



300 MHz, 2.5 Ω , Dual SPDT Analog Switches

DESCRIPTION

The DG3516, DG3517 are dual SPDT analog switches which operate from 1.8 V to 5.5 V single rail power supply. They are design for audio, video, and USB switching applications.

The devices have 2.5 Ω on-resistance and 300 MHz 3dB bandwidth. 0.2 Ω on-resistance matching and 1 Ω flatness make the device high linearity. The devices are 1.6 V logic compatible within the full operation voltage range.

These switches are built on a sub-micron high density process that brings low power consumption and low voltage performance.

The switches are packaged in MICRO FOOT chip scale package of 4 mm x 3 mm bump array.

As a committed partner to the community and environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations. For MICRO FOOT analog switch products manufactured with tin/silver/copper (SnAgCu) device termination, the lead (Pb)-free “-E1” suffix is being used as a designator.

FEATURES

- Halogen-free according to IEC 61249-2-21 Definition
- 1.8 V to 5.5 V operation
- 2.5 Ω at 2.7 V R_{ON}
- 300 MHz - 3 dB bandwidth
- ESD method 3015.7 > 2 kV
- Latch-up current 200 mA (JESD 78)
- 1.6 V logic compatible
- Compliant to RoHS Directive 2002/95/EC

BENEFITS

- Space Saving MICRO FOOT® Package
- High Linearity
- Low Power Consumption
- High Bandwidth
- Full Rail Signal Swing Range

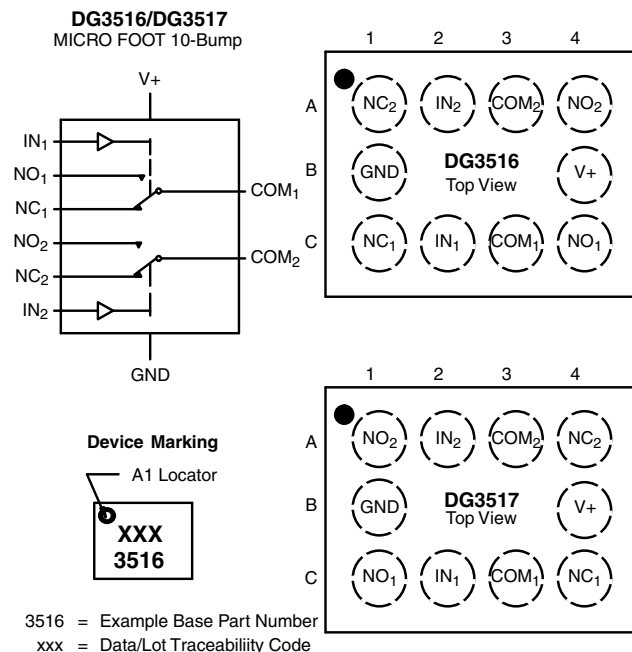
APPLICATIONS

- Cellular Phones
- MP3
- Media Players
- Modems
- Hard Drives
- PCMCIA



RoHS
COMPLIANT
HALOGEN
FREE

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE

Logic	NC1 and NC2	NO1 and NO2
0	ON	OFF
1	OFF	ON

ORDERING INFORMATION

Temp. Range	Package	Part Number
- 40 °C to 85 °C	MICRO FOOT: 10 Bump (4 x 3, 0.5 mm Pitch, 238 μ m Bump Height)	DG3516DB-T5-E1 DG3517DB-T5-E1

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ABSOLUTE MAXIMUM RATINGS

Parameter		Limit	Unit
Reference V+ to GND		- 0.3 to + 6	V
IN, COM, NC, NO ^a		- 0.3 to (V+ + 0.3)	
Continuous Current (NO, NC, COM)		± 100	mA
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		± 200	
Storage Temperature	(D Suffix)	- 65 to 150	°C
Package Solder Reflow Conditions ^b	IR/Convection	250	
ESD per Method 3015.7		> 2	kV
Power Dissipation (Packages) ^c	MICRO FOOT: 10 Bump (4 mm x 3 mm) ^d	457	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 5.7 mW/°C above 70 °C.

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.

SPECIFICATIONS (V+ = 3 V)

Parameter	Symbol	Test Conditions Otherwise Unless Specified $V_+ = 2.7\text{ V}$ to 3.6 V , $V_{\text{IN}} = 0.5\text{ V}$ 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	$V_{\text{NO}}, V_{\text{NC}}, V_{\text{COM}}$			Full	0		V_+	V
On-Resistance ^d	R_{ON}	$V_+ = 2.7\text{ V}$ $I_{\text{NO}}, I_{\text{NC}} = 10\text{ mA}$	$V_{\text{COM}} = 1.5\text{ V}$	Room Full		2.5	3.5 3.8	Ω
R_{ON} Flatness ^d	R_{ON} Flatness		$V_{\text{COM}} = 1, 1.5, 2\text{ V}$	Room		0.52	1	
On-Resistance Match Between Channels ^d	$\Delta R_{\text{DS(on)}}$		$V_{\text{COM}} = 1.5\text{ V}$	Room			0.25	
Switch Off Leakage Current	$I_{\text{NO(off)}}$ $I_{\text{NC(off)}}$	$V_+ = 3.3\text{ V}$, $V_{\text{NO}}, V_{\text{NC}} = 0.3\text{ V}/3\text{ V}$, $V_{\text{COM}} = 3\text{ V}/0.3\text{ V}$		Room Full	- 2 - 20		2 20	nA
	$I_{\text{COM(off)}}$			Room Full	- 2 - 20		2 20	
Channel-On Leakage Current	$I_{\text{COM(on)}}$	$V_+ = 3.3\text{ V}$, $V_{\text{NO}}, V_{\text{NC}} = V_{\text{COM}} = 0.3\text{ V}/3\text{ V}$		Room Full	- 2 - 20		2 20	
Digital Control								
Input High Voltage ^d	V_{INH}			Full	1.4			V
Input Low Voltage	V_{INL}			Full			0.5	
Input Capacitance	C_{in}			Full		5		pF
Input Current	I_{INL} or I_{INH}	$V_{\text{IN}} = 0\text{ V}$ or V_+		Full	1		1	μA



SPECIFICATIONS (V+ = 3 V)								
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 2.7 V to 3.6 V, VIN = 0.5 V or 1.4 V ^e		Temp. ^a	Limits - 40 °C to 85 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Dynamic Characteristics								
Turn-On Time	tON	V+ = 2.7 V, VNO or VNC = 1.5 V RL = 300 Ω, CL = 35 pF		Room Full		21	51 52	ns
Turn-Off Time	tOFF			Room Full		15	45 46	
Break-Before-Make Time	td			Full	1			
Charge Injection ^d	QINJ	CL = 1 nF, VGEN = 2 V, RGEN = 0 Ω		Room		1		pC
Off-Isolation ^d	OIRR	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room		- 74		dB
			f = 10 MHz	Room		- 54		
Crosstalk ^d	XTALK		f = 1 MHz	Room		- 76		
			f = 10 MHz	Room		- 56		
NO, NC Off Capacitance ^d	CNO(off)	VIN = 0 or V+, f = 1 MHz		Room		12		pF
	CNC(off)			Room		12		
Channel-On Capacitance ^d	CNO(on)			Room		40		
	CNC(on)			Room		40		
Power Supply								
Power Supply Current	I+	VIN = 0 V or V+		Room Full			1 1	μA

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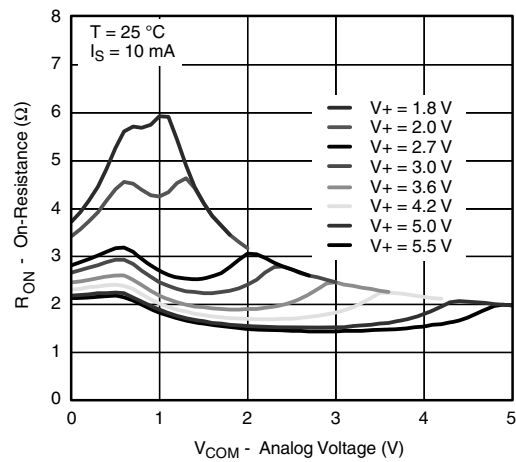
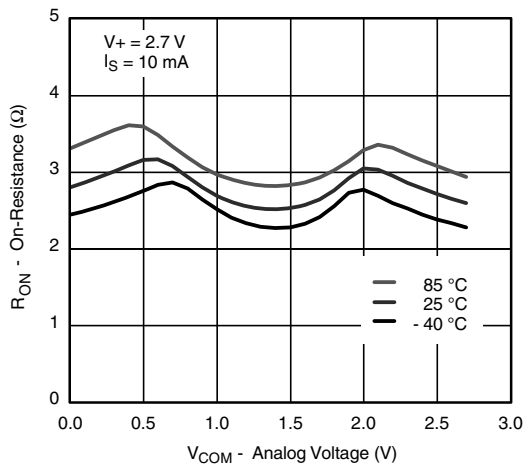
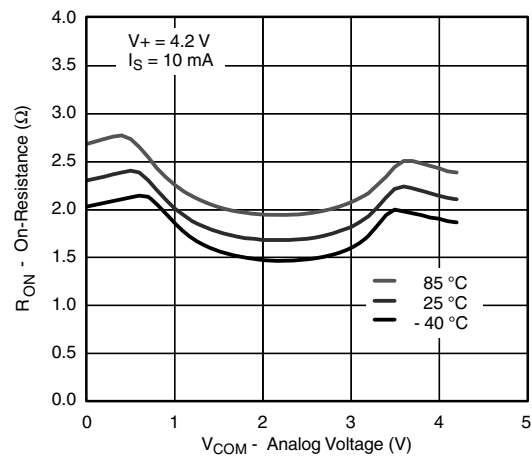
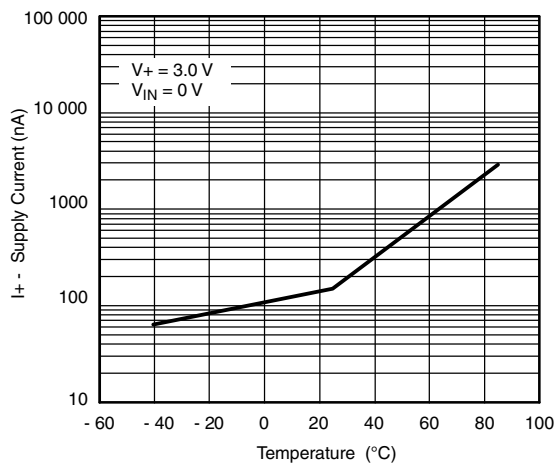
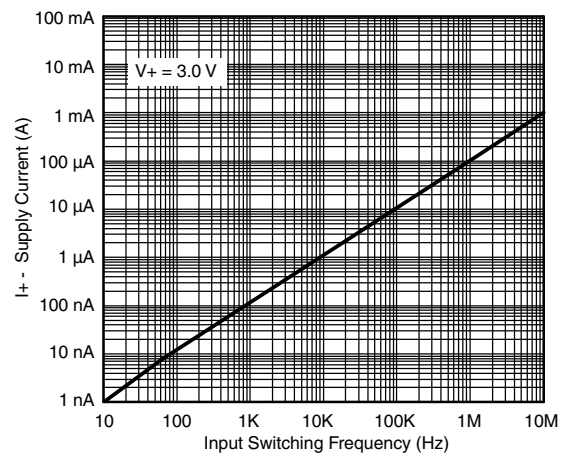
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SPECIFICATIONS (V+ = 5 V)								
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 4.2 V to 5.5 V, VIN = 0.8 V or 2 V ^e		Temp. ^a	Limits - 40 °C to 85 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Analog Switch								
Analog Signal Range ^d	VNO, VNC, VCOM			Full	0		V+	V
On-Resistance ^d	RON	V+ = 4.2 V INO, INC = 10 mA	VCOM = 3.5 V	Room Full		2.2	2.9 3.1	Ω
RON Flatness ^d	RON Flatness		VCOM = 1, 2, 3.5 V	Room		0.53	1	
On-Resistance Match Between Channels ^d	ΔRDS(on)		VCOM = 3.5 V	Room			0.25	
Switch Off Leakage Current	INO(off) INC(off)	V+ = 5.5 V, VNO, VNC = 1 V/4.5 V, VCOM = 4.5 V/1 V		Room Full	- 2 - 20		2 20	nA
	ICOM(off)			Room Full	- 2 - 20		2 20	
Channel-On Leakage Current	ICOM(on)	V+ = 5.5 V, VNO, VNC = VCOM = 1 V/4.5 V		Room Full	- 2 - 20		2 20	
Digital Control								
Input High Voltage ^d	VINH			Full	2			V
Input Low Voltage	VINL			Full			0.8	
Input Capacitance	Cin			Full		5		pF
Input Current	IINL or IINH	VIN = 0 or V+		Full	1		1	μA
Dynamic Characteristics								
Turn-On Time	tON	V+ = 4.2 V, VNO or VNC = 3 V RL = 300 Ω, CL = 35 pF		Room Full		15	45 46	ns
Turn-Off Time	tOFF			Room Full		12	42 43	
Break-Before-Make Time	td			Full	1			
Charge Injection ^d	QINJ	CL = 1 nF, VGEN = 2 V, RGEN = 0 Ω		Room		1		pC
Off-Isolation ^d	OIRR	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room		- 74		dB
Crosstalk ^d	XTALK		f = 10 MHz	Room		- 54		
			f = 1 MHz	Room		- 78		
			f = 10 MHz	Room		- 56		
NO, NC Off Capacitance ^d	CNO(off)	VIN = 0 or V+, f = 1 MHz		Room		12		pF
	CNC(off)			Room		12		
Channel-On Capacitance ^d	CNO(on)			Room		40		
	CNC(on)			Room		40		
Power Supply								
Power Supply Current	I+	VIN = 0 V or V+		Room Full			1 1	μA

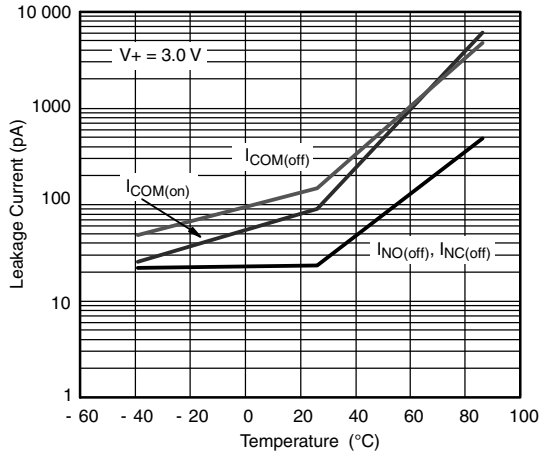
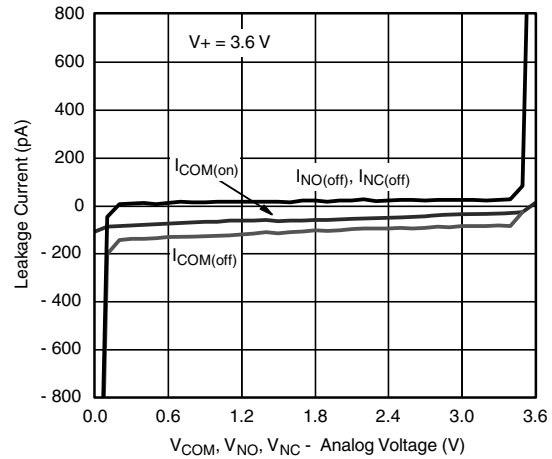
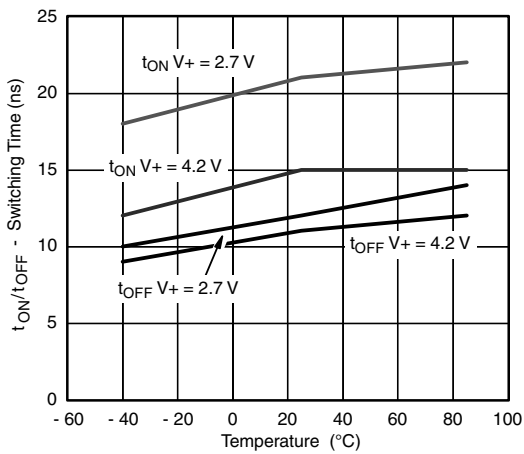
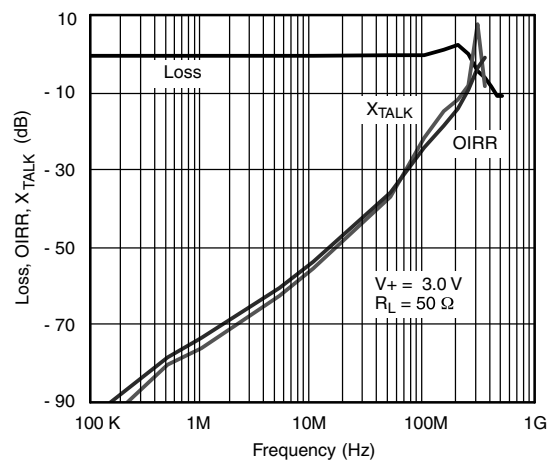
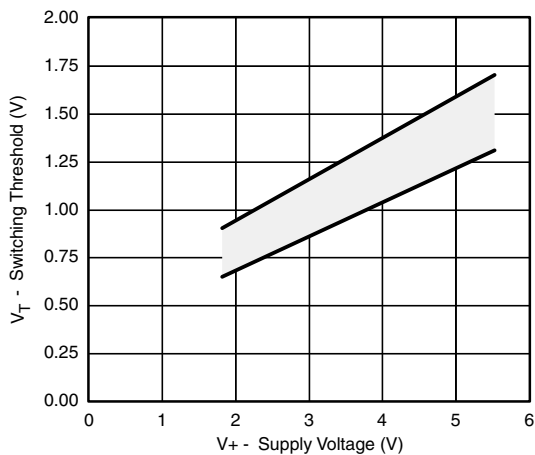
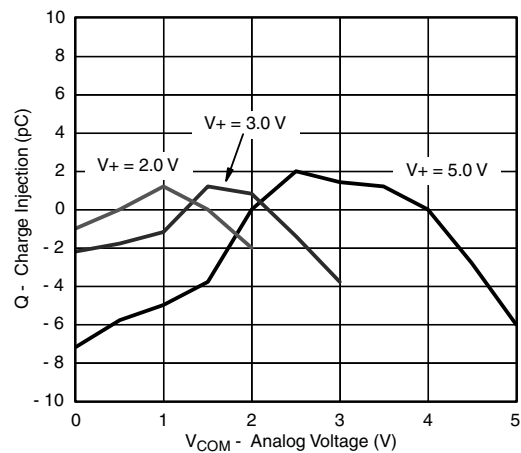
Notes:

- Room = 25 °C, Full = as determined by the operating suffix.
- Typical values are for design aid only, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- Guarantee by design, nor subjected to production test.
- V_{IN} = input voltage to perform proper function.
- Guaranteed by 5 V testing, not production tested.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted) **R_{ON} vs. V_{COM} and Single Supply Voltage** **R_{ON} vs. Analog Voltage and Temperature** **R_{ON} vs. Analog Voltage and Temperature****Supply Current vs. Temperature****Supply Current vs. Input Switching Frequency**

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**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

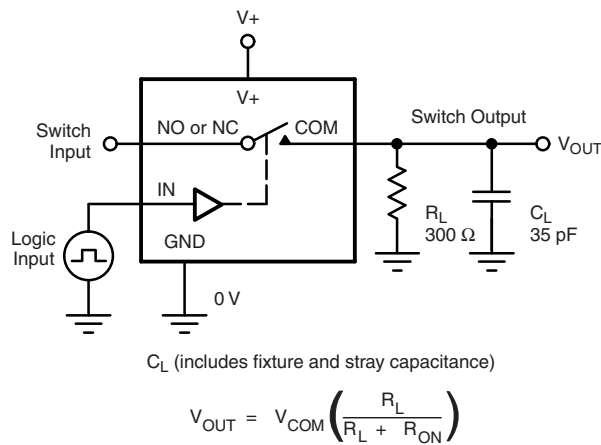
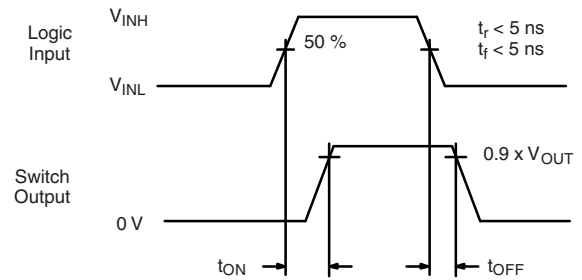


Figure 1. Switching Time



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

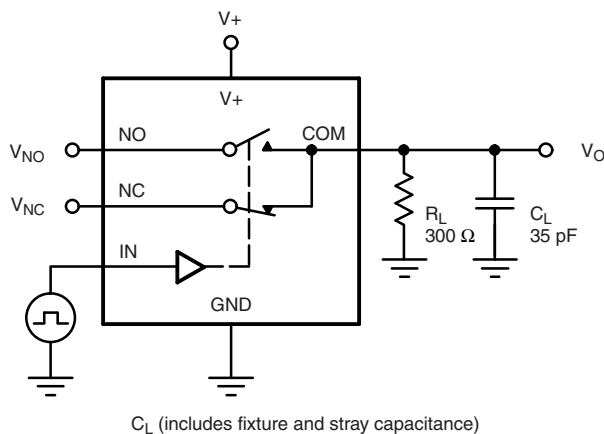


Figure 2. Break-Before-Make Interval

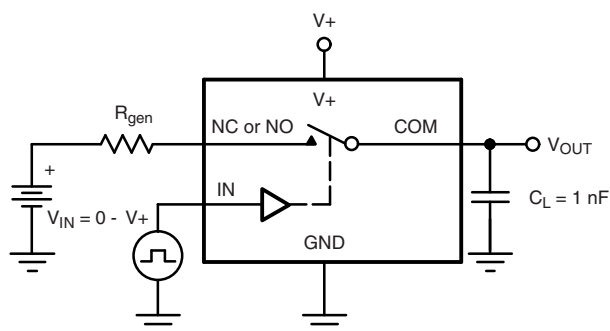
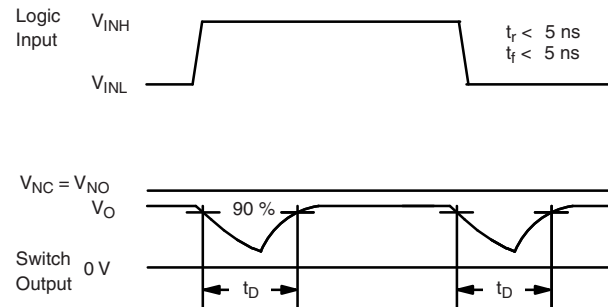
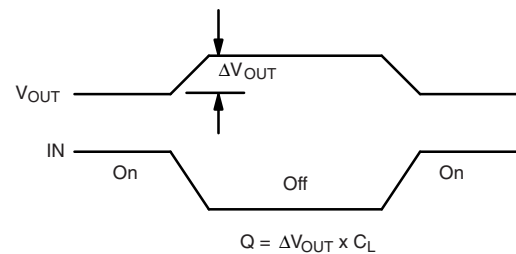


Figure 3. Charge Injection



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

TEST CIRCUITS

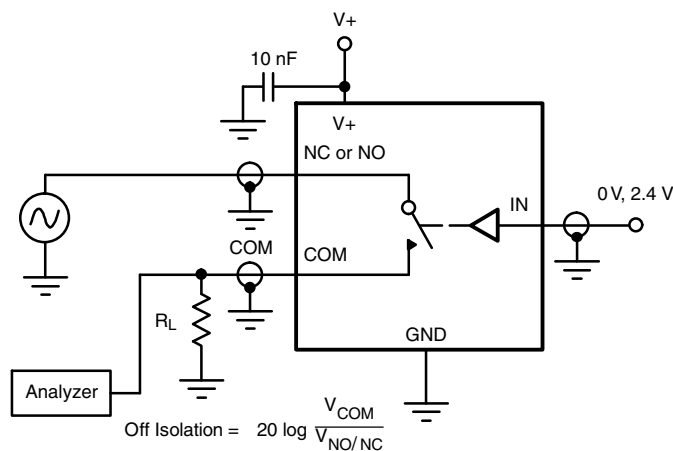


Figure 4. Off-Isolation

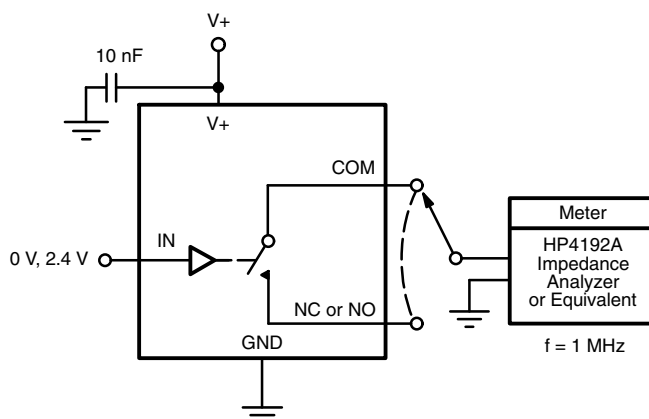
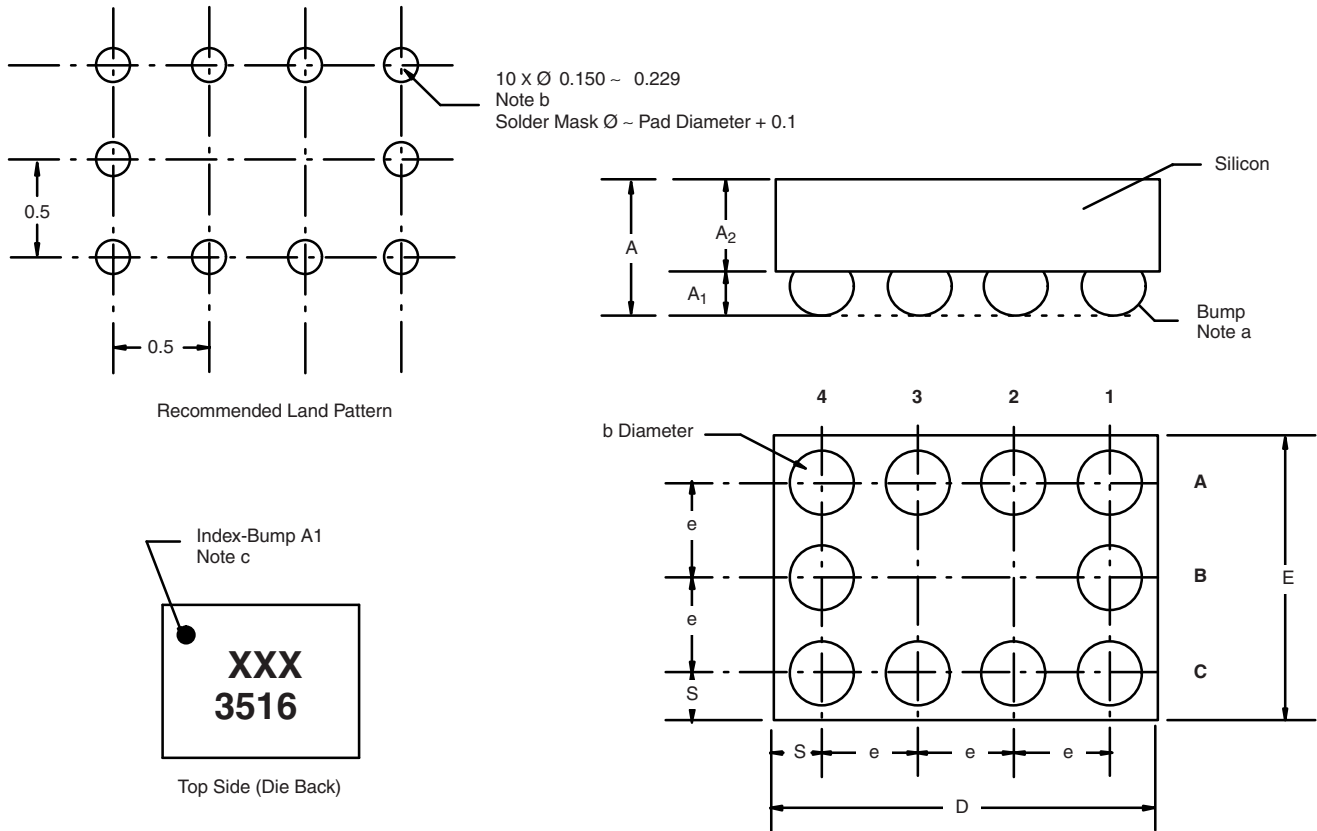


Figure 5. Channel Off/On Capacitance



PACKAGE OUTLINE

MICRO FOOT: 10 BUMP (4 x 3 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.

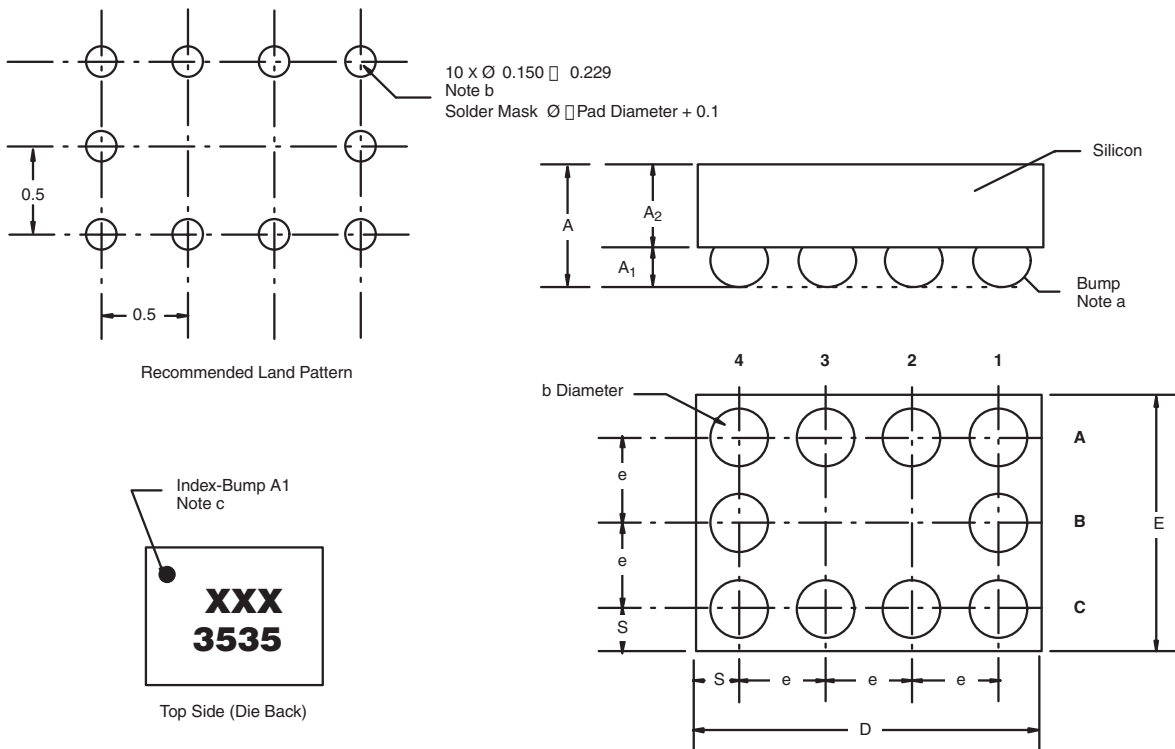
Dim.	Millimeters ^a		Inches	
	Min.	Max.	Min.	Max.
A	0.688	0.753	0.0271	0.0296
A ₁	0.218	0.258	0.0086	0.0102
A ₂	0.470	0.495	0.0185	0.0195
b	0.306	0.346	0.0120	0.0136
D	1.980	2.020	0.0780	0.0795
E	1.480	1.520	0.0583	0.0598
e	0.5 BASIC		0.0197 BASIC	
S	0.230	0.270	0.0091	0.0106

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?73404.

MICRO FOOT: 10-BUMP (4 mm x 3 mm, 0.5 mm PITCH, 0.238 mm BUMP HEIGHT)



Notes

(unless otherwise specified)

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Note

- Use millimeters as the primary measurement.

ECN: S11-1065-Rev. A, 13-Jun-11
DWG: 6001



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