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 mm x 1.8 mm 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

- Wide operation voltage range: 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)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

BENEFITS

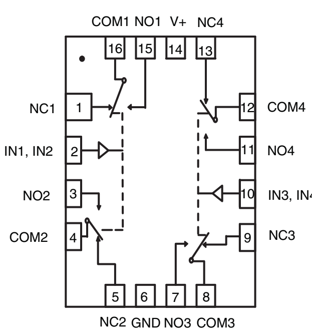
- Reduced power consumption
- High accuracy
- Reduce board space
- Low voltage logic compatible
- High bandwidth

APPLICATIONS

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

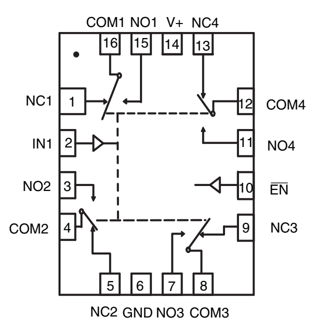
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2788
miniQFN-16



Top View

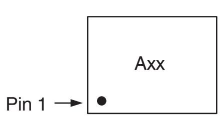
DG2789
miniQFN-16



Top View

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



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

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	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 UNLESS OTHERWISE SPECIFIED** **V+ = 3 V, ± 10 %, V_{IN} = 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]	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		-	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	$I_{NO(off)}$, $I_{NC(off)}$	V+ = 3.3 V, V_{NO}, V_{NC} = 0.3 V/3 V, V_{COM} = 3 V/0.3 V	Room	-1	-	1	nA
			Full	-10	-	10	
	$I_{COM(off)}$		Room	-1	-	1	
			Full	-10	-	10	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 3.3 V, V_{NO}, V_{NC} = V_{COM} = 0.3 V/3 V	Room	-1	-	1	
			Full	-10	-	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	Room	-	47	72	ns
			Full	-	-	75	
Turn-Off Time	t_{OFF}		Room	-	15	43	
			Full	-	-	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	-	
NO, NC 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+			1.65	-	4.3	V
Power Supply Current	I+	V_{IN} = 0 or V+	Full	-	-	1	µA

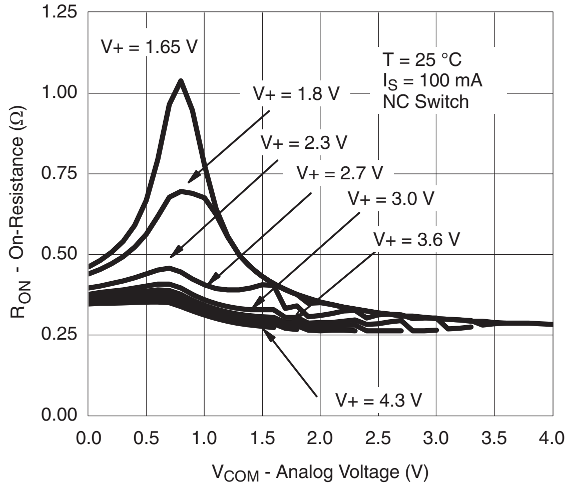
SPECIFICATIONS (V+ = 3 V)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS UNLESS OTHERWISE SPECIFIED** $V+ = 3$ V, ± 10 %, $V_{IN} = 0.5$ or 1.4 V [e]	**TEMP.** [a]	**LIMITS -40 °C to 85 °C**			**UNIT**
				MIN. [b]	**TYP.** [c]	**MAX.** [b]	
Analog Switch							
Analog Signal Range [d]	V_{NO}, V_{NC}, 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 V, $V_{COM} = 4$ V/0.3 V	Room	-10	-	10	nA
			Full	-100	-	100	
	$I_{COM(off)}$		Room	-10	-	10	
			Full	-100	-	100	
Channel-On Leakage Current [d]	$I_{COM(on)}$	$V+ = 4.3$ V, V_{NO}, $V_{NC} = V_{COM} = 3$ V/4 V	Room	-10	-	10	
			Full	-100	-	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+			1.65	-	4.3	V
Power Supply Current	I+	$V_{IN} = 0$ or V+	Full	-	-	1	µA

Notes

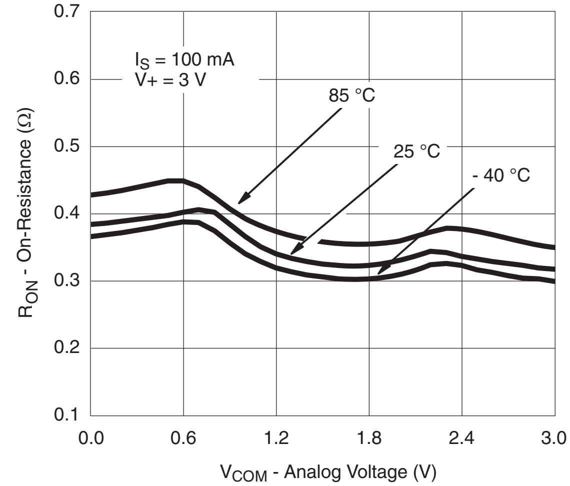
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee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

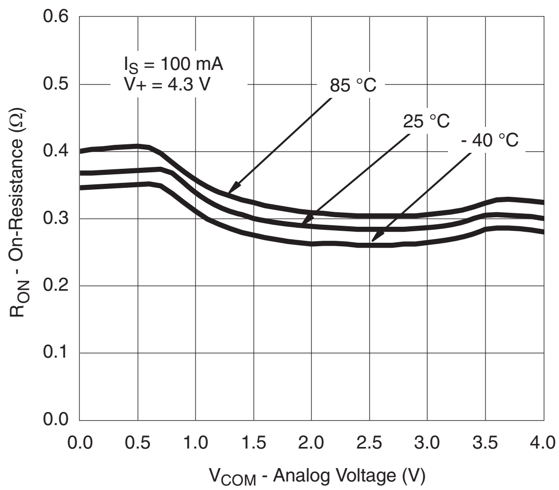
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



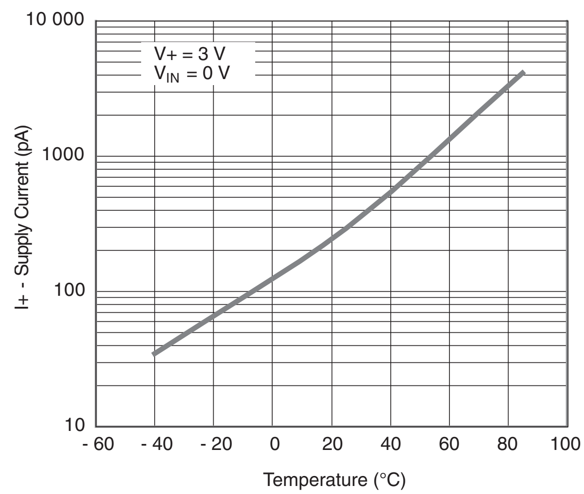
R_{ON} vs. V_{COM} and Supply Voltage



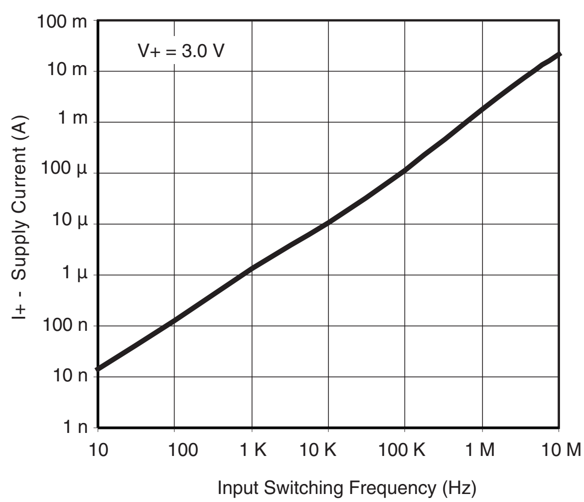
R_{ON} vs. Analog Voltage and Temperature



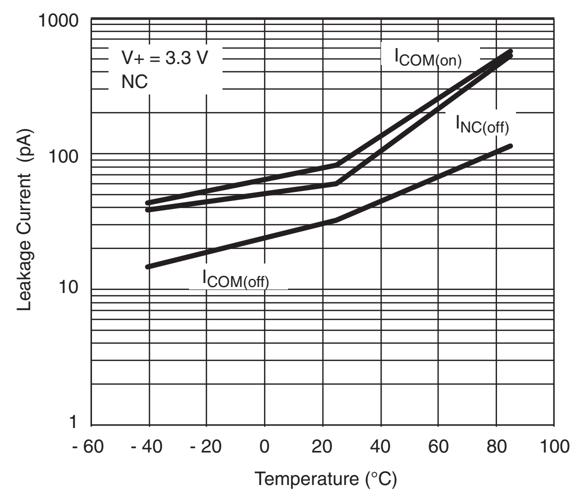
R_{ON} vs. Analog Voltage and Temperature



Supply Current vs. Temperature

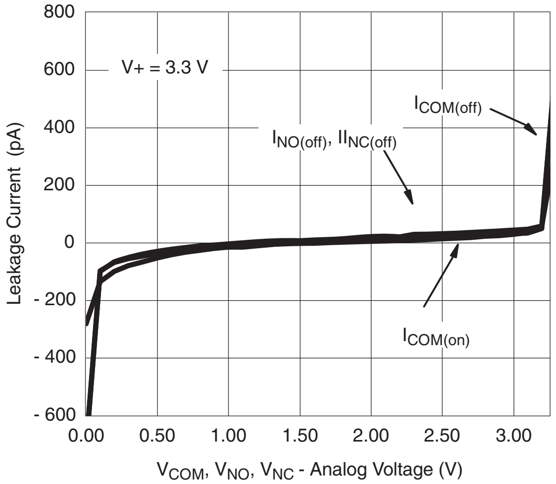


Supply Current vs. Input Switching Frequency

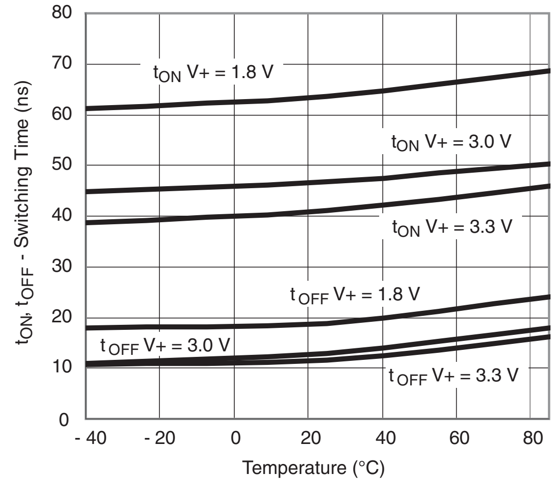


Leakage Current vs. Temperature

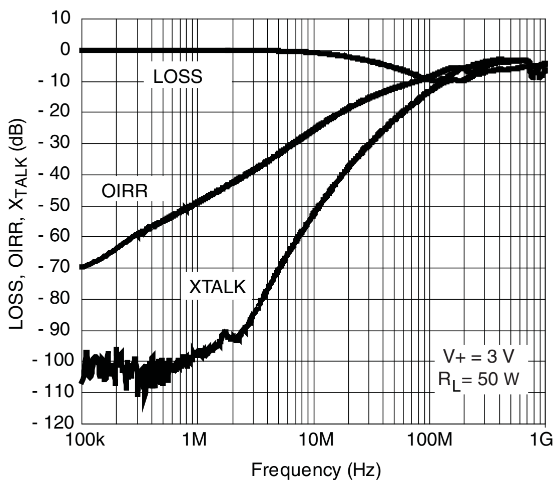
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



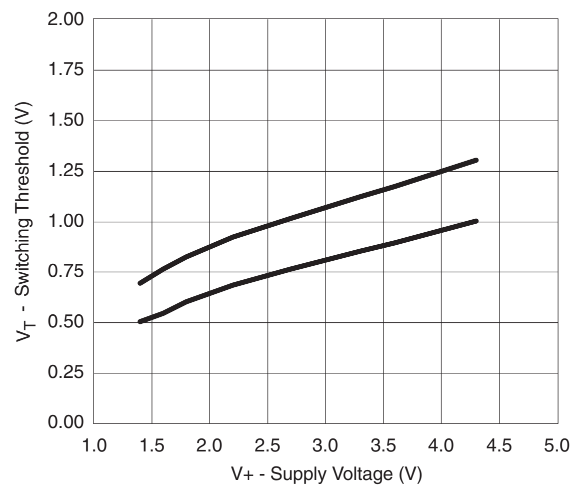
Leakage vs. Analog Voltage



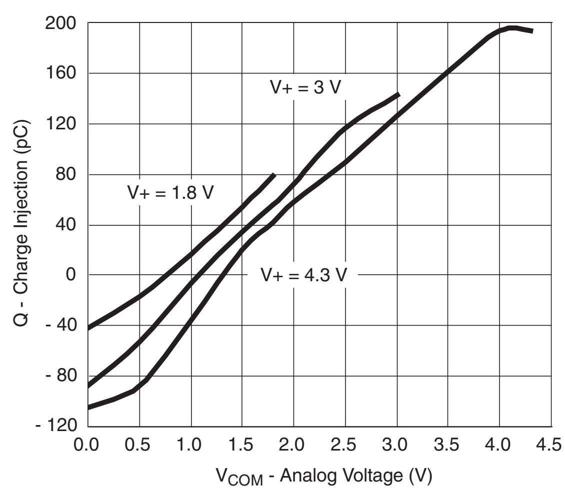
Switching Time vs. Temperature



Insertion Loss, Off-Isolation Crosstalk vs. Frequency



Switching Threshold vs. Supply Voltage



Charge Injection vs. Analog Voltage

TEST CIRCUITS

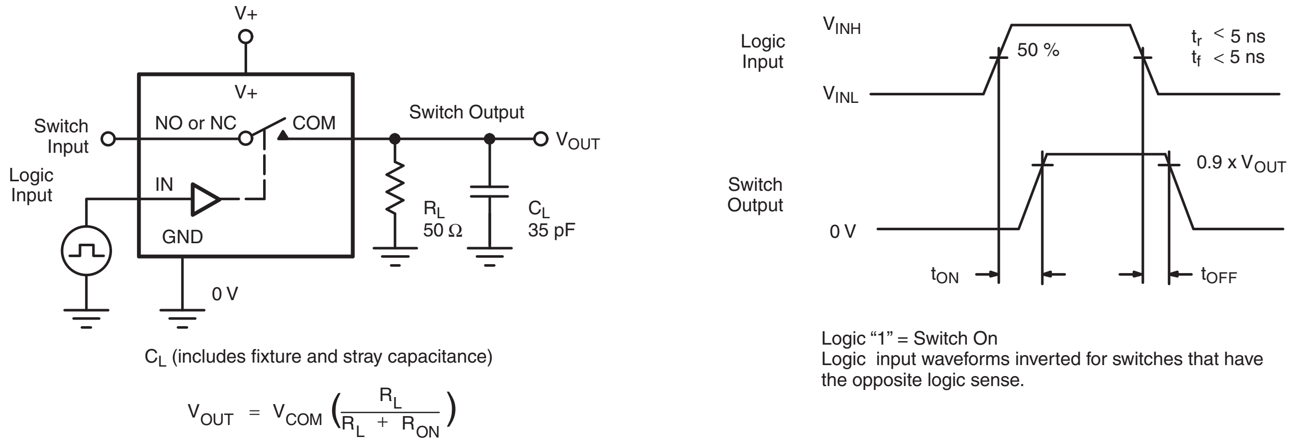


Fig. 1 - Switching Time

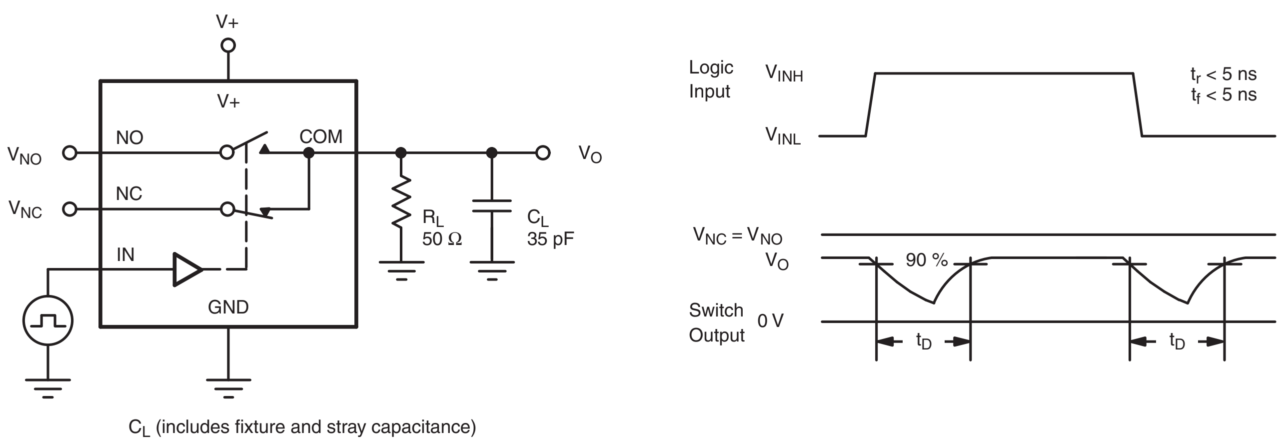


Fig. 2 - Break-Before-Make Interval

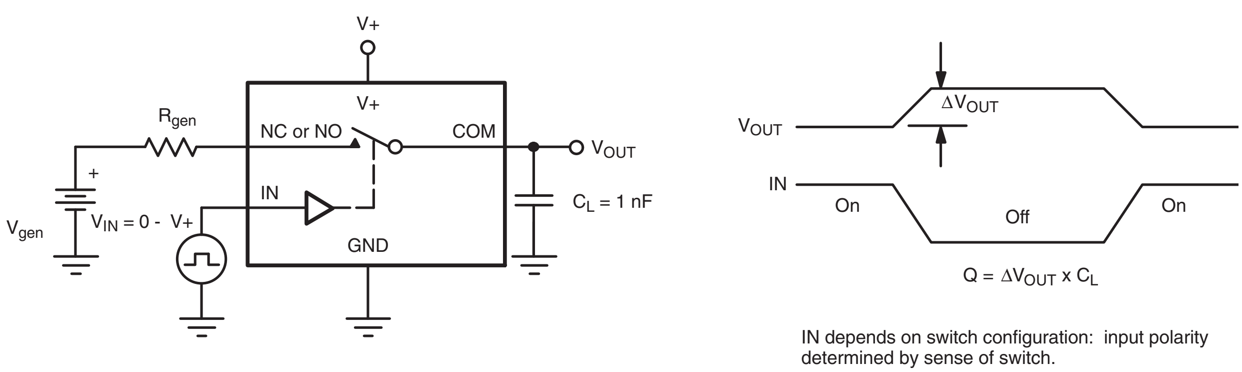


Fig. 3 - Charge Injection

TEST CIRCUITS

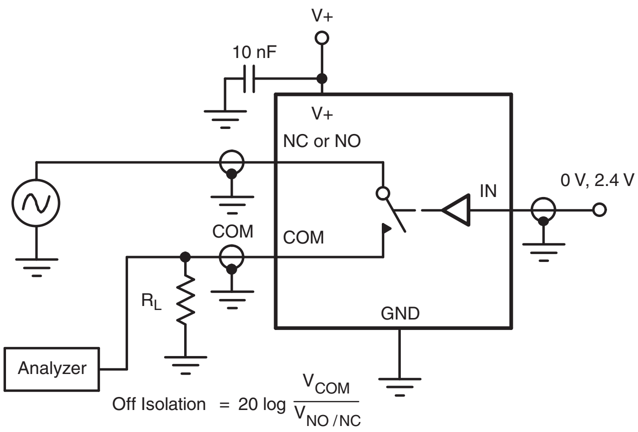


Fig. 4 - Off-Isolation

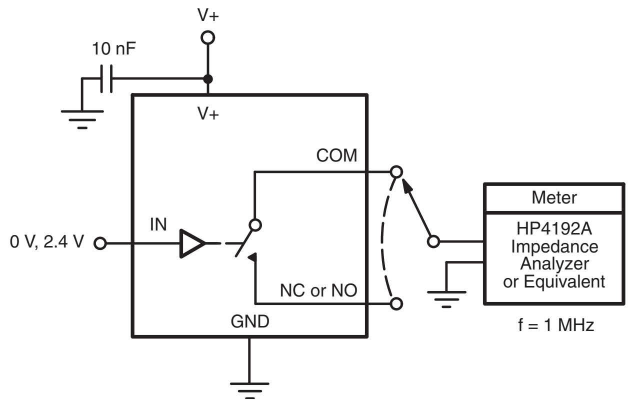
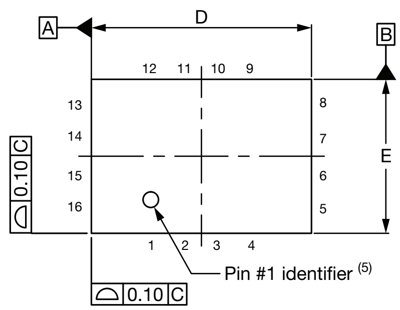


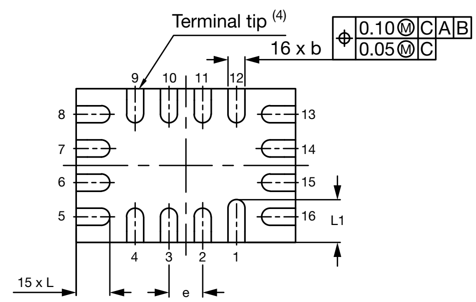
Fig. 5 - Channel Off/On Capacitance

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.

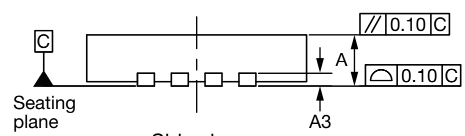
Thin miniQFN16 Case Outline



Top view



Bottom view



Side view

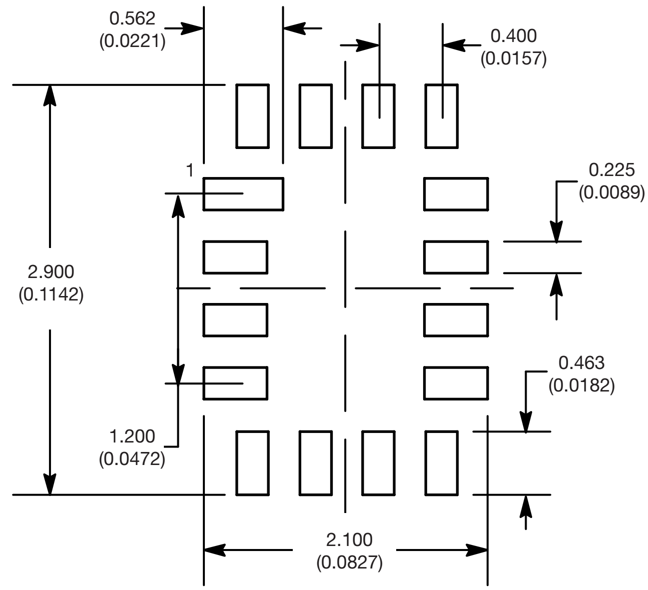
DIMENSIONS	MILLIMETERS (1)			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0	-	0.05	0	-	0.002
A3	0.15 ref.			0.006 ref.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.50	2.60	2.70	0.098	0.102	0.106
e	0.40 BSC			0.016 BSC		
E	1.70	1.80	1.90	0.067	0.071	0.075
L	0.35	0.40	0.45	0.014	0.016	0.018
L1	0.45	0.50	0.55	0.018	0.020	0.022
N (3)	16			16		
Nd (3)	4			4		
Ne (3)	4			4		

Notes

(1) Use millimeters as the primary measurement.
(2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
(3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
(4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
(5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
(6) Package warpage max. 0.05 mm.

ECN: T16-0226-Rev. B, 09-May-16
DWG: 6023

RECOMMENDED MINIMUM PADS FOR MINI QFN 16L



Mounting Footprint
Dimensions in mm (inch)

Disclaimer

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