# ACE5019A

**18V Low Current Consumption 350mA CMOS Voltage Regulator**

## Description

The ACE5019A series are a group of positive voltage regulators manufactured by CMOS technologies with low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The ACE5019A series can deliver 300mA output current and allow an input voltage as high as 18V. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

## Features

- Low Quiescent Current: 2μA
- Operating Voltage Range: 2.5V～18V
- Output Current: 350mA
- Low Dropout Voltage：160mV@100mA($V_{OUT}$=3.3V)
- Output Voltage: 1.2~ 5.0V
- High Accuracy: ±2%/±1%（Typ.）
- High Power Supply Rejection Ratio: 65dB@1kHz
- Low Output Noise:
- 27x$V_{OUT}$ $\mu V_{RMS}$ (10Hz~100kHz)
- Excellent Line and Load Transient Response
- Built-in Current Limiter, Short-Circuit Protection

## Application

- Cordless Phones
- Radio control systems
- Laptop, Palmtops and PDAs
- Single-lens reflex DSC
- PC peripherals with memory
- Wireless Communication Equipments
- Portable Audio Video Equipments
- Car Navigation Systems
- LAN Cards
- Ultra Low Power Microcontroller

## Absolute Maximum Ratings (1) Unless otherwise specified, $T_A$=25°C

| Parameter | | Symbol | Max | Unit |
|---|---|---|---|---|
| Input Voltage(2) | | $V_{IN}$ | -0.3~24 | V |
| Output Voltage(2) | | $V_{OUT}$ | -0.3~10 | V |
| CE PIN Voltage | | $V_{CE}$ | -0.3~24 | V |
| Output Current | | $I_{OUT}$ | 600 | mA |
| Power Dissipation | SOT-23-3 | Pd | 0.4 | W |
| | SOT-23-5 | | 0.4 | |
| | SOT-89-3 | | 0.6 | |
| Operating Junction Temperature Range(3) | | $T_{opr}$ | - 40~125 | °C |
| Storage Temperature | | $T_{stg}$ | - 40~125 | °C |
| Lead Temperature(Soldering, 10 sec) | | $T_{solder}$ | 260 | °C |
| ESD rating(4) | | Human Body Model -(HBM) | 8 | kV |
| | | Machine Model- (MM) | 400 | V |

Note:

(1) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods my affect device reliability.

(2) All voltages are with respect to network ground terminal.

(3) The ACE5019A includes over temperature protection that is intended to protect the device during momentary overload. Junction temperature will exceed 125°C when over temperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

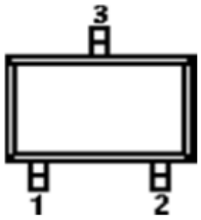
(4) ESD testing is performed according to the respective JESD22 JEDEC standard.
The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

## Recommended Operating Conditions

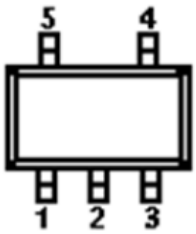
| Parameter | MIN. | MAX. | Units |
|---|---|---|---|
| Supply voltage at $V_{IN}$ | 2.5 | 18 | V |
| Operating junction temperature range, Tj | -40 | 125 | °C |
| Operating free air temperature range, $T_A$ | -40 | 85 | °C |

## Packaging Type

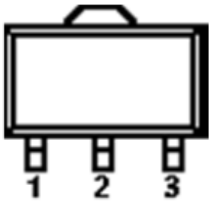
SOT-23-3




SOT-23-5




SOT-89-3



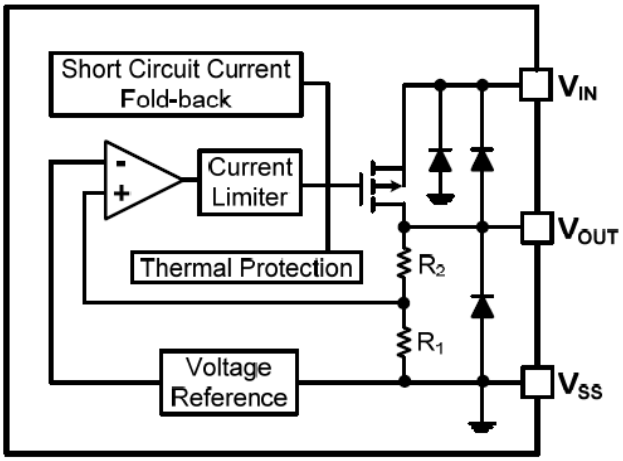

| SOT-23-3 | | | SOT-23-5 | | | SOT-89-3 | | | Pin Name | Function |
|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | A | B | C | A | B | C | | |
| 1 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | $V_{SS}$ | Ground |
| 2 | 2 | 1 | 5 | 3 | 5 | 3 | 1 | 3 | $V_{OUT}$ | Output |
| 3 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 1 | $V_{IN}$ | Power input |
| | | | | | 3 | | | | CE | Chip Enable Pin |
| | | | 3/4 | 4/5 | 4 | | | | NC | No Connection |

## Ordering information

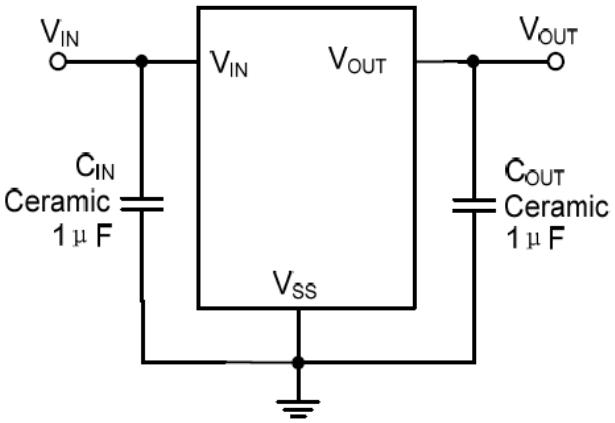
ACE5019A X XX XX + H

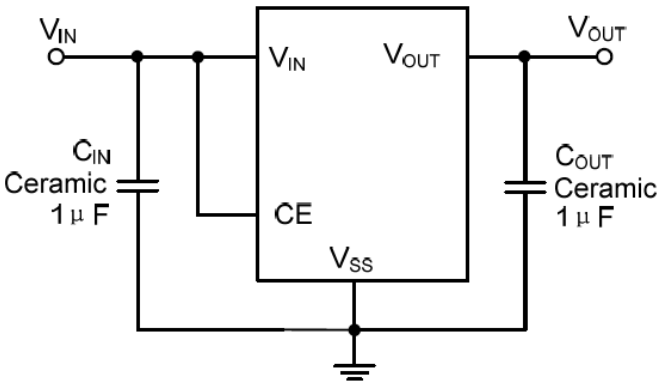
- Halogen - free
- Pb - free
- BMA：SOT-23-3A
  BMB：SOT-23-3B
  BMC：SOT-23-3C
  BNA：SOT-23-5A
  BNB：SOT-23-5B
  BNC：SOT-23-5C
  AMA：SOT-89-3A
  AMB：SOT-89-3B
  AMC：SOT-89-3C
- Output Voltage：1.2 / 1.5V …../5.0V
- A：1%
  B：2%

## Block Diagram




## Typical Application Circuit



## Electrical Characteristics

($V_{IN}$=$V_{OUT}$+1V, $C_{IN}$=$C_{OUT}$=1μF,$T_A$=25 °C, unless otherwise specified)

| Parameter | Symbol | Conditions | | Min | Typ(1) | Max | Units |
|---|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | | 2.5 | | 18 | V |
| Output Voltage Range | $V_{OUT}$ | | | 1.2 | | 5 | V |
| DC Output Accuracy | | $I_{OUT}$=1mA | | -2 | | 2 | % |
| | | | | -1 | | 1 | % |
| Dropout Voltage | $V_{dif}$(2) | $I_{OUT}$=100mA, $V_{OUT}$=3.3V | | | 160 | | mV |
| Supply Current | $I_{SS}$ | $I_{OUT}$=0A | | | 2 | 5 | μA |
| Line Regulation | $\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta V_{IN}}$ | $I_{OUT}$ =10mA $V_{OUT}$ +1V≤$V_{IN}$≤18V | | | 0.01 | 0.3 | %/V |
| Load Regulation | $\Delta V_{OUT}$ | $V_{IN}$= $V_{OUT}$ +1V, 1mA≤$I_{OUT}$≤100mA | | | 10 | | mV |
| Temperature Coefficient | $\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta T_A}$ | $I_{OUT}$=10mA, -40°C<$T_A$<125°C | | | 50 | | ppm |
| Output Current Limit | $I_{LIM}$ | $V_{OUT}$=0.5x$V_{OUT(Normal)}$, $V_{IN}$ = 5V | | 350 | 500 | | mA |
| Short Current | $I_{SHORT}$ | $V_{OUT}$ =$V_{SS}$ | | | 25 | | mA |
| Power Supply Rejection Ratio | PSRR | $I_{OUT}$=50mA | 100Hz | | 80 | | dB |
| | | | 1kHz | | 65 | | |
| | | | 10kHz | | 50 | | |
| | | | 100kHz | | 45 | | |
| Output Noise Voltage | $V_{ON}$ | BW=10Hz to 100kHz | | | 27 x $V_{OUT}$ | | $\mu V_{RMS}$ |
| Thermal Shutdown Temperature | $T_{SD}$ | | | | 150 | | °C |
| Thermal Shutdown Hysteresis | $\Delta TS_D$ | | | | 20 | | °C |
| Standby Current | $I_{STBY}$ | CE = $V_{SS}$ | | | | 0.2 | μA |
| CE "High" Voltage | $V_{CE}$"H" | | | 1.5 | | $V_{IN}$ | V |
| CE "Low" Voltage | $V_{CE}$"L" | | | | | 0.3 | V |
| $C_{OUT}$ Auto-Discharge Resistance | $R_{DISCHRG}$ | $V_{IN}$=5V, $V_{OUT}$=3.0V, $V_{CE}$=$V_{SS}$ | | | 150 | | Ω |

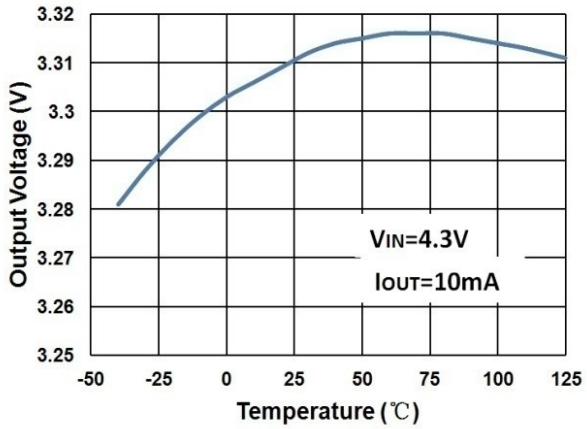
Note:

(1) Typical numbers are at 25°C and represent the most likely norm.

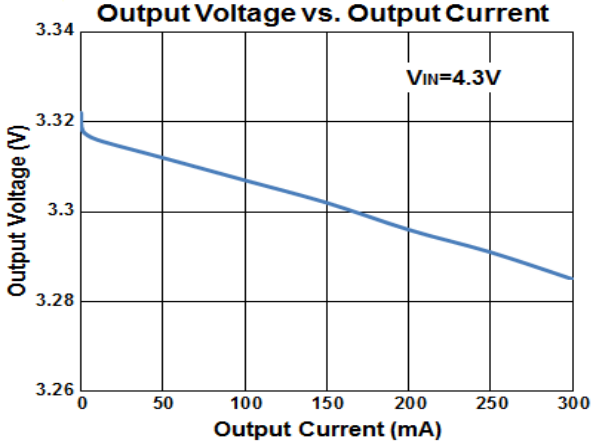
(2) $V_{dif}$ : The Difference Of Output Voltage And Input Voltage When Input Voltage Is Decreased Gradually Till Output Voltage Equals To 98% Of $V_{OUT}$ (E).

## Typical Performance Characteristics

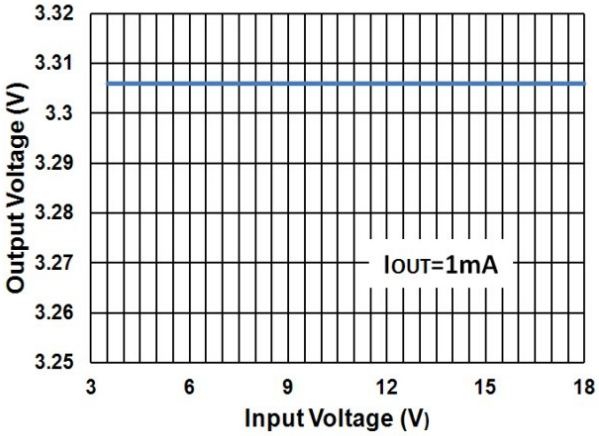
Output Voltage vs. Temperature



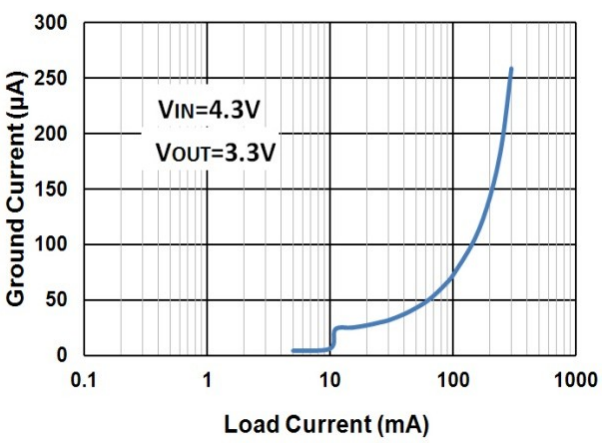

Output Voltage vs. Output Current



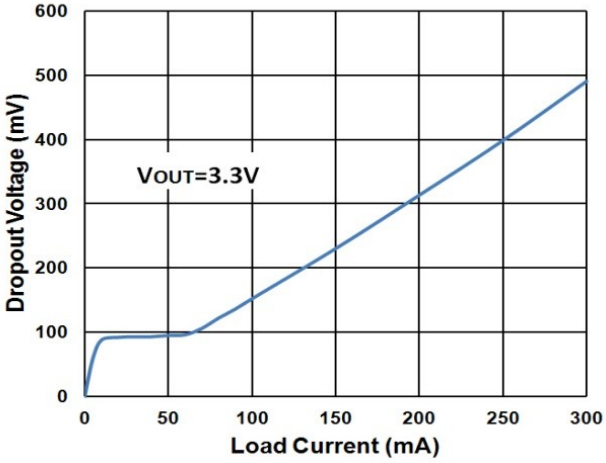

Output Voltage vs. Input Voltage



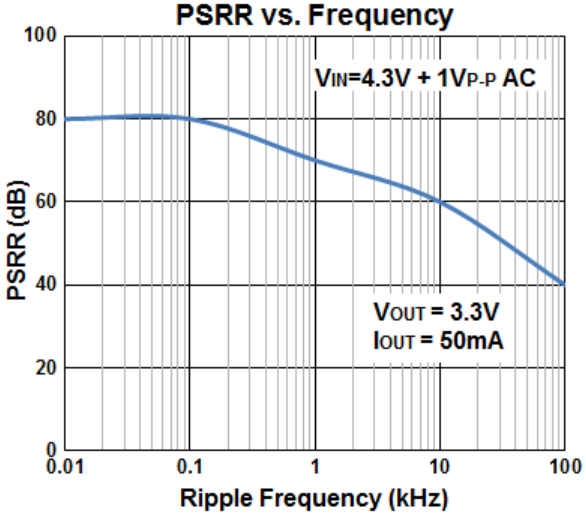

Ground Current vs. Load Current



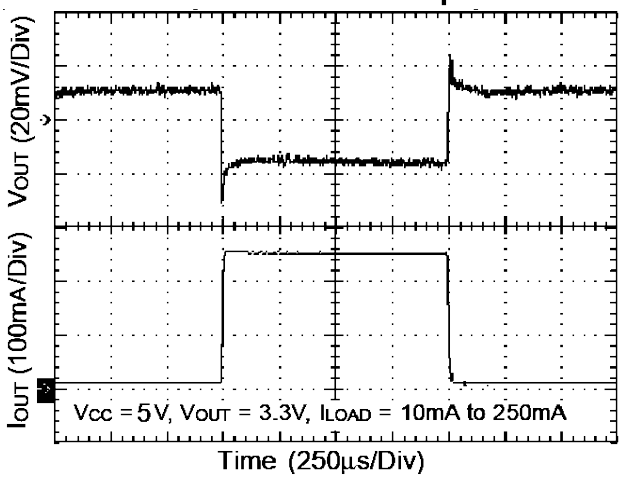

Dropout Voltage vs. Load Current



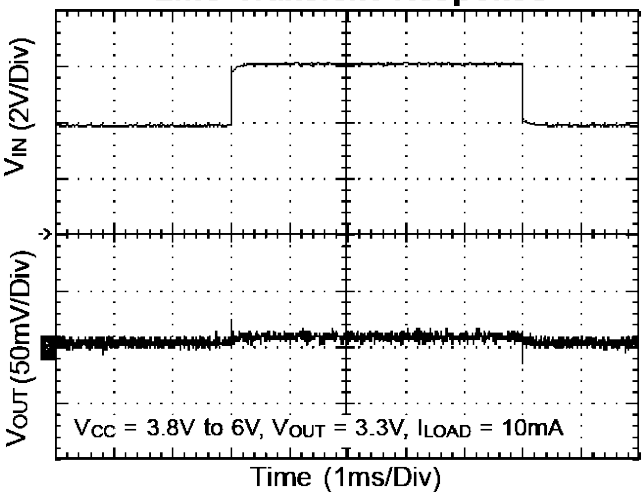

PSRR vs. Frequency



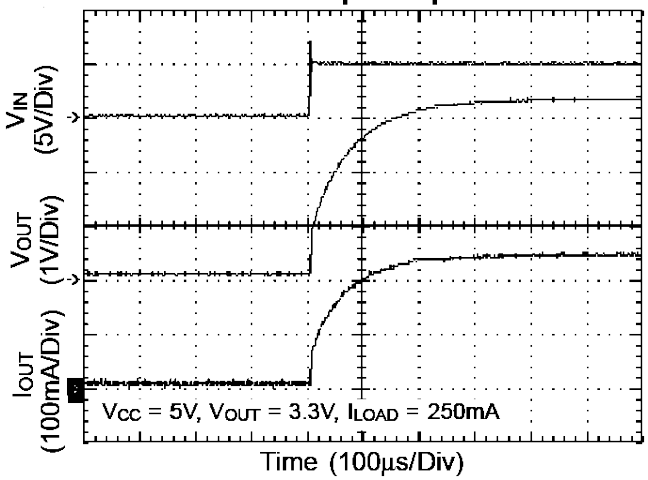
**Load Transient Response**



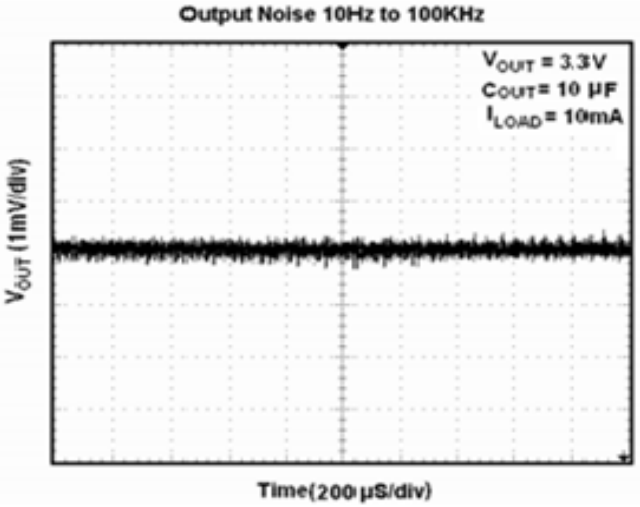

**Line Transient Response**




**Power Up Response**




**Output Noise 10Hz to 100KHz**



## Application Information

### Selection of Input/ Output Capacitors

In general, all the capacitors need to be low leakage. Any leakage the capacitors have will reduce efficiency, increase the quiescent current.

A recent trend in the design of portable devices has been to use ceramic capacitors to filter DC-DC converter inputs. Ceramic capacitors are often chosen because of their small size, low equivalent series resistance (ESR) and high RMS current capability. Also, recently, designers have been looking to ceramic capacitors due to shortages of tantalum capacitors.

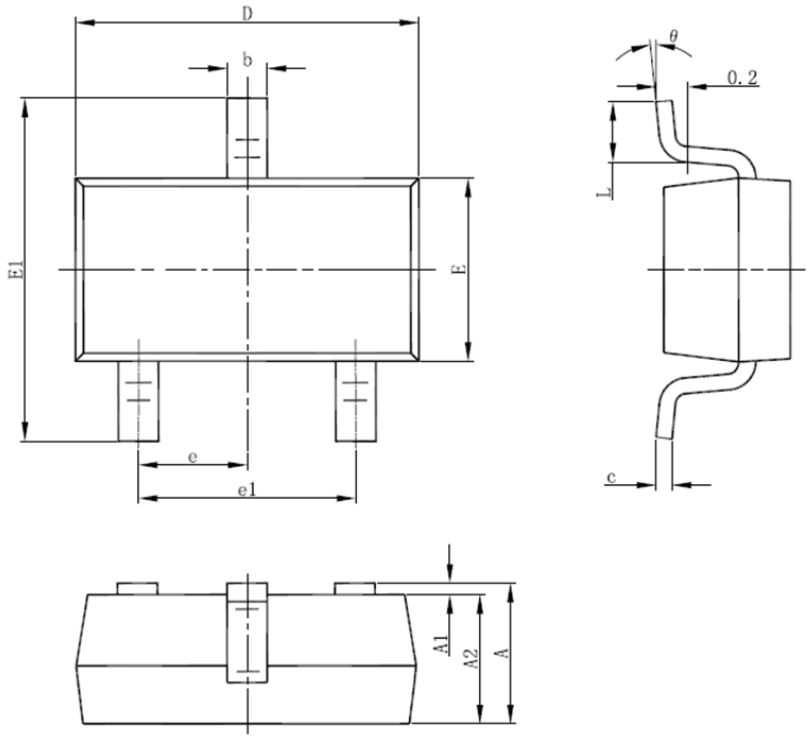
Unfortunately, using ceramic capacitors for input filtering can cause problems. Applying a voltage step to a ceramic capacitor causes a large current surge that stores energy in the inductances of the power leads. A large voltage spike is created when the stored energy is transferred from these inductances into the ceramic capacitor. These voltage spikes can easily be twice the amplitude of the input voltage step. (See "Ceramic Input Capacitors Can Cause Overvoltage Transients"——Linear Technology application note 88, March 2001)

Many types of capacitors can be used for input bypassing; however, caution must be exercised when using multilayer ceramic capacitors (MLCC). Because of the self-resonant and high Q characteristics of some types of ceramic capacitors, high voltage transients can be generated under some start-up conditions, such as connecting the LDO input to a live power source. Adding a 3Ω resistor in series with an X5R ceramic capacitor will minimize start-up voltage transients.

The LDO also requires an output capacitor for loop stability. Connect a 1μF tantalum capacitor from OUT to GND close to the pins. For improved transient response, this output capacitor may be ceramic.

## Packing Information

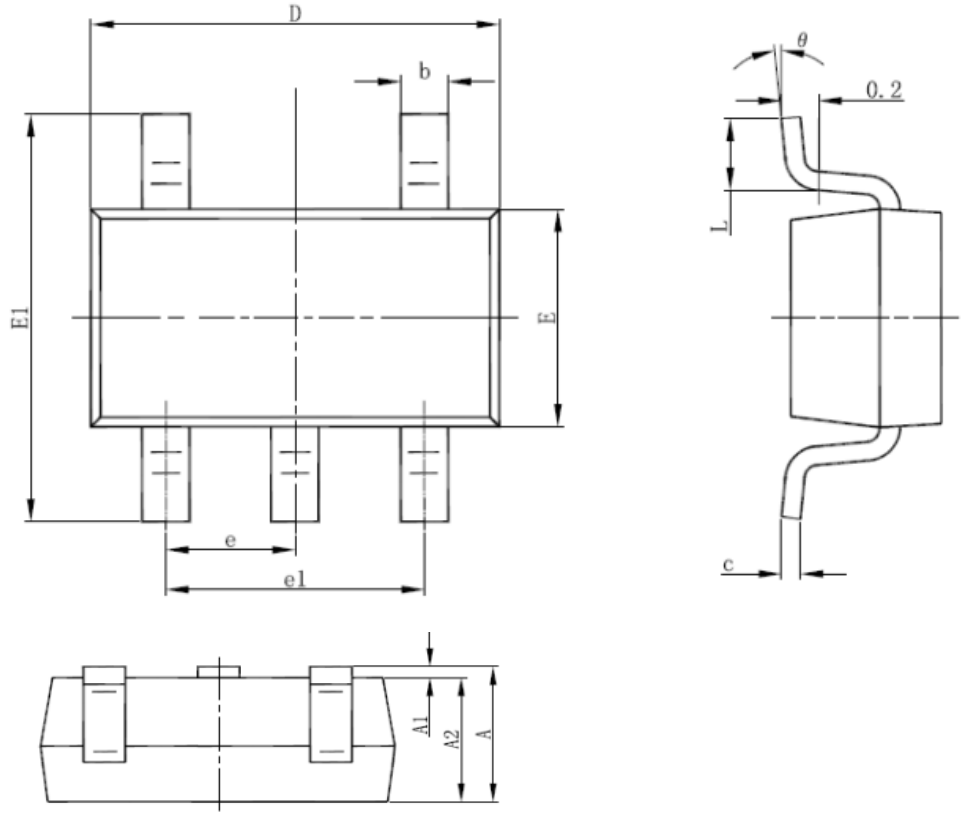
### SOT-23-3




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

## Packing Information

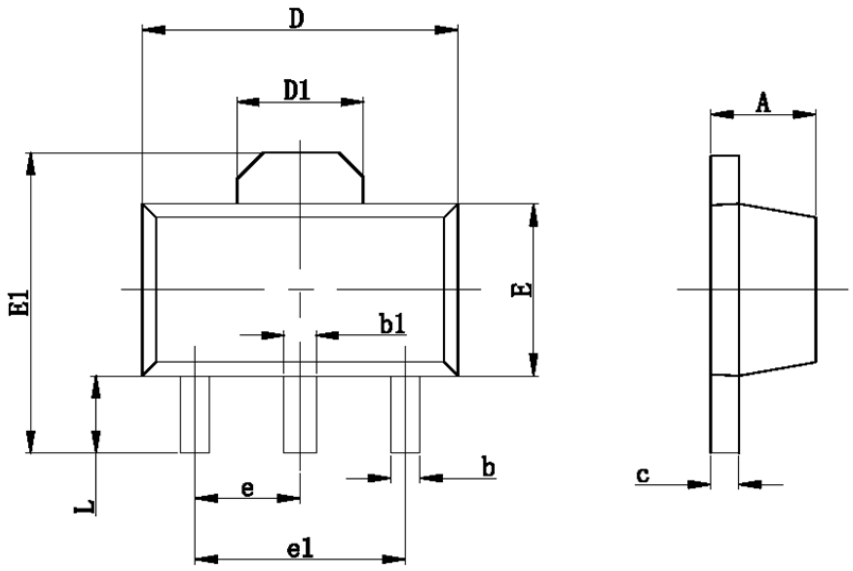
### SOT-23-5




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

## Packing Information

### SOT-89-3




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.400 | 1.600 | 0.055 | 0.063 |
| b | 0.320 | 0.520 | 0.013 | 0.197 |
| b1 | 0.400 | 0.580 | 0.016 | 0.023 |
| c | 0.350 | 0.440 | 0.014 | 0.017 |
| D | 4.400 | 4.600 | 0.173 | 0.181 |
| D1 | 1.550 REF | | 0.061 REF | |
| E | 2.300 | 2.600 | 0.091 | 0.102 |
| E1 | 3.940 | 4.250 | 0.155 | 0.167 |
| e | 1.500 TYP | | 0.060 TYP | |
| e1 | 3.000 TYP | | 0.118 TYP | |
| L | 0.900 | 1.200 | 0.035 | 0.047 |

Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.