

SK6117

1A Bipolar Linear Regulator

General Description

The SK6117 is a series of low dropout three-terminal regulators with a dropout. It provide a fixed output voltage from 1.2V to 5V. And an adjustable output voltage, which can provide an output voltage from 1.25V to 12V with external resistors.

The SK6117 offers thermal shutdown function to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within 2%.

SK6117 is available in SOT-223 and TO-252 packages.

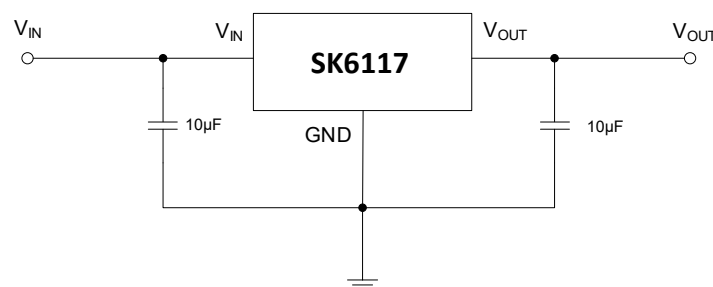
Features

- Maximum Input Operating Voltage: 15V
- Maximum Output Current is 1A
- Fixed Output Voltage: 1.2V/1.5V/1.8V/2.5V/3.3V/5.0V
- Adjustable Output Voltage: 1.25V to 12V
- Quiescent Current: 2mA (typ.)
- Voltage Accuracy: $\pm 2\%$
- Pb Free & ROHS Compliant

Applications

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

Typical Application Circuits

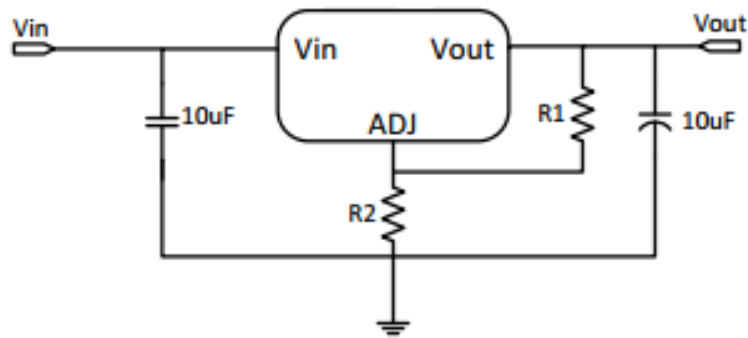


Fixed Output Voltage Version

Note

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

Typical Application Circuits (Continued)



Adjustable Output Voltage Version

Note: The output voltage of adjustable version follows the equation: $V_{OUT} = 1.25 \times (1 + R2/R1) + I_{ADJ} \times R2$. We can ignore I_{ADJ} because I_{ADJ} (about 50μA) is much less than the current of R1 (about 2~10mA).

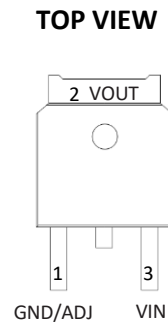
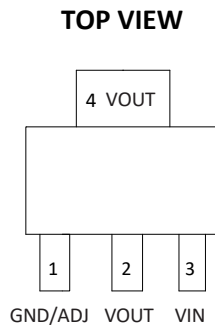
(1) To meet the minimum load current (>10mA) requirement, R1 is recommended to be 125Ω or lower. As SK6117-ADJ can keep itself stable at load current about 2mA, R1 is not allowed to be higher than 625Ω.

(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.

(3) As R1 is normally in the range of 100Ω~500Ω, the value of C_{ADJ} should satisfy this equation:

$$1/(2\pi \times f_{ripple} \times C_{ADJ}) < R1$$

Pin Configuration



Pin Description

| PIN NO. | | PIN NAME | FUNCTION |
|---------|-------|----------|--------------------|
| SOT223 | TO252 | | |
| 1 | 1 | GND/ADJ | GND/ADJ pin |
| 2 | 2 | VOUT | Output voltage pin |
| 3 | 3 | VIN | Input voltage pin |
| 4 | - | VOUT | Output voltage pin |

Ordering Information

| Part Number | Package | Temperature | Quantity/ Reel |
|-------------|---------|-------------|----------------|
| SK6117-XXLR | SOT223 | -40°C~85°C | 2500 |
| SK6117-ADLR | SOT223 | -40°C~85°C | 2500 |
| SK6117-XXOR | TO252 | -40°C~85°C | 2000 |
| SK6117-ADOR | TO252 | -40°C~85°C | 2000 |

NOTE:

XX indicates output voltage. For example, 33 means product outputs 3.3V, AD means adjustable output.
SK6117 devices are Pb-free and RoHS compliant.

Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|---------------|------------------------------------|------------|------|
| V_{IN_MAX} | Max Input Voltage | 18 | V |
| T_j | Max Operating Junction Temperature | +150 | °C |
| T_A | Ambient Temperature | -40~+85 | °C |
| T_S | Storage Temperature | -55~+150 | °C |
| T_{SOLDER} | Package Lead Soldering Temperature | 260°C, 10s | |

Thermal Information

| Symbol | Parameter | Package | Value | Unit |
|-----------------|--------------------|---------|-------|------|
| $R_{\theta JA}$ | Thermal resistance | SOT-223 | 140 | °C/W |
| | | TO-252 | 120 | °C/W |

Electrical Characteristics

T_A=25°C, unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------|-------------------|--|-------|------|-------|------|
| V _{IN} | Input Voltage | | - | 15 | 18 | V |
| V _{REF} | Reference Voltage | SK6117-ADJ 10mA ≤ I _{OUT} ≤ 1A, V _{IN} = 2.55V | 1.225 | 1.25 | 1.275 | V |
| V _{OUT} | Output Voltage | SK6117-1.2V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 2.5V | 1.176 | 1.2 | 1.224 | V |
| | | SK6117-1.5V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 2.8V | 1.47 | 1.5 | 1.53 | V |
| | | SK6117-1.8V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 3.1V | 1.764 | 1.8 | 1.836 | V |
| | | SK6117-2.5V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 3.8V | 2.45 | 2.5 | 2.55 | V |
| | | SK6117-2.85V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 4.15V | 2.793 | 2.85 | 2.907 | V |
| | | SK6117-3.3V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 4.6V | 3.234 | 3.3 | 3.366 | V |
| | | SK6117-5.0V 0 ≤ I _{OUT} ≤ 1A, V _{IN} = 6.3V | 4.9 | 5 | 5.1 | V |
| ΔV _{OUT} | Line Regulation | SK6117-1.2V I _{OUT} = 10mA, 2.5V ≤ V _{IN} ≤ 10V | | 4 | 19 | mV |
| | | SK6117-1.5V I _{OUT} = 10mA, 2.8V ≤ V _{IN} ≤ 10V | | 5 | 26 | mV |
| | | SK6117-ADJ I _{OUT} = 10mA, 2.55V ≤ V _{IN} ≤ 12V | | 5 | 24 | mV |
| | | SK6117-1.8V I _{OUT} = 10mA, 3.1V ≤ V _{IN} ≤ 12V | | 5 | 32 | mV |
| | | SK6117-2.5V I _{OUT} = 10mA, 3.8V ≤ V _{IN} ≤ 12V | | 8 | 41 | mV |
| | | SK6117-2.85V I _{OUT} = 10mA, 4.15V ≤ V _{IN} ≤ 12V | | 8 | 46 | mV |
| | | SK6117-3.3V I _{OUT} = 10mA, 4.6V ≤ V _{IN} ≤ 12V | | 9 | 49 | mV |
| | | SK6117-5.0V I _{OUT} = 10mA, 6.3V ≤ V _{IN} ≤ 12V | | 10 | 56 | mV |

Electrical Characteristics (Continued)

T_A=25°C, unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|---------------------------------|--|-----|-----|-----|------|
| ΔV_{OUT} | Load Regulation | SK6117-1.2V Vin=2.5V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-1.5V Vin=2.8V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-ADJ Vin=2.55V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-1.8V Vin=3.1V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-2.5V Vin=2.8V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-2.85V Vin=4.15V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-3.3 Vin=4.6V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| | | SK6117-5.0 Vin=6.3V, 10mA≤I _{OUT} ≤1A | | 10 | 40 | mV |
| V _{DROP} | Dropout Voltage | I _{OUT} =100mA | | 1.1 | 1.3 | V |
| | | I _{OUT} =1A | | 1.2 | 1.5 | V |
| I _Q | Quiescent Current | Vin=10V, Vout=1.2, 1.5V Vin=12V, Vout=1.8, 2.5, 3.3, 5.0V | | 2 | 5 | mA |
| I _{ADJ} | Adjust Pin Current | SK6117-ADJ Vin=5V, 10mA≤I _{OUT} ≤1A | | 55 | 120 | μA |
| I _{CHANGE} | I _{ADJ} Change Current | SK6117-ADJ Vin=5V, 10mA≤I _{OUT} ≤1A | | 0.2 | 10 | μA |
| I _{MIN} | Minimum Load Current | SK6117-ADJ | | 2 | 10 | mA |

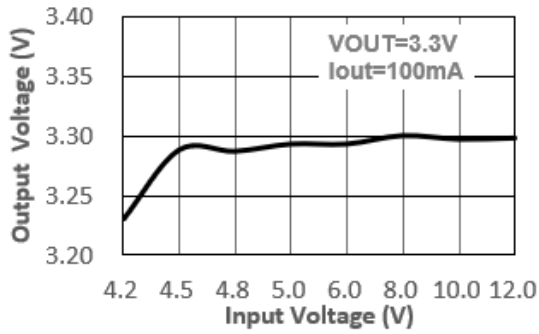
Note

- (1) All test are conducted under ambient temperature 25°C and within a short period of time 20ms.
- (2) Load current smaller than minimum load current of SK6117-ADJ will lead to unstable or oscillation output.

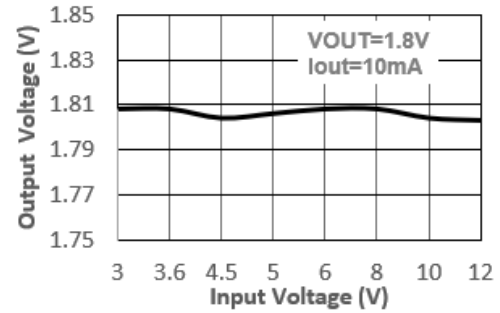
Typical Performance Characteristics

$T_A=25^{\circ}\text{C}$, unless otherwise noted.

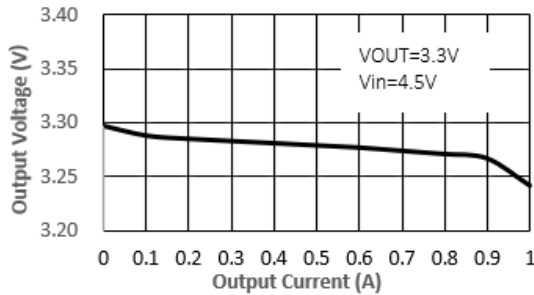
Output Voltage vs. Input Voltage ($V_{OUT}=3.3\text{V}$)



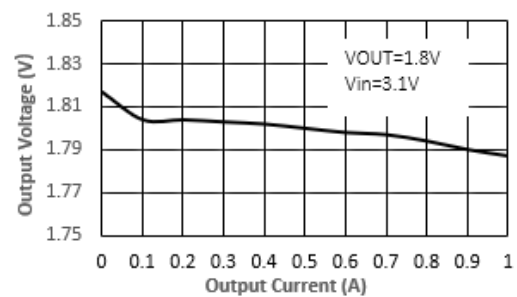
Output Voltage vs. Input Voltage ($V_{OUT}=1.8\text{V}$)



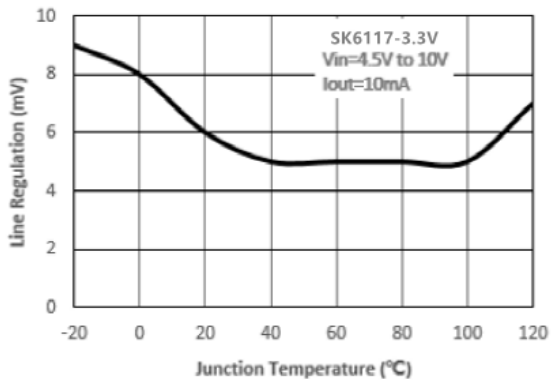
Output Voltage vs. Output Current ($V_{OUT}=3.3\text{V}$)



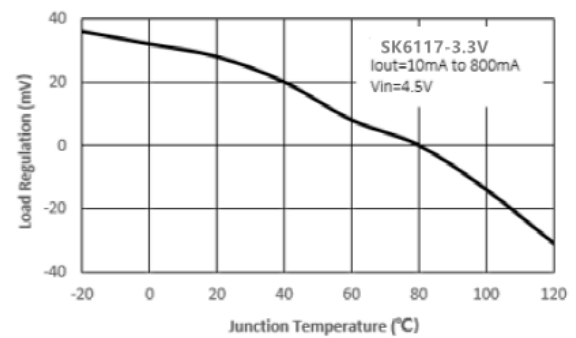
Output Voltage vs. Output Current ($V_{OUT}=1.8\text{V}$)



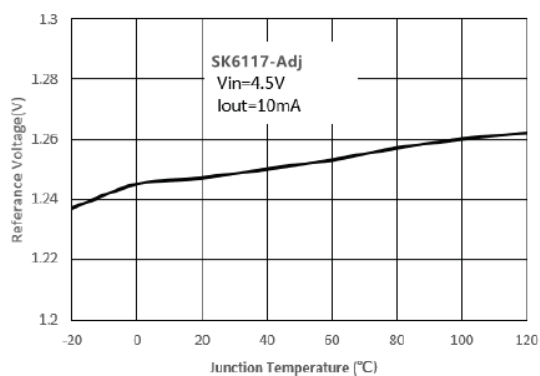
Line Regulation vs. Junction Temperature



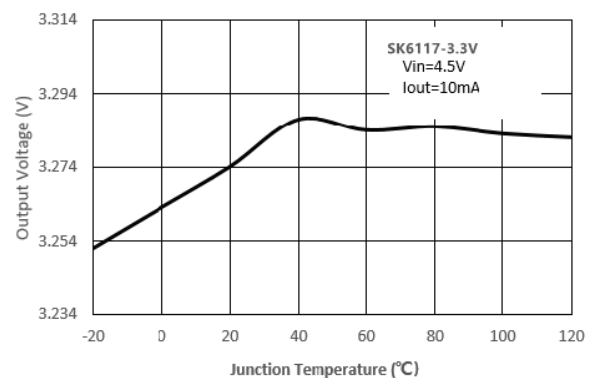
Load Regulation vs. Junction Temperature



Reference Voltage vs. Junction Temperature



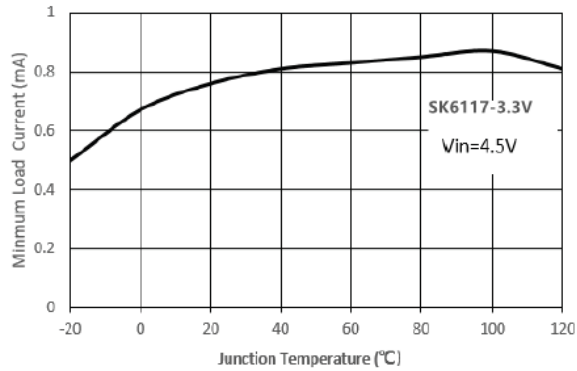
Output Voltage vs. Junction Temperature



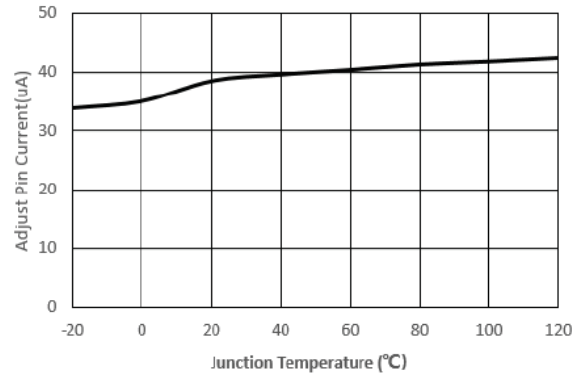
Typical Performance Characteristics (Continued)

$T_A=25^{\circ}\text{C}$, unless otherwise noted.

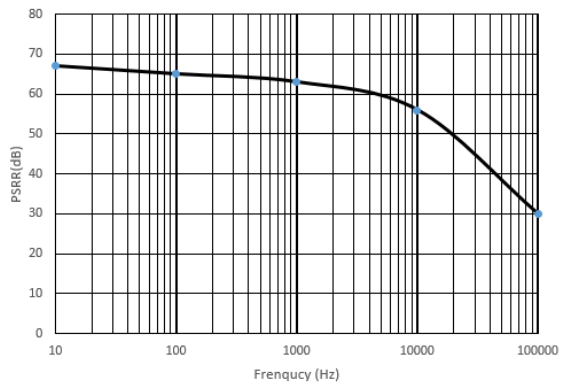
Minimum Load Current vs. Junction Temperature



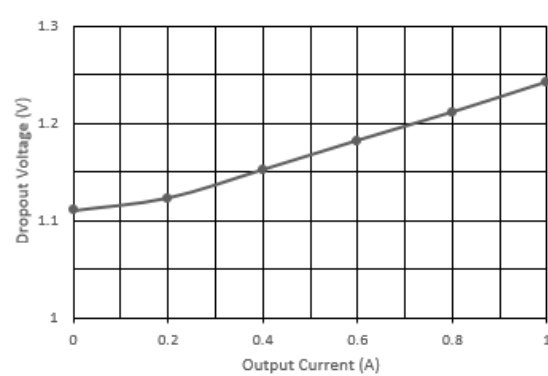
Adjust Pin Current vs. Junction Temperature



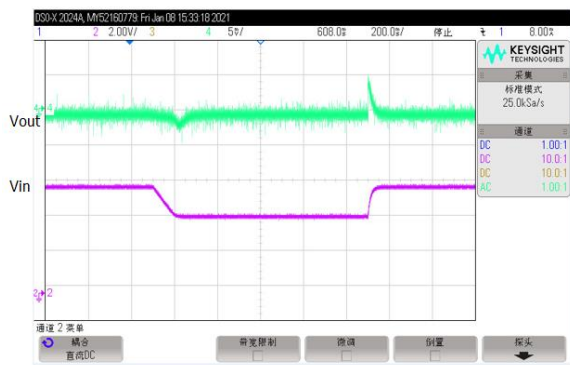
PSRR vs. Frequency



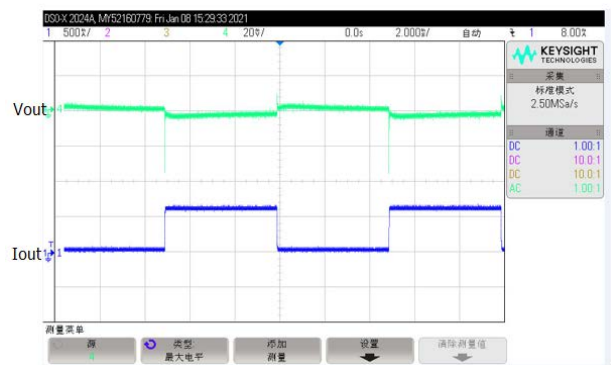
Dropout Voltage vs. Output Current



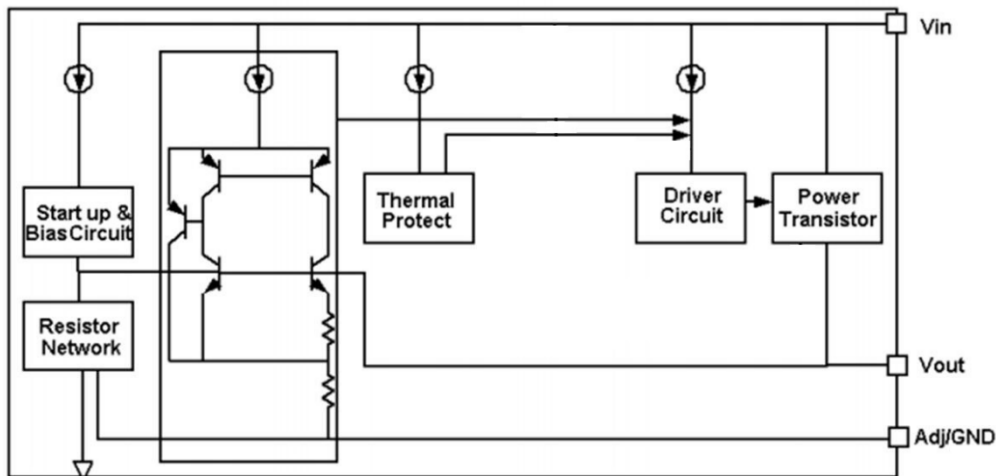
Line Transient Response



Load Transient Response



Block Diagram



Functional Description

SK6117 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 driver circuit and so on.

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.

Thermal Considerations

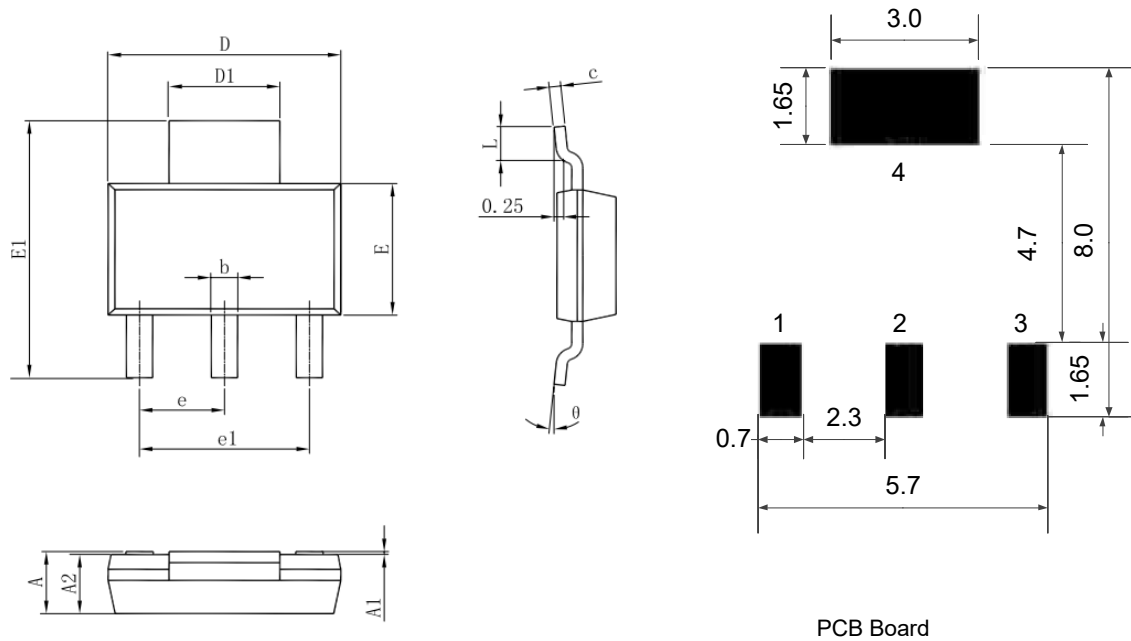
We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by SK6117 is very large.

SK6117 series uses SOT223 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 SK6117 could allow on itself is less than 1W.

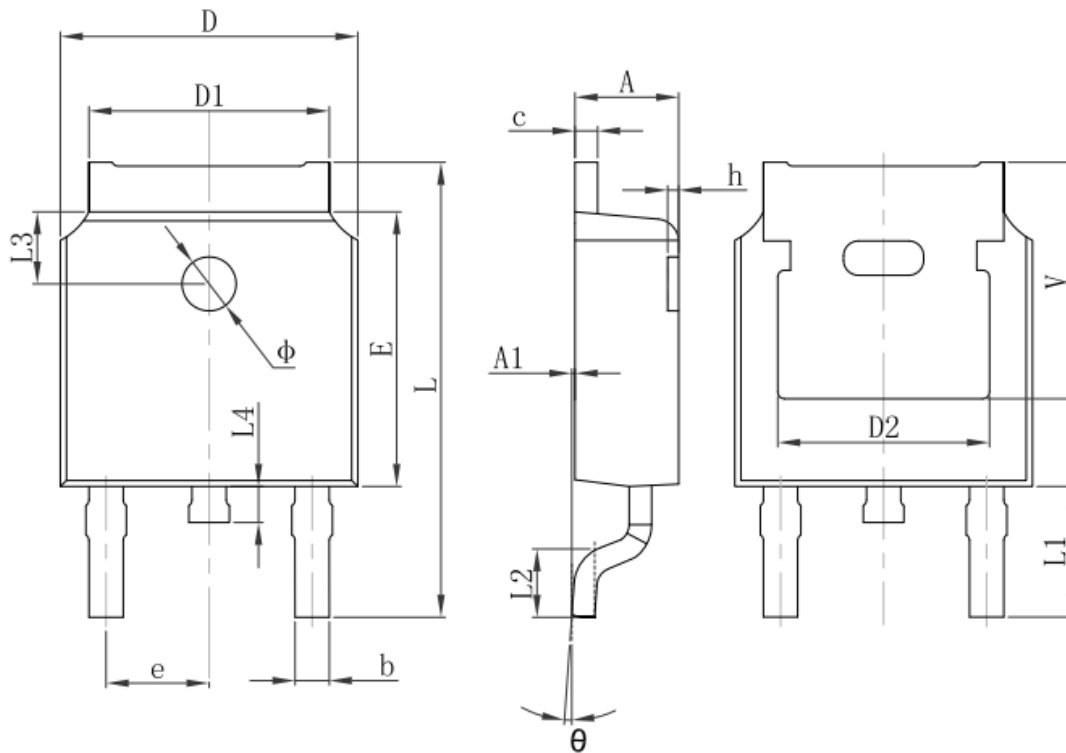
And furthermore, the SK6117 will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

Package Dimensions: SOT223



| 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° |

Package Dimensions: TO252



| 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. | |