

## 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.

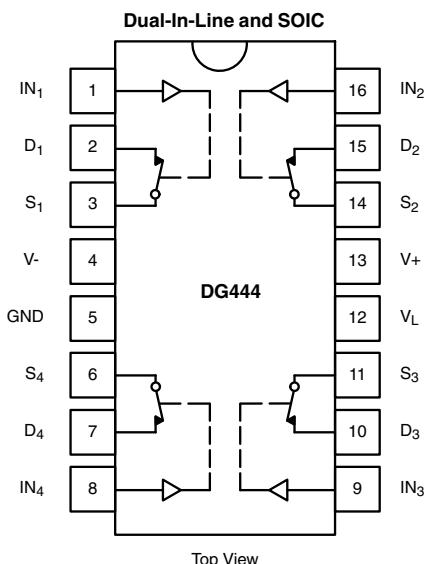
### FEATURES

- Low on-resistance: 50  $\Omega$
- 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"  $\leq$  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

# DG444, DG445

Vishay Siliconix



## ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ , 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 <sup>a</sup> , $V_S$ , $V_D$	(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) <sup>b</sup>	450	mW
	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 $V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ $V_L = 5\text{ V}$ , $V_{IN} = 2.4\text{ V}$ , $0.8\text{ V}^e$	Temp. <sup>a</sup>	D Suffix - 40 °C °C to 85 °C			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>d</sup>	$V_{ANALOG}$		Full	- 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	Ω
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	- 0.5 - 5	± 0.01	0.5 5	nA
	$I_{D(off)}$		Room Full	- 0.5 - 5	± 0.01	0.5 5	
Channel On Leakage Current	$I_{D(on)}$	$V_+ = 16.5\text{ V}$ , $V_- = -16.5\text{ V}$ $V_S = V_D = \pm 15.5\text{ V}$	Room Full	- 0.5 - 10	± 0.08	0.5 10	
<b>Digital Control</b>							
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	
<b>Dynamic Characteristics</b>							
Turn-On Time	$t_{ON}$	$R_L = 1\text{ kΩ}$ , $C_L = 35\text{ pF}$ $V_S = \pm 10\text{ V}$ , See Figure 2	Room		120	250	ns
Turn-Off Time	$t_{OFF}$		DG444	Room		110	
			DG445	Room		160	
Charge Injection <sup>e</sup>	Q	$C_L = 1\text{ nF}$ , $V_S = 0\text{ V}$ $V_{gen} = 0\text{ V}$ , $R_{gen} = 0\text{ Ω}$	Room		- 1		pC
Off Isolation <sup>e</sup>	OIRR	$R_L = 50\text{ Ω}$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$	Room		60		dB
Crosstalk (Channel-to-Channel) <sup>d</sup>	$X_{TALK}$		Room		100		
Source Off Capacitance	$C_{S(off)}$	$f = 1\text{ MHz}$	Room		4		pF
Drain Off Capacitance	$C_{D(off)}$		Room		4		
Channel On Capacitance	$C_{D(on)}$	$V_{ANALOG} = 0\text{ V}$	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. <sup>a</sup>	D Suffix -40 °C °C to 85 °C			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Power Supplies</b>							
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 <sub>L</sub>		Room Full		0.001	1 5	
Ground Current	I <sub>GND</sub>		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. <sup>a</sup>	Limits -40 °C °C to 85 °C			Unit
				Min. <sup>b</sup>	Typ. <sup>c</sup>	Max. <sup>b</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>d</sup>	V <sub>ANALOG</sub>		Full	0		12	V
Drain-Source On-Resistance <sup>d</sup>	R <sub>DS(on)</sub>	I <sub>S</sub> = -10 mA, V <sub>D</sub> = 3 V, 8 V V <sub>+</sub> = 10.8 V, V <sub>L</sub> = 5.25 V	Room Full		100	160 200	Ω
<b>Dynamic Characteristics</b>							
Turn-On Time	t <sub>ON</sub>	R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 35 pF, V <sub>S</sub> = 8 V See Figure 2	Room		300	450	ns
Turn-Off Time	t <sub>OFF</sub>		Room		60	200	
Charge Injection	Q	C <sub>L</sub> = 1 nF, V <sub>gen</sub> = 6 V, R <sub>gen</sub> = 0 Ω	Room		2		pC
<b>Power Supplies</b>							
Positive Supply Current	I+	V <sub>+</sub> = 13.2 V, V <sub>IN</sub> = 0 or 5 V	Room Full		0.001	1 5	μA
Negative Supply Current	I-	V <sub>IN</sub> = 0 or 5 V	Room Full	-1 -5	-0.0001		
Logic Supply Current	I <sub>L</sub>	V <sub>L</sub> = 5.25 V, V <sub>IN</sub> = 0 or 5 V	Room Full		0.001	1 5	
Ground Current	I <sub>GND</sub>	V <sub>IN</sub> = 0 or 5 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<sub>IN</sub> = input voltage to perform proper function.

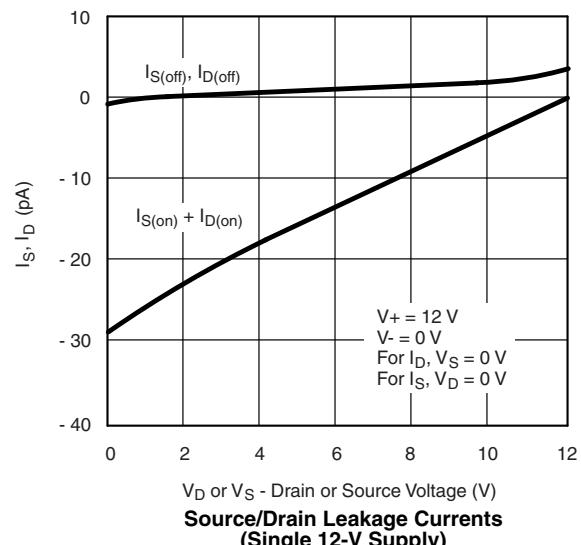
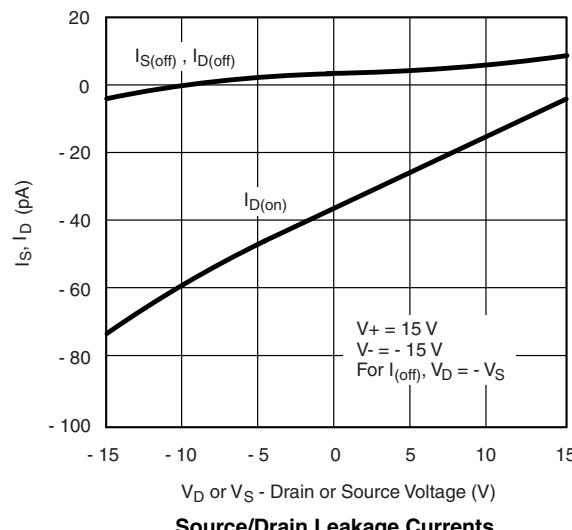
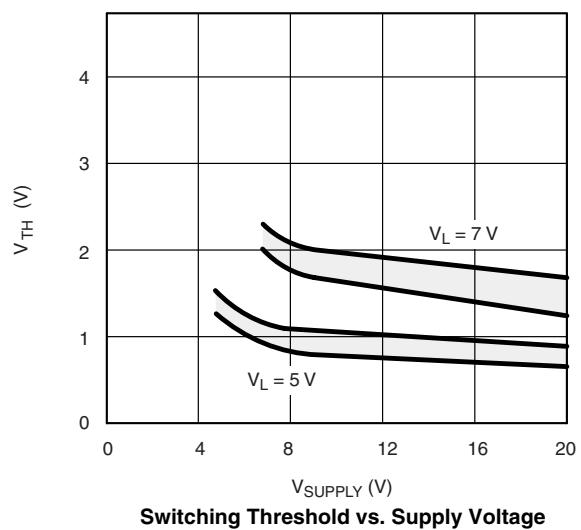
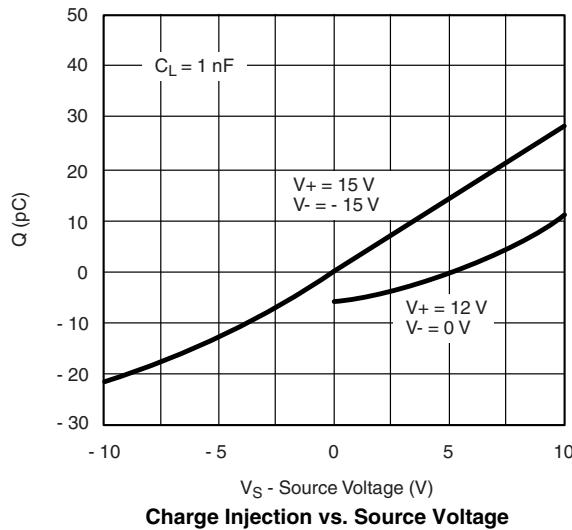
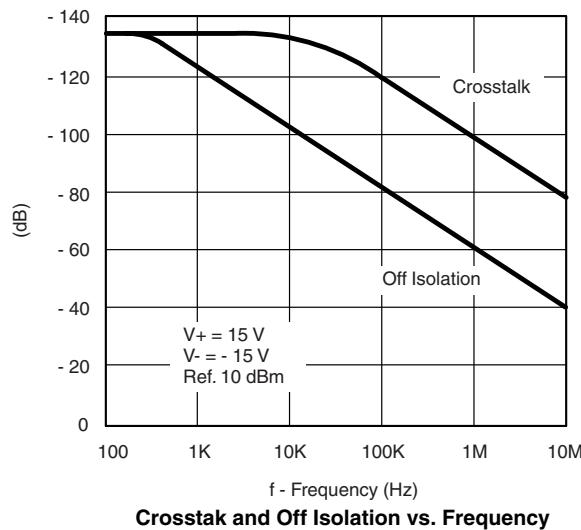
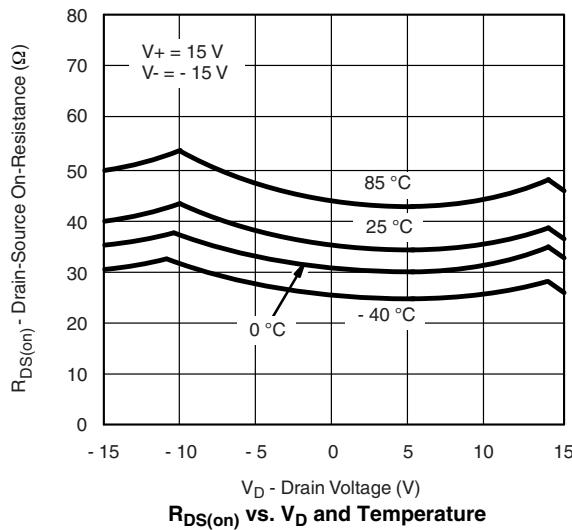
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

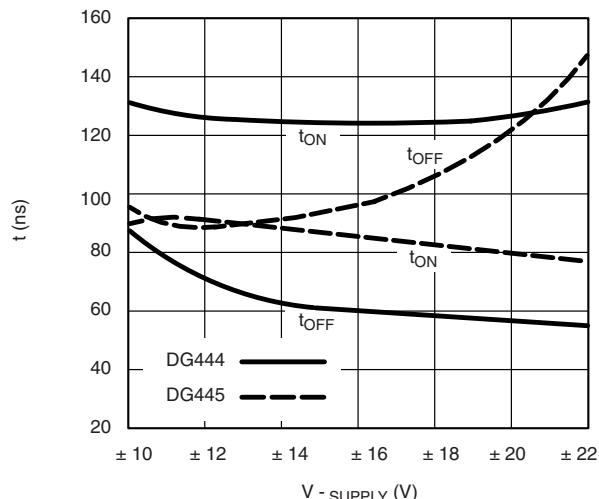
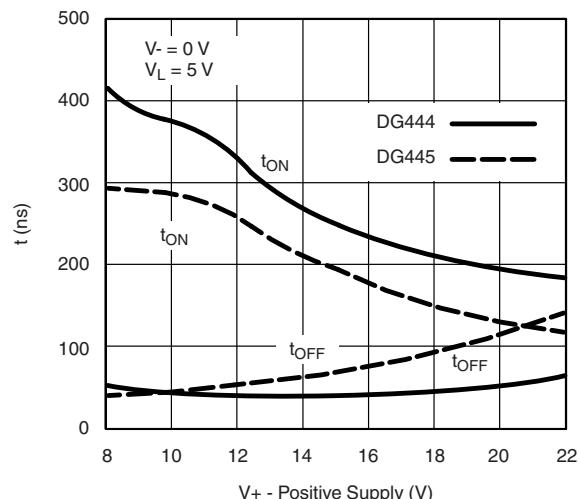
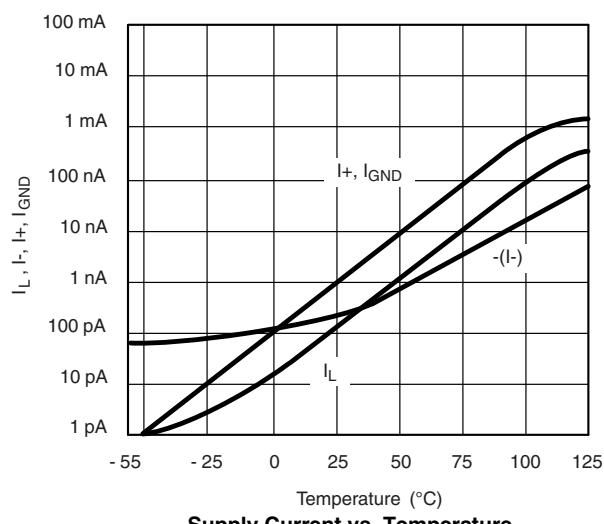
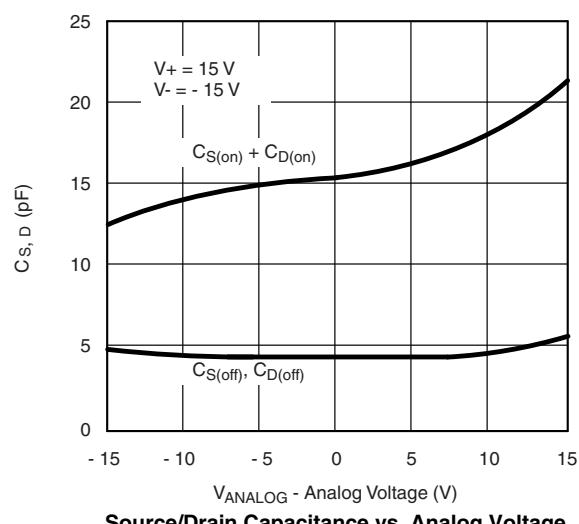
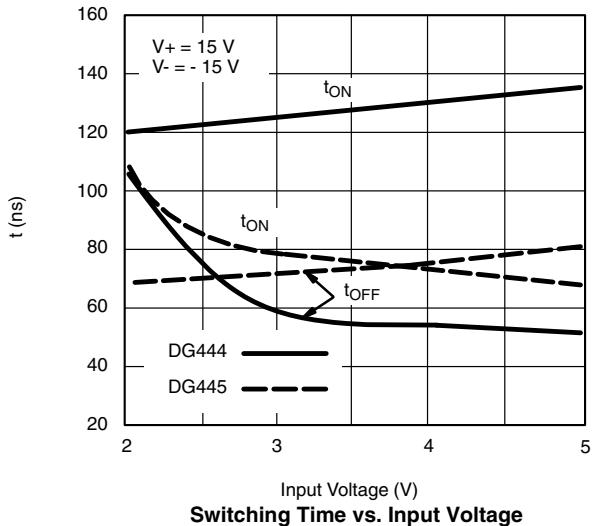
# DG444, DG445

Vishay Siliconix



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



**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**

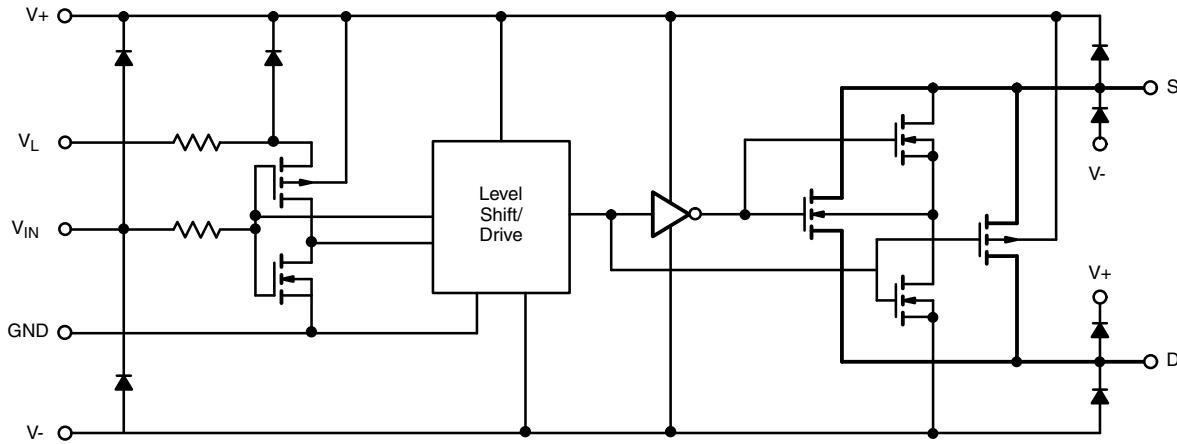
**SCHEMATIC DIAGRAM** Typical Channel

Figure 1.

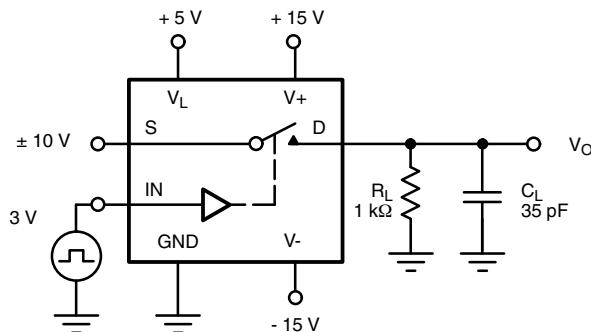
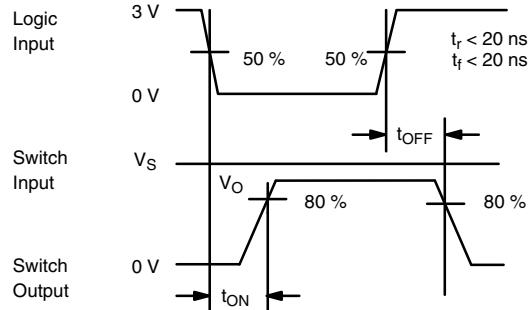
**TEST CIRCUITS** $C_L$  (includes fixture and stray capacitance)

Figure 2. Switching Time

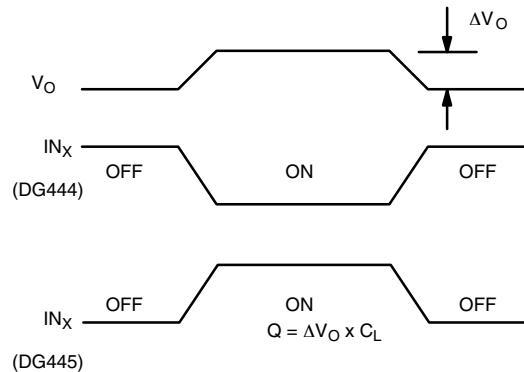
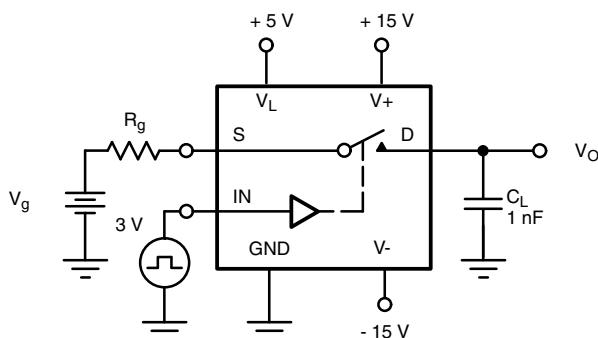


Figure 3. Charge Injection

## TEST CIRCUITS

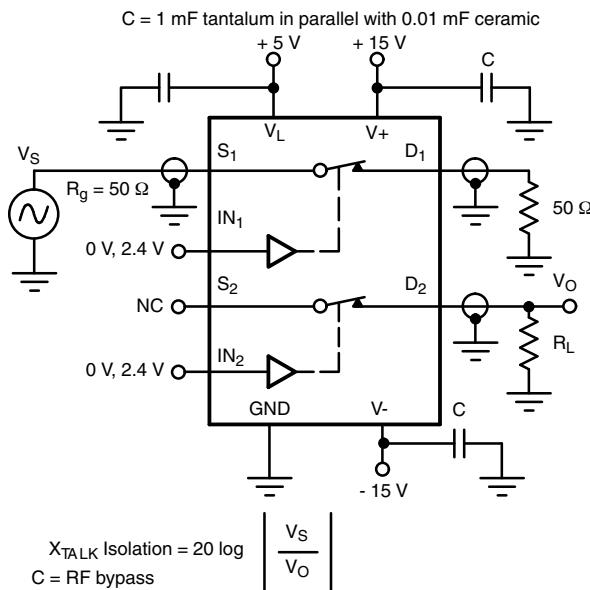


Figure 4. Crosstalk

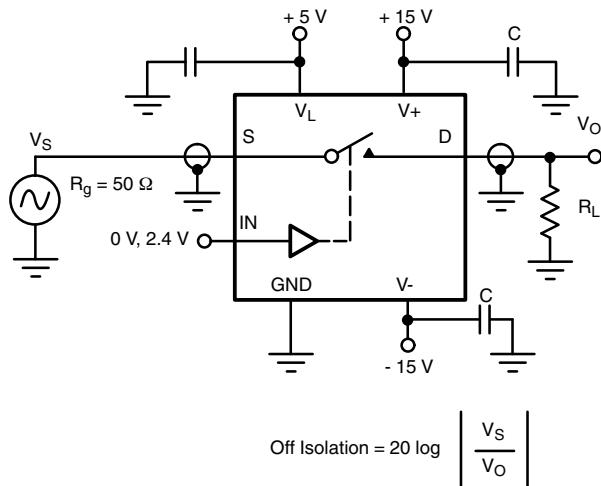


Figure 5. Off Isolation

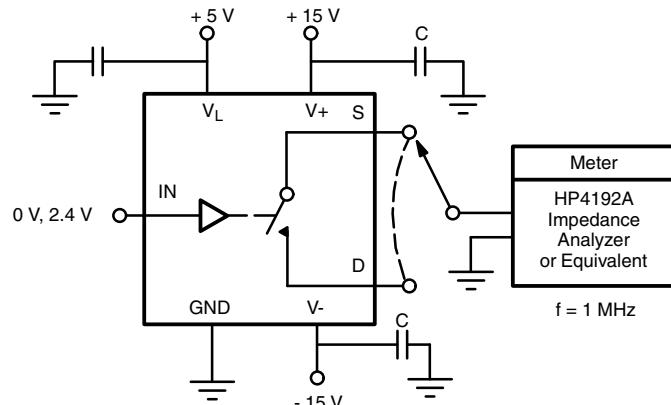


Figure 6. Source/Drain Capacitances

## APPLICATIONS

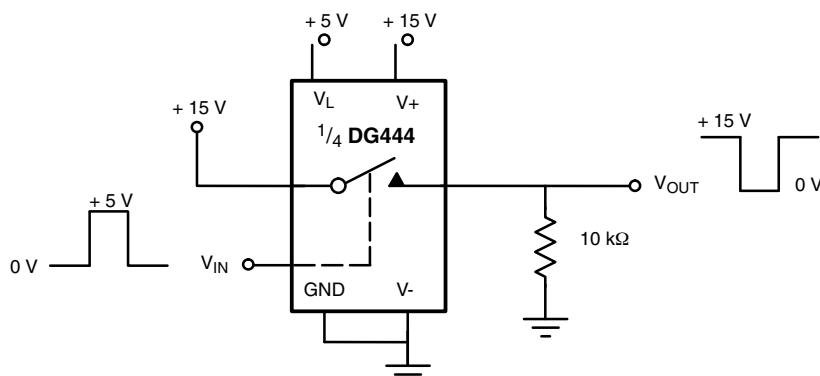


Figure 7. Level Shifter

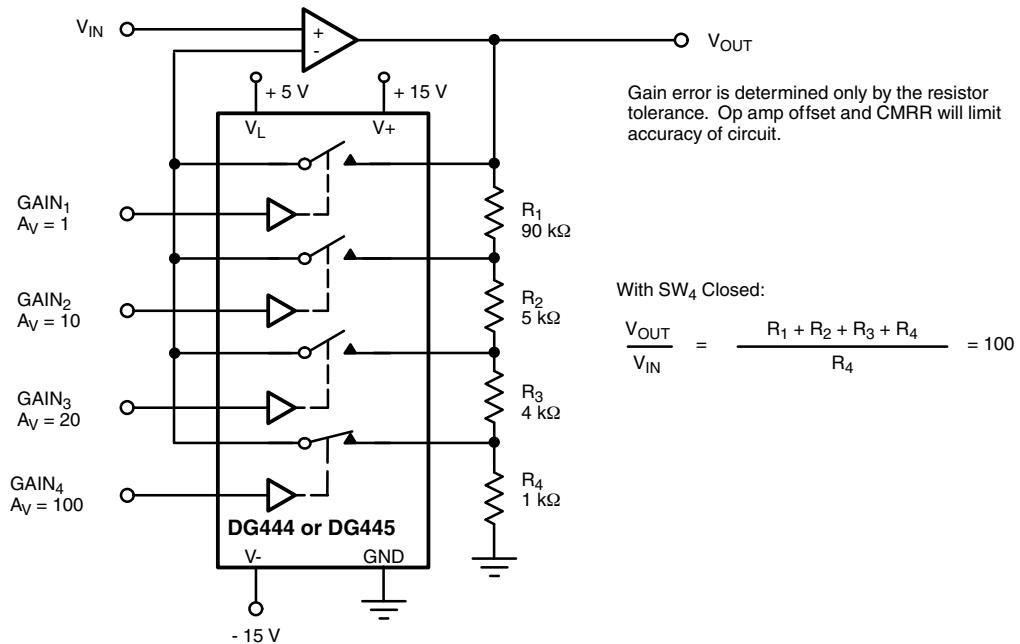
**APPLICATIONS**

Figure 8. Precision-Weighted Resistor Programmable-Gain Amplifier

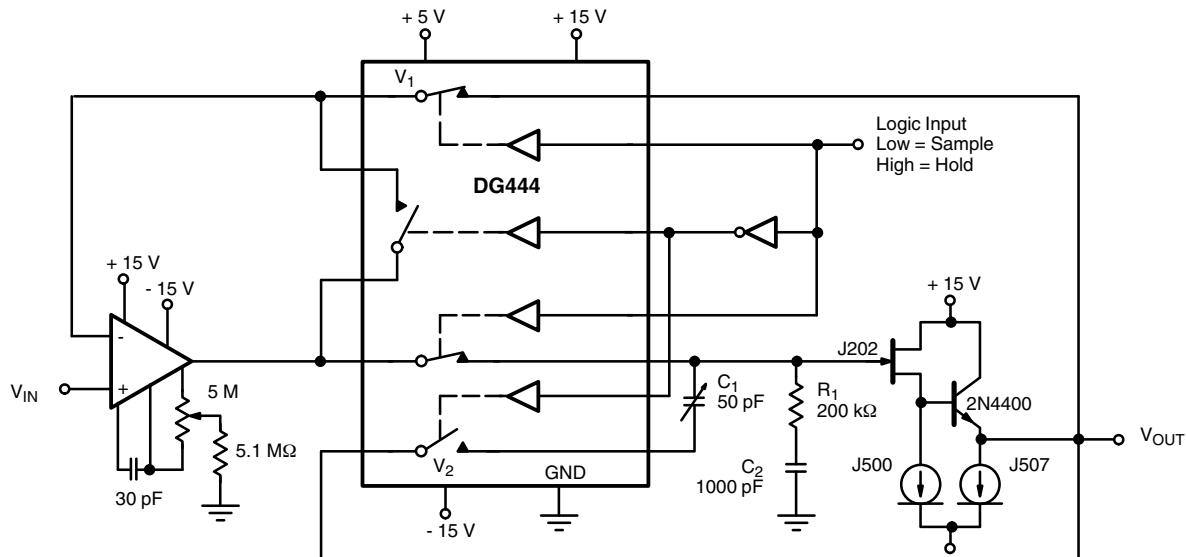
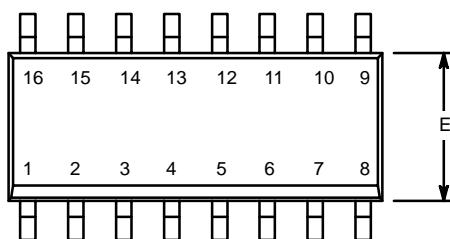


Figure 9. Precision Sample-and-Hold

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](http://www.vishay.com/ppg?70054).

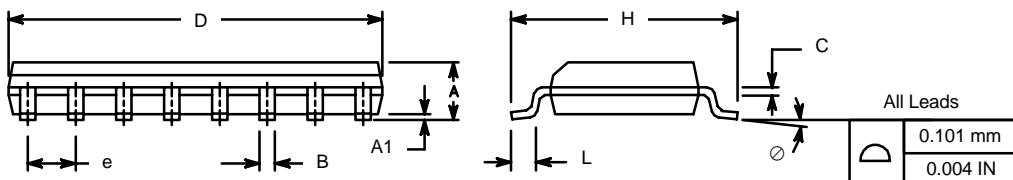
**SOIC (NARROW): 16-LEAD**

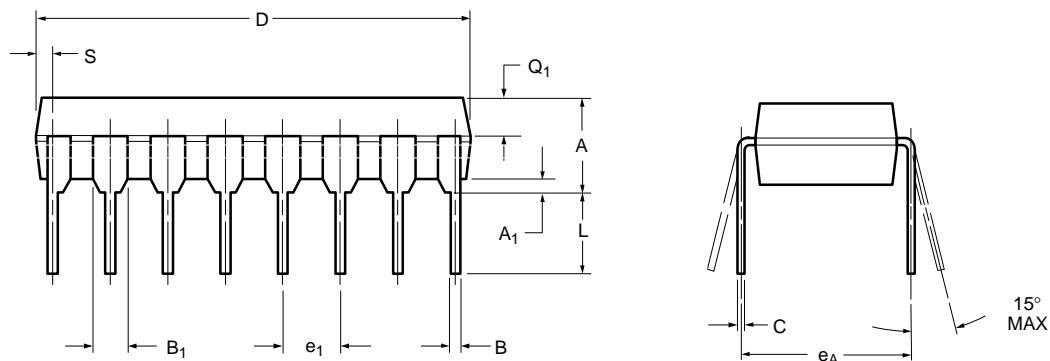
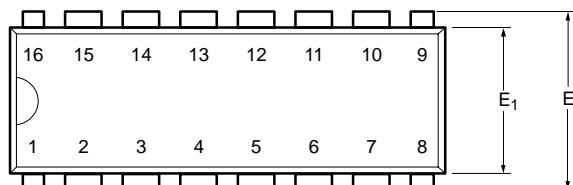
JEDEC Part Number: MS-012



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

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

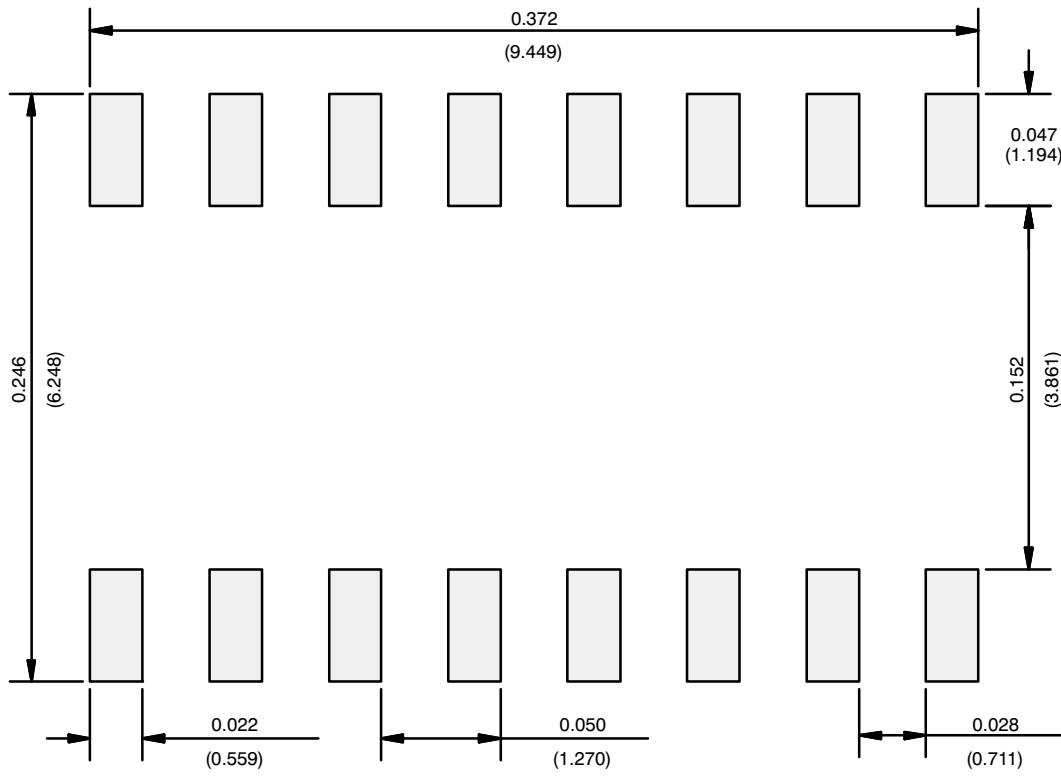


**PDIP: 16-LEAD**


Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
<b>A</b>	3.81	5.08	0.150	0.200
<b>A<sub>1</sub></b>	0.38	1.27	0.015	0.050
<b>B</b>	0.38	0.51	0.015	0.020
<b>B<sub>1</sub></b>	0.89	1.65	0.035	0.065
<b>C</b>	0.20	0.30	0.008	0.012
<b>D</b>	18.93	21.33	0.745	0.840
<b>E</b>	7.62	8.26	0.300	0.325
<b>E<sub>1</sub></b>	5.59	7.11	0.220	0.280
<b>e<sub>1</sub></b>	2.29	2.79	0.090	0.110
<b>e<sub>A</sub></b>	7.37	7.87	0.290	0.310
<b>L</b>	2.79	3.81	0.110	0.150
<b>Q<sub>1</sub></b>	1.27	2.03	0.050	0.080
<b>S</b>	0.38	1.52	.015	0.060

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

## RECOMMENDED MINIMUM PADS FOR SO-16



[Return to Index](#)



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- Техническая поддержка проекта, помошь в подборе аналогов, поставка прототипов;
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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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