

1A Low Dropout Voltage Regulator

Outline:

BL1117 is a series of low dropout three-terminal regulators with a dropout of 1.2V at 1A load current.

Other than a fixed version ($V_{out} = 1.8V, 2.5V, 2.85V, 3.3V, 5V$), BL1117 has an adjustable version, which can provide an output voltage from 1.25 to 13.8V with only two external resistors.

BL1117 offers thermal shut down and current limit functions, to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within $\pm 1\%$.

BL1117 is available in SOT-223, TO-252 and TO-220 power package.

Features:

- Other than a fixed version and an adjustable version, output value can be customized on command.
- Maximum output current is 1A
- Output voltage accuracy is within $\pm 1\%$
- Range of operation input voltage: Max 15V
- Line regulation: 0.2%
- Load regulation: 0.4%
- Environment Temperature: $-50^{\circ}\text{C} \sim 140^{\circ}\text{C}$

Applications:

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

Selection Guide:

BL1117-XX X X

Package Type:

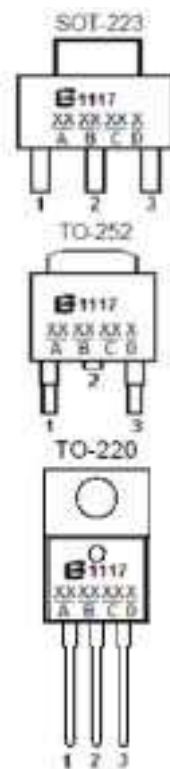
X: SOT-223
Y: TO-252
Z: TO-220

Temp. Range & Rohs Std.:
C: 140C & Pb-free Rhos Std
Z: 140C & Pb/Sn Plating

Output Voltage:

18 1.8V
25 2.5V
28 2.85V
50 5.0V
Default: Adjustable Version

Pin Configuration:



A:
Means
Manufacture
weeks

B:
Means
Manufacture LOT
No.

C:
Means Output
Voltage Value

D:
Means Temp.
Range&Rohs Std

Pin Description:
Fixed Version

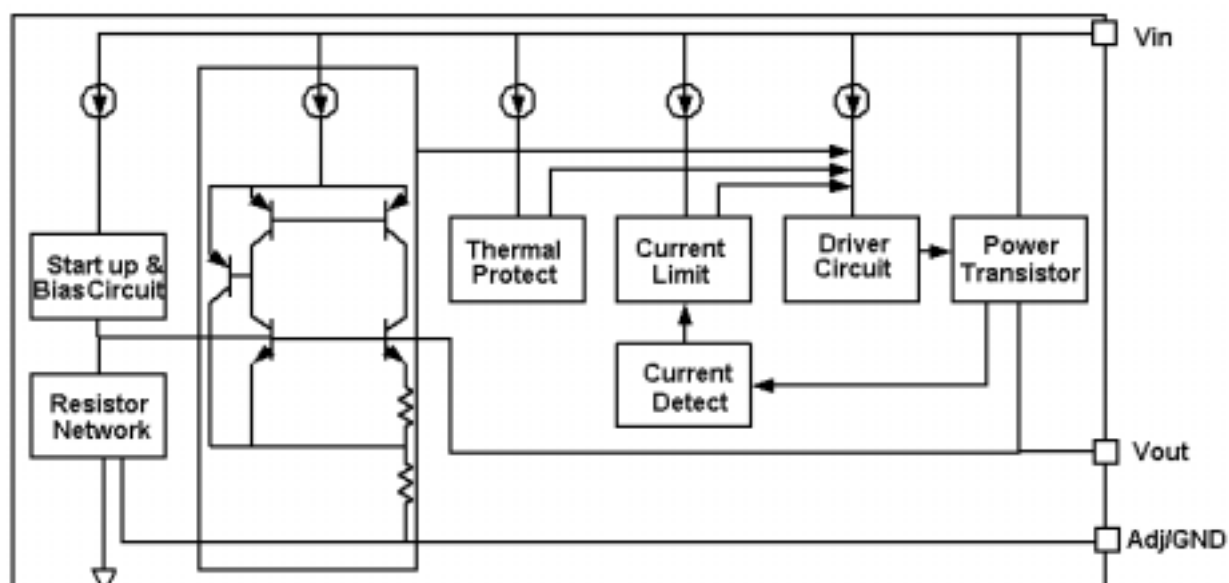
Pin No.	Symbol	Definition
1	GND	Ground
2	Vout	Output
3	Vin	Input

Adjustable Version

Pin No.	Symbol	Definition
1	Adj.	Adjustable
2	Vout	Output
3	Vin	Input

Ordering Information:

Package Marking	Output Voltage	Package Type
BL1117-18CX	1.8 V	SOT-223
BL1117-25CX	2.5 V	SOT-223
BL1117-28CX	2.85V	SOT-223
BL1117-33CX	3.3 V	SOT-223
BL1117-50CX	5.0V	SOT-223
BL1117-CX	Adj.	SOT-223
BL1117-18CY	1.8 V	TO-252
BL1117-25CY	2.5 V	TO-252
BL1117-28CY	2.85V	TO-252
BL1117-33CY	3.3 V	TO-252
BL1117-50CY	5.0V	TO-252
BL1117-CY	Adj.	TO-252
BL1117-18CZ	1.8 V	TO-220
BL1117-25CZ	2.5 V	TO-220
BL1117-28CZ	2.85V	TO-220
BL1117-33CZ	3.3 V	TO-220
BL1117-50CZ	5.0V	TO-220
BL1117-CZ	Adj.	TO-220

Block Diagrams:


Absolute Maximum Ratings:

Maximum Input Voltage-----18V
 Junction Temperature (T_J) -----150°C
 Environment Temperature (T_A) -----140°C
 Storage Temperature (T_S)-----65~150°C
 Lead Temperature and Time -----260°C,10S

Recommended Work Conditions:

Item	Min	Recommended	Max	Unit
Input Voltage Range			15	V
Environment Temperature	-50		140	°C

Electrical Characteristics (Table 1):

 T_J=25°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{ref}	Reference Voltage	I _{out} =10mA, V _{in} -V _{out} =2V 10mA ≤ I _{out} ≤ 1A, 1.5V ≤ V _{in} -V _{out} ≤ 12V	1.238 1.225	1.25 1.25	1.262 1.275	V
V _{out}	Output Voltage	BL1117-1.80V I _{out} =10mA, V _{in} =3.8V, T _J =25°C 0 ≤ I _{out} ≤ 1A, 3.2V ≤ V _{in} ≤ 12V	1.782 1.764	1.80 1.80	1.818 1.836	V
		BL1117-2.5V I _{out} =10mA, V _{in} =4.5V, T _J =25°C 0 ≤ I _{out} ≤ 1A, 3.9V ≤ V _{in} ≤ 12V	2.475 2.45	2.5 2.5	2.525 2.55	V
		BL1117-2.85V I _{out} =10mA, V _{in} =4.85V, T _J =25°C 0 ≤ I _{out} ≤ 1A, 4.25V ≤ V _{in} ≤ 12V	2.822 2.793	2.85 2.85	2.878 2.907	V
		BL1117-3.3V I _{out} =10mA, V _{in} =5V, T _J =25°C 0 ≤ I _{out} ≤ 1A, 4.75V ≤ V _{in} ≤ 12V	3.267 3.234	3.3 3.3	3.333 3.366	V
		BL1117-5V I _{out} =10mA, V _{in} =7V, T _J =25°C 0 ≤ I _{out} ≤ 1A, 6.5V ≤ V _{in} ≤ 12V	4.95 4.9	5 5	5.05 5.1	V
ΔV _{out}	Line Regulation (note1)	BL1117-ADJ I _{out} =10mA, 1.5V ≤ V _{in} -V _{out} ≤ 13.775V		0.035	0.2	%
		BL1117-1.8V I _{out} =10mA, 3.2V ≤ V _{in} ≤ 15V		9	12	mV
		BL1117-2.5V I _{out} =10mA, 3.9V ≤ V _{in} ≤ 15V		9	12	mV
		BL1117-2.85V I _{out} =10mA, 4.25V ≤ V _{in} ≤ 15V		9	12	mV

		BL1117-3.3V $I_{out}=10mA, 4.75V \leq V_{in} \leq 15V$		9	12	mV
		BL1117-5V $I_{out}=10mA, 6.5V \leq V_{in} \leq 15V$		9	12	mV
ΔV_{out}	Load Regulation (note1, 2)	BL1117-ADJ $V_{in}-V_{out}=3V, 10mA \leq I_{out} \leq 1A$		0.2	0.4	%
		BL1117-1.8V $V_{in}=3.2V, 0 \leq I_{out} \leq 1A$		3	10	mV
		BL1117-2.5V $V_{in}=3.9V, 0 \leq I_{out} \leq 1A$		3	10	mV
		BL1117-2.85V $V_{in}=4.25V, 0 \leq I_{out} \leq 1A$		3	10	mV
		BL1117-3.3V $V_{in}=4.75V, 0 \leq I_{out} \leq 1A$		3	10	mV
		BL1117-5V $V_{in}=6.5V, 0 \leq I_{out} \leq 1A$		3	10	mV
$V_{in}-V_{out}$	Dropout Voltage (note3)	$\Delta V_{out}, \Delta V_{ref}=1\%, I_{out}=100mA$		1.11	1.2	V
		$\Delta V_{out}, \Delta V_{ref}=1\%, I_{out}=500mA$		1.18	1.25	V
		$\Delta V_{out}, \Delta V_{ref}=1\%, I_{out}=1A$		1.26	1.3	V
I_{limit}	Current Limit	$V_{in}-V_{out}=2V, T_j=25^\circ C$	1.25	1.4	1.6	A
	Minimum Load Current (note4)	BL1117-ADJ		5	10	mA
I_q	Quiescent Current	BL1117-1.8V, $V_{in}-V_{out}=1.25V$		4	8	mA
		BL1117-2.5V, $V_{in}-V_{out}=1.25V$		4	8	mA

		BL1117-2.85V, Vin-Vout=1.25V		4	8	mA
		BL1117-3.3V, Vin-Vout=1.25V		4	8	mA
		BL1117-5V, Vin-Vout=1.25V		4	8	mA
I _{Adj}	Adjust Pin Current (Adjustable Version)			55	120	uA
I _{change}	Adjust Pin Current Change			0.2		uA
	Temperature Stability				0.5	%
θ _{JC}	Thermal Resistor	SOT-223		20		°C / W
		TO-252		10		
		TO-220		4.5		

Note:

- Note1: The Parameters of Line Regulation and Load Regulation in Table1 are tested under constant junction temperature. The Curve of Load Regulation vs. Temperature is shown in typical parameter curve that follows.
- Note2: When I_{out} varies between 0~1A, Vin-Vout varies between 1.5V~12V under constant junction temperature, the parameter is satisfied the criterion in table. If temperature varies between $-50^{\circ}\text{C} \leq T_A \leq 140^{\circ}\text{C}$, it needs output current to be larger than 10mA to satisfy the criterion.
- Note3: Dropout Voltage is specified over the full output current range of the device, and it is tested under following testing conditions: First step is to find out the V_{out} value(V_{out1}) when Vin1=V_{out}+1.5V, second step is to decrease Vin(Vin2) until V_{out} value is equal to 99%*V_{out1}(V_{out2}). V_{dropout}=Vin2-V_{out2}.
- Note4: Minimum Load Current is defined as the minimum output current required to maintain regulation. When $1.5\text{V} \leq \text{Vin-Vout} \leq 12\text{V}$, the device is guaranteed to regulate if the output current is greater than 10mA.

Detailed Description:

BL1117 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, current limit, power transistors and its driver circuit and so on.

The thermal shut down and current limit modules can assure chip and its application system working safety when the junction temperature is larger than 140°C or output current is larger than 1.4A.

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

Typical Application :

BL1117 has an adjustable version and five fixed versions, Chart1 is its typical application:

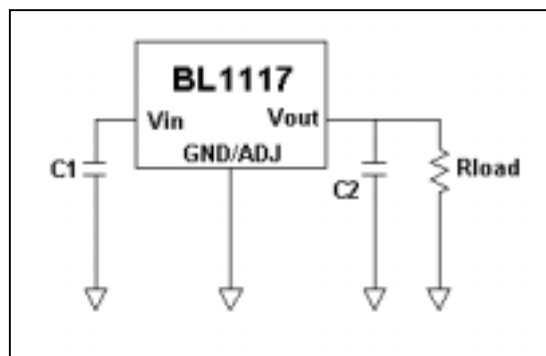


Chart 1: Application circuit of BL1117 fixed version

Application Hints:

1. Recommend using 10uF tan capacitor as bypass capacitor(C1) for all application circuit.
2. Recommend using 22uF tan capacitor to assure circuit stability.
3. Using a bypass capacitor(CAdj) between the adjust terminal and ground can improve ripple rejection, This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of CAdj should be less than the resistor's(R1) which is between output and adjust pins to prevent ripple from being amplified at any ripple frequency. As R1 is normally in the range of 200Ω~350Ω, the value of CAdj should satisfy this equation: $2 \times \text{Fripple} \times C_{\text{Adj}} < R1$. Recommend using 10uF tan capacitor.

Output Voltage of Adjustable Version:

The BL1117 adjustable version provide 1.25V Reference Voltage. Any output voltage between 1.25V~13.8V can be available by choosing two external resistors (connection method is shown in chart 2). In chart 2, R1,R2 is the two external resistors

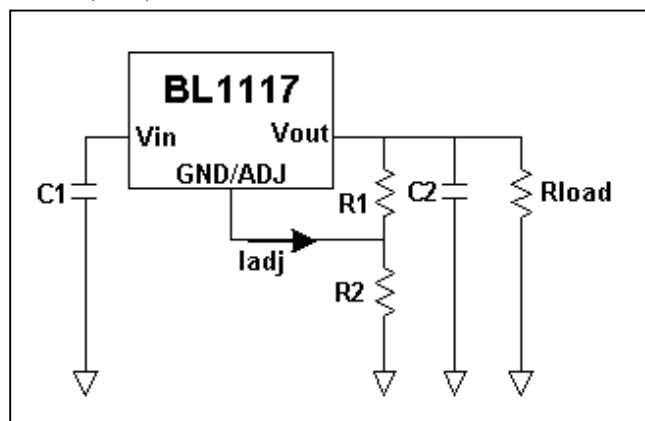


Chart 2. Application Circuit of BL1117 adjustable version

Explanation :

The output voltage of adjustable version satisfies this followed equation:

$V_{Out}=V_{Ref}*(1+R2/R1)+I_{Adj}*R2$. We can ignore I_{Adj} because I_{Adj} (about 50uA) is much less than the current of $R1$ (about 4mA).

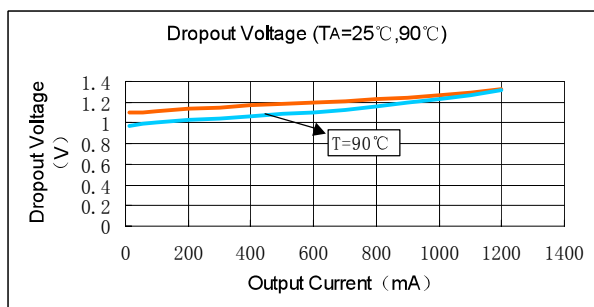
How to choose $R1$: The value of $R1$ should be in the range of $200\Omega \sim 350\Omega$ to assure chip working normally without any load. To assure the electrical performance showed in table 1, the output current should be larger than 5mA. If $R1$ is too large, the minimum output current should be larger than 4mA, The best working condition is to assure that the output current exceeds 10mA.

Thermal Considerations:

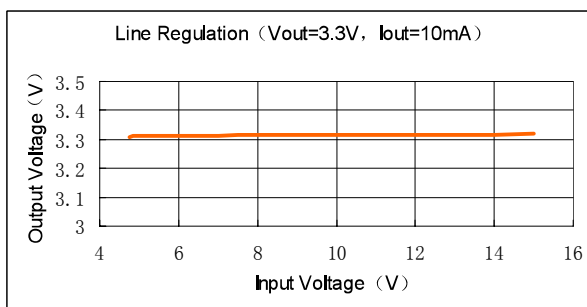
We have to take heat dissipation into consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by BL1117 is very large. BL1117 series uses SOT-223 package type and its thermal resistance is about $20^{\circ}\text{C}/\text{W}$. And the copper area of application board can affect the total thermal resistance. If copper area is 5cm^2 (two sides), the resistance is about $30^{\circ}\text{C}/\text{W}$. So 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.

Typical Characteristics:

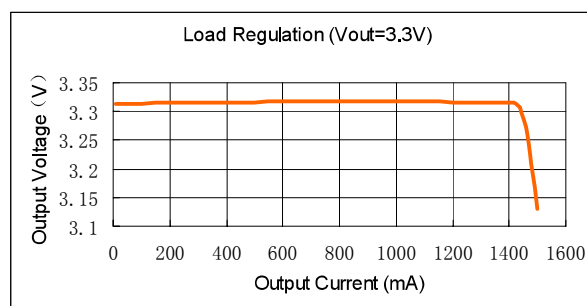
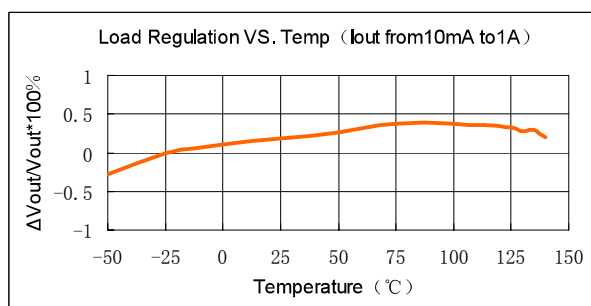
1.BL1117 Dropout Voltage



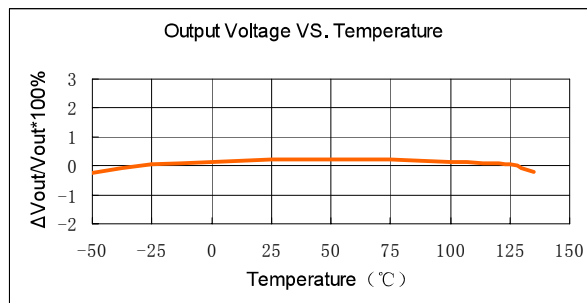
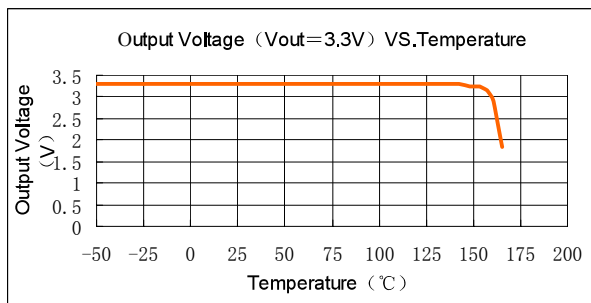
2.BL1117 Line Regulation



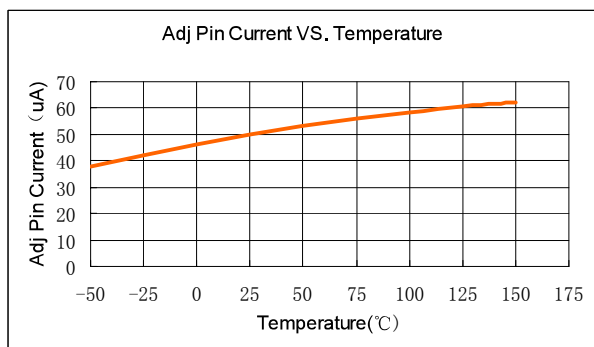
3.BL1117 Load Regulation



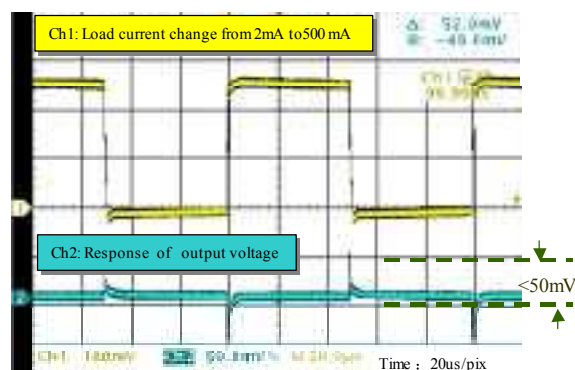
4.BL1117 Temperature Stability



5.BL1117 Adj Pin Current VS. Temperature

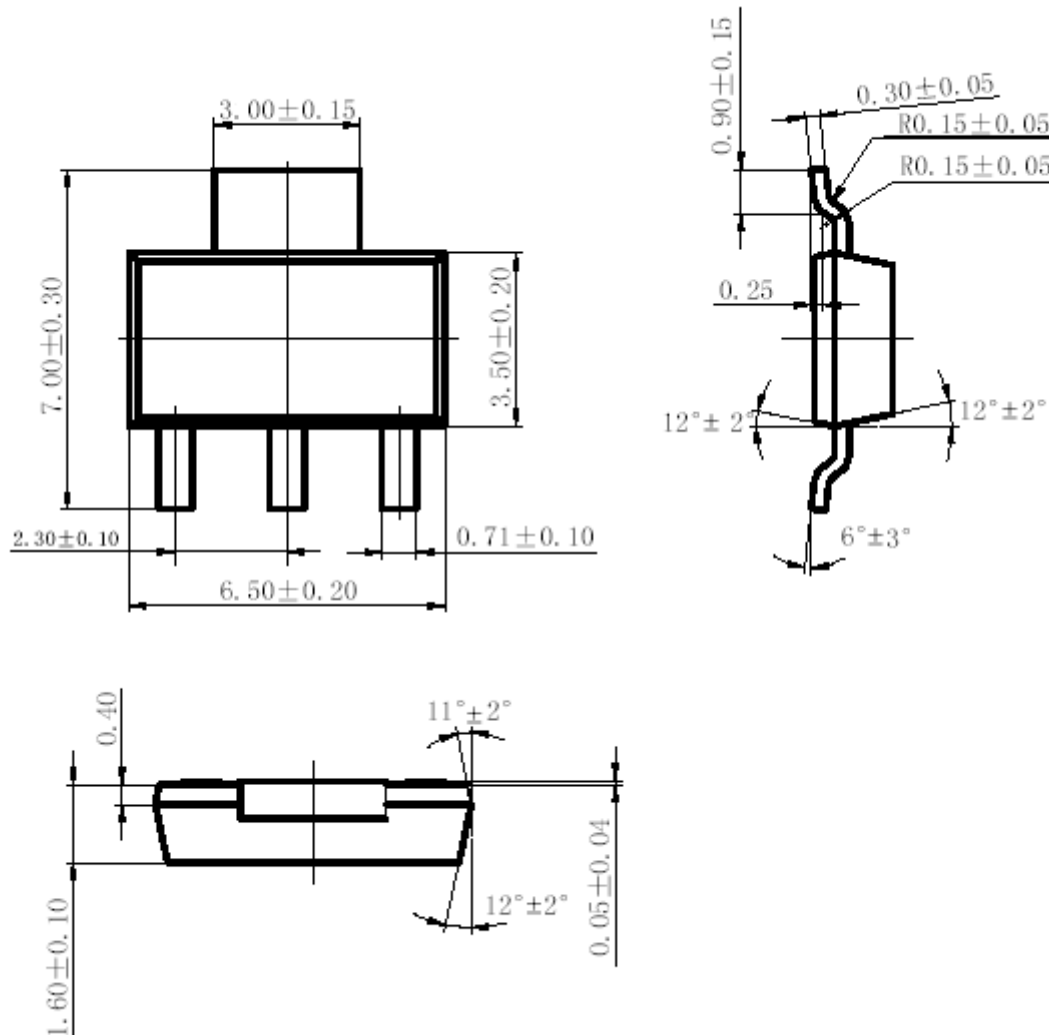


6.BL1117 Load Transient Response

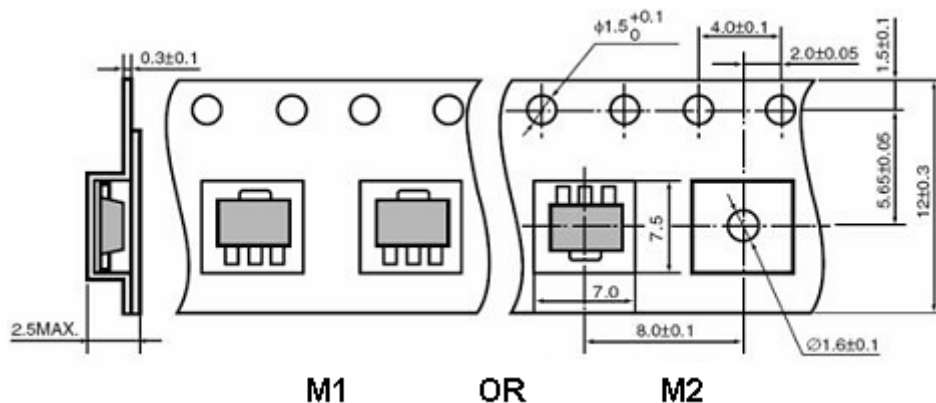


Package outline:

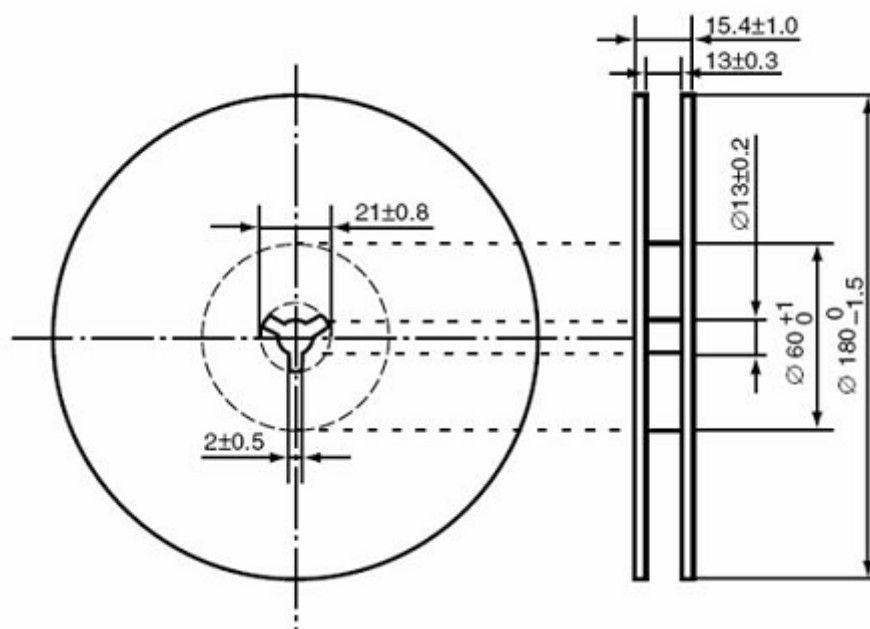
1.SOT-223

Package	SOT-223	Devices per reel	1000	Unit	mm
Package specification:  The technical drawing includes three views of the SOT-223 package: Top View: Shows a rectangular body with a central square pad. Dimensions include a total width of 6.50 ± 0.20 mm, a total height of 7.00 ± 0.30 mm, and a central pad width of 3.00 ± 0.15 mm. The distance from the pad to the side leads is 2.30 ± 0.10 mm, and the distance from the pad to the bottom leads is 0.71 ± 0.10 mm. The body thickness is 3.50 ± 0.20 mm. Side View: Shows the profile of the package with a maximum height of 0.90 ± 0.15 mm. The lead height is 0.30 ± 0.05 mm, and the lead thickness is 0.25 mm. The lead angle is $12^\circ \pm 2^\circ$. The body thickness is 0.05 ± 0.04 mm. Cross-sectional View: Shows the internal structure of the package with a lead angle of $11^\circ \pm 2^\circ$ and a body thickness of 0.05 ± 0.04 mm.					

Taping dimension: (M1: Standard Type , M2: Customized)



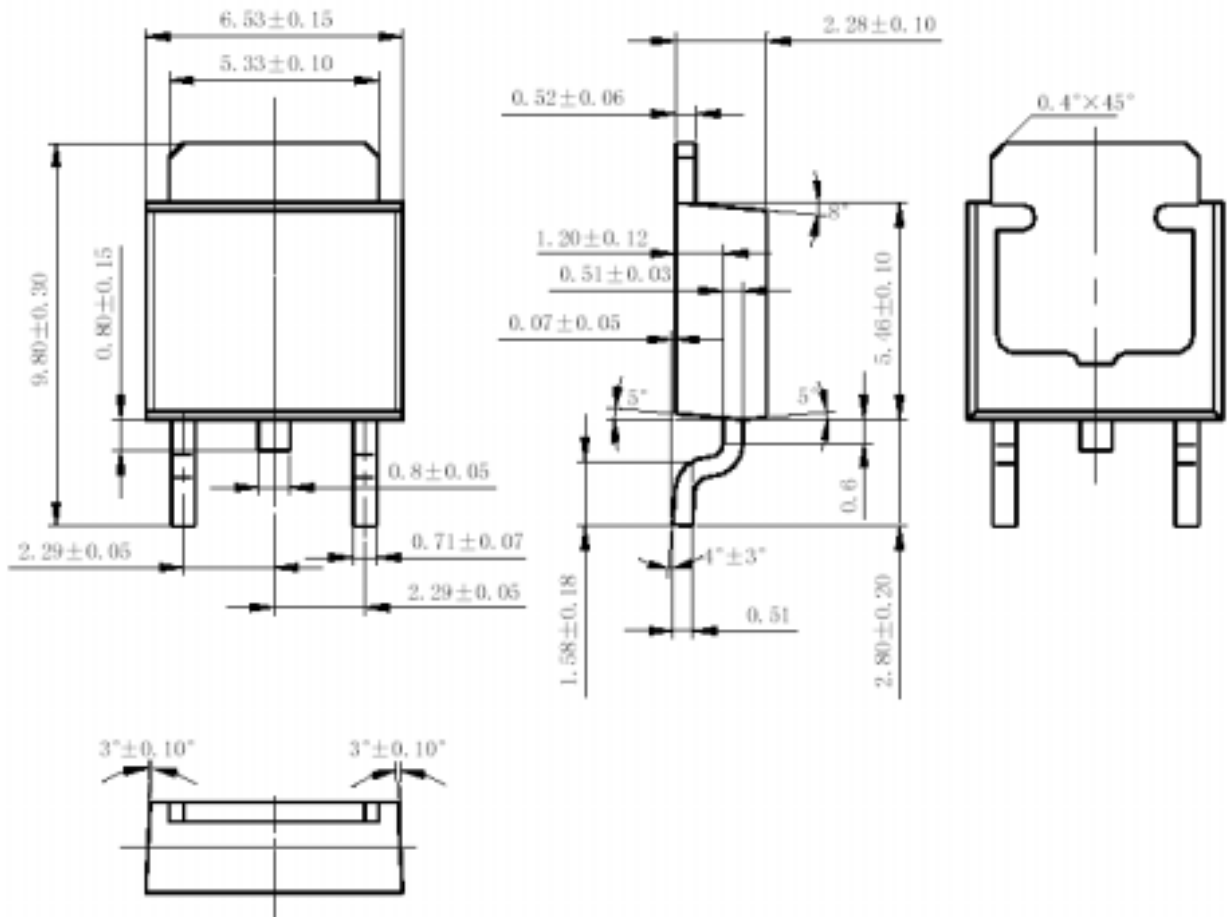
Taping reel dimension:



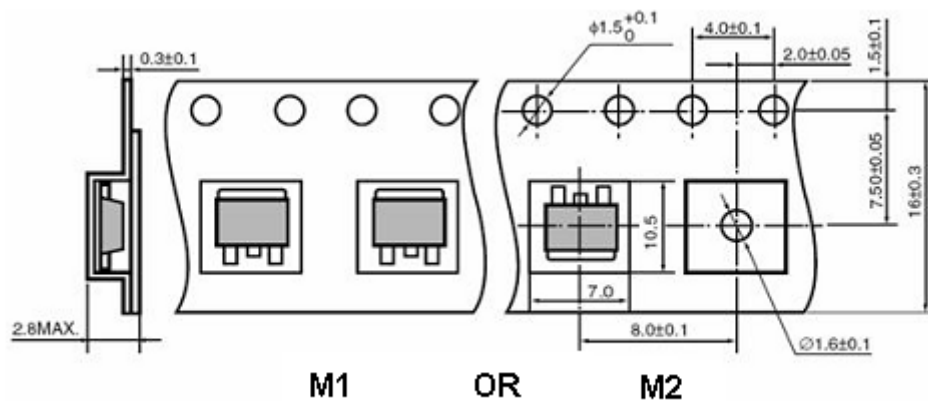
2.TO-252

Package	TO-252	Devices per reel	2500	Unit	mm
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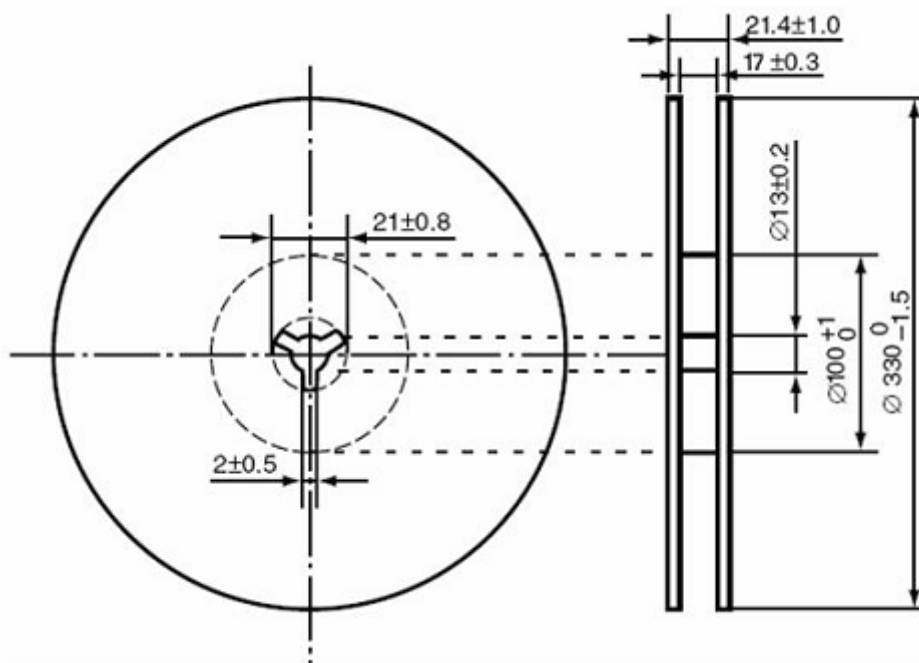
Package specification:



Taping dimension: (M1: Standard Type , M2: Customized)



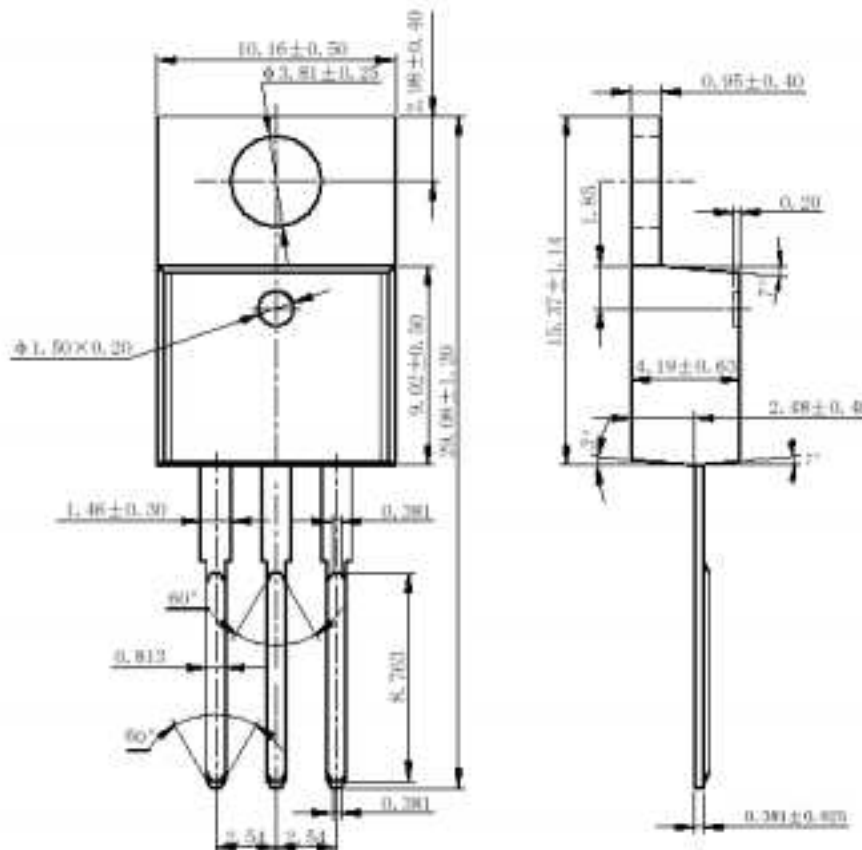
Taping reel dimension:



3.TO-220

Package	TO-220	Devices per tube	50	Unit	mm
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Package specification:



Tube dimension:

