

### Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 2Ω at 3.0V
- Wide V<sub>CC</sub> Range: +1.8V to +5.5V
- Low Power Consumption : 5μW
- Rail-to-Rail switching throughout Signal Range
- Fast Switching Speed: 30ns max. at 5V
- High Off Isolation: -57dB at 10MHz
- -57dB (1 MHz) Crosstalk Rejection Reduces Signal Distortion
- Break-Before-Make Switching
- Extended Industrial Temperature Range: -40°C to 85°C
- Low On-Resistance Replacement for NC7SB3157
- Packaging (Pb-free & Green available):
  - 6-pin SOT-23 (T)
  - 6-contact TDFN-6 (ZC)

### Applications

- Cell Phones
- PDAs
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals

### Pin Description

Pin Number	Name	Description
1	B <sub>1</sub>	Data Port
2	GND	Ground
3	B <sub>0</sub>	Data Port (Normally Closed)
4	A	Common Output/Data Port
5	V <sub>CC</sub>	Positive Power Supply
6	S	Logic Control

### Logic Function Table

Logic Input(s)	Function
0	B <sub>0</sub> Connected to A
1	B <sub>1</sub> Connected to A

### Description

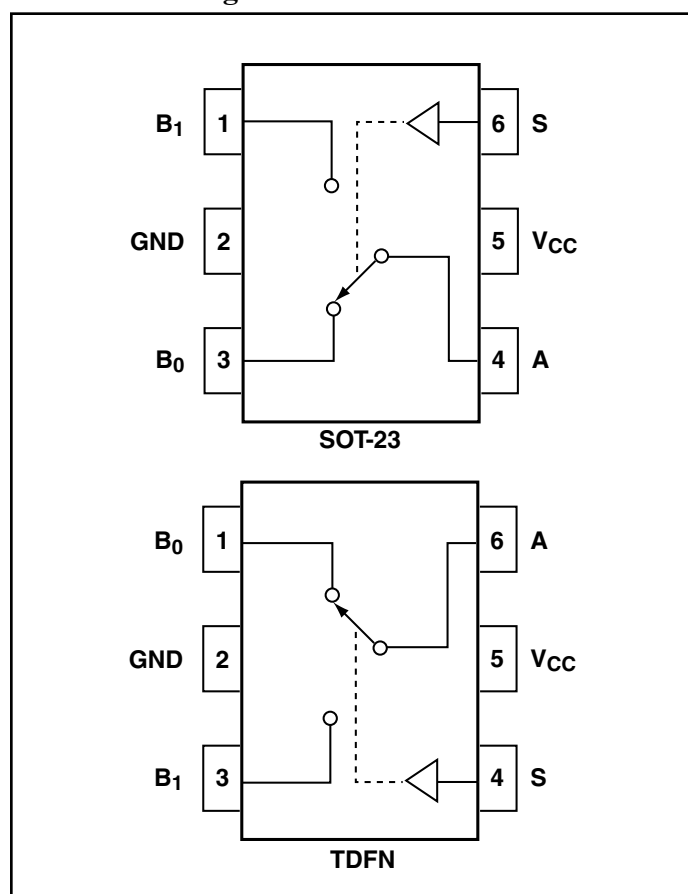
The PI5A3159 is a high-bandwidth, fast single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Specified over a wide operating power supply voltage range, 1.8V to 5.5V, the PI5A3159 has a maximum On-Resistance of 4Ω at 1.8V, 2.4Ω at 2.3V & 1Ω at 4.5V.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

Control input, S, tolerates input drive signals up to 5.5V, independent of supply voltage.

PI5A3159 is a low On-Resistance replacement for the PI5A3157 and NC7SB3157.

### Connection Diagrams



### Absolute Maximum Ratings

Voltages Referenced to GND

V+ ..... -0.5V to +5.5V

V<sub>IN</sub>, V<sub>COM</sub>, V<sub>NC</sub>, V<sub>NO</sub> <sup>(1)</sup> ..... -0.5V to V<sub>+</sub> +0.3V  
 or 30mA, whichever occurs first

Current (any terminal)..... ±200mA

Peak Current, COM, NO, NC

(Pulsed at 1ms, 10% duty cycle)..... ±400mA

### Thermal Information

Continuous Power Dissipation

SOT23 (derate 7.1mW/°C above +70°C)..... 0.5W

Storage Temperature ..... -65°C to +150°C

Lead Temperature (soldering, 10s) ..... +300°C

**Note:**

1. Signals on NC, NO, COM, or IN exceeding V<sub>+</sub> 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 +5V Supply

(V<sub>+</sub> = +5V ± 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, 4)</sup>	V <sub>ANALOG</sub>		Full	0		V+	V
On-Resistance	R <sub>ON</sub>	V <sub>+</sub> = 4.5V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = +2.5V	25		0.70	0.90	Ω
On-Resistance Match Between Channels <sup>(5)</sup>	ΔR <sub>ON</sub>		Full			1.1	
On-Resistance Flatness <sup>(6)</sup>	R <sub>FLAT(ON)</sub>	V <sub>+</sub> = 4.5V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 1V, 1.5V, 2.5V	25		0.03	0.05	
			Full			0.10	
NO or NC Off Leakage Current <sup>(7)</sup>	I <sub>NO(OFF)</sub> or I <sub>NC(OFF)</sub>	V <sub>+</sub> = 5.5V, V <sub>COM</sub> = 0V, V <sub>NO</sub> or V <sub>NC</sub> = 4.5V	25	2	0.01	2	nA
			Full			20	
COM On Leakage Current <sup>(7)</sup>	I <sub>COM(ON)</sub>	V <sub>+</sub> = 5.5V, V <sub>COM</sub> = 4.5V, V <sub>NO</sub> or V <sub>NC</sub> = 4.5V	25	-4		4	
			Full		-40	0.3	40

**Electrical Specifications - Single +5V Supply (continued)**

 (V+ = + 5V ± 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>									
Input HIGH Voltage	V <sub>IH</sub>	Guaranteed Logic HIGH level					V		
Input LOW Voltage	V <sub>IL</sub>	Guaranteed Logic LOW level				0.8			
Input Current with HIGH Voltage	I <sub>INH</sub>	V <sub>IN</sub> = 2.4V, all others = 0.8V		-1	0.005	1	μA		
Input Current with LOW Voltage	I <sub>INL</sub>	V <sub>IN</sub> = 0.8V, all others = 2.4V		-1	0.005	1			
<b>Dynamic</b>									
Turn-On-Time	t <sub>ON</sub>	V <sub>CC</sub> = 5V, See Fig. 1	25		20	35	ns		
			Full			40			
Turn-Off-Time	t <sub>OFF</sub>		25		15	20			
			Full			35			
Break-Before-Make	t <sub>BBM</sub>	See Fig. 3	25	1	12	14.5			
			Full	1	17.5				
Charge Injection <sup>(3)</sup>	Q		C <sub>L</sub> -1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0V, See Fig 2	25		40			pC
Off Isolation	O <sub>IRR</sub>		R <sub>L</sub> = 50Ω, f = 1MHz, See Fig 4			-57			dB
CrossTalk <sup>(9)</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, f = 1MHz, See Fig 4			-57				
NC or NO Capacitance	C <sub>NC/NO(OFF)</sub>	f = 1MHz, See Fig 6			42		pF		
COM Off Capacitance	C <sub>COM(OFF)</sub>	f = 1MHz, See Fig 6			83				
COM On Capacitance	C <sub>COM(ON)</sub>	f = 1MHz, See Fig 7			130				
<b>Supply</b>									
Power-Supply Range	V+		Full	1.8		5.5	V		
Positive Supply Current	I+	V+ = 5.5V, V <sub>IN</sub> = 0V or V+, All Channels ON or OFF	Full		0.5	1	μA		

**Notes:**

- The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
- Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
- Guaranteed by design.
- Device is NOT guaranteed to function per the datasheet specification outside of 0 to V+ range.
- ΔR<sub>ON</sub> = R<sub>ON</sub> max. - R<sub>ON</sub> min.
- Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.
- Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
- Off Isolation = 20log<sub>10</sub> [ V<sub>COM</sub> / (V<sub>NO</sub> or V<sub>NC</sub>) ]. See Figure 4.
- Between any two switches. See Figure 5.

**Electrical Specifications - Single +3.3V Supply**

 (V+ = +3.3V ± 10%, GND = 0V, V<sub>INH</sub> = 2.0V, V<sub>INL</sub> = 0.6V)

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>			0		V+	V
On-Resistance	R <sub>ON</sub>	V+ = 3V, I <sub>COM</sub> = -24mA, V <sub>NO</sub> or V <sub>NC</sub> = 2.0V	25		1.4	1.8	Ω
			Full			2.2	
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>	V+ = 3.3V, I <sub>COM</sub> = -24mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.0V	25		0.04	0.05	
			Full		0.11		
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V+ = 3.3V, I <sub>COM</sub> = -24mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.0V	25		0.17	0.2	
			Full		0.25		
<b>Dynamic</b>							
Turn-On-Time	t <sub>ON</sub>	V <sub>CC</sub> = 5V, See Fig. 1	25		30	40	ns
			Full			55	
Turn-Off-Time	t <sub>OFF</sub>		25		20	25	
			Full			40	
Break-Before-Make	t <sub>BBM</sub>	See Fig. 3	25	1	21	29	
Charge Injection <sup>(3)</sup>	Q	C <sub>L</sub> -1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0V, See Fig 2	25		30		pC
<b>Supply</b>							
Positive Supply Current	I+	V+ = 3.6V, V <sub>IN</sub> = 0V or V+, All Channels ON or OFF	Full		0.5	1	μA
<b>Logic Input</b>							
Input HIGH Voltage	V <sub>IH</sub>	Guaranteed Logic HIGH level	Full	2			V
Input LOW Voltage	V <sub>IL</sub>	Guaranteed Logic LOW level	Full			0.6	
Input HIGH Current	I <sub>INH</sub>	V <sub>IN</sub> = 2.4V, all others = 0.8V	Full	-1		1	μA
Input LOW Current	I <sub>INL</sub>	V <sub>IN</sub> = 0.8V, all others = 2.4V	Full	-1		1	

**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.

**Electrical Specifications - Single +2.5V Supply**

 (V+ = +2.5V ± 10%, GND = 0V, V<sub>INH</sub> = 1.8V, V<sub>INL</sub> = 0.6V)

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>			0		V+	V
On-Resistance	R <sub>ON</sub>	V+ = 1.8V, I <sub>COM</sub> = -2mA, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V	25		1.6	2	Ω
			Full			2.7	
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>	V+ = 1.8V, I <sub>COM</sub> = -2mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 1.5V	25		0.13	0.16	
			Full		0.2		
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V+ = 1.8V, I <sub>COM</sub> = -2mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 1.5V	25		0.25	0.3	
			Full		0.45		
<b>Dynamic</b>							
Turn-On-Time	t <sub>ON</sub>	V+ = 2.5V, V <sub>NO</sub> or V <sub>NC</sub> = 1.8V, See Fig. 1	25		40	55	ns
			Full			70	
Turn-Off-Time	t <sub>OFF</sub>	V+ = 2.5V, V <sub>NO</sub> or V <sub>NC</sub> = 1.8V, See Fig. 1	25		30	40	
			Full			55	
Break-Before-Make	t <sub>BBM</sub>	See Fig. 3	25	1	33	39	
Make-Before-Break	t <sub>MBB</sub>	See Fig. 4	25	1	9	13	
Charge Injection <sup>(3)</sup>	Q	C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0V, See Fig 2	25		20		pC
<b>Supply</b>							
Positive Supply Current	I <sub>+</sub>	V+ = 2.75V, V <sub>IN</sub> = 0V or V+, All Channels ON or OFF	Full		0.5	1	μA
<b>Logic Input</b>							
Input HIGH Voltage	V <sub>IH</sub>	Guaranteed Logic HIGH level	Full	1.8			V
Input LOW Voltage	V <sub>IL</sub>	Guaranteed Logic LOW level	Full			0.6	
Input HIGH Current	I <sub>INH</sub>	V <sub>IN</sub> = 2.0V, all others = 0.8V	Full	-1		1	μA
Input LOW Current	I <sub>INL</sub>	V <sub>IN</sub> = 0.8V, all others = 2.0V	Full	-1		1	

**Notes:**

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- Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
- Guaranteed by design.
- ΔR<sub>ON</sub> = R<sub>ON</sub> max. - R<sub>ON</sub> min.
- Flatness is defined as the difference between the maximum and minimum value of On-Resistance measured.

**Electrical Specifications - Single +1.8V Supply**

 (V+ = +1.8V ± 10%, GND = 0V, V<sub>INH</sub> = 1.5V, V<sub>INL</sub> = 0.6V)

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>			0		V+	V
On-Resistance	R <sub>ON</sub>	V+ = 1.8V, I <sub>COM</sub> = -2mA, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V	25		2.8	4	Ω
			Full			5	
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>	V+ = 1.8V, I <sub>COM</sub> = -2mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.6V, 1.5V	25		0.44	0.6	
			Full		0.7		
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V+ = 1.8V, I <sub>COM</sub> = -2mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.6V, 1.5V	25		0.5	0.6	
			Full		0.9		
<b>Dynamic</b>							
Turn-On-Time	t <sub>ON</sub>	V+ = 1.8V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, See Fig. 1	25		65	70	ns
			Full			95	
Turn-Off-Time	t <sub>OFF</sub>	V+ = 1.8V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, See Fig. 1	25		40	55	
			Full			70	
Break-Before-Make	t <sub>BBM</sub>	See Fig. 3	25	1	60	72	
Charge Injection <sup>(3)</sup>	Q	C <sub>L</sub> -1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0V, See Fig 2	25		10		pC
<b>Supply</b>							
Positive Supply Current	I <sub>+</sub>	V+ = 2.0, V <sub>IN</sub> = 0V or V+, All Channels ON or OFF	Full		0.5	1	μA
<b>Logic Input</b>							
Input HIGH Voltage	V <sub>IH</sub>	Guaranteed Logic HIGH level	Full	1.8			V
Input LOW Voltage	V <sub>IL</sub>	Guaranteed Logic LOW level	Full			0.6	
Input HIGH Current	I <sub>INH</sub>	V <sub>IN</sub> = 1.5V, all others = 0.8V	Full	-1		1	μA
Input LOW Current	I <sub>INL</sub>	V <sub>IN</sub> = 0.8V, all others = 1.5V	Full	-1		1	

**Notes:**

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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.

### Test Circuits/Timing Diagrams

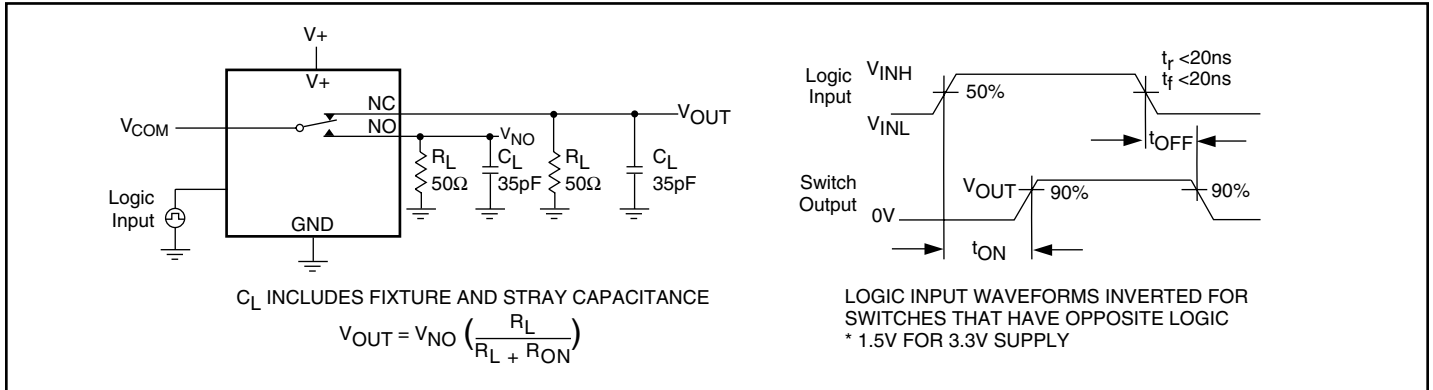


Figure 1. Switching Time

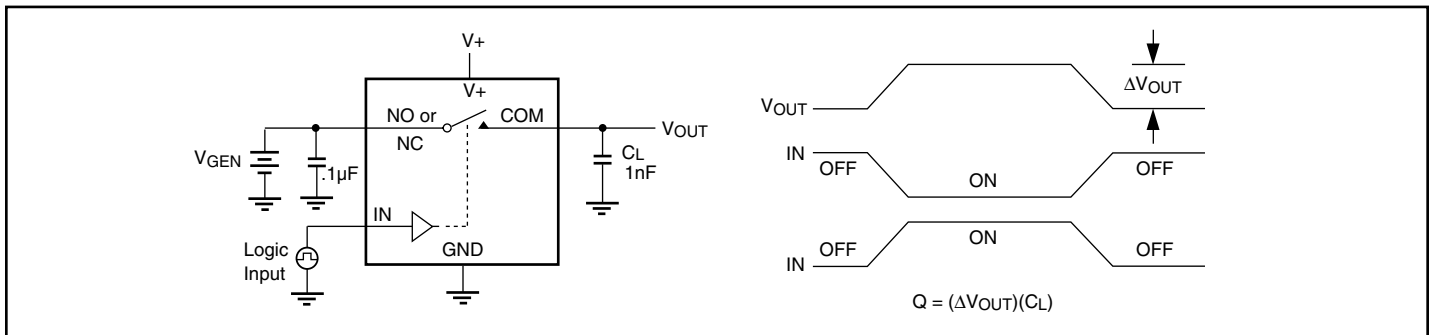


Figure 2. Charge Injection

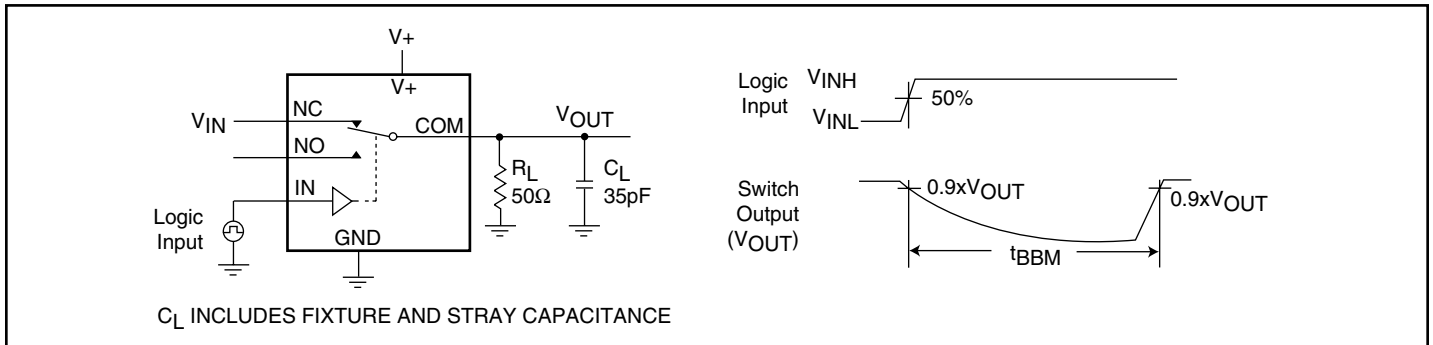
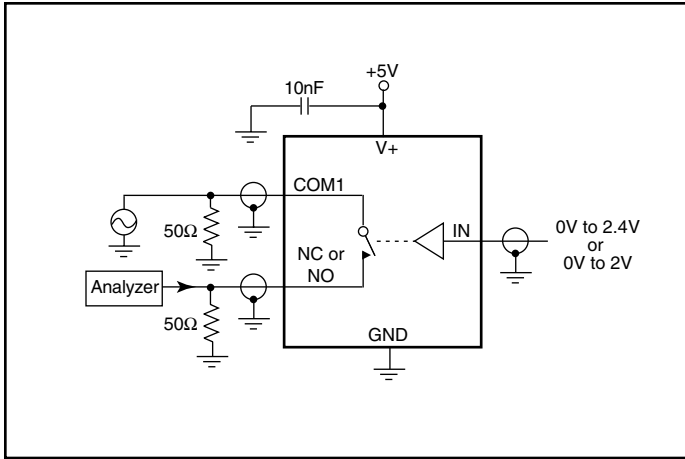
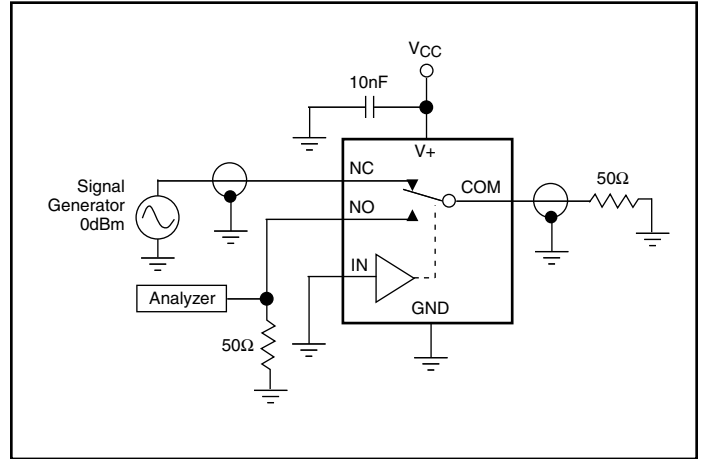


Figure 3. Break-Before-Make Interval

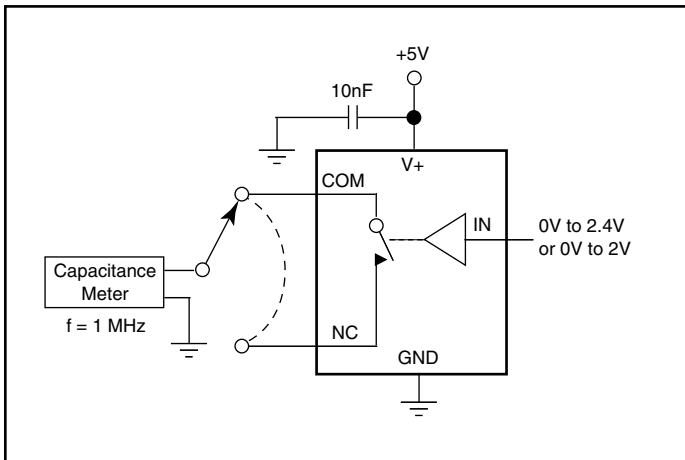
**Test Circuits/Timing Diagrams (continued)**



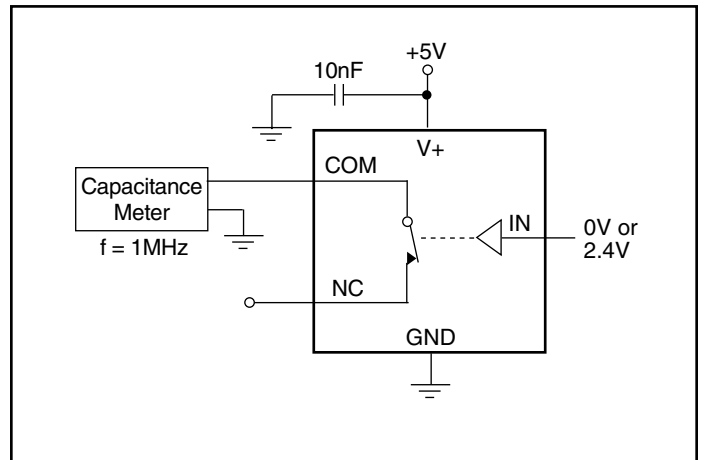
**Figure 4. Off Isolation/On-Channel Bandwidth**



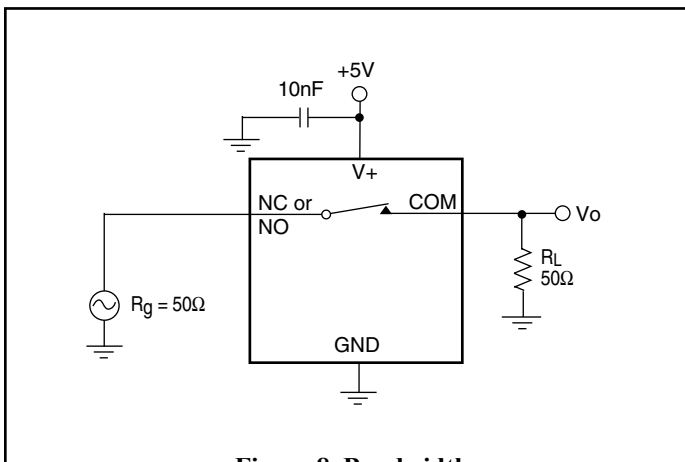
**Figure 5. Crosstalk**



**Figure 6. Channel-Off Capacitance**



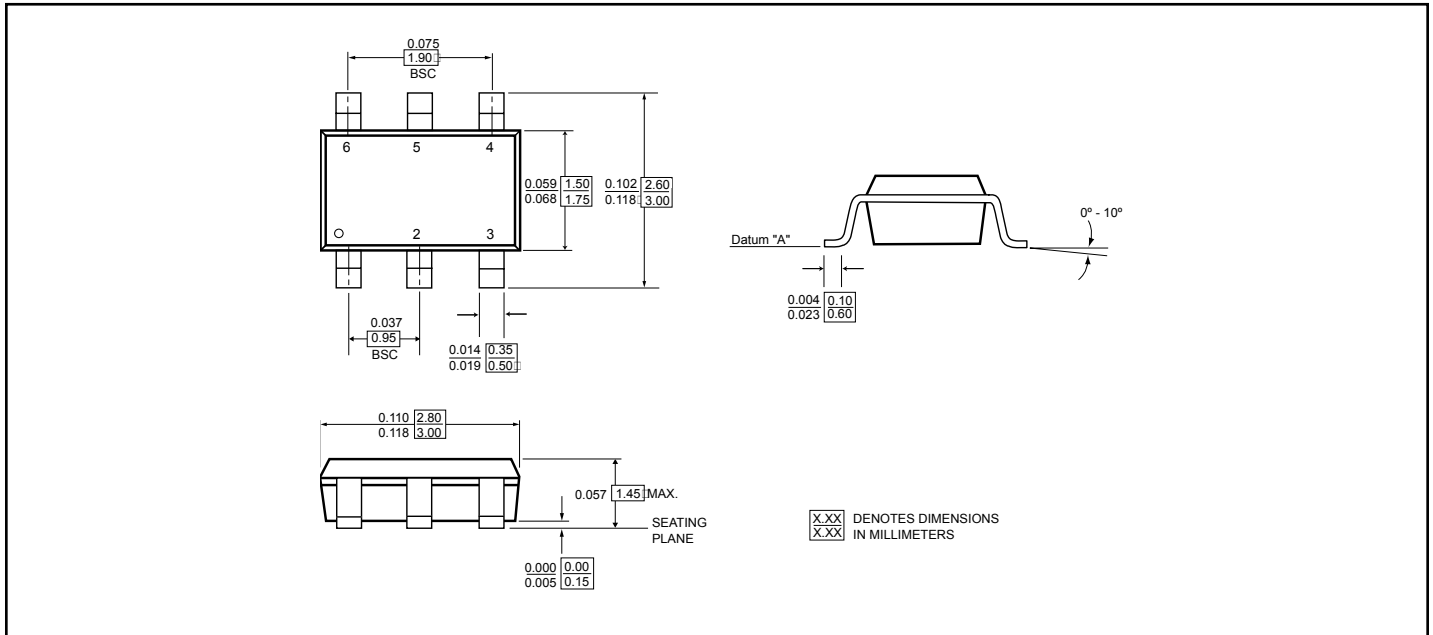
**Figure 7. Channel-On Capacitance**



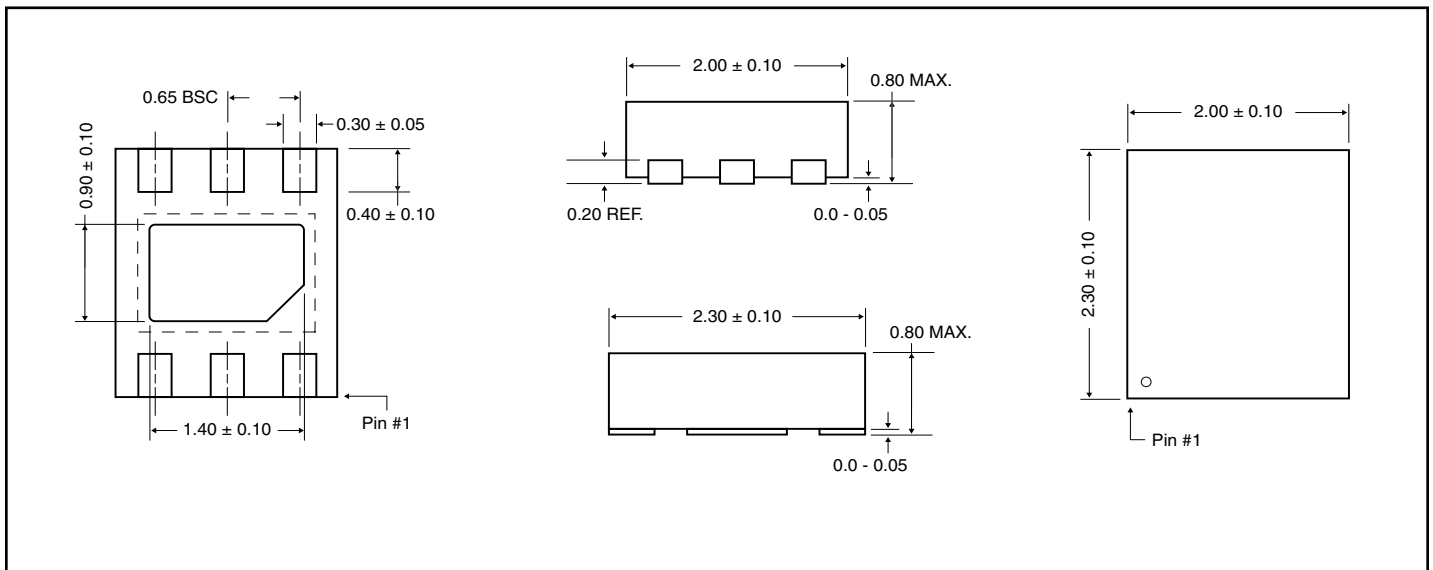
**Figure 8. Bandwidth**



**Packaging Mechanical: 6-Pin SOT-23(T)**



**Packaging Mechanical: 6-Pin TDFN (ZC)**



**Ordering Information**

<b>Ordering Code</b>	<b>Package Code</b>	<b>Package Description</b>	<b>Top Marking</b>
PI5A3159TX	T	6-pin SOT-23	ZL
PI5A3159TEX	T	6-pin SOT-23	Z̄L
PI5A3159ZCX <sup>(1)</sup>	ZC	6-contact TDFN	ZL
PI5A3159ZCEX	ZC	Pb-free & Green 6-contact TDFN	ZL

**Notes:**

1. This product has always shipped as only a lead free product, but since it was introduced prior to Pericom's strategy of adding an E to all Green/Lead free parts many customers order it without the E suffix. Please migrate new designs and qualification to include the E suffix. Pericom at this point in time will continue to offer devices marked both ways, but may at a later date eliminate the non-E part number.
2. Thermal Characteristics can be found on the world wide web at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
3. Number of transistors : 753
4. X = Tape and reel