

Quad SPST CMOS Analog Switches

DESCRIPTION

The DG441, DG442 monolithic quad analog switches are designed to provide high speed, low error switching of analog and audio signals. The DG441 has a normally closed function. The DG442 has a normally open function. Combining low on-resistance (50 Ω , typ.) with high speed (t_{ON} 150 ns, typ.), the DG441, DG442 are ideally suited for upgrading DG201A/202 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 DG441, DG442 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

- **Halogen-free according to IEC 61249-2-21 Definition**
- Low on-resistance: 50 Ω
- Low leakage: 80 pA
- Low power consumption: 0.2 mW
- Fast switching action - t_{ON} : 150 ns
- Low charge injection - Q: - 1 pC
- DG201A/DG202 upgrades
- TTL/CMOS-compatible logic
- Single supply capability
- **Compliant to RoHS Directive 2002/95/EC**



RoHS
COMPLIANT
HALOGEN
FREE

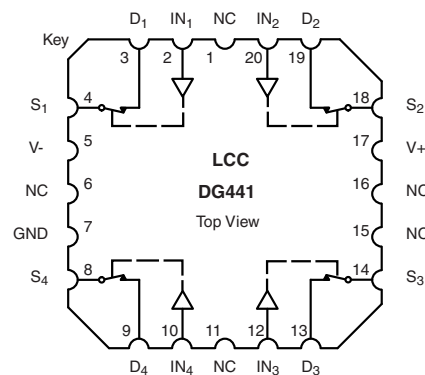
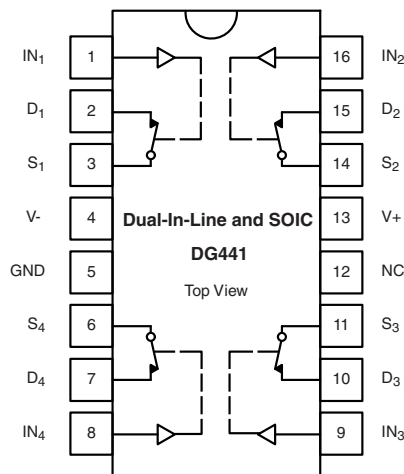
BENEFITS

- Less signal errors and distortion
- Reduced power supply requirements
- Faster throughput
- Improved reliability
- Reduced pedestal errors
- Simplifies retrofit
- Simple interfacing

APPLICATIONS

- Audio switching
- Battery powered systems
- Data acquisition
- Hi-Rel systems
- Sample-and-hold circuits
- Communication systems
- Automatic test equipment
- Medical instruments

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE

| Logic | DG441 | DG442 |
|-------|-------|-------|
| 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 | DG441DJ DG441DJ-E3 |
| | | DG442DJ DG442DJ-E3 |
| | 16-pin narrow SOIC | DG441DY DG441DY-E3 DG441DY-T1 DG441DY-T1-E3 |
| | | DG442DY DG442DY-E3 DG442DY-T1 DG442DY-T1-E3 |

| ABSOLUTE MAXIMUM RATINGS | | | |
|---------------------------------------------------------------|---------------------------------|----------------------------------------------------------|------|
| Parameter | | Limit | Unit |
| V+ to V- | | 44 | V |
| GND to V- | | 25 | |
| 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 | (AK suffix) | - 65 to 150 | °C |
| | (DJ, DY suffix) | - 65 to 125 | |
| Power Dissipation (Package) ^b | 16-pin plastic DIP ^c | 450 | mW |
| | 16-pin CerDIP ^d | 900 | |
| | 16-pin narrow SOIC ^d | 900 | |
| | LCC-20 ^d | 1200 | |

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 12 mW/°C above 75 °C.

SCHEMATIC DIAGRAM Typical Channel

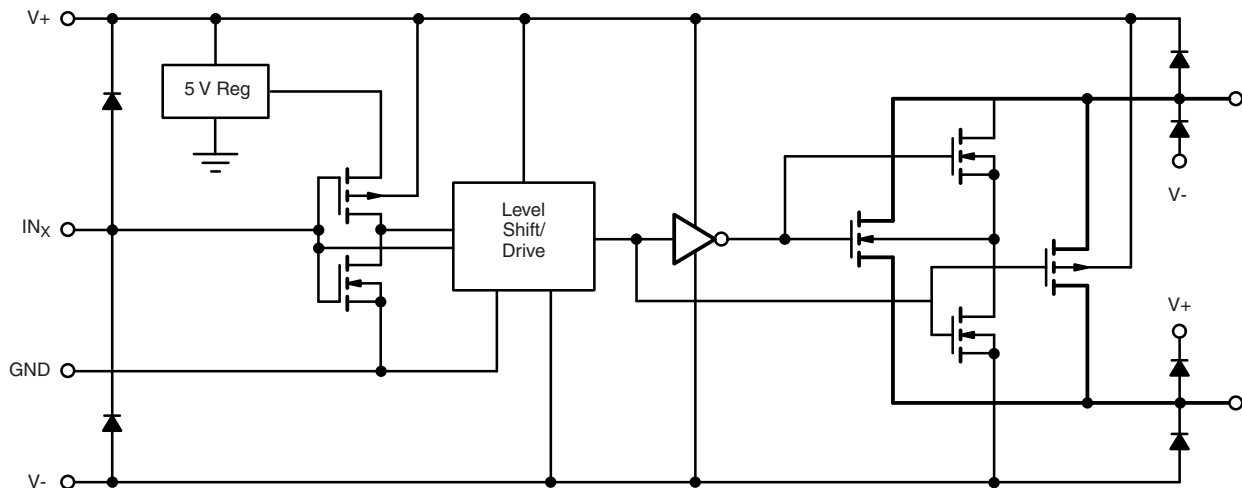


Figure 1.



| SPECIFICATIONS^a (Dual Supplies) | | | | | | | | | | |
|---------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------|-------------------------------|-------------------|------------------------------|-------------------|---------------|-----|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ $V_{IN} = 2.4\text{ V}$, 0.8 V^f | Temp. ^b | Typ. ^c | A Suffix - 55 °C to 125 °C | | D Suffix - 40 °C to 85 °C | | Unit | |
| | | | | | Min. ^d | Max. ^d | Min. ^d | Max. ^d | | |
| Analog Switch | | | | | | | | | | |
| Analog Signal Range ^e | V_{ANALOG} | | Full | | - 15 | 15 | - 15 | 15 | V | |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $I_S = -10\text{ mA}$, $V_D = \pm 8.5\text{ V}$ $V_+ = 13.5\text{ V}$, $V_- = -13.5\text{ V}$ | Room Full | 50 | | 85 100 | | 85 100 | Ω | |
| On-Resistance Match Between Channels ^e | $\Delta R_{DS(on)}$ | $I_S = -10\text{ mA}$, $V_D = \pm 10\text{ V}$ $V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ | Room Full | | | 4 5 | | 4 5 | | |
| Switch Off Leakage Current | $I_{S(off)}$ | $V_+ = 16.5\text{ V}$, $V_- = -16.5\text{ V}$ $V_D = \pm 15.5\text{ V}$, $V_S = \pm 15.5\text{ V}$ | Room Full | ± 0.01 | - 0.5 - 20 | 0.5 20 | - 0.5 - 5 | 0.5 5 | nA | |
| | $I_{D(off)}$ | | Room Full | ± 0.01 | - 0.5 - 20 | 0.5 20 | - 0.5 - 5 | 0.5 5 | | |
| Channel On Leakage Current | $I_{D(on)}$ | $V_+ = 16.5\text{ V}$, $V_- = -16.5\text{ V}$ $V_S = V_D = \pm 15.5\text{ V}$ | Room Full | ± 0.08 | - 0.5 - 40 | 0.5 40 | - 0.5 - 10 | 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 | - 0.01 | - 500 | 500 | - 500 | 500 | nA | |
| Input Current V_{IN} High | I_{IH} | V_{IN} under test = 2.4 V All Other = 0.8 V | Full | 0.01 | - 500 | 500 | - 500 | 500 | | |
| Dynamic Characteristics | | | | | | | | | | |
| Turn-On Time | t_{ON} | $R_L = 1\text{ k}\Omega$, $C_L = 35\text{ pF}$ $V_S = \pm 10\text{ V}$ See Figure 2 | Room | 150 | | 250 | | 250 | ns | |
| Turn-Off Time | DG441 DG442 | | t_{OFF} | Room | 90 | | 120 | | | 120 |
| | | | | Room | 110 | | 210 | | | 210 |
| Charge Injection ^e | Q | $C_L = 1\text{ nF}$, $V_S = 0\text{ V}$ $V_{gen} = 0\text{ V}$, $R_{gen} = 0\ \Omega$ | Room | - 1 | | | | | pC | |
| Off Isolation ^e | OIRR | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $f = 1\text{ MHz}$ | Room | 60 | | | | | dB | |
| Crosstalk (Channel-to-Channel) | X_{TALK} | | Room | 100 | | | | | | |
| Source Off Capacitance ^e | $C_{S(off)}$ | $f = 1\text{ MHz}$ | Room | 4 | | | | | pF | |
| Drain Off Capacitance ^e | $C_{D(off)}$ | | Room | 4 | | | | | | |
| Channel On Capacitance ^e | $C_{D(on)}$ | | $V_{ANALOG} = 0\text{ V}$ | Room | 16 | | | | | |
| Power Supplies | | | | | | | | | | |
| Positive Supply Current | I+ | $V_+ = 16.5\text{ V}$, $V_- = -16.5\text{ V}$ $V_{IN} = 0$ or 5 V | Full | 15 | | 100 | | 100 | μA | |
| Negative Supply Current | I- | | Room | - 0.0001 | - 1 | | - 1 | | | |
| | | | Full | | - 5 | | - 5 | | | |
| Ground Current | I_{GND} | | Full | - 15 | - 100 | | - 100 | | | |



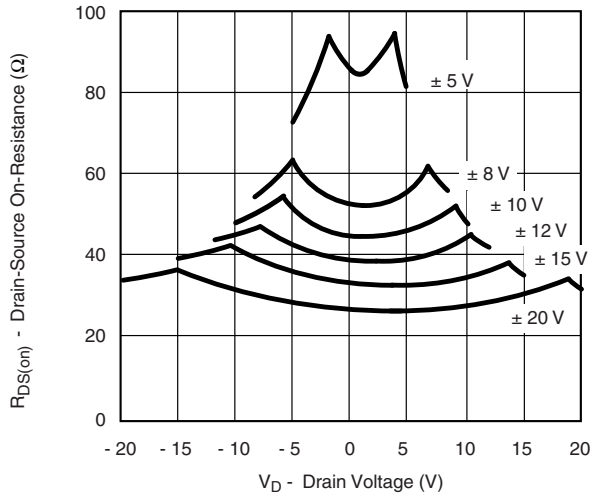
| SPECIFICATIONS^a (Single Supply) | | | | | | | | | |
|---------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------------------|-------------------|------------------------------|-------------------|---------------|
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_+ = 12\text{ V}, V_- = 0\text{ V}$ $V_{IN} = 2.4\text{ V}, 0.8\text{ V}^f$ | Temp. ^b | Typ. ^c | A Suffix - 55 °C to 125 °C | | D Suffix - 40 °C to 85 °C | | Unit |
| | | | | | Min. ^d | Max. ^d | Min. ^d | Max. ^d | |
| Analog Switch | | | | | | | | | |
| Analog Signal Range ^e | V_{ANALOG} | | Full | | 0 | 12 | 0 | 12 | V |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $I_S = -10\text{ mA}, V_D = 3\text{ V}, 8\text{ V}$ $V_+ = 10.8\text{ V}$ | Room Full | 100 | | 160 200 | | 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 | | 450 | ns |
| Turn-Off Time | t_{OFF} | | Room | 60 | | 200 | | 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_+ | $V_+ = 13.2\text{ V}, V_- = 0\text{ V}$ $V_{IN} = 0\text{ or }5\text{ V}$ | Full | 15 | | 100 | | 100 | μA |
| Negative Supply Current | I_- | | Room | - 0.0001 | - 1 | | - 1 | | |
| | | | Full | | - 100 | | - 100 | | |
| Ground Current | I_{GND} | | Full | - 15 | - 100 | | - 100 | | |

Notes:

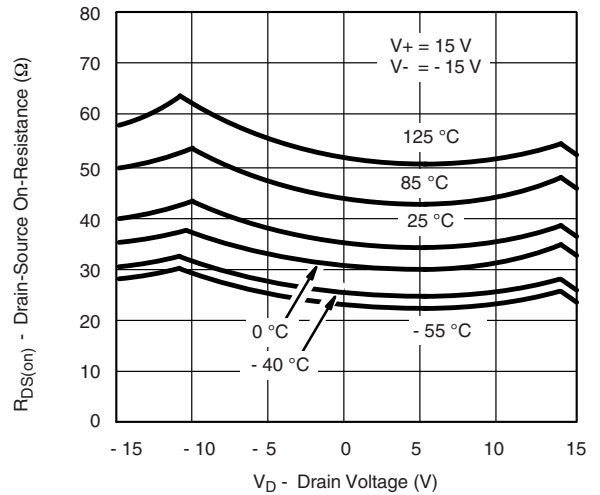
- Refer to PROCESS OPTION FLOWCHART.
- Room = 25 °C, Full = as determined by the operating temperature suffix.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum,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

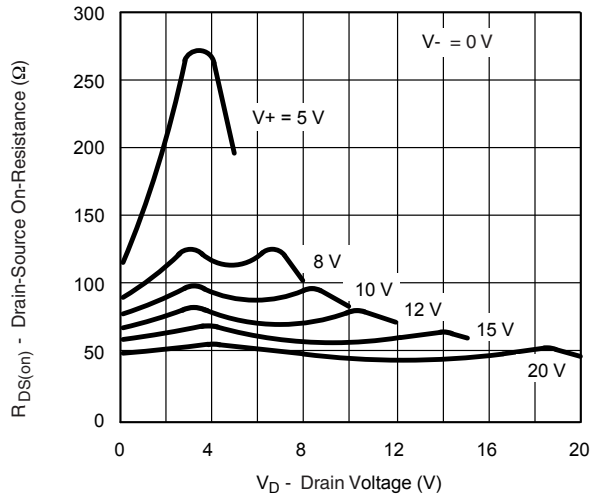
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



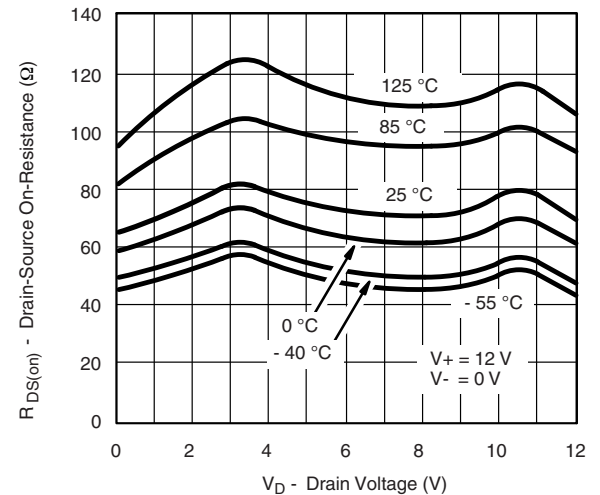
R_{DS(on)} vs. V_D and Power Supply Voltage



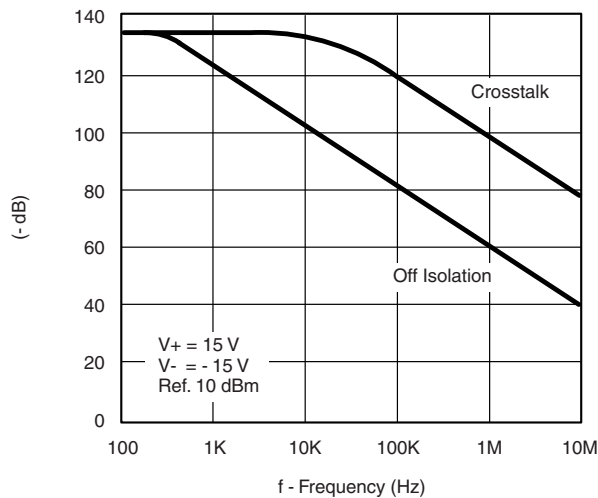
R_{DS(on)} vs. V_D and Temperature



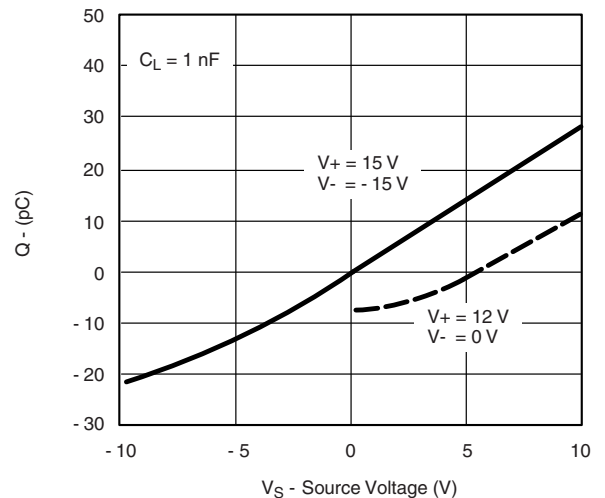
R_{DS(on)} vs. V_D and Unipolar Power Supply Voltage



R_{DS(on)} vs. V_D and Temperature (Single 12-V Supply)

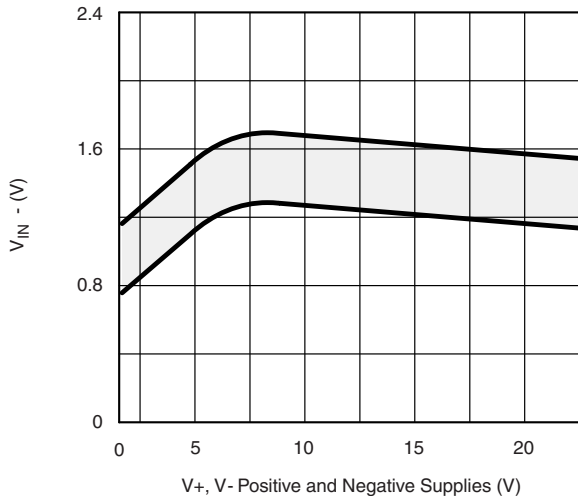


Crosstalk and Off Isolation vs. Frequency

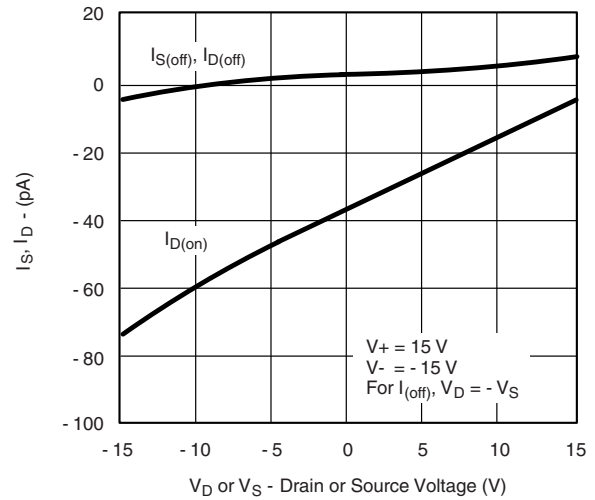


Charge Injection vs. Source Voltage

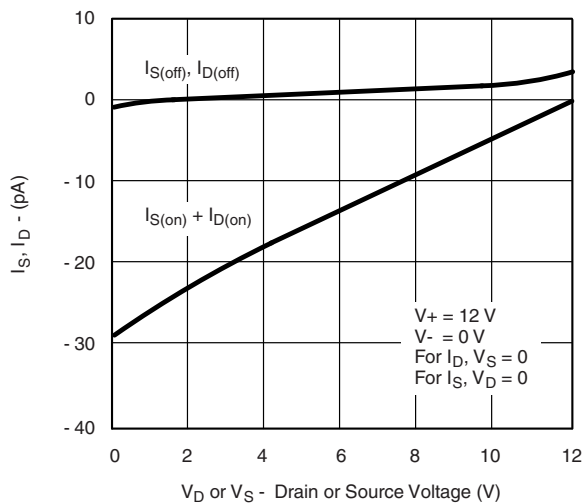
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



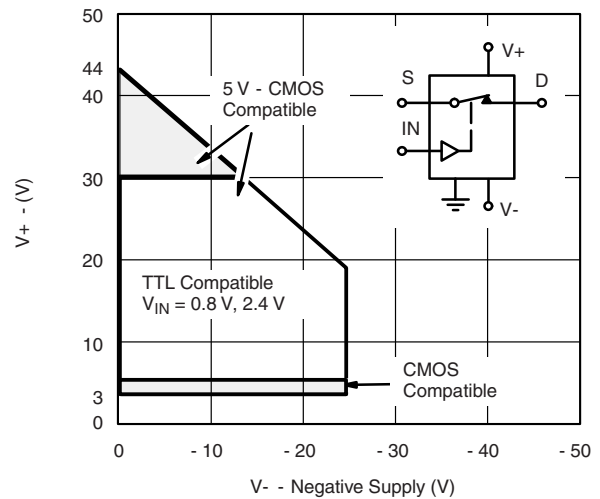
Switching Threshold vs. Supply Voltage



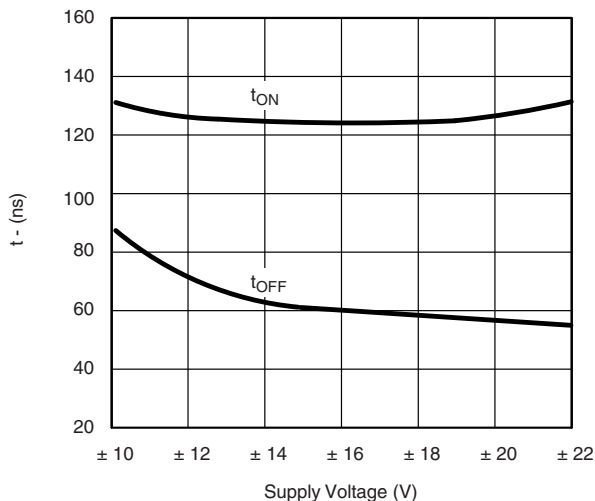
Source/Drain Leakage Currents



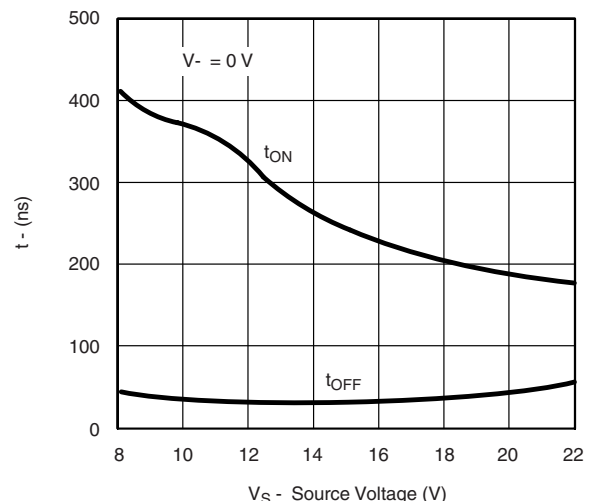
Source/Drain Leakage Currents (Single 12 V Supply)



Operating Voltage

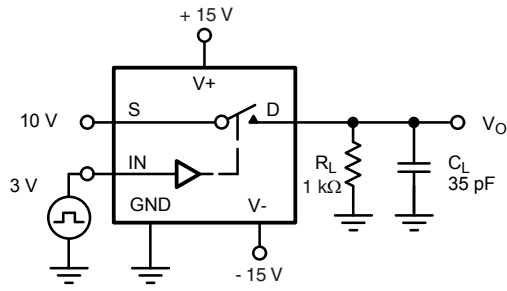


Switching Time vs. Power Supply Voltage

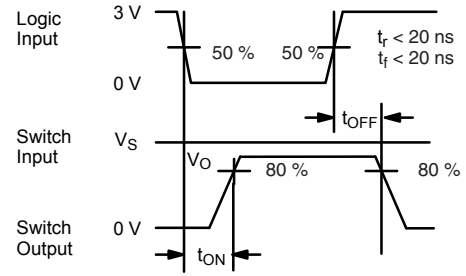


Switching Time vs. Power Supply Voltage

TEST CIRCUITS



C_L (includes fixture and stray capacitance)



Note: Logic input waveform is inverted for DG442.

Figure 2. Switching Time

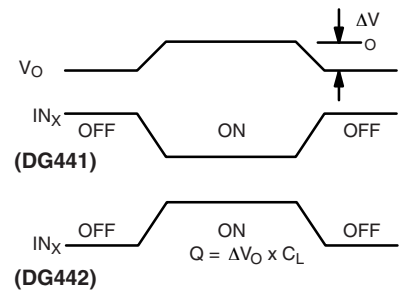
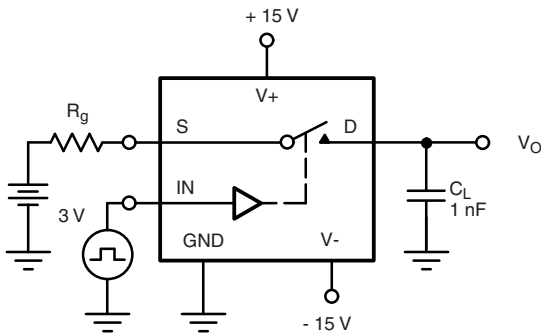
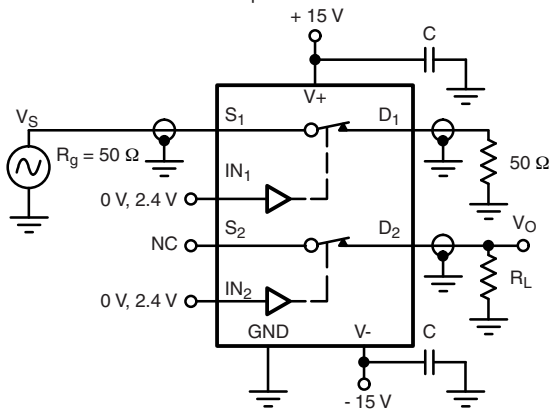


Figure 3. Charge Injection

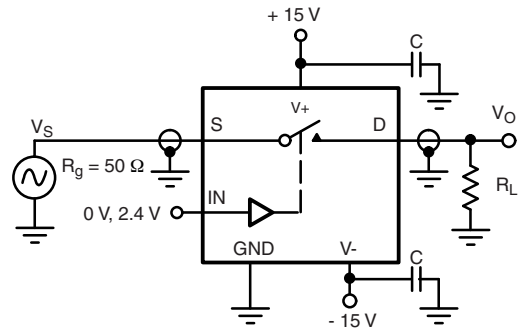
$C = 1 \text{ mF}$ tantalum in parallel with 0.01 mF ceramic



$$X_{\text{TALK Isolation}} = 20 \log \left| \frac{V_S}{V_O} \right|$$

$C = \text{RF bypass}$

Figure 4. Crosstalk



$$\text{Off Isolation} = 20 \log \left| \frac{V_S}{V_O} \right|$$

Figure 5. Off Isolation

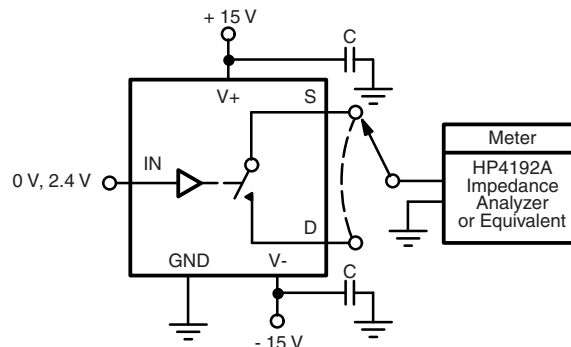


Figure 6. Source/Drain Capacitances

APPLICATIONS

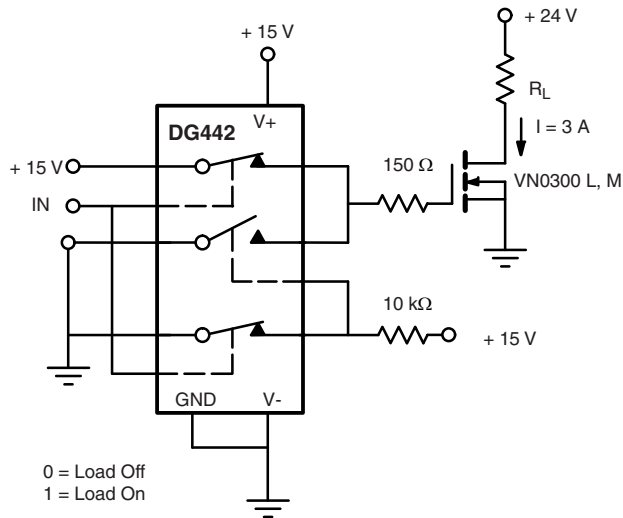


Figure 7. Power MOSFET Driver

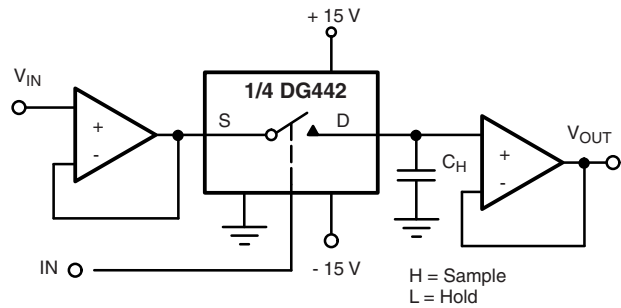


Figure 8. Open Loop Sample-and-Hold

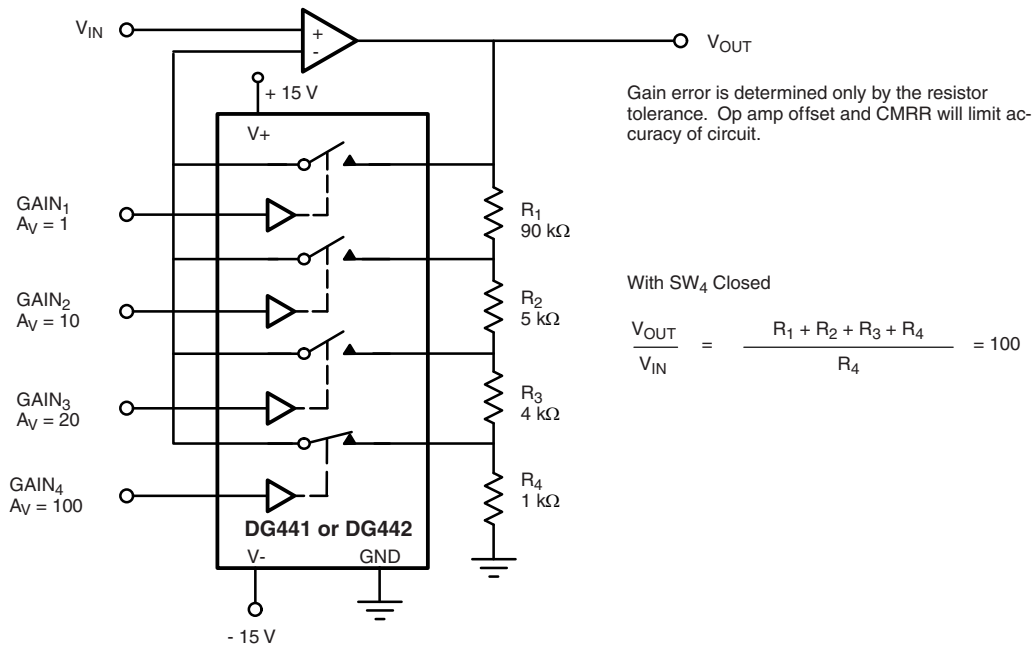


Figure 9. Precision-Weighted Resistor Programmable-Gain Amplifier

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?70053.



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

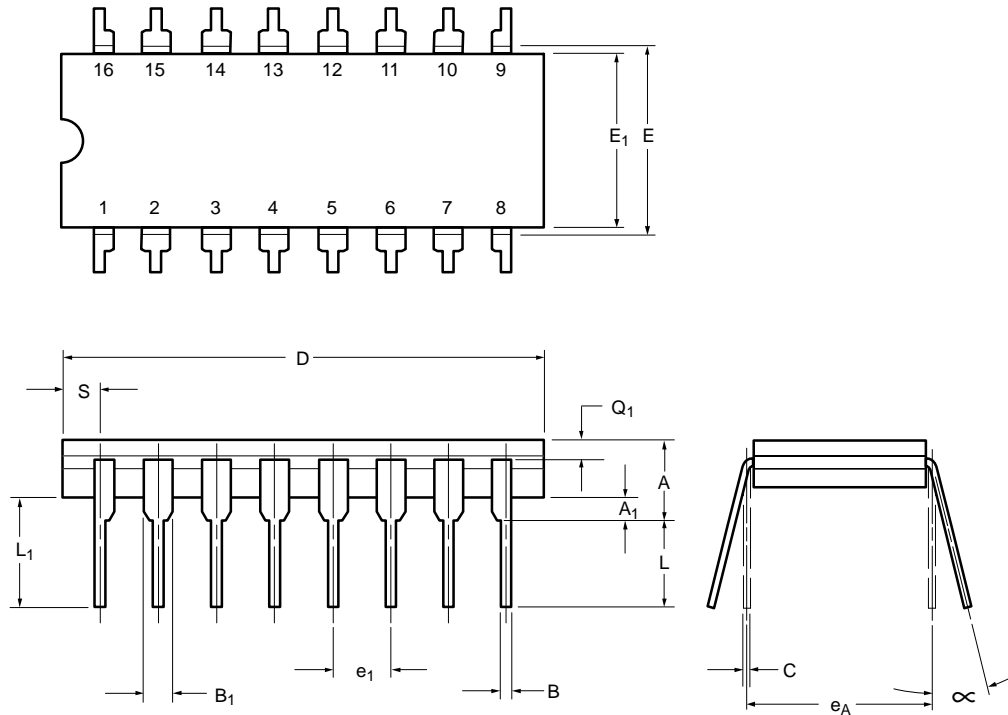


| Dim | MILLIMETERS | | INCHES | |
|----------------------|-------------|-------|--------|-------|
| | Min | Max | Min | Max |
| A | 3.81 | 5.08 | 0.150 | 0.200 |
| A₁ | 0.38 | 1.27 | 0.015 | 0.050 |
| B | 0.38 | 0.51 | 0.015 | 0.020 |
| B₁ | 0.89 | 1.65 | 0.035 | 0.065 |
| C | 0.20 | 0.30 | 0.008 | 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



CERDIP: 16-LEAD

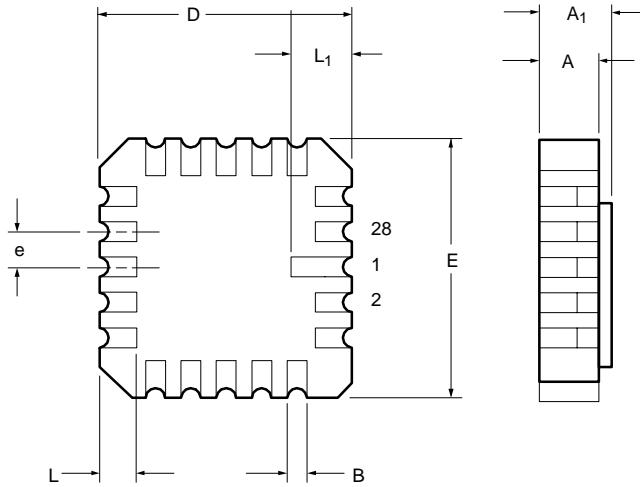


| Dim | MILLIMETERS | | INCHES | |
|----------------|-------------|-------|-----------|-------|
| | Min | Max | Min | Max |
| A | 4.06 | 5.08 | 0.160 | 0.200 |
| A ₁ | 0.51 | 1.14 | 0.020 | 0.045 |
| B | 0.38 | 0.51 | 0.015 | 0.020 |
| B ₁ | 1.14 | 1.65 | 0.045 | 0.065 |
| C | 0.20 | 0.30 | 0.008 | 0.012 |
| D | 19.05 | 19.56 | 0.750 | 0.770 |
| 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 | 3.81 | 5.08 | 0.150 | 0.200 |
| Q ₁ | 1.27 | 2.16 | 0.050 | 0.085 |
| S | 0.38 | 1.14 | 0.015 | 0.045 |
| ∞ | 0° | 15° | 0° | 15° |

ECN: S-03946—Rev. G, 09-Jul-01
DWG: 5403



20-LEAD LCC



| Dim | MILLIMETERS | | INCHES | |
|----------------------|-------------|------|-----------|-------|
| | Min | Max | Min | Max |
| A | 1.37 | 2.24 | 0.054 | 0.088 |
| A₁ | 1.63 | 2.54 | 0.064 | 0.100 |
| B | 0.56 | 0.71 | 0.022 | 0.028 |
| D | 8.69 | 9.09 | 0.342 | 0.358 |
| E | 8.69 | 9.09 | 0.442 | 0.358 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 1.14 | 1.40 | 0.045 | 0.055 |
| L₁ | 1.96 | 2.36 | 0.077 | 0.093 |

ECN: S-03946—Rev. B, 09-Jul-01
DWG: 5321

RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads
Dimensions in Inches/(mm)

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Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.



Стандарт Электрон Связь

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Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

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