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

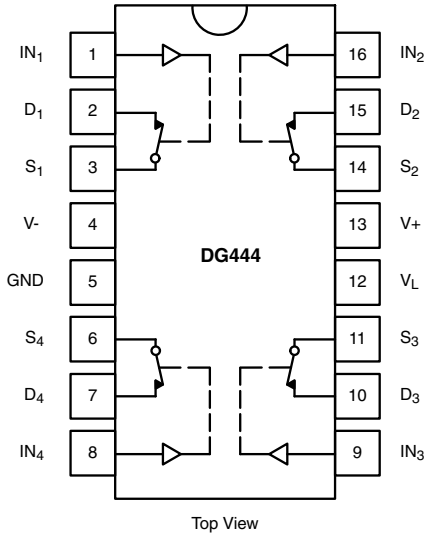
- Low on-resistance: 50 Ω
- Low leakage: 80 pA
- Low power consumption: 22 nW
- Fast switching action - t_{ON}: 120 ns
- Low charge injection
- DG211, DG212 upgrades
- TTL/CMOS logic compatible

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

Dual-In-Line and SOIC



Top View

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							
		Test Conditions **Unless Otherwise Specified** V+ = 15 V, V- = - 15 V V_L = 5 V, V_{IN} = 2.4 V, 0.8 V[e]		**D Suffix** - 40 °C °C to 85 °C			
Parameter	**Symbol**		**Temp.[a]**	**Min.[b]**	**Typ.[c]**	**Max.[b]**	**Unit**
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- = - 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		

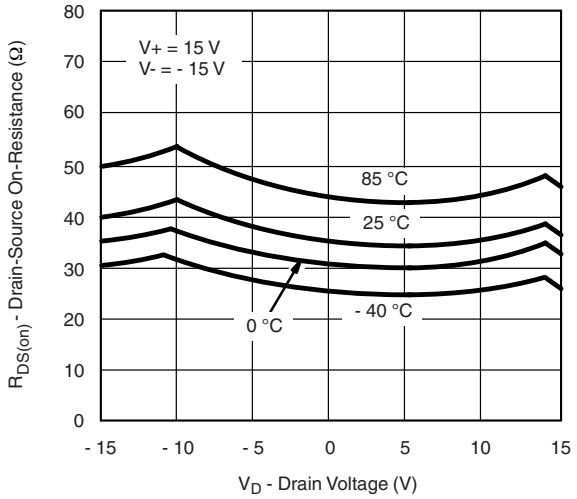
SPECIFICATIONS for Dual Supplies							
Parameter	**Symbol**	**Test Conditions Unless Otherwise Specified** V+ = 15 V, V- = - 15 V V_L = 5 V, V_{IN} = 2.4 V, 0.8 V[e]	**Temp.[a]**	**D Suffix - 40 °C °C to 85 °C** **Min.[b]**	**Typ.[c]**	**Max.[b]**	**Unit**
Power Supplies							
Positive Supply Current	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 V, V- = 0 V V_L = 5 V, V_{IN} = 2.4 V, 0.8 V[e]	**Temp.[a]**	**Limits - 40 °C °C to 85 °C** **Min.[b]**	**Typ.[c]**	**Max.[b]**	**Unit**
Analog Switch							
Analog Signal Range[d]	V_{ANALOG}		Full	0		12	V
Drain-Source On-Resistance[d]	$R_{DS(on)}$	I_S = - 10 mA, V_D = 3 V, 8 V V+ = 10.8 V, V_L = 5.25 V	Room Full		100	160 200	Ω
Dynamic Characteristics							
Turn-On Time	t_{ON}	R_L = 1 kΩ, C_L = 35 pF, V_S = 8 V See Figure 2	Room		300	450	ns
Turn-Off Time	t_{OFF}		Room		60	200	
Charge Injection	Q	C_L = 1 nF, V_{gen} = 6 V, R_{gen} = 0 Ω	Room		2		pC
Power Supplies							
Positive Supply Current	I+	V+ = 13.2 V, V_{IN} = 0 or 5 V	Room Full		0.001	1 5	µA
Negative Supply Current	I-	V_{IN} = 0 or 5 V	Room Full	- 1 - 5	- 0.0001		
Logic Supply Current	I_L	V_L = 5.25 V, V_{IN} = 0 or 5 V	Room Full		0.001	1 5	
Ground Current	I_{GND}	V_{IN} = 0 or 5 V	Full	- 1 - 5	- 0.001		

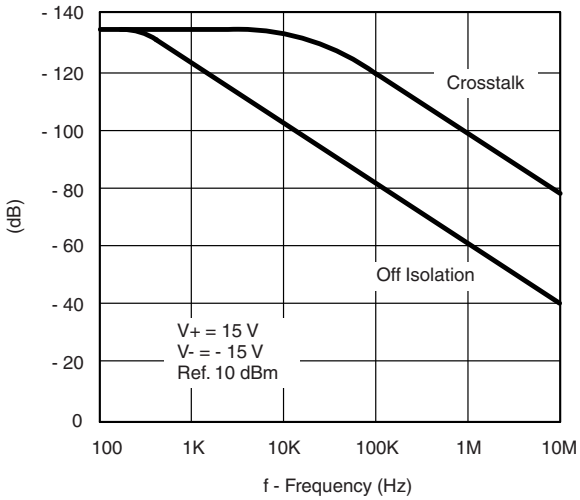
Notes:
a. Room = 25 °C, Full = as determined by the operating temperature suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.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

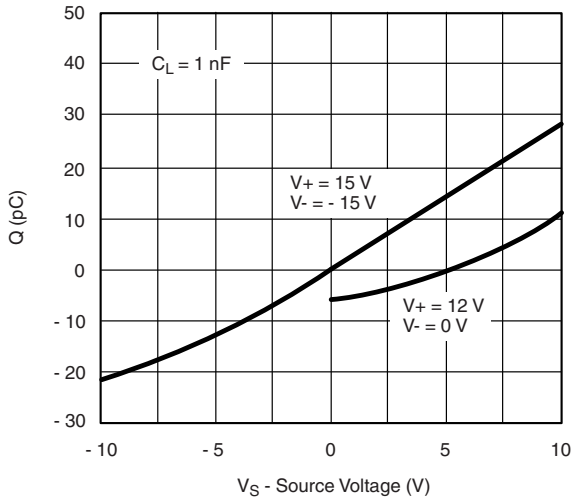
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



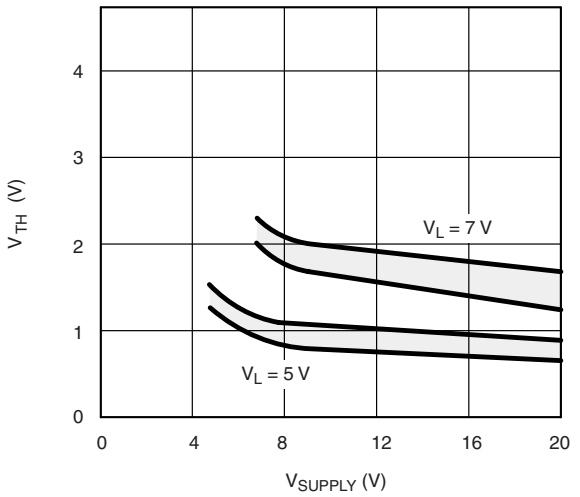
$R_{DS(on)}$ vs. V_D and Temperature



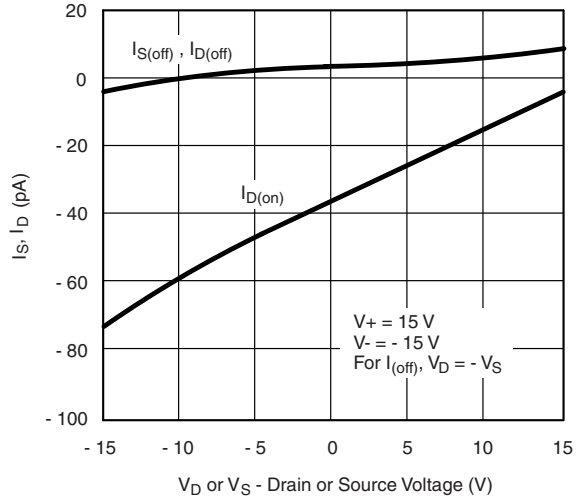
Crosstak and Off Isolation vs. Frequency



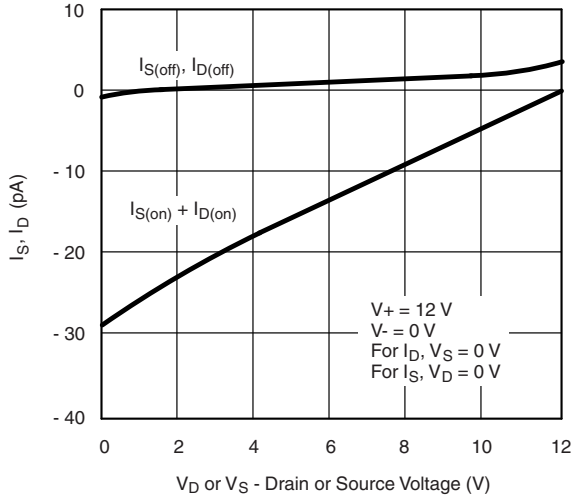
Charge Injection vs. Source Voltage



Switching Threshold vs. Supply Voltage

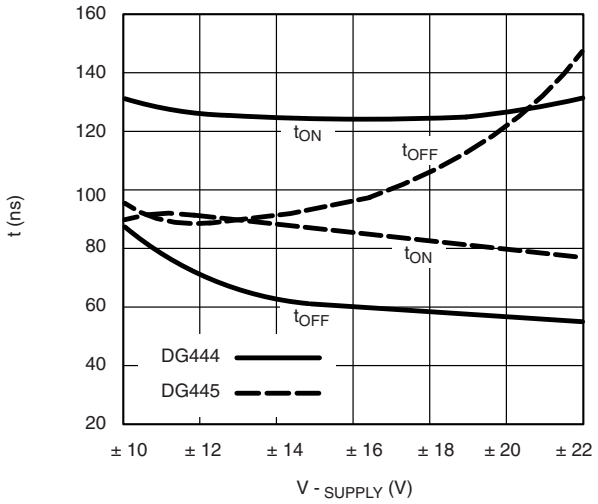


Source/Drain Leakage Currents

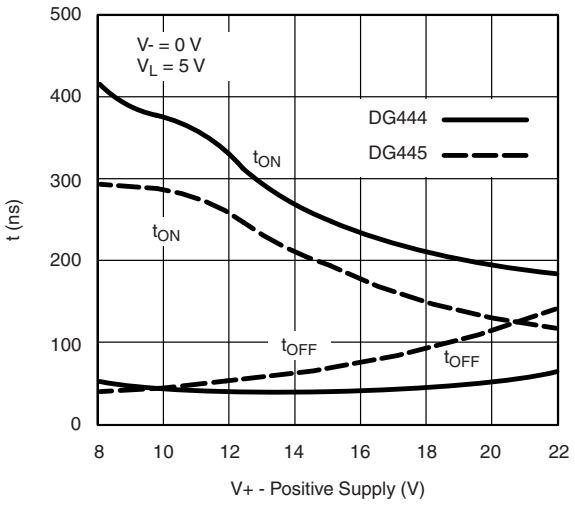


Source/Drain Leakage Currents (Single 12-V Supply)

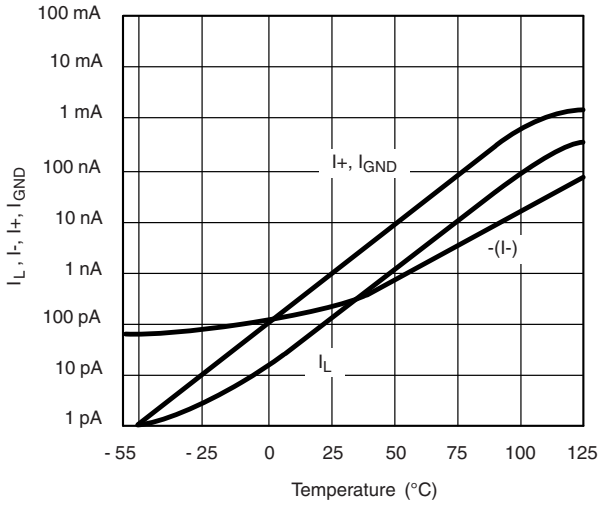
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



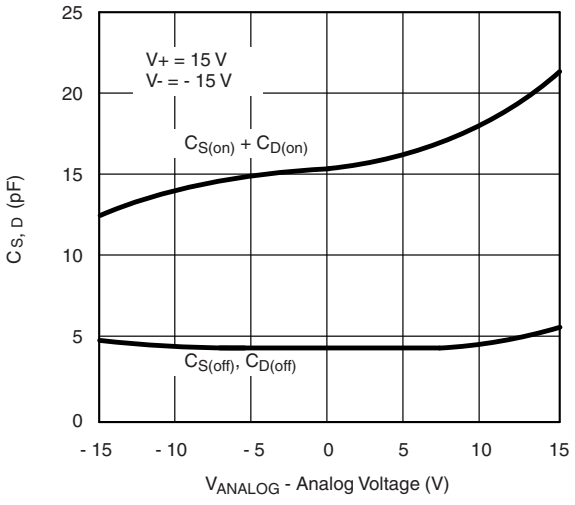
Switching Time vs. Power Supply Voltage



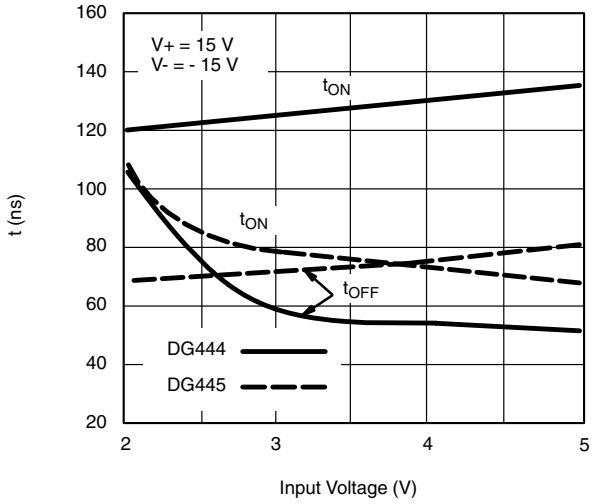
Switching Times vs. Power Supply Voltage



Supply Current vs. Temperature



Source/Drain Capacitance vs. Analog Voltage



Switching Time vs. Input Voltage

SCHEMATIC DIAGRAM Typical Channel

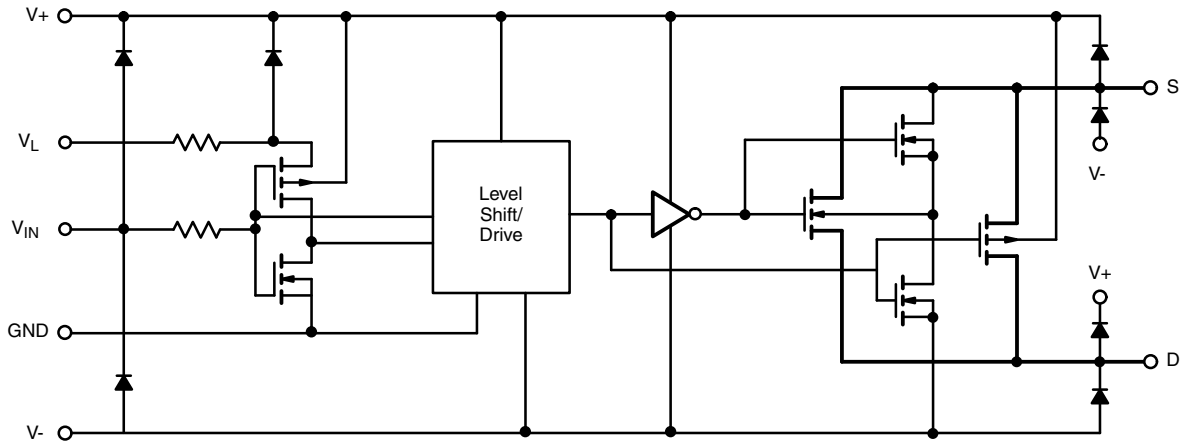
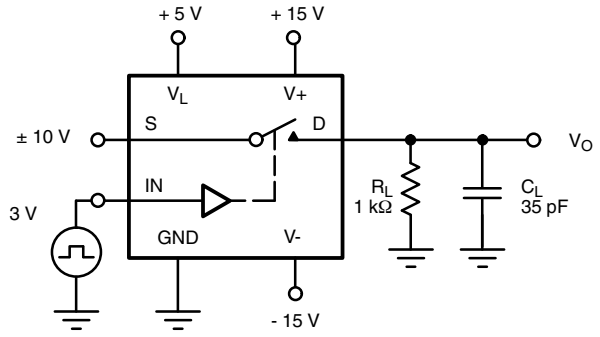
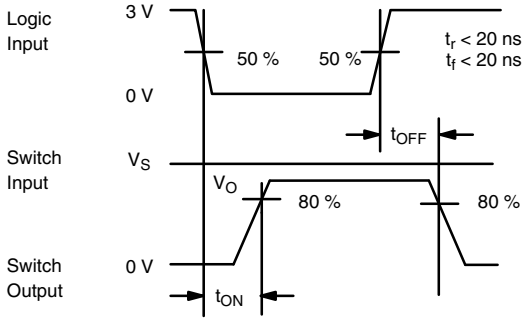


Figure 1.

TEST CIRCUITS

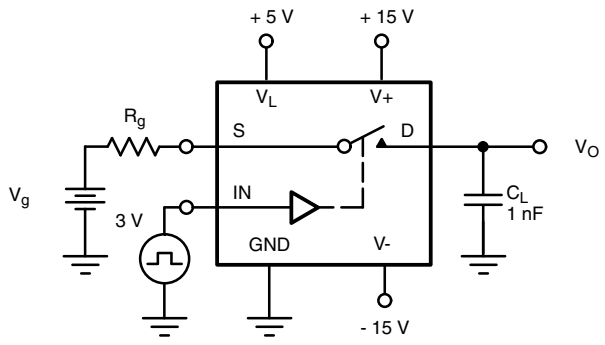


C_L (includes fixture and stray capacitance)



Note: Logic input waveform is inverted for DG445.

Figure 2. Switching Time



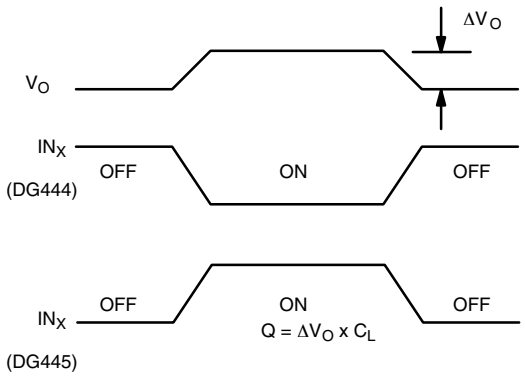


Figure 3. Charge Injection

TEST CIRCUITS

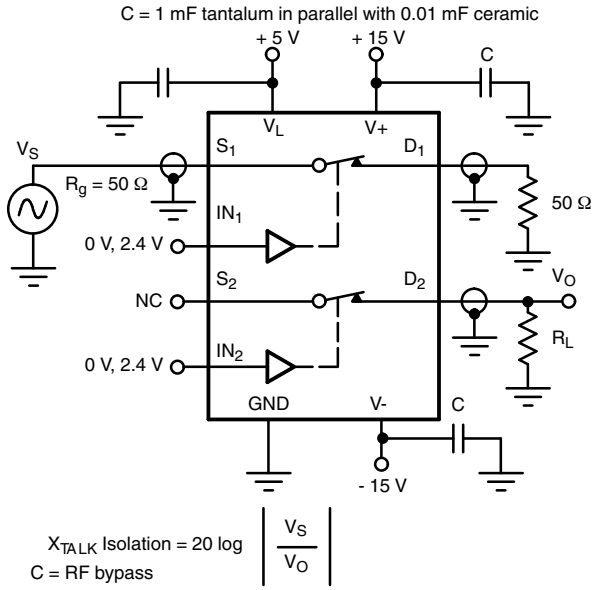


Figure 4. Crosstalk

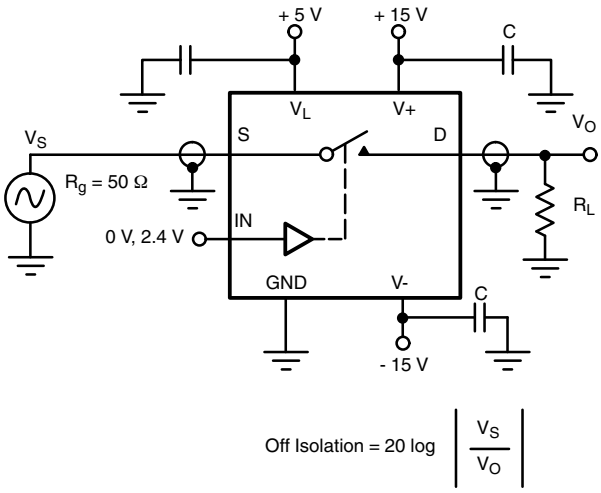


Figure 5. Off Isolation

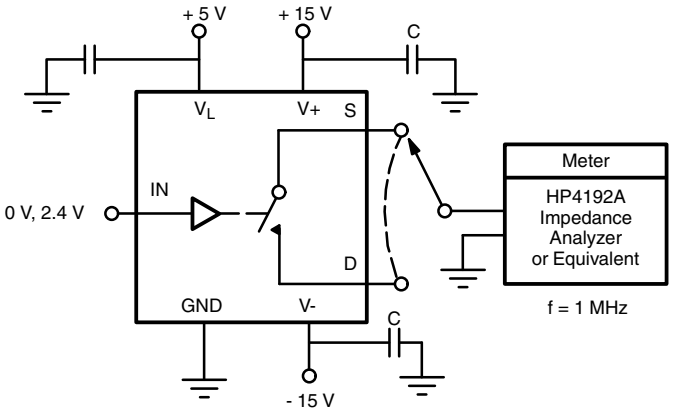


Figure 6. Source/Drain Capacitances

APPLICATIONS

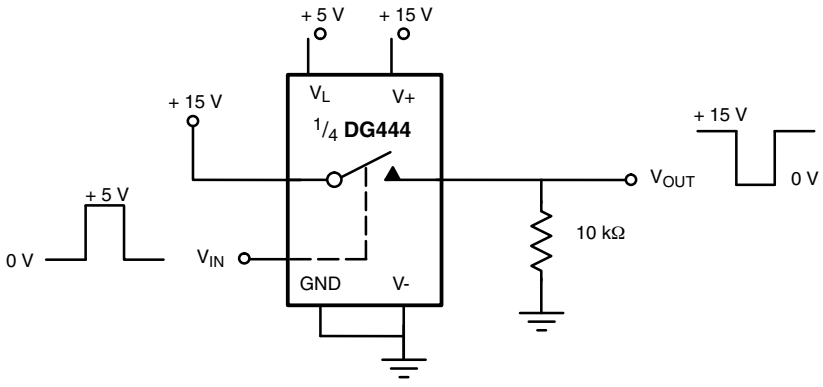


Figure 7. Level Shifter

APPLICATIONS

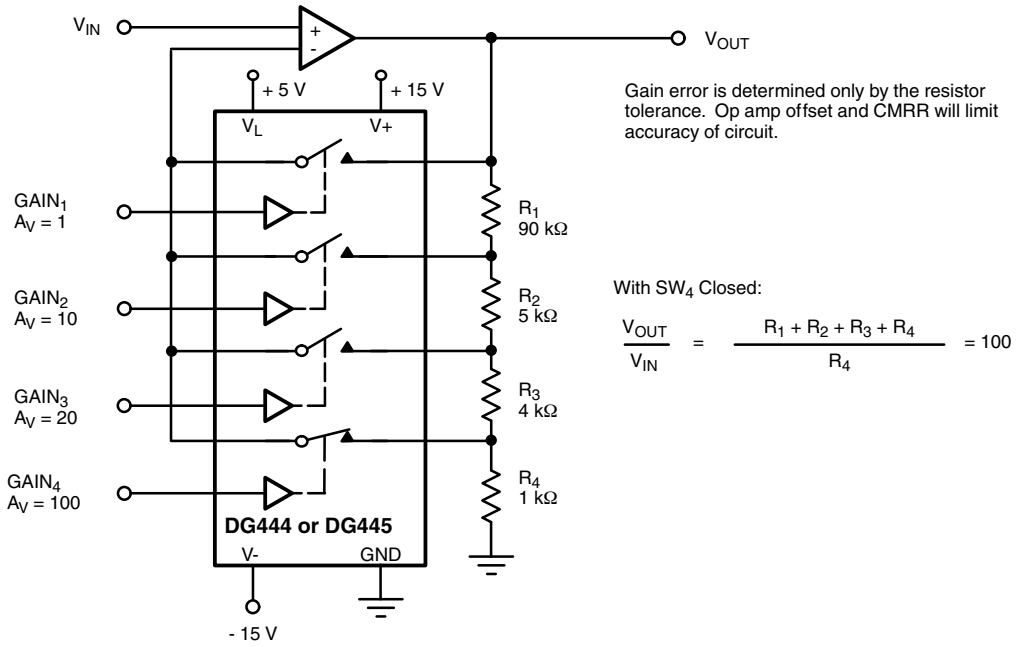


Figure 8. Precision-Weighted Resistor Programmable-Gain Amplifier

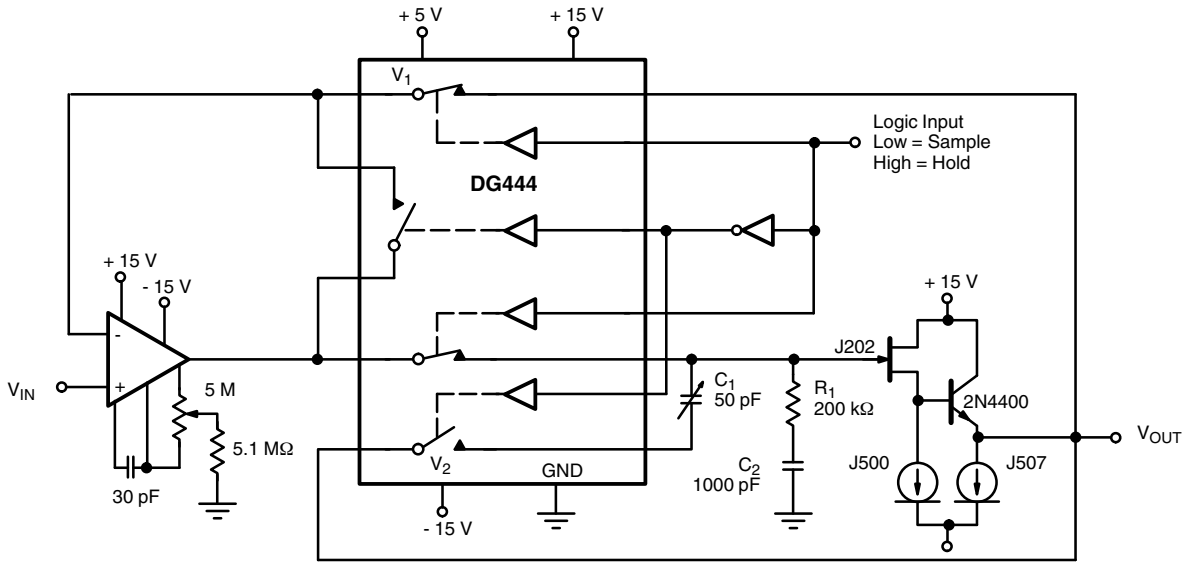
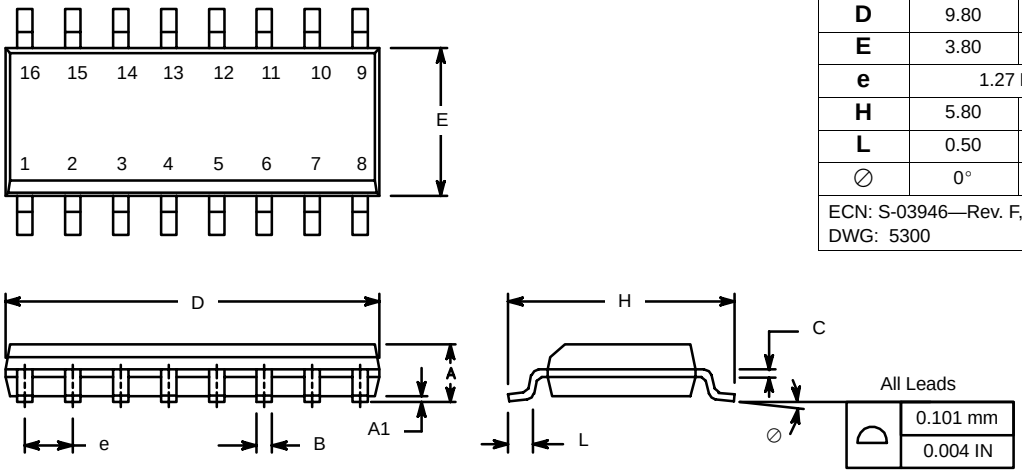


Figure 9. Precision Sample-and-Hold

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.

SOIC (NARROW): 16-LEAD

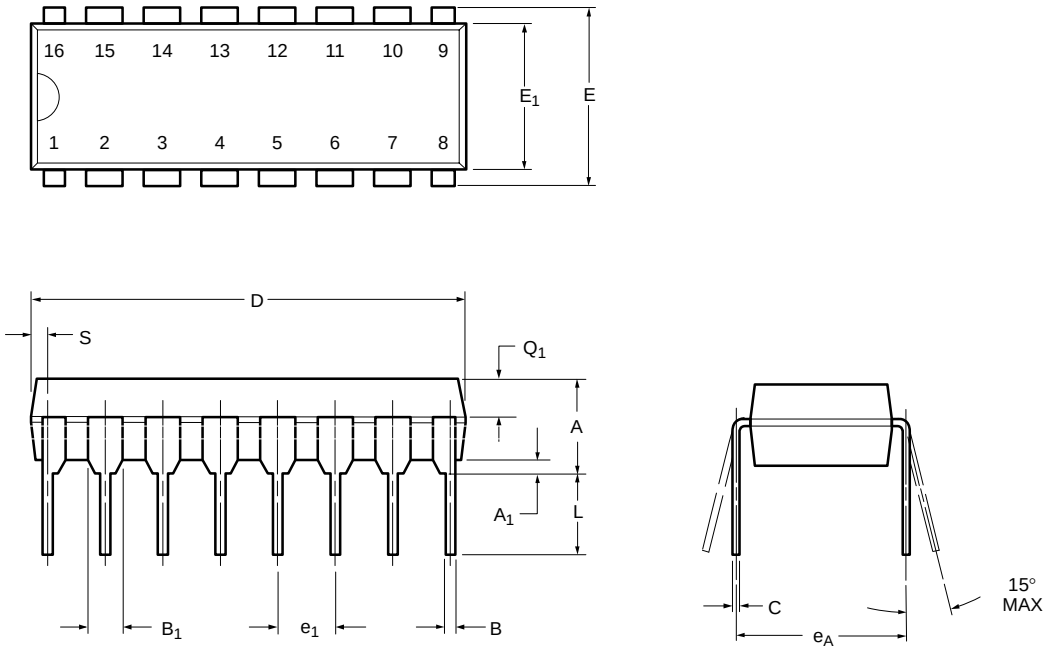
JEDEC Part Number: MS-012



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°

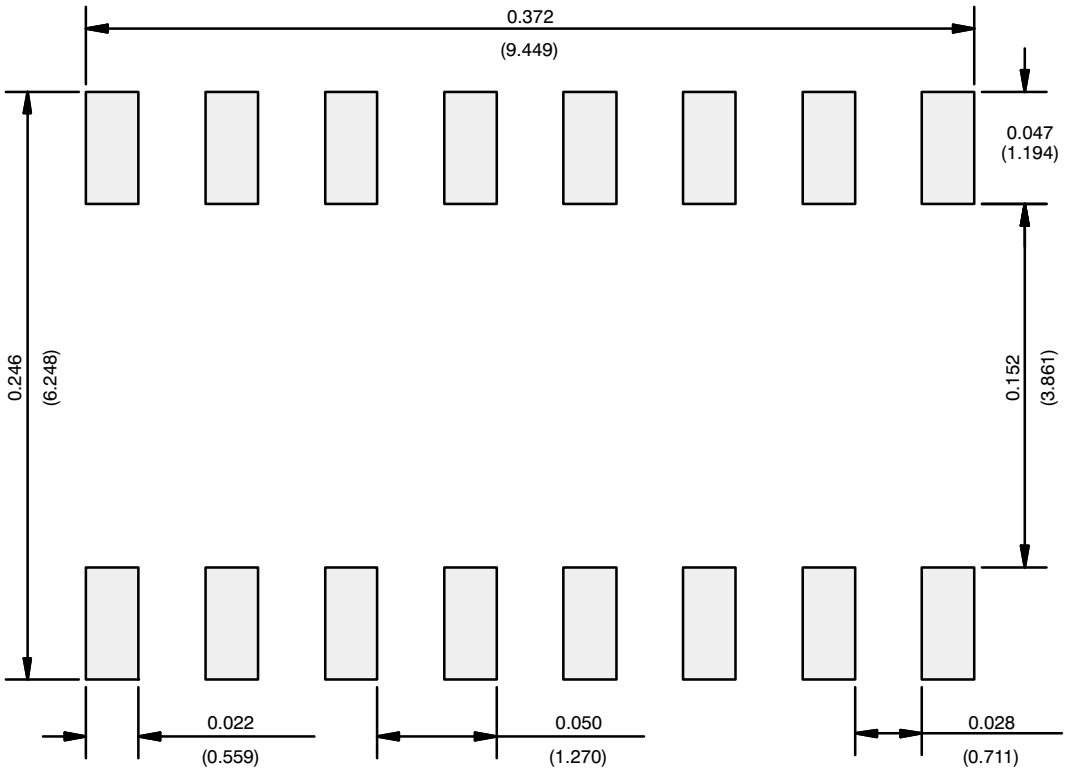
ECN: S-03946—Rev. F, 09-Jul-01
DWG: 5300

PDIP: 16-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	3.81	5.08	0.150	0.200
A_1	0.38	1.27	0.015	0.050
B	0.38	0.51	0.015	0.020
B_1	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
E_1	5.59	7.11	0.220	0.280
e_1	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
Q_1	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)

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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.

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- Поставка сложных, дефицитных, либо снятых с производства позиций;
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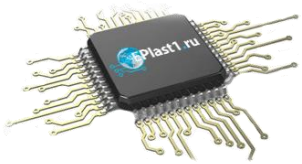
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- 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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