

## High-Speed, Low $r_{ON}$ , SPDT Analog Switch (2:1 Multiplexer)

**DESCRIPTION**

The DG2307 is a single-pole-double-throw switch/2:1 mux designed for 2 to 5.5 V applications. Using Vishay Siliconix proprietary sub-micro CMOS process, the DG2307 achieves low on-resistance, low power consumption. It is 1.6 V TTL logic compatible across the operation voltage range. With its low  $r_{ON}$  and low parasitic capacitance character, it is ideal for clock signal and high speed data stream switching. It has low insertion loss and negligible propagation delay.

The DG2307 can handle both analog and digital signals and permits signals to be transmitted in either direction. When Bn pin is at off status, the path will have a high impedance with respect to the output. Break before make is guaranteed.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations. For analog switching products manufactured with 100 % matte tin device terminations, the lead (Pb)-free "-E3" suffix is being used as a designator.

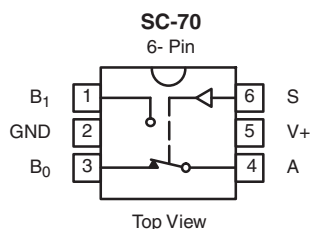
**FEATURES**

- Operates From Single 2 ~ 5.5 V
- SC70-6 Package
- $5\ \Omega$  Switch Connection Between Ports
- Minimal Propagation Delay
- TTL Compatible Input Level
- RoHS Compliant


**RoHS**  
COMPLIANT

**APPLICATIONS**

- Cellular Phones
- PDAs
- GPS
- MP3
- Data Acquisition

**FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION**


Device Marking: G1

**TRUTH TABLE**

| Logic Input (S) | Function                      |
|-----------------|-------------------------------|
| 0               | B <sub>0</sub> Connected to A |
| 1               | B <sub>1</sub> Connected to A |

**ORDERING INFORMATION**

| Temp Range    | Package | Part Number    |
|---------------|---------|----------------|
| - 40 to 85 °C | SC70-6  | DG2307DL-T1-E3 |



| 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 V) |      |
| Continuous Current (Any terminal)              |                         | ± 50                  | mA   |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) |                         | ± 200                 |      |
| Storage Temperature                            | (D Suffix)              | - 65 to 150           | °C   |
| Power Dissipation (Packages) <sup>b</sup>      | 6-Pin SC70 <sup>c</sup> | 250                   | 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.

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                             |                      |   |   |                   |                         |      |              |      |
|--|----------------------|---|---|-------------------|-------------------------|------|--------------|------|
| Parameter                                  | Symbol               | Test Conditions<br>Otherwise Unless 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 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+ = 2.3 to 5.5 V   |   | Full              | 0.7 V+                  |      |              | V    |
| Low Level Input Voltage                    | V <sub>SL</sub>      | 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              |                         | 4    | 6            | Ω    |
|  |                      |   | V <sub>BN</sub> = 2.3 V, I <sub>A</sub> = - 30 mA | Full              |                         | 9    | 12           |      |
|  |                      | V+ = 3.0 V  | V <sub>BN</sub> = 0 V, I <sub>A</sub> = - 24 mA   | Full              |                         | 6    | 9            |      |
|  |                      |   | V <sub>BN</sub> = 1.5 V, I <sub>A</sub> = - 24 mA | Full              |                         | 13.5 | 20           |      |
| On Resistance Matching<br>Between Channels | ΔR <sub>ON</sub>     | V+ = 4.5 V, V <sub>BN</sub> = 0 V, I <sub>A</sub> = - 30 mA   |   | Room              |                         | 0.32 |              |      |
|  |                      | V+ = 3.0 V, V <sub>BN</sub> = 0 V, I <sub>A</sub> = - 24 mA   |   | Room              |                         | 0.31 |              |      |
| 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 |      |
| <b>Power Supply</b>                        |                      |   |   |                   |                         |      |              |      |
| Power Supply Range                         | V+                   |   |   | Full              | 2                       |      | 5.5          |      |
| Quiescent Supply Current                   | I+                   | V+ = 5.5 V, V <sub>A</sub> = V <sub>B</sub> = V+ or GND   |   | Room<br>Full      |                         |      | 1<br>10      | μA   |



| SPECIFICATIONS                                     |                   |  |                                     |                         |                  |                  |      |
|--|-------------------|--|-------------------------------------|-------------------------|------------------|------------------|------|
| Parameter  | Symbol            | Test Conditions<br>Otherwise Unless 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 to 85 °C |                  |                  | Unit |
|  |                   |  |                                     | Min <sup>b</sup>        | Typ <sup>c</sup> | Max <sup>b</sup> |      |
| <b>AC Electrical Characteristics</b>               |                   |  |                                     |                         |                  |                  |      |
| Prop Delay Time <sup>f</sup>                       | $t_{PHL}/t_{PLH}$ | $V_A = 0\text{ V}$   | $V_+ = 2.3\text{ to }2.7\text{ V}$  | Full                    |                  | 1.2              | ns   |
|  |                   |  | $V_+ = 3.0\text{ to }3.6\text{ V}$  | 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 $t_{PZH}$   | $V_+ = 2.3\text{ to }2.7\text{ V}$  | Room Full               |                  | 5.9<br>6.2       | ns   |
|  |                   |  | $V_+ = 3.0\text{ to }3.6\text{ V}$  | Room Full               |                  | 4.1<br>4.5       |      |
|  |                   |  | $V_+ = 4.5\text{ to }5.5\text{ V}$  | Room 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 $t_{PHZ}$   | $V_+ = 2.3\text{ to }2.7\text{ V}$  | Room Full               |                  | 5.9<br>6.2       | ns   |
|  |                   |  | $V_+ = 3.0\text{ to }3.6\text{ V}$  | Room Full               |                  | 4.1<br>4.5       |      |
|  |                   |  | $V_+ = 4.5\text{ to }5.5\text{ V}$  | Room Full               |                  | 2.6<br>2.9       |      |
| Break-Before-Make Time <sup>d</sup>                | $t_{BBM}$         |  | $V_+ = 2.3\text{ to }2.7\text{ V}$  | Full                    | 0.5              |                  | ns   |
|  |                   |  | $V_+ = 3.0\text{ to }3.65\text{ V}$ | 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                | pC   |
|  |                   |  | $V_+ = 3.3\text{ V}$                | Room                    |                  | 3                |      |
| <b>Analog Switch Characteristics</b>               |                   |  |                                     |                         |                  |                  |      |
| Off Isolation <sup>d</sup>                         | OIRR              | $V_+ = 5\text{ V}$ , $R_L = 50\ \Omega$ , $f = 10\text{ MHz}$  | 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              |                  | pF   |
| 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.

**LOGIC DIAGRAM (POSITIVE LOGIC)**

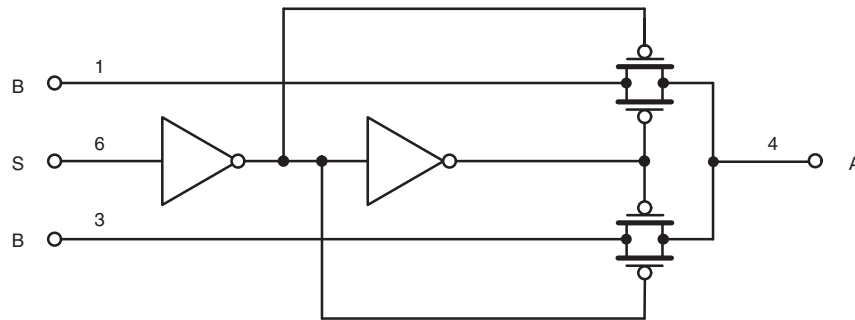
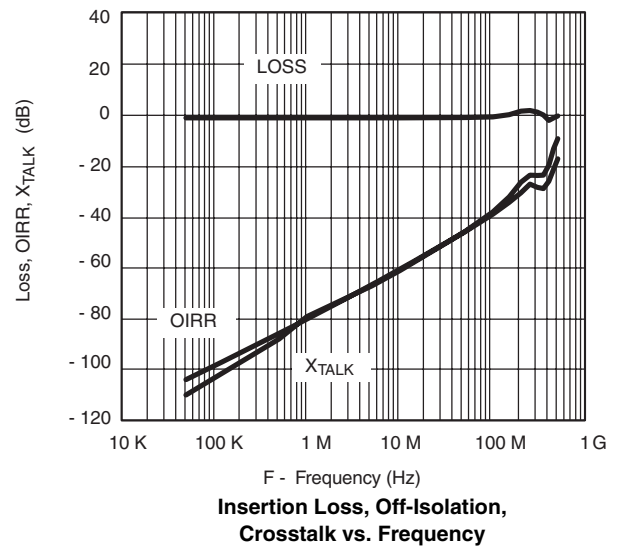
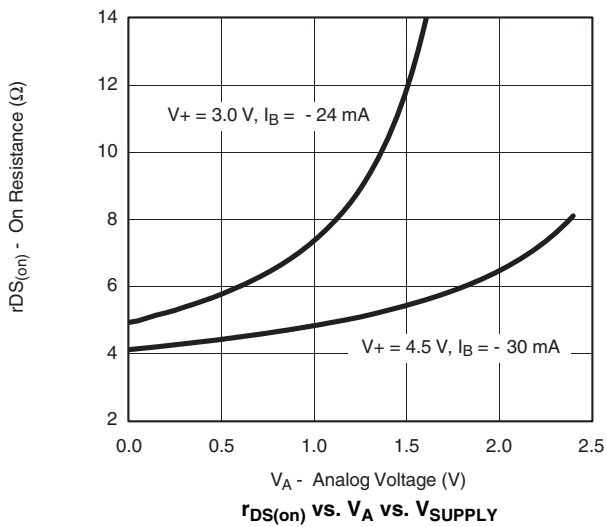


Figure 1.

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



**AC LOADING AND WAVEFORMS**

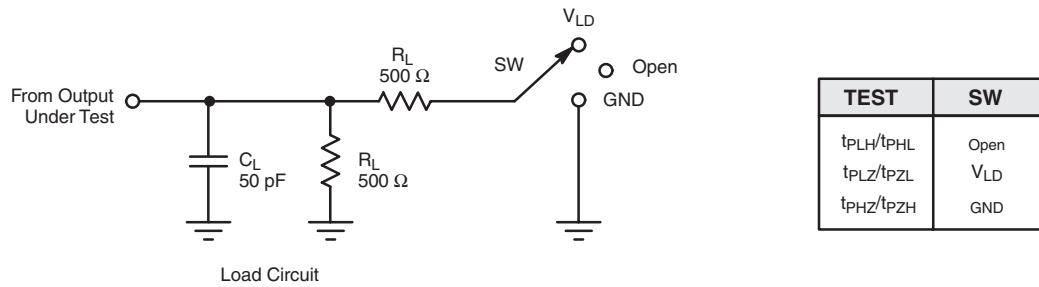


Figure 2. AC Test Circuit

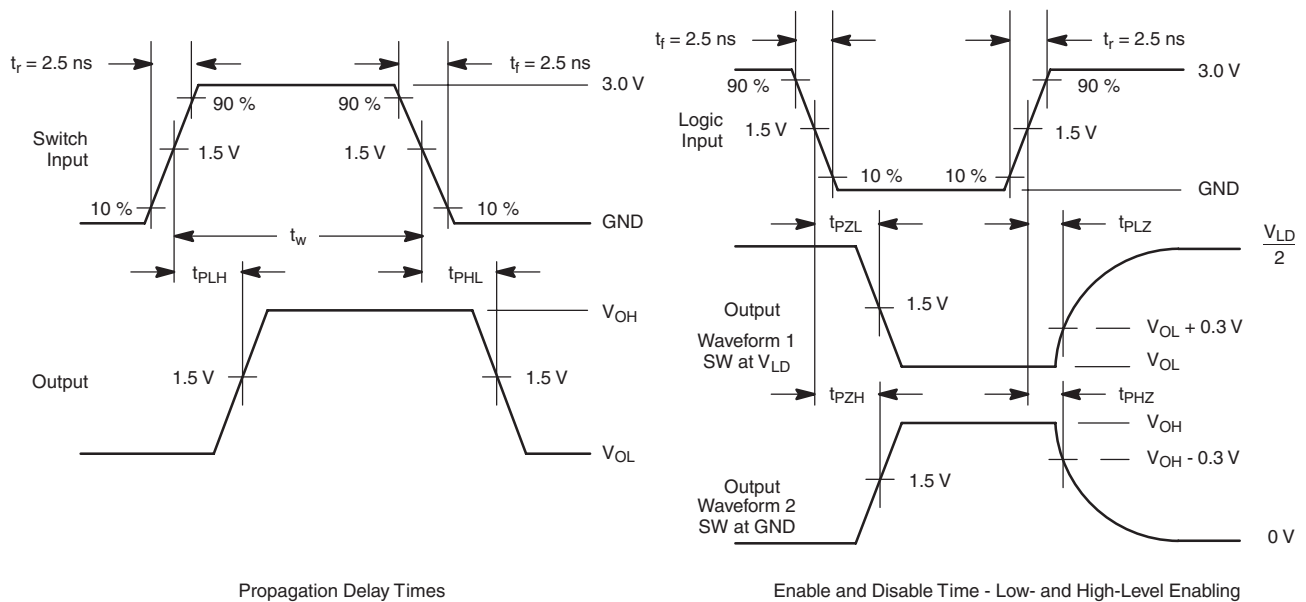
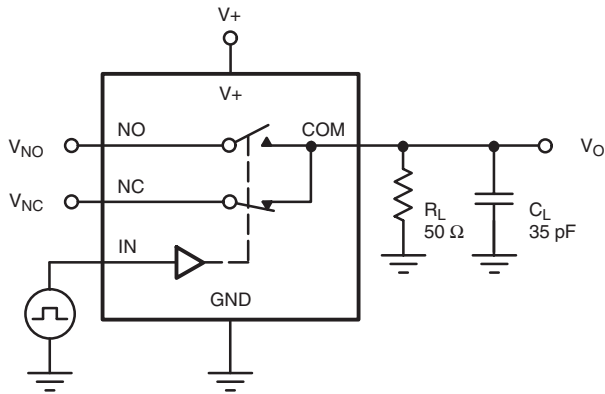


Figure 3. AC Waveforms

Notes:

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

TEST CIRCUITS



$C_L$  (includes fixture and stray capacitance)

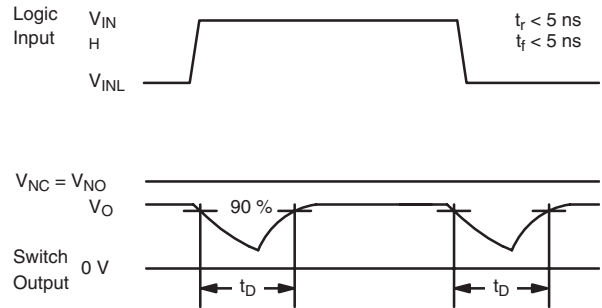
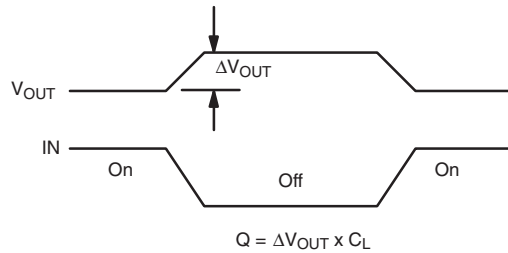
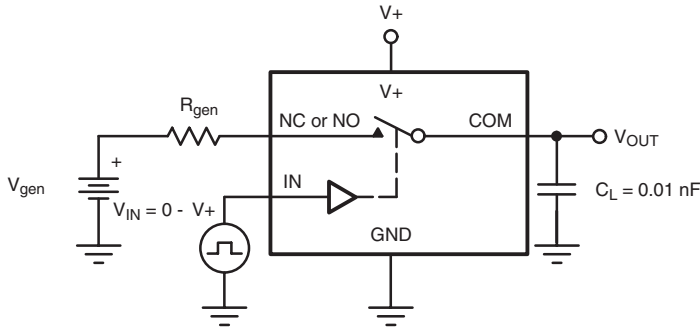


Figure 4. Break-Before-Make Interval



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

Figure 5. Charge Injection

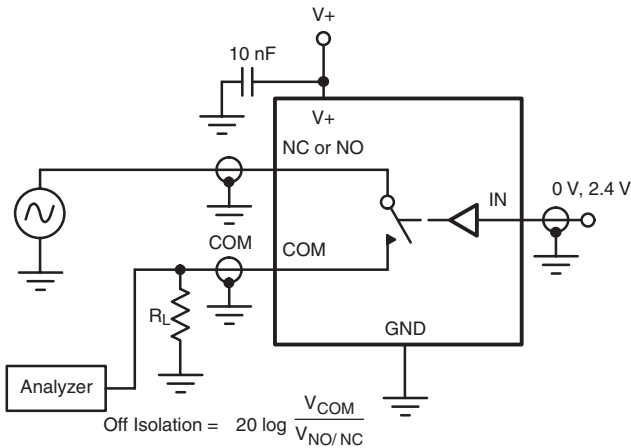


Figure 6. Off-Isolation

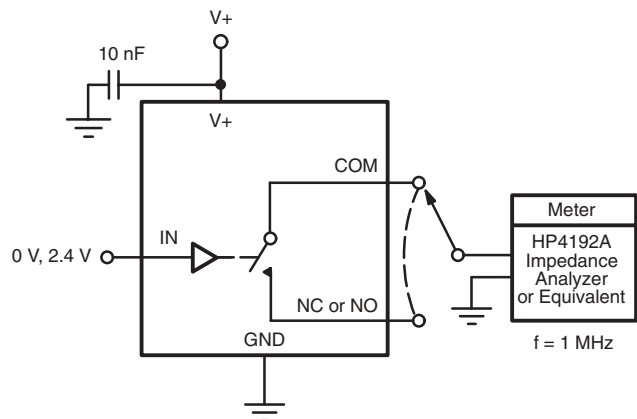


Figure 7. Channel Off/On Capacitance

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