

## Low Voltage, Dual DPDT in miniQFN16

### DESCRIPTION

The DG2599 is a CMOS Dual DPDT (Dual Double Pole Double Throw) analog switch that operates over a wide voltage range of 1.65 V to 5 V. It is optimized for portable applications switching audio, SIM card signals, and other low power signals.

The DG2599 features low ON resistance of 2.8  $\Omega$  at 3 V power supply, fast switching speed, and low power consumption even when control logic signals are below  $V+$  power supply voltage. The well matched dual DPDT switches conduct signals equally in both directions. The DG2599 is designed to guarantee break before make switching.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. DG2599 are offered in a miniQFN package. The miniQFN package has a nickel palladium- gold device termination and is represented by the lead (Pb)-free “-E4” suffix. The nickel-palladium-gold device terminations meet all JEDEC® standards for reflow and MSL ratings.

### FEATURES

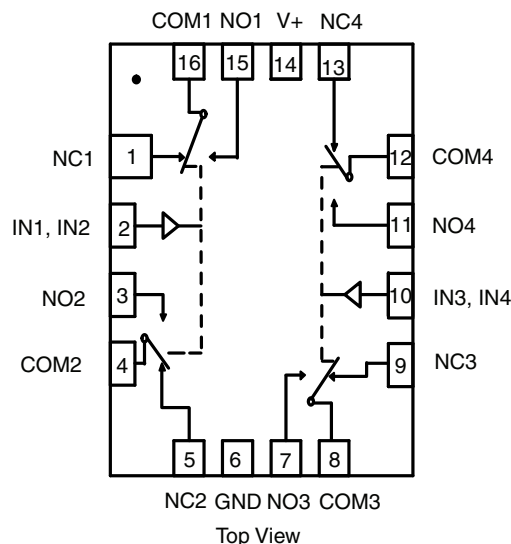
- Halogen-free according to IEC 61249-2-21 definition
- Low voltage operation: 1.65 V to 5.5 V
- Low on-resistance: 2.8  $\Omega$  at  $V+ = 3$  V
- Power off protection on COM1 and COM2 pins
- Latch up current great than 300 mA per JESD78
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### APPLICATIONS

- Cellular phones
- PMPs and PDAs
- Modems and peripherals
- Computers and ebooks
- Tablet devices
- Displays and gaming
- STB

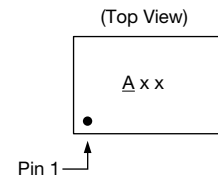
ORDERING INFORMATION	
PART NUMBER	PACKAGE
DG2599DN-T1-GE4	miniQFN16 1.8 mm x 2.6 mm



### TRUTH TABLE (DG2599)

LOGIC	NC1, 2, 3 AND 4	NO 1, 2, 3 AND 4
0	ON	OFF
1	OFF	ON

Device Marking: A xx  
xx = Date/Lot Traceability Code



Note: Pin 1 has long lead



<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Reference to GND	V+		-0.3 to +6	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)			± 300	
Peak current (pulsed at 1 ms, 10 % duty cycle)			± 500	
Storage temperature (D suffix)			-65 to +150	°C
Package solder reflow conditions <sup>d</sup>	miniQFN16		250	
Power dissipation (packages) <sup>b</sup>	miniQFN16 <sup>c</sup>		525	mW

**Note**

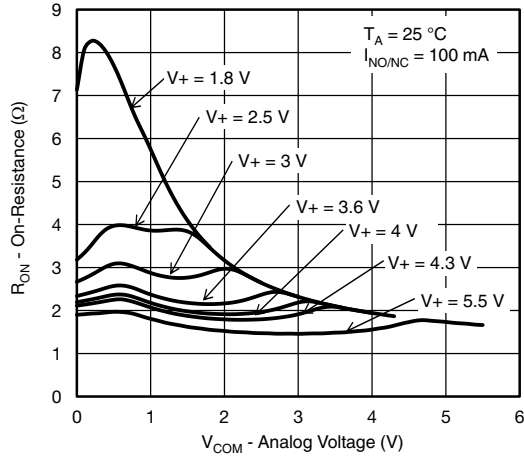
- a. Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings
- b. All leads welded or soldered to PC board
- c. Derate 6.6 mW/°C above 70 °C
- d. Manual soldering with iron is not recommended for leadless components. The 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

<b>ELECTRICAL CHARACTERISTICS</b> ( $V_+ = 3\text{ V}$ )						
PARAMETER	TEST CONDITIONS	TEMP.	MIN.	TYP.	MAX.	UNIT
<b>Power Supply and Signal</b>						
V+ supply voltage		Full	1.65	-	5.5	V
V+ supply current	$V_{IN} = 0\text{ or }V_+$	Full	-	0.001	2	µA
Analog signal range		Full	0	-	V+	V
<b>Switch On-Resistance and Leakage</b>						
Drain-source on-resistance	$V_+ = 3\text{ V}$ , $I_{NO/NC} = 100\text{ mA}$ , $V_{COM} = 0.9\text{ V}$ , $2.3\text{ V}$	Room	-	2.8	3.3	W
		Full	-	-	3.6	
On-resistance flatness	$V_+ = 3\text{ V}$ , $I_{NO/NC} = 100\text{ mA}$ , $V_{COM} = 0\text{ to }V_+$	Room	-	0.24	1.1	W
		Full	-	-	1.3	
Switch off leakage current	$V_+ = 4.3\text{ V}$ , $V_{NO/NC} = 0.3\text{ V}/4\text{ V}$ , $V_{COM} = 4\text{ V}/0.3\text{ V}$	Room	-10	0.1	10	nA
		Full	-100	-	100	
Channel on-leakage current	$V_+ = 4.3\text{ V}$ , $V_{NO/NC}$ and $V_{COM} = 0.3\text{ V}/4\text{ V}$	Room	-10	0.1	10	nA
		Full	-100	-	100	
<b>Digital Control</b>						
Input, high voltage	$V_+ = 4.3\text{ V}$	Full	1.6	-	-	V
	$V_+ = 3\text{ V}$		1.3	-	-	
Input, low voltage	$V_+ = 4.3\text{ V}$	Full	-	-	0.6	V
	$V_+ = 3\text{ V}$		-	-	0.5	
Input, bias current	$V_{IN} = V_+$	Full	-1	0.01	1	µA
<b>Dynamic Characteristics</b>						
Turn on-time	$V_{COM}$ or $V_{NO/NC} = 3\text{ V}$ , $R_L = 50\text{ }\Omega$ , $C_L = 35\text{ pF}$	Room	-	-	90	ns
		Full	-	-	115	
Turn off-time	$V_{COM}$ or $V_{NO/NC} = 3\text{ V}$ , $R_L = 50\text{ }\Omega$ , $C_L = 35\text{ pF}$	Room	-	-	70	ns
		Full	-	-	85	
Break before make time	$V_{COM}$ or $V_{NO/NC} = 3\text{ V}$ , $R_L = 50\text{ }\Omega$ , $C_L = 35\text{ pF}$	Room	2	-	-	ns
		Full	2	-	-	
Charge injection	$C_L = 1\text{ nF}$ , $R_{GEN} = 0\text{ }\Omega$	Room	-	± 10	-	pC
Off isolation	$R_L = 50\text{ }\Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$		-	-66	-	dB
Crosstalk	$R_L = 50\text{ }\Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ , non-adjacent channels		-	-110	-	
3 dB bandwidth	$C_L = 5\text{ pF}$ , $R_L = 50\text{ }\Omega$		-	186	-	MHz

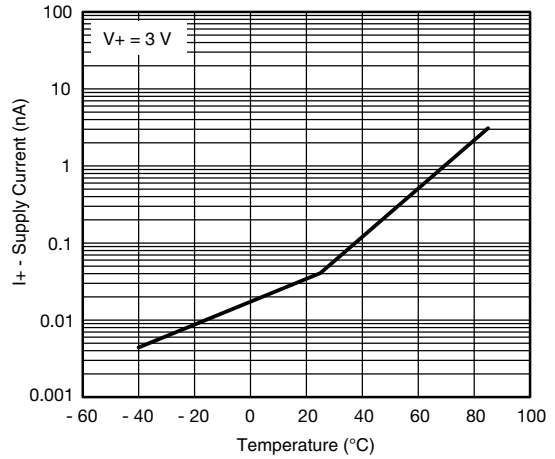


ELECTRICAL CHARACTERISTICS ( $V_+ = 3\text{ V}$ )						
PARAMETER	TEST CONDITIONS	TEMP.	MIN.	TYP.	MAX.	UNIT
Source off capacitance	$V_{IN} = 0$ or $V_+$ , $f = 1\text{ MHz}$		-	9	-	pF
Channel on capacitance	$V_{IN} = 0$ or $V_+$ , $f = 1\text{ MHz}$		-	26	-	

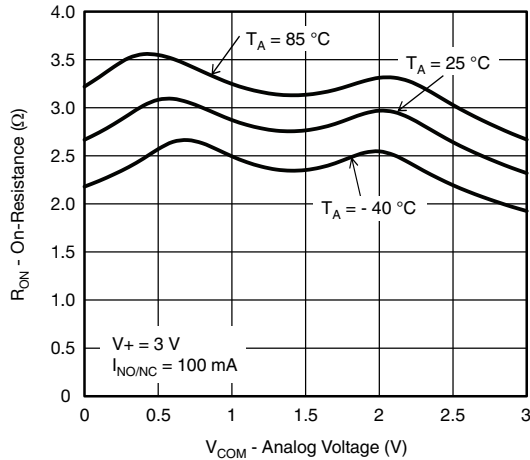
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



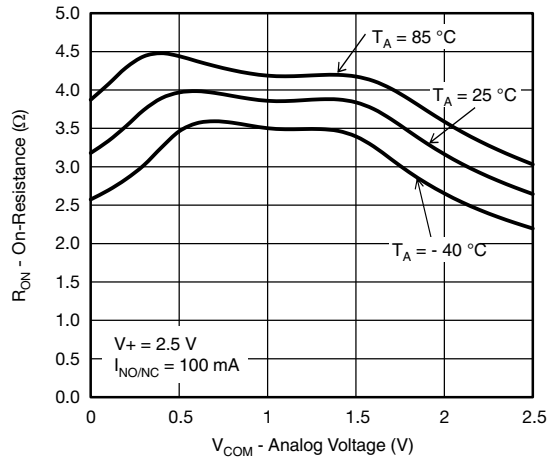
**RON vs. VCOM and Single Supply Voltage**



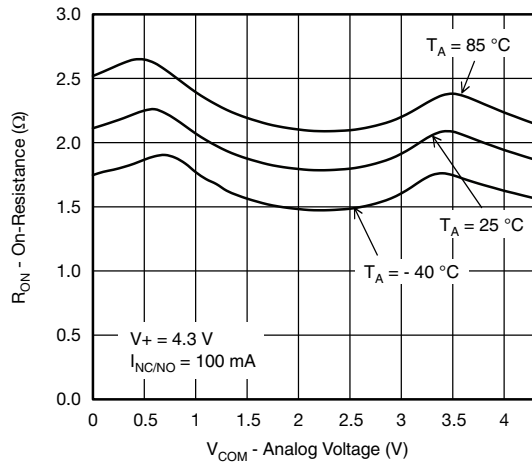
**Supply Current vs. Temperature**



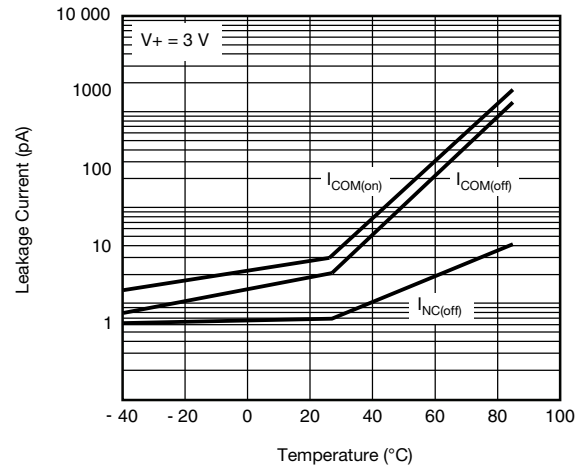
**RON vs. Analog Voltage and Temperature**



**RON vs. Analog Voltage and Temperature**

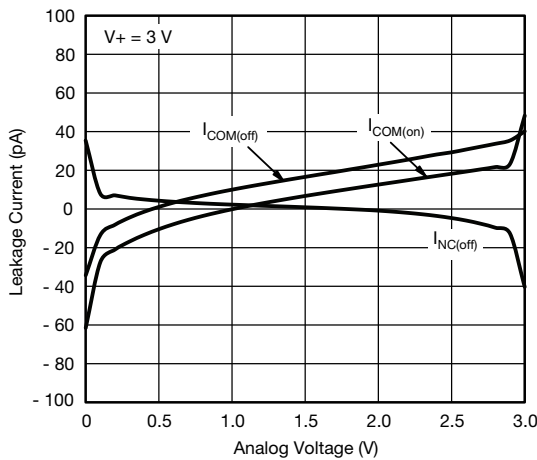


**RON vs. Analog Voltage and Temperature**

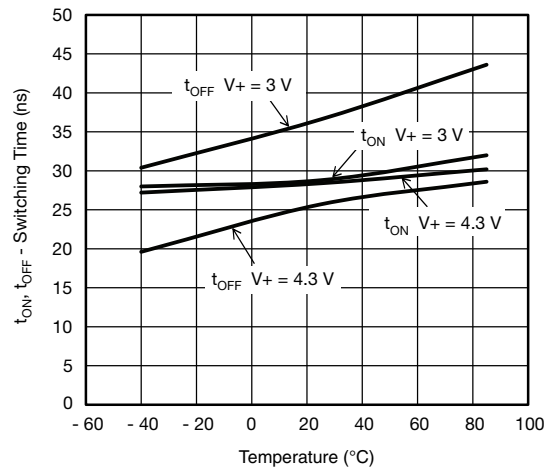


**Leakage Current vs. Temperature**

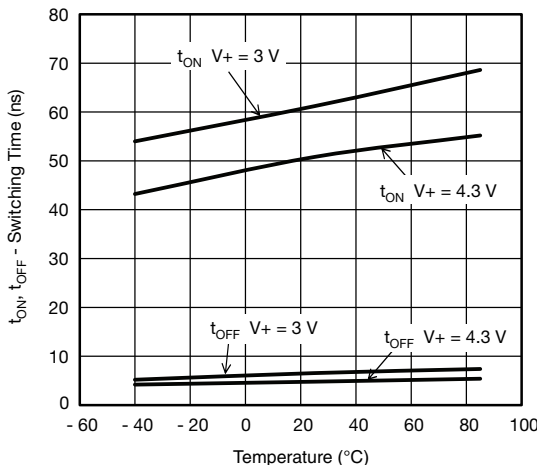
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



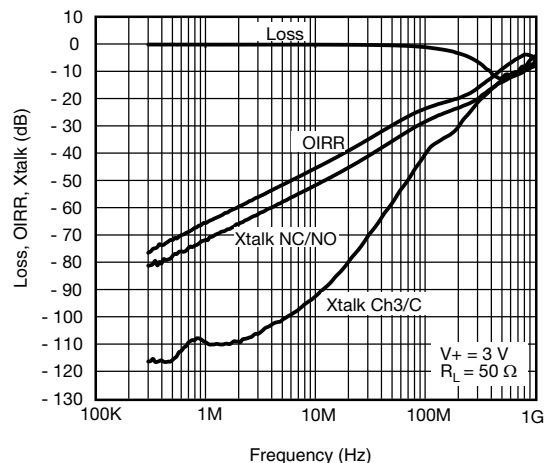
**Leakage vs. Analog Voltage**



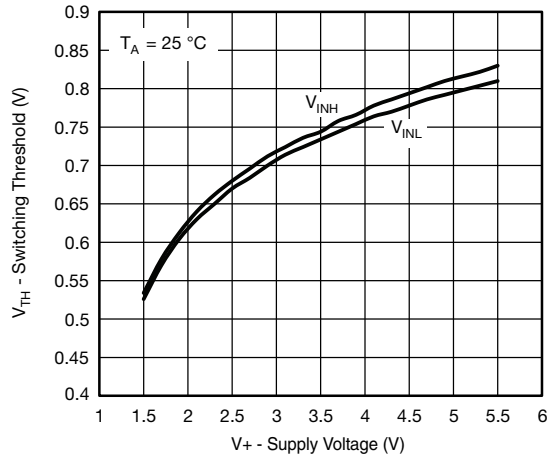
**(NO) Switching Time vs. Temperature**



**(NC) Switching Time vs. Temperature**

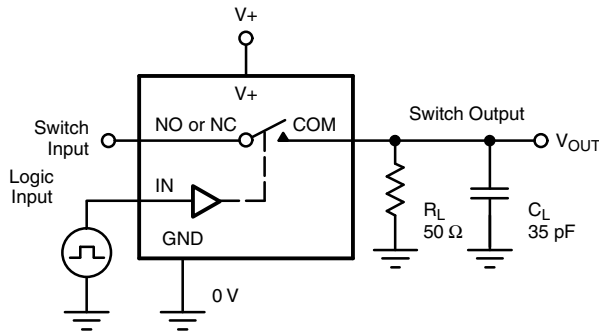


Insertion Loss, Off Isolation and Crosstalk



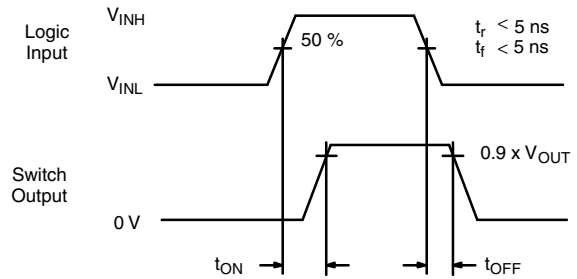
Switching Threshold vs. Supply Voltage

TEST CIRCUITS



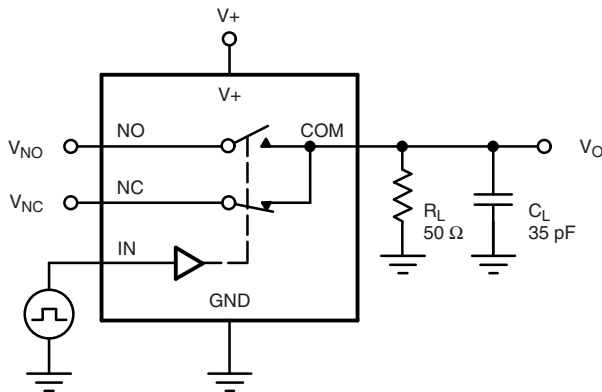
C<sub>L</sub> (includes fixture and stray capacitance)

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

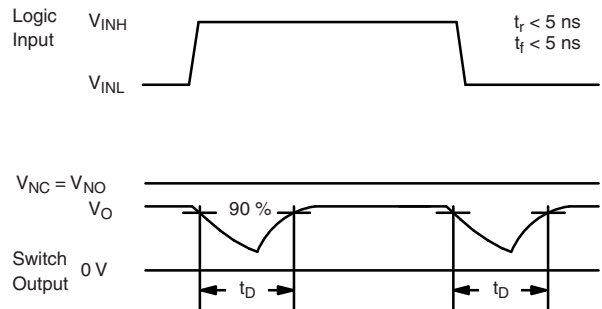


Logic "1" = Switch On  
Logic input waveforms inverted for switches that have the opposite logic sense.

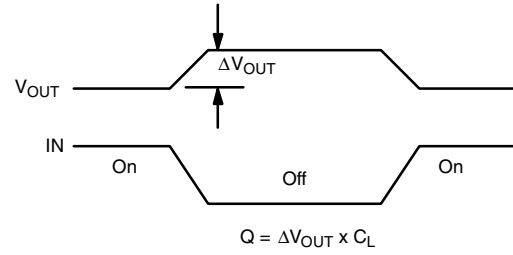
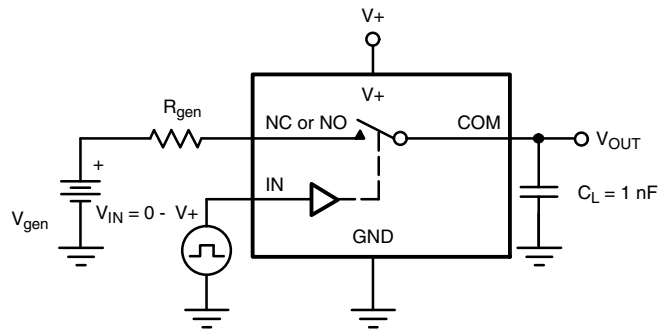
Switching Time



C<sub>L</sub> (includes fixture and stray capacitance)

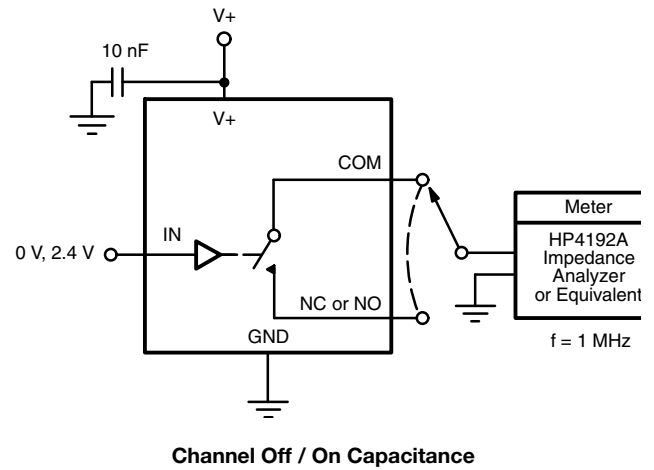
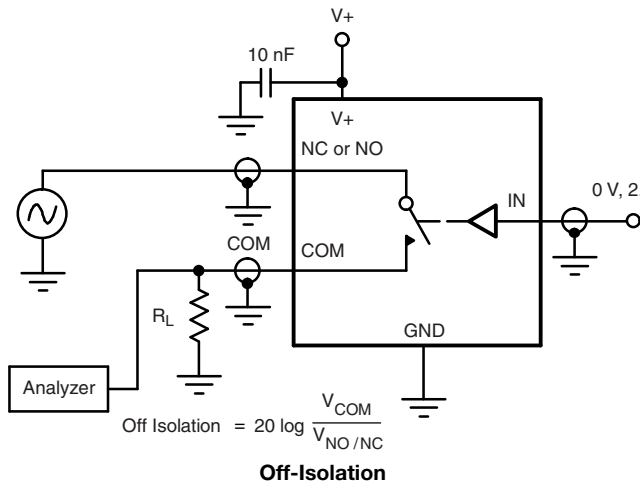


Break-Before-Make Interval



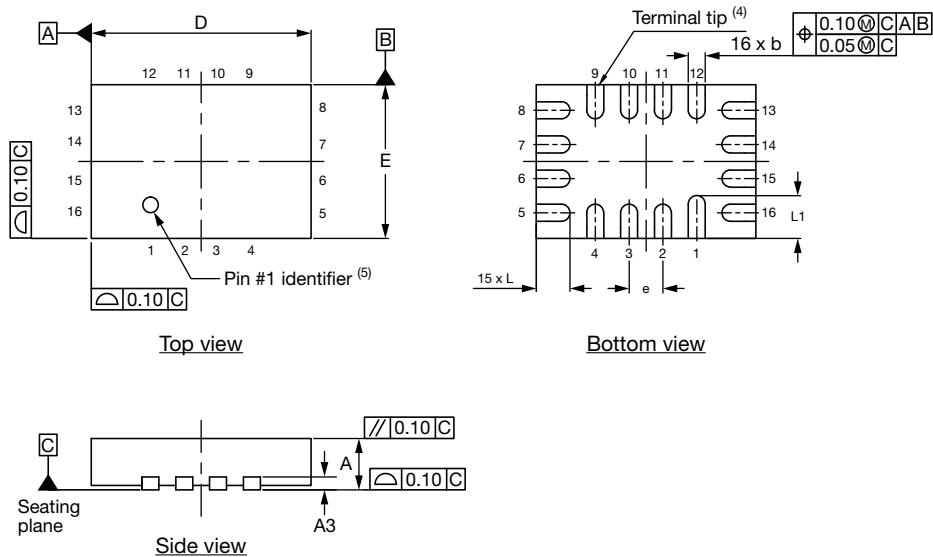
$IN$  depends on switch configuration: input polarity determined by sense of switch.

**Charge Injection**

**TEST CIRCUITS**


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?67667](http://www.vishay.com/ppg?67667).

### 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		

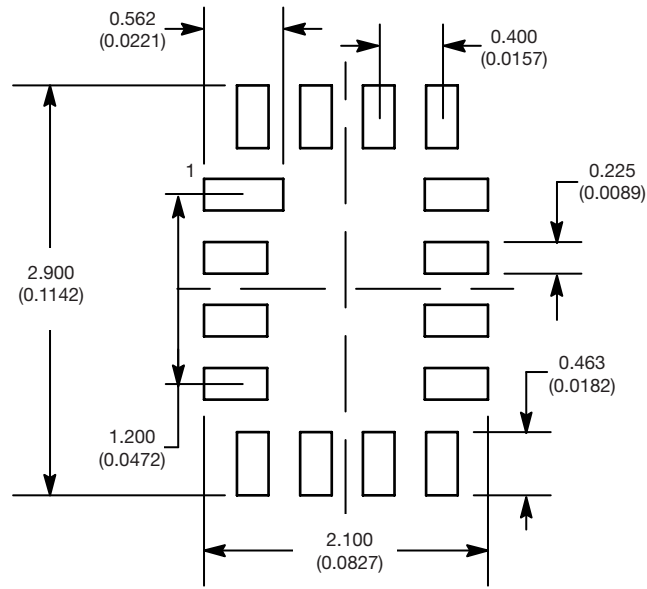
#### Notes

- (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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