

## SPST Wide Bandwidth Analog Switch Description

The PI3A125B is a single-pole single throw (SPST) normally close (NC) CMOS switch. The switch is open when IN is HIGH. The high-precision device is ideal for low-distortion audio, video, signal switching and routing. Specified over a wide operating power supply voltage, 1.65V to 6.0V, the PI3A125B has on-resistance of 12-ohms at 1.65V, 9-ohms at 2.3V & 6-ohms at 4.5V.

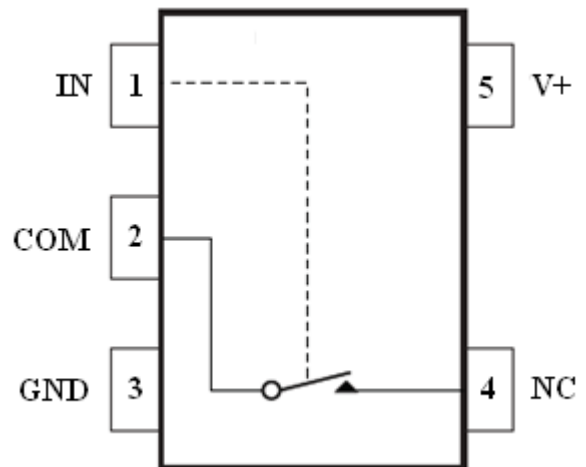
The control input, IN, is independent of supply voltage.

### Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 8Ω at 3.0V
- Wide V<sub>CC</sub> Range: 1.65V to 6.0V
- Rail-to-Rail Signal Range
- Control Input Overvoltage Tolerance: 6.0V
- Fast Transition Speed: 2ns at 5.0V
- High Off Isolation: -63dB @ 10MHz
- Break-Before-Make Switching
- I/O Pins have Power-off Protection Functions
- Extended Industrial Temperature Range: -40 °C to 85 °C
- Packaging (Pb-free & Green):
  - 5-pin SC70 (C)
  - 5-pin SOT23 (TA)

### Pin Assignment

**PI3A125B SOT23-5/SC70-5  
Package (Top View)**



### Applications

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

### Pin Description

| Pin No. | Pin Name | Description             |
|---------|----------|-------------------------|
| 1       | IN       | Logic Control           |
| 2       | COM      | Common Output/Data Port |
| 3       | GND      | Ground                  |
| 4       | NC       | Data Port               |
| 5       | V+       | Positive Power Supply   |

### Logic Function Table

| Logic Inputs (IN) | Function |
|-------------------|----------|
| 0                 | ON       |
| 1                 | OFF      |

## Maximum Ratings

|  |                       |
|--|-----------------------|
| Storage Temperature.....   | -65°C to +150°C       |
| Ambient Temperature with Power Applied.....                          | -40°C to +85°C        |
| Supply Voltage $V_+$ .....   | -0.3V to +7.0V        |
| DC Control Voltage $V_{IN}$ .....                                    | -0.5V to 7.0V         |
| DC Input Voltage ( $V_{NC}$ , $V_{COM}$ ).....                       | -0.3V to $V_+ + 0.5V$ |
| DC Output Current $I_{OUT}$ .....                                    | 128mA                 |
| DC $V_+$ or Ground Current $I_+ / I_{GND}$ .....                     | $\pm 100mA$           |
| Junction Temperature under Bias ( $T_J$ ) .....                      | 150 °C                |
| Junction Lead Temperature ( $T_L$ )<br>(Soldering, 10 seconds) ..... | 260 °C                |
| Power Dissipation ( $P_d$ ) @ +85 °C .....                           | 180mW                 |
| ESD (HBM).....   | 2000V                 |

**Note:**

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## Recommended Operating Conditions

| Symbol        | Parameter                        | Conditions             | Min. | Typ. | Max.  | Unit |
|---------------|----------------------------------|------------------------|------|------|-------|------|
| $V_+$         | Operating Voltage                | -                      | 1.65 | -    | 6.0   | V    |
| $V_{IN}$      | Control Input Voltage            | -                      | 0    | -    | 6.0   | V    |
| $V_{INPUT}$   | Switch Input Voltage             | -                      | 0    | -    | $V_+$ | V    |
| $V_{OUT}$     | Output Voltage                   | -                      | 0    | -    | $V_+$ | V    |
| $T_A$         | Operating Temperature            | -                      | -40  | 25   | 85    | °C   |
| $t_r$ , $t_f$ | Control Input Rise and Fall Time | $V_+ = 2.3V$ to $3.6V$ | 0    | -    | 10    | ns/V |
|               |                                  | $V_+ = 4.5V$ to $6.0V$ | 0    | -    | 5     | ns/V |

**Note:** Control input must be held HIGH or LOW; it must not float.

**DC Electrical Characteristics**

 (T<sub>A</sub> = -40 °C to 85 °C, unless otherwise noted.)

| Parameter           | Description                                  | Test Conditions  | Temperature     | Min. | Typ. | Max. | Units |
|---------------------|--|--|-----------------|------|------|------|-------|
| V <sub>IAR</sub>    | Analog Input Signal Range                    | V+   | -40 °C to 85 °C | 0    | -    | 6    | V     |
| R <sub>ON</sub>     | ON Resistance <sup>(1)</sup>                 | V+=4.5V, I <sub>O</sub> = 30mA, V <sub>INPUT</sub> = 0V                              | 25 °C           | -    | 4    | 6    | Ω     |
|                     |  | V+=4.5V, I <sub>O</sub> =-30mA, V <sub>INPUT</sub> =2.4V                             |                 | -    | 5    | 8    |       |
|                     |  | V+=4.5V, I <sub>O</sub> =-30mA, V <sub>INPUT</sub> =4.5V                             |                 | -    | 7    | 11   |       |
|                     |  | V+=4.5V, I <sub>O</sub> =30mA, V <sub>INPUT</sub> = 0V                               | -40 °C to 85 °C | -    | -    | 6    |       |
|                     |  | V+=4.5V, I <sub>O</sub> =-30mA, V <sub>INPUT</sub> =2.4V                             |                 | -    | -    | 8    |       |
|                     |  | V+=4.5V, I <sub>O</sub> =-30mA, V <sub>INPUT</sub> =4.5V                             |                 | -    | -    | 11   |       |
|                     |  | V+=3.0V, I <sub>O</sub> =24mA, V <sub>INPUT</sub> =0V                                | 25 °C           | -    | 5    | 8    |       |
|                     |  | V+=3.0V, I <sub>O</sub> =-24mA, V <sub>INPUT</sub> =3.0V                             |                 | -    | 10   | 15   |       |
|                     |  | V+=3.0V, I <sub>O</sub> =24mA, V <sub>INPUT</sub> =0V                                | -40 °C to 85 °C | -    | -    | 8    |       |
|                     |  | V+=3.0V, I <sub>O</sub> =-24mA, V <sub>INPUT</sub> =3.0V                             |                 | -    | -    | 15   |       |
|                     |  | V+=2.3V, I <sub>O</sub> =8mA, V <sub>INPUT</sub> =0V                                 | 25 °C           | -    | 6    | 9    |       |
|                     |  | V+=2.3V, I <sub>O</sub> =-8mA, V <sub>INPUT</sub> =2.3V                              |                 | -    | 13   | 20   |       |
|                     |  | V+=2.3V, I <sub>O</sub> =8mA, V <sub>INPUT</sub> =0V                                 | -40 °C to 85 °C | -    | -    | 9    |       |
|                     |  | V+=2.3V, I <sub>O</sub> =-8mA, V <sub>INPUT</sub> =2.3V                              |                 | -    | -    | 20   |       |
|                     |  | V+=1.65V, I <sub>O</sub> =4mA, V <sub>INPUT</sub> =0V                                | 25 °C           | -    | 8    | 12   |       |
|                     |  | V+=1.65V, I <sub>O</sub> =-4mA, V <sub>INPUT</sub> =1.65V                            |                 | -    | 20   | 30   |       |
|                     |  | V+=1.65V, I <sub>O</sub> =4mA, V <sub>INPUT</sub> = 0V                               | -40 °C to 85 °C | -    | -    | 12   |       |
|                     |  | V+=1.65V, I <sub>O</sub> =-4mA, V <sub>INPUT</sub> =1.65V                            |                 | -    | -    | 30   |       |
| R <sub>ONF</sub>    | ON Resistance <sup>(1,2,4)</sup><br>Flatness | V+=5.0V, I <sub>A</sub> =-30mA, 0 ≤ V <sub>INPUT</sub> ≤ V+                          | 25 °C           | -    | 6    | -    | Ω     |
|                     |  | V+=3.3V, I <sub>A</sub> =-24mA, 0 ≤ V <sub>INPUT</sub> ≤ V+                          |                 | -    | 12   | -    |       |
|                     |  | V+=2.5V, I <sub>A</sub> =-8mA, 0 ≤ V <sub>INPUT</sub> ≤ V+                           |                 | -    | 22   | -    |       |
|                     |  | V+=1.8V, I <sub>A</sub> =-4mA, 0 ≤ V <sub>INPUT</sub> ≤ V+                           |                 | -    | 90   | -    |       |
| V <sub>IH</sub>     | Input High Voltage<br>(Logic High Level)     | V+=1.65V   | -40 °C to 85 °C | 1    | -    | -    | V     |
|                     |  | V+ = 2.3V  |                 | 1.2  | -    | -    |       |
|                     |  | V+ = 3V  |                 | 1.3  | -    | -    |       |
|                     |  | V+ = 4.2V  |                 | 1.5  | -    | -    |       |
|                     |  | V+ = 6.0V  |                 | 1.8  | -    | -    |       |
| V <sub>IL</sub>     | Input Low Voltage<br>(Logic Low Level)       | V+=1.65V   | -40 °C to 85 °C | -    | -    | 0.4  | V     |
|                     |  | V+ = 2.3V  |                 | -    | -    | 0.6  |       |
|                     |  | V+ = 3V  |                 | -    | -    | 0.8  |       |
|                     |  | V+ = 4.2V  |                 | -    | -    | 1    |       |
|                     |  | V+ = 6.0V  |                 | -    | -    | 1.2  |       |
| I <sub>LKC</sub>    | Input Leakage Current                        | 0 ≤ V <sub>IN</sub> ≤ 6.0V, V+ = 0V to 6.0V  | 25 °C           | -    | -    | ±0.1 | μA    |
| -40 °C to 85 °C     | -  | -  | ±1.0            |      |      |      |       |
| I <sub>PWROFF</sub> | Input Leakage Current for Power off          | 0 ≤ V <sub>INPUT</sub> ≤ 5.5V, V+ = 0V   | -40 °C to 85 °C | -5   | -    | 5    | μA    |
| I <sub>OFF</sub>    | OFF State Leakage Current                    | 0 ≤ V <sub>IN</sub> ≤ 6.0V, V+ = 1.65V to 6.0V                                       | 25 °C           | -    | -    | ±0.1 | μA    |
|                     |  |  | -40 °C to 85 °C | -    | -    | ±10  |       |
| I+                  | Quiescent Supply Current                     | All channels ON or OFF, V <sub>IN</sub> = V+ or GND, I <sub>OUT</sub> = 0, V+ = 6.0V | 25 °C           | -    | -    | 1    | μA    |
|                     |  |  | -40 °C to 85 °C | -    | -    | 5    |       |

**Notes:**

1. Measured by voltage drop between COM and NC pins at the indicated current through the device. ON resistance is determined by the lower of the voltages on two ports (COM or NC).
2. Parameter is characterized but not tested in production.
3. Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions. Guaranteed by design.

(1)

**Capacitance**

 (T<sub>A</sub> = 25 °C, unless otherwise noted.)

| Symbol              | Parameter           | Test Conditions                                 | Min. | Typ. | Max. | Units |
|---------------------|---------------------|---|------|------|------|-------|
| C <sub>IN</sub>     | Control Input       | V <sub>+</sub> = 5.0V, f = 1 MHz <sup>(1)</sup> | -    | 2.5  | -    | pF    |
| C <sub>OFF</sub>    | NC Port, Switch OFF |   | -    | 5.0  | -    |       |
| C <sub>COM ON</sub> | COM Port, Switch ON |   | -    | 15.0 | -    |       |

**Notes:**

1. Capacitance is characterized but not tested in production

**Switch and AC Characteristics** <sup>(1)</sup>

| Parameter        | Description      | Test Conditions  | Supply Voltage   | Temperature | Min. | Typ. | Max. | Units |
|------------------|------------------|--|--|-------------|------|------|------|-------|
| t <sub>ON</sub>  | Turn-On Time     | R <sub>L</sub> =100Ω, C <sub>L</sub> =35pF,<br>See Test Circuit Figure 1.                            | V <sub>+</sub> =3.3V, V <sub>NC</sub> =3.0V,<br>V <sub>IH</sub> =3.0V, | -40~+85 °C  | -    | 3.6  | 6    | ns    |
|                  |                  |  | V <sub>+</sub> =5.0V, V <sub>NC</sub> =3V,<br>V <sub>IL</sub> =3V,     |             | -    | 3    | 5    |       |
| t <sub>OFF</sub> | Turn-Off Time    | R <sub>L</sub> =100Ω, C <sub>L</sub> =35pF,<br>See Test Circuit Figure 1.                            | V <sub>+</sub> =3.3V, V <sub>NC</sub> =3.0V,<br>V <sub>IH</sub> =3.0V, | -40~+85 °C  | -    | 3    | 5    | ns    |
|                  |                  |  | V <sub>+</sub> =5.0V, V <sub>NC</sub> =3V,<br>V <sub>IL</sub> =3V,     |             | -    | 2.5  | 4    |       |
| Q                | Charge Injection | C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> =50Ω.<br>See Test Circuit Figure 2. | V <sub>+</sub> = 5.0V  | +25 °C      | -    | 5    | -    | pC    |
|                  |                  |  | V <sub>+</sub> = 3.3V  |             | -    | 4    | -    |       |
| OIRR             | Off Isolation    | R <sub>L</sub> =50Ω, V <sub>GEN</sub> =0V, R <sub>GEN</sub><br>=0Ω, f =10MHz.                        | V <sub>+</sub> =1.65V to 5.5V  | 25 °C       | -    | -63  | -    | dB    |
| f <sub>3dB</sub> | -3dB Bandwidth   | See Test Circuit Figure 5.   | V <sub>+</sub> =1.65V to 5.5V  | +25 °C      | -    | 500  | -    | MHz   |

**Notes:**

1. Guaranteed by design.
2. The device contributes no other propagation delay other than the RC delay of the switch ON resistance and the 35pF load capacitance, when driven by an ideal voltage source with zero output impedance.

Test Circuits and Timing Diagrams

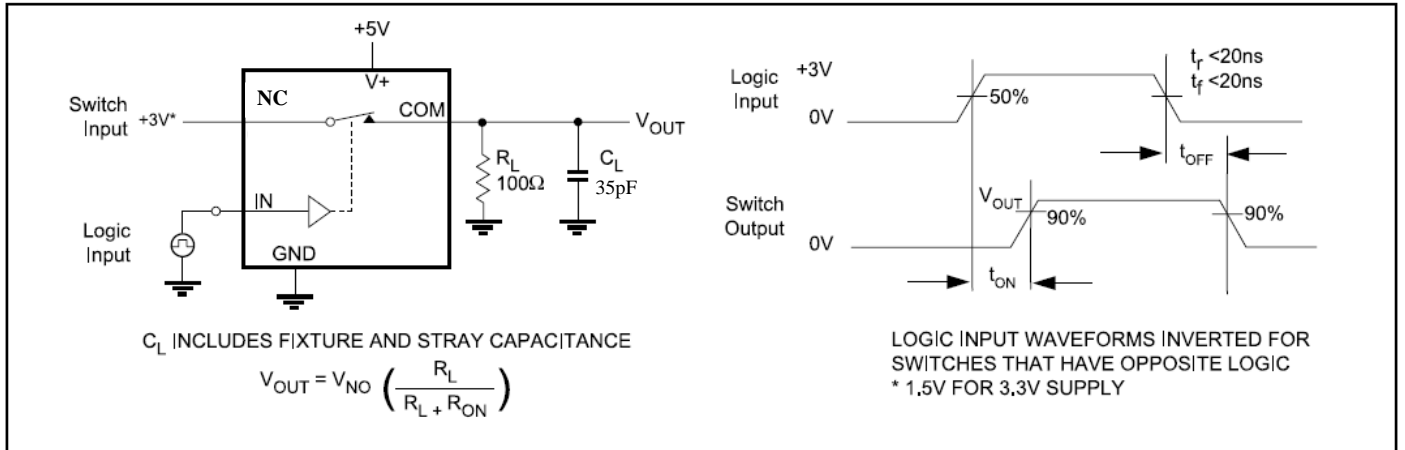


Figure 1. Switching Time

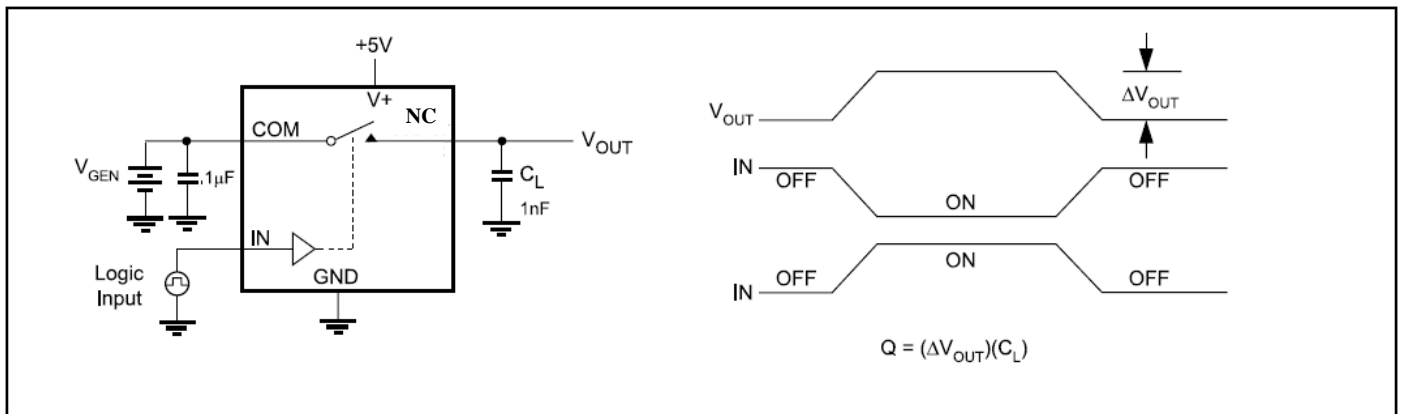


Figure 2. Charge Injection

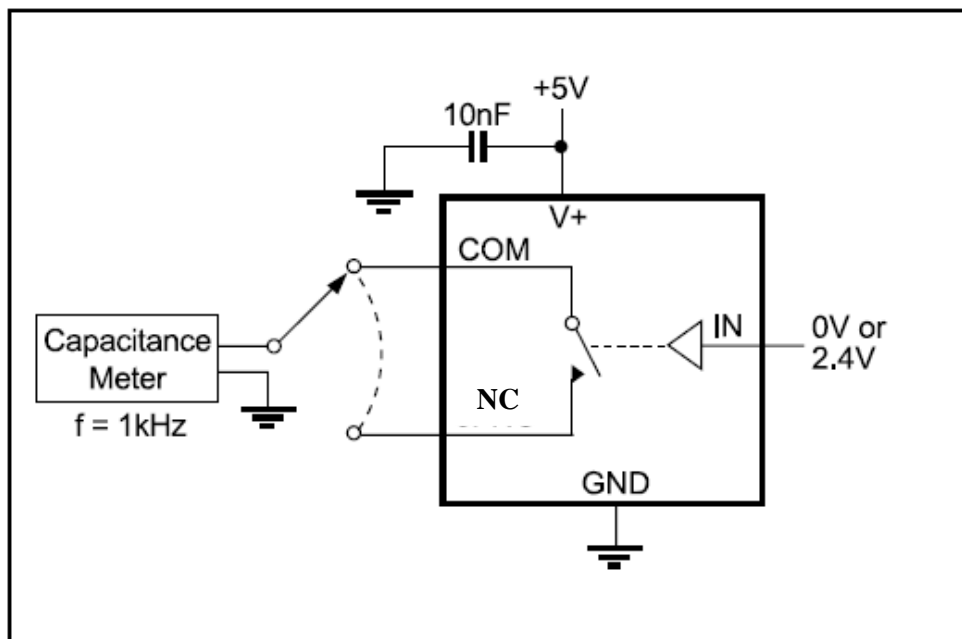


Figure 3. Channel-Off Capacitance

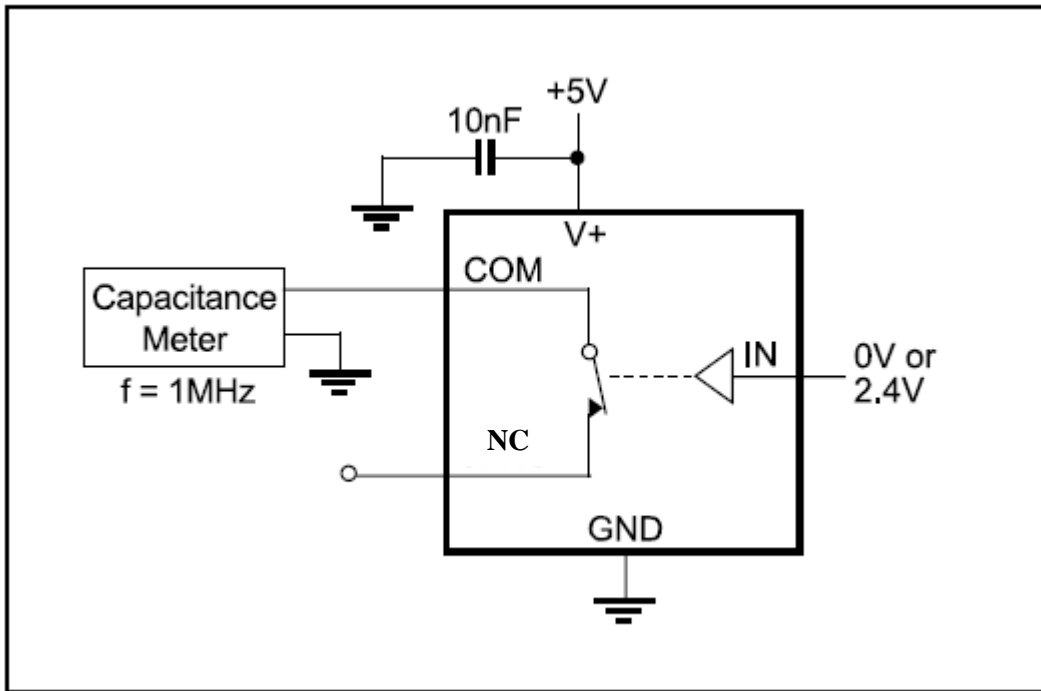


Figure 4. Channel-On Capacitance

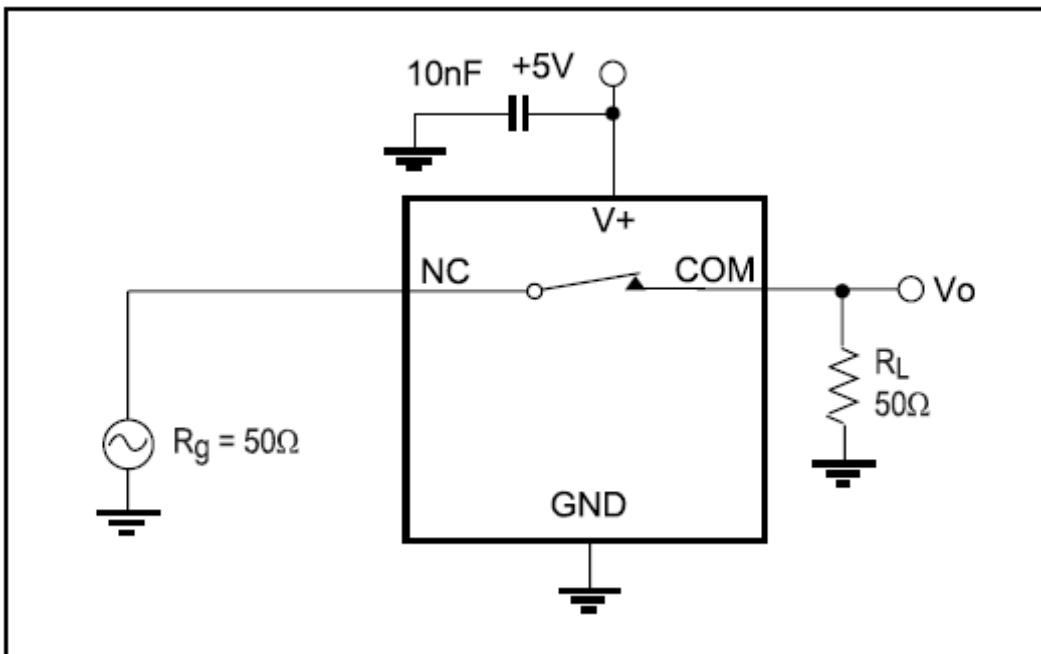
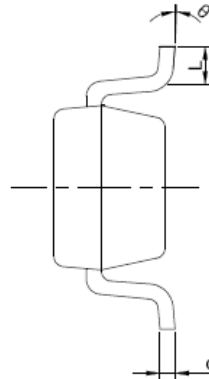
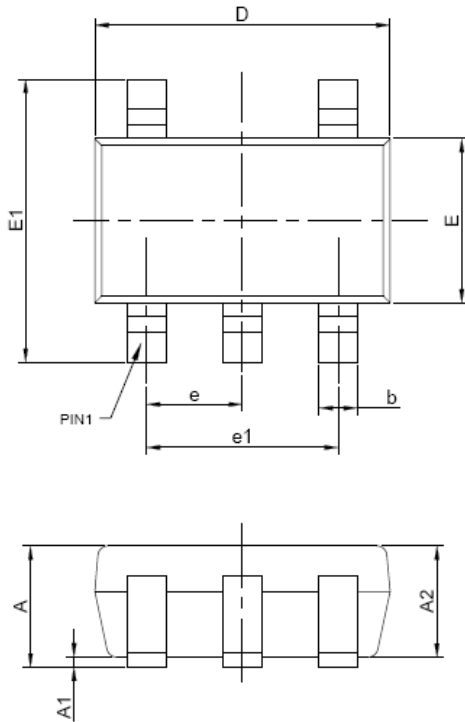


Figure 5. Bandwidth

**Mechanical Information**
**SOT23-5L**


| PKG. DIMENSIONS(MM) |          |      |
|---------------------|----------|------|
| SYMBOL              | Min      | Max  |
| A                   | 1.05     | 1.25 |
| A1                  | 0.00     | 0.10 |
| A2                  | 1.05     | 1.15 |
| b                   | 0.30     | 0.50 |
| c                   | 0.10     | 0.20 |
| D                   | 2.82     | 3.02 |
| E                   | 1.50     | 1.70 |
| E1                  | 2.65     | 2.95 |
| e                   | 0.95 BSC |      |
| e1                  | 1.80     | 2.00 |
| L                   | 0.30     | 0.80 |
| θ                   | 0°       | 8°   |

**Note:**

1. Ref: JEDEC MO-178C/AA



DATE: 06/18/13

DESCRIPTION: 5-Pin, Small Outline Transistor Plastic Package (SOT23)

PACKAGE CODE: TA (TA5)

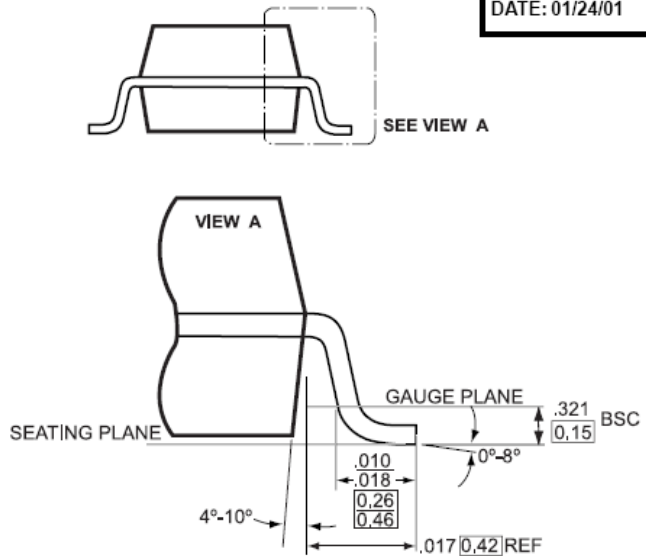
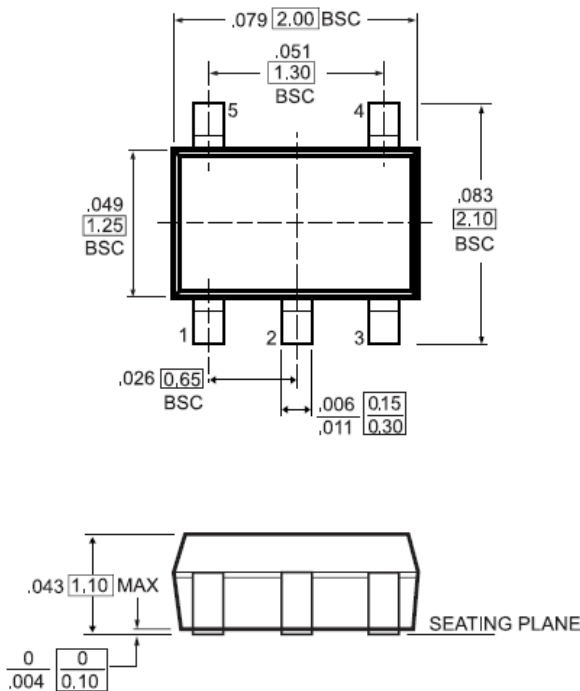
DOCUMENT CONTROL #: PD-2144

REVISION: --

SC70-5L

DOCUMENT CONTROL NO.  
PD - 1901

REVISION: B  
DATE: 01/24/01



XXX DENOTES DIMENSIONS  
IN MILLIMETERS

Notes:  
1) Controlling dimensions in millimeters  
2) Ref: JEDEC MO-203AA



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2380 Bering Drive, San Jose, CA 95131  
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DESCRIPTION: 5-PIN SHRINK SOT (SC70-5)

PACKAGE CODE: C5

### Marking Description



Note:  
pU: Top Mark.  
XX: Date Code

### Ordering Information

| Part Number | Package Code | Package                      | Top Marking |
|-------------|--------------|------------------------------|-------------|
| PI3A125BCE  | C            | Lead Free and Green SC70-5L  | pU          |
| PI3A125BTAE | TA           | Lead Free and Green SOT23-5L | pU          |

Notes:

- E = Pb-free and Green
- Adding X Suffix= Tape/Reel

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