

## High-Speed Quad SPST CMOS Analog Switch

### 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

### Description

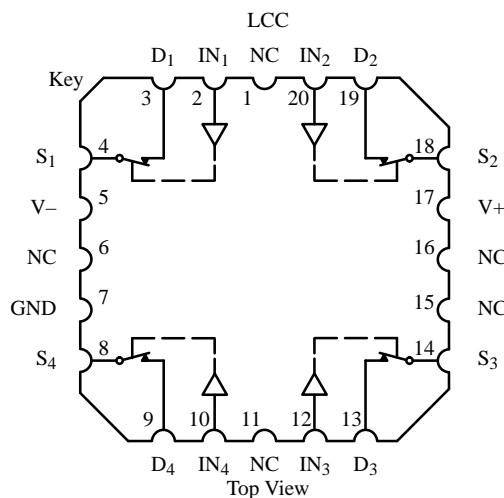
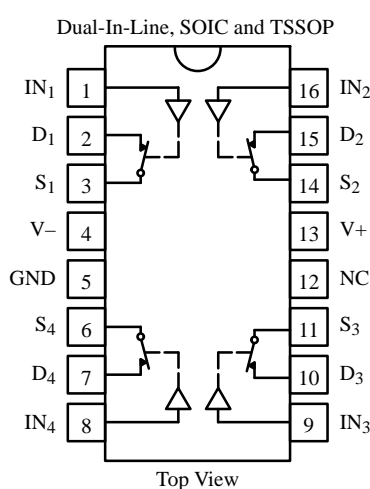
The DG201HS is an improved monolithic device containing four independent analog switches. It is designed to provide high speed, low error switching of analog signals. Combining low on-resistance (25  $\Omega$ ) with high speed ( $t_{ON}$ : 38 ns), the DG201HS is ideally suited for high speed data acquisition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

### 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

Updates to this data sheet may be obtained via facsimile by calling Siliconix FaxBack, 1-408-970-5600. Please request FaxBack document #70038.

## Ordering Information

Temp Range	Package	Part Number
-40 to 85°C	16-Pin Plastic DIP	DG201HSDJ
	16-Pin Narrow SOIC	DG201HSDY
	16-Pin TSSOP	DG201HSDQ
-55 to 125°C	16-Pin CerDIP	DG201HSAK/883
	LCC-20	DG201HSAZ/883

## Absolute Maximum Ratings

V+ to V-	44 V	16-Pin CerDIP <sup>d</sup>	900 mW
GND to V-	25 V	16-Pin Narrow Body SOIC and TSSOP <sup>e</sup>	600 mW
Digital Inputs <sup>a</sup> V <sub>S</sub> , V <sub>D</sub>	(V-) -4 V to (V+) +4 V or 30 mA, whichever occurs first	LCC-20 <sup>d</sup>	900 mW
Continuous Current (Any Terminal)	30 mA	Notes:	
Current, S or D (Pulsed 1 ms, 10% duty cycle)	100 mA	a. 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.	
Storage Temperature (A Suffix)	-65 to 150°C	b. All leads welded or soldered to PC board.	
(D Suffix)	-65 to 125°C	c. Derate 6 mW/°C above 75°C.	
Power Dissipation (Package) <sup>b</sup>		d. Derate 12 mW/°C above 75°C.	
16-Pin Plastic DIP <sup>c</sup>	470 mW	e. Derate 7.6 mW/°C above 75°C.	

## Schematic Diagram (Typical Channel)

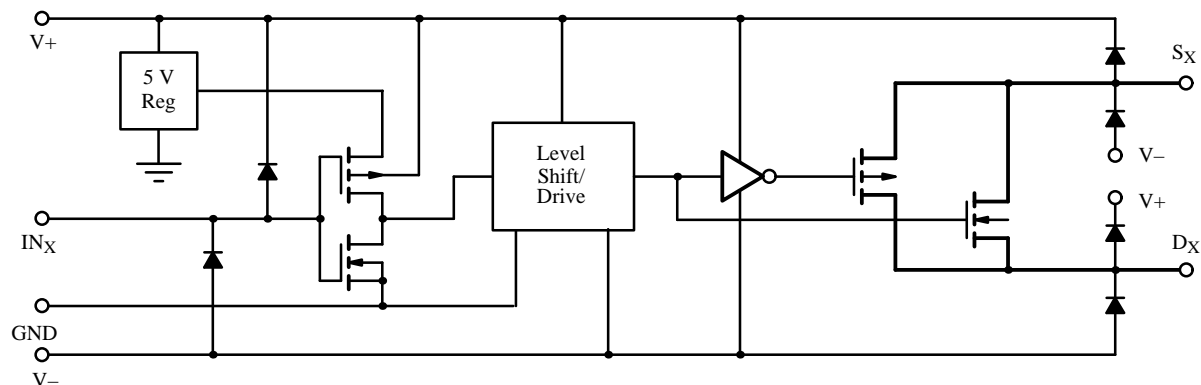


Figure 1.

## Specifications<sup>a</sup>

Parameter	Symbol	Conditions Unless Otherwise Specified $V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ $V_{IN} = 3\text{ V}$ , $0.8\text{ V}^f$	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>	
<b>Analog Switch</b>									
Analog Signal Range <sup>e</sup>	$V_{ANALOG}$		Full		$V_-$	$V_+$	$V_-$	$V_+$	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	25		50 75		50 75	$\Omega$
$r_{DS(on)}$ Match			Room	3					%
Switch Off Leakage Current	$I_{S(off)}$	$V_+ = 16.5\text{ V}$ , $V_- = -16.5\text{ V}$ $V_D = \pm 15.5\text{ V}$ $V_S = \mp 15.5\text{ V}$	Room Full	0.1	-1 -60	1 60	-1 -20	1 20	nA
	$I_{D(off)}$		Room Full	0.1	-1 -60	1 60	-1 -20	1 20	
Channel On Leakage Current	$I_{D(on)}$	$V_+ = 16.5\text{ V}$ , $V_- = -16.5\text{ V}$ $V_S = V_D = \mp 15.5\text{ V}$	Room Full	0.1	-1 -60	1 60	-1 -20	1 20	
<b>Digital Control</b>									
Input, High Voltage	$V_{INH}$		Full		2.4		2.4		V
Input, Low Voltage	$V_{INL}$		Full			0.8		0.8	
Input Capacitance	$C_{in}$		Full	5					pF
Input Current	$I_{INL}$ OR $I_{INH}$	$V_{IN}$ under test = 0.8 V, 3 V	Full		-1	1	-1	1	$\mu\text{A}$
<b>Dynamic Characteristics</b>									
Turn-On Time	$t_{ON}$	$R_L = 1\text{ k}\Omega$ , $C_L = 35\text{ pF}$ $V_S = \pm 10\text{ V}$ , $V_{INH} = 3\text{ V}$ See Figure 3	Room Full	48		60 75		60 75	ns
Turn-Off Time	$t_{OFF1}$		Room Full	30		50 70		50 70	
	$t_{OFF2}$		Room	150					
Output Settling Time to 0.1%	$t_s$		Room	180					
Charge Injection	Q	$C_L = 1\text{ nF}$ , $V_S = 0\text{ V}$ $V_{gen} = 0\text{ V}$ , $R_{gen} = 0\text{ }\Omega$	Room	-5					pC
OFF Isolation	OIRR	$R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$ $f = 100\text{ kHz}$	Room	85					dB
Crosstalk (Channel-to-Channel)	$X_{TALK}$	Any Other Channel Switches $R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$ $f = 100\text{ kHz}$	Room	100					
Source Off Capacitance	$C_{S(off)}$	$V_S, V_D = 0\text{ V}$ , $f = 1\text{ MHz}$	Room	8					pF
Drain Off Capacitance	$C_{D(off)}$		Room	8					
Channel On Capacitance	$C_{D(on)}$		Room	30					
Drain-to-Source Capacitance	$C_{DS(off)}$		Room	0.5					
<b>Power Supplies</b>									
Positive Supply Current	$I_+$	$V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ $V_{IN} = 0$ or $5\text{ V}$	Room Full	4.5		10		10	mA
Negative Supply Current	$I_-$		Room Full	3.5	-6		-6		
Power Consumption <sup>c</sup>	$P_C$			Full			240		240

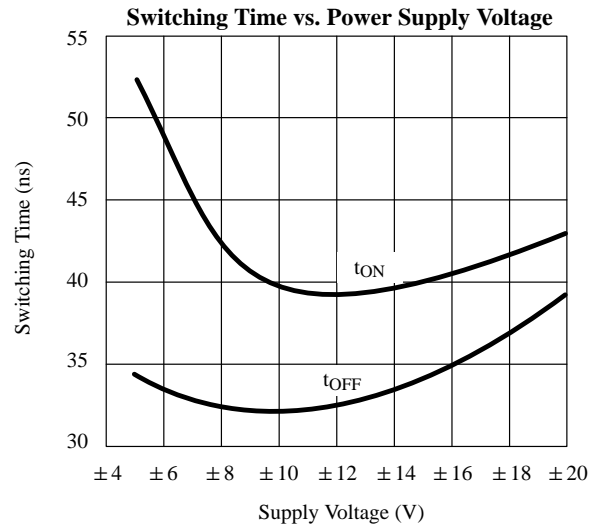
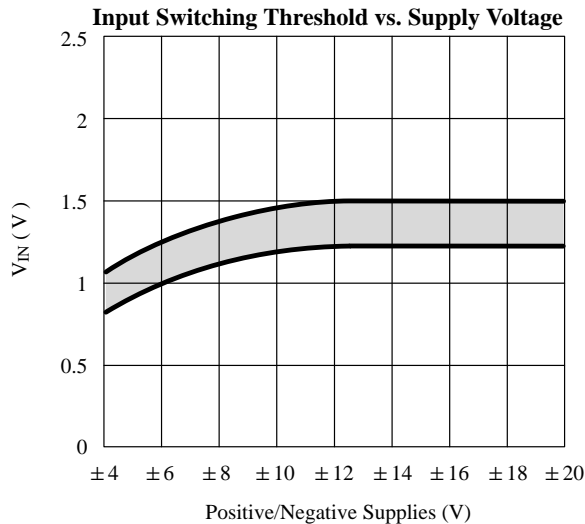
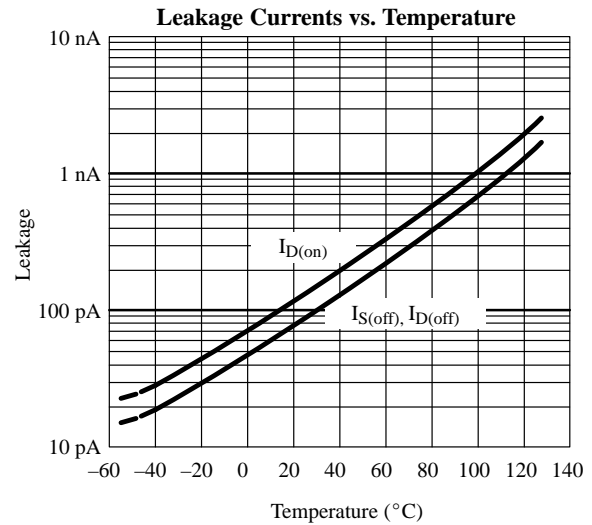
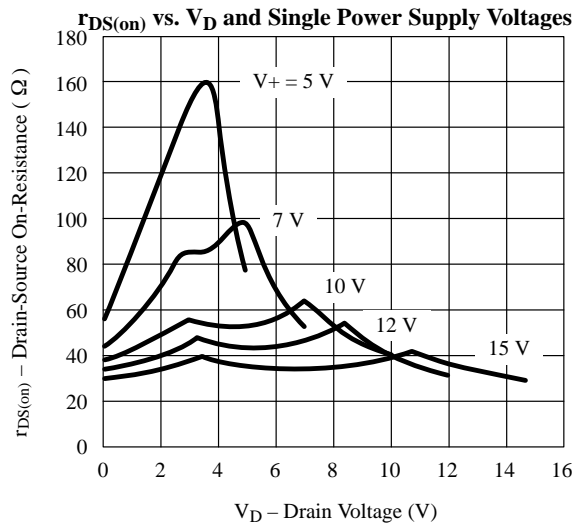
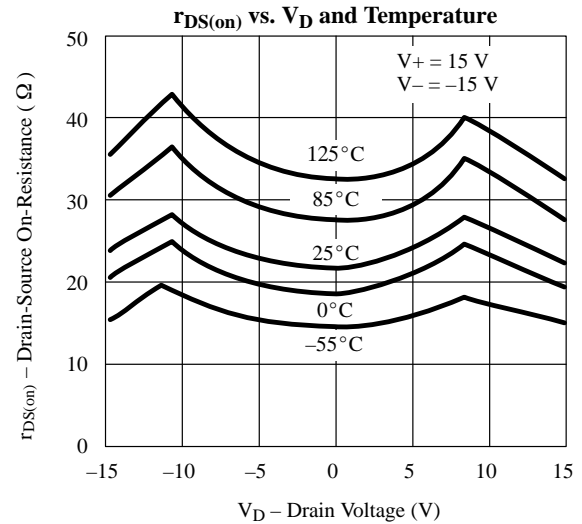
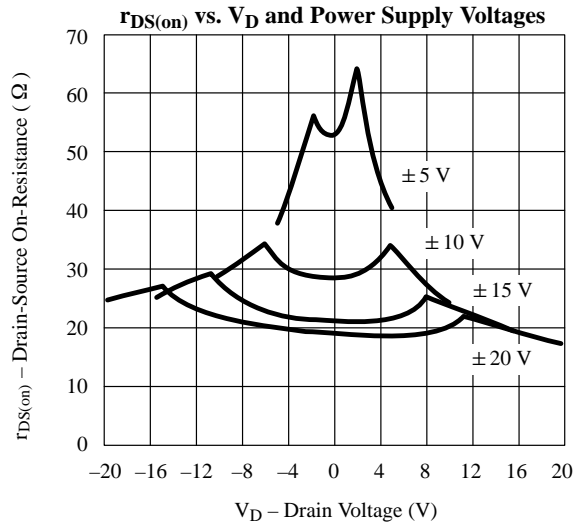
## Specifications<sup>a</sup> for Single Supply

Parameter	Symbol	Conditions Unless Otherwise Specified $V_+ = 10.8\text{ V to }16.5\text{ V}$ $V_- = \text{GND} = 0\text{ V}$ $V_{IN} = 3\text{ V, }0.8\text{ V}^f$	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>	
<b>Analog Switch</b>									
Analog Signal Range <sup>e</sup>	$V_{ANALOG}$		Full		0	$V_+$	0	$V_+$	V
Drain-Source On-Resistance	$r_{DS(on)}$	$I_S = -10\text{ mA, }V_D = 8.5\text{ V}$ $V_+ = 10.8\text{ V}$	Room Full	65		90 120		90 120	$\Omega$
Switch Off Leakage Current	$I_{S(off)}$	$V_+ = 16.5\text{ V, }V_S = 0.5\text{ V, }10\text{ V}$ $V_D = 10\text{ V, }0.5\text{ V}$	Room Full	0.1	-1 -60	1 60	-1 -20	1 20	nA
	$I_{D(off)}$		Room Full	0.1	-1 -60	1 60	-1 -20	1 20	
Channel On Leakage Current	$I_{D(on)} + I_{S(on)}$	$V_+ = 16.5\text{ V, }V_D = 0.5\text{ V, }10\text{ V}$	Room Full	0.1	-1 -60	1 60	-1 -20	1 20	
<b>Digital Control</b>									
Input, High Voltage	$V_{INH}$		Full		2.4		2.4		V
Input, Low Voltage	$V_{INL}$		Full			0.8		0.8	
Input Capacitance	$C_{in}$		Full	5					pF
Input Current	$I_{INL}$ or $I_{INH}$	$V_+ = 16.5\text{ V}$ $V_{IN}$ under test = 0.8 V, 3 V	Full		-1	1	-1	1	$\mu\text{A}$
<b>Dynamic Characteristics</b>									
Turn-On Time	$t_{ON}$	$R_L = 1\text{ k}\Omega, C_L = 35\text{ pF, }V_S = 2\text{ V}$ $V = 10.8\text{ V, See Figure 2}$	Room Full			50 70		50 70	ns
Turn-Off Time	$t_{OFF1}$		Room Full			50 70		50 70	
	$t_{OFF2}$		Room	150					
Output Settling Time to 0.1%	$t_s$		Room	180					
Charge Injection	Q	$C_L = 1\text{ nF, }V_S = 0\text{ V}$ $V_{gen} = 0\text{ V, }R_{gen} = 0\text{ }\Omega$	Room	10					pC
Off Isolation	OIRR	$R_L = 1\text{ k}\Omega, C_L = 10\text{ pF}$ $f = 100\text{ kHz}$	Room	85					dB
Crosstalk (Channel-to-Channel)	$X_{TALK}$	Any Other Channel Switches $R_L = 1\text{ k}\Omega, C_L = 10\text{ pF}$ $f = 100\text{ kHz}$	Room	100					
Source Off Capacitance	$C_{S(off)}$	$f = 1\text{ MHz}$	Room	10					pF
Drain Off Capacitance	$C_{D(off)}$		Room	10					
Channel On Capacitance	$C_{D(on)}$		$V_{ANALOG} = 0\text{ V}$	Room	30				
<b>Power Supplies</b>									
Positive Supply Current	$I_+$	$V_+ = 15\text{ V, }V_{IN} = 0\text{ or }5\text{ V}$	Full			10		10	mA
Power Consumption <sup>e</sup>	$P_C$		Full			150		150	mW

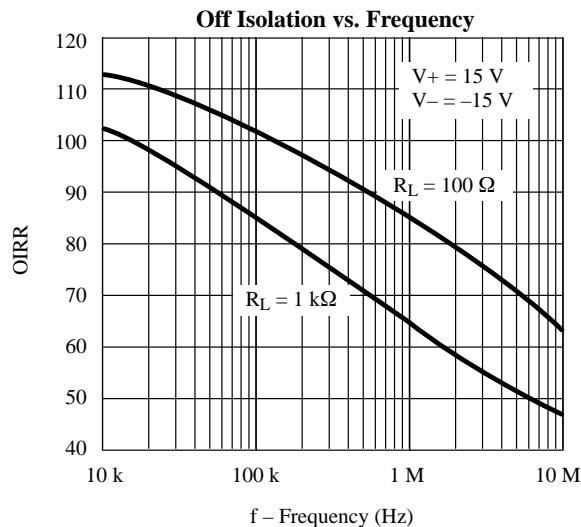
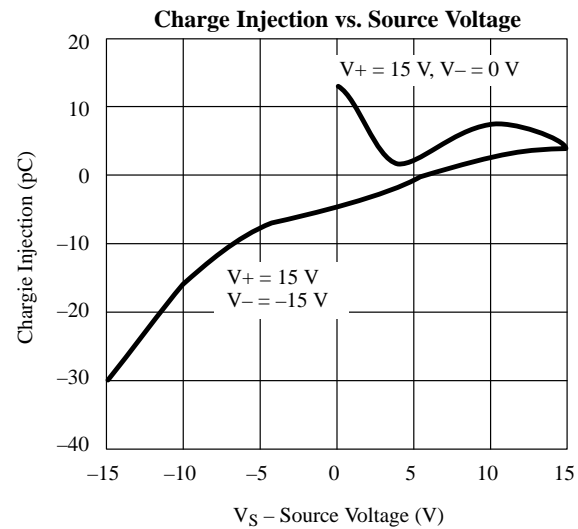
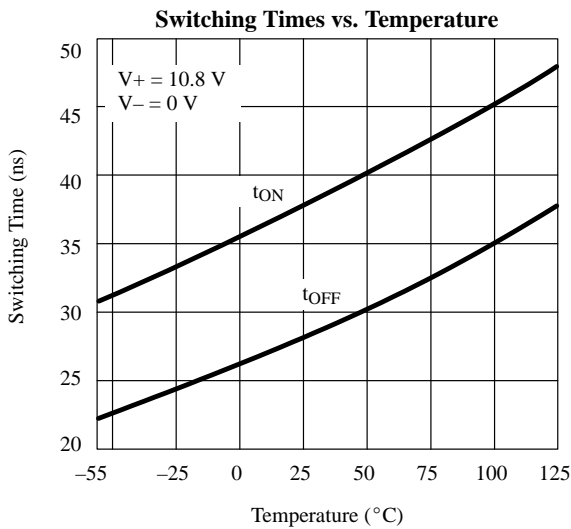
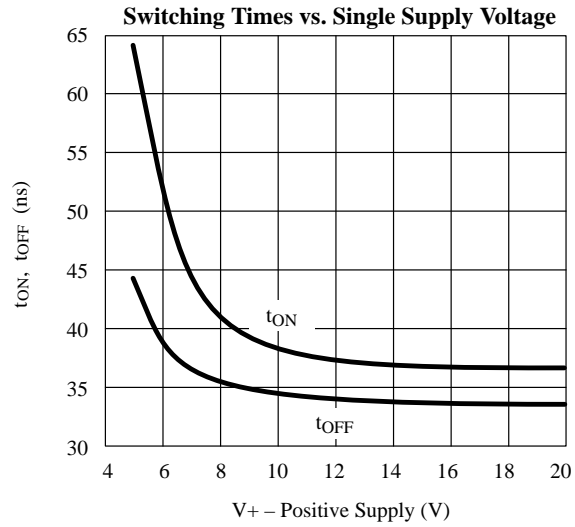
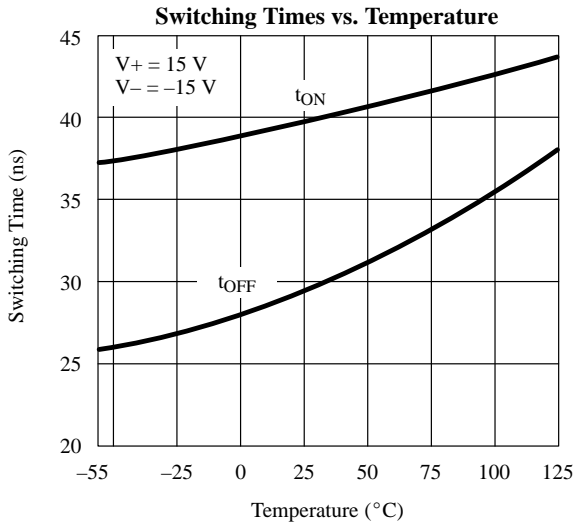
Notes:

- 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 data sheet.
- Guaranteed by design, not subject to production test.
- $V_{IN}$  = input voltage to perform proper function.

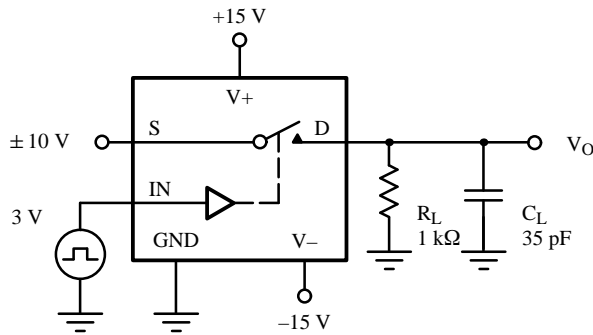
## Typical Characteristics



## Typical Characteristics (Cont'd)

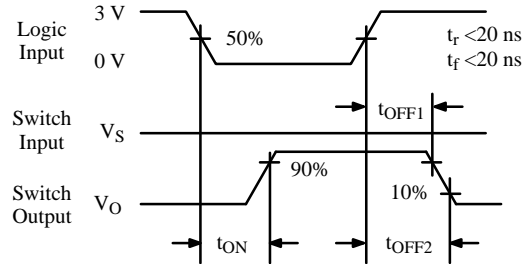


## Test Circuits

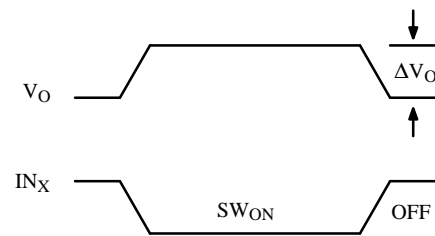
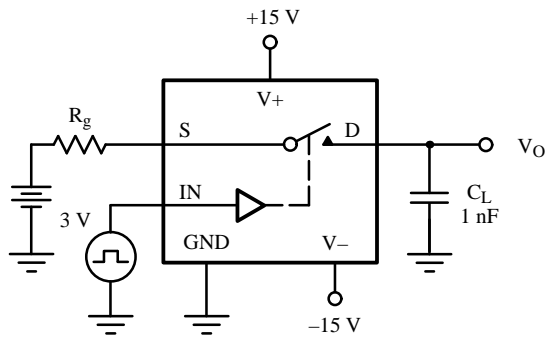


$C_L$  (includes fixture and stray capacitance)

$$V_O = V_S \frac{R_L}{R_L + r_{DS(on)}}$$

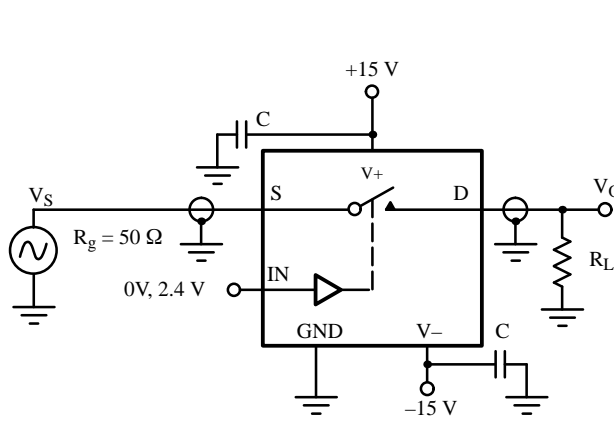


**Figure 2.** Switching Time



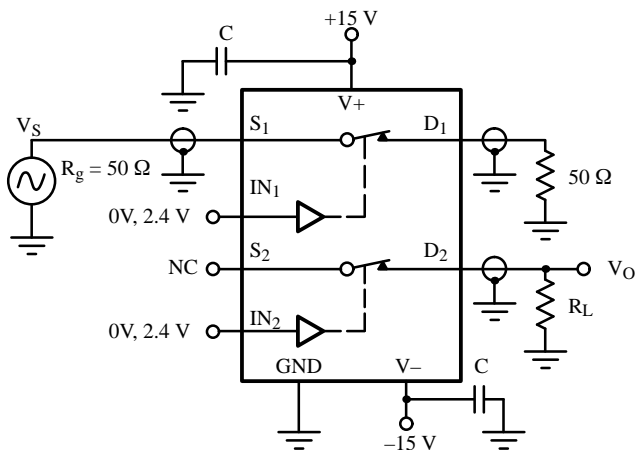
$$Q = \Delta V_O \times C_L$$

**Figure 3.** Charge Injection



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

**Figure 4.** Off Isolation



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

$C = \text{RF bypass}$

**Figure 5.** Crosstalk

## Applications

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

