

Quad Monolithic SPST CMOS Analog Switches

December 1993

Features

- Low Power Consumption
- CMOS Compatible
- $\pm 15V$ Analog Signal Range
- Single or Dual Supply Capability
- Alternate Source

Ordering Information

| PART NUMBER | TEMP. RANGE | PACKAGE |
|---------------|-----------------|---------------------|
| DG308AAK | -55°C to +125°C | 16 Lead Ceramic DIP |
| DG308ABK | -25°C to +85°C | 16 Lead Ceramic DIP |
| DG308ACK | 0°C to +70°C | 16 Lead Ceramic DIP |
| DG308ACJ | 0°C to +70°C | 16 Lead Plastic DIP |
| DG308ACY | 0°C to +70°C | 16 Lead SOIC (W) |
| DG308AAK/883B | -55°C to +125°C | 16 Lead Ceramic DIP |
| DG309AK | -55°C to +125°C | 16 Lead Ceramic DIP |
| DG309BK | -25°C to +85°C | 16 Lead Ceramic DIP |
| DG309CK | 0°C to +70°C | 16 Lead Ceramic DIP |
| DG309CJ | 0°C to +70°C | 16 Lead Plastic DIP |
| DG309CY | 0°C to +70°C | 16 Lead SOIC (W) |
| DG309AK/883B | -55°C to +125°C | 16 Lead Ceramic DIP |

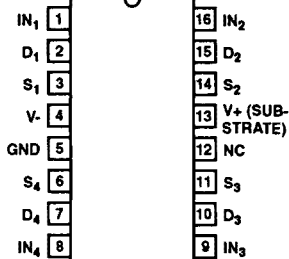
Description

The DG308A and DG309 quad monolithic SPST CMOS switches are latch proof and are designed to block signals up to 30V peak-to-peak when OFF. Featuring low ON resistance, low power consumption, and rail-to-rail analog signal range, these switches are ideally suited for high speed switching applications in communications, instrumentation and process control. The DG308A "normally-closed" and DG309 "normally-open" switches have single and dual supply capability. The input thresholds are CMOS compatible.

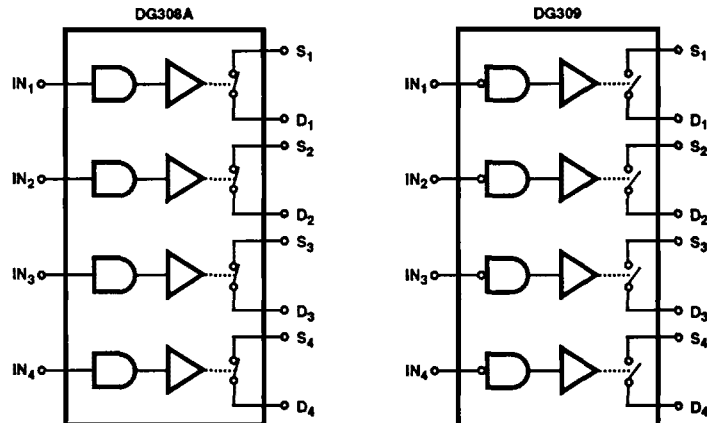
The DG308A and DG309 switches are available over commercial, industrial, and military temperature ranges.

Pinout

DG308A, DG309
(CDIP, PDIP, SOIC)
TOP VIEW



Functional Diagrams



NOTES:

1. Four SPST switches per package.
2. Switches shown for logic "1" input

TRUTH TABLE

| LOGIC | DG308A | DG309 |
|-------|--------|-------|
| 0 | OFF | ON |
| 1 | ON | OFF |

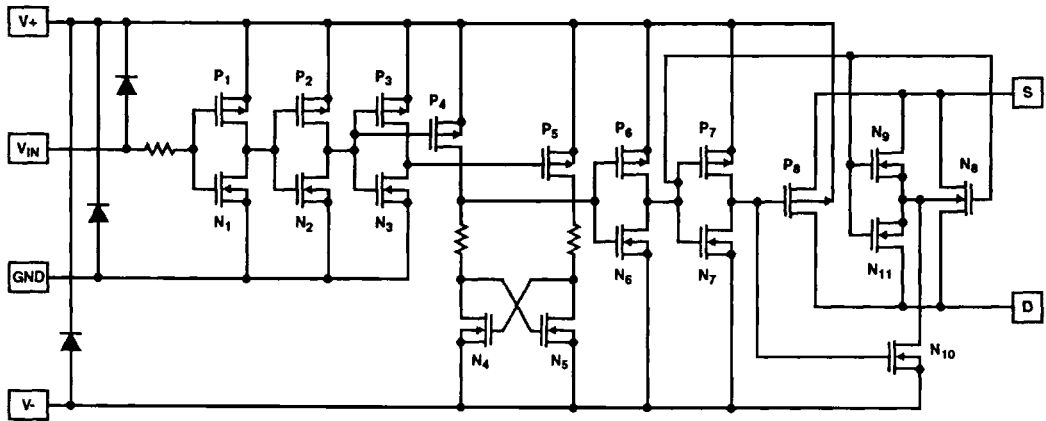
Logic "0" $\leq 3.5V$, Logic "1" $\geq 11V$

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SWITCHES

Typical Schematic Diagram (One Channel)

DG308A



Specifications DG308A, DG309

Absolute Maximum Ratings

| | |
|--|--------------------|
| V+ to V- | 44V |
| V- to Ground | -25V |
| V _{IN} to Ground (Note 1) | (V- -2V), (V+ +2V) |
| V _S or V _D to V+ (Note 1) | +2, (V- -2V) |
| V _S or V _D to V- (Note 1) | -2, (V+ +2V) |
| Current, any Terminal Except S or D | .30mA |
| Continuous Current, S or D | .20mA |
| Peak Current, S or D (Pulsed at 1ms, 10% Duty Cycle Max) | .70mA |
| Lead Temperature (Soldering 10s) | +300°C |
| Storage Temperature Range | |
| C Suffix | -65°C to +125°C |
| A & B Suffix | -65°C to +150°C |

Thermal Information

| | | |
|-----------------------------|---------------|-----------------|
| Thermal Resistance | θ_{JA} | θ_{JC} |
| Ceramic DIP Package | 80°C/W | 24°C/W |
| Plastic DIP Package | 100°C/W | - |
| SOIC DIP Package | 100°C/W | - |
| Junction Temperature | | |
| Plastic DIP Package | | +150°C |
| Ceramic DIP Package | | +175°C |
| Operating Temperature Range | | |
| *A* Suffix | | -55°C to +125°C |
| *B* Suffix | | -25°C to +85°C |
| *C* Suffix | | 0°C to +70°C |

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Specifications V+ = 15V, V- = -15V, GND = 0V, T_A = +25°C

| PARAMETERS | TEST CONDITIONS | DG308AA/DG309A | | | DG308AB/C, DG309B/C | | | UNITS | |
|---|---|--|-----------------|------|---------------------|-----------------|------|-------|----|
| | | MIN | (NOTE 2) TYP | MAX | MIN | (NOTE 2) TYP | MAX | | |
| DYNAMIC CHARACTERISTICS | | | | | | | | | |
| Turn-On Time, t _{ON} | See Figure 1 | - | 130 | 200 | - | 130 | 200 | ns | |
| Turn-Off Time, t _{OFF} | See Figure 1 | - | 90 | 150 | - | 90 | 150 | ns | |
| Charge Injection, Q | C _L = 1μF, R _S = 0, V _S = 0V | - | -10 | - | - | -10 | - | pC | |
| Source OFF Capacitance, C _{S(OFF)} | f = 140kHz V _S = 0V V _{IN} = 0V (DG308A) V _{IN} = 15V (DG309) | - | 11 | - | - | 11 | - | pF | |
| Drain OFF Capacitance, C _{D(OFF)} | V _D = 0V V _{IN} = 0V (DG308A) V _{IN} = 15V (DG309) | - | 8 | - | - | 8 | - | pF | |
| Channel ON Capacitance, C _{D(ON)} + C _{S(ON)} | V _S = V _D = 0V V _{IN} = 15V (DG308A) V _{IN} = 0V (DG309) | - | 27 | - | - | 27 | - | pF | |
| OFF Isolation, OIRR | V _{IN} = 0V (DG308A) V _{IN} = 15V (DG309), R _L = 75Ω, V _S = 2V _{p,p} , f = 500kHz (Note 4) | - | 78 | - | - | 78 | - | dB | |
| INPUT | | | | | | | | | |
| Input Current with Voltage High, I _{INH} | V _{IN} = 15V | - | 0.001 | 1 | - | 0.001 | 1 | μA | |
| Input Current with Voltage Low, I _{INL} | V _{IN} = 0V | -1.0 | -0.001 | - | -1.0 | -0.001 | - | μA | |
| SWITCH | | | | | | | | | |
| Analog Signal Range, V _{ANALOG} | | -15 | - | 15 | -15 | - | 15 | V | |
| Drain Source ON Resistance, R _{DS(ON)} | V _{IN} = 11V (DG308A) V _{IN} = 3.5V (DG309) | I _S = -1mA, V _D = +10V | - | 60 | 100 | - | 60 | 100 | Ω |
| | | I _S = 1mA, V _D = -10V | - | 60 | 100 | - | 60 | 100 | Ω |
| Drain ON Leakage Current, I _{D(ON)} | V _D = V _S = 14V V _D = V _S = -14V | - | 0.1 | 1 | - | 0.1 | 5 | nA | |
| | | -2 | -0.1 | - | -5 | -0.1 | - | nA | |
| Source OFF Leakage Current, I _{S(OFF)} | V _{IN} = 3.5V (DG308A) V _{IN} = 11V (DG309) | V _S = 14V, V _D = -14V | - | 0.1 | 1 | - | 0.1 | 5 | nA |
| | | V _S = -14V, V _D = 14V | -1 | -0.1 | - | -5 | -0.1 | - | nA |
| Drain OFF Leakage Current, I _{D(OFF)} | V _S = -14V, V _D = 14V V _S = 14V, V _D = -14V | - | 0.1 | 1 | - | 0.1 | 5 | nA | |
| | | -1 | -0.1 | - | -5 | -0.1 | - | nA | |
| POWER SUPPLY CHARACTERISTICS | | | | | | | | | |
| Positive Supply Current, I ₊ | All Channels ON or OFF | - | 0.001 | 10 | - | 0.001 | 100 | μA | |
| Negative Supply Current, I ₋ | V _{IN} = 0V or 15V | -10 | -0.001 | - | -100 | -0.001 | - | μA | |

Specifications DG308A, DG309

Electrical Specifications

$V_+ = 15V$, $V_- = -15V$, $GND = 0V$, $T_A =$ Over Operating Temperature Range

| PARAMETERS | TEST CONDITIONS | DG308AA/DG309A | | | DG308AB/C, DG309B/C | | | UNITS | |
|--|-----------------------------|----------------------------|-----------------|-----|---------------------|-----------------|-----|---------|----------|
| | | MIN | (NOTE 2) TYP | MAX | MIN | (NOTE 2) TYP | MAX | | |
| INPUT | | | | | | | | | |
| Input Current with Voltage High, I_{INH} | $V_{IN} = 15V$ | - | - | 1 | - | - | 1 | μA | |
| Input Current with Voltage Low, I_{INL} | $V_{IN} = 0V$ | -1 | - | - | -1 | - | - | μA | |
| SWITCH | | | | | | | | | |
| Analog Signal Range, V_{ANALOG} | | -15 | - | 15 | -15 | - | 15 | V | |
| Drain Source ON Resistance, $R_{DS(ON)}$ | $V_{IN} = 11V$ (DG308A) | $I_S = -1mA$, $V_D = 10V$ | - | - | 150 | - | - | 125 | Ω |
| | | $I_S = 1mA$, $V_D = -10V$ | - | - | 150 | - | - | 125 | Ω |
| Drain ON Leakage Current, $I_{D(ON)}$ | $V_{IN} = 3.5V$ (DG309) | $V_D = V_S = 14V$ | - | - | 100 | - | - | 200 | nA |
| | | $V_D = V_S = -14V$ | -200 | - | - | -200 | - | - | nA |
| Source OFF Leakage Current, $I_{S(OFF)}$ | $V_{IN} = 3.5V$ (DG308A) | $V_S = 14V$, $V_D = -14V$ | - | - | 100 | - | - | 100 | nA |
| | | $V_S = -14V$, $V_D = 14V$ | -100 | - | - | -100 | - | - | nA |
| Drain OFF Leakage Current, $I_{D(OFF)}$ | $V_{IN} = 11V$ (DG309) | $V_S = -14V$, $V_D = 14V$ | - | - | 100 | - | - | 100 | nA |
| | | $V_S = 14V$, $V_D = -14V$ | -100 | - | - | -100 | - | - | nA |
| POWER SUPPLY CHARACTERISTICS | | | | | | | | | |
| Positive Supply Current, I_+ | $V_{IN} = 0V$ or $15V$ | - | - | 100 | - | - | 100 | μA | |
| Negative Supply Current, I_- | | -100 | - | - | -100 | - | - | μA | |

NOTES:

1. Signals on V_S , V_D , or V_{IN} exceeding V_+ or V_- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
2. Typical values are for design aid only, not guaranteed and not subject to production testing.
3. The algebraic convention whereby the most negative value is a minimum, and the most positive is a maximum, is used in this data sheet.
4. OFF isolation = $20 \log V_D/V_S$, where V_S = input to OFF switch, and V_D = output.

Test Circuits

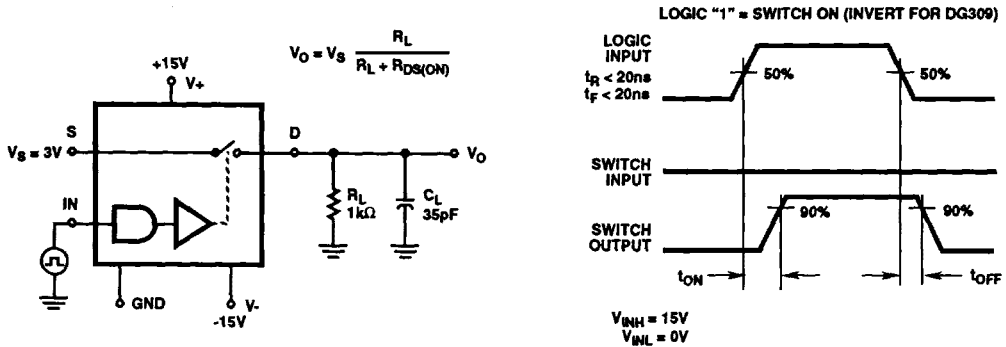


FIGURE 1. t_{ON} AND t_{OFF} SWITCHING TEST

Die Characteristics

DIE DIMENSIONS:
2058 μ m x 2109 μ m

METALLIZATION:
Type: Al
Thickness: 10k \AA \pm 1k \AA

GLASSIVATION:
Type: PSG Over Nitride
PSG Thickness: 7k \AA \pm 1.4k \AA
Nitride Thickness: 8k \AA \pm 1.2k \AA

WORST CASE CURRENT DENSITY:
9.1 x 10⁴ A/cm²

Metallization Mask Layout

