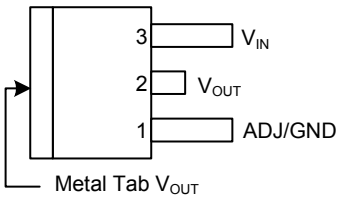
Liteon Semiconductor Corporation
LSP1117
1A Low Dropout Linear Regulator

■ FEATURES
- 1.4V maximum dropout at full load current
- Fast transient response
- Output current limiting
- Built-in thermal shutdown
- Good noise rejection
- Low ESR Ceramic Capacitor(MLCC) Required for Stability

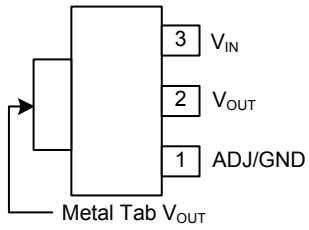
■ APPLICATIONS
- PC Motherboard
- LCD Monitor
- Graphic Card
- DVD-video player
- NIC/Switch
- Telecom Equipment
- ADSL Modem
- Printer and other Peripheral Equipment

■ GENERAL DESCRIPTION
The LSP1117 is a series of low dropout three-terminal regulators with a dropout of 1.4V at 1A output current.
The LSP1117 series provides current limiting and thermal shutdown. Its circuit includes a trimmed bandgap reference to assure output voltage accuracy to be within 2% for 1.2V, 1.5V, 1.8V, 2.5V, 3.3.V, 5.0V and adjustable versions. Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal shutdown provides protection against any combination of overload and ambient temperature that would create excessive junction temperature.
The LSP1117 has an adjustable version that can provide the output voltage from 1.2V to 18V with only two external resistors.
The LSP1117 series is available in the industry standard TO252-3L and SOT223 power packages.

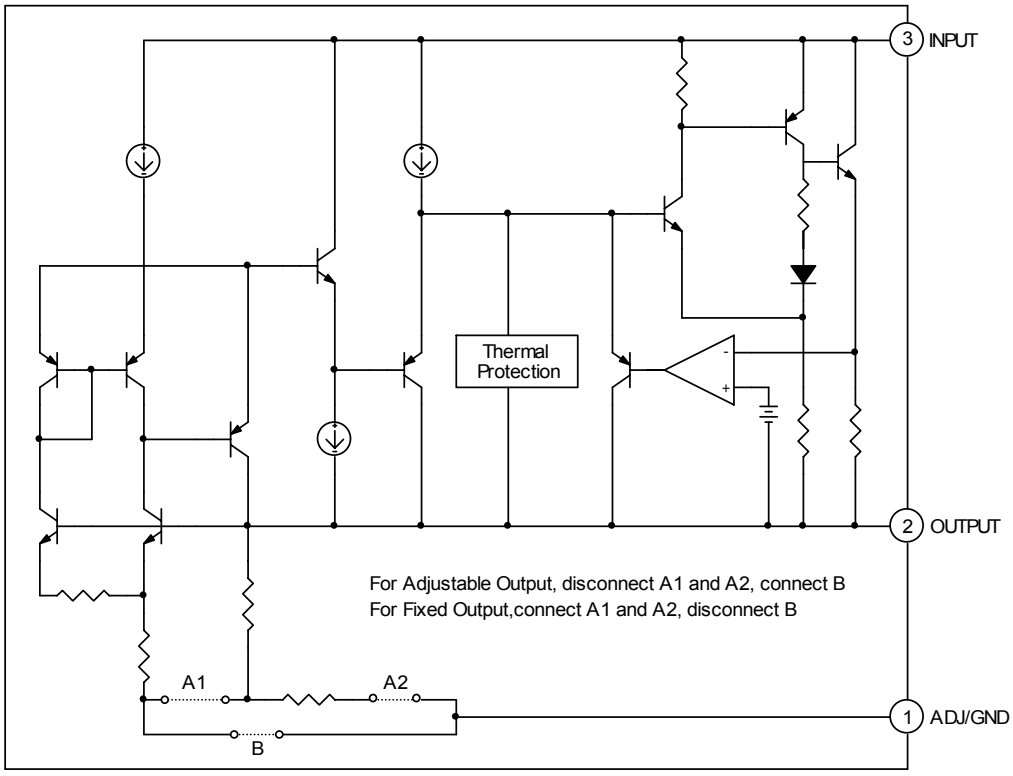
■ PIN CONFIGURATION
(1) TO252-3L



(2) SOT223



■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (NOTE 1)

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	23	V
T_J	Maximum Junction Temperature	150	°C
T_S	Storage Temperature	-65~150	°C
T_{LEAD}	Lead Temperature (10 sec.)	300	°C
ESD	ESD (Machine Model)	600	V

Note 1: Stresses greater than those listed under " Absolute Maximum Ratings" may cause permanent damage to the device. These are stress rating only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

■ RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	20	V
T_J	Operating Junction Temperature Range	-40~125	°C

■ ELECTRICAL CHARACTERISTICS

Operating Conditions: V_{IN}≤10V, T_J=25°C, unless otherwise specified

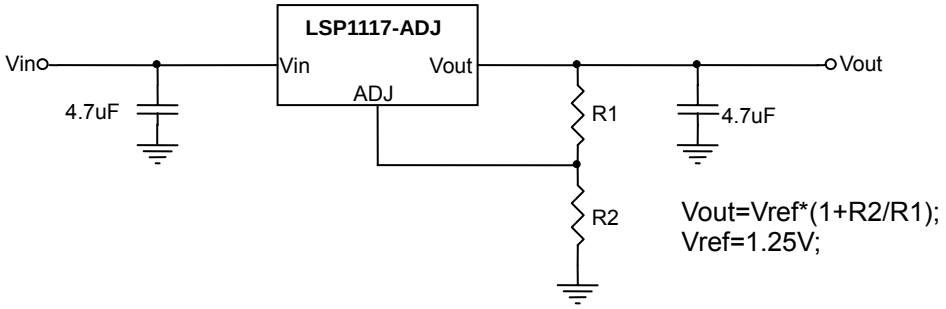
Parameter	Symbol	Test Condition		Min.	Typ.	Max.	Unit
Reference Voltage	V_{REF}	LSP1117 -Adj	I_O=10mA, V_{IN}-V_{OUT}=1.5V	1.225	1.250	1.275	V
			I_O=10mA,1.5V≤V_{IN}-V_{OUT}≤8V	1.225	1.250	1.275	
Output Voltage	V_{OUT}	LSP1117 -1.2	I_O=10mA, V_{IN}=3V	1.188	1.2	1.212	
			I_O=10mA, 3V≤V_{IN}≤10V	1.176	1.2	1.224	
		LSP1117 -1.5	I_O=10mA, V_{IN}=3V	1.485	1.5	1.515	V
			I_O=10mA, 3V≤V_{IN}≤10V	1.470	1.5	1.530	
		LSP1117 -1.8	I_O=10mA, V_{IN}=3.3V	1.782	1.8	1.818	V
			I_O=10mA, 3.3V≤V_{IN}≤10V	1.764	1.8	1.836	V
		LSP1117 -2.5	I_O=10mA, V_{IN}=4V	2.475	2.5	2.525	V
			I_O=10mA, 4V≤V_{IN}≤10V	2.450	2.5	2.550	V
		LSP1117 -3.3	I_O=10mA, V_{IN}=4.8V	3.267	3.3	3.333	V
			I_O=10mA, 4.8V≤V_{IN}≤10V	3.235	3.3	3.365	
		LSP1117 -5.0	I_O=10mA, V_{IN}=6.5V	4.950	5.0	5.050	V
			I_O=10mA, 6.5V≤V_{IN}≤12V	4.900	5.0	5.100	
Line Regulation	Reg_{LINE}	LSP1117-XXX	I_O=10mA,1.5V≤V_{IN}-V_{OUT}≤7V		0.1	0.3	%
			I_O=10mA,1.5V≤V_{IN}-V_{OUT}≤10V		0.1	0.5	%
Load Regulation	Reg_{Load}	LSP1117 -Adj	VIN= 3V, 10mA<Io<1A		1		%
		LSP1117 -1.2	VIN= 3V, 10mA<Io<1A		10	12	mV
		LSP1117 -1.5	VIN= 3V, 10mA<Io<1A		12	15	mV
		LSP1117 -1.8	VIN= 3.3V, 10mA<Io<1A		15	18	mV
		LSP1117 -2.5	VIN= 4V, 10mA<Io<1A		20	25	mV
		LSP1117 -3.3	VIN= 5V, 10mA<Io<1A		26	33	mV
		LSP1117 -5.0	VIN= 6.5V, 10mA<Io<1A		40	50	mV
Dropout Voltage	V_{IN}- V_{OUT}	LSP1117-XXX	I_{OUT} = 1A ,ΔV_{OUT}=1%V_{OUT}		1.3	1.4	V
Current Limit	I_{LIMT}	LSP1117-XXX	V_{IN}-V_{OUT}=3V	1.1			A
Ripple Rejection		LSP1117-XXX	F=120Hz,C_{OUT}=25uF Tantalum, V_{IN}-V_{OUT}=3V		60	70	dB
Temperature Stability		LSP1117-XXX	I_O=10mA		0.5		%

■ ELECTRICAL CHARACTERISTICS (CONTINUED)

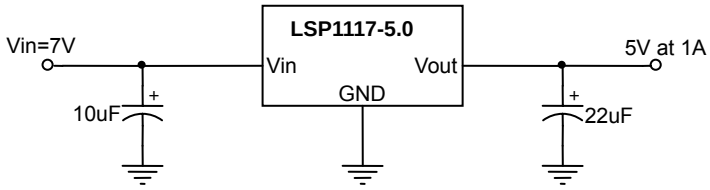
Operating Conditions: V_{IN}≤10V, T_J=25°C, unless otherwise specified

Parameter	Symbol	Test Condition		Min.	Typ.	Max.	Unit
Adjust Pin Current		I_O=10mA~1A, 1.5V≤V_{IN}-V_{OUT}≤10V			60	120	μA
Adjust Pin Current Change		I_O=10mA~1A, 1.4V≤V_{IN}-V_{OUT}≤10V			0.2	5	μA
Minimum Load Current(ADJ)		LSP1117 E	1.5V≤V_{IN}-V_{OUT}≤10V		1.7	5	mA
		LSP1117			5	10	mA
Quiescent Current	Iq	V_{IN}=V_{OUT}+1.25V			5	10	mA
Long-term Stability		T_A=125°C, 1000hrs			0.3		%
RMS Output Noise (% of V_{OUT})		T_A=25°C, 10Hz≤f≤10kHz			0.003		%
Power Dissipation	Pd	TO252-3L			1.2		W
		SOT223			0.85		
Thermal Resistance, Junction to Ambient (No heat sink, No air flow)	θ JA	TO252-3L			83		°C/W
		SOT223			117		
Thermal Resistance, Junction to case	θ JC	TO252-3L			10		°C/W
		SOT223			15		
Thermal Shutdown		Junction Temperature			150		°C
Thermal Shutdown Hysteresis					25		°C

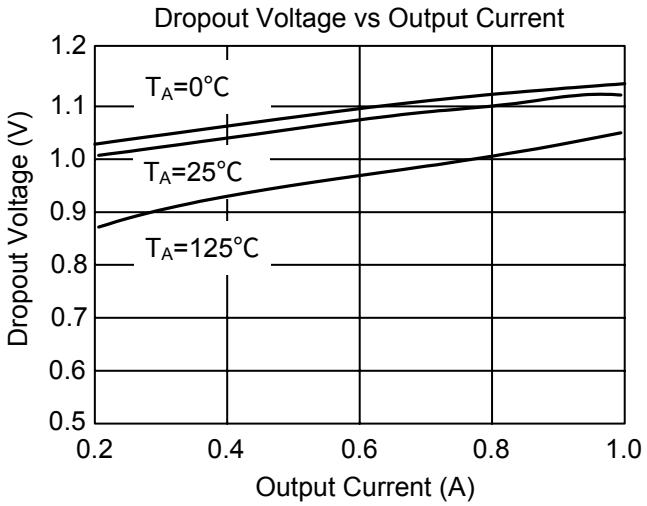
■ TYPICAL APPLICATIONS

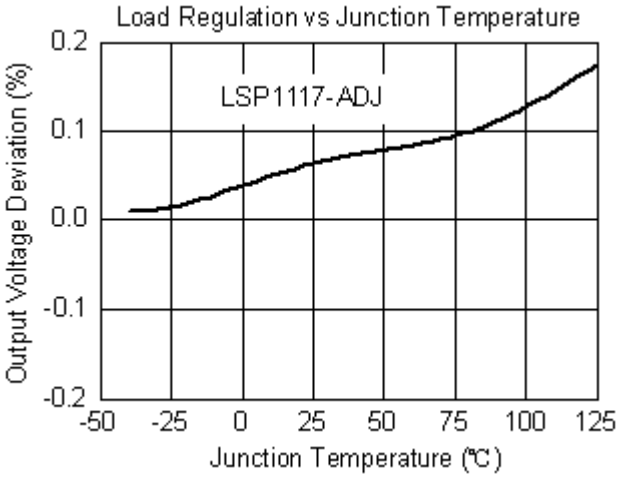


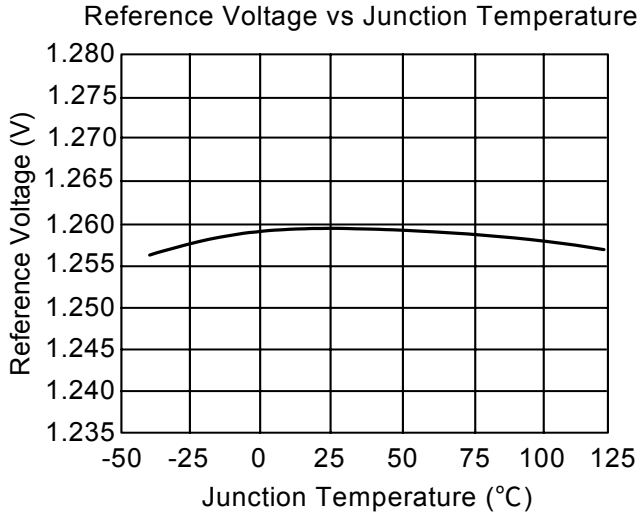
The LSP1117 keeps a constant 1.25V between the output pin and the adjust pin. By placing a resistor R1 across these two pins a constant current flows through R1, adding to the Iadj current and into the R2 resistor producing a voltage equal to the (1.25/R1)*R2+Iadj*R2 which will be added to the 1.25V to set the output voltage. This is summarized in the above equation. Since the minimum load current requirement of the LSP1117 is 10mA, R1 is typically selected to be 121Ω resistor so that it automatically satisfies the minimum current requirement. Notice that since Iadj is typically in the range of 50uA it only adds a small error to the output voltage and should only be considered when a very precise output voltage setting is required. For example, in a typical 3.3V application where R1=121Ω and R2=200Ω the error due to Iadj is only 0.3% of the nominal set point.

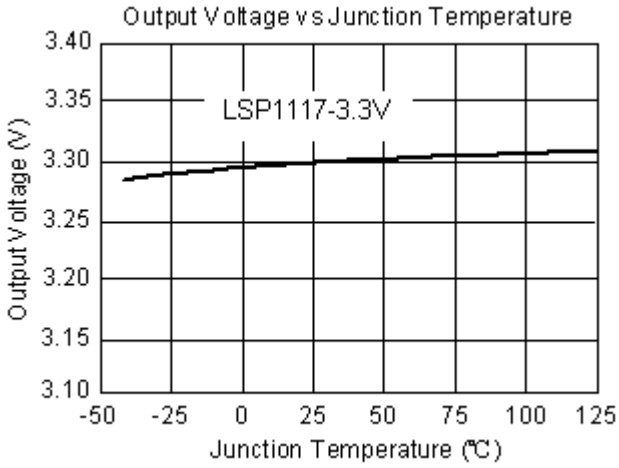


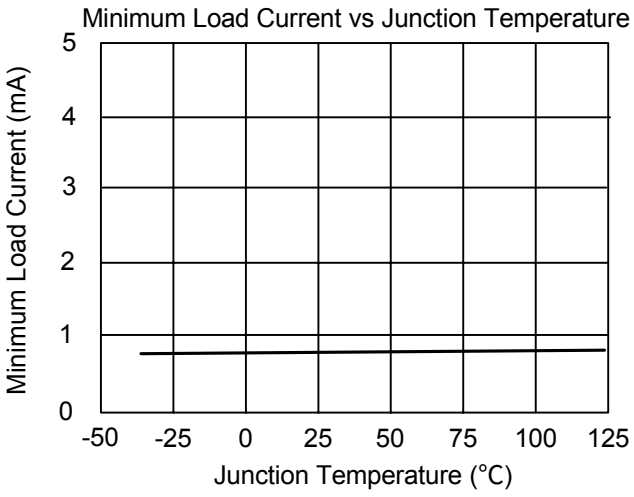
■ TYPICAL PERFORMANCE CHARACTERISTICS

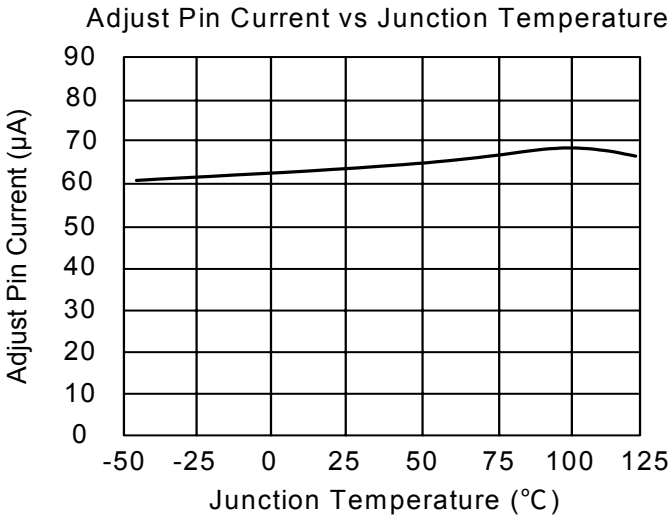




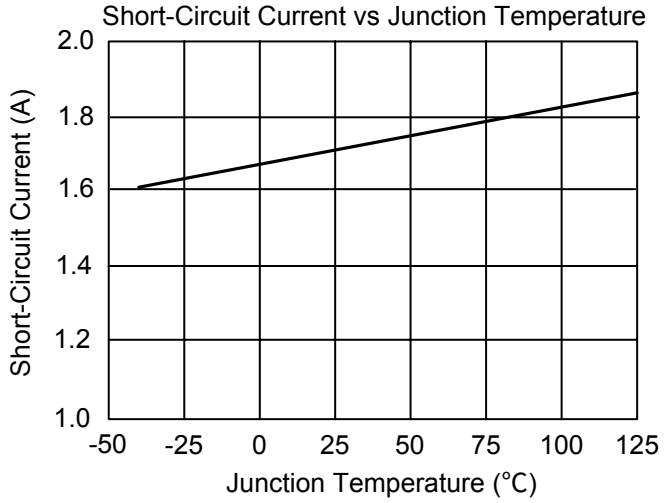


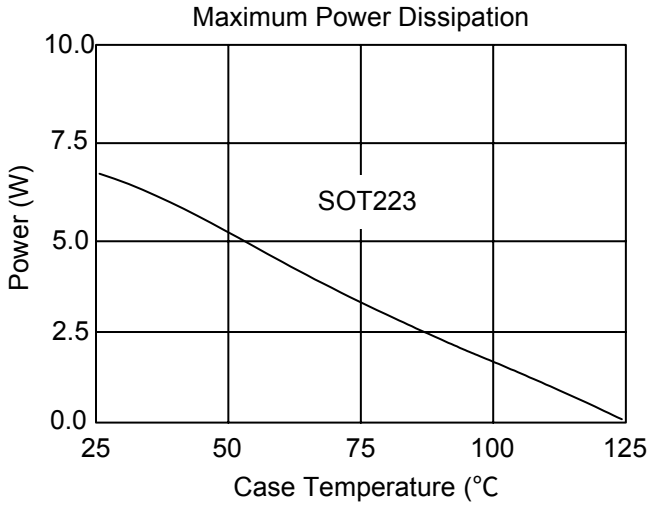


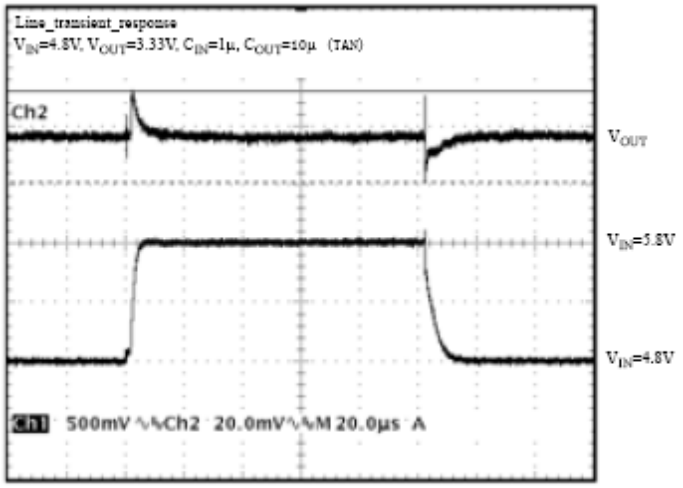




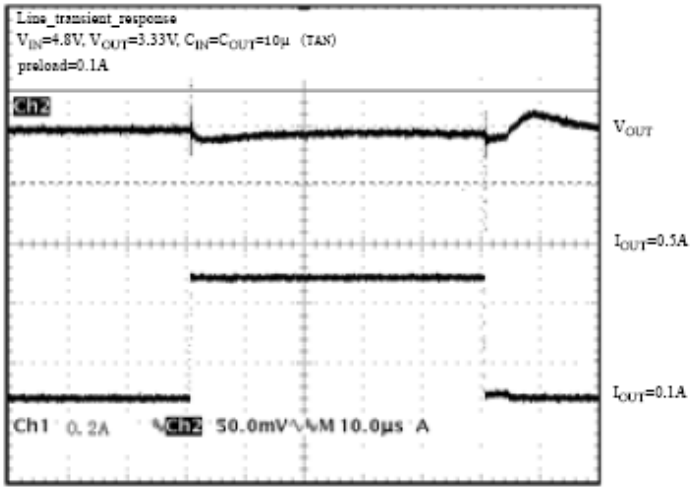
■ TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)



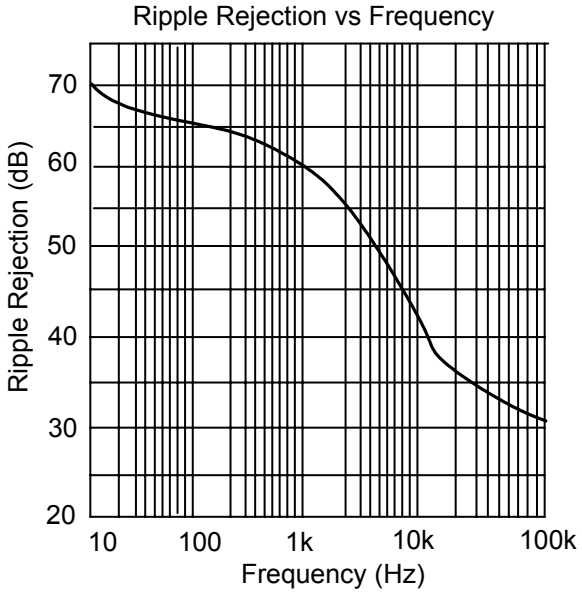




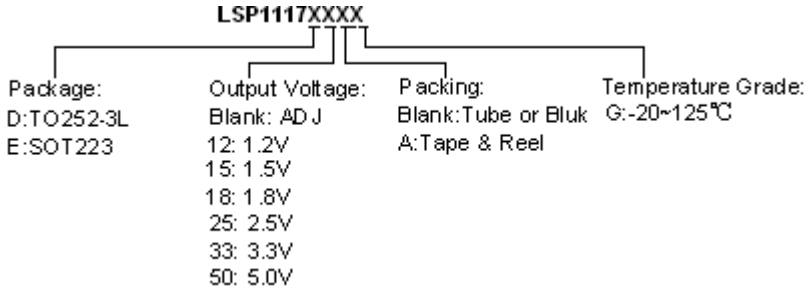
Line Transient Response



Load Transient Response

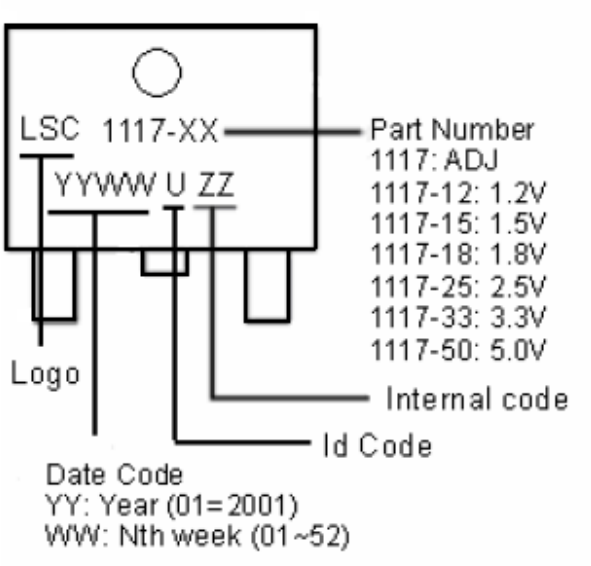


■ ORDERING INFORMATION

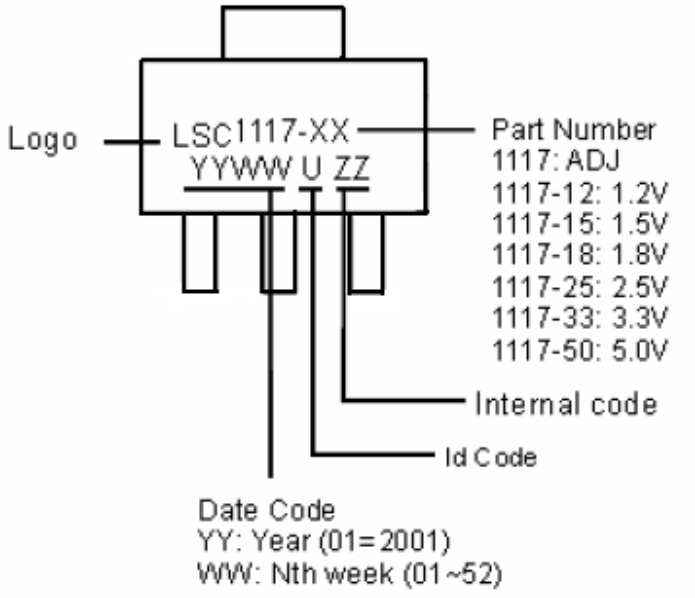


■ MARKING INFORMATION

(1) TO252-3L

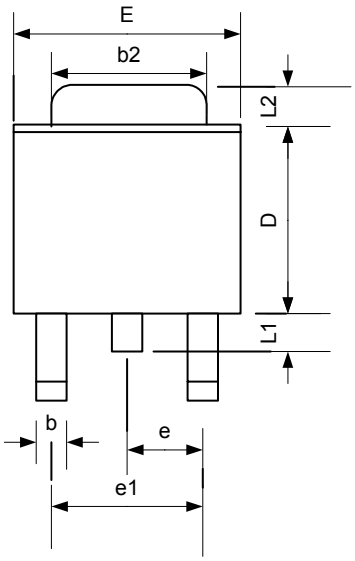


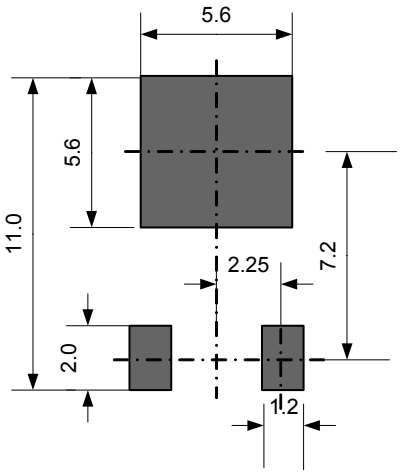
(2) SOT223



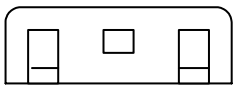
■ PACKAGE INFORMATION

(1) TO252-3L





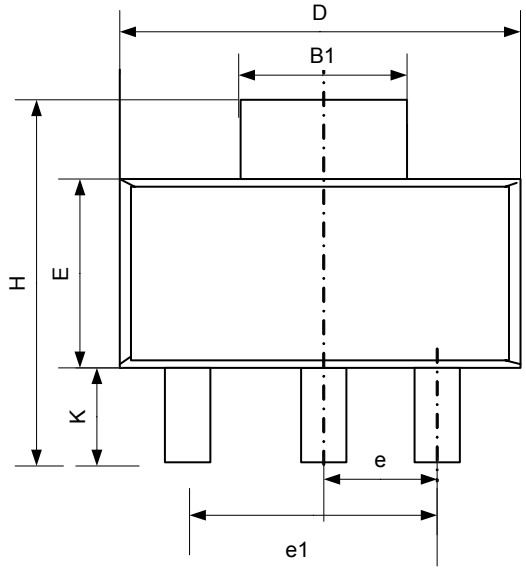
Land Pattern Recommendation (Unit : mm)

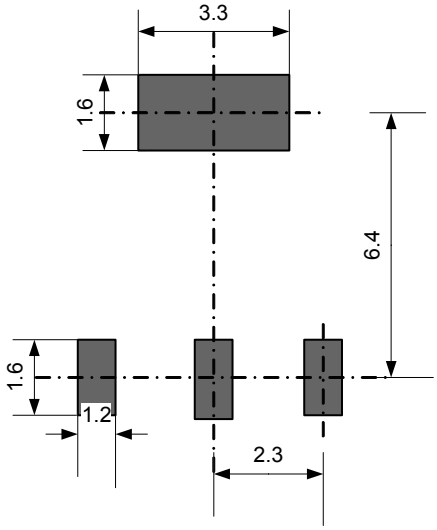


Notes:
1. JEDEC Outline:TO-252 AB
2. Mils suggested for positive contact at mounting

Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	2.18	2.29	2.39	0.086	0.090	0.094
A1	1.02	1.15	1.27	0.040	0.045	0.050
b		0.61TYP.			0.024TYP.	
b2	5.20	5.35	5.50	0.205	0.211	0.217
C	0.46	0.52	0.58	0.018	0.020	0.023
C1	0.46	0.52	0.58	0.018	0.020	0.023
D	5.33	5.57	5.80	0.210	0.219	0.228
E	6.35	6.58	6.80	0.250	0.259	0.268
e		2.25BSC.			0.089BSC.	
e1		4.50BSC.			0.177BSC.	
H	9.00	9.70	10.40	0.354	0.382	0.409
L	0.51			0.020		
L1	0.64	0.83	1.02	0.025	0.033	0.040
L2	1.52	1.78	2.03	0.060	0.070	0.080

(2) SOT223





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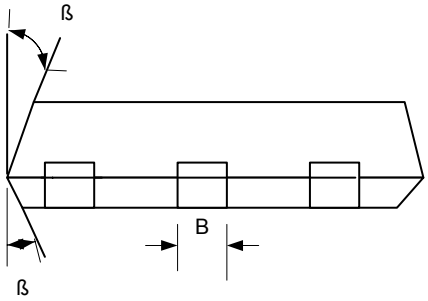

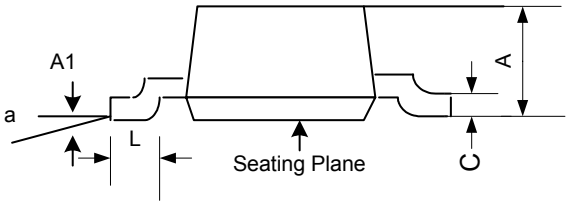

Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.50	1.65	1.80	0.059	0.065	0.071
A1	0.02	0.05	0.08	0.001	0.002	0.003
B	0.60	0.70	0.80	0.024	0.028	0.031
B1	2.90		3.15(Ref.)	0.114		0.124(Ref.)
c	0.28	0.30	0.32	0.011	0.012	0.013
D	6.30	6.50	6.70	0.248	0.256	0.264
E	3.30	3.50	3.70	0.130	0.138	0.146
e	2.3Basic			0.091Basic		
e1	4.6Basic			0.181Basic		
H	6.70	7.00	7.30	0.264	0.276	0.287
L	0.91	1.00	1.10	0.036	0.039	0.043
K	1.50	1.75	2.00	0.059	0.069	0.079
α	0^o	5^o	10^o	0^o	5^o	10^o
β		13^o			13^o	

■ UPDATE HISTORY

Date	Version	Descriptions
20090410	V1.1	Add 1.2V output version; Revise temperature to -20~125°C; Revise Vin from 12V to 20V (By Fredwu);
20090716	V1.2	Change max power dissipation and θ_{JA} (By Fredwu);