

# High Speed, Low Voltage, 3 Ω, Quad SPDT CMOS Analog Switch

## DESCRIPTION

The DG2706 is a high speed, low voltage, low On-resistance, quad SPDT (single pole double throw) analog switch. It operates from a 1.65 V to 4.3 V single power supply and achieves 3 Ω switch On-resistance. When turned on, each switch conducts equally in both directions. Its switch on resistance flatness is 0.6 Ω and channel to channel matching is of 0.3 Ω when powered with single 3.15 V supply. All channels guaranteed break before make switching.

Control logic input has 0.5 V to 1.65 V logic threshold. It features a 190 MHz - 3 dB bandwidth, - 90 dB crosstalk and - 70 dB off-isolation at 1 MHz.

The DG2706 is an ideal fit for low voltage battery powered devices switching audio, video, multi-media data streams, and control signals between different functional circuits or ports.

The DG2707 comes in a small miniQFN-16 lead package (1.8 mm x 2.6 mm x 0.75 mm). As a committed partner to community and the environment, Vishay Siliconix manufactures this product with the lead(Pb)-free device terminations and is 100 % RoHS compliant.

## FEATURES

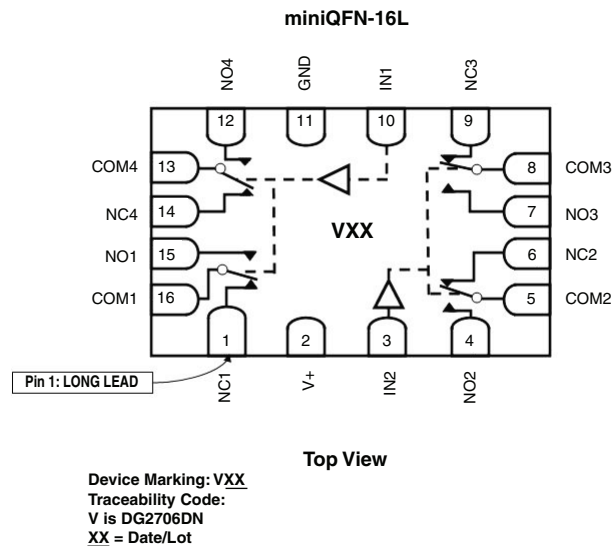
- Operation voltage range: 1.65 V to 4.3 V
- Guaranteed On-resistance: 3.0 Ω at 3.15 V
- Low voltage logic threshold
- Low crosstalk: - 70 dB
- High off-isolation: - 90 dB
- Ultra small package: miniQFN16 of 1.8 mm x 2.6 mm


**RoHS**  
COMPLIANT

## APPLICATIONS

- Dual SIM card switch
- A/V and analog signal routing
- Battery operated devices
- Data acquisition systems
- Communications systems
- Medical and ATE equipments

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



## ORDERING INFORMATION

Temp. Range	Package	Part Number
- 40 °C to 85 °C	miniQFN-16	DG2706DN-T1-E4

<b>TRUTH TABLE DG2706 QUAD SPDT, miniQFN-16L</b>			
Select Input		On Switches	
IN1 (Pin 10)	IN2 (Pin 3)	Description (Pin)	Common (Pin)
0	X	NC1 (Pin 1)	COM1 (Pin 16)
1	X	NO1 (Pin 15)	
0	X	NC4 (Pin 14)	COM4 (Pin 13)
1	X	NO4 (Pin 12)	
X	0	NC2 (Pin 6)	COM2 (Pin 5)
	1	NO2 (Pin 4)	
X	0	NC3 (Pin 9)	COM3 (Pin 3)
	1	NO3 (Pin 7)	

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)			
Parameter		Limit	Unit
Reference to GND	V+	- 0.3 to 5.0	V
	IN, COM, NC, NO <sup>a</sup>	- 0.3 to (V+ + 0.3)	
Current (Any terminal except NO, NC or COM)		30	mA
Continuous Current (NO, NC, or COM)		± 250	
Peak Current (Pulsed at 1 ms, 10 % Duty Cycle)		± 500	
Storage Temperature (D Suffix)		- 65 to 150	°C
Thermal Resistance (Package) <sup>b</sup>	miniQFN-16	152	°C/W
Power Dissipation (Package) <sup>b</sup>	miniQFN-16 <sup>c, d</sup>	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.



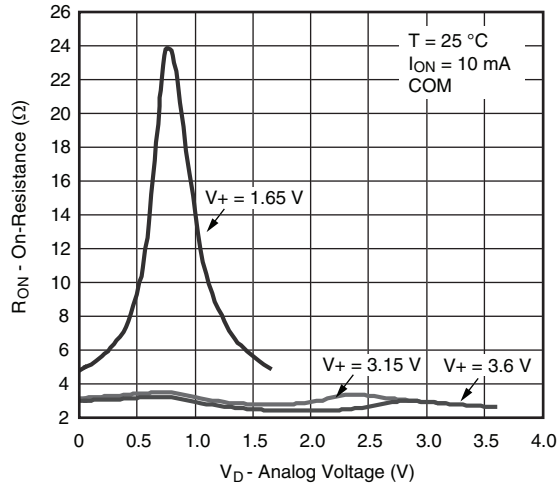
SPECIFICATIONS (V+ = 3.15 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified	Temp. <sup>b</sup>	Limits - 40 °C to 85 °C			Unit
				Min. <sup>d</sup>	Typ. <sup>c</sup>	Max. <sup>d</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>	R <sub>DS(on)</sub>	Full	0		V+	V
On-Resistance	R <sub>DS(on)</sub>	V+ = 3.15 V, I <sub>NO/NC</sub> = 10 mA, V <sub>COM</sub> = 1.0 V	Room		3	5.5	Ω
			Full			6	
R <sub>ON</sub> Match	ΔR <sub>(ON)</sub>	V+ = 3.15 V, I <sub>NO/NC</sub> = 10 mA, V <sub>COM</sub> = 1.0 V	Room		0.3		
R <sub>ON</sub> Resistance Flatness	R <sub>ON</sub>	V+ = 3.15 V, I <sub>NO/NC</sub> = 10 mA,	Room		0.6		
Channel Off Leakage Current	I <sub>NO/NC(off)</sub>	V+ = 3.6 V, V <sub>NO/NC</sub> = 0.5 V/3 V, V <sub>COM</sub> = 3 V/0.5 V	Room	- 5		5	nA
			Full	- 10		10	
	Room		- 5		5		
	Full		- 10		10		
Channel-On Leakage Current	I <sub>COM(on)</sub>	Room	- 10		10		
		Full	- 20		20		
<b>Digital Control</b>							
Input High Voltage	V <sub>INH</sub>		Full	1.65			V
Input Low Voltage	V <sub>INL</sub>		Full			0.4	
Input Current	I <sub>INL</sub> or I <sub>INH</sub>	V <sub>IN</sub> = 0 or V+	Full	- 1		1	μA
<b>Dynamic Characteristics</b>							
Break-Before-Make Time	t <sub>BBM</sub>	V <sub>NO</sub> , V <sub>NC</sub> = 1.5 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF	Room		1		ns
			Full	5			
Enable Turn-On Time	t <sub>ON(EN)</sub>		Room		20	45	
			Full			55	
Enable Turn-Off Time	t <sub>OFF(EN)</sub>		Room		15	35	
			Full			45	
Charge Injection <sup>d</sup>	Q <sub>INJ</sub>	C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>NC/NO</sub> = 2 V	Room		3		pC
Off-Isolation <sup>d</sup>	OIRR	V+ = 3.15 V, f = 1 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room		- 70		dB
Crosstalk <sup>d, f</sup>	X <sub>TALK</sub>		Room		- 90		
Bandwidth <sup>d</sup>	BW	V+ = 3.15 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, - 3 dB	Room		190		MHz
Total Harmonic Distortion <sup>d</sup>	THD	V+ = 3.15 V, R <sub>LOAD</sub> = 600 Ω	Room		0.02		%
N <sub>O</sub> , N <sub>C</sub> Off Capacitance <sup>d</sup>	CS <sub>NC(off)</sub>	V+ = 3.15 V, f = 1 MHz	Room		16		pF
	CS <sub>NO(on)</sub>				15		
Channel-On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>					31	
<b>Power Supply</b>							
Power Supply Range	V+			1.65		4.3	V
Power Supply Current	I+	V <sub>IN</sub> = 0 or V+	Full			1	μA

Notes:

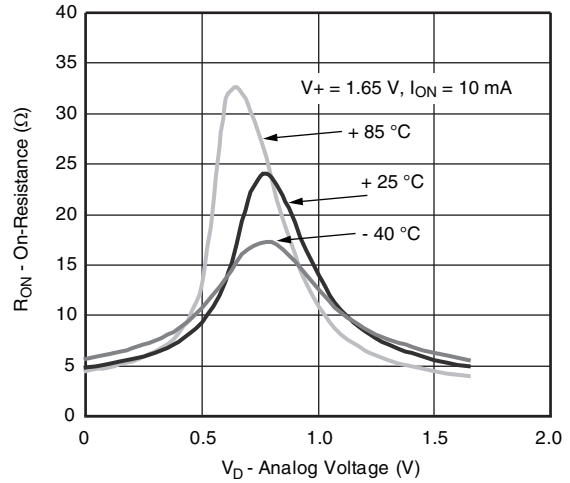
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d.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

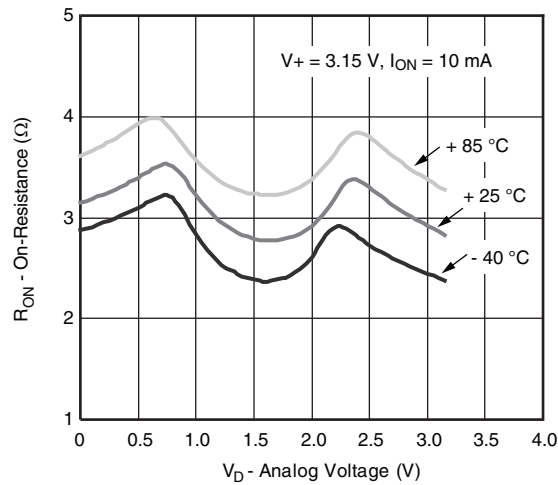
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



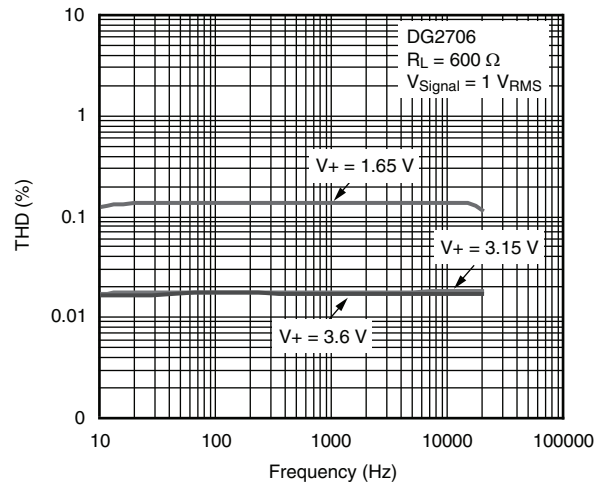
**$R_{ON}$  vs.  $V_D$  and Single Supply Voltage**



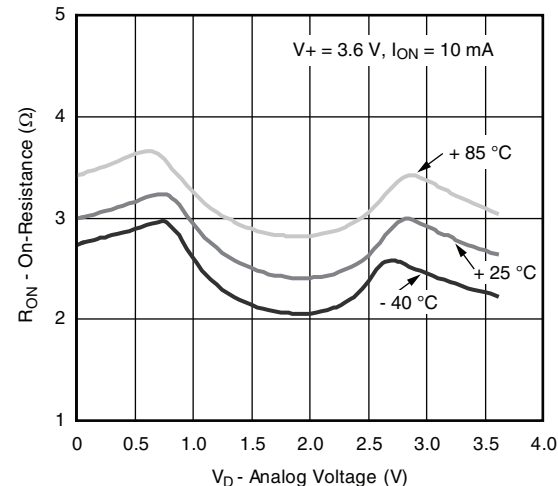
**$R_{ON}$  vs. Analog Voltage and Temperature**



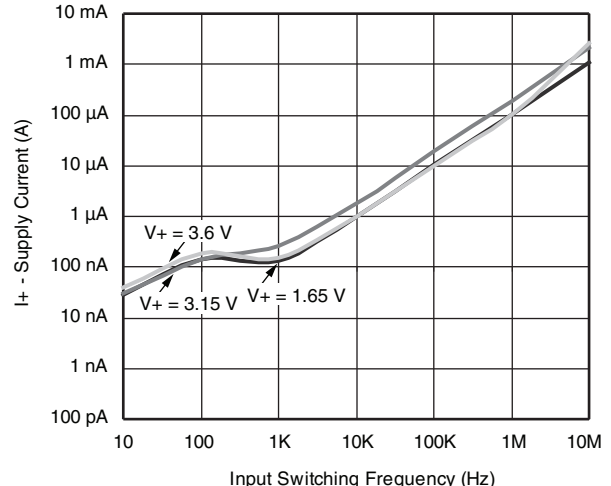
**$R_{ON}$  vs. Analog Voltage and Temperature**



**Switching Threshold vs. Supply Voltage**

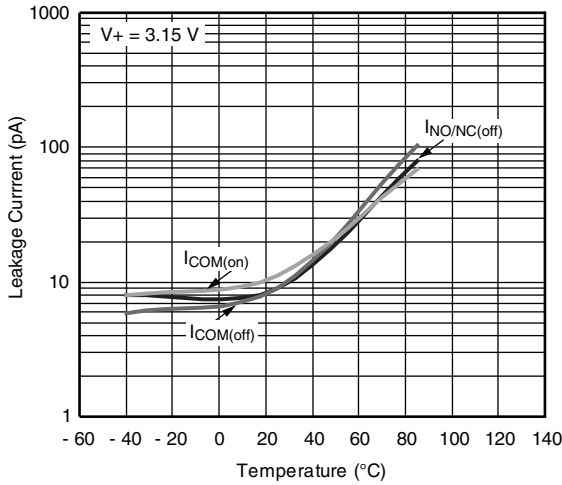


**$R_{ON}$  vs. Analog Voltage and Temperature**

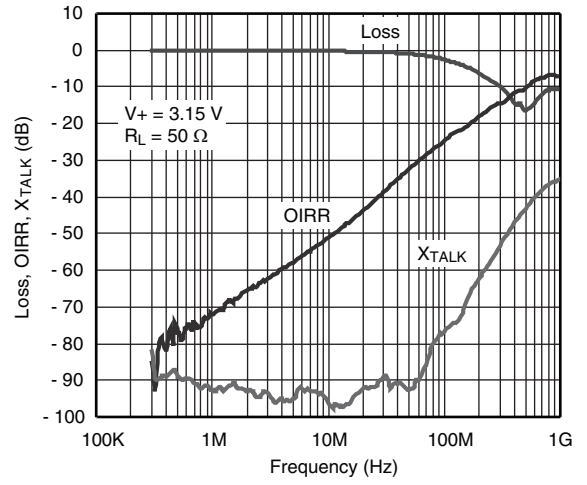


**Supply Current vs. Input Switching Frequency**

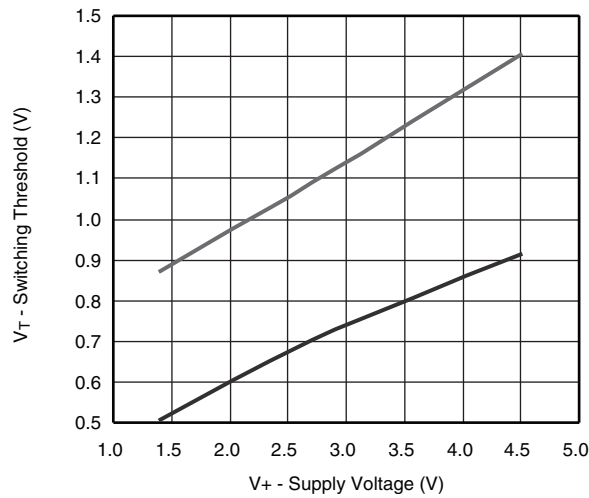
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



**Leakage Current vs. Temperature**

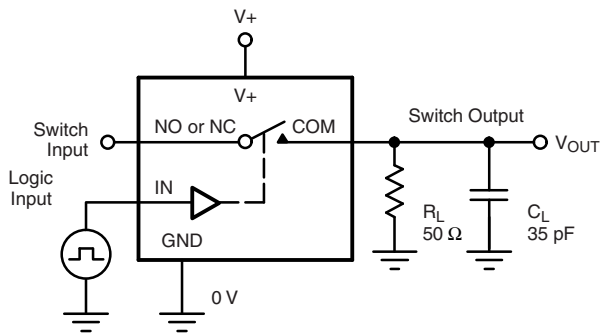


**Insertion Loss, Off-Isolation Crosstalk vs. Frequency**



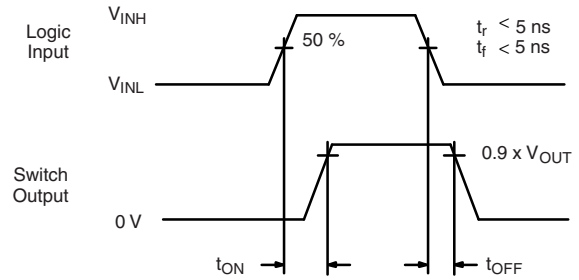
**Switching Threshold vs. Supply Voltage**

TEST CIRCUITS



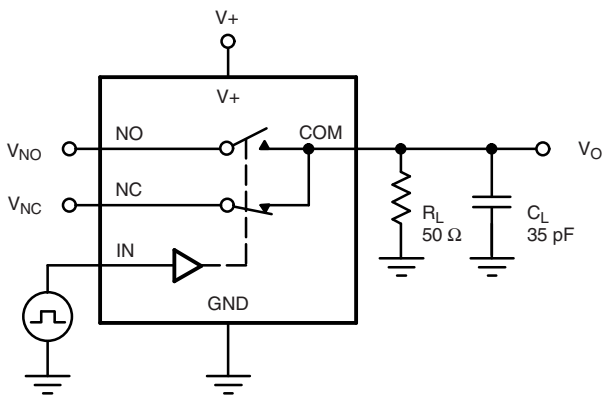
$C_L$  (includes fixture and stray capacitance)

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



Logic "1" = Switch on  
Logic input waveforms inverted for switches that have the opposite logic sense.

Figure 1. Switching Time



$C_L$  (includes fixture and stray capacitance)

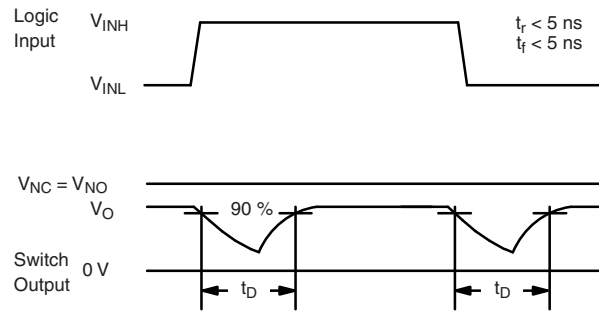
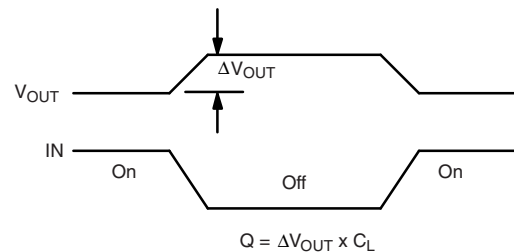
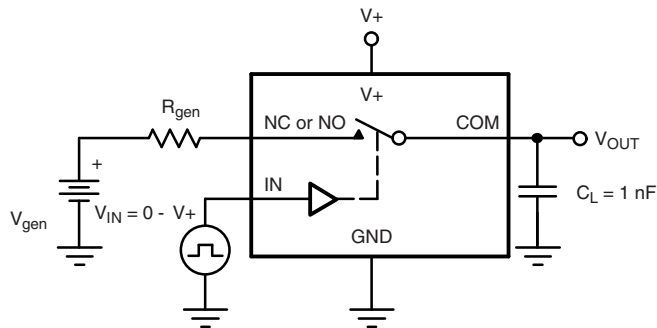
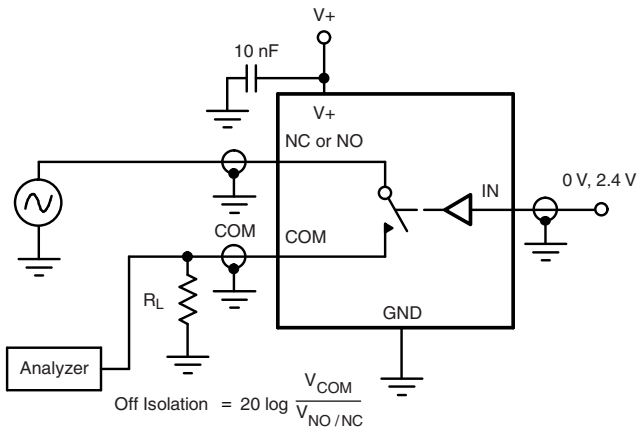
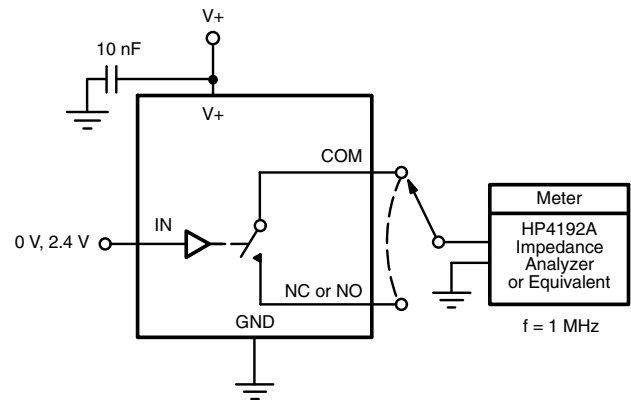


Figure 2. Break-Before-Make Interval



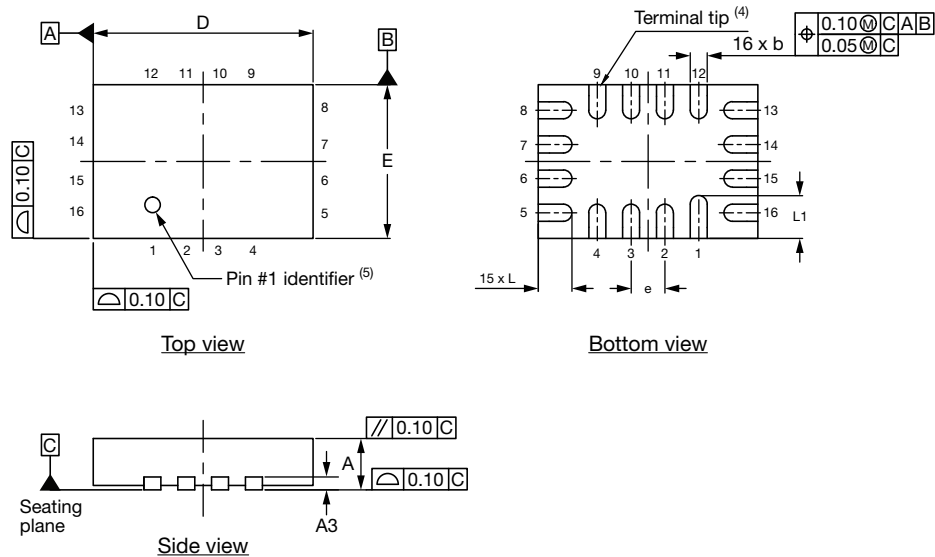
IN depends on switch configuration: input polarity determined by sense of switch.

Figure 3. Charge Injection

**TEST CIRCUITS**

**Figure 4. Off-Isolation**

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

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?68392](http://www.vishay.com/ppg?68392).

## Thin miniQFN16 Case Outline



DIMENSIONS	MILLIMETERS <sup>(1)</sup>			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 <sup>(3)</sup>	16			16		
Nd <sup>(3)</sup>	4			4		
Ne <sup>(3)</sup>	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)



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