

Precision Wide Bandwidth Analog Switch

Features

- Rail-To-Rail operation
- Pin-compatible with 3125 BusSwitch & 74 series 125
- Single-Supply operation: 2V to 6V
- Low ON-resistance: 8Ω typical @ 5V
- Tight match between channels: 0.9Ω typical
- R_{ON} flatness: $3W$ typical
- Low power consumption: $0.5\ \mu W$ typical
- High Speed, $T_{ON} = 8\mu s$ typical
- High-current channel capability: $>100mA$
- Wide bandwidth: $>200\ MHz$

Applications

- Instrumentation, ATE
- Audio Switching and Routing
- Telecommunications Systems
- Data Communications
- Battery-Powered Systems
- Replaces Mechanical Relays

Description

Pericom PI5A101 is an all-purpose analog switch designed for single-supply operation from +2V to +6V. This switch is ideal for audio, video, and data switching and routing.

The PI5A101 is a quad SPST (single-pole, single-throw) NC (normally closed) function.

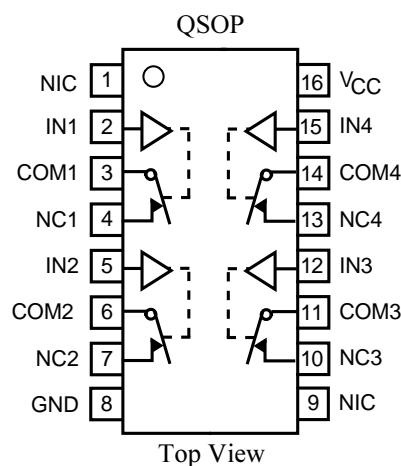
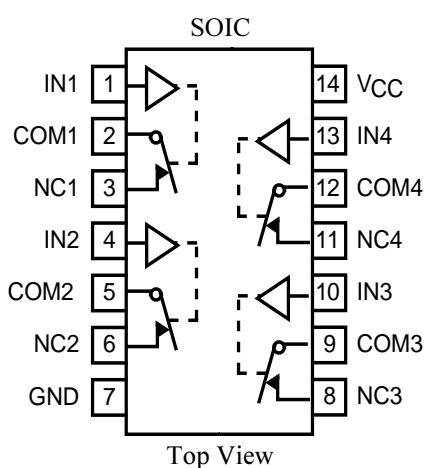
When on, each switch conducts current equally well in either direction. When off, they block voltages up to the power-supply rails.

The PI5A101 is fully specified with +5V and +3.3V supplies. With +5V the R_{ON} is 8Ω typical, making it ideal for replacing mechanical relays in data communications, test equipment, and instrumentation applications. Matching between channels is better than 2Ω . R_{ON} flatness is better than 4Ω over the specified range.

These analog switches also offer wide bandwidths ($>200\ MHz$ high speed ($T_{ON} > 15ns$), and low charge injection ($Q > 10pC$).

The PI5A101 is available in the narrow-body 14-pin small SOIC and 16-pin QSOP packages for operation over the industrial ($-40^{\circ}C$ to $+85^{\circ}C$) temperature range.

Functional Diagrams, Pin Configurations and Truth Tables



Switches show for logic "0" input
NIC = Not Internally Connected

Logic	Switch
0	ON
1	OFF

Ordering Information

P/N	Package
PI5A101W	Narrow Body SOIC-14
PI5A101Q	QSOP-16

Electrical Specifications - Single +5V Supply ($V_{CC} = +5V \pm 10\%$, $GND = 0V$, $V_{INH} = 2.4V$, $V_{INL} = 0.8V$)

Description	Parameter	Conditions	Temp. (°C)	Min. ⁽²⁾	Typ. ⁽¹⁾	Max. ⁽²⁾	Units
Analog Switch							
Analog Signal Range ⁽³⁾	V _{ANALOG}		Full	0		V _{CC}	V
On-Resistance	R _{ON}	V _{CC} = 4.5V, I _{COM} = -30mA, V _{NO} or V _{NC} = +2.5V	25		8	10	Ω
			Full			12	
On-Resistance Match Between Channels ⁽⁴⁾	ΔR _{ON}		25		0.9	2	
			Full			4	
On-Resistance Flatness ⁽⁵⁾	R _{FLAT(ON)}	V _{CC} = 5V, I _{COM} = -30mA, V _{NO} or V _{NC} = 1V, 2.5V, 4V	25		3	4	
			Full			5	
NO or NC Off Leakage Current ⁽⁶⁾	I _{NO(OFF)} or I _{NC(OFF)}	V _{CC} = 5.5V,V _{COM} = 0V, V _{NO} or V _{NC} = 4.5V	25		0.05		nA
			Full	-80		80	
COM Off Leakage Current ⁽⁶⁾	I _{COM(OFF)}	V ₊ = 5.5V, V _{COM} = +4.5V V _{NO} or V _{NC} = ±0V	25		0.05		
			Full	-80		80	
COM On Leakage Current ⁽⁶⁾	I _{COM(ON)}	V _{CC} = 5.5V, V _{COM} = +4.5V V _{NO} or V _{NC} = +4.5V	25		0.07		
			Full	-80		80	
Logic Input							
Input High Voltage	V _{INH}	Guaranteed Logic High Level	Full	2			V
Input Low Voltage	V _{INL}	Guaranteed Logic Low Level				0.8	
Input Current with Input Voltage High	I _{INH}	V _{IN} =2.4V, all others = 0.8V		-1	0.005	1	μA
Input Current with Input Voltage Low	I _{INL}	V _{IN} =0.8V, all others = 2.4V					

Electrical Specifications - Single +5V Supply ($V_{CC} = +5V \pm 10\%$, $GND = 0V$, $V_{INH} = 2.4V$, $V_{INL} = 0.8V$) **continued**

Dynamic							
Turn-On Time	t _{ON}	V _{CC} = 5V, see Figure 1	25		8	15	nc
			Full			20	
Turn-Off Time	t _{OFF}		25		3.5	7	
			Full			10	
Charge Injection ⁽³⁾	Q	C _L = 1nF, V _{GEN} = 0V, R _{GEN} = 0Ω, see Figure 2	25		7	10	pC
Off Isolation	OIRR	R _L = 50Ω, C _L = 5pF, f = 10 MHz, see Figure 3			-55		dB
Crosstalk ⁽⁸⁾	I _{COM(OFF)}	R _L = 50Ω, C _L = 5pF, f = 10 MHz, see Figure 4			-92		
NC or NO Capacitance	C _(OFF)	f = 1kHz, see Figure 5			8		pF
COM Off Capacitance	C _{COM(OFF)}				8		
COM On Capacitance	C _{COM(ON)}	f = 1kHz, see Figure 6			14		
-3dB Bandwidth	BW	R _L = 50Ω, see Figure 7	Full		230		MHz
Distortion ⁽⁹⁾	D	R _L = 10kΩ			0.03		%
Supply							
Power-Supply Range	V _{CC}		Full	2		6	V
Positive Supply Current	I _{CC}	V _{CC} = 5.5V, V _{IN} = 0V or V _{CC} . All channels on or off				1	μA

Absolute Maximum Ratings

Voltages Referenced to GND	
V _{CC}	–0.5V to +7V
V _{IN} , V _{COM} , V _{NC} ⁽¹⁾	–0.5V to V _{CC} +2V
.....	or 30mA, whichever occurs first
Current (any terminal except COM, NO, NC)	30mA
Current: COM, NO, NC (pulsed at 1ms, 10% duty cycle)	120mA

Thermal Information

Continuous Power Dissipation	
Narrow SO & QSOP (derate 8.7mW/°C above +70°C)	650mW
Storage Temperature	–65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

Note 1.

Signals on NC, COM, or IN exceeding V_{CC} or GND are clamped by internal diodes. Limit forward diode current to 30mA.

Caution: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.

Electrical Specifications-Single +3.3V Supply (V_{CC} = +3.3V ± 10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V)

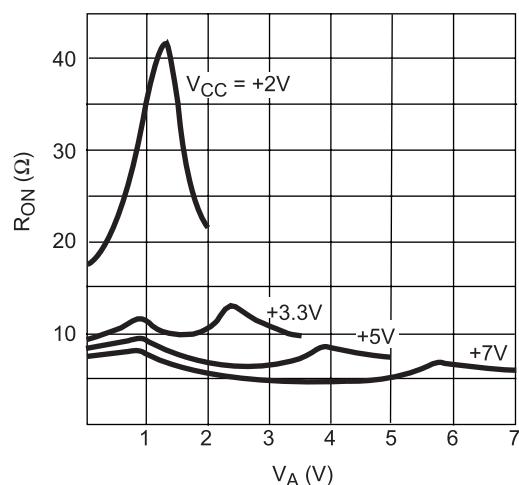
Parameter	Symbol	Conditions	Temp(°C)	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Units
Analog Switch							
Analog Signal Range ⁽³⁾	V _{ANALOG}		Full	0		V _{CC}	V
On-Resistance	R _{ON}	V _{CC} = 3V, I _{COM} = −30mA, V _{NO} or V _{NC} = 1.5V	25		12	18	Ω
			Full			22	
On-Resistance Match Between Channels ⁽⁴⁾	ΔR _{ON}	V _{CC} = 3.3V, I _{COM} = −30mA, V _{NO} or V _{NC} = 0.8V, 2.5V	25		1	2	
			Full			4	
On-Resistance Flatness ^(3,5)	R _{FLAT(ON)}		25		4	10	
			Full			12	
Dynamic							
Turn-On Time	t _{ON}	V _{CC} =3.3V, V _{NO} or V _{NC} = 1.5V see Figure 1	25		14	25	ns
			Full			40	
Turn-Off Time	t _{OFF}		25		5	12	
			Full			20	
Charge Injection ⁽³⁾	Q	C _L =1nf, V _{GEN} = 0V, R _{GEN} = 0V, Fig.2	25		5	10	pC
Supply							
Positive Supply Current	I _{CC}	V _{CC} = 3.6V, V _{IN} = 0V or V _{CC} All channels on or off	Full			1	μA

Notes:

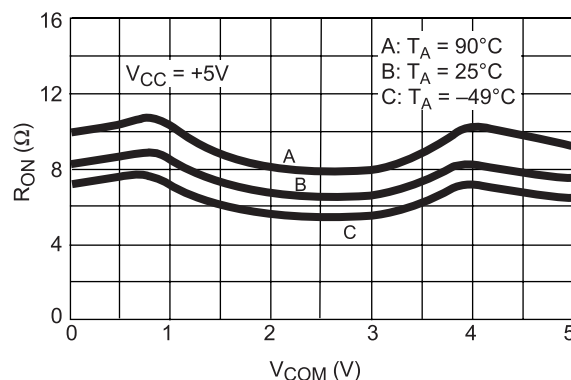
1. The algebraic convention, where the most negative value is a minimum and the most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design
4. ΔR_{ON} = R_{ON} MAX - R_{ON} MIN
5. Flatness is defined as the difference between the maximum and minimum value of on-resistance measured.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
7. Off Isolation = 20log₁₀ V_B / V_A. See Figure 3.
8. Between any two switches. See Figure 4.
9. D = R_{FLAT(ON)}/R_L.

Typical Operating Characteristics ($T_A = +25^\circ\text{C}$, unless otherwise noted)

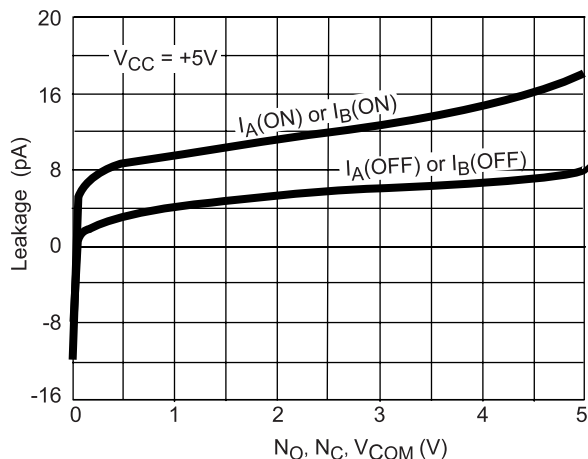
R_{ON} vs. V_{COM}



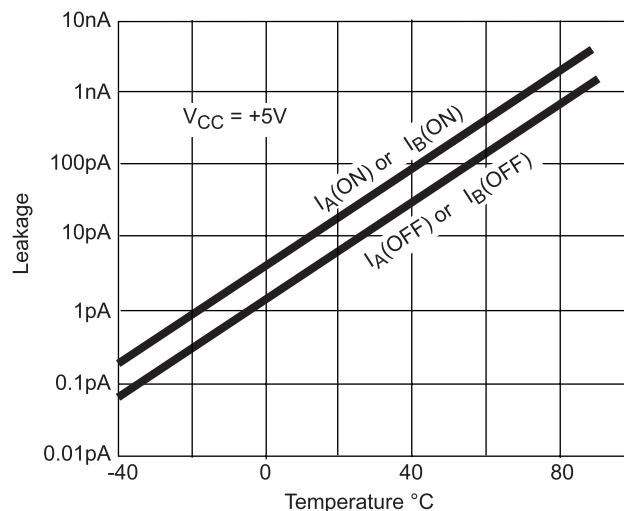
R_{ON} vs. V_{COM} and Temperature



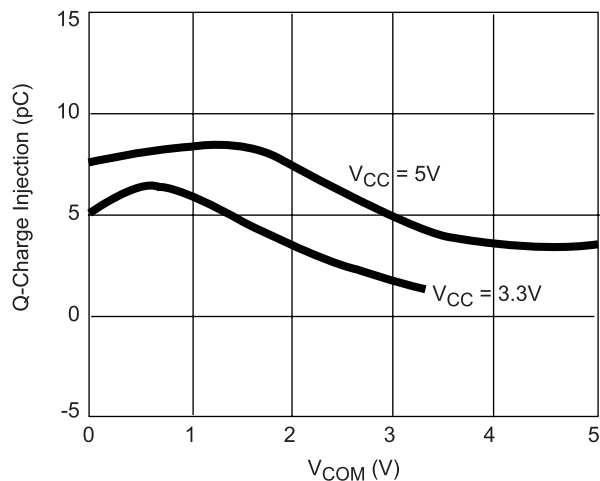
Leakage Currents vs. Analog Voltage



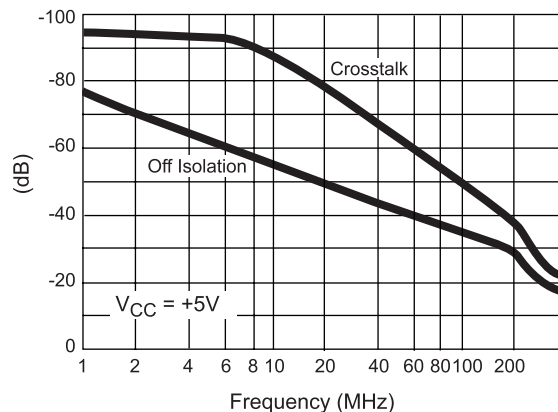
Leakage Current vs. Temperature

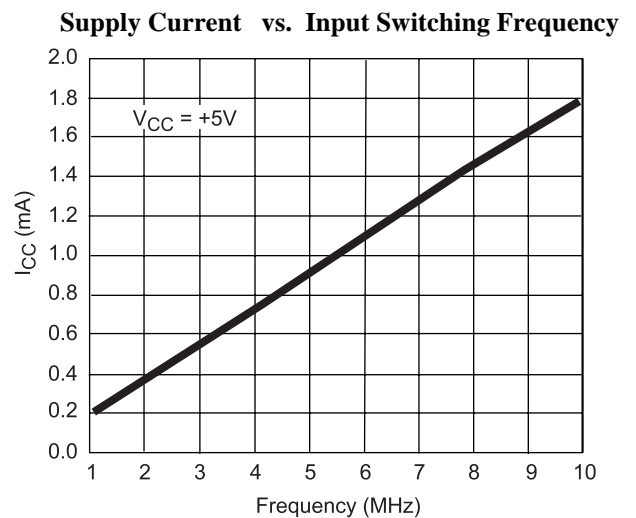
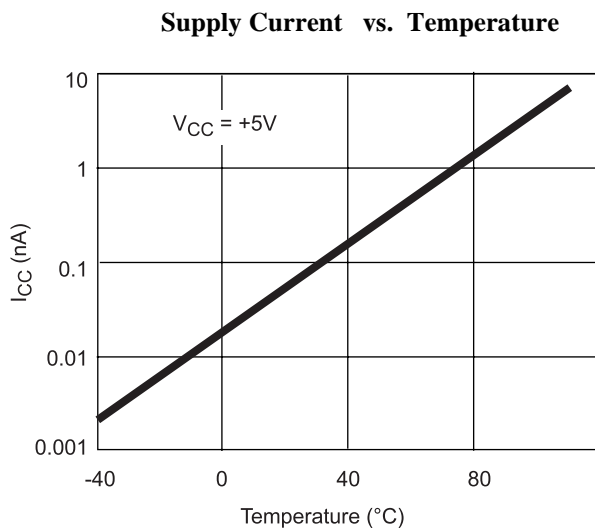
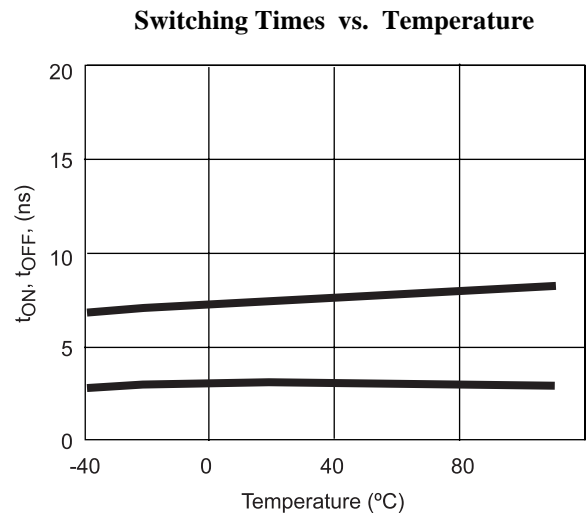
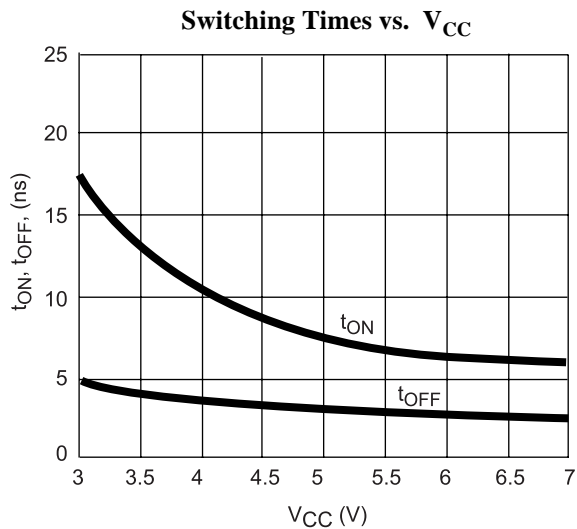
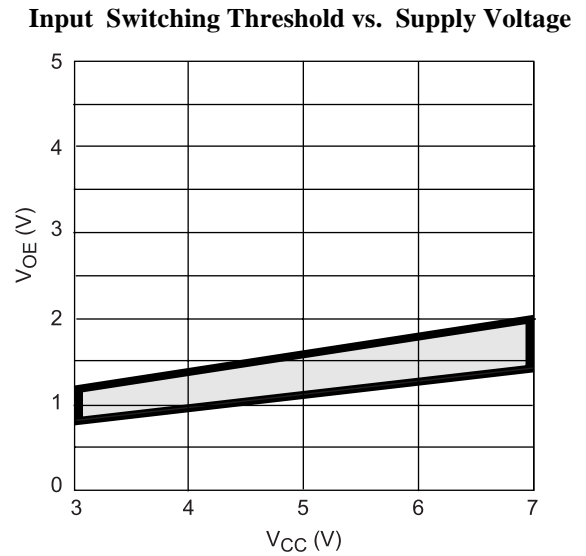
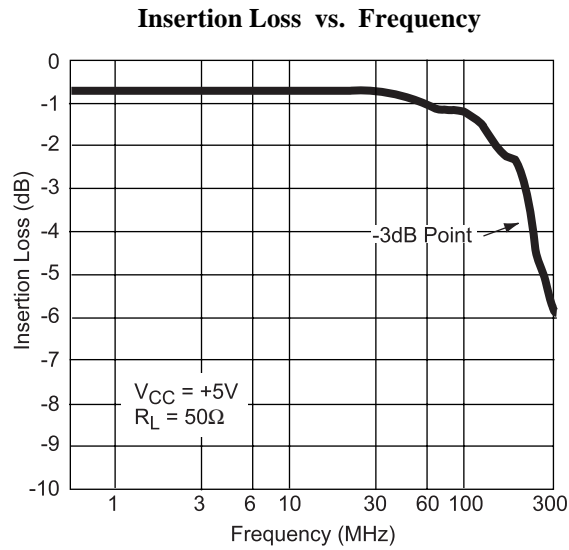


Charge Injection vs. Analog Voltage



Crosstalk and Off-Isolation vs. Frequency





Test Circuits/Timing Diagrams

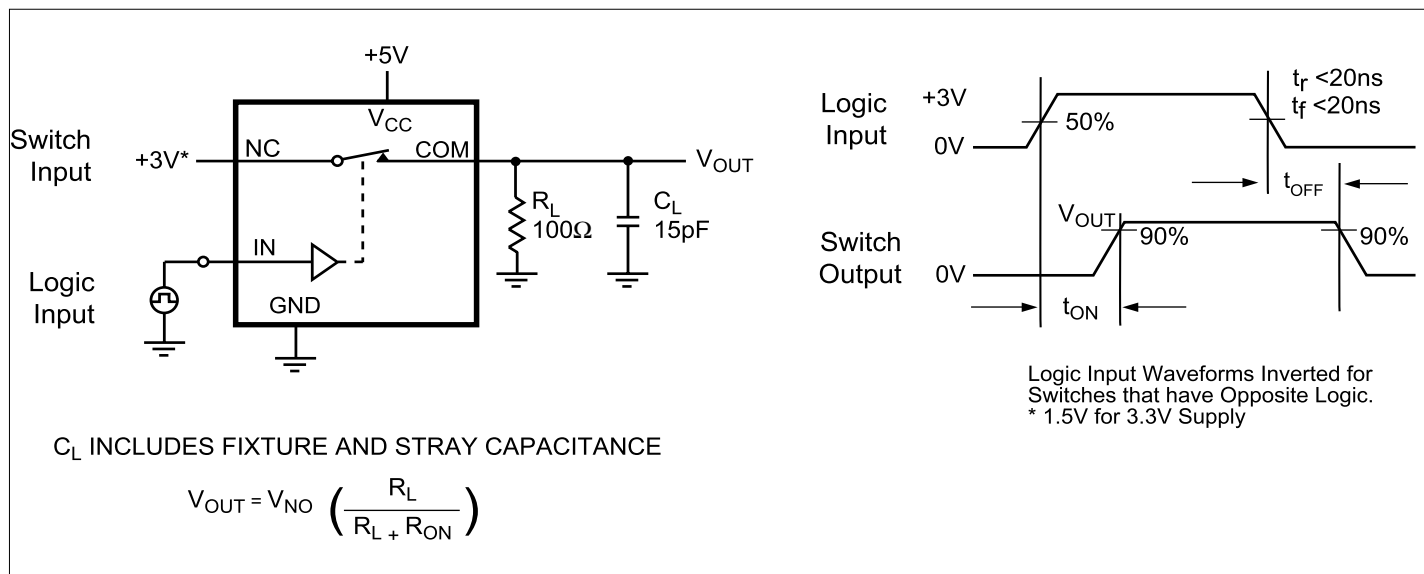


Figure 1. Switching Time

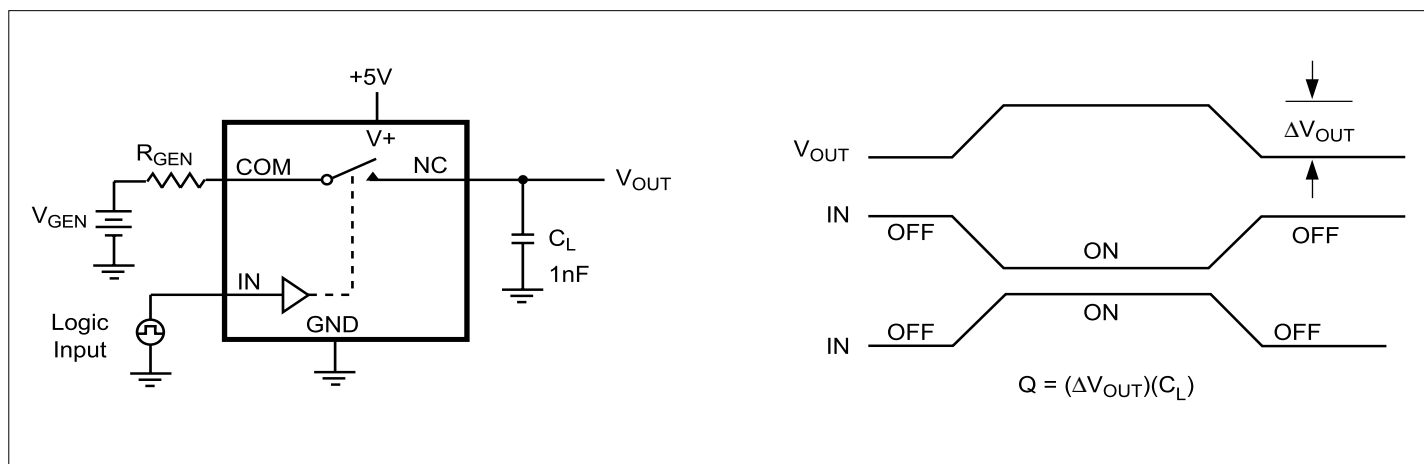


Figure 2. Charge Injection

Test Circuits/Timing Diagrams (continued)

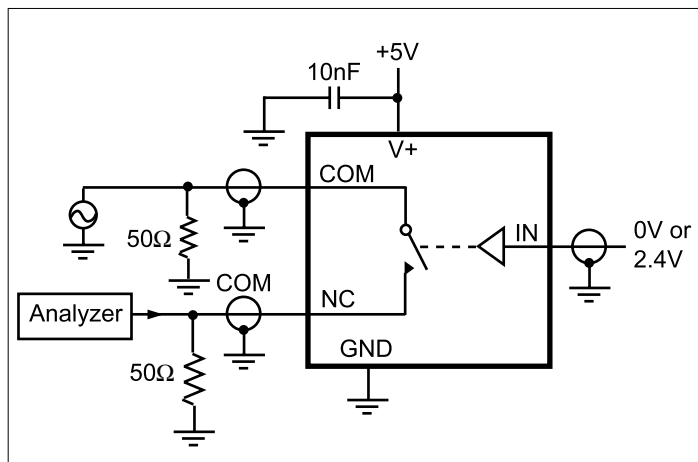


Figure 3. Off Isolation

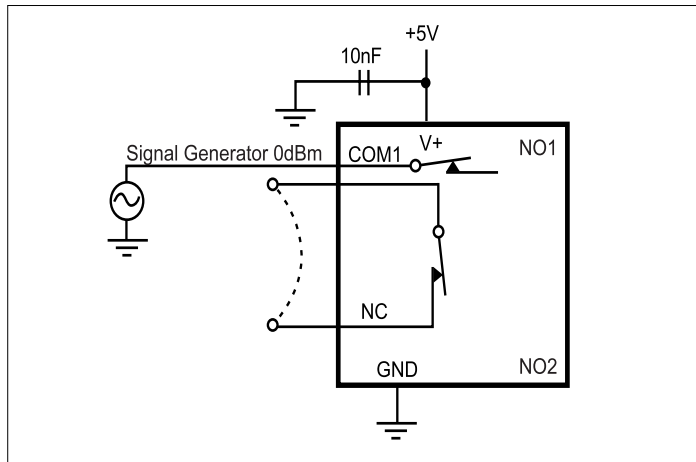


Figure 4. Crosstalk

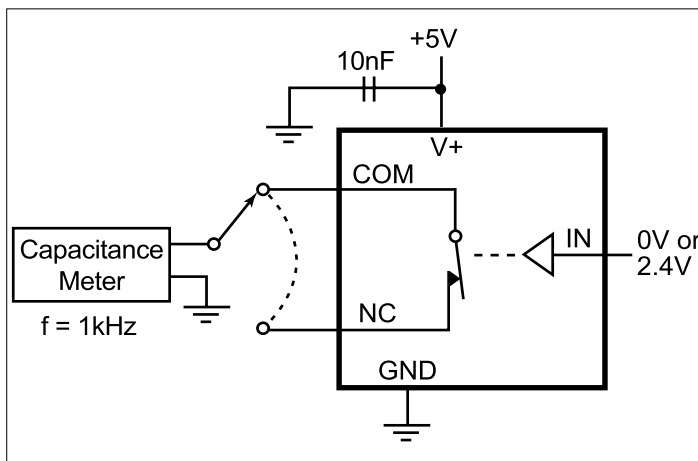


Figure 5. Channel-Off Capacitance

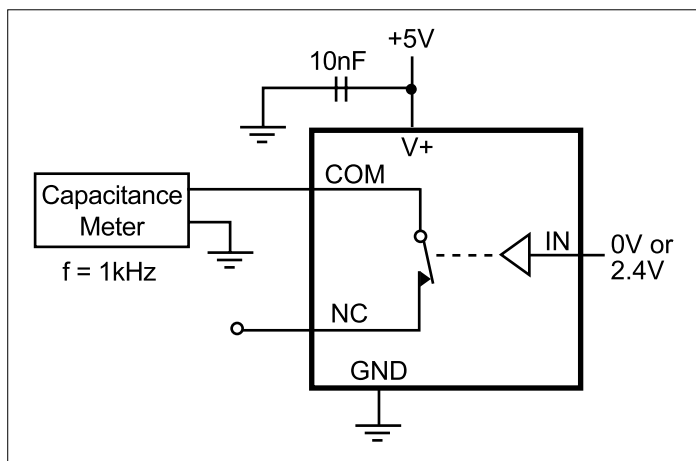


Figure 6. Channel-On Capacitance

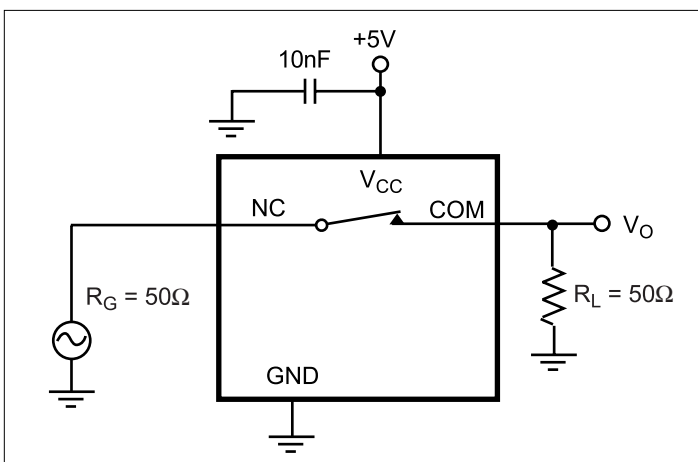


Figure 7. Bandwidth