



## General Description

LD1117SxxCTR is a series of low dropout three-terminal regulators with a dropout of 1.3V at 800mA load current. LD1117SxxCTR features a very low standby current 2mA compared to 5mA of competitor.

Other than a fixed version,  $V_{out} = 1.2V, 1.8V, 2.5V, 2.85V, 3.3V,$  and  $5V$ , LD1117SxxCTR has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

LD1117SxxCTR offers thermal shut down function, to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within 2%. Other output voltage accuracy can be customized on demand, such as 1%.

LD1117SxxCTR is available in SOT-223 power package.

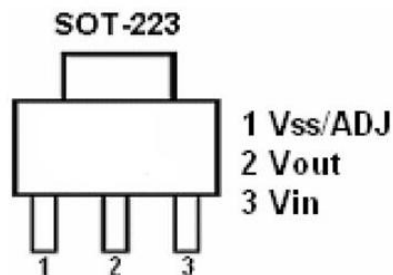
## Features

- Maximum output current is 0.8A
- Range of operation input voltage: Max 15V
- Line regulation: 0.03%/V (typ.)
- Standby current: 2mA (typ.)
- Load regulation: 0.2%/A (typ.)
- Environment Temperature:  $-20^{\circ}C \sim 85^{\circ}C$

## Application

- Power Management for Computer Mother
- Board, Graphic Card
- LCD Monitor and LCD TV
- DVD Decode Board
- ADSL Modem
- Post Regulators For Switching Supplies

## Pin Configuration And Descriptions



## Order Information

| Orderable Device | Package | Output Voltage                           | Packing Option |
|------------------|---------|------------------------------------------|----------------|
| LD1117SxxCTR     | SOT-223 | 1.2V, 1.8V, 2.5V, 2.85V, 3.3V, 5.0V, adj | 2500/Reel      |

xx: From 12-50, ADJ



## Absolute Maximum Ratings

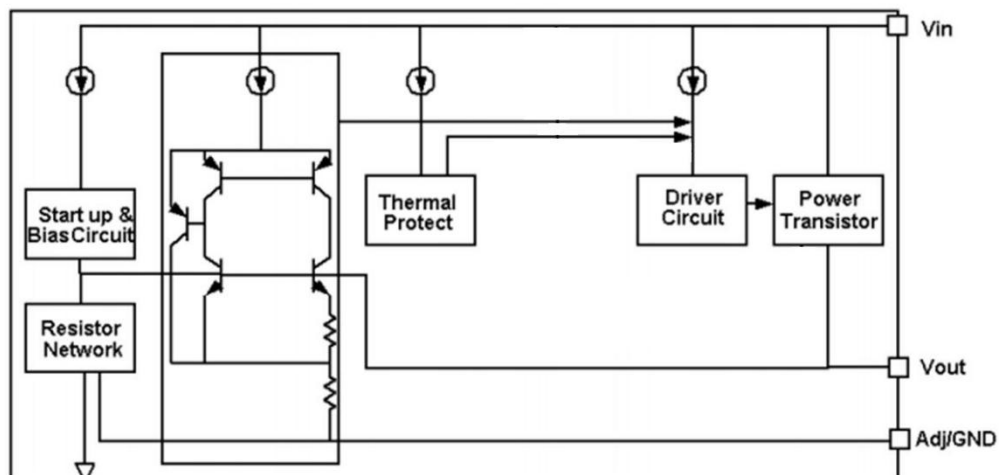
| Description                                | Symbol   | Value Range | Unit |
|--------------------------------------------|----------|-------------|------|
| MAX Input Voltage                          | $V_{IN}$ | 18          | V    |
| Max Operating Junction Temperature         | $T_j$    | 150         | °C   |
| Storage Temperature                        | $T_s$    | -55~+150    | °C   |
| Recommended operating junction temperature | $T_j$    | -20~125     | °C   |

Note: Stresses greater than 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 Ratings” for extended periods may affect device reliability.

## Heat Dissipation

| Description        | Symbol        | Package | Value Range | Unit |
|--------------------|---------------|---------|-------------|------|
| Thermal resistance | $\theta_{JA}$ | SOT-223 | 20          | °C/W |

## Block Diagram





DC Characteristics (unless otherwise noted T<sub>A</sub>= 25°C)

| Symbol            | Parameter         | Conditions                                                                | Min   | Typ  | Max   | Unit |
|-------------------|-------------------|---------------------------------------------------------------------------|-------|------|-------|------|
| V <sub>ref</sub>  | Reference voltage | LD1117SADJCTR<br>10mA ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 3.25V | 1.225 | 1.25 | 1.275 | V    |
| V <sub>out</sub>  | Output voltage    | LD1117S12CTR<br>0 ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 3.2V      | 1.176 | 1.2  | 1.224 | V    |
|                   |                   | LD1117S18CTR<br>0 ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 3.8V      | 1.764 | 1.8  | 1.836 | V    |
|                   |                   | LD1117S25CTR<br>0 ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 4.5V      | 2.45  | 2.5  | 2.55  | V    |
|                   |                   | LD1117S285CTR<br>0 ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 4.85V    | 2.793 | 2.85 | 2.907 | V    |
|                   |                   | LD1117S33CTR<br>0 ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 5.3V      | 3.234 | 3.3  | 3.366 | V    |
|                   |                   | LD1117S50CTR<br>0 ≤ I <sub>out</sub> ≤ 800mA, V <sub>in</sub> = 7.0V      | 4.9   | 5    | 5.1   | V    |
| ΔV <sub>out</sub> | Line regulation   | LD1117S12CTR<br>I <sub>out</sub> = 10mA, 2.7V ≤ V <sub>in</sub> ≤ 10V     |       | 0.03 | 0.2   | %/V  |
|                   |                   | LD1117SADJCTR<br>I <sub>out</sub> = 10mA, 2.75V ≤ V <sub>in</sub> ≤ 12V   |       | 0.03 | 0.2   | %/V  |
|                   |                   | LD1117S18CTR<br>I <sub>out</sub> = 10mA, 3.3V ≤ V <sub>in</sub> ≤ 12V     |       | 0.03 | 0.2   | %/V  |
|                   |                   | LD1117S25CTR<br>I <sub>out</sub> = 10mA, 4.0V ≤ V <sub>in</sub> ≤ 12V     |       | 0.03 | 0.2   | %/V  |
|                   |                   | LD1117S285CTR<br>I <sub>out</sub> = 10mA, 4.35V ≤ V <sub>in</sub> ≤ 12V   |       | 0.03 | 0.2   | %/V  |
|                   |                   | LD1117S33CTR<br>I <sub>out</sub> = 10mA, 4.8V ≤ V <sub>in</sub> ≤ 12V     |       | 0.03 | 0.2   | %/V  |
|                   |                   | LD1117S50CTR<br>I <sub>out</sub> = 10mA, 6.5V ≤ V <sub>in</sub> ≤ 12V     |       | 0.03 | 0.2   | %/V  |
| ΔV <sub>out</sub> | Load regulation   | LD1117S12CTR<br>V <sub>in</sub> = 2.7V, 10mA ≤ I <sub>out</sub> ≤ 800mA   |       | 2    | 8     | mV   |
|                   |                   | LD1117SADJCTR<br>V <sub>in</sub> = 2.75V, 10mA ≤ I <sub>out</sub> ≤ 800mA |       | 2    | 8     | mV   |
|                   |                   | LD1117S18CTR<br>V <sub>in</sub> = 3.3V, 10mA ≤ I <sub>out</sub> ≤ 800mA   |       | 3    | 12    | mV   |
|                   |                   | LD1117S25CTR<br>V <sub>in</sub> = 4.0V, 10mA ≤ I <sub>out</sub> ≤ 800mA   |       | 4    | 16    | mV   |
|                   |                   | LD1117S285CTR<br>V <sub>in</sub> = 4.35V, 10mA ≤ I <sub>out</sub> ≤ 800mA |       | 5    | 20    | mV   |
|                   |                   | LD1117S33CTR<br>V <sub>in</sub> = 4.8V, 10mA ≤ I <sub>out</sub> ≤ 800mA   |       | 6    | 24    | mV   |
|                   |                   | LD1117S50CTR<br>V <sub>in</sub> = 6.5, 10mA ≤ I <sub>out</sub> ≤ 800mA    |       | 9    | 36    | mV   |



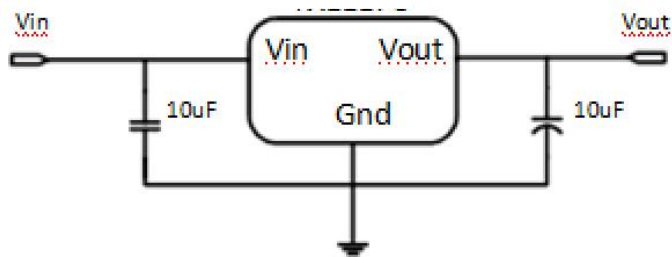
|         |                             |                                         |  |      |     |     |
|---------|-----------------------------|-----------------------------------------|--|------|-----|-----|
| Vdrop   | Dropout voltage             | Iout =100mA                             |  | 1.2  | 1.3 | V   |
|         |                             | Iout=800mA                              |  | 1.3  | 1.5 | V   |
| Imin    | Minimum load current        | LD1117SADJCTR                           |  | 2    | 10  | mA  |
| Iq      | Quiescent Current           | LD1117S12CTR,Vin=10V                    |  | 2    | 5   | mA  |
|         |                             | LD1117S18CTR,Vin=12V                    |  | 2    | 5   | mA  |
|         |                             | LD1117S25CTR,Vin=12V                    |  | 2    | 5   | mA  |
|         |                             | LD1117S285CTR,Vin=12V                   |  | 2    | 5   | mA  |
|         |                             | LD1117S33CTR,Vin=12V                    |  | 2    | 5   | mA  |
|         |                             | LD1117S50CTR,Vin=12V                    |  | 2    | 5   | mA  |
| IAdj    | Adjust pin current          | LD1117SADJCTR<br>Vin=5V,10mA≤Iout≤800mA |  | 55   | 120 | uA  |
| Ichange | Iadj change                 | LD1117SADJCTR<br>Vin=5V,10mA≤Iout≤800mA |  | 0.2  | 10  | uA  |
| OTP     | Thermal Shutdown            | Junction Temperature                    |  | +200 |     | ℃   |
|         | Thermal Shutdown Hysteresis | Junction Temperature                    |  | +30  |     | ℃   |
| ΔV/ΔT   | Temperature coefficient     |                                         |  | ±100 |     | ppm |
| θJC     | Thermal resistance          | SOT-223                                 |  | 20   |     | ℃/W |

Note1: All test are conducted under ambient temperature 25℃ and within a short period of time 20ms

Note2: Load current smaller than minimum load current of LD1117SADJCTR will lead to unstable or oscillation output.

Application Circuit

Basic Circuits



Application circuit of LD1117SxxCTR fixed version



## Function Description

LD1117SxxCTR is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, power transistors and its drive circuit and so on.

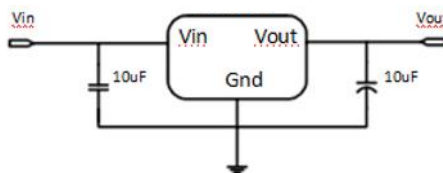
The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140°C.

The bandgap module provides stable reference voltage, whose temperature coefficient is compensated by careful design considerations. The temperature coefficient is under 100 ppm/°C. And the accuracy of output voltage is guaranteed by trimming technique.

## Typical Application

LD1117SxxCTR has an adjustable version and six fixed versions (1.2V, 1.8V, 2.5V, 2.85V, 3.3V and 5V)

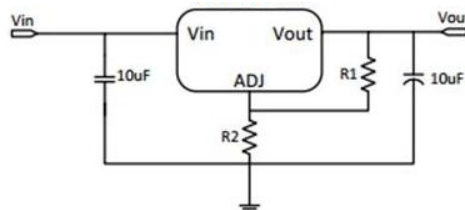
### Fixed Output Voltage Version



Application circuit of LD1117SxxCTR fixed version

- 1) Recommend using 10uF tan capacitor as bypass capacitor (C1) for all application circuit.
- 2) Recommend using 10uF tan capacitor to assure circuit stability.

### Adjustable Output Voltage Version



Application Circuit of LD1117SxxCTR

The output voltage of adjustable version follows the equation:  $V_{out} = 1.25 \times (1 + R_2/R_1) + I_{Adj} \times R_2$ . We can ignore  $I_{Adj}$  because  $I_{Adj}$  (about 50uA) is much less than the current of  $R_1$  (about 2~10mA).

1) To meet the minimum load current (>10mA) requirement,  $R_1$  is recommended to be 125ohm or lower. As LD1117SxxCTR can keep itself stable at load current about 2mA,  $R_1$  is not allowed to be higher than 625ohm.

2) Using a bypass capacitor ( $C_{ADJ}$ ) between the ADJ pin and ground can improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of  $C_{ADJ}$  should be less than  $R_1$  to prevent ripple from being amplified. As  $R_1$  is normally in the range of 100Ω~500Ω, the value of  $C_{ADJ}$  should satisfy this equation:  $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R_1$ .

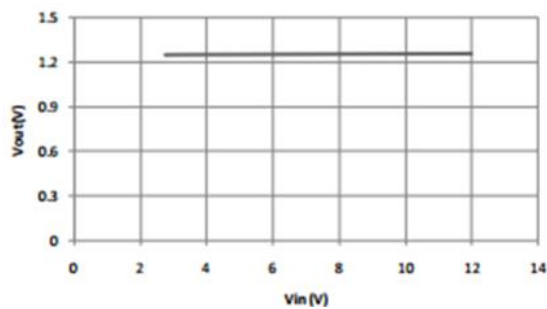


## Thermal Considerations

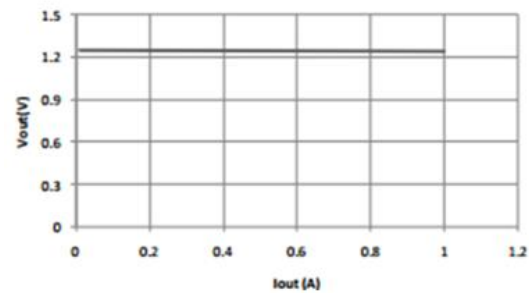
We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by LD1117xxCTR is very large. LD1117SxxCTR series uses SOT-223 package type and its thermal resistance is about  $20^{\circ}\text{C}/\text{W}$ . And the copper area of application board can affect the total thermal resistance. If copper area is  $5\text{cm} \times 5\text{cm}$  (two sides), the resistance is about  $30^{\circ}\text{C}/\text{W}$ . So the total thermal resistance is about  $20^{\circ}\text{C}/\text{W} + 30^{\circ}\text{C}/\text{W}$ . We can decrease total thermal resistance by increasing copper area in application board. When there is no good heat dissipation copper are in PCB, the total thermal resistance will be as high as  $120^{\circ}\text{C}/\text{W}$ , then the power dissipation of LD1117SxxCTR could allow on itself is less than 1W. And furthermore, LD1117SxxCTR will work at junction temperature higher than  $125^{\circ}\text{C}$  under such condition and no lifetime is guaranteed.

## Typical Characteristics

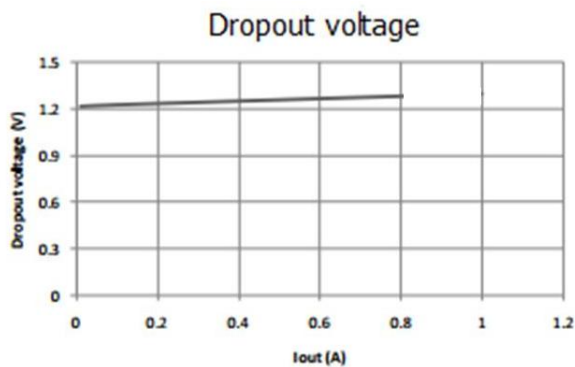
Line regulation



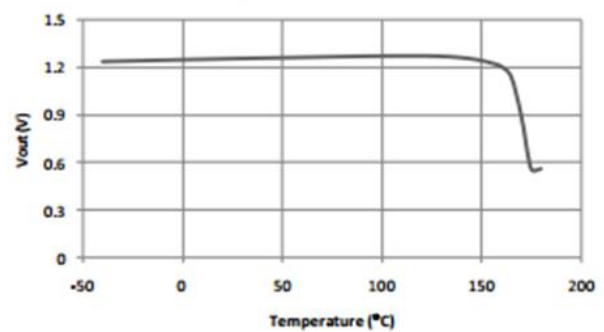
Load regulation



Dropout voltage

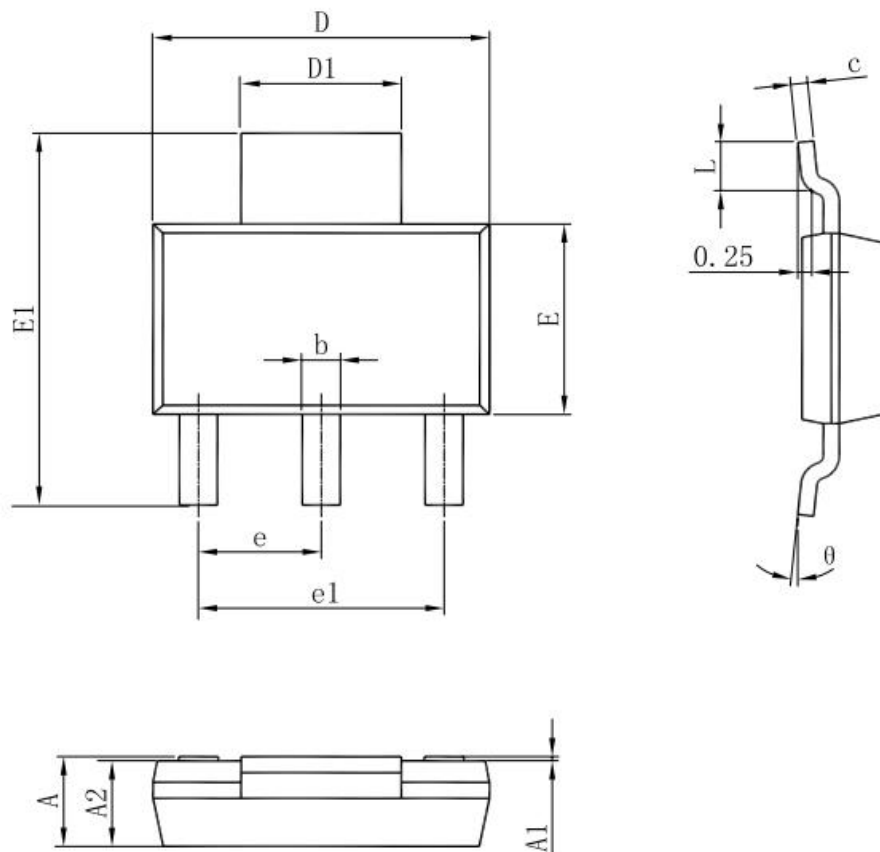


Thermal performance with OTP





## Package Outline Dimensions SOT-223



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.520                     | 1.800 | 0.060                | 0.071 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 1.500                     | 1.700 | 0.059                | 0.067 |
| b      | 0.660                     | 0.820 | 0.026                | 0.032 |
| c      | 0.250                     | 0.350 | 0.010                | 0.014 |
| D      | 6.200                     | 6.400 | 0.244                | 0.252 |
| D1     | 2.900                     | 3.100 | 0.114                | 0.122 |
| E      | 3.300                     | 3.700 | 0.130                | 0.146 |
| E1     | 6.830                     | 7.070 | 0.269                | 0.278 |
| e      | 2.300(BSC)                |       | 0.091(BSC)           |       |
| e1     | 4.500                     | 4.700 | 0.177                | 0.185 |
| L      | 0.900                     | 1.150 | 0.035                | 0.045 |
| θ      | 0°                        | 10°   | 0°                   | 10°   |



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