

Quad SPST CMOS Analog Switches

FEATURES

- Low On-Resistance: 50 Ω
- Low Leakage: 80 pA
- Low Power Consumption: 22 nW
- Fast Switching Action— t_{ON} : 120 ns
- Low Charge Injection
- DG211/DG212 Upgrades
- TTL/CMOS Logic Compatible

BENEFITS

- Low Signal Errors and Distortion
- Reduced Power Supply Requirements
- Faster Throughput
- Improved Reliability
- Reduced Pedestal Errors
- Simple Interfacing

APPLICATIONS

- Audio Switching
- Battery Powered Systems
- Data Acquisition
- Sample-and-Hold Circuits
- Telecommunication Systems
- Automatic Test Equipment
- Single Supply Circuits
- Hard Disk Drives

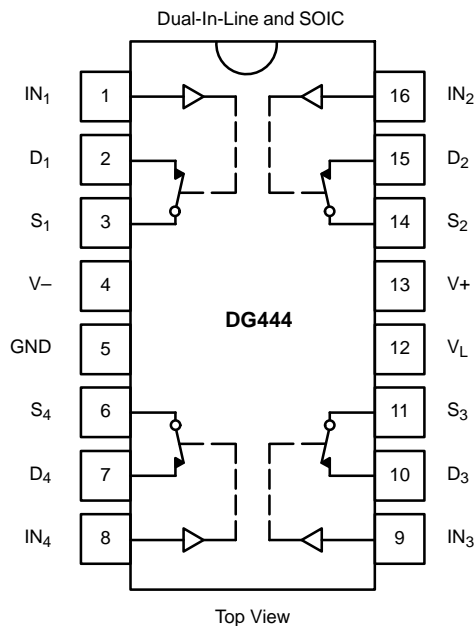
DESCRIPTION

The DG444/DG445 monolithic quad analog switches are designed to provide high speed, low error switching of analog signals. The DG444 has a normally closed function. The DG445 has a normally open function. Combining low power (22 nW, typ) with high speed (t_{ON} : 120 ns, typ), the DG444/DG445 are ideally suited for upgrading DG211/212 sockets. Charge injection has been minimized on the drain for use in sample-and-hold circuits.

To achieve high-voltage ratings and superior switching performance, the DG444/DG445 are built on Vishay Siliconix's high-voltage silicon-gate process. An epitaxial layer prevents latchup.

Each switch conducts equally well in both directions when on, and blocks input voltages to the supply levels when off.

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



| TRUTH TABLE | | |
|-------------|-------|-------|
| Logic | DG444 | DG445 |
| 0 | ON | OFF |
| 1 | OFF | ON |

Logic "0" \leq 0.8 V
Logic "1" \geq 2.4 V

| ORDERING INFORMATION | | |
|----------------------|--------------------|-------------|
| Temp Range | Package | Part Number |
| -40°C to 85°C | 16-Pin Plastic DIP | DG444DJ |
| | | DG445DJ |
| | 16-Pin Narrow SOIC | DG444DY |
| | | DG445DY |



ABSOLUTE MAXIMUM RATINGS

| | |
|---|--|
| V+ to V- | 44 V |
| GND to V- | 25 V |
| V _L | (GND -0.3 V) to (V+) + 0.3 V |
| Digital Inputs ^a V _S , V _D | (V-) -2 V to (V+) +2 V or 30 mA, whichever occurs first |
| Continuous Current (Any Terminal) | 30 mA |
| Current, S or D (Pulsed 1 ms, 10% duty cycle) | 100 mA |
| Storage Temperature | -65 to 125°C |

| | |
|--|--------|
| Power Dissipation (Package) ^b | |
| 16-Pin Plastic DIP ^c | 450 mW |
| 16-Pin Narrow Body SOIC ^d | 640 mW |

- Notes:
- Signals on S_X, D_X, or I_{NX} exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
 - All leads welded or soldered to PC Board.
 - Derate 6 mW/°C above 75°C
 - Derate 8 mW/°C above 75°C

| SPECIFICATIONS FOR DUAL SUPPLIES | | | | | | | | | |
|---|---------------------|---|---------------------------|-------------------------|------------------|------------------|--------|----|-----|
| 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 ^e | Temp ^a | D Suffix -40 to 85°C | | | Unit | | |
| | | | | Min ^b | Typ ^c | Max ^b | | | |
| Analog Switch | | | | | | | | | |
| Analog Signal Range ^d | V _{ANALOG} | | Full | -15 | | 15 | V | | |
| Drain-Source On-Resistance | r _{DS(on)} | I _S = -10 mA, V _D = ±8.5 V V+ = 13.5 V, V- = -13.5 V | Room Full | | 50 | 85 100 | Ω | | |
| Switch Off Leakage Current | I _{S(off)} | V+ = 16.5 V, V- = -16.5 V V _D = ±15.5 V, V _S = ∓15.5 V | Room Full | -0.5 -5 | ±0.01 | 0.5 5 | nA | | |
| | I _{D(off)} | | Room Full | -0.5 -5 | ±0.01 | 0.5 5 | | | |
| Channel On Leakage Current | I _{D(on)} | V+ = 16.5 V, V- = -16.5 V V _S = V _D = ±15.5 V | Room Full | -0.5 -10 | ±0.08 | 0.5 10 | | | |
| Digital Control | | | | | | | | | |
| Input Current V _{IN} Low | I _{IL} | V _{IN} under test = 0.8 V All Other = 2.4 V | Full | -500 | -0.01 | 500 | nA | | |
| Input Current V _{IN} High | I _{IH} | V _{IN} under test = 2.4 V All Other = 0.8 V | Full | -500 | 0.01 | 500 | | | |
| Dynamic Characteristics | | | | | | | | | |
| Turn-On Time | t _{ON} | R _L = 1 kΩ, C _L = 35 pF V _S = ±10 V, See Figure 2 | Room | | | 120 | 250 | ns | |
| Turn-Off Time | t _{OFF} | | DG444 | Room | | | 110 | | 140 |
| | | | DG445 | Room | | | 160 | | 210 |
| Charge Injection ^e | Q | C _L = 1 nF, V _S = 0 V V _{gen} = 0 V, R _{gen} = 0 Ω | Room | | | -1 | | pC | |
| Off Isolation ^e | OIRR | R _L = 50 Ω, C _L = 5 pF, f = 1 MHz | Room | | | 60 | | dB | |
| Crosstalk (Channel-to-Channel) ^d | X _{TALK} | | Room | | | 100 | | | |
| Source Off Capacitance | C _{S(off)} | f = 1 MHz | Room | | | 4 | | pF | |
| Drain Off Capacitance | C _{D(off)} | | Room | | | 4 | | | |
| Channel On Capacitance | C _{D(on)} | | V _{ANALOG} = 0 V | Room | | | 16 | | |
| Power Supplies | | | | | | | | | |
| Positive Supply Current | I+ | V+ = 16.5 V, V- = -16.5 V V _{IN} = 0 or 5 V | Room Full | | | 0.001 | 1 5 | μA | |
| Negative Supply Current | I- | | Room Full | -1 -5 | | -0.0001 | | | |
| Logic Supply Current | I _L | | Room Full | | | 0.001 | 1 5 | | |
| Ground Current | I _{GND} | | Room Full | -1 -5 | | -0.001 | | | |



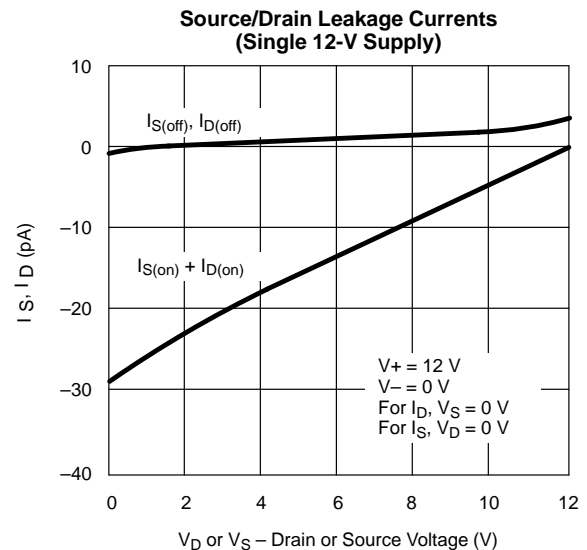
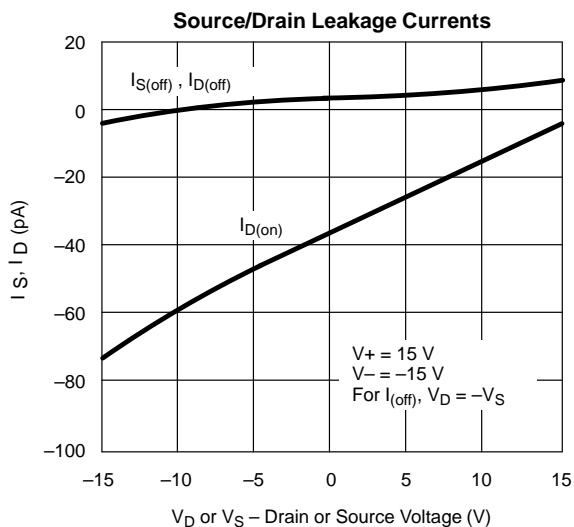
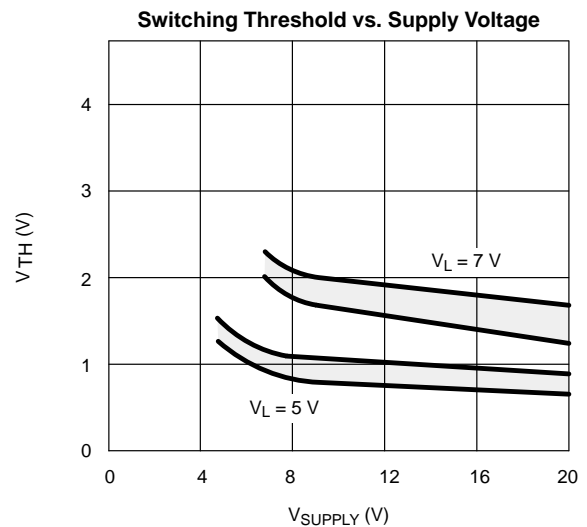
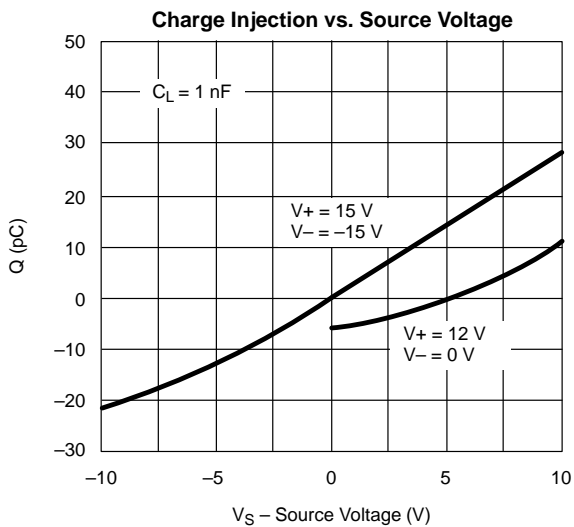
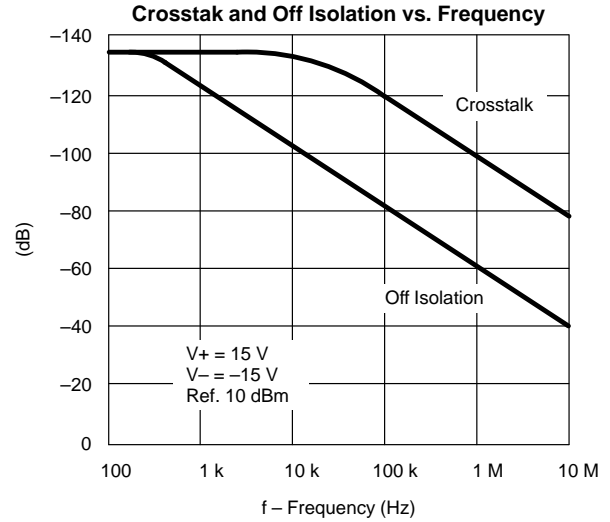
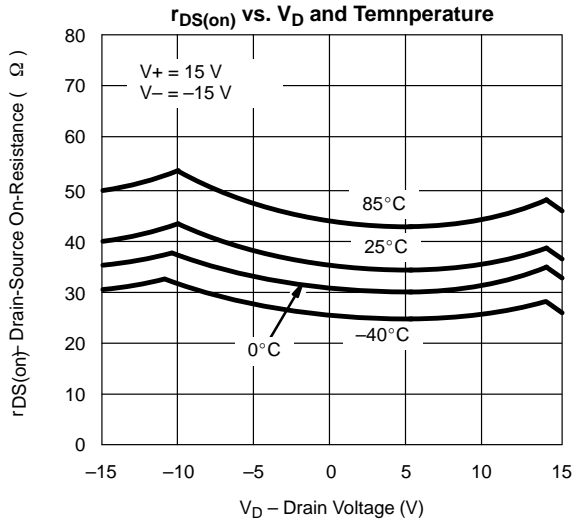
| SPECIFICATIONS FOR UNIPOLAR SUPPLIES | | | | | | | |
|---|--------------|--|-------------------|-------------------------|------------------|------------------|---------------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_+ = 12\text{ V}$, $V_- = 0\text{ V}$ $V_L = 5\text{ V}$, $V_{IN} = 2.4\text{ V}$, 0.8 V^e | Temp ^a | D Suffix -40 to 85°C | | | Unit |
| | | | | Min ^b | Typ ^c | Max ^b | |
| Analog Switch | | | | | | | |
| Analog Signal Range ^d | V_{ANALOG} | | Full | 0 | | 12 | V |
| Drain-Source On-Resistance ^d | $r_{DS(on)}$ | $I_S = -10\text{ mA}$, $V_D = 3\text{ V}$, 8 V $V_+ = 10.8\text{ V}$, $V_L = 5.25\text{ V}$ | Room Full | | 100 | 160 200 | Ω |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t_{ON} | $R_L = 1\text{ k}\Omega$, $C_L = 35\text{ pF}$, $V_S = 8\text{ V}$ See Figure 2 | Room | | 300 | 450 | ns |
| Turn-Off Time | t_{OFF} | | Room | | 60 | 200 | |
| Charge Injection | Q | $C_L = 1\text{ nF}$, $V_{gen} = 6\text{ V}$, $R_{gen} = 0\ \Omega$ | Room | | 2 | | pC |
| Power Supplies | | | | | | | |
| Positive Supply Current | I_+ | $V_+ = 13.2\text{ V}$, $V_{IN} = 0\text{ or }5\text{ V}$ | Room Full | | 0.001 | 1 5 | μA |
| Negative Supply Current | I_- | $V_{IN} = 0\text{ or }5\text{ V}$ | Room Full | -1 -5 | -0.0001 | | |
| Logic Supply Current | I_L | $V_L = 5.25\text{ V}$, $V_{IN} = 0\text{ or }5\text{ V}$ | Room Full | | 0.001 | 1 5 | |
| Ground Current | I_{GND} | $V_{IN} = 0\text{ or }5\text{ V}$ | Room Full | -1 -5 | -0.001 | | |

Notes:

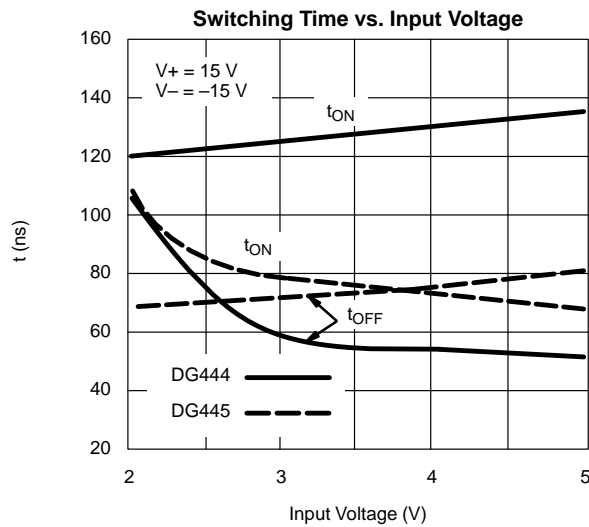
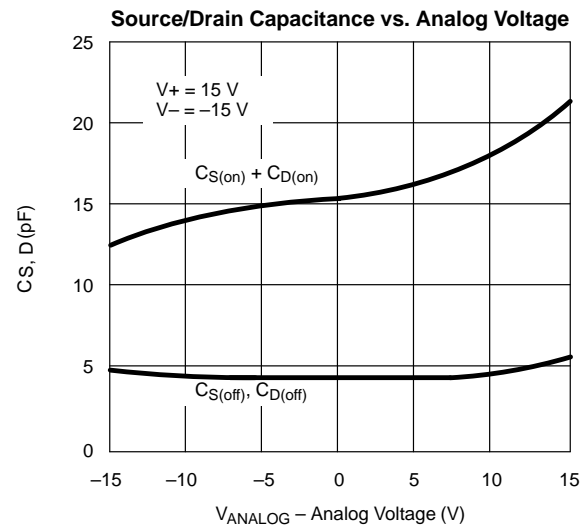
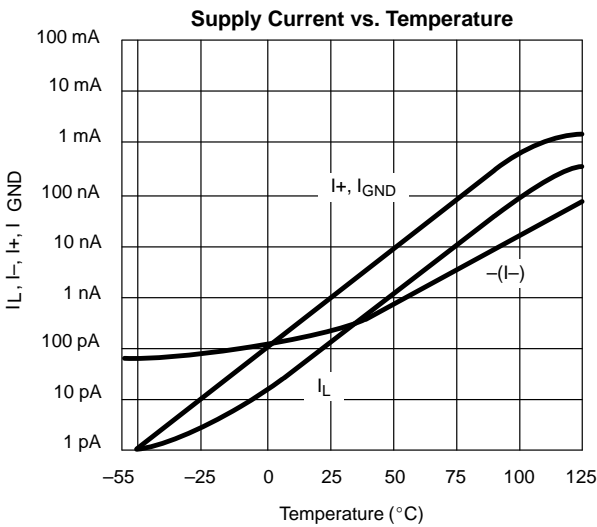
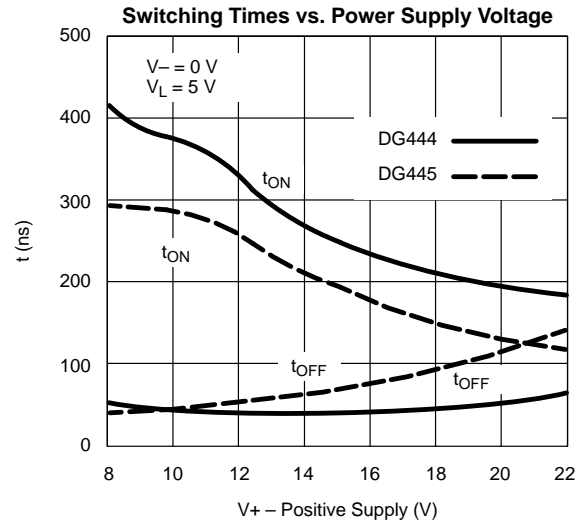
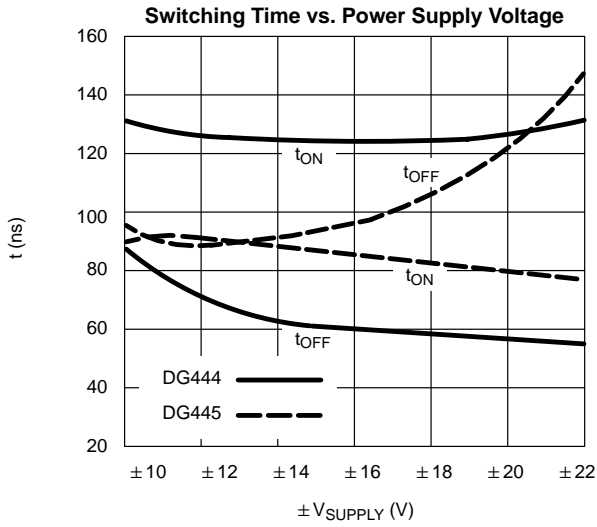
- Room = 25°C, Full = as determined by the operating temperature suffix.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- Guaranteed by design, not subject to production test.
- V_{IN} = input voltage to perform proper function.



TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

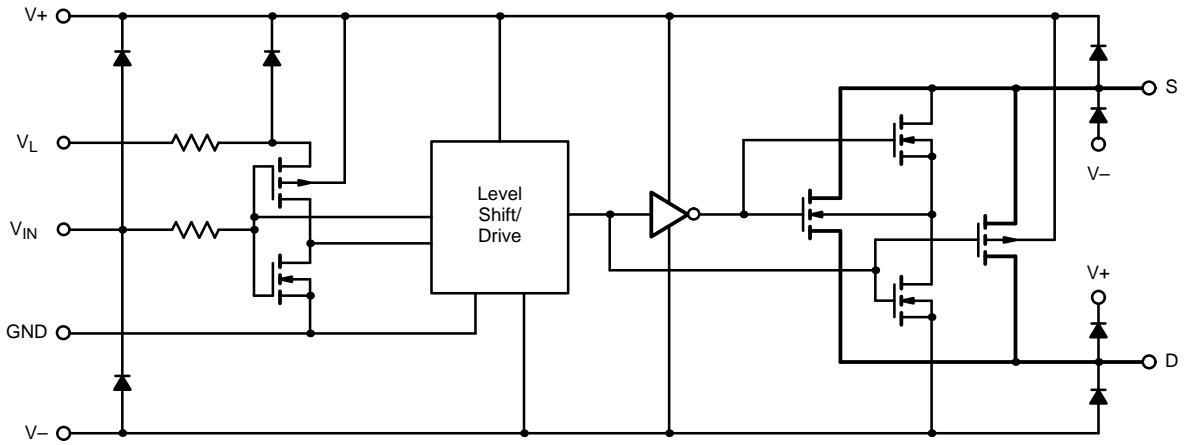
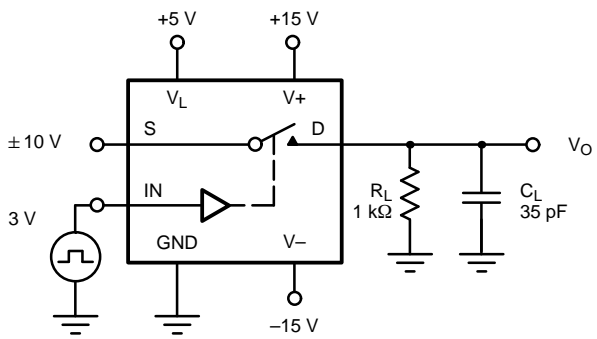
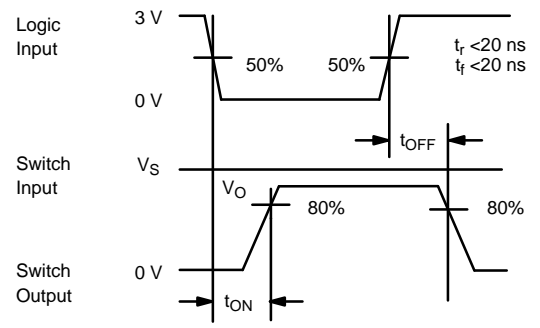


FIGURE 1.

TEST CIRCUITS



C_L (includes fixture and stray capacitance)



Note: Logic input waveform is inverted for DG445.

FIGURE 2. Switching Time

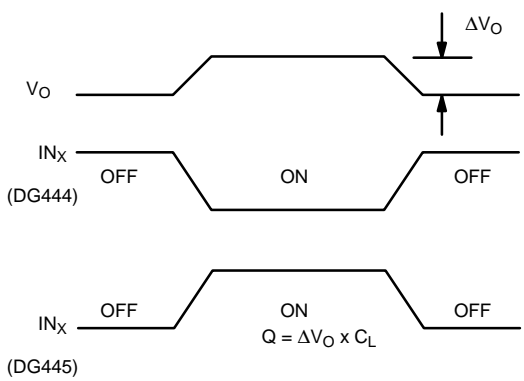
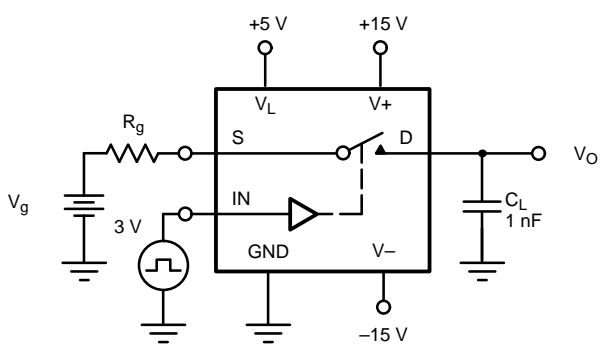


FIGURE 3. Charge Injection

TEST CIRCUITS

C = 1 mF tantalum in parallel with 0.01 mF ceramic

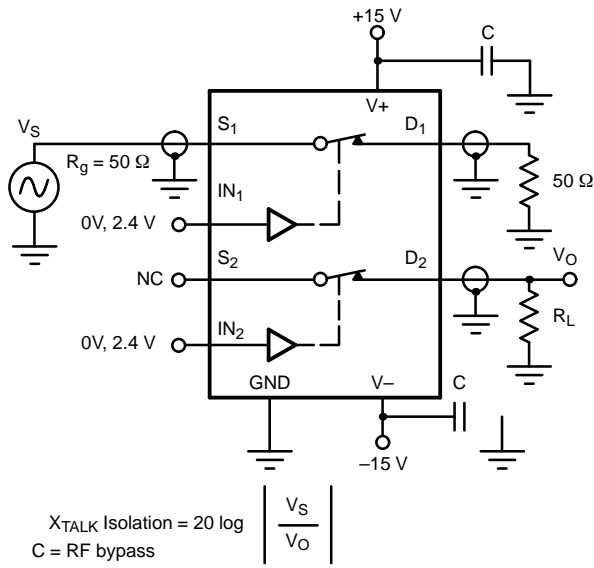


FIGURE 4. Crosstalk

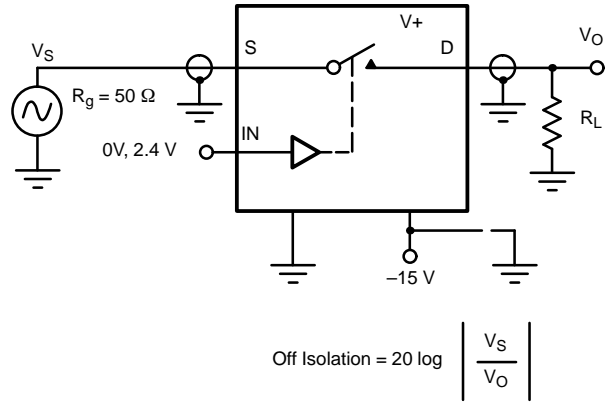
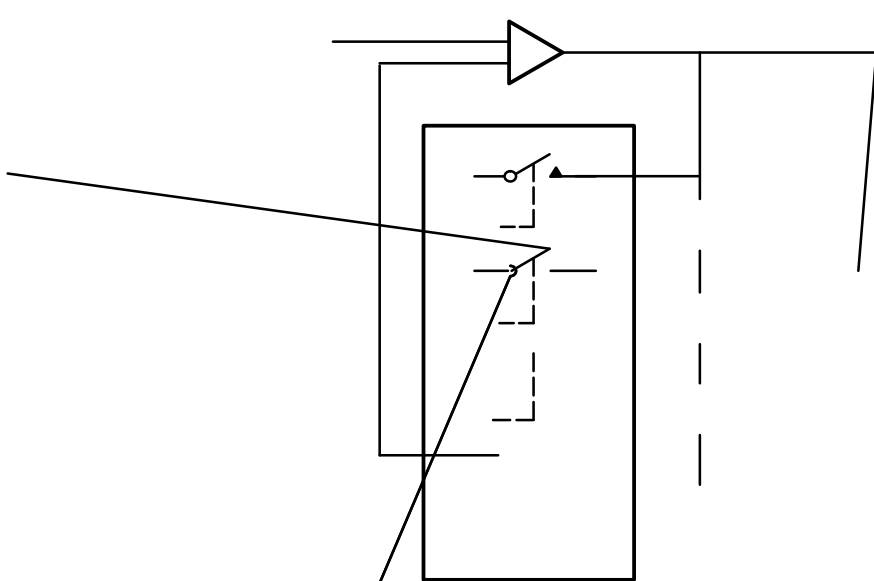


FIGURE 5. Off Isolation

FIGURE 6. Source/Drain Capacitances

APPLICATIONS





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