

Low Voltage Dual SPDT Analog Switch with Negative Swing Audio Capability

DESCRIPTION

The DG2750 is a dual SPDT low on-resistance switch designed to from a single 1.8 V to 5.0 V power supply. It is a bi-directional switch, and is capable of switching negative swing audio without the need for a coupling capacitor. With a single power supply, the audio signal can swing over the range from $((V+) - 5.0)$ to $V+$.

Guaranteed to operate with 1.4 V logic when $V+$ is in the range of 2.7 V to 5.0 V, the DG2750 will allow an easy interface with low voltage DSP or ASIC control logic.

The DG2750 is built on sub micron CMOS low voltage process technology, has very low quiescent current, and provides greater than 300 mA latch-up protection, as tested per JESD78.

The DG2750 is assembled in ultra compact mQFN10 package of 1.4 mm x 1.8 mm.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device termination. The miniQFN-10 package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free “-E4” suffix to the ordering part number. The nickel-palladium-gold device terminations meet all JEDEC standards for reflow and MSL rating.

As a further sign of Vishay Siliconix's commitment, the DG2750 is fully RoHS complaint and Halogen free.

FEATURES

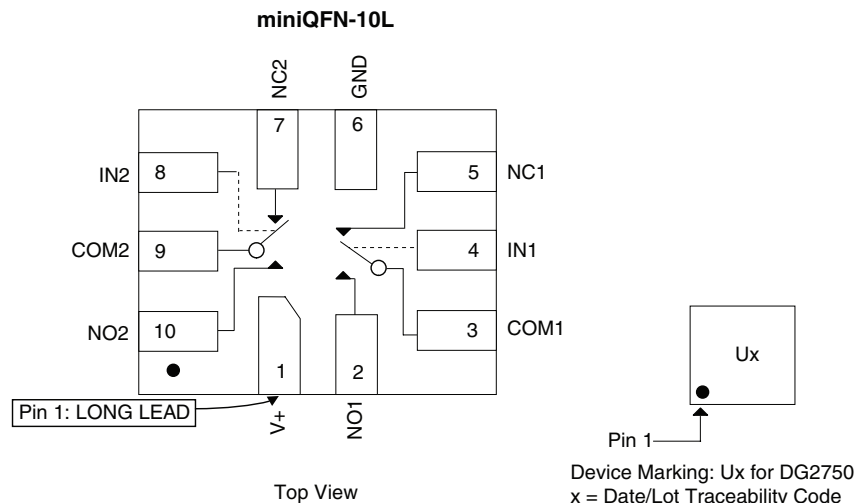
- Capable to switch negative swing audio without dc blocking capacitor
- Low on-resistance
- 1.4 V high logic
- Latch-up current > 300 mA (JESD78)
- Reduced power consumption
- Reduce board space
- Compliant to RoHS directive 2002/95/EC


RoHS
COMPLIANT

APPLICATIONS

- Cellular phones
- Portable media players
- Computer and game machine
- Handheld healthcare and instruments

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



ORDERING INFORMATION

| Temp. Range | Package | Part Number |
|------------------|------------|----------------|
| - 40 °C to 85 °C | miniQFN-10 | DG2750DN-T1-E4 |

| TRUTH TABLE, DG2750 | | |
|---------------------|-------------|------------|
| IN1 (Pin 4) | IN2 (Pin 8) | Function |
| 0 | X | COM1 = NC1 |
| 1 | X | COM1 = NO1 |
| X | 0 | COM2 = NC2 |
| X | 1 | COM2 = NO2 |

| ABSOLUTE MAXIMUM RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | |
|--|--------------------------|--|------|
| Parameter | | Limit | Unit |
| Reference to GND | V+, IN | - 0.3 to 5.5 | V |
| | COM, NO, NC ^a | (V+) - 5.5 or - 2.5 whichever higher, (V+ + 0.3) | |
| Current (Any Terminal except COM, NO, NC, IN) | | 30 | mA |
| Continuous Current (COM, NO, NC, IN) | | ± 250 | |
| Peak Current (Pulsed at 1 ms, 10 % Duty Cycle) | | ± 500 | |
| Storage Temperature (D Suffix) | | - 65 to 150 | °C |
| Power Dissipation (Packages) ^b | miniQFN-10 ^c | 208 | mW |
| ESD (Human Body Model) I/O to GND | | 8 | kV |
| Latch-up (per JESD78) | | 500 | mA |

Notes:

a. Signals on COM, NO, NC, exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

b. All leads welded or soldered to PC board.

c. Derate 2.6 mW/°C above 70 °C.

| SPECIFICATIONS $V_+ = 2.7\text{ V}$, ± 10 % | | | | | | | |
|--|--------------------------------------|--|--------------------|----------------------------|-------------------|-------------------|------|
| Parameter | Symbol | Test Conditions Otherwise Unless Specified | Temp. ^a | Limits - 40 °C to 85 °C | | | Unit |
| | | | | Min. ^b | Typ. ^c | Max. ^b | |
| Analog Switch | | | | | | | |
| Analog Signal Range ^d | V _{ANALOG} | | Full | - 2.5 | | V+ | V |
| On-Resistance | R _{DS(on)} | $V_+ = 2.7\text{ V}$, $V_S = ((V_+) - 4.5\text{ V}, - 1\text{ V}, 0\text{ V}, 1\text{ V}, 2\text{ V}, V_+)$, $I_S = 100\text{ mA}$ | Room | | 0.6 | 1.0 | Ω |
| On-Resistance Match | ΔR _{ON} | | Full | | | 1.3 | |
| On-Resistance Resistance Flatness | R _{ON} Flatness | | Room | | 0.1 | | |
| Switch Off Leakage Current | I _{NO/NC(off)} | $V_+ = 2.7\text{ V}$, $V_{NC/NO} = - 2.5\text{ V}$ or 2.5 V , $V_{COM} = 2.5\text{ V}$ or $- 2.5\text{ V}$ | Room | | 50 | | nA |
| | I _{COM(off)} | | Full | - 250 | | 250 | |
| Channel On Leakage Current | I _{COM(on)} | | Room | | 50 | | |
| | | | Full | - 250 | | 250 | |
| Digital Control | | | | | | | |
| Input Voltage High | V _{INH} | $V_+ = 2.7\text{ V}$ to 4.3 V | Full | 1.4 | | | V |
| Input Voltage Low | V _{INL} | | Full | | | 0.6 | |
| Input Capacitance | C _{IN} | | Room | | 6.5 | | pF |
| Input Current | I _{INL} or I _{INH} | $V_{IN} = 0$ or V_+ | Full | - 1 | | 1 | μA |
| Dynamic Characteristics | | | | | | | |
| Break-Before-Make Time ^{e, d} | t _{BBM} | $V_+ = 3.0\text{ V}$, $V_S = 1.5\text{ V}$, $R_L = 50\text{ }^\Omega$, $C_L = 35\text{ pF}$ | Room | 800 | 1040 | | ns |
| | | | Full | 1000 | | | |
| Enable Turn-On Time ^{e, d} | t _{ON(EN)} | | Room | | 1140 | 1350 | |
| | | | Full | | | 1700 | |
| Enable Turn-Off Time ^{e, d} | t _{OFF(EN)} | | Room | | 90 | 130 | |
| | | | Full | | | 150 | |

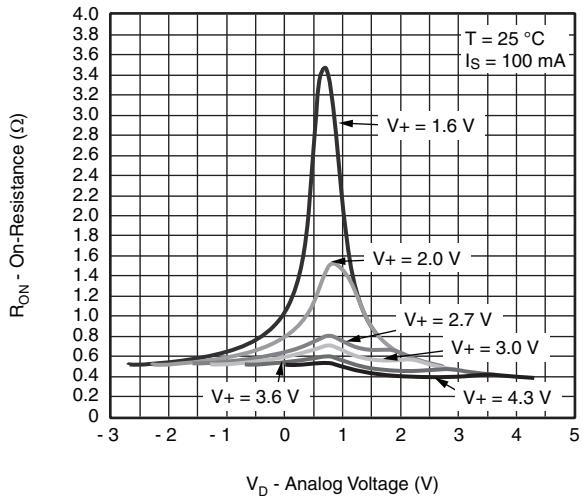
| SPECIFICATIONS $V_+ = 2.7\text{ V}, \pm 10\%$ | | | | | | | |
|--|---------------------|--|--------------------|----------------------------|-------------------|-------------------|---------------|
| Parameter | Symbol | Test Conditions Otherwise Unless Specified | Temp. ^a | Limits - 40 °C to 85 °C | | | Unit |
| | | | | Min. ^b | Typ. ^c | Max. ^b | |
| Dynamic Characteristics | | | | | | | |
| Charge Injection ^d | Q_{INJ} | $C_L = 1\text{ nF}, R_{GEN} = 0\ \Omega, V_{GEN} = 0\text{ V}$ | Room | | 4 | | pC |
| Off-Isolation ^d | OIRR | $V_+ = 3.0\text{ V}, R_L = 50\ \Omega, C_L = 5\text{ pF},$ $f = 300\text{ kHz}$ | | | - 54.7 | | dB |
| Crosstalk ^d | X_{TALK} | | | | - 60.8 | | |
| Bandwidth ^d | BW | $V_+ = 3.0\text{ V}, R_L = 50\ \Omega, - 3\text{ dB}$ | | | 34 | | MHz |
| Channel-Off Capacitance ^d | $C_{NC/NO(off)}$ | $V_+ = 3.0\text{ V}, f = 1\text{ MHz}$ | | | 30 | | pF |
| Channel-On Capacitance ^d | $C_{COM/NC/NO(on)}$ | | | | 81 | | |
| Power Supply | | | | | | | |
| Power Supply Range | V_+ | | | 1.8 | | 5.0 | V |
| Power Supply Current | I_+ | $V_{IN} = 0\text{ V}, \text{ or } V_+$ | Full | | | 2 | μA |

Notes:

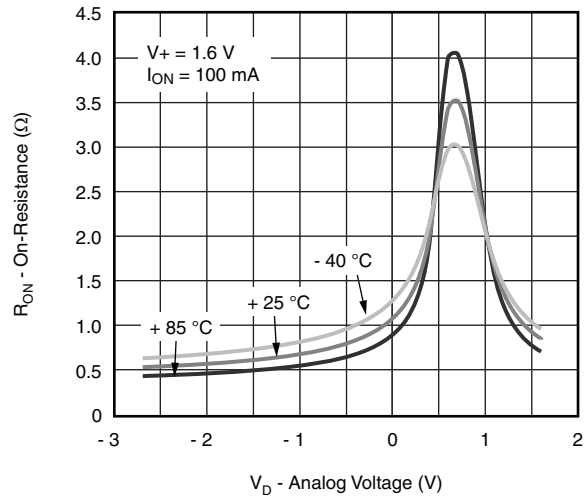
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d. 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 25 °C, unless otherwise noted

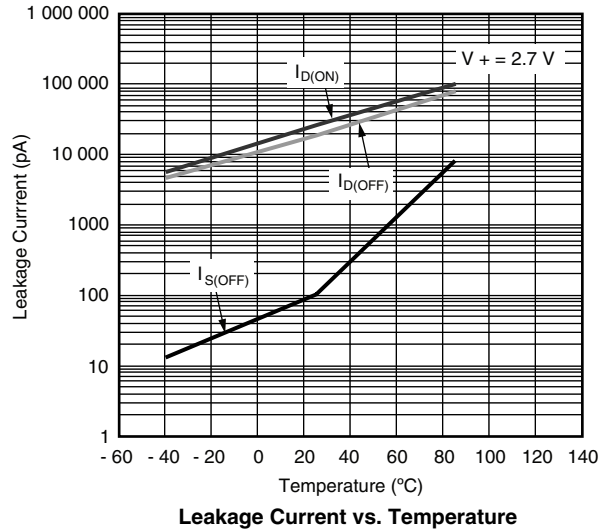
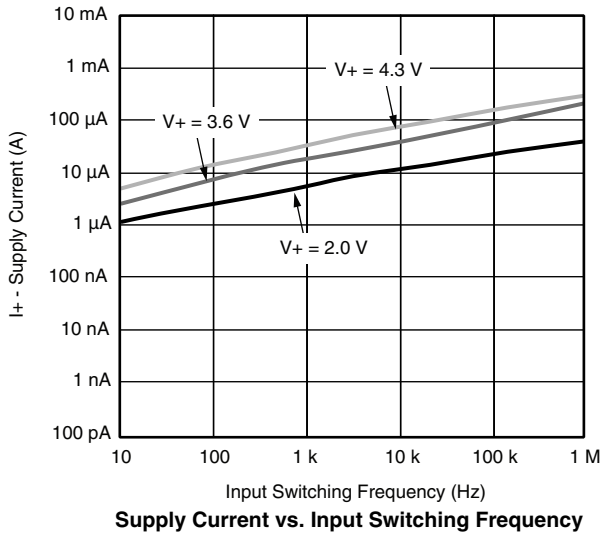
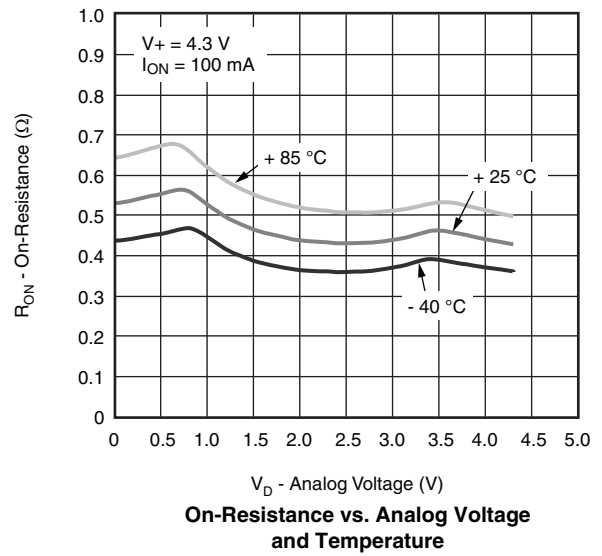
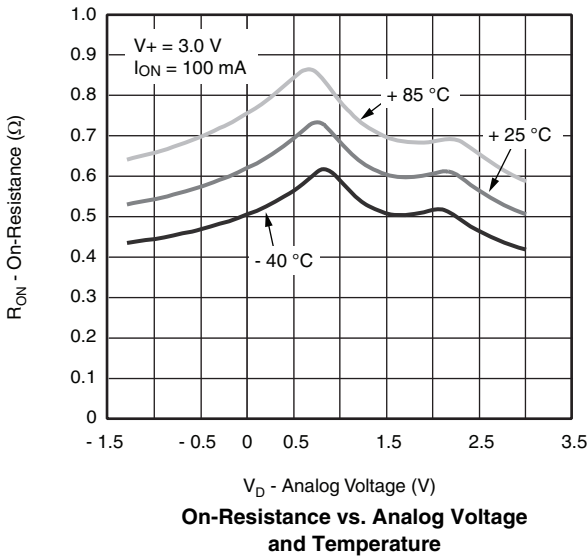
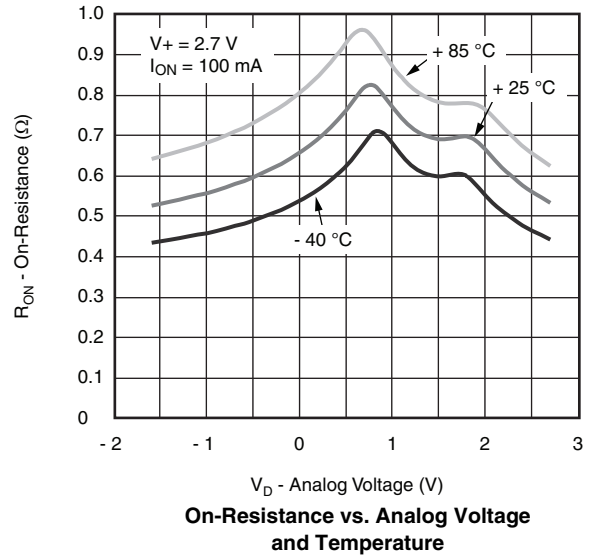
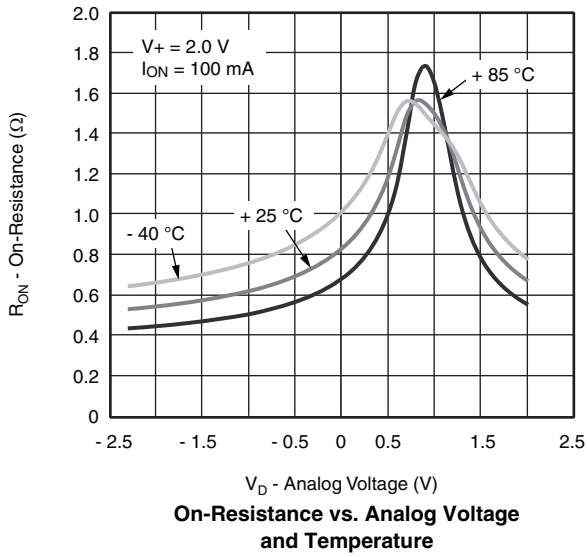


On-Resistance vs. V_D and Single Supply Voltage

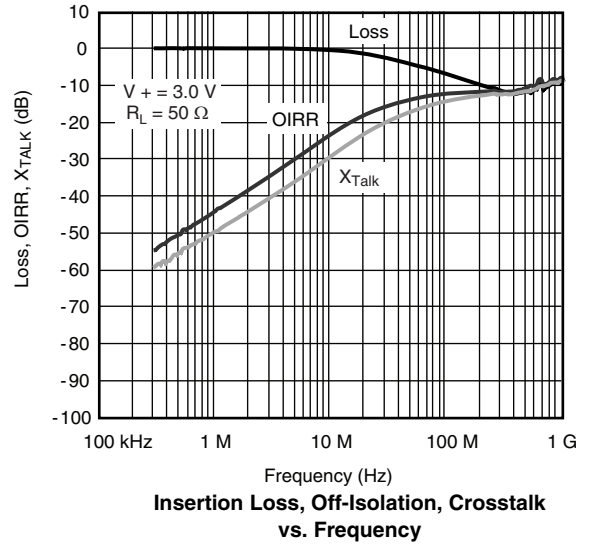
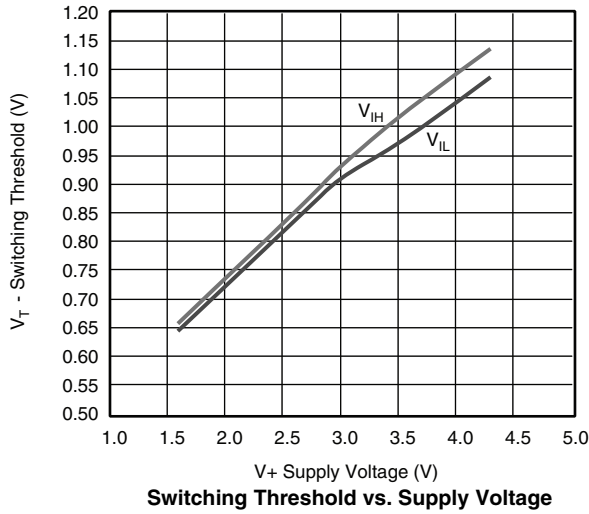


On-Resistance vs. Analog Voltage and Temperature

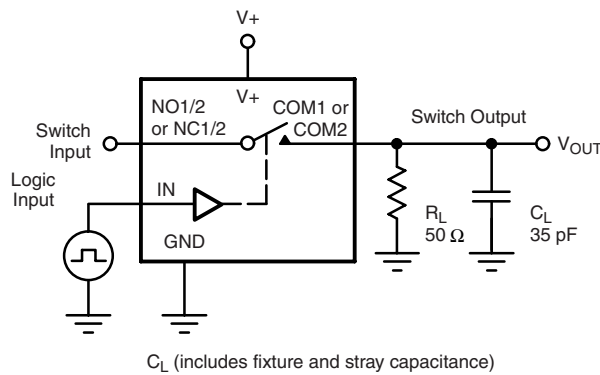
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

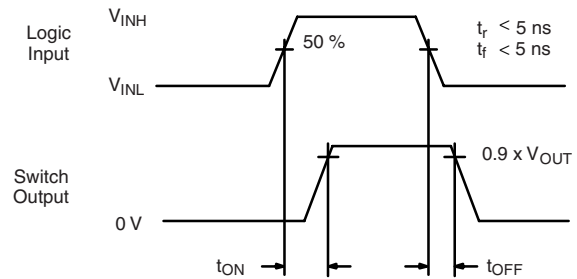


TEST CIRCUITS



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

Figure 1. Switching Time



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

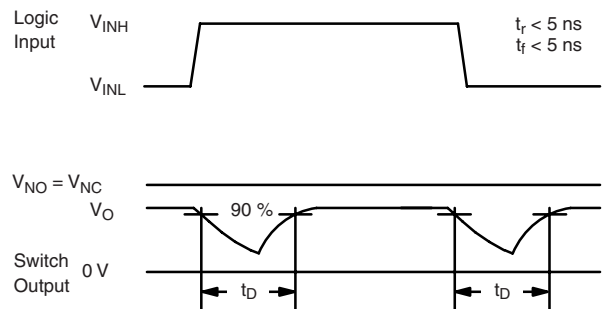
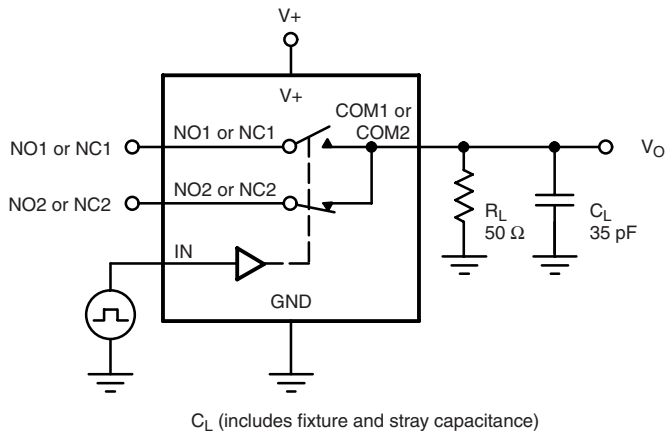
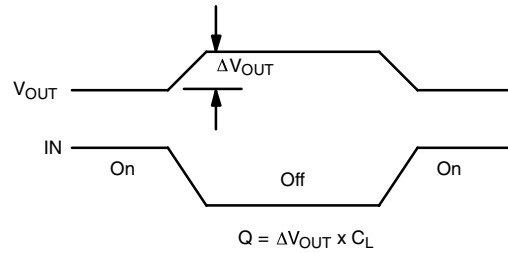
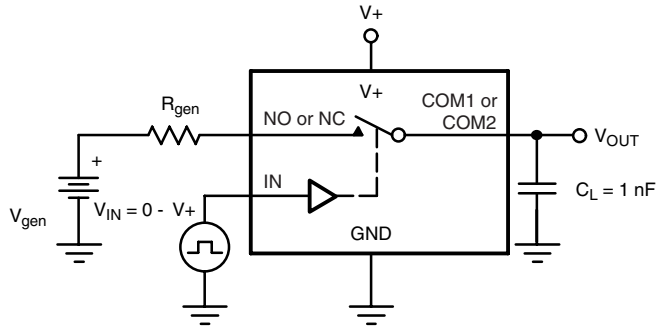


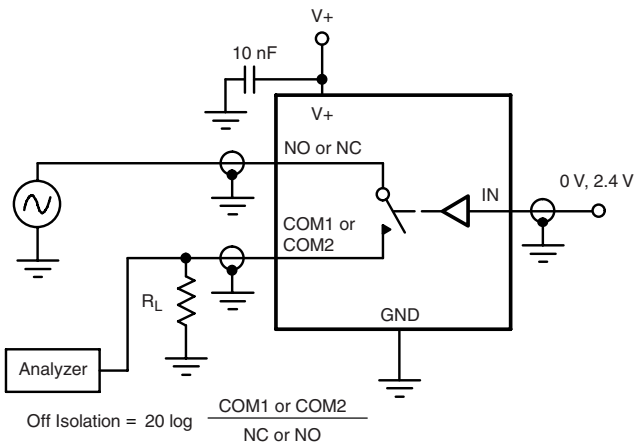
Figure 2. Break-Before-Make Interval

TEST CIRCUITS



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

Figure 3. Charge Injection



$$\text{Off Isolation} = 20 \log \frac{\text{COM1 or COM2}}{\text{NC or NO}}$$

Figure 4. Off-Isolation

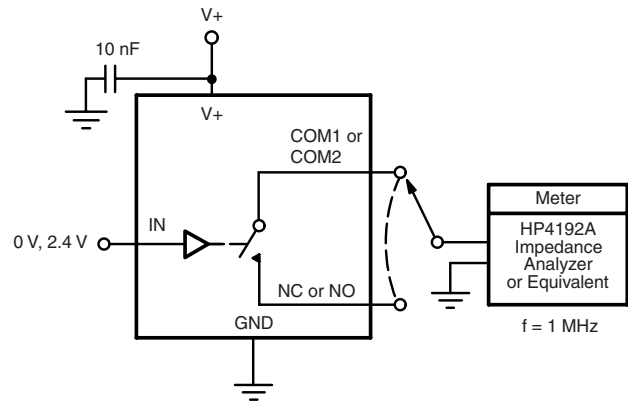
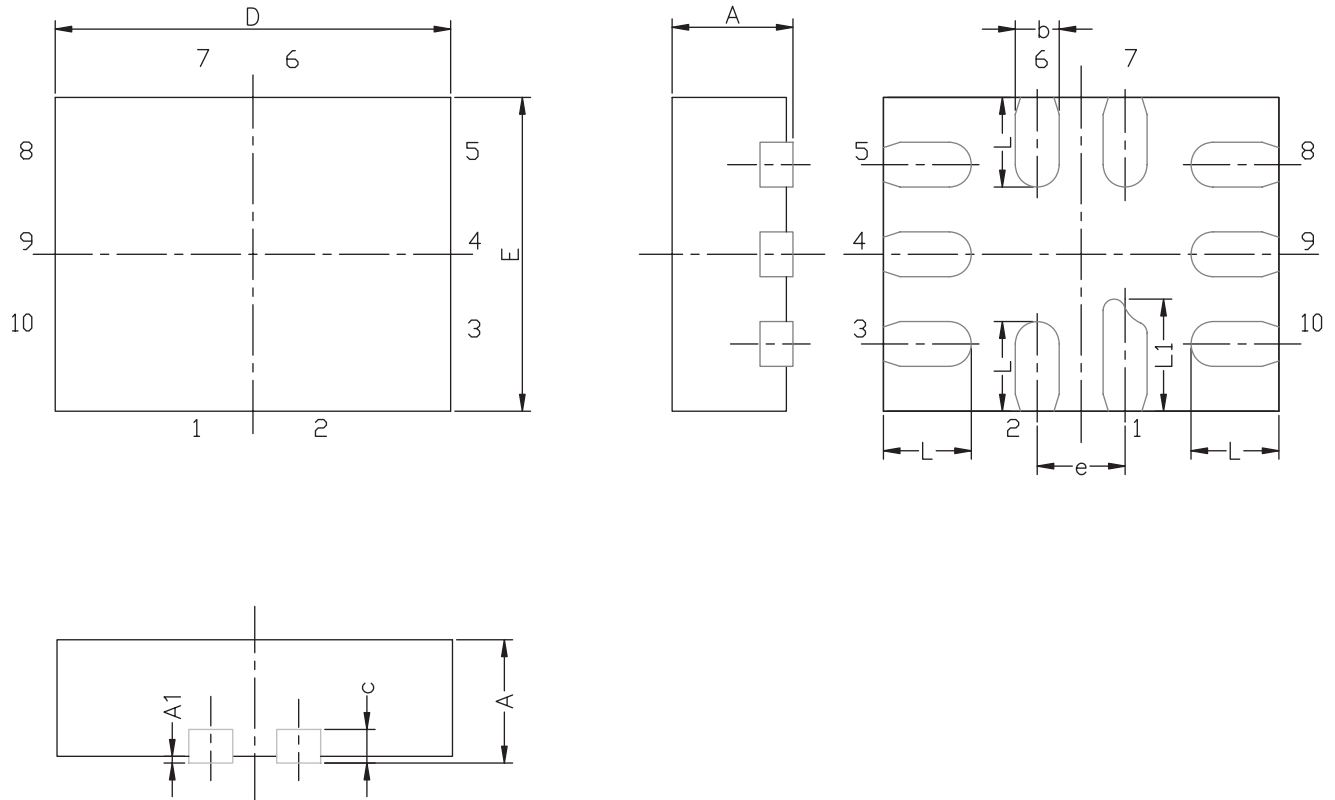


Figure 5. Channel Off/On Capacitance

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 www.vishay.com/ppg?64736.

MINI QFN-10L CASE OUTLINE



| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|--------|--------|
| | MIN. | NAM. | MAX. | MIN. | NAM. | MAX. |
| A | 0.50 | 0.55 | 0.60 | 0.0197 | 0.0217 | 0.0236 |
| A1 | 0.00 | - | 0.05 | 0.000 | - | 0.002 |
| b | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| c | 0.15 REF | | | 0.006 REF | | |
| D | 1.75 | 1.80 | 1.85 | 0.069 | 0.071 | 0.073 |
| E | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| e | 0.40 BSC | | | 0.016 BSC | | |
| L | 0.35 | 0.40 | 0.45 | 0.014 | 0.016 | 0.018 |
| L1 | 0.45 | 0.50 | 0.55 | 0.0177 | 0.0197 | 0.0217 |

ECN T-07039-Rev. A, 12-Feb-07
DWG: 5957

RECOMMENDED MINIMUM PADS FOR MINI QFN 10L



Mounting Footprint
Dimensions in mm (inch)



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.