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)

Pb-free
RoHS COMPLIANT

BENEFITS

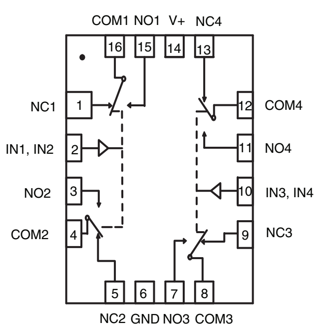
- Reduced power consumption
- High accuracy
- Reduce board space
- TTL/1.8 V logic compatible
- High bandwidth

APPLICATIONS

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

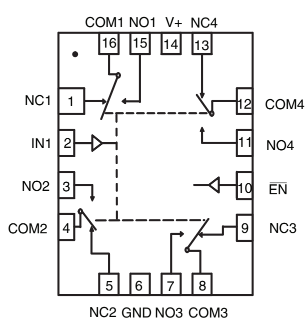
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2788
miniQFN-16

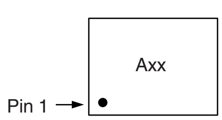


Top View

DG2789
miniQFN-16



Top View



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 °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	°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/°C above 70 °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.

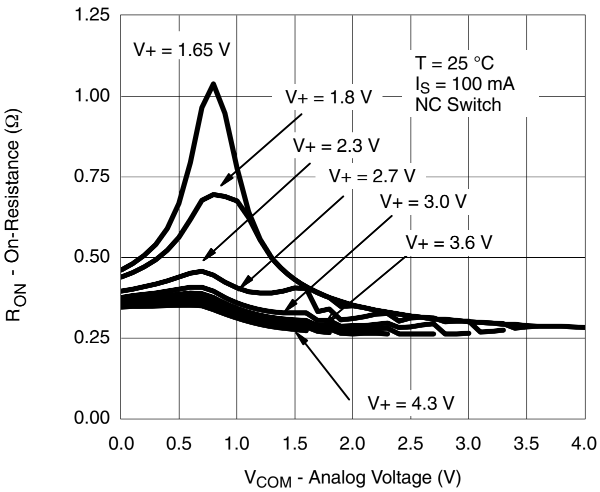
SPECIFICATIONS (V+ = 3 V)							
Parameter	**Symbol**	**Test Conditions Otherwise Unless Specified** V+ = 3 V, ± 10 %, V_{IN} = 0.5 or 1.4 V[e]	**Temp.**[a]	**Limits - 40 °C to 85 °C Min.**[b]	**Typ.**[c]	**Max.**[b]	**Unit**
Analog Switch							
Analog Signal Range[d]	V_{NO}, V_{NC}, V_{COM}		Full	0		V+	V
On-Resistance	R_{ON}	V+ = 2.7 V, V_{COM} = 0.5 V, I_{NO}, I_{NC} = 100 mA	Room		0.4	0.5	Ω
		V+ = 2.7 V, V_{COM} = 1.5 V, I_{NO}, I_{NC} = 100 mA	Room		0.33		
			Full			0.56	
R_{ON} Flatness[d]	R_{ON} Flatness	V+ = 2.7 V, V_{COM} = 0 to V+, I_{NO}, I_{NC} = 100 mA	Room		0.1	0.15	
R_{ON} Match[d]	ΔR_{ON}		Room		0.05		
Switch Off Leakage Current	$I_{NO(off)}$, $I_{NC(offF)}$	V+ = 3.3 V, V_{NO}, V_{NC} = 0.3 V/3.0 V, V_{COM} = 3.0 V/0.3 V	Room Full	- 1 - 10		1 10	nA
	$I_{COM(off)}$		Room Full	- 1 - 10		1 10	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 3.3 V, V_{NO}, V_{NC} = V_{COM} = 0.3 V/3.0 V	Room Full	- 1 - 10		1 10	
Digital Control							
Input High Voltage	V_{INH}		Full	1.4			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							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 1.5 V, R_L = 50 Ω, C_L = 35 pF	Romm Full		47	72 75	ns
Turn-Off Time	t_{OFF}		Room Full		15	43 45	
Break-Before-Make Time	t_d		Full	1			
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω	Room		87		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz	Room		- 69		dB
		R_L = 50 Ω, C_L = 5 pF, f = 1 MHz			- 49		
Crosstalk[d, f]	X_{TALK}	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz			- 106		
		R_L = 50 Ω, C_L = 5 pF, f = 1 MHz			- 96		
N_O, N_C Off Capacitance[d]	$C_{NO(off)}$	f = 1 MHz	Room		81		pF
	$C_{NC(off)}$		Room		81		
Channel-On Capacitance[d]	$C_{NO(on)}$		Room		186		
	$C_{NC(on)}$		Room		186		
Power Supply							
Power Supply Range	V+			2.7		3.3	V
Power Supply Current	I+	V_{IN} = 0 or V+	Full			1.0	µA

SPECIFICATIONS (V+ = 4.3 V)							
Parameter	**Symbol**	**Test Conditions Otherwise Unless Specified** V+ = 4.3 V, V_{IN} = 0.5 or 1.6 V[e]	**Temp.**[a]	**Limits** - 40 °C to 85 °C **Min.**[b]	**Typ.**[c]	**Max.**[b]	**Unit**
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	Room		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]	$I_{NO(off)}$, $I_{NC(offF)}$	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

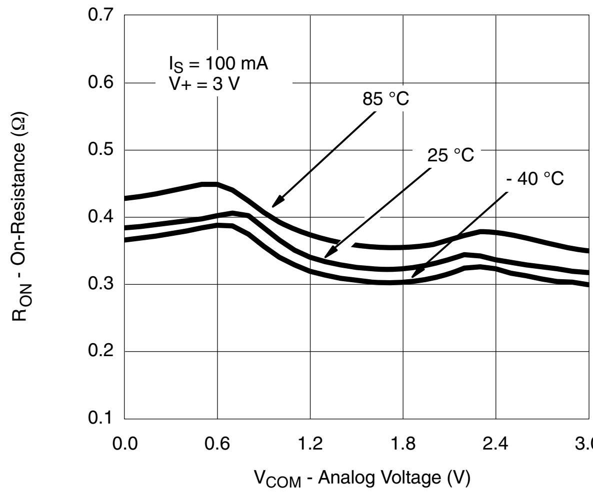
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee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

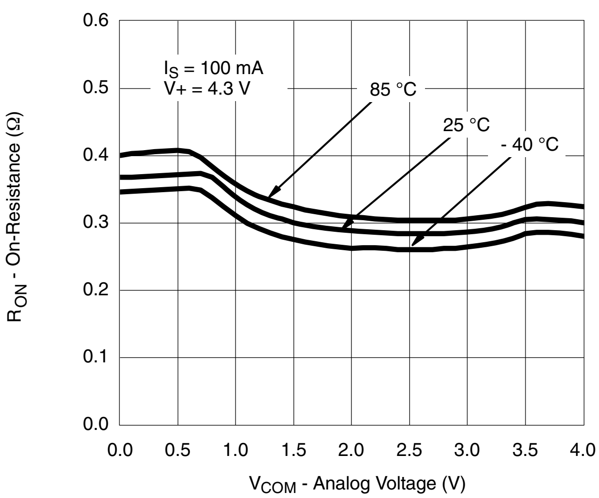
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



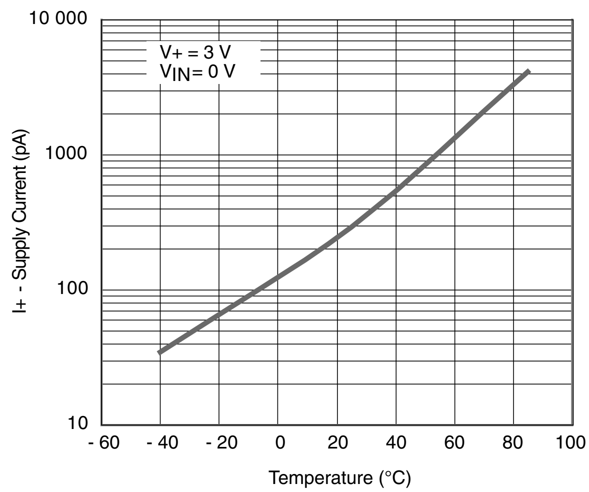
R_{ON} vs. V_{COM} and Supply Voltage



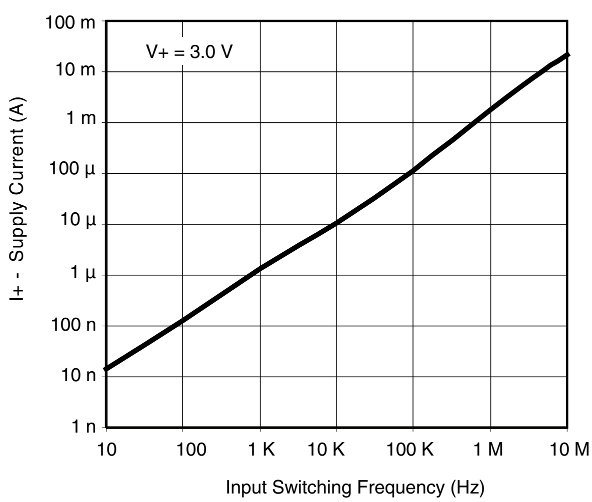
R_{ON} vs. Analog Voltage and Temperature



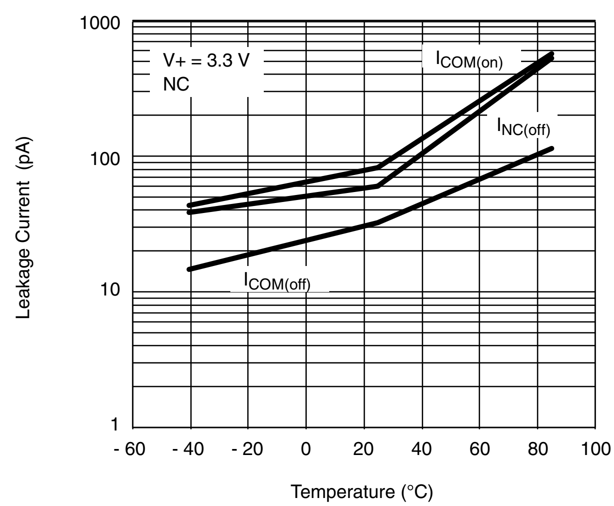
R_{ON} vs. Analog Voltage and Temperature



Supply Current vs. Temperature

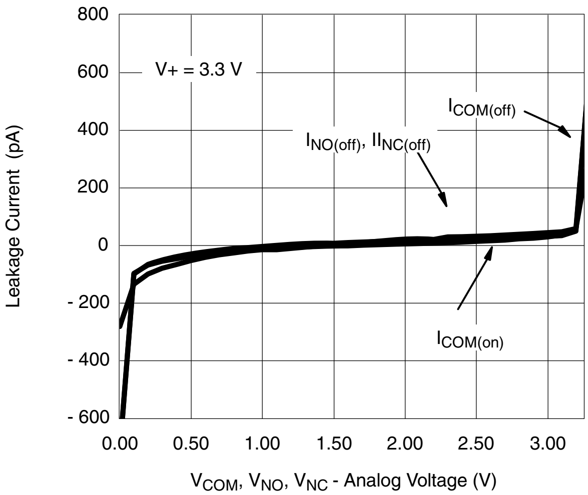


Supply Current vs. Input Switching Frequency

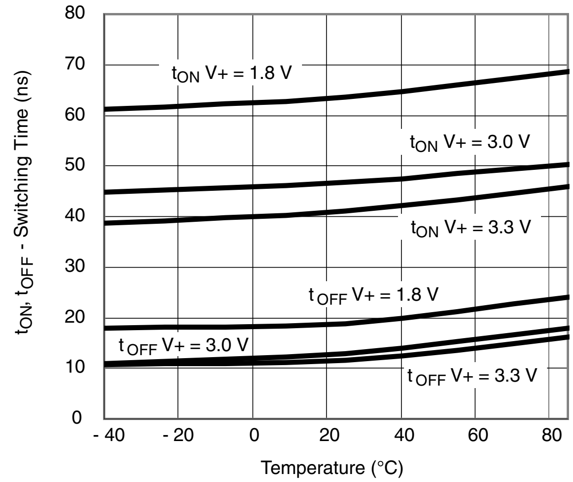


Leakage Current vs. Temperature

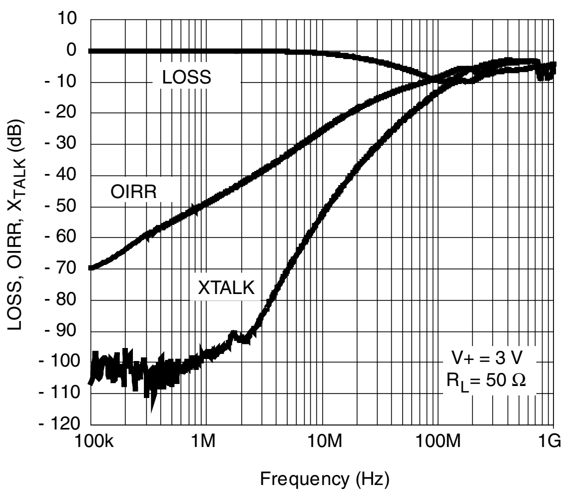
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



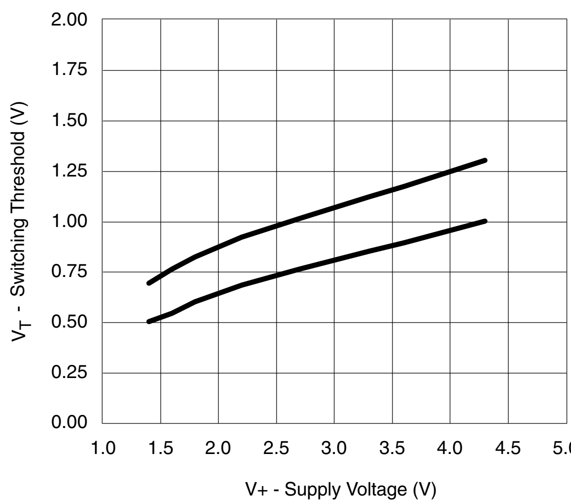
Leakage vs. Analog Voltage



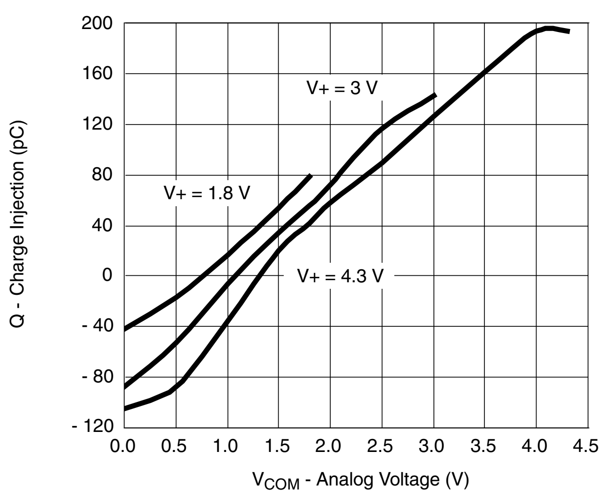
Switching Time vs. Temperature



Insertion Loss, Off-Isolation Crosstalk vs. Frequency



Switching Threshold vs. Supply Voltage



Charge Injection vs. Analog Voltage

TEST CIRCUITS

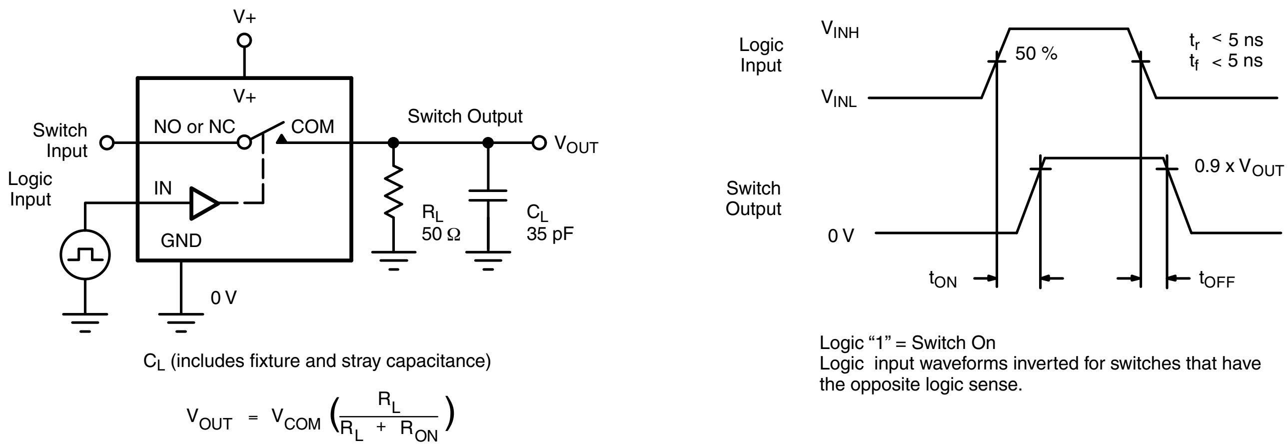


Figure 1. Switching Time

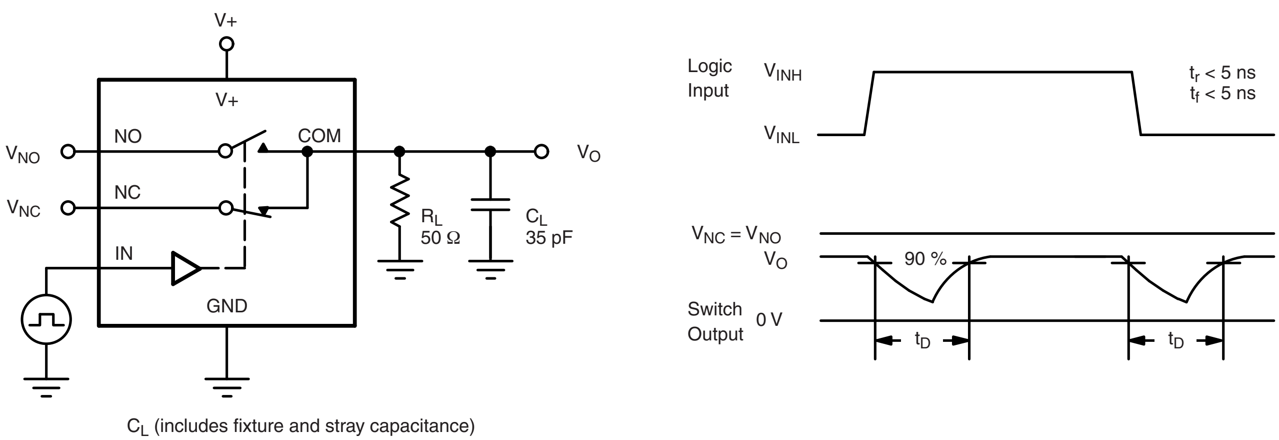


Figure 2. Break-Before-Make Interval

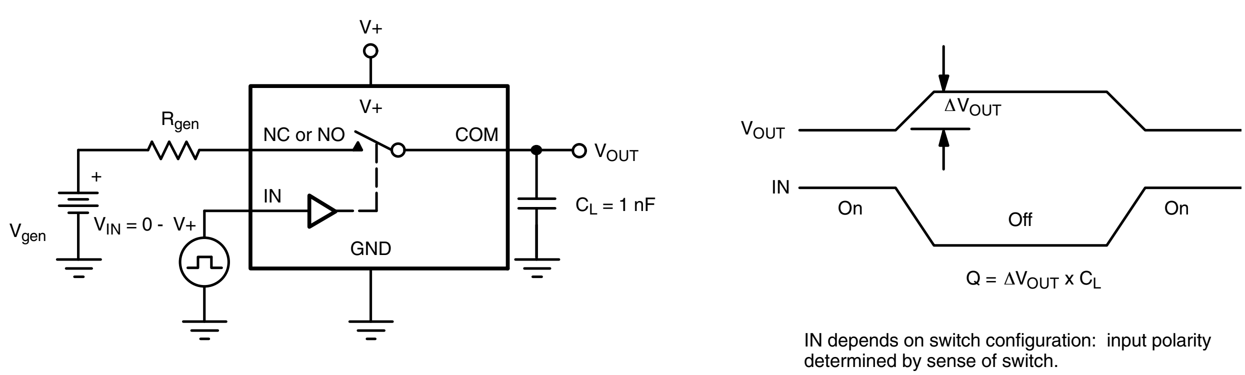


Figure 3. Charge Injection

TEST CIRCUITS

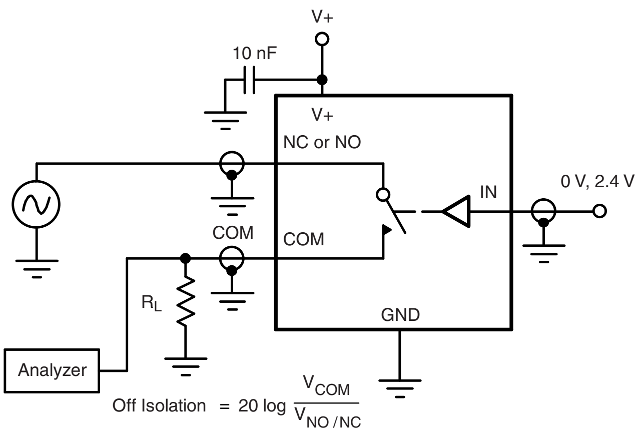


Figure 4. Off-Isolation

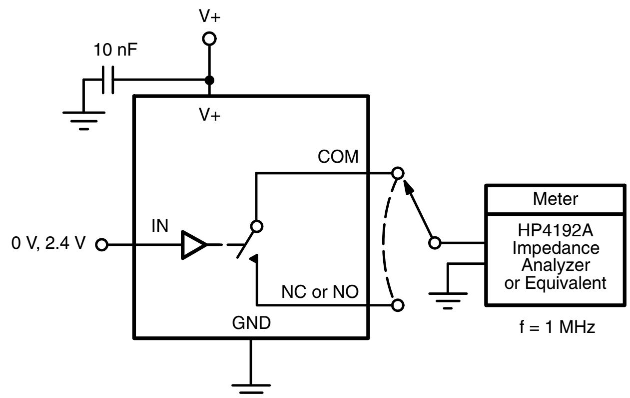
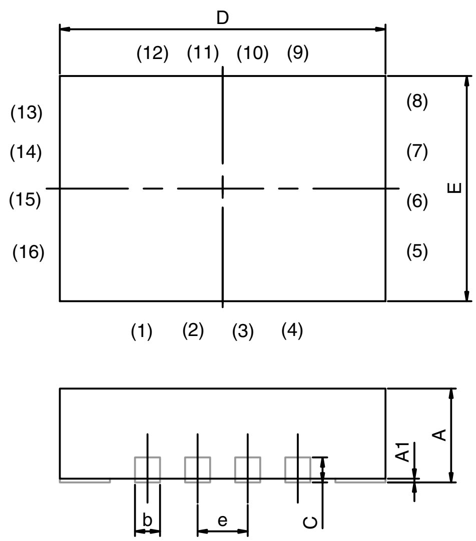
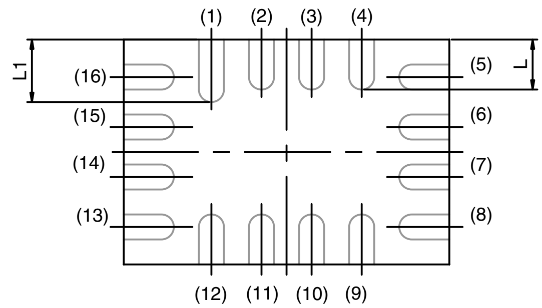


Figure 5. Channel Off/On Capacitance

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



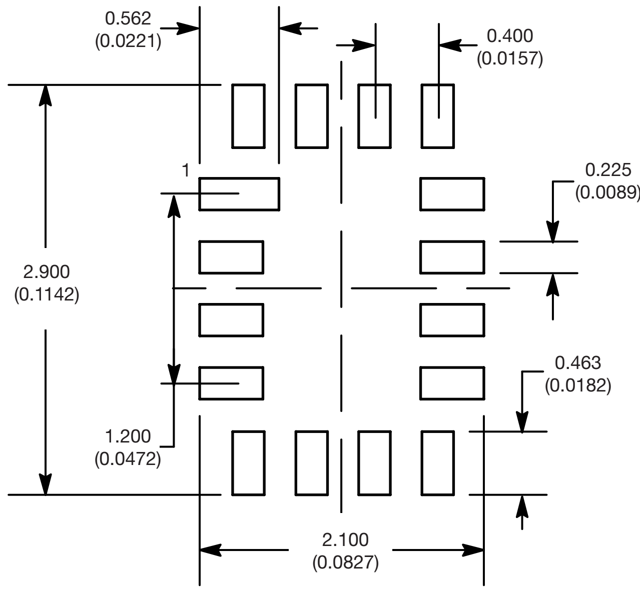


BACK SIDE VIEW

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

RECOMMENDED MINIMUM PADS FOR MINI QFN 16L



Mounting Footprint
Dimensions in mm (inch)

Disclaimer

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