

# 1A Low Dropout Positive Voltage Regulator

## GENERAL DESCRIPTION

The EC50117S series of positive adjustable and fixed regulators are designed to provide 1A with high efficiency. All internal circuitry is designed to operate down to 1.4V input to output differential. On-chip trimming adjusts the reference voltage to 1%. Current limit the typical value of 1.5A allows to minimizing the stress on both the regulator and the power source circuitry under overload conditions.

## Applications

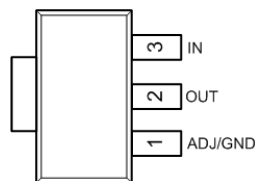
- Efficiency Linear Regulators
- Post Regulators for Switching Supplies
- Adjustable Power Supply

## FEATURES

- Adjustable or Fixed Voltage.
- Output current of 1A.
- Low Dropout Voltage 1.2V(Typ.) at 1A Output Current.
- 0.04% Line Regulation
- 0.2 % Load Regulation
- 100% Thermal Limit Burn-In
- Fast Transient Response
- Current-Limit : 1A Typ. at  $T_J = 25^\circ\text{C}$
- On-Chip Thermal Limiting :  $150^\circ\text{C}$  Typ.

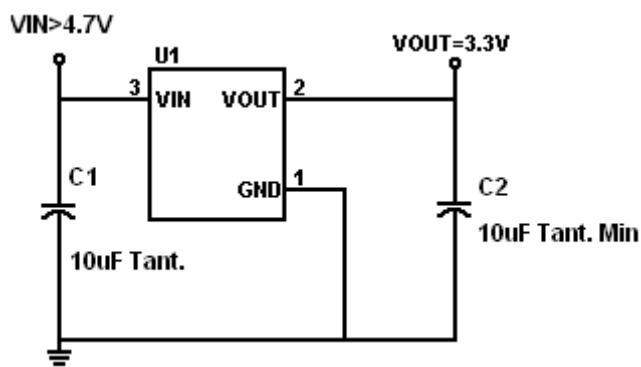
## PIN ASSIGNMENT

Package: SOT223-3L

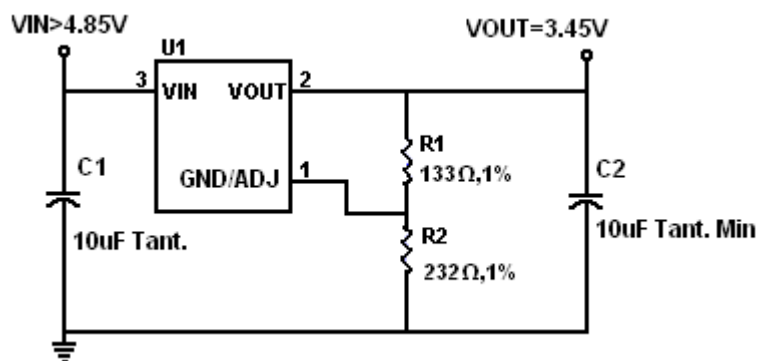


## Typical Application Circuits

Fixed Voltage Regulator



Adjustable Voltage Regulator



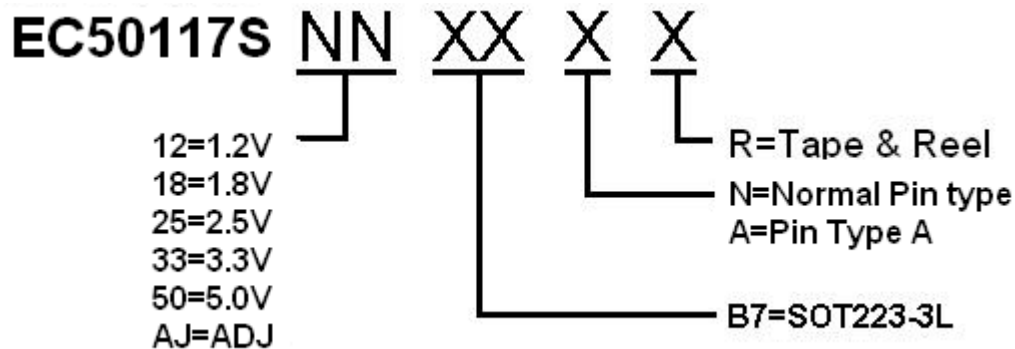
Notes :

- 1.) C1 need if device is far from filter capacitors
- 2.) C2 minimum value required for stability.

$$V_{OUT} = V_{REF} \times (1 + R2/R1) + I_{ADJ} \times R2$$

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## Ordering Information



| Part Number    | Package   | Marking                    | Marking Information                                                                                                                                                                                            |
|----------------|-----------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EC50117SXXB7NR | SOT223-3L | 1117SXX<br>LLLLLLLL<br>DDT | 1. 1117S : Product Code<br>2. XX : is the output voltage code<br>12=1.2V;18=1.8V 25=2.5V;33=3.3V;<br>50=5.0V;A=ADJ<br>3. LLLLLLLL : Lot No<br>4. DD : Manufacturing Date Code<br>5. T : Internal tracking Code |

## ABSOLUTE MAXIMUM RATINGS

| Characteristics                        |           | Symbol        | Maximum     | Unit   |
|----------------------------------------|-----------|---------------|-------------|--------|
| DC Supply Voltage                      |           | $V_{IN}$      | 20          | V      |
| Operating Junction Temperature Range   |           | $T_{OPR}$     | -40 to +125 | °C     |
| Storage Temperature Range              |           | $T_{STG}$     | -65 to 150  | °C     |
| Lead Temperature (Soldering) 10 Sec    |           | $T_{LEAD}$    | 300         | °C     |
| Electrostatic Discharge Sensitivity    |           | H.B.M         | 3           | KV/Min |
| Thermal Resistance Junction to Ambient | SOT223-3L | $\theta_{JA}$ | 135         | °C/W   |
| Thermal Resistance Junction to Case    | SOT223-3L | $\theta_{JC}$ | 27          | °C/W   |
| Internal Power Dissipation             | SOT223-3L | $P_D$         | 0.74        | W      |

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.



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## ELECTRICAL CHARACTERISTICS

(I<sub>LOAD</sub>=0mA, T<sub>j</sub>=25°C, unless otherwise noted.)

| Parameter                                 | Test Conditions   |                                                                                                                          | Min   | Typ  | Max   | Units |
|-------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------|-------|------|-------|-------|
| Output Voltage                            | All fixed version | V <sub>IN</sub> =V <sub>OUT</sub> +1.5V, Variator from nominal V <sub>OUT</sub>                                          | -1.5  |      | 1.5   | %     |
|                                           |                   | 1.5V ≤ V <sub>IN</sub> -V <sub>OUT</sub> ≤ 10V, I <sub>LOAD</sub> =0mA to 1A, Variator from nominal V <sub>OUT</sub> (★) | -2    |      | +2    | %     |
|                                           | EC50117S-1.2V     | 1.5V ≤ V <sub>IN</sub> -V <sub>OUT</sub> ≤ 10V, I <sub>LOAD</sub> =0mA to 1A, Variator from nominal V <sub>OUT</sub> (★) | -3    |      | +2    | %     |
| Output Voltage                            | EC50117S-ADJ      | Maximum P <sub>D</sub> <2.25W                                                                                            | 1.25  |      | 14.6  | V     |
| Reference Voltage<br>(Note 1)             | EC50117S-ADJ      | V <sub>IN</sub> =+5V, I <sub>LOAD</sub> =10mA                                                                            | 1.232 | 1.25 | 1.268 | V     |
|                                           |                   | 1.5V ≤ V <sub>IN</sub> -V <sub>OUT</sub> ≤ 10V, I <sub>LOAD</sub> =10mA to 1A(★)                                         | 1.225 | 1.25 | 1.275 | V     |
| Output Voltage Accuracy(at wafer testing) | All               | V <sub>IN</sub> =V <sub>OUT</sub> +1.5V, I <sub>LOAD</sub> =10mA                                                         | -0.6  | 0    | +0.6  | %     |
| Line Regulation                           | ALL               | 1.5V ≤ V <sub>IN</sub> -V <sub>OUT</sub> ≤ 10V, I <sub>LOAD</sub> =10mA (★)                                              |       | 0.04 | 0.238 | %     |
| Load Regulation<br>(Note 1)               | ALL               | V <sub>IN</sub> =V <sub>OUT</sub> +1.5V, I <sub>LOAD</sub> =10mA to 1A(★)                                                |       | 0.2  | 0.4   | %     |
| Minimum Load Current                      | EC50117S-ADJ      | V <sub>IN</sub> =+5V, V <sub>ADJ</sub> =0V(★)                                                                            |       | 2    | 7     | mA    |
| Ground Pin Current                        | All fixed version | V <sub>IN</sub> =V <sub>OUT</sub> +1.5V<br>I <sub>LOAD</sub> =10mA to 1A(★)                                              |       | 3.5  | 10    | mA    |
| Adjust pin current                        | EC50117S-ADJ      | 1.5V ≤ V <sub>IN</sub> -V <sub>OUT</sub> ≤ 10V, I <sub>LOAD</sub> =10mA (★)                                              |       | 35   | 60    | μA    |
| Current Limit                             | All               | V <sub>IN</sub> -V <sub>OUT</sub> =1.5V(★)                                                                               | 1     | 1.5  | 2     | A     |
|                                           |                   | T <sub>j</sub> =25°C                                                                                                     |       | 1    |       | A     |
| Ripple Rejection<br>(Note 2)              | All               | V <sub>IN</sub> -V <sub>OUT</sub> =2.5V, I <sub>LOAD</sub> =1A                                                           | 60    |      |       | dB    |
| Dropout voltage<br>(Note 1,3)             | All               | I <sub>LOAD</sub> =1A(★)                                                                                                 |       | 1.2  | 1.4   | V     |
| Temperature coefficient                   | All               | V <sub>IN</sub> -V <sub>OUT</sub> =1.5V, I <sub>LOAD</sub> =10mA(★)                                                      |       |      | 0.015 | %/°C  |
| On-chip Thermal Limit                     | All               |                                                                                                                          |       | 150  |       | °C    |

The“(★)” denotes the specification which apply over the full operating junction temperature range, -40°C~125°C

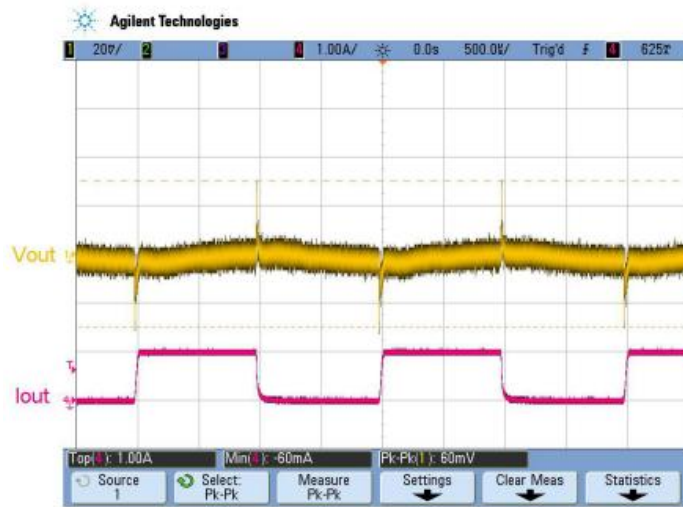
Note :

1. Low duty pulse testing with Kelvin connections requires.
2. 120Hz input ripple (C<sub>ADJ</sub> for ADJ=25uF)
3. ΔV<sub>OUT</sub>, ΔV<sub>REF</sub>=1%

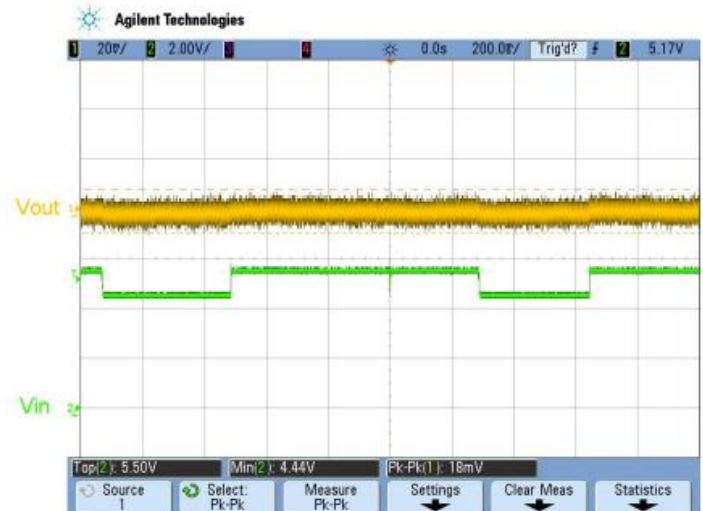
# 1A Low Dropout Positive Voltage Regulator

## Typical Characteristics

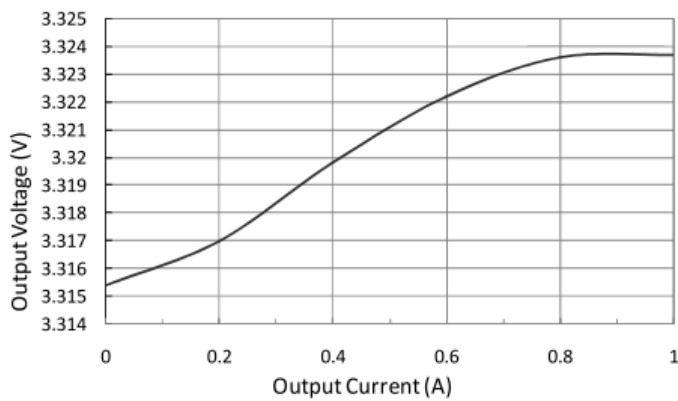
### Load Transient Response



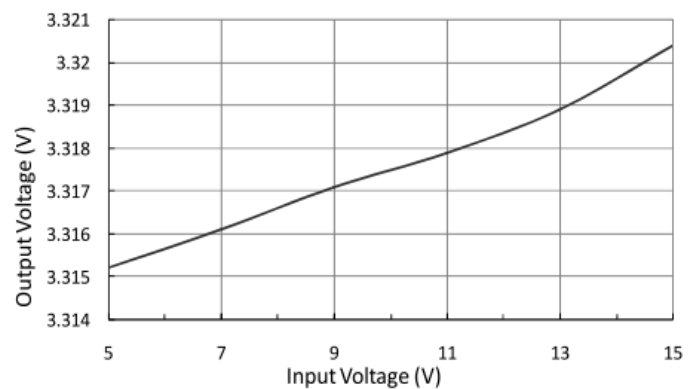
### Line Transient Response



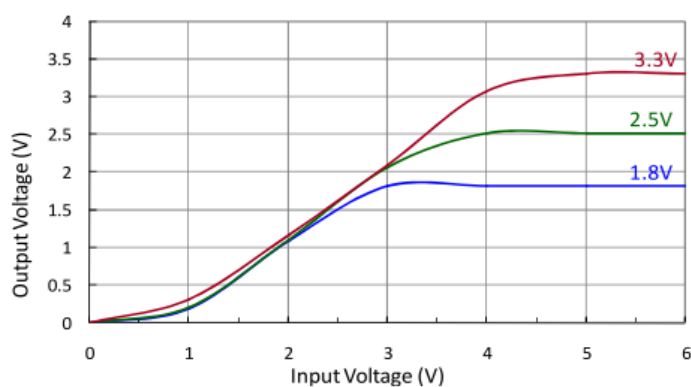
### Load Regulation (Input Voltage = 5V)



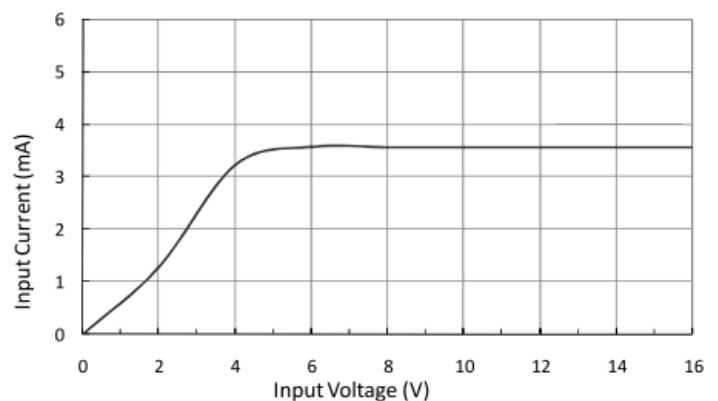
### Line Regulation (Output Current=100mA)



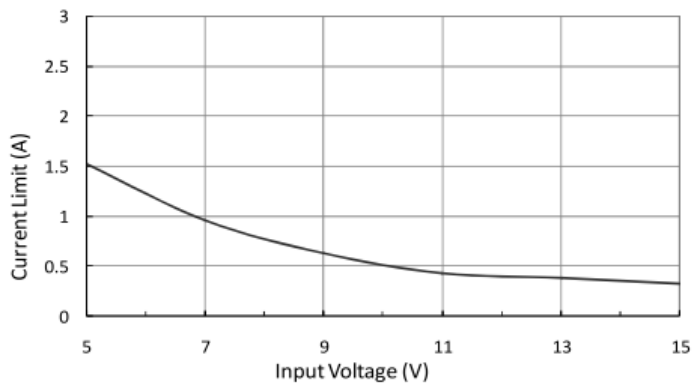
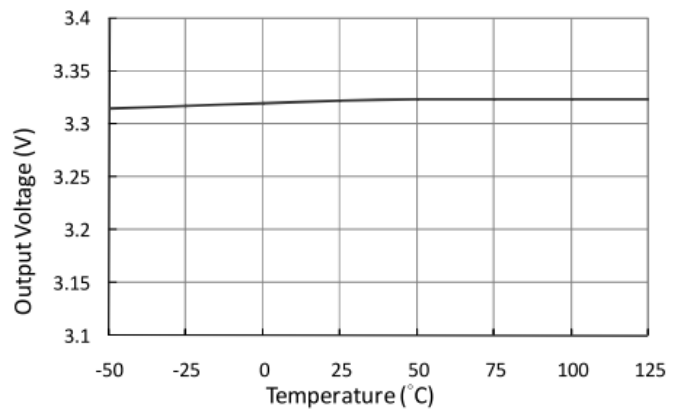
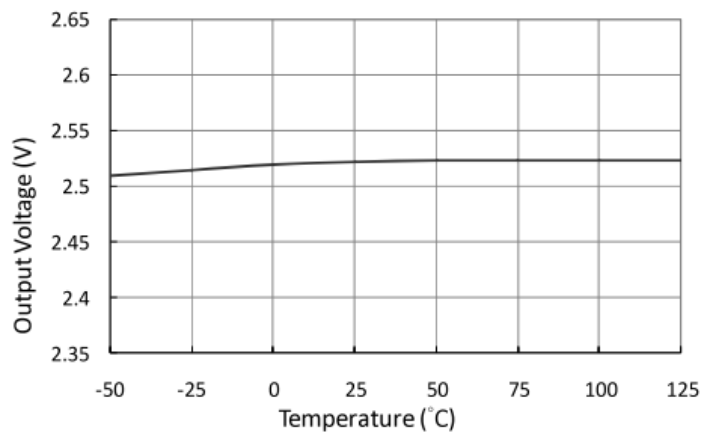
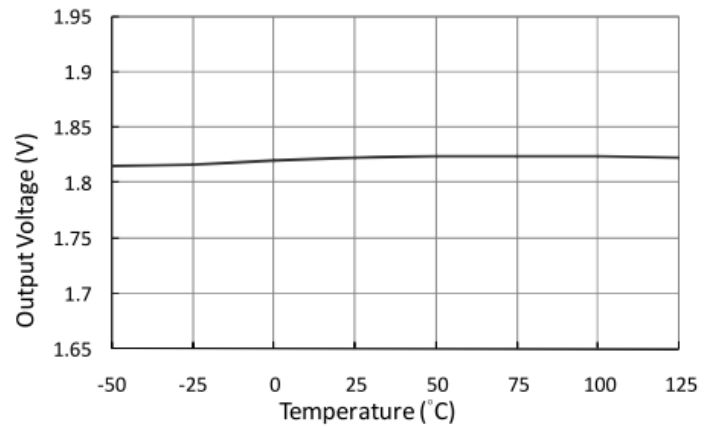
### Output Voltage vs. Input Voltage



### Input Current vs. Input Voltage



# 1A Low Dropout Positive Voltage Regulator

**Current Limit vs. Input Voltage**

**Output Voltage vs. Temperature (3.3V)**

**Output Voltage vs. Temperature (2.5V)**

**Output Voltage vs. Temperature (1.8V)**


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### APPLICATION INFORMATION

#### Output Voltage

The EC50117S develops a 1.25V reference voltage between the output and the adjust terminal. By placing a resistor between these two terminals, a constant current is caused to flow through R1 and down through R2 to set the overall output voltage. Normally, this current is chosen to be the specified minimum load current of 10mA. For fixed voltage devices R1 and R2 are included in the device.

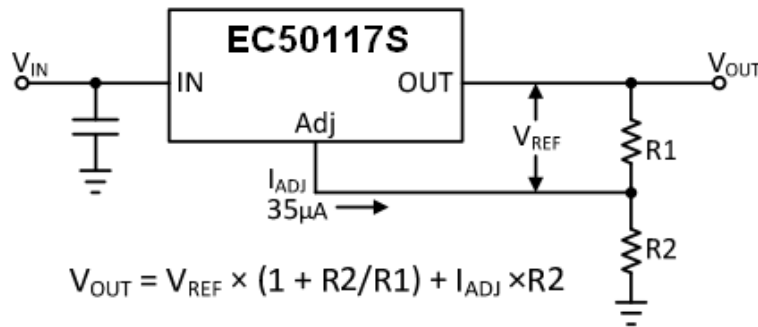


Figure 1: Basic adjustable regulator.

#### Load Regulation

When the adjustable regulator is used, load regulation will be limited by the resistance of the wire connecting the regulator to the load. The data sheet specification for load regulation is measured at the output pin of the device.

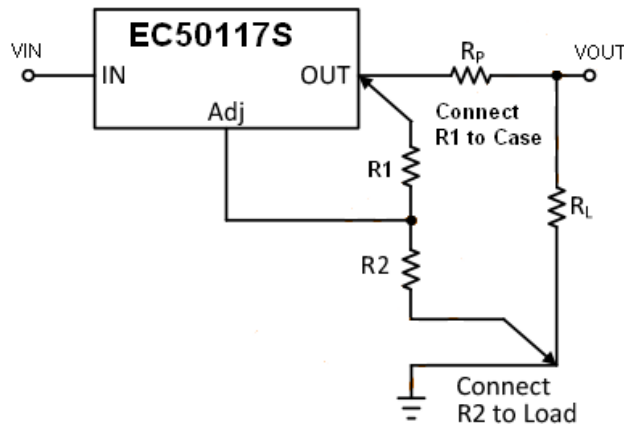


Figure 2 : Connections for best load regulation.

Best load regulation is obtained when the top of the resistor divider (R1) is tied directly to the output pin of the device not to the load. For fixed voltage, devices the top of R1 is internally connected to the output, and the ground pin can be connected to low side of the load. If R1 is connected to the load, R\_P is multiplied by the divider ratio, the effective resistance between the regulator and the load would be:

$R_P \times (1 + R2/R1)$ ,  $R_P$  = Parasitic Line Resistance

## 1A Low Dropout Positive Voltage Regulator

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### Input Capacitor

An input capacitor of 10 $\mu$ F or greater is recommended. Tantalum or aluminum electrolytic capacitors can be used for bypassing. Larger Values will improve ripple rejection by bypassing the input to the regulator.

### Output Capacitor

The EC50117S requires an output capacitor to maintain stability and improve transient response. Proper capacitor selection is important to ensure proper operation. The EC50117S output capacitor selection is dependent upon the ESR (equivalent series resistance) of the output capacitor to maintain stability. When the output capacitor is 10 $\mu$ F or greater, the output capacitor should have an ESR less than 1 $\Omega$ . This will improve transient response as well as promote stability. A low-ESR solid tantalum capacitor works extremely well and provides good transient response and stability over temperature.

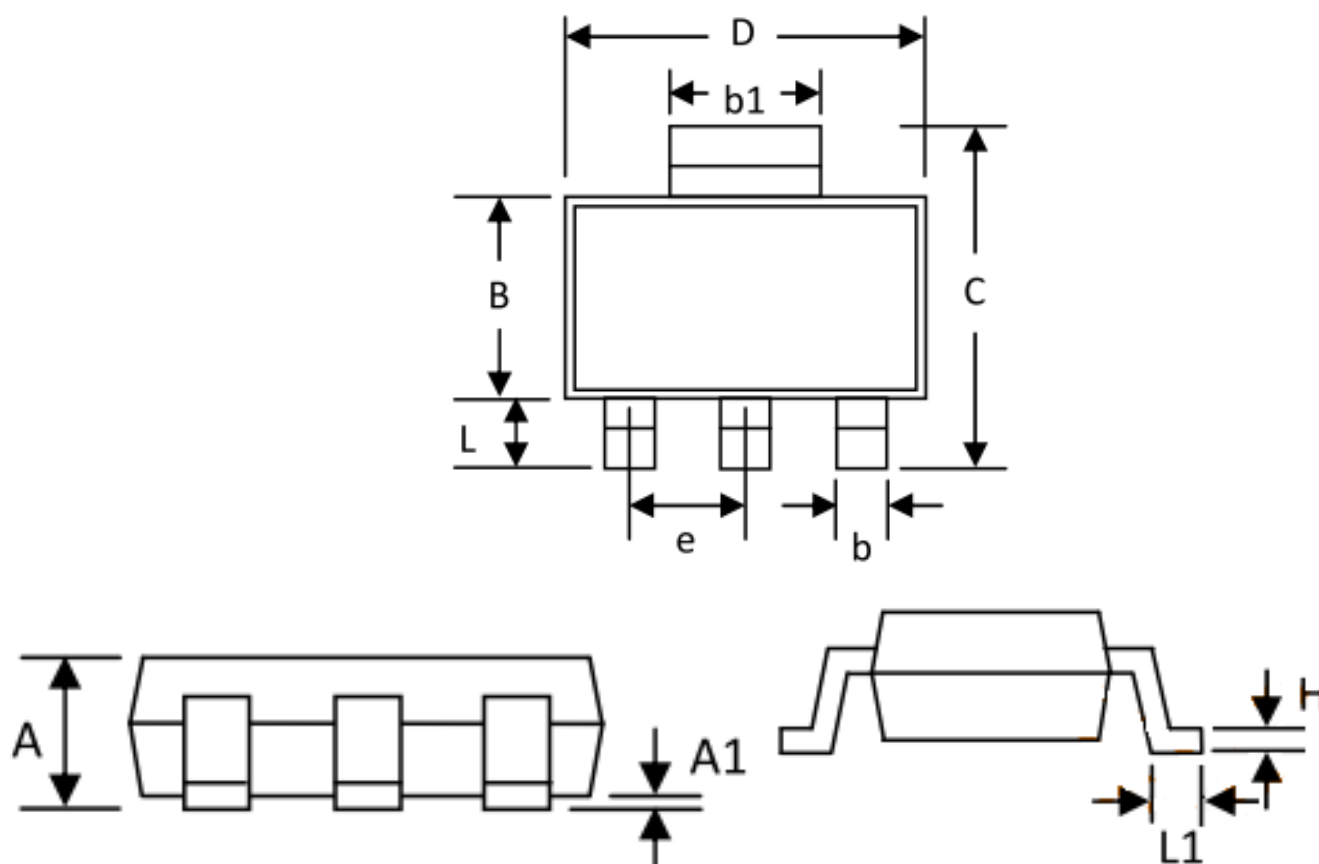
Aluminum electrolytics can also be used, as long as the ESR of the capacitor is <1 $\Omega$ . The value of the output capacitor can be increased without limit. Higher capacitance values help to improve transient response and ripple rejection and reduce output noise.

### Ripple Rejection

The curves for Ripple Rejection were generated using an adjustable device with the adjust pin bypassed. With a 25 $\mu$ F bypassing capacitor, 75dB ripple rejection is obtainable at any output level. The impedance of the adjust pin capacitor, at the ripple frequency, should be <R1. R1 is normally in the range of 100 $\Omega$  to 200 $\Omega$ . The size of the required adjust pin capacitor is the function of the input ripple frequency. At 120Hz, with R1=100 $\Omega$ , the adjust pin capacitor should be 13 $\mu$ F. For fixed voltage devices and adjustable devices without an adjust pin capacitor, the output ripple will increase as the ratio of the output voltage to the reference voltage (VOUT /VREF).

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## Mechanical Dimensions OUTLINE DRAWING SOT223-3L



| Symbol | Dimensions in mm |       |
|--------|------------------|-------|
|        | Min              | Max   |
| A      | 1.400            | 1.800 |
| A1     | 0.000            | 0.120 |
| B      | 3.300            | 3.700 |
| b      | 0.600            | 0.840 |
| b1     | 2.900            | 3.150 |
| C      | 6.700            | 7.300 |
| D      | 6.200            | 6.700 |
| e      | 2.300 BSC        |       |
| H      | 0.230            | 0.350 |
| L      | 1.500            | 2.000 |
| L1     | 0.750            | 1.150 |