

Low Voltage, 0.6 Ω , Dual SPDT Analog Switch

DESCRIPTION

The DG2735, DG2736 are low voltage, low on-resistance, dual single-pole/double-throw (SPDT) monolithic CMOS analog switches designed for high performance switching of analog signals. Combining low-power, high speed, low on-resistance, and small package size, the DG2735, DG2736 are ideal for portable and battery power applications.

The DG2735, DG2736 have an operation range from 1.65 V to 4.3 V single supply. The DG2735 has two separate control pins with for the separated two SPDT switched. The DG2736 has an EN pin. All switches are at high impedance mode when the EN is high.

The DG2735, DG2736 are guaranteed 1.65 V logic compatible, allowing the easy interface with low voltage DSP or MCU control logic and ideal for one cell Li-ion battery direct power.

The switch conducts signals within power rails equally well in both directions when on, and blocks up to the power supply level when off. Break-before-make is guaranteed.

The DG2735, DG2736 are built on Vishay Siliconix's sub micron CMOS low voltage process technology and provides greater than 300 mA latch-up protection, as tested per JESD78.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. DG2735, DG2736 are offered in a miniQFN package. The miniQFN package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free "-E4" suffix. The nickel-palladium-gold device terminations meet all JEDEC standards for reflow and MSL ratings.

FEATURES

- Low voltage operation (1.65 V to 4.3 V)
- Low on-resistance - R_{ON} : 0.6 Ω at 2.7 V
- Fast switching: t_{ON} = 55 ns at 2.7 V
- T_{OFF} = 40 ns at 2.7 V
- Latch-up current > 300 mA (JESD78)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

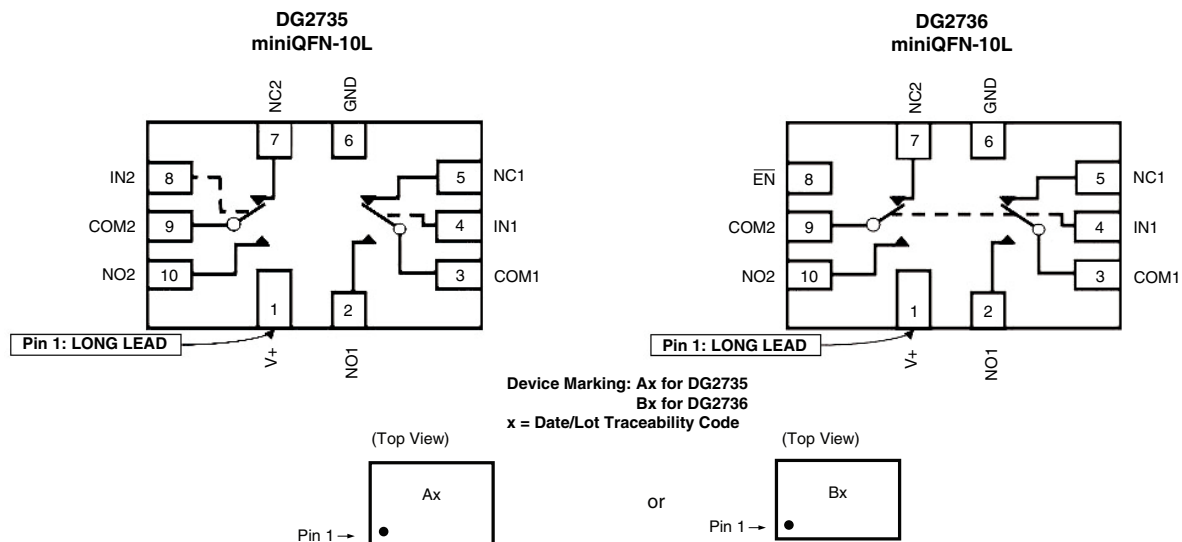
BENEFITS

- Reduced power consumption
- High accuracy
- Reduce board space
- TTL/1.65 V logic compatible

APPLICATIONS

- Cellular phones
- Speaker headset switching
- Audio and video signal routing
- PCMCIA cards
- Battery operated systems
- Portable media player Handheld test instruments

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION





| TRUTH TABLE | | | |
|-------------|------------------|--------|--------|
| Logic | EN (DG2736 only) | NC1, 2 | NO1, 2 |
| 0 | 1 | OFF | OFF |
| 1 | 1 | OFF | OFF |
| 0 | 0 | ON | OFF |
| 1 | 0 | OFF | ON |

| ORDERING INFORMATION | | |
|----------------------|-----------|----------------------------------|
| Temp. Range | Package | Part Number |
| - 40 °C to 85°C | miniQFN10 | DG2735DN-T1-E4 DG2736DN-T1-E4 |

| ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted) | | | | |
|---|------------------------------|---------------------|------|--|
| Parameter | Symbol | Limit | Unit | |
| Reference to GND | V+ | - 0.3 to 5 | V | |
| | IN, COM, NC, NO ^a | - 0.3 to (V+ + 0.3) | | |
| Current (Any terminal except NO, NC or COM) | | 30 | mA | |
| Continuous Current (NO, NC, or COM) | | ± 250 | | |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) | | ± 500 | | |
| Storage Temperature (D Suffix) | | - 65 to 150 | °C | |
| Power Dissipation (Packages) ^b | miniQFN10 ^c | 208 | 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. All leads welded or soldered to PC board.
- c. Derate 4 mW/C above 70 °C.

| SPECIFICATIONS (V+ = 3 V) | | | | | | | |
|--|--------------------------|--|--------------------|----------------------------|-------------------|-------------------|------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified V+ = 3 V, ± 10 %, V _{IN} = 0.4 V or 1.65 V ^e | Temp. ^a | Limits - 40 °C to 85 °C | | | Unit |
| | | | | Min. ^b | Typ. ^c | Max. ^b | |
| Analog Switch | | | | | | | |
| Analog Signal Range ^d | V _{analog} | R _{DS(on)} | Full | 0 | | V+ | V |
| On-Resistance | R _{DS(on)} | V+ = 2.7 V, I _{NO/NC} = 100 mA, V _{COM} = 0.5 V | Room | | 0.5 | 0.6 | Ω |
| | | V+ = 2.7 V, I _{NO/NC} = 100 mA, V _{COM} = 1.5 V | | | | | |
| | | V+ = 2.7 V, I _{NO/NC} = 100 mA, V _{COM} = 0.5 V | Full | | 0.5 | | |
| | | V+ = 2.7 V, I _{NO/NC} = 100 mA, V _{COM} = 1.5 V | | | | | |
| | | V+ = 4.3 V, I _{NO/NC} = 100 mA, V _{COM} = 0.9 V | Room | | 0.4 | 0.5 | |
| | | V+ = 4.3 V, I _{NO/NC} = 100 mA, V _{COM} = 2.5 V | | | 0.3 | | |
| | | V+ = 4.3 V, I _{NO/NC} = 100 mA, V _{COM} = 0.9 V | Full | | 0.5 | | |
| | | V+ = 4.3 V, I _{NO/NC} = 100 mA, V _{COM} = 2.5 V | | | | | |
| R _{ON} Match ^d | ΔR _{ON} | V+ = 2.7 V, I _{NO/NC} = 100 mA, V _{COM} = 0.5 V, 1.5 V V+ = 4.3 V, I _{NO/NC} = 100 mA, V _{COM} = 0.9 V, 2.5 V | Room | | 0.06 | 0.08 | |
| R _{ON} resistance flatness ^d | R _{ON} flatness | V+ = 2.7 V, I _{NO/NC} = 100 mA, V _{COM} = 0.5 V, 1.5 V | Room | | | 0.15 | |
| Switch Off Leakage Current | I _{NO/NC(off)} | V+ = 4.3 V, V _{NO/NC} = 0.3 V/4 V, V _{COM} = 4 V/0.3 V | Room | - 2 | | 2 | nA |
| | | | Full | - 10 | | 10 | |
| | Room | | - 2 | | 2 | | |
| | Full | | - 10 | | 10 | | |
| Channel-On Leakage Current | I _{COM(on)} | V+ = 4.3 V, V _{NO/NC} = V _{COM} = 4 V/0.3 V | Room | - 5 | | 5 | |
| | | | Full | - 20 | | 20 | |



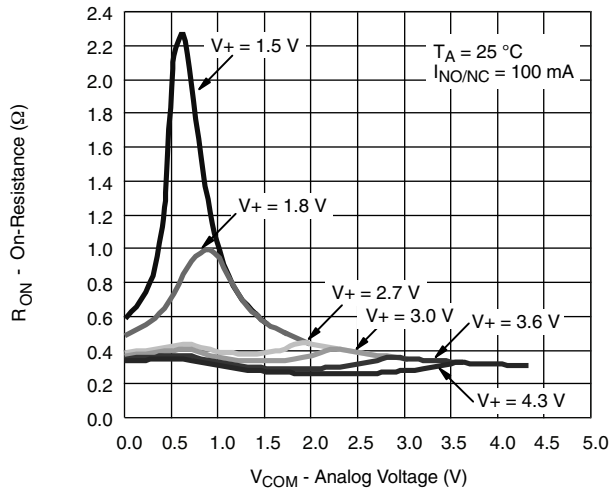
| SPECIFICATIONS (V+ = 3 V) | | | | | | | | |
|--|--------------------------------------|---|--------------------|----------------------------|-------------------|-------------------|------|--|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified V+ = 3 V, ± 10 %, V _{IN} = 0.4 V or 1.65 V ^e | Temp. ^a | Limits - 40 °C to 85 °C | | | Unit | |
| | | | | Min. ^b | Typ. ^c | Max. ^b | | |
| Digital Control | | | | | | | | |
| Input High Voltage | V _{INH} | | Full | 1.65 | | | V | |
| Input Low Voltage | V _{INL} | | Full | | | 0.4 | | |
| Input Capacitance | C _{IN} | | Full | | 6 | | pF | |
| Input Current | I _{INL} or I _{INH} | V _{IN} = 0 or V+ | Full | - 1 | | 1 | µA | |
| Dynamic Characteristics | | | | | | | | |
| Break-Before-Make Time ^e | t _{BBM} | V+ = 3.6 V, V _{NO} , V _{NC} = 1.5 V, R _L = 50 Ω, C _L = 35 pF | Room | 1 | 5 | | ns | |
| Turn-On Time ^e | t _{ON} | | Room | | 50 | 78 | | |
| | | | Full | | | 80 | | |
| Turn-Off Time ^e | t _{OFF} | | Room | | 35 | 58 | | |
| | | | Full | | | 60 | | |
| Enable Turn-On Time ^e DG2736 (EN) | t _{ON(EN)} | | Room | | 50 | 78 | | |
| | | | Full | | | 80 | | |
| Enable Turn-Off Time ^e DG2736 (EN) | t _{OFF(EN)} | | Room | | 35 | 58 | | |
| | | Full | | | 60 | | | |
| Off-Isolation ^d | O _{IRR} | R _L = 50 Ω, C _L = 5 pF, f = 100 kHz | Room | | - 70 | | dB | |
| Crosstalk ^d | X _{TALK} | | | | - 70 | | | |
| 3dB bandwidth ^d | | R _L = 50 Ω, C _L = 5 pF | Room | | 50 | | MHz | |
| NO, NC Off Capacitance ^d | C _{NO(off)} | V _{IN} = 0 V, or V+, f = 1 MHz | Room | | 55 | | pF | |
| | C _{NC(off)} | | | | 55 | | | |
| Channel On Capacitance ^d | C _{NO(on)} | | | | | 130 | | |
| | C _{NC(on)} | | | | | 130 | | |
| Power Supply | | | | | | | | |
| Power Supply Range | V+ | | | 1.65 | | 4.3 | V | |
| Power Supply Current | I+ | V _{IN} = 0 or V+ | Full | | | 1 | µA | |

Notes:

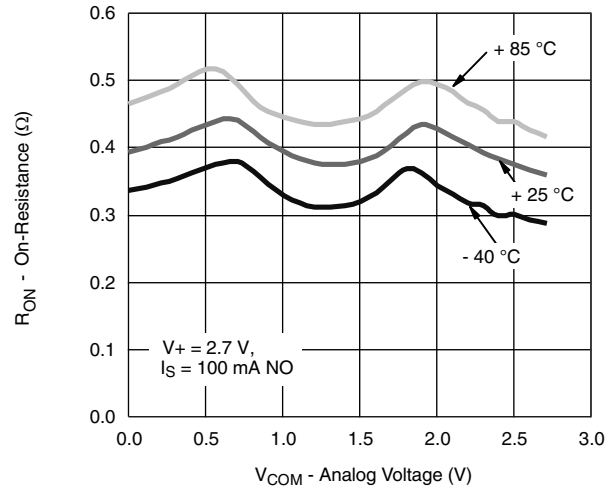
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d.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

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.

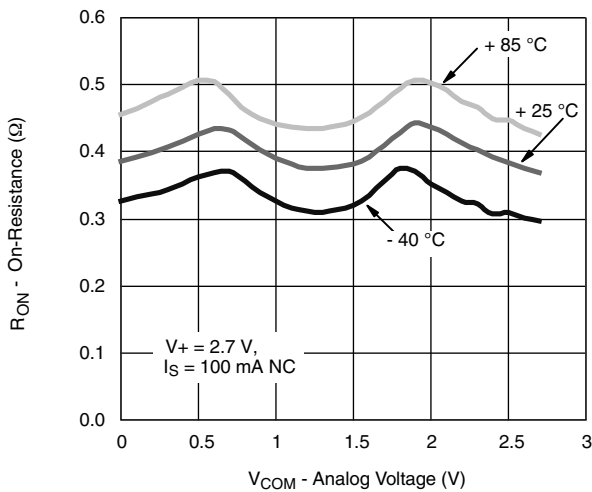
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



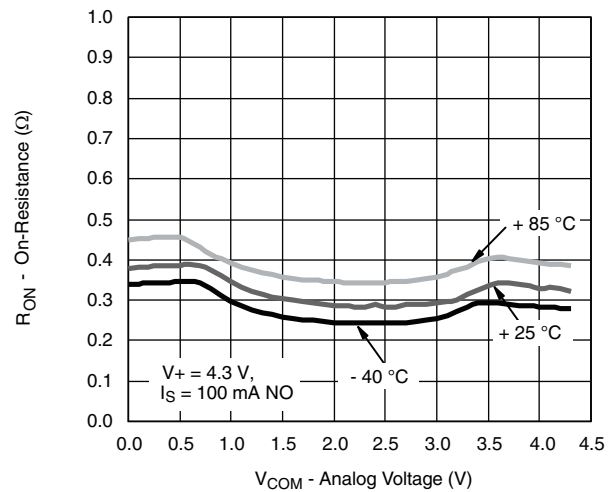
R_{ON} vs. V_{COM} and Supply Voltage



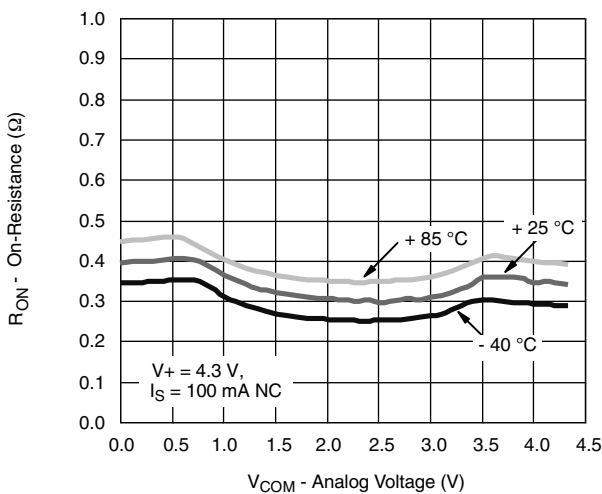
R_{ON} vs. Analog Voltage and Temperature



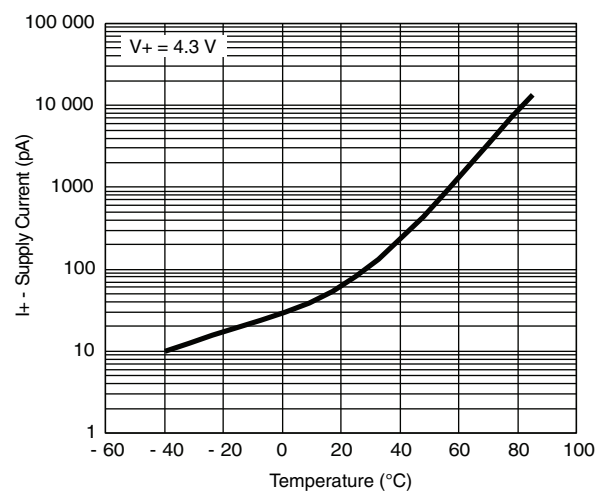
R_{ON} vs. Analog Voltage and Temperature



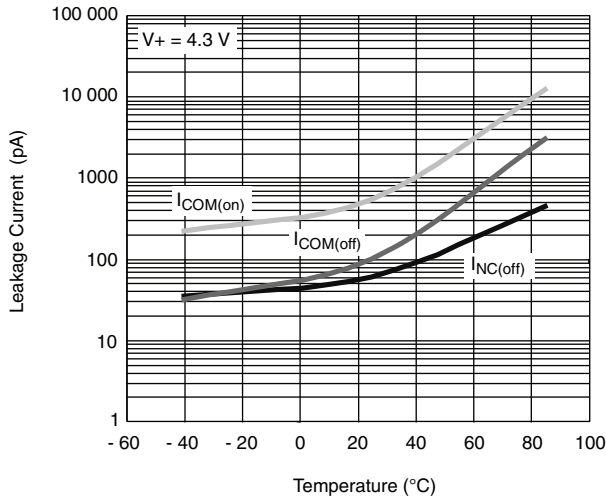
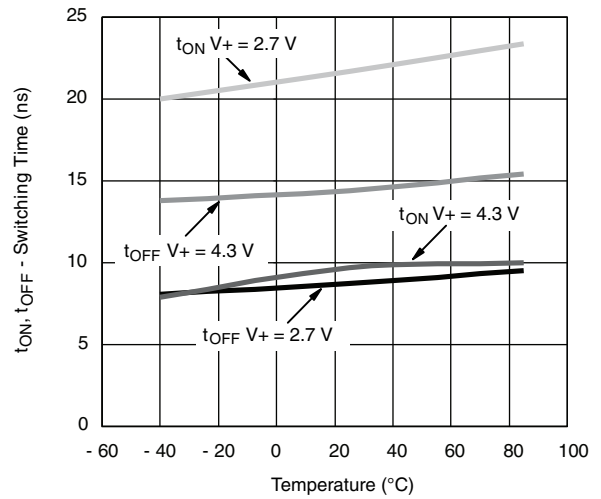
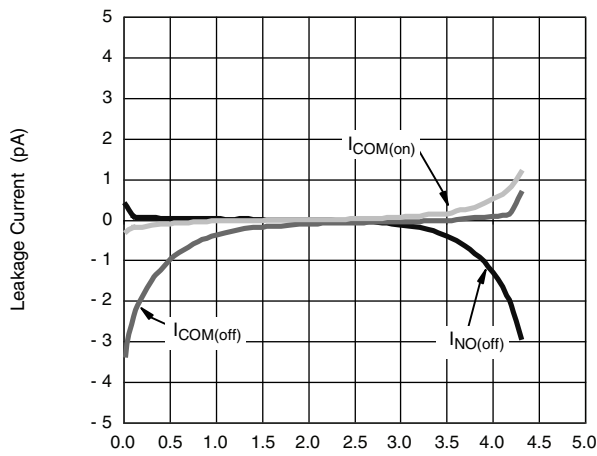
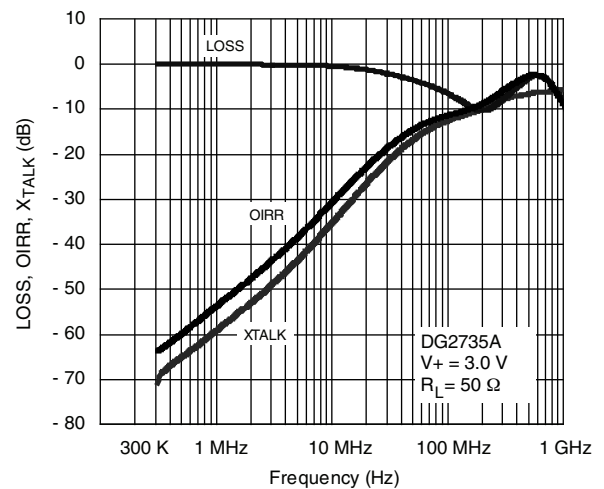
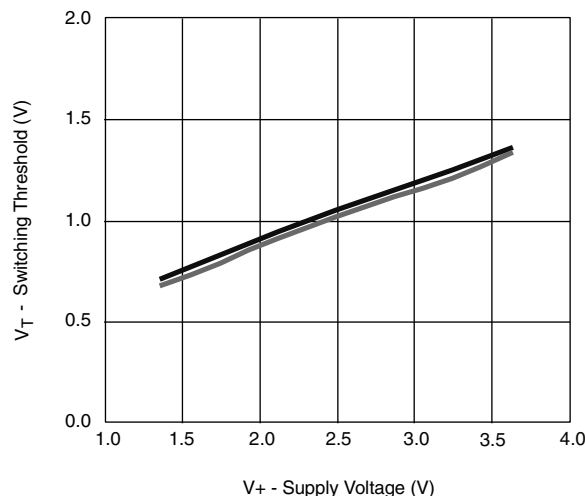
R_{ON} vs. Analog Voltage and Temperature



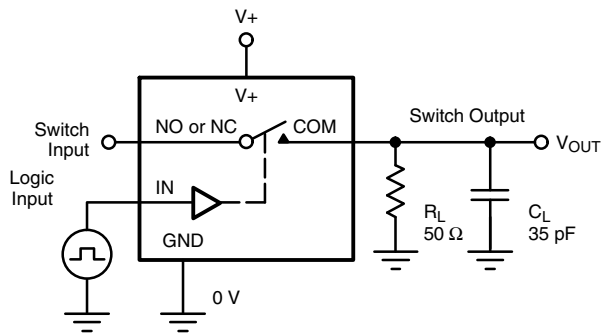
R_{ON} vs. Analog Voltage and Temperature



Supply Current vs. Temperature

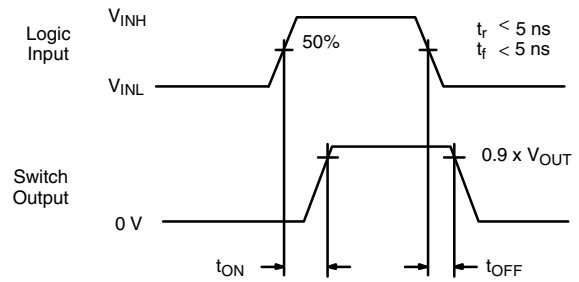
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Leakage Current vs. Temperature

Switching Time vs. Temperature

Leakage vs. Analog Voltage

Insertion Loss, Off-Isolation Crosstalk vs. Frequency

Switching Threshold vs. Supply Voltage

TEST CIRCUITS



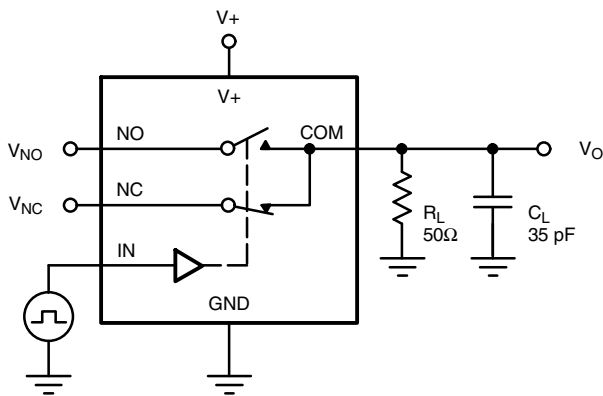
C_L (includes fixture and stray capacitance)

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



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)

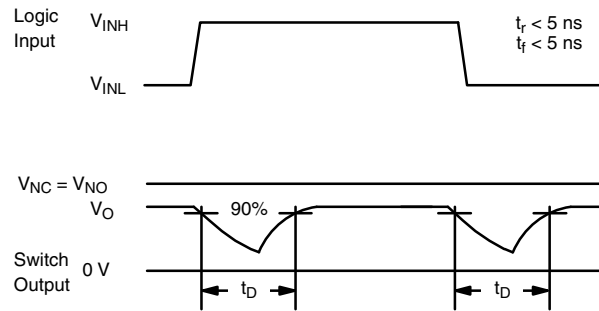
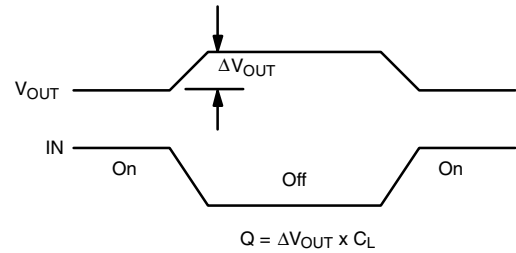
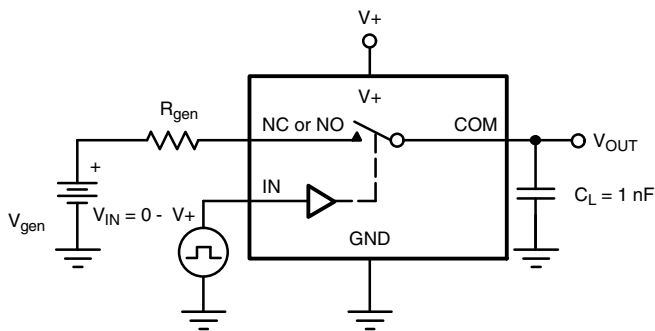
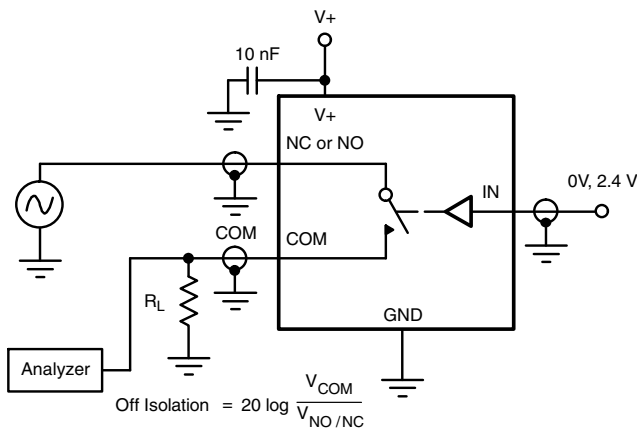
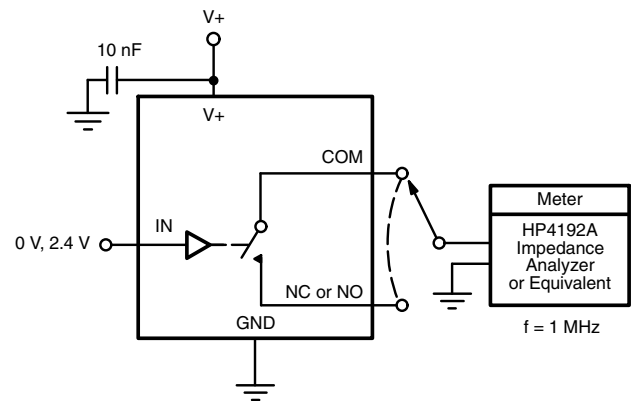


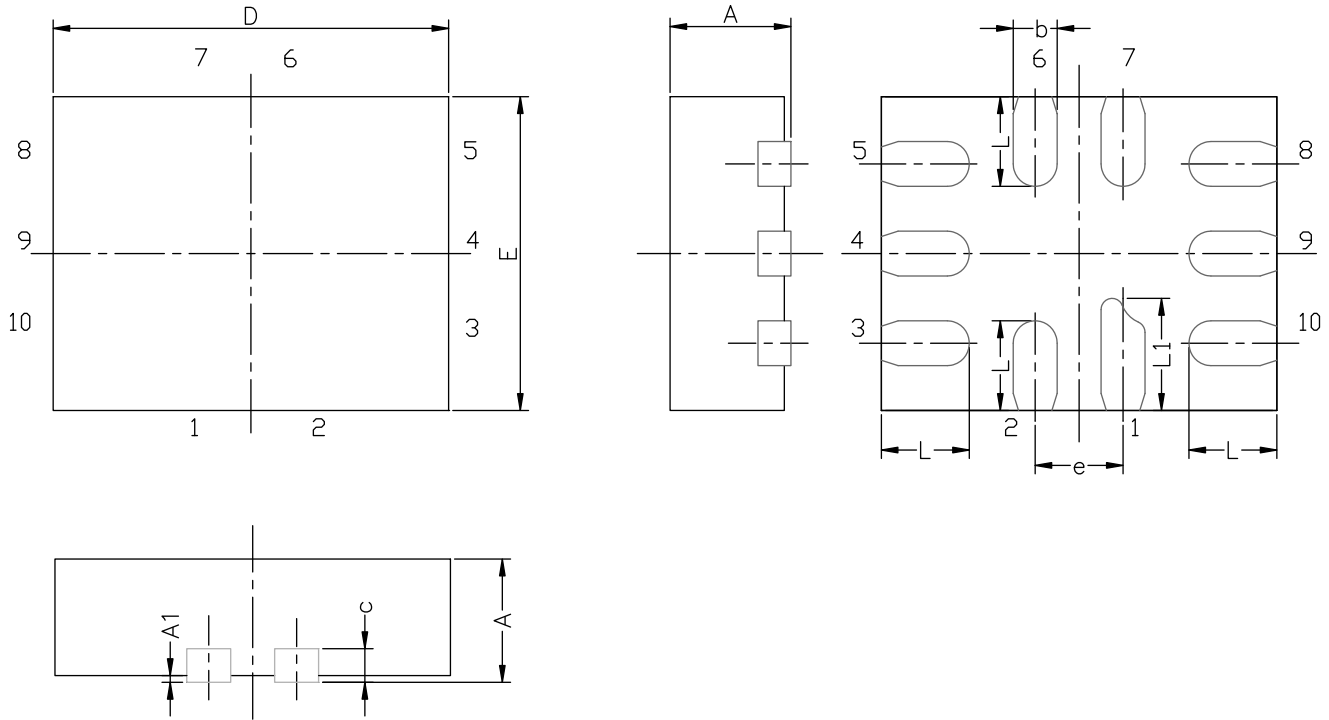
Figure 2. Break-Before-Make Interval

TEST CIRCUITS


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

Figure 3. Charge Injection

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?74420.

MINI QFN-10L CASE OUTLINE


| DIM | MILLIMETERS | | | INCHES | | |
|-----|-----------------------------------|------|------|-----------------------------------|--------|--------|
| | MIN. | NAM. | MAX. | MIN. | NAM. | MAX. |
| A | 0.45 | 0.55 | 0.60 | 0.0177 | 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 | 0.150 or 0.127 REF ⁽¹⁾ | | | 0.006 or 0.005 REF ⁽¹⁾ | | |
| D | 1.70 | 1.80 | 1.90 | 0.067 | 0.071 | 0.075 |
| E | 1.30 | 1.40 | 1.50 | 0.051 | 0.055 | 0.059 |
| 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 |

Note

⁽¹⁾ The dimension depends on the leadframe that assembly house used.

ECN T16-0163-Rev. B, 16-May-16
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.