PI5A101

Precision Wide-Bandwidth Analog Switch

Features

- Rail-To-Rail operation
- Pin-compatible with 3125 Bus Switch & 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: 3Ω typical
- Low power consumption: 0.5µ-ohm typical
- High Speed, T_{ON} = 8ns typical
- High-current channel capability: >100mA
- Wide bandwidth: >200 MHz
- Packaging (Pb-free & Green available):
  -14-pin SOIC (W)
  -16-pin QSOP (Q)

Applications

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

Description

Pericom Semiconducto's 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.

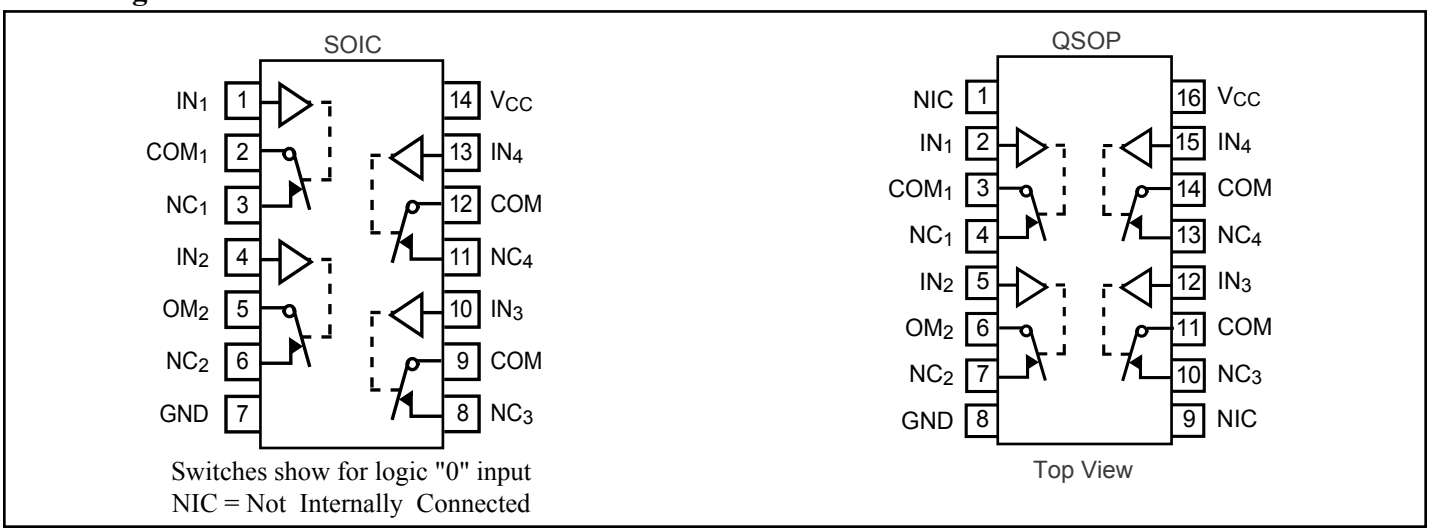
When on, each switch conducts current equally well in either direction. When off, they block voltages up to the power-supply rails.

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 bandwidth (>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°C to +85°C) temperature range.

Pin Configurations



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

Truth Table

Logic	Switch
0	ON
1	OFF

Electrical Specifications - Single +5V Supply (V_{CC} = +5V ± 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} = 4.5V, I_{COM} = -30mA, V_{NO} or V_{NC} = +2.5V	25		8	10	Ω
			Full			18	
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_{CC} = 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_{IH}	Guaranteed logic High Level	Full	2			V
Input Low Voltage	V_{IL}	Guaranteed logic Low Level					
Input Current with Voltage High	I_{INH}	V_{IN} = 2.4V, all others = 0.8V				0.8	µA
Input Current with Voltage Low	I_{INL}	V_{IN} = 0.8V, all others = 2.4V		-1	0.005	1	

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

Parameter	Symbol	Conditions	Temp.(°C)	Min.(1)	Typ.(2)	Max.(1)	Units
Dynamic							
Turn-On Time	t_{ON}	V_{CC} = 5V, see figure 1	25		8	15	ns
			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} = 0V, Figure 2	25		7	10	pC
Off Isolation	O_{IRR}	R_L = 50Ω, C_L = 5pF, f = 10MHz, see figure 3			-55		dB
Crosstalk(8)	$I_{COM(OFF)}$	R_L = 50Ω, C_L = 5pF, f = 10MHz, 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		
3-dB Bandwidth	BW	R_L = 10kΩ	Full		230		MHz
Distortion(9)	D				0.03		%
Supply							
Power-Supple Range	V_{CC}		Full	2		6	V
Positve Supply Current	I_{CC}	V_{CC} = 3.6V, V_{IN} = 0V or V+, 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

Notes

1. Signals on NC, COM, or IN exceeding V_{CC} or GND are clamped by internal diodes. Limit forward diode current to 30mA.
2. 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)

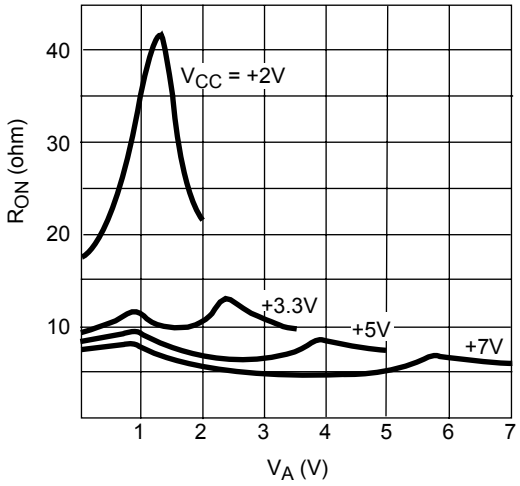
Parameter	Symbol	Conditions	Temp.(°C)	Min.(1)	Typ.(2)	Max.(1)	Units
Analog Switch							
Analog Signal Range(3)	V_{ANALOG}		Full	0		V_{CC}	V
On-Resistance	R_{ON}	V_{CC} = 3V, I_{COM} = -30mA, V_{NO} or V_{NC} = 1.5V	25		7.2	18	Ω
			Full			28	
On-Resistance Match Between Channels(4)	ΔR_{ON}		25		0.2	2	
			Full			4	
On-Resistance Flatness(3,5)	$R_{FLAT(ON)}$	V_{CC} = 3.3V, I_{COM} = -30mA, V_{NO} or V_{NC} = 0.8V, 2.5V	25		2.72	10	
			Full			12	
Dynamic							
Turn-On Time	t_{ON}	V_{CC} = 3.3V, V_{NO} or V_{NC} = 1.5V, see figure 1	25		7	25	ns
			Full			40	
Turn-Off Time	t_{OFF}		25		1	12	
			Full			20	
Charge Injection(3)	Q	C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0Ω, Figure 2	25		1.6	10	pC
Supply							
Positve Supply Current	I_{CC}	V_{CC} = 3.6V, V_{IN} = 0V or V_{CC}, All Channels on or off	Full			1	µA

Notes:

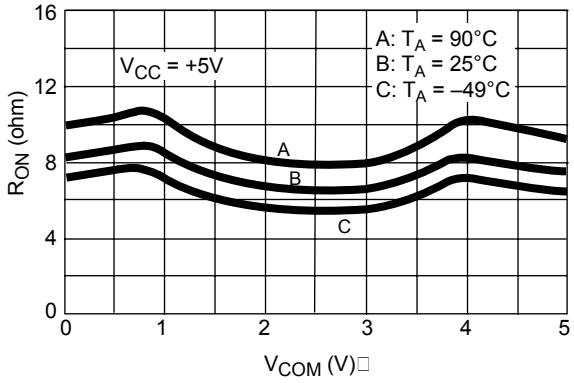
1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design
4. $\Delta R_{ON} = R_{ON}$ MAX - R_{ON} MIN
5. Flatness 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 +25ºC.
7. Off Isolation = $20\log_{10} V_B / V_A$. See Figure 3.
8. Between any two switches. See Figure 4.
9. $D = R_{FLAT(ON)}/R_L$.

Typical Operating Characteristics (T_A = +25ºC, unless otherwise noted)

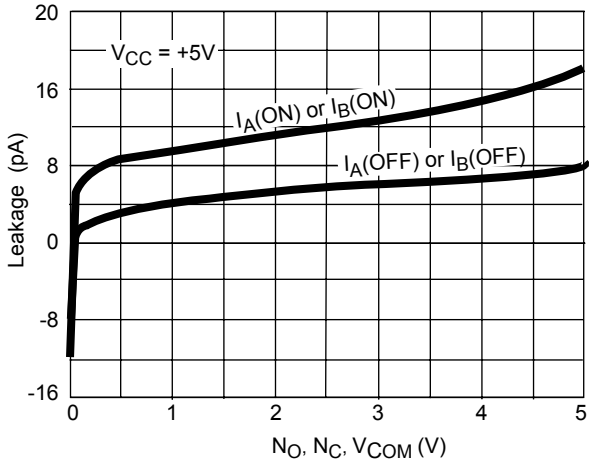
R_{ON} vs. V_{COM}



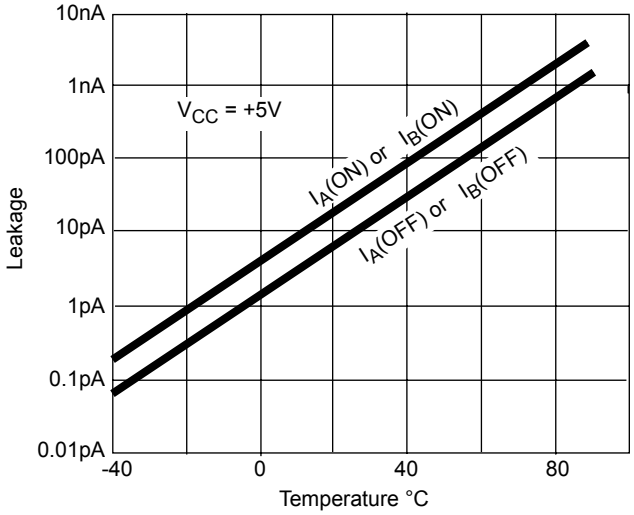
R_{ON} vs. V_{COM} and Temperature



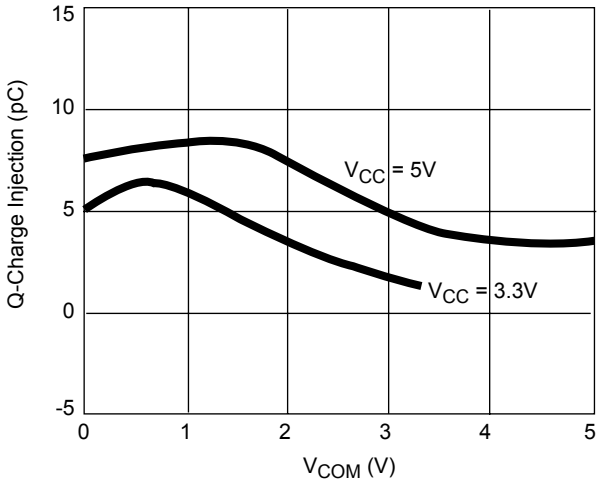
Leakage Currents vs. Analog Voltage



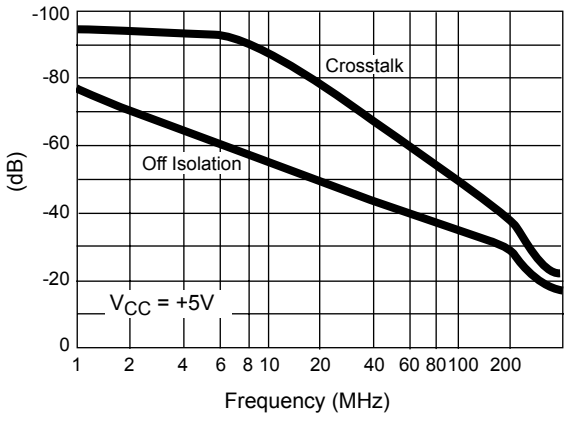
Leakage Current vs. Temperature



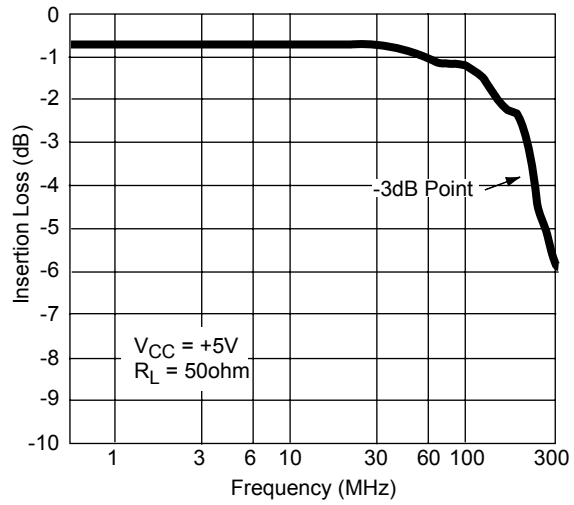
Charge Injection vs. Analog Voltage



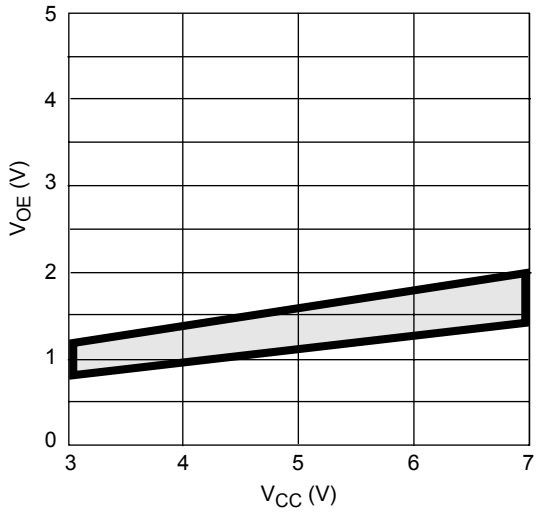
Crosstalk and Off-Isolation vs. Frequency



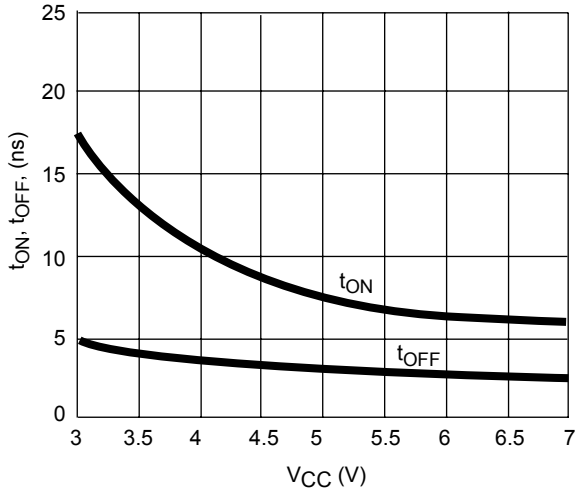
Insertion Loss vs. Frequency



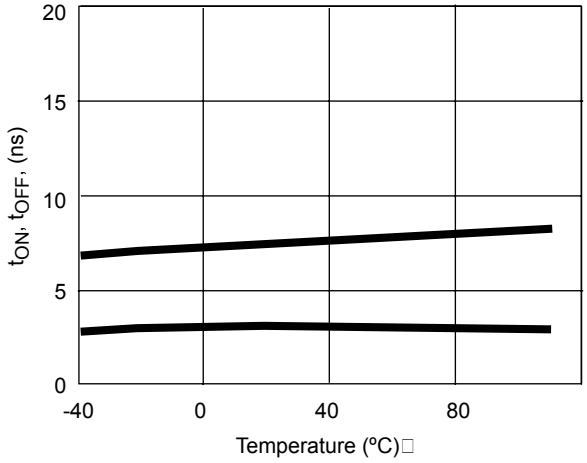
Input Switching Threshold vs. Supply Voltage



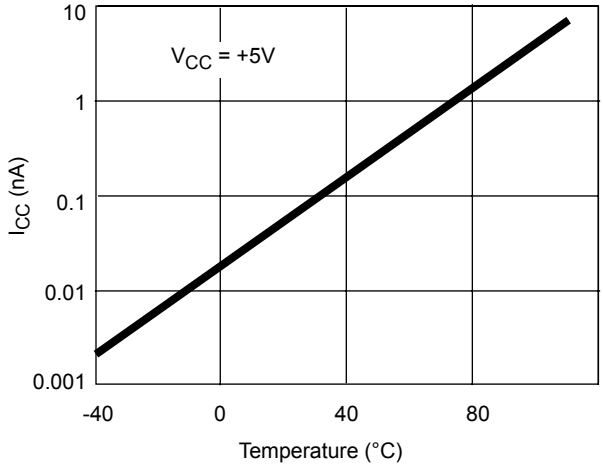
Switching Times vs. V_{CC}



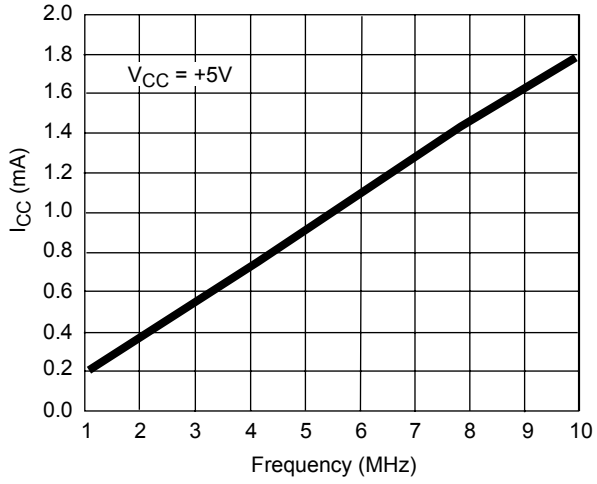
Switching Times vs. Temperature



Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency



Test Circuits/Timing Diagrams

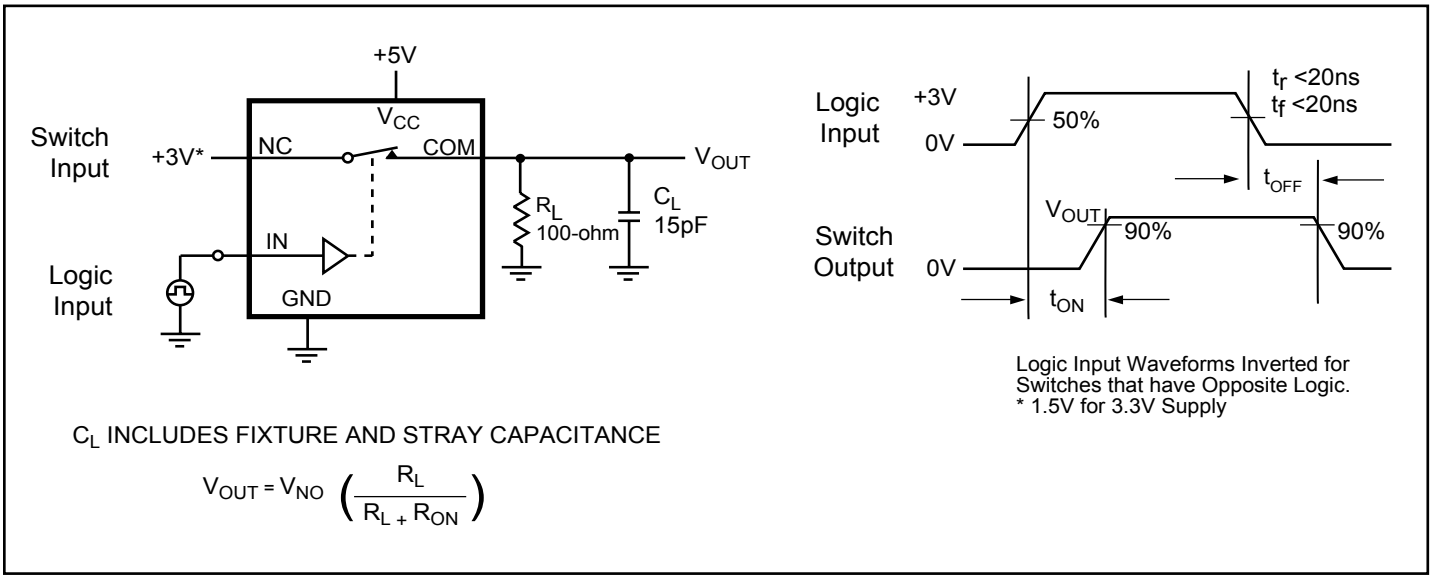


Figure 1. Switching Time

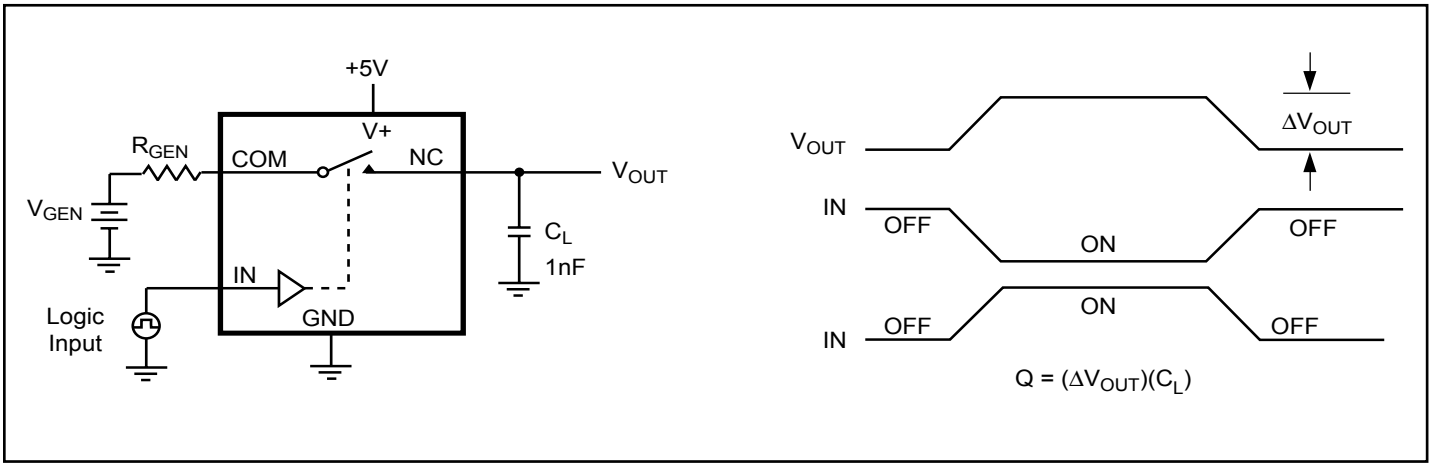


Figure 2. Charge Injection

Test Circuits/Timing Diagrams (continued)

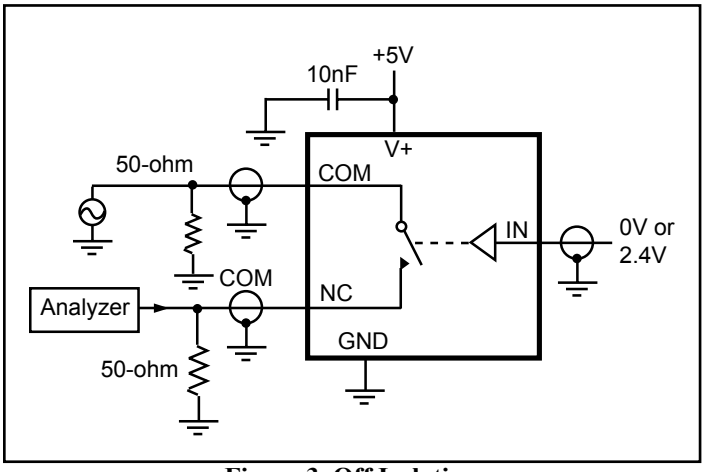


Figure 3. Off Isolation

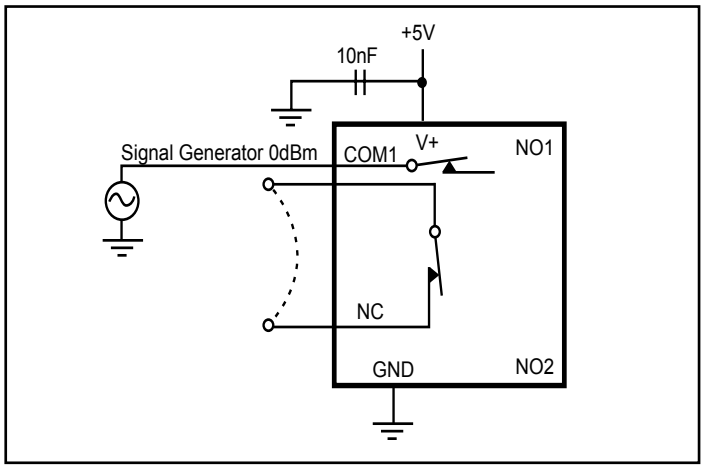


Figure 4. Crosstalk

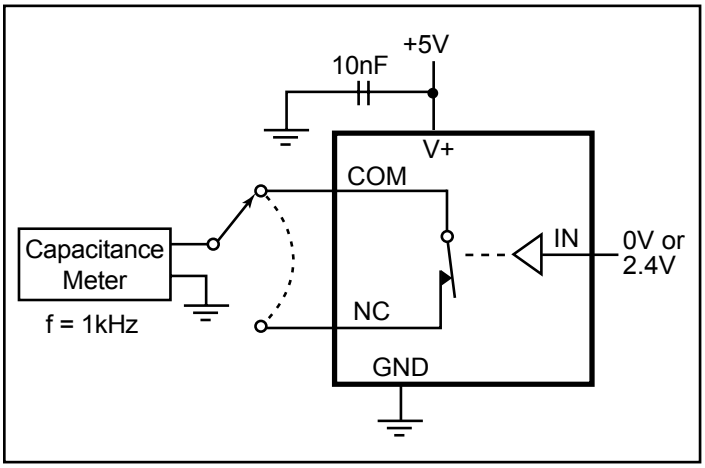


Figure 5. Channel-Off Capacitance

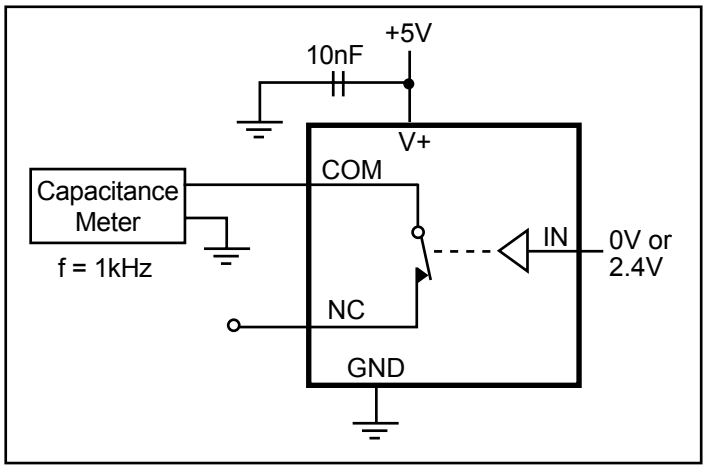


Figure 6. Channel-On Capacitance

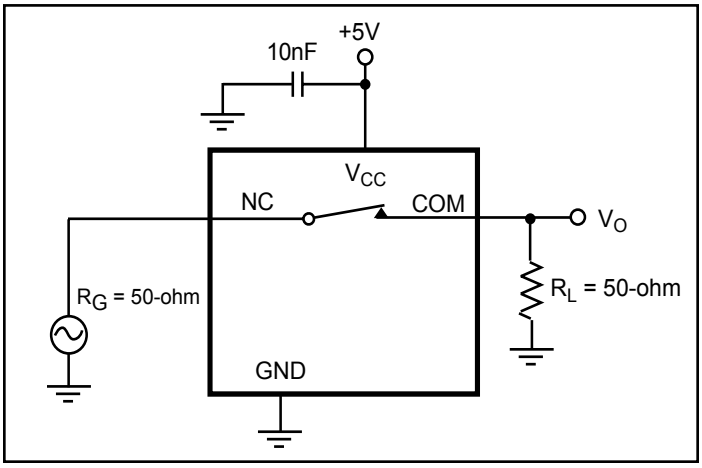
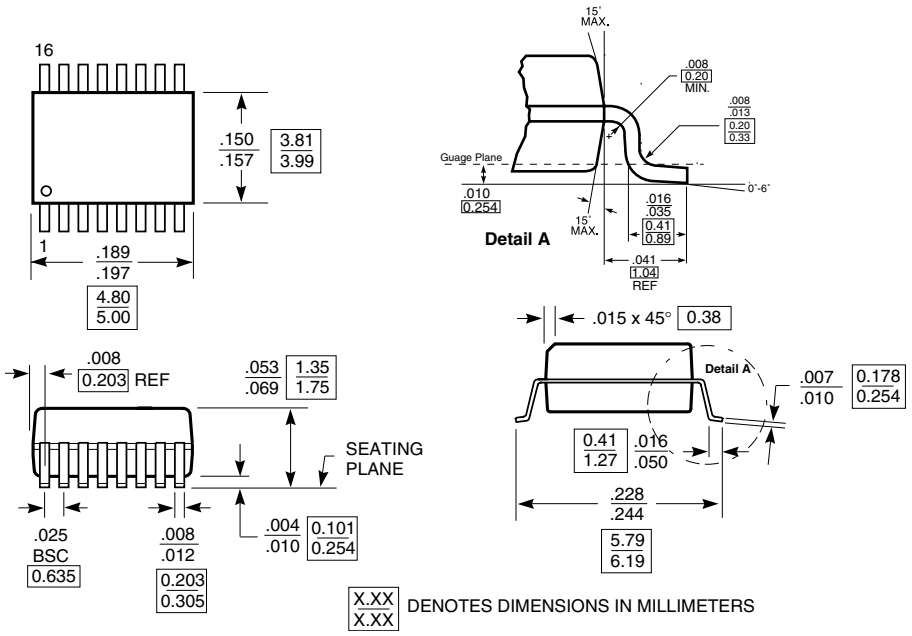
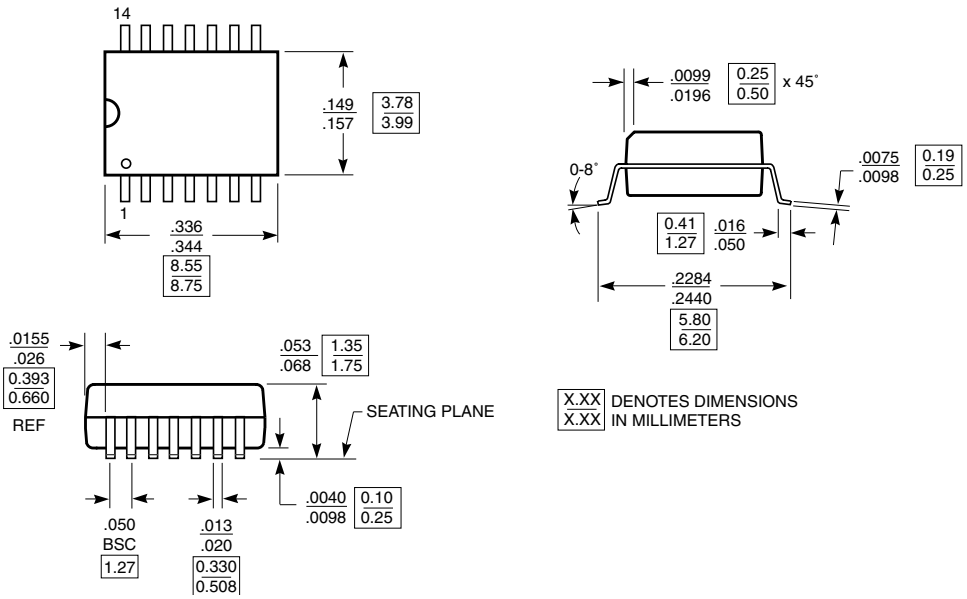


Figure 7. Bandwidth

Packaging Mechanical: 16-Pin, QSOP (Q)



Packaging Mechanical: 14-Pin, SOIC (W)



Ordering Information

Ordeing Code	Package Code	Package Description
PI5A101Q	Q	16-pin, QSOP
PI5A101QE	Q	Pb-free & Green, 16-pin, QSOP
PI5A101W	W	14-pin SOIC
PI5A101WE	W	Pb-free & Green, 14-pin SOIC

Notes:

1. Thermal characteristics can be found on the company web site at www.pericom.com/packaging/