Technology

ACE1117C
1A Bipolar Linear Regulator

Description

ACE1117C is a series of low dropout three-terminal regulators with a dropout of 1.26V at 1A load current.

Other than a fixed version（Vout＝1.2V,1.8V,2.5V,2.85V,3.3V,5V）, ACE1117C has an adjustable version, which can provide an output voltage from 1.25 to 13.8V with only two external resistors.

ACE1117C 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 1.5%(1.2V version is within 2%).Other output voltage accuracy can be customized on command, such as 1% or 2%.

Features

- Other than a fixed version and an adjustable version, ouput value can be customized on command.
- Maximum output current is 1A.
- Range of operation input voltage: Max 15V
- Line regulation: 0.2%.
- Load regulation: 0.4%.
- Environment Temperature: -40℃~85℃

Application

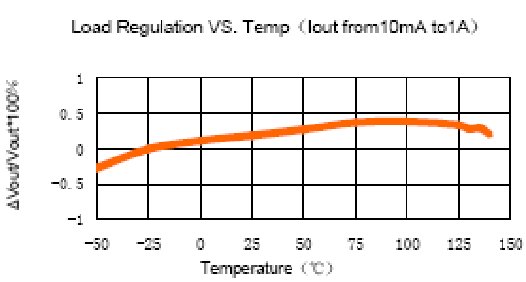
- Power Management for Computer Mother Board, Graphic Card
- LCD Monitor and LCD TV
- DVD Decode Board
- ADSL Modem
- Post Regulators for switching supplies

Absolute Maximum Ratings

Parameter		Symbol	Max	Unit
Input voltage		V_{IN}	15	V
Operating Junction Temperature		T_J	150	°C
Ambient Temperature		T_A	-40~85	°C
Package Thermal Resistance	SOT-223		20	°C/W
	TO-252		12.5	
Storage temperature		T_S	- 40 to 150	°C

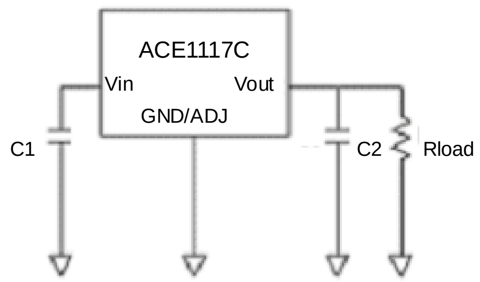
Note: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

Electrical Characteristics



Typical Application

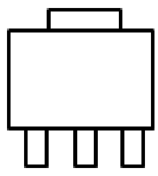
Application circuit of ACE1117C fixed version



Note: Input capacitor (Cin=10uF) and output capacitor (Cout=22uF) are recommended in all application circuit. Tantalum capacitor is recommended.

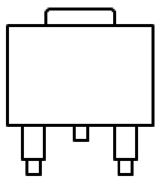
Packaging Type

SOT-223



1 2 3

TO-252



1 2 3

Pin	Symbol
1	ADJ/GND
2	Vout
3	Vin

Ordering information

Selection Guide

ACE1117C XX XX + H

- H: Halogen - free
- +: Pb - free
- XX (second): XM : SOT-223; YM : TO-252
- XX (first): Output Voltage : 1.5 / 1.8V / 2.5V / 3.3V….. 5.0V / Default: Adjustable Version

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Mum	Unit
Output Voltage	Vout	ACE1117C-1.2V Iout=10mA, Vin=3.2V, T_J=25℃ 0≦Iout≦1A, 3.0V≦Vin≦12V	1.176 1.14	1.20 1.20	1.224 1.248	V
		ACE1117C-1.8V Iout=10mA, Vin=3.8V, T_J=25℃ 0≦Iout≦1A, 3.2V≦Vin≦12V	1.773 1.764	1.80 1.80	1.827 1.836	
		ACE1117C-2.5V Iout=10mA, Vin=4.5V, T_J=25℃ 0≦Iout≦1A, 3.9V≦Vin≦12V	2.462 2.45	2.5 2.5	2.538 2.55	
		ACE1117C-2.85V Iout=10mA, Vin=4.85V, T_J=25℃ 0≦Iout≦1A, 4.25V≦Vin≦12V	2.807 2.793	2.85 2.85	2.893 2.907	
		ACE1117C-3.3V Iout=10mA, Vin=5V, T_J=25℃ 0≦Iout≦1A, 4.75V≦Vin≦12V	3.250 3.234	3.3 3.3	3.349 3.366	
		ACE1117C-5V Iout=10mA, Vin=7V, T_J=25℃ 0≦Iout≦1A, 6.5V≦Vin≦12V	4.925 4.9	5 5	5.075 5.1	
Reference Voltage	V_{REF}	I_{OUT}=10mA, V_{IN}-V_{OUT}=2V 10mA≦Iout≦1A, 1.5V≦Vin-Vout≦12V	1.231 1.225	1.25 1.25	1.268 1.275	V
Line Regulation (Note 1)	△Vout	ACE1117C-ADJ Iout=10mA, 1.5V≦Vin-Vout≦13.775V		0.035	0.2	mV
		ACE1117C-1.2V Iout=10mA, 3.0V≦Vin≦15V		10	15	
		ACE1117C-1.8V Iout=10mA, 3.8V≦Vin≦15V		10	15	
		ACE1117C-2.5V Iout=10mA, 3.9V≦Vin≦15V		10	15	
		ACE1117C-2.85V Iout=10mA, 4.25V≦Vin≦15V		10	15	
		ACE1117C-3.3V Iout=10mA, 4.75V≦Vin≦15V		10	15	
		ACE1117C-5V Iout=10mA, 6.5V≦Vin≦15V		10	15	
Load Regulation (Notd1,2)	△Vout	ACE1117C-ADJ Vin-Vout=3V, 10mA≦Iout≦1A		0.2	0.4	mV
		ACE1117C-1.2V		8	20	

		Vin=3.0V, 0≦Iout≦1A				
		ACE1117C-1.8V Vin=3.2V, 0≦Iout≦1A		8	20	
		ACE1117C-2.5V Vin=3.9V, 0≦Iout≦1A		8	20	
		ACE1117C-2.85V Vin=4.25V, 0≦Iout≦1A		8	20	
		ACE1117C-3.3V Vin=4.75V, 0≦Iout≦1A		8	20	
		ACE1117C-5V Vin=6.5V, 0≦Iout≦1A		8	20	
Quiescent Current	I_Q	ACE1117C-1.2V, Vin-Vout=1.25V		4	8	mA
		ACE1117C-1.8V, Vin-Vout=1.25V		4	8	
		ACE1117C-2.5V, Vin-Vout=1.25V		4	8	
		ACE1117C-2.85V, Vin-Vout=1.25V		4	8	
		ACE1117C-3.3V, Vin-Vout=1.25V		4	8	
		ACE1117C-5V, Vin-Vout=1.25V		4	8	
Adjust Pin Current (Adjustable version)	I_{ADJ}			55	120	uA
Adjust Pin Current Change	Ichange			0.2		uA
Current Limit	Ilimit	Vin-Vout=2V, T_J=25℃	1	1.2	1.4	A
Minimum load Current (Note 4)		ACE1117C-ADJ		5	10	mA
Temperature Stability					0.5	%
Thermal Resistor	ΘJC	SOT-223		20		℃/W
		TO-252		10		

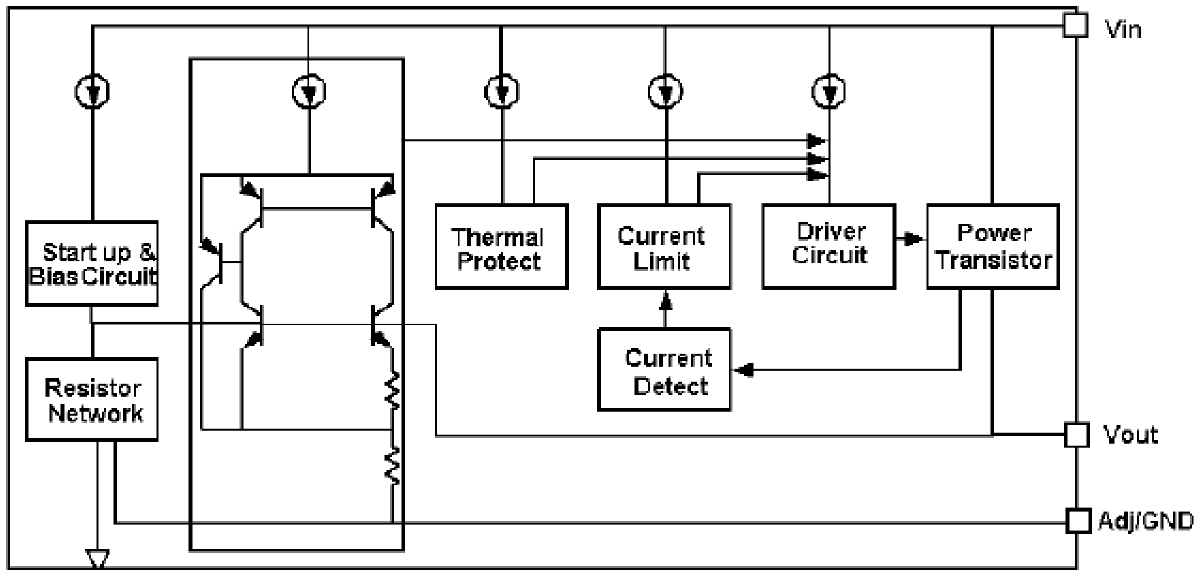
Note1: The Parameters of Line Regulation and Load Regulation in Table1 are tested under constant junction temperature. The Curve of Load Regulation vs. Temperature is shown in typical parameter curve that follows.

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 -40℃≤TA≤85℃，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 98.5%*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.

Block Diagram



Detailed Description

ACE1117C 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 1.2A.

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

ACE1117C has an adjustable version and five fixed versions, Chart 1 is typical application:

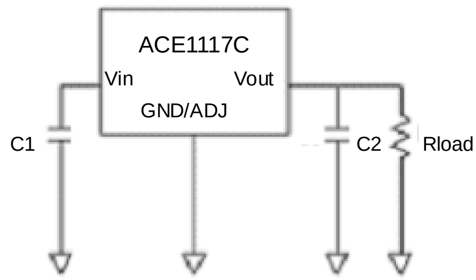


Chart 1: Application circuit of ACE1117C fixed version

Application Hints

The typical Linear regulator would require external capacitors to ensure stability. However, ACE1117C is designed in such a way that these external capacitor can be omitted if the PCB layout is tight and system noise is not very high. For better transient and PSRR performance, the Input and Output capacitors are still recommended.

- Recommend using 10uF tan capacitor as bypass capacitor(C1) for all application circuit.
- Recommend using 22uF tan capacitor to assure circuit stability.
- 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: 1/(2*Fripple*Cadj)<R1. Recommend using 10uF tan capacitor.

Output voltage of adjustable version

ACE1117C 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

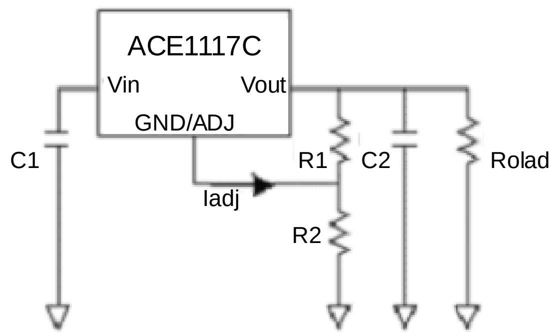


Chart 2. Application Circuit of ACE1117C adjustable version

Explanation

The output voltage of adjustable version satisfies this followed equation: Vout=Vref*(1+R2/R1)+Iadj*R2. We can ignore Iadj because Iadj (about 50uA) is much less than the current of R1(about 4mA).

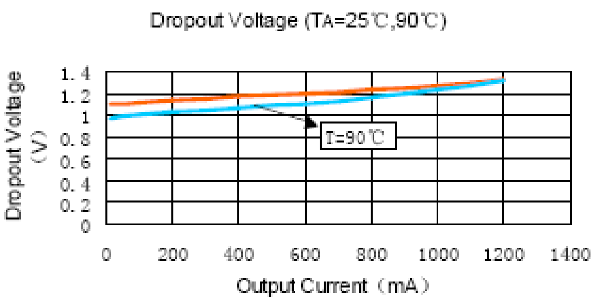
How to choose R1：The value of R1 should be in the range of 200Ω～350Ω to assure chip working normally without any load. To assure the electrical performance showed in table 1, the output current should be larger than 5mA. If R1 is too large, the minimum output current should be larger than 4mA , The best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

Thermal Considerations

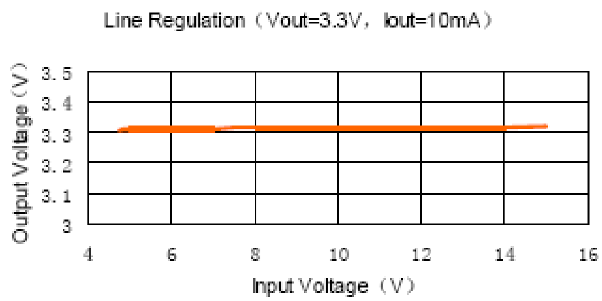
We have to take heat dissipation into consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by ACE1117C is very large. ACE1117C series uses SOT-223 package type and its thermal resistance is about 20℃/W. And 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 Performance Characteristic

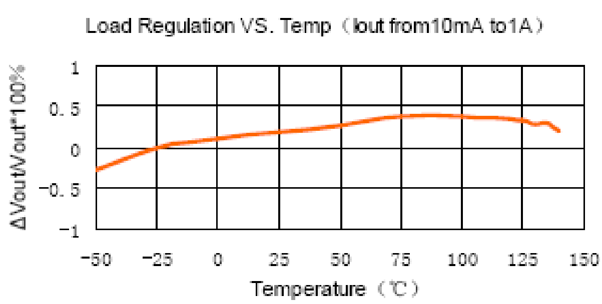
1.ACE1117C Dropout Voltage

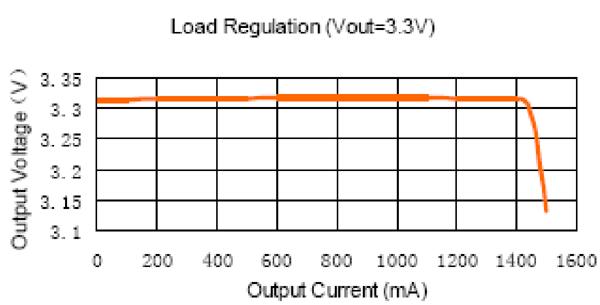


2.ACE1117C Line Regulation

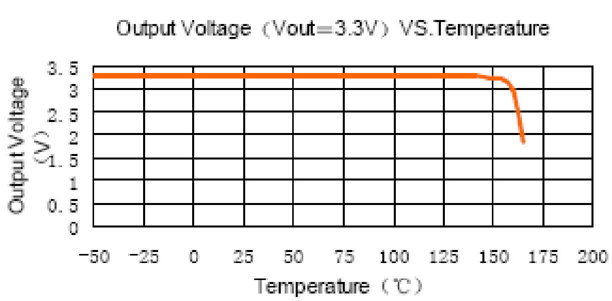


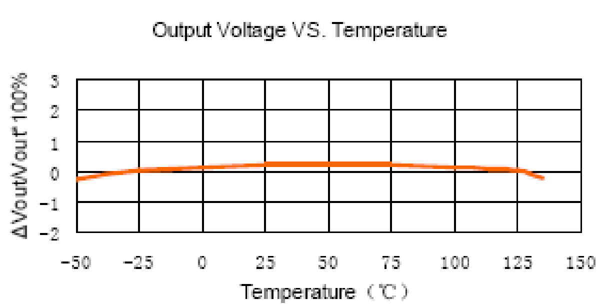
3.ACE1117C Load Regulation



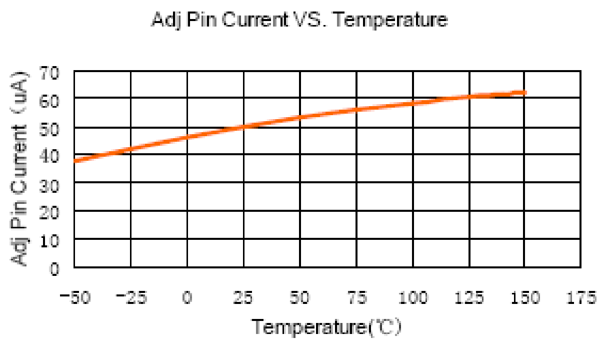


4.ACE1117C Temperature Stability

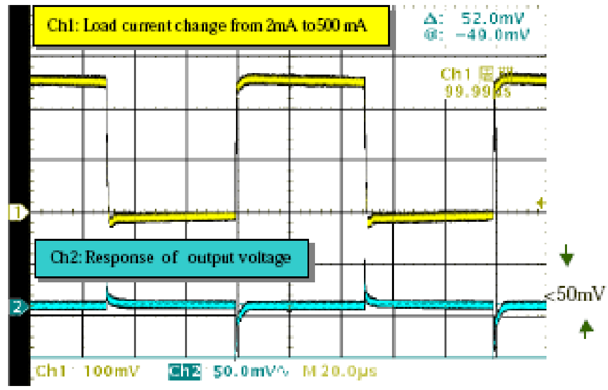




5.ACE1117C Adj Pin Current vs. Temperature

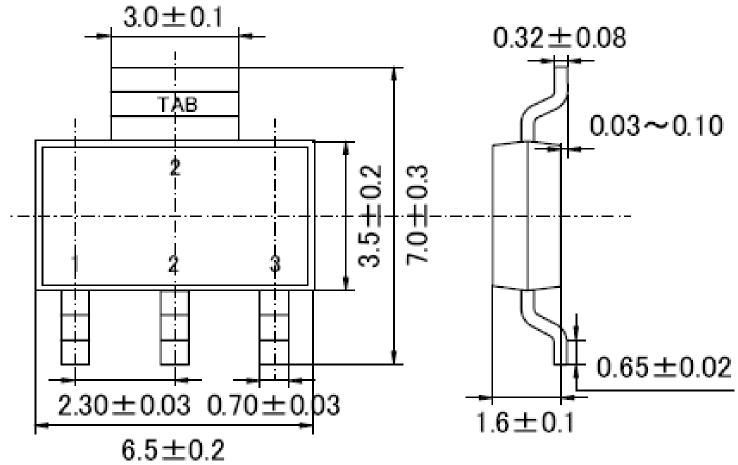


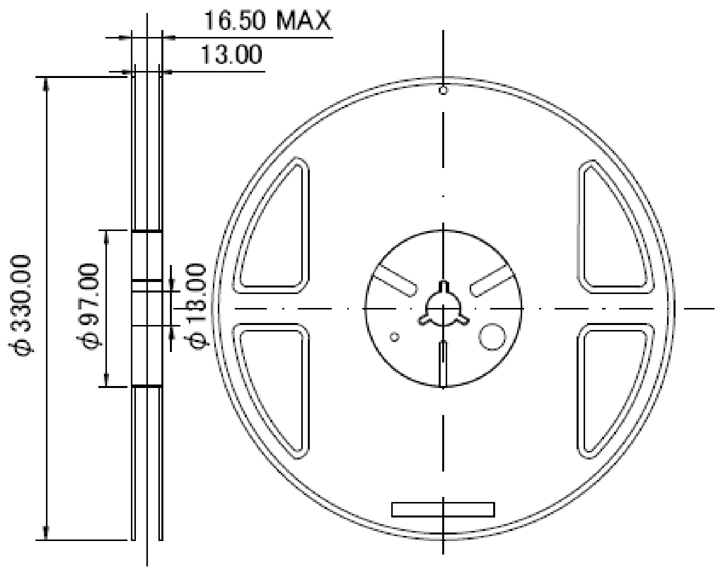
6.ACE1117C Load Transient Response



Packing Information

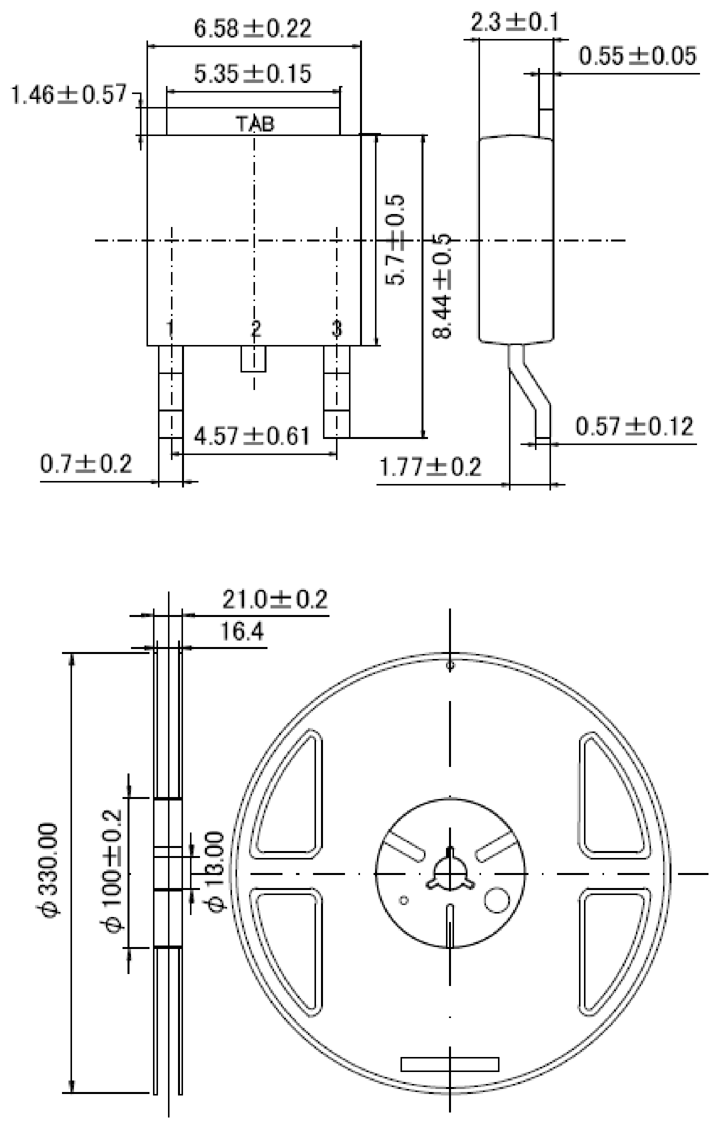
SOT-223





Packing Information

TO-252



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