

## High-Speed Quad SPST CMOS Analog Switch

### DESCRIPTION

The DG201HS is an improved monolithic device containing four independent analog switches. It is designed to provide high speed, low error switching of analog signals. Combining low on-resistance (25  $\Omega$ ) with high speed ( $t_{ON}$ : 38 ns), the DG201HS is ideally suited for high speed data acquisition requirements.

To achieve high voltage ratings and superior switching performance, the DG201HS is built on a proprietary 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 values, when off.

### FEATURES

- Fast Switching- $t_{ON}$ : 38 ns
- Low On-Resistance: 25  $\Omega$
- Low Leakage: 100 pA
- Low Charge Injection
- TTL/CMOS Logic Compatible
- Single Supply Compatibility
- High Current Rating: - 30 mA

### BENEFITS

- Faster Throughput
- Higher Accuracy
- Reduced Pedestal Error
- Upgrades Existing Designs
- Simple Interfacing
- Replaces HI201HS, ADG201HS
- Space Savings (TSSOP)

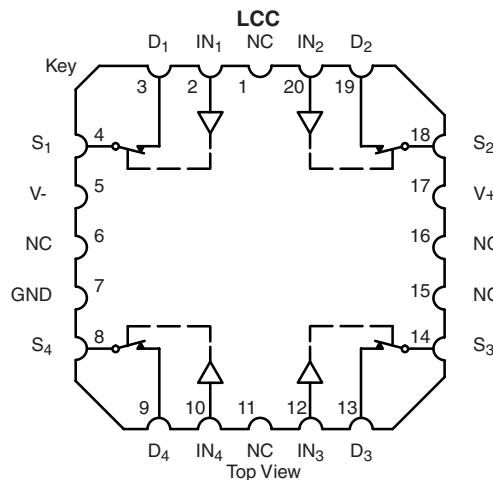
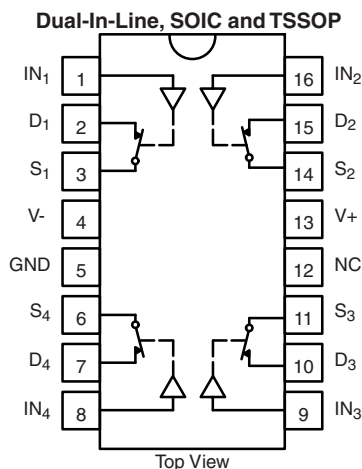
### APPLICATIONS

- Data Acquisition
- Hi-Rel Systems
- Sample-and-Hold Circuits
- Communication Systems
- Automatic Test Equipment
- Integrator Reset Circuits
- Choppers
- Gain Switching
- Avionics



**RoHS\***  
COMPLIANT

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE	
Logic	Switch
0	ON
1	OFF

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

\* Pb containing terminations are not RoHS compliant, exemptions may apply

## ORDERING INFORMATION

Temp Range	Package	Part Number
- 40 to 85 °C	16-Pin Plastic DIP	DG201HSDJ DG201HSDJ-E3
	16-Pin Narrow SOIC	DG201HSDY DG201HSDY-E3 DG201HSDY-T1 DG201HSDY-T1-E3
	16-Pin TSSOP	DG201HSDQ DG201HSDQ-E3 DG201HSDQ-T1 DG201HSDQ-T1-E3

## ABSOLUTE MAXIMUM RATINGS

Parameter	Limit	Unit
V+ to V-	44	V
GND to V-	25	
Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>	(V-) - 4 to (V+) + 4 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	(A Suffix)	- 65 to 150
	(D Suffix)	- 65 to 125
Power Dissipation (Package) <sup>b</sup>	16-Pin Plastic DIP <sup>c</sup>	470
	16-Pin CerDIP <sup>d</sup>	900
	16-Pin Narrow Body SOIC and TSSOP <sup>e</sup>	600
	LCC-20 <sup>d</sup>	900

Notes:

- Signals on S<sub>X</sub>, D<sub>X</sub>, or IN<sub>X</sub> 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 12 mW/°C above 75 °C.
- Derate 7.6 mW/°C above 75 °C.

## SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

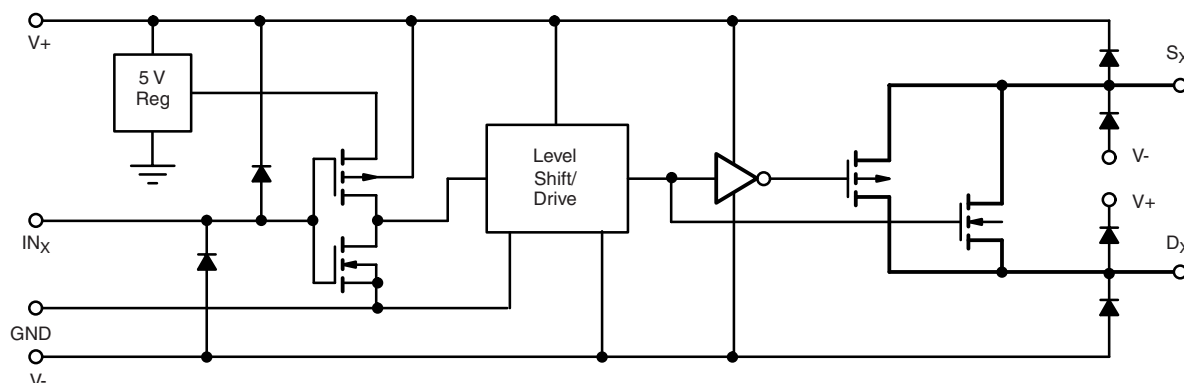


Figure 1.



SPECIFICATIONS <sup>a</sup>									
Parameter	Symbol	Test Conditions Unless Specified V <sub>+</sub> = 15 V, V <sub>-</sub> = - 15 V V <sub>IN</sub> = 3 V, 0.8 V <sup>f</sup>	Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix - 55 to 125 °C		D Suffix - 40 to 85 °C		Unit
					Min <sup>d</sup>	Max <sup>d</sup>	Min <sup>d</sup>	Max <sup>d</sup>	
Analog Switch									
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full		V-	V+	V-	V+	V
Drain-Source On-Resistance	r <sub>DS(on)</sub>	I <sub>S</sub> = - 10 mA, V <sub>D</sub> = ± 8.5 V V <sub>+</sub> = 13.5 V, V <sub>-</sub> = - 13.5 V	Room Full	25		50 75		50 75	Ω
r <sub>DS(on)</sub> Match			Room	3					%
Switch Off Leakage Current	I <sub>S(off)</sub>	V <sub>+</sub> = 16.5 V, V <sub>-</sub> = - 16.5 V V <sub>D</sub> = ± 15.5 V V <sub>S</sub> = ± 15.5 V	Room Full	0.1	- 1 - 60	1 60	- 1 - 20	1 20	nA
	I <sub>D(off)</sub>		Room Full	0.1	- 1 - 60	1 60	- 1 - 20	1 20	
Channel On Leakage Current	I <sub>D(on)</sub>	V <sub>+</sub> = 16.5 V, V <sub>-</sub> = - 16.5 V V <sub>S</sub> = V <sub>D</sub> = ± 15.5 V	Room Full	0.1	- 1 - 60	1 60	- 1 - 20	1 20	
Digital Control									
Input, High Voltage	V <sub>INH</sub>		Full		2.4		2.4		V
Input, Low Voltage	V <sub>INL</sub>		Full			0.8		0.8	
Input Capacitance	C <sub>IN</sub>		Full	5					pF
Input Current	I <sub>INH</sub> or I <sub>INL</sub>	V <sub>IN</sub> under test = 0.8 V, 3 V	Full		- 1	1	- 1	1	μA
Dynamic Characteristics									
Turn-On Time	t <sub>ON</sub>	R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 35 pF V <sub>S</sub> = ± 10 V, V <sub>INH</sub> = 3 V See Figure 2	Room Full	48		60 75		60 75	ns
Turn-Off Time	t <sub>OFF1</sub>		Room Full	30		50 70		50 70	
	t <sub>OFF2</sub>		Room	150					
Output Settling Time to 0.1 %	t <sub>s</sub>		Room	180					
Charge Injection	Q	C <sub>L</sub> = 1 nF, V <sub>S</sub> = 0 V V <sub>gen</sub> = 0 V, R <sub>gen</sub> = 0 Ω	Room	- 5					pC
Off Isolation	OIRR	R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 10 pF f = 100 kHz	Room	85					dB
Crosstalk (Channel-to-Channel)	X <sub>TALK</sub>	Any Other Channel Switches R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 10 pF f = 100 kHz	Room	100					
Source Off Capacitance	C <sub>S(off)</sub>	V <sub>S</sub> , V <sub>D</sub> = 0 V, f = 1 MHz	Room	8					pF
Drain Off Capacitance	C <sub>D(off)</sub>		Room	8					
Channel On Capacitance	C <sub>D(on)</sub>		Room	30					
Drain-to-Source Capacitance	C <sub>DS(off)</sub>		Room	0.5					
Power Supplies									
Positive Supply Current	I <sub>+</sub>	V <sub>+</sub> = 15 V, V <sub>-</sub> = - 15 V V <sub>IN</sub> = 0 or 5 V	Room Full	4.5		10		10	mA
Negative Supply Current	I <sub>-</sub>		Room Full	3.5	- 6		- 6		
Power Consumption <sup>c</sup>	P <sub>C</sub>			Full			240		240

Notes:

a. Refer to PROCESS OPTION FLOWCHART.

b. Room = 25 °C, Full = as determined by the operating temperature suffix.

c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.

e. Guaranteed by design, not subject to production test.

f. V<sub>IN</sub> = input voltage to perform proper function.

**SPECIFICATIONS<sup>a</sup> FOR SINGLE SUPPLY**

Parameter	Symbol	Test Conditions Unless Specified V+ = 10.8 V to 16.5 V, V- = GND = 0 V, VIN = 3 V, 0.8 V <sup>f</sup>	Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix - 55 to 125 °C		D Suffix - 40 to 85 °C		Unit
					Min <sup>d</sup>	Max <sup>d</sup>	Min <sup>d</sup>	Max <sup>d</sup>	
Analog Switch									
Analog Signal Range <sup>e</sup>	VANALOG		Full		0	V+	0	V+	V
Drain-Source On-Resistance	rDS(on)	IS = - 10 mA, VD = 8.5 V V+ = 10.8 V	Room Full	65		90 120		90 120	Ω
Switch Off Leakage Current	IS(off)	V+ = 16.5 V VS = 0.5 V, 10 V VD = 10 V, 0.5 V	Room Full	0.1	- 1 - 60	1 60	- 1 - 20	1 20	nA
	ID(off)		Room Full	0.1	- 1 - 60	1 60	- 1 - 20	1 20	
Channel On Leakage Current	ID(on) + IS(on)	V+ = 16.5 V VD = 0.5 V, 10 V	Room Full	0.1	- 1 - 60	1 60	- 1 - 20	1 20	
Digital Control									
Input, High Voltage	VINH		Full		2.4		2.4		V
Input, Low Voltage	VINL		Full			0.8		0.8	
Input Capacitance	CIN		Full	5					pF
Input Current	IINH or IINL	V+ = 16.5 V VIN under test = 0.8 V, 3 V	Full		- 1	1	- 1	1	μA
Dynamic Characteristics									
Turn-On Time	tON	RL = 1 kΩ, CL = 35 pF VS = 2 V, V = 10.8 V See Figure 2	Room Full			50 70		50 70	ns
Turn-Off Time	tOFF1		Room Full			50 70		50 70	
	tOFF2		Room	150					
Output Settling Time to 0.1 %	ts		Room	180					
Charge Injection	Q	CL = 1 nF, VS = 0 V Vgen = 0 V, Rgen = 0 Ω	Room	10					pC
Off Isolation	OIRR	RL = 1 kΩ, CL = 10 pF f = 100 kHz	Room	85					dB
Crosstalk (Channel-to-Channel)	XTALK	Any Other Channel Switches RL = 1 kΩ, CL = 10 pF f = 100 kHz	Room	100					
Source Off Capacitance	CS(off)	f = 1 MHz	Room	10					pF
Drain Off Capacitance	CD(off)		Room	10					
Channel On Capacitance	CD(on)	VANALOG = 0 V	Room	30					
Power Supply									
Positive Supply Current	I+	V+ = 15 V, VIN = 0 or 5 V	Full			10		10	mA
Power Consumption <sup>c</sup>	PC		Full			150		150	mW

## Notes:

a. Refer to PROCESS OPTION FLOWCHART.

b. Room = 25 °C, Full = as determined by the operating temperature suffix.

c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

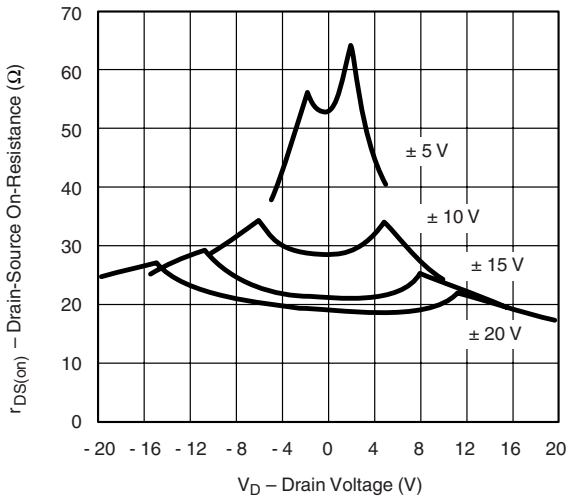
d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.

e. Guaranteed by design, not subject to production test.

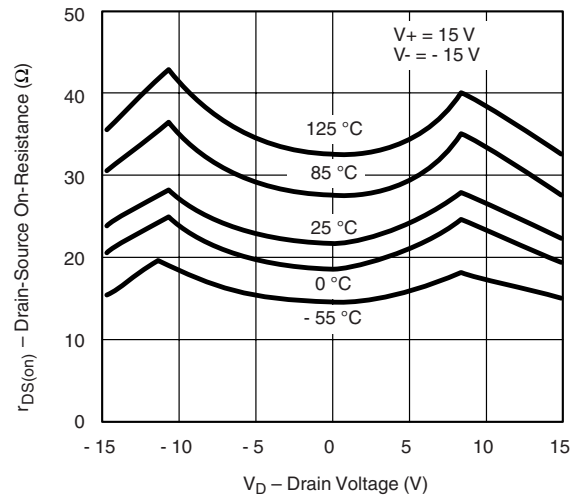
f.  $V_{\text{IN}}$  = input voltage to perform proper function.

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.

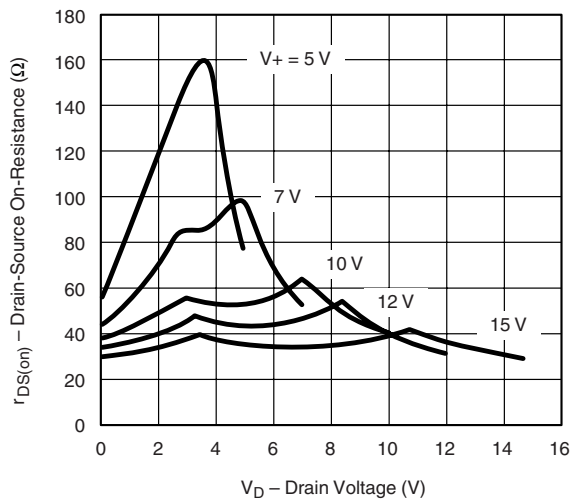
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



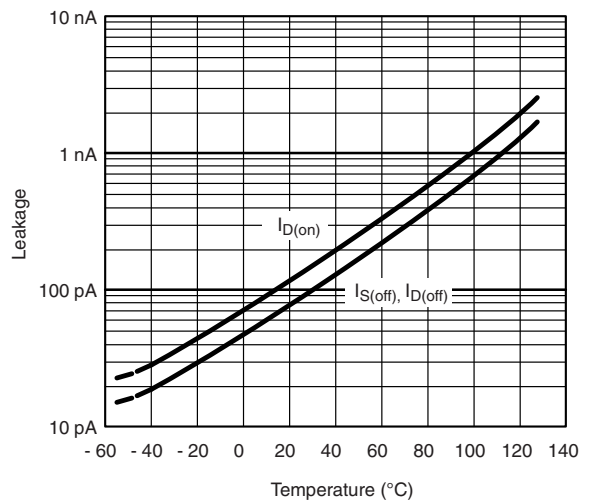
$r_{DS(on)}$  vs.  $V_D$  and Power Supply Voltages



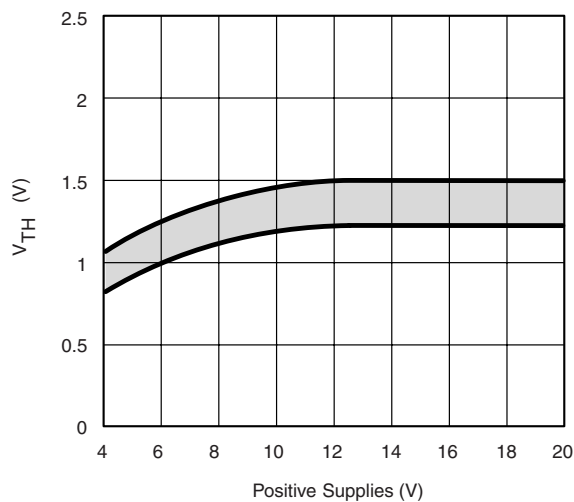
$r_{DS(on)}$  vs.  $V_D$  and Temperature



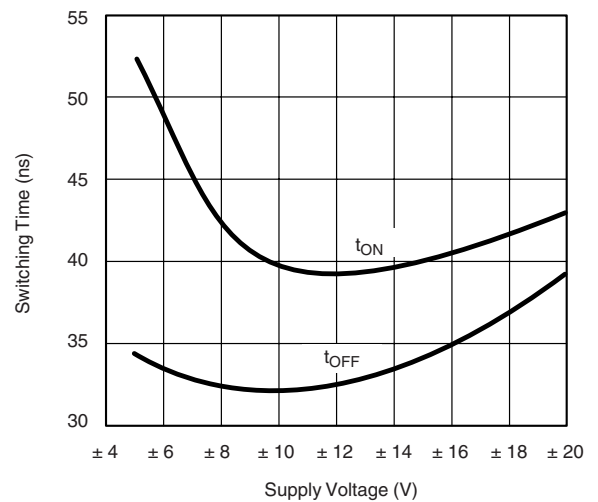
$r_{DS(on)}$  vs.  $V_D$  and Single Power Supply Voltages



Leakage Currents vs. Temperature

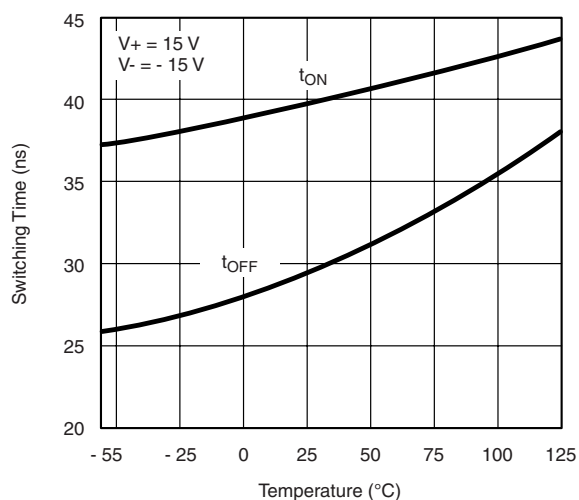


Input Switching Threshold vs. Supply Voltage

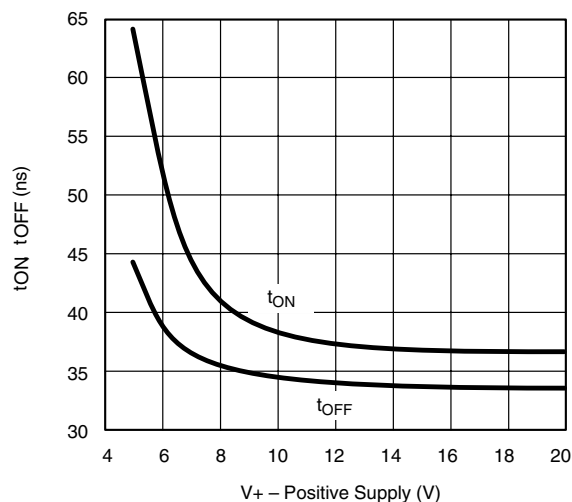


Switching Time vs. Power Supply Voltage

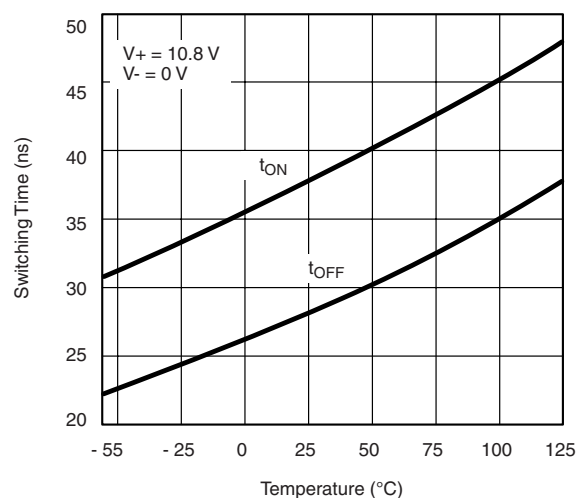
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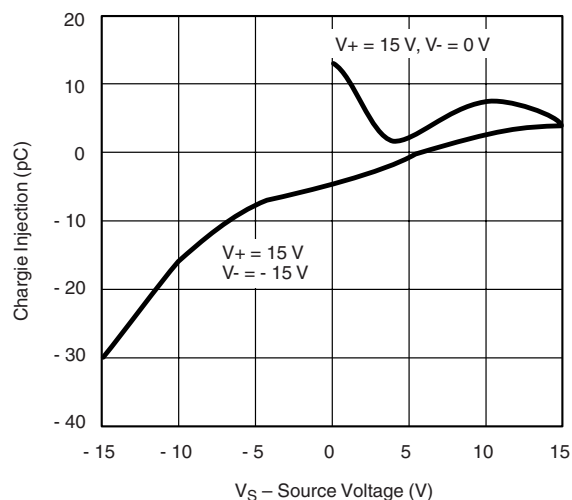
Switching Times vs. Temperature



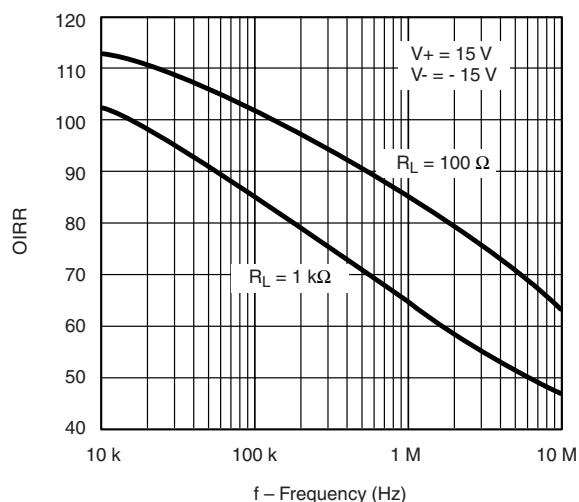
Switching Times vs. Power Supply Voltage



Switching Times vs. Temperature



Charge Injection vs. Source Voltage



Off Isolation vs. Frequency

## TEST CIRCUITS

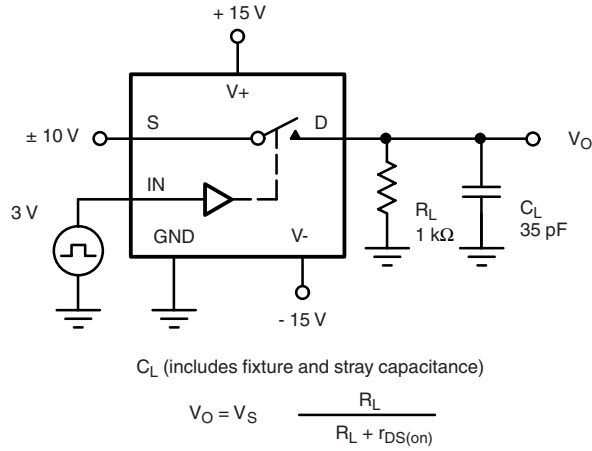


Figure 2. Switching Time

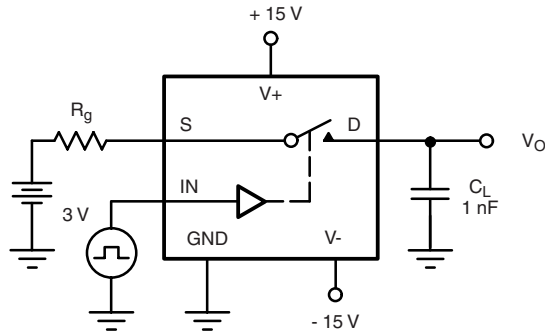
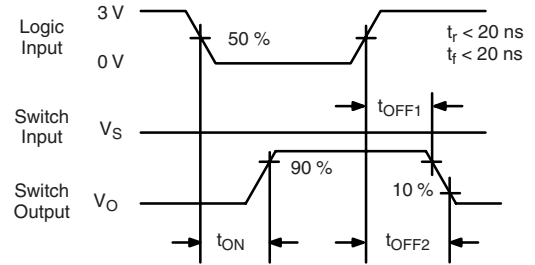


Figure 3. Charge Injection

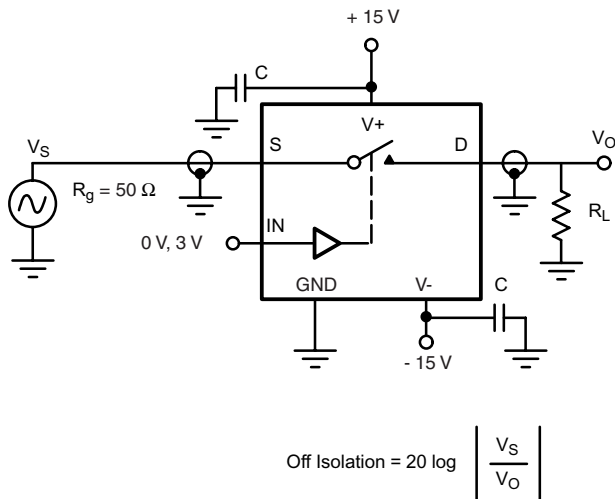
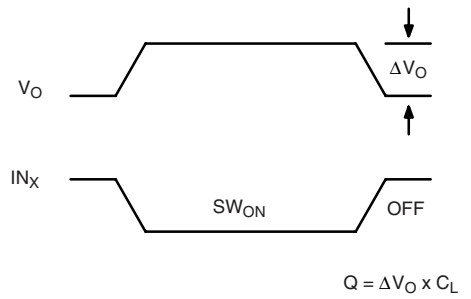


Figure 4. Off Isolation

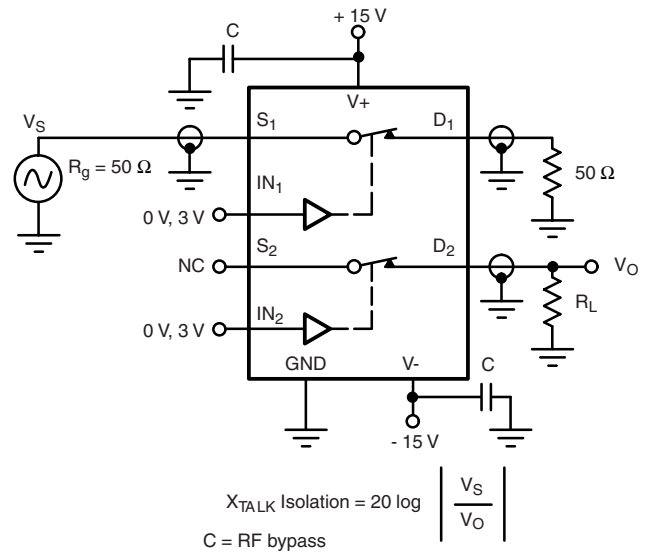
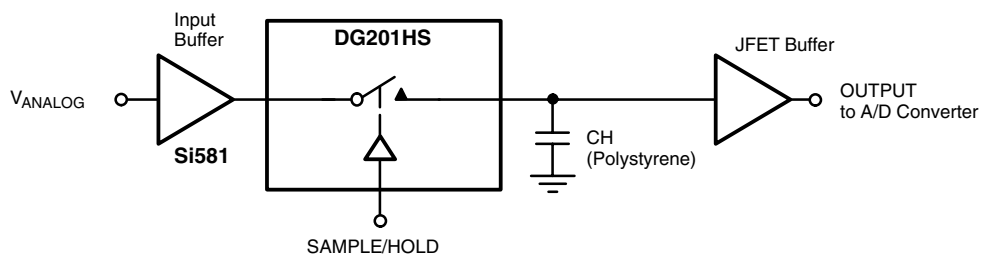


Figure 5. Crosstalk

### APPLICATIONS

A high-speed, low-glitch analog switch such as Vishay Siliconix's DG201HS improves the accuracy and shortens the acquisition and settling times of a sample-and-hold circuit.



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