



## Low-Voltage, Low $R_{ON}$ , Dual DPDT Analog Switch

### DESCRIPTION

The DG3015 is a dual double-pole/double-throw monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low power, high speed, low on-resistance and small physical size, the DG3015 is ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG3015 is built on Vishay Siliconix's low voltage J12 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.

### FEATURES

- Low Voltage Operation (2.7 V to 3.3 V)
- Low On-Resistance -  $R_{ON}$ : 0.8  $\Omega$
- 3 dB Loss at 100 MHz
- Fast Switching:  $t_{ON}$  = 40 ns  
 $t_{OFF}$  = 35 ns
- MICRO FOOT® Package
- Compliant to RoHS Directive 2002/95/EC



RoHS  
COMPLIANT

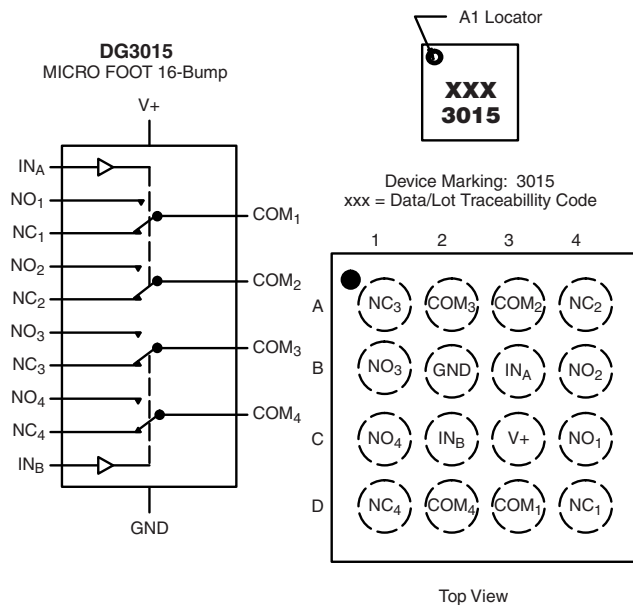
### BENEFITS

- 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



TRUTH TABLE		
Logic	NC1, 2, 3 and 4	NO1, 2, 3 and 4
0	ON	OFF
1	OFF	ON

ORDERING INFORMATION		
Temp Range	Package	Part Number
- 40 °C to 85 °C	MICRO FOOT: 16 Bump (4 x 4, 0.5 mm Pitch, 238 $\mu$ m Bump Height)	DG3015DB-T2-E1



<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)			
Parameter		Limit	Unit
Reference $V_+$ to GND		- 0.3 to + 6	V
IN, COM, NC, $NO^a$		- 0.3 to ( $V_+ + 0.3\text{ V}$ )	
Current (Any terminal except NO, NC or COM)		30	mA
Continuous Current (NO, NC or COM)		$\pm 150$	
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		$\pm 250$	
Storage Temperature	(D Suffix)	- 65 to 150	$^\circ\text{C}$
Package Solder Reflow Conditions <sup>b</sup>	IR/Convection	250	
Power Dissipation (Packages) <sup>c</sup>	MICRO FOOT: 16 Bump (4 x 4 mm) <sup>d</sup>	719	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. Refer to IPC/JEDEC (J-STD-020B)

c. All bumps welded or soldered to PC Board.

d. Derate 9 mW/ $^\circ\text{C}$  above 70  $^\circ\text{C}$ .

Permanent damage to the device may occur when the "Absolute Maximum Ratings" are exceeded. These stress ratings do not indicate conditions for which the device is intended to be functional. Functionality is only guaranteed to the conditions specified by the parametric table within the document.

<b>SPECIFICATIONS (<math>V_+ = 3\text{ V}</math>)</b>							
Parameter	Symbol	Test Conditions Otherwise Unless Specified $V_+ = 3\text{ V}$ , $\pm 10\%$ , $V_{IN} = 0.4\text{ V}$ or $2\text{ V}^e$	Temp. <sup>a</sup>	Limits - 40 $^\circ\text{C}$ to 85 $^\circ\text{C}$			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>d</sup>	$V_{NO}$ , $V_{NC}$ , $V_{COM}$		Full	0		$V_+$	V
On-Resistance	$R_{ON}$	$V_+ = 2.7\text{ V}$ , $V_{COM} = 0.2\text{ V}/1.5\text{ V}$ $I_{NO}$ , $I_{NC} = 100\text{ mA}$	Room Full		0.80	1.2 1.3	$\Omega$
$R_{ON}$ Flatness	$R_{ON}$ Flatness	$V_+ = 2.7\text{ V}$ , $V_{COM} = 0$ to $V_+$ , $I_{NO}$ , $I_{NC} = 100\text{ mA}$	Room		0.16		
$R_{ON}$ Match	$\Delta R_{ON}$		Room		0.15		
Switch Off Leakage Current	$I_{NO(off)}$ $I_{NC(off)}$	$V_+ = 3.3\text{ V}$ , $V_{NO}$ , $V_{NC} = 1\text{ V}/3\text{ V}$ , $V_{COM} = 3\text{ V}/1\text{ V}$	Room Full	- 2 - 20		2 20	nA
	$I_{COM(off)}$		Room Full	- 2 - 20		2 20	
Channel-On Leakage Current	$I_{COM(on)}$	$V_+ = 3.3\text{ V}$ , $V_{NO}$ , $V_{NC} = V_{COM} = 1\text{ V}/3\text{ V}$	Room Full	- 2 - 20		2 20	
<b>Digital Control</b>							
Input High Voltage	$V_{INH}$		Full	2			V
Input Low Voltage	$V_{INL}$		Full			0.4	
Input Capacitance	$C_{in}$		Full		4		pF
Input Current	$I_{INL}$ or $I_{INH}$	$V_{IN} = 0$ or $V_+$	Full	- 1		1	$\mu\text{A}$
<b>Dynamic Characteristics</b>							
Turn-On Time	$t_{ON}$	$V_{NO}$ or $V_{NC} = 2\text{ V}$ , $R_L = 300\text{ }\Omega$ , $C_L = 35\text{ pF}$	Room Full		40	65 67	ns
Turn-Off Time	$t_{OFF}$		Room Full		35	60 62	
Break-Before-Make Time	$t_d$		Full	1	3		
Charge Injection <sup>d</sup>	$Q_{INJ}$	$C_L = 1\text{ nF}$ , $V_{GEN} = 0\text{ V}$ , $R_{GEN} = 0\text{ }\Omega$	Room		7		pC
Off-Isolation <sup>d</sup>	OIRR	$R_L = 50\text{ }\Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$	Room		- 67		dB
Crosstalk <sup>d</sup>	$X_{TALK}$		Room		- 70		
$N_O$ , $N_C$ Off Capacitance <sup>d</sup>	$C_{NO(off)}$ $C_{NC(off)}$	$V_{IN} = 0$ or $V_+$ , $f = 1\text{ MHz}$	Room		63		pF
	Channel-On Capacitance <sup>d</sup>		$C_{NO(on)}$ $C_{NC(on)}$	Room		67	
				Room		200	
				Room		196	



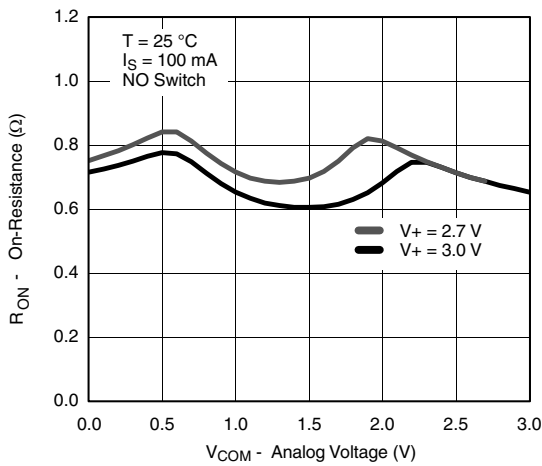
SPECIFICATIONS (V+ = 3 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, VIN = 0.4 V or 2 V <sup>e</sup>	Temp. <sup>a</sup>	Limits - 40 °C to 85 °C			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Power Supply</b>							
Power Supply Range	V+			2.7		3.3	V
Power Supply Current	I+	VIN = 0 or V+	Full			1	µA

Notes:

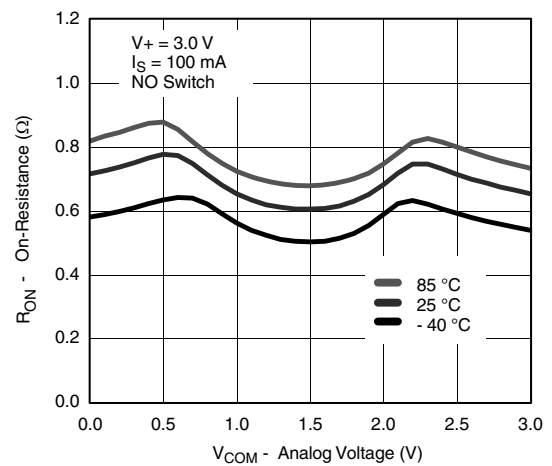
- a. Room = 25 °C, full = as determined by the operating suffix.
- b. Typical values are for design aid only, not guaranteed nor subject to production testing.
- c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- d.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

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.

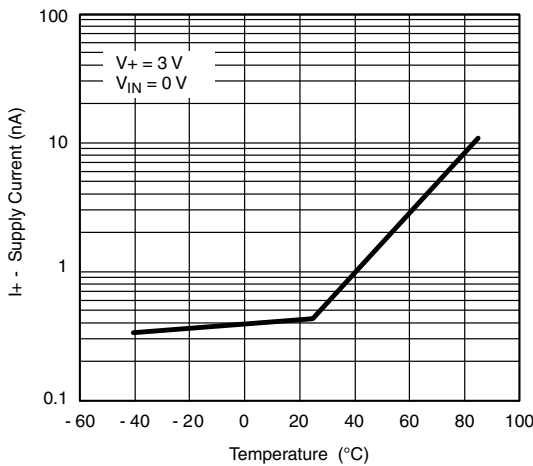
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



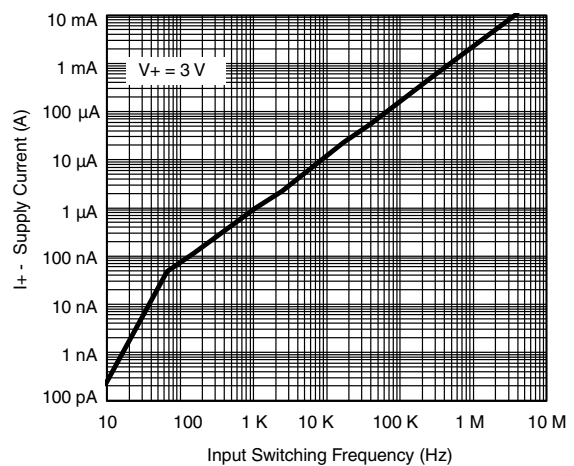
**RON vs. VCOM and Single Supply Voltage**



**RON vs. Analog Voltage and Temperature**



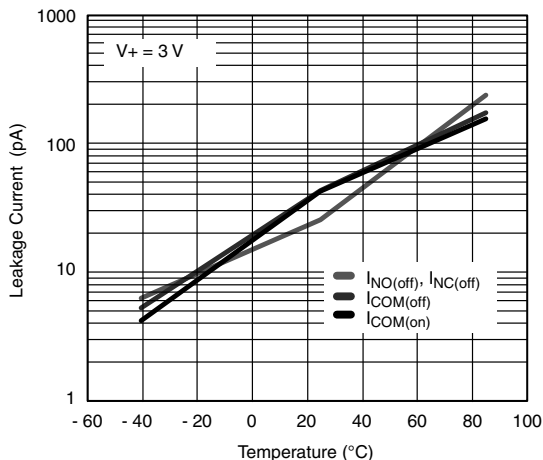
**Supply Current vs. Temperature**



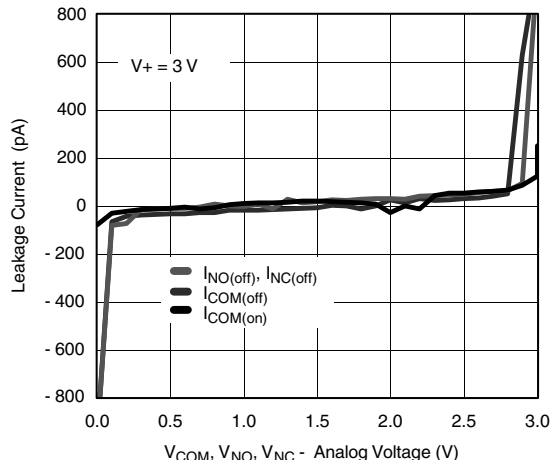
**Supply Current vs. Input Switching Frequency**



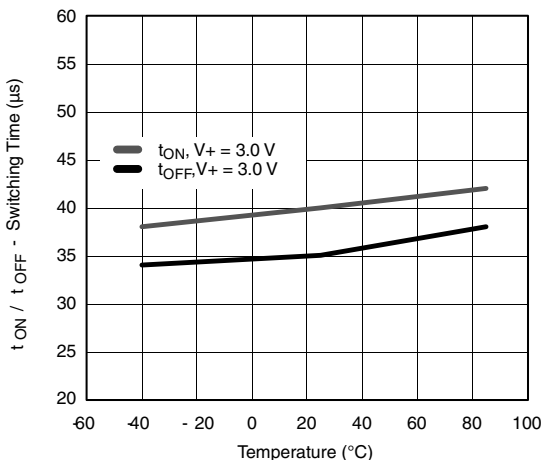
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



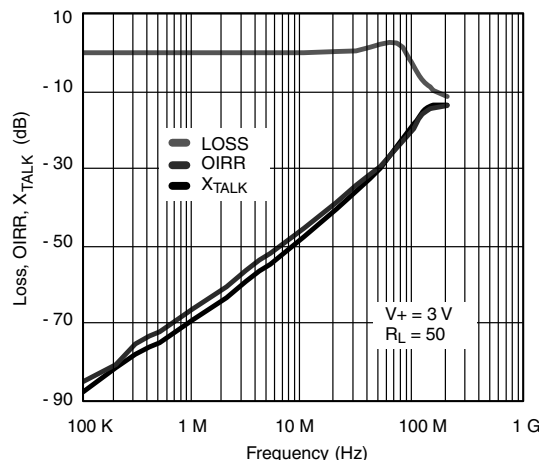
**Leakage Current vs. Temperature**



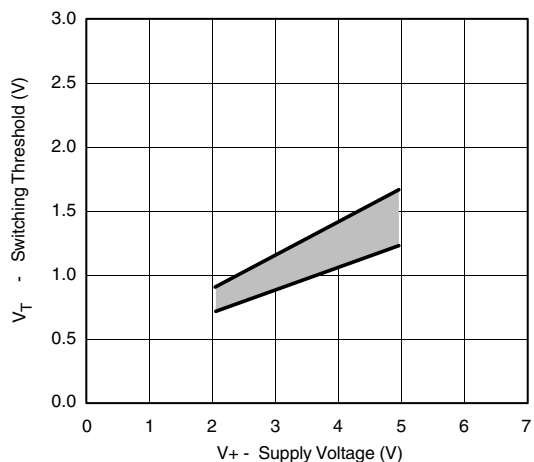
**Leakage vs. Analog Voltage**



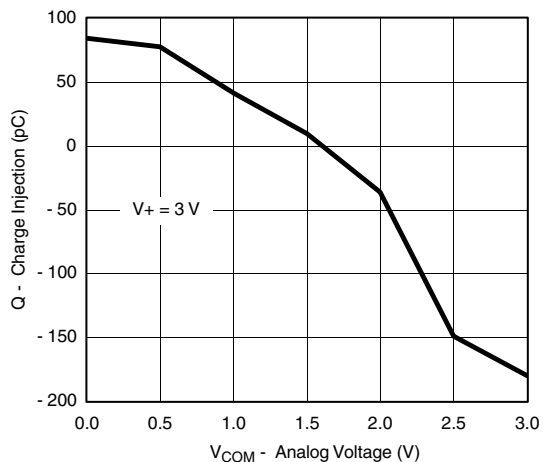
**Switching Time vs. Temperature**



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

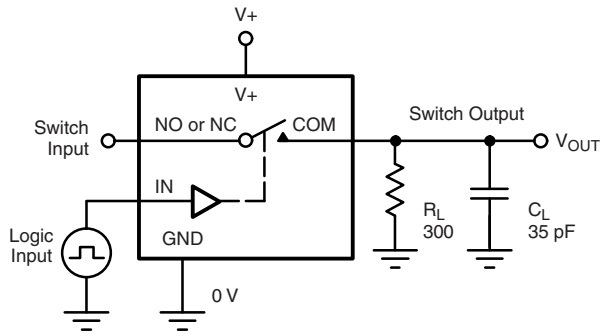


**Switching Threshold vs. Supply Voltage**



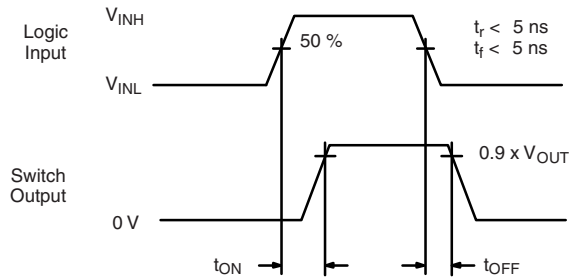
**Charge Injection vs. Analog Voltage**

TEST CIRCUITS



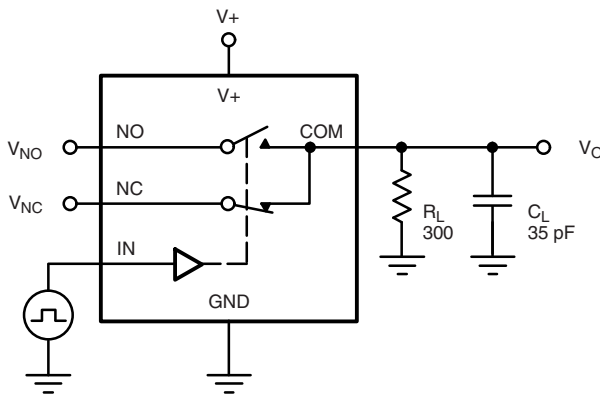
$C_L$  (includes fixture and stray capacitance)

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



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)

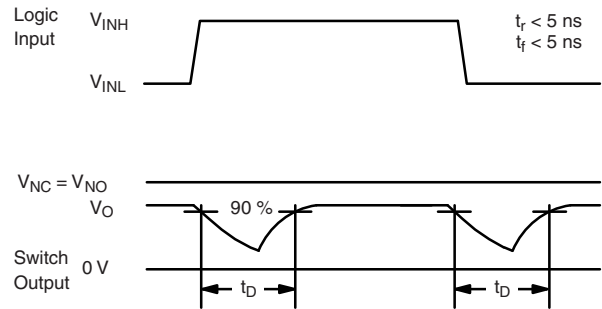
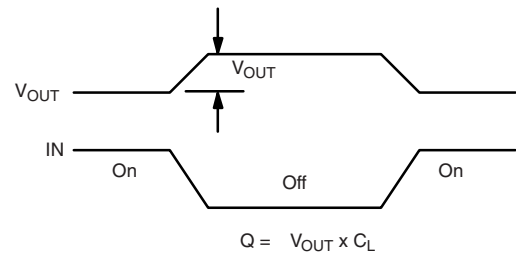
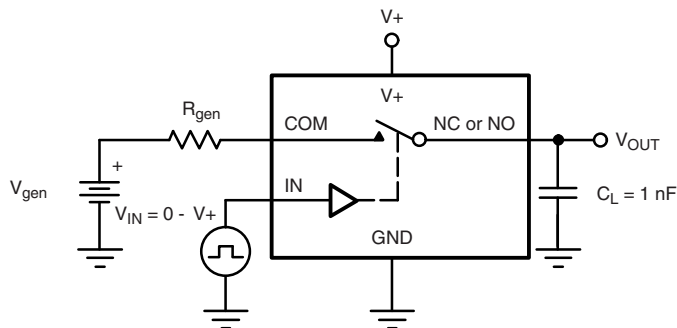


Figure 2. Break-Before-Make Interval



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

Figure 3. Charge Injection

TEST CIRCUITS

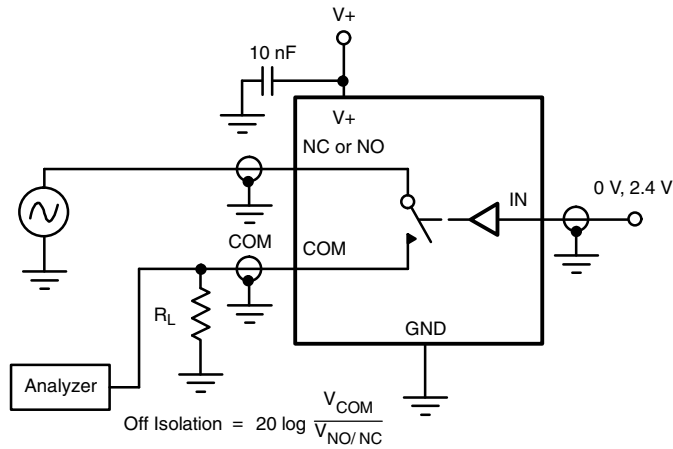


Figure 4. Off-Isolation

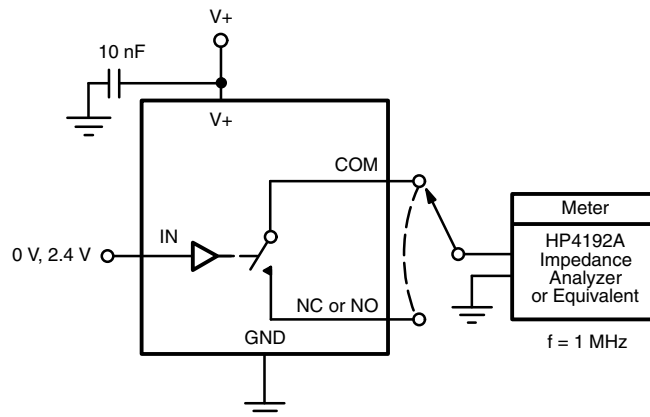
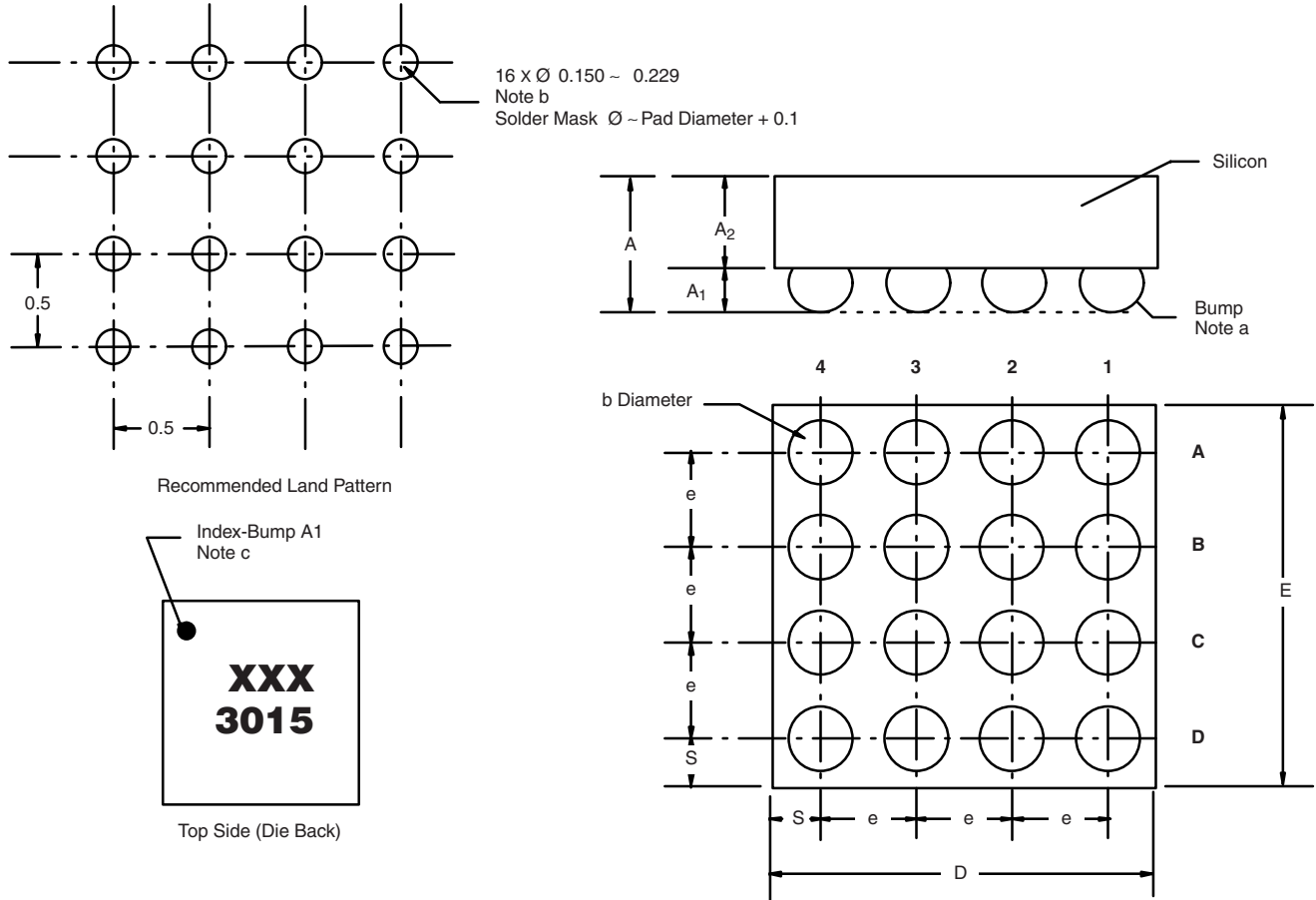


Figure 5. Channel Off/On Capacitance



**PACKAGE OUTLINE**

**MICRO FOOT: 16 BUMP (4 x 4, 0.5 mm PITCH, 0.238 mm BUMP HEIGHT)**



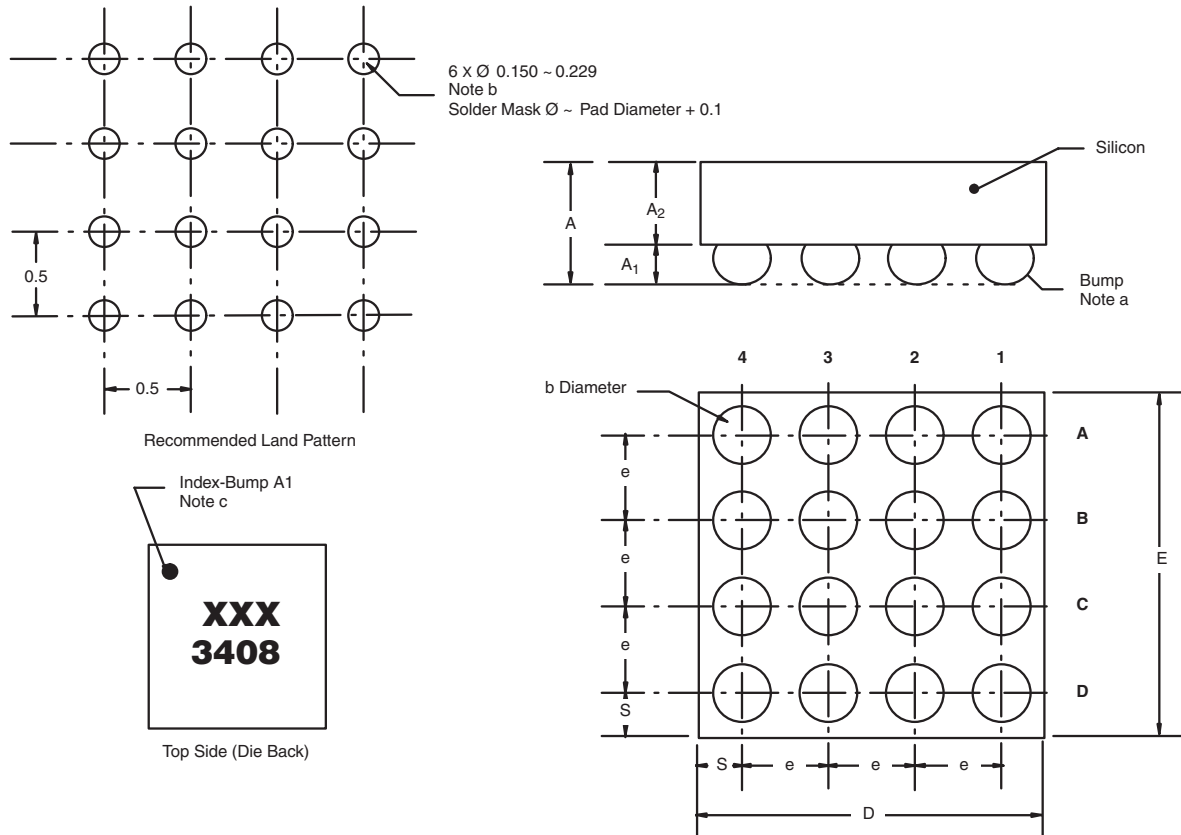
- Notes (Unless Otherwise Specified):
- a. Bump is Lead (Pb)-free Sn/Ag/Cu.
  - b. Non-solder mask defined copper landing pad.
  - c. Laser Mark on silicon die back; back-lapped, no coating. Shown is not actual marking; sample only.

Dim.	Millimeters <sup>a</sup>		Inches	
	Min.	Max.	Min.	Max.
A	0.688	0.753	0.0271	0.0296
A <sub>1</sub>	0.218	0.258	0.0086	0.0102
A <sub>2</sub>	0.470	0.495	0.0185	0.0195
b	0.306	0.346	0.0120	0.0136
D	1.980	2.020	0.0780	0.0795
E	1.980	2.020	0.0780	0.0795
e	0.5 BASIC		0.0197 BASIC	
S	0.230	0.270	0.0091	0.0106

- Notes:
- a. Use millimeters as the primary measurement.

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?72962](http://www.vishay.com/ppg?72962).

## MICRO FOOT: 16-BUMP (4 mm x 4 mm, 0.5 mm PITCH, 0.238 mm BUMP HEIGHT)



### Notes

(unless otherwise specified)

- a. Bump is lead (Pb)-free Sn/Ag/Cu.
- b. Non-solder mask defined copper landing pad.
- c. Laser mark on silicon die back; back-lapped, no coating. Shown is not actual marking; sample only.

DIM.	MILLIMETERS <sup>a</sup>		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.688	0.753	0.0271	0.0296
A <sub>1</sub>	0.218	0.258	0.0086	0.0102
A <sub>2</sub>	0.470	0.495	0.0185	0.0195
b	0.306	0.346	0.0120	0.0136
D	1.980	2.020	0.0780	0.0795
E	1.980	2.020	0.0780	0.0795
e	0.5 BASIC		0.0197 BASIC	
S	0.230	0.270	0.0091	0.0106

### Note

- a. Use millimeters as the primary measurement.

ECN: S11-1065-Rev. A, 13-Jun-11  
DWG: 6000





## 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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

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.