

## Low Voltage SPST 0.8Ω Analog Switch

### Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.8Ω at 3.0V
- Wide V<sub>CC</sub> Range: 1.65V to 5.5V
- Rail-to-Rail Signal Range
- Control Input Overvoltage Tolerance: 5.5V
- Fast Transition Speed: 2ns at 5.0V
- High Bandwidth: 200 MHz
- I/O pins Have Power-off Protection Functions
- Extended Industrial Temperature Range: -40 °C to 85 °C
- Packaging (Pb-free & Green):
  - 5-pin SOT23
  - 5-pin SC70

### Description

The PI5A3167C is a high-bandwidth, fast single-pole single-throw (SPST) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. The device features ultra low RON of 0.8Ω typical at 3.0V VCC and will operate over the wide VCC range of 1.65V to 5.5V.

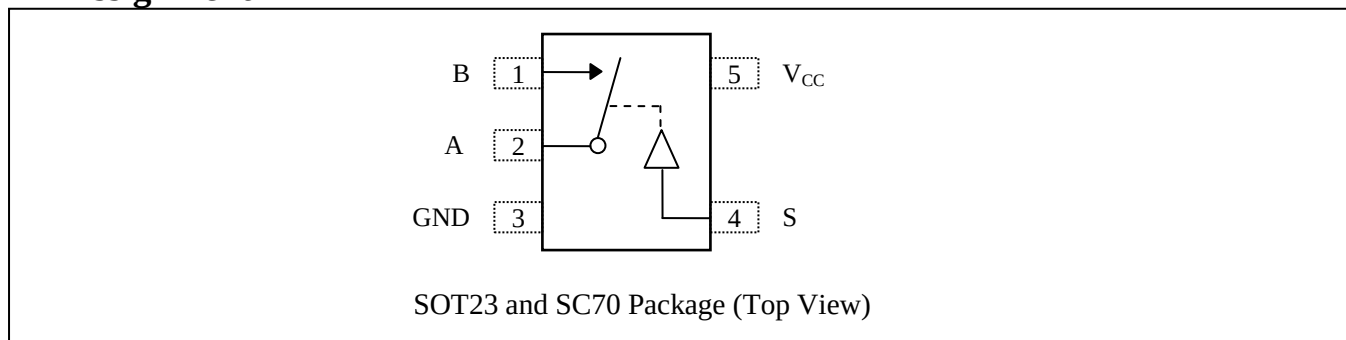
The PI5A3167C features very low quiescent current even when the control voltage is lower than the VCC supply. This feature services the mobile handset applications very well by allowing direct interface with baseband processor general purpose I/Os.

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

### Applications

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

### Pin Assignment



### Pin Description

| Pin No | Pin Name | Description                  |
|--------|----------|------------------------------|
| 1      | B        | Data Port (normally connect) |
| 2      | A        | Common Output/Data Port      |
| 3      | GND      | Ground                       |
| 4      | S        | Logic Control                |
| 5      | VCC      | Positive Power Supply        |

### Logic Function Table

| Logic Input(S) | Function(A to B) |
|----------------|------------------|
| 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 $V_{CC}$ .....                                        | -0.5V to +7.0V            |
| DC Switch Voltage $V_S$ .....                                        | -0.5V to +7.0V            |
| DC Input Voltage $V_{IN}$ .....                                      | -0.5V to +7.0V            |
| DC Output Current $V_{OUT}$ .....                                    | 128mA                     |
| DC $V_{CC}$ or Ground Current $I_{CC}/I_{GND}$ .....                 | ±100mA                    |
| Junction Temperature under Bias ( $T_J$ ) .....                      | 150 °C                    |
| Junction Lead Temperature ( $T_L$ )<br>(Soldering, 10 seconds) ..... | 260 °C                    |
| ESD (HBM) .....                                                      | 4KV                       |
| Power Dissipation ( $P_D$ ) @ +85 °C .....                           | SOT23 250mW<br>SC70 200mW |

### 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 |
|------------|--------------------------|---------------------------------------|------|------|----------|------|
| $V_{CC}$   | Operating Voltage        | -                                     | 1.65 | -    | 5.5      | V    |
| $V_{IN}$   | DC Input Voltage         | -                                     | 0    | -    | $V_{CC}$ | V    |
| $V_S$      | Switch Input Voltage     | -                                     | 0    | -    | 5.5      | V    |
| $V_{OUT}$  | Output Voltage           | -                                     | 0    | -    | $V_{CC}$ | V    |
| $T_A$      | Operating Temperature    | -                                     | -40  | 25   | 85       | °C   |
| $t_r, t_f$ | Input Rise and Fall Time | Control Input $V_{CC} = 2.7V$ to 3.6V | 0    | -    | 10       | ns/V |
|            |                          | Control Input $V_{CC} = 4.5V$ to 5.5V | 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                                                                         | Supply Voltage                 | Min | Typ   | Max             | Units |
|-----------------------|---------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------|-----|-------|-----------------|-------|
| V <sub>IAR</sub>      | Analog Input Signal Range             | -                                                                                       | V <sub>CC</sub>                | 0   | -     | V <sub>CC</sub> | V     |
| R <sub>ON</sub>       | ON Resistance <sup>(1)</sup>          | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V                                             | 4.5V                           | -   | 0.7   | 1.0             | Ω     |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 2.4V                                           |                                | -   | 0.6   | 0.9             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 4.5V                                           |                                | -   | 0.8   | 1.1             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V                                             | 3.0V                           | -   | 0.8   | 1.2             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 3.0V                                           |                                | -   | 0.9   | 1.8             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V                                             | 2.3V                           | -   | 1.0   | 1.3             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 2.3V                                           |                                | -   | 1.2   | 1.7             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V                                             | 1.65V                          | -   | 1.3   | 1.8             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 1.65V                                          |                                | -   | 2.0   | 2.6             |       |
| R <sub>ONF</sub>      | ON Resistance Flatness <sup>(2)</sup> | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V, 2.4V, 4.5V                                 | 4.5V                           | -   | 0.2   | 0.4             | Ω     |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V, 1.5V, 3.3V                                 | 3.3V                           | -   | 0.2   | 0.4             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V, 1.1V, 2.5V                                 | 2.5V                           | -   | 0.4   | 0.6             |       |
|                       |                                       | I <sub>A</sub> = 100mA, V <sub>B</sub> = 0V, 0.7V, 1.8V                                 | 1.8V                           | -   | 1.0   | 1.4             |       |
| V <sub>IH</sub>       | Input High Voltage                    | Logic High Level                                                                        | V <sub>CC</sub> = 1.65V        | 1   | -     | -               | V     |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 2.3V         | 1.2 | -     | -               |       |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 3V           | 1.3 | -     | -               |       |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 4.2V         | 1.5 | -     | -               |       |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 5.5V         | 1.8 | -     | -               |       |
| V <sub>IL</sub>       | Input Low Voltage                     | Logic Low Level                                                                         | V <sub>CC</sub> = 1.65V        | -   | -     | 0.4             | V     |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 2.3V         | -   | -     | 0.6             |       |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 3V           | -   | -     | 0.8             |       |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 4.2V         | -   | -     | 1               |       |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 5.5V         | -   | -     | 1.2             |       |
| I <sub>OFF(B)</sub>   | Source Off Leakage Current            | V <sub>CC</sub> =5.5V, V <sub>A</sub> =1V, 4.5V<br>V <sub>B</sub> =1V, 4.5V             | V <sub>CC</sub> = 3V           | -20 | -     | +20             | nA    |
| I <sub>NC(A, B)</sub> | Channel On Leakage Current            | -                                                                                       | V <sub>CC</sub> = 1.65 to 5.5V | -40 | -     | +40             |       |
| I <sub>PWROFF</sub>   | Input Leakage Current for Power off   | 0 ≤ V <sub>A</sub> ≤ 5.5V, 0 ≤ V <sub>B</sub> ≤ 5.5V                                    | V <sub>CC</sub> = 0V           | -5  | -     | 5               | uA    |
| I <sub>CC</sub>       | Quiescent Supply Current              | All channels ON or OFF,<br>V <sub>B</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> =0 | V <sub>CC</sub> = 3.6V         | -   | 0.002 | 0.1             | μA    |
|                       |                                       |                                                                                         | V <sub>CC</sub> = 5.5V         | -   | 0.002 | 0.1             |       |

### Notes:

1. Measured by voltage drop between A and B pins at the indicated current through the device. ON resistance is determined by the lower of the voltages on two ports (A or B).
2. Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions. Guaranteed by design.

## Capacitance<sup>(1)</sup>

| Symbol              | Parameter              | Test Conditions                                           | Min. | Typ. | Max. | Units |
|---------------------|------------------------|-----------------------------------------------------------|------|------|------|-------|
| C <sub>IN</sub>     | Control Input          | V <sub>CC</sub> = 5.0V, f = 1 MHz, T <sub>A</sub> = 25 °C | -    | 3.5  | -    | pF    |
| C <sub>IO-B</sub>   | For B Port, Switch OFF |                                                           | -    | 15.0 | -    |       |
| C <sub>IOA-ON</sub> | For A Port, Switch ON  |                                                           | -    | 34.0 | -    |       |

### Notes:

1. Capacitance is characterized but not tested in production

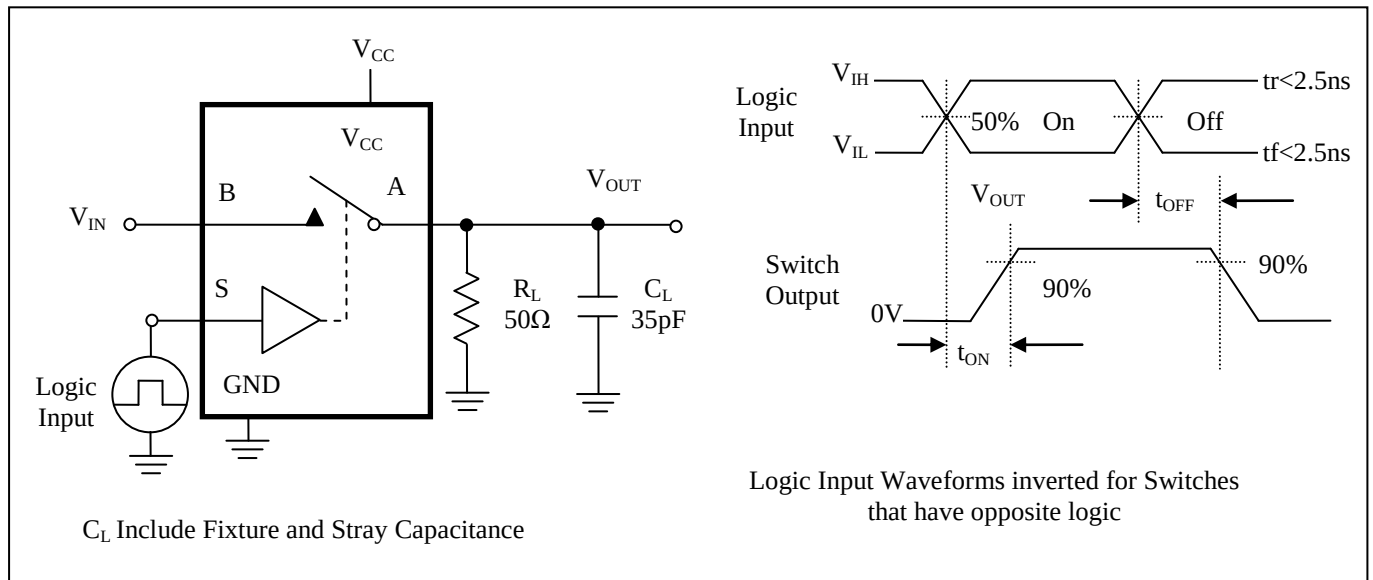
**Switch and AC Characteristics <sup>(1)</sup>**

| Parameter | Description               | Test Conditions                                                                                          | Supply Voltage             | Min | Typ   | Max | Units |
|-----------|---------------------------|----------------------------------------------------------------------------------------------------------|----------------------------|-----|-------|-----|-------|
| $t_{ON}$  | Turn on Time              | See Figure 1                                                                                             | $V_{CC} = 2.7V$ to $3.6V$  | -   | 3     | 5   | ns    |
|           |                           |                                                                                                          | $V_{CC} = 4.5V$ to $5.5V$  | -   | 2     | 4   |       |
| $t_{OFF}$ | Turn off Time             | See Figure 1                                                                                             | $V_{CC} = 2.7V$ to $3.6V$  | -   | 9     | 14  |       |
|           |                           |                                                                                                          | $V_{CC} = 4.5V$ to $5.5V$  | -   | 5     | 7.5 |       |
| Q         | Charge Injection          | $C_L = 1nF$ , $V_{GEN} = 0V$ ,<br>$R_{GEN} = 0\Omega$ .<br>See Figure 2                                  | $V_{CC} = 5.0V$            | -   | 35    | -   | pC    |
|           |                           |                                                                                                          | $V_{CC} = 3.3V$            | -   | 25    | -   |       |
| $O_{IRR}$ | Off Isolation             | $R_L = 50\Omega$ , $V_{GEN} = 0V$ ,<br>$R_{GEN} = 0\Omega$ , $f = 1MHz$ .<br>See Figure 3 <sup>(2)</sup> | $V_{CC} = 1.65V$ to $5.5V$ | -   | -70   | -   | dB    |
| $f_{3dB}$ | -3dB Bandwidth            | See Figure 6                                                                                             | $V_{CC} = 1.65V$ to $5.5V$ | -   | 200   | -   | MHz   |
| $T_{HD}$  | Total Harmonic Distortion | $R_L = 600\Omega$ , $V_{IN} = 0.5V_{pp}$ ,<br>$f = 20Hz$ to $20kHz$<br>See Figure 7                      | $V_{CC} = 2.7V$ to $4.2V$  | -   | 0.015 | -   | %     |

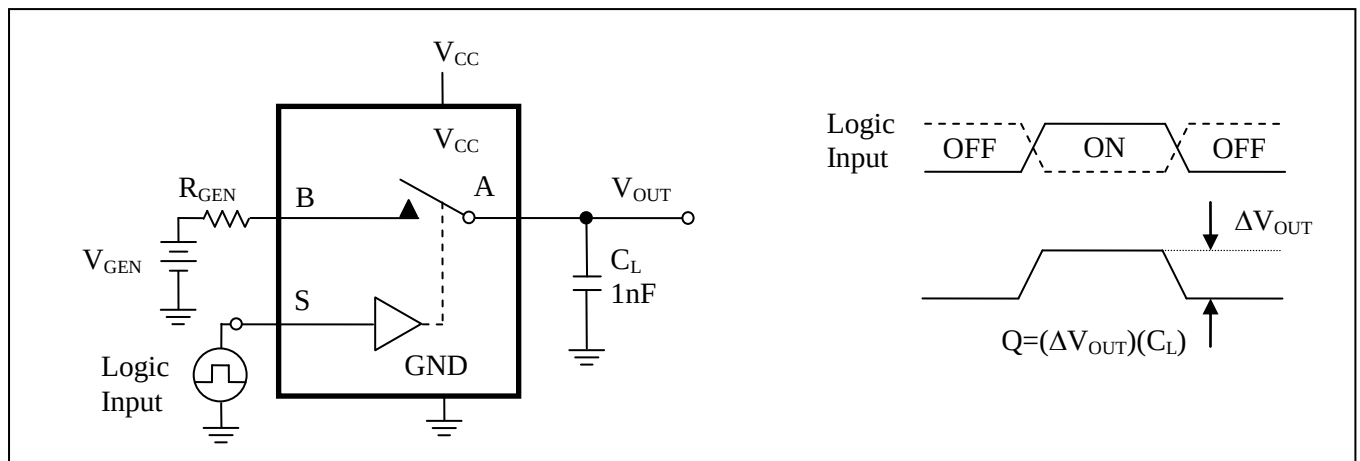
**Notes:**

1. Guaranteed by design.
2. Off Isolation =  $20 \log_{10}[V_B/V_A]$  and is measured in dB.

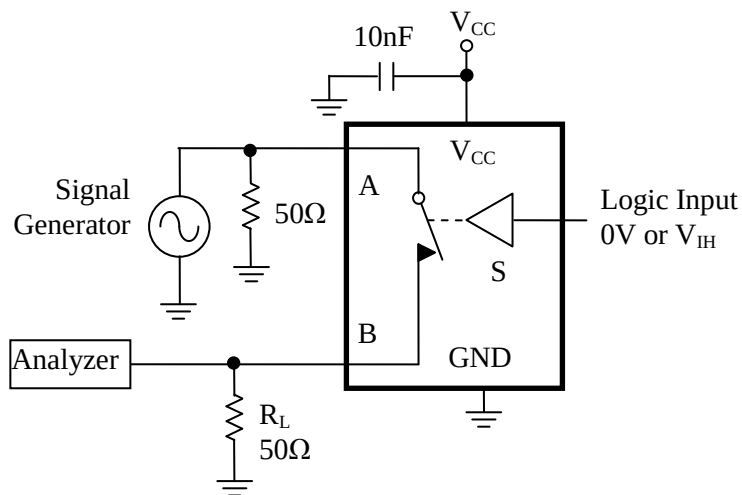
## Test Circuits and Timing Diagrams



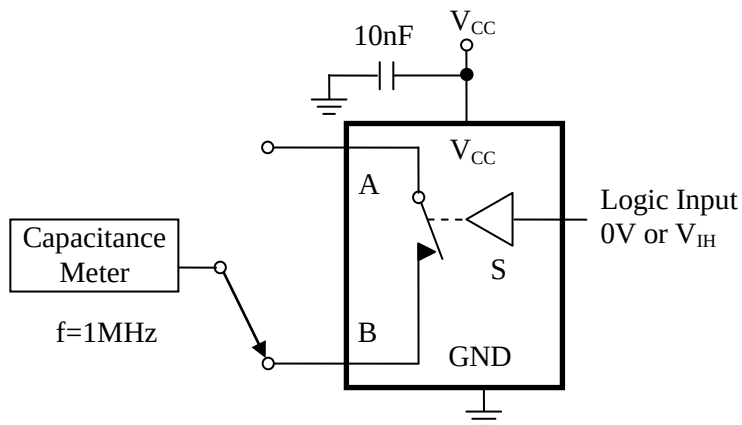
**Figure 1. Turn ON/OFF Timing**



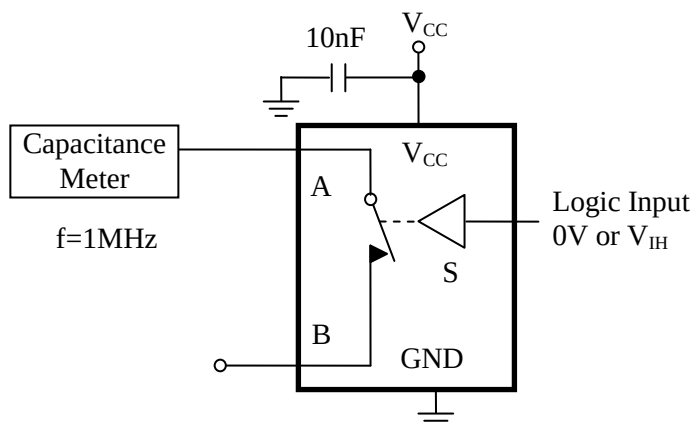
**Figure 2. Charge Injection Test**



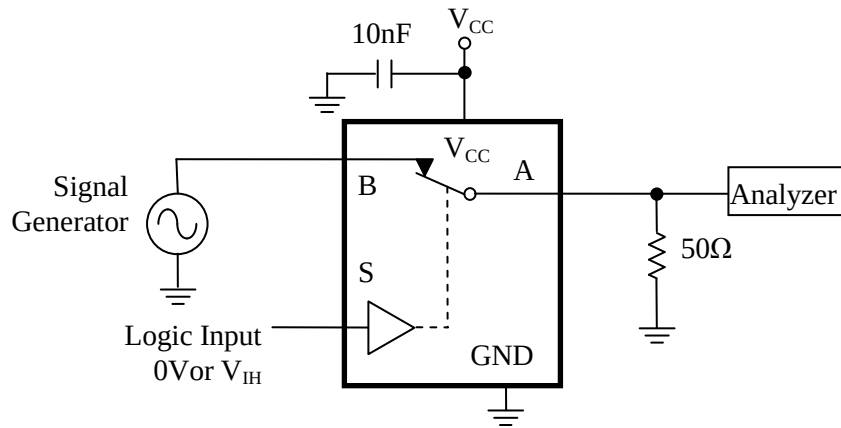
**Figure 3. Off Isolation**



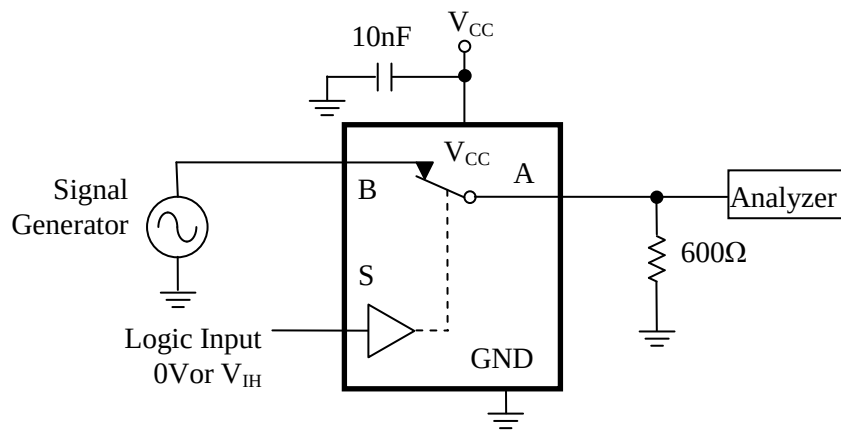
**Figure 4. Channel Off Capacitance**



**Figure 5. Channel On Capacitance**



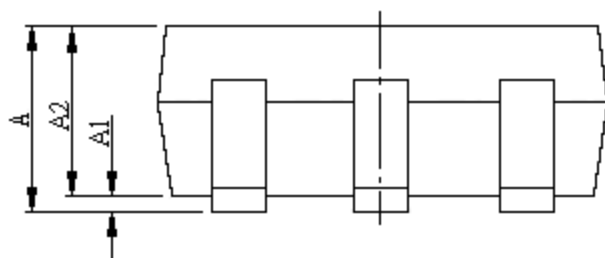
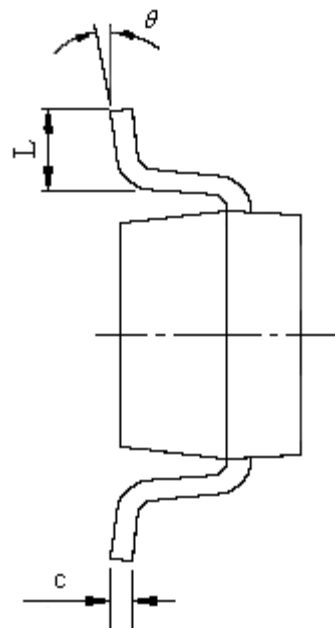
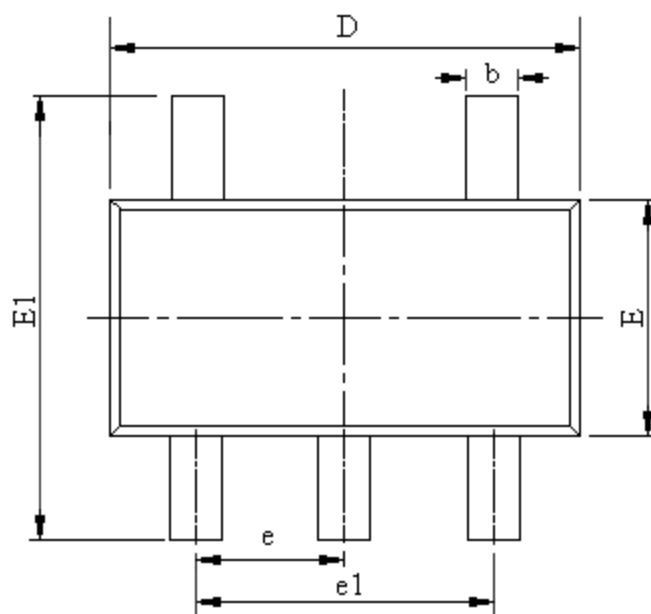
**Figure 6. Bandwidth**



**Figure 7. Harmonic Distortion**

## Mechanical Information

TA (SOT23-5)

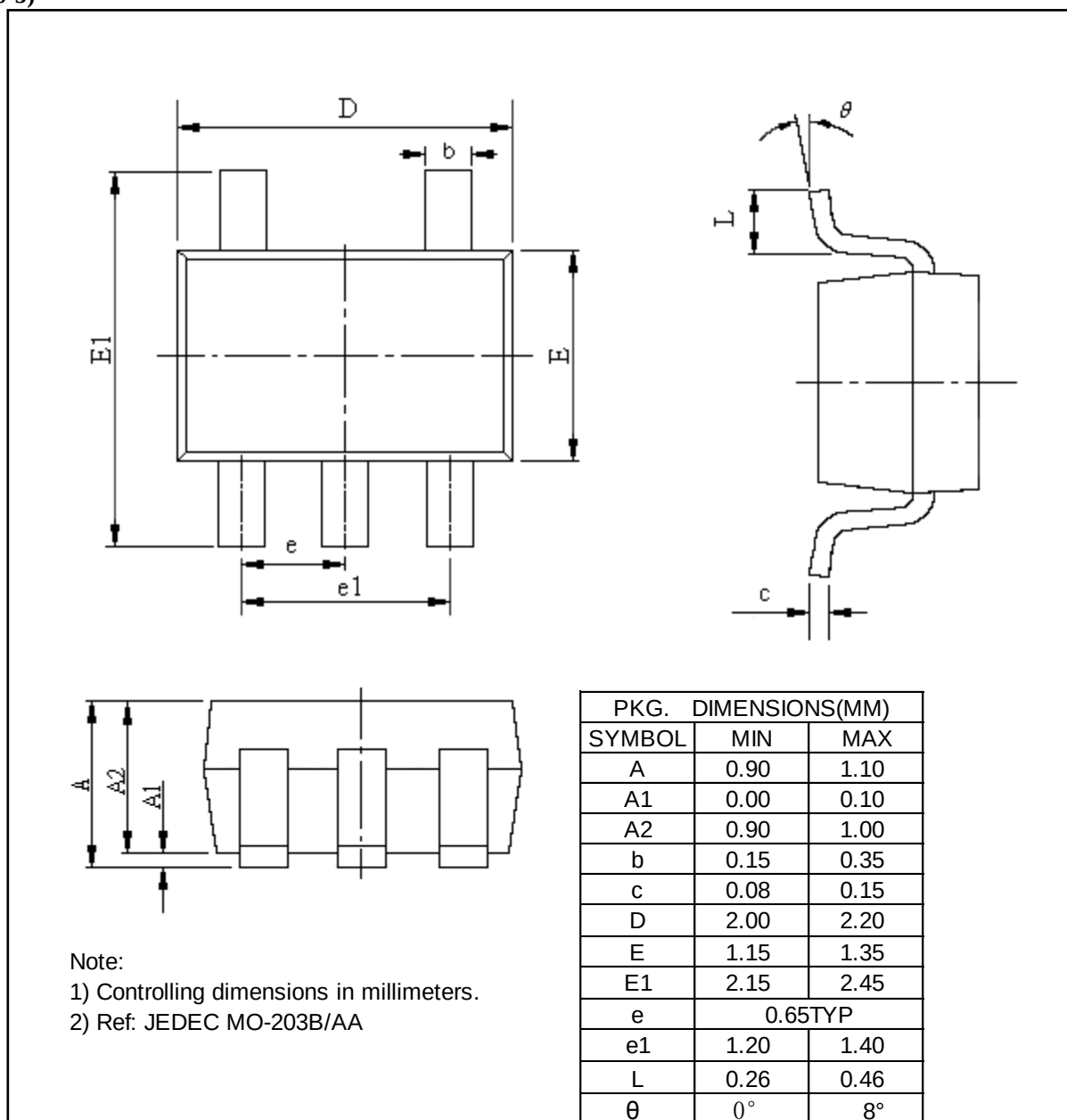


Note:

- 1) Controlling dimensions in millimeters.
- 2) Ref: JEDEC MO-178C/AA

| 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                   | 0.95BSC |      |
| e1                  | 1.80    | 2.00 |
| L                   | 0.30    | 0.60 |
| θ                   | 0°      | 8°   |



**C (SC70-5)**


## Ordering Information

| Part Number  | Package Code | Package                          | Top Marking |
|--------------|--------------|----------------------------------|-------------|
| PI5A3167CCE  | C            | Lead Free and Green SC70-5 (C)   | rE          |
| PI5A3167CTAE | TA           | Lead Free and Green SOT23-5 (TA) | rE          |

### Notes:

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

Pericom Semiconductor Corporation • 1-800-435-2336 • [www.pericom.com](http://www.pericom.com)

Pericom reserves the right to make changes to its products or specifications at any time, without notice, in order to improve design or performance and to supply the best possible product. Pericom does not assume any responsibility for use of any circuitry described other than the circuitry embodied in Pericom product. The company makes no representations that circuitry described herein is free from patent infringement or other rights, of Pericom.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Diodes Incorporated:](#)

[PI5A3167CCEX](#)