

High Voltage Single SPDT Analog Switch in SOT23-8

DESCRIPTION

The DG449 is a dual supply single-pole/double-throw (SPDT) switches. On resistance is $38\ \Omega$ and flatness is $2.6\ \Omega$ max over the specified analog signal range. These analog switches were designed to provide high speed, low error switching of precision analog signals. The primary application areas are in the routing and switching in telecommunications and test equipment. Combining low power, low leakages, low on-resistance and small physical size, the DG449 is also ideally suited for portable and battery powered industrial and military equipment.

The DG449 operates either from a single $+7\ \text{V}$ to $36\ \text{V}$ supply or from dual $\pm 4.5\ \text{V}$ to $\pm 20\ \text{V}$ supplies. It is offered in the very popular, small SOT23-8 package.

FEATURES

- $\pm 15\ \text{V}$ analog signal range
- On-resistance - $R_{DS(on)}$: $38\ \Omega$ max.
- V_L logic supply not required
- TTL CMOS input compatible
- Rail to rail signal handling
- Dual or single supply operation


RoHS
COMPLIANT

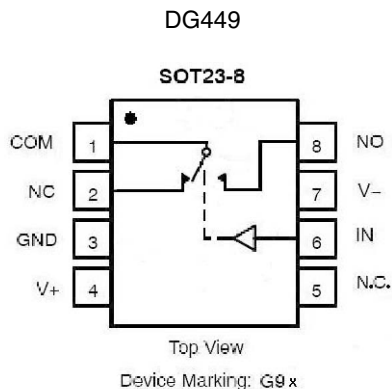
BENEFITS

- Wide dynamic range
- Low signal errors and distortion
- Break-before-make switching action
- Simple interfacing
- Small SOT23-8 package; reduced board space
- Improved reliability

APPLICATIONS

- Precision test equipment
- Precision instrumentation
- Communications systems
- PBX, PABX systems
- Audio equipment
- Redundant systems
- PC multimedia boards
- Hard disc drives

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE

| Logic | NC | NO |
|-------|-----|-----|
| 0 | ON | OFF |
| 1 | OFF | ON |

Logic "0" $\leq 0.8\ \text{V}$
Logic "1" $\geq 2.4\ \text{V}$



| ORDERING INFORMATION | | |
|----------------------|-------------|---------------|
| Temp. Range | Package | Part Number |
| - 40 to 85 °C | 8-Pin SOT23 | DG449DS-T1-E3 |

| ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted) | | | |
|---|---------------------------|--|------|
| Parameter (Voltages Referenced to V-) | Symbol | Limit | Unit |
| V+ | | 44 | V |
| GND | | 25 | |
| Digital Inputs ^a , V _{no/nc} , V _{COM} | | (V-) - 2 V to (V+) + 2 V or 30 mA, whichever occurs first | |
| Current , (Any Terminal) Continuous | | 30 | mA |
| Current (NO, NC or COM) Pulsed at 1 ms, 10 % duty cycle | | 100 | |
| Storage Temperature | | - 65 to 150 | °C |
| Power Dissipation (Package) ^b | 8-Pin SOT-23 ^c | 675 | mW |

Notes:

- a. Signals on NO, NC, COM, or IN exceeding V+ or 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 8.4 mW/°C above 70 °C.



| SPECIFICATIONS ^a | | | | | | | |
|--|-----------------------------|--|--------------------|------------------------------|-------------------|-------------------|------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified V ₊ = 15 V, V ₋ = - 15 V V _{IN} = 2.4 V, 0.8 V ^f | Temp. ^b | D Suffix - 40 °C to 85 °C | | | Unit |
| | | | | Min. ^d | Typ. ^c | Max. ^d | |
| Analog Switch | | | | | | | |
| Analog Signal Range ^e | V _{ANALOG} | | Full | - 15 | | 15 | V |
| On-Resistance | R _{ON} | I _{no/nc} = 1 mA, V _{COM} = ± 8.5 V V ₊ = 13.5 V, V ₋ = - 13.5 V | Room | | 38 | 45 | Ω |
| On Resistance MATCH | ΔR _{ON} | | Full | | | 5 | |
| On-Resistance Flatness | R _{ON} Flatness | I _{no/nc} = 1 mA, V _{COM} = ± 5 V, 0 V V ₊ = 13.5 V, V ₋ = - 13.5 V | Room | | 2.6 | 7 | Ω |
| | | | Full | | | 8 | |
| Switch Off Leakage Current | I _{no/nc(off)} | V ₊ = 16.5, V ₋ = - 16.5 V V _{COM} = ± 15.5 V V _{no/nc} = -/+ 15.5 V | Room | - 1 | - 0.1 | 1 | nA |
| | I _{COM(off)} | | Full | - 10 | | 10 | |
| Channel On Leakage Current | I _{COM(on)} | V ₊ = 16.5 V, V ₋ = - 16.5 V V _{COM} = V _{no/nc} = ± 15.5 V | Room | - 2 | - 0.1 | 2 | nA |
| | | | Full | - 20 | | 20 | |
| Digital Control | | | | | | | |
| Input, High Voltage | I _{INH} | | Full | 2.4 | | | V |
| Input, Low Voltage | I _{INL} | | Full | | | 0.8 | |
| Input Capacitance ^e | C _{IN} | | Room | | 4 | | pF |
| Input Current V _{IN} High or Low | I _{IN} | V _{IN} = 0 or 5 V | | - 1 | | 1 | μA |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t _{ON} | R _L = 300 Ω, C _L = 35 pF V _{no/nc} = ± 10 V | Room | | 107 | 146 | ns |
| Turn-Off Time | t _{OFF} | | Full | | | 155 | |
| Charge Injection ^e | Q | C _L = 1 nF, V _{gen} = 0 V, R _{gen} = 0 Ω | Room | | 5 | | pC |
| Off-Isolation ^e | OIRR | R _L = 50 Ω, C _L = 5 pF, f = 1 MHz | Room | | - 69 | | dB |
| Crosstalk ^e | X _{TALK} | R _L = 50 Ω, C _L = 5 pF, f = 1 MHz | | | - 80 | | |
| Source NO, NC Off Capacitance ^e | C _{no/nc(off)} | f = 1 MHz | Room | | 8 | | pF |
| Channel On Capacitance ^e | C _{COM(on)} | f = 1 MHz | Room | | 18 | | |
| Power Supplies | | | | | | | |
| Positive Supply Current | I ₊ | V ₊ = 16.5 V, V ₋ = - 16.5 V V _{IN} = 0, 5 V or, V ₊ | Room | | 4 | 20 | μA |
| Negative Supply Current | I ₋ | | Full | - 1 | | 30 | |
| | | | Full | - 3 | | | |

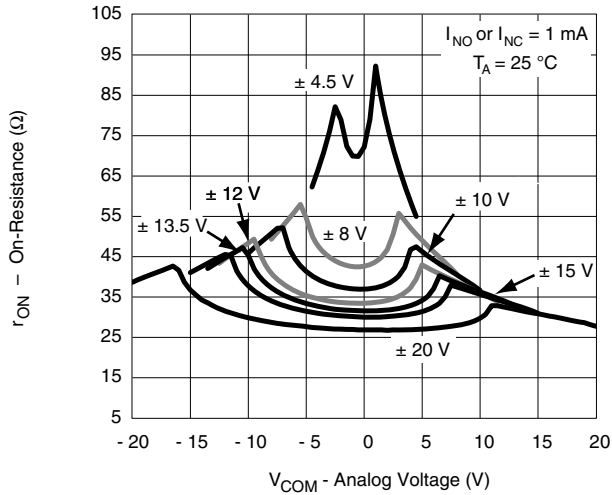
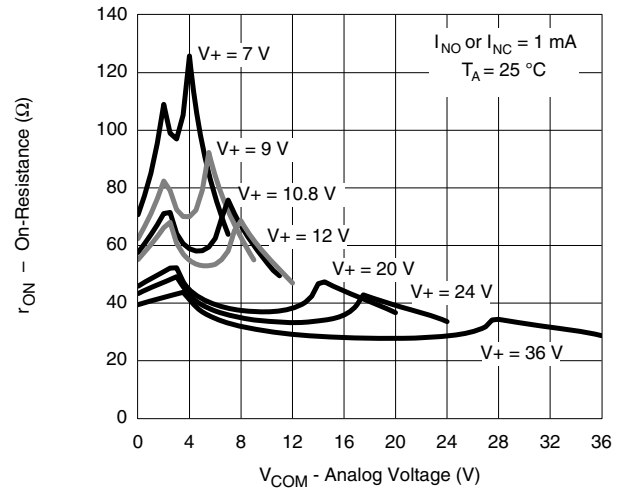
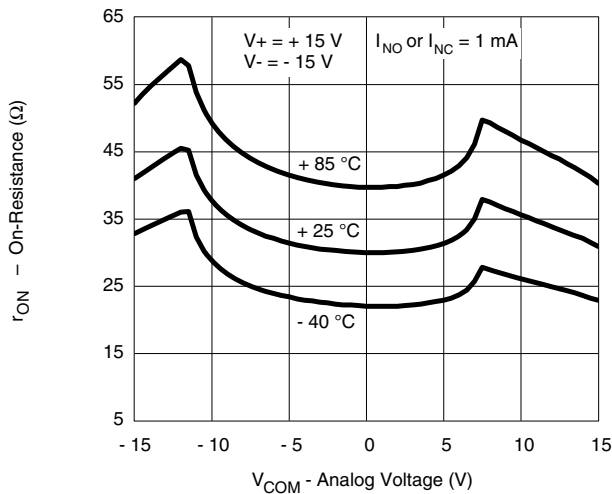
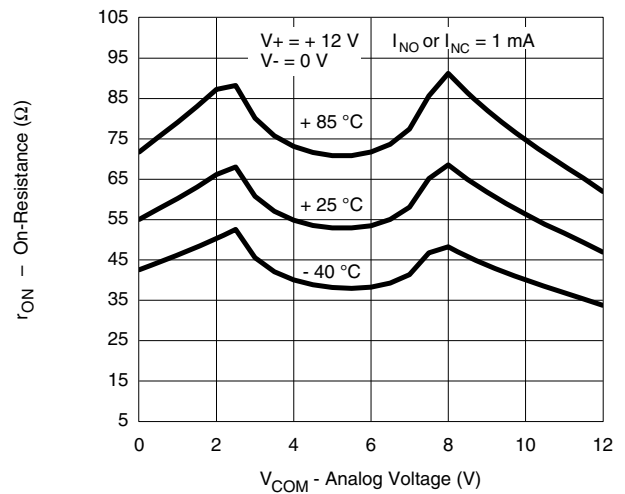
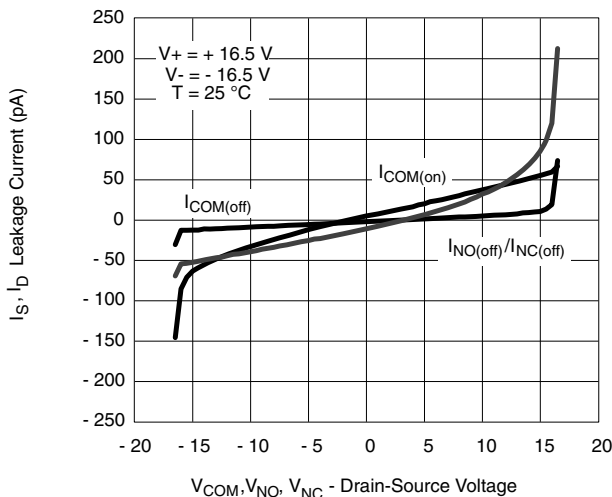
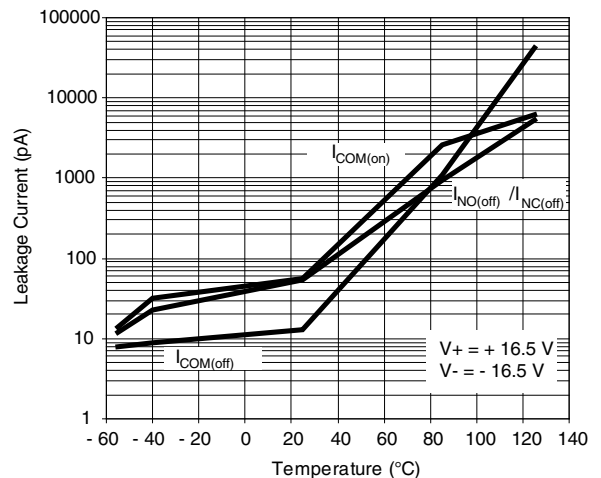


| SPECIFICATIONS ^a | | | | | | | |
|----------------------------------|-----------------------------|---|--------------------|------------------------------|-------------------|-------------------|------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified V ₊ = 12 V, V ₋ = 0 V V _{IN} = 2.4 V, 0.8 V ^f | Temp. ^b | D Suffix - 40 °C to 85 °C | | | Unit |
| | | | | Min. ^d | Typ. ^c | Max. ^d | |
| Analog Switch | | | | | | | |
| Analog Signal Range ^e | V _{ANALOG} | | Full | 0 | | 12 | V |
| On-Resistance | R _{ON} | I _{no/nc} = 1 mA, V _{COM} = 3, 8 V V ₊ = 10.8 V | Room | | 67 | 85 | Ω |
| On-Resistance MATCH | ΔR _{ON} | | Full | | | 4 | |
| On-Resistance Flatness | R _{ON} Flatness | I _{no/nc} = 1 mA, V _{COM} = 2, 6, 10 V V ₊ = 10.8 V | Room | | 17 | 25 | |
| | | | Full | | | 31 | |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t _{ON} | V _{NO, NC} = 10 V, R _L = 300 Ω, C _L = 35 pF | Room | | 133 | 168 | nS |
| Turn-Off Time | t _{OFF} | | Full | | 58 | 92 | |
| Charge Injection ^e | Q | C _L = 1 nF, V _{gen} = 0 V, R _{gen} = 0 Ω | Room | | 6 | | pC |
| Power Supplies | | | | | | | |
| Positive Supply Current | I ₊ | V ₊ = 13.2 V, V _{IN} = 0 V, 5 V or V ₊ | Room | | 3 | 20 | μA |
| | | | Full | | | 30 | |

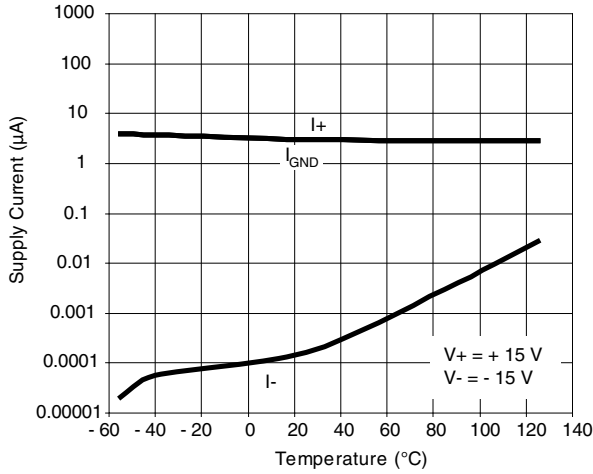
Notes:

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

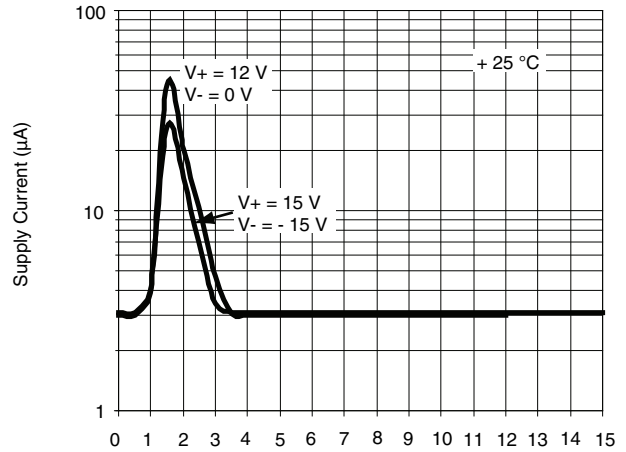
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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

 r_{ON} vs. V_{COM} and Dual Supply Voltage

On Resistance vs. V_{COM} and Single Supply Voltage

On Resistance vs. V_{COM} and Temperature

On Resistance vs. V_{COM} and Temperature

Leakage Current vs. Analog Voltage

Leakage Current vs. Temperature

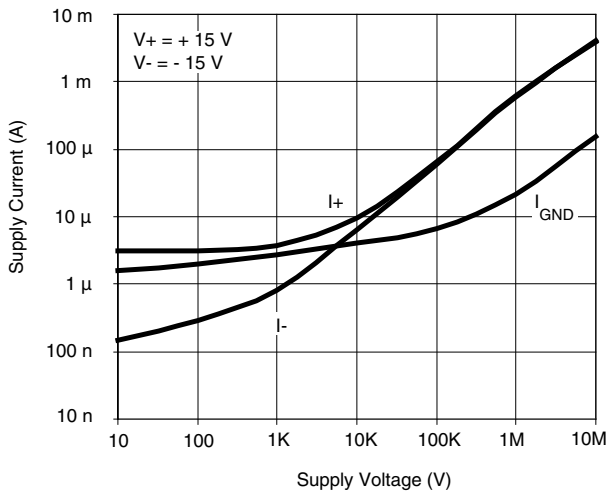
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



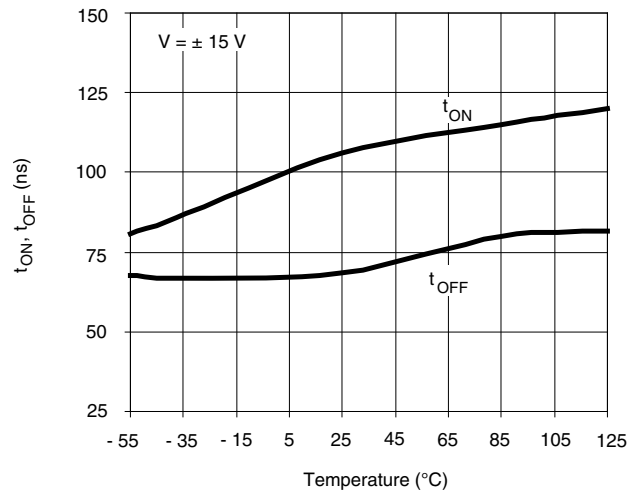
Supply Current vs. Temperature



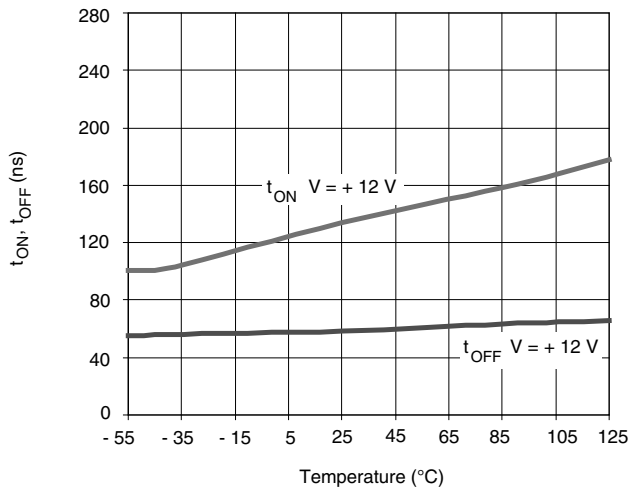
Supply Current vs. Input Voltage



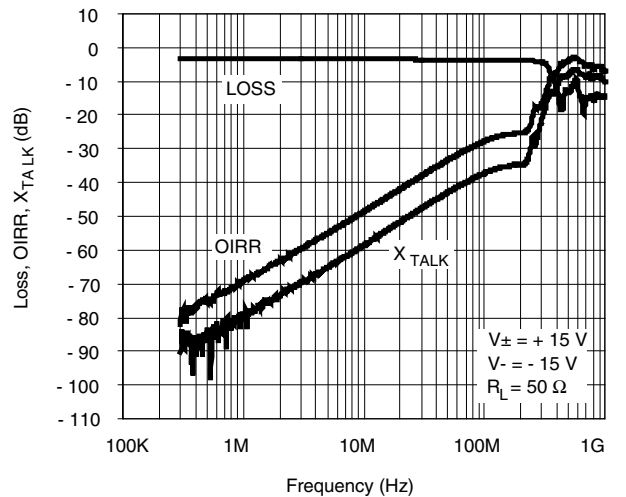
Supply Current vs. Input Switching Frequency



Switching Time vs. Temperature and Single Supply Voltage

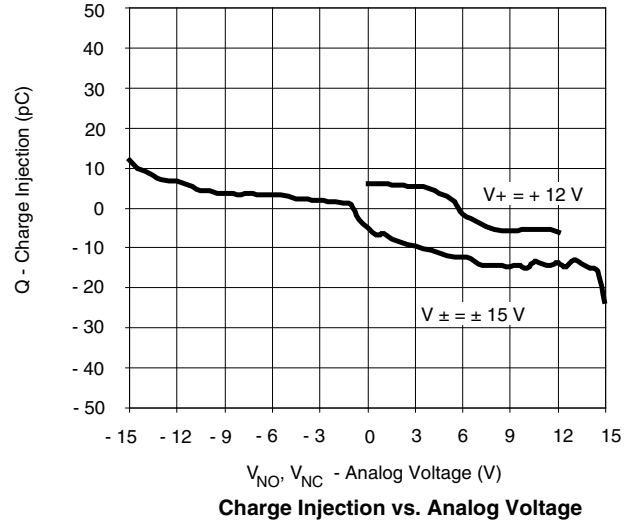
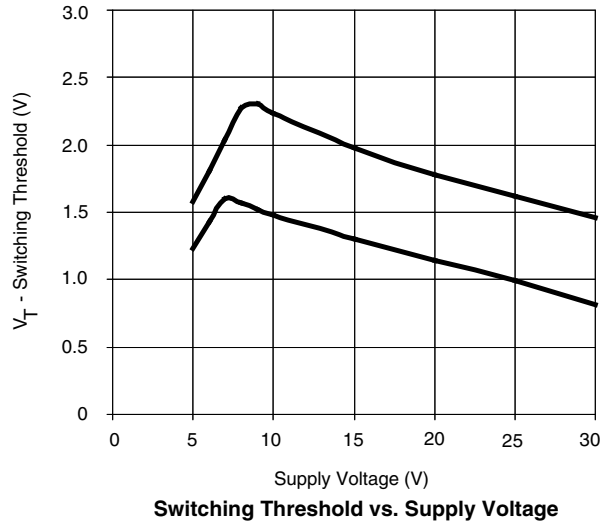


Switching Time vs. Temperature and Single Supply Voltage



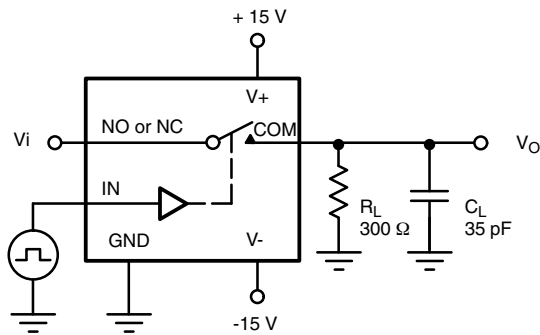
Insertion Loss, Off-Isolation, Crosstalk vs. Frequency

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



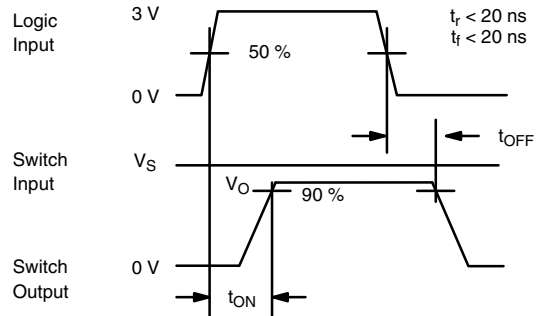
TEST CIRCUITS

V_O is the steady state output with the switch on.



C_L (includes fixture and stray capacitance)

$$V_O = V_i \frac{R_L}{R_L + r_{ON}}$$



Note: Logic input waveform is inverted for switches that have the opposite logic sense.

Figure 1. Switching Time

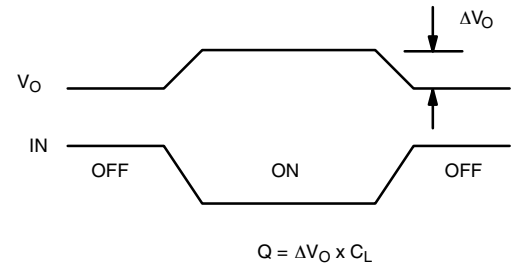
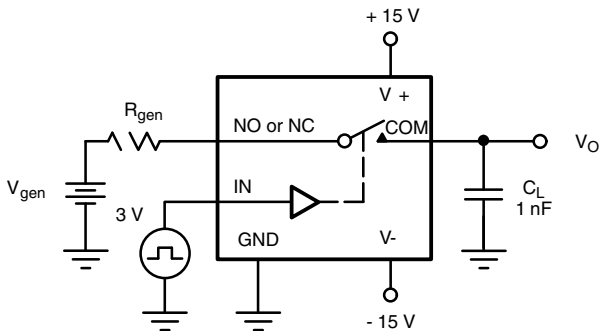


Figure 2. Charge Injection

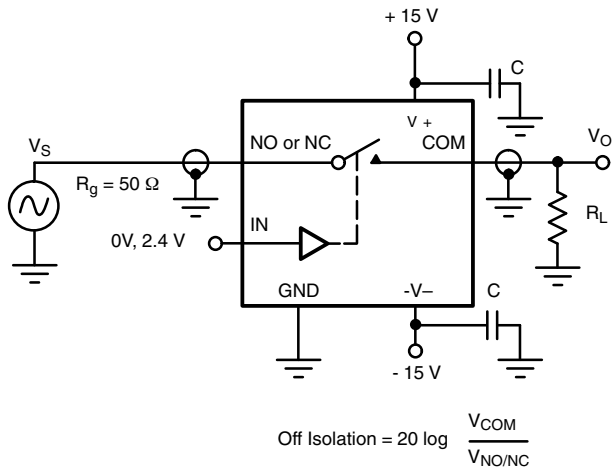


Figure 3. Off Isolation

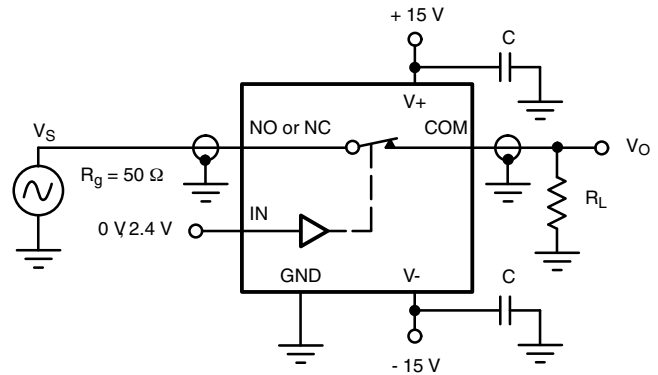


Figure 4. Insertion Loss

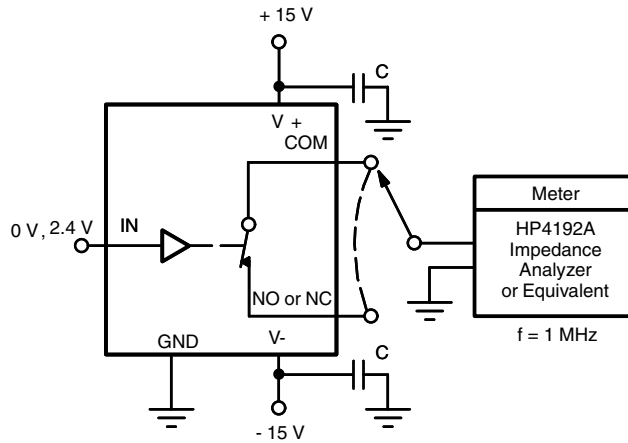
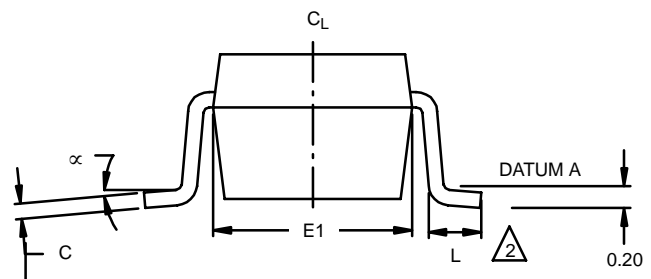
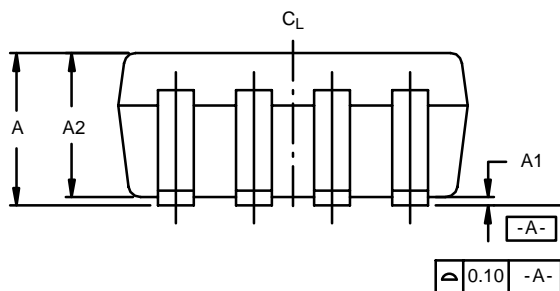
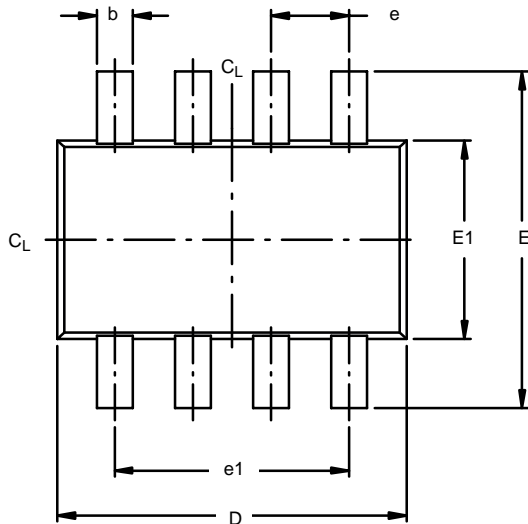


Figure 5. Channel ON/OFF Capacitances

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SOT-23 : 8-LEAD



NOTES:

1. All dimensions are in millimeters.
2. Foot length measured at intercept point between Datum A and lead surface.
3. Package outline exclusive of mold flash and metal burr.
4. Package outline inclusive of solder plating.
5. No molding flash allowed on the top and bottom lead surface.

| Dim | MILLIMETERS | | | INCHES | | |
|-----------|-------------|--------|-------|-----------|-------|-------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.90 | 1.27 | 1.45 | 0.035 | 0.05 | 0.057 |
| A1 | 0.00 | 0.0762 | 0.15 | 0.000 | 0.003 | 0.006 |
| A2 | 0.90 | 1.20 | 1.30 | 0.035 | 0.047 | 0.051 |
| b | 0.22 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 |
| C | 0.09 | 0.152 | 0.20 | 0.004 | 0.006 | 0.008 |
| D | 2.80 | 2.9 | 3.00 | 0.11 | 0.114 | 0.118 |
| E | 2.60 | 2.8 | 23.00 | 0.102 | 0.11 | 0.118 |
| E1 | 1.50 | 1.65 | 1.75 | 0.059 | 0.065 | 0.069 |
| e | 0.65 REF | | | 0.026 REF | | |
| e1 | 1.95 REF | | | 0.077 REF | | |
| L | 0.35 | 0.45 | 0.55 | 0.014 | 0.018 | 0.022 |
| α | 0° | 4° | 8° | 0° | 4° | 8° |

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