

High-Speed Quad SPST CMOS Analog Switch

Features

- Fast Switching— t_{ON} : 38 ns
- Low On-Resistance: 25 Ω
- 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

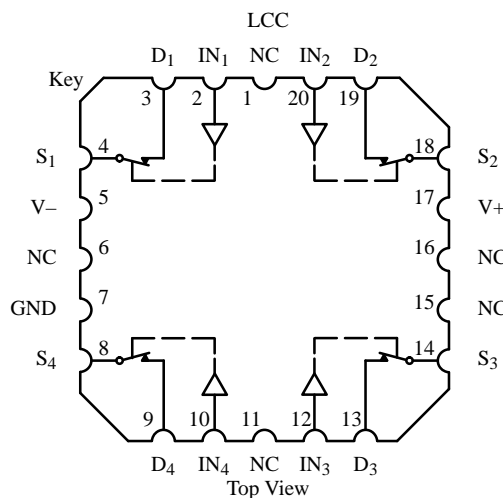
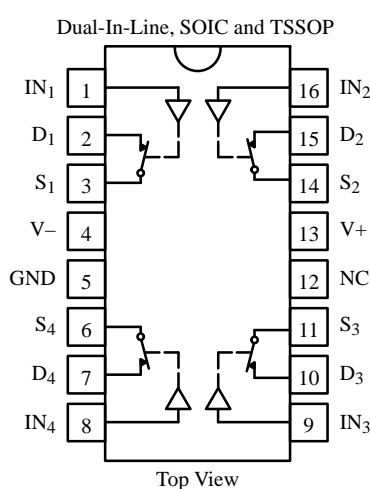
The DG201HS is an improved monolithic device containing four independent analog switches. It is designed to provide high speed, low error switching of analog signals. Combining low on-resistance (25 Ω) with high speed (t_{ON} : 38 ns), the DG201HS is ideally suited for high speed data acquisition requirements.

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 ^d	900 mW
GND to V-	25 V	16-Pin Narrow Body SOIC and TSSOP ^e	600 mW
Digital Inputs ^a V _S , V _D	(V-) -4 V to (V+) +4 V or 30 mA, whichever occurs first	LCC-20 ^d	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 _X , D _X , or IN _X 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) ^b		d. Derate 12 mW/°C above 75°C.	
16-Pin Plastic DIP ^c	470 mW	e. Derate 7.6 mW/°C above 75°C.	

Schematic Diagram (Typical Channel)

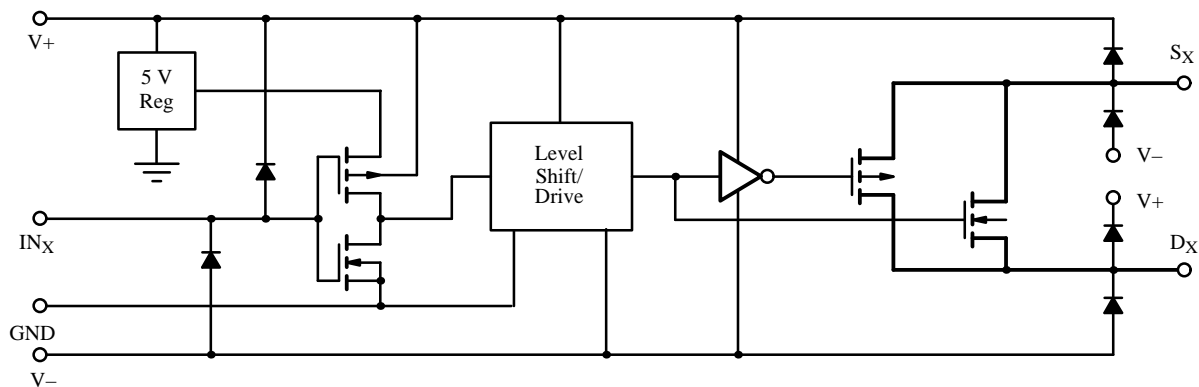


Figure 1.

Specifications^a

Parameter	Symbol	Conditions Unless Otherwise Specified $V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ $V_{IN} = 3\text{ V}$, 0.8 V^f	Temp ^b	Typ ^c	A Suffix -55 to 125°C		D Suffix -40 to 85°C		Unit	
					Min ^d	Max ^d	Min ^d	Max ^d		
Analog Switch										
Analog Signal Range ^e	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		Ω
$r_{DS(on)}$ 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		
Digital Control										
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	μA	
Dynamic Characteristics										
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						
Power Supplies										
Positive Supply Current	I_+	$V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ $V_{IN} = 0$ or 5 V	Room Full	4.5		10		10	mA	
Negative Supply Current	I_-		Room Full	3.5	-6		-6			
Power Consumption ^c	P_C			Full			240		240	mW

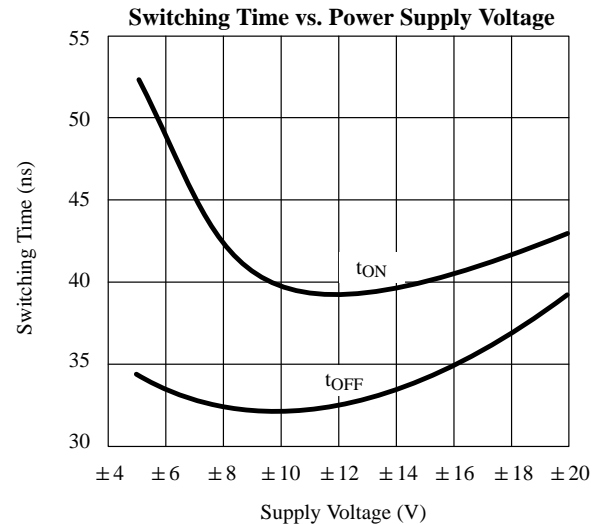
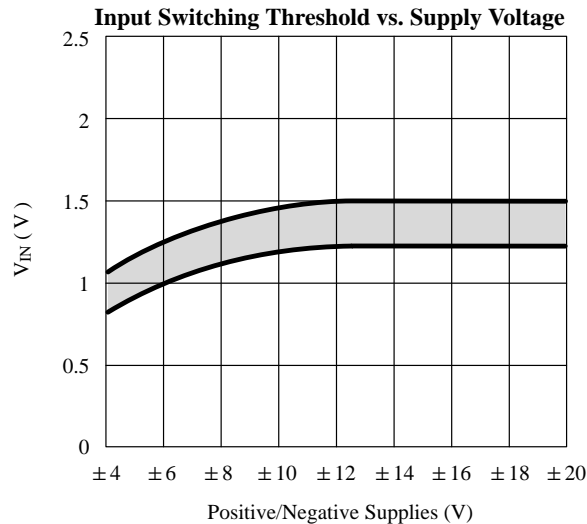
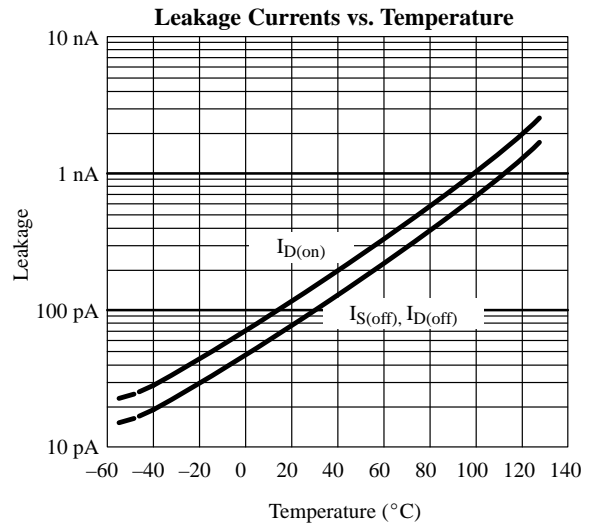
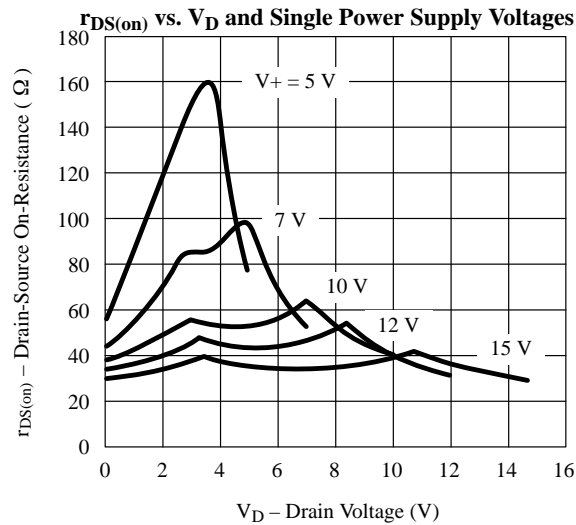
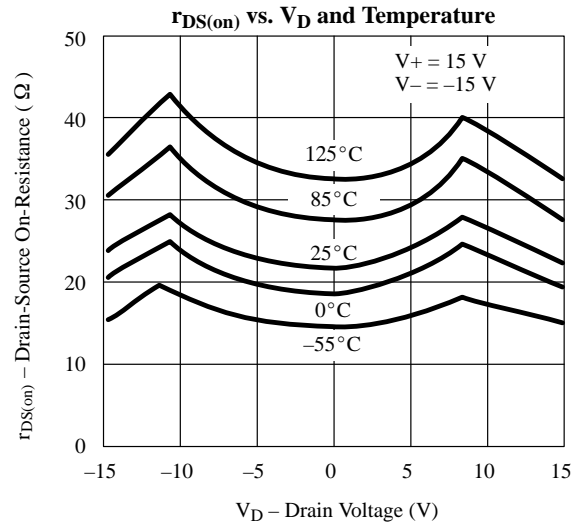
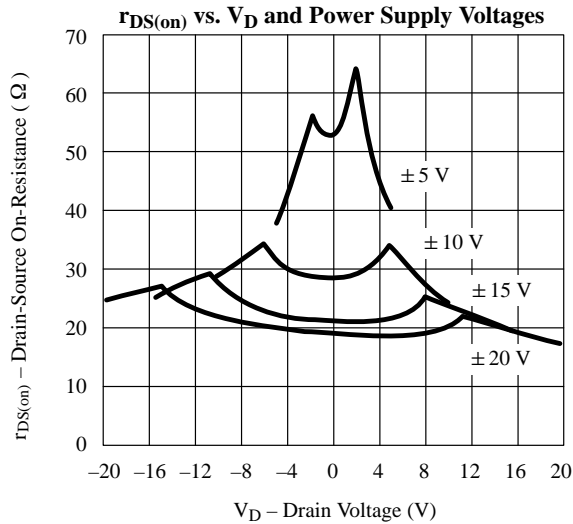
Specifications^a for Single Supply

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 ^b	Typ ^c	A Suffix -55 to 125°C		D Suffix -40 to 85°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Analog Switch									
Analog Signal Range ^e	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	Ω
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	
Digital Control									
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	μA
Dynamic Characteristics									
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				
Power Supplies									
Positive Supply Current	I_+	$V_+ = 15\text{ V, }V_{IN} = 0\text{ or }5\text{ V}$	Full			10		10	mA
Power Consumption ^e	P_C		Full			150		150	mW

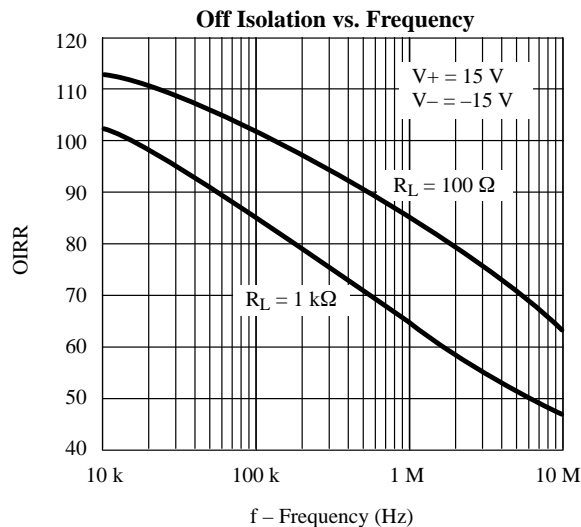
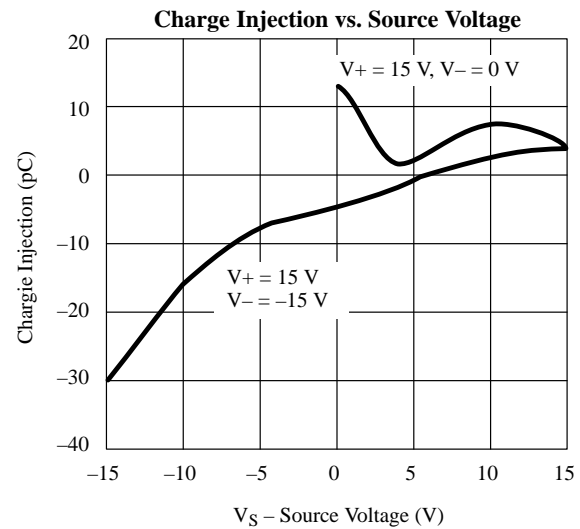
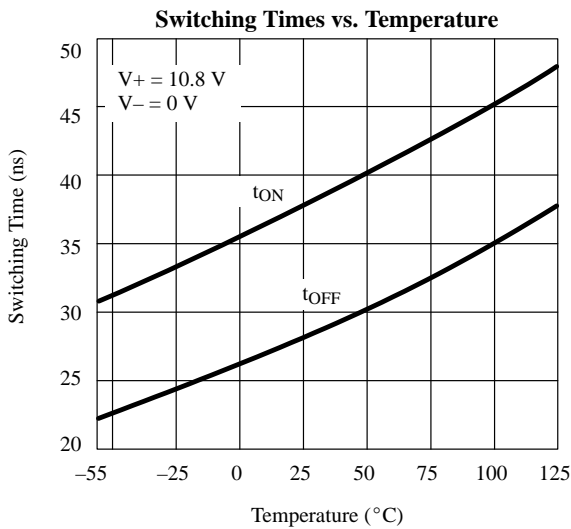
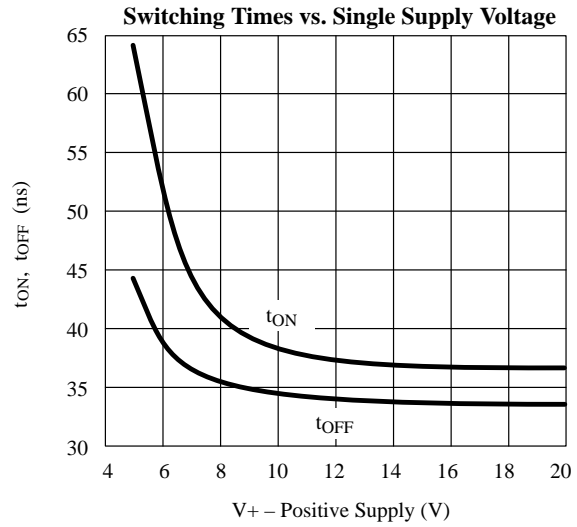
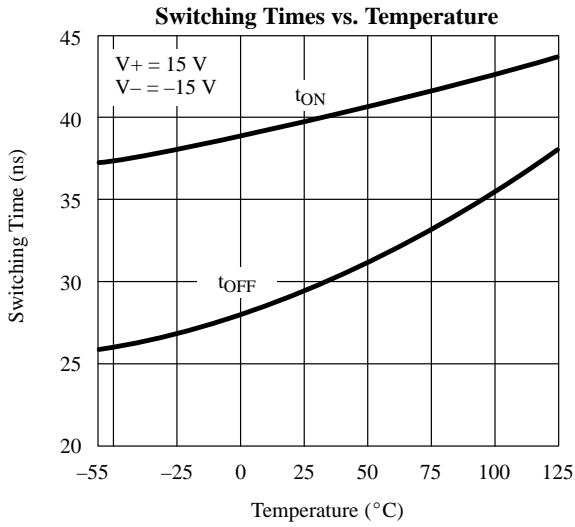
Notes:

- 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.

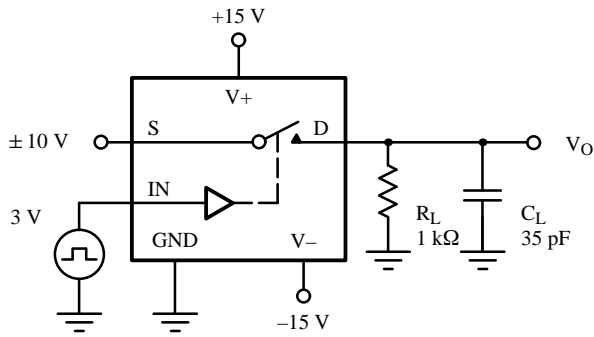
Typical Characteristics



Typical Characteristics (Cont'd)



Test Circuits



C_L (includes fixture and stray capacitance)

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

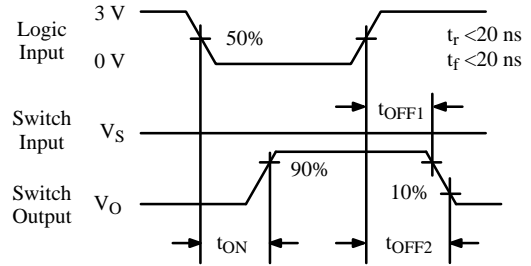


Figure 2. Switching Time

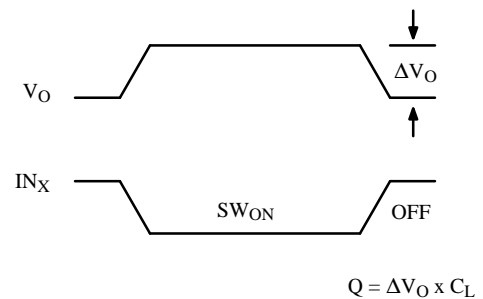
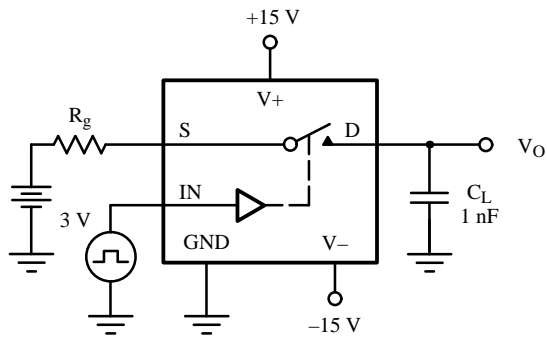
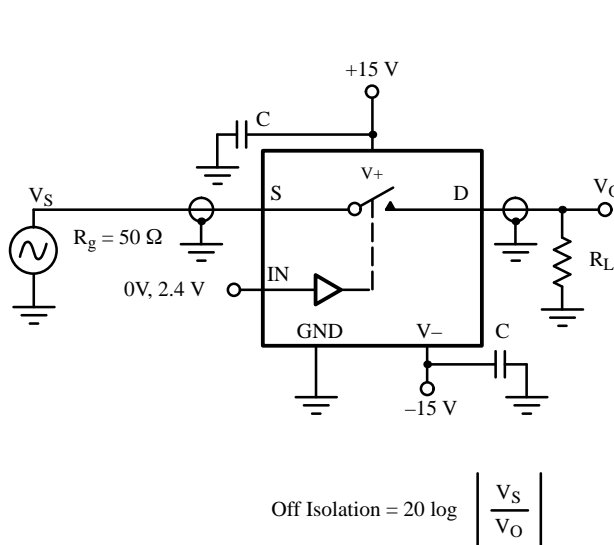
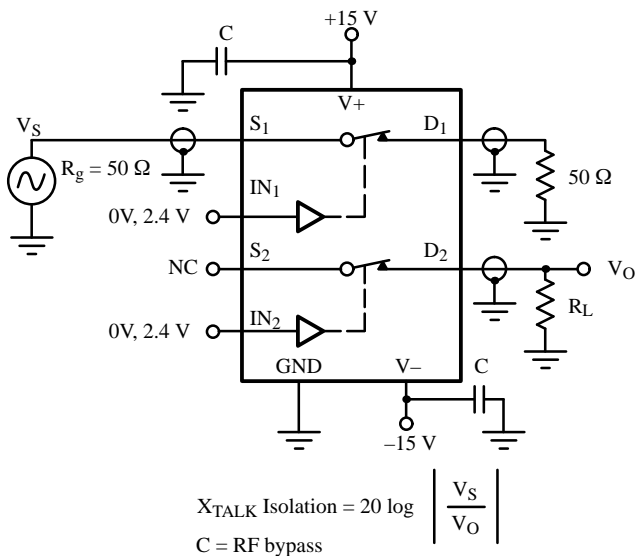


Figure 3. Charge Injection



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

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.

