1A Low Dropout Voltage Regulator

LR1117C

Outline：

LR1117C is aseries of low dropout three-terminal regulators with a dropout of 1.2V at 1A load current.

Other than a fixed version（Vout＝1.2V 1.8V,2.5V,2.85V,3.3V,5V）, LR1117C has an adjustable version, which can provide an output voltage from 1.25 to 13.8V with only two external resistors。

LR1117C 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 ±2%.

LR1117C is available in SOT-223,TO-252 and TO-220 power package。

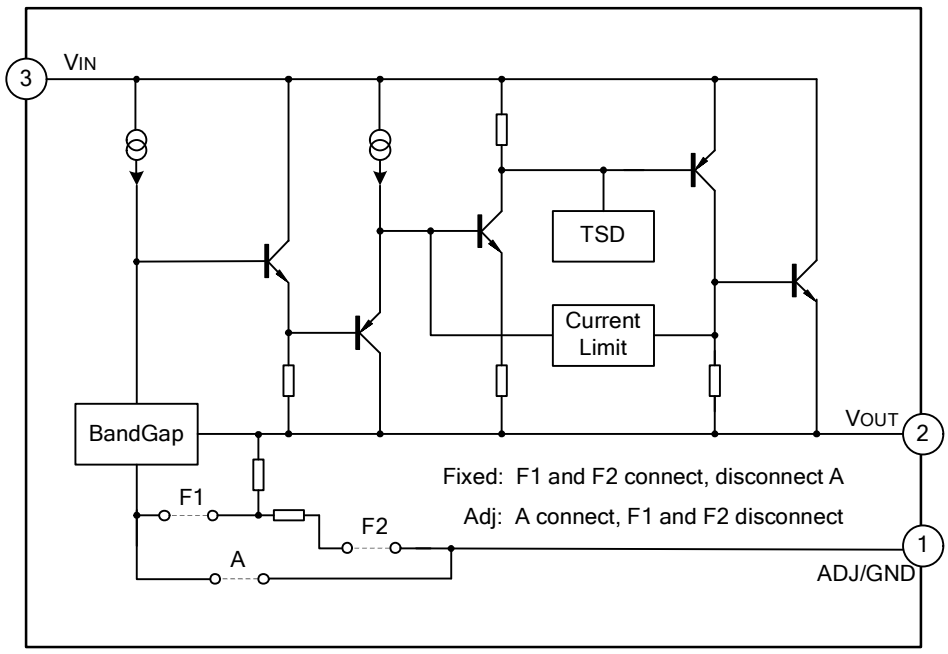
Features：

- 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 ±2%
- Range of operation input voltage: Max 15V
- Line regulation: 0.2%
- Load regulation: 0.4%
- Environment Temperature: -50℃~140℃

Applications：

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

Block Diagrams：



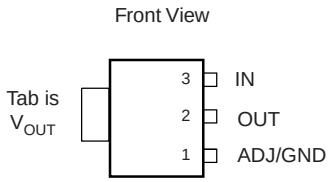
Pin Description：

Fixed Version

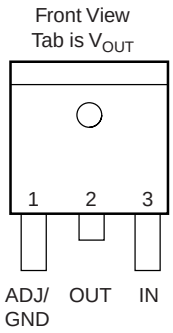
Pin No.	Symbol	Definition
1	GND	Ground
2	Vout	Output
3	Vin	Input

Adjustable Version

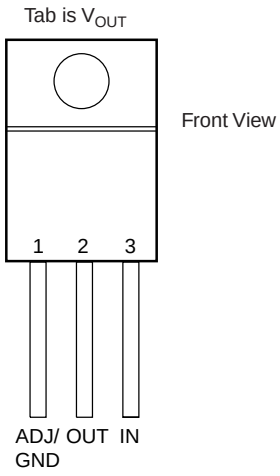
Pin No.	Symbol	Definition
1	Adj.	Adjustable
2	Vout	Output
3	Vin	Input



4-Lead Plastic SOT-223
Θ_{JC} = 15°C/W*



3-Lead Plastic TO-252
Θ_{JC} = 3°C/W*



3-Lead Plastic TO-220
Θ_{JC} = 3°C/W*

Ordering Information:

Package Marking	Output Voltage	Package Type
LR1117CS12X	1.2 V	SOT-223
LR1117CS18X	1.8 V	SOT-223
LR1117CS25X	2.5 V	SOT-223
LR1117CS285	2.85V	SOT-223
LR1117CS33X	3.3 V	SOT-223
LR1117CS5X	5.0V	SOT-223
LR1117CSX	Adj.	SOT-223
LR1117CD12X	1.2 V	TO-252
LR1117CD18X	1.8 V	TO-252
LR1117CD25X	2.5 V	TO-252
LR1117CD285	2.85V	TO-252
LR1117CD33X	3.3 V	TO-252
LR1117CD5X	5.0V	TO-252
LR1117CDX	Adj.	TO-252
LR1117CT12X	1.2 V	TO-220
LR1117CT18X	1.8 V	TO-220
LR1117CT25X	2.5 V	TO-220
LR1117CT285	2.85V	TO-220
LR1117CT33X	3.3 V	TO-220
LR1117CT5X	5.0V	TO-220
LR1117CTX	Adj.	TO-220

Absolute Maximum Ratings：

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

Recommended Work Conditions：

Item	Min	Recommended	Max	Unit
Input Voltage Range			12	V
Environment Temperature	-50		140	°C

Electrical Characteristics (Table 1)：

Tj=25℃

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vref	Reference Voltage	Iout=10mA, Vin-Vout=2V 10mA≤Iout≤1A ,1.5V≤Vin-Vout≤12V	1.238 1.225	1.25 1.25	1.262 1.275	V
Vout	Output Voltage	LR1117-1.80V Iout=10mA,Vin=3.8V,Tj=25℃ 0≤Iout≤1A ,3.2V≤Vin≤12V	1.782 1.764	1.80 1.80	1.818 1.836	V
		LR1117-2.5V Iout=10mA,Vin=4.5V,Tj=25℃ 0≤Iout≤1A ,3.9V≤Vin≤12V	2.475 2.45	2.5 2.5	2.525 2.55	V
		LR1117-2.85V Iout=10mA,Vin=4.85V,Tj=25℃ 0≤Iout≤1A ,4.25V≤Vin≤12V	2.822 2.793	2.85 2.85	2.878 2.907	V
		LR1117-3.3V Iout=10mA,Vin=5V,Tj=25℃ 0≤Iout≤1A ,4.75V≤Vin≤12V	3.267 3.234	3.3 3.3	3.333 3.366	V
		LR1117-5V Iout=10mA,Vin=7V,Tj=25℃ 0≤Iout≤1A ,6.5V≤Vin≤12V	4.95 4.9	5 5	5.05 5.1	V
ΔVout	Line Regulation (note1)	LR1117-ADJ Iout=10mA,1.5V≤Vin-Vout≤13.775V		0.035	0.2	%
		LR1117-1.8V Iout=10mA,3.2V≤Vin≤15V		9	12	mV
		LR1117-2.5V Iout=10mA,3.9V≤Vin≤15V		9	12	mV
		LR1117-2.85V Iout=10mA,4.25V≤Vin≤15V		9	12	mV

		LR1117-3.3V Iout=10mA,4.75V≤Vin≤15V		9	12	mV
		LR1117-5V Iout=10mA,6.5V≤Vin≤15V		9	12	mV
ΔVout	Load Regulation (note1, 2)	LR1117-ADJ Vin-Vout=3V, 10mA≤Iout≤1A		0.2	0.4	%
		LR1117-1.8V Vin=3.2V, 0≤Iout≤1A		3	10	mV
		LR1117-2.5V Vin=3.9V, 0≤Iout≤1A		3	10	mV
		LR1117-2.85V Vin=4.25V, 0≤Iout≤1A		3	10	mV
		LR1117-3.3V Vin=4.75V, 0≤Iout≤1A		3	10	mV
		LR1117-5V Vin=6.5V, 0≤Iout≤1A		3	10	mV
Vin-Vout	Dropout Voltage （note3）	ΔVout, ΔVref =1%，Iout=100mA		1.11	1.2	V
		ΔVout, ΔVref,=1%，Iout=500mA		1.18	1.25	V
		ΔVout, ΔVref,=1%，Iout=1A		1.26	1.3	V
Ilimit	Current Limit	Vin-Vout=2V, Tj=25℃	1.25	1.4	1.6	A
	Minimum Load Current （note4）	LR1117-ADJ		5	10	mA
Iq	Quiescent Current	LR1117-1.8V,Vin-Vout=1.25V		4	8	mA
		LR1117-2.5V, Vin-Vout=1.25V		4	8	mA

		LR1117-2.85V, Vin-Vout=1.25V		4	8	mA
		LR1117-3.3V, Vin-Vout=1.25V		4	8	mA
		LR1117-5V, Vin-Vout=1.25V		4	8	mA
IAdj	Adjust Pin Current (Adjustable Version)			55	120	uA
Ichange	Adjust Pin Current Change			0.2		uA
	Temperature Stability				0.5	%
θ JC	Thermal Resistor	SOT-223		20		℃ / 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 Iout 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℃≤T_A≤140℃，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 Vout value(Vout1) when Vin1=Vout+1.5V, second step is to decrease Vin(Vin2) until Vout value is equal to 99%*Vout1(Vout2). Vdropout=Vin2-Vout2.

Note4：Minimum Load Current is defined as the minimum output current required to maintain regulation. When 1.5V≦Vin-Vout≦12V，the device is guaranteed to regulate if the output current is greater than 10mA.

Detailed Description:

LR1117C 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℃ 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/℃. And the accuracy of output voltage is guaranteed by trimming technique,

Typical Application：

LR1117C has an adjustable version and five fixed versions, Chart1 is its typical application：

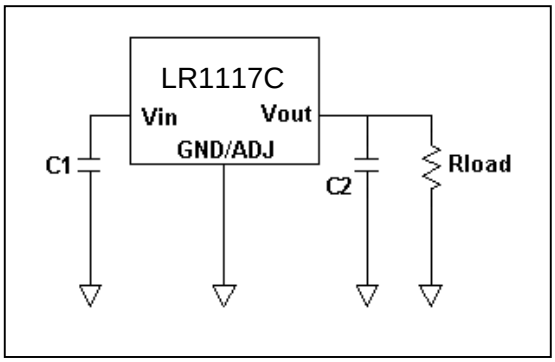


Chart 1: Application circuit of LR1117C fixed version

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(C_{Adj}) 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 C_{Adj} 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 C_{Adj} should satisfy this equation: $1/(2\pi * Fripple * C_{adj}) < R1$. Recommend using 10uF tan capacitor.

Output Voltage of Adjustable Version：

The LR1117C 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

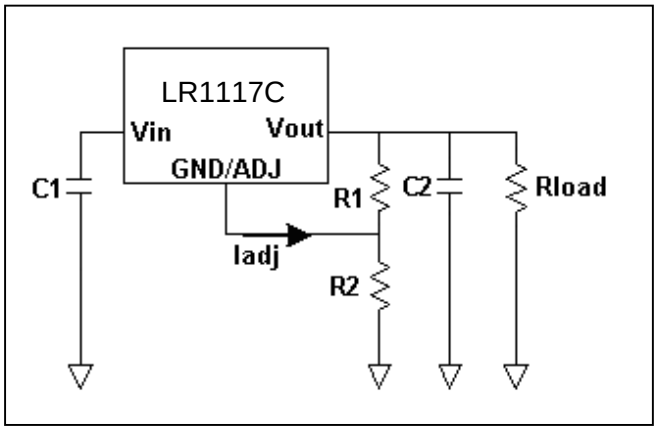


Chart 2. Application Circuit of LR1117C adjustable version

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).

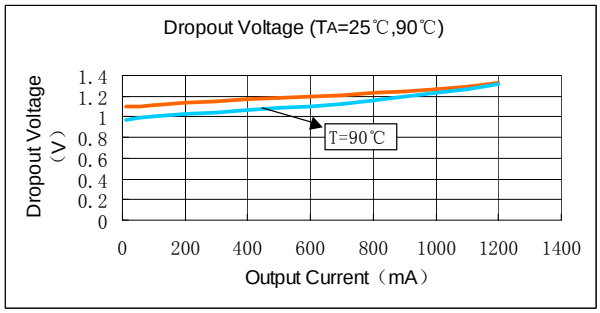
How to choose R1：The value of R1 should be in the range of 200Ω～350Ω to assure chip working normally without any load. To assure the electrical performance showed in table 1, the output current should be larger than 5mA. If R1 is too large, the minimum output current should be larger than 4mA , The best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

Thermal Considerations：

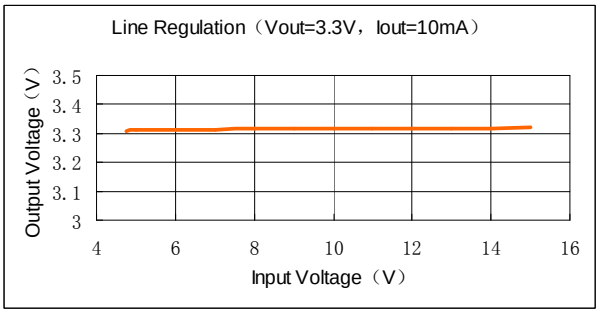
We have to take heat dissipation into consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by LR1117C is very large. LR1117C series uses SOT-223 package type and its thermal resistance is about 20℃/W. And 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℃/W. So total thermal resistance is about 20℃/W+30℃/W. We can decrease total thermal resistance by increasing copper area in application board.

Typical Characteristics：

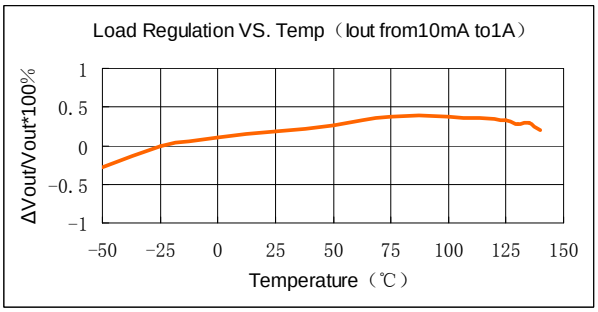
1.LR1117C Dropout Voltage

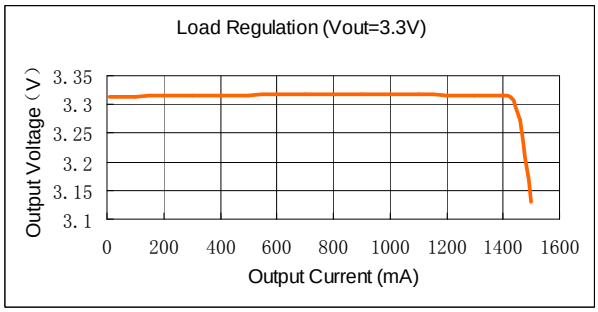


2.LR1117C Line Regulation

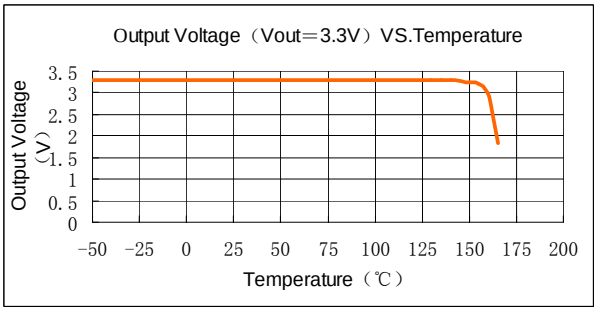


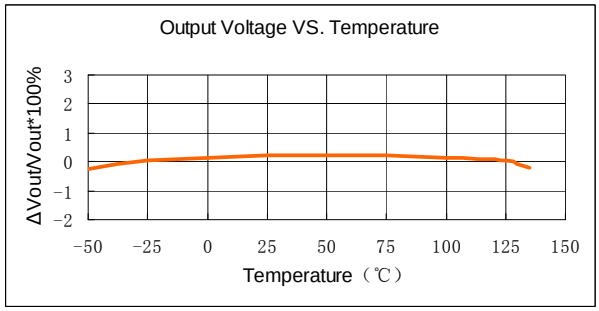
3.LR1117C Load Regulation



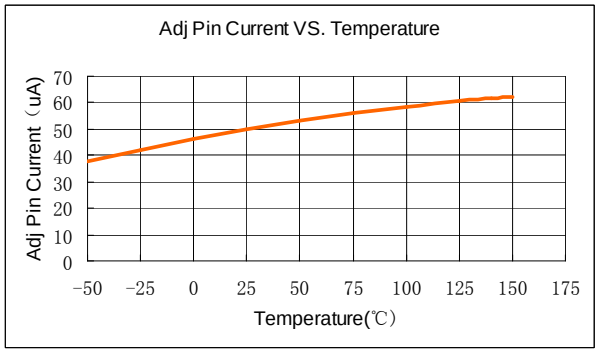


4.LR1117C Temperature Stability

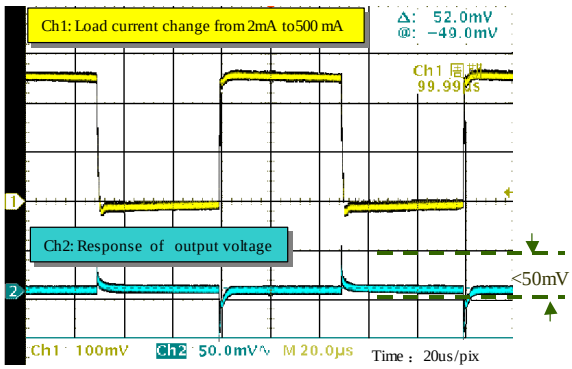




5.LR1117C Adj Pin Current VS. Temperature



6.LR1117C Load Transient Response

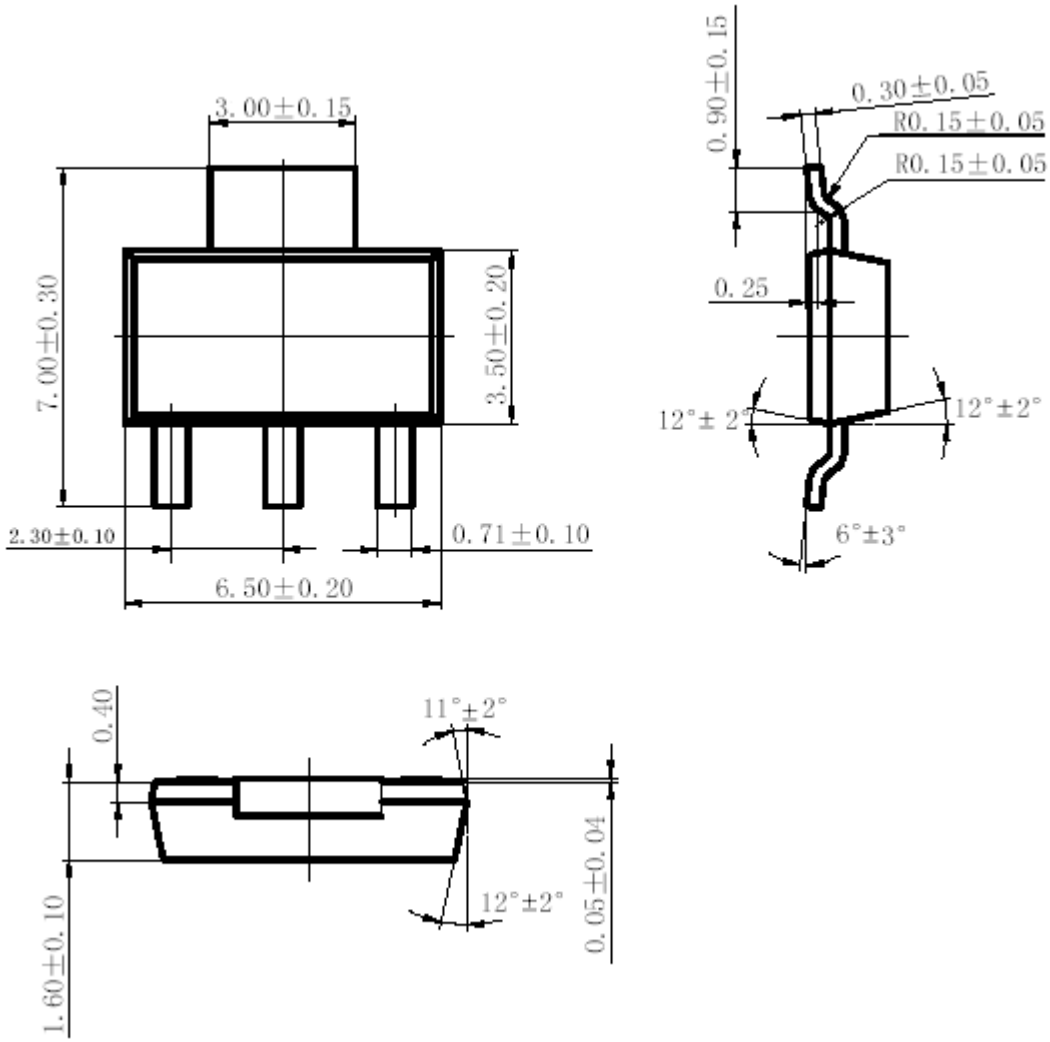


Package outline:

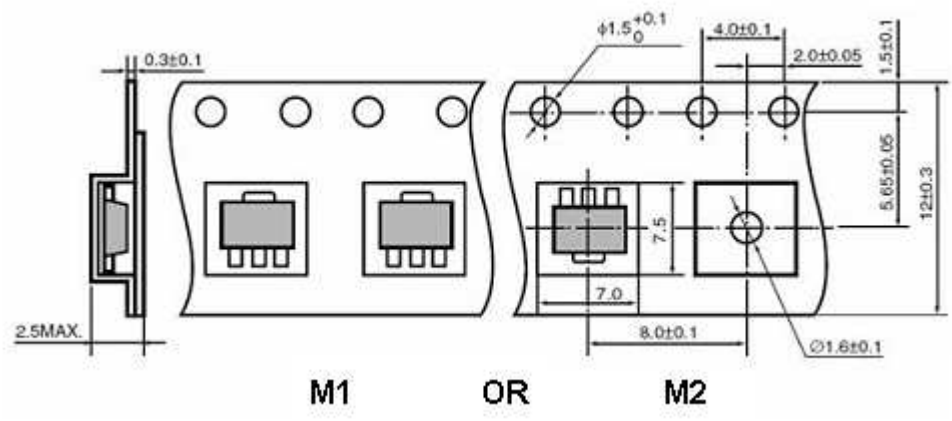
1.SOT-223

Package	SOT-223	Devices per reel	1000	Unit	mm

Package specification：



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



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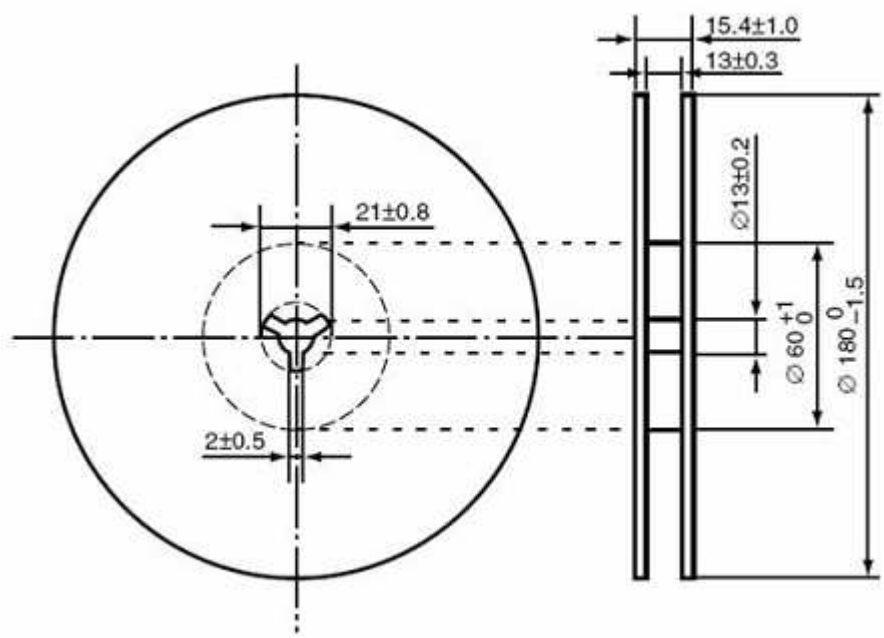
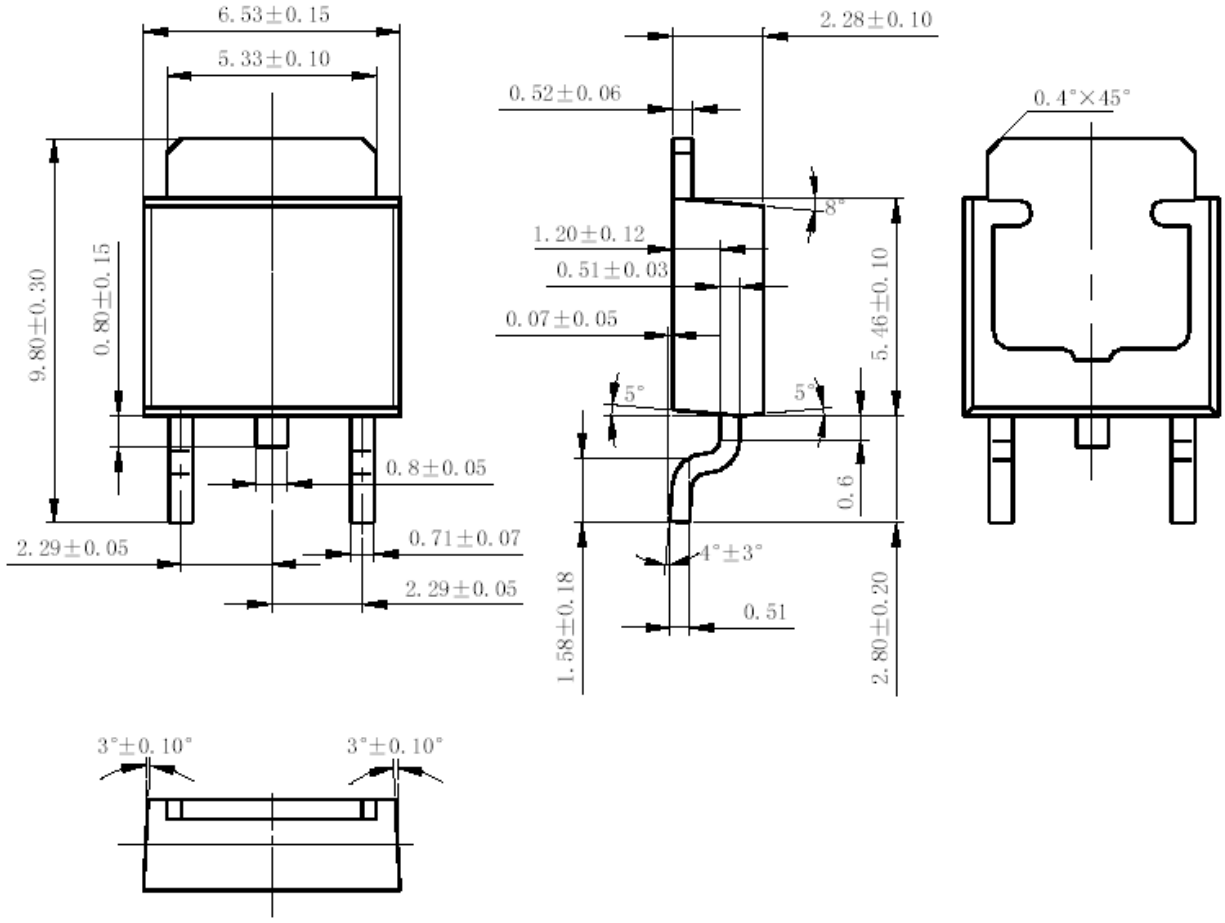


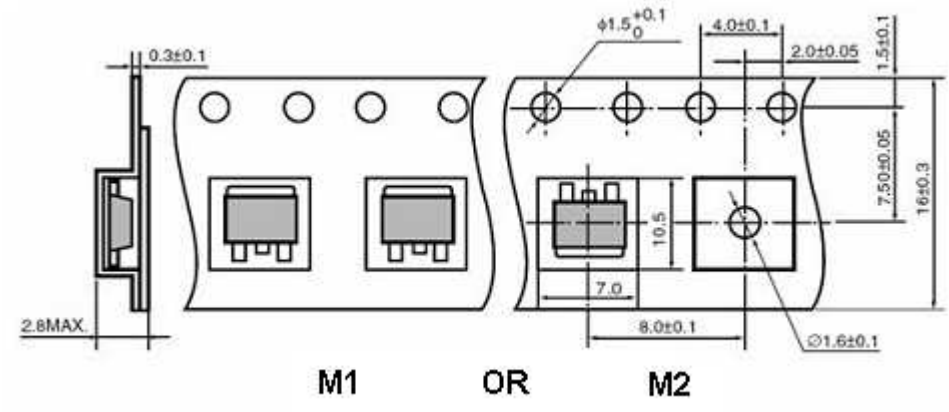
2.TO-252

Package	TO-252	Devices per reel	2500	Unit	mm

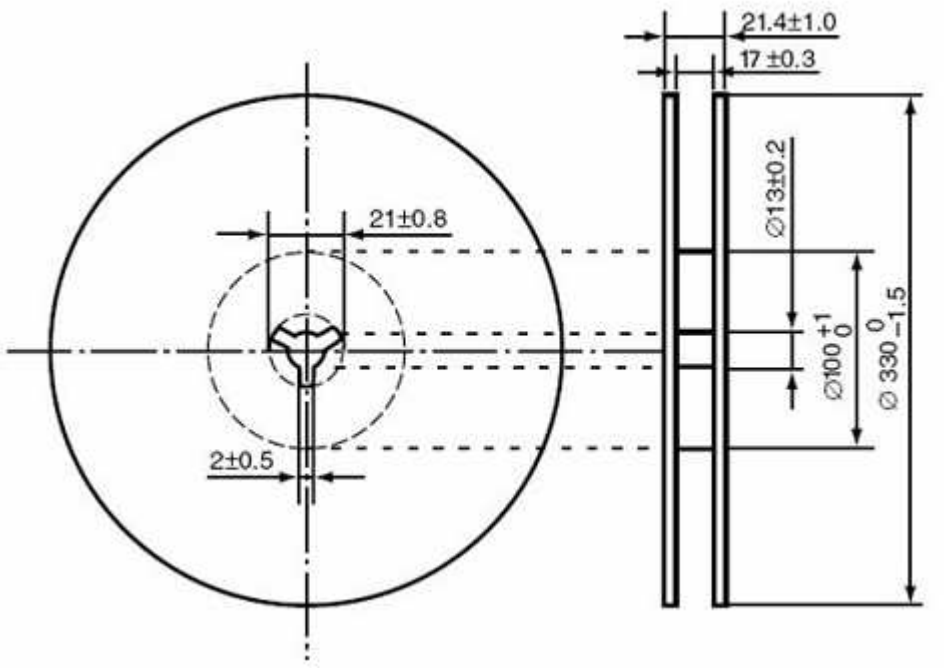
Package specification：



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



Taping reel dimension



3.TO-220

Package	TO-220	Devices per tube	50	Unit	mm

Package specification：