

## 2 Port, USB 2.0 High Speed (480 Mbps) Switch, DPDT Analog Switch

### DESCRIPTION

The DG2722 is 2 port high speed analog switch optimized for USB 2.0 signal switching. The DG2722 switch is configured in DPDT. It handles bidirectional signal flow, achieving a 900 MHz - 3 dB bandwidth, and a port to port crosstalk and isolation at - 49 dB.

Processed with high density sub micron CMOS, the DG2722 provide low parasitic capacitance. Signals are routed with minimized phase distortion and attain a bit to bit skew as low as 40 pS.

The DG2722 is designed for a wide range of operating voltages, from 2.7 V to 4.3 V that can be driven directly from one cell Li-ion battery. On-chip circuitry protects against conditions when either the D+/D- lines are shorted to the  $V_{BUS}$  at the USB port. Additionally, logic control pins (S and  $\overline{OE}$ ) can tolerate the presence of voltages that are above the supply power rail ( $V_+$ ). The control logic threshold is guaranteed to be ( $V_{IH} = 1.3$  V/min). Latch up current is 300 mA, as per JESD78, and its ESD tolerance exceeds 8 kV.

Packaged in ultra small miniQFN-10 (1.4 mm x 1.8 mm x 0.55 mm), it is ideal for portable high speed mix signal switching application.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device termination. The miniQFN-10 package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free “-E4” suffix to the ordering part number. The nickel-palladium-gold device terminations meet all JEDEC standards for reflow and MSL rating.

As a further sign of Vishay Siliconix's commitment, the DG2722 is fully RoHS compliant.

### FEATURES

- **Halogen-free according to IEC 61249-2-21 Definition**
- Wide operation voltage range
- Low on-resistance,  $7 \Omega$  (typical at 3 V)
- Low capacitance,  $C_{ON} = 5.8$  pF (typical)
- 3 dB high bandwidth: 900 MHz (typical)
- Low bit to bit skew: 40 pS (typical)
- Low power consumption
- Low logic threshold: V
- Power down protection: D+/D- pins can tolerate up to 5 V when  $V_+ = 0$  V
- Logic (S and  $\overline{OE}$ ) above  $V_+$  tolerance
- 8 kV ESD protection (HBM)
- Latch-up current 300 mA per JESD78
- Lead (Pb)-free low profile miniQFN-10 (1.4 mm x 1.8 mm x 0.55 mm)
- **Compliant to RoHS Directive 2002/95/EC**

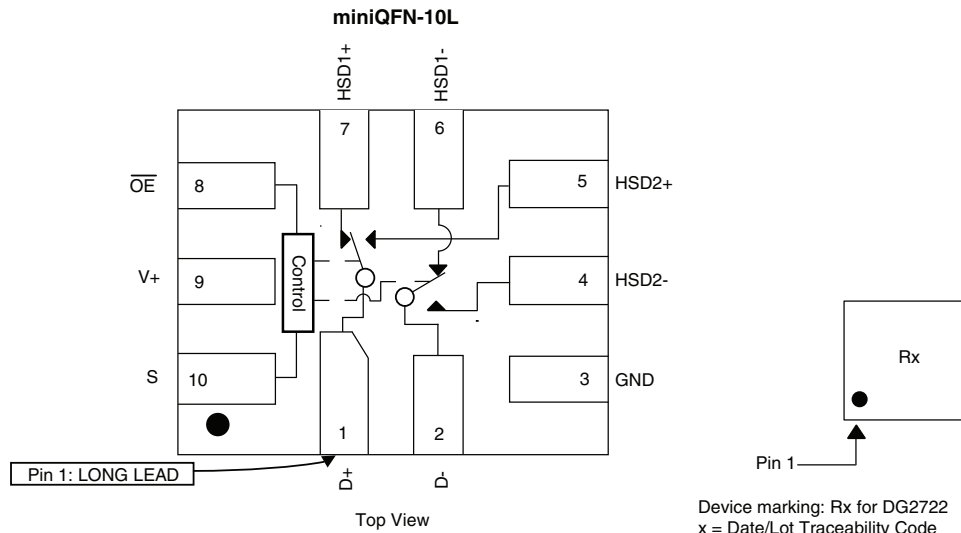


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Cellular phones
- Portable media players
- PDA
- Digital camera
- GPS
- Notebook computer
- TV, monitor, and set top box

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION





ORDERING INFORMATION		
Temp. Range	Package	Part Number
- 40 °C to 85 °C	miniQFN-10	DG2722DN-T1-E4

TRUTH TABLE		
$\overline{OE}$ (Pin 8)	S (Pin 10)	Function
0	0	D+ = HSD1+ and D- = HSD1-
0	1	D+ = HSD2+ and D- = HSD2-
1	X	Disconnect

PIN DESCRIPTIONS	
Pin Name	Description
$\overline{OE}$	Bus Switch Enable
S	Select Input
HSD1±, HSD2±, D±	Data Port

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)			
Parameter		Limit	Unit
Reference to GND	V+	- 0.3 to 5	V
	S, $\overline{OE}$ , D±, HSD1±, HSD2± <sup>a</sup>	- 0.3 to (V+ + 0.3)	
Current (Any Terminal except S, $\overline{OE}$ , D±, HSD1±, HSD2±)		30	mA
Continuous Current (S, $\overline{OE}$ , D±, HSD1±, HSD2±)		± 250	
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-10 <sup>c</sup>	208	mW
ESD (Human Body Model) I/O to GND		8	kV
Latch-up (Current Injection)		300	mA

Notes:

- a. Signals on S,  $\overline{OE}$ , D±, HSD1±, HSD2± 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 2.6 mW/°C above 70 °C.

SPECIFICATIONS (V+ = 3 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified	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 <sub>ANALOG</sub>	R <sub>DS(on)</sub>	Full	0		V+	V
On-Resistance	R <sub>DS(on)</sub>	V+ = 3 V, I <sub>D±</sub> = 8 mA, V <sub>HSD1/2±</sub> = 0.4 V	Room		7	8	Ω
			Full			9	
On-Resistance Match <sup>d</sup>	ΔR <sub>ON</sub>	V+ = 3 V, I <sub>D±</sub> = 8 mA, V <sub>HSD1/2±</sub> = 0.4 V	Room		0.8		Ω
On-Resistance Resistance Flatness <sup>d</sup>	R <sub>ON Flatness</sub>	V+ = 3 V, I <sub>D±</sub> = 8 mA, V <sub>HSD1/2±</sub> = 0 V, 1 V	Room		2		
Switch Off Leakage Current	I <sub>(off)</sub>	V+ = 4.3 V, V <sub>HSD1/2±</sub> = 0.3 V, 3 V, V <sub>D±</sub> = 3 V, 0.3 V	Full	- 100		100	nA
Channel On Leakage Current	I <sub>(on)</sub>	V+ = 4.3 V, V <sub>HSD1/2±</sub> = 0.3 V, 4 V, V <sub>D±</sub> = 4 V, 0.3 V	Full	- 200		200	
<b>Digital Control</b>							
Input Voltage High	V <sub>INH</sub>	V+ = 3 V to 3.6 V	Full	1.3			V
		V+ = 4.3 V	Full	1.5			
Input Voltage Low	V <sub>INL</sub>	V+ = 3 V to 4.3 V	Full			0.5	
Input Capacitance	C <sub>IN</sub>		Full		6.5		pF
Input Current	I <sub>INL</sub> or I <sub>INH</sub>	V <sub>IN</sub> = 0 or V+	Full	- 1		1	μA



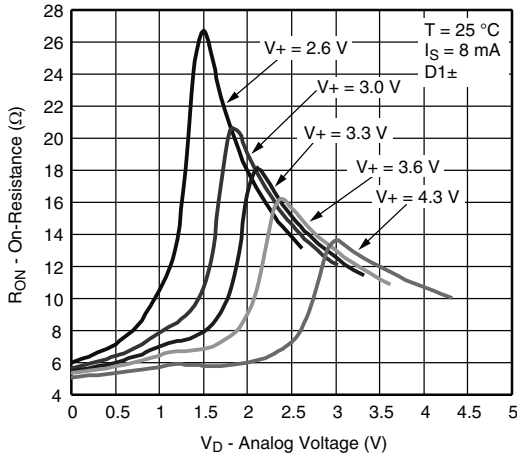
SPECIFICATIONS (V+ = 3 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified	Temp. <sup>a</sup>	Limits - 40 °C to 85 °C			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Dynamic Characteristics</b>							
Break-Before-Make Time <sup>e, d</sup>	t <sub>BBM</sub>	V+ = 3 V, V <sub>D1/2±</sub> = 1.5 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF	Room		5		ns
S, $\overline{OE}$ Turn-On Time <sup>e, d</sup>	t <sub>ON</sub>		Room			30	
S, $\overline{OE}$ Turn-Off Time <sup>e, d</sup>	t <sub>OFF</sub>		Room			25	
			Full				
Charge Injection <sup>d</sup>	Q <sub>INJ</sub>	C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>GEN</sub> = 0 V	Room		0.5		pC
Off-Isolation <sup>d</sup>	OIRR	V+ = 3 V to 3.6 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 240 MHz			- 30		dB
Crosstalk <sup>d</sup>	X <sub>TALK</sub>				- 45		
Bandwidth <sup>d</sup>	BW	V+ = 3 V to 3.6 V, R <sub>L</sub> = 50 Ω, - 3 dB			900		MHz
D+/D- On Capacitance	C <sub>ON</sub>	V+ = 3.3 V, $\overline{OE}$ = 0 V, f = 240 MHz			5.8		pF
D1n, D2n Off Capacitance	C <sub>OFF</sub>	V+ = $\overline{OE}$ = 3.3 V, f = 240 MHz			2.2		
Channel-to-Channel Skew <sup>d</sup>	t <sub>SK(O)</sub>	V+ = 3 V to 3.6 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF			50		ps
Skew Off Opposite Transitions of the Same Output <sup>d</sup>	t <sub>SK(p)</sub>				20		
Total Jitter <sup>d</sup>	t <sub>J</sub>				200		
<b>Power Supply</b>							
Power Supply Range	V+			2.6		4.3	V
Power Supply Current	I+	V <sub>IN</sub> = 0 V, or V+	Full			2	μA

Notes:

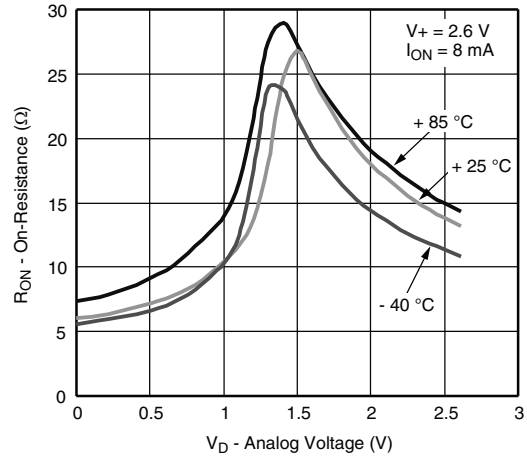
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d. Guarantee by design, not subjected to production test.
- e. V<sub>IN</sub> = input voltage to perform proper function.
- f. Crosstalk measured between channels.

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.

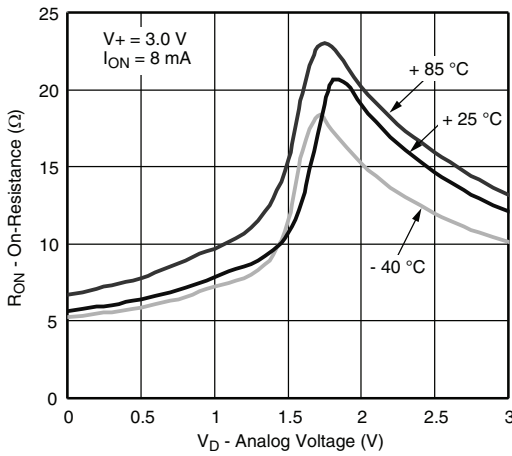
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



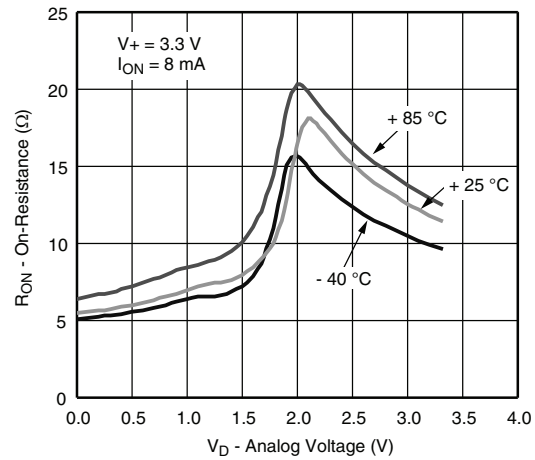
**$R_{ON}$  vs.  $V_D$  and Single Supply Voltage**



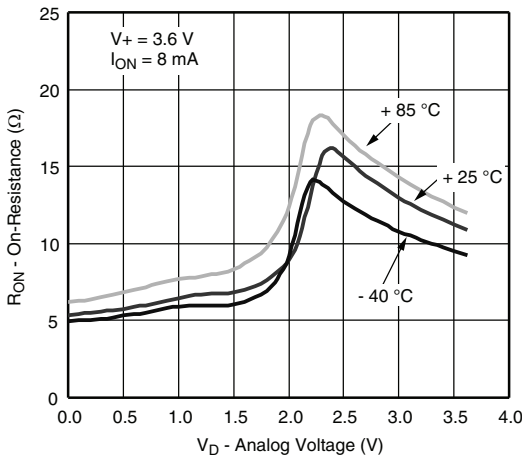
**$R_{ON}$  vs. Analog Voltage and Temperature**



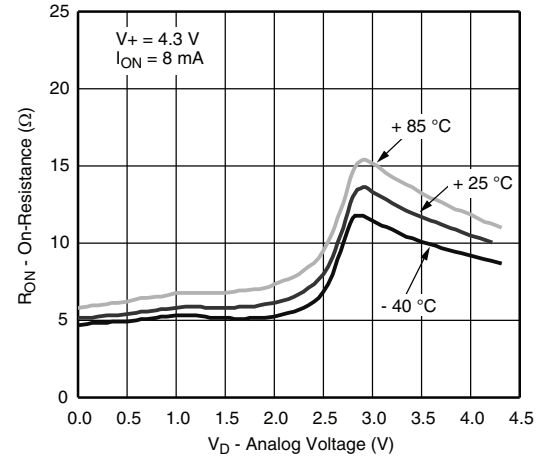
**$R_{ON}$  vs. Analog Voltage and Temperature**



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

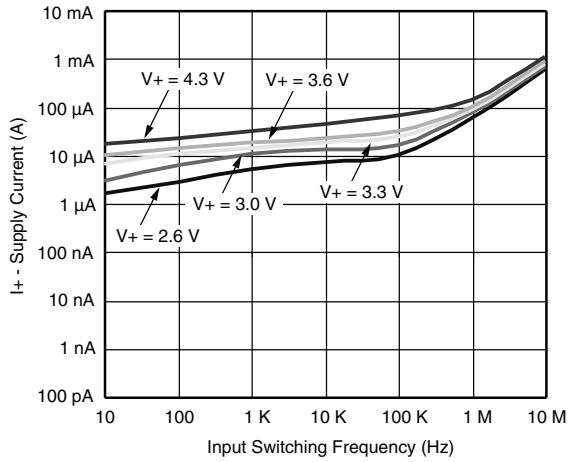


**$R_{ON}$  vs. Analog Voltage and Temperature**

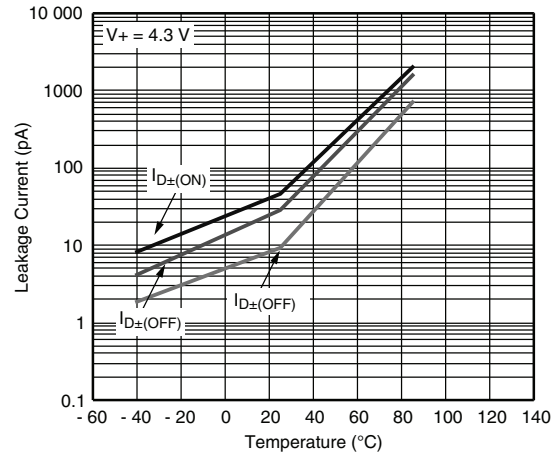


**$R_{ON}$  vs. Analog Voltage and Temperature**

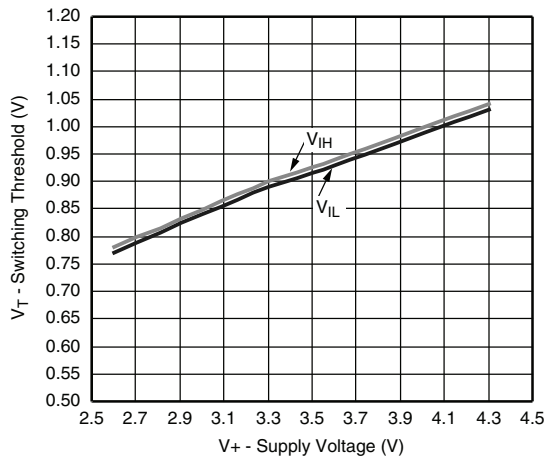
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



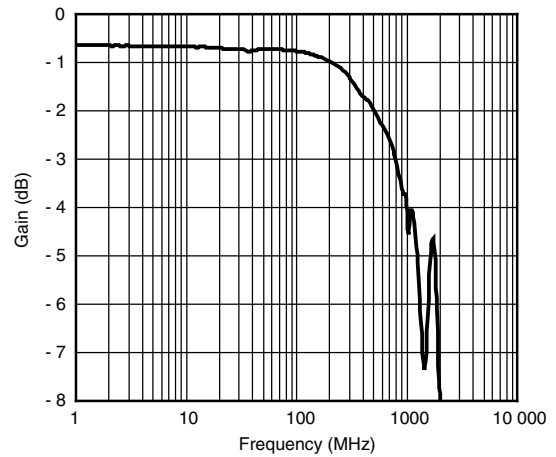
**Supply Current vs. Input Switching Frequency**



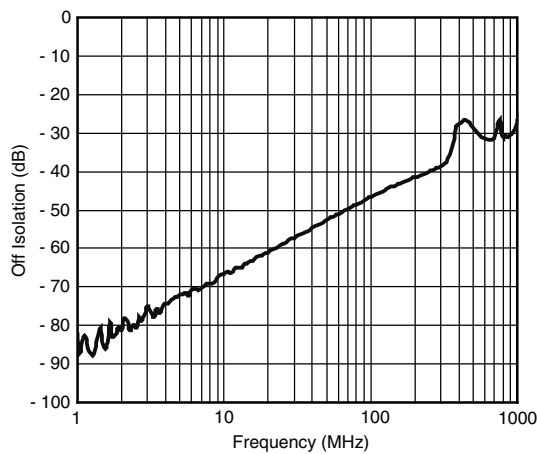
**Leakage Current vs. Temperature**



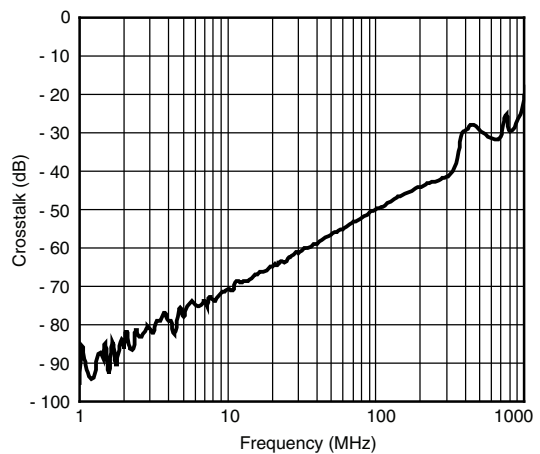
**Switching Threshold vs. Supply Voltage**



**Gain vs. Frequency,  $V_+ = 3.3\text{ V}$**

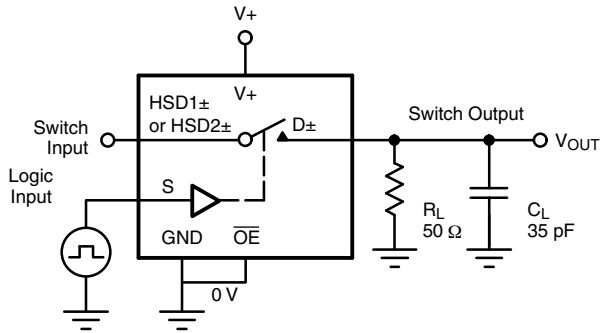


**Off-Isolation,  $V_+ = 3.3\text{ V}$**



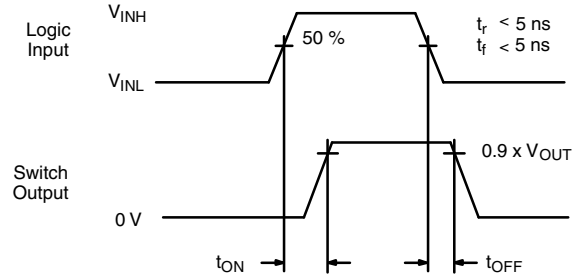
**Crosstalk,  $V_+ = 3.3\text{ V}$**

TEST CIRCUITS



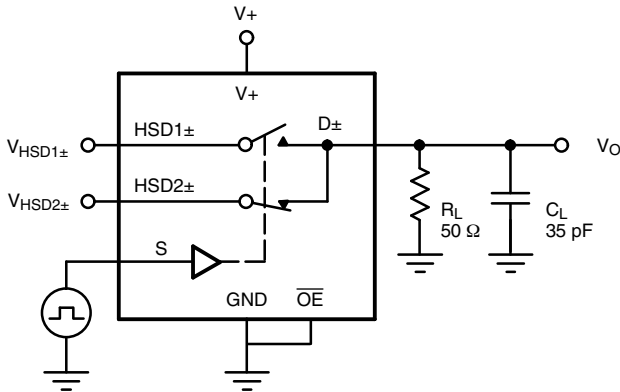
$C_L$  (includes fixture and stray capacitance)

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



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)

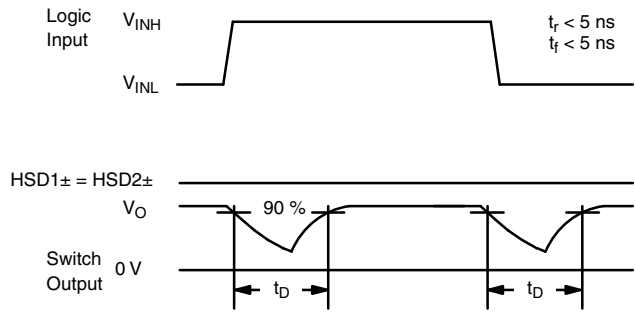
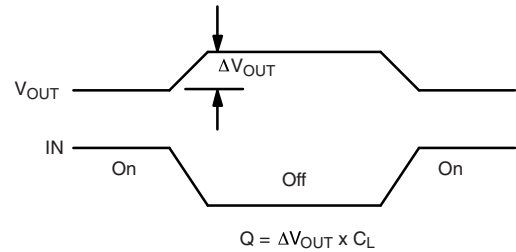
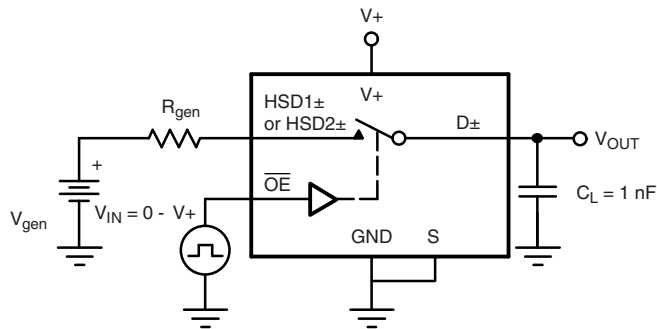
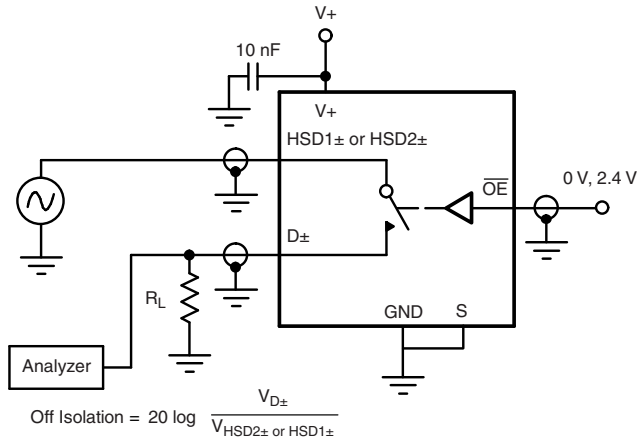
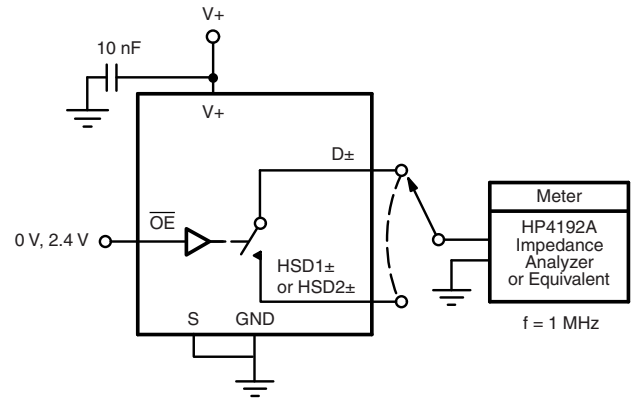


Figure 2. Break-Before-Make Interval



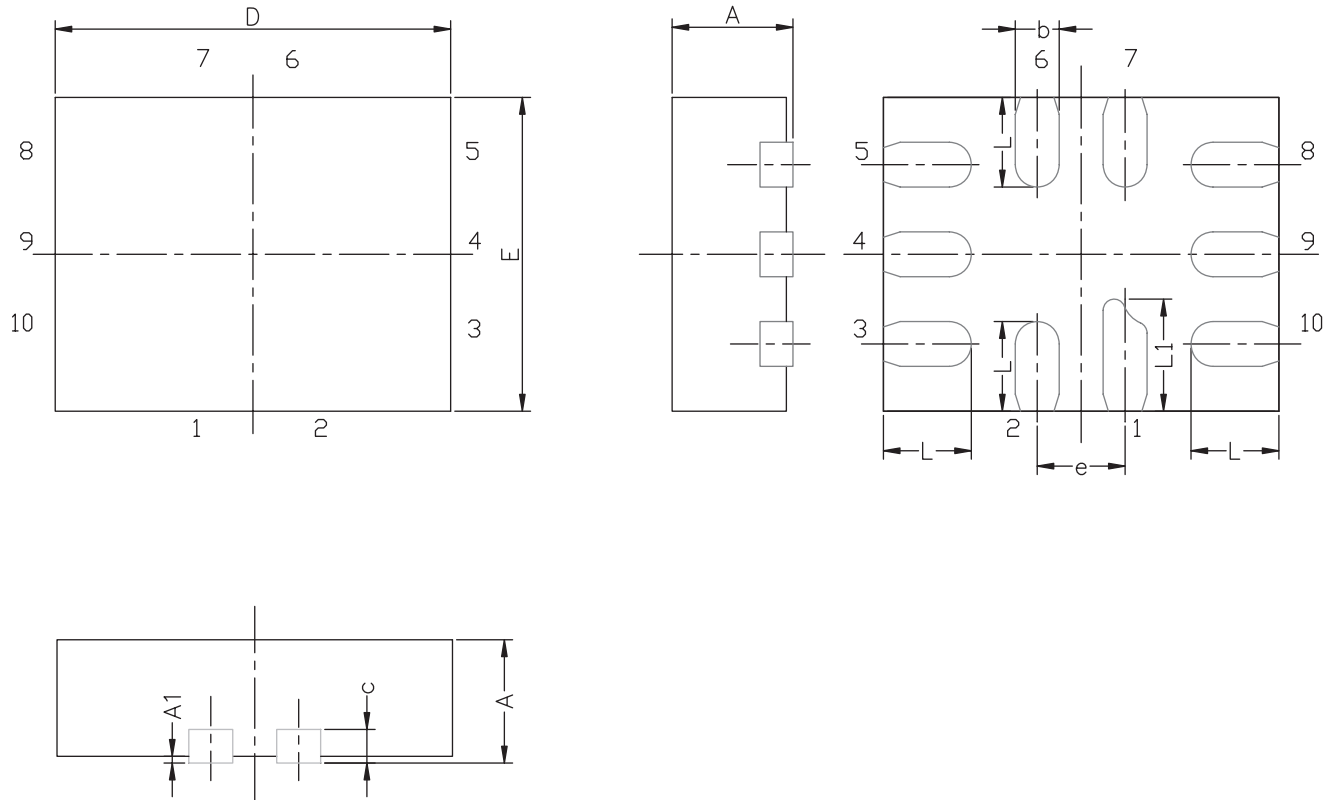
IN depends on switch configuration: input polarity determined by sense of switch.

Figure 3. Charge Injection

**TEST CIRCUITS**

**Figure 4. Off-Isolation**

**Figure 5. Channel Off/On Capacitance**

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## MINI QFN-10L CASE OUTLINE



DIM	MILLIMETERS			INCHES		
	MIN.	NAM.	MAX.	MIN.	NAM.	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	1.75	1.80	1.85	0.069	0.071	0.073
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
L1	0.45	0.50	0.55	0.0177	0.0197	0.0217

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DWG: 5957





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