

Low Voltage, Low On-Resistance, Dual DPDT/Quad SPDT Analog Switch

DESCRIPTION

The DG2788, DG2789 are monolithic CMOS analog switching products designed for high performance switching of analog signals. Combining low power, high speed, low on-resistance and small physical size, the DG2788, DG2789 are ideal for portable and battery powered applications requiring high performance and efficient use of board space. The DG2788, DG2789 are built on Vishay Siliconix's low voltage process. An epitaxial layer prevents latchup. Break-before-make is guaranteed.

The switch conducts equally well in both directions when on, and blocks up to the power supply level when off. The DG2788 is configured as a dual Double Pole Double Throw switches while the DG2789 is configured as a Quad Single Pole Double Throw. The DG2789 has one control pin for all four SPDT switches and also has an enable pin that can turn all switches off.

The DG2788 and DG2789 comes in a small miniQFN-16 lead package (2.6 x 1.8 x 0.75 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

- Low voltage operation (1.65 V to 4.3 V)
- Low on-resistance - R_{ON} : 0.4 Ω typ. at 2.7 V
- Fast switching: t_{ON} = 47 ns
 t_{OFF} = 15 ns
- miniQFN-16 package
- Latch-up current > 300 mA (JESD78)


RoHS
COMPLIANT

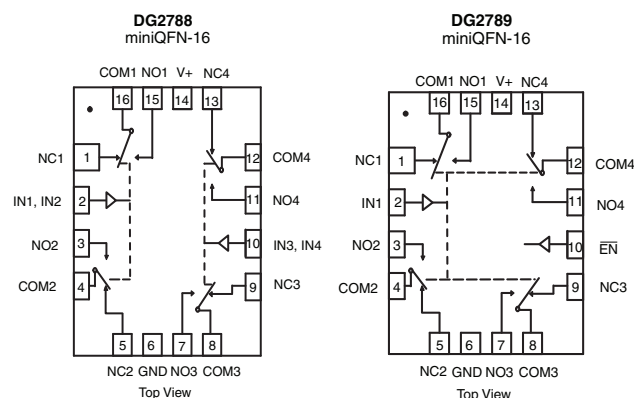
BENEFITS

- Reduced power consumption
- High accuracy
- Reduce board space
- TTL/1.8 V logic compatible
- High bandwidth

APPLICATIONS

- Cellular phones
- Speaker headset switching
- Audio and video signal routing
- PCMCIA cards
- Battery operated systems

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



Device Marking: Axx for DG2788
Bxx for DG2789
xx = Date/Lot Traceability Code
Note: Pin 1 has long lead

TRUTH TABLE (DG2788)

Logic	NC1, 2, 3 and 4	NO1, 2, 3 and 4
0	ON	OFF
1	OFF	ON

TRUTH TABLE (DG2789)

EN Logic	IN Logic	NC1, 2, 3 and 4	NO1, 2, 3 and 4
0	0	ON	OFF
0	1	OFF	ON
1	x	OFF	OFF

ORDERING INFORMATION

Temp. Range	Package	Part Number
- 40 °C to 85 °C	miniQFN-16	DG2788DN-T1-E4 DG2789DN-T1-E4

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)				
Parameter		Symbol	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	$^{\circ}\text{C}$
Package Solder Reflow Conditions ^d	miniQFN-16		250	
Power Dissipation (Packages) ^b	miniQFN-16 ^c		525	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 6.6 mW/ $^{\circ}\text{C}$ above 70 $^{\circ}\text{C}$
- d. Manual soldering with iron is not recommended for leadless components. The miniQFN-16 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.



SPECIFICATIONS (V+ = 3 V)									
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, VIN = 0.5 or 1.4 V ^e	Temp. ^a	Limits - 40 °C to 85 °C			Unit		
				Min. ^b	Typ. ^c	Max. ^b			
Analog Switch									
Analog Signal Range ^d	VNO, VNC, VCOM		Full	0		V+	V		
On-Resistance	RON	V+ = 2.7 V, VCOM = 0.5 V, INO, INC = 100 mA	Room		0.4	0.5	Ω		
		V+ = 2.7 V, VCOM = 1.5 V, INO, INC = 100 mA		0.33					
			Full		0.56				
RON Flatness ^d	RON Flatness	V+ = 2.7 V, VCOM = 0 to V+, INO, INC = 100 mA	Room		0.1	0.15			
RON Match ^d	ΔRON		Room		0.05				
Switch Off Leakage Current	INO(off), INC(off)F	V+ = 3.3 V, VNO, VNC = 0.3 V/3.0 V, VCOM = 3.0 V/0.3 V	Room Full	- 1 - 10		1 10	nA		
	ICOM(off)		Room Full	- 1 - 10		1 10			
Channel-On Leakage Current	ICOM(on)	V+ = 3.3 V, VNO, VNC = VCOM = 0.3 V/3.0 V	Room Full	- 1 - 10		1 10			
Digital Control									
Input High Voltage	VINH		Full	1.4			V		
Input Low Voltage	VINL		Full			0.5			
Input Capacitance	Cin		Full		6		pF		
Input Current	IINL or IINH	VIN = 0 or V+	Full	- 1		1	μA		
Dynamic Characteristics									
Turn-On Time	tON	VNO or VNC = 1.5 V, RL = 50 Ω, CL = 35 pF	Romm Full		47	72 75	ns		
Turn-Off Time	tOFF		Room Full		15	43 45			
Break-Before-Make Time	td		Full	1					
Charge Injection ^d	QINJ	CL = 1 nF, VGEN = 0 V, RGEN = 0 Ω	Room		87		pC		
Off-Isolation ^d	OIRR	RL = 50 Ω, CL = 5 pF, f = 100 kHz	Room		- 69		dB		
		RL = 50 Ω, CL = 5 pF, f = 1 MHz			- 49				
Crosstalk ^{d, f}	XTALK	RL = 50 Ω, CL = 5 pF, f = 100 kHz			- 106				
		RL = 50 Ω, CL = 5 pF, f = 1 MHz			- 96				
NO, NC Off Capacitance ^d	CNO(off)	f = 1 MHz	Room		81		pF		
	CNC(off)		Room		81				
Channel-On Capacitance ^d	CNO(on)		Room		186				
	CNC(on)		Room		186				
Power Supply									
Power Supply Range	V+				2.7			3.3	V
Power Supply Current	I+	VIN = 0 or V+	Full			1.0	μA		

SPECIFICATIONS (V+ = 4.3 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 4.3 V, VIN = 0.5 or 1.6 V ^e	Temp. ^a	Limits - 40 °C to 85 °C			Unit
				Min. ^b	Typ. ^c	Max. ^b	
Analog Switch							
Analog Signal Range ^d	V _{NO} , V _{NC} , V _{COM}		Full	0		V+	V
On-Resistance	R _{ON}	V+ = 4.3 V, V _{COM} = 0.9 V, I _{NO} , I _{NC} = 100 mA	Room		0.32	0.45	Ω
		V+ = 4.3 V, V _{COM} = 2.5 V, I _{NO} , I _{NC} = 100 mA			0.27		
			Full		0.5		
R _{ON} Flatness ^d	R _{ON} Flatness	V+ = 4.3 V, V _{COM} = 0 to V+, I _{NO} , I _{NC} = 100 mA	Room		0.1	0.15	
R _{ON} Match ^d	ΔR _{ON}		Room		0.03		
Switch Off Leakage Current ^d	I _{NO(off)} , I _{NC(off)}	V+ = 4.3 V, V _{NO} , V _{NC} = 0.3 V/4.0 V, V _{COM} = 4.0 V/0.3 V	Room Full	-10 - 100		10 100	nA
	I _{COM(off)}		Room Full	- 10 - 100		10 100	
Channel-On Leakage Current ^d	I _{COM(on)}	V+ = 4.3 V, V _{NO} , V _{NC} = V _{COM} = 3.0 V/4.0 V	Room Full	- 10 - 100		10 100	
Digital Control							
Input High Voltage	V _{INH}		Full	1.6			V
Input Low Voltage	V _{INL}		Full			0.5	
Input Capacitance	C _{in}		Full		6		pF
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V+	Full	- 1		1	μA
Dynamic Characteristics							
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 0 V, R _{GEN} = 0 Ω	Room		105		pC
N _O , N _C Off Capacitance ^d	C _{NO(off)}	f = 1 MHz	Room		79		pF
	C _{NC(off)}		Room		79		
Channel-On Capacitance ^d	C _{NO(on)}		Room		183		
	C _{NC(on)}		Room		183		
Power Supply							
Power Supply Range	V+					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.

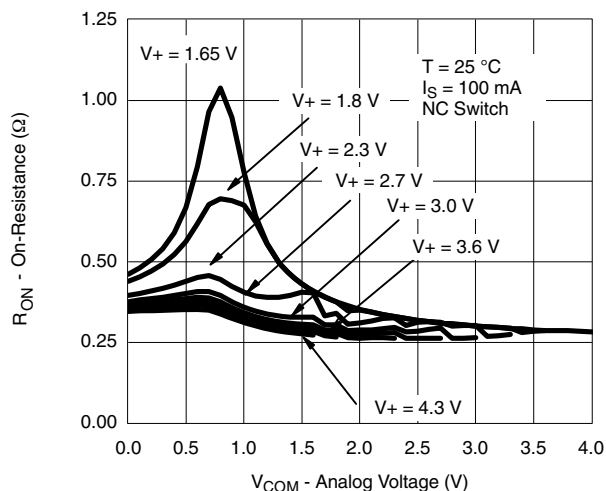
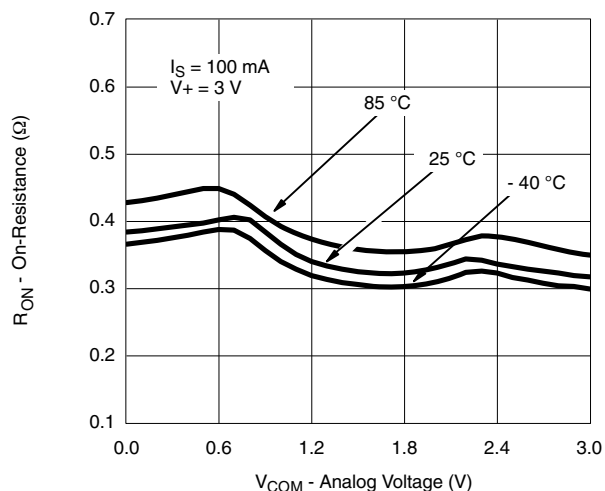
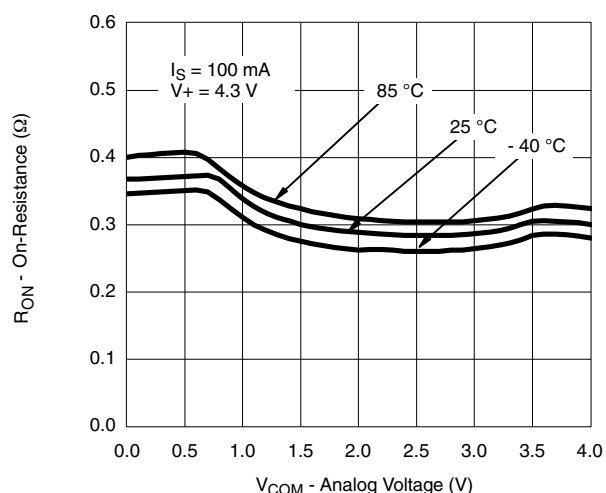
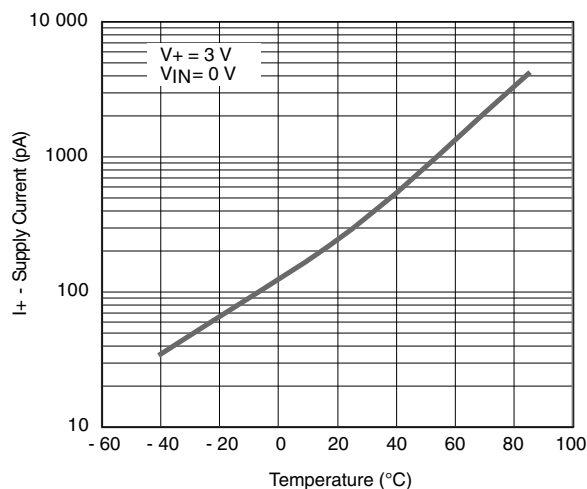
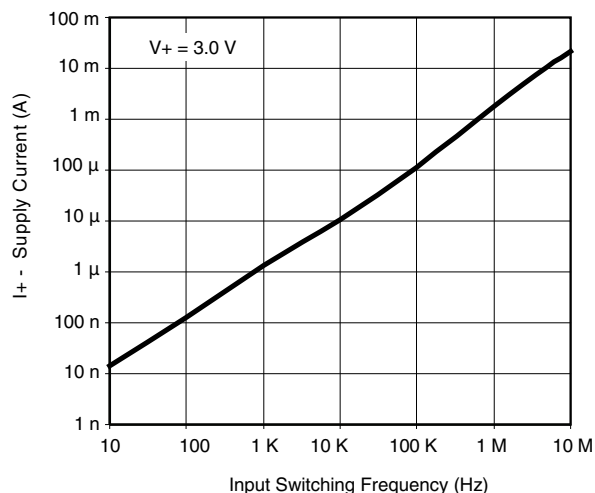
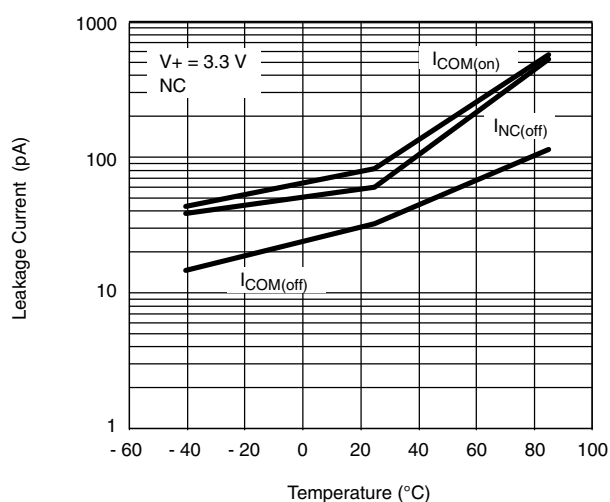
c. Typical values are for design aid only, not guaranteed nor subject to production testing.

d. Guarantee by design, not subjected to production test.

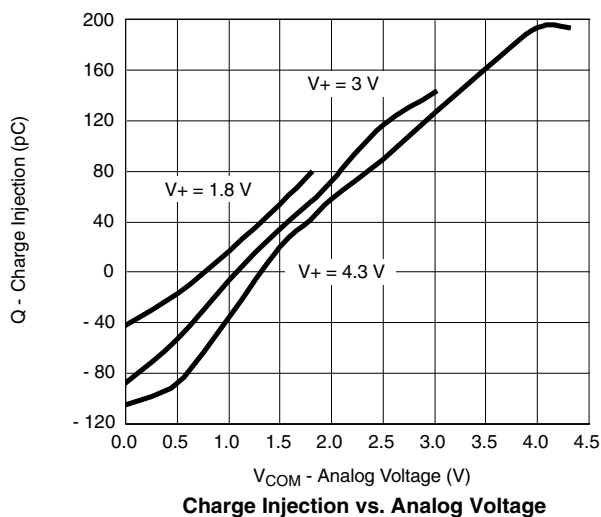
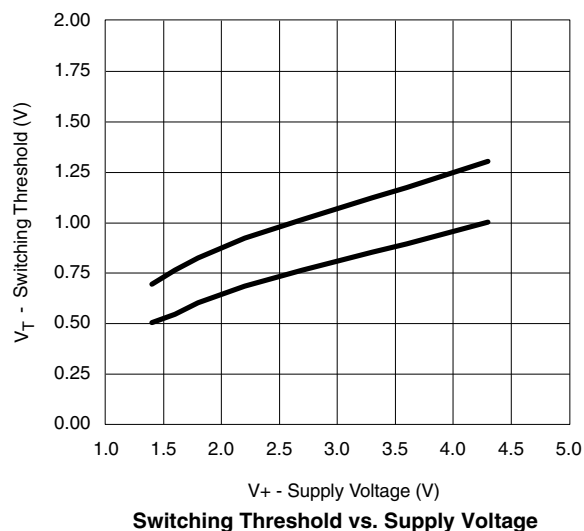
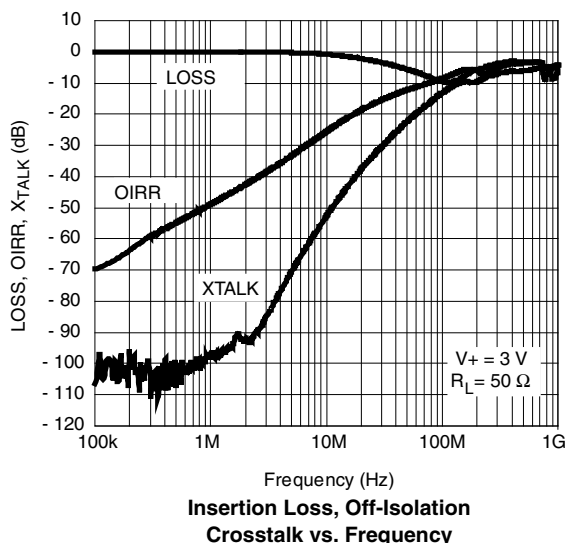
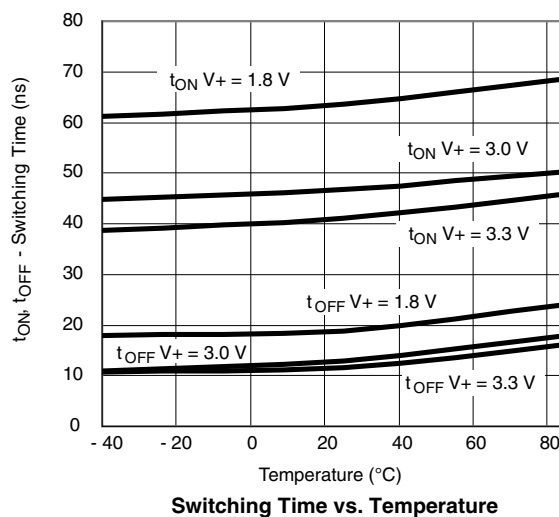
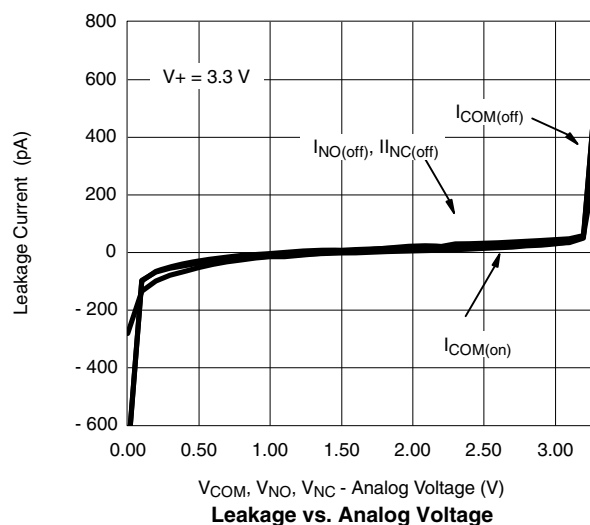
e. V_{IN} = input voltage to perform proper function.

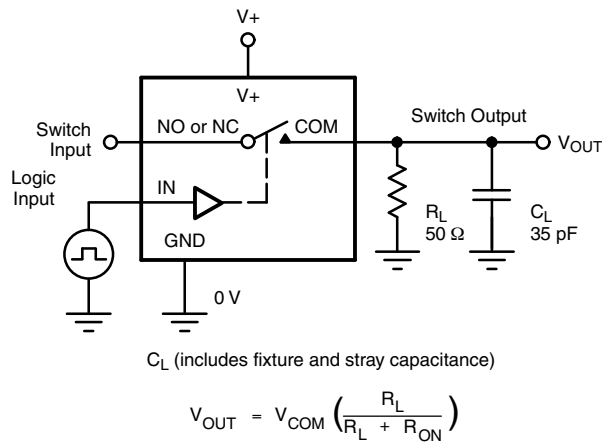
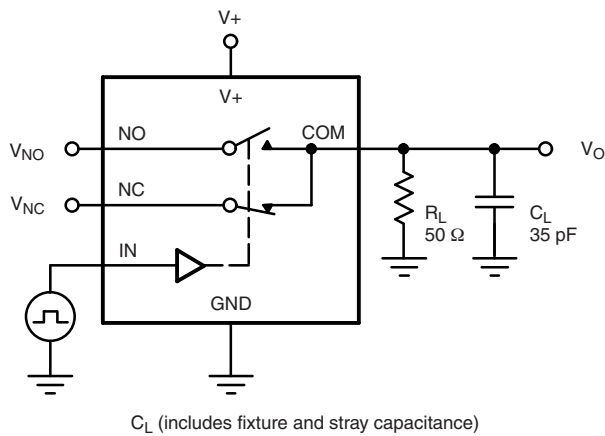
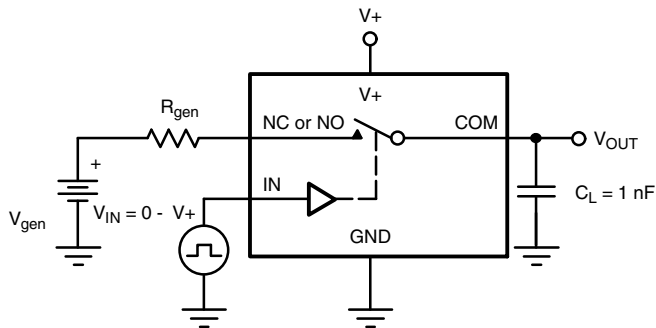
f. Crosstalk measured between channels.

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

 R_{ON} vs. V_{COM} and Supply Voltage

 R_{ON} vs. Analog Voltage and Temperature

 R_{ON} vs. Analog Voltage and Temperature

Supply Current vs. Temperature

Supply Current vs. Input Switching Frequency

Leakage Current vs. Temperature

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



TEST CIRCUITS

Figure 1. Switching Time

Figure 2. Break-Before-Make Interval

Figure 3. Charge Injection

TEST CIRCUITS

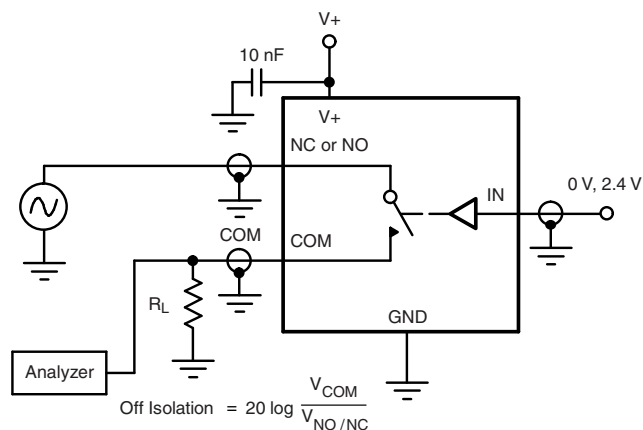


Figure 4. Off-Isolation

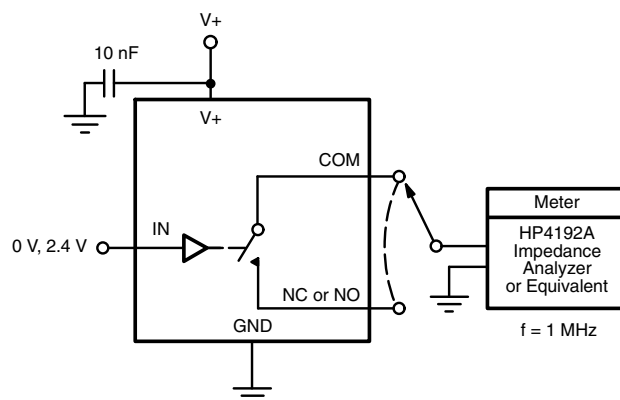
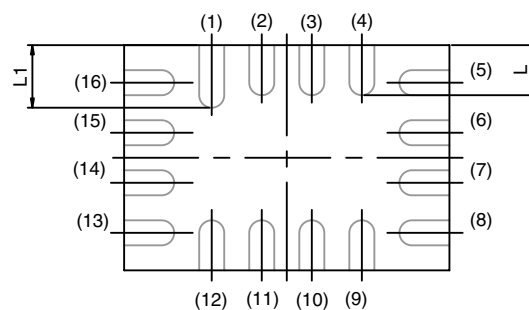
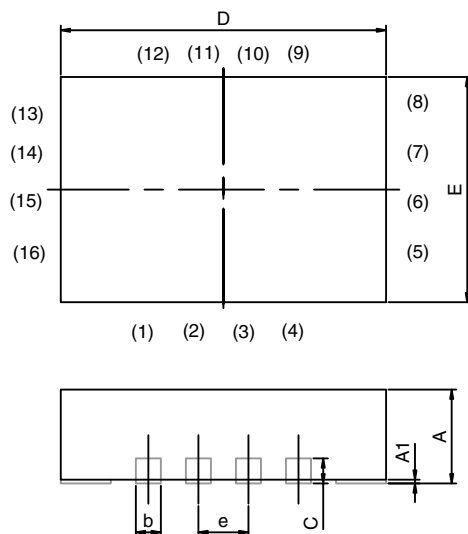


Figure 5. Channel Off/On Capacitance

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?73863.

MINI QFN-16L



BACK SIDE VIEW

DIM	MILLIMETERS			INCHES		
	MIN.	NAM	MAX.	MIN.	NAM	MAX.
A	0.70	0.75	0.80	0.0275	0.0295	0.0315
A1	0	-	0.05	0	-	0.002
b	0.15	0.20	0.25	0.0059	0.0078	0.0098
C	0.15	0.20	0.25	0.0059	0.0078	0.0098
D	2.60 BSC			0.1023 BSC		
E	1.80 BSC			0.0708 BSC		
e	0.40 BSC			0.0157 BSC		
L	0.35	0.40	0.45	0.0137	0.0157	0.0177
L1	0.45	0.50	0.55	0.0177	0.0196	0.0216

ECN T-06380-Rev. A, 14-Aug-06
DWG: 5954



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