

Low Voltage SPDT 0.8Ω Analog Switch

Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.8Ω at 3.0V
- Wide V_{CC} Range: 1.65V to 5.5V
- Rail-to-Rail Signal Range
- Control Input Overvoltage Tolerance: 5.5V(Min)
- Fast Transition Speed: 12ns at 5.0V
- High Bandwidth: 150 MHz
- Extended Industrial Temperature Range: -40 °C to 85 °C
- Packaging (Pb-free & Green):
 - 6-pin SOT23
 - 6-pin SC70
 - 6-Pin UDFN 1mm×1mm

Applications

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

Description

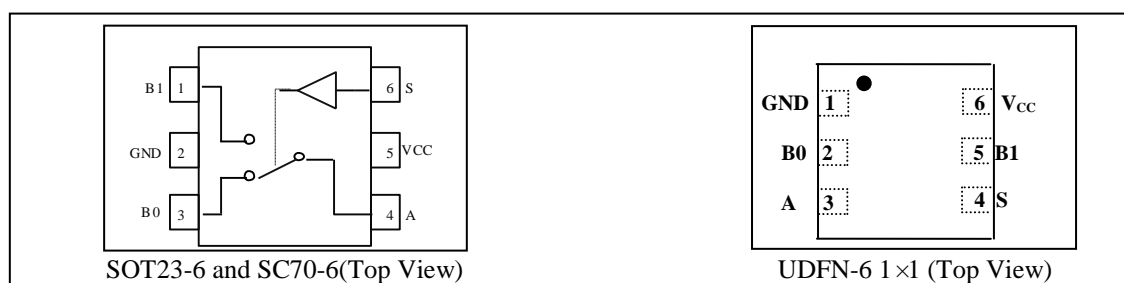
The PI5A4157 is a high-bandwidth, fast single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. The device features ultra low RON of 0.8Ω typical at 3.0V VCC and will operate over the wide VCC range of 1.65V to 5.5V.

The PI5A4157 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.

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

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

Pin Assignment



Pin Description

| Pin No | | Pin Name | Description |
|-------------------|---------------|-----------------|--------------------------------|
| SOT23-6 SC70-6 | UDFN-6 1x1 | | |
| 1 | 5 | B1 | Data Port |
| 2 | 1 | GND | Ground |
| 3 | 2 | B0 | Data Port (Normally connected) |
| 4 | 3 | A | Common Output/Data Port |
| 5 | 6 | V _{CC} | Positive Power Supply |
| 6 | 4 | S | Logic control |

Logic Function Table

| Logic Inputs(S) | Function |
|-----------------|-----------------------------|
| 0 | B ₀ connect to A |
| 1 | B ₁ connect to A |

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 $V_{CC}+0.5V$ |
| 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} | $\pm 100mA$ |
| Junction Temperature under Bias (T_J) | 150 °C |
| Junction Lead Temperature (T_L) (Soldering, 10 seconds) | 260 °C |
| ESD (HBM) | 5KV |
| Power Dissipation (Pd) @ +85 °C | SOT23 250mW SC70 200mW UDFN1x1 150mW |

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} | Control Input Voltage | - | 0 | - | V_{CC} | V |
| V_S | Switch Input Voltage | - | 0 | - | V_{CC} | 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_A = -40 °C to 85 °C, unless otherwise noted.)

| Parameter | Description | Test Conditions | Supply Voltage | Min | Typ | Max | Units |
|--|---|---|--------------------------------|-----|-------|-----------------|-------|
| V _{IAR} | Analog Input Signal Range | - | V _{CC} | 0 | - | V _{CC} | V |
| R _{ON} | ON Resistance ⁽¹⁾ | I _O = 100mA, V _{IN} = 0V | 4.5V | - | 0.7 | 1.1 | Ω |
| | | I _O = 100mA, V _{IN} = 2.4V | | - | 0.6 | 1.0 | |
| | | I _O = 100mA, V _{IN} = 4.5V | | - | 0.8 | 1.2 | |
| | | I _O = 100mA, V _{IN} = 0V | 3.0V | - | 0.8 | 1.3 | |
| | | I _O = 100mA, V _{IN} = 3.0V | | - | 0.9 | 1.9 | |
| | | I _O = 100mA, V _{IN} = 0V | 2.3V | - | 1.0 | 1.5 | |
| | | I _O = 100mA, V _{IN} = 2.3V | | - | 1.2 | 1.8 | |
| | | I _O = 100mA, V _{IN} = 0V | 1.65V | - | 1.3 | 1.9 | |
| | | I _O = 100mA, V _{IN} = 1.65V | | - | 2.0 | 2.8 | |
| ΔR _{ON} | ON Resistance Match Between Channels ^(1,2,3) | I _A = 100mA, V _{Bn} = 3.15V | 4.5V | - | 0.01 | 0.03 | Ω |
| | | I _A = 100mA, V _{Bn} = 2.1V | 3.0V | - | 0.02 | 0.04 | |
| | | I _A = 100mA, V _{Bn} = 1.6V | 2.3V | - | 0.03 | 0.06 | |
| | | I _A = 100mA, V _{Bn} = 1.15V | 1.65V | - | 0.03 | 0.06 | |
| R _{ONF} | ON Resistance Flatness ^(1,2,4) | I _A = 100mA, V _{Bn} = 0V, 2.4V, 4.5V | 4.5V | - | 0.2 | 0.4 | Ω |
| | | I _A = 100mA, V _{Bn} = 0V, 1.5V, 3.3V | 3.3V | - | 0.2 | | |
| | | I _A = 100mA, V _{Bn} = 0V, 1.1V, 2.5V | 2.5V | - | 0.4 | 0.6 | |
| | | I _A = 100mA, V _{Bn} = 0V, 0.7V, 1.8V | 1.8V | - | 1.0 | 1.4 | |
| V _{IH} | Input High Voltage | Logic High Level | V _{CC} = 1.65V | 0.9 | - | - | V |
| | | | V _{CC} = 2.3V | 1.0 | - | - | |
| | | | V _{CC} = 3V | 1.1 | - | - | |
| | | | V _{CC} = 4.2V | 1.2 | - | - | |
| | | | V _{CC} = 5.5V | 1.3 | - | - | |
| V _{IL} | Input Low Voltage | Logic Low Level | V _{CC} = 1.65V | - | - | 0.6 | V |
| | | | V _{CC} = 2.3V | - | - | 0.6 | |
| | | | V _{CC} = 3V | - | - | 0.6 | |
| | | | V _{CC} = 4.2V | - | - | 0.8 | |
| | | | V _{CC} = 5.5V | - | - | 0.8 | |
| I _{OFF} (NO) or I _{OFF} (NC) | Source Off Leakage Current | V _{CC} = 5.5V, V _A = 1V, 4.5V V _{Bn} = 1V, 4.5V | V _{CC} = 3V | -20 | - | +20 | nA |
| I _{INC} (ON), I _{INO} (ON), I _{ICOM} (ON) | Channel On Leakage Current | - | V _{CC} = 1.65 to 5.5V | -40 | - | +40 | |
| I _{CC} | Quiescent Supply Current | All channels ON or OFF, V _{IN} = V _{CC} or GND, I _{OUT} = 0 | V _{CC} = 3.6V | - | 0.002 | 0.1 | μA |
| | | | V _{CC} = 5.5V | - | 0.002 | 0.1 | |
| I _{CCT} | Increase in I _{CC} per Input | Input at 2.7V | V _{CC} = 4.3V | - | 0.2 | 10.0 | μA |

Notes:

- 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).
- Parameter is characterized but not tested in production.
- ΔR_{ON} = R_{ON} max - R_{ON} min. measured at identical V_{CC}, temperature and voltage levels.
- Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions.

Capacitance ⁽¹⁾

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------------|------------------------|--|-----|------|-----|-------|
| C_{IN} | Control Input | $V_{CC} = 5.0V, f = 1 \text{ MHz}, T_A = 25^\circ C$ | - | 3.5 | - | pF |
| C_{IO-B} | For B Port, Switch OFF | | - | 15.0 | - | |
| C_{IOA-ON} | For A Port, Switch ON | | - | 34.0 | - | |

Notes:

1. Capacitance is characterized but not tested in production

Switch and AC Characteristics ⁽¹⁾

| Parameter | Description | Test Conditions | Supply Voltage | Min | Typ | Max | Units |
|------------|---------------------------|--|-----------------------------------|-----|-------|-----|-------|
| t_{BBM} | Break Before Make Time | See Figure 2 | $V_{CC} = 2.7V \text{ to } 3.6V$ | - | 10 | 20 | ns |
| | | | $V_{CC} = 4.5V \text{ to } 5.5V$ | - | 6 | 12 | |
| t_{ON} | Turn on Time | See Figure 1 | $V_{CC} = 2.7V \text{ to } 3.6V$ | - | 12 | 25 | |
| | | | $V_{CC} = 4.5V \text{ to } 5.5V$ | - | 9 | 18 | |
| t_{OFF} | Turn off Time | See Figure 1 | $V_{CC} = 2.7V \text{ to } 3.6V$ | - | 17 | 35 | |
| | | | $V_{CC} = 4.5V \text{ to } 5.5V$ | - | 10 | 20 | |
| Q | Charge Injection | $C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0\Omega$. See Figure 3 | $V_{CC} = 5.0V$ | - | 35 | - | pC |
| | | | $V_{CC} = 3.3V$ | - | 25 | - | |
| OIRR | Off Isolation | $R_L = 50\Omega, V_{GEN} = 0V, R_{GEN} = 0\Omega, f = 1MHz$. See Figure 4 ⁽²⁾ | $V_{CC} = 1.65V \text{ to } 5.5V$ | - | -70 | - | dB |
| X_{TALK} | Crosstalk Isolation | $f = 1MHz$, See Figure 5 | $V_{CC} = 1.65V \text{ to } 5.5V$ | - | -70 | - | |
| f_{3dB} | -3dB Bandwidth | See Figure 8 | $V_{CC} = 1.65V \text{ to } 5.5V$ | - | 150 | - | MHz |
| T_{HD} | Total Harmonic Distortion | $R_L = 600\Omega, V_{IN} = 0.5V_{pp}, f = 20Hz \text{ to } 20kHz$ See Figure 9 | $V_{CC} = 2.7V \text{ to } 4.2V$ | - | 0.015 | - | % |

Notes:

1. Guaranteed by design.

2. Off Isolation = $20 \log_{10} [V_{BN}/V_A]$ and is measured in dB.

Test Circuits and Timing Diagrams

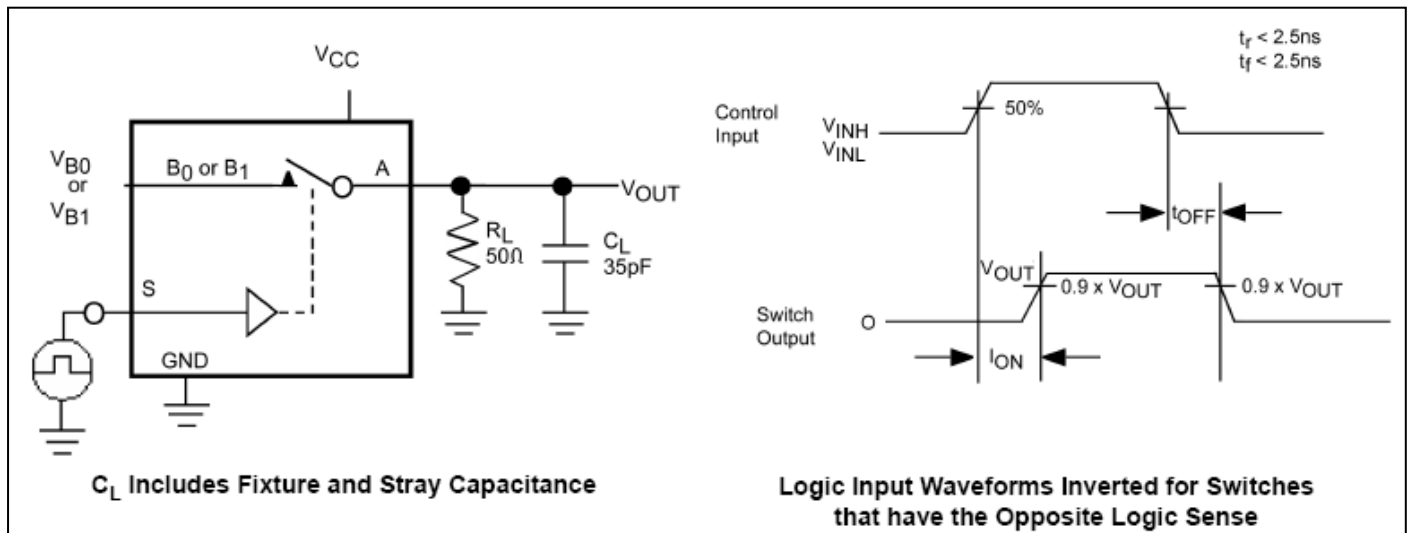


Figure 1. Turn ON/OFF Timing

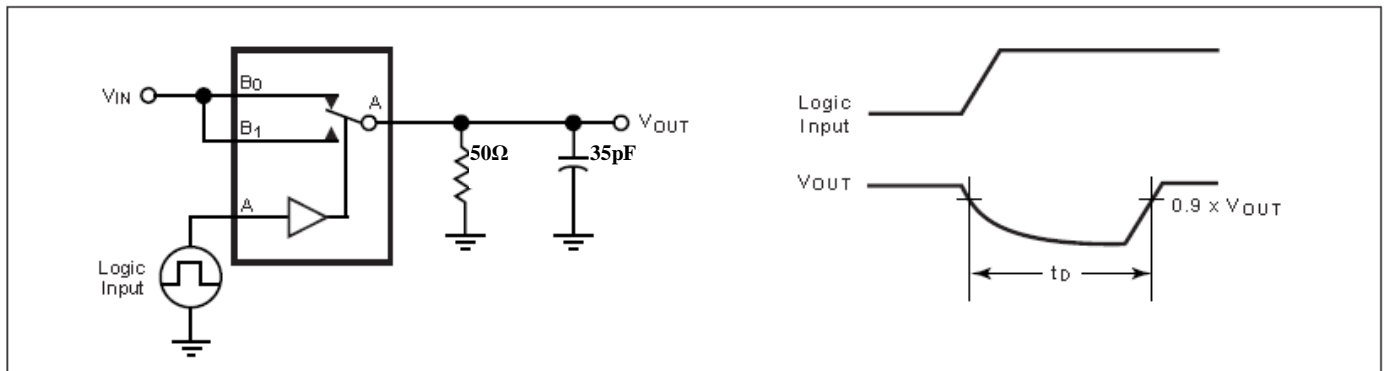


Figure 2. Break Before Make Interval Timing

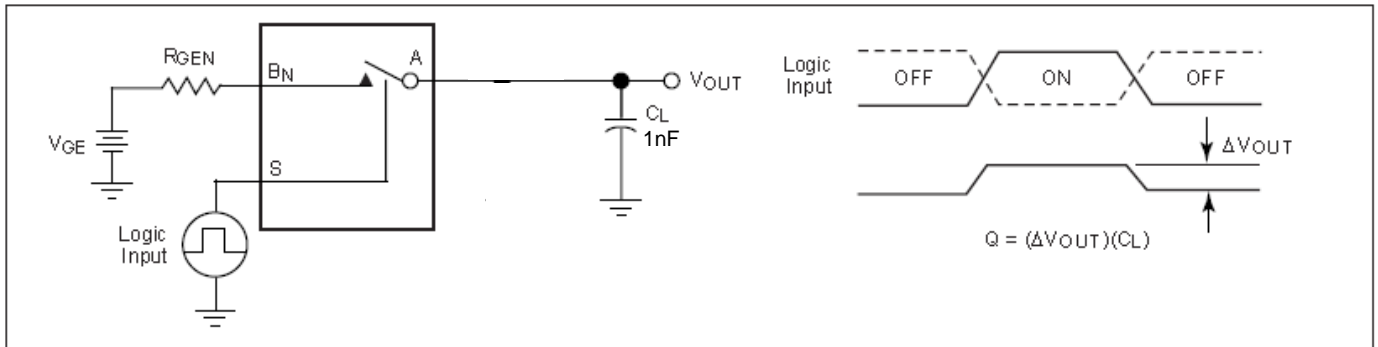


Figure 3. Charge Injection Test

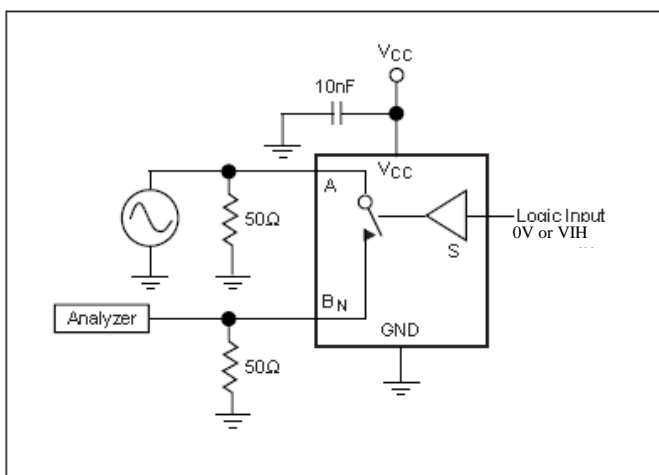


Figure 4. Off Isolation

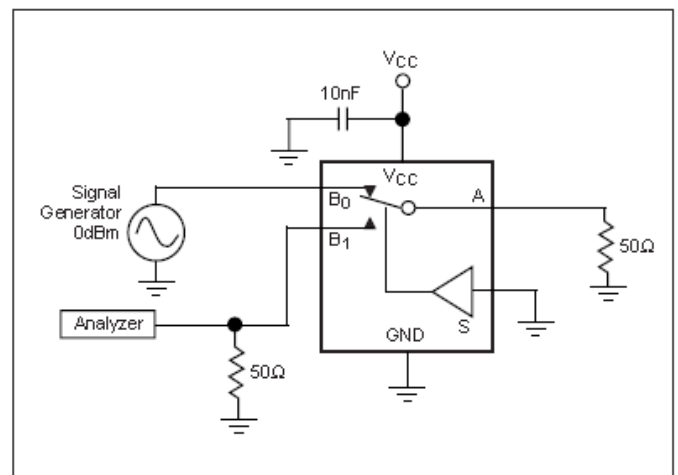


Figure 5. Crosstalk

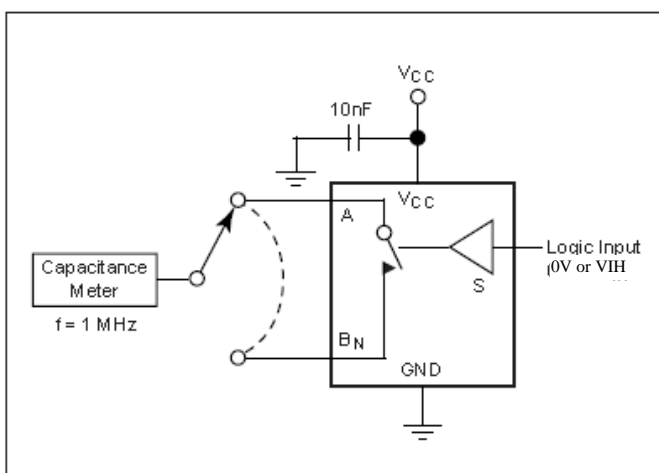


Figure 6. Channel Off Capacitance

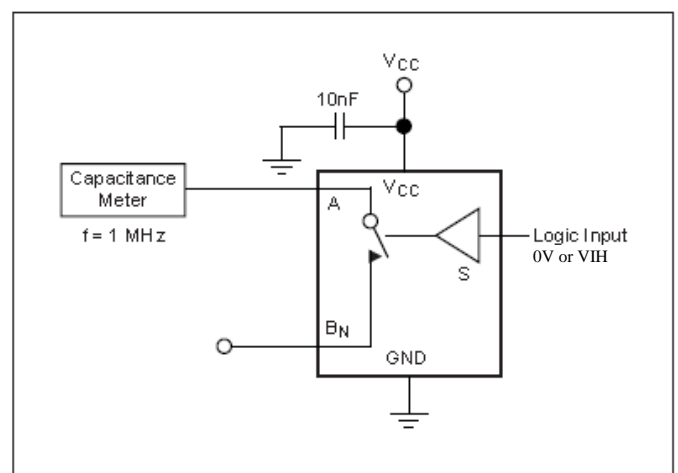


Figure 7. Channel On Capacitance

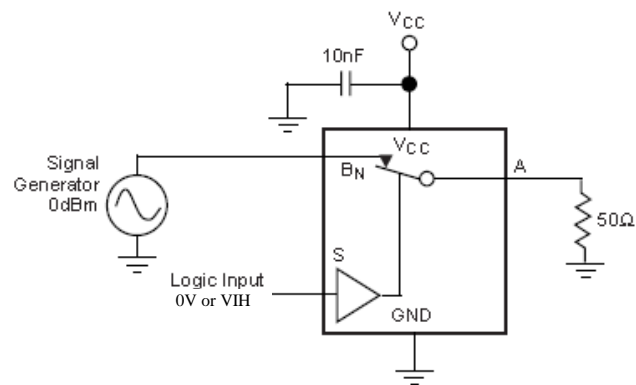


Figure 8. Bandwidth

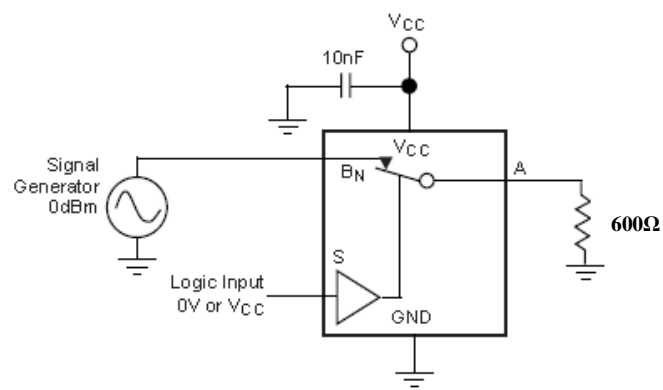
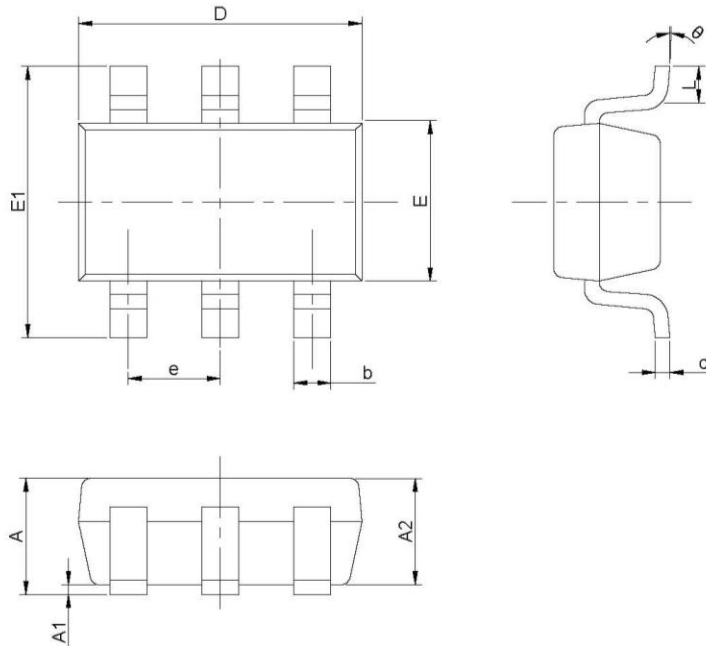


Figure 9. Harmonic Distortion

Mechanical Information

TA (6-pin SOT23)



| PKG. DIMENSIONS(MM) | | |
|---------------------|----------|------|
| SYMBOL | Min | Max |
| A | - | 1.45 |
| A1 | 0.00 | 0.15 |
| A2 | 0.90 | 1.30 |
| b | 0.30 | 0.50 |
| c | 0.08 | 0.22 |
| D | 2.75 | 3.05 |
| E | 1.45 | 1.75 |
| E1 | 2.60 | 3.00 |
| e | 0.95 BSC | |
| L | 0.30 | 0.60 |
| θ | 0° | 8° |

Note:

1. Ref. JEDEC MO-178C/AB
2. PACKAGE OUTLINE DIMENSIONS DO NOT INCLUDE MOLD FLASH AND METAL BURR



DATE: 03/29/16

DESCRIPTION: 6-Pin, Small Outline Transistor Plastic Package (SOT23)

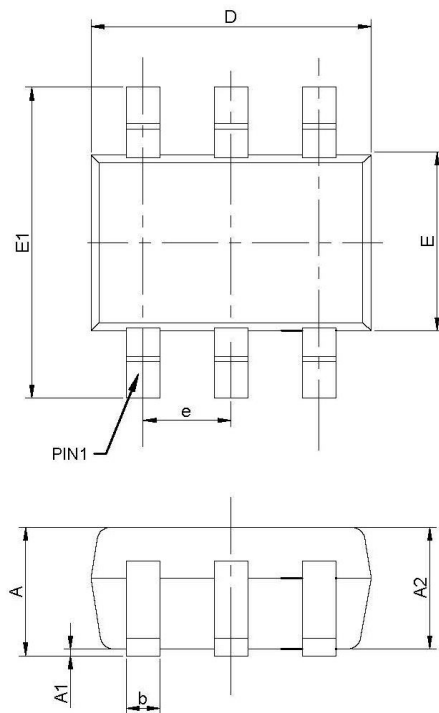
PACKAGE CODE: TA (TA6)

DOCUMENT CONTROL #: PD-2145

REVISION: A

16-0082

C (6-pin SC70)



| PKG. DIMENSIONS(MM) | | |
|---------------------|----------|------|
| SYMBOL | Min | Max |
| A | - | 1.10 |
| A1 | 0.00 | 0.10 |
| A2 | 0.70 | 1.00 |
| b | 0.15 | 0.40 |
| c | 0.08 | 0.22 |
| D | 1.80 | 2.20 |
| E | 1.10 | 1.40 |
| E1 | 1.80 | 2.40 |
| e | 0.65 BSC | |
| L | 0.26 | 0.46 |
| θ | 0° | 8° |

Notes:

1. Comply with MO-203C/AB, except b Max, D Min and D Max.
2. PACKAGE OUTLINE DIMENSIONS DO NOT INCLUDE MOLD FLASH AND METAL BURR



DATE: 03/29/16

DESCRIPTION: 6-Pin, SOT363 (SC70)

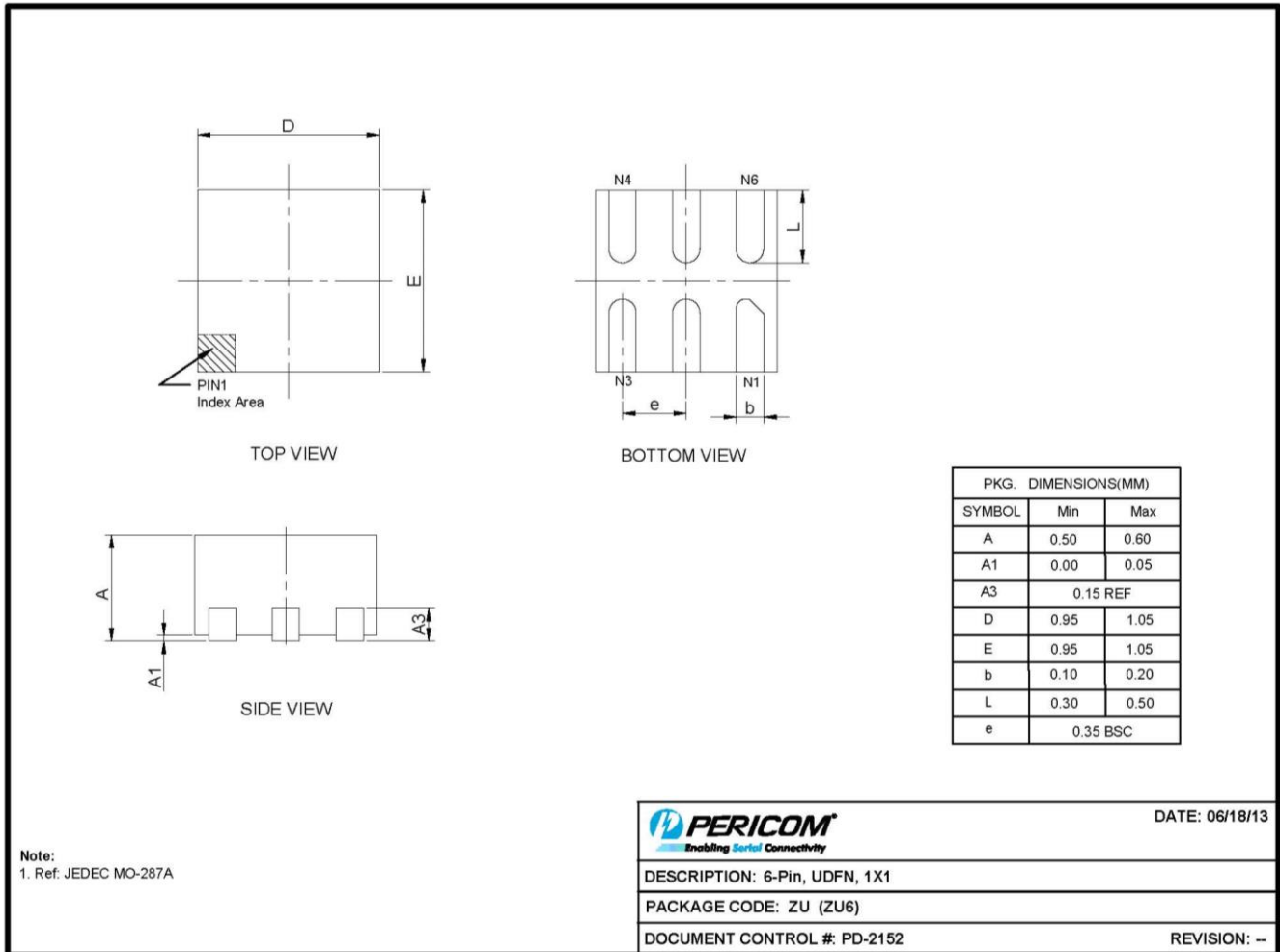
PACKAGE CODE: C (C6)

DOCUMENT CONTROL#: PD-1902

REVISION: B

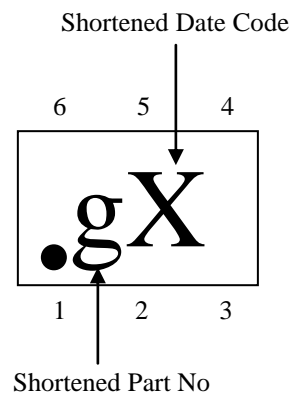
16-0078

ZU (6-pin UDFN 1x1)



13-0191

Marking Description



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

Ordering Information

| Part Number | Package Code | Package | Top Marking |
|--------------|--------------|--|-------------|
| PI5A4157CEX | C | 6-Pin, SOT363 (SC70), Tape & Reel | mA |
| PI5A4157TAEX | TA | 6-Pin, Small Outline Transistor Plastic Package (SOT23), Tape & reel | mA |
| PI5A4157ZUEX | ZU | 6-Pin, 1x1 (UDFN), Tape & reel | g |

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free and Green
- X suffix = Tape/Reel

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