

# Low-Voltage, Low R<sub>ON</sub>, 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 JI2 process. An epitaxial layer prevents latchup. Break-beforemake 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:  $t_{ON} = 40 \text{ ns}$  $t_{OFF} = 35 \text{ ns}$
- MICRO FOOT® Package
- Compliant to RoHS Directive 2002/95/EC

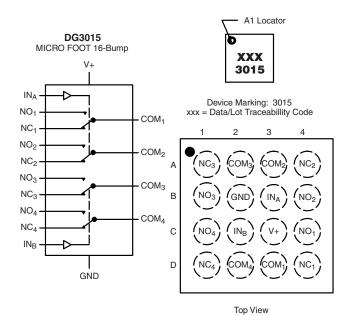
#### **BENEFITS**

- **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 μm Bump Height)	DG3015DB-T2-E1			

Document Number: 72962 S-70853-Rev. C, 30-Apr-07

## **DG3015**

# Vishay Siliconix



<b>ABSOLUTE MAXIMUM RATINGS</b> (T <sub>A</sub> = 25 °C, unless otherwise noted)					
Parameter	Limit	Unit			
Reference V+ to GND	- 0.3 to + 6	V			
IN, COM, NC, NO <sup>a</sup>	- 0.3 to (V+ + 0.3 V)	V			
Current (Any terminal except NO, NC or	30				
Continuous Current (NO, NC or COM)	± 150	mA			
Peak Current (Pulsed at 1 ms, 10 % duty	± 250				
Storage Temperature	(D Suffix)	- 65 to 150	00		
Package Solder Reflow Conditions <sup>b</sup>	IR/Convection	250	°C		
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/°C above 70 °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.

SPECIFICATIONS (V+ = 3 V)								
		Test Conditions Otherwise Unless Specified		Limits - 40 °C to 85 °C				
Parameter	Symbol	$V+ = 3 V$ , $\pm 10 \%$ , $V_{IN} = 0.4 V$ or $2 V^e$	Temp.a	Min.b	Typ.c	Max.b	Unit	
Analog Switch								
Analog Signal Range <sup>d</sup>	$V_{NO}, V_{NC}, V_{COM}$		Full	0		V+	٧	
On-Resistance	R <sub>ON</sub>	$V+ = 2.7 \text{ V}, V_{COM} = 0.2 \text{ V}/1.5 \text{ V}$ $I_{NO}, I_{NC} = 100 \text{ mA}$	Room Full		0.80	1.2 1.3		
R <sub>ON</sub> Flatness	R <sub>ON</sub> Flatness	$V+ = 2.7 \text{ V}, V_{COM} = 0 \text{ to } V+,$	Room		0.16		Ω	
R <sub>ON</sub> Match	$\Delta R_{ON}$	$I_{NO}$ , $I_{NC} = 100 \text{ mA}$	Room		0.15			
Switch Off Leakage Current	I <sub>NO(off)</sub> I <sub>NC(off)</sub>	V+ = 3.3 V,	Room Full	- 2 - 20		2 20	nA	
Omion on Lourage our one	I <sub>COM(off)</sub>	$V_{NO}$ , $V_{NC} = 1 \text{ V/3 V}$ , $V_{COM} = 3 \text{ V/1 V}$	Room Full	- 2 - 20		2 20		
Channel-On Leakage Current	I <sub>COM(on)</sub>	$V+ = 3.3 \text{ V}, V_{NO}, V_{NC} = V_{COM} = 1 \text{ V/3 V}$	Room Full	- 2 - 20		2 20		
Digital Control				I.	•		ı	
Input High Voltage	V <sub>INH</sub>		Full	2			V	
Input Low Voltage	V <sub>INL</sub>		Full			0.4	V	
Input Capacitance	C <sub>in</sub>		Full		4		pF	
Input Current	I <sub>INL</sub> or I <sub>INH</sub>	$V_{IN} = 0$ or $V+$	Full	- 1		1	μΑ	
Dynamic Characteristics								
Turn-On Time	t <sub>ON</sub>		Room Full		40	65 67		
Turn-Off Time	t <sub>OFF</sub>	$V_{NO}$ or $V_{NC}$ = 2 V, $R_L$ = 300 $\Omega$ , $C_L$ = 35 pF	Room Full		35	60 62	ns	
Break-Before-Make Time	t <sub>d</sub>		Full	1	3			
Charge Injection <sup>d</sup>	$Q_{INJ}$	$C_L$ = 1 nF, $V_{GEN}$ = 0 V, $R_{GEN}$ = 0 $\Omega$	Room		7		рC	
Off-Isolation <sup>d</sup>	OIRR	$R_1 = 50 \Omega$ , $C_1 = 5 pF$ , $f = 1 MHz$	Room		- 67		dB	
Crosstalk <sup>d</sup>	X <sub>TALK</sub>	00 22, OL - 0 pr, r - 1 Miliz	Room		- 70		ub	
N <sub>O</sub> , N <sub>C</sub> Off Capacitance <sup>d</sup>	C <sub>NO(off)</sub>		Room		63			
14O, 14C On Capacitance	C <sub>NC(off)</sub>	$V_{IN} = 0$ or $V+$ , $f = 1$ MHz	Room		67		pF	
Channel-On Capacitance <sup>d</sup>	C <sub>NO(on)</sub>	Room			200		Pi	
Channel-On Capacitance	C <sub>NC(on)</sub>		Room		196			

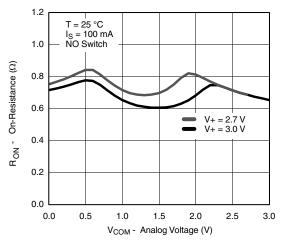


SPECIFICATIONS (V+ = 3 V)							
	Test Conditions Otherwise Unless Specified			Limits - 40 °C to 85 °C			
Parameter	Symbol	$V+ = 3 V, \pm 10 \%, V_{IN} = 0.4 V \text{ or } 2 V^{e}$	Temp.a	Min.b	Typ.c	Max.b	Unit
Power Supply							
Power Supply Range	V+			2.7		3.3	V
Power Supply Current	l+	$V_{IN} = 0$ or V+	Full			1	μΑ

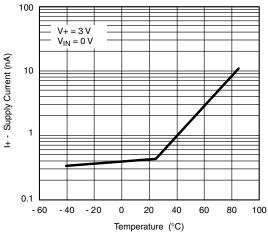
- a. Room = 25 °C, full = as determined by the operating suffix.
- b. Typical values are for design aid only, not guaranteed nor subject to production testing.
- c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- d.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

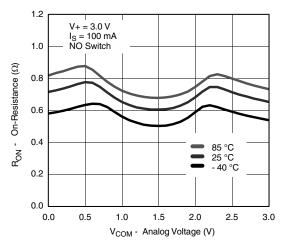
#### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



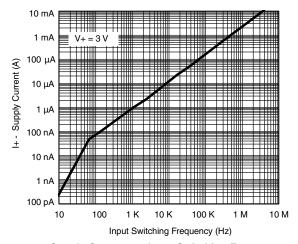
 $\rm R_{ON}$  vs.  $\rm V_{COM}$  and Single Supply Voltage



Supply Current vs. Temperature



R<sub>ON</sub> vs. Analog Voltage and Temperature



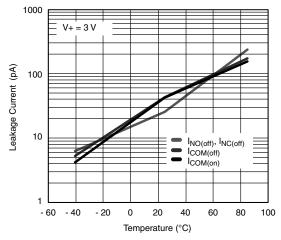
Supply Current vs. Input Switching Frequency

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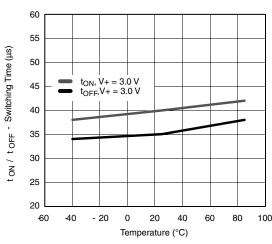
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## Vishay Siliconix

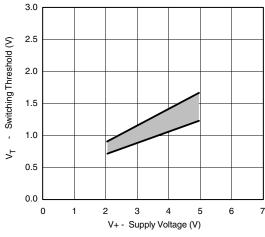
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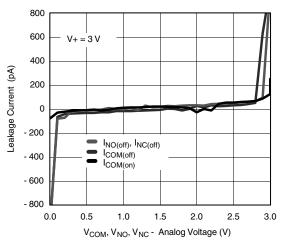
Leakage Current vs. Temperature



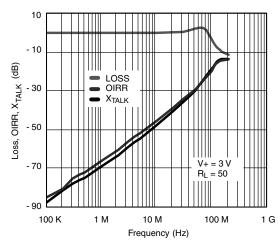
Switching Time vs. Temperature



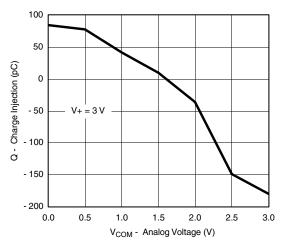
Switching Threshold vs. Supply Voltage



Leakage vs. Analog Voltage



Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



Charge Injection vs. Analog Voltage

Logic

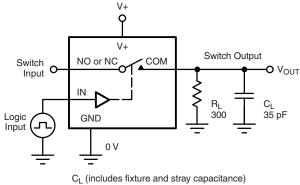
Input

Switch Output



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#### **TEST CIRCUITS**

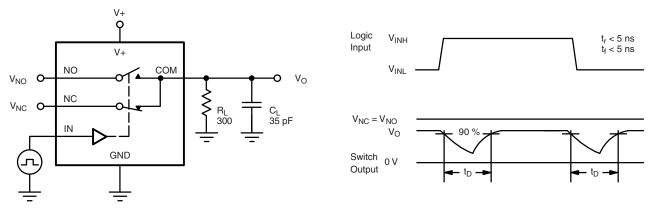


 $V_{INH}$  $t_r < 5 \text{ ns}$ 50 %  $t_f < 5 \text{ ns}$  $V_{\mathsf{INL}}$ 0.9 x V<sub>OUT</sub> 0 V  $t_{ON}$ 

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

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

Figure 1. Switching Time



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

Figure 2. Break-Before-Make Interval

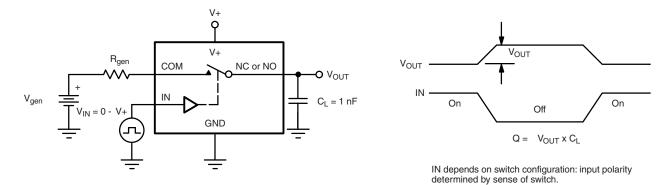


Figure 3. Charge Injection

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#### **TEST CIRCUITS**



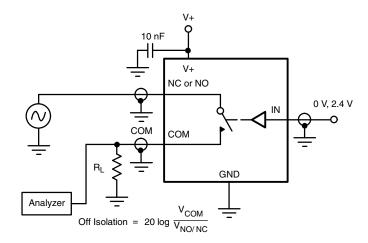


Figure 4. Off-Isolation

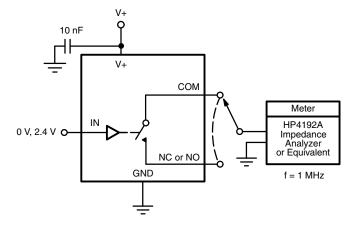
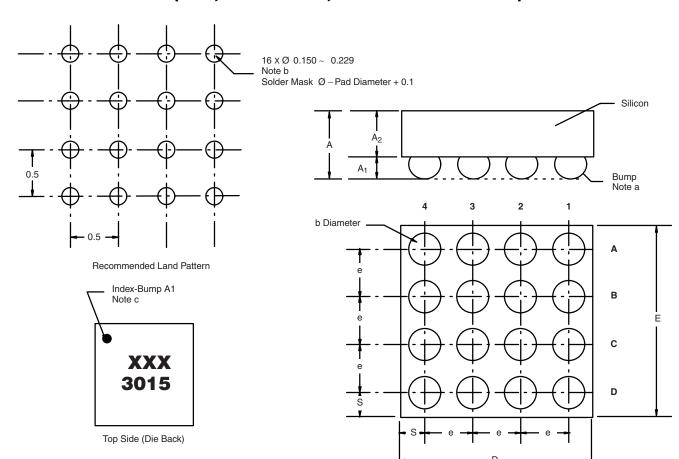


Figure 5. Channel Off/On Capacitance



#### **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		
Diiii.	Min.	Max.	Min.	Max.	
Α	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	
е	0.5 B	0.5 BASIC 0.0197 BASIC		BASIC	
S	0.230	0.270	0.0091	0.0106	

#### Notes:

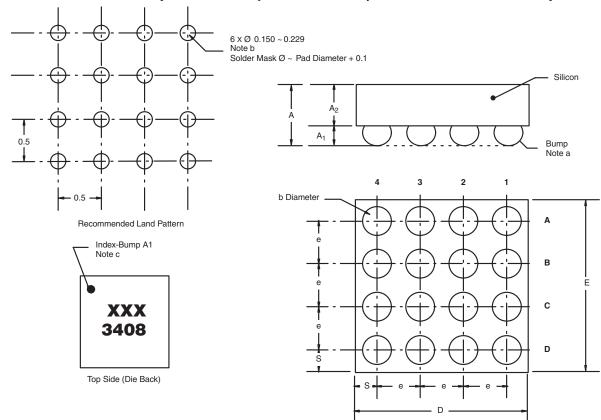
a. Use millimeters as the primary measurement.

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

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



#### Notes

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- a. Bump is lead (Pb)-free Sn/Ag/Cu.
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ECN: S11-1065-Rev. A, 13-Jun-11 DWG: 6000

Document Number: 63273

Revision: 13-Jun-11



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