

## Features

- Single-Supply Operation (+2V to +6V)
- Rail-to-Rail Analog Signal Dynamic Range
- Low On-Resistance ( $6\Omega$  typ. with 5V supply)  
Minimizes Distortion and Error Voltages
- On-Resistance Flatness,  $3\Omega$  typ.
- Low Charge Injection Reduces Glitch Errors.  $Q = 4\text{pC}$  typ.
- High Speed.  $t_{\text{ON}} = 10\text{ns}$  typ.
- Wide -3dB Bandwidth: 326 MHz (typ.)
- High-Current Channel Capability:  $>100\text{mA}$
- TTL/CMOS Logic Compatible
- Low Power Consumption ( $0.5\mu\text{W}$  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

## 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  $V+$ .

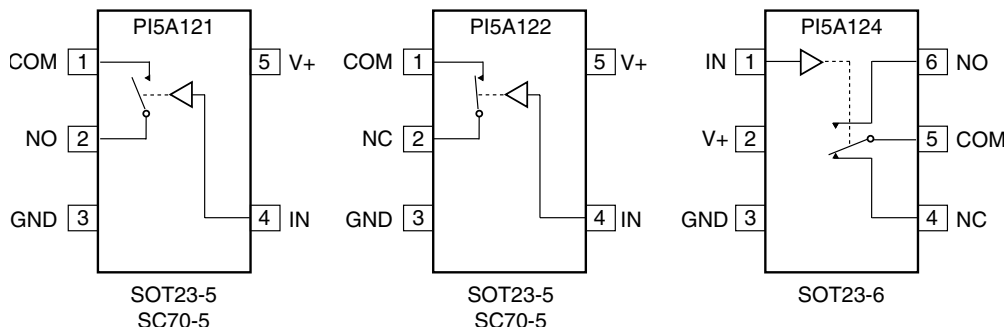
These switches are fully specified with +5V, and +3.3V supplies. With +5V, they guarantee  $<10\Omega$  On-Resistance. On-Resistance matching between channels is within  $2\Omega$ . On-Resistance flatness is less than  $55\Omega$  over the specified range. These switches also guarantee fast switching speeds ( $t_{\text{ON}} < 20\text{ns}$ ).

These products are available in 5-pin SC70 and/or 6-pin SOT23 plastic packages for operation over the industrial ( $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ ) temperature range.

## Applications

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

## 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+ ..... -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+ 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+ = +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+                  | V     |
| On-Resistance                                       | R <sub>ON</sub>                              | V+ = 4.5V,<br>I <sub>COM</sub> = -30mA,<br>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+ = 5V,<br>I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1V, 2.5V, 4V | 25        |                     | 2.72                | 3.5                 |       |
|                                                     |                                              |                                                                                            | Full      |                     |                     | 4                   |       |
| NO or NC Off Leakage Current <sup>(6)</sup>         | I <sub>NO(OFF)</sub> or I <sub>NC(OFF)</sub> | V+ = 5.5V,<br>V <sub>COM</sub> = 0V,<br>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+ = 5.5V, V <sub>COM</sub> = +4.5V,<br>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+ = 5.5V,<br>V <sub>COM</sub> = +4.5V<br>V <sub>NO</sub> or V <sub>NC</sub> = +4.5V       | 25        |                     | 0.20                |                     |       |
|                                                     |                                              |                                                                                            | Full      | -80                 |                     | 80                  |       |

**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 |
|---------------------------------|-----------------------|------------------------------------------------------------------------------|----------|---------------------|---------------------|---------------------|-------|
| Logic Input                     |                       |                                                                              |          |                     |                     |                     |       |
| 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                   |       |
| Dynamic                         |                       |                                                                              |          |                     |                     |                     |       |
| Turn-On Time                    | t <sub>ON</sub>       | V <sub>CC</sub> = 5V, Figure 1                                               | 25       |                     | 7                   | 15                  | ns    |
|                                 |                       |                                                                              | Full     |                     |                     | 20                  |       |
| Turn-Off Time                   | t <sub>OFF</sub>      |                                                                              | 25       |                     | 1                   | 7                   |       |
|                                 |                       |                                                                              | Full     |                     |                     | 10                  |       |
| 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    |
| Off Isolation                   | O <sub>IRR</sub>      | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 10MHz, Figure 3              |          |                     | -43                 |                     | dB    |
| Crosstalk <sup>(8)</sup>        | X <sub>TALK</sub>     | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 10MHz, Figure 4              |          |                     | -43                 |                     |       |
| NC or NO Capacitance            | C <sub>(OFF)</sub>    | f = 1kHz, Figure 5                                                           |          |                     | 5.5                 |                     | pF    |
| COM Off Capacitance             | C <sub>COM(OFF)</sub> |                                                                              |          |                     | 5.5                 |                     |       |
| COM On Capacitance              | C <sub>COM(ON)</sub>  |                                                                              |          | f = 1kHz, Figure 6  |                     | 13                  |       |
| -3dB Bandwidth                  | BW                    | R <sub>L</sub> = 50Ω, Figure 7                                               | Full     |                     | 326                 |                     | MHz   |
| Supply                          |                       |                                                                              |          |                     |                     |                     |       |
| Power-Supply Range              | V+                    |                                                                              | Full     | 2                   |                     | 6                   | V     |
| Positve Supply Current          | I+                    | V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 0V or V+                           |          |                     |                     | 1                   | μA    |

**Notes:**

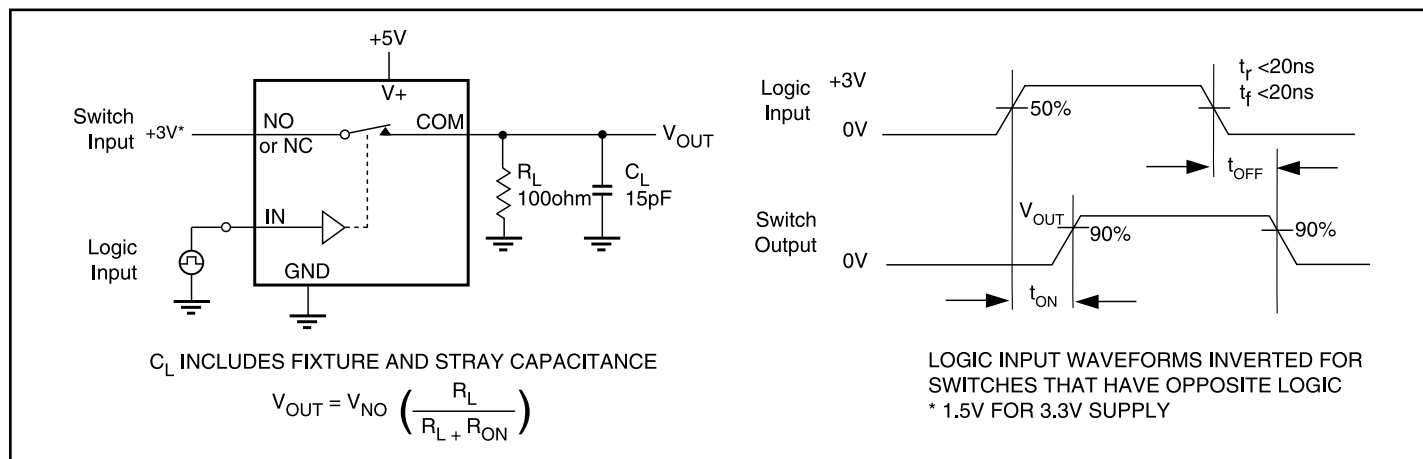
- The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
- Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
- Guaranteed by design
- ΔR<sub>ON</sub> = R<sub>ON</sub> max - R<sub>ON</sub> min
- 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 3.
- Between any two switches. See Figure 4.

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

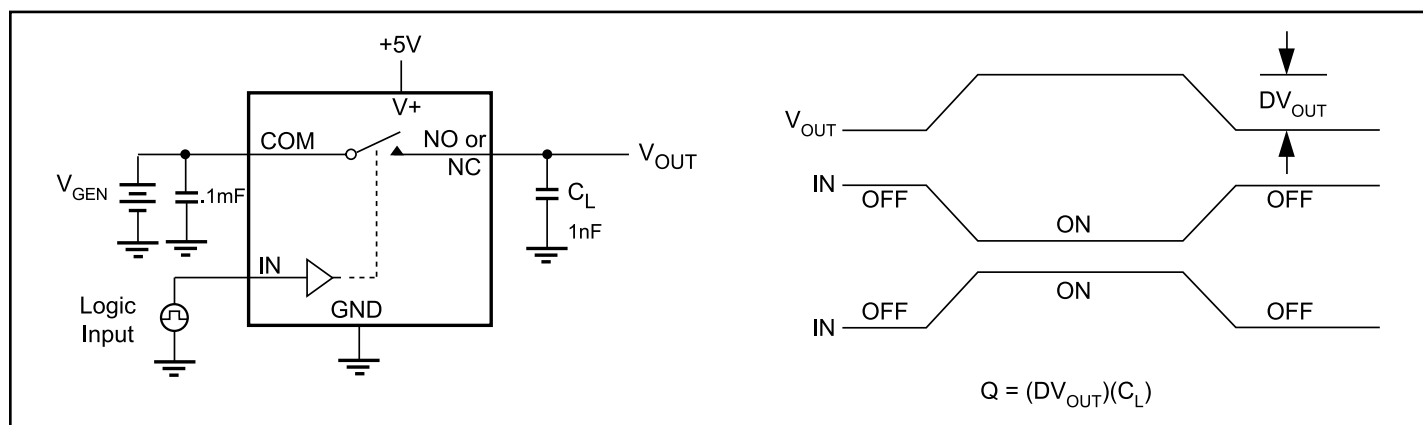
(V+ = +3.3V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

| Parameter                                           | Symbol                | Conditions                                                                           | Temp.(°C) | Min.(1) | Typ.(2) | Max.(1) | Units |
|-----------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------|-----------|---------|---------|---------|-------|
| Analog Switch                                       |                       |                                                                                      |           |         |         |         |       |
| 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       |       |
|                                                     |                       |                                                                                      | Full      |         |         | 2       |       |
| On-Resistance Flatness <sup>(3,5)</sup>             | R <sub>FLAT(ON)</sub> |                                                                                      | 25        |         | 0.5     | 4       |       |
|                                                     |                       |                                                                                      | Full      |         |         | 5       |       |
| Dynamic                                             |                       |                                                                                      |           |         |         |         |       |
| 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    |
| Supply                                              |                       |                                                                                      |           |         |         |         |       |
| Positive Supply Current                             | I+                    | V+ = 3.6V, V <sub>IN</sub> = 0V or V+ All Channels on or off                         | Full      |         |         | 1       | μA    |
| Logic Input                                         |                       |                                                                                      |           |         |         |         |       |
| 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       |       |

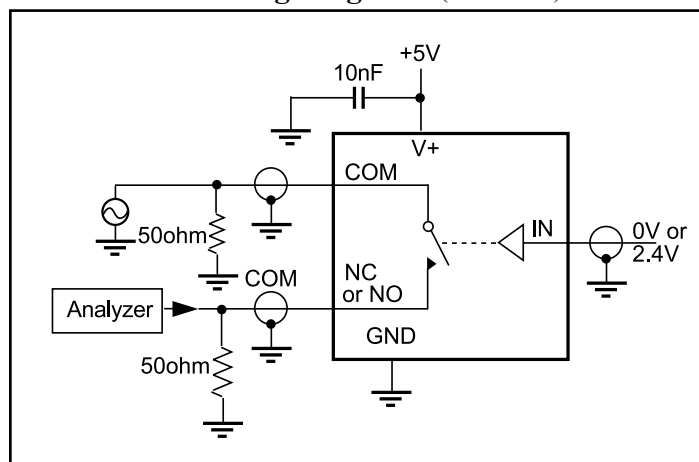
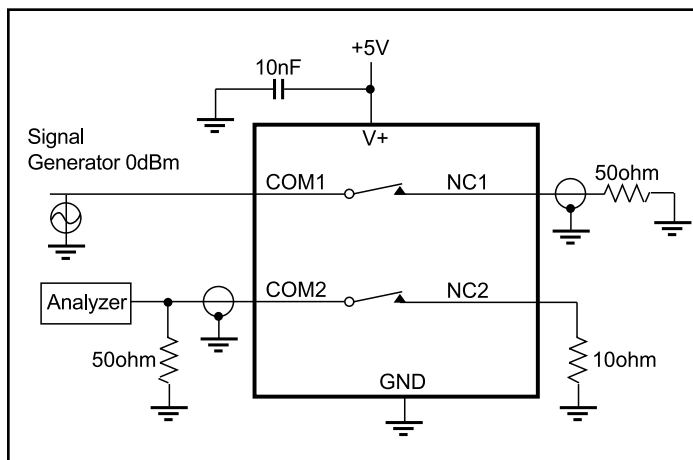
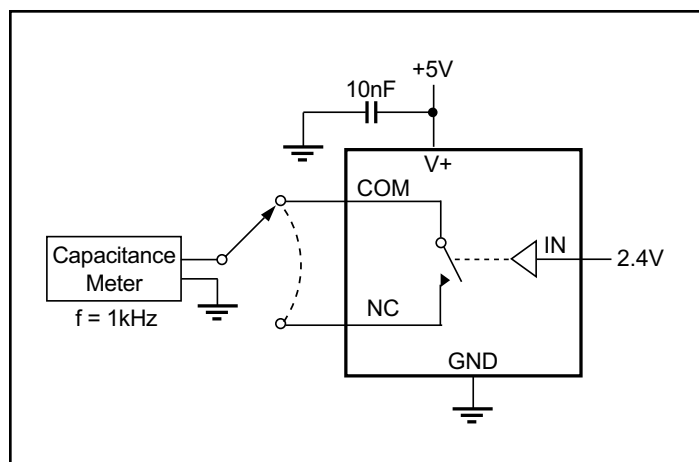
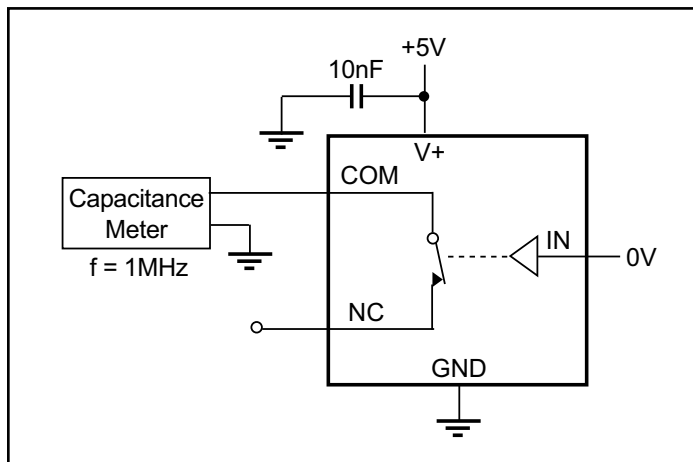
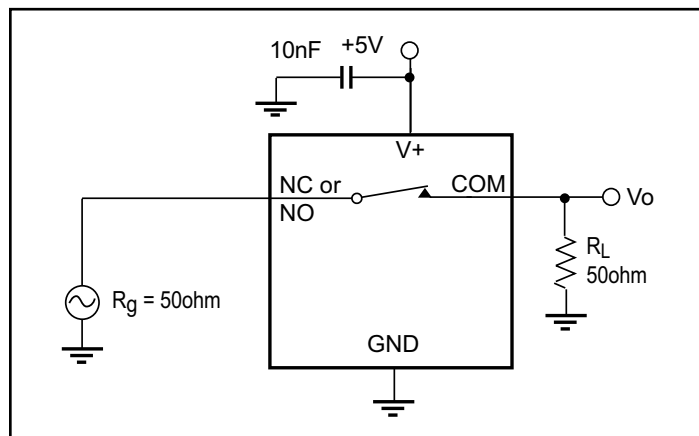
### Test Circuits/Timing Diagrams

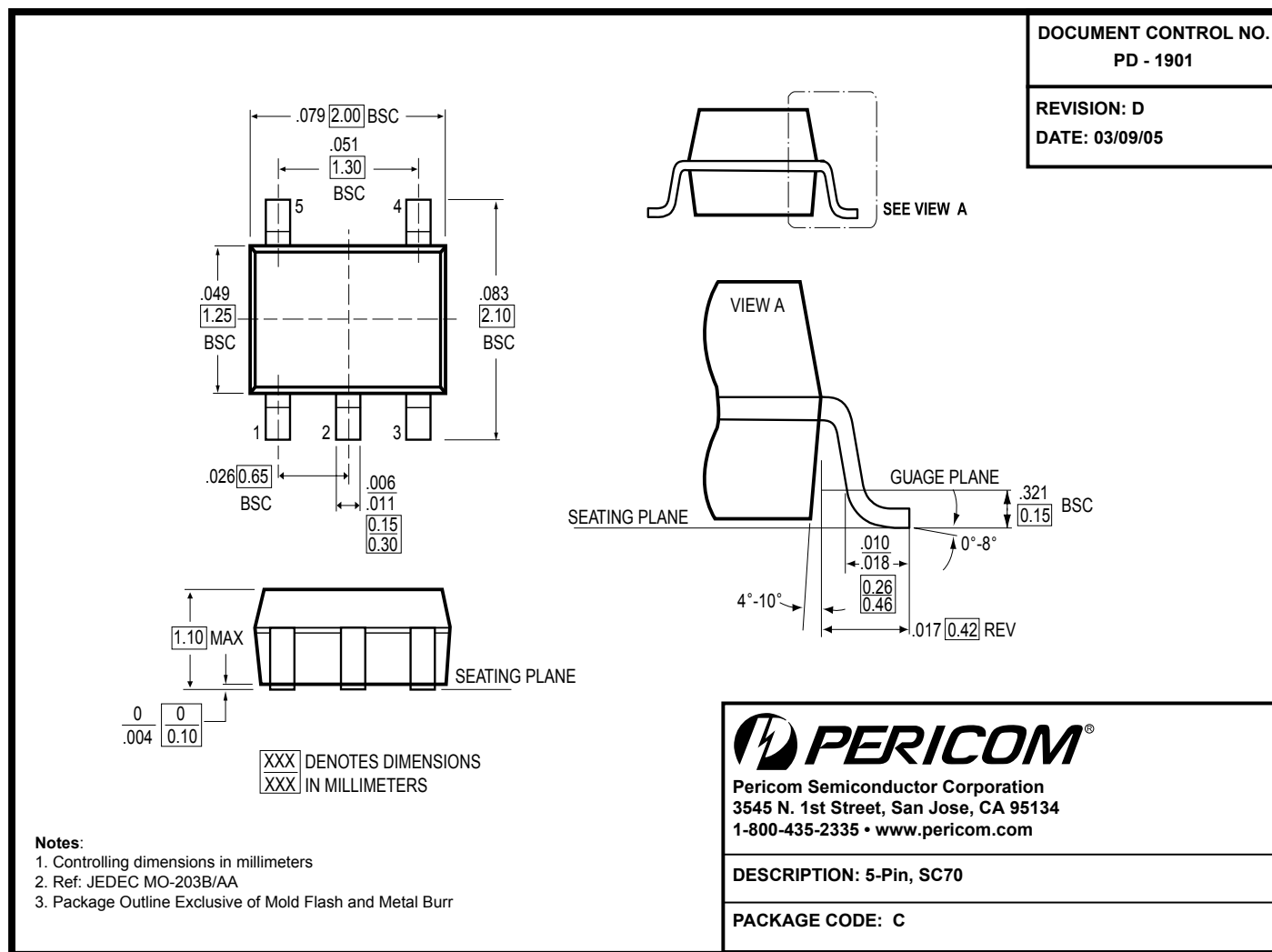


**Figure 1. Switching Time**

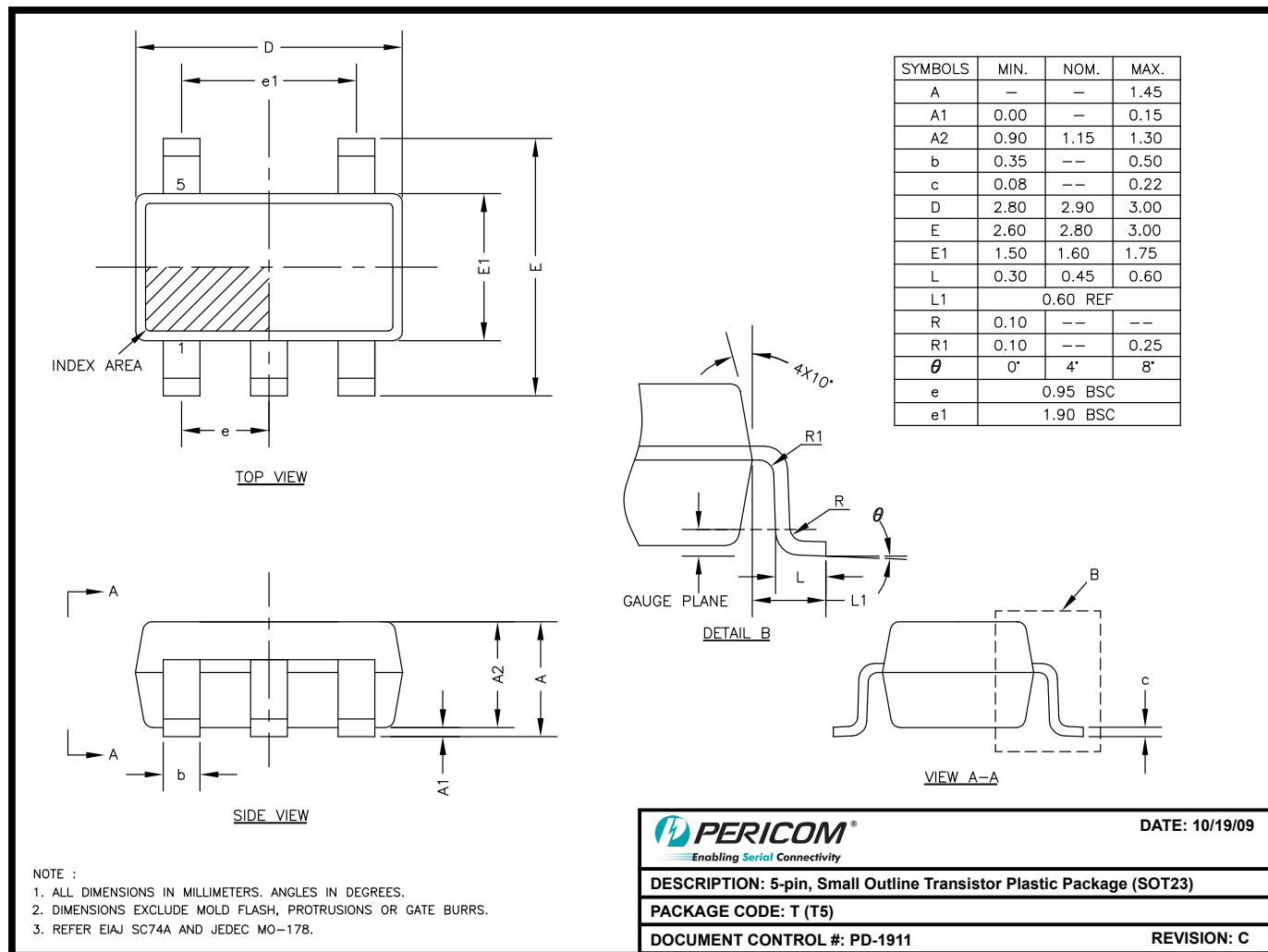


**Figure 2. Charge Injection**

**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)**

**Note:**

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

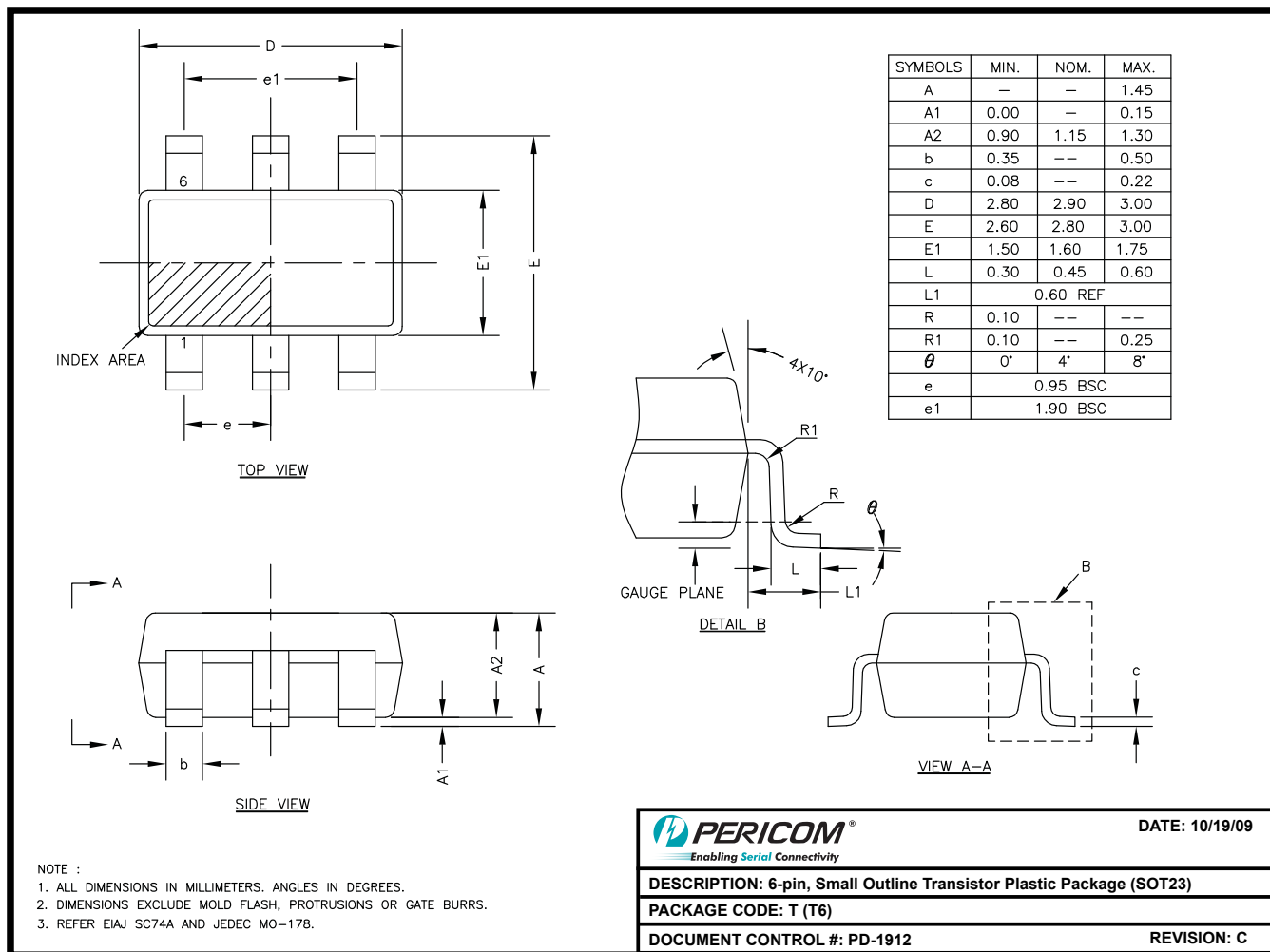
**Packaging Mechanical: 5-pin SOT23 (T)**


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 | $\bar{Z}$ V |
| PI5A121CEX    | C              | Pb-free & Green, 5-pin, 50-mil wide SOT23 | $\bar{Z}$ V |
| PI5A122TEX    | T              | Pb-free & Green, 5-pin, 65-mil wide SOT23 | $\bar{Z}$ U |
| PI5A122CEX    | C              | Pb-free & Green, 5-pin, 50-mil wide SOT23 | $\bar{Z}$ U |
| PI5A124TX     | T              | 6-pin, 65-mil wide SOT23                  | ZT          |
| PI5A124TEX    | T              | Pb-free & Green, 6-pin, 65-mil wide SOT23 | $\bar{Z}$ T |

**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