# 0.25 Ω Low-Voltage Dual SPDT Analog Switch

## DESCRIPTION

The DG3535, DG3536 is a sub 1 Ω (0.25 Ω at 2.7 V) dual SPDT analog switches designed for low voltage applications.

The DG3535, DG3536 has on-resistance matching (less than 0.05 Ω at 2.7 V) and flatness (less than 0.2 Ω at 2.7 V) that are guaranteed over the entire voltage range. Additionally, low logic thresholds makes the DG3535, DG3536 an ideal interface to low voltage DSP control signals.

The DG3535, DG3536 has fast switching speed with break-before-make guaranteed. In the On condition, all switching elements conduct equally in both directions. Off-isolation and crosstalk is - 69 dB at 100 kHz.

The DG3535, DG3536 is built on Vishay Siliconix's high-density low voltage CMOS process. An eptiaxial layer is built in to prevent latchup. The DG3535, DG3536 contains the additional benefit of 2000 V ESD protection.

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

## FEATURES

- Low voltage operation
- Low on-resistance - $R_{ON}$: 0.25 Ω at 2.7 V
- - 69 dB OIRR at 2.7 V, 100 kHz
- MICRO FOOT® package
- ESD protection > 2000 V

Pb-free
RoHS COMPLIANT

## BENEFITS

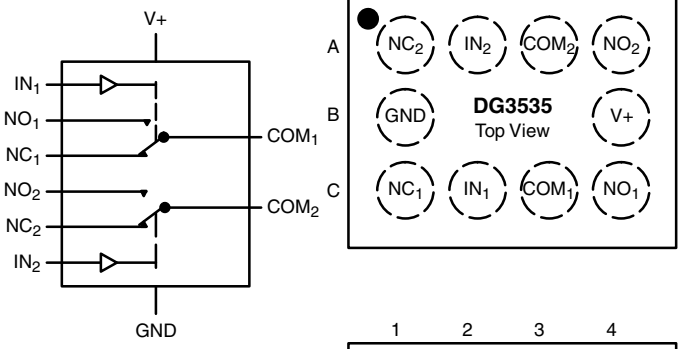
- Reduced power consumption
- High accuracy
- Reduce board space
- 1.6 V logic compatible
- High bandwidth

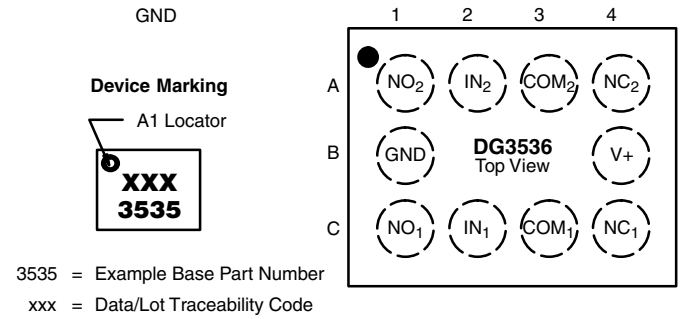
## APPLICATIONS

- Cellular phones
- Speaker headset switching
- Audio and video signal routing
- PCMCIA cards
- Battery operated systems
- Relay replacement

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

**DG3535, DG3536**
MICRO FOOT 10-Bump




**Device Marking**




3535 = Example Base Part Number
xxx = Data/Lot Traceability Code

**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 µm Bump Height) | DG3535DB-T5-E1<br>DG3535DB-T1-E1<br>DG3536DB-T5-E1 |

## 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 V) | |
| Continuous Current (NO, NC, COM) | | ± 300 | mA |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) | | ± 500 | |
| 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 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.*

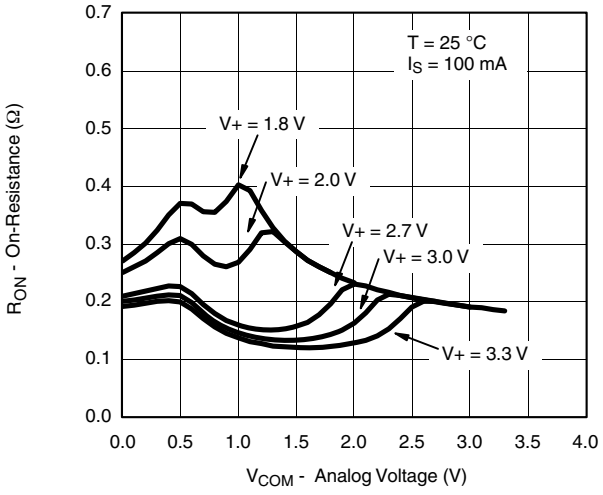
## SPECIFICATIONS (V+ = 3.0 V)

| Parameter | Symbol | Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, $V_{IN}$ = 0.5 V or 1.4 V[e] | Temp.[a] | Limits - 40 to 85 °C Min.[b] | Typ.[c] | Max.[b] | Unit |
|---|---|---|---|---|---|---|---|
| **Analog Switch** | | | | | | | |
| Analog Signal Range[d] | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | Full | 0 | | V+ | V |
| On-Resistance[d] | $R_{ON}$ | V+ = 2.7 V, $V_{COM}$ = 0.6/1.5 V, $I_{NO}$, $I_{NC}$ = 100 mA | Room<br>Full | | 0.25 | 0.4<br>0.5 | Ω |
| $R_{ON}$ Flatness[d] | $R_{ON}$ Flatness | | Room | | | 0.15 | |
| On-Resistance Match Between Channels[d] | $\Delta R_{DS(on)}$ | | Room | | | 0.05 | |
| Switch Off Leakage Current | $I_{NO(off)}$ $I_{NC(off)}$ | V+ = 3.3 V, $V_{NO}$, $V_{NC}$ = 0.3 V/3 V, $V_{COM}$ = 3 V/0.3 V | Room<br>Full | - 2<br>- 20 | | 2<br>20 | nA |
| | $I_{COM(off)}$ | | Room<br>Full | - 2<br>- 20 | | 2<br>20 | |
| Channel-On Leakage Current | $I_{COM(on)}$ | V+ = 3.3 V, $V_{NO}$, $V_{NC}$ = $V_{COM}$ = 0.3 V/3 V | Room<br>Full | - 2<br>- 20 | | 2<br>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 | | 10 | | pF |
| Input Current | $I_{INL}$ or $I_{INH}$ | $V_{IN}$ = 0 or V+ | Full | 1 | | 1 | µA |

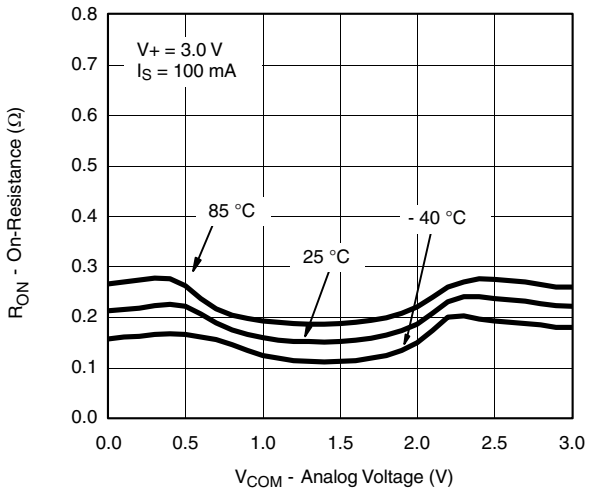
| **SPECIFICATIONS** (V+ = 3.0 V) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions Otherwise Unless Specified** V+ = 3 V, ± 10 %, $V_{IN}$ = 0.5 V or 1.4 V[e] | **Temp.[a]** | **Limits - 40 °C to 85 °C Min.[b]** | **Typ.[c]** | **Max.[b]** | **Unit** |
| **Dynamic Characteristics** | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{NO}$ or $V_{NC}$ = 2.0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF | Room<br>Full | | 52 | 82<br>90 | ns |
| Turn-Off Time | $t_{OFF}$ | | Room<br>Full | | 43 | 73<br>78 | |
| Break-Before-Make Time | $t_d$ | | Room | 1 | 6 | | |
| Charge Injection[d] | $Q_{INJ}$ | $C_L$ = 1 nF, $V_{GEN}$ = 1.5 V, $R_{GEN}$ = 0 Ω | Full | | 21 | | pC |
| Off-Isolation[d] | OIRR | $R_L$ = 50 Ω, $C_L$ = 5 pF, f = 100 kHz | Room | | - 69 | | dB |
| Crosstalk[d] | $X_{TALK}$ | | Room | | - 69 | | |
| $N_O$, $N_C$ Off Capacitance[d] | $C_{NO(off)}$ | $V_{IN}$ = 0 or V+, f = 1 MHz | Room | | 145 | | pF |
| | $C_{NC(off)}$ | | Room | | 145 | | |
| Channel-On Capacitance[d] | $C_{NO(on)}$ | | Room | | 406 | | |
| | $C_{NC(on)}$ | | Room | | 406 | | |
| **Power Supply** | | | | | | | |
| Power Supply Current | I+ | $V_{IN}$ = 0 or V+ | Room<br>Full | | 0.001 | 1.0<br>1.0 | 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. $V_{IN}$ = input voltage to perform proper function.

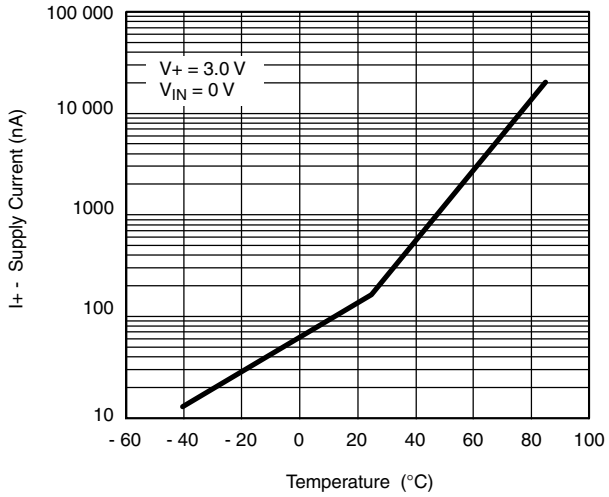
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



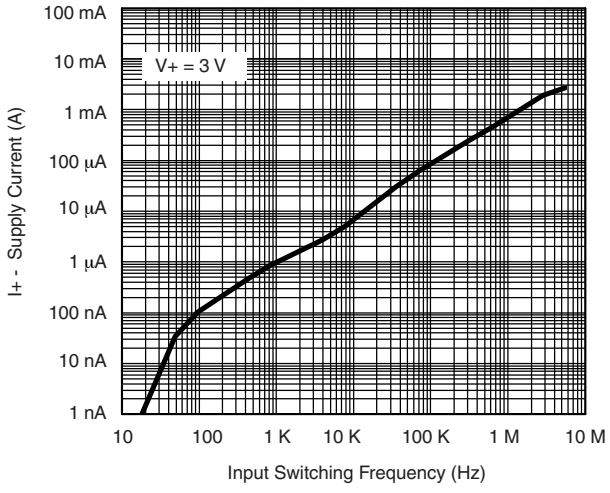

**$R_{ON}$ vs. $V_{COM}$ and Supply Voltage**



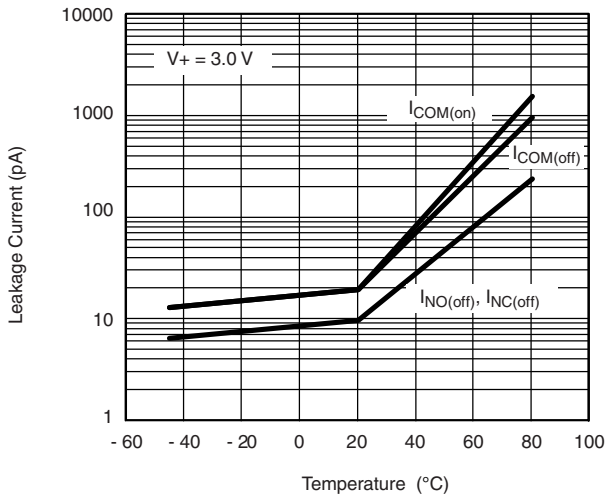

**$R_{ON}$ vs. Analog Voltage and Temperature (NC1)**



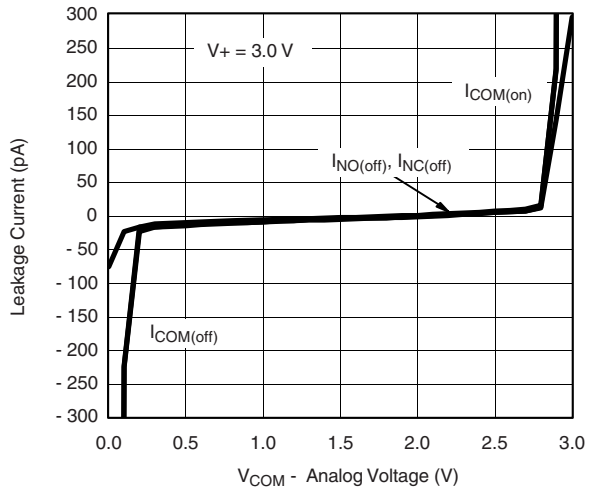

**Supply Current vs. Temperature**




**Supply Current vs. Input Switching Frequency**

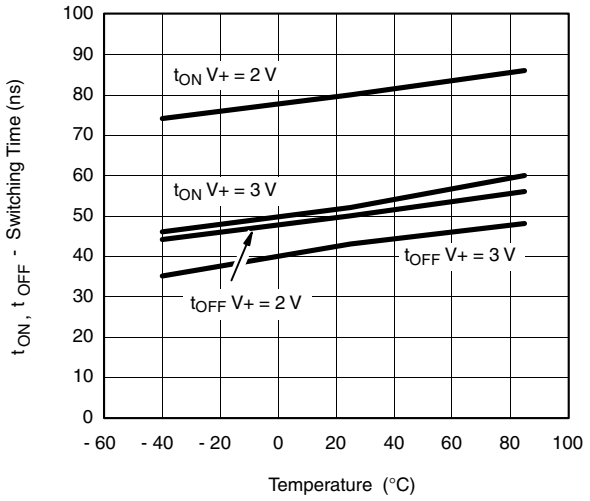



**Leakage Current vs. Temperature**

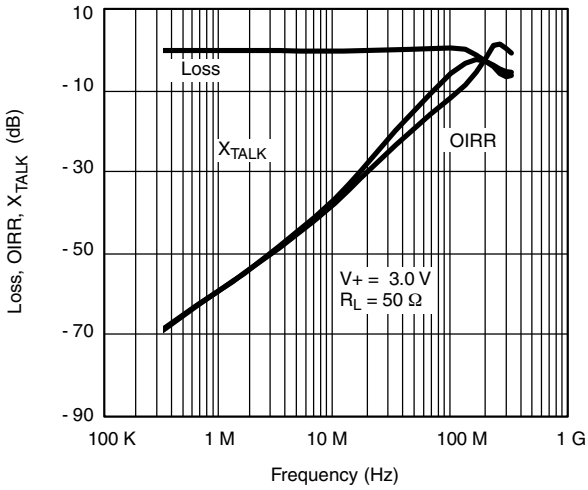



**Leakage vs. Analog Voltage**

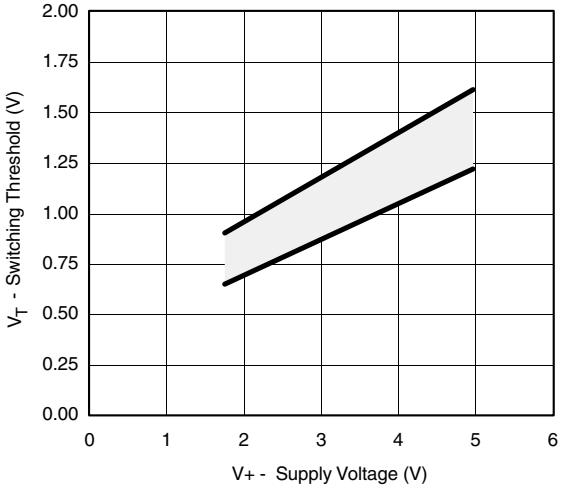
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



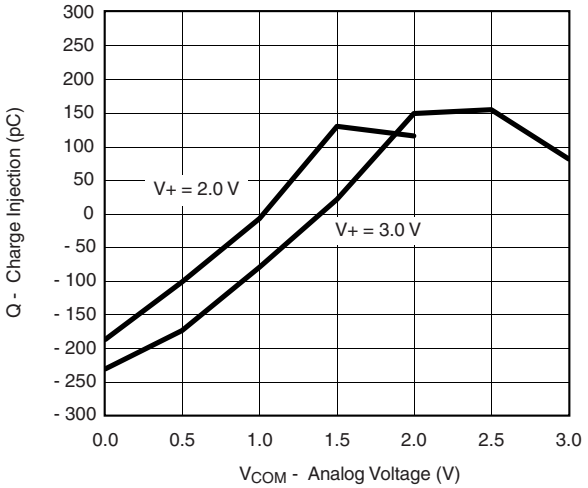

**Switching Time vs. Temperature**




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

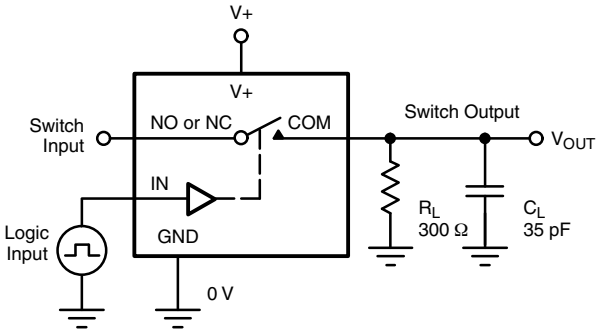



**Switching Threshold vs. Supply Voltage**



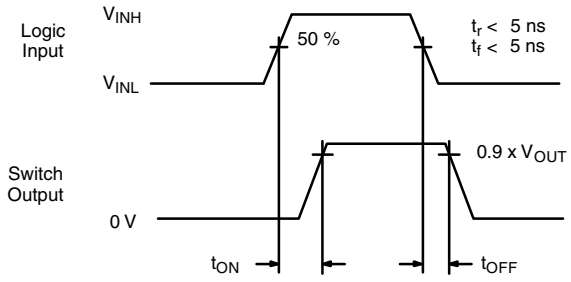

**Charge Injection vs. Analog Voltage**

## TEST CIRCUITS



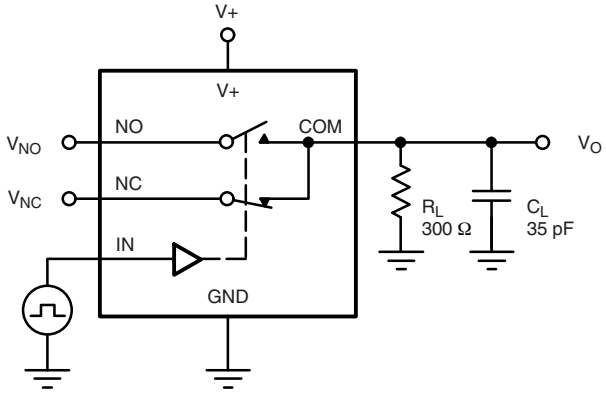

$C_L$ (includes fixture and stray capacitance)

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




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

**Figure 1. Switching Time**

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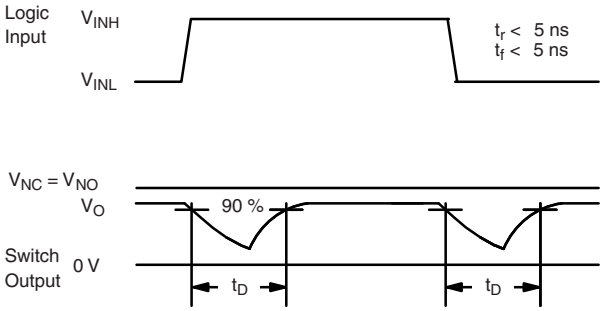
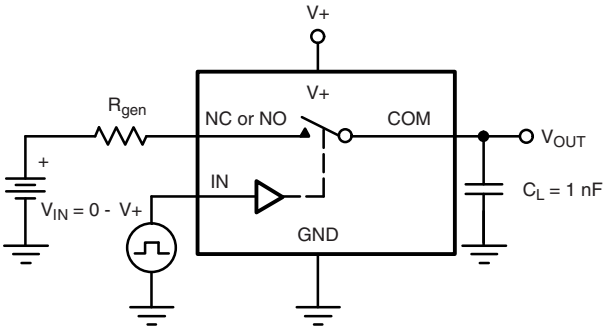
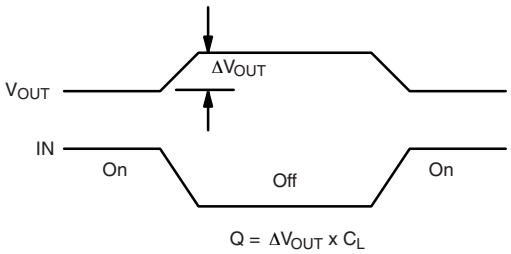



**Figure 2. Break-Before-Make Interval**




$Q = \Delta V_{OUT} \times C_L$

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

**Figure 3. Charge Injection**

## TEST CIRCUITS

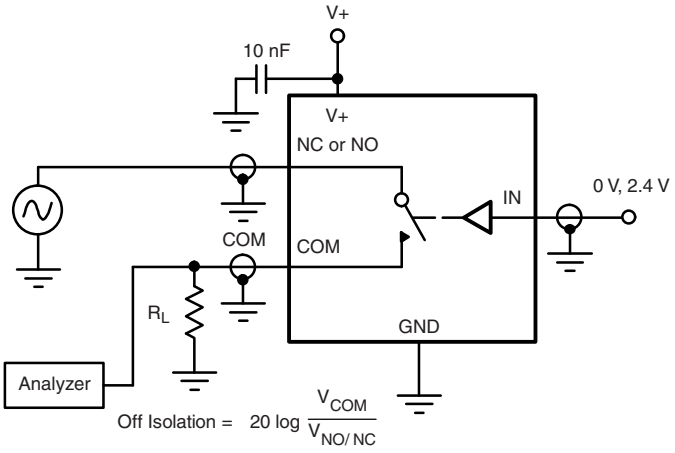



**Figure 4. Off-Isolation**

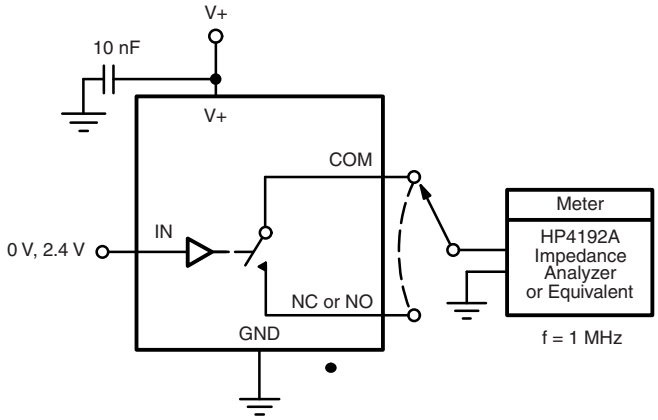
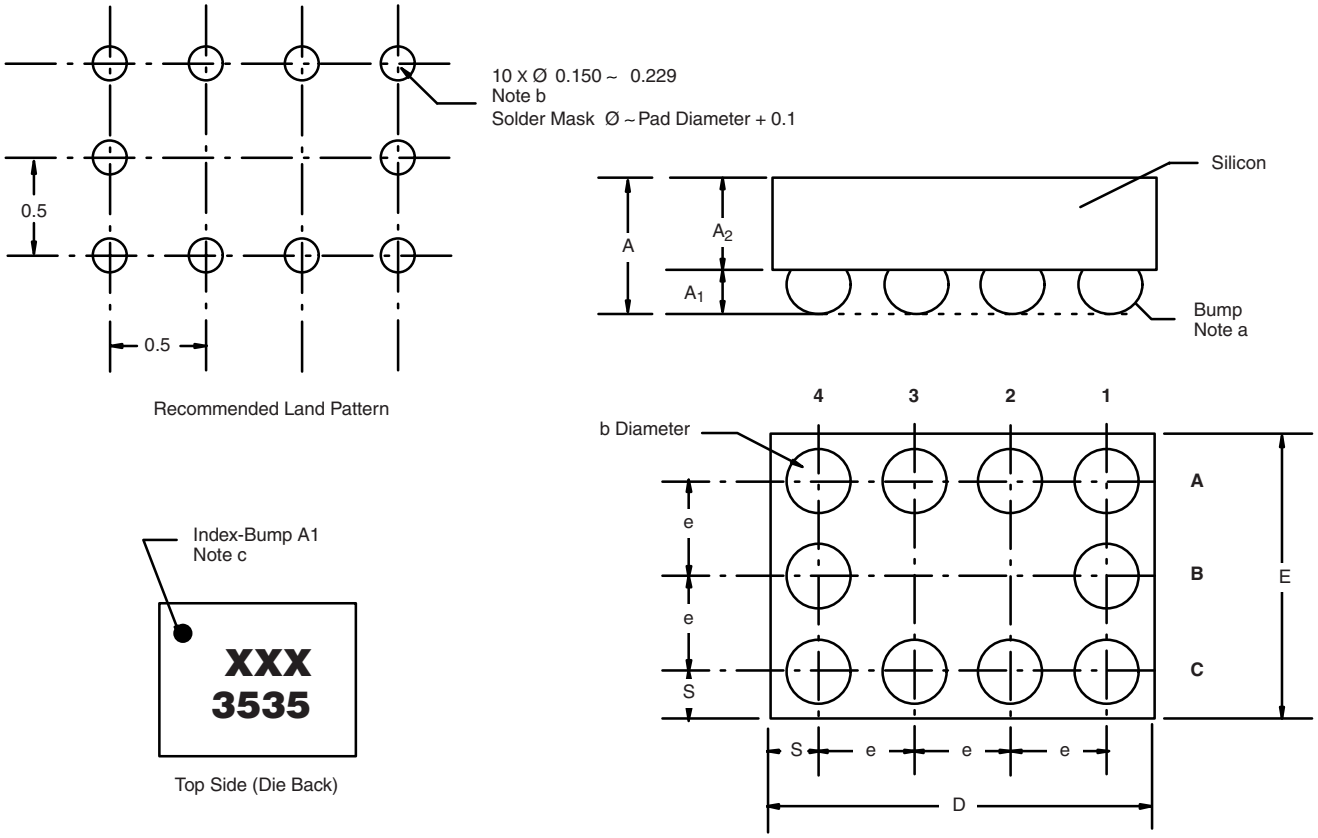



**Figure 5. Channel Off/On Capacitance**

## PACKAGE OUTLINE

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



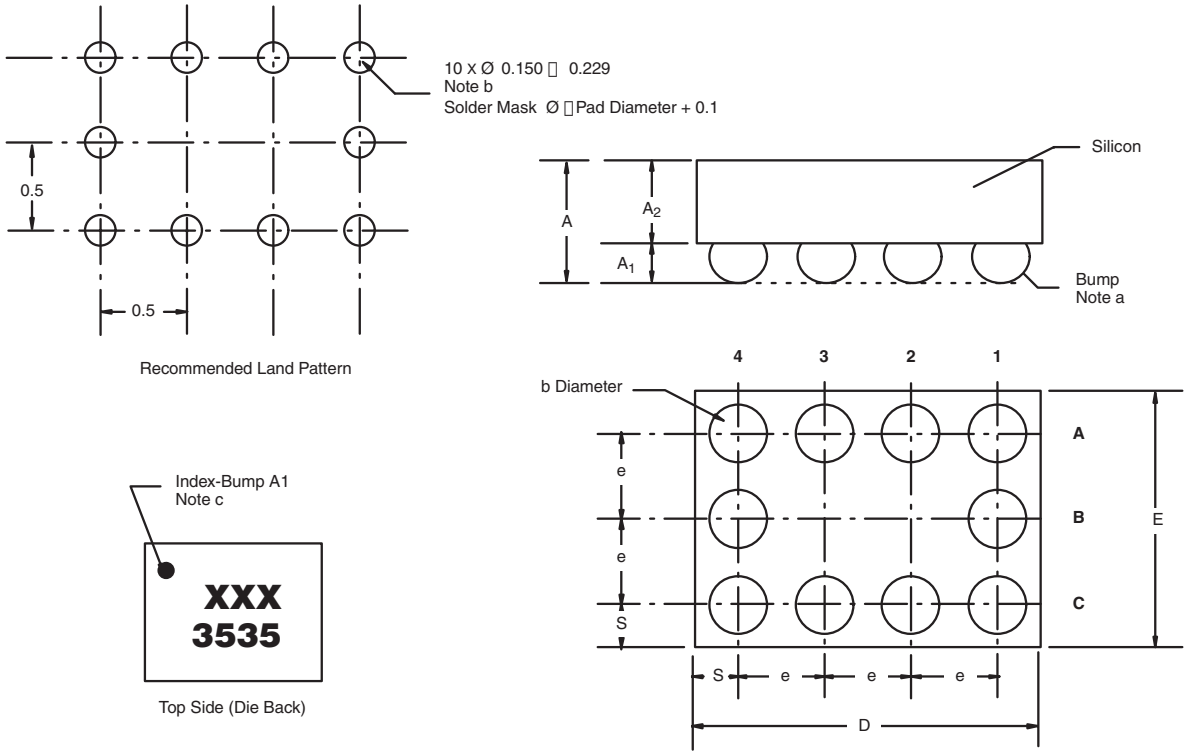

Notes (Unless Otherwise Specified):
a. Bump is Lead Free Sn/Ag/Cu.
b. Non-solder mask defined copper landing pad.
c. Laser Mark on silicon die back; back-lapped, no coating. Shown is not actual marking; sample only.

| 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?72961.*

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

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**Note**

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

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**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.**

LifeElectronics
Живое партнерство

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*ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703*

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- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
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- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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