

## 40V, Low Power, High Accuracy, High PSRR LDO Regulators

### Description

The ME6233 series are high accuracy, CMOS LDO Voltage Regulators, offering low power, high ripple rejection ratio and low dropout. the ME6233 series is ideal for today's cutting edge mobile phone. Internally the ME6233 includes a reference voltage source, error amplifiers, driver transistors, current limiters and phase compensators. The ME6233's current limiters' foldback circuit also operates as a short protect for the output current limiter and the output pin. The ME6233 series is also fully compatible with low ESR ceramic capacitors, reducing cost and improving output stability. This high level of output stability is maintained even during frequent load fluctuations, due to the excellent transient response performance and high PSRR achieved across a broad range of frequencies. The CE function allows the output of regulator to be turned off, resulting in greatly reduced power consumption.

### Applications

- Mobile phones
- Cordless phones, radio communication equipment
- Portable games
- Cameras, Video cameras
- Reference voltage sources
- Battery powered equipment

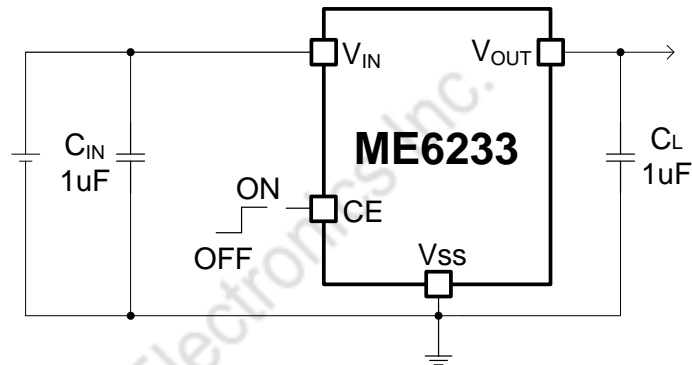
### Feature

- Maximum Output Current: 100mA  
( $V_{IN}=4.5V, V_{OUT}=3.3V$ )
- Dropout Voltage: 116mV@ $I_{OUT}=10mA$  ( $V_{OUT}=3.3V$ )
- Operating Voltage Range: 4.5V~40V
- Output Voltage Range: 1.6V~12.0V
- Highly Accuracy:  $\pm 1\%$
- Low Power Consumption: 3.5uA (TYP.)
- Standby Current: 0.4 uA (TYP.)
- High Ripple Rejection: 61dB@1KHz (ME6233C33)
- Line Regulation: 0.035%/V (TYP.)
- Built-in temperature protection and current limiting protection

### Package

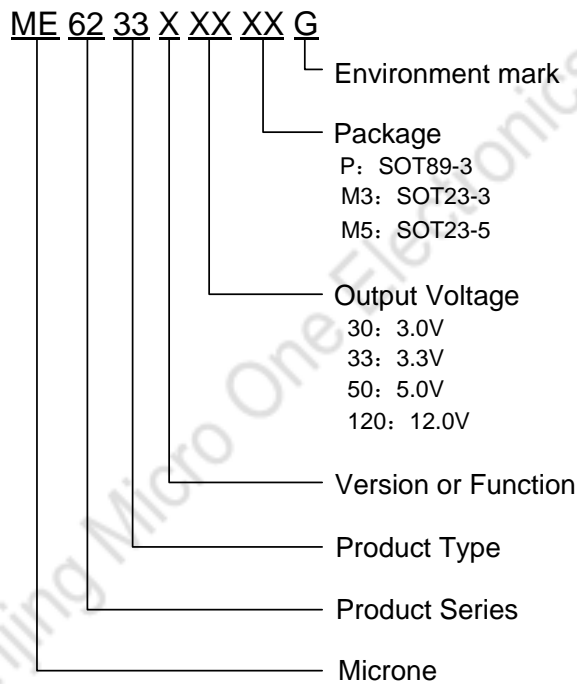
- 3-pin SOT23-3、SOT89-3
- 5-pin SOT23-5

## Typical Application Circuit



**Note:** Ceramic capacitor with X7R and X5R offer improved voltage and temperature coefficients. 10uF Ceramic capacitor is recommended for excellent load transient response and line transient response.

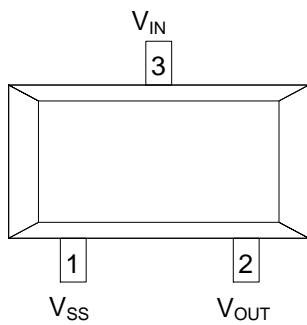
## Selection Guide



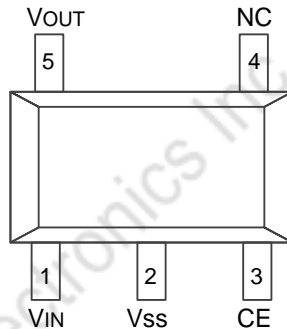
| product serie | Product Function                                      |
|---------------|---|
| ME6233A30M3G  | $V_{OUT}=3.0V$ ; Package: SOT23-3                     |
| ME6233A33PG   | $V_{OUT}=3.3V$ ; Package: SOT89-3                     |
| ME6233A50M3G  | $V_{OUT}=5.0V$ ; Package: SOT23-3                     |
| ME6233A50PG   | $V_{OUT}=5.0V$ ; Package: SOT89-3                     |
| ME6233A120PG  | $V_{OUT}=12.0V$ ; Package: SOT89-3                    |
| ME6233C30M5G  | Enable can be set; $V_{OUT}=3.0V$ ; Package: SOT23-5  |
| ME6233C33M5G  | Enable can be set; $V_{OUT}=3.3V$ ; Package: SOT23-5  |
| ME6233C50M5G  | Enable can be set; $V_{OUT}=5.0V$ ; Package: SOT23-5  |
| ME6233C120M5G | Enable can be set; $V_{OUT}=12.0V$ ; Package: SOT23-5 |

**NOTE:** If you need other voltage and package, please contact our sales staff.

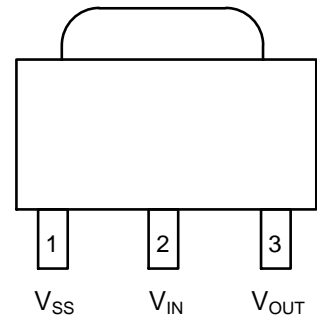
## Pin Configuration (Top View)



SOT23-3



SOT23-5

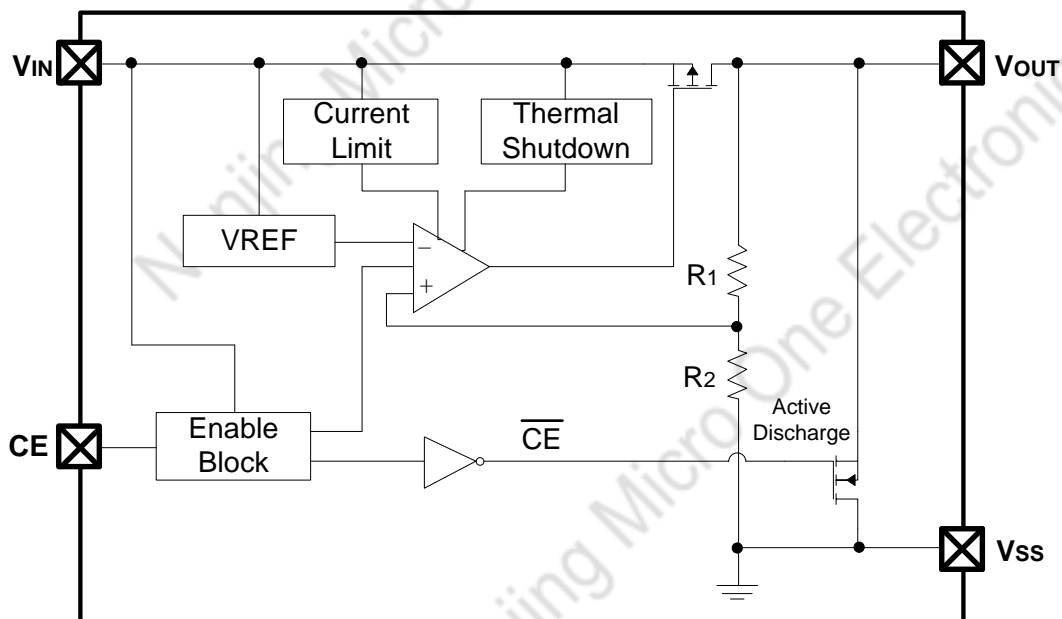


SOT89-3

## Pin Assignment

| PIN Number (SOT23-3) | PIN Number (SOT23-5) | PIN Number (SOT89-3) | symbol           | Function       |
|----------------------|----------------------|----------------------|------------------|----------------|
| 3                    | 1                    | 2                    | V <sub>IN</sub>  | Power Input    |
| 1                    | 2                    | 1                    | V <sub>SS</sub>  | Ground         |
| -                    | 3                    | -                    | CE               | ON/OFF Control |
| -                    | 4                    | -                    | NC               | No Connect     |
| 2                    | 5                    | 3                    | V <sub>OUT</sub> | Output         |

## Block Diagram



## Absolute Maximum Ratings

| Parameter   | Symbol    | Ratings                          | Units              |
|---|-----------|----------------------------------|--------------------|
| Input Voltage   | $V_{IN}$  | -0.3 ~ 40                        | V                  |
| CE Pin Voltage  | $V_{CE}$  | $V_{IN} - 0.3 \sim V_{IN} + 0.3$ | V                  |
| $V_{OUT}$ Voltage                                       | $V_{OUT}$ | $V_{IN} - 0.3 \sim V_{IN} + 0.3$ | V                  |
| $V_{OUT}$ Current                                       | $I_{OUT}$ | 300                              | mA                 |
| Internal Power Dissipation ( $T_A = 25^\circ\text{C}$ ) | SOT23-3   | 0.54                             | W                  |
|   | SOT23-5   | 0.6                              |                    |
|   | SOT89-3   | 1.25                             |                    |
| Thermal resistance (Junction to air)                    | SOT23-3   | 230                              | $^\circ\text{C/W}$ |
|   | SOT23-5   | 210                              |                    |
|   | SOT89-3   | 100                              |                    |
| Operating Ambient Temperature Range                     | $T_{Opr}$ | -40~+85                          | $^\circ\text{C}$   |
| Storage Temperature Range                               | $T_{stg}$ | -55~+150                         | $^\circ\text{C}$   |
| Maximum junction temperature                            | $T_J$     | -40~+150                         | $^\circ\text{C}$   |

## Electrical Characteristic

( $V_{IN} = V_{OUT} + 1.5\text{V}$ ,  $V_{CE} = V_{IN}$ ,  $C_{IN} = C_L = 1\mu\text{F}$ ,  $T_a = 25^\circ\text{C}$ , unless otherwise noted)

| Parameter                          | Symbol   | Conditions   | Min.   | Typ.                     | Max.   | Units         |
|------------------------------------|--|--|--------|--------------------------|--------|---------------|
| Operating Input Voltage            | $V_{IN}$   |  | 4.5    | -                        | 40     | V             |
| Output Voltage                     | $V_{OUT(E)}$<br>(Note 2)                             | $I_{OUT} = 10\text{mA}$ , $V_{IN} = V_{OUT} + 2\text{V}$                       | X 0.99 | $V_{OUT(T)}$<br>(Note 1) | X 1.01 | V             |
| Maximum Output Current             | $I_{OUTMAX}$   | $V_{IN} = V_{OUT} + 2\text{V}$   | -      | 100                      | -      | mA            |
| Load Regulation                    | $\Delta V_{OUT}$                                     | $V_{IN} = V_{OUT} + 2\text{V}$ , $1\text{mA} \leq I_{OUT} \leq 100\text{mA}$   | -      | 11                       | -      | mV            |
| Dropout Voltage<br>(Note 3)        | $V_{DIF}$  | $I_{OUT} = 10\text{mA}$  | -      | 0.116                    | -      | V             |
|                                    |  | $I_{OUT} = 50\text{mA}$  | -      | 0.577                    | -      |               |
|                                    |  | $I_{OUT} = 100\text{mA}$   | -      | 1.198                    | -      |               |
| Supply Current                     | $I_{SS}$   | $V_{IN} = V_{OUT} + 2\text{V}$ $V_{OUT} < 8\text{V}$                           | -      | 3.5                      | 6      | $\mu\text{A}$ |
|                                    |  | $V_{IN} = V_{OUT} + 2\text{V}$ $8 \leq V_{OUT} \leq 12\text{V}$                | -      | 5                        | 7      |               |
| Stand-by Current                   | $I_{CEL}$  | $V_{CE} = 0\text{V}$   | -      | 0.4                      | 1      | $\mu\text{A}$ |
| Line Regulation                    | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $I_{OUT} = 10\text{mA}$ ,<br>$V_{OUT} + 2\text{V} \leq V_{IN} \leq 40\text{V}$ | -      | 0.01                     | -      | %/V           |
| Output Current Limit               | $I_{LIM}$  | Peak Output Current  | -      | 211                      | -      | mA            |
| CE "High" Voltage                  | $V_{CEH}$  | Start up   | 0.9    | -                        | -      | V             |
| CE "Low" Voltage                   | $V_{CEL}$  | Shut down  | -      | -                        | 0.7    | V             |
| Active Output Discharge Resistance | $R_{DIS}$  | $V_{CE} < 0.5\text{V}$   | -      | 1600                     | -      | $\Omega$      |
| Ripple Rejection                   | PSRR   | $V_{IN} = 5\text{V} + 1\text{V}_{rmsAC}$ , $f = 100\text{Hz}$                  | -      | 63                       | -      | dB            |

|                                      |                 |   |           |   |     |   |             |
|--------------------------------------|-----------------|---|-----------|---|-----|---|-------------|
| Rate(Note 4)                         |                 | $I_{OUT}=10mA$                            | $f=1kHz$  | - | 61  | - |             |
|                                      |                 |   | $f=10kHz$ | - | 45  | - |             |
| Thermal Shutdown Temperature(Note 4) | $T_{SD}$        | Temperature increasing,<br>$I_{OUT}=10mA$ |           | - | 151 | - | $^{\circ}C$ |
| Thermal Shutdown Hysteresis(Note 4)  | $\Delta T_{SD}$ | Temperature falling                       |           | - | 25  | - | $^{\circ}C$ |

### NOTES:

- $V_{OUT}(T)$  : Specified Output Voltage
- $V_{OUT}(E)$  : Effective Output Voltage ( i.e. The output voltage when " $V_{OUT}(T)+1.0V$ " is provided at the Vin pin while maintaining a certain Iout value.)
- $V_{DIF}$ :  $V_{IN1} - V_{OUT}(E)'$   
 $V_{IN1}$  : The input voltage when  $V_{OUT}(E)'$  appears as input voltage is gradually decreased.  
 $V_{OUT}(E)'$  = A voltage equal to 98% of the output voltage whenever an amply stabilized Iout { $V_{OUT}(T)+1.0V$ } is input.
- guaranteed by design.

## Typical Performance Characteristics

**ME6233C33M5G** ( $V_{CE} = V_{IN}, T_a=25^{\circ}C$ ,  $C_{IN}=C_L=1\mu F$ , unless otherwise noted.)

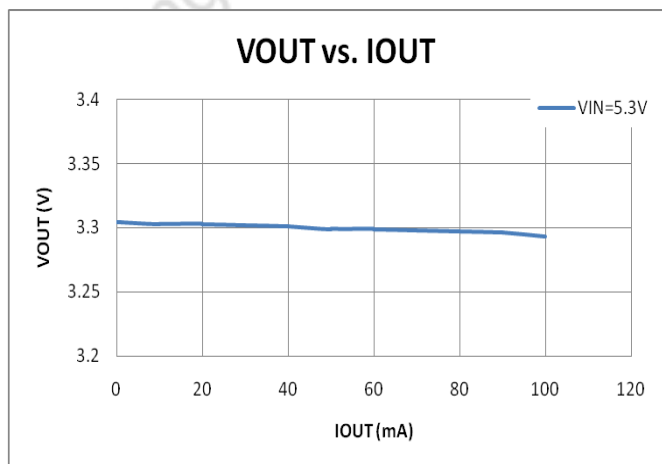


Figure 1. Output Voltage vs. Output Current

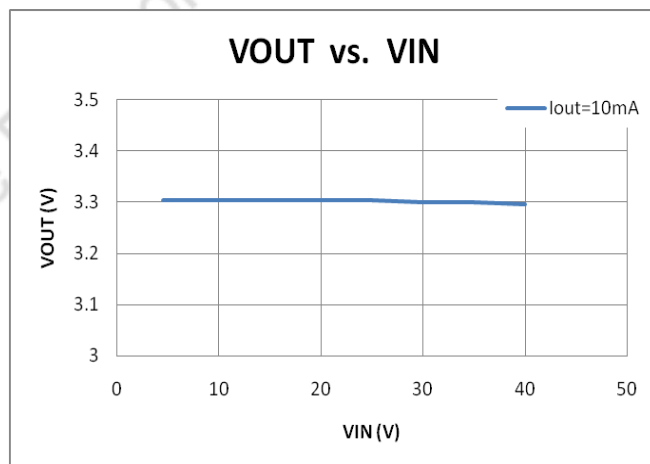


Figure 2. Output Voltage vs. Input Voltage

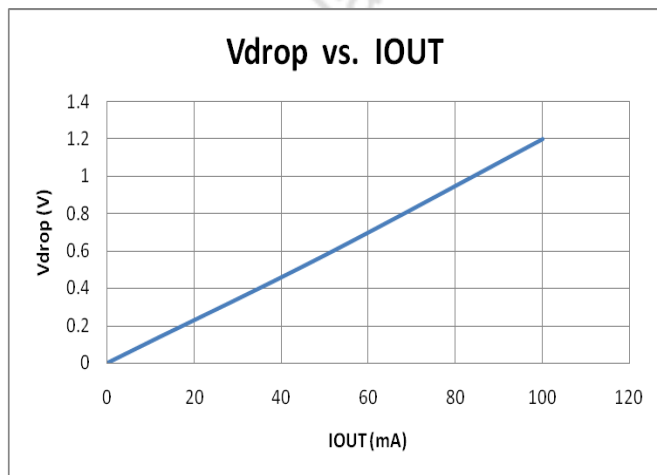


Figure 3. Dropout Voltage vs. Output Current

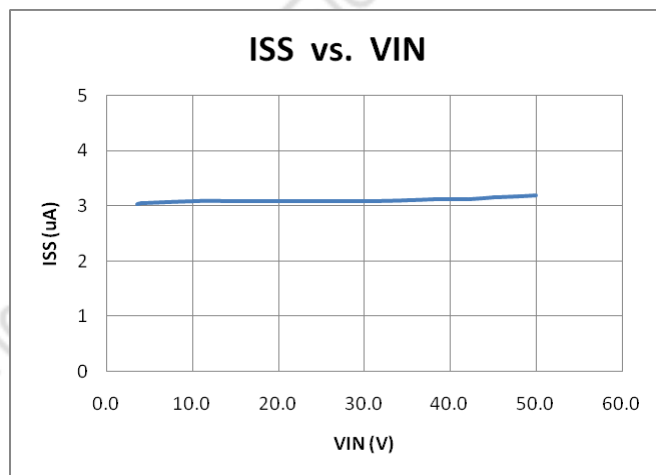


Figure 4. Quiescent Current vs. Input Voltage

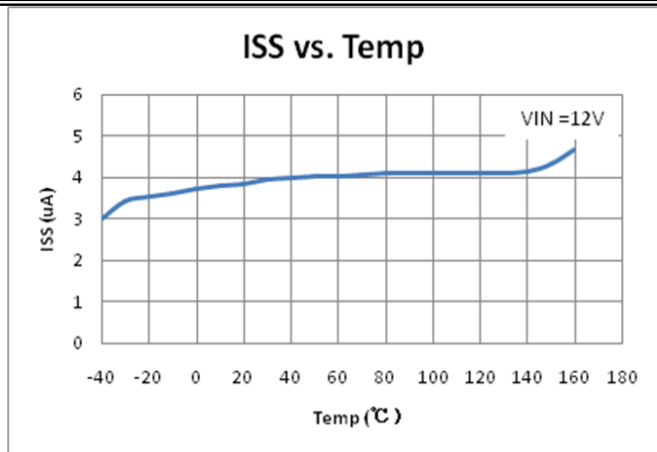


Figure 5. Quiescent Current vs. Temperature

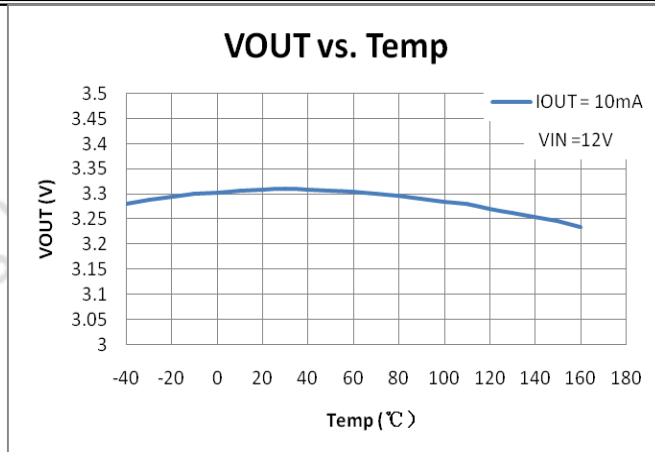


Figure 6. Output Voltage vs. Temperature

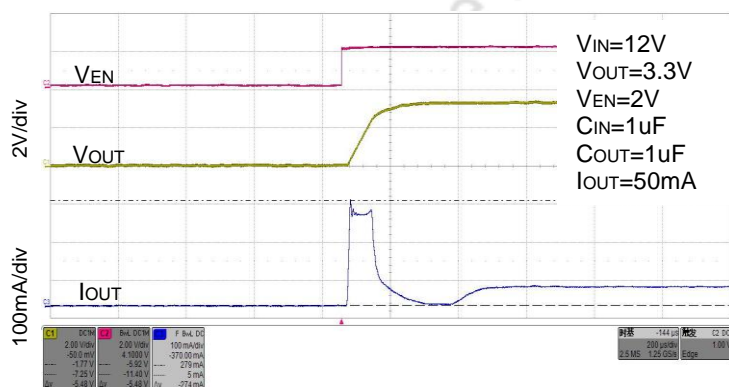


Figure 7. Enable Turn-on Response

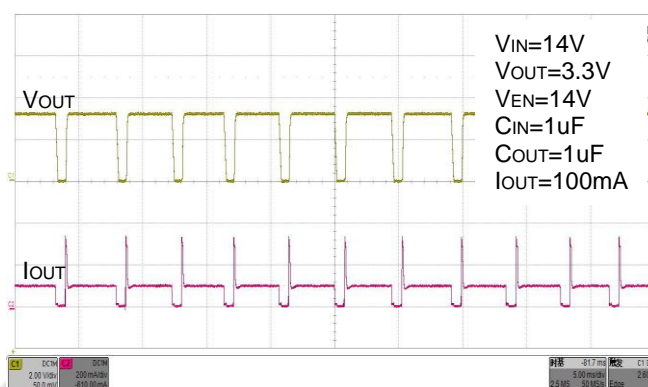


Figure 8. Thermal Shutdown

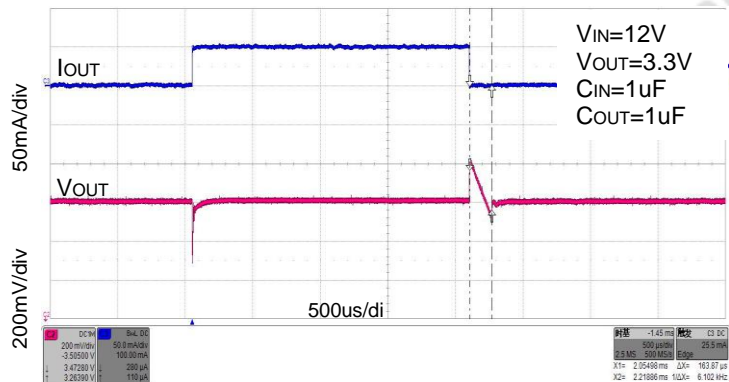


Figure 9. Load Transient Response  
IOUT=1mA to 50mA

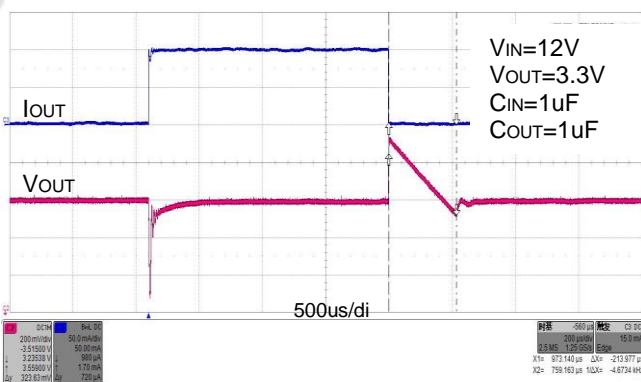


Figure 10. Load Transient Response  
IOUT=10mA to 100mA

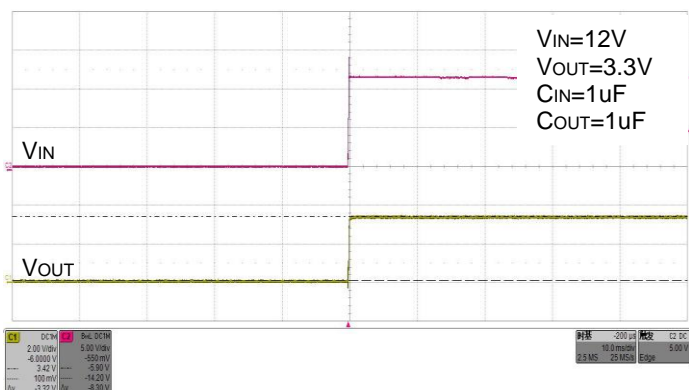


Figure 11. Single Hot plug and hot Un-plug

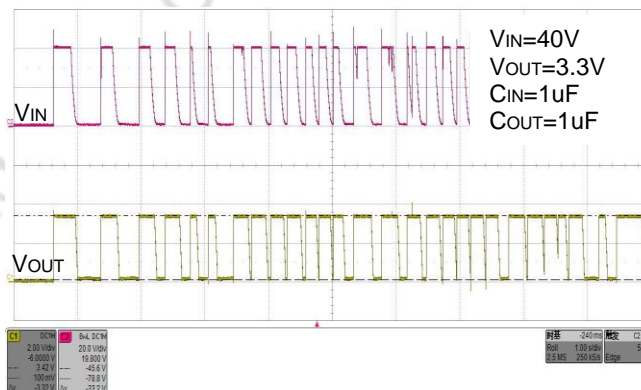
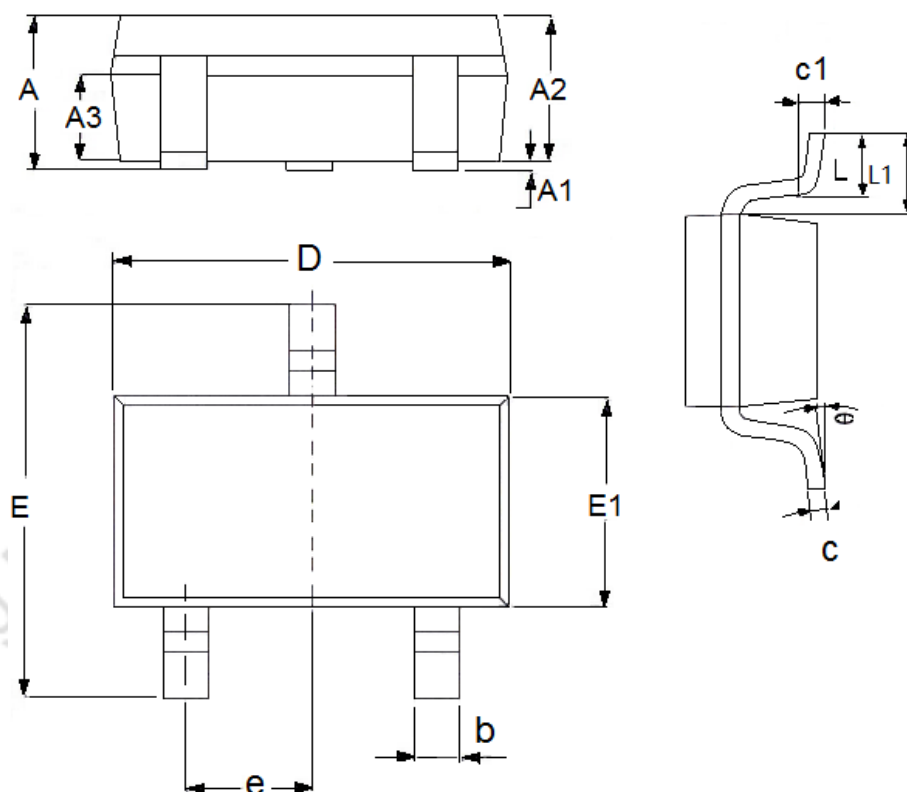


Figure 12. Continuous Hot plug and hot Un-plug

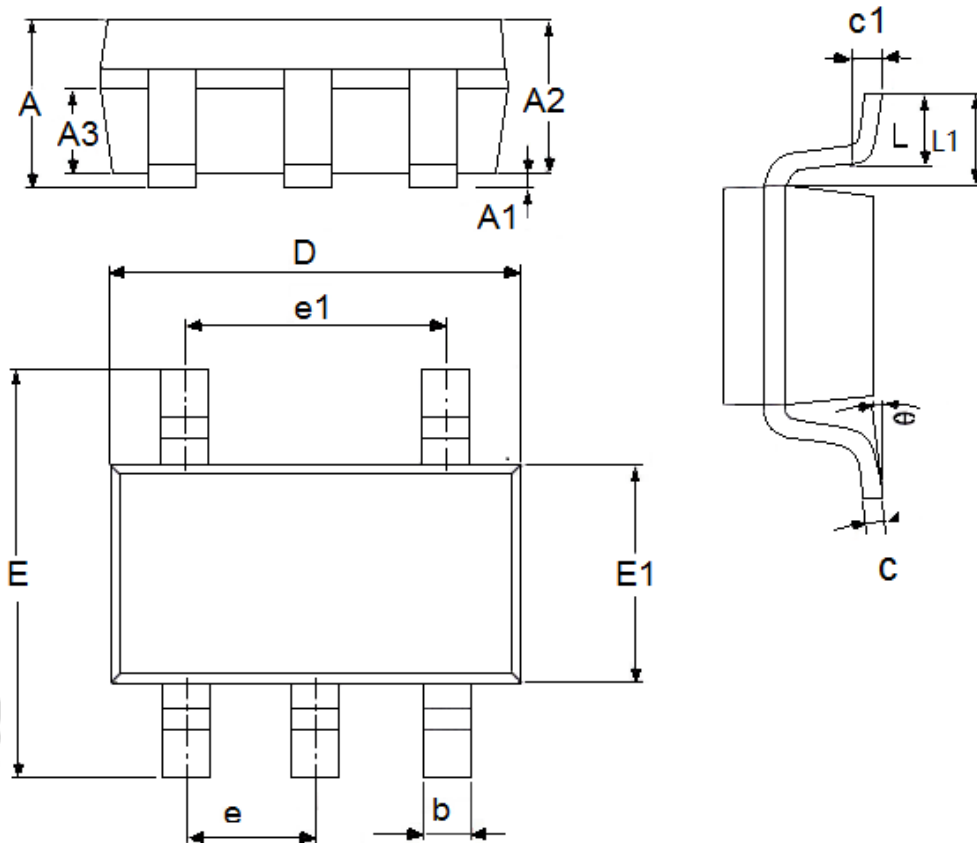
## Packaging Information

- Package Type:SOT23-3



| DIM | Millimeters |      | Inches      |        |
|-----|-------------|------|-------------|--------|
|     | Min         | Max  | Min         | Max    |
| A   | 1.05        | 1.45 | 0.0413      | 0.0571 |
| A1  | 0           | 0.15 | 0.0000      | 0.0059 |
| A2  | 0.9         | 1.3  | 0.0354      | 0.0512 |
| A3  | 0.6         | 0.7  | 0.0236      | 0.0276 |
| b   | 0.25        | 0.5  | 0.0098      | 0.0197 |
| c   | 0.1         | 0.25 | 0.0039      | 0.0098 |
| D   | 2.8         | 3.1  | 0.1102      | 0.1220 |
| E   | 2.6         | 3.1  | 0.1023      | 0.1220 |
| E1  | 1.5         | 1.8  | 0.0591      | 0.0709 |
| e   | 0.95(TYP)   |      | 0.0374(TYP) |        |
| L   | 0.25        | 0.6  | 0.0098      | 0.0236 |
| L1  | 0.59(TYP)   |      | 0.0232(TYP) |        |
| θ   | 0           | 8°   | 0.0000      | 8°     |
| c1  | 0.2(TYP)    |      | 0.0079(TYP) |        |

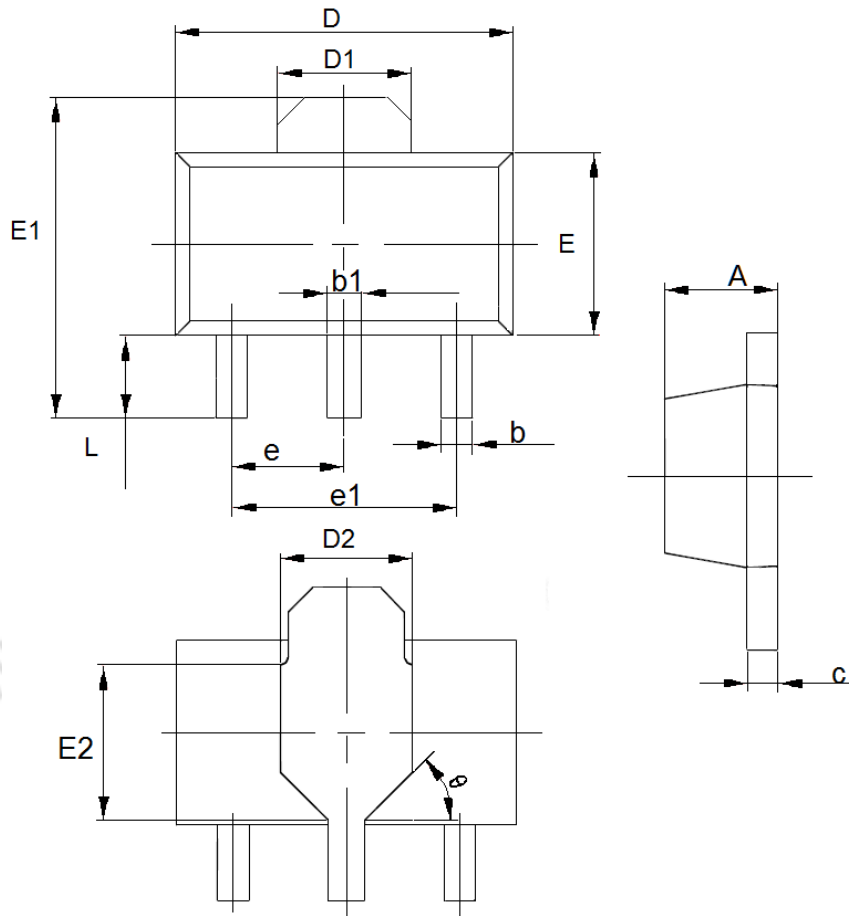
● Package Type:SOT23-5



| DIM | Millimeters |      | Inches      |        |
|-----|-------------|------|-------------|--------|
|     | Min         | Max  | Min         | Max    |
| A   | 1.05        | 1.45 | 0.0413      | 0.0571 |
| A1  | 0           | 0.15 | 0.0000      | 0.0059 |
| A2  | 0.9         | 1.3  | 0.0354      | 0.0512 |
| A3  | 0.6         | 0.7  | 0.0236      | 0.0276 |
| b   | 0.25        | 0.5  | 0.0098      | 0.0197 |
| c   | 0.1         | 0.23 | 0.0039      | 0.0091 |
| D   | 2.82        | 3.05 | 0.1110      | 0.1201 |
| e1  | 1.9(TYP)    |      | 0.0748(TYP) |        |
| E   | 2.6         | 3.05 | 0.1024      | 0.1201 |
| E1  | 1.5         | 1.75 | 0.0512      | 0.0689 |
| e   | 0.95(TYP)   |      | 0.0374(TYP) |        |
| L   | 0.3         | 0.6  | 0.0118      | 0.0236 |
| L1  | 0.59(TYP)   |      | 0.0232(TYP) |        |
| θ   | 0           | 8°   | 0.0000      | 8°     |
| c1  | 0.2(TYP)    |      | 0.0079(TYP) |        |



● Package Type: SOT89-3



| DIM      | Millimeters |      | Inches      |        |
|----------|-------------|------|-------------|--------|
|          | Min         | Max  | Min         | Max    |
| A        | 1.4         | 1.6  | 0.0551      | 0.0630 |
| b        | 0.32        | 0.52 | 0.0126      | 0.0205 |
| b1       | 0.4         | 0.58 | 0.0157      | 0.0228 |
| c        | 0.35        | 0.45 | 0.0138      | 0.0177 |
| D        | 4.4         | 4.6  | 0.1732      | 0.1811 |
| D1       | 1.55(TYP)   |      | 0.061(TYP)  |        |
| D2       | 1.75(TYP)   |      | 0.0689(TYP) |        |
| e1       | 3.0(TYP)    |      | 0.1181(TYP) |        |
| E        | 2.3         | 2.6  | 0.0906      | 0.1023 |
| E1       | 3.94        | 4.4  | 0.1551      | 0.1732 |
| E2       | 1.9(TYP)    |      | 0.0748(TYP) |        |
| e        | 1.5(TYP)    |      | 0.0591(TYP) |        |
| L        | 0.8         | 1.2  | 0.0315      | 0.0472 |
| $\theta$ | 45°         |      | 45°         |        |

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