
		$R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 100\text{ kHz}$			- 100				
3 dB bandwidth <sup>d</sup>		$R_L = 50\ \Omega, C_L = 5\text{ pF}$	Room		93		MHz		
Source Off Capacitance <sup>d</sup>	$C_{\text{NX(off)}}$	$f = 1\text{ MHz}, V_{\text{NX}} = 0\text{ V}$	Room		75		pF		
Drain Off Capacitance <sup>d</sup>	$C_{\text{COM(off)}}$	$f = 1\text{ MHz}, V_{\text{COM}} = 0\text{ V}$	Room		55				
Drain On Capacitance <sup>d</sup>	$C_{\text{COM(on)}}$	$f = 1\text{ MHz}, V_{\text{COM}} = V_{\text{NX}} = 0\text{ V}$	Room		100				
Total Harmonic Distortion <sup>d</sup>	THD	$V_+ = 2.7\text{ V}$ to $3.6\text{ V}, V_{\text{IN}} = 0.5\text{ Vp-p}$ $f = 20\text{ Hz}$ to $20\text{ kHz}$	Room		0.03		%		
<b>Power Supply</b>									
Power Supply Range	$V_+$			1.6		4.3	V		
Power Supply Current	$I_+$	$V_{\text{IN}} = 0$ or $V_+$	Full			1.0	$\mu\text{A}$		

Notes:

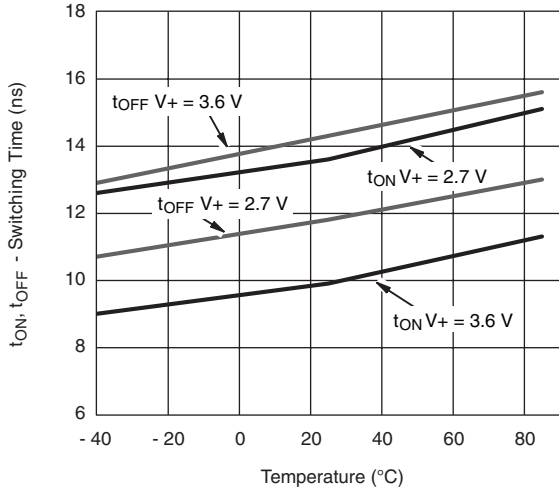
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d.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

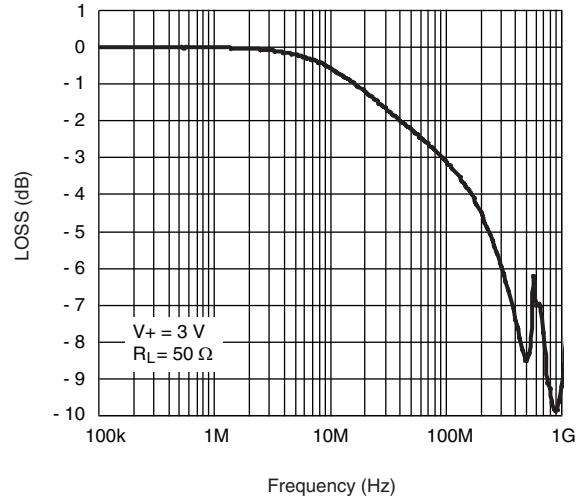
### TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



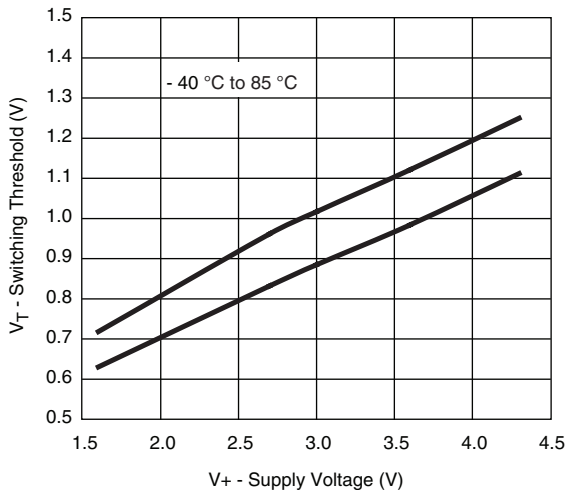
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



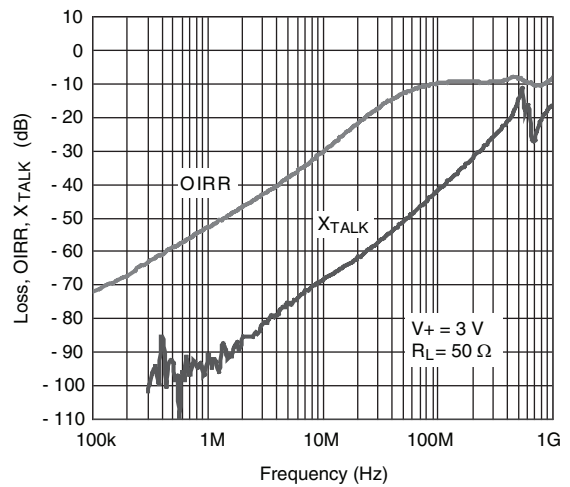
**Switching Time vs. Temperature**



**Insertion Loss vs. Frequency**

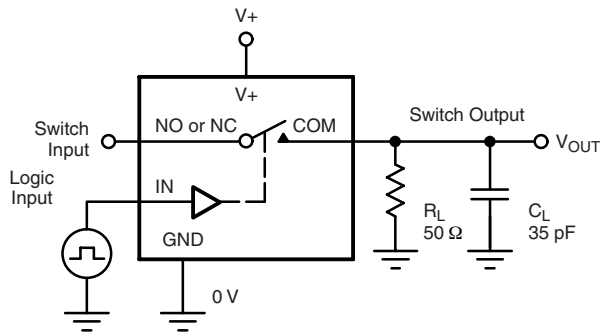


**Switching Threshold vs. Supply Voltage**



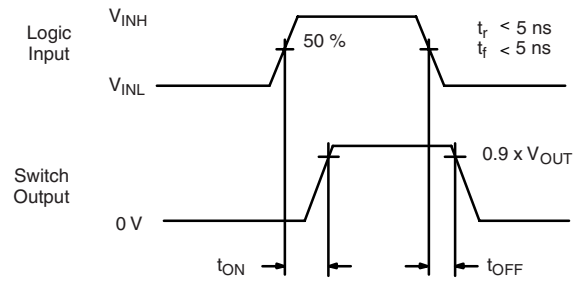
**Off-Isolation and Crosstalk vs. Frequency**

**TEST CIRCUITS**



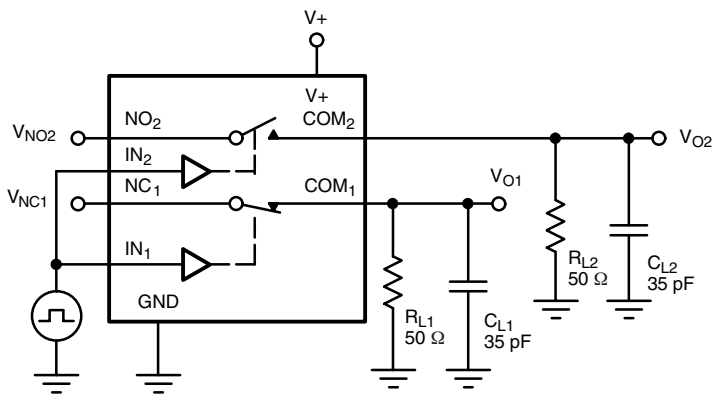
$C_L$  (includes fixture and stray capacitance)

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

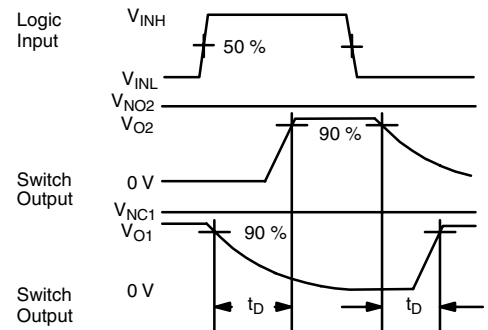


Logic "1" = Switch On  
Logic input waveforms inverted for switches that have the opposite logic sense.

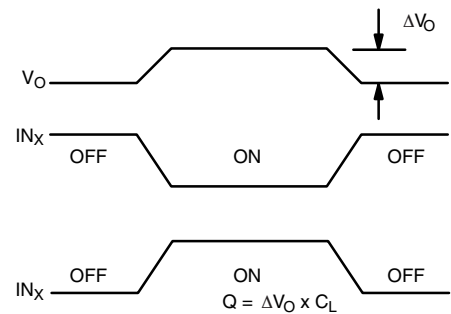
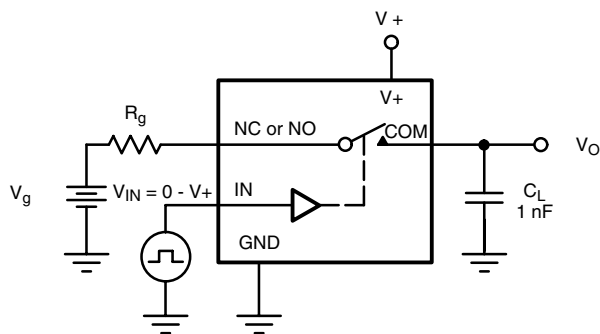
**Figure 1. Switching Time**



$C_L$  (includes fixture and stray capacitance)



**Figure 2. Break-Before-Make (DG2749)**



**Figure 3. Charge Injection**

TEST CIRCUITS

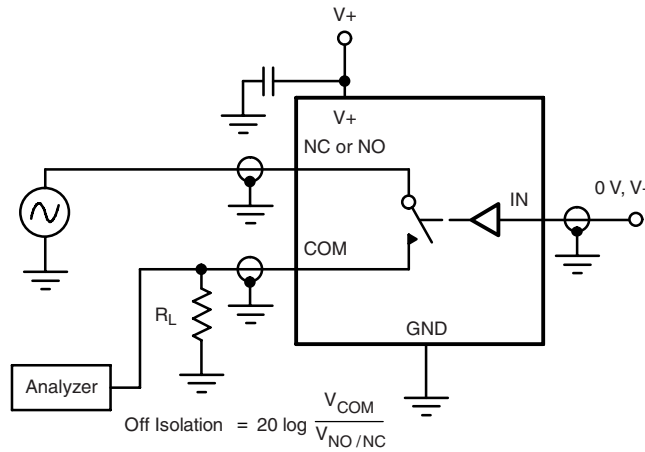


Figure 4. Off-Isolation

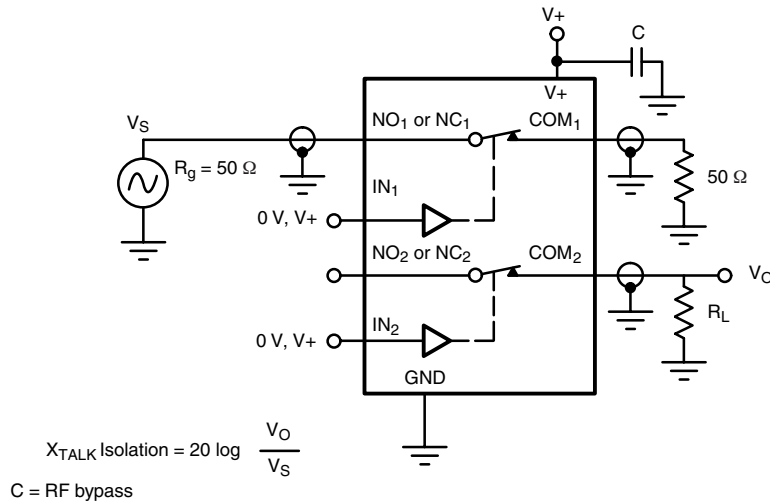


Figure 5. Crosstalk

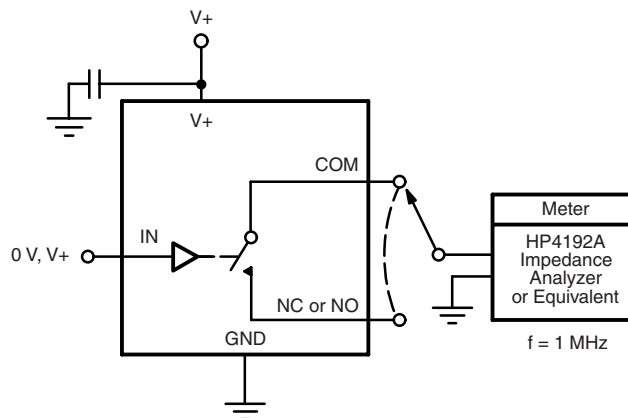
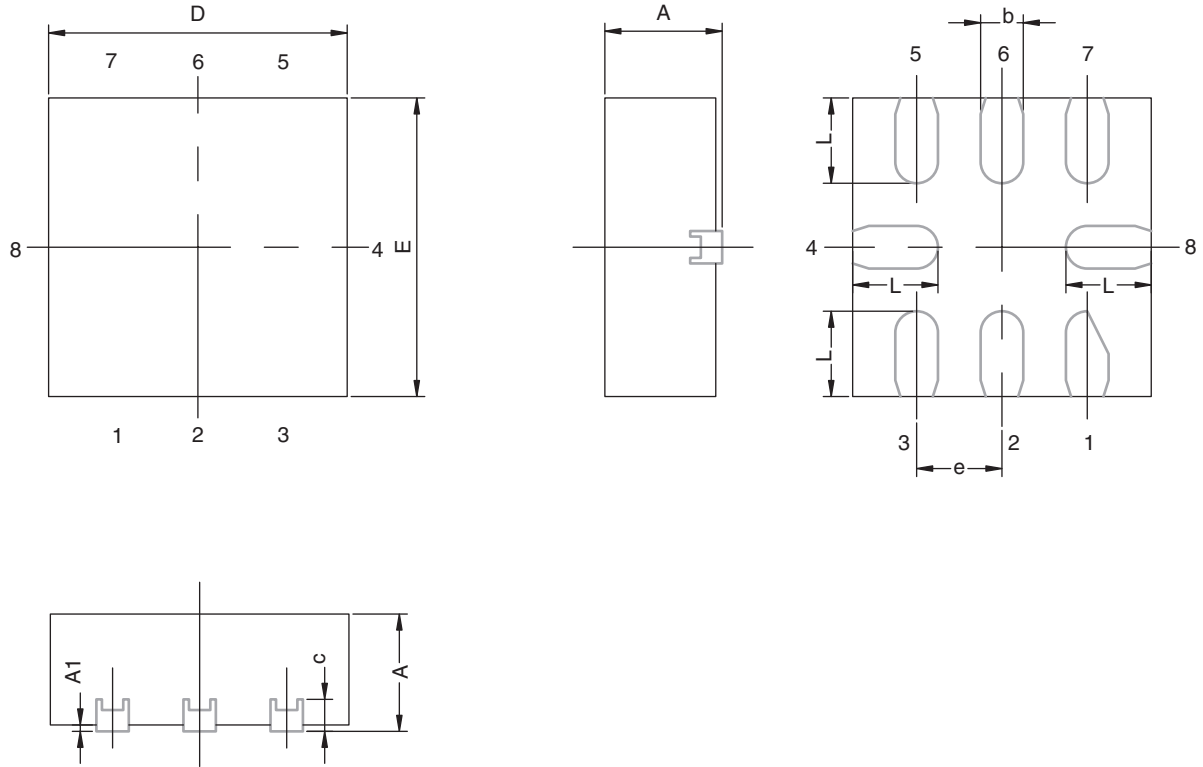


Figure 6. Channel Off/On Capacitance

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## 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						
DWG: 5964						





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