

## High-Speed, Low $R_{ON}$ , SPDT Analog Switch (2:1 Multiplexer/Demultiplexer Bus Switch)

**DESCRIPTION**

The DG3157 is a high-speed single-pole double-throw, low power, TTL-Compatible bus switch. Using sub-micro CMOS technology, the DG3157 achieves low on-resistance and negligible propagation delay.

The DG3157 can handle both analog and digital signals and permits signals with amplitudes of up to  $V_{CC}$  to be transmitted in either direction.

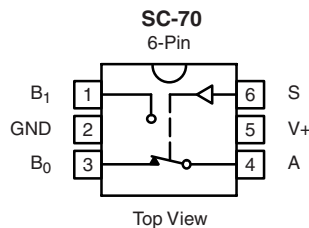
When the Select pin is low,  $B_0$  is connected to the output A pin. When the Select pin is high,  $B_1$  is connected to the output A pin. The path that is open will have a high-impedance state with respect to the output. Make-before-break is guaranteed. An epitaxial layer prevents latch-up.

**FEATURES**

- Halogen-free According to IEC 61249-2-21
- Direct cross to industry standard *SN74LVC1G3157*, *NC7SB3157*, *NLASB3175*, *PI5A3157*, and *STG3157*
- SC-70 6-lead package
- 1.65 V to 5.5 V  $V_{CC}$  operation
- 5  $\Omega$  connection between ports
- Minimal propagation delay
- Break-before-make switching
- Zero bounce in flow-through mode



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

**FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION**


Device Marking: G1

| TRUTH TABLE     |                      |
|-----------------|----------------------|
| Logic Input (S) | Function             |
| 0               | $B_0$ Connected to A |
| 1               | $B_1$ Connected to A |

| ORDERING INFORMATION |         |   |
|----------------------|---------|---|
| Temp. Range          | Package | Part Number   |
| - 40 °C to 85 °C     | SC-70-6 | DG3157DL-T1-E3<br>DG3157DL-T1-GE3<br>(Halogen-free) |



| ABSOLUTE MAXIMUM RATINGS                       |                          |      |
|--|--------------------------|------|
| Parameter                                      | Limit                    | Unit |
| Reference V+ to GND                            | - 0.3 to + 6             | V    |
| S, A, B <sup>a</sup>                           | - 0.3 to (V+ + 0.3)      |      |
| Continuous Current (Any terminal)              | ± 50                     | mA   |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) | ± 200                    |      |
| Storage Temperature                            | D Suffix                 | °C   |
| Power Dissipation (Packages) <sup>b</sup>      | 6-Pin SC-70 <sup>c</sup> | mW   |

Notes:

- a. Signals on A, or B or S 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 3.1 mW/°C above 70 °C.

| SPECIFICATIONS                                   |                      |   |  |                            |                   |                   |      |
|--|----------------------|---|--|----------------------------|-------------------|-------------------|------|
| Parameter  | Symbol               | Test Conditions<br>Unless Otherwise Specified<br>V+ = 3.0 V, V <sub>S</sub> = 0.25 V to 0.7 V+ <sup>e</sup> | Temp. <sup>a</sup>   | Limits<br>- 40 °C to 85 °C |                   |                   | Unit |
|  |                      |   |  | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| <b>DC Characteristics</b>                        |                      |   |  |                            |                   |                   |      |
| High Level Input Voltage                         | V <sub>SH</sub>      | V+ = 1.65 to 1.95 V   | Full   | 0.75 V+                    |                   |                   | V    |
|  |                      | V+ = 2.3 to 5.5 V   | Full   | 0.7 V+                     |                   |                   |      |
| Low Level Input Voltage                          | V <sub>SL</sub>      | V+ = 1.65 to 1.95 V   | Full   |                            |                   | 0.25 V+           | V    |
|  |                      | V+ = 2.3 to 5.5 V   | Full   |                            |                   | 0.3 V+            |      |
| On Resistance                                    | R <sub>ON</sub>      | V+ = 4.5 V  | V <sub>BN</sub> = 0 V, I <sub>A</sub> = 30 mA                  | Full                       | 6                 | 7                 | Ω    |
|  |                      |   | V <sub>BN</sub> = 2.3 V, I <sub>A</sub> = - 30 mA              | Full                       | 6                 | 12                |      |
|  |                      |   | V <sub>BN</sub> = 4.5 V, I <sub>A</sub> = - 30 mA              | Full                       | 9                 | 15                |      |
|  |                      | V+ = 3.0 V  | V <sub>BN</sub> = 0 V, I <sub>A</sub> = 24 mA                  | Full                       | 8                 | 9                 |      |
|  |                      |   | V <sub>BN</sub> = 3.0 V, I <sub>A</sub> = - 24 mA              | Full                       | 12                | 20                |      |
|  |                      | V+ = 2.3 V  | V <sub>BN</sub> = 0 V, I <sub>A</sub> = 8 mA                   | Full                       | 9                 | 12                |      |
|  |                      |   | V <sub>BN</sub> = 2.3 V, I <sub>A</sub> = - 8 mA               | Full                       | 13                | 30                |      |
|  |                      | V+ = 1.65 V   | V <sub>BN</sub> = 0 V, I <sub>A</sub> = 4 mA                   | Full                       | 12                | 20                |      |
| V <sub>BN</sub> = 1.8 V, I <sub>A</sub> = - 4 mA | Full                 |   | 18   | 50                         |                   |                   |      |
| On Resistance Flatness                           | R <sub>FLAT</sub>    | 0 < V <sub>BN</sub> < V+  | V+ = 4.5 V, I <sub>A</sub> = - 30 mA                           | Room                       | 6                 |                   | Ω    |
|  |                      |   | V+ = 3.0 V, I <sub>A</sub> = - 24 mA                           | Room                       | 12                |                   |      |
|  |                      |   | V+ = 2.3 V, I <sub>A</sub> = - 8 mA                            | Room                       | 22                |                   |      |
|  |                      |   | V+ = 1.65 V, I <sub>A</sub> = - 4 mA                           | Room                       | 90                |                   |      |
| On Resistance Matching Between Channels          | ΔR <sub>ON</sub>     |   | V+ = 4.5 V, V <sub>BN</sub> = 3.15 V, I <sub>A</sub> = - 30 mA | Room                       | 0.32              |                   | Ω    |
|  |                      |   | V+ = 3.0 V, V <sub>BN</sub> = 2.1 V, I <sub>A</sub> = - 24 mA  | Room                       | 0.31              |                   |      |
|  |                      |   | V+ = 2.3 V, V <sub>BN</sub> = 1.6 V, I <sub>A</sub> = - 8 mA   | Room                       | 0.30              |                   |      |
|  |                      |   | V+ = 1.65 V, V <sub>BN</sub> = 1.15 V, I <sub>A</sub> = - 4 mA | Room                       | 0.29              |                   |      |
| Input Leakage Current                            | I <sub>S</sub>       | V+ = 5.5 V, V <sub>A</sub> = 5.5 V  | Room<br>Full   | - 0.1<br>- 1.0             |                   | 0.1<br>- 1.0      | μA   |
| Off Stage Switch Leakage                         | I <sub>BN(off)</sub> | V+ = 5.5 V, V <sub>A</sub> /V <sub>B</sub> = 0 V/5.5 V  | Room<br>Full   | - 0.1<br>- 1.0             |                   | 0.1<br>- 1.0      |      |
| On State Switch Leakage                          | I <sub>BN(on)</sub>  | V+ = 5.5 V, V <sub>A</sub> /V <sub>B</sub> = 0 V/5.5 V  | Room<br>Full   | - 0.1<br>- 1.0             |                   | 0.1<br>- 1.0      |      |



| SPECIFICATIONS                                     |                   |  |                                      |                    |                            |                   |                   |               |
|--|-------------------|--|--------------------------------------|--------------------|----------------------------|-------------------|-------------------|---------------|
| Parameter  | Symbol            | Test Conditions<br>Unless Otherwise Specified<br>$V_+ = 3.0\text{ V}$ , $V_S = 0.25\text{ V}$ to $0.7\text{ V}$ <sup>e</sup> |                                      | Temp. <sup>a</sup> | Limits<br>- 40 °C to 85 °C |                   |                   | Unit          |
|  |                   |  |                                      |                    | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |               |
| <b>Power Supply</b>                                |                   |  |                                      |                    |                            |                   |                   |               |
| Power Supply Range                                 | $V_+$             |  |                                      | Full               | 1.65                       |                   | 5.5               | V             |
| Quiescent Supply Current                           | $I_+$             | $V_+ = 5.5\text{ V}$ , $V_A = V_B = V_+$ or GND  |                                      | Room<br>Full       |                            |                   | 1<br>10           | $\mu\text{A}$ |
| <b>AC Electrical Characteristic</b>                |                   |  |                                      |                    |                            |                   |                   |               |
| Prop Delay Time <sup>f</sup>                       | $t_{PHL}/t_{PLH}$ | $V_A = 0\text{ V}$   | $V_+ = 1.65\text{ to }1.95\text{ V}$ | Full               |                            |                   |                   | ns            |
|  |                   |  | $V_+ = 2.3\text{ to }2.7\text{ V}$   | Full               |                            | 1.2               |                   |               |
|  |                   |  | $V_+ = 3.0\text{ to }3.6\text{ V}$   | Full               |                            | 0.8               |                   |               |
|  |                   |  | $V_+ = 4.5\text{ to }5.5\text{ V}$   | Full               |                            | 0.3               |                   |               |
| Output Enable Time <sup>f</sup>                    | $t_{PZL}/t_{PZH}$ | $V_{LOAD} = 2 \times V_+$ for $t_{PZL}$<br>$V_{LOAD} = 0\text{ V}$ for $t_{PZH}$   | $V_+ = 1.65\text{ to }1.95\text{ V}$ | Room<br>Full       |                            | 10.2<br>10.4      |                   | ns            |
|  |                   |  | $V_+ = 2.3\text{ to }2.7\text{ V}$   | Room<br>Full       |                            | 5.9<br>6.2        |                   |               |
|  |                   |  | $V_+ = 3.0\text{ to }3.6\text{ V}$   | Room<br>Full       |                            | 4.1<br>4.5        |                   |               |
|  |                   |  | $V_+ = 4.5\text{ to }5.5\text{ V}$   | Room<br>Full       |                            | 2.6<br>2.9        |                   |               |
| Output Disable Time <sup>f</sup>                   | $t_{PLZ}/t_{PHZ}$ | $V_{LOAD} = 2 \times V_+$ for $t_{PLZ}$<br>$V_{LOAD} = 0\text{ V}$ for $t_{PHZ}$   | $V_+ = 1.65\text{ to }1.95\text{ V}$ | Room<br>Full       |                            | 10.2<br>10.4      |                   | ns            |
|  |                   |  | $V_+ = 2.3\text{ to }2.7\text{ V}$   | Room<br>Full       |                            | 5.9<br>6.2        |                   |               |
|  |                   |  | $V_+ = 3.0\text{ to }3.6\text{ V}$   | Room<br>Full       |                            | 4.1<br>4.5        |                   |               |
|  |                   |  | $V_+ = 4.5\text{ to }5.5\text{ V}$   | Room<br>Full       |                            | 2.6<br>2.9        |                   |               |
| Break-Before-Make Time <sup>d</sup>                | $t_{BBM}$         | $V_+ = 1.65\text{ to }1.95\text{ V}$   | Full                                 | 0.5                |                            |                   |                   | ns            |
|  |                   | $V_+ = 2.3\text{ to }2.7\text{ V}$   | Full                                 | 0.5                |                            |                   |                   |               |
|  |                   | $V_+ = 3.0\text{ to }3.65\text{ V}$  | Full                                 | 0.5                |                            |                   |                   |               |
|  |                   | $V_+ = 4.5\text{ to }5.5\text{ V}$   | Full                                 | 0.5                |                            |                   |                   |               |
| Charge Injection <sup>d</sup>                      | Q                 | $C_L = 0.1\text{ nF}$ , $V_{GEN} = 0\text{ V}$<br>$R_{GEN} = 0\ \Omega$  | $V_+ = 5\text{ V}$                   | Room               |                            | 7                 |                   | $\mu\text{C}$ |
|  |                   |  | $V_+ = 3.3\text{ V}$                 | Room               |                            | 3                 |                   |               |
| <b>Analog Switch Characteristics</b>               |                   |  |                                      |                    |                            |                   |                   |               |
| Off Isolation <sup>d</sup>                         | OIRR              | $R_L = 50\ \Omega$ , $f = 10\text{ MHz}$   |                                      | Room               |                            | - 57.6            |                   | dB            |
| Crosstalk <sup>d</sup>                             | $X_{TALK}$        |  |                                      | Room               |                            | - 58.7            |                   |               |
| - 3 db Bandwidth <sup>d</sup>                      | BW                | $R_L = 50\ \Omega$   |                                      | Room               |                            | > 250             |                   | MHz           |
| <b>Capacitance</b>                                 |                   |  |                                      |                    |                            |                   |                   |               |
| Control Pin Capacitance <sup>d</sup>               | $C_{IN}$          | $V_+ = 0\text{ V}$   |                                      | Room               |                            | 4.9               |                   | $\mu\text{F}$ |
| B Port Off Capacitance <sup>d</sup>                | $C_{IO-B}$        | $V_+ = 5\text{ V}$   |                                      | Room               |                            | < 6.5             |                   |               |
| A Port Capacitance When Switch Enable <sup>d</sup> | $C_{IO-A(on)}$    |  |                                      | Room               |                            | < 18.5            |                   |               |

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, nor subjected to production test.
- e.  $V_{IN}$  = input voltage to perform proper function.
- f. Guaranteed by design and not production tested. The bus switch propagation delay is a function of the RC time constant contributed by the on-resistance and the specified load capacitance with an ideal voltage source (zero output impedance) driving the switch.

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.

**LOGIC DIAGRAM** Positive Logic

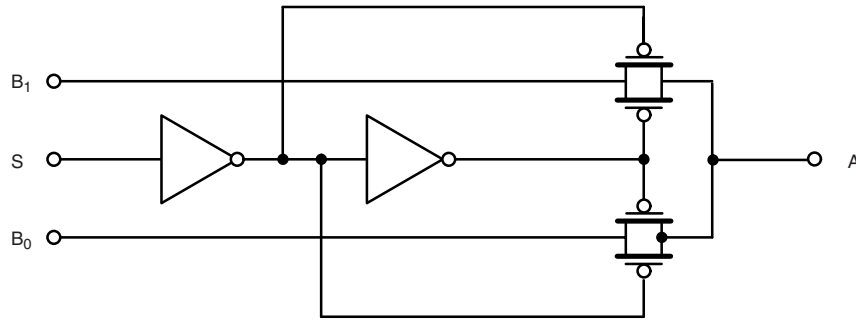
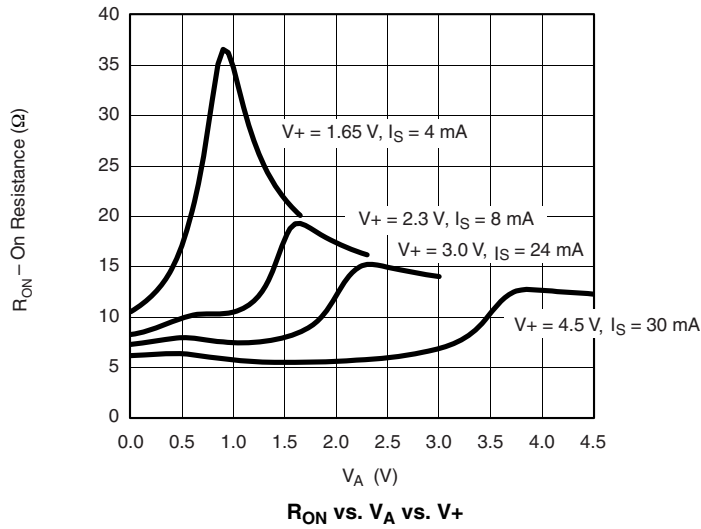
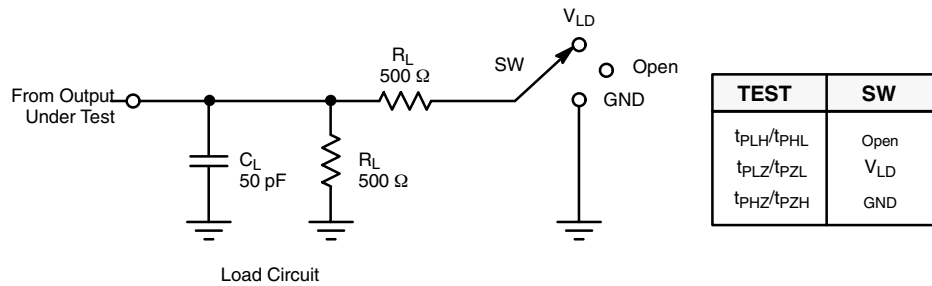


Figure 1.

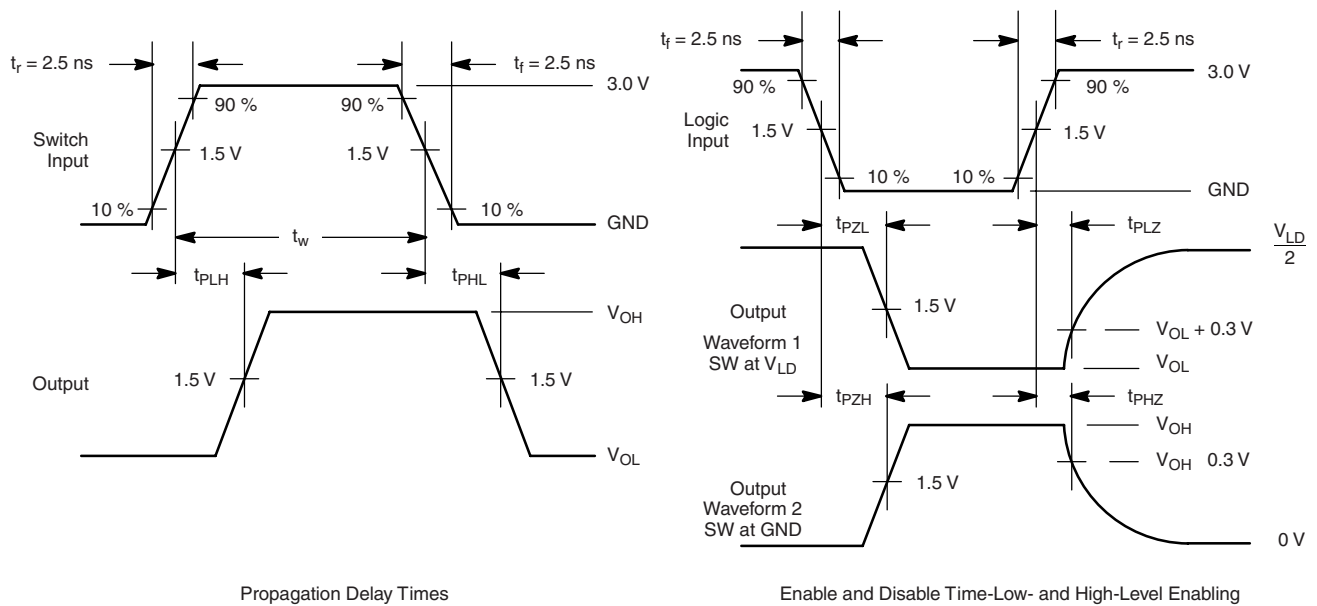
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**AC LOADING AND WAVEFORMS**



**Figure 2. AC Test Circuit**

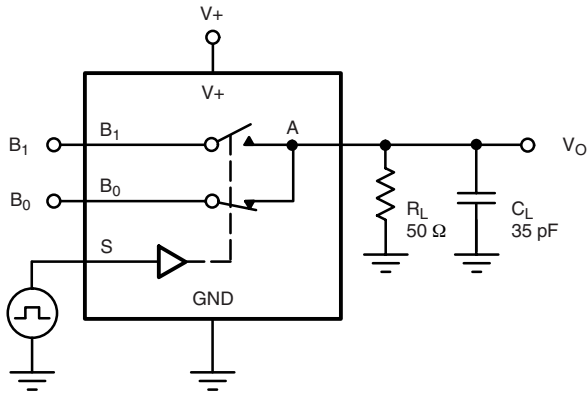


**Figure 3. AC Waveforms**

Notes:

- $C_L$  includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
- Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ .
- The outputs are measured one at a time with one transition per measurement.
- $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
- $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{dis}$ .
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{dis}$ .
- $V_{LD} = 2 \text{ V+}$ .

TEST CIRCUITS



$C_L$  (includes fixture and stray capacitance)

Figure 4. Break-Before-Make Interval

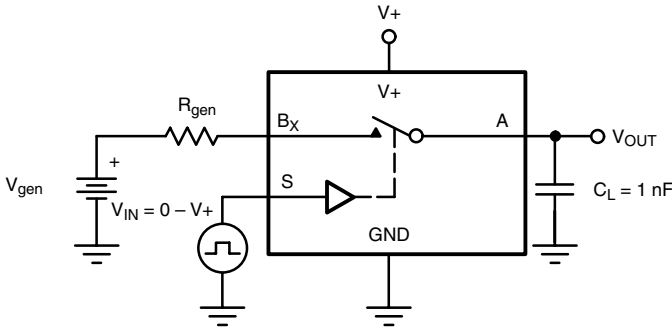
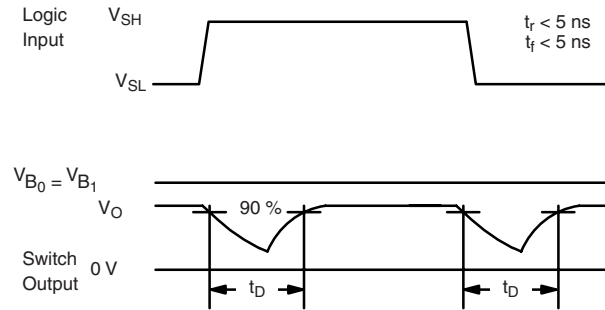
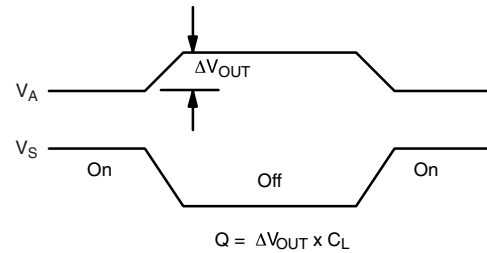


Figure 5. Charge Injection



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

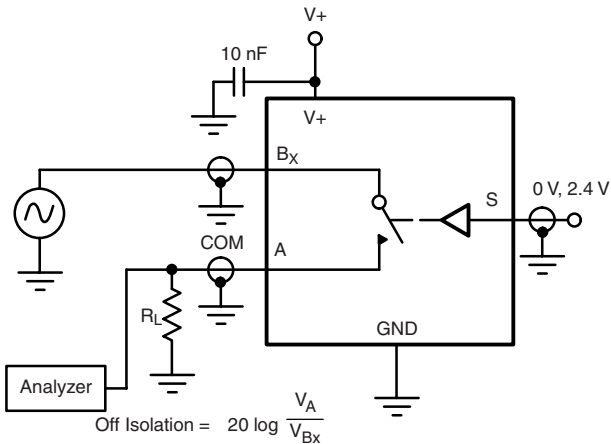


Figure 6. Off-Isolation

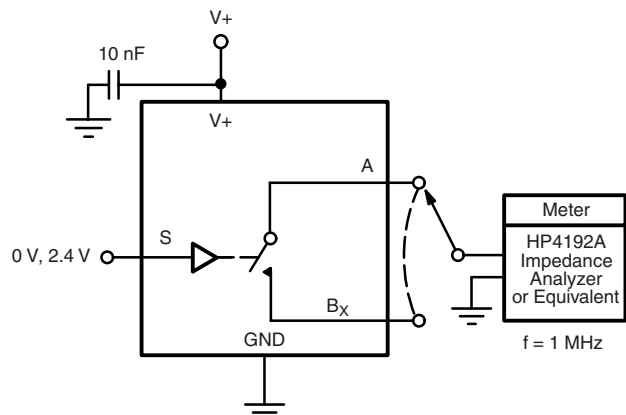


Figure 7. Channel Off/On Capacitance

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### SC-70: 6-LEADS



| Dim            | MILLIMETERS |      |      | INCHES   |       |       |
|----------------|-------------|------|------|----------|-------|-------|
|                | Min         | Nom  | Max  | Min      | Nom   | Max   |
| A              | 0.90        | –    | 1.10 | 0.035    | –     | 0.043 |
| A <sub>1</sub> | –           | –    | 0.10 | –        | –     | 0.004 |
| A <sub>2</sub> | 0.80        | –    | 1.00 | 0.031    | –     | 0.039 |
| b              | 0.15        | –    | 0.30 | 0.006    | –     | 0.012 |
| c              | 0.10        | –    | 0.25 | 0.004    | –     | 0.010 |
| D              | 1.80        | 2.00 | 2.20 | 0.071    | 0.079 | 0.087 |
| E              | 1.80        | 2.10 | 2.40 | 0.071    | 0.083 | 0.094 |
| E <sub>1</sub> | 1.15        | 1.25 | 1.35 | 0.045    | 0.049 | 0.053 |
| e              | 0.65BSC     |      |      | 0.026BSC |       |       |
| e <sub>1</sub> | 1.20        | 1.30 | 1.40 | 0.047    | 0.051 | 0.055 |
| L              | 0.10        | 0.20 | 0.30 | 0.004    | 0.008 | 0.012 |
| α              | 7°Nom       |      |      | 7°Nom    |       |       |

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DWG: 5550



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[TC4W53FU\(TE12L,F\)](#) [74HC2G66DC.125](#) [ADG619BRMZ-REEL](#) [ADG1611BRUZ-REEL7](#) [LTC201ACN#PBF](#) [74LV4066DB,118](#)  
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