

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: $0.5\mu\text{-ohm}$ typical
- High Speed, $T_{ON} = 8\text{ns}$ typical
- High-current channel capability: $>100\text{mA}$
- Wide bandwidth: $>200\text{ MHz}$
- 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.

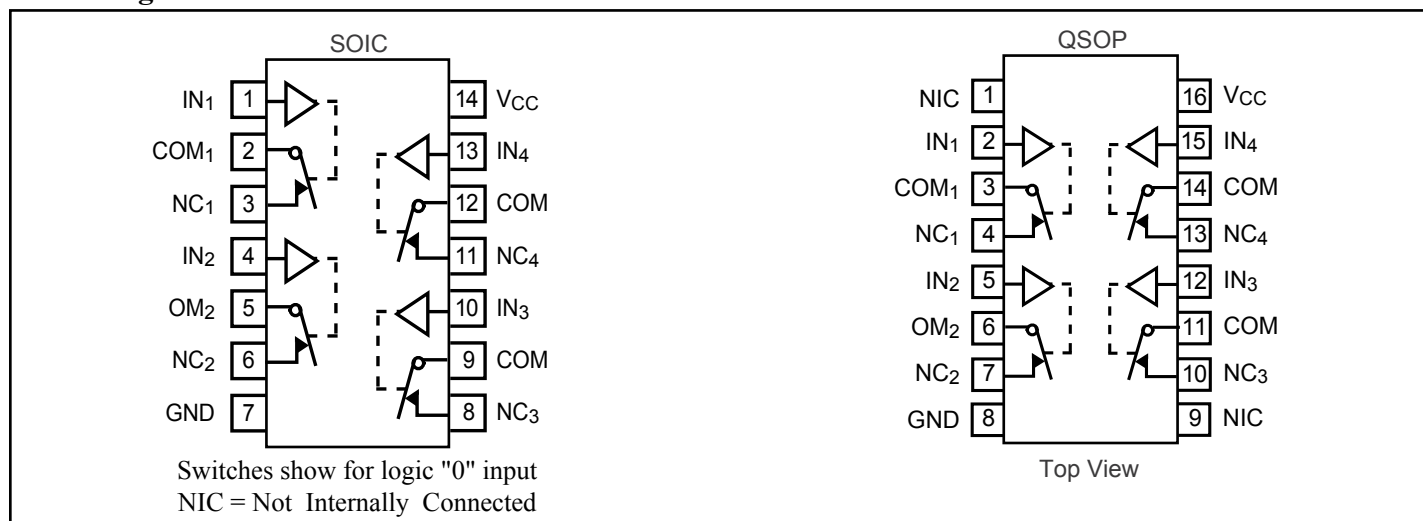
When on, each switch conducts current equally well in either direction. When off, they block voltages up to the power-supply rails.

The PI5A101 is fully specified with +5V and +3.3V supplies. With +5V the R_{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 ($>200\text{ MHz}$ high speed ($T_{ON} > 15\text{ns}$), and low charge injection ($Q > 10\text{pC}$).

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 $+85^\circ\text{C}$) 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. ⁽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 Leak-age 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 ($V_{CC} = +5V \pm 10\%$, $GND = 0V$, $V_{INH} = 2.4V$, $V_{INL} = 0.8V$) (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-Supply Range	V _{CC}		Full	2		6	V
Positive 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.

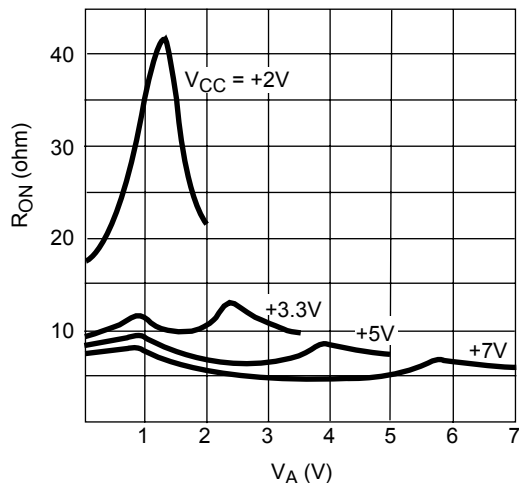
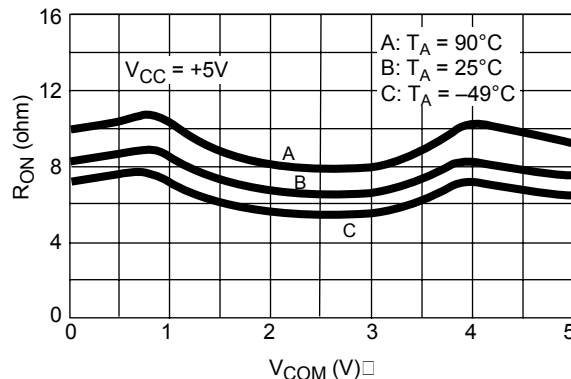
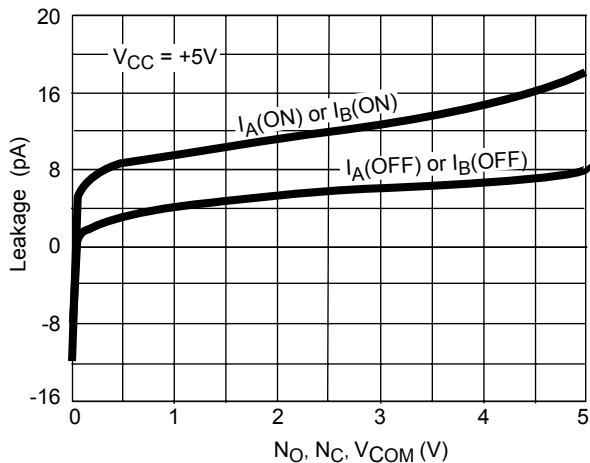
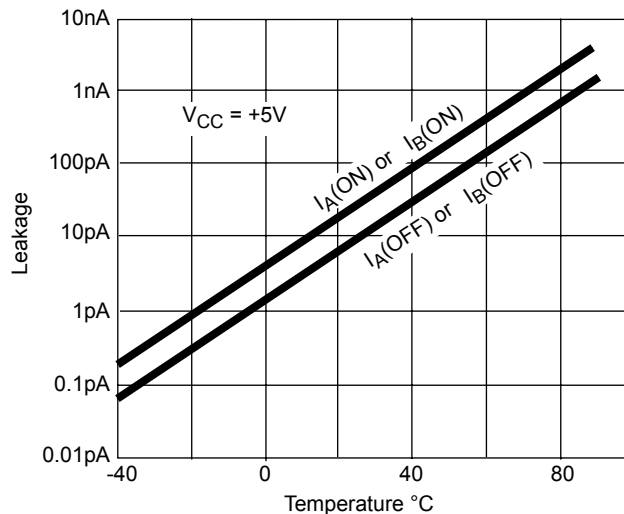
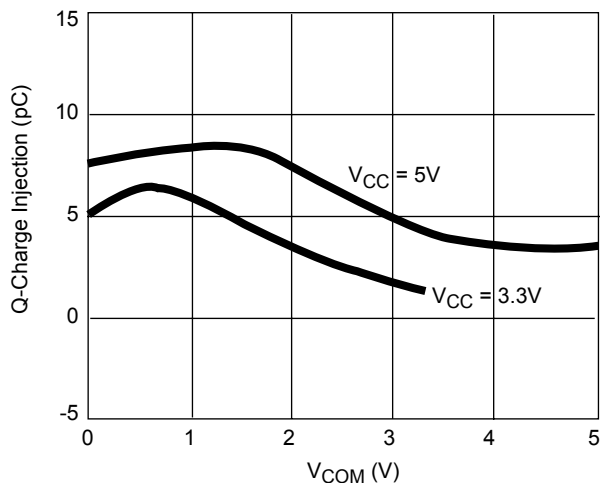
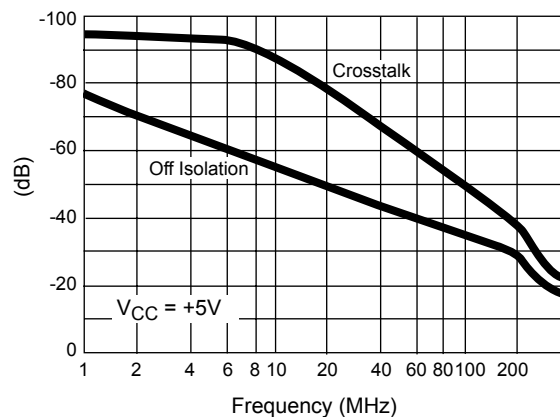
Electrical Specifications-Single +3.3V Supply (V_{CC} = +3.3V ± 10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V)

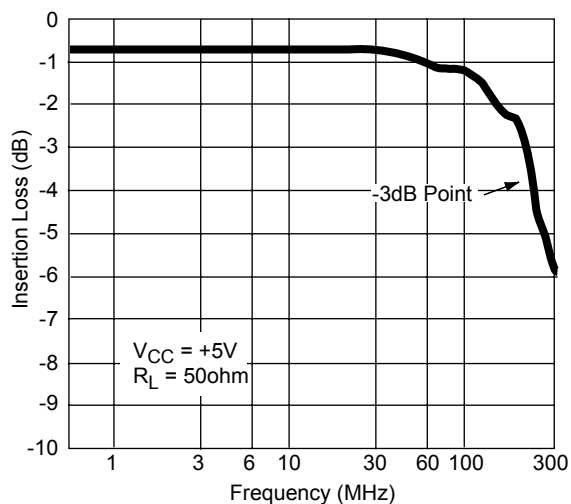
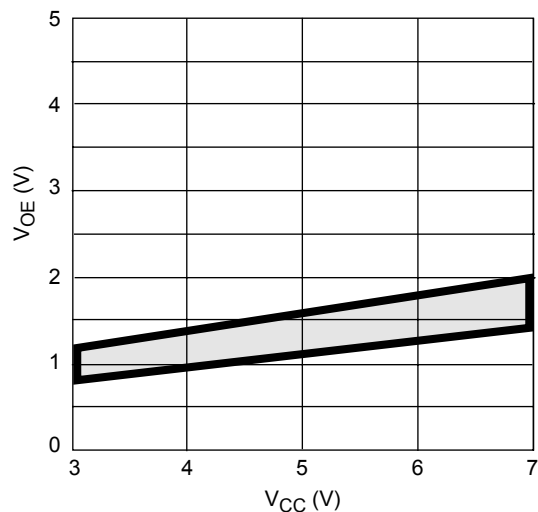
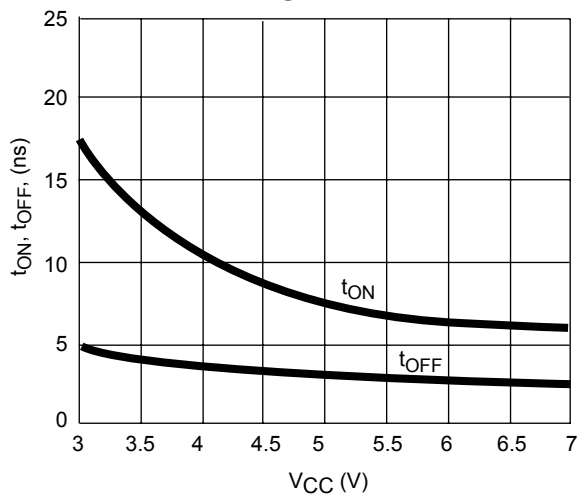
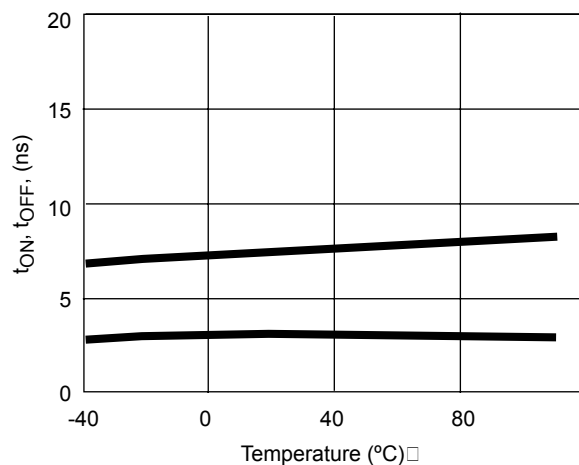
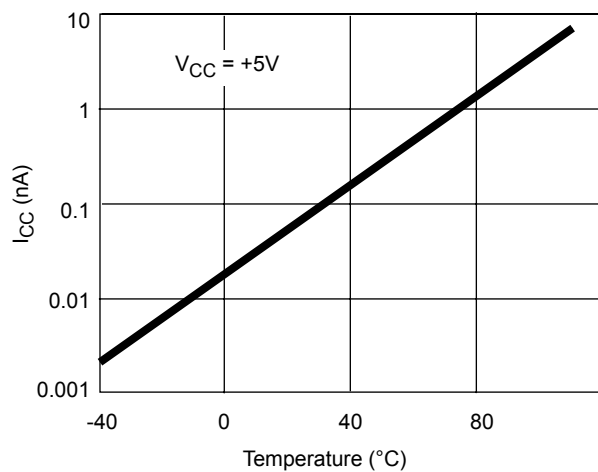
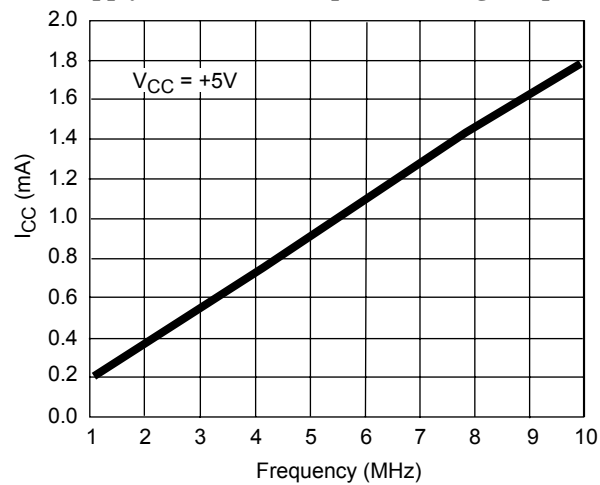
Parameter	Symbol	Conditions	Temp.(°C)	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Units
Analog Switch							
Analog Signal Range ⁽³⁾	V _{ANALOG}		Full	0		V _{CC}	V
On-Resistance	R _{ON}	V _{CC} = 3V, I _{COM} = -30mA, V _{NO} or V _{NC} = 1.5V	25		7.2	18	Ω
On-Resistance Match Between Channels ⁽⁴⁾	ΔR _{ON}		Full			28	
			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							
Positive Supply Current	I _{CC}	V _{CC} = 3.6V, V _{IN} = 0V or V _{CC} , All Channels on or off	Full			1	μA

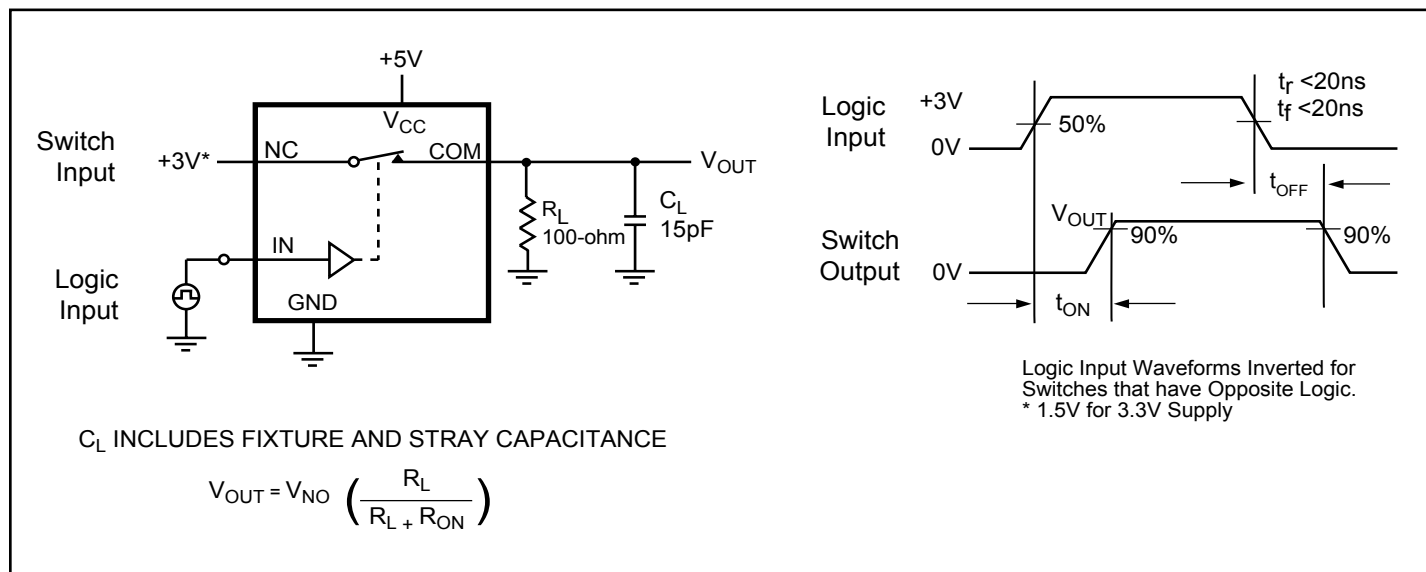
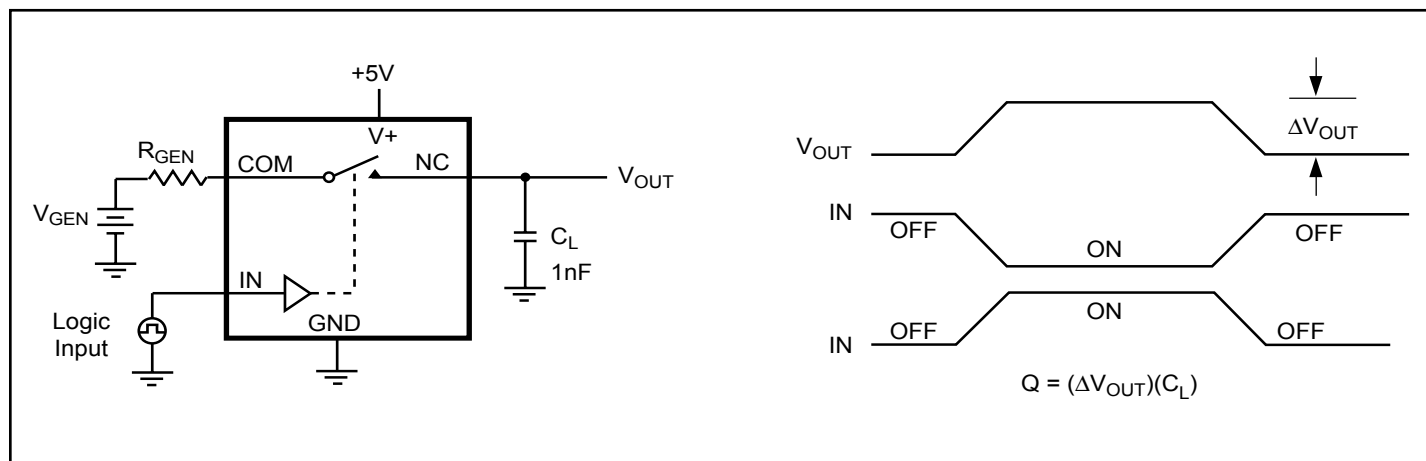
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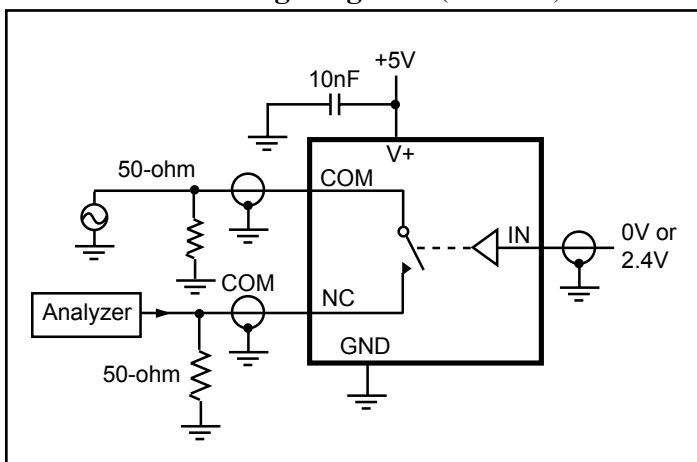
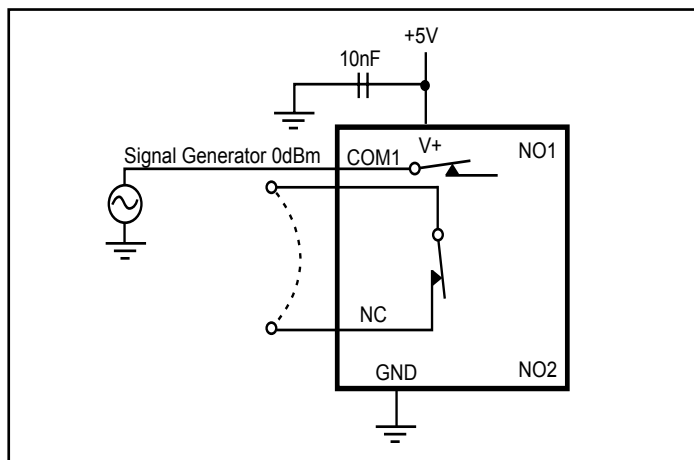
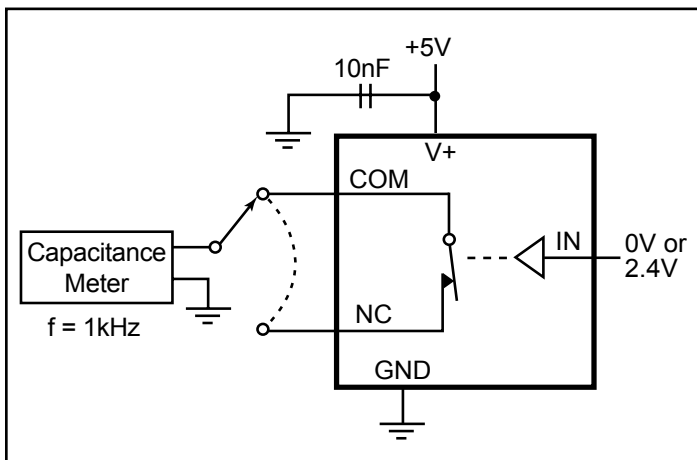
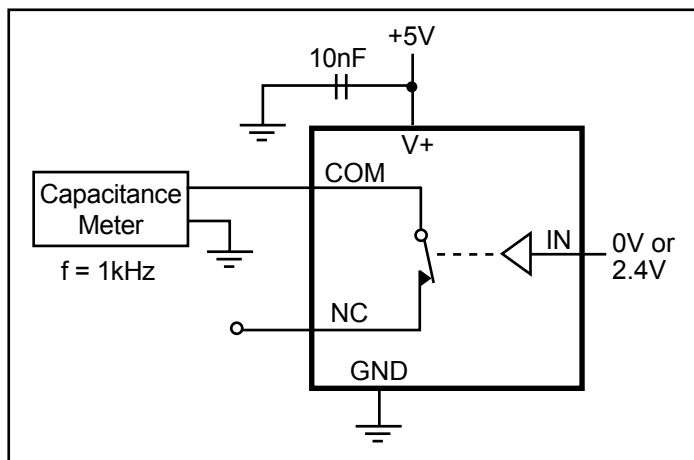
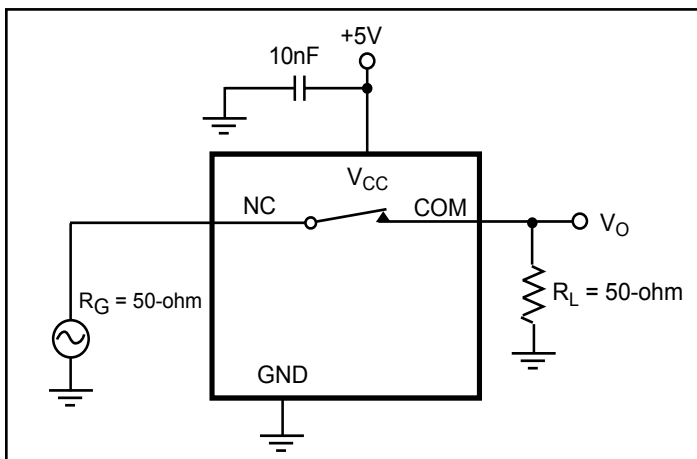
1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design
4. ΔR_{ON} = R_{ON} MAX - R_{ON} MIN
5. Flatness is defined 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)

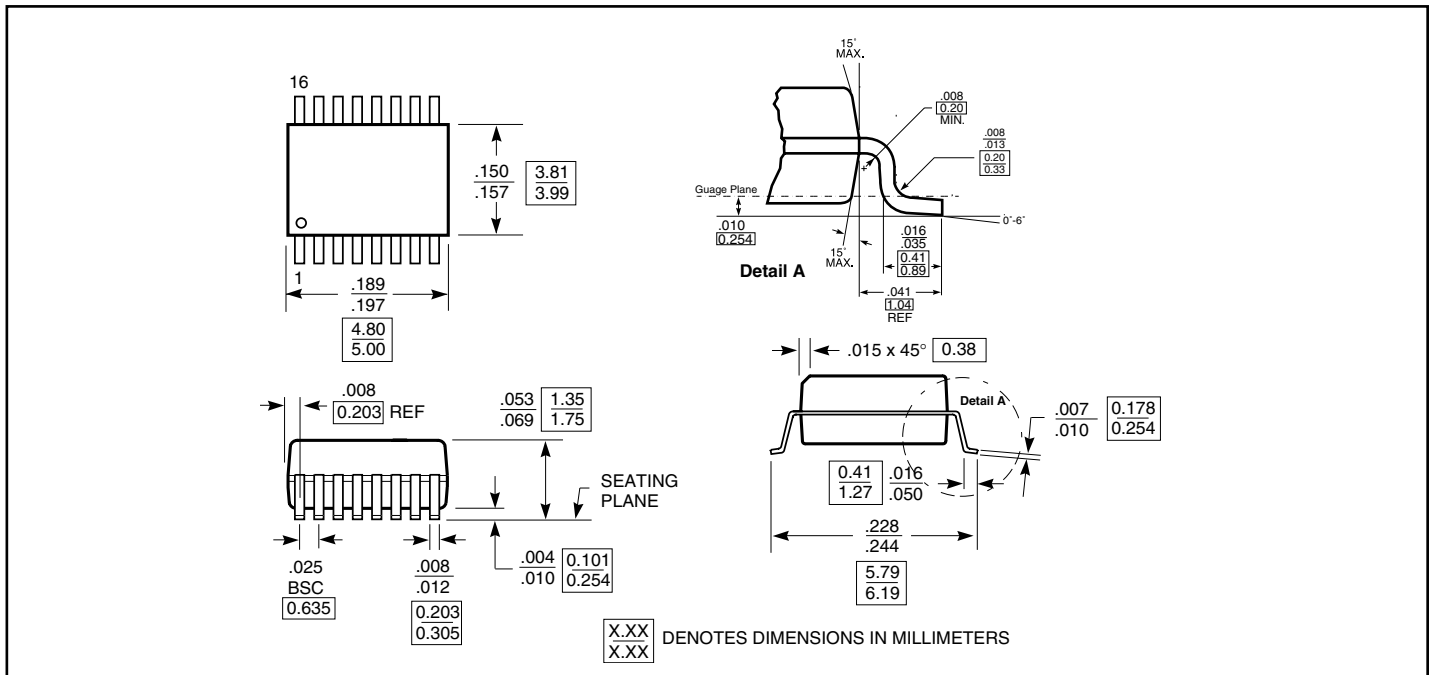
 R_{ON} vs. V_{COM}

 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


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


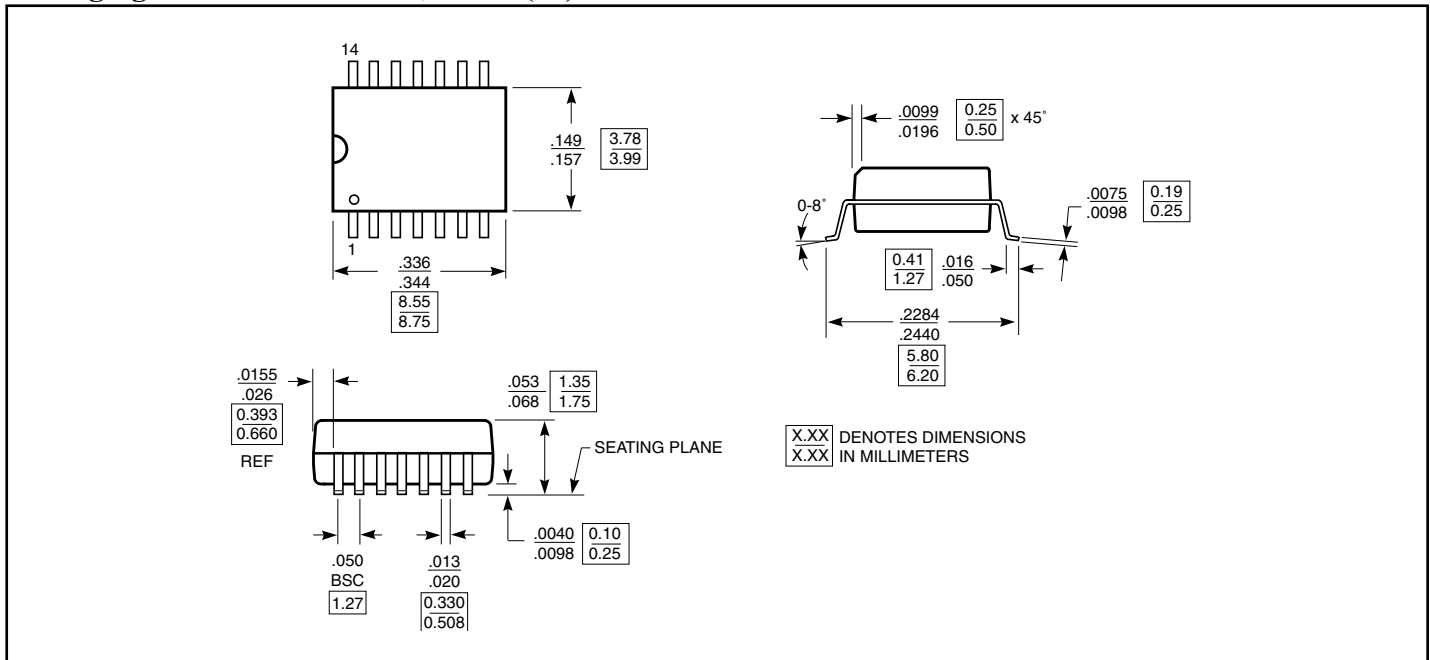
Test Circuits/Timing Diagrams

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

Ordering 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/