



**THE DATASHEET OF  
PI5A101W**



## 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<sub>ON</sub> flatness: 3Ω typical
- Low power consumption: 0.5μ-ohm typical
- High Speed, T<sub>ON</sub> = 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 Semiconductor'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.

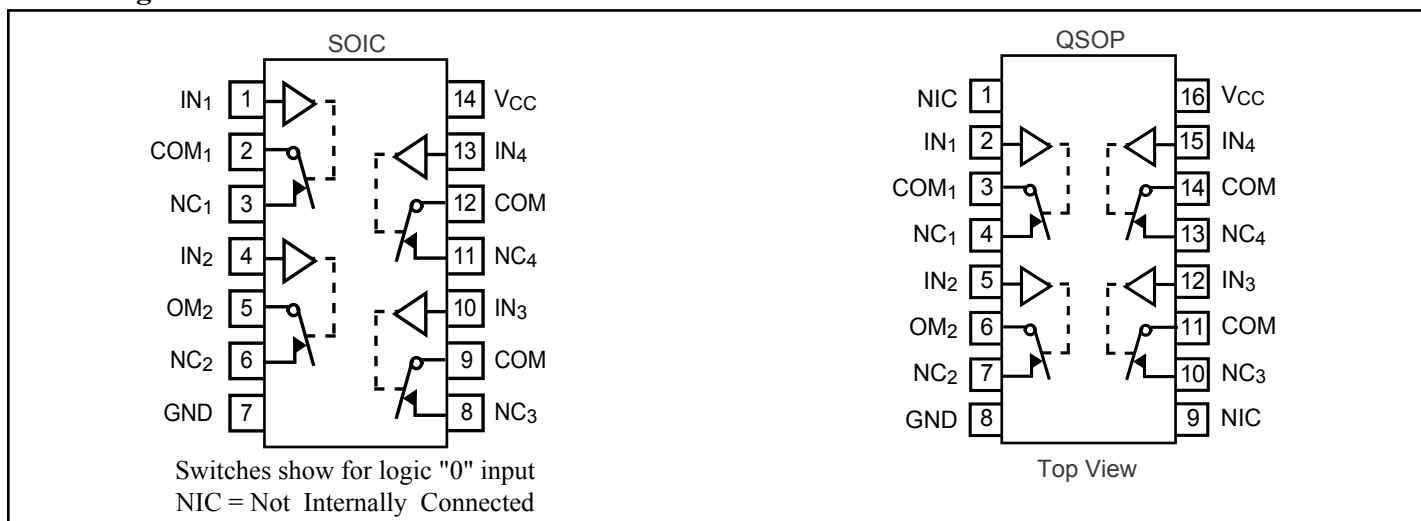
When on, each switch conducts current equally well in either direction. When off, they block voltages up to the power-supply rails.

The PI5A101 is fully specified with +5V and +3.3V supplies. With +5V the R<sub>ON</sub> 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<sub>ON</sub> flatness is better than 4Ω over the specified range.

These analog switches also offer wide bandwidth (>200 MHz high speed (T<sub>ON</sub> >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



### Truth Table

Logic	Switch
0	ON
1	OFF

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

Parameter	Symbol	Conditions	Temp.(°C)	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units	
<b>Analog Switch</b>								
Analog Signal Range <sup>(3)</sup>	$V_{ANALOG}$		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	$\Omega$	
On-Resistance Match Between Channels <sup>(4)</sup>	$\Delta R_{ON}$		Full			18		
On-Resistance Flatness <sup>(5)</sup>	$R_{FLAT(ON)}$	$V_{CC} = 5V$ , $I_{COM} = -30mA$ , $V_{NO}$ or $V_{NC} = 1V, 2.5V, 4V$	25		0.9	2		
			Full			4		
NO or NC Off Leakage Current <sup>(6)</sup>	$I_{NO(OFF)}$ or $I_{NC(OFF)}$	$V_{CC} = 5.5V$ , $V_{COM} = 0V$ , $V_{NO}$ or $V_{NC} = 4.5V$	25		0.05		nA	
COM Off Leakage Current <sup>(6)</sup>	$I_{COM(OFF)}$		Full	-80		80		
COM On Leakage Current <sup>(6)</sup>	$I_{COM(ON)}$	$V_{CC} = 5.5V$ , $V_{COM} = +4.5V$ , $V_{NO}$ or $V_{NC} = +4.5V$	25		0.05			
			Full	-80		80		
<b>Logic Input</b>								
Input High Voltage	$V_{IH}$	Guaranteed logic High Level	Full				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	$\mu A$
Input Current with Voltage Low	$I_{INL}$	$V_{IN} = 0.8V$ , all others = 2.4V					-1	

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

Parameter	Symbol	Conditions	Temp.(°C)	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units
<b>Dynamic</b>							
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 <sup>(3)</sup>	Q	$C_L = 1nF$ , $V_{GEN} = 0V$ , $R_{GEN} = 0V$ , Figure 2	25		7	10	pC
Off Isolation	$O_{IRR}$	$R_L = 50\Omega$ , $C_L = 5pF$ , $f = 10MHz$ , see figure 3			-55		dB
Crosstalk <sup>(8)</sup>	$I_{COM(OFF)}$	$R_L = 50\Omega$ , $C_L = 5pF$ , $f = 10MHz$ , 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	$R_L = 10k\Omega$	Full		230		MHz
Distortion <sup>(9)</sup>	D				0.03		%
<b>Supply</b>							
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

### Absolute Maximum Ratings

Voltages Referenced to GND	
V <sub>CC</sub> .....	-0.5V to +7V
V <sub>IN</sub> , V <sub>COM</sub> , V <sub>NC</sub> <sup>(1)</sup> .....	-0.5V to V <sub>CC</sub> +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<sub>CC</sub> 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<sub>CC</sub> = +3.3V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

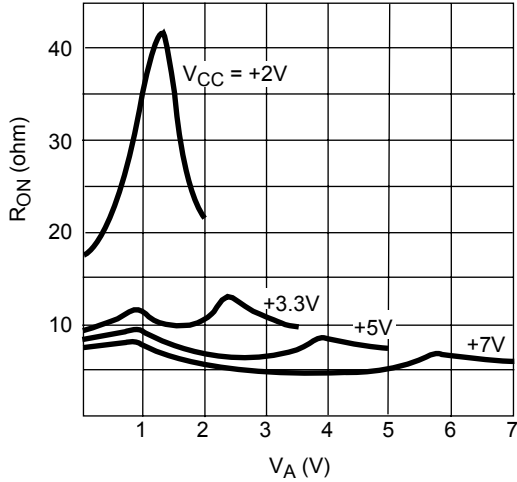
Parameter	Symbol	Conditions	Temp.(°C)	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units
<b>Analog Switch</b>							
Analog Signal Range <sup>(3)</sup>	V <sub>ANALOG</sub>		Full	0		V <sub>CC</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>CC</sub> = 3V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V	25		7.2	18	Ω
			Full			28	
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>	V <sub>CC</sub> = 3.3V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V	25		0.2	2	
			Full			4	
On-Resistance Flatness <sup>(3,5)</sup>	R <sub>FLAT(ON)</sub>	V <sub>CC</sub> = 3.3V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V	25		2.72	10	
			Full			12	
<b>Dynamic</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>CC</sub> = 3.3V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, see figure 1	25		7	25	ns
			Full			40	
Turn-Off Time	t <sub>OFF</sub>	V <sub>CC</sub> = 3.3V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, see figure 1	25		1	12	
			Full			20	
Charge Injection <sup>(3)</sup>	Q	C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 2	25		1.6	10	pC
<b>Supply</b>							
Positive Supply Current	I <sub>CC</sub>	V <sub>CC</sub> = 3.6V, V <sub>IN</sub> = 0V or V <sub>CC</sub> , All Channels on or off	Full			1	μA

#### Notes:

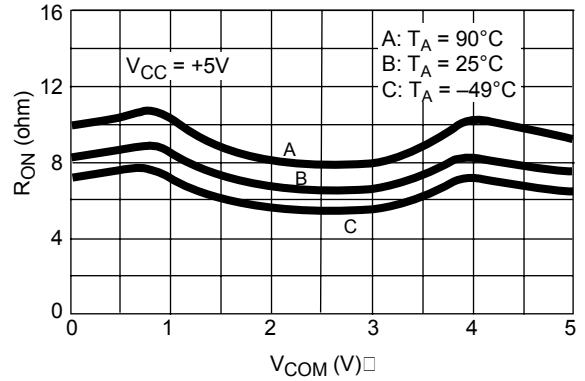
1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design
4. ΔR<sub>ON</sub> = R<sub>ON</sub> MAX - R<sub>ON</sub> 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 = 20log<sub>10</sub> V<sub>B</sub> / V<sub>A</sub>. See Figure 3.
8. Between any two switches. See Figure 4.
9. D = R<sub>FLAT(ON)</sub>/R<sub>L</sub>.

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

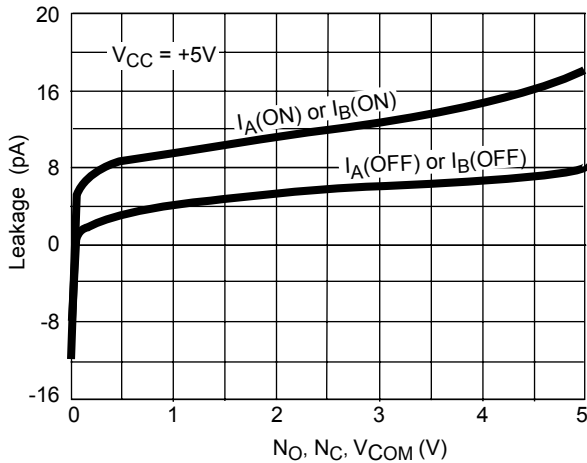
$R_{ON}$  vs.  $V_{COM}$



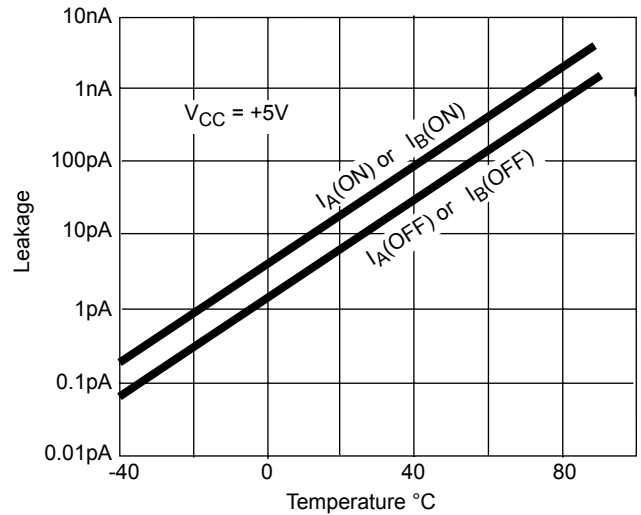
$R_{ON}$  vs.  $V_{COM}$  and Temperature



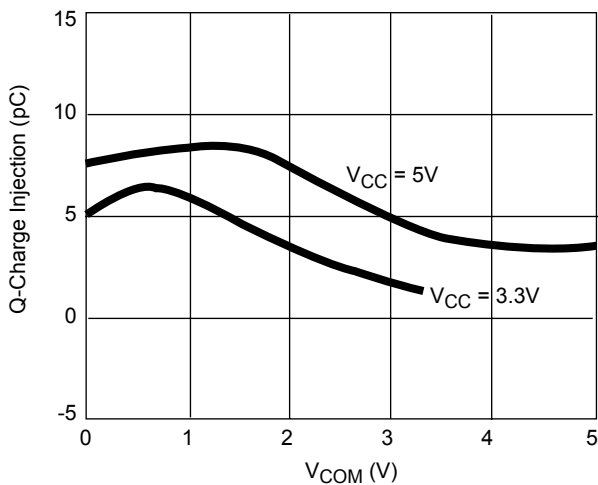
Leakage Currents vs. Analog Voltage



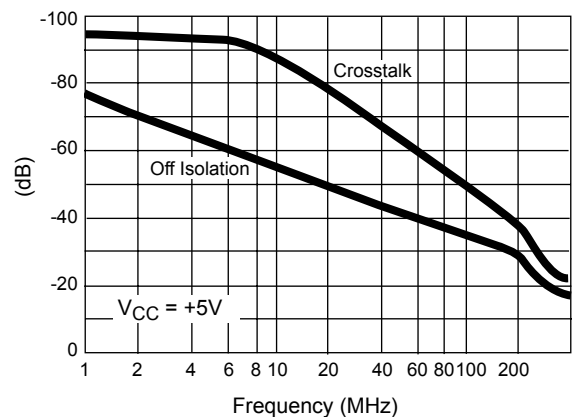
Leakage Current vs. Temperature



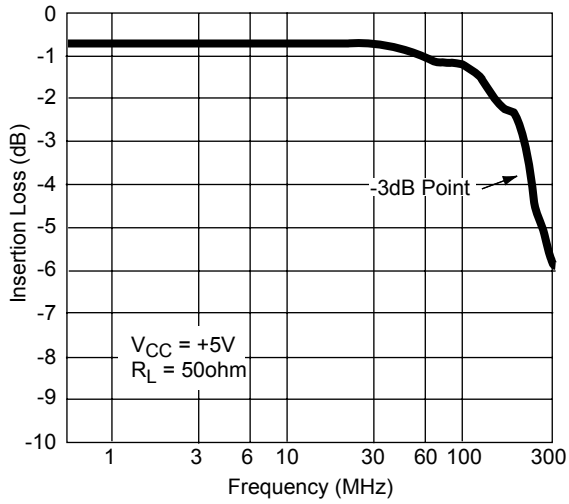
Charge Injection vs. Analog Voltage



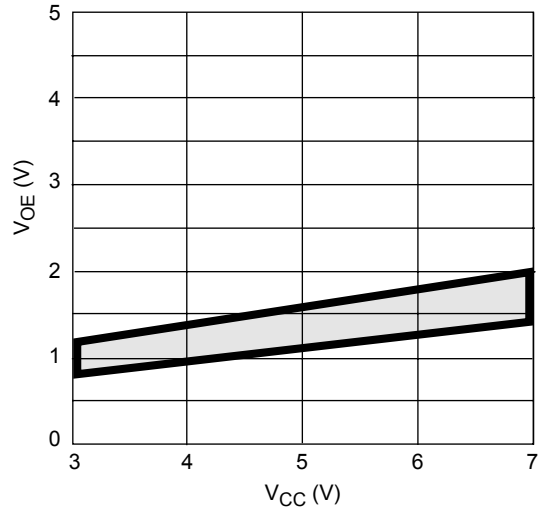
Crosstalk and Off-Isolation vs. Frequency



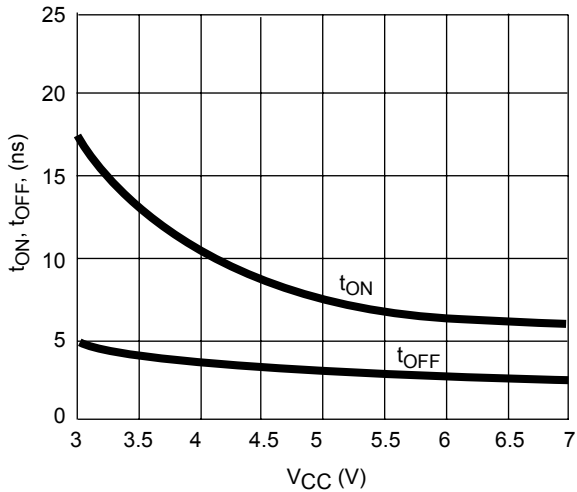
Insertion Loss vs. Frequency



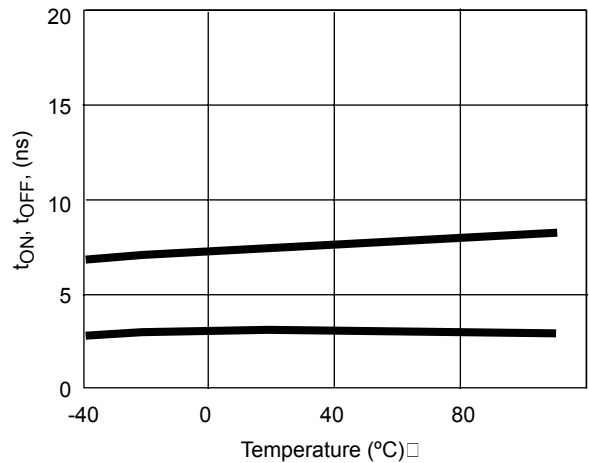
Input Switching Threshold vs. Supply Voltage



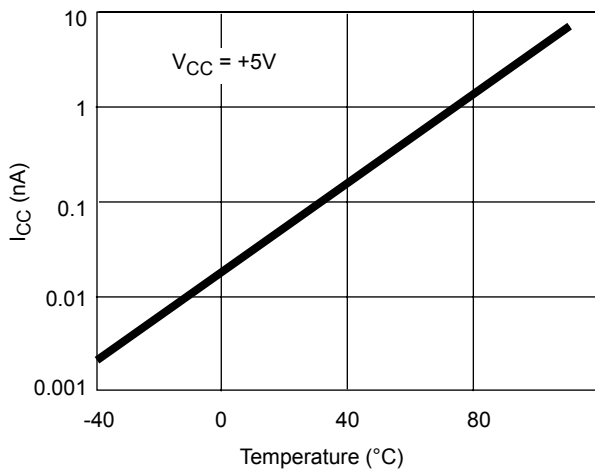
Switching Times vs.  $V_{CC}$



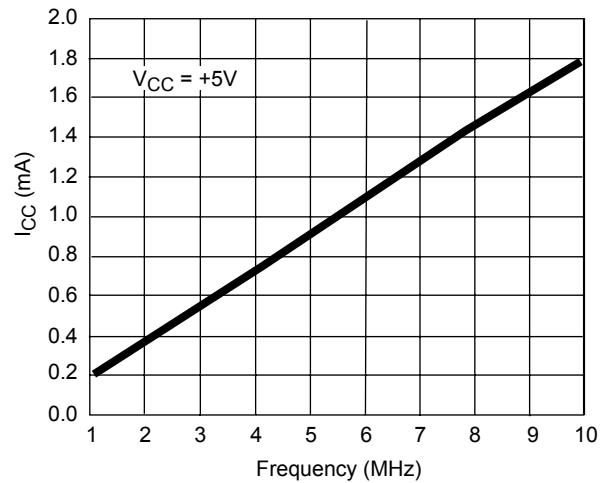
Switching Times vs. Temperature



Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency



Test Circuits/Timing Diagrams

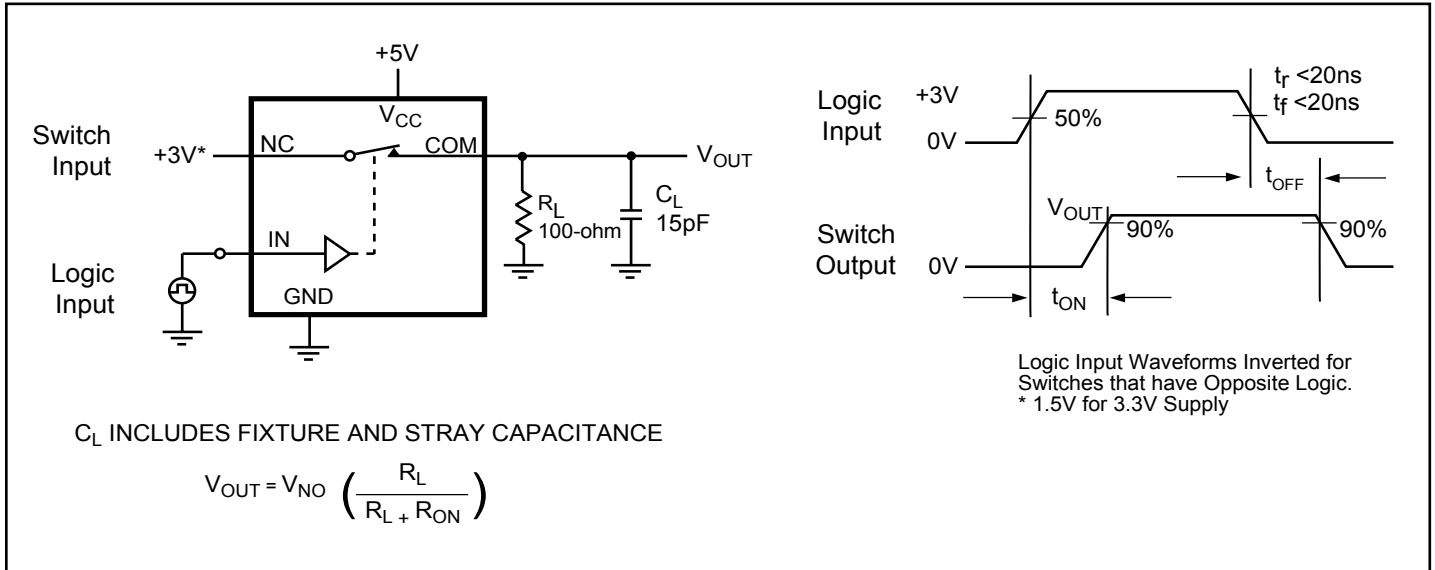


Figure 1. Switching Time

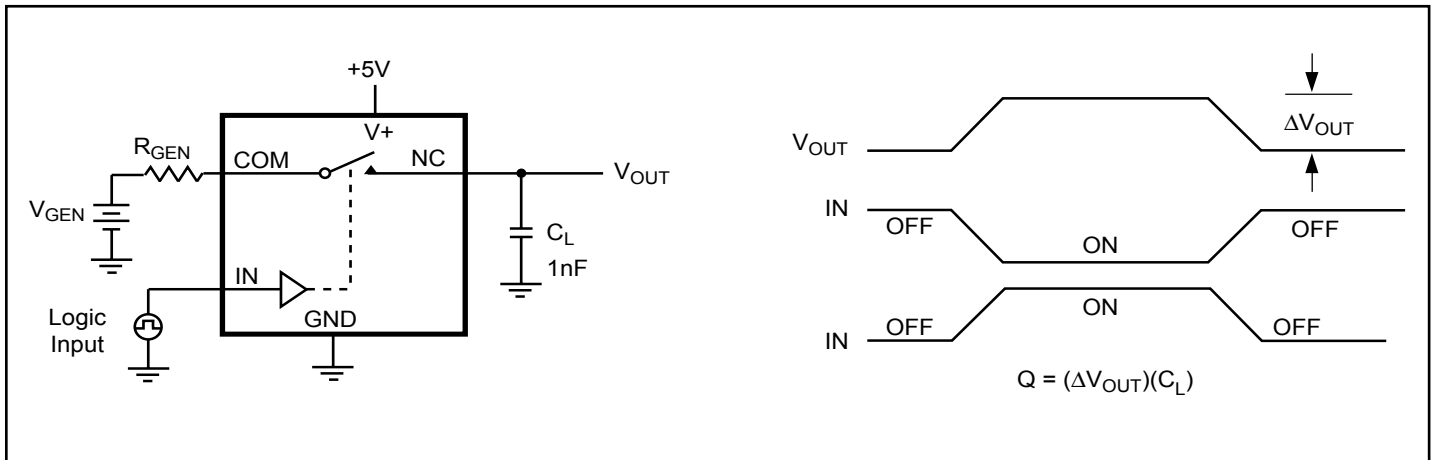
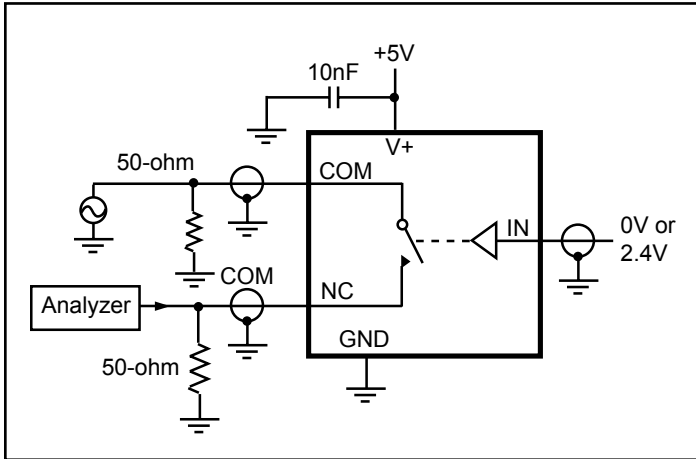
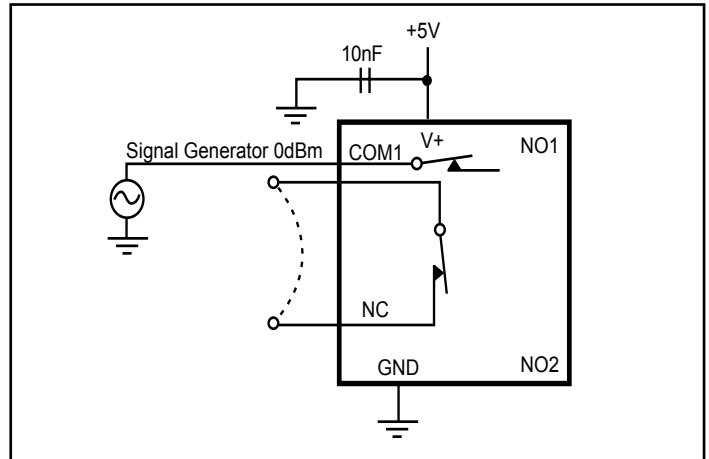


Figure 2. Charge Injection

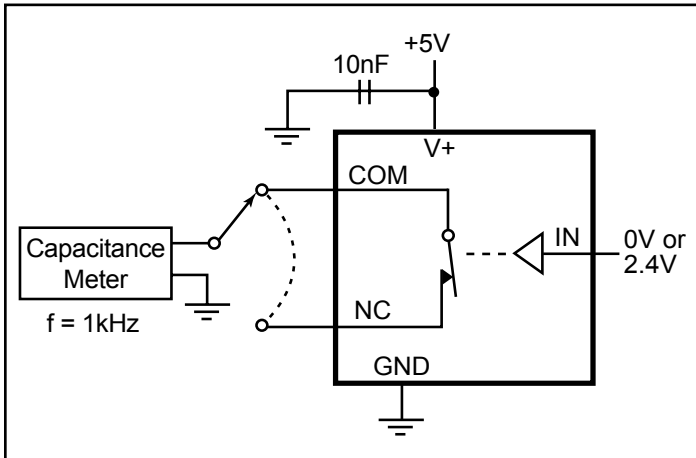
**Test Circuits/Timing Diagrams** (continued)



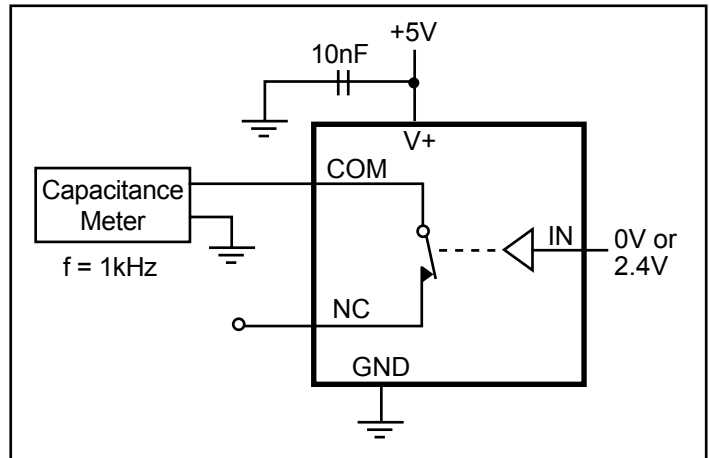
**Figure 3. Off Isolation**



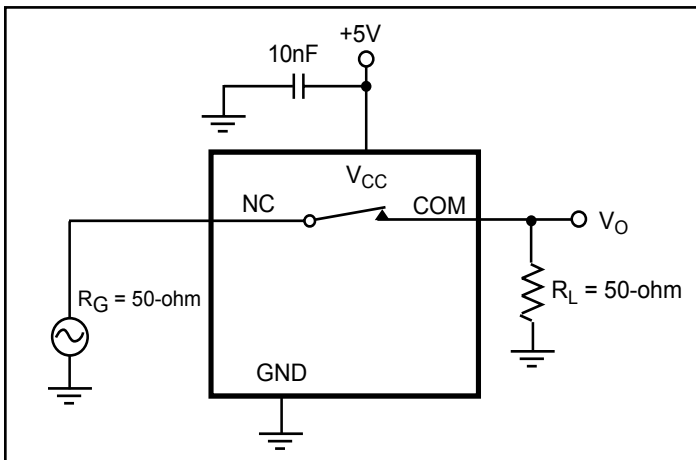
**Figure 4. Crosstalk**



**Figure 5. Channel-Off Capacitance**

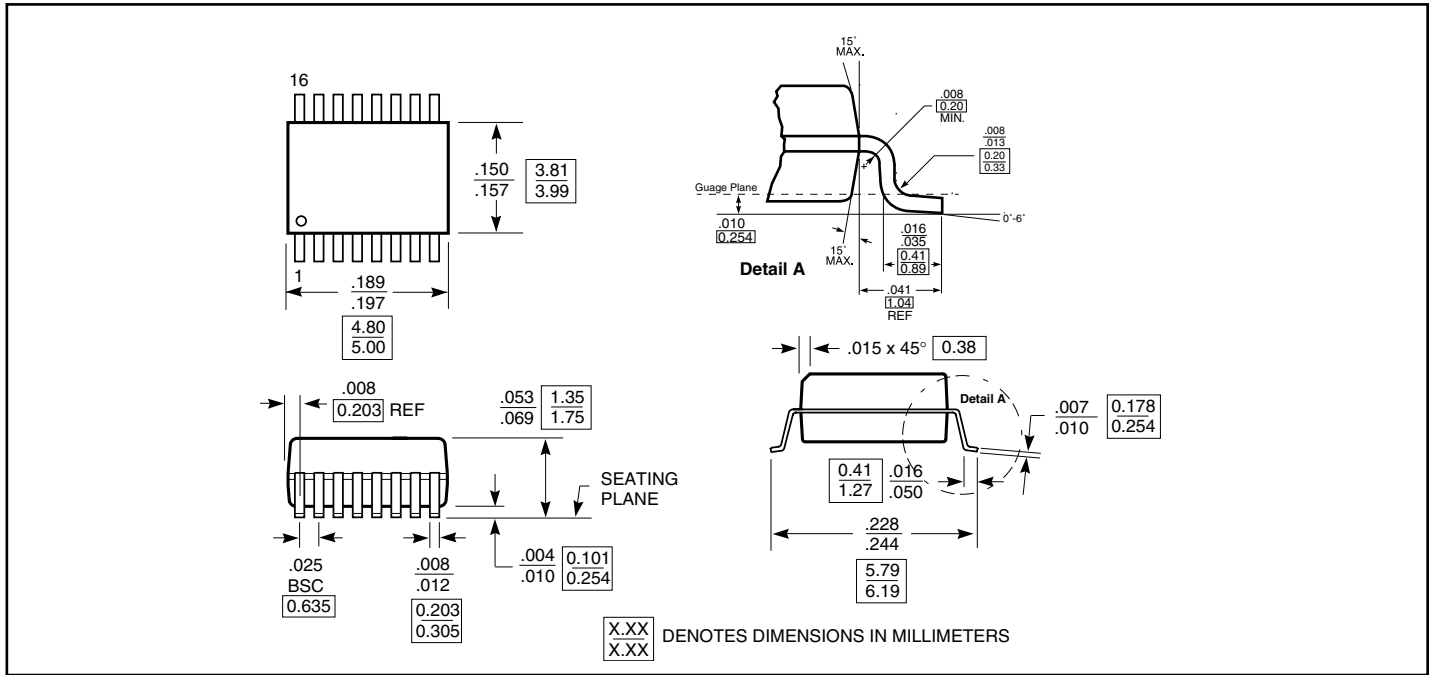


**Figure 6. Channel-On Capacitance**

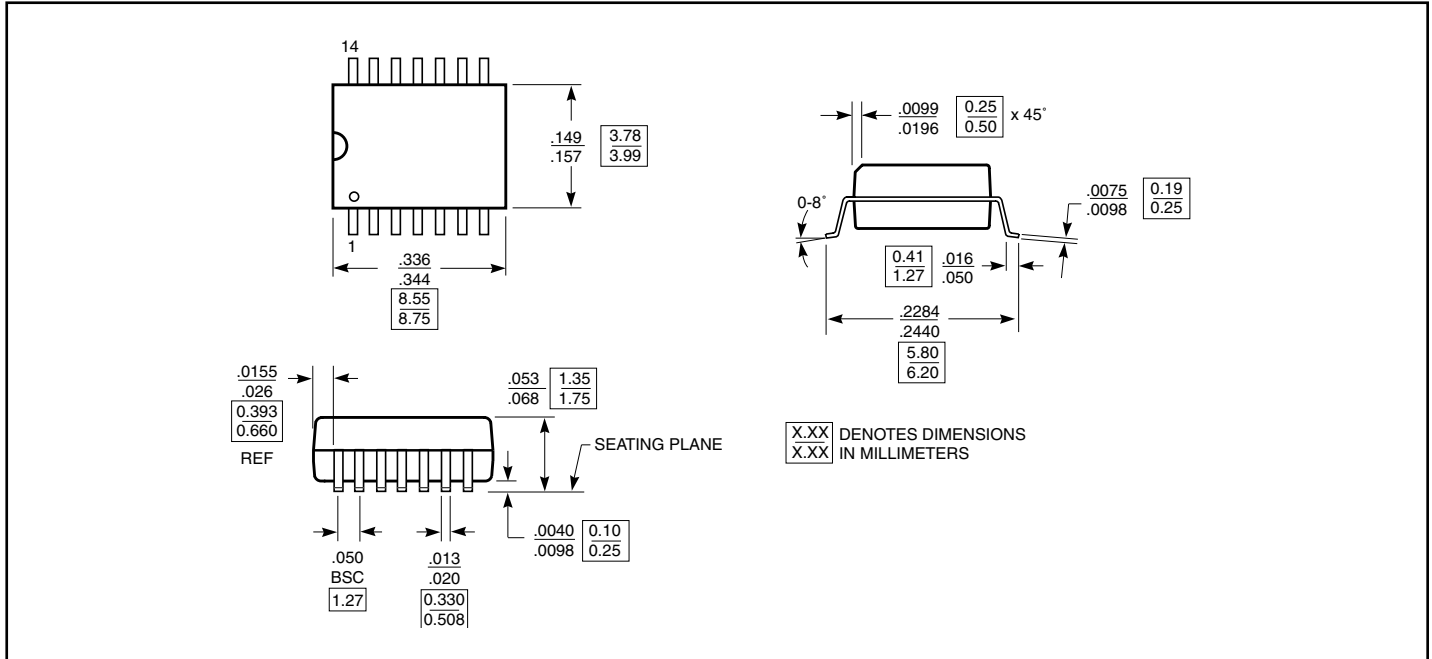


**Figure 7. Bandwidth**

Packaging Mechanical: 16-Pin, QSOP (Q)



Packaging Mechanical: 14-Pin, SOIC (W)



**Ordering Information**

<b>Ordering Code</b>	<b>Package Code</b>	<b>Package Description</b>
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/](http://www.pericom.com/packaging/)

## Looking for pricing, stock, or lifecycle information?

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 [Diodes Incorporated](#) Information

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-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management