

## Features

- Single-Supply Operation (+2V to +6V)
- Rail-to-Rail Analog Signal Dynamic Range
- Low On-Resistance (6Ω typ. with 5V supply)  
Minimizes Distortion and Error Voltages
- On-Resistance Flatness, 3Ω typ.
- Low Charge Injection Reduces Glitch Errors. Q = 4pC typ.
- High Speed. t<sub>ON</sub> = 10ns typ.
- Wide -3dB Bandwidth: 326 MHz (typ.)
- High-Current Channel Capability: >100mA
- TTL/CMOS Logic Compatible
- Low Power Consumption (0.5µW typ)
- Small outline transistor package minimizes board area
- Packaging (Pb-free & Green available):
  - 5-pin 65-mil wide SOT23 (T) for PI5A121 and PI5A122
  - 6-pin 65-mil wide SOT23 (T) for PI5A124
  - 5-pin 50-mil wide SC70 (C) for PI5A121/PI5A122

## Applications

- Audio, Video Switching, and Routing
- Battery-Powered Communication Systems
- Computer Peripherals
- Telecommunications
- Portable Instrumentation
- Mechanical Relay Replacement
- Cell Phones
- PDAs

## Description

The PI5A121/PI5A122/PI5A124 are analog switches designed for single-supply operation. These high-precision devices are ideal for low-distortion audio, video, signal switching and routing.

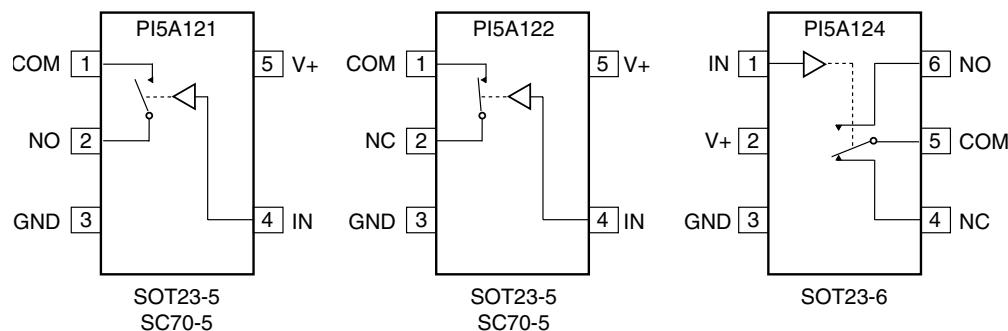
The PI5A121 is a single-pole throw (SPST) normally open (NO) switch. The switch is open when IN is LOW. The PI5A122 is a single-pole single-throw (SPST) normally closed (NC) switch.

Each switch conducts current equally well in either direction when on. When off, they block voltages up to V<sub>+</sub>.

These switches are fully specified with +5V, and +3.3V supplies. With +5V, they guarantee <10Ω On-Resistance. On-Resistance matching between channels is within 2Ω. On-Resistance flatness is less than 55Ω over the specified range. These switches also guarantee fast switching speeds (t<sub>ON</sub> <20ns).

These products are available in 5-pin SC70 and/or 6-pin SOT23 plastic packages for operation over the industrial (-40°C to +85°C) temperature range.

## Functional Diagrams, Pin Configurations and Truth Tables



Switches shown for Logic "0" input

IN	PI5A121	PI5A122
0	OFF	ON
1	ON	OFF

PI5A124		
LOGIC	NC	NO
0	ON	OFF
1	OFF	ON

### Absolute Maximum Ratings

Voltages Referenced to Gnd

V<sub>+</sub> ..... -0.5V to +7V

V<sub>IN</sub>, V<sub>COM</sub>, V<sub>NC</sub>, V<sub>NO</sub> (Note 1) ..... -0.5V to V<sub>CC</sub> +2V or 30mA, whichever occurs first

Current (any terminal) ..... ±25mA

Peak Current, COM, NO, NC

(Pulsed at 1ms, 10% duty cycle) ..... ±25mA

### Thermal Information

Continuous Power Dissipation

SOT23-6 (derate 7mW/°C above +70°C) ..... 550mW

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)</sup>	V <sub>ANALOG</sub>		Full	0		V <sub>+</sub>	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		7.2	10	Ω	
			Full			12		
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>		25		0.2	2		
			Full			4		
On-Resistance Flatness <sup>(5)</sup>	R <sub>FLAT(ON)</sub>	V <sub>+</sub> = 5V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 1V, 2.5V, 4V	25		2.72	3.5	nA	
			Full			4		
NO or NC Off Leakage Current <sup>(6)</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		0.18		nA	
			Full	-80		80		
COM Off Leakage Current <sup>(6)</sup>	I <sub>COM(OFF)</sub>	V <sub>+</sub> = 5.5V, V <sub>COM</sub> = +4.5V, V <sub>NO</sub> or V <sub>NC</sub> = ± 0V	25		0.20			
			Full	-80		80		
COM On Leakage Current <sup>(6)</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		0.20		nA	
			Full	-80		80		

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

(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>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				0.8		
Input Current with Voltage High	I <sub>INH</sub>	V <sub>IN</sub> = 2.4V, all others = 0.8V		-1	0.005	1	μA	
Input Current with Voltage Low	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, Figure 1	25		7	15	ns	
Turn-Off Time	t <sub>OFF</sub>		Full			20		
Charge Injection <sup>(3)</sup>	Q		25		1	7		
Off Isolation	O <sub>IRR</sub>		Full			10		
Crosstalk <sup>(8)</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 10MHz, Figure 4	25		1.6	10	pC	
NC or NO Capacitance	C <sub>(OFF)</sub>	f = 1kHz, Figure 5			-43		dB	
COM Off Capacitance	C <sub>COM(OFF)</sub>				-43			
COM On Capacitance	C <sub>COM(ON)</sub>	f = 1kHz, Figure 6			5.5		pF	
-3dB Bandwidth	BW	R <sub>L</sub> = 50Ω, Figure 7			5.5			
<b>Supply</b>								
Power-Supply Range	V <sub>+</sub>		Full	2		6	V	
Positive Supply Current	I <sub>+</sub>	V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 0V or V <sub>+</sub>				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.  $\Delta R_{ON} = R_{ON \text{ max}} - R_{ON \text{ min}}$
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 =  $20\log_{10} [ V_{COM} / (V_{NO} \text{ or } V_{NC}) ]$ . See Figure 3.
8. Between any two switches. See Figure 4.

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

(V+ = +3.3V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

Parameter	Symbol	Conditions	Temp.(°C)	Min.(1)	Typ.(2)	Max.(1)	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> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V	25		12	18	Ω	
			Full			22		
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>	V+ = 3.3V, I <sub>COM</sub> = -30mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V	25		1	1	Ω	
			Full			2		
On-Resistance Flatness <sup>(3,5)</sup>	R <sub>FLAT(ON)</sub>		25		0.5	4		
			Full			5		
<b>Dynamic</b>								
Turn-On Time	t <sub>ON</sub>	V+ = 3.3V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, Figure 1	25		15	25	ns	
			Full			40		
Turn-Off Time	t <sub>OFF</sub>		25		1.5	12		
			Full			20		
Charge Injection <sup>(3)</sup>	Q	C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0V, Figure 2	25		1.3	10	pC	
<b>Supply</b>								
Positive Supply Current	I <sub>+</sub>	V+ = 3.6V, V <sub>IN</sub> = 0V or V+ All Channels on or off	Full			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			0.8		
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		

### Test Circuits/Timing Diagrams

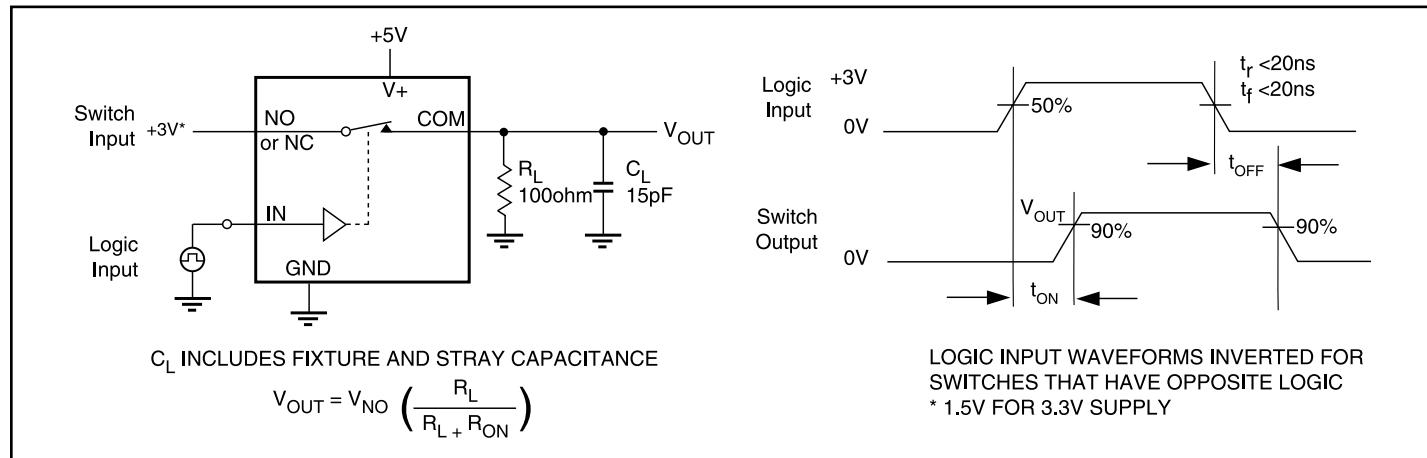


Figure 1. Switching Time

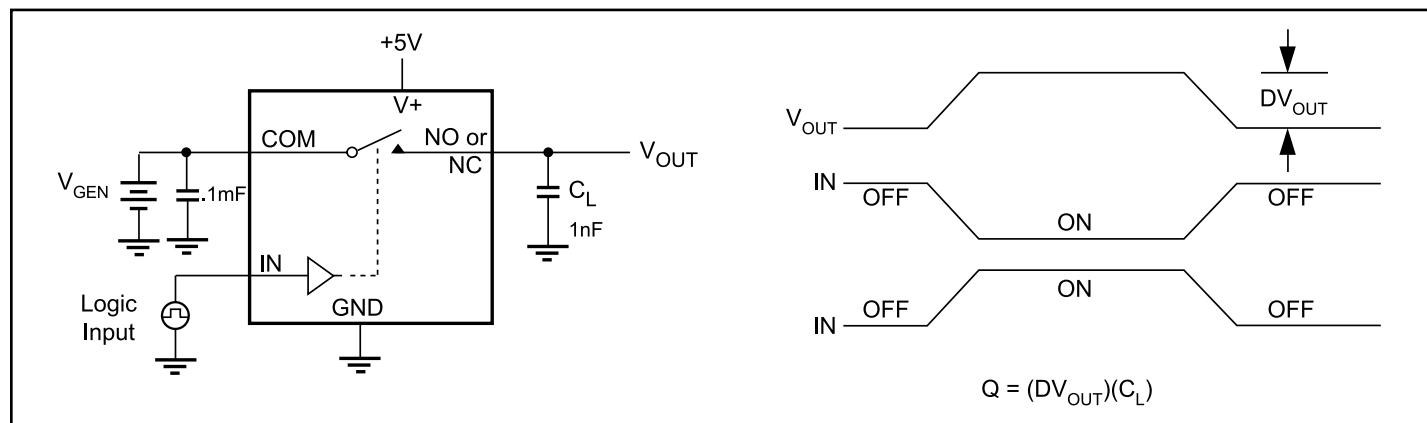
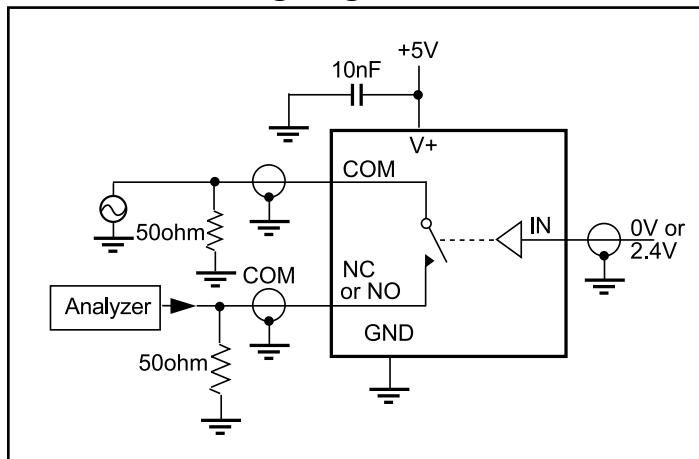
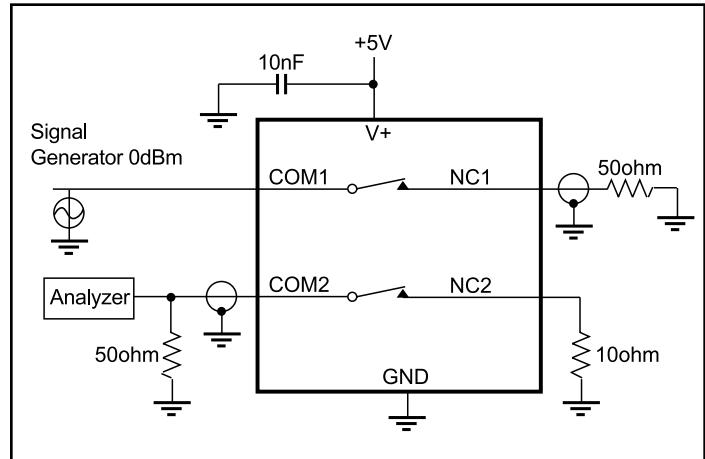
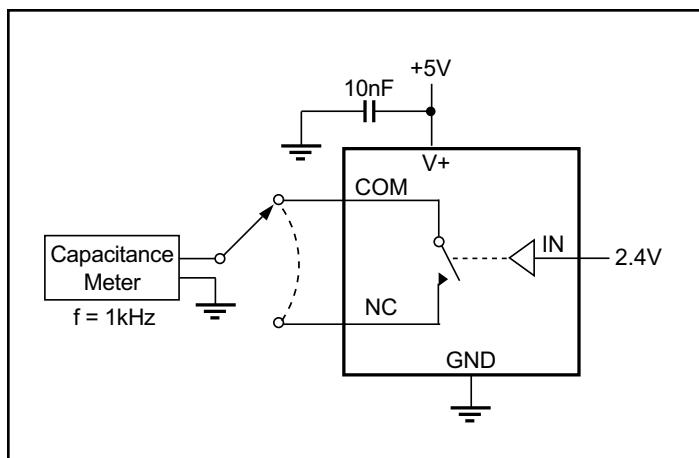
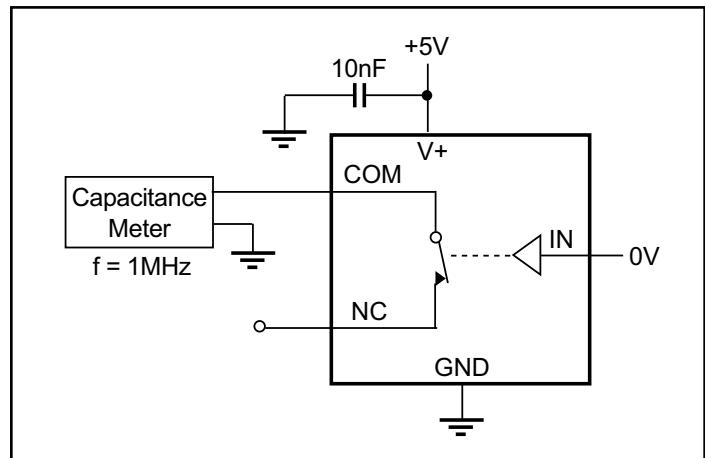
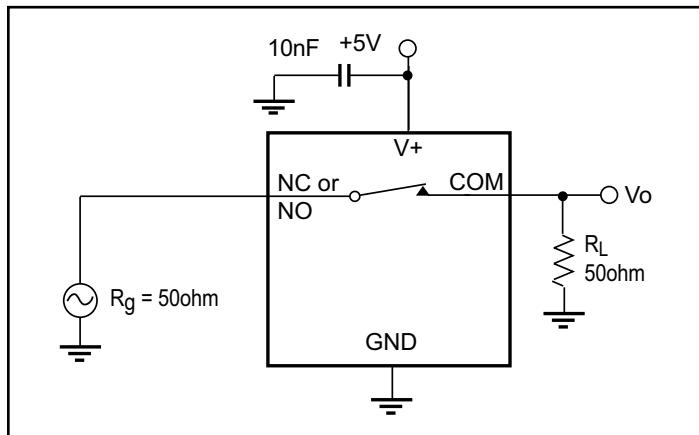
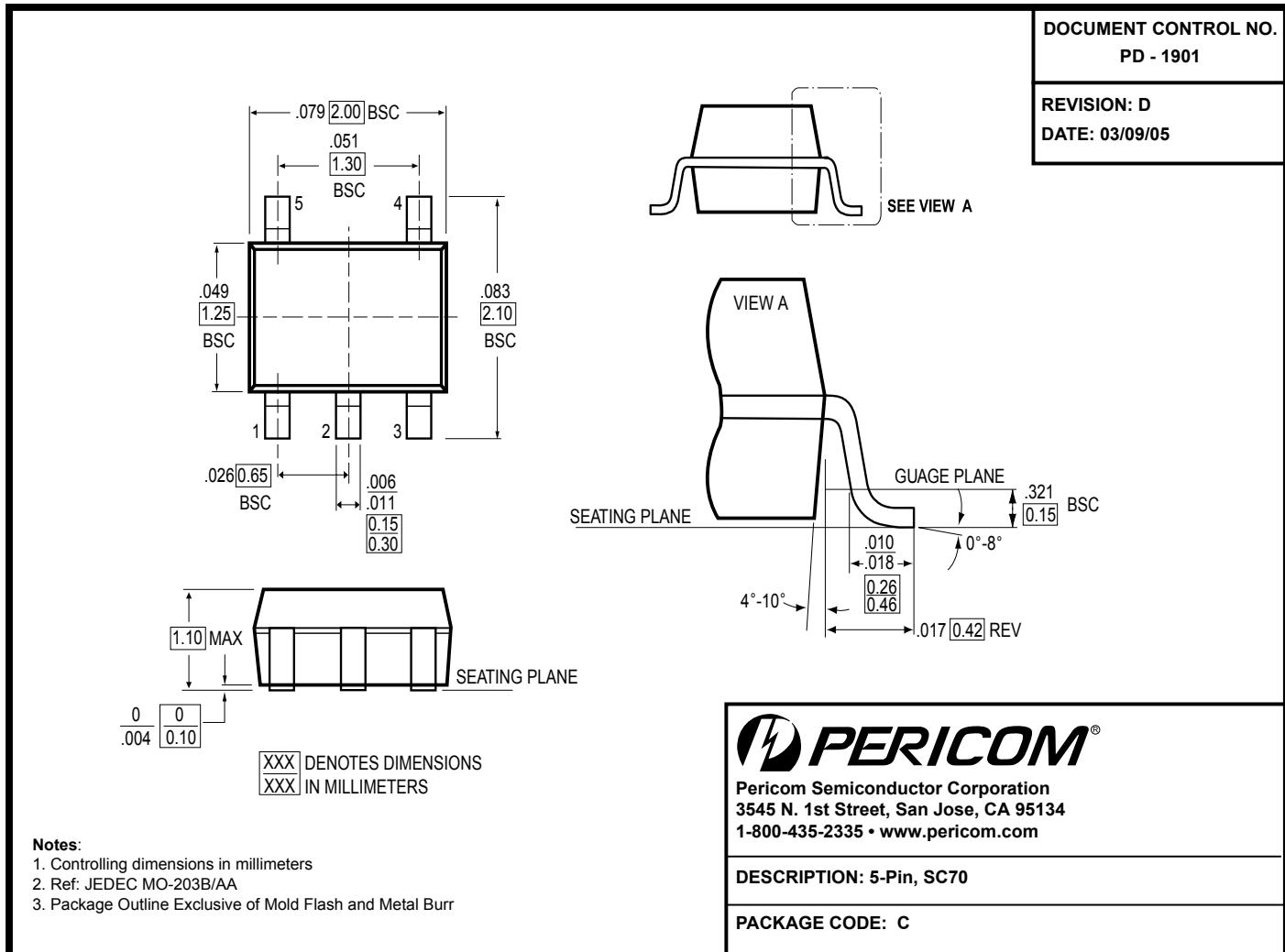
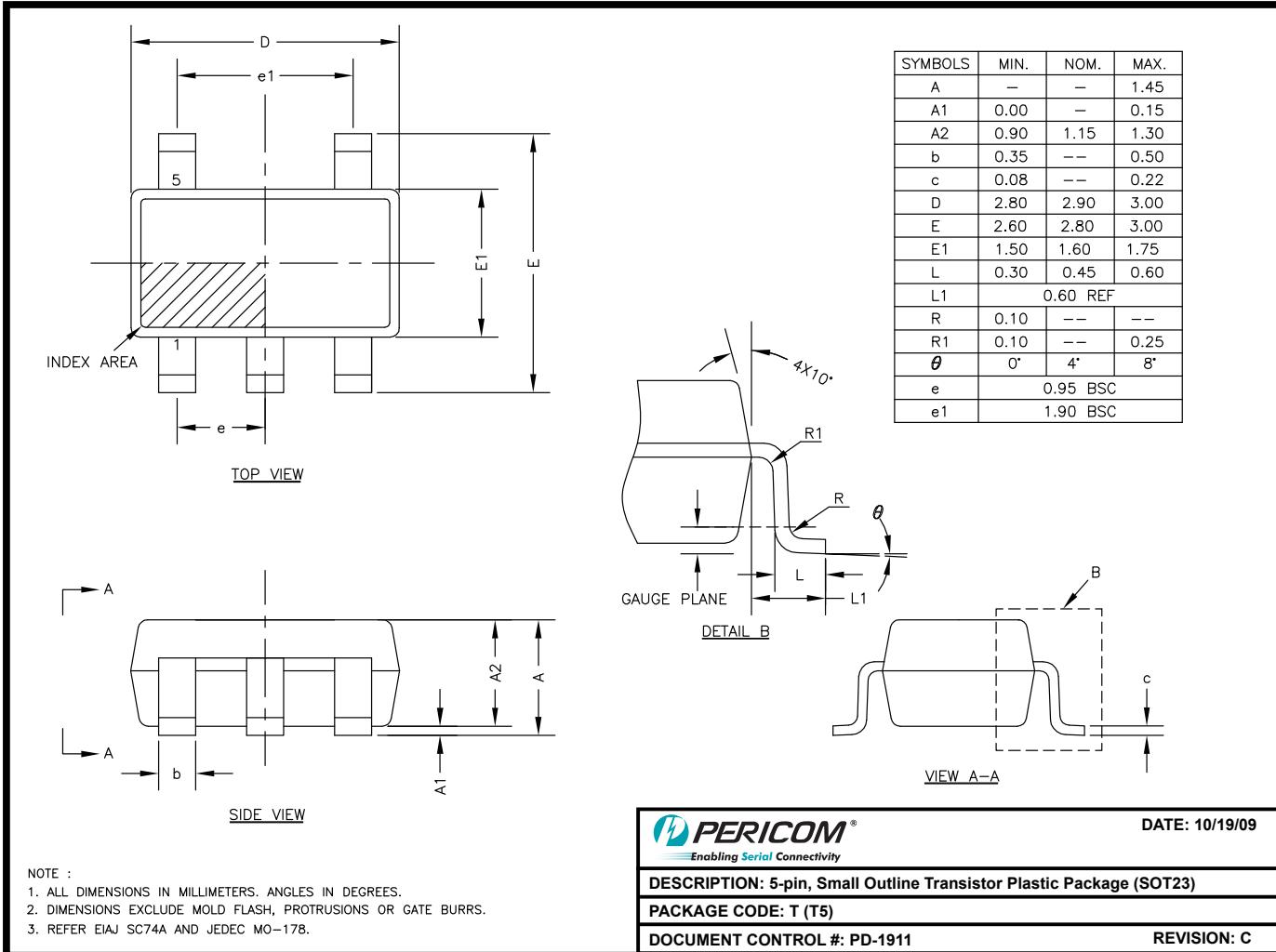


Figure 2. Charge Injection

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

**Figure 3. Off Isolation**

**Figure 4. Crosstalk (124 only)**

**Figure 5. Channel-Off Capacitance**

**Figure 6. Channel-On Capacitance**

**Figure 7. Bandwidth**

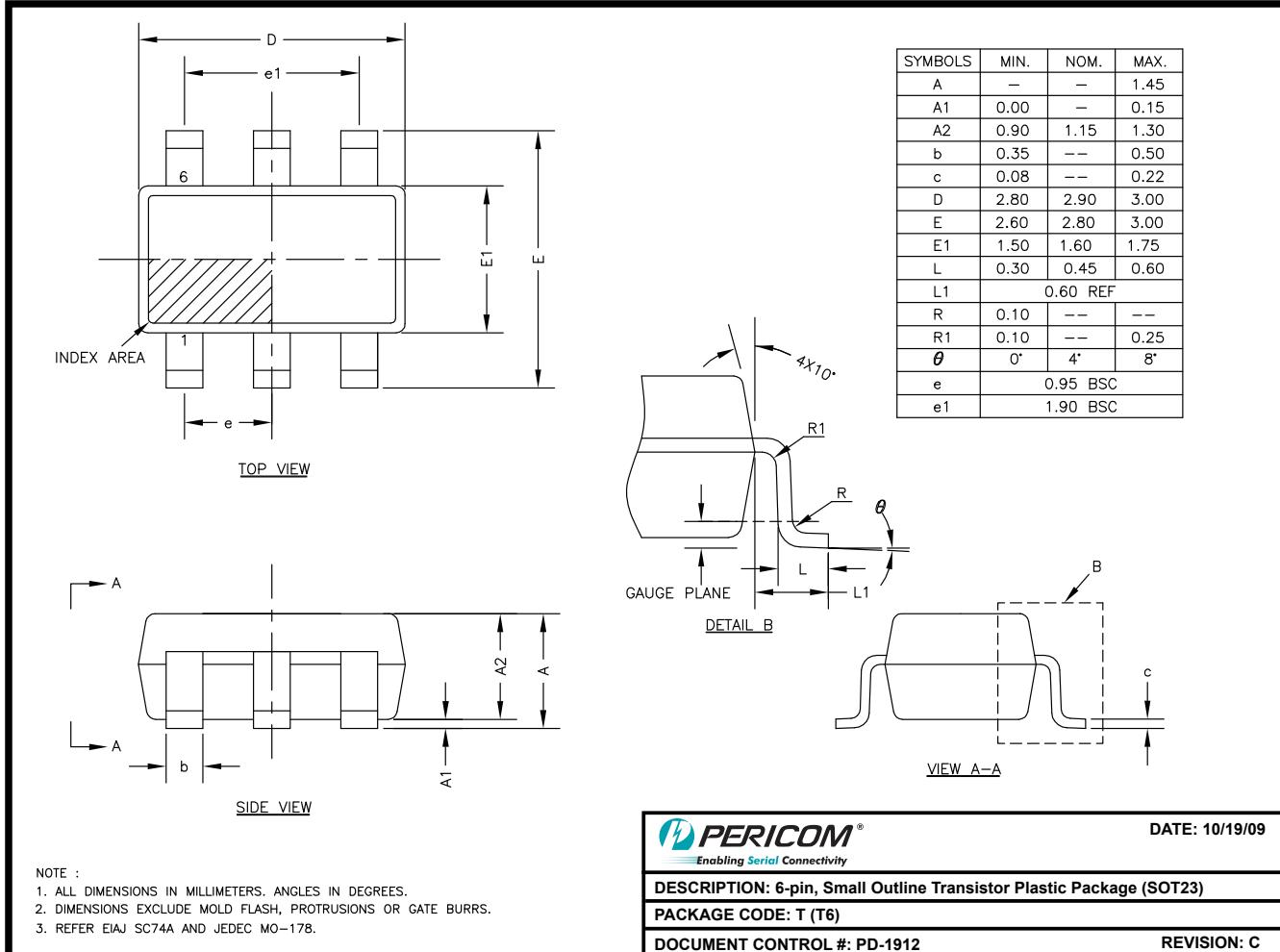
**Packaging Mechanical: 5-pin SC70 (C)**


**Packaging Mechanical: 5-pin SOT23 (T)**


09-0130

**Note:**

- For latest package info, please check: <http://www.pericom.com/products/packaging/mechanicals.php>

**Packaging Mechanical: 6-pin SOT23 (T)**


09-0131

**Note:**

- For latest package info, please check: <http://www.pericom.com/products/packaging/mechanicals.php>

**Ordering Information**

Ordering Code	Packaging Code	Package Type	Top Marking
PI5A121TX	T	5-pin, 65-mil wide SOT-23	ZV
PI5A121TEX	T	Pb-free & Green, 5-pin, 65-mil wide SOT23	ŽV
PI5A121CEX	C	Pb-free & Green, 5-pin, 50-mil wide SOT23	ŽV
PI5A122TEX	T	Pb-free & Green, 5-pin, 65-mil wide SOT23	ŽU
PI5A122CEX	C	Pb-free & Green, 5-pin, 50-mil wide SOT23	ŽU
PI5A124TX	T	6-pin, 65-mil wide SOT23	ZT
PI5A124TEX	T	Pb-free & Green, 6-pin, 65-mil wide SOT23	ŽT

## Notes:

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
- E = Pb-free and Green
- Adding an X suffix = Tape/Reel