1A Bipolar Linear Regulator

S-LR1117C

DESCRIPTION

S-LRLR1117C is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. S-LR1117C 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, 3.3V, 5V, and 12V, LR1117C has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

S-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%. Other output voltage accuracy can be customized on demand, such as ±1%

S-LR1117C is available in SOT-223,TO-252 power package.

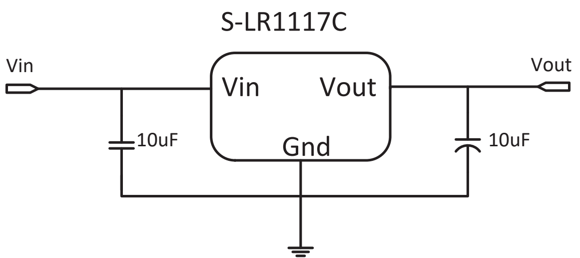
FEATURES

- Other than a fixed version and an adjustable version, output value can be customized on demand.
- Maximum output current is 1A
- Range of operation input voltage: Max 15V
- Standby current: 2mA (typ.)
- Line regulation: 0.1%/V (typ.)
- Load regulation: 10mV (typ.)
- Environment Temperature: -40°C~125°C
- S- prefix for automotive and other applications requiring unique site and control change requirements; AEC-Q100 qualified and PPAP capable.

APPLICATIONS

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

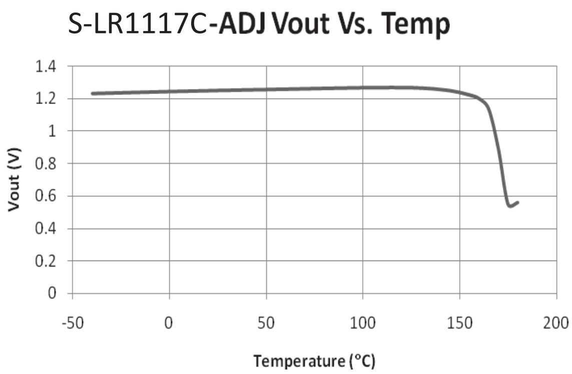
TYPICAL APPLICATION



Application circuit of S-LR1117C 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

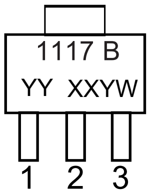
S-LR1117CX XX X

- Temp. Range & Rohs Std.
  X: Pb-free Rohs Std,Output voltage accuracy within ±2%
- Output Voltage:
  12……1.2V
  15……1.5V
  18……1.8V
  25……2.5V
  33……3.3V
  50……5.0V
  ……ADJ
- Package Type:
  S: SOT-223
  D: TO-252

PIN CONFIGURATION AND MARKING

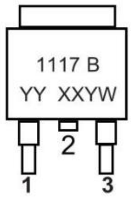
Pin Description:

SOT-223



Pin No.	Symbol	Definition
1	Vss/ADJ	Ground
2	Vout	Output
3	Vin	Input

TO-252



Pin No.	Symbol	Definition
1	Vss/ADJ	Ground/Adjustable
2	Vout	Output
3	Vin	Input

1117 B: Fixed product code
YY: Output voltage
XX: Lot NO. YW: Year week code

ABSOLUTE MAXIMUM RATING

Parameter	Value
Max Input Voltage	18V①
Max Operating Junction Temperature(Tj)	150°C
Ambient Operating Temperature(Ta)	-40°C - 125°C
Storage Temperature(Ts)	-40°C - 150°C
Lead Temperature & Time	260°C, 10S

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

RECOMMENDED WORK CONDITIONS

Parameter		Value
Input Voltage Range		Max. 15V
Operating Junction Temperature(Tj)		-40°C -125°C
Environment Temperature		-40°C -125°C
Thermal resistance - Junction to Case	SOT-223	25°C/W
	TO-252	10°C/W
Thermal resistance - Junction to Ambient (No air flow)	SO-T223	136°C/W
	TO-252	105°C/W

Note: 1.Rθja Test conditions:The device mounted on 42.25mm2(Pin2) FR-4 board with 2oz. Copper

2. $$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

ELECTRICAL CHARACTERISTICS

Tj=25°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vref	Reference Voltage	S-LR1117-ADJ 10mA≤Iout≤1A , Vin=3.25V	1.225	1.25	1.275	V
Vout	Output Voltage	S-LR1117-1.2V 0≤Iout≤1A , Vin=3.2V	1.176	1.2	1.224	V
		S-LR1117-1.5V 0≤Iout≤1A , Vin=3.5V	1.47	1.5	1.53	V
		S-LR1117-1.8V 0≤Iout≤1A , Vin=3.8V	1.764	1.8	1.836	V
		S-LR1117-2.5V 0≤Iout≤1A , Vin=4.5V	2.45	2.5	2.55	V
		S-LR1117-3.3V 0≤Iout≤1A , Vin=5.3V	3.234	3.3	3.366	V
		S-LR1117-5.0V 0≤Iout≤1A , Vin=7.0V	4.9	5	5.1	V
		S-LR1117-12.0V 0≤Iout≤1A , Vin=14V	11.76	12	12.24	V
ΔVout	Line Regulation	S-LR1117-1.2V Iout=10mA, 2.7V≤Vin≤10V		0.1	0.2	%/V
		S-LR1117-ADJ Iout=10mA, 2.75V≤Vin≤12V		0.1	0.2	%/V
		S-LR1117-1.5V out=10mA, 3.0V≤Vin≤12V		0.1	0.2	%/V
		S-LR1117-1.8V Iout=10mA, 3.3V≤Vin≤12V		0.1	0.2	%/V
		S-LR1117-2.5V Iout=10mA, 4.0V≤Vin≤12V		0.1	0.2	%/V
		S-LR1117-3.3V Iout=10mA, 4.8V≤Vin≤12V		0.1	0.2	%/V
		S-LR1117-5.0V Iout=10mA, 6.5V≤Vin≤12V		0.1	0.2	%/V
		S-LR1117-12.0V Iout=10mA, 13.5V≤Vin≤20V		0.1	0.2	%/V
ΔVout	Load Regulation	S-LR1117-1.2V Vin =2.7V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-ADJ Vin =2.75V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-1.5V Vin=3.0V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-1.8V Vin=3.3V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-2.5V Vin=4.0V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-3.3V Vin=4.8V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-5.0V Vin=6.5V, 10mA≤Iout≤1A		10	30	mV
		S-LR1117-12.0V Vin=13.5V, 10mA≤Iout≤1A		10	30	mV

ELECTRICAL CHARACTERISTICS continued

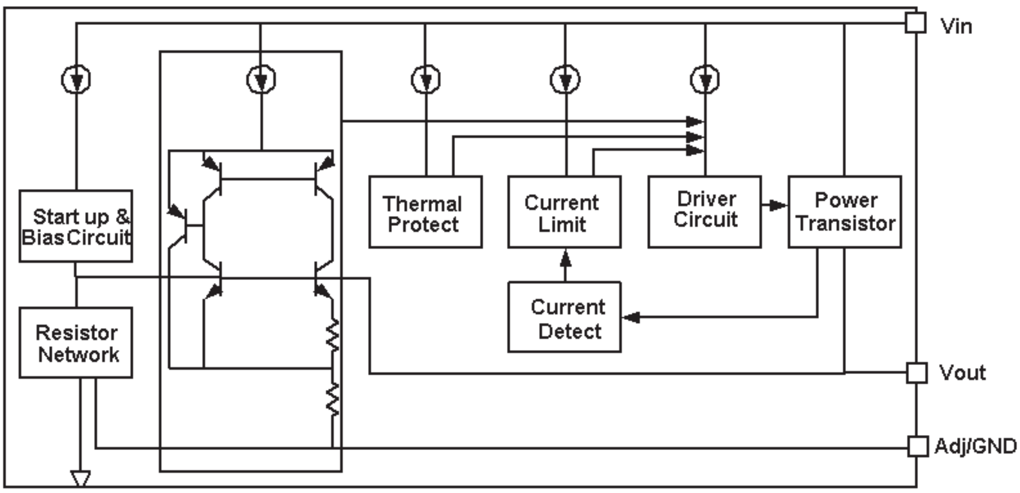
Tj=25°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vdrop	Dropout Voltage	Iout=100mA		1.23	1.3	V
		Iout=1A		1.3	1.5	V
Ilimit	Current Limit	Vin-Vout=2V, Tj=25°C	1			A
SVR	Supply Voltage Rejection	f = 120Hz, VIN − VOUT = 3V + 1VPP Ripple		60		dB
Imin	Minimum Load Current	S-LR1117-ADJ		2	10	mA
Iq	Quiescent Current	S-LR1117-1.2V, Vin =10V	1	2	5	mA
		S-LR1117-1.5V, Vin =11V	1	2	5	mA
		S-LR1117-1.8V, Vin =12V	1	2	5	mA
		S-LR1117-2.5V,Vin =12V	1	2	5	mA
		S-LR1117-3.3V, Vin =12V	1	2	5	mA
		S-LR1117-5.0V, Vin =12V	1	2	5	mA
		S-LR1117-12.0V, Vin =20V	1	2	5	mA
IAdj	Adjust Pin Current	S-LR1117-ADJ Vin =5V, 10mA≤Iout≤1A	35	55	120	uA
Ichange	Iadj change	S-LR1117-ADJ Vin =5V, 10mA≤Iout≤1A		0.2	10	uA
ΔV/ΔT	Temperature coefficient			±100		ppm

Note1: All test are conducted under ambient temperature 25°C and within a short period of time 20ms

Note2: Load current smaller than minimum load current of S-LR1117C-ADJ will lead to unstable or oscillation output.

BLOCK DIAGRAM



DETAILED DESCRIPTION

S-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.

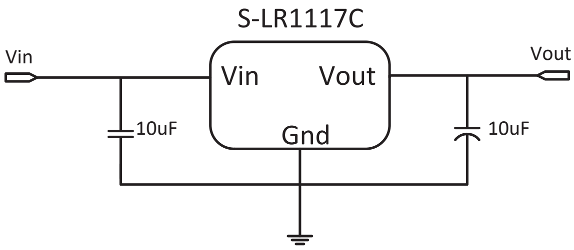
The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140°C.

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

S-LR1117C has an adjustable version and six fixed versions (1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5V and 12V)

Fixed Output Voltage Version

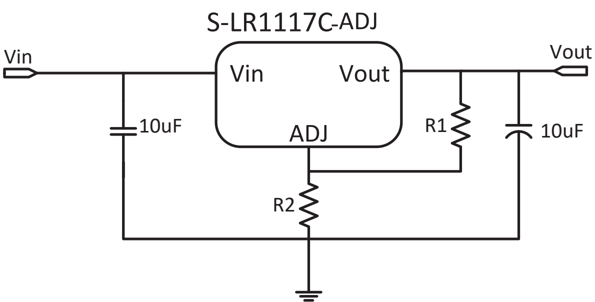


Application circuit of LR1117C fixed version

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

S-LR1117C-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 S-LR1117C-ADJ

The output voltage of adjustable version follows the equation: $V_{out}=1.25\times(1+R2/R1)+I_{Adj}\times R2$. 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 S-LR1117C-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: $1/(2\pi \times f_{ripple} \times C_{ADJ})<R1$.*

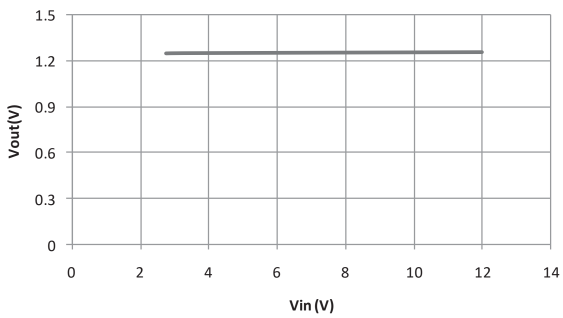
THERMAL CONSIDERATIONS

We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by S-LR1117 is very large. S-LR1117 series uses SOT-223 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 S-LR1117 could allow on itself is less than 1W. And furthermore, S-LR1117 will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

TYPICAL PERFORMANCE CHARACTERISTIC CURVES

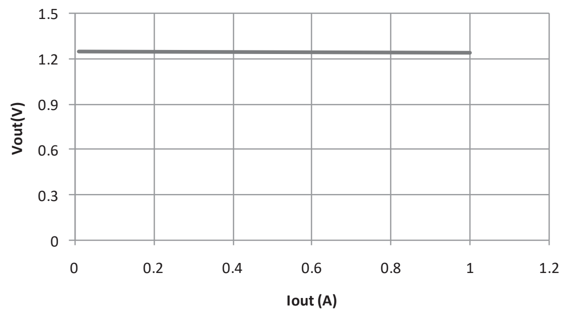
Line Regulation

-ADJ Vout Vs. Vin



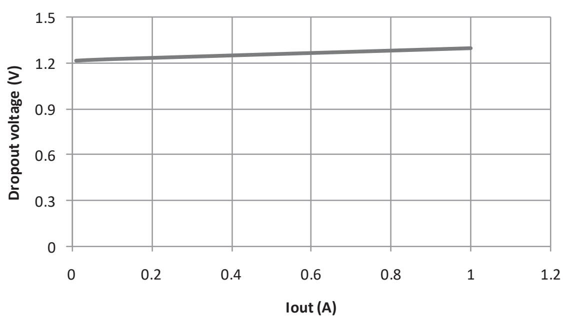
Load Regulation

-ADJ Vout Vs. Iout



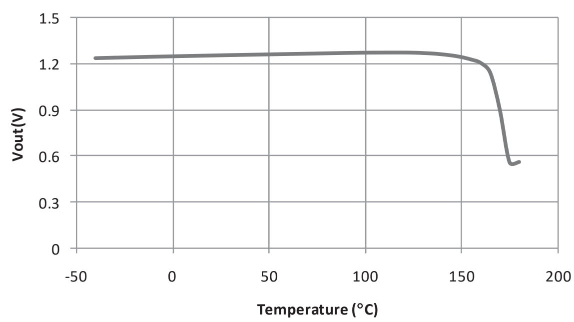
Dropout Voltage

-ADJ Dropout Vs. Iout



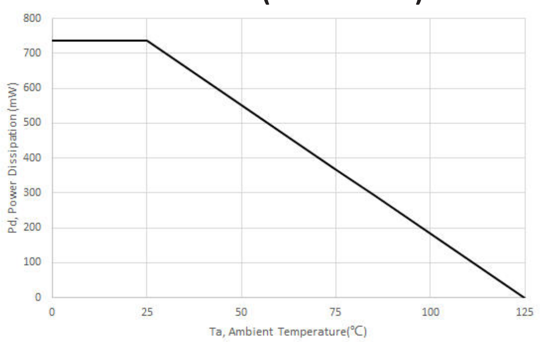
Thermal performance with OTP

-ADJ Vout Vs. Temp

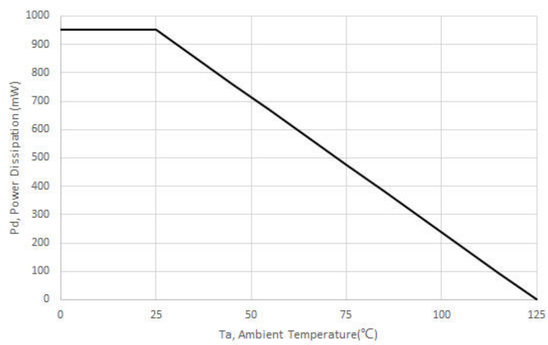


Derating Curve

Pd Vs. Ta(S-LR1117CS)



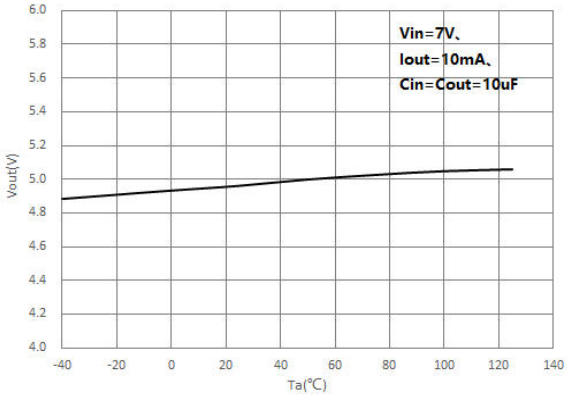
Pd Vs. Ta(S-LR1117CD)



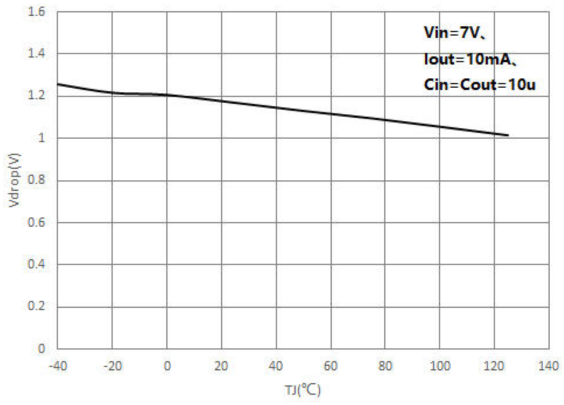
Note PCB size 30.0mm×25.0mm×1.6mm(FR4) Copper Foil Thickness 35um

TYPICAL PERFORMANCE CHARACTERISTIC CURVES

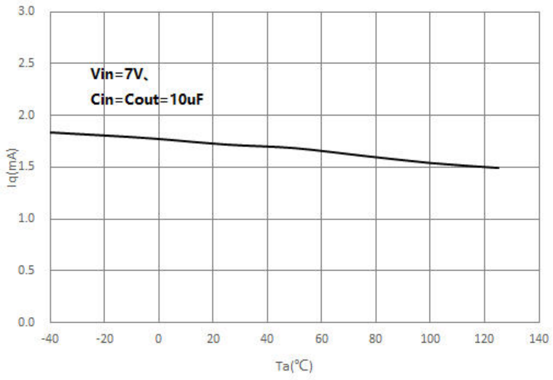
Vdrop Vs. Ta



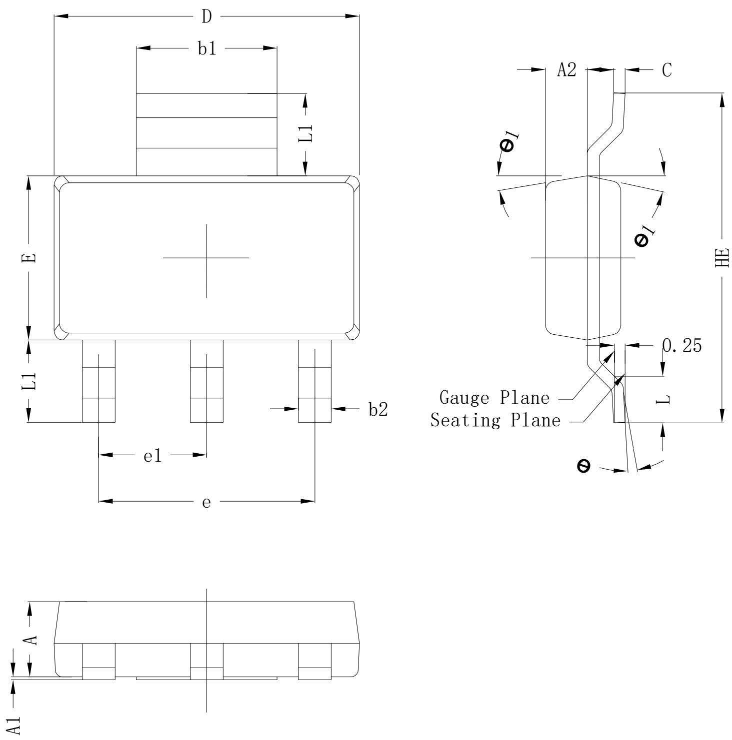
Vdrop Vs. Tj



Iq Vs. Ta



SOT-223 PACKAGE OUTLINE DIMENSIONS

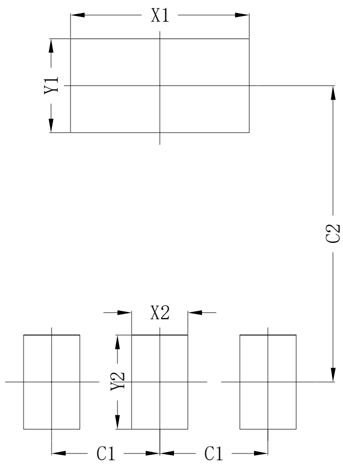


SOT223			
DIM	MIN	NOR	MAX
A	1.50	1.60	1.70
A1	0.00	0.05	0.10
A2	0.80	0.90	1.00
b1	2.90	3.02	3.10
b2	0.60	0.72	0.80
c	0.20	0.27	0.35
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	4.60BSC		
e1	2.30BSC		
HE	6.80	7.00	7.20
L	0.80	1.00	1.20
L1	1.75(REF)		
θ	0º~8º		
θ 1	8º	10º	12º
All Dimensions in mm			

GENERAL NOTES

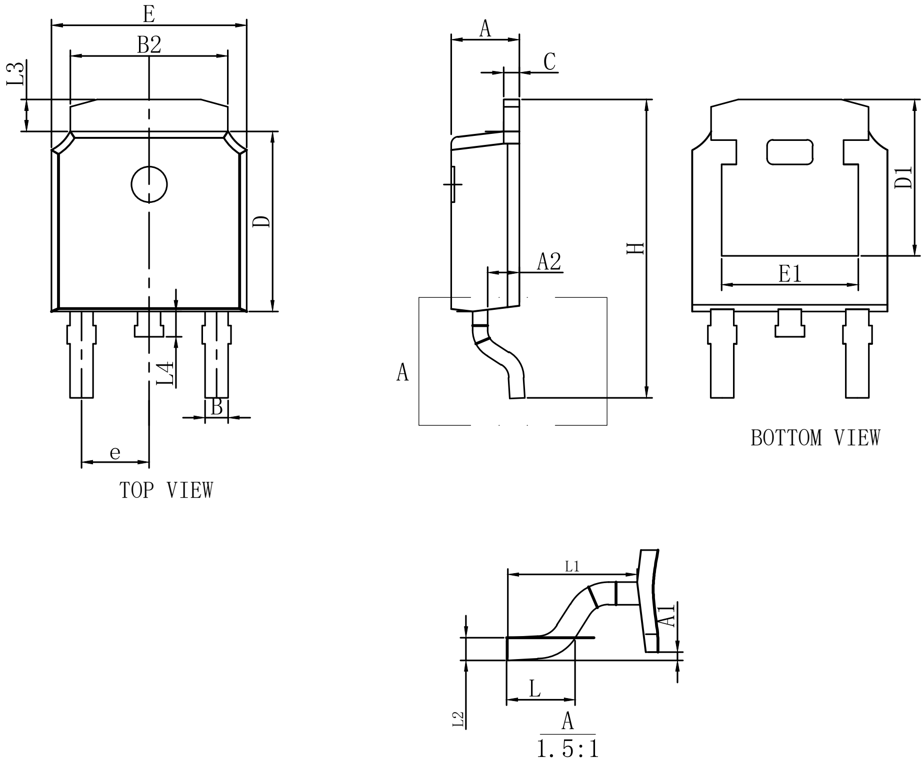
1. Top package surface finish Ra0.4±0.2um
2. Bottom package surface finish Ra0.7±0.2um
3. Side package surface finish Ra0.4±0.2um
4. Protrusion or Gate Burrs shall not exc d 0.10mm per side.

Suggested Pad layout



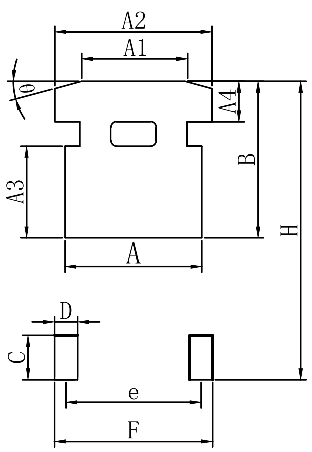
SOT223	
DIM	(mm)
X1	3.80
Y1	2.00
X2	1.20
Y2	2.00
C1	2.30
C2	6.30

TO-252-2L PACKAGE OUTLINE DIMENSIONS



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	2.15	2.30	2.45
A1	0	-	0.20
A2	0.90	1.07	1.17
B	0.68	0.78	0.88
B2	5.20	5.33	5.46
C	0.49	-	0.58
D	5.90	6.10	6.30
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	4.83	5.03
e	2.286BSC		
H	9.8	10.10	10.4
L	1.09	1.29	1.49
L1	2.90REF		
L3	0.88	1.08	1.28
L4	0.55	0.80	1.05

Suggested Pad layout



DIM	MIN(mm)
A	6.03
A1	4.50
A2	6.46
A3	4.10
A4	2.37
B	6.50
C	2.50
D	1.68
e	4.80
H	12.35
F	5.95

DEVICE MARKING AND REEL INFORMATION

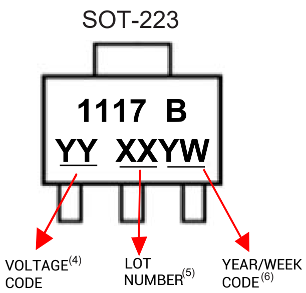
DEVICE[1]	Package	Output Voltage	Marking[2][3]	Shipping
S-LR1117CSxxX	SOT-223	1.25V~12V	1117 B	2.5K/Reel
S-LR1117CDxxX	TO-252	1.25V~12V	1117 B	2.5K/Reel

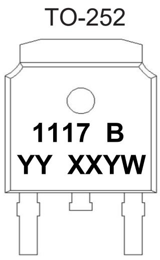
(1) The "xx" in part number represents output voltage, eg "18" = 1.8V, "50" = 5.0V, "" (left blank) = ADJ.

(2) The "X" in the marking 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



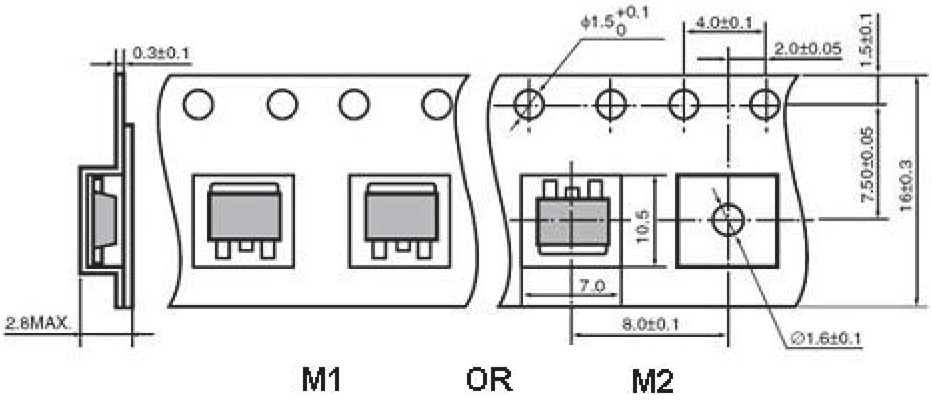


(4) The two letters "YY" in the Marking represent output voltage.

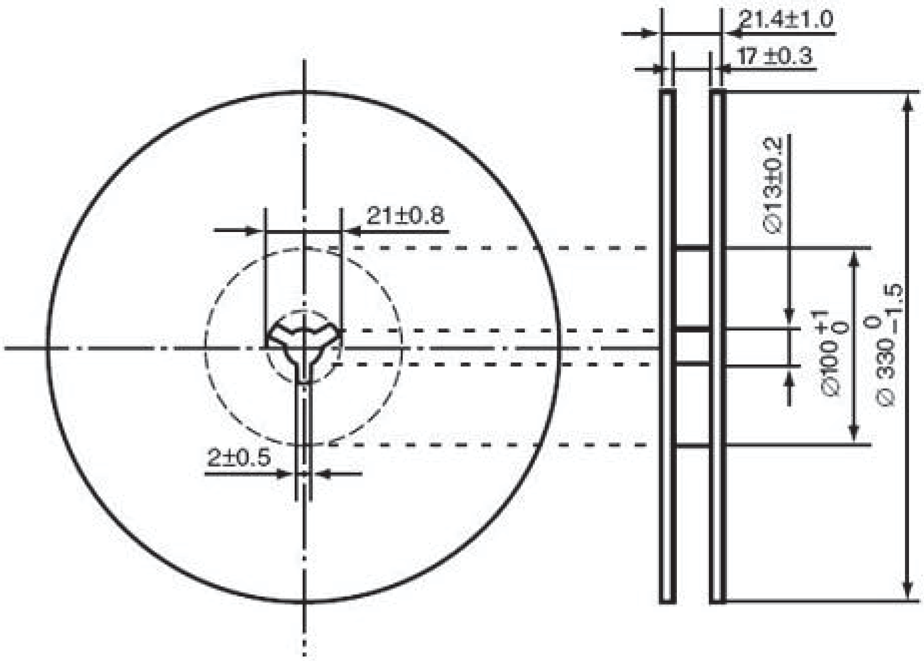
(5) The LOT NUMBER is only used for internal production control of the factory.

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

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



Taping reel dimension：



REVISION HISTORY

Version	Description	Update by	Update Date
1.6	Update POD; Delete marking information when SOT-223 adjustable Version	Li Song	2022-09-26
1.7	Add power derating curve; Delete thermal resistance;	Chen S	2023-09-21
1.8	Add device marking and reel information.	Chen S	2024-08-21

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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