

## 1.0A Adjustable Voltage High Speed LDO Regulators ME1117 Series

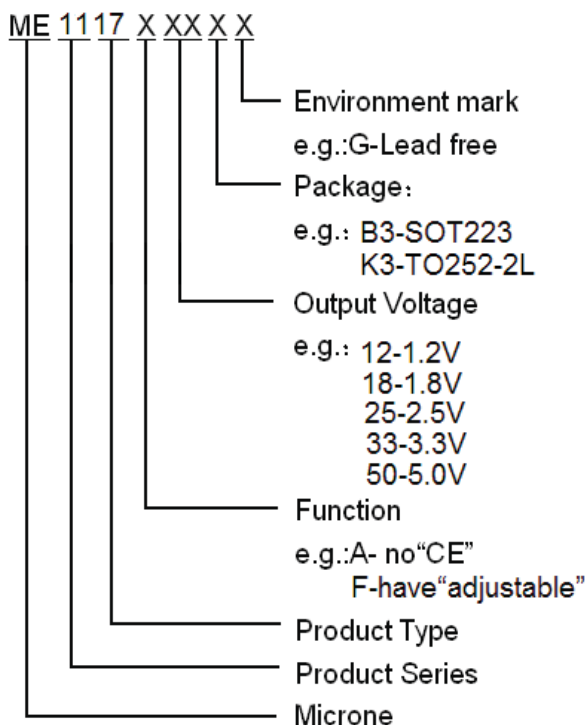
### General Description

The ME1117 series are highly accurate, low noise, LDO Voltage Regulators that are capable of providing an output current that is in excess of 1.0 A with a maximum dropout voltage of 1.3 V at 1.0A. This series contains six fixed output voltages of 1.2 V, 1.8 V, 2.5 V, 3.3 V, and 5.0 V that have no minimum load requirement to maintain regulation. Also included is an adjustable output version that can be programmed from 1.25 V to 15 V with two external resistors. On chip trimming adjusts the reference/output voltage to within  $\pm 2.0\%$  accuracy. Internal protection features consist of output current limiting, safe operating area compensation, and thermal shutdown. The ME1117 series can operate with up to 15 V input. Devices are available in SOT223, TO252-2L .

### Features

- Output Current in Excess of 1.0A
- Dropout Voltage: 1V@ I<sub>OUT</sub> =100mA
- Operating Voltage Range:  
4.8V~15V (ME1117A33)
- Highly Accuracy:  $\pm 2\%$
- Adjustable Output Voltage Option
- Standby Current: 3mA (TPY.)
- High Ripple Rejection: 60dB@1KHz(ME1117A33)
- Line Regulation: 0.1% (TYP.)
- Temperature Stability  $\leq 0.5\%$
- Current Limit (1.3A)
- Thermal Shutdown Protection (160°C)
- Small Packages: SOT223、TO252-2L

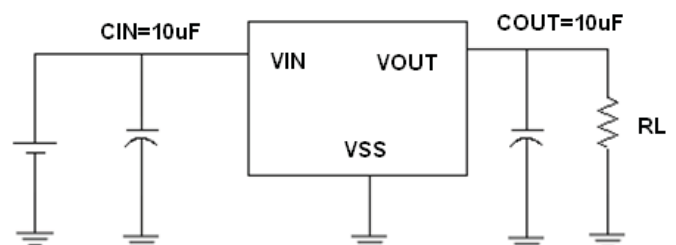
### Selection Guide



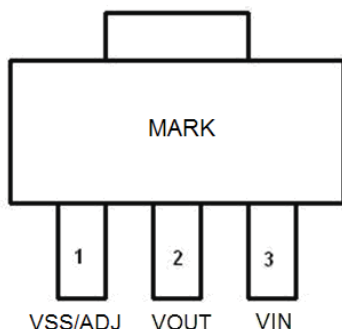
### Typical Application

- Consumer and Industrial Equipment Point of Regulation
- Switching Power Supply Post Regulation
- Hard Drive Controllers
- Battery Chargers

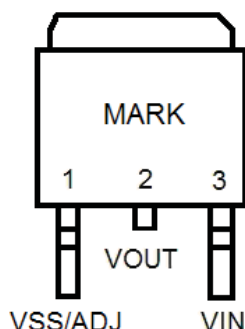
### Typical Application Circuit



## Pin Configuration



SOT223



TO252-2L

## Pin Assignment

ME1117AXX

| Pin Number | Pin Name  | Functions   |
|------------|-----------|-------------|
| 1          | $V_{SS}$  | Ground      |
| 2          | $V_{OUT}$ | Output      |
| 3          | $V_{IN}$  | Power Input |

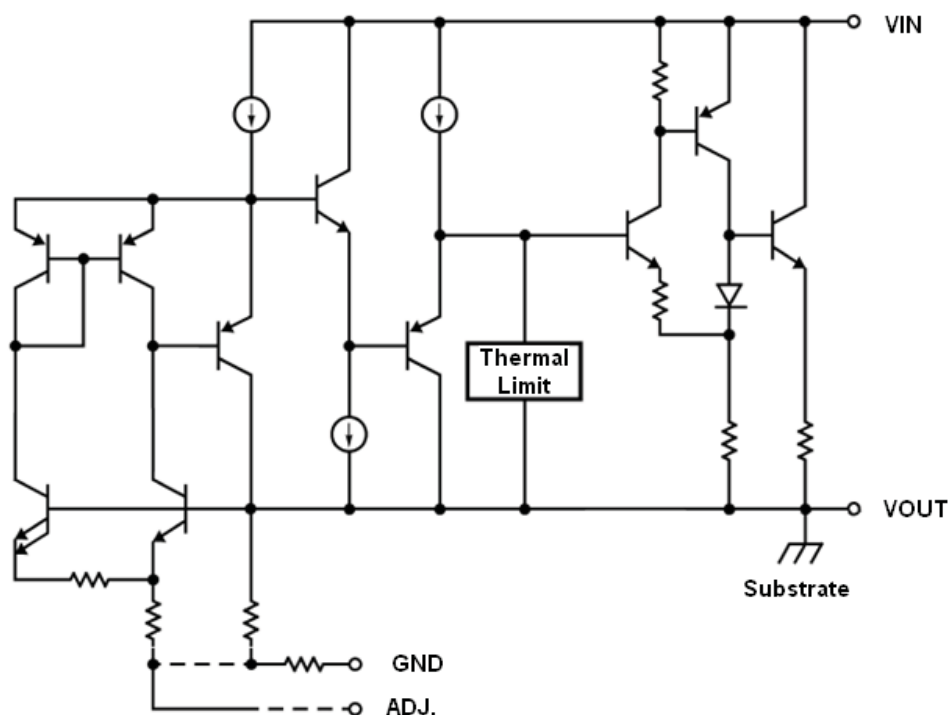
ME1117F

| Pin Number | Pin Name  | Functions         |
|------------|-----------|-------------------|
| 1          | $V_{ADJ}$ | Adjustable Output |
| 2          | $V_{OUT}$ | Output            |
| 3          | $V_{IN}$  | Power Input       |

## Absolute Maximum Ratings

| Parameter   | Symbol    | Ratings                        | Units                 |
|---|-----------|--------------------------------|-----------------------|
| Input Voltage   | $V_{IN}$  | 20                             | V                     |
| Output Current  | $I_{OUT}$ | 1.3                            | A                     |
| Output Voltage  | $V_{OUT}$ | $V_{SS}-0.3 \sim V_{IN} + 0.3$ | V                     |
| Power Dissipation   | SOT223    | $P_D$                          | 750                   |
|   | TO252-2L  |                                | 2000                  |
| Operating Temperature Range   | $T_{OPR}$ | $-40 \sim +125$                | $^{\circ}C$           |
| Storage Temperature Range   | $T_{STG}$ | $-40 \sim +150$                | $^{\circ}C$           |
| Junction Temperature Range  | $T_J$     | $0 \sim +150$                  | $^{\circ}C$           |
| Lead Temperature  | SOT223    |                                | $260^{\circ}C, 4sec$  |
|   | TO252-2L  |                                | $260^{\circ}C, 10sec$ |
| Thermal Resistance<br>Junction-to-Case                                      | SOT223    |                                | 15                    |
|   | TO252-2L  |                                | 10                    |
| Thermal Resistance<br>Junction-to-Ambient<br>(No heat sink;<br>No air flow) | SOT223    |                                | 136                   |
|   | TO252-2L  |                                | 92                    |

## Block Diagram



## Electrical Characteristics

### ME1117F

( $V_{IN} = V_{OUT} + 1.5V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                 | Symbol                | Conditions   | Min.                           | Typ.         | Max.                           | Units      |
|---------------------------|-----------------------|--|--------------------------------|--------------|--------------------------------|------------|
| Reference Voltage         | $V_{REF}$             | $V_{IN} = V_{OUT} + 1.5V$ , $I_{OUT} = 10mA$<br>$10mA \leq I_{OUT} \leq 1A$ ,<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$ | $\times 0.98$<br>$\times 0.98$ | 1.25<br>1.25 | $\times 1.02$<br>$\times 1.02$ | V          |
| Maximum Output Current    | $I_{OUTMAX}$          | $V_{IN} = V_{OUT} + 1.5V$  |                                | 1000         |                                | mA         |
| Minimum Output Current    | $I_{OUTMIN}$          | $V_{IN} = V_{OUT} + 1.5V$  |                                | 2            |                                | mA         |
| Line Regulation           | $\Delta V_{REF-LINE}$ | $I_{OUT} = 10mA$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$  |                                | 0.03         | 0.2                            | %          |
| Load Regulation           | $\Delta V_{REF-LOAD}$ | $V_{IN} = V_{OUT} + 1.5V$ , $0mA \leq I_{OUT} \leq 1A$   |                                | 0.2          | 0.4                            | %          |
| Adjustment Pin Current    | $I_{ADJ}$             | $V_{IN} = V_{OUT} + 1.5V$  |                                | 12           | 30                             | $\mu A$    |
| Adjust Pin Current Change |                       | $10mA \leq I_{OUT} \leq 1A$ ,<br>$1.5V \leq V_{IN} - V_{OUT} \leq 15V$   |                                | 0.2          | 5                              | $\mu A$    |
| Thermal Shutdown          |                       | Junction Temperature   |                                | 150          |                                | $^\circ C$ |

## ME1117A12

( $V_{IN} = V_{OUT} + 1.5V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                | Symbol                | Conditions   | Min.                           | Typ.       | Max.                           | Units      |
|--------------------------|-----------------------|--|--------------------------------|------------|--------------------------------|------------|
| Output Voltage           | $V_{OUT}$             | $I_{OUT} = 10mA, V_{IN} = V_{OUT} + 1.5V$<br>$10mA \leq I_{OUT} \leq 1A,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$ | $\times 0.98$<br>$\times 0.98$ | 1.2<br>1.2 | $\times 1.02$<br>$\times 1.02$ | V          |
| Maximum Output Current   | $I_{OUTMAX}$          | $V_{IN} = V_{OUT} + 1.5V$  |                                | 1000       |                                | mA         |
| Load Regulation          | $\Delta V_{OUT-LOAD}$ | $V_{IN} = V_{OUT} + 1.5V, 0mA \leq I_{OUT} \leq 1A$  |                                | 2          | 15                             | mV         |
| Dropout Voltage (Note 1) | $V_{DIF1}$            | $I_{OUT} = 100mA$  |                                | 1.05       | 1.10                           | V          |
|                          | $V_{DIF2}$            | $I_{OUT} = 500mA$  |                                | 1.20       | 1.30                           | V          |
|                          | $V_{DIF3}$            | $I_{OUT} = 1A$   |                                | 1.30       | 1.40                           | V          |
| Quiescent Current        | $I_{SS}$              | $V_{IN} = V_{OUT} + 1.5V$  |                                | 2.8        | 8                              | mA         |
| Line Regulation          | $\Delta V_{OUT-LINE}$ | $I_{OUT} = 10mA,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$   |                                | 1          | 6                              | mV         |
| Ripple Rejection Rate    | PSRR                  | $V_{IN} = 12V$<br>$+1Vp-pAC$   | $I_{OUT} = 10mA, 1k$<br>HZ     |            | 65                             | dB         |
|                          |                       |  | $I_{OUT} = 100mA, 1$<br>kHz    |            | 60                             |            |
| Thermal Shutdown         | $T_J$                 | Junction Temperature   |                                | 150        |                                | $^\circ C$ |

## ME1117A18

( $V_{IN} = V_{OUT} + 1.5V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                | Symbol                | Conditions   | Min.                           | Typ.       | Max.                           | Units      |
|--------------------------|-----------------------|--|--------------------------------|------------|--------------------------------|------------|
| Output Voltage           | $V_{OUT}$             | $I_{OUT} = 10mA, V_{IN} = V_{OUT} + 1.5V$<br>$10mA \leq I_{OUT} \leq 1A,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$ | $\times 0.98$<br>$\times 0.98$ | 1.8<br>1.8 | $\times 1.02$<br>$\times 1.02$ | V          |
| Maximum Output Current   | $I_{OUTMAX}$          | $V_{IN} = V_{OUT} + 1.5V$  |                                | 1000       |                                | mA         |
| Load Regulation          | $\Delta V_{OUT-LOAD}$ | $V_{IN} = V_{OUT} + 1.5V, 0mA \leq I_{OUT} \leq 1A$  |                                | 2          | 10                             | mV         |
| Dropout Voltage (Note 1) | $V_{DIF1}$            | $I_{OUT} = 100mA$  |                                | 1.05       | 1.10                           | V          |
|                          | $V_{DIF2}$            | $I_{OUT} = 500mA$  |                                | 1.20       | 1.30                           | V          |
|                          | $V_{DIF3}$            | $I_{OUT} = 1A$   |                                | 1.30       | 1.40                           | V          |
| Quiescent Current        | $I_{SS}$              | $V_{IN} = V_{OUT} + 1.5V$  |                                | 2.2        | 8                              | mA         |
| Line Regulation          | $\Delta V_{OUT-LINE}$ | $I_{OUT} = 10mA,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$   |                                | 1          | 6                              | mV         |
| Ripple Rejection Rate    | PSRR                  | $V_{IN} = 12V$<br>$+1Vp-pAC$   | $I_{OUT} = 10mA, 1kHz$         |            | 65                             | dB         |
|                          |                       |  | $I_{OUT} = 100mA, 1kHz$        |            | 60                             |            |
| Thermal Shutdown         |                       | Junction Temperature   |                                | 150        |                                | $^\circ C$ |

## ME1117A25

( $V_{IN} = V_{OUT} + 1.5V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                   | Symbol                | Conditions   | Min.  | Typ.       | Max.                           | Units      |
|-----------------------------|-----------------------|--|---|------------|--------------------------------|------------|
| Output Voltage              | $V_{OUT}$             | $I_{OUT} = 10mA, V_{IN} = V_{OUT} + 1.5V$<br>$10mA \leq I_{OUT} \leq 1A,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$ | $\times 0.98$<br>$\times 0.98$                    | 2.5<br>2.5 | $\times 1.02$<br>$\times 1.02$ | V          |
| Maximum Output Current      | $I_{OUTMAX}$          | $V_{IN} = V_{OUT} + 1.5V$  |   | 1000       |                                | mA         |
| Load Regulation             | $\Delta V_{OUT-LOAD}$ | $V_{IN} = V_{OUT} + 1.5V$<br>$0mA \leq I_{OUT} \leq 1000mA$  |   | 1          | 10                             | mV         |
| Dropout Voltage<br>(Note 1) | $V_{DIF1}$            | $I_{OUT} = 100mA$  |   | 1.05       | 1.10                           | V          |
|                             | $V_{DIF2}$            | $I_{OUT} = 800mA$  |   | 1.20       | 1.30                           | V          |
|                             | $V_{DIF3}$            | $I_{OUT} = 1A$   |   | 1.30       | 1.40                           | V          |
| Quiescent Current           | $I_{SS}$              | $V_{IN} = V_{OUT} + 1.5V$  |   | 2.2        | 5                              | mA         |
| Line Regulation             | $\Delta V_{OUT-LINE}$ | $I_{OUT} = 10mA,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$   |   | 2          | 6                              | mV         |
| Ripple Rejection Rate       | PSRR                  | $V_{IN} = 12V$<br>$+1Vp-pAC$   | $I_{OUT} = 10mA, 1kHz$<br>$I_{OUT} = 100mA, 1kHz$ | 65<br>60   |                                | dB         |
| Thermal Shutdown            |                       | Junction Temperature   |   | 150        |                                | $^\circ C$ |

## ME1117A33

( $V_{IN} = V_{OUT} + 1.5V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                   | Symbol                | Conditions   | Min.  | Typ.       | Max.                           | Units      |
|-----------------------------|-----------------------|--|---|------------|--------------------------------|------------|
| Output Voltage              | $V_{OUT}$             | $I_{OUT} = 10mA, V_{IN} = V_{OUT} + 1.5V$<br>$10mA \leq I_{OUT} \leq 1A,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$ | $\times 0.98$<br>$\times 0.98$                    | 3.3<br>3.3 | $\times 1.02$<br>$\times 1.02$ | V          |
| Maximum Output Current      | $I_{OUTMAX}$          | $V_{IN} = V_{OUT} + 1.5V$  |   | 1000       |                                | mA         |
| Load Regulation             | $\Delta V_{OUT-LOAD}$ | $V_{IN} = V_{OUT} + 1.5V, 0mA \leq I_{OUT} \leq 1A$  |   | 2          | 10                             | mV         |
| Dropout Voltage<br>(Note 1) | $V_{DIF1}$            | $I_{OUT} = 100mA$  |   | 1.05       | 1.10                           | V          |
|                             | $V_{DIF2}$            | $I_{OUT} = 800mA$  |   | 1.20       | 1.30                           | V          |
|                             | $V_{DIF3}$            | $I_{OUT} = 1A$   |   | 1.30       | 1.40                           | V          |
| Quiescent Current           | $I_{SS}$              | $V_{IN} = V_{OUT} + 1.5V$  |   | 3          | 10                             | mA         |
| Line Regulation             | $\Delta V_{OUT-LINE}$ | $I_{OUT} = 10mA,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$   |   | 2          | 6                              | mV         |
| Ripple Rejection Rate       | PSRR                  | $V_{IN} = 12V$<br>$+1Vp-pAC$   | $I_{OUT} = 10mA, 1kHz$<br>$I_{OUT} = 100mA, 1kHz$ | 65<br>60   |                                | dB         |
| Thermal Shutdown            |                       | Junction Temperature   |   | 150        |                                | $^\circ C$ |

## ME1117A50

( $V_{IN} = V_{OUT} + 1.5V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                   | Symbol                | Conditions   | Min.                           | Typ.       | Max.                           | Units      |
|-----------------------------|-----------------------|--|--------------------------------|------------|--------------------------------|------------|
| Output Voltage              | $V_{OUT}$             | $I_{OUT} = 10mA, V_{IN} = V_{OUT} + 1.5V$<br>$10mA \leq I_{OUT} \leq 1A,$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$ | $\times 0.98$<br>$\times 0.98$ | 5.0<br>5.0 | $\times 1.02$<br>$\times 1.02$ | V          |
| Maximum Output Current      | $I_{OUTMAX}$          | $V_{IN} = V_{OUT} + 1.5V$  |                                | 1000       |                                | mA         |
| Load Regulation             | $\Delta V_{OUT-LOAD}$ | $V_{IN} = V_{OUT} + 1.5V, 0mA \leq I_{OUT} \leq 1A$  |                                | 8          | 15                             | mV         |
| Dropout Voltage<br>(Note 1) | $V_{DIF1}$            | $I_{OUT} = 100mA$  |                                | 1.05       | 1.10                           | V          |
|                             | $V_{DIF2}$            | $I_{OUT} = 800mA$  |                                | 1.20       | 1.30                           | V          |
|                             | $V_{DIF3}$            | $I_{OUT} = 1A$   |                                | 1.30       | 1.40                           | V          |
| Quiescent Current           | $I_{SS}$              | $V_{IN} = V_{OUT} + 1.5V$  |                                | 4.7        | 10                             | mA         |
| Line Regulation             | $\Delta V_{OUT-LINE}$ | $I_{OUT} = 10mA$<br>$V_{OUT} + 1.5V \leq V_{IN} \leq 15V$  |                                | 2          | 10                             | mV         |
| Ripple Rejection Rate       | PSRR                  | $V_{IN} = 12V$<br>$+1Vp-pAC$   | $I_{OUT} = 10mA, 1kHz$         |            | 65                             | dB         |
|                             |                       |  | $I_{OUT} = 100mA, 1kHz$        |            | 60                             |            |
| Thermal Shutdown            |                       | Junction Temperature   |                                | 150        |                                | $^\circ C$ |

Note :

1.  $V_{DIF}$ :  $V_{IN1} - V_{OUT}(E)'$

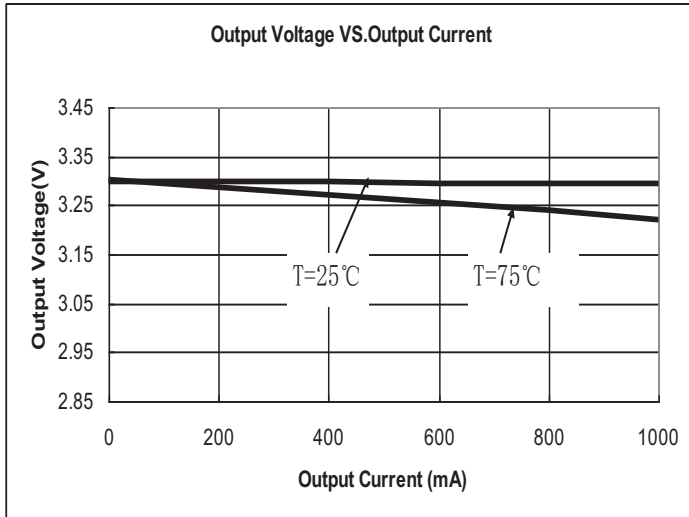
$V_{IN1}$  : The input voltage when  $V_{OUT}(E)'$  appears as input voltage is gradually decreased.

$V_{OUT}(E)'$  = A voltage equal to 99% of the output voltage whenever an amply stabilized lout and  $\{V_{OUT}(T) + 1.5V\}$  is input.

## Type Characteristics

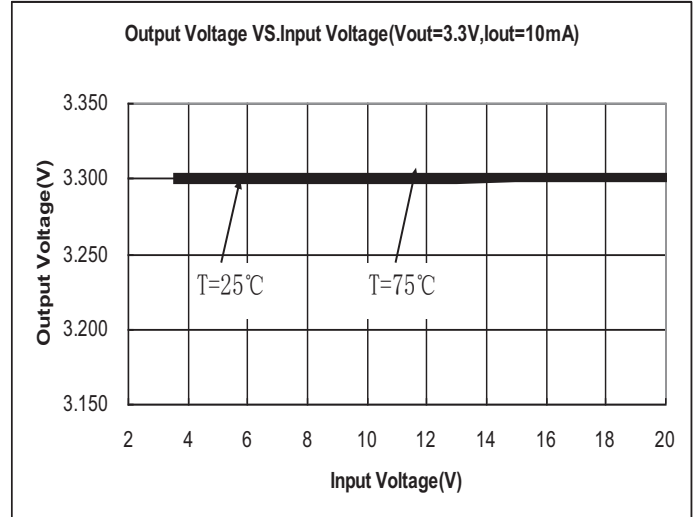
(1) Output Voltage VS. Output Current  
 $(V_{IN}=V_{OUT}+1.5V)$

ME1117A33

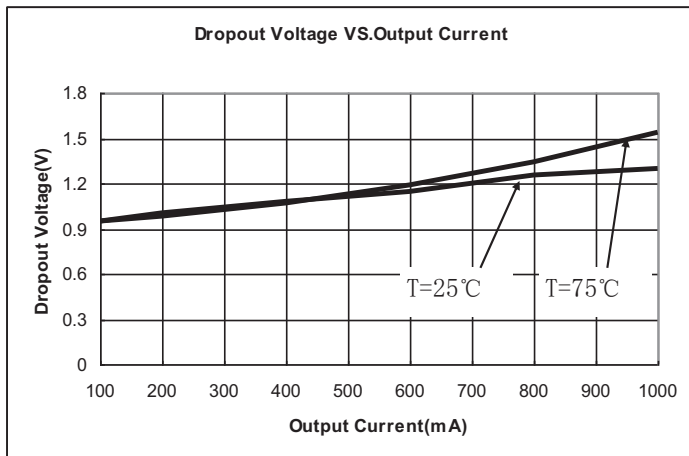


(2) Output Voltage VS. Input Voltage  
 $(V_{out}=3.3V, I_{OUT}=10mA)$

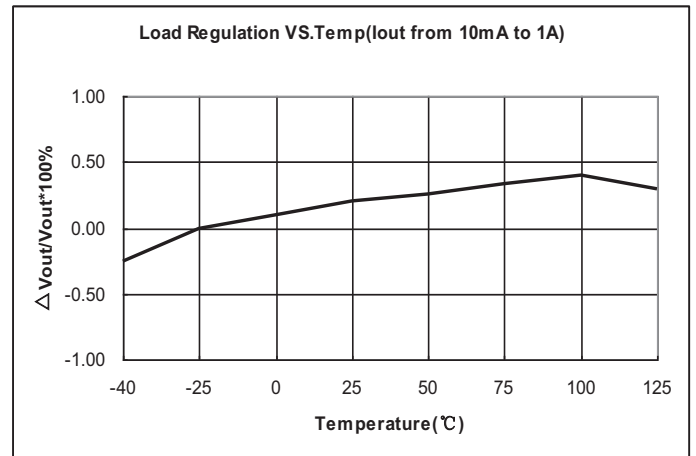
ME1117A33



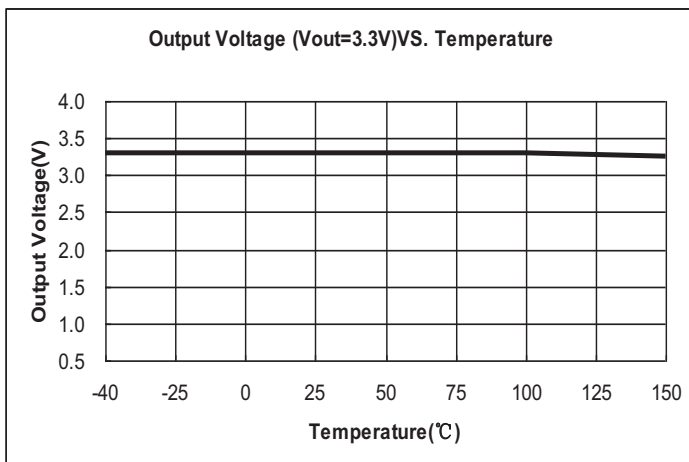
(3) Dropout Voltage VS. Output Current  
 ME1117A33



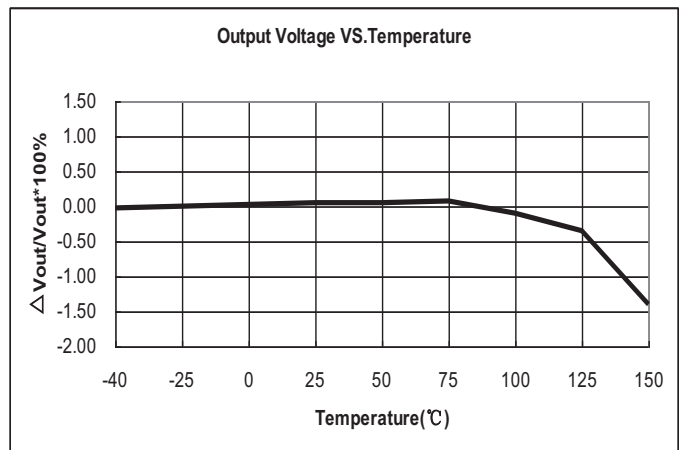
(4) Load Regulation VS. Temp (Iout from 10mA to 1A)  
 ME1117A33



(5) Output Voltage VS. Temperature  
 ME1117A33

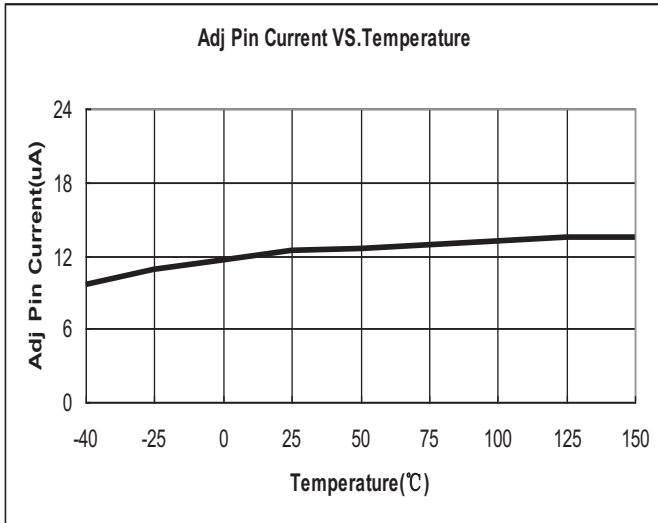


(6) Output Voltage Change VS. Temperature  
 ME1117A33



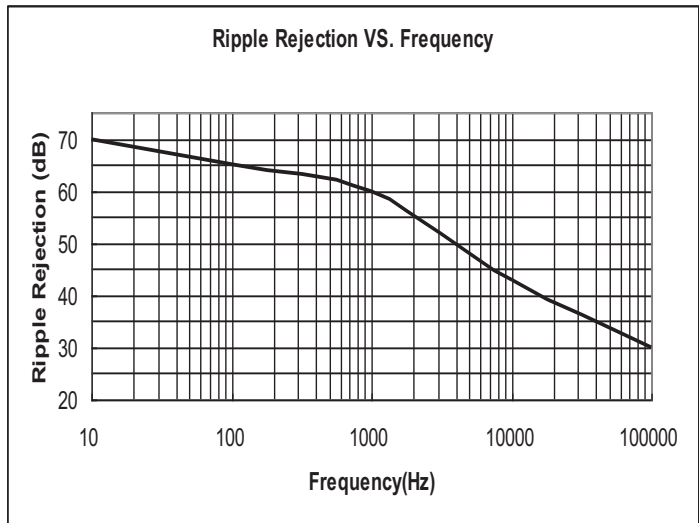
(7) Adj Pin Current VS. Temperature

ME1117F



(8) Ripple Rejection vs. Frequency

ME1117A33



(9) Line Transient Response

ME1117A33

Ch1: Output Voltage Ch3: Input Voltage

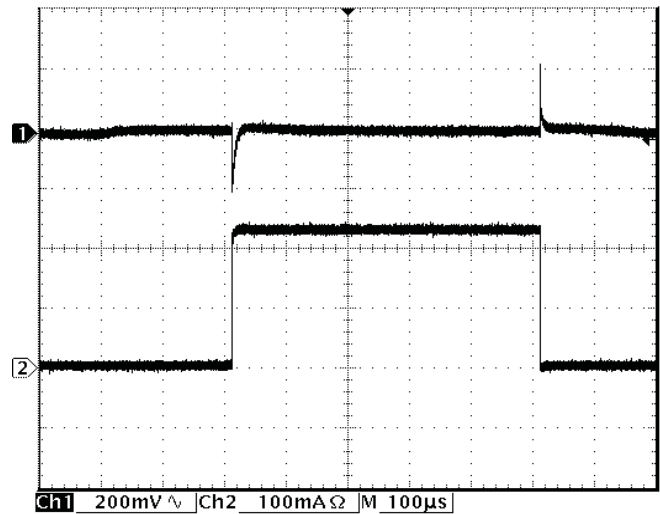
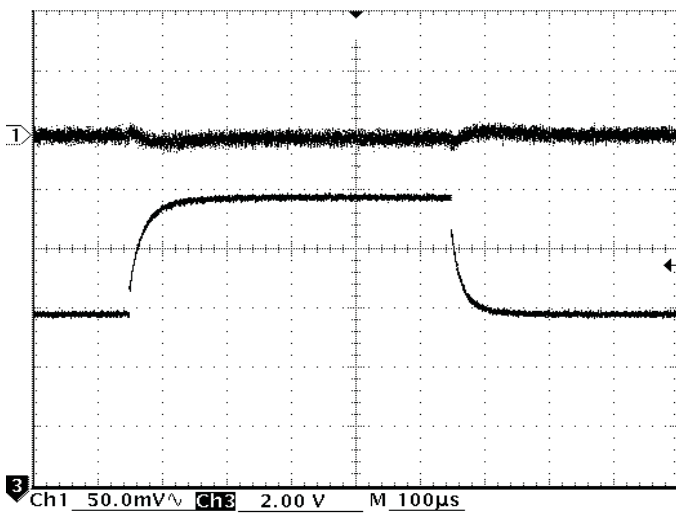
$V_{IN}=8V\sim 12V, I_{OUT}=0mA, T_a = 25^\circ C$

(10) Load Transient Response

ME1117A33

Ch1: Output Voltage Ch2: Load Current

$V_{IN}=4.8V, I_{OUT}=0mA \sim 240mA, T_a = 25^\circ C$





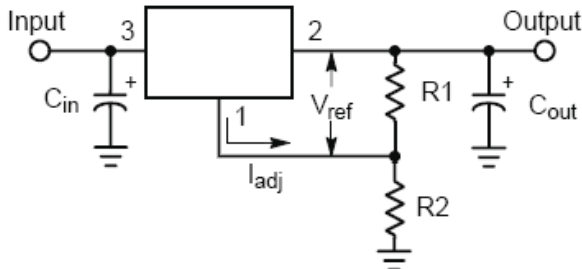
## Applications Information

### ➤ Introduction

The ME1117 features a significant reduction in dropout voltage along with enhanced output voltage accuracy and temperature stability when compared to older industry standard three-terminal adjustable regulators.

### ➤ Output Voltage

The typical application circuit for adjustable output regulator is shown in following Figure. They develop and maintain the nominal 1.25 V reference voltage between the output and adjust pins. The reference voltage is programmed to a constant current source by resistor R1, and this current flows through R2 to ground to set the output voltage. The programmed current level is usually selected to be greater than the specified 3.0mA minimum that is required for regulation. Since the adjust pin current,  $I_{ADJ}$ , is significantly lower and constant with respect to the programmed load current, it generates a small output voltage error that can usually be ignored.



$$V_{out} = V_{ref} \left( 1 + \frac{R2}{R1} \right) + I_{adj} R2$$

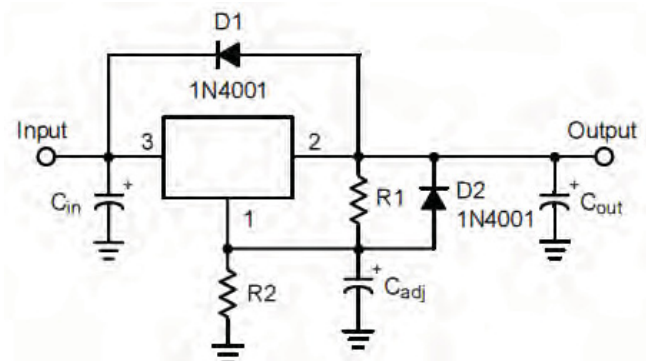
### ➤ External Capacitors

Input bypass capacitor  $C_{IN}$  may be required for regulator stability. This capacitor will reduce the circuit's sensitivity when powered from a complex source. A 10uF ceramic or tantalum capacitor should be adequate for most applications. Frequency compensation for the regulator is provided by capacitor  $C_{OUT}$  and its use is mandatory to ensure output stability. A minimum capacitance value of 4.7uF with an equivalent series resistance (ESR) that is within the limits of 0.25 ohm to 2.2 ohm is required. Higher values of output capacitance can be used to enhance loop

stability and transient response with the additional benefit of reducing output noise. The output ripple will increase linearly for fixed and adjustable devices as the ratio of output voltage to the reference voltage increases.

### ➤ Protection Diodes

The ME1117 has two internal low impedance diode paths that normally do not require protection when used in the typical regulator applications. The first path connects between  $V_{OUT}$  and  $V_{IN}$ , and it can withstand a peak surge current of about 15 A. Only when  $V_{IN}$  is shorted to ground and  $C_{OUT}$  is greater than 100uF, it becomes possible for device damage to occur. Under these conditions, diode D1 is required to protect the device. The second path connects between  $C_{ADJ}$  and  $V_{OUT}$ , and it can withstand a peak surge current of about 150mA. Protection diode D2 is required if the output is shorted to ground and  $C_{ADJ}$  is greater than 10uF.

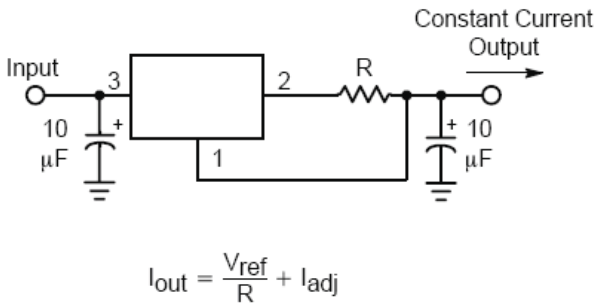


### ➤ Thermal Considerations

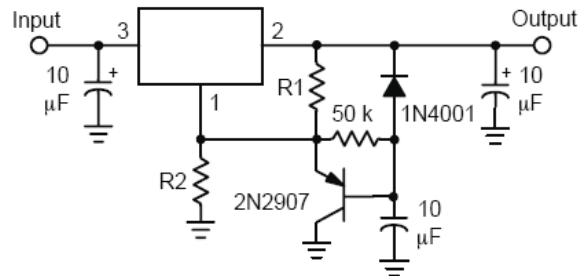
This series contains an internal thermal limiting circuit that is designed to protect the regulator in the event that the maximum junction temperature is exceeded. When activated, typically at 175°C, the regulator output switches off and then back on as the die cools.

## Other Application Circuit

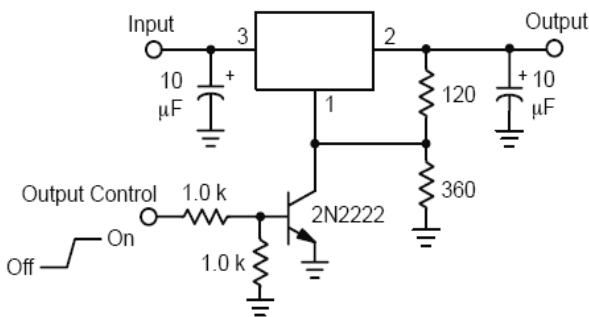
(1) Constant Current Regulator



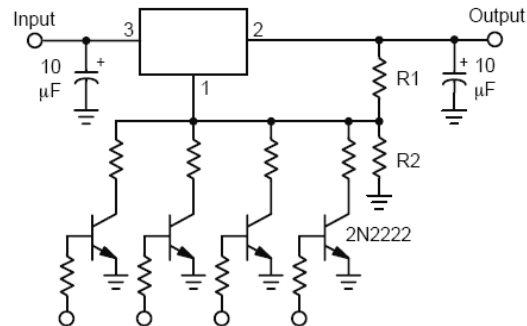
(2) Slow Turn-On Regulator



(3) Regulator with Shutdown

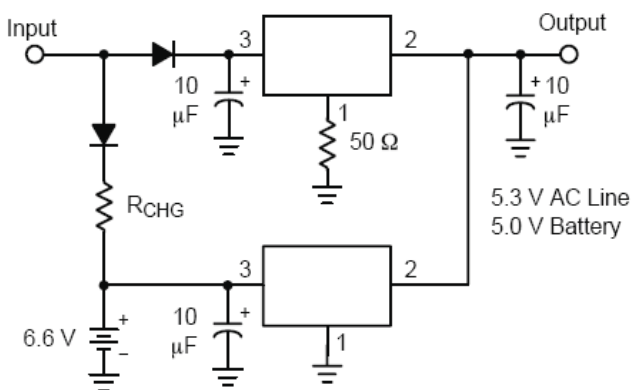


(4) Digitally Controlled Regulator



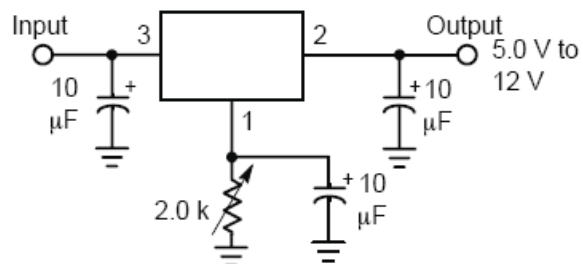
Resistor R2 sets the maximum output voltage. Each transistor reduces the output voltage when turned on.

(5) Battery Backed-Up Power Supply



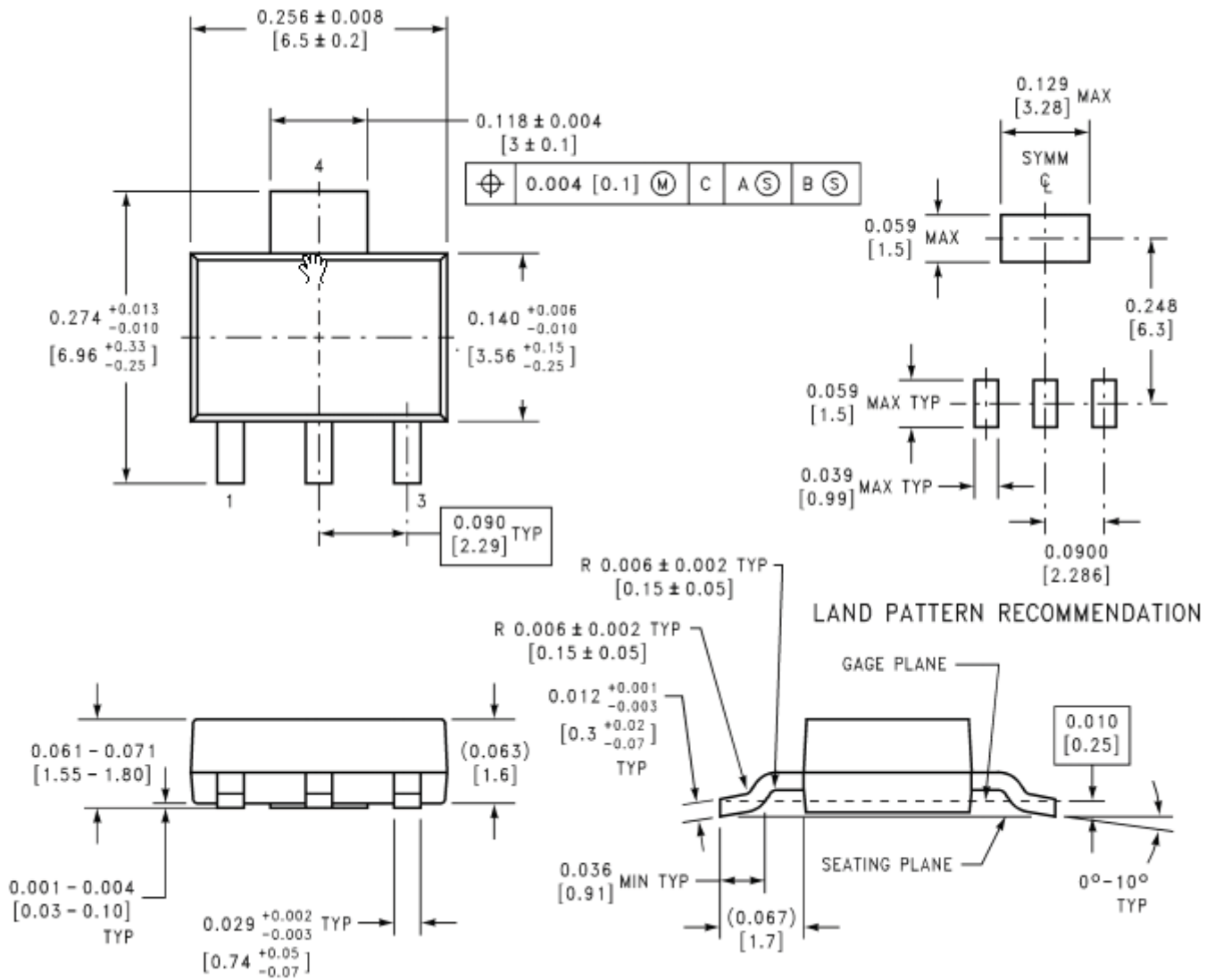
The 50 ohm resistor that is in series with the ground pin of the upper regulator level shifts its output 300 mV higher than the lower regulator. This keeps the lower regulator off until the input source is removed.

(6) Adjusting Output of Fixed Voltage Regulators

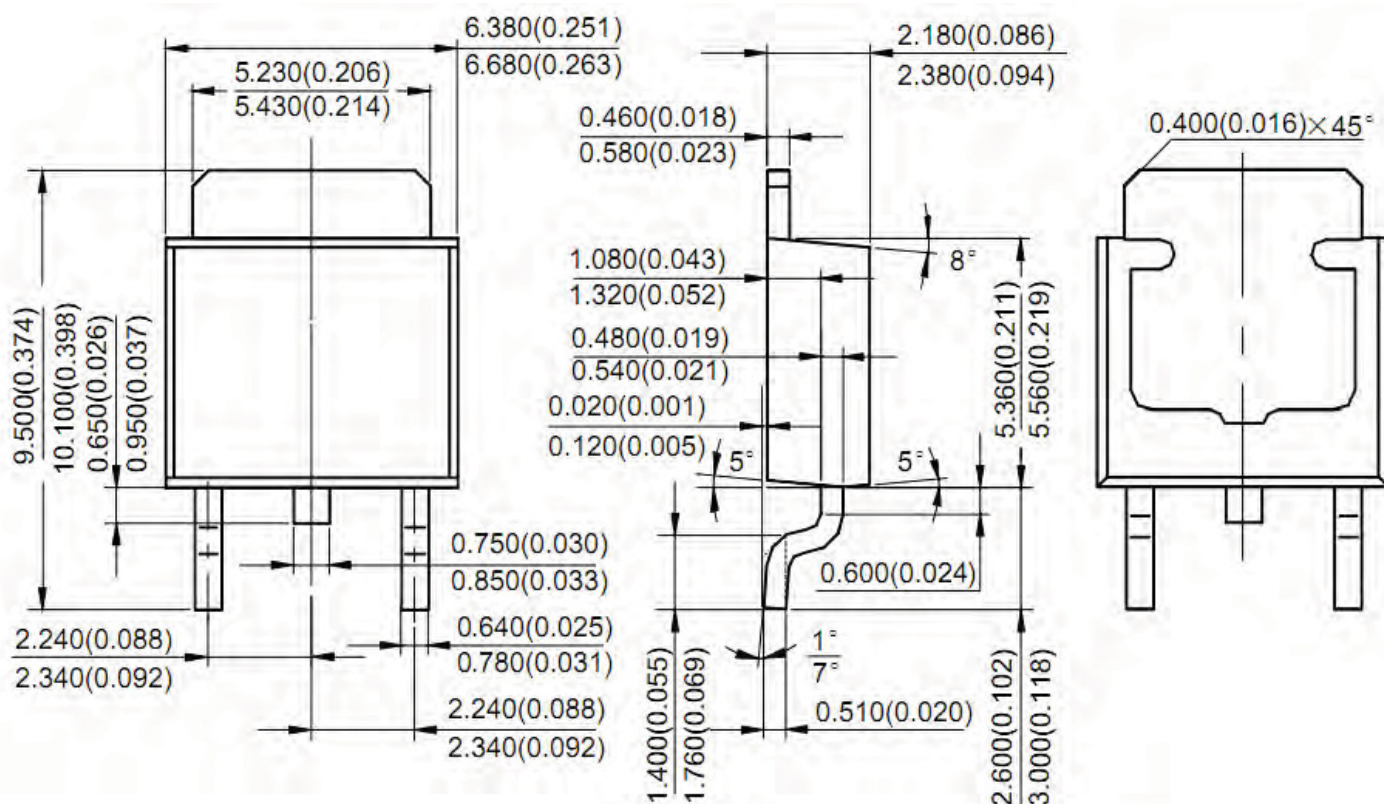


Packaging Information

● SOT223



● TO252-2L



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