



Low Voltage, Dual SPDT Analog Switch with Charge Pump

DESCRIPTION

The DG2616, DG2617, DG2618 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 DG2616, DG2617, DG2618 are ideal for portable and battery powered applications.

The DG2616, DG2617, DG2618 have built-in charge-pump circuitry which lowers the minimum supply voltage to + 1.5 V while maintaining low on-resistance. The Control circuitry allows the DG2616, DG2617, DG2618 to operate in different configurations.

Built on Vishay Siliconix's low voltage process, the DG2616, DG2617, DG2618 has an epitaxial layer that prevents latch-up. Break-before-make is guaranteed.

The DG2616, DG2617, DG2618 are manufactured in space saving DFN-10 (3.0 x 3.0 mm). And as a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations and is 100 % RoHS compliant.

FEATURES

- Low voltage operation (1.5 V to 3.6 V)
- Low on-resistance - R_{ON} : 4.2 Ω typ. at 2.7 V
- Fast switching: t_{ON} = 39 ns
 t_{OFF} = 8 ns
- DFN-10 package

**RoHS**
COMPLIANT

BENEFITS

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

APPLICATIONS

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

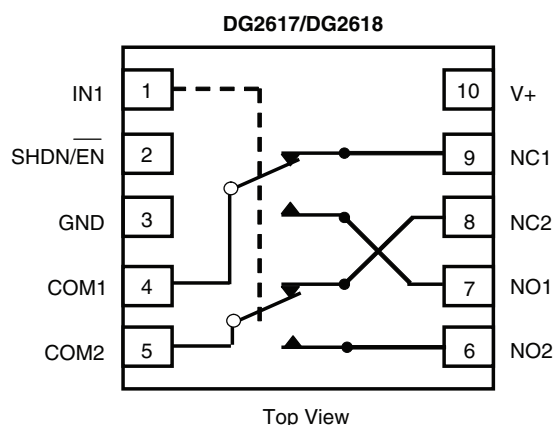
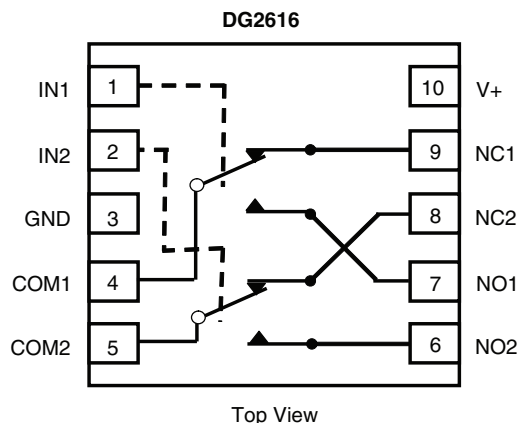
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

TRUTH TABLE DG2616		
Logic	NC1, 2	NO1, 2
0	ON	OFF
1	OFF	ON

TRUTH TABLE DG2617				
SHDN/ $\overline{EN}$ Logic	IN Logic	NC1, 2	NO1, 2	Charge Pump
0	0	ON	OFF	ON
0	1	OFF	ON	ON
1	0	ON	OFF	OFF
1	1	OFF	ON	OFF

TRUTH TABLE DG2618				
SHDN/ $\overline{EN}$ Logic	IN Logic	NC1, 2	NO1, 2	Charge Pump
0	0	ON	OFF	ON
0	1	OFF	ON	ON
1	x	OFF	OFF	OFF

ORDERING INFORMATION		
Temp. Range	Package	Part Number
- 40 °C to 85 °C	DFN-10	DG2616DN-T1-E4 DG2617DN-T1-E4 DG2618DN-T1-E4



ABSOLUTE MAXIMUM RATINGS $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted			
Parameter		Limit	Unit
Reference to GND	V+	- 0.3 to 6.0	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)		± 150	
Peak Current (Pulsed at 1 ms, 10 % Duty Cycle)		± 300	
Storage Temperature (D-Suffix)		- 65 to 150	$^{\circ}\text{C}$
Package Solder Reflow Conditions ^d			
Power Dissipation (Packages) ^b	DFN-10 ^c	1191	mW

Notes:

- Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads welded or soldered to PC board.
- Derate 14.9 mW/ $^{\circ}\text{C}$ above 70 $^{\circ}\text{C}$
- Manual soldering with iron is not recommended for leadless components. The DFN-10 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+ = 1.5 V, VCOM = 1.5 V, INO, INC = 10 mA	Room Full		5.3	7.0 8.0	Ω	
		V+ = 2.7 V, VCOM = 1.5 V, INO, INC = 10 mA	Room		4.2	7.0		
		V+ = 2.7 V, VCOM = 2.7 V, INO, INC = 10 mA			4.7			
			Full			8.0		
		V+ = 3.6 V, VCOM = 3.6 V, INO, INC = 10 mA	Room Full		5.5	7.0 8.0		
RON Flatness ^d	RON Flatness	V+ = 2.7 V, VCOM = 1.5 V, 2.7 V, INO, INC = 10 mA	Room		0.6	2.0		
RON Match ^d	ΔRON		Room		0.1			
On Resistance (Shutdown)	RSHDN	V+ = 3.6 V, VCOM = 1.7 V, INO, INC = 10 mA	Room Full		15	20 21		
Switch Off Leakage Current	INO(off), INC(off)	V+ = 3.6 V, VNO, VNC = 0.3 V/3.3 V, VCOM = 3.3 V/0.3 V	Room Full	- 2 - 10		2 10	nA	
	ICOM(off)		Room Full	- 2 - 10		2 10		
Channel-On Leakage Current	ICOM(on)	V+ = 3.6 V, VNO, VNC = VCOM = 0.3 V/3.3 V	Room Full	- 2 - 10		2 10		
Digital Control								
Input High Voltage	VINH	V+ = 1.5 V	Full	1.0			V	
		V+ = 2.7 V to 3.6 V		1.4				
Input Low Voltage	VINL	V+ = 1.5 V				0.4		
		V+ = 2.7 V to 3.6 V				0.5		
Input Capacitance	Cin		Full		3.2		pF	
Input Current	INL or INH	VIN = 0 or V+	Full	- 1		1	μA	
Dynamic Characteristics								
Turn-On Time	tON	V+ = 2.7 or 3.6 V, VNO or VNC = 1.5 V, RL = 50 Ω, CL = 35 pF	Room Full		39	69 76	ns	
Turn-Off Time	tOFF		Room Full		9	39 41		
Break-Before-Make Time	td		Full	1				
Charge Injection ^d	QINJ		CL = 1 nF, VGEN = 0 V, RGEN = 0 Ω	Room		7		pC
Off-Isolation ^d	OIRR	RL = 50 Ω, CL = 5 pF, f = 1 MHz	Room		- 77		dB	
		RL = 50 Ω, CL = 5 pF, f = 100 MHz			- 32			
Crosstalk ^{d, f}	XTALK	RL = 50 Ω, CL = 5 pF, f = 1 MHz			- 80			
		RL = 50 Ω, CL = 5 pF, f = 100 MHz			- 32			
NO, NC Off Capacitance ^d	CNO(off)	f = 1 MHz	Room		9		pF	
	CNC(off)		Room		7			
Channel-On Capacitance ^d	CNO(on)		Room		21			
	CNC(on)		Room		19			

SPECIFICATIONS $V_+ = 3\text{ V}$								
Parameter	Symbol	Test Conditions Otherwise Unless Specified $V_+ = 3\text{ V}, \pm 10\%, V_{\text{IN}} = 0.5\text{ or }1.4\text{ V}^{\text{e}}$		Temp. ^a	Limits - 40 °C to 85 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Power Supply								
Power Supply Range	V+				1.5		3.6	V
Power Supply Current	I+	$V_+ = 3.6\text{ V}, V_{\text{IN}} = 0\text{ or }V_+, \text{SHDN}/\overline{\text{EN}} = 0\text{ V}$		Full		104	300	μA
		$V_+ = 3.6\text{ V}, V_{\text{IN}} = 0\text{ or }V_+, \text{SHDN}/\overline{\text{EN}} = V_+$				0.1	2	

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.

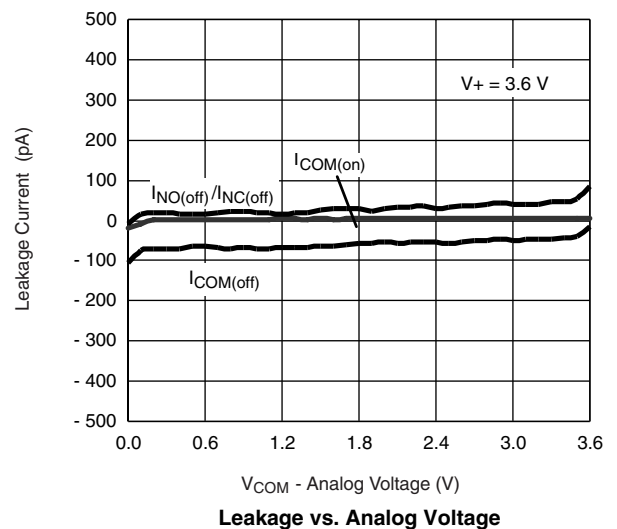
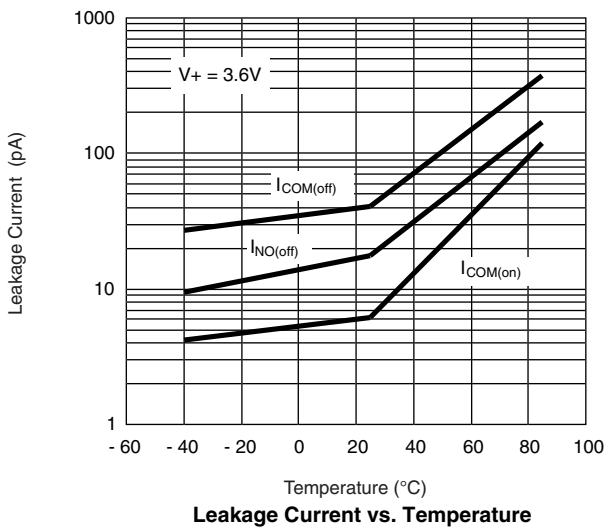
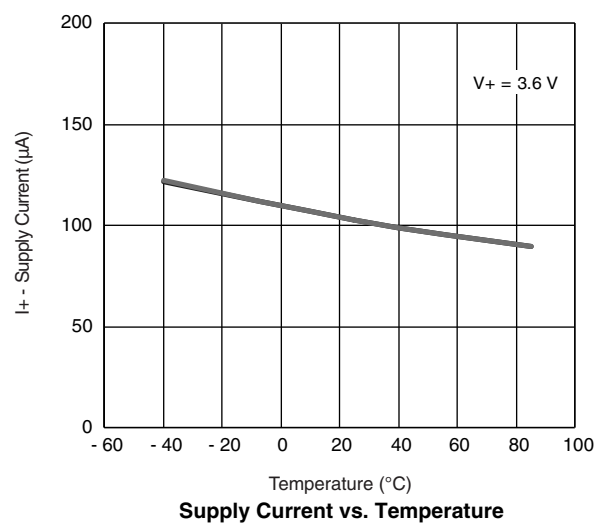
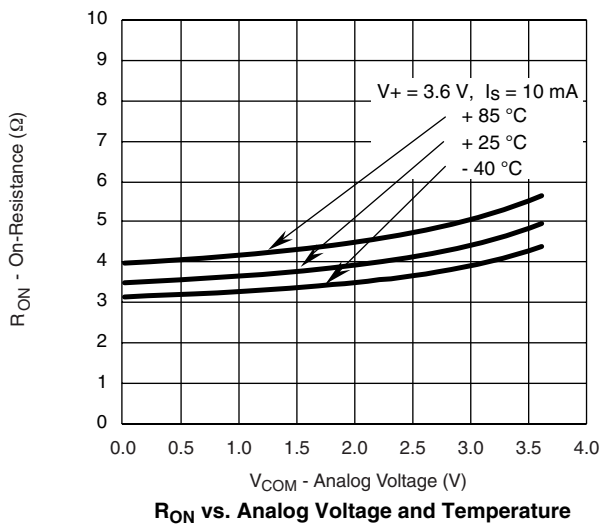
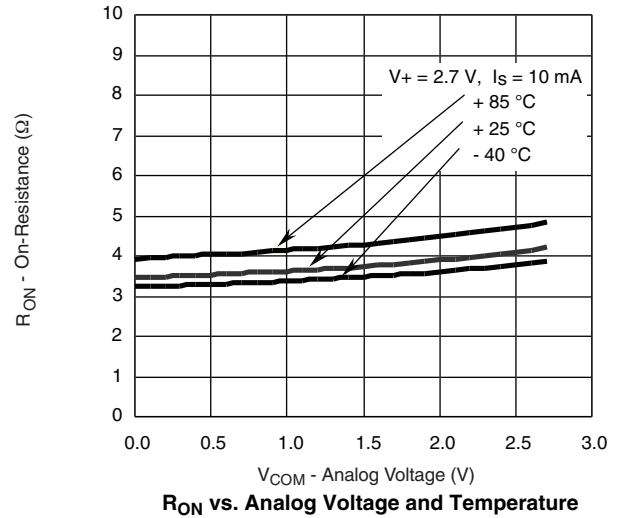
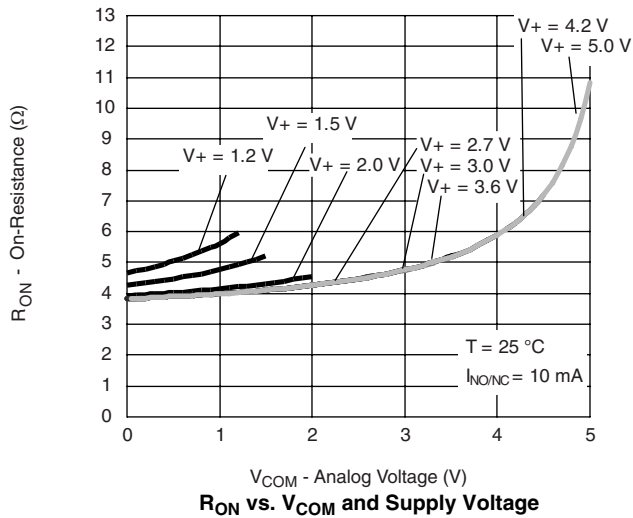
c. Typical values are for design aid only, not guaranteed nor subject to production testing.

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

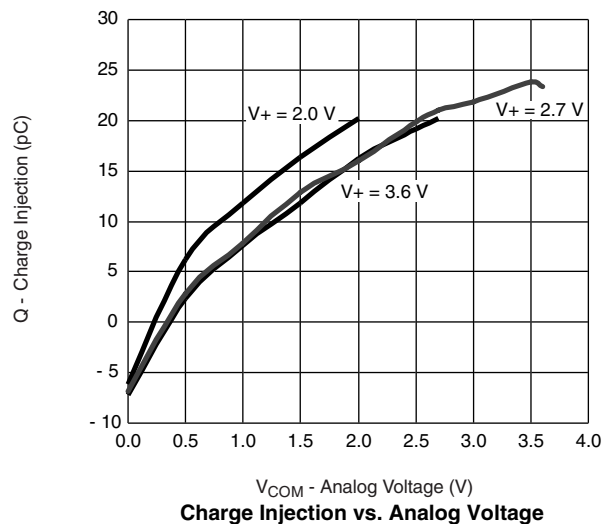
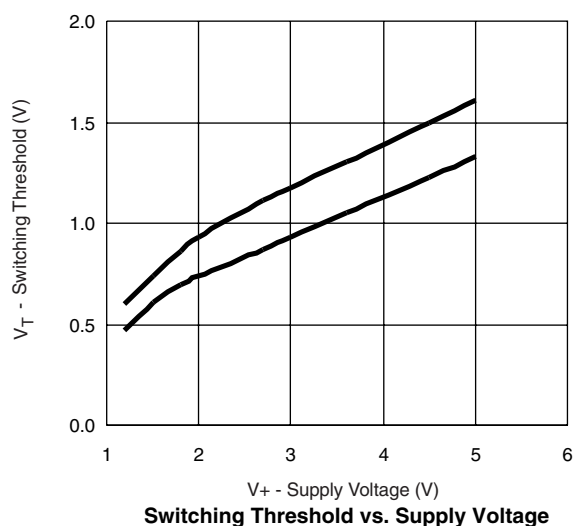
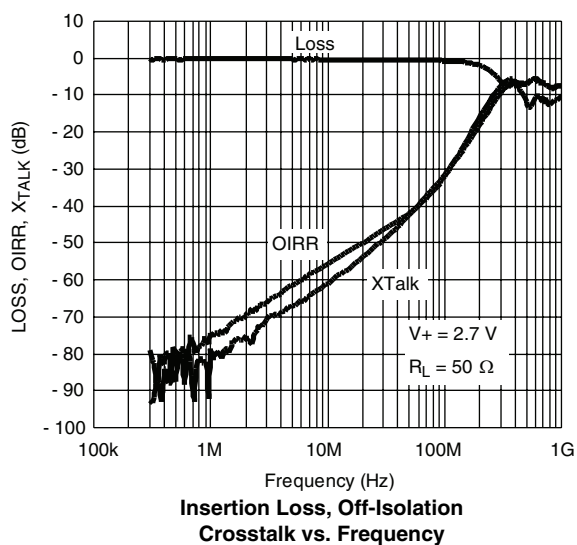
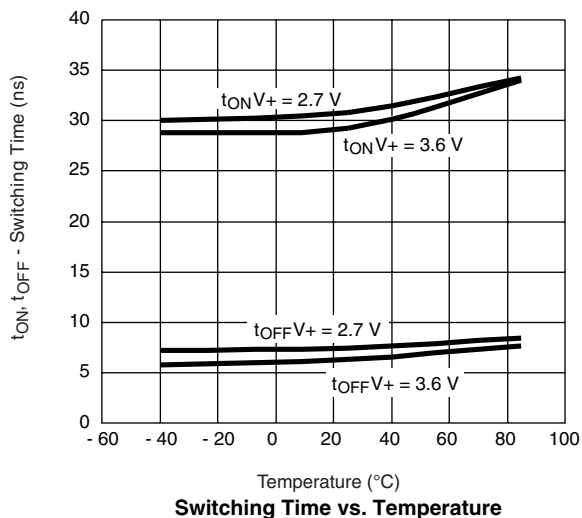
e. V_{IN} = input voltage to perform proper function.

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

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



TEST CIRCUITS

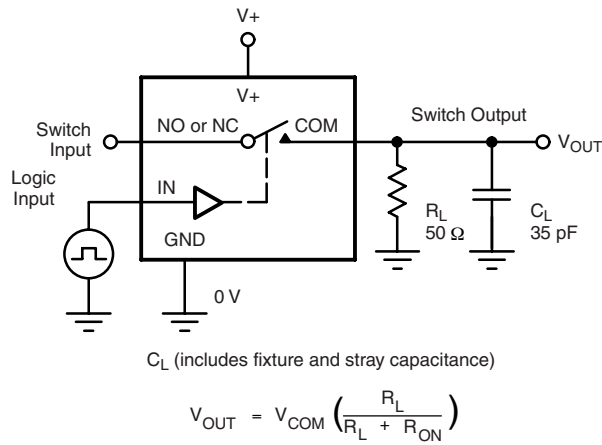
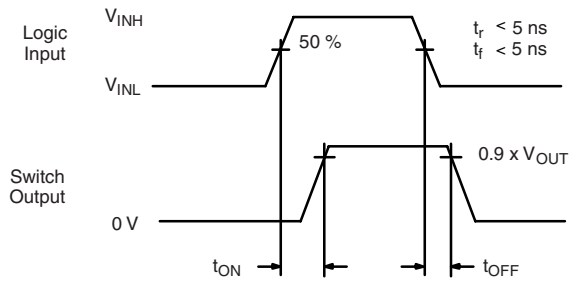


Figure 1. Switching Time



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

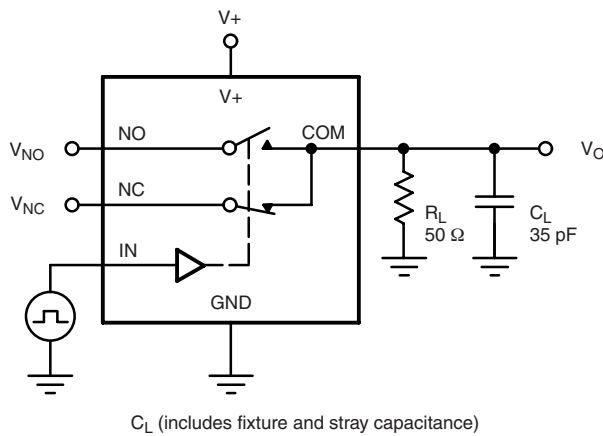


Figure 2. Break-Before-Make Interval

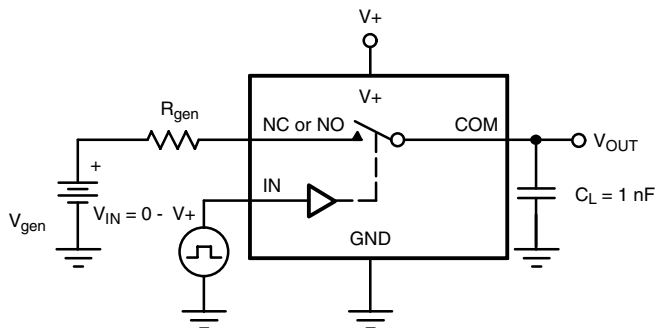
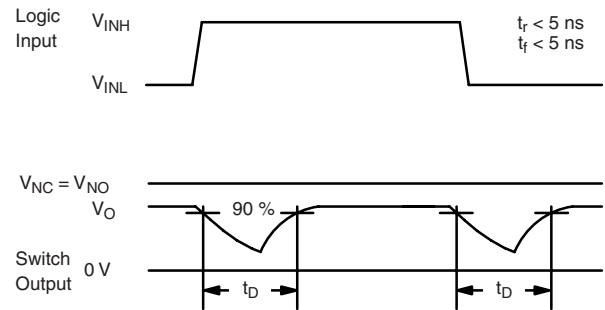
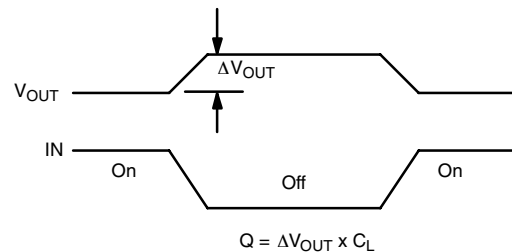


Figure 3. Charge Injection



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

TEST CIRCUITS

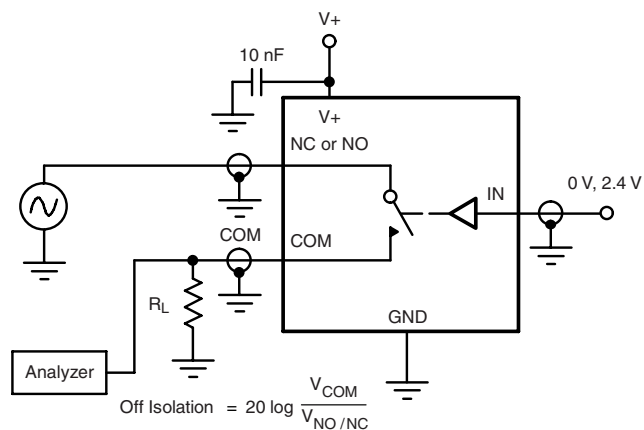


Figure 4. Off-Isolation

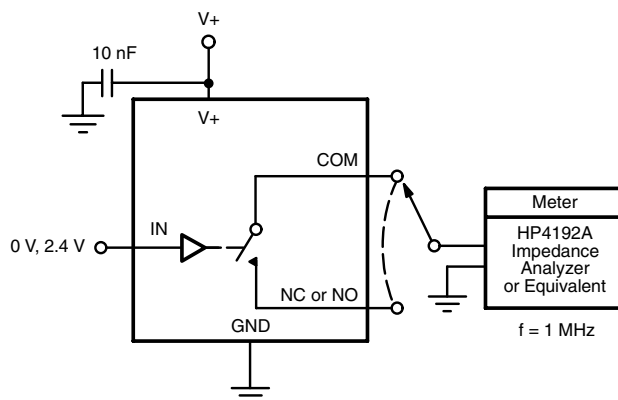
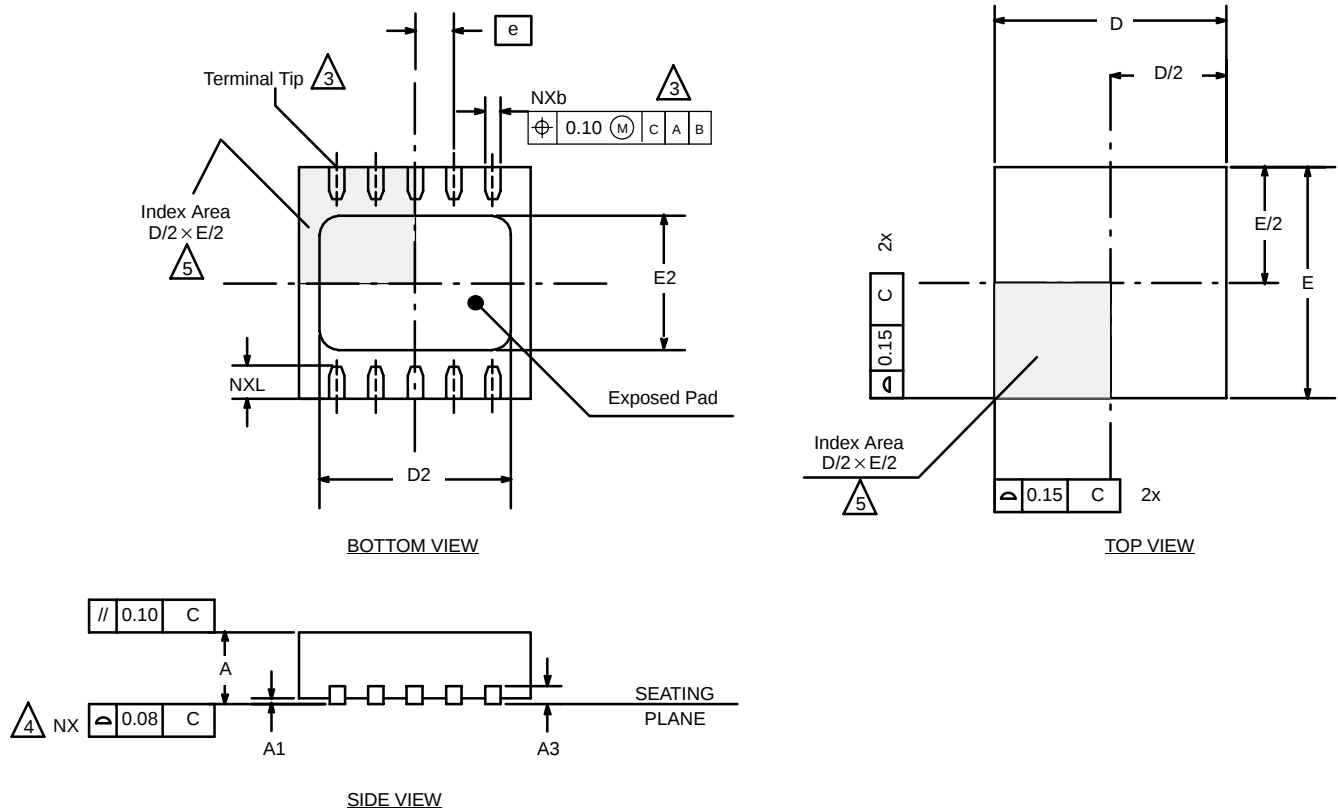


Figure 5. Channel Off/On Capacitance

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 <http://www.vishay.com/ppg?74411>.



DFN-10 LEAD (3 X 3)



NOTES:

1. All dimensions are in millimeters and inches.

2. N is the total number of terminals.

3. Dimension b applies to metallized terminal and is measured between 0.15 and 0.30 mm from terminal tip.

4. Coplanarity applies to the exposed heat sink slug as well as the terminal.

5. The pin #1 identifier may be either a mold or marked feature, it must be located within the zone indicated.

Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.80	0.90	1.00	0.031	0.035	0.039
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.20 BSC			0.008 BSC		
b	0.18	0.23	0.30	0.007	0.009	0.012
D	3.00 BSC			0.118 BSC		
D2	2.20	2.38	2.48	0.087	0.094	0.098
E	3.00 BSC			0.118 BSC		
E2	1.49	1.64	1.74	0.059	0.065	0.069
e	0.50 BSC			0.020 BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020
*Use millimeters as the primary measurement.						
ECN: S-42134—Rev. A, 29-Nov-04						
DWG: 5943						



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.