# AMS1117

## 1A Bipolar Linear Regulator

## Features

- Output current is 1A
- Range of operation input voltage: 15V
- Line regulation: 0.03%/V (typ.)
- Standby current: 2mA (typ.)
- Load regulation: 0.2%/A (typ.)
- Environment Temperature: -20℃~85℃

## Applications

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

## General Description

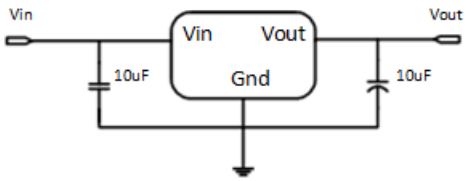
AMS1117 is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. AMS1117 features a very low standby current 2mA compared to 5mA of competitor.

Other than a fixed version, Vout = 1.2V, 1.5V, 1.8V, 2.5V, 2.85V，3.3V, and 5V, AMS1117 has an adjustable version,which can provide an output voltage from 1.25 to 12V with only two external resistors.

AMS1117 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%.

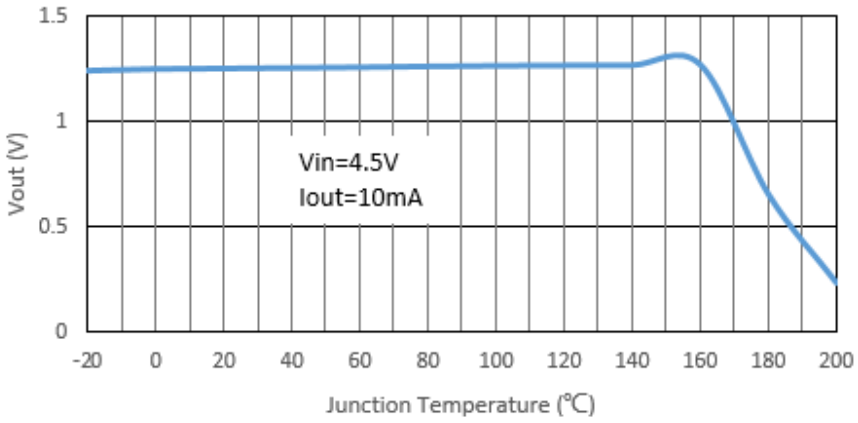
AMS1117 is available in SOT-223, TO-252 power package.

## Typical Application




Application circuit of AMS1117 fixed version

## Typical Electrical Characteristic




## Selection Table

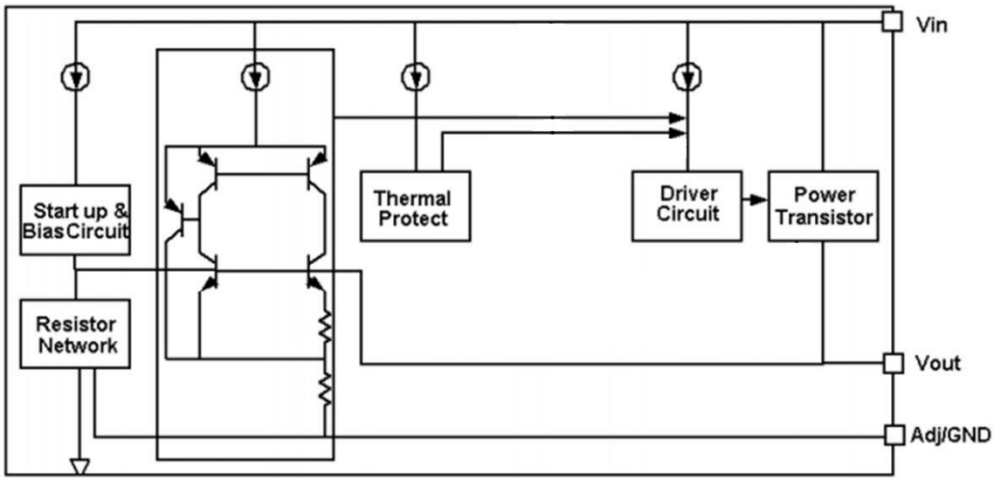
| Marking | Part No. | Output Voltage | Package |
|---|---|---|---|
| 1117<br>XX YYWW | XX=12 | 1.2V | SOT-223<br>TO-252 |
| | XX=15 | 1.5V | |
| | XX=18 | 1.8V | |
| | XX=28 | 2.85V | |
| | XX=25 | 2.5V | |
| | XX=33 | 3.3V | |
| | XX=50 | 5.0V | |
| | XX=ADJ | Adj | |

## Ordering Information

| Marking | Designator | Description |
|---|---|---|
| 1117<br>XX YYWW | 1117 | Product code |
| | XX | Output Voltage(1.2~12.0V) |
| | YYWW | DATE CODE |

Note:"XX" stands for output voltages. Other voltages can be specially customized

## Block Diagram




## Pin Configuration

SOT223 (Top View)

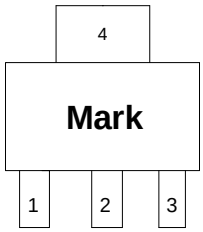



Table1: AMS1117 series (SOT223 PKG)

| PIN NO. | PIN NAME | FUNCTION |
|---|---|---|
| 1 | VSS/ADJ | VSS/ADJ pin |
| 2 | VOUT | Output voltage pin |
| 3 | VIN | Input voltage pin |
| 4 | VOUT | Output voltage pin |

TO252 (Top View)

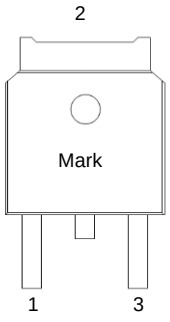



Table2: AMS1117 series (TO252 PKG)

| PIN NO. | PIN NAME | FUNCTION |
|---|---|---|
| 1 | VSS/ADJ | VSS/ADJ pin |
| 2 | VOUT | Output voltage pin |
| 3 | VIN | Input voltage pin |

## Absolute Maximum Ratings

Max Input Voltage ····· ····· ····· ··18V
Max Operating Junction Temperature(Tj) ····· ····· ····· ··150℃
Ambient Temperature(Ta) ····· ····· ····· ···-20℃~ 85℃
Storage Temperature(Ts)····· ····· ····· ···-40℃~150℃
Lead Temperature & Time····· ····· ····· ··260℃ 10S
Caution: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

## Electrical Characteristics

$T_A$=25℃，unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Vin | Input voltage | | -- | 15 | 18 | V |
| Vref | Reference voltage | AMS1117-Adj<br>10mA≤Iout≤1A , Vin=3.25V | 1.225 | 1.25 | 1.275 | V |
| Vout | Output voltage | AMS1117-1.2V<br>0≤Iout≤1A , Vin=2.7V | 1.176 | 1.2 | 1.224 | V |
| | | AMS1117-1.5V<br>0≤Iout≤1A , Vin=3.0V | 1.47 | 1.5 | 1.53 | V |
| | | AMS1117-1.8V<br>0≤Iout≤1A , Vin=3.3V | 1.764 | 1.8 | 1.836 | V |
| | | AMS1117-2.5V<br>0≤Iout≤1A , Vin=4.0V | 2.45 | 2.5 | 2.55 | V |
| | | AMS1117-2.85V<br>0≤Iout≤1A , Vin=4.35V | 2.793 | 2.85 | 2.907 | V |
| | | AMS1117-3.3V<br>0≤Iout≤1A , Vin=4.8V | 3.234 | 3.3 | 3.366 | V |
| | | AMS1117-5.0V<br>0≤Iout≤1A , Vin=6.5V | 4.9 | 5 | 5.1 | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| △Vout | Line regulation | AMS1117-1.2V<br>Iout=10mA, 2.7V≤Vin≤10V | | 4 | 19 | mV |
| | | AMS1117-1.5V<br>Iout=10mA, 3.0V≤Vin≤10V | | 5 | 26 | mV |
| | | AMS1117-ADJ<br>Iout=10mA, 2.75V≤Vin≤12V | | 5 | 24 | mV |
| | | AMS1117-1.8V<br>Iout=10mA, 3.3V≤Vin≤12V | | 5 | 32 | mV |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | AMS1117-2.5V<br>Iout=10mA, 4.0V≤Vin≤12V | | 8 | 41 | mV |
| | | AMS1117-2.85V<br>Iout=10mA, 4.35V≤Vin≤12V | | 8 | 46 | mV |
| | | AMS1117-3.3V<br>Iout=10mA, 4.8V≤Vin≤12V | | 9 | 49 | mV |
| | | AMS1117-5.0V<br>Iout=10mA, 6.5V≤Vin≤12V | | 10 | 56 | mV |

| | | | | | | |
|---|---|---|---|---|---|---|
| △Vout | Load regulation | AMS1117-1.2V<br>Vin =2.7V, 10mA≤Iout≤1A | | 3 | 8 | mV |
| | | AMS1117-1.5V<br>Vin =3.0V, 10mA≤Iout≤1A | | 3 | 8 | mV |
| | | AMS1117-ADJ<br>Vin =2.75V, 10mA≤Iout≤1A | | 4 | 8 | mV |
| | | AMS1117-1.8V<br>Vin =3.3V, 10mA≤Iout≤1A | | 4 | 12 | mV |
| | | AMS1117-2.5V<br>Vin =4.0V, 10mA≤Iout≤1A | | 5 | 16 | mV |
| | | AMS1117-2.85V<br>Vin =4.35V, 10mA≤Iout≤1A | | 6 | 20 | mV |
| | | AMS1117-3.3<br>Vin =4.8V, 10mA≤Iout≤1A | | 7 | 24 | mV |
| | | AMS1117-5.0<br>Vin =6.5V, 10mA≤Iout≤1A | | 10 | 36 | mV |
| Vdrop | Dropout voltage | Iout =100mA | | 1.15 | 1.3 | V |
| | | Iout=1A | | 1.3 | 1.5 | V |
| Imin | Minimum load current | AMS1117-ADJ | | 2 | 10 | mA |
| Iq | Quiescent Current | AMS1117-1.2V,Vin=10V | | 2 | 5 | mA |
| | | AMS1117-1.5V,Vin=10V | | 2 | 5 | mA |
| | | AMS1117-1.8V,Vin=12V | | 2 | 5 | mA |
| | | AMS1117-2.5V,Vin=12V | | 2 | 5 | mA |
| | | AMS1117-2.85V,Vin=12V | | 2 | 5 | mA |
| | | AMS1117-3.3V,Vin=12V | | 2 | 5 | mA |
| | | AMS1117-5.0V,Vin=12V | | 2 | 5 | mA |
| Iadj | Adjust pin current | AMS1117-ADJ<br>Vin=5V,10mA≤Iout≤1A | | 55 | 120 | uA |
| Ichange | Iadj change | AMS1117-ADJ | | 0.2 | 10 | uA |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Vin=5V,10mA≤Iout≤1A | | | | |
| OTP | Thermal Shutdown | Junction Temperature | | +200 | | ℃ |
| | Thermal Shutdown Hysteresis | Junction Temperature | | +30 | | ℃ |
| Δ Vout | Temperature coefficient | Vin=4.5V, Iout=10mA<br>VOUT=3.3V<br>20℃≤Ta≤120℃ | | 30 | | mV |
| θ JC | Thermal resistance | SOT-223 | | 20 | | ℃/W |
| | | TO-252 | | 10 | | |

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

Note2: Load current smaller than minimum load current of AMS1117-ADJ will lead to unstable or oscillation output.

## Detailed Description

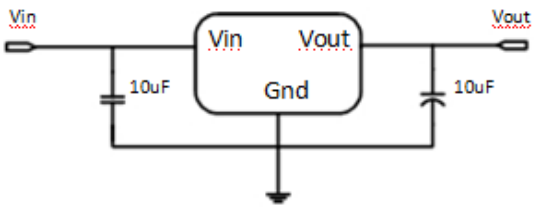
AMS1117is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, power transistors and its driver 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.

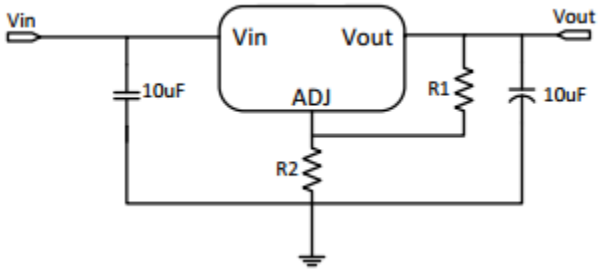
## Typical Application

AMS1117 has an adjustable version and six fixed versions (1.2V, 1.5V,1.8V, 2.5V, 2.85V , 3.3V and 5V)**Fixed Output Voltage Version**




Application circuit of AMS1117 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.




Application Circuit of AMS1117-ADJ

The output voltage of adjustable version follows the equation: Vout=1.25×(1+R2/R1)+IAdj×R2. We can ignore IAdj because IAdj (about 50uA) is much less than the current of R1 (about 2~10mA).

1) To meet the minimum load current (>10mA) requirement, R1 is recommended to be 125ohm or lower. As AMS1117-ADJ can keep itself stable at load current about 2mA, R1 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 R1 to prevent ripple from being amplified. As R1 is normally in the range of 100Ω~500Ω, the value of $C_{ADJ}$ should satisfy this equation: $1/(2\pi \times f_{ripple} \times C_{ADJ})<R1$.

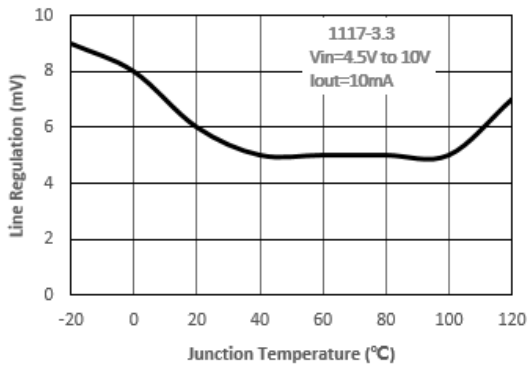
## Thermal Considerations

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 AMS1117is very large. AMS1117series uses SOT-
223 package type and its thermal resistance is about 20°C/W. And the copper area of application board can affect the total thermal resistance. If copper area is 5cm*5cm (two sides), the resistance is about 30°C/W. So the total thermal resistance is about 20°C/W + 30°C/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°C/W, then the power dissipation of AMS1117could allow on itself is less than 1W. And furthermore, AMS1117will work at junction
temperature higher than 125°C under such condition and no lifetime is guaranteed.

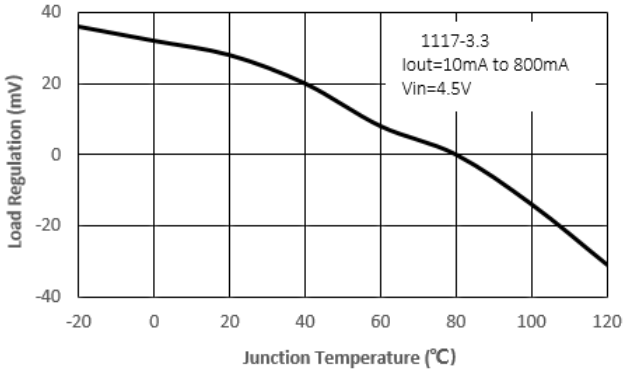
## Typical Performance Characteristics

$T_A$=25℃, unless otherwise noted

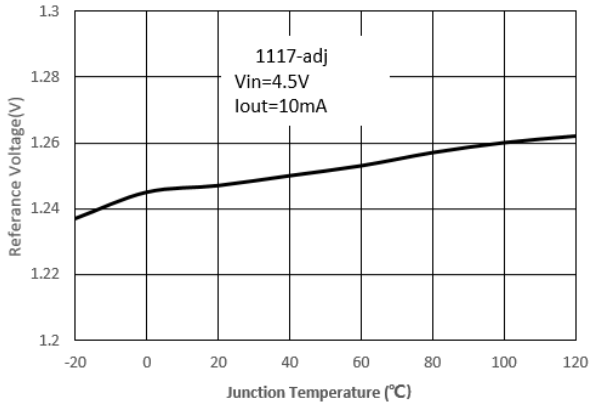
**Line Regulation vs. Junction Temperature**



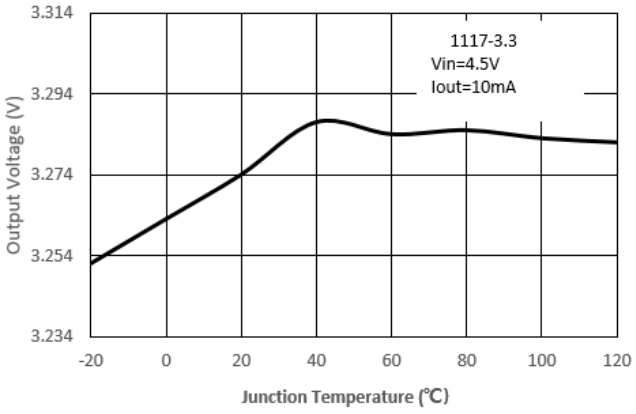

**Load Regulation vs. Junction Temperature**



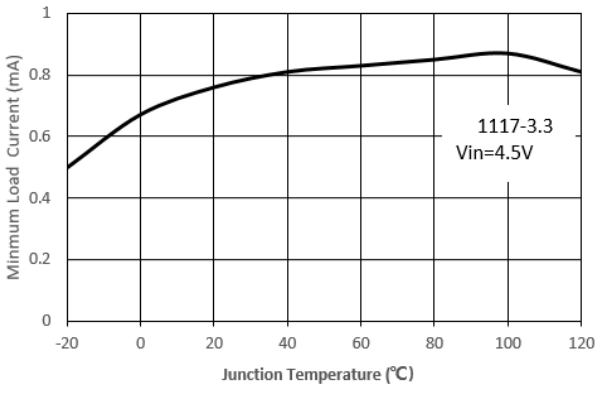

**Reference Voltage vs. Junction Temperature**



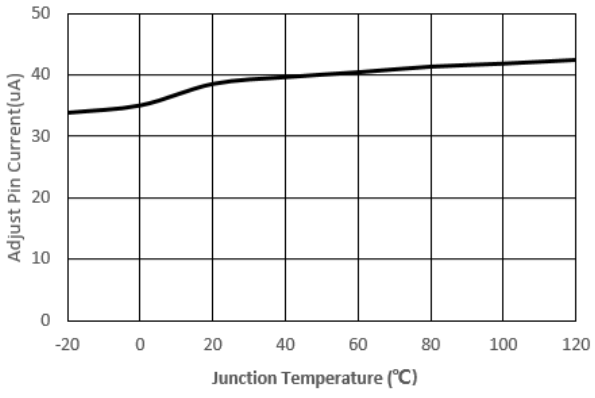

**Output Voltage vs. Junction Temperature**



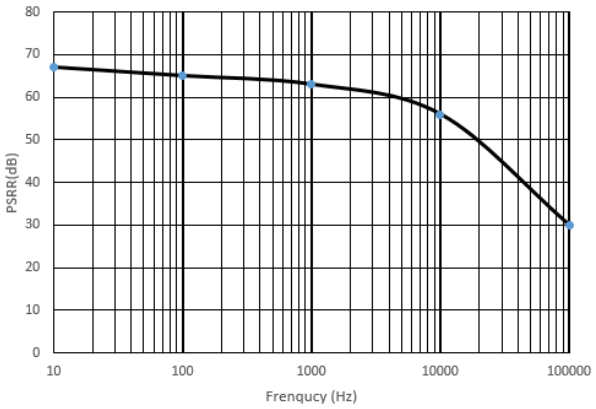

**Minimum Load Current vs. Junction Temperature**



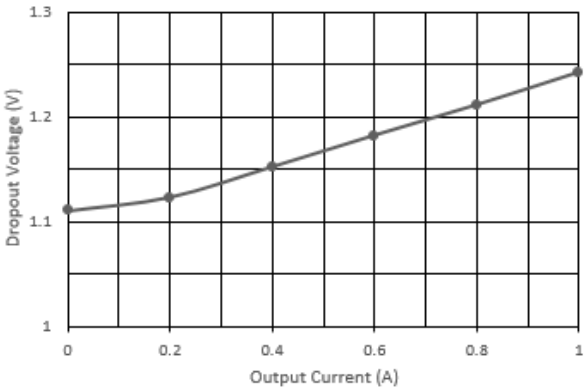

**Adjust Pin Current vs. Junction Temperature**



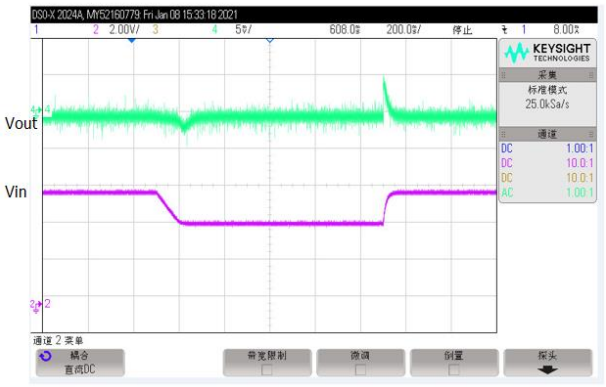
PSRR vs. Frequency



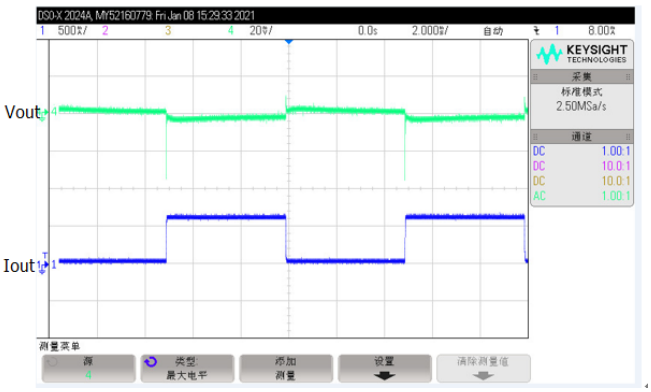

Dropout Voltage vs. Ouput Current




**Line Transient Response**

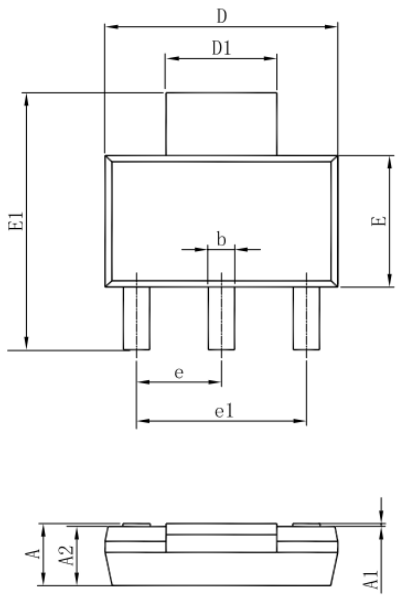


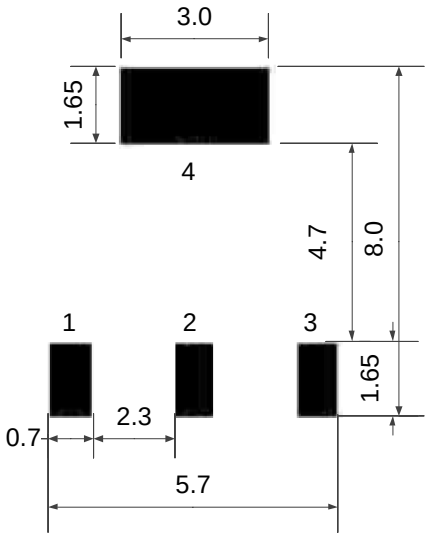

**Load Transient Response**



## Package Information

SOT-223 PACKAGE OUTLINE DIMENSIONS

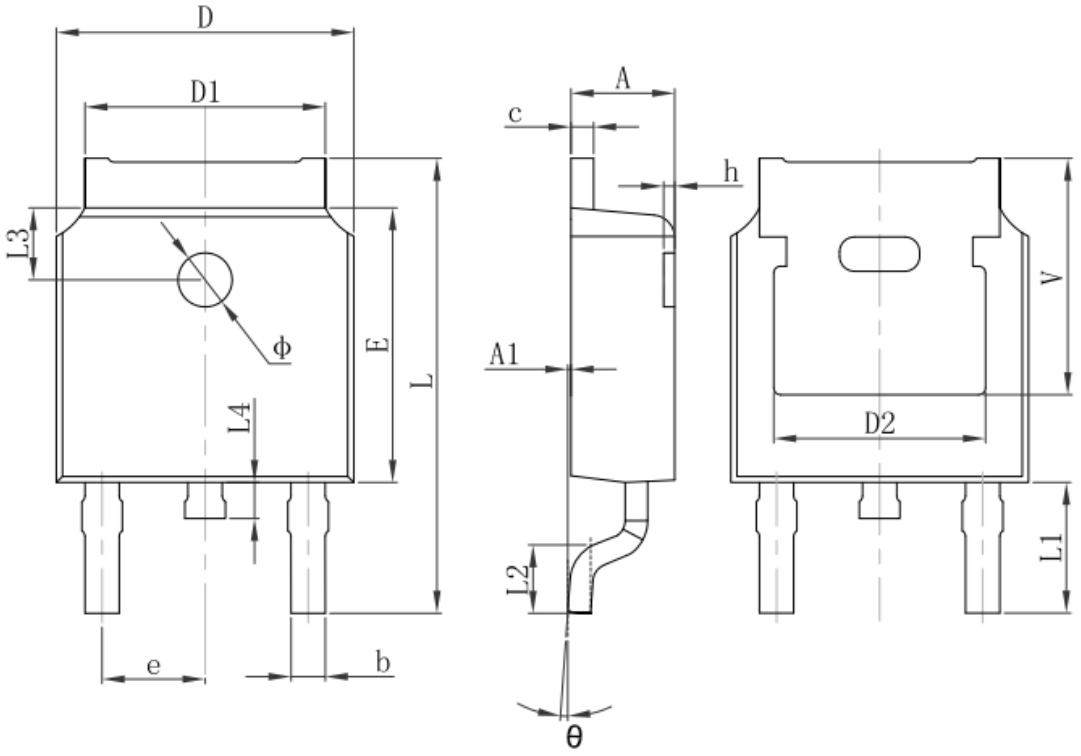



PCB Board

| 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° |

## TO-252-2L PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 REF. | | 0.190 REF. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 REF. | | 0.114 REF. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 REF. | | 0.063 REF. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 REF. | | 0.211 REF. | |

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