1A Bipolar Linear Regulator

LR1117D

■ DESCRIPTION

LR1117D is a series of low dropout three- terminal regulators with a dropout of 1.3V at 1A load current. LR1117D 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, 5V, LR1117D has an adjustable version, which can provide an output voltage from 1.25V to 12V with only two external resistors.

LR1117D offers thermal shut down functions, 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%

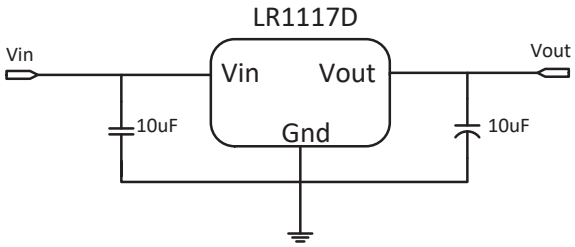
■ FEATURES

- Other than a fixed version and an adjustable version, output value can be customized on demand.
- Output current : 1.0A
- Range of operation input voltage: Max 15V
- Standby current: 4mA (typ.)
- Line regulation: 0.03%/V (typ.)
- Load regulation: 0.2%/A (typ.)
- Environment Temperature: -40°C~85°C
- We declare that material of product compliance with ROHS requirements and Pb Free.

■ APPLICATIONS

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

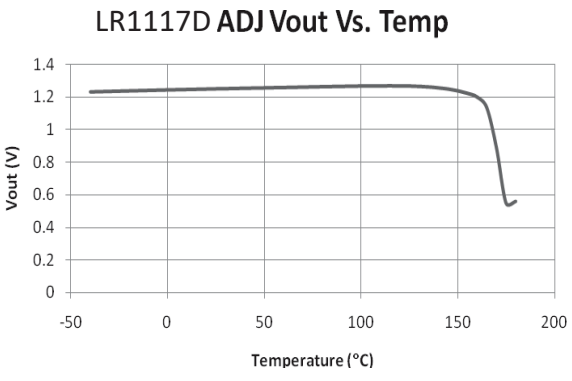
■ TYPICAL APPLICATION



Application circuit of LR1117D fixed version

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

■ TYPICAL ELECTRICAL CHARACTERISTIC



■ ORDERING INFORMATION

LR1117DS *XX* P/PB

- Pin No
- Output Voltage:
  - 12……1.2V
  - 15……1.5V
  - 18……1.8V
  - 25……2.5V
  - 28……2.85V
  - 33……3.3V
  - 50……5.0V
  - ……ADJ

■ PIN CONFIGURATION

SOT-89-3

Pin No.		Symbol	Definition
P	PB		
1	1	Vss	Ground
2	3	Vin	Input
3	2	Vout	Output

■ ABSOLUTE MAXIMUM RATING

Parameter	Value
Max Input Voltage	18V
Max Operating Junction Temperature(Tj)	150°C
Storage Temperature(Ts)	-40°C - 150°C
Lead Temperature & Time	260°C, 10s

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

■ RECOMMENDED WORK CONDITIONS

Parameter	Value
Input Operation Voltage Range	Max. 15V
Operating Junction Temperature(Tj)	-40°C –125°C

■ THERMAL DATA

Parameter	Value
Junction to Ambient (θ_{JA})	225 °C/W

(1).PCB Size:30.0mm ×25.0mm ×1.6mm,FR-4 Board, 1 oz Cu

■ ELECTRICAL CHARACTERISTICS

Tj=25°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vref	Reference Voltage	LR1117D-ADJ 10mA≤Iout≤1A , Vin=3.25V	1.225	1.25	1.275	V
Vout	Output Voltage	LR1117D-1.2V 0≤Iout≤1A , Vin=3.2V	1.164	1.2	1.224	V
		LR1117D-1.5V 0≤Iout≤1A , Vin=3.5V	1.47	1.5	1.53	V
		LR1117D-1.8V 0≤Iout≤1A , Vin=3.8V	1.764	1.8	1.836	V
		LR1117D-2.5V 0≤Iout≤1A , Vin=4.5V	2.45	2.5	2.55	V
		LR1117D-2.85V 0≤Iout≤1A , Vin=4.85V	2.793	2.85	2.907	V
		LR1117D-3.3V 0≤Iout≤1A , Vin=5.3V	3.234	3.3	3.366	V
		LR1117D-5.0V 0≤Iout≤1A , Vin=7.0V	4.9	5	5.1	V
ΔVout	Line Regulation	LR1117D-ADJ Iout=10mA, 2.75V≤Vin≤12V		0.03	0.2	%/V
		LR1117D-1.2V Iout=10mA, 2.7V≤Vin≤10V		0.03	0.2	%/V
		LR1117D-1.5V out=10mA, 3.0V≤Vin≤12V		0.03	0.2	%/V
		LR1117D-1.8V out=10mA, 3.0V≤Vin≤12V		0.03	0.2	%/V
		LR1117D-2.5V Iout=10mA, 3.3V≤Vin≤12V		0.03	0.2	%/V
		LR1117D-2.85V Iout=10mA, 4.0V≤Vin≤12V		0.03	0.2	%/V
		LR1117D-3.3V Iout=10mA, 4.8V≤Vin≤12V		0.03	0.2	%/V
		LR1117D-5.0V Iout=10mA, 6.5V≤Vin≤12V		0.03	0.2	%/V
ΔVout	Load Regulation	LR1117D-ADJ Vin =2.75V, 10mA≤Iout≤1A		2	8	mV
		LR1117D-1.2V Vin =2.7V, 10mA≤Iout≤1A		2	8	mV
		LR1117D-1.5V Vin=3.0V, 10mA≤Iout≤1A		2	10	mV
		LR1117D-1.8V Vin=3.3V, 10mA≤Iout≤1A		3	12	mV
		LR1117D-2.5V Vin=3.8V, 10mA≤Iout≤1A		4	16	mV
		LR1117D-2.85V Vin=4.35V, 10mA≤Iout≤1A		5	20	mV
		LR1117D-3.3V Vin=4.8V, 10mA≤Iout≤1A		6	24	mV
		LR1117D-5.0V Vin=6.5V, 10mA≤Iout≤1A		9	36	mV

■ ELECTRICAL CHARACTERISTICS continued

Tj=25°C

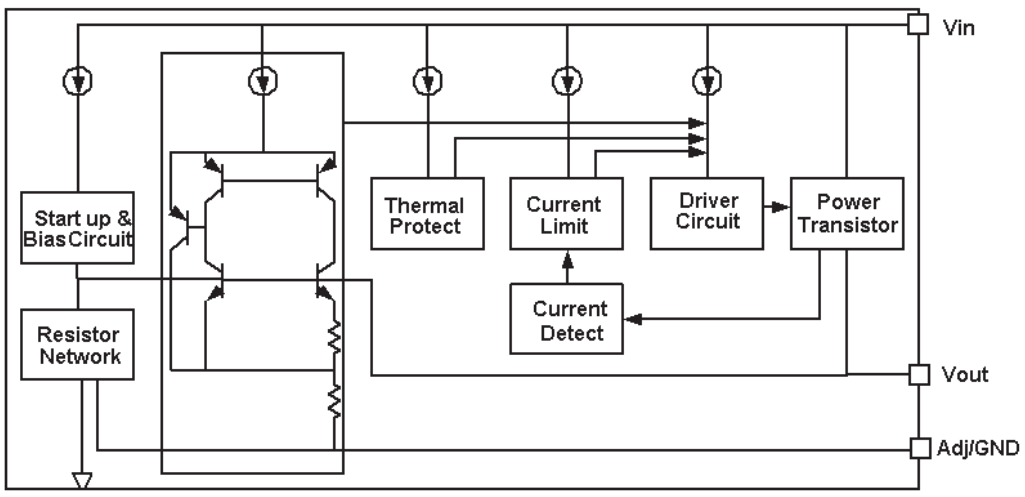
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vdrop	Dropout Voltage	Iout=100mA		1.15	1.4	V
		Iout=1A		1.2	1.4	V
Ilimit	Current Limit	Vin-Vout=1.5V, Tj=25°C	1	1.5		A
SVR	Supply Voltage Rejection	f = 120Hz, VIN − VOUT = 3V + 1VPP Ripple	60			dB
Imin	Minimum Load Current	LR1117D-ADJ		2	10	mA
Iq	Quiescent Current	LR1117D-1.2V, Vin =10V	1	4	6	mA
		LR1117D-1.5V, Vin=11V	1	4	6	mA
		LR1117D-1.8V, Vin =11V	1	4	6	mA
		LR1117D-1.5V, Vin =11V	1	4	6	mA
		LR1117D-2.5V, Vin =12V	1	4	6	mA
		LR1117D-2.85V,Vin =12V	1	4	6	mA
		LR1117D-3.3V, Vin =12V	1	4	6	mA
		LR1117D-5.0V, Vin =12V	1	4	6	mA
IAdj	Adjust Pin Current	$1.5V \le V_{IN} - V_{OUT} \le 10V$ I_{LOAD}=10 mA		35	60	uA
ΔV/ΔT	Temperature coefficient			±100		ppm

(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 LR1117 -ADJ will lead to unstable or oscillation output.

(3) : In practical application, Package PD should be taken into consideration and not exceeded

■ BLOCK DIAGRAM



■ DETAILED DESCRIPTION

LR1117D 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.

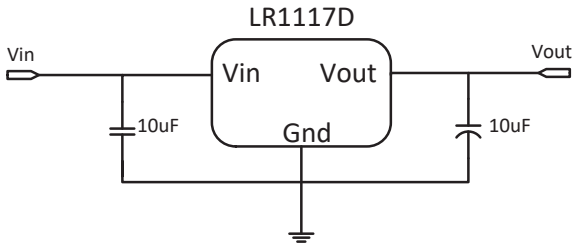
The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140°C.

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

LR1117D has an adjustable version and six fixed versions (1.2V, 1.5V,1.8V, 2.5V, 2.85V, 3.3V, 5V)

Fixed Output Voltage Version

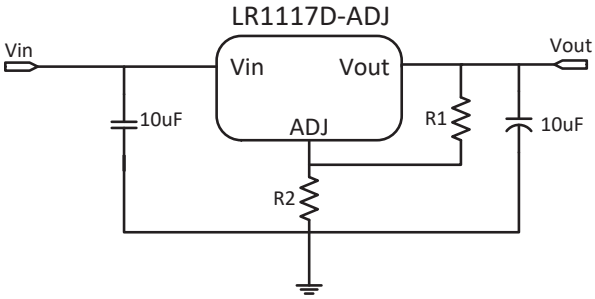


Application circuit of LR1117D fixed version

(1) Recommend using 10uF tan capacitor or MLCC capacitor as bypass capacitor (C1) for all application circuit.
(2) Recommend using 10uF tan capacitor MLCC capacitor to assure circuit stability.
(3) Capacitor ESR range: 3mΩ ~ 22Ω

Adjustable Output Voltage Version

LR1117D-ADJ provides a 1.25V reference voltage. Any output voltage between 1.25V~12V can be achievable by choosing two external resistors (schematic is shown below), R1 and R2



Application Circuit of LR1117D-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 LR1117D-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: $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R1$.*

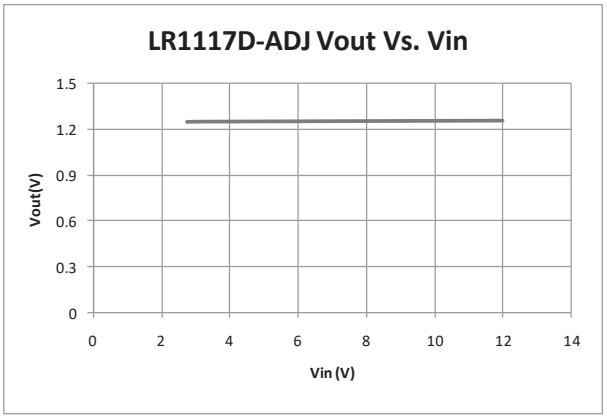
■ THERMAL CONSIDERATIONS

We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large.

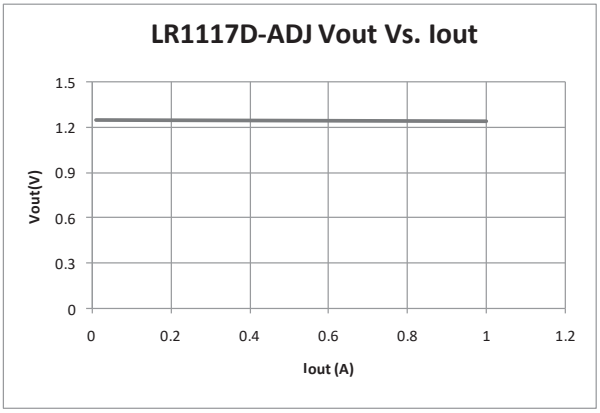
■ TYPICAL PERFORMANCE CHARACTERISTICS

T=25°C unless specified.

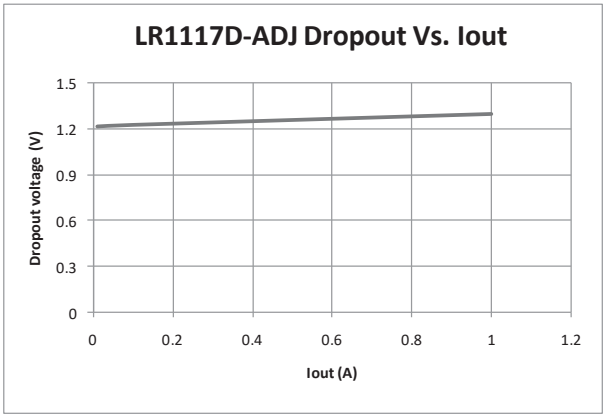
Line Regulation



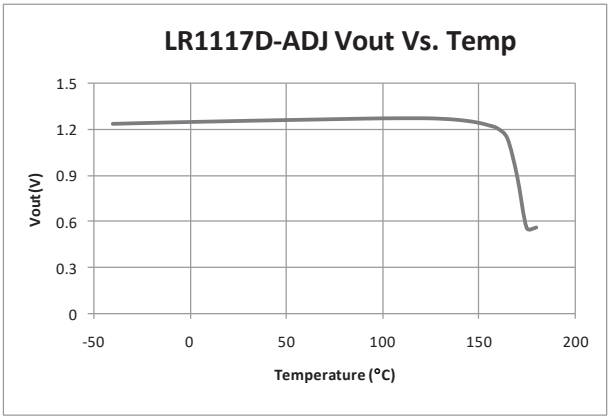
Load Regulation



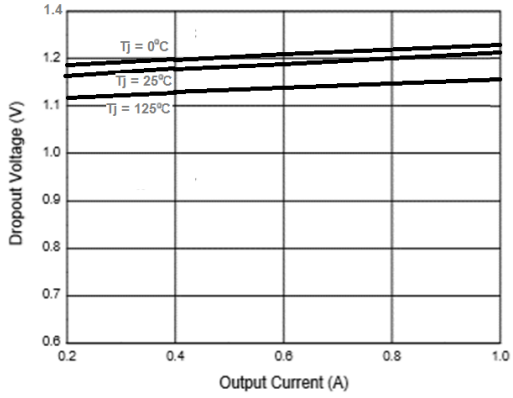
Dropout Voltage



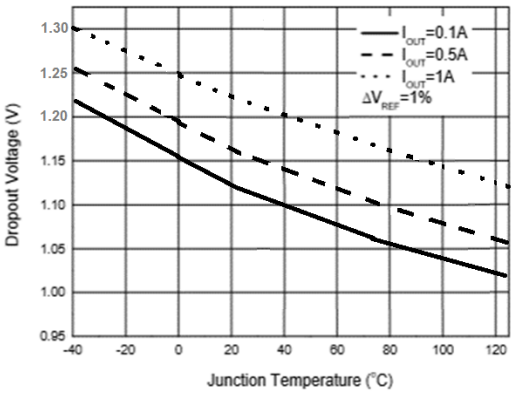
Thermal performance with OTP



Dropout Voltage vs. Output Current

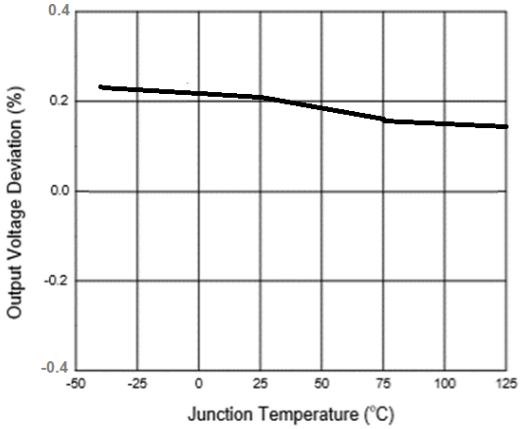


Dropout Voltage vs. Junction Temperature

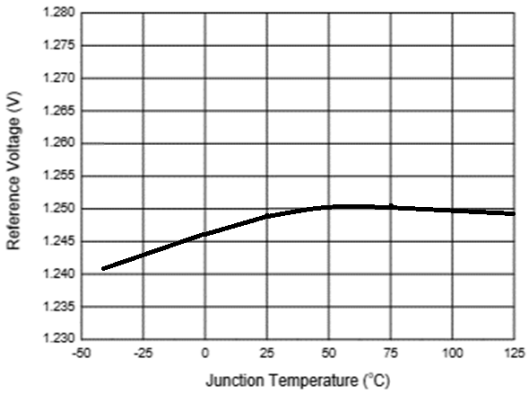


Load Regulation vs. Junction Temperature

1117MMK (Adj)

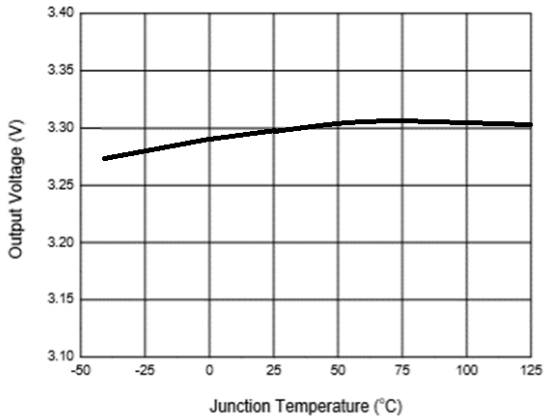


Reference Voltage vs. Junction Temperature

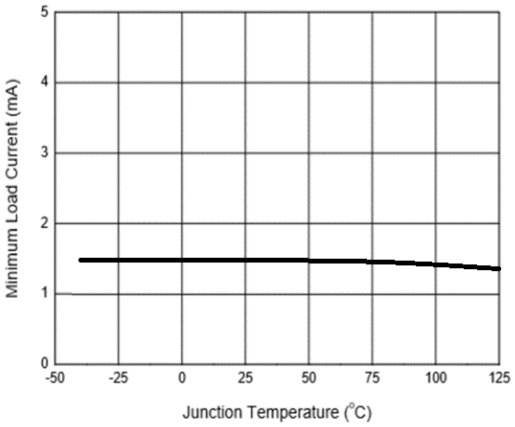


Output Voltage vs. Junction Temperature

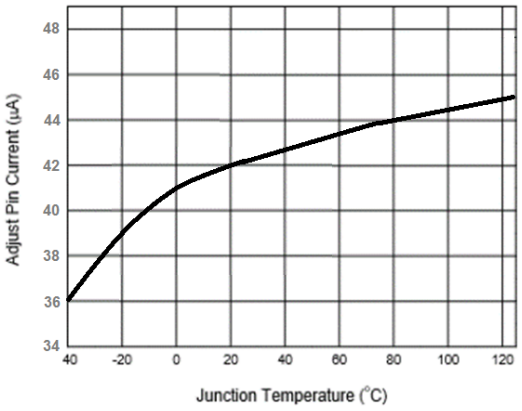
1117MMK-3.3



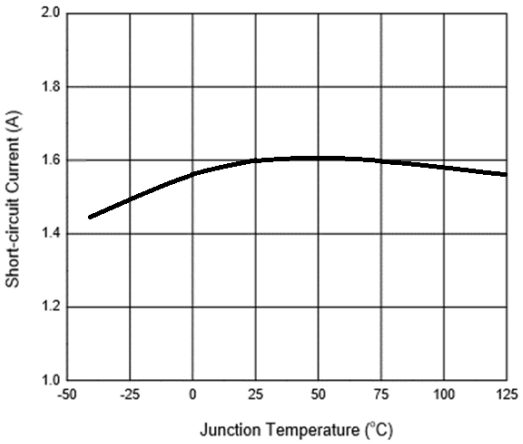
Minimum Load Current vs. Junction Temperature



Adjust Pin Current vs. Junction Temperature

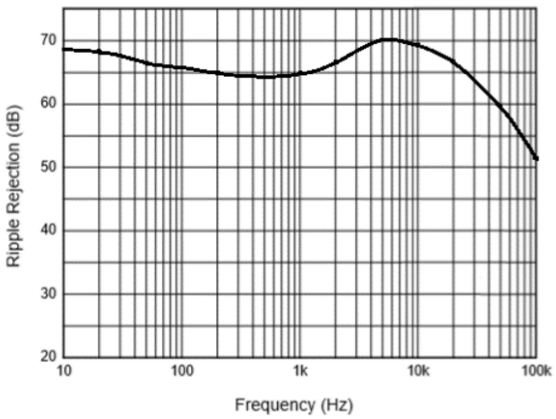


Short-circuit Current vs. Junction Temperature

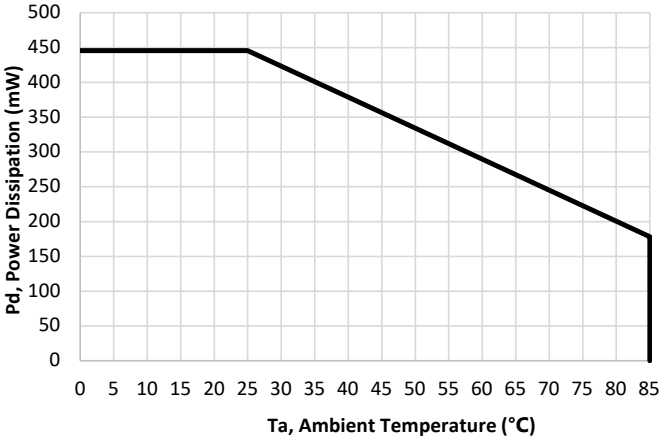


Ripple Rejection vs. Frequency

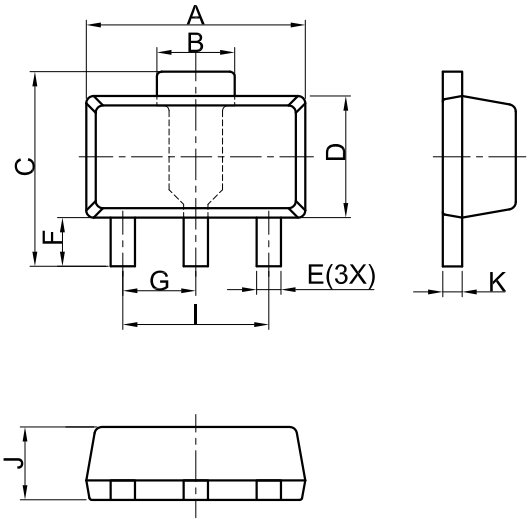
Vin=Vout+2.5 V, Iout=100mA, Cout=10uF



Derating Curve



■ PACKAGING INFORMATION

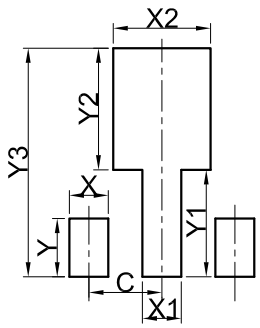


SOT89			
DIM	MIN	NOR	MAX
A	4.30	4.50	4.70
B	1.40	1.60	1.80
C	3.90	4.00	4.25
D	2.30	2.50	2.70
E	0.40	0.50	0.58
F	0.90	1.00	1.20
G	1.50 BSC		
I	3.00 BSC		
J	1.40	1.50	1.60
K	0.34	0.40	0.50
All Dimensions in mm			

GENERAL NOTES

1. Top package surface finish Ra0.4±0.2um
2. Bottom package surface finish Ra0.7±0.2um
3. Side package surface finish Ra0.4±0.2um
4. Protrusion or Gate Burrs shall not exceed 0.10mm per side.

■ SOLDERING FOOTPRINT



SOT89	
DIM	(mm)
X	0.80
Y	1.20
X1	0.80
Y1	2.20
X2	2.00
Y2	2.50
C	1.50
Y3	4.70

■ DEVICE MARKING AND REEL SPECTION

DEVICE(1)	Package	Output Voltage	Marking(2)(3)	Shipping
LR1117DSxxP	SOT-89-3	1.2V~5.0V	EDX	1K/Reel
LR1117DSxxPB	SOT-89-3	1.2V~5.0V	ETX	1K/Reel
LR1117DSP	SOT-89-3	ADJ(1.25~12V)	EDA	1K/Reel
LR1117DSPB	SOT-89-3	ADJ(1.25~12V)	ETA	1K/Reel

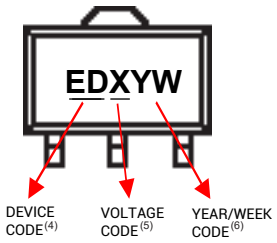
(1) The "xx" in part number represents output voltage, eg "18" = 1.8V, "50" = 5.0V.

(2) "X" changes a long with the output voltage, as figure below.

(3) There are additional marking, which relates to the date code. For detailed information, please refer to MARKING INFORMATION APPENDIX below.

■ MARKING INFORMATION APPENDIX

SOT-89-3



(4) The first two letters in the Marking represent DEVICE CODE.

(5) The following letter "X" in the Marking changes along with the output voltage, as the chart shows below.

Voltage(V)	0.8	0.9	1.0	1.2	1.5	1.8	2.5	2.7	2.8	3.0	3.3	3.6	4.0	5.0
Symbol	j	O	D	E	F	G	H	I	J	K	L	M	N	P

(6) The last two letters in the Marking represent YEAR/WEEK CODE.

■ REVISION HISTORY

Version	Description	Update by	Update Date
1.0	LRC ORIGINAL RELEASE.	Wu Jie	2021-07-15
1.1	Add power derating curve. Add marking diagram.	Chen S	2023-12-25

DISCLAIMER

- Curve guarantee in the specification. The curve of test items with electric parameter is used as quality guarantee. The curve of test items without electric parameter is used as reference only.

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