



3.9 Ω , 8-Channel / Dual 4-Channel, ± 15 V, +12 V, ± 5 V Precision Multiplexers

DESCRIPTION

The DG1408E is a precision analog multiplexer comprising eight single-ended channels. The DG1409E is a dual four single-ended channels analog multiplexer. Built on a new CMOS process, the Vishay Siliconix DG1408E and DG1409E offer low on-resistance of 3.9 Ω . The low and flat resistance over the full signal range provides excellent linearity and low signal distortion. The new CMOS platform also ensures ultra low power dissipation, minimized parasitic capacitance, and low charge injection.

The DG1408E and DG1409E can operate from either a single 4.5 V to 24 V power supply, or from dual ± 4.5 V to ± 15 V power supplies. The DG1408E connects one of eight inputs to a common output as determined by a 3-bit binary address (A0, A1, A2). The DG1409E connects one of four inputs to a common output for both multiplexers as determined by a 2-bit binary address (A0 and A1). Break-before-make switching action protects against momentary crosstalk between adjacent channels. The part does not require a VL logic supply, while all digital inputs have 0.8 V and 2 V logic thresholds to ensure low-voltage TTL / CMOS compatibility. Together with the compact package, these make the part a great fit for battery operated systems.

The DG1408E and DG1409E on channel conduct signal equally well in both directions. In the off state each channel blocks voltages up to the power supply rails. An enable (EN) function allows the user to reset the multiplexer / demultiplexer to all switches off for stacking several devices.

The advance performance of low insertion loss and low distortion make the device ideal for signal switching and relay replacement in a wide range of applications.

DG1408E and DG1409E are available in RoHS-compliant, halogen-free QFN16, 4 mm x 4 mm package.

FEATURES

- 35 V supply max. rating
- 3.9 Ω typical and 4.2 Ω max. on-resistance at 25 $^{\circ}$ C
- 0.59 Ω on-resistance flatness
- Channel to channel on-resistance match: 0.27 Ω
- Up to 250 mA continuous current
- Supports single and dual supply operation
- Fully specified at ± 15 V, +12 V, and ± 5 V
- Integrated VL supply
- Low voltage logic compatible inputs, $V_{IH} = 2$ V, $V_{IL} = 0.8$ V
- BBM (break-before-make switching)
- Low parasitic capacitance:
DG1408E, $C_{S(off)} = 13$ pF, $C_{D(on)} = 104$ pF
DG1409E, $C_{S(off)} = 13$ pF, $C_{D(on)} = 70$ pF
- Rail to rail signal handling
- QFN16, 4 mm x 4 mm packages
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

BENEFITS

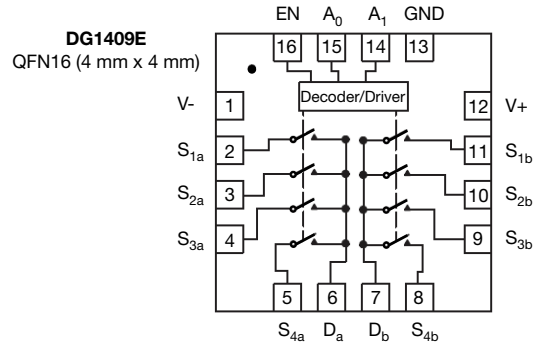
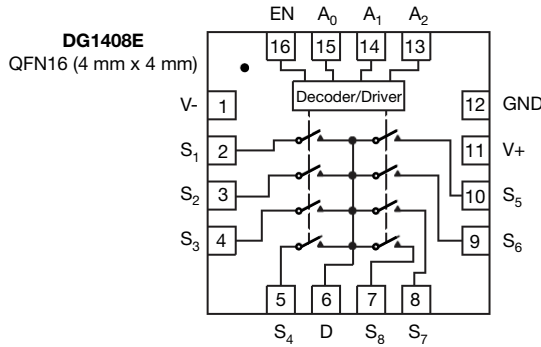
- Low insertion loss
- Low distortion
- Low power consumption
- Compact solution
- Low charge injection over the full signal range

APPLICATIONS

- Medical and healthcare equipment
- Data acquisition system
- Industrial control and automation
- Test and measurement equipment
- Communication systems
- Battery powered systems
- Sample and hold circuits
- Audio and video signal switching
- Relay replacement



FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



| TRUTH TABLE - DG1408E | | | | |
|-----------------------|----|----|----|-----------|
| A2 | A1 | A0 | EN | ON SWITCH |
| X | X | X | 0 | None |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 2 |
| 0 | 1 | 0 | 1 | 3 |
| 0 | 1 | 1 | 1 | 4 |
| 1 | 0 | 0 | 1 | 5 |
| 1 | 0 | 1 | 1 | 6 |
| 1 | 1 | 0 | 1 | 7 |
| 1 | 1 | 1 | 1 | 8 |

| TRUTH TABLE - DG1409E | | | |
|-----------------------|----|----|-----------|
| A1 | A0 | EN | ON SWITCH |
| X | X | 0 | None |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 2 |
| 1 | 0 | 1 | 3 |
| 1 | 1 | 1 | 4 |

Note
 • QFN exposed pad tied to V-

| ORDERING INFORMATION | | | | |
|----------------------|---------------|-------------------|-------------------------------------|----------------------|
| PART | CONFIGURATION | TEMPERATURE RANGE | PACKAGE | ORDERING PART NUMBER |
| DG1408E | 8:1 MUX | -40 °C to +125 °C | QFN (4 mm x 4 mm) 16L (variation 2) | DG1408EEN-T1-GE4 |
| DG1409E | Dual 4:1 MUX | | | DG1409EEN-T1-GE4 |

| ABSOLUTE MAXIMUM RATINGS | | | |
|---|--|-----------------------------|------|
| ELECTRICAL PARAMETER | CONDITIONS | LIMITS | UNIT |
| V+ | Reference to GND | -0.3 V to +25 V | V |
| V- | Reference to GND | +0.3 V to -25 V | |
| V+ to V- | | +35 | |
| Analog inputs (S or D) | | V- (-0.3 V) to V+ (+0.3 V) | |
| Digital inputs | | GND (-0.3 V) to V+ (+0.3 V) | |
| Maximum continuous switch current | QFN (4 mm x 4 mm) 16L, T _A = 25 °C | 250 | mA |
| | QFN (4 mm x 4 mm) 16L, T _A = 125 °C | 100 | |
| Maximum pulse switch current | Pulse at 1 ms, 10 % duty cycle | 500 | |
| Thermal resistance | QFN (4 mm x 4 mm) 16L | 32 | °C/W |
| ESD human body model (HBM); per ANSI / ESDA / JEDEC® JS-001 | | 6000 | V |
| Latch up current, per JESD78D | | 200 | mA |
| Temperature | | | |
| Operating temperature | | -40 to +125 | °C |
| Max. operating junction temperature | | 150 | |
| Storage temperature | | -65 to +150 | |

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.

| RECOMMENDED OPERATING RANGE | | | |
|-----------------------------|---------|---------|------|
| ELECTRICAL | MINIMUM | MAXIMUM | UNIT |
| Single supply (V+) | 4.5 | 24 | V |
| Dual supplies (V+ and V-) | ± 4.5 | ± 16.5 | |



| ELECTRICAL CHARACTERISTICS | | | | | | | |
|--------------------------------|-----------------------|--|----------------|---------------------|----------------------|--------------------------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 15 V, V- = -15 V V _{AX} , V _{EN} = 2 V, 0.8 V | +25 °C | -40 °C to +85 °C | -40 °C to +125 °C | MIN. / TYP. / MAX. | UNIT |
| Analog Switch | | | | | | | |
| Analog signal range | V _{ANALOG} | | V- to V+ | | | - | V |
| Drain-source On-resistance | R _{DS(on)} | V _S = ± 10 V, I _S = -10 mA, V _L = +13.5 V, V ₋ = -13.5 V | 3.9 | - | - | Typ. | Ω |
| On-resistance flatness | R _{flat(on)} | | 4.2 | 5.1 | 6.1 | Max. | |
| On-resistance matching | ΔR _{DS(on)} | | 0.59 | - | - | Typ. | |
| | | | 0.7 | 0.9 | 1.1 | Max. | |
| Source off leakage current | I _{S(off)} | V ₊ = +16.5 V, V ₋ = -16.5 V, V _S = ± 10 V, V _D = ± 10 V | ± 0.027 | - | - | Typ. | nA |
| Drain off leakage current | I _{D(off)} | | ± 0.55 | ± 1 | ± 10 | Max. | |
| | | | ± 0.018 | - | - | Typ. | |
| | | | ± 0.45 | ± 2 | ± 20 | Max. | |
| Drain on leakage current | I _{D(on)} | V ₊ = +16.5 V, V ₋ = -16.5 V, V _S = V _D = ± 10 V | ± 0.05 | - | - | Typ. | nA |
| | | | ± 1.5 | ± 4 | ± 35 | Max. | |
| Digital Control | | | | | | | |
| Input, high voltage | V _{INH} | | - | - | 2 | Min. | V |
| Input, low voltage | V _{INL} | | - | - | 0.8 | Max. | |
| Input leakage | I _{IN} | V _{IN} = V _{GND} or V ₊ | 0.016 | - | - | Typ. | μA |
| | | | - | - | ± 0.1 | Max. | |
| Digital input capacitance | C _{IN} | | 3.1 | - | - | Typ. | pF |
| Dynamic Characteristics | | | | | | | |
| Transition time | t _{TRANS} | V _{S1} = +10 V / -10 V, V _{S8} = -10 V / +10 V, R _L = 100 Ω, C _L = 35 pF | 133 | - | - | Typ. | ns |
| | | | 180 | 214 | 245 | Max. | |
| Break-before-make time | t _{OPEN} | V _{S1} = V _{S8} = 10 V, R _L = 100 Ω, C _L = 35 pF | 29 | - | - | Typ. | |
| | | | - | - | 10 | Min. | |
| Enable turn-on time | t _{ON(EN)} | V _{S1} = 10 V, V _{S2} - V _{S8} = 0 V, R _L = 100 Ω, C _L = 35 pF | 100 | - | - | Typ. | |
| | | | 130 | 160 | 185 | Max. | |
| Enable turn-off time | t _{OFF(EN)} | | 75 | - | - | Typ. | |
| | | | 105 | 120 | 140 | Max. | |
| Charge injection | Q _{INJ} | C _{INJ} = 1 nF, R _{GEN} = 0 Ω, V _S = 0 V | DG1408E -31 | - | - | Typ. | pC |
| Off isolation | OIRR | C _L = 5 pF, R _L = 50 Ω, 1 MHz | -58 | - | - | Typ. | dB |
| Cross talk | X _{TALK} | | -64 | - | - | | |
| Total harmonic distortion + N | THD + N | R _L = 100 Ω, 15 V _{p-p} , f = 20 Hz to 20 kHz | 0.025 | - | - | Typ. | % |
| -3dB, bandwidth | BW | R _L = 50 Ω | DG1408E 55 | - | - | Typ. | MHz |
| | | | DG1409E 90 | - | - | | |
| Source off capacitance | C _{S(off)} | f = 1 MHz, V _S = 0 V | 13 | - | - | Typ. | pF |
| Drain off capacitance | C _{D(off)} | | DG1408E 85 | - | - | Typ. | |
| | | | DG1409E 43 | - | - | | |
| Drain on capacitance | C _{D(on)} | | DG1408E 104 | - | - | Typ. | |
| | | | DG1409E 70 | - | - | | |
| Power Supply | | | | | | | |
| Power supply range | | GND = 0 V | ± 4.5 / ± 16.5 | | | Min. / Max. | V |
| Positive supply current | I ₊ | V _{AX} , V _{EN} = 0 V, 5 V, V ₊ , V ₊ = +16.5 V, V ₋ = -16.5 V | 3.4 | 3.8 | 4 | Typ. | μA |
| | | | - | - | 10 | Max. | |
| Negative supply current | I ₋ | V _{AX} , V _{EN} = 0 V, V ₊ , V ₊ = +16.5 V, V ₋ = -16.5 V | 0.0002 | 0.0085 | 0.33 | Typ. | μA |
| | | | - | - | 1 | Max. | |



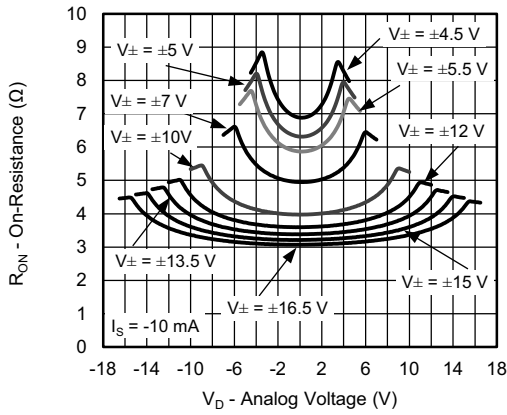
| ELECTRICAL CHARACTERISTICS | | | | | | | |
|--------------------------------|-----------------------|--|---------------------|---------------------|----------------------|--------------------------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V ₊ = 12 V, V ₋ = 0 V V _{AX} , V _{EN} = 2 V, 0.8 V | +25 °C | -40 °C to +85 °C | -40 °C to +125 °C | MIN. / TYP. / MAX. | UNIT |
| Analog Switch | | | | | | | |
| Analog signal range | V _{ANALOG} | | 0 to V ₊ | | | - | V |
| Drain-source On-resistance | R _{DS(on)} | V _S = 0 V / 10 V, I _S = -10 mA, V ₊ = +10.8 V, V ₋ = 0 V | 7.5 | - | - | Typ. | Ω |
| | | | 8 | 10 | 12 | Max. | |
| On-resistance flatness | R _{flat(on)} | | 2 | - | - | Typ. | |
| | | | 2.2 | 2.5 | 3 | Max. | |
| On-resistance matching | ΔR _{DS(on)} | | 0.3 | - | - | Typ. | |
| | | | 0.5 | 0.8 | 1 | Max. | |
| Source off leakage current | I _{S(off)} | V ₊ = +13.2 V, V ₋ = 0 V, V _S = 1 V / 10 V, V _D = 10 V / 1 V | ± 0.01 | - | - | Typ. | nA |
| | | | ± 0.55 | ± 1 | ± 8 | Max. | |
| Drain off leakage current | I _{D(off)} | | ± 0.01 | - | - | Typ. | |
| | | | ± 0.3 | ± 2 | ± 20 | Max. | |
| Drain on leakage current | I _{D(on)} | V ₊ = +13.2 V, V ₋ = 0 V, V _S = V _D = 1 V / 10 V | ± 0.01 | - | - | Typ. | |
| | | | ± 1.5 | ± 3 | ± 20 | Max. | |
| Digital Control | | | | | | | |
| Input, high voltage | V _{INH} | | - | - | 2 | Min. | V |
| Input, low voltage | V _{INL} | | - | - | 0.8 | Max. | |
| Input leakage | I _{IN} | V _{IN} = V _{GND} or V ₊ | 0.018 | - | - | Typ. | μA |
| | | | - | - | ± 0.1 | Max. | |
| Digital input capacitance | C _{IN} | | 3.1 | - | - | Typ. | pF |
| Dynamic Characteristics | | | | | | | |
| Transition time | t _{TRANS} | V _{S1} = 8 V / 0 V, V _{S8} = 0 V / 8 V, R _L = 100 Ω, C _L = 35 pF | 134 | - | - | Typ. | ns |
| | | | 190 | 235 | 280 | Max. | |
| Break-before-make time | t _{OPEN} | V _{S1} = V _{S8} = 8 V, R _L = 100 Ω, C _L = 35 pF | 64 | - | - | Typ. | |
| | | | - | - | 14 | Min. | |
| Enable turn-on time | t _{ON(EN)} | V _{S1} = 8 V, V _{S2} - V _{S8} = 0 V, R _L = 100 Ω, C _L = 35 pF | 117 | - | - | Typ. | |
| | | | 151 | 180 | 215 | Max. | |
| Enable turn-off time | t _{OFF(EN)} | | 79 | - | - | Typ. | |
| | | | 105 | 125 | 145 | Max. | |
| Charge injection | Q _{INj} | C _{INj} = 1 nF, R _{GEN} = 0 Ω, V _S = 6 V | DG1408E 5 | - | - | Typ. | pC |
| | | | DG1409E -22 | - | - | | |
| Off isolation | OIRR | C _L = 5 pF, R _L = 50 Ω, 1 MHz | -58 | - | - | Typ. | dB |
| Cross talk | X _{TALK} | | -64 | - | - | | |
| Total harmonic distortion + N | THD + N | R _L = 100 Ω, 6 V _{p-p} , f = 20 Hz to 20 kHz | 0.055 | - | - | Typ. | % |
| -3dB, bandwidth | BW | R _L = 50 Ω | DG1408E 50 | - | - | Typ. | MHz |
| | | | DG1409E 78 | - | - | | |
| Source off capacitance | C _{S(off)} | f = 1 MHz, V _S = 6 V | 16 | - | - | Typ. | pF |
| Drain off capacitance | C _{D(off)} | | DG1408E 100 | - | - | | |
| | | | DG1409E 53 | - | - | | |
| Drain on capacitance | C _{D(on)} | | DG1408E 122 | - | - | Typ. | |
| | | DG1409E 81 | - | - | | | |
| Power Supply | | | | | | | |
| Power supply range | | GND = 0 V, V ₋ = 0 V | 4.5 / 24 | | | Min. / Max. | V |
| Positive supply current | I ₊ | V _{AX} , V _{EN} = 0 V, V ₊ , V ₊ = +13.2 V, V ₋ = 0 V | 2.8 | 4.8 | 5.5 | Typ. | μA |
| | | | | - | - | 8 | |
| | | V _{AX} , V _{EN} = 5 V, V ₊ = 13.2 V, V ₋ = 0 V | 2.8 | 3.1 | 3.6 | Typ. | |
| | | | | - | - | 8 | |



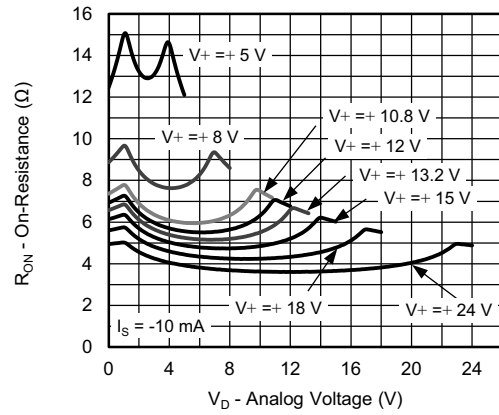
| ELECTRICAL CHARACTERISTICS | | | | | | | |
|--------------------------------|-----------------------|--|----------------|---------------------|----------------------|--------------------------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = -5 V V _{AX} , V _{EN} = 2 V, 0.8 V | +25 °C | -40 °C to +85 °C | -40 °C to +125 °C | MIN. / TYP. / MAX. | UNIT |
| Analog Switch | | | | | | | |
| Analog signal range | V _{ANALOG} | | V- to V+ | | | - | V |
| Drain-source On-resistance | R _{DS(on)} | V _S = ± 3.5 V, I _S = -10 mA, V+ = +4.5 V, V- = -4.5 V | 8.8 | - | - | Typ. | Ω |
| | | | 10 | 12 | 14 | Max. | |
| On-resistance flatness | R _{flat(on)} | | 2 | - | - | Typ. | |
| | | | 2.5 | 3 | 3.2 | Max. | |
| On-resistance matching | ΔR _{DS(on)} | | 0.36 | - | - | Typ. | |
| | | | 0.55 | 1 | 1.5 | Max. | |
| Source off leakage current | I _{S(off)} | V+ = +5.5 V, V- = -5.5 V, V _S = ± 4.5 V, V _D = ± 4.5 V | ± 0.04 | - | - | Typ. | nA |
| | | | ± 0.55 | ± 1 | ± 10 | Max. | |
| Drain off leakage current | I _{D(off)} | | ± 0.04 | - | - | Typ. | |
| | | ± 0.3 | ± 3 | ± 20 | Max. | | |
| Drain on leakage current | I _{D(on)} | V+ = +5.5 V, V- = -5.5 V, V _S = V _D = ± 4.5 V | ± 0.05 | - | - | Typ. | |
| | | | ± 1.5 | ± 4 | ± 30 | Max. | |
| Digital Control | | | | | | | |
| Input, high Voltage | V _{INH} | | - | - | 2 | Min. | V |
| Input, low Voltage | V _{INL} | | - | - | 0.8 | Max. | |
| Input leakage | I _{IN} | V _{IN} = V _{GND} or V+ | 0.017 | - | - | Typ. | μA |
| | | | - | - | ± 0.1 | Max. | |
| Digital input capacitance | C _{IN} | | 3.1 | - | - | Typ. | pF |
| Dynamic Characteristics | | | | | | | |
| Transition time | t _{TRANS} | V _{S1} = +3 V / -3 V, V _{S8} = -3 V / +3 V, R _L = 100 Ω, C _L = 35 pF | 160 | - | - | Typ. | ns |
| | | | 210 | 260 | 280 | Max. | |
| Break-before-make time | t _{OPEN} | V _{S1} = V _{S8} = 3 V, R _L = 100 Ω, C _L = 35 pF | 73 | - | - | Typ. | |
| | | | - | - | 10 | Min. | |
| Enable turn-on time | t _{ON(EN)} | V _{S1} = 3 V, V _{S2} - V _{S8} = 0 V, R _L = 100 Ω, C _L = 35 pF | 120 | - | - | Typ. | |
| | | | | 160 | 200 | 230 | |
| Enable turn-off time | t _{OFF(EN)} | | | 86 | - | - | Typ. |
| | | | 110 | 132 | 155 | Max. | |
| Charge injection | Q _{INJ} | C _{INJ} = 1 nF, R _{GEN} = 0 Ω, V _S = 0 V | DG1408E 7 | - | - | Typ. | pC |
| | | | DG1409E -15 | - | - | | |
| Off isolation | OIRR | C _L = 5 pF, R _L = 50 Ω, 1 MHz | -58 | - | - | Typ. | dB |
| Cross talk | X _{TALK} | | -64 | - | - | | |
| Total harmonic distortion + N | THD + N | R _L = 100 Ω, 5 V _{p-p} , f = 20 Hz to 20 kHz | 0.07 | - | - | Typ. | % |
| -3dB, bandwidth | BW | R _L = 50 Ω | DG1408E 46 | - | - | Typ. | MHz |
| | | | DG1409E 78 | - | - | | |
| Source off capacitance | C _{S(off)} | f = 1 MHz, V _S = 0 V | 17 | - | - | Typ. | pF |
| Drain off capacitance | C _{D(off)} | | DG1408E 109 | - | - | Typ. | |
| | | | DG1409E 55 | - | - | | |
| Drain on capacitance | C _{D(on)} | | DG1408E 126 | - | - | Typ. | |
| | | DG1409E 83 | - | - | | | |
| Power Supply | | | | | | | |
| Power supply range | | GND = 0 V | ± 4.5 / ± 16.5 | | | Min. / Max. | V |
| Positive supply current | I+ | V _{AX} , V _{EN} = 0 V, 3 V, V+, V+ = +5.5 V, V- = -5.5 V | 1.7 | 2.2 | 2.4 | Typ. | μA |
| | | | - | - | 5 | Max. | |
| Negative supply current | I- | V _{AX} , V _{EN} = 0 V, V+, V+ = +5.5 V, V- = -5.5 V | 0.08 | 0.12 | 0.14 | Typ. | μA |
| | | | - | - | 1 | Max. | |



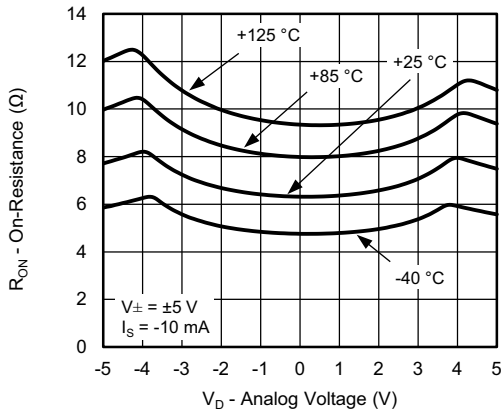
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



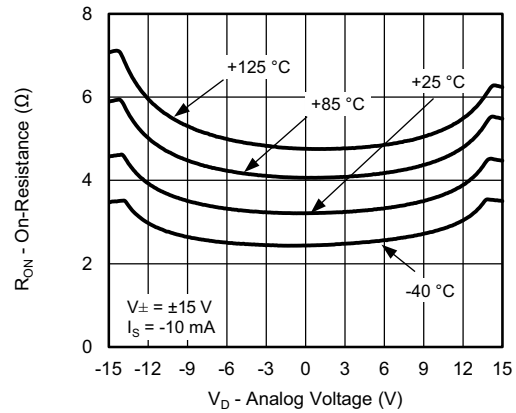
On-Resistance vs. Analog Voltage



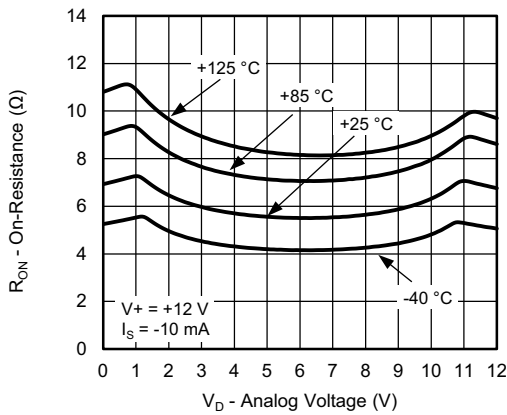
On-Resistance vs. Analog Voltage



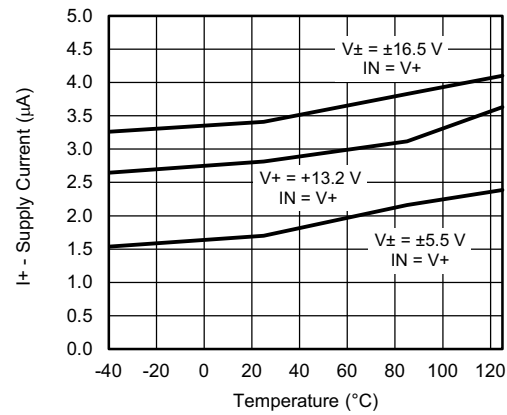
On-Resistance vs. Analog Voltage



On-Resistance vs. Analog Voltage



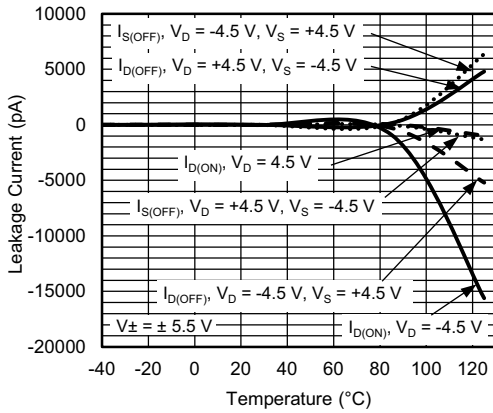
On-Resistance vs. Analog Voltage



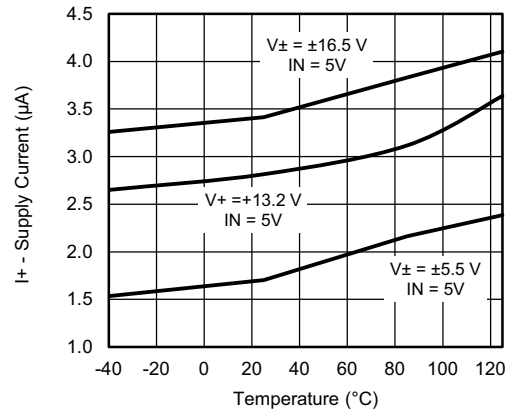
Supply Current vs. Temperature



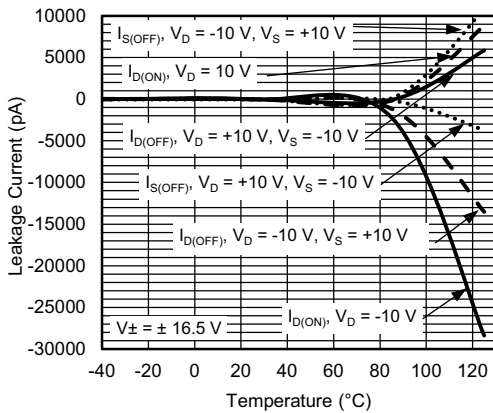
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



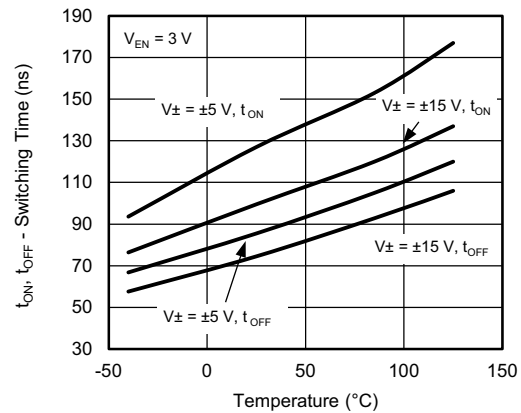
Leakage Current vs. Temperature



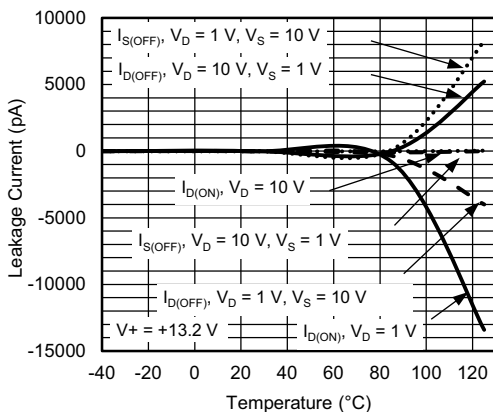
Supply Current vs. Temperature



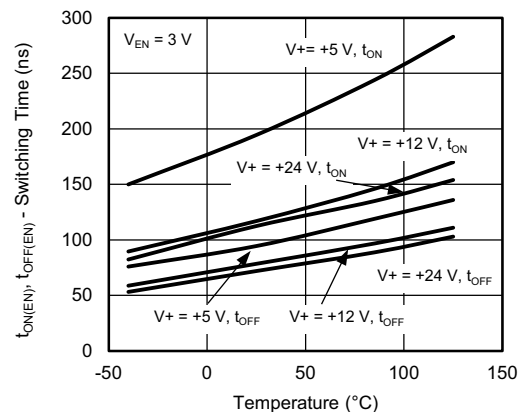
Leakage Current vs. Temperature



Switching Time vs. Temperature

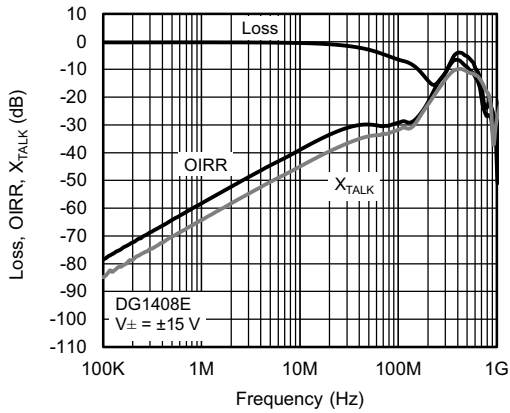


Leakage Current vs. Temperature

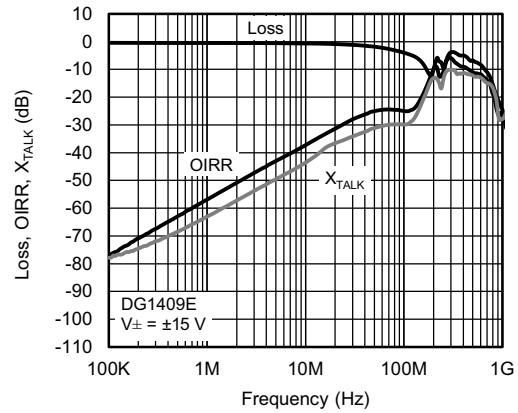


Switching Time vs. Temperature

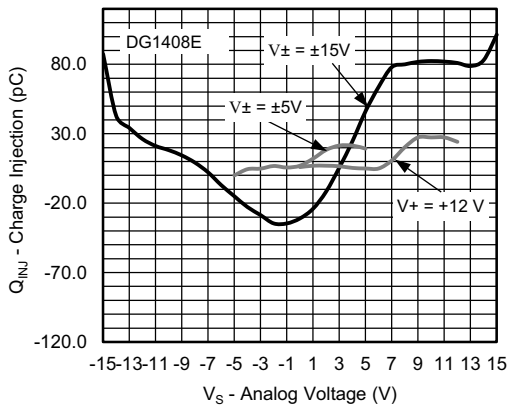
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



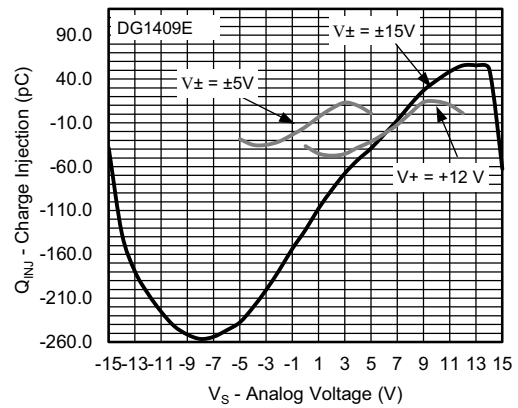
Loss, OIRR, X_{TALK} vs. Frequency



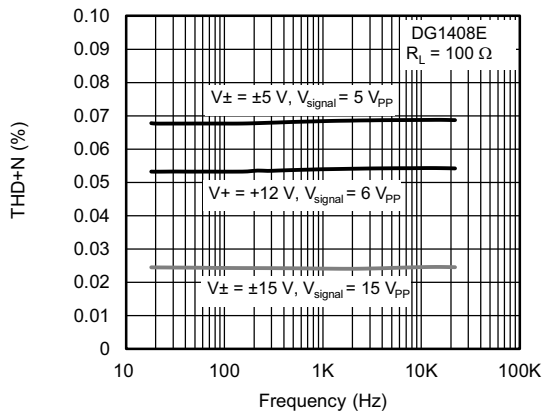
Loss, OIRR, X_{TALK} vs. Frequency



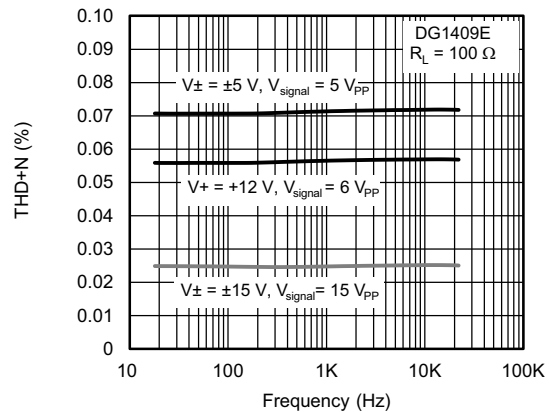
Charge Injection vs. Source Voltage



Charge Injection vs. Source Voltage



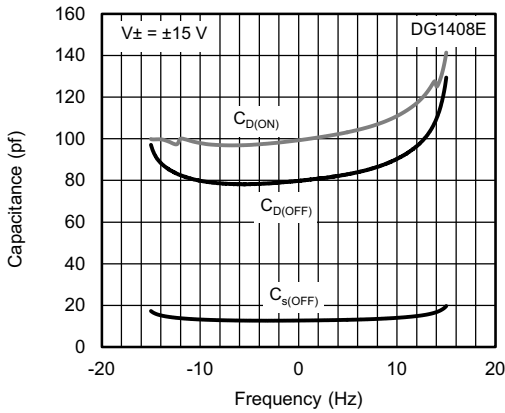
THD + N vs. Frequency



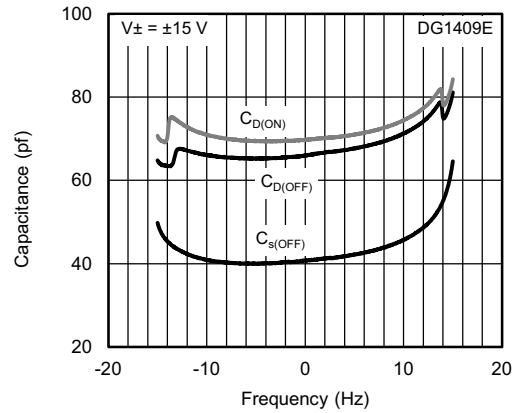
THD + N vs. Frequency



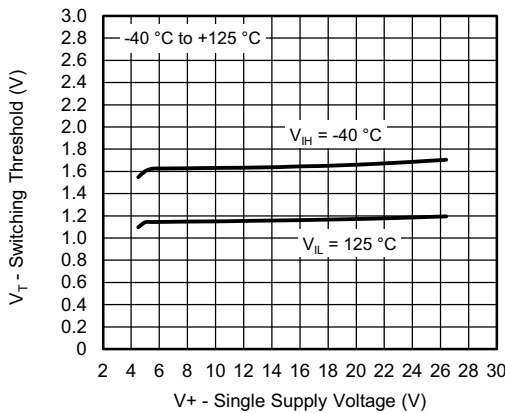
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



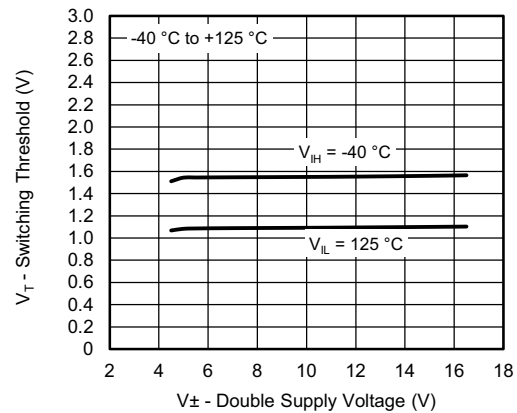
Capacitance vs. Analog Voltage



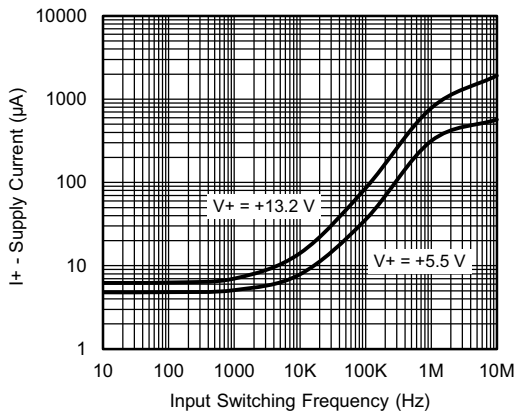
Capacitance vs. Analog Voltage



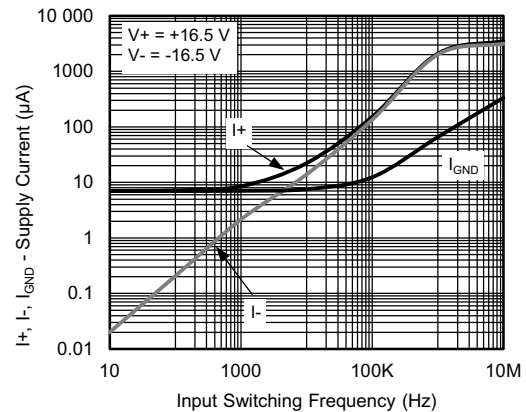
Switching Threshold vs. Supply Voltage



Switching Threshold vs. Supply Voltage



Positive Supply Current vs. Switching Frequency



Double Supply Current vs. Switching Frequency

TEST CIRCUITS

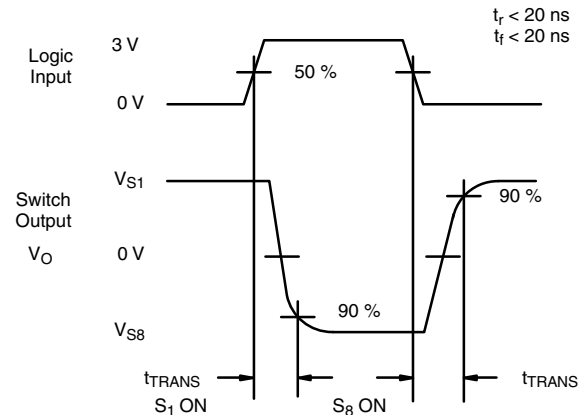
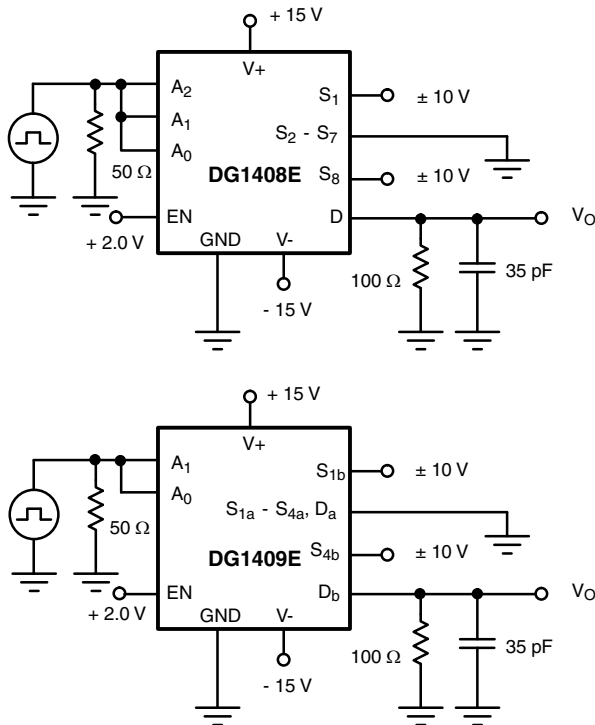


Fig. 1 - Transition Time

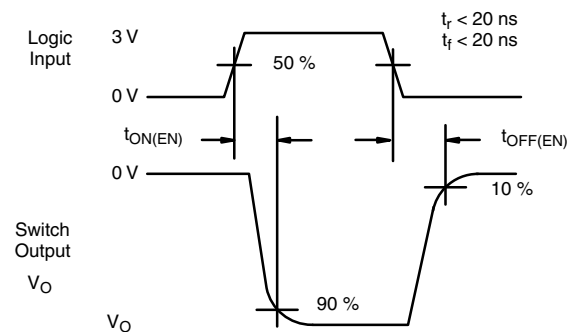
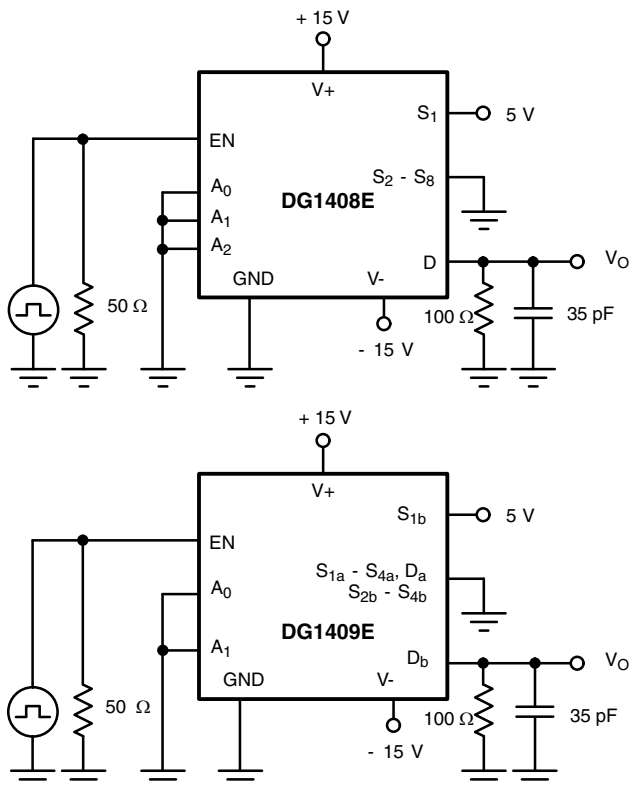


Fig. 2 - Enable Switching Time

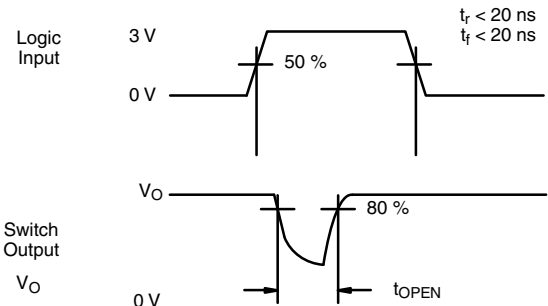
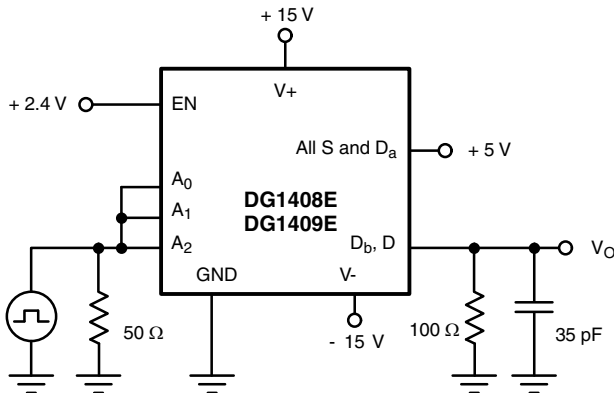


Fig. 3 - Break-Before-Make Internal

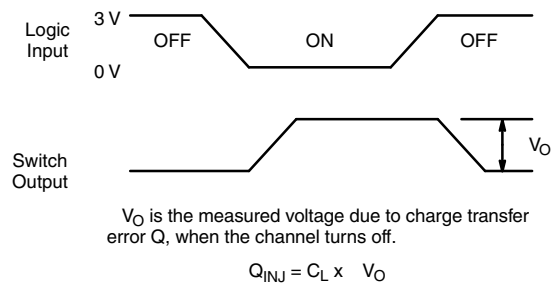
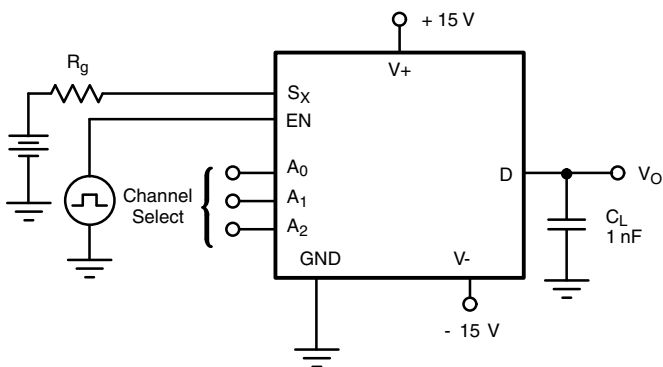


Fig. 4 - Charge Injection

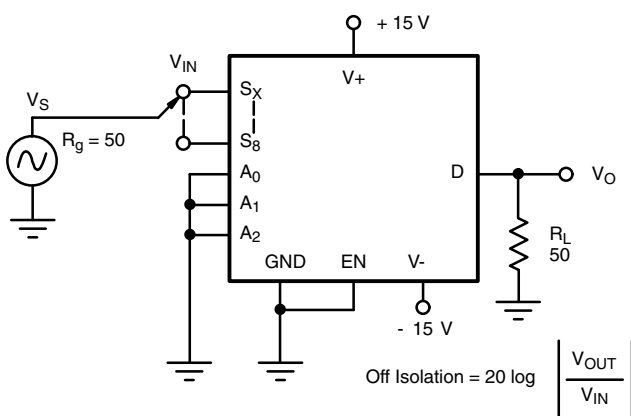


Fig. 5 - Off-Isolation

$$\text{Off Isolation} = 20 \log \left| \frac{V_{OUT}}{V_{IN}} \right|$$

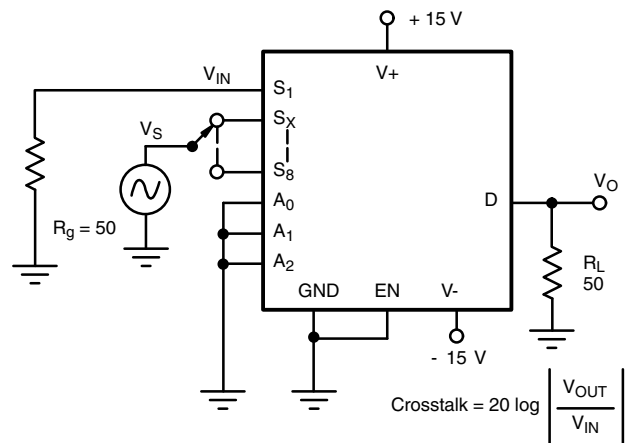
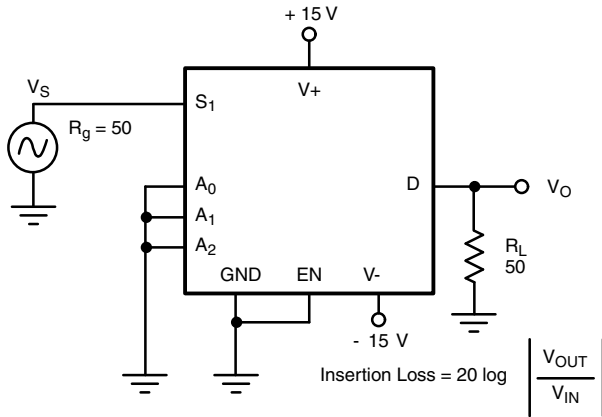
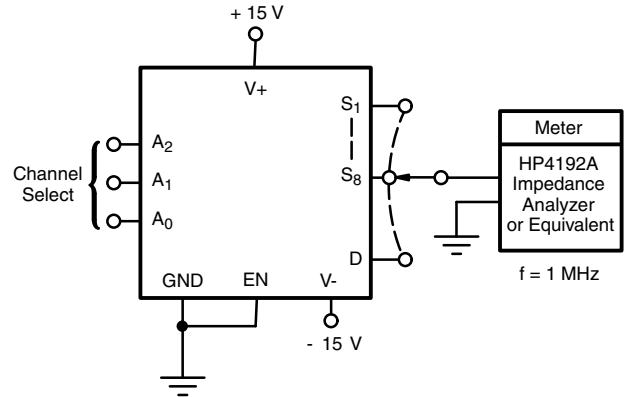


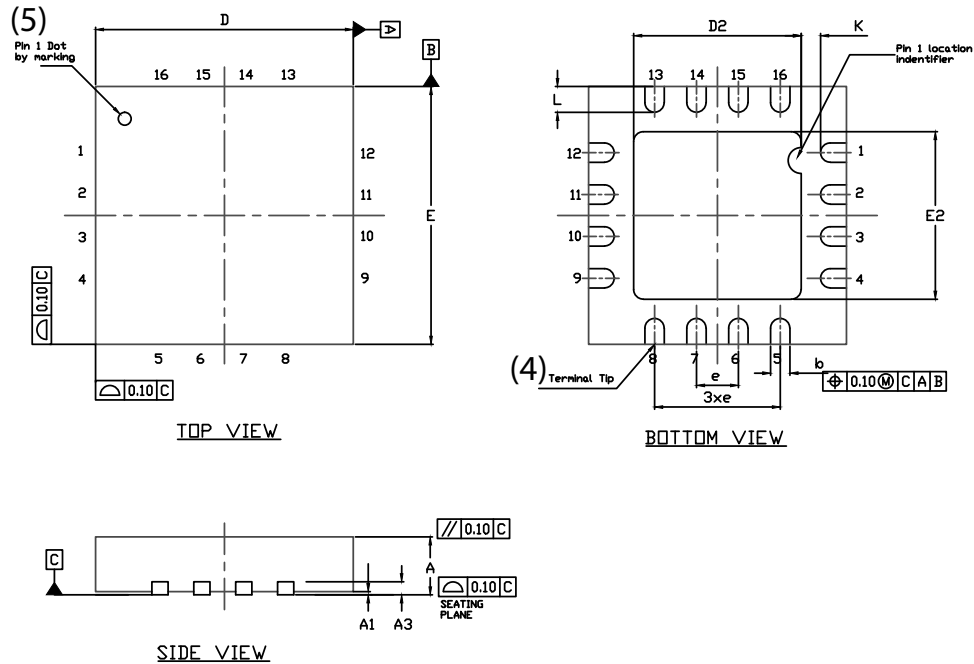
Fig. 6 - Crosstalk

$$\text{Crosstalk} = 20 \log \left| \frac{V_{OUT}}{V_{IN}} \right|$$


Fig. 7 - Insertion Loss

Fig. 8 - Source Drain Capacitance

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QFN 4x4-16L Case Outline



| DIM | VARIATION 1 | | | | | | VARIATION 2 | | | | | |
|-------------------|----------------------------|------|------|------------|-------|-------|----------------------------|------|------|------------|-------|-------|
| | MILLIMETERS ⁽¹⁾ | | | INCHES | | | MILLIMETERS ⁽¹⁾ | | | INCHES | | |
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.75 | 0.85 | 0.95 | 0.029 | 0.033 | 0.037 | 0.75 | 0.85 | 0.95 | 0.029 | 0.033 | 0.037 |
| A1 | 0 | - | 0.05 | 0 | - | 0.002 | 0 | - | 0.05 | 0 | - | 0.002 |
| A3 | 0.20 ref. | | | 0.008 ref. | | | 0.20 ref. | | | 0.008 ref. | | |
| b | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| D | 4.00 BSC | | | 0.157 BSC | | | 4.00 BSC | | | 0.157 BSC | | |
| D2 | 2.0 | 2.1 | 2.2 | 0.079 | 0.083 | 0.087 | 2.5 | 2.6 | 2.7 | 0.098 | 0.102 | 0.106 |
| e | 0.65 BSC | | | 0.026 BSC | | | 0.65 BSC | | | 0.026 BSC | | |
| E | 4.00 BSC | | | 0.157 BSC | | | 4.00 BSC | | | 0.157 BSC | | |
| E2 | 2.0 | 2.1 | 2.2 | 0.079 | 0.083 | 0.087 | 2.5 | 2.6 | 2.7 | 0.098 | 0.102 | 0.106 |
| K | 0.20 min. | | | 0.008 min. | | | 0.20 min. | | | 0.008 min. | | |
| L | 0.5 | 0.6 | 0.7 | 0.020 | 0.024 | 0.028 | 0.3 | 0.4 | 0.5 | 0.012 | 0.016 | 0.020 |
| N ⁽³⁾ | 16 | | | 16 | | | 16 | | | 16 | | |
| Nd ⁽³⁾ | 4 | | | 4 | | | 4 | | | 4 | | |
| Ne ⁽³⁾ | 4 | | | 4 | | | 4 | | | 4 | | |

Notes

- (1) Use millimeters as the primary measurement.
- (2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
- (3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
- (4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
- (5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
- (6) Package warpage max. 0.05 mm.

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 DWG: 5890



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