

### Description

ACE509 series is a group of positive voltage output, low power consumption, low dropout voltage regulator.

ACE509 can provide output value in the range of 1.2V~4.5V every 0.1V step. It also can be customized on command.

ACE509 includes high accuracy voltage reference, error amplifier, current limit circuit and output driver module with discharge capability.

ACE509 has excellent load and line transient response and good temperature characteristics, which can assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within  $\pm 2\%$ .

### Features

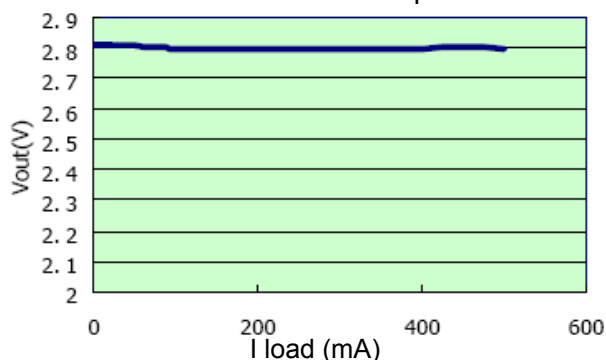
- Low Power Consumption: 75uA (Typ.)
- Low output noise (47uVRMS)
- Standby Mode: 0.1uA
- Low dropout Voltage: 0.46V@500mA (Typ.)
- High Ripple Rejection: 66dB@100Hz (Typ.)
- Low Temperature Coefficient:  $\pm 100\text{ppm}/^\circ\text{C}$
- Excellent Line regulation: 0.05%/V
- Build-in chip enable and discharge circuit
- Output Voltage Range: 1.2V~4.5V (customized on command every 0.1V step)
- Highly Accurate:  $\pm 2\%$  ( $\pm 1\%$  customized)
- Output Current Limit

### Application

- Power source for cellular phones and various kind of PCSs
- Battery Powered equipment
- Power Management of MP3, PDA, DSC, Mouse, PS2 Games
- Reference Voltage Source
- Regulation after Switching Power

### Typical Performance Characteristic:

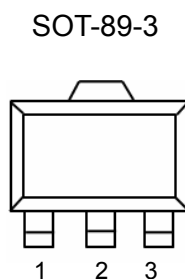
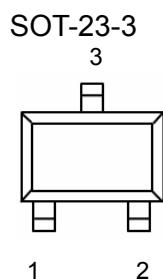
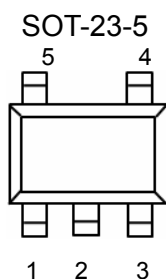
ACE509-2.8V Output



### Absolute Maximum Ratings

| Parameter            | Symbol         | Max         | Unit |
|----------------------|----------------|-------------|------|
| Input Voltage        |                | 10          | V    |
| Output Current       |                | 500         | mA   |
| Power Dissipation    |                |             |      |
| SOT-23-5             |                | 250         | mW   |
| SOT-23-3             |                | 200         |      |
| SOT-89-3             |                | 500         |      |
| TO-92                |                | 350         |      |
| Junction temperature | T <sub>J</sub> | 125         | °C   |
| Storage temperature  | T <sub>s</sub> | - 45 to 150 | °C   |

### Packaging Type

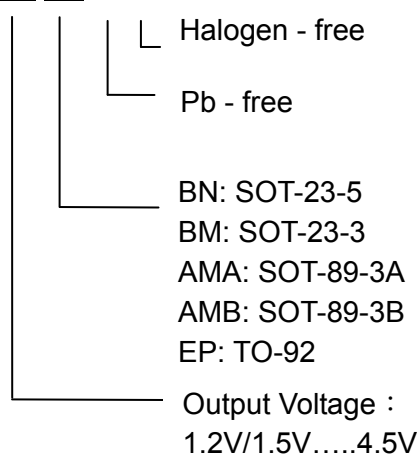


| Pin              | SOT-23-5 | SOT-23-3 | SOT-89-3(A) | SOT-89-3(B) | TO-92 | Function        |
|------------------|----------|----------|-------------|-------------|-------|-----------------|
| V <sub>OUT</sub> | 5        | 2        | 1           | 3           | 3     | Output pin      |
| V <sub>DD</sub>  | 1        | 3        | 3           | 2           | 1     | Input Pin       |
| V <sub>SS</sub>  | 2        | 1        | 2           | 1           | 2     | Ground Pin      |
| CE               | 3        |          |             |             |       | Chip Enable Pin |
| NC               | 4        |          |             |             |       | No Connection   |

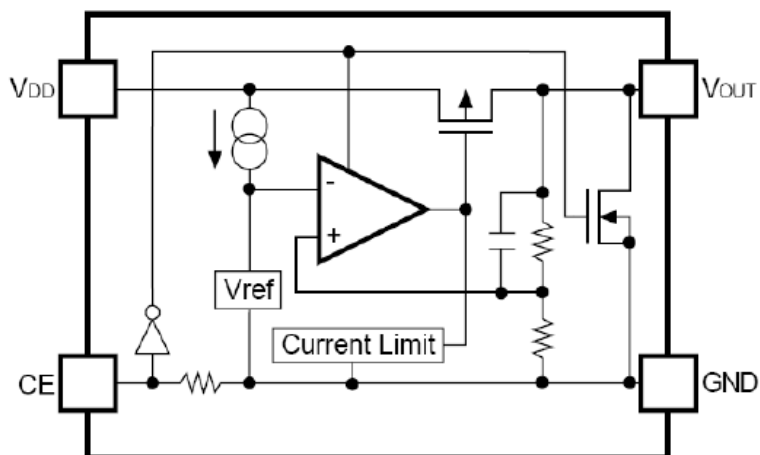
### Ordering information

#### Selection Guide

ACE509 XX XX + H



### Block Diagram



### Recommended Work Conditions

| Item                | Min | Recommended | Max | Unit |
|---------------------|-----|-------------|-----|------|
| Input Voltage Range |     |             | 8   | V    |
| Ambient Temperature | -40 |             | 85  | °C   |

### Electrical Characteristics

(Test Conditions:  $C_{in}=1\mu F$ ,  $C_{out}=3.4\mu F$ ,  $T_A=25^\circ C$ , unless otherwise specified.)

ACE509, for arbitrary output voltage

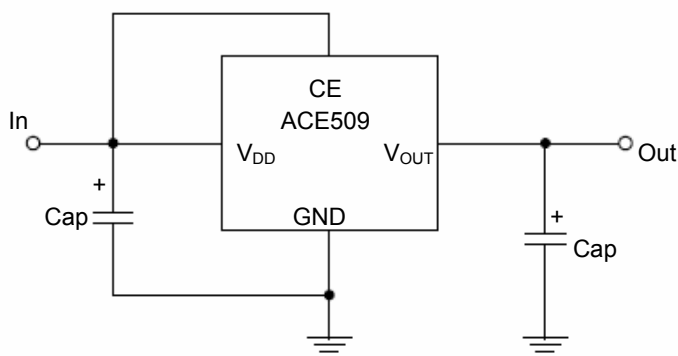
| Symbol                                     | Parameter                               | Conditions   | Min                   | Typ                | Max                   | Units   |
|--|---|--|-----------------------|--------------------|-----------------------|---------|
| $V_{in}$                                   | Input Voltage                           |  |                       |                    | 8                     | V       |
| $V_{out}$                                  | Output Voltage                          | $V_{in} = \text{Set } V_{out} + 1V$<br>$1mA \leq I_{out} \leq 30mA$  | $V_{out} \times 0.98$ | $V_{out} \times 1$ | $V_{out} \times 1.02$ | V       |
| $I_{out} \text{ (Max.)}$                   | Maximum Output Current                  | $V_{in} - V_{out} = 1V$  | 500                   |                    |                       | mA      |
| $V_{drop}^1$                               | Dropout Voltage, $V_{out} \geq 2.8V$    | $I_{out} = 100mA$  |                       | 88                 | 120                   | mV      |
|  |   | $I_{out} = 300mA$  |                       | 270                | 350                   | mV      |
|  |   | $I_{out} = 500mA$  |                       | 460                | 600                   | mV      |
| $\Delta V_{out} / \Delta V_{in} - V_{out}$ | Line Regulation                         | $I_{out} = 40mA$<br>$2.8V \leq V_{in} \leq 8V$                       |                       | 0.05               | 0.2                   | %/V     |
| $\Delta V_{out} / \Delta I_{out}$          | Load Regulation                         | $V_{in} = \text{Set } V_{out} + 1V$<br>$1mA \leq I_{out} \leq 500mA$ |                       | 20                 | 40                    | mV      |
| $I_{ss}$                                   | Supply Current                          | $V_{in} = \text{Set } V_{out} + 1V$                                  |                       | 75                 | 90                    | $\mu A$ |
| $I_{standby}$                              | Supply Current (Standby)                | $V_{in} = \text{Set } V_{out} + 1V$<br>$V_{ce} = GND$                |                       | 0.1                | 1.0                   | $\mu A$ |
| $\Delta V_{out} / \Delta T \cdot V_{out}$  | Output Voltage Temperature Coefficiency | $I_{out} = 30mA$   |                       | $\pm 100$          |                       | ppm/°C  |

|      |                            |   |     |     |      |       |
|------|----------------------------|---|-----|-----|------|-------|
| PSRR | Ripple Rejection           | F=100Hz,<br>Ripple=0.5Vp-p<br>Vin=Set Vout+1V |     | 65  |      | dB    |
| Ilim | Short Current Limit        | Vout=0V                                       |     | 200 |      | mA    |
| Rpd  | CE Pull down<br>Resistance |   | 2.0 | 5.0 | 10.0 | MΩ    |
| Vceh | CE Input Voltage "H"       |   | 1.5 |     | Vin  | V     |
| Vcel | CE Input Voltage "L"       |   | 0   |     | 0.25 | V     |
| en   | Output Noise               | BW=10Hz~100kHz                                |     | 47  |      | uVrms |

$V_{drop} = V_{in1} - (V_{out2} * 0.98)$   $V_{out2}$  is the output voltage when  $V_{in} = V_{out1} + 1.0V$  and  $I_{out} = 300mA$  or  $I_{out} = 500mA$ .

$V_{in1}$  is the input voltage at which the output voltage becomes 98% of  $V_{out1}$  after gradually decreasing the input voltage.

### Typical Application Circuit



Application hints:

Note1: Input capacitor ( $C_{in} = 1\mu F$ ) is recommended in all application circuit.

Note2: Output capacitor ( $C_{out} = 3.3\mu F / 4.7\mu F$ ) is recommended in all application to assure the stability of circuit.

### Explanation :

ACE509 series is a group of positive voltage output, low noise, low power consumption, low dropout voltage regulator.

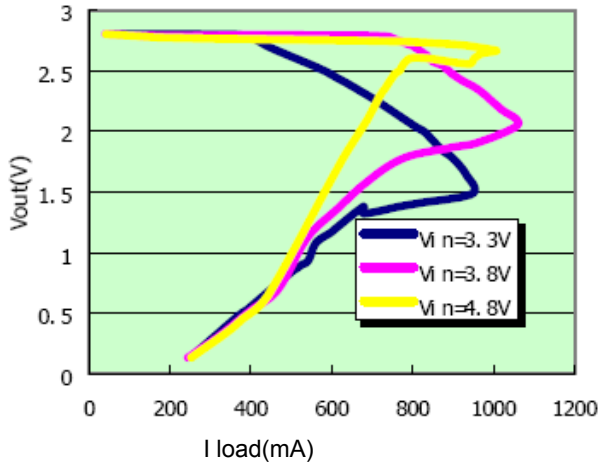
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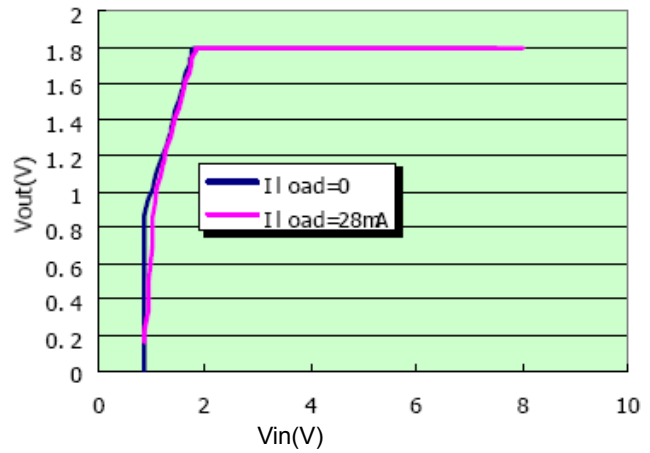
ACE509 has excellent load and line transient response and good temperature characteristics, which can assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within  $\pm 2\%$ .

### Typical Performance Characteristics

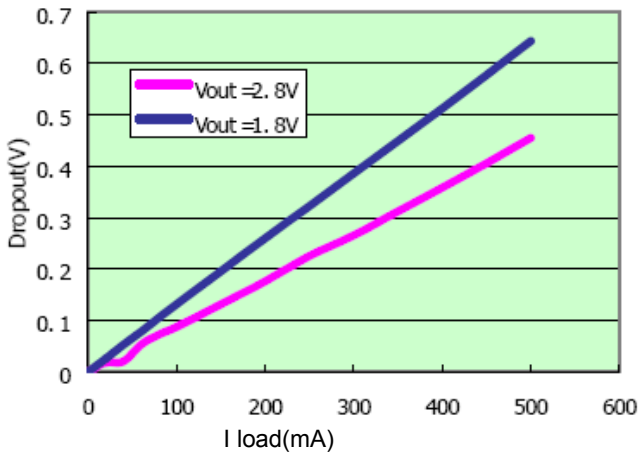
1. Output Voltage vs. Output Current  
(with output short protection)



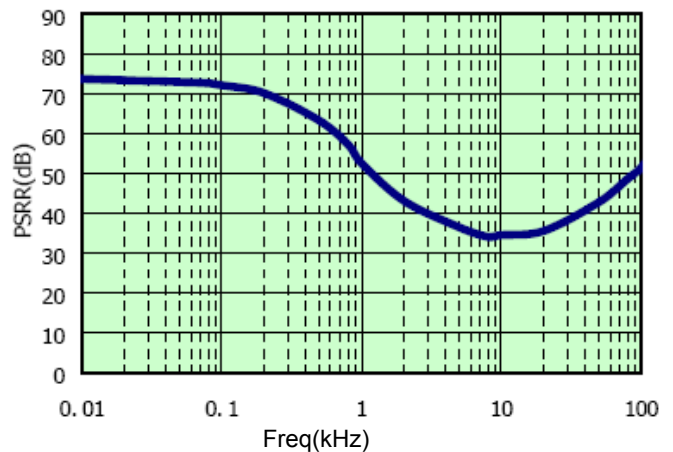
2. Output Voltage vs. Input Voltage



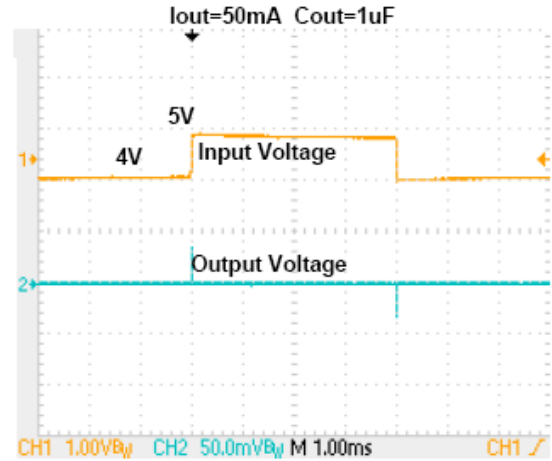
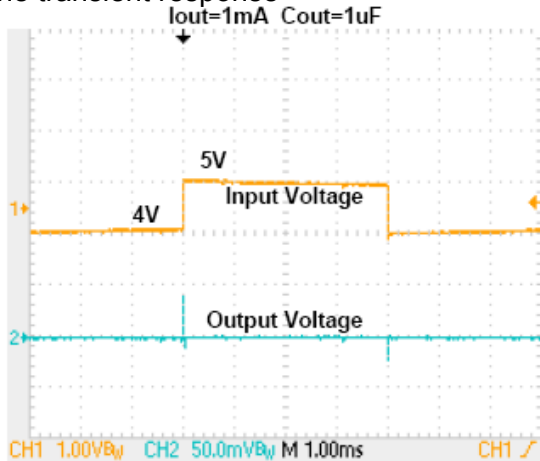
3. Dropout Voltage vs. Output Current



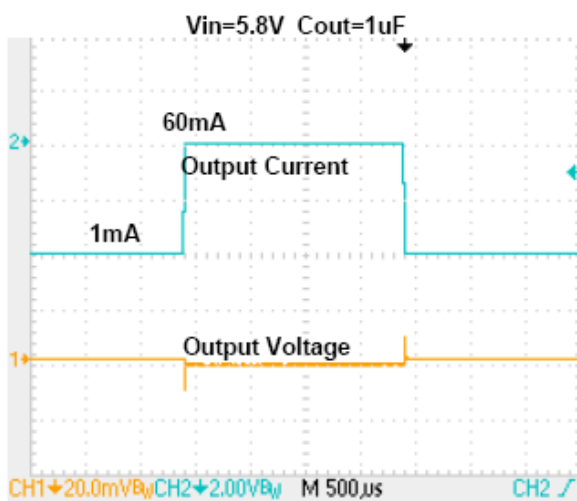
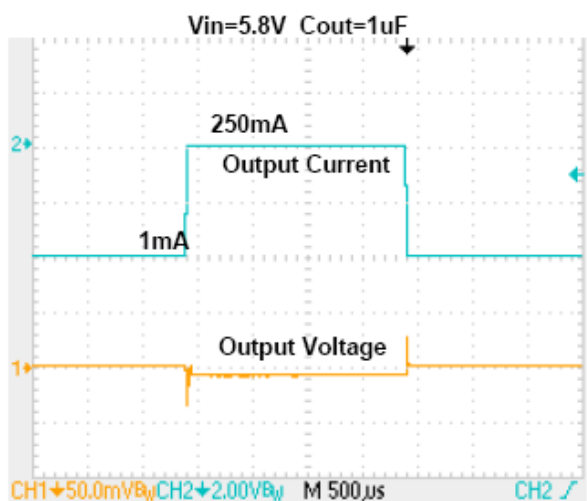
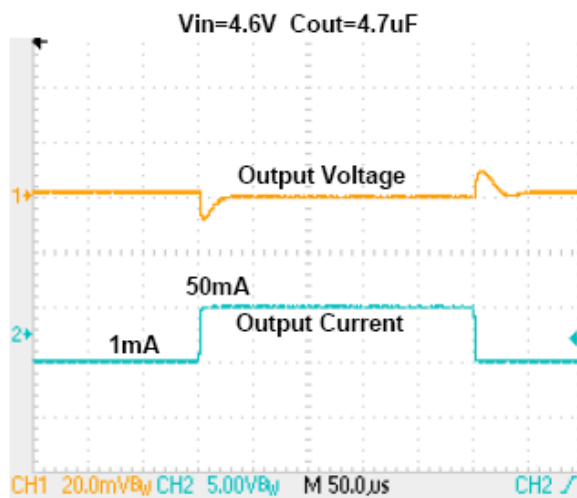
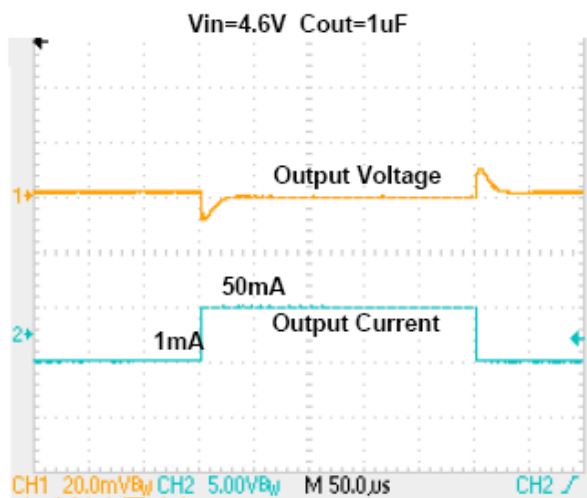
4. Ripple rejection vs. Frequency



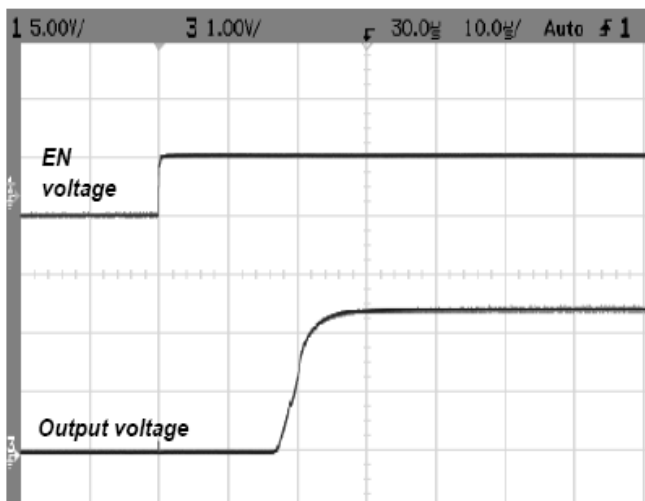
5. Line transient response



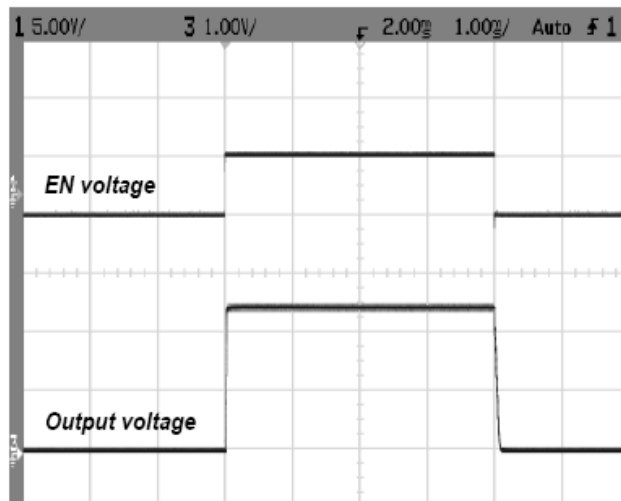
## 6. Load transient response



## 7. Startup response

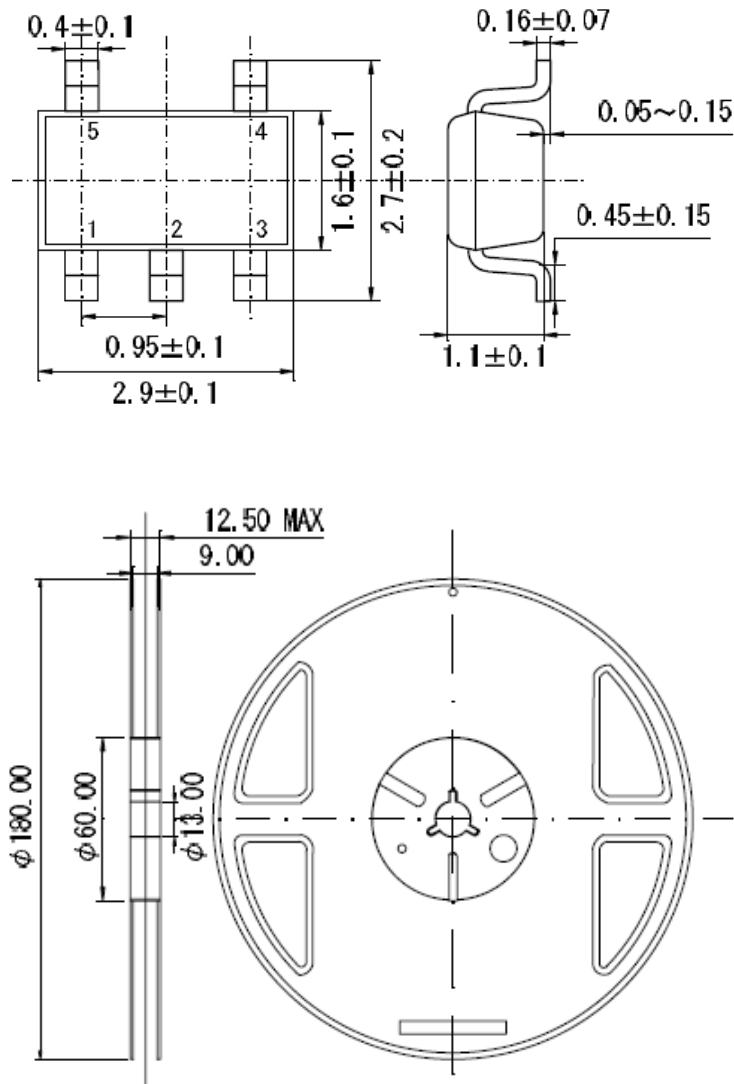


## 8. Shutdown response



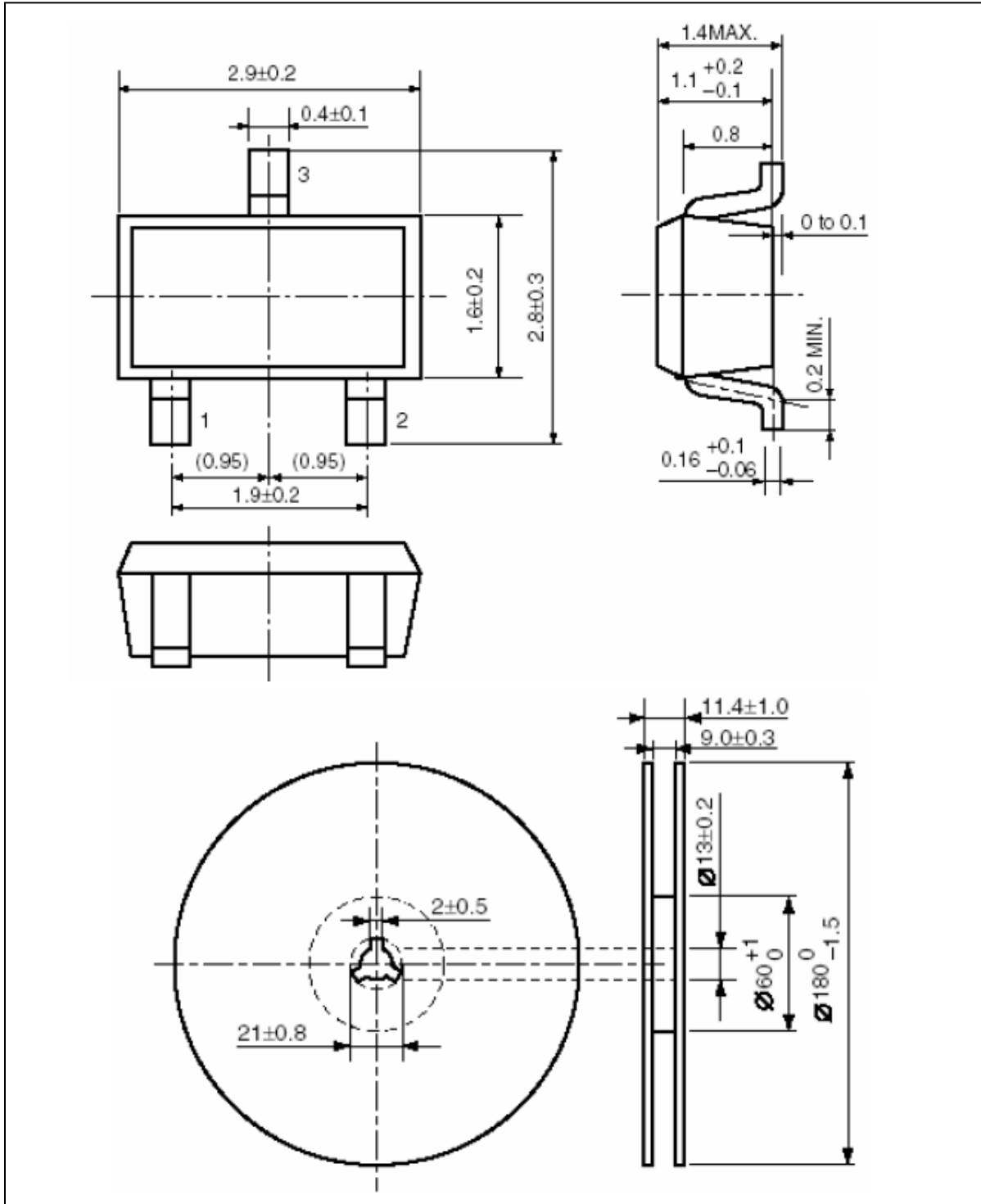
### Packing Information

#### SOT-23-5



### Packing Information

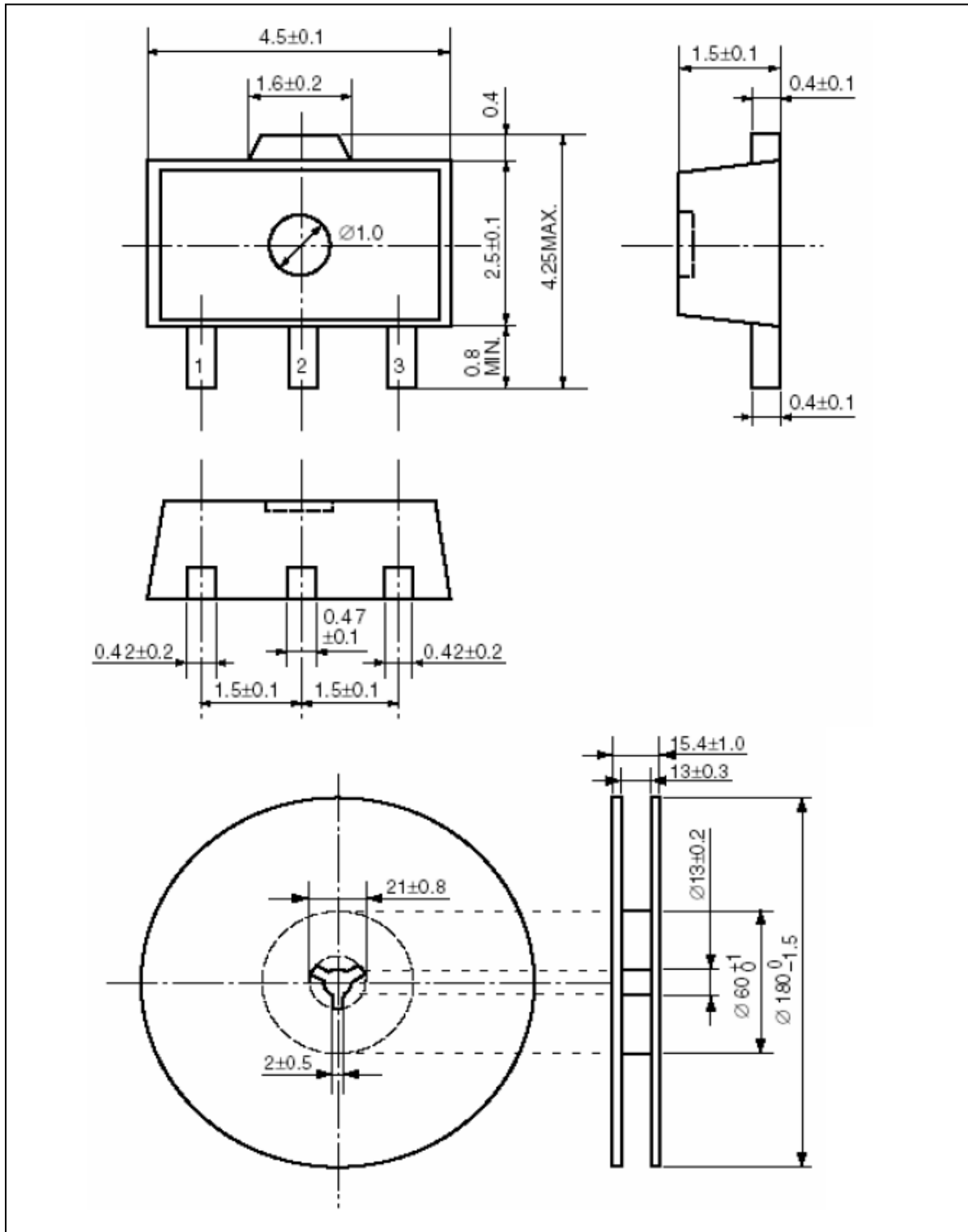
#### SOT-23-3





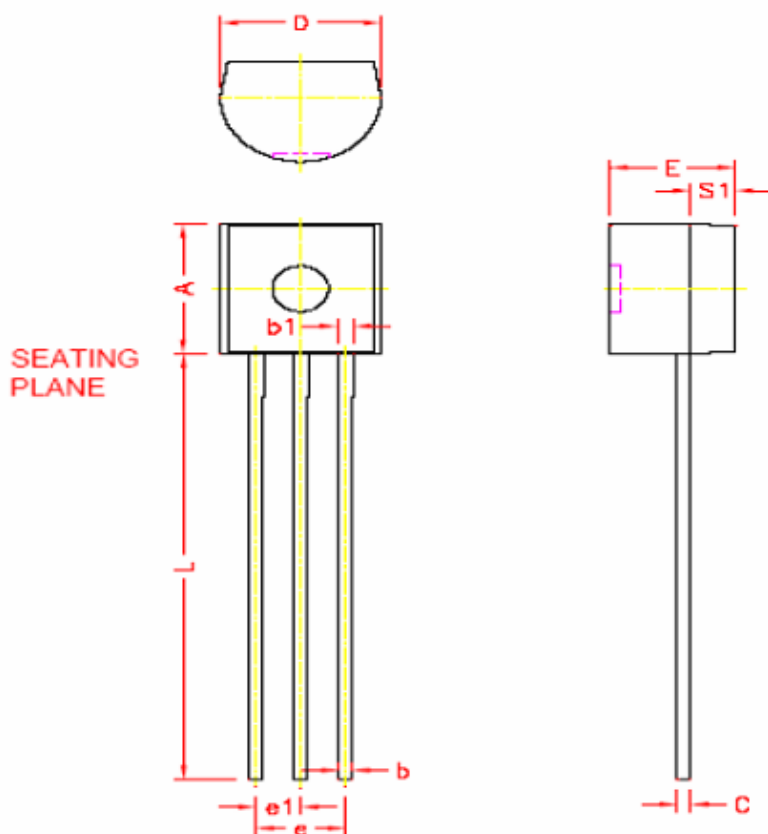
### Packing Information

#### SOT-89-3



### Packing Information

#### TO-92



| REF. | Millimeter |      | REF. | Millimeter |      |
|------|------------|------|------|------------|------|
|      | Min.       | Max. |      | Min.       | Max. |
| A    | 4.45       | 4.70 | D    | 4.44       | 4.7  |
| S1   | 1.02       | —    | E    | 3.30       | 3.81 |
| b    | 0.36       | 0.51 | L    | 12.70      | —    |
| b1   | 0.36       | 0.76 | e1   | 1.15       | 1.39 |
| C    | 0.36       | 0.51 | e    | 2.42       | 2.66 |
|      |            |      |      |            |      |

### Notes

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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 whose 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.

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