

Quad SPST CMOS Analog Switches

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, DG212 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.

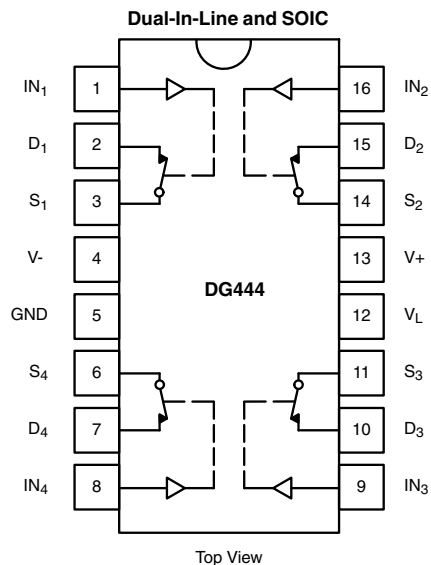
FEATURES

- 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

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



| TRUTH TABLE | | |
|-------------|-------|-------|
| Logic | DG444 | DG445 |
| 0 | On | Off |
| 1 | Off | On |

Logic "0" ≤ 0.8 V
 Logic "1" ≥ 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 (T _A = 25 °C, unless otherwise noted) | | | |
|---|--|-----|------|
| Parameter | Limit | | Unit |
| V ₊ to V ₋ | 44 | | V |
| GND to V ₋ | 25 | | |
| V _L | (GND - 0.3) to (V ₊) + 0.3 | | |
| Digital Inputs ^a , V _S , V _D | (V ₋) - 2 to (V ₊) + 2 or 30 mA, whichever occurs first | | |
| Continuous Current (Any Terminal) | 30 | | mA |
| Current, S or D (Pulsed at 1 ms, 10 % Duty Cycle) | 100 | | |
| Storage Temperature | - 65 to 125 | | °C |
| Power Dissipation (Package) ^b | 16-Pin Plastic DIP ^c | 450 | mW |
| | 16-Pin Narrow Body SOIC ^d | 640 | |

Notes:

- a. 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.
- b. All leads welded or soldered to PC board.
- c. Derate 6 mW/°C above 75°C.
- d. 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 °C 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 | | | |



| SPECIFICATIONS for Dual Supplies | | | | | | | |
|----------------------------------|------------------|---|--------------------|---------------------------------|-------------------|-------------------|---------------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}$ $V_L = 5\text{ V}, V_{IN} = 2.4\text{ V}, 0.8\text{ V}^e$ | Temp. ^a | D Suffix - 40 °C °C to 85 °C | | | Unit |
| | | | | Min. ^b | Typ. ^c | Max. ^b | |
| Power Supplies | | | | | | | |
| Positive Supply Current | I+ | $V_+ = 16.5\text{ V}, V_- = -16.5\text{ V}$ $V_{IN} = 0\text{ or }5\text{ V}$ | 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 | | |

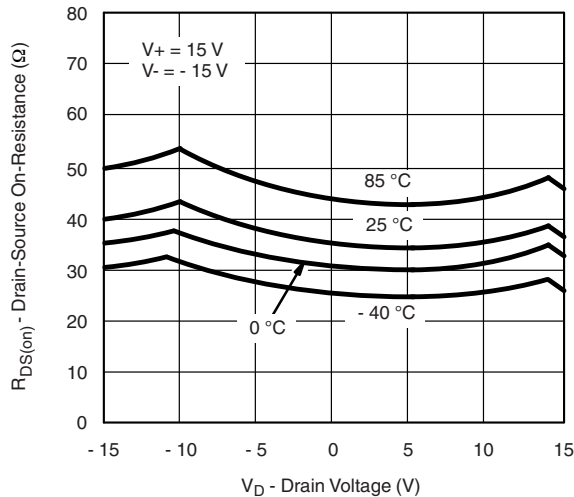
| SPECIFICATIONS for Unipolar Supplies | | | | | | | |
|---|---------------------|---|--------------------|-------------------------------|-------------------|-------------------|---------------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_+ = 12\text{ V}, V_- = 0\text{ V}$ $V_L = 5\text{ V}, V_{IN} = 2.4\text{ V}, 0.8\text{ V}^e$ | Temp. ^a | Limits - 40 °C °C 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)} | $I_S = -10\text{ mA}, V_D = 3\text{ V}, 8\text{ V}$ $V_+ = 10.8\text{ V}, V_L = 5.25\text{ V}$ | 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} | $V_{IN} = 0\text{ or }5\text{ V}$ | Full | -1 -5 | -0.001 | | |

Notes:

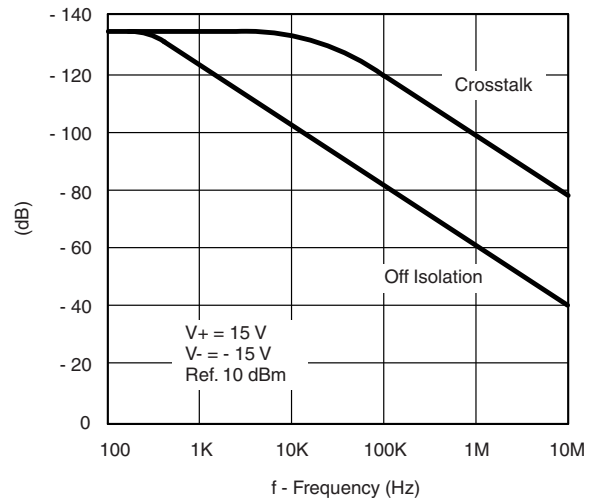
- a. Room = 25 °C, Full = as determined by the operating temperature suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- d. Guaranteed by design, not subject to production test.
- e. 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.

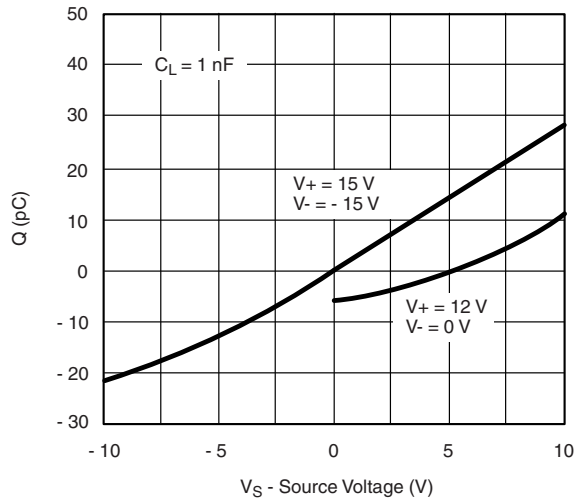
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



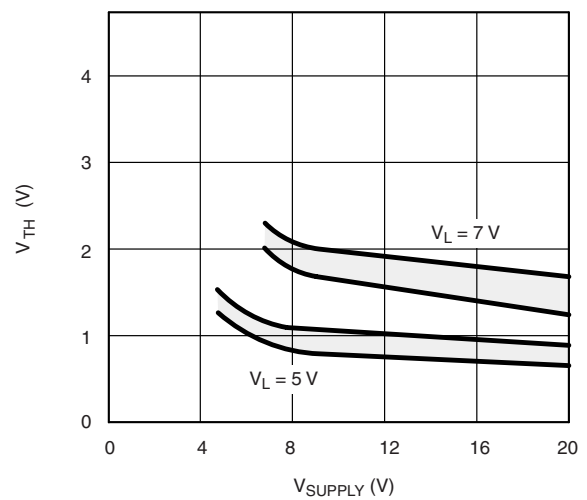
$R_{DS(on)}$ vs. V_D and Temperature



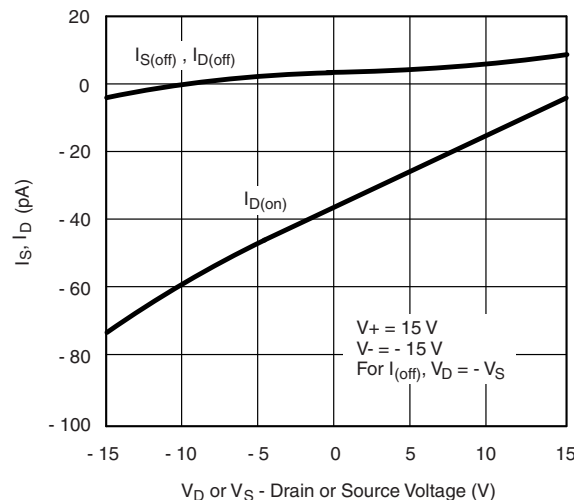
Crosstalk and Off Isolation vs. Frequency



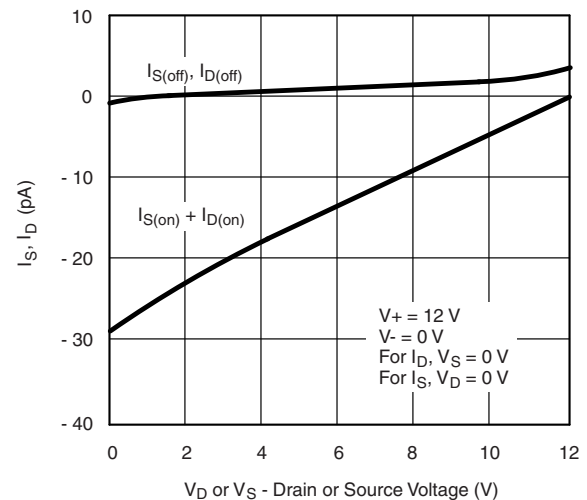
Charge Injection vs. Source Voltage



Switching Threshold vs. Supply Voltage

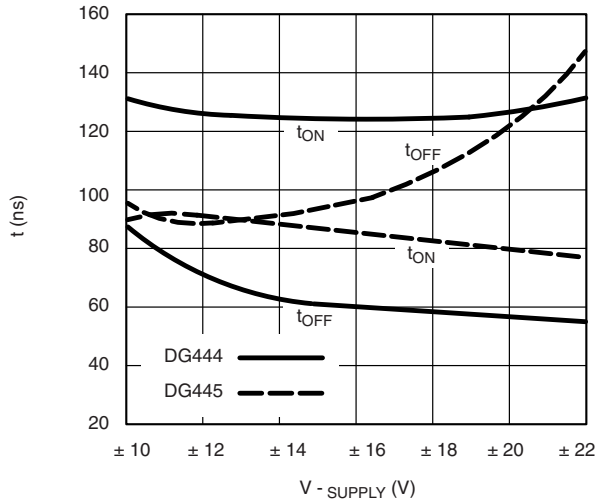


Source/Drain Leakage Currents

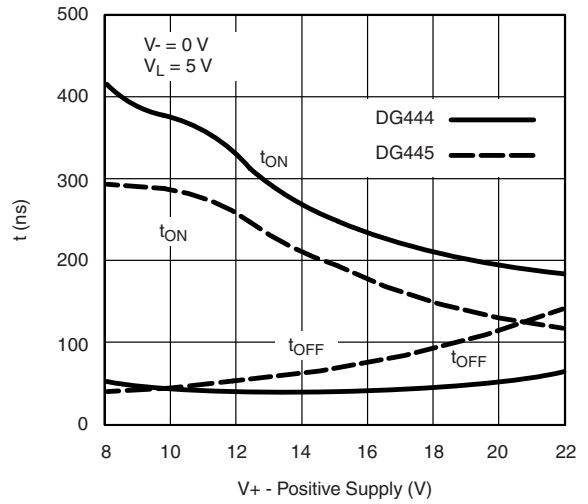


Source/Drain Leakage Currents (Single 12-V Supply)

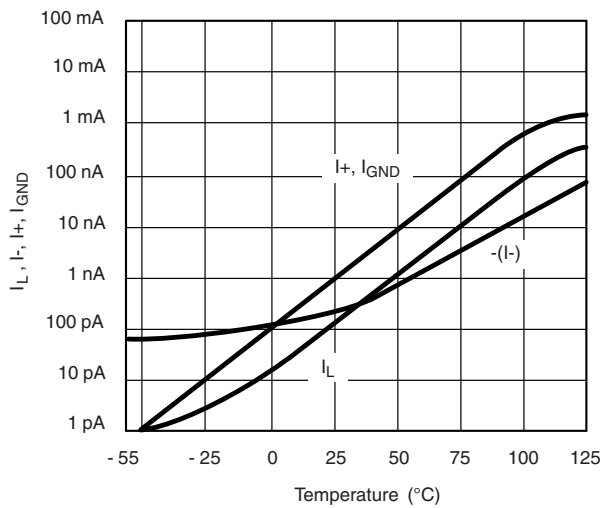
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)



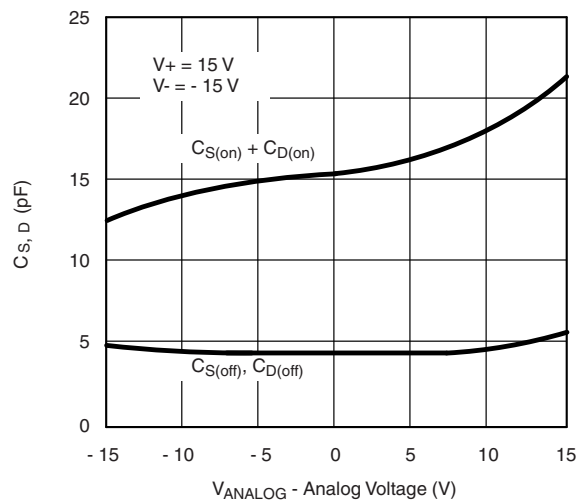
Switching Time vs. Power Supply Voltage



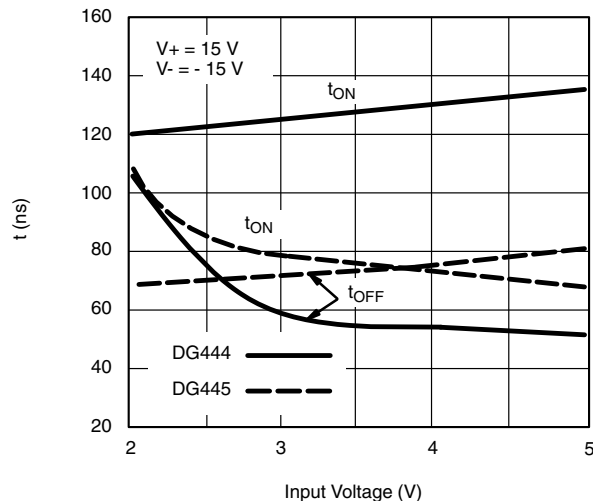
Switching Times vs. Power Supply Voltage



Supply Current vs. Temperature



Source/Drain Capacitance vs. Analog Voltage



Switching Time vs. Input Voltage

TEST CIRCUITS

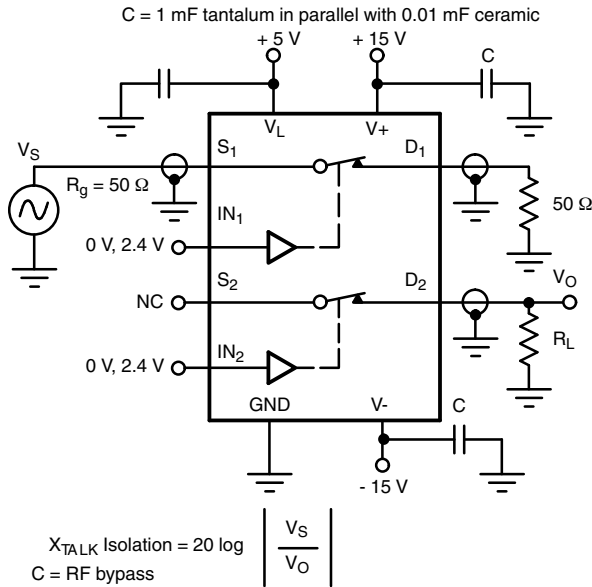


Figure 4. Crosstalk

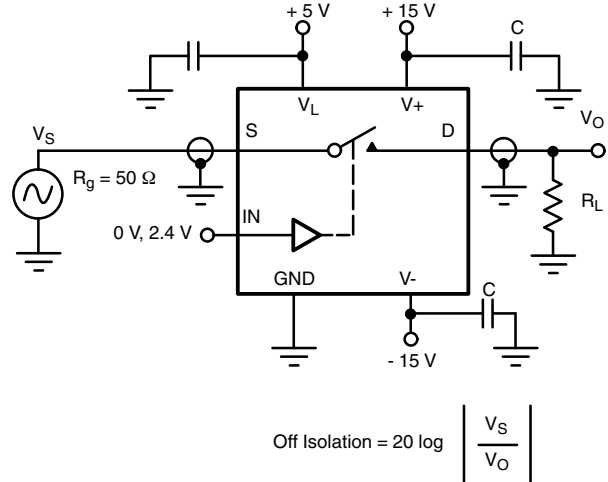


Figure 5. Off Isolation

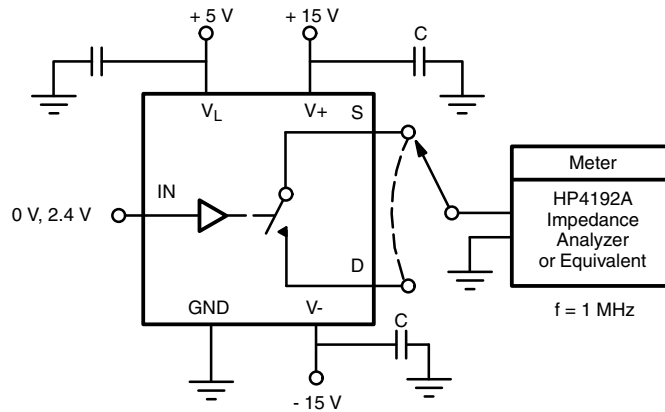


Figure 6. Source/Drain Capacitances

APPLICATIONS

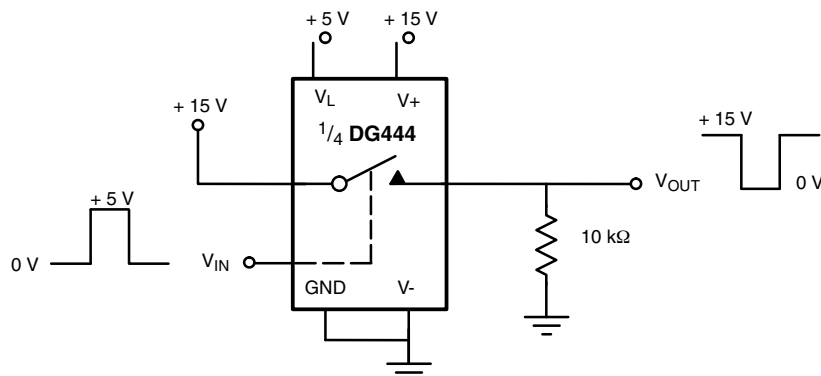


Figure 7. Level Shifter

APPLICATIONS

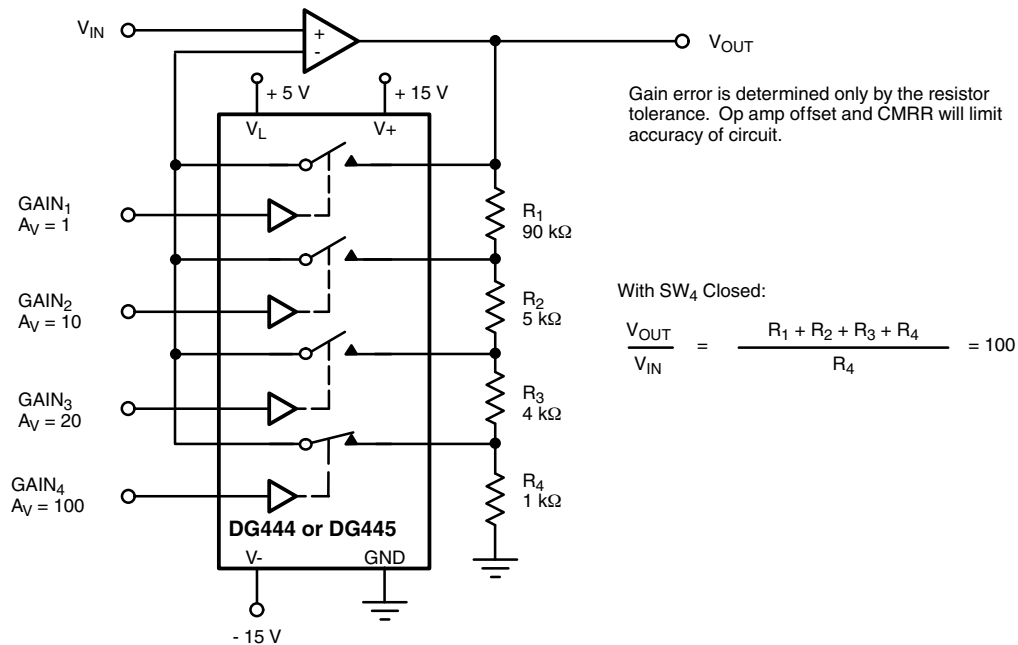


Figure 8. Precision-Weighted Resistor Programmable-Gain Amplifier

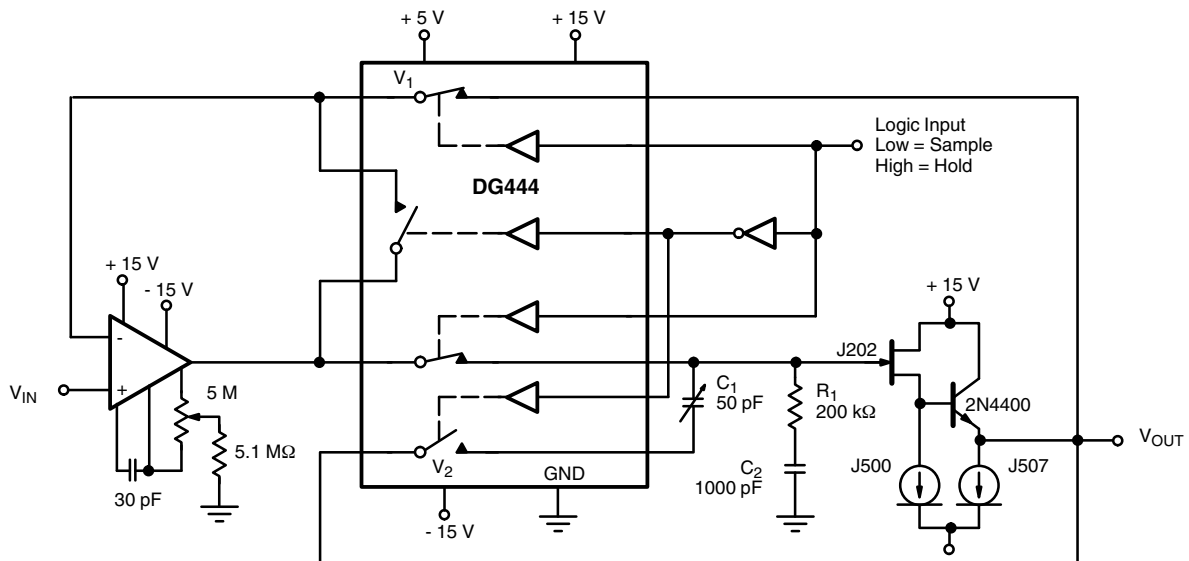


Figure 9. Precision Sample-and-Hold

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?70054.



SOIC (NARROW): 16-LEAD
JEDEC Part Number: MS-012



| Dim | MILLIMETERS | | INCHES | |
|----------------|-------------|-------|-----------|-------|
| | Min | Max | Min | Max |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A ₁ | 0.10 | 0.20 | 0.004 | 0.008 |
| B | 0.38 | 0.51 | 0.015 | 0.020 |
| C | 0.18 | 0.23 | 0.007 | 0.009 |
| D | 9.80 | 10.00 | 0.385 | 0.393 |
| E | 3.80 | 4.00 | 0.149 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| L | 0.50 | 0.93 | 0.020 | 0.037 |
| ∅ | 0° | 8° | 0° | 8° |

ECN: S-03946—Rev. F, 09-Jul-01
DWG: 5300





PDIP: 16-LEAD



| Dim | MILLIMETERS | | INCHES | |
|----------------------|-------------|-------|--------|-------|
| | Min | Max | Min | Max |
| A | 3.81 | 5.08 | 0.150 | 0.200 |
| A₁ | 0.38 | 1.27 | 0.015 | 0.050 |
| B | 0.38 | 0.51 | 0.015 | 0.020 |
| B₁ | 0.89 | 1.65 | 0.035 | 0.065 |
| C | 0.20 | 0.30 | 0.008 | 0.012 |
| D | 18.93 | 21.33 | 0.745 | 0.840 |
| E | 7.62 | 8.26 | 0.300 | 0.325 |
| E₁ | 5.59 | 7.11 | 0.220 | 0.280 |
| e₁ | 2.29 | 2.79 | 0.090 | 0.110 |
| e_A | 7.37 | 7.87 | 0.290 | 0.310 |
| L | 2.79 | 3.81 | 0.110 | 0.150 |
| Q₁ | 1.27 | 2.03 | 0.050 | 0.080 |
| S | 0.38 | 1.52 | .015 | 0.060 |

ECN: S-03946—Rev. D, 09-Jul-01
DWG: 5482

RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



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- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
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- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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