



Precision Monolithic Quad SPST CMOS Analog Switches

DESCRIPTION

The DG417B, DG418B, DG419B monolithic CMOS analog switches were designed to provide high performance switching of analog signals. Combining low power, low leakages, high speed, low on-resistance and small physical size, the DG417B series is ideally suited for portable and battery powered industrial and military applications requiring high performance and efficient use of board space.

To achieve high-voltage ratings and superior switching performance, the DG417B series is built on Vishay Siliconix's high voltage silicon gate (HVSG) process. Break-before-make is guaranteed for the DG419B, which is an SPDT configuration. An epitaxial layer prevents latchup.

Each switch conducts equally well in both directions when on, and blocks up to the power supply level when off.

The DG417B and DG418B respond to opposite control logic levels as shown in the Truth Table.

FEATURES

- ± 15 V analog signal range
- On-resistance - $R_{DS(on)}$: 15 Ω
- Fast switching action - t_{ON} : 110 ns
- TTL and CMOS compatible
- 8-pin CerDIP package

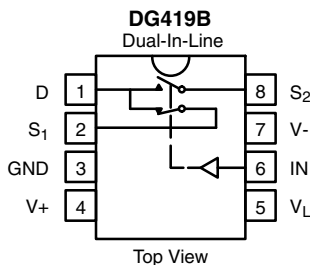
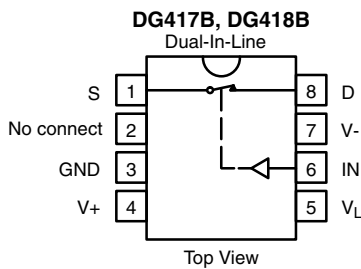
BENEFITS

- Widest dynamic ranges
- Low signal errors and distortion
- Break-before-make switching action
- Simple interfacing
- Reduced board space
- Improved reliability

APPLICATIONS

- Precision test equipment
- Precision instrumentation
- Battery powered systems
- Sample-and-hold circuits
- Military radios
- Hi-Rel systems
- Guidance and control systems
- Hard disk drivers

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



| TRUTH TABLE | | |
|-------------|--------|--------|
| LOGIC | DG417B | DG418B |
| 0 | On | Off |
| 1 | Off | On |

Notes

- Logic "0" ≤ 0.8 V
- Logic "1" ≥ 2.4 V

| TRUTH TABLE (DG419B) | | |
|----------------------|-----------------|-----------------|
| LOGIC | SW ₁ | SW ₂ |
| 0 | On | Off |
| 1 | Off | On |

Notes

- Logic "0" ≤ 0.8 V
- Logic "1" ≥ 2.4 V

| ORDERING INFORMATION | | | | | | |
|----------------------|---------------|-------------------|--------------|---------------|--------------|-----------------|
| PART | CONFIGURATION | TEMP. RANGE | PACKAGE | ORDERING PART | GENERIC | DSCC NUMBER |
| DG417B | SPST x 1, NC | - 55 °C to 125 °C | 8-pin CerDIP | 9073704PA | DG417BAK/883 | 5962-9073704MPA |
| | | | | DG417BAK | DG417BAK | - |
| | | | | DG417BAK-E3 | DG417BAK-E3 | - |
| DG418B | SPST x 1, NO | | | 9073705PA | DG418BAK/883 | 5962-9073705MPA |
| | | | | DG418BAK | DG418BAK | - |
| | | | | DG418BAK-E3 | DG418BAK-E3 | - |
| DG419B | SPDT x 1 | | | 9073706PA | DG419BAK/883 | 5962-9073706MPA |
| | | | | DG419BAK | DG419BAK | - |
| | | | | DG419BAK-E3 | DG419BAK-E3 | - |

| ABSOLUTE MAXIMUM RATINGS | | | |
|--|---------------------------|---|------|
| PARAMETER | | LIMIT | UNIT |
| Voltages Referenced to V- | V+ | 44 | V |
| | GND | 25 | |
| V_L | | (GND - 0.3) to (V+) + 0.3 | |
| Digital inputs ^a , V_S , V_D | | (V-) - 2 V to (V+) + 2 or 30 mA, whichever occurs first | |
| Current, (any terminal) continuous | | 30 | mA |
| Current (S or D) pulsed at 1 ms, 10 % duty cycle | | 100 | |
| Storage temperature | | - 65 to 150 | °C |
| Power dissipation (package) ^b | 8-pin CerDIP ^c | 600 | mW |

Notes

- Signals on S_X , D_X or IN_X exceeding V + or V - will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads soldered or welded to PC board.
- Derate 8 mW/°C above 75 °C.

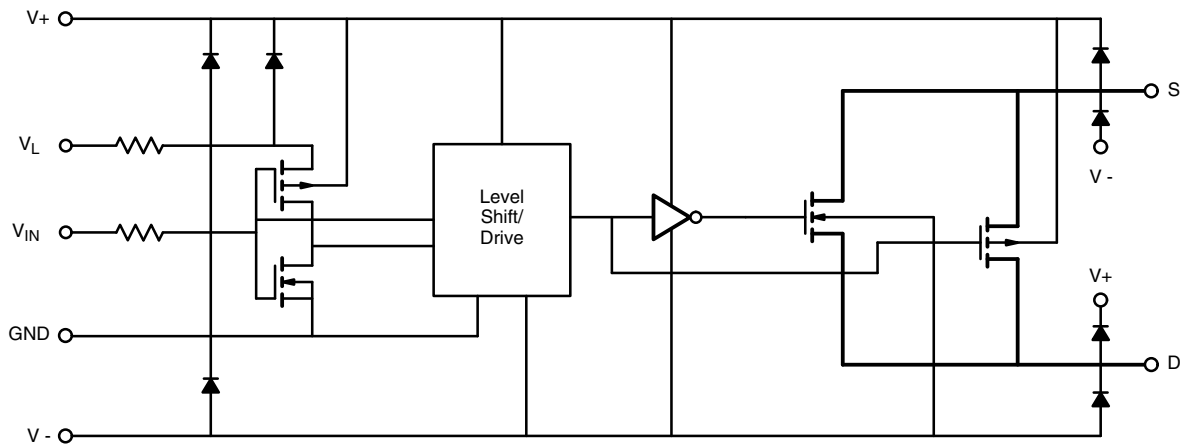
SCHEMATIC DIAGRAM (Typical Channel)


Fig. 1



| SPECIFICATIONS ^a | | | | | | | | |
|---|---------------------|--|--------------------|-------------------|-------------------------------|-------------------|------|--|
| PARAMETER | SYMBOL | TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V ₊ = 15 V, V ₋ = - 15 V V _L = 5 V, V _{IN} = 2.4 V, 0.8 V ^f | TEMP. ^b | TYP. ^c | A SUFFIX - 55 °C to 125 °C | | UNIT | |
| | | | | | MIN. ^d | MAX. ^d | | |
| Analog Switch | | | | | | | | |
| Analog Signal Range ^e | V _{ANALOG} | | Full | | - 15 | 15 | V | |
| Drain-Source On-Resistance | R _{DS(on)} | I _S = - 10 mA, V _D = ± 12.5 V V ₊ = 13.5 V, V ₋ = - 13.5 V | Room | 15 | | 25 | Ω | |
| | | | Full | 15 | | 34 | | |
| Switch Off Leakage Current | I _{S(off)} | V ₊ = 16.5, V ₋ = - 16.5 V V _D = ± 15.5 V, V _S = ± 15.5 V | Room | - 0.1 | - 0.25 | 0.25 | nA | |
| | | | Full | - 0.1 | - 20 | 20 | | |
| | DG417B | | Room | - 0.1 | - 0.25 | 0.25 | | |
| | | | Full | - 0.1 | - 20 | 20 | | |
| | DG418B | | Room | - 0.1 | - 0.25 | 0.25 | | |
| | | | Full | - 0.1 | - 20 | 20 | | |
| Channel On Leakage Current | I _{D(on)} | V ₊ = 16.5 V, V ₋ = - 16.5 V V _S = V _D = ± 15.5 V | DG417B | Room | - 0.4 | - 0.4 | 0.4 | |
| | | | DG417B | Full | - 0.4 | - 40 | 40 | |
| | | | DG418B | Room | - 0.4 | - 0.4 | 0.4 | |
| | | | DG418B | Full | - 0.4 | - 40 | 40 | |
| DG419B | Room | - 0.4 | - 0.75 | 0.75 | | | | |
| DG419B | Full | - 0.4 | - 60 | 60 | | | | |
| Digital Control | | | | | | | | |
| Input Current, V _{IN} Low | I _{IL} | | Full | | - 0.5 | 0.5 | μA | |
| Input Current, V _{IN} High | I _{IH} | | Full | | - 0.5 | 0.5 | | |
| Dynamic Characteristics | | | | | | | | |
| Turn-On Time | t _{ON} | R _L = 300 Ω, C _L = 35 pF V _S = ± 10 V, see switching time test circuit | DG417B | Room | 62 | | 89 | |
| | | | DG417B | Full | 62 | | 106 | |
| Turn-Off Time | t _{OFF} | | DG418B | Room | 62 | | 89 | |
| | | | DG418B | Full | 62 | | 106 | |
| DG417B | Room | | 53 | | 80 | | | |
| | Full | | 53 | | 88 | | | |
| DG418B | Room | 53 | | 80 | | | | |
| | Full | 53 | | 88 | | | | |
| Transition Time | t _{TRANS} | R _L = 300 Ω, C _L = 35 pF V _{S1} = ± 10 V, V _{S2} = ± 10 V | DG419B | Room | 60 | | 87 | |
| | | | DG419B | Full | 60 | | 96 | |
| Break-Before-Make Time Delay | t _D | R _L = 300 Ω, C _L = 35 pF V _{S1} = V _{S2} = ± 10 V | DG419B | Room | 16 | 3 | | |
| Charge Injection | Q | C _L = 10 nF, V _{gen} = 0 V, R _{gen} = 0 Ω | Room | 38 | | | pC | |
| Off Isolation ^e | OIRR | R _L = 50 Ω, C _L = 5 pF, f = 1 MHz | Room | - 82 | | | dB | |
| Channel-to-Channel Crosstalk ^e | X _{TALK} | | DG419B | Room | - 88 | | | |
| Source Off Capacitance ^e | C _{S(off)} | f = 1 MHz, V _S = 0 V | Room | 12 | | | pF | |
| Drain Off Capacitance ^e | C _{D(off)} | | DG417B | Room | 12 | | | |
| | | | DG418B | Room | 12 | | | |
| Channel On Capacitance ^e | C _{D(on)} | | DG417B | Room | 50 | | | |
| | | DG418B | Room | 50 | | | | |
| | | DG419B | Room | 57 | | | | |



| SPECIFICATIONS ^a | | | | | | | | |
|----------------------------------|---------------------|---|--------|--------------------|-------------------|-------------------------------|-------------------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS UNLESS OTHERWISE SPECIFIED $V_+ = 12\text{ V}$, $V_- = -0\text{ V}$ $V_L = 5\text{ V}$, $V_{IN} = 2.4\text{ V}$, 0.8 V^f | | TEMP. ^b | TYP. ^c | A SUFFIX - 55 °C to 125 °C | | UNIT |
| | | | | | | MIN. ^d | MAX. ^d | |
| Power Supplies | | | | | | | | |
| Positive Supply Current | I ₊ | $V_+ = 16.5\text{ V}$, $V_- = -16.5\text{ V}$ $V_{IN} = 0\text{ V}$ or 5 V | Room | 0.001 | | 1 | μA | |
| | | | Full | | | 5 | | |
| Negative Supply Current | I ₋ | | Room | - 0.001 | - 1 | | | |
| | | | Full | | - 5 | | | |
| Logic Supply Current | I _L | | Room | 0.001 | | 1 | | |
| | | | Full | | | 5 | | |
| Ground Current | I _{GND} | | Room | - 0.001 | - 1 | | | |
| | | | Full | | - 5 | | | |
| Analog Switch | | | | | | | | |
| Analog Signal Range ^e | V _{ANALOG} | | Full | | 0 | 12 | V | |
| Drain-Source On-Resistance | R _{DS(on)} | $I_S = -10\text{ mA}$, $V_D = 3.8\text{ V}$ $V_+ = 10.8\text{ V}$ | Room | 26 | | 35 | Ω | |
| | | | Full | 26 | | 52 | | |
| Dynamic Characteristics | | | | | | | | |
| Turn-On Time | t _{ON} | $R_L = 300\text{ Ω}$, $C_L = 35\text{ pF}$ $V_S = 8\text{ V}$, see switching time test circuit | Room | 100 | | 125 | ns | |
| | | | Full | 100 | | 155 | | |
| Turn-Off Time | t _{OFF} | | Room | 38 | | 66 | | |
| | | | Full | 38 | | 69 | | |
| Break-Before-Make Time Delay | t _D | $R_L = 300\text{ Ω}$, $C_L = 35\text{ pF}$ | DG419B | Room | 62 | 25 | | |
| Transition Time | t _{TRANS} | $R_L = 300\text{ Ω}$, $C_L = 35\text{ pF}$ $V_{S1} = 0\text{ V}$, 8 V , $V_{S2} = 8\text{ V}$, 0 V | Room | 95 | | 119 | | |
| | | | Full | 95 | | 153 | | |
| Charge Injection | Q | $C_L = 10\text{ nF}$, $V_{gen} = 0\text{ V}$, $R_{gen} = 0\text{ Ω}$ | Room | 18 | | | pC | |
| Power Supplies | | | | | | | | |
| Positive Supply Current | I ₊ | $V_+ = 13.2\text{ V}$, $V_L = 5.25\text{ V}$ $V_{IN} = 0\text{ V}$ or 5 V | Room | 0.001 | | 1 | μA | |
| | | | Full | 0.001 | | 5 | | |
| Negative Supply Current | I ₋ | | Room | - 0.001 | - 1 | | | |
| | | | Full | | - 5 | | | |
| Logic Supply Current | I _L | | Room | 0.001 | | 1 | | |
| | | | Full | | | 5 | | |
| Ground Current | I _{GND} | | Room | - 0.001 | - 1 | | | |
| | | | Full | | - 5 | | | |

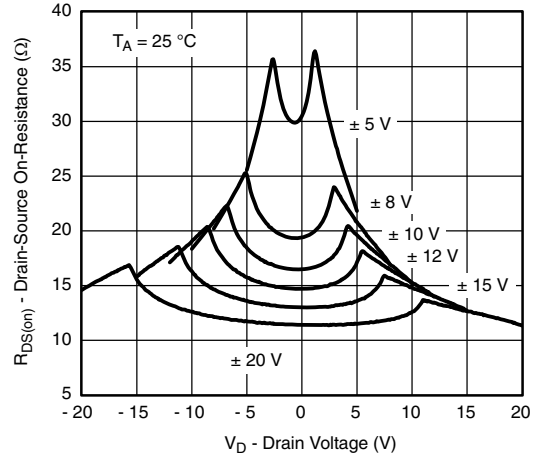
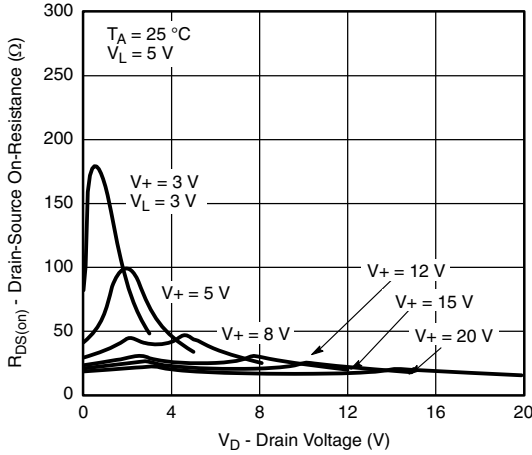
Notes

- 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 datasheet.
- 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.

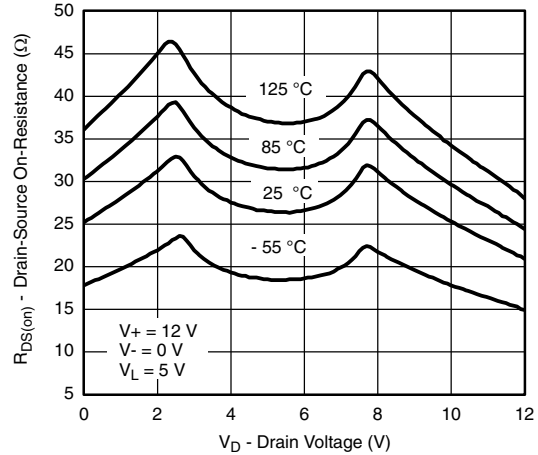
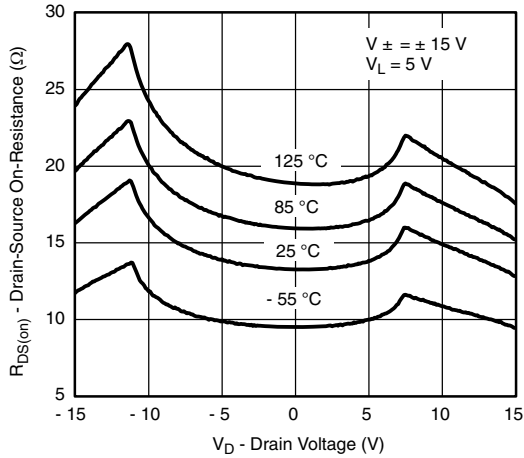


TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



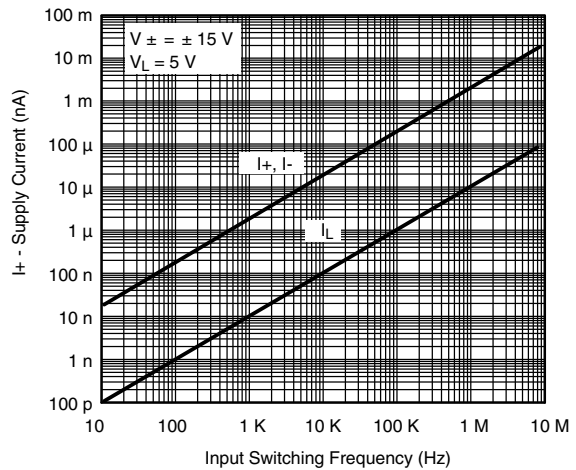
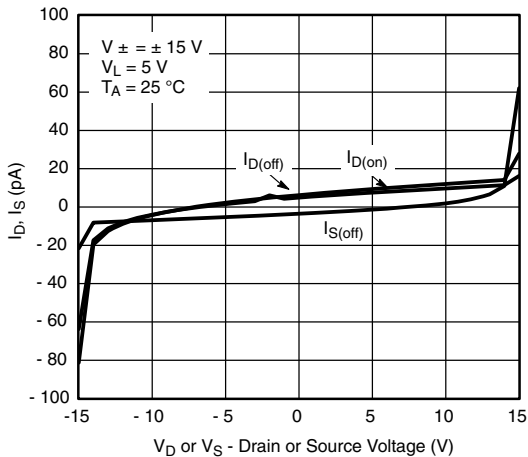
On-Resistance vs. V_D and Unipolar Power Supply Voltage

On-Resistance vs. V_D and Dual Supply Voltage



On-Resistance vs. V_D and Temperature

On-Resistance vs. V_D and Temperature

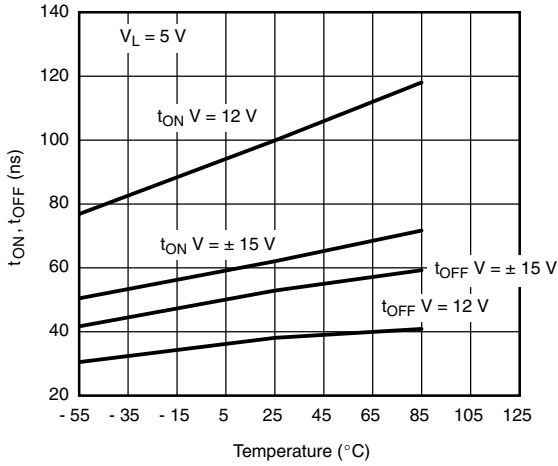


Leakage vs. Analog Voltage

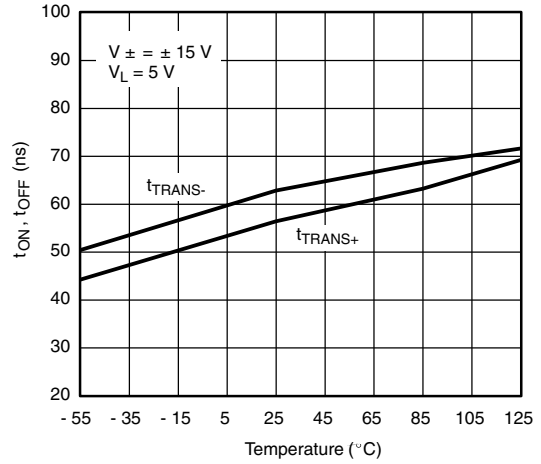
Supply current vs. Input Switching Frequency



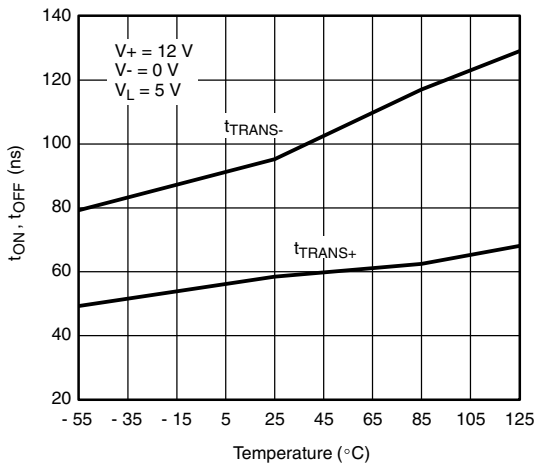
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



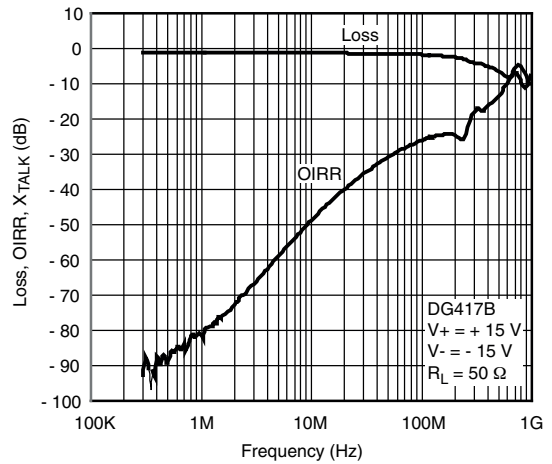
Switching Time vs. Temperature



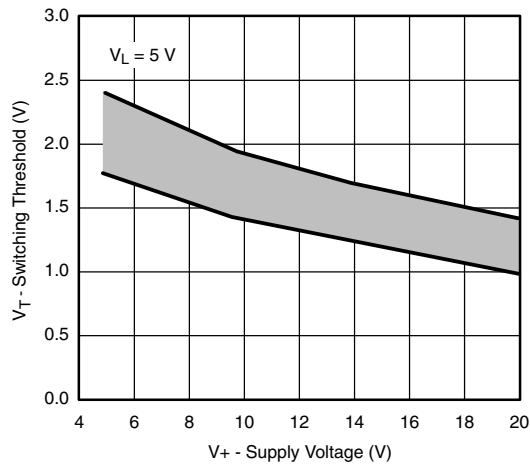
Transition Time vs. Temperature



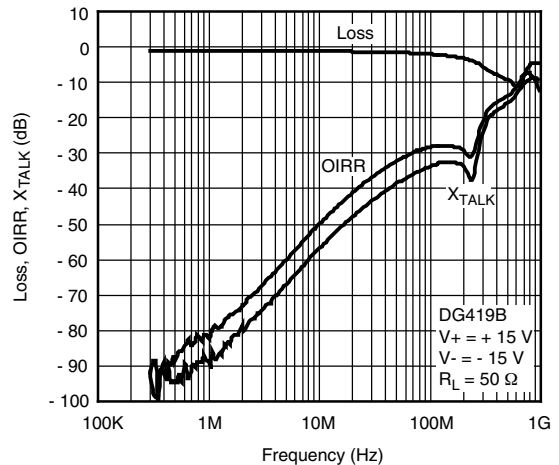
Transition Time vs. Temperature



Insertion Loss, Off-Isolation Crosstalk vs. Frequency

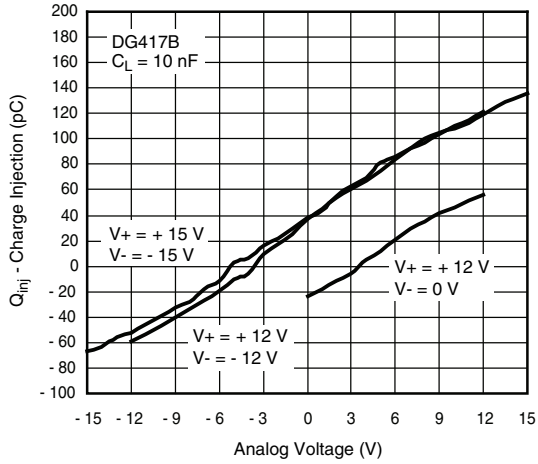


Switching Threshold vs. Supply Voltage

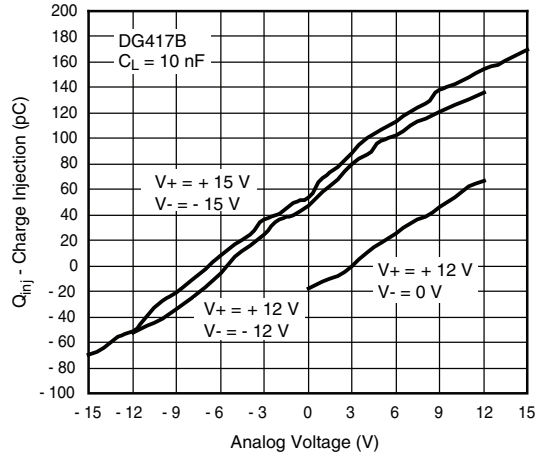


Insertion Loss, Off-Isolation Crosstalk vs. Frequency

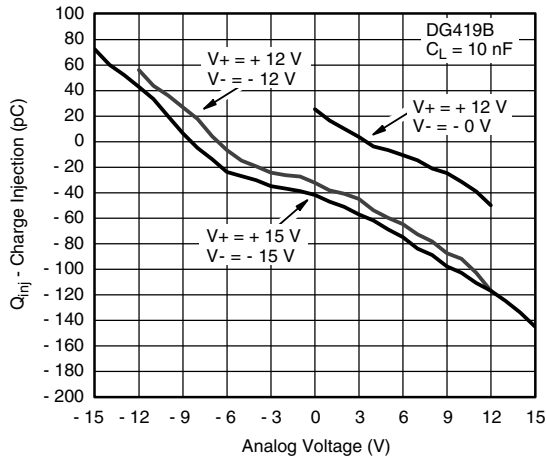
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



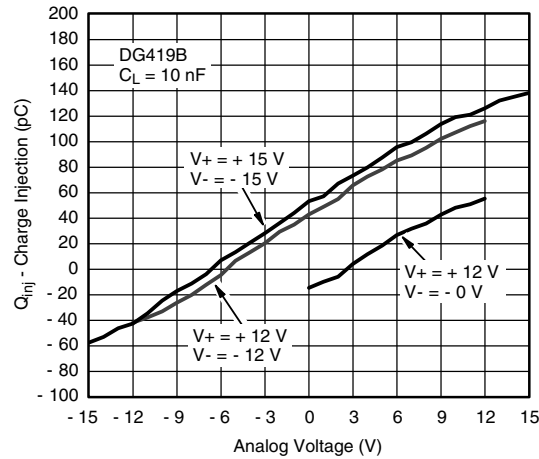
Charge Injection vs. Analog Voltage
(Measured at drain pin)



Charge Injection vs. Analog Voltage
(Measured at source pin)



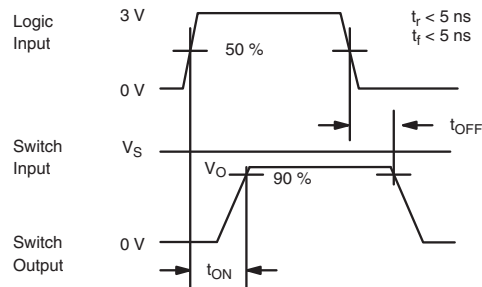
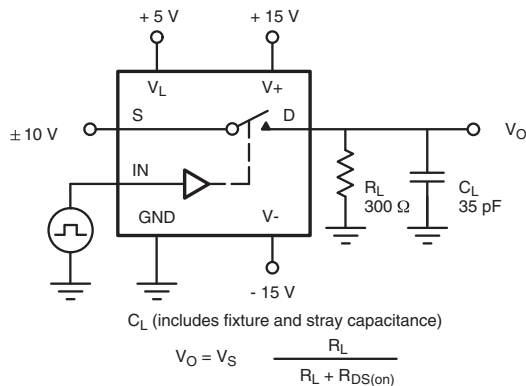
Charge Injection vs. Analog Voltage
(Measured at drain pin)



Charge Injection vs. Analog Voltage
(Measured at source pin)

TEST CIRCUITS

V_O is the steady state output with the switch on.



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

Fig. 2 - Switching Time (DG417B, DG418B)

TEST CIRCUITS

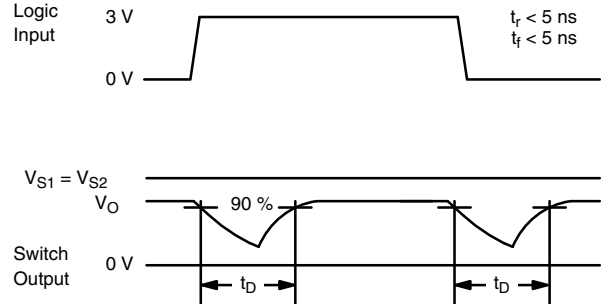
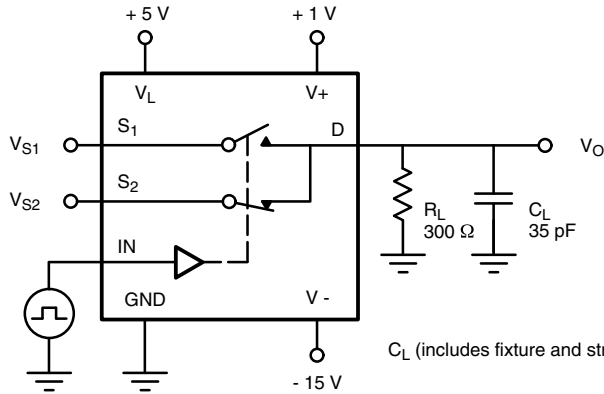


Fig. 3 - Break-Before-Mak (DG419B)

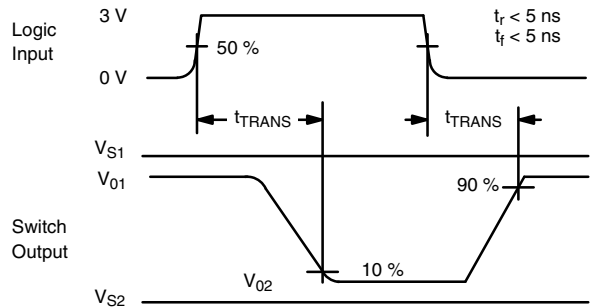
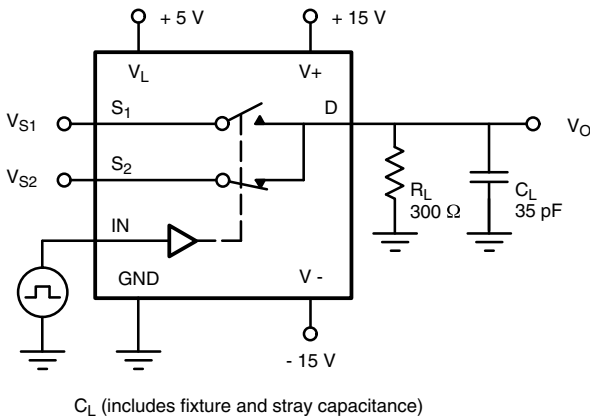


Fig. 4 - Transition Time (DG419B)

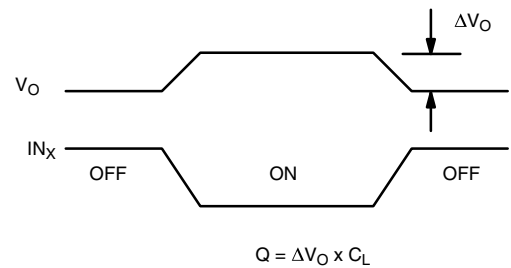
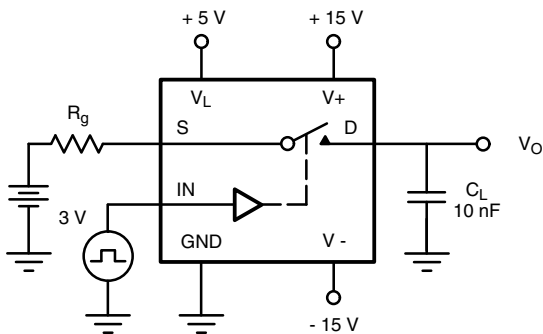
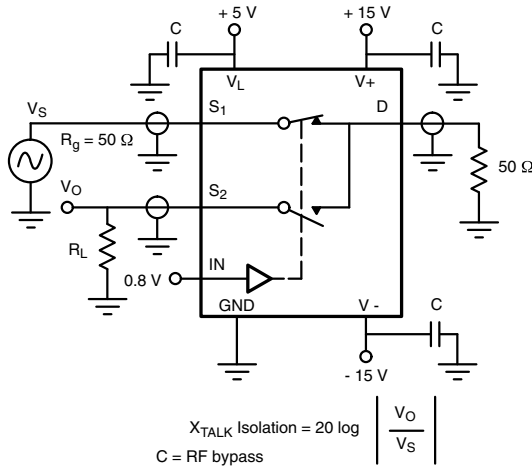
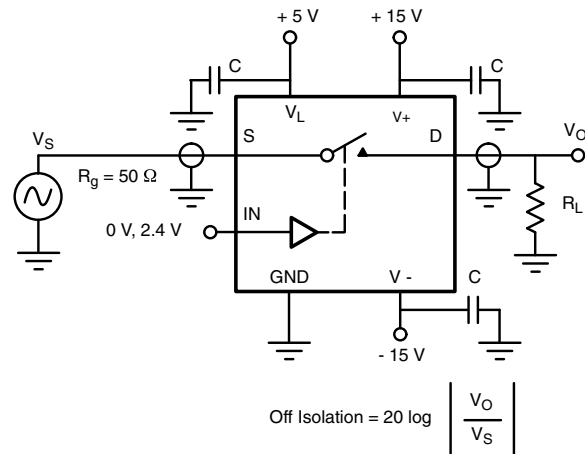
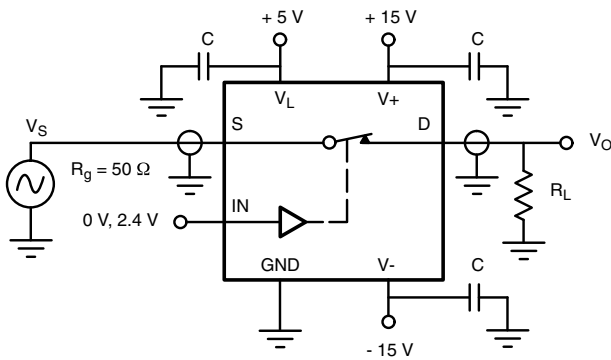
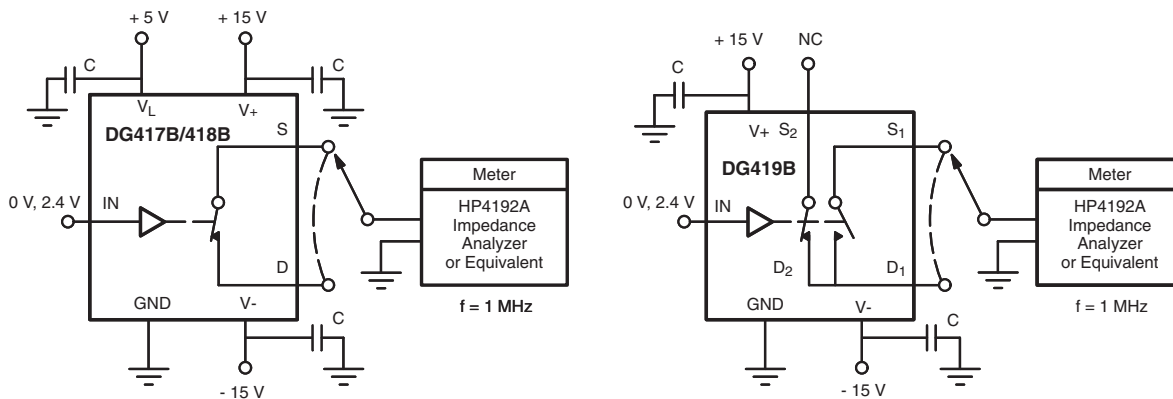


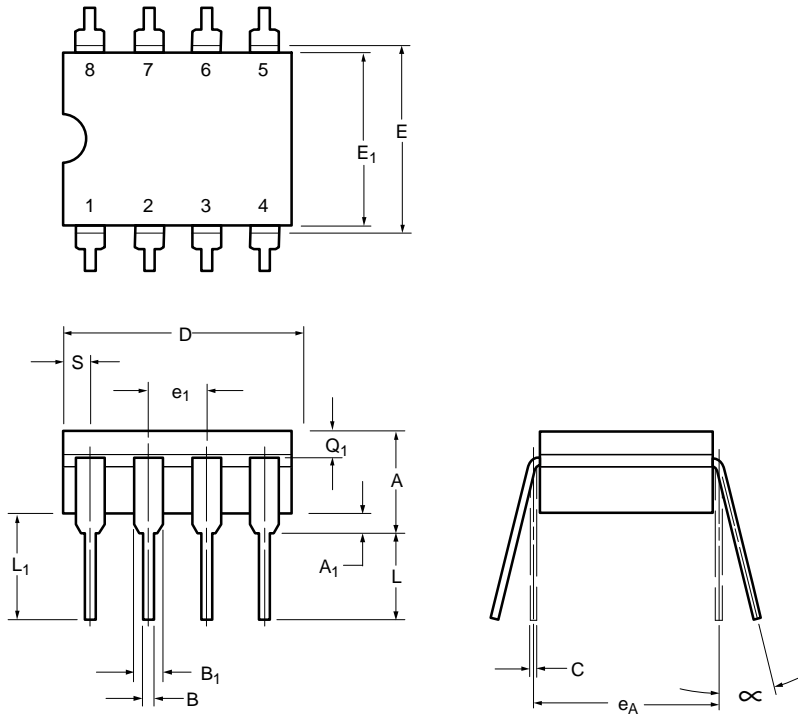
Fig. 5 - Charge Injection

TEST CIRCUITS

Fig. 6 - Crosstalk

Fig. 7 - Off Isolation

Fig. 8 - Insertion Loss

Fig. 9 - Source-Drain Capacitances

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CERDIP: 8-LEAD



| Dim | MILLIMETERS | | INCHES | |
|----------------|-------------|-------|-----------|-------|
| | Min | Max | Min | Max |
| A | 4.06 | 5.08 | 0.160 | 0.200 |
| A ₁ | 0.51 | 1.14 | 0.020 | 0.045 |
| B | 0.38 | 0.51 | 0.015 | 0.020 |
| B ₁ | 1.14 | 1.65 | 0.045 | 0.065 |
| C | 0.20 | 0.30 | 0.008 | 0.012 |
| D | 9.40 | 10.16 | 0.370 | 0.400 |
| E | 7.62 | 8.26 | 0.300 | 0.325 |
| E ₁ | 6.60 | 7.62 | 0.260 | 0.300 |
| e ₁ | 2.54 BSC | | 0.100 BSC | |
| e _A | 7.62 BSC | | 0.300 BSC | |
| L | 3.18 | 3.81 | 0.125 | 0.150 |
| L ₁ | 3.18 | 5.08 | 0.150 | 0.200 |
| Q ₁ | 1.27 | 2.16 | 0.050 | 0.085 |
| S | 0.64 | 1.52 | 0.025 | 0.060 |
| ∞ | 0° | 15° | 0° | 15° |

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DWG: 5348



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