

## Low Voltage, Fault Protection, SP3T Analog Switch (3:1 Multiplexer/Demultiplexer)

**DESCRIPTION**

The DG2522 is a low on-resistance SP3T analog switch design to operation from 1.6 V to 5.5 V.

The DG2522 switches signals in either direction with amplitudes up to  $V_+$ . Protection circuit is built in to isolate the signals if any of them swings above  $V_+$ . It guaranteed low leakage level for isolation in power down mode.

Built on Vishay Siliconix's sub-micro CMOS technology, the DG2522 achieves switch on-resistance of  $0.8 \Omega$  at 4.5 V  $V_+$  with  $0.6 \Omega$  flatness. It has superior 0.008 % THD (total harmonic distortion) over frequency of 20 Hz to 20 kHz. It provides -59 dB off-Isolation, -65 dB crosstalk at 1 MHz, and 105 MHz -3 dB bandwidth.

The select pin of the control logic input can tolerate voltages above  $V_+$  up to 5.5 V. Logic high 1.8 V is guaranteed over the full  $V_+$  range that makes it compatible with many low voltage digital control circuits.

The features of ultra small package size, wide  $V_+$  range, low on-resistance, low logic threshold, and switch isolation under fault condition make it an ideal device for battery operated devices to handle signals such as audio, video, data stream, and other high accuracy signals.

The DG2522 comes in a small miniQFN-8 lead package of 1.4 mm x 1.4 mm 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 termination and is 100 % RoHS compliant.

**FEATURES**

- Isolation at  $V_+ = 0$  V and signal above  $V_+$
- Logic input tolerates up to 5.5 V
- 1.6 V to 5.5 V operation voltage range
- Guaranteed 1.8 V  $V_{TH(high)}$  at  $V_+ = 4.5$  V
- 0.008 % total harmonic distortion
- Low switch on-resistance
- 300 mA latch up current per JESD78

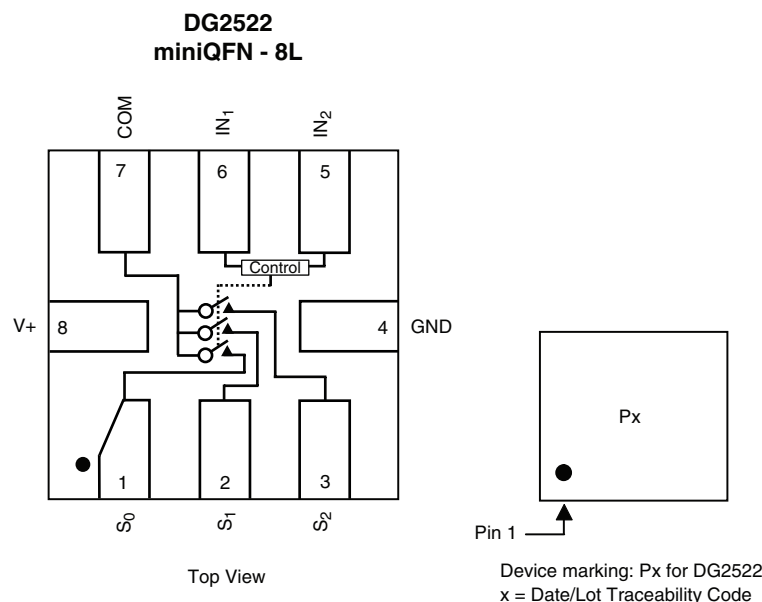

**RoHS**  
COMPLIANT

**BENEFITS**

- Ultra small miniQFN8 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 and PDAs
- GPS and portable media players
- Modems and wireless cards
- Computers peripherals
- Communication and network circuits
- Low voltage data acquisition systems
- Portable instrumentation

**FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION**




TRUTH TABLE DG2522		
IN <sub>1</sub> (Pin 6)	IN <sub>2</sub> (Pin 5)	Function
0	0	COM disconnect
1	0	COM (Pin 7) = S <sub>0</sub> (Pin 1)
0	1	COM (Pin 7) = S <sub>1</sub> (Pin 2)
1	1	COM (Pin 7) = S <sub>2</sub> (Pin 3)

ORDERING INFORMATION		
Temp. Range	Package	Part Number
- 40 °C to 85 °C	miniQFN-8L	DG2522DN-T1-E4

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted			
Parameter		Limit	Unit
Reference to GND	V+	- 0.3 to 6.0	V
	IN, COM, S <sub>x</sub> <sup>a</sup>	- 0.3 to (V+ + 0.3)	
Current (Any terminal except S <sub>x</sub> or COM)		30	mA
Continuous Current (S <sub>x</sub> 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 S<sub>0</sub>, S<sub>1</sub>, S<sub>2</sub> and 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.



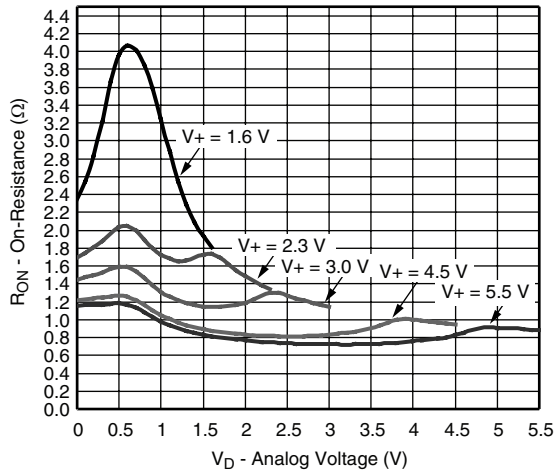
SPECIFICATIONS $V_+ = 5\text{ V}$							
Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 5\text{ V}, \pm 10\%, V_{IN} = 0.6\text{ V}$ or $1.8\text{ V}^e$	Temp. <sup>a</sup>	Limits - 40 °C to 85 °C			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>d</sup>	$V_{\text{analog}}$	$R_{\text{DS(on)}}$	Full	0		$V_+$	V
On-Resistance	$R_{\text{DS(on)}}$	$V_+ = 4.5\text{ V}, I_{\text{SX}} = 100\text{ mA}, V_{\text{COM}} = 2.5\text{ V}$	Room		0.8	1.1	$\Omega$
		$V_+ = 4.5\text{ V}, I_{\text{SX}} = 100\text{ mA}, V_{\text{COM}} = 2.5\text{ V}$	Full			1.5	
$R_{\text{ON}}$ Match	$\Delta R_{\text{ON}}$	$V_+ = 4.5\text{ V}, I_{\text{SX}} = 100\text{ mA}, V_{\text{COM}} = 2.5\text{ V}$	Room			0.1	
$R_{\text{ON}}$ Resistance Flatness	$R_{\text{ON}}$ flatness	$V_+ = 4.5\text{ V}, I_{\text{SX}} = 100\text{ mA}, V_{\text{COM}} = 0.5\text{ V}, 2.5\text{ V}$	Room		0.2	0.6	
Switch Off Leakage Current	$I_{\text{SX(off)}}$	$V_+ = 5.5\text{ V}, V_{\text{SX}} = 1\text{ V}/4.5\text{ V}, V_{\text{COM}} = 4.5\text{ V}/1\text{ V}$	Room	- 20		20	nA
			Full	- 120		120	
	Room		- 20		20		
	Full		- 120		120		
Channel-On Leakage Current	$I_{\text{COM(on)}}$	$V_+ = 4.3\text{ V}, V_{\text{SX}} = V_{\text{COM}} = 4.5\text{ V}/1\text{ V}$	Room	- 20		20	
			Full	- 120		120	
Power Down Leakage		$V_+ = 0\text{ V}, V_{\text{SX}} = 0\text{ V}/5.5\text{ V}, V_{\text{COM}} = 5.5\text{ V}/0\text{ V}$	Room	- 1	0.001	1	$\mu\text{A}$
			Full	- 25		25	
<b>Digital Control</b>							
Input High Voltage	$V_{\text{INH}}$	$V_+ = 2.7\text{ V}$	Full	1.6			V
		$V_+ = 4.5\text{ V}$	Full	1.8			
Input Low Voltage	$V_{\text{INL}}$		Full			0.6	
Input Capacitance	$C_{\text{IN}}$	$f = 1\text{ MHz}, V_{\text{INX}} = 0\text{ V}$	Room		5		pF
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>							
Break-Before-Make Time <sup>e</sup>	$t_{\text{BBM}}$	$V_+ = 5.0\text{ V}, V_{\text{SX}} = V_+, R_{\text{L}} = 50\ \Omega, C_{\text{L}} = 35\text{ pF}$ (see figure 2)	Room		8		ns
			Full	14			
Enable Turn-On Time <sup>e</sup>	$t_{\text{ON}}$	$V_+ = 5.0\text{ V}, V_{\text{SX}} = V_+, R_{\text{L}} = 50\ \Omega, C_{\text{L}} = 35\text{ pF}$ (see figure 1)	Room		53	75	
			Full			85	
Enable Turn-Off Time <sup>e</sup>	$t_{\text{OFF}}$		Room		40	60	
			Full			70	
Charge Injection <sup>d</sup>	Q	$C_{\text{L}} = 1\text{ nF}, R_{\text{GEN}} = 0\ \Omega, V_{\text{GEN}} = 0\text{ V}$	Room		27		pC
Off-Isolation <sup>d</sup>	$O_{\text{IRR}}$	$R_{\text{L}} = 50\ \Omega, C_{\text{L}} = 5\text{ pF}, f = 1\text{ MHz}$	Room		- 59		dB
Crosstalk <sup>d</sup>	$X_{\text{TALK}}$	$R_{\text{L}} = 50\ \Omega, C_{\text{L}} = 5\text{ pF}, f = 1\text{ MHz}$			- 64		
- 3 dB Bandwidth <sup>d</sup>	BW	$R_{\text{L}} = 50\ \Omega, C_{\text{L}} = 5\text{ pF}$	Room		105		MHz
Source Off Capacitance <sup>d</sup>	$C_{\text{SX(off)}}$	$f = 1\text{ MHz}, V_{\text{NX}} = 0\text{ V}$	Room		17		pF
Drain Off Capacitance <sup>d</sup>	$C_{\text{COM(off)}}$	$f = 1\text{ MHz}, V_{\text{COM}} = 0\text{ V}$	Room		51		
Drain On Capacitance <sup>d</sup>	$C_{\text{COM(on)}}$	$f = 1\text{ MHz}, V_{\text{COM}} = V_{\text{NX}} = 0\text{ V}$	Room		70		
Total Harmonic Distortion <sup>d</sup>	THD	$V_+ = 5\text{ V}, V_{\text{IN}} = 1\text{ V}_{\text{RMS}}, R_{\text{L}} = 600\ \Omega, f = 20\text{ Hz}$ to $20\text{ kHz}$	Room		0.008		%
<b>Power Supply</b>							
Power Supply Range	$V_+$			1.6		5.5	V
Power Supply Current	$I_+$	$V_{\text{IN}} = 0$ or $V_+$	Full			1.0	$\mu\text{A}$

Notes:

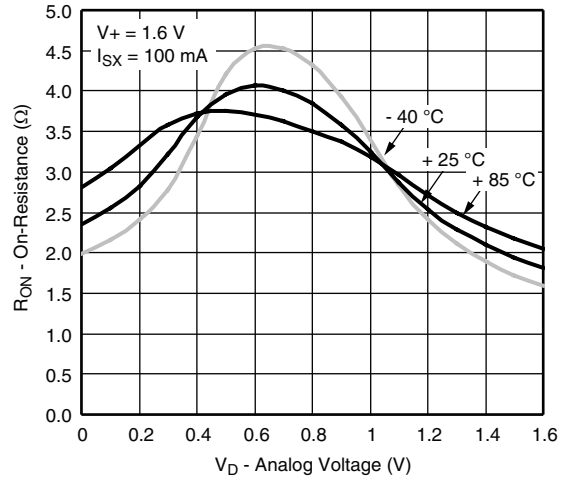
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d.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

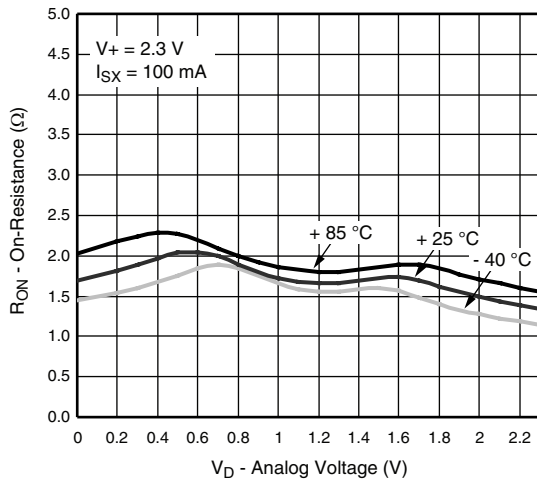
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



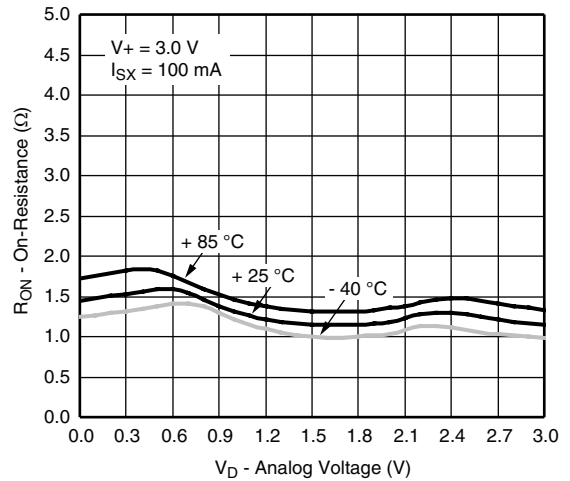
**R<sub>ON</sub> vs. V<sub>D</sub> and Single Supply Voltage**



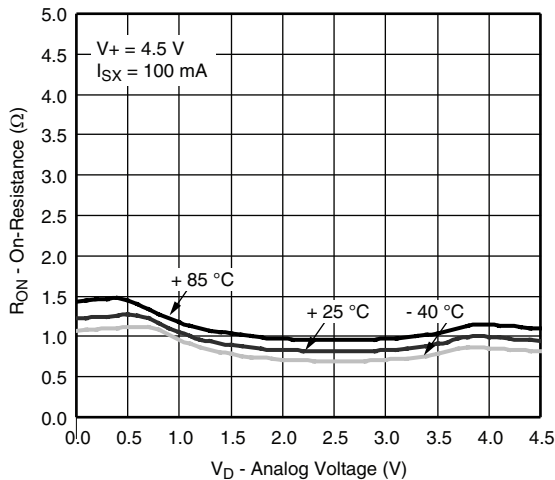
**R<sub>ON</sub> vs. Analog Voltage and Temperature**



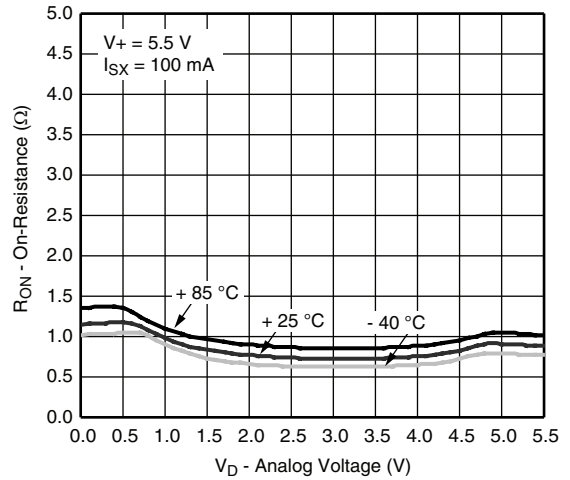
**R<sub>ON</sub> vs. Analog Voltage and Temperature**



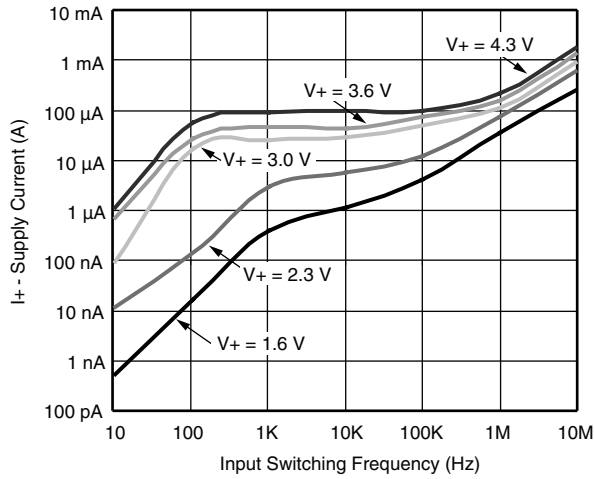
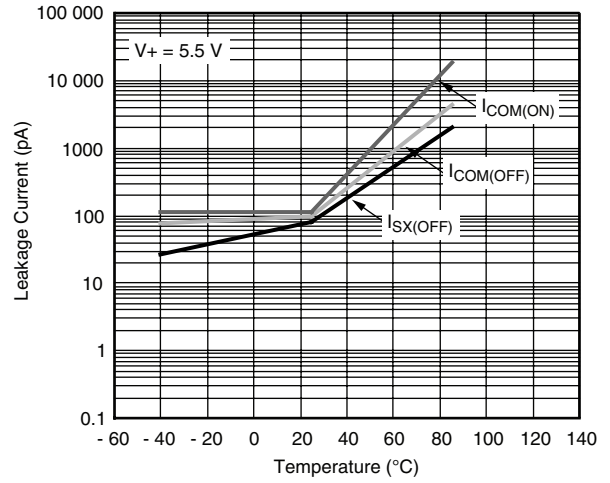
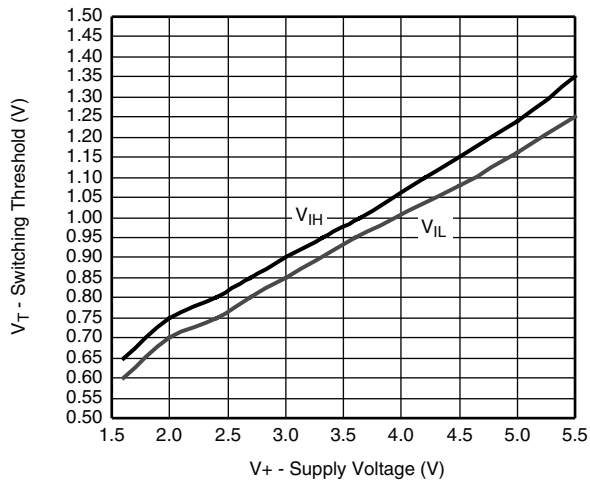
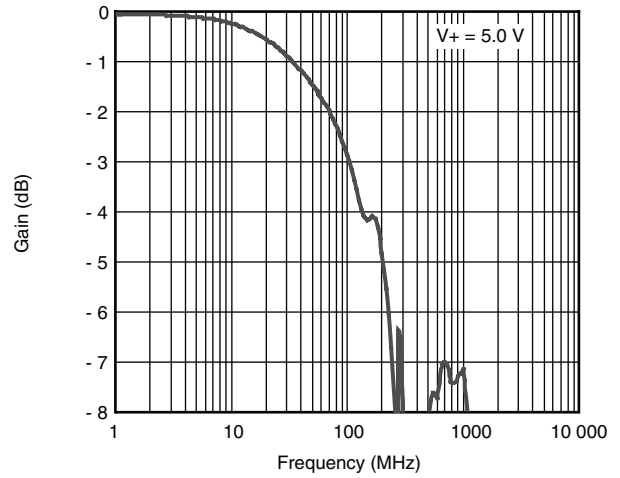
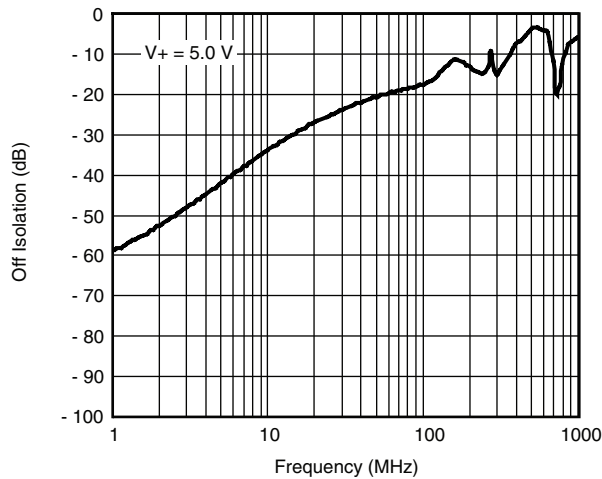
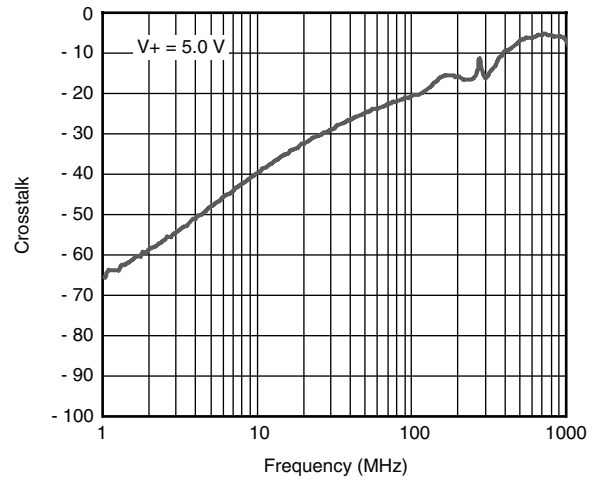
**R<sub>ON</sub> vs. Analog Voltage and Temperature**



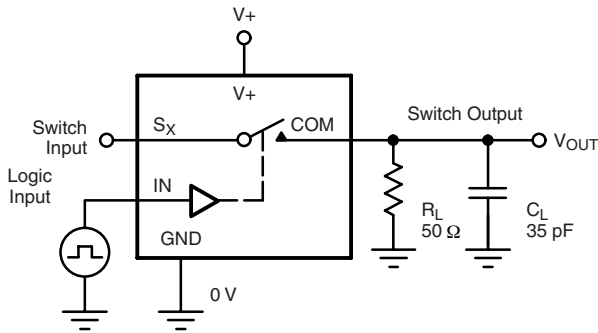
**R<sub>ON</sub> vs. Analog Voltage and Temperature**



**R<sub>ON</sub> vs. Analog Voltage and Temperature**

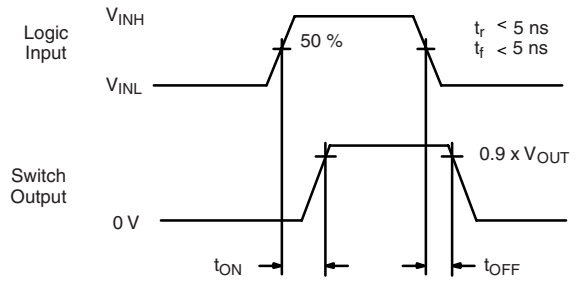
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Supply Current vs. Input Switching Frequency**

**Leakage Current vs. Temperature**

**Switching Threshold vs. Supply Voltage**

**Gain vs. Frequency**

**Off Isolation vs. Frequency**

**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

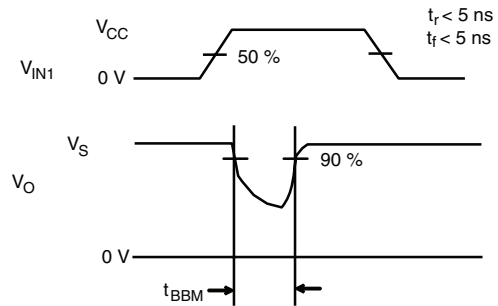
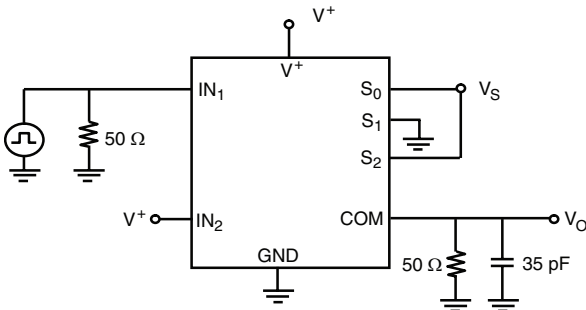


Figure 2. Break-Before-Make (DG2749)

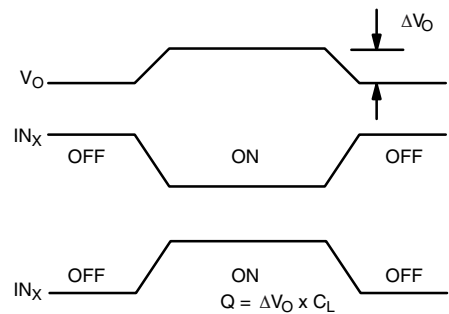
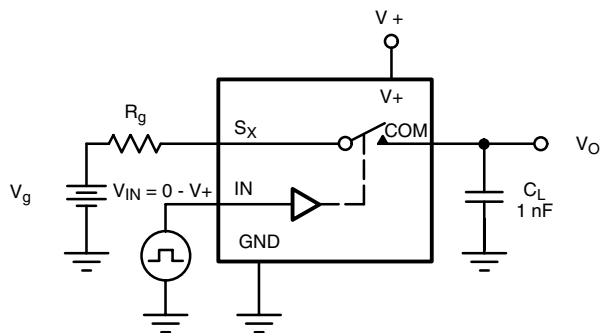
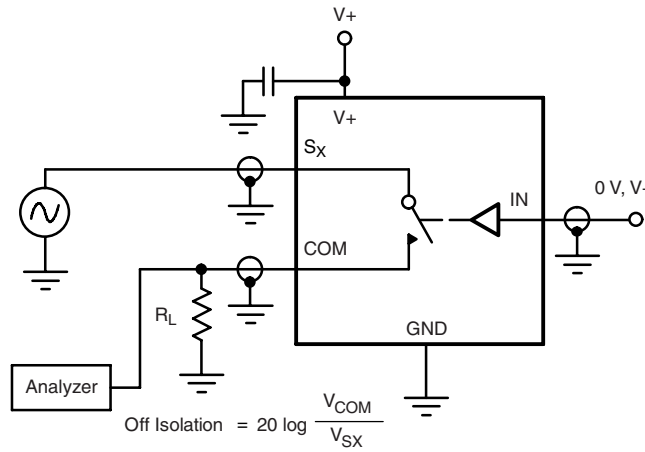
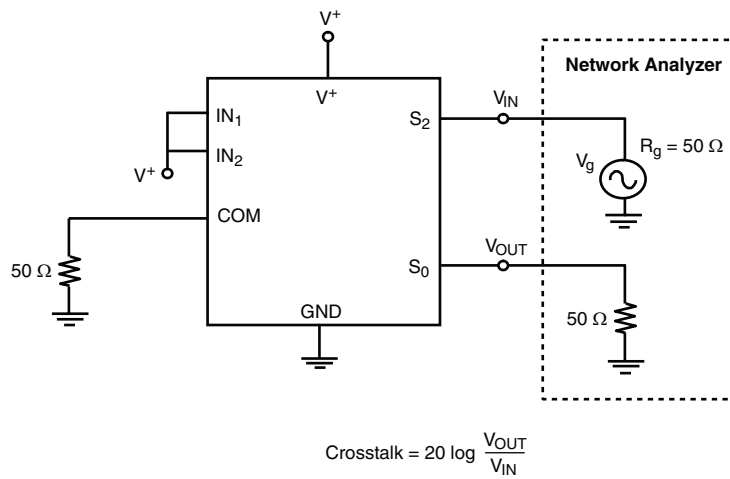
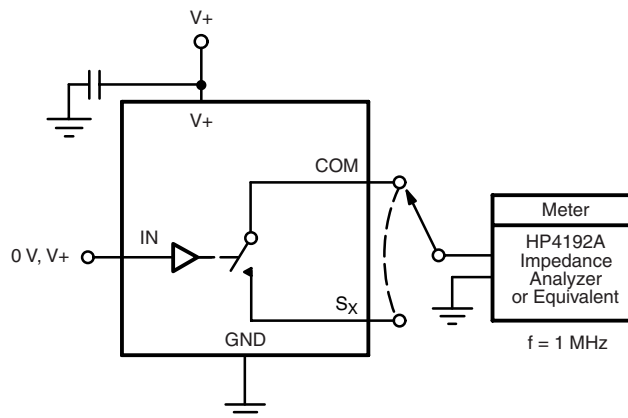
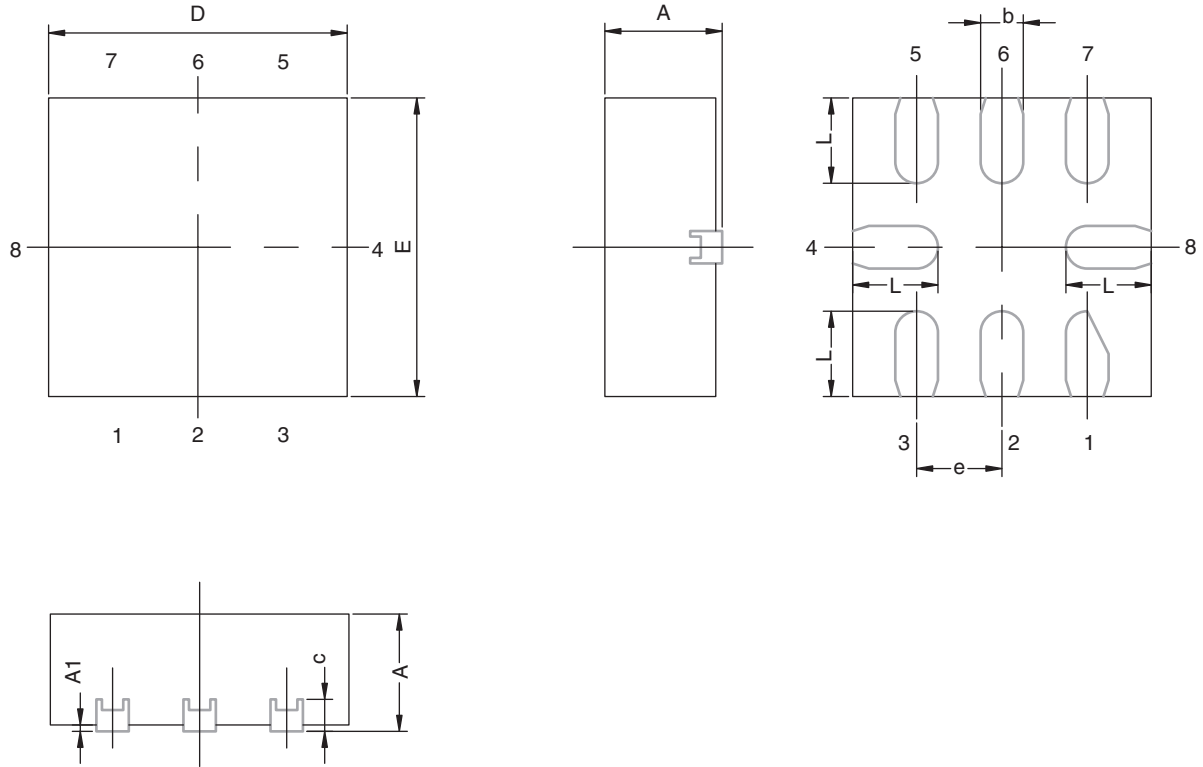


Figure 3. Charge Injection

**TEST CIRCUITS**

**Figure 4. Off-Isolation**

**Figure 5. Crosstalk**

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

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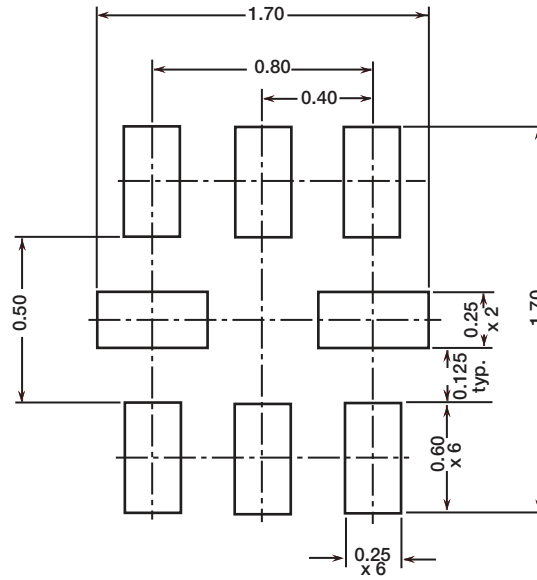
## MINIQFN-8L CASE OUTLINE



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						



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



Suggested Minimum Pad  
Dimensions in mm



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