1A LOW DROPOUT VOLTAGE REGULATOR

Description

The AMS1117 is a series of low dropout voltage regulators which can provide up to 1A of output current. The AMS1117 is available in six fixed voltage, 1.2, 1.5, 1.8, 2.5, 3.3 and 5.0V. Additionally it is also available in adjustable version. On chip precision trimming adjusts the reference/ output voltage to within ± 2%. On-chip thermal limiting provides protection against any combination of overload and ambient temperatures that would create excessive junction temperatures.

The AMS1117 series is available in SOT-223, TO-252, SOT89 packages. A minimum of 10uF tantalum capacitor is required at the output to improve the transient response and stability.

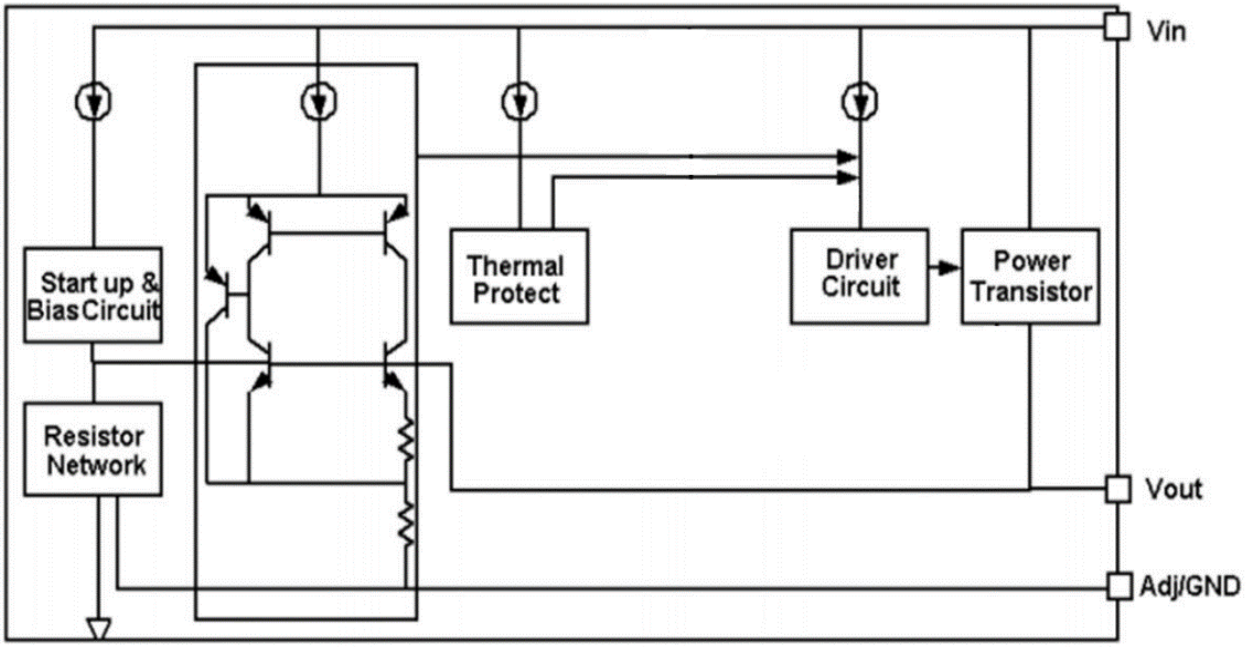
Features

- Low Dropout Voltage.
- Load regulation: 0.5% Max.
- Optimized for Low Voltage
- On-chip thermal limiting.
- Maximum Input Voltage : 30V
- Adjustable Output Voltage or Fixed 1.2V, 1.5V, 1.8V, 2.5V, 3.3V,5V
- Standard SOT-223,TO-252 ,SOT89 Packages

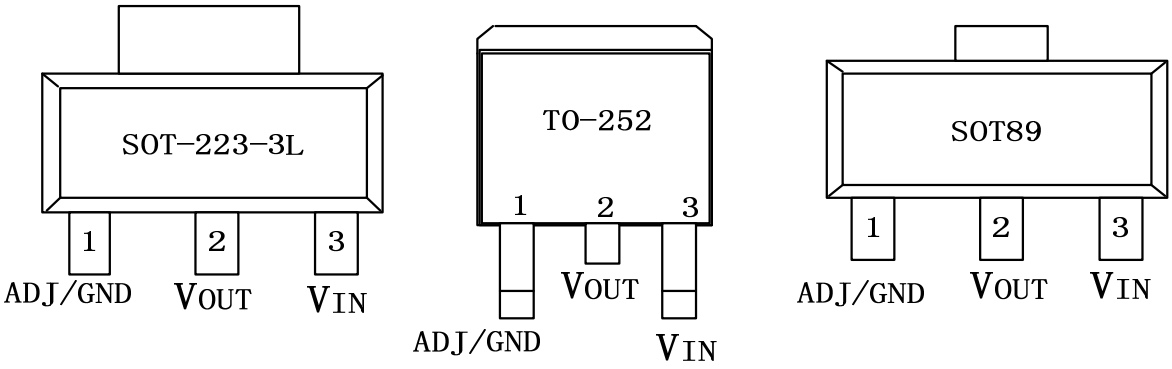
Applications

- Post Regulator for switching DC/DC Converter
- High Efficiency Linear Regulator
- Battery Chargers
- PC Add on Card
- Motherboard clock supplies
- LCD Monitor r
- Set-top Box

Block Diagram



Pin Description



Absolute Maximum Ratings

Symbol	Description	Max	Units
VIN	Input Voltage	30	V
I_{OUT}	DC Output Current	PD/(V_{IN}-V_{OUT})	mA
TJ	Operating Junction Temperature Range	-40 to 125	℃
θ JA	Thermal Resistance (SOT-223)	150	℃/W
θ JA	Thermal Resistance (TO-252)	125	℃/W
θ JA	Thermal Resistance (SOT89)	225	℃/W
PD	Maximum Power Dissipation (SOT-223)	600	mW
PD	Maximum Power Dissipation (TO-252)	900	mW
PD	Maximum Power Dissipation (SOT89)	400	mW

Electrical Characteristics (Vin =<7V, Tj= 25℃ unless otherwise Specified. The ~ denotes specifications which apply over the specified operating temperature range .)

Parameter	Conditions	Min.	Typ.	Max.	Units
Reference voltage	VIN=Vout+2V,10mA≤IOUT≤1A AMS1117-ADJ	1.225(-2%)	1.250	1.275(+2%)	V
Output voltage	10mA≤IOUT≤1A, VIN=Vout+2V				V
	AMS1117-1.2	1.176	1.20	1.224	
	AMS1117-1.5	1.470	1.50	1.530	
	AMS1117-1.8	1.764	1.80	1.836	
	AMS1117-2.5	2.450	2.50	2.550	
	AMS1117-3.3	3.234	3.30	3.366	
	AMS1117-5.0	4.90	5.0	5.10	
Line regulation1,2	(VOUT+ 1.5V)≤VIN≤12V, IOUT= 10mA		0.15	0.30	%
Load regulation1,2	(VIN-VOUT) = 2V, 10mA≤ IOUT≤1A		0.20	0.50	%
Dropout voltage	VREF= 1%,IOUT=1A		1.30	1.40	V
Current limit	(VIN-VOUT)=2V	1			A
Adjust pin current	AMS1117-ADJ 1.5V≤ (VIN-VOUT)≤7V, 10mA≤IOUT≤1A		50	120	uA
Minimum load current	1.5V≤(VIN-VOUT)≤12V		3	10	mA
Quiescent current	VIN= VOUT+1.25V		3	10	mA
Ripple rejection	f = 120Hz, Cout= 22uF Tantalum , (VIN-VOUT) = 3V, Iout=1A	60	70		dB
Thermal regulation	TA= 25℃, 30ms pulse		0.008	0.04	%/W
Temperature stability			0.5		%
Long-term stability	TA= 125℃, 1000hrs.		0.3	1.0	%
RMS output noise (%of VOUT)	TA= 25℃, 10Hz≤ f ≤10kHz		0.003		%
Thermal resistance, junction to case	SOT-223		15		℃ /W
	TO-252		10		℃ /W
	SOT89		20		℃ /W
Thermal shutdown	Junction temperature		150		℃
Thermal shutdown hysteresis			10		℃

1、See thermal regulation specifications for changes in output voltage due to heating effects. Load and line regulation are measured at a constant junction temperature by low duty cycle pulse testing.

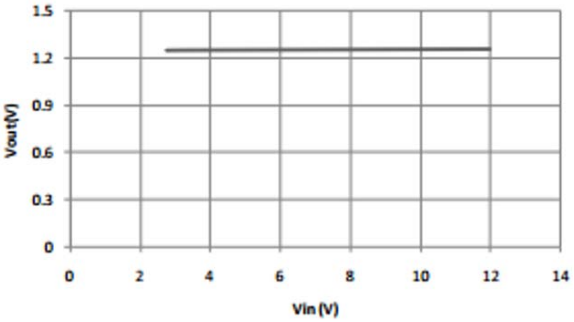
2、Line and load regulation are guaranteed up to the maximum power dissipation (1.2W). Power dissipation is determined by input/output differential and the output current. Guaranteed maximum output power will not be available over the full input/ output voltage range.

3、Output current must be limited to meet the absolute maximum ratings of the part.

Typical Performance Characteristics (TA=25℃, unless otherwise noted.)

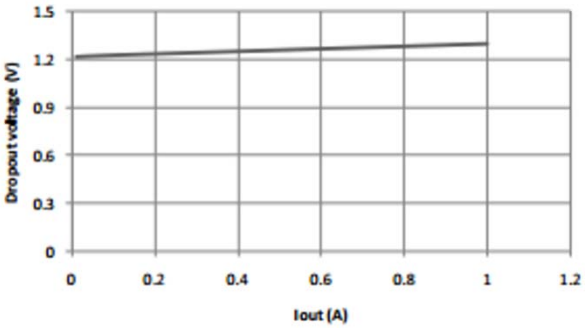
Line regulation

AMS1117-ADJ Vout Vs. Vin



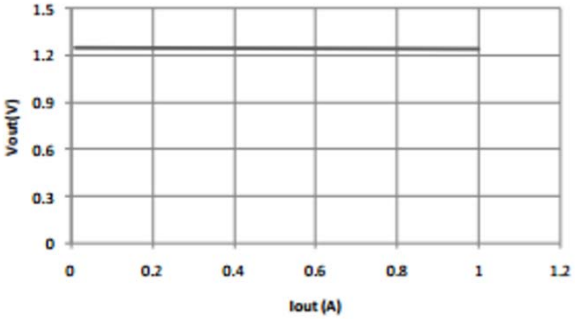
Dropout Voltage

AMS1117 Dropout Voltage



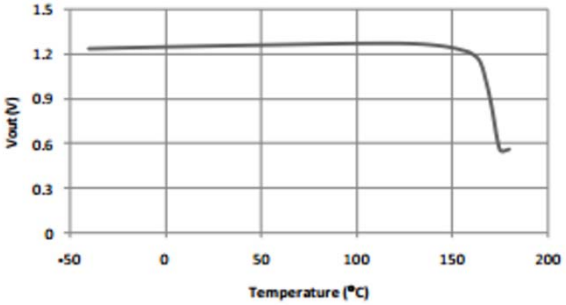
Load regulation

AMS1117-ADJ Vout Vs. Iout



Thermal performance with OTP

AMS1117 Thermal performance with OTP



Application Information
Output voltage adjustment

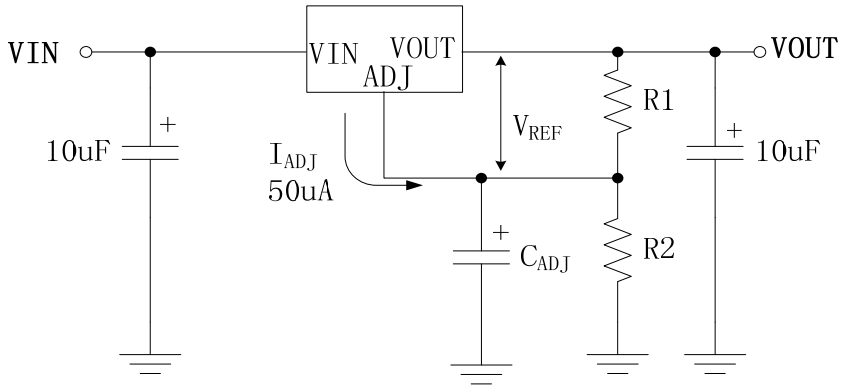
The AMS1117 regulates the output by comparing the output voltage to an internally generated reference voltage. On the adjustable version as shown in Fig.1, the VREF is available externally as 1.25V between VOUT and ADJ. The voltage ratio formed by R1 and R2 should be set to conduct 10mA (minimum output load).

The output voltage is given by the following equation:

VOUT = VREF (1 + R2/R1) + IADJ X R2

On fixed versions of AMS1117, the voltage divider is provided internally

Figure 1. Basic Adjustable Regulator



Input Bypass Capacitor

An input capacitor is recommended. A 10μF tantalum on the input is a suitable input bypassing for almost all applications.

Adjust Terminal Bypass Capacitor

The adjust terminal can be bypassed to ground with a bypass capacitor (CADJ) to improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. At any ripple frequency, the impedance of the CADJ should be less than R1 to prevent the ripple from being amplified:

$$(2\pi * f_{RIPPLE} * C_{ADJ}) < R1$$

The R1 is the resistor between the output and the adjust pin. Its value is normally in the range of 100- 200Ω. For e

Output Capacitor

AMS1117 requires a capacitor from VOUT to GND to provide compensation feedback to the internal gain stage. This is to ensure stability at the output terminal. Typically, a 10μF tantalum or 50μF aluminum electrolytic is sufficient.

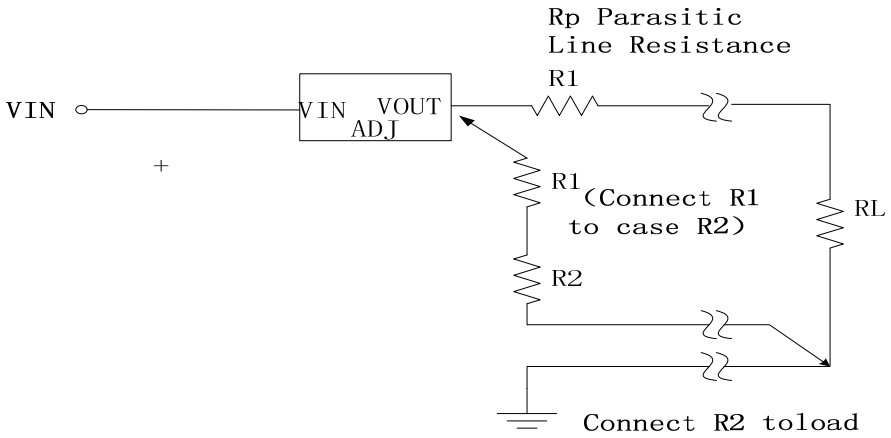
Note: It is important that the ESR for this capacitor does not exceed 0.5 Ω.

The output capacitor does not have a theoretical upper limit and increasing its value will increase stability. COUT = 100μF or more is typical for high current regulator design. xample, with R1 = 124Ω and fRIPPLE = 120Hz, the CADJ should be > 11μF.

Load Regulation

When the adjustable regulator is used (Fig.2), the best load regulation is accomplished when the top of the resistor divider (R1) is connected directly to the output pin of the AMS1117. When so connected, RP is not multiplied by the divider ratio. For Fixed output version, the top of R1 is internally connected to the output and ground pins can be connected to low side of the load

Figure 2. Best Load Regulation Using Adjustable Output Regulator



Thermal Protection

AMS1117 has thermal protection which limits junction temperature to 150℃. However, device functionality is only guaranteed to a maximum junction temperature of +125℃. The power dissipation and junction temperature for AMS1117 in DPAK package are given by

$$P_D = (V_{IN} - V_{OUT}) * I_{out}$$

$$T_{JUNCTION} = T_{AMBIENT} + (P_D * \theta_{JA})$$

Note: TJUNCTION must not exceed 125℃

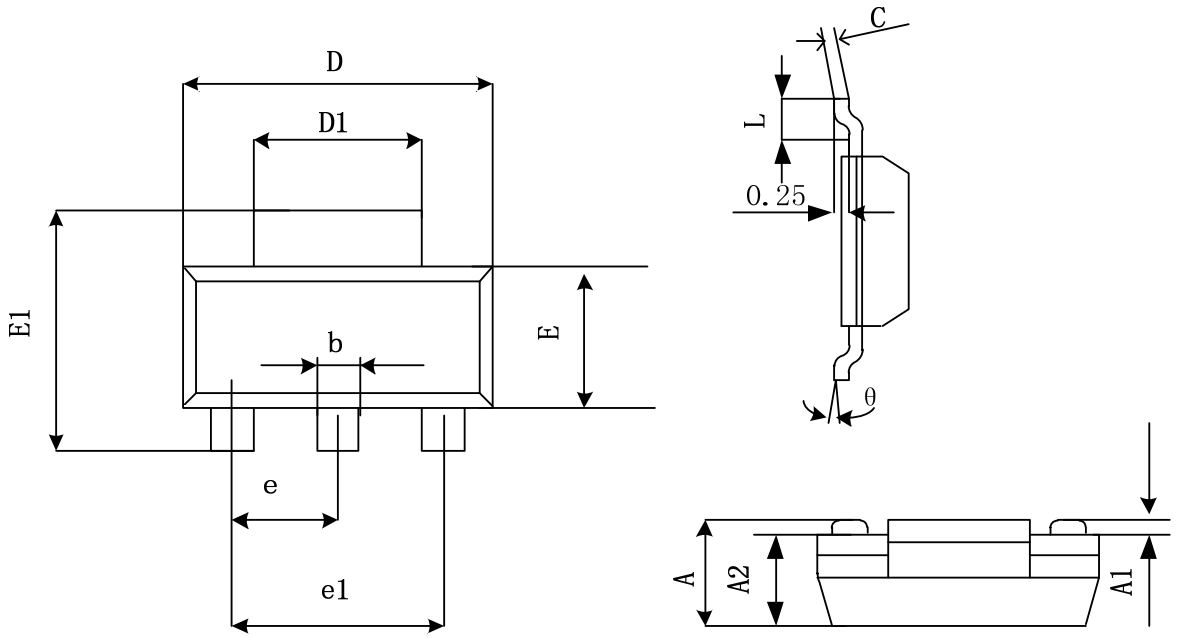
Thermal Consideration

The AMS1117 series contain thermal limiting circuitry designed to protect itself from over-temperature conditions. Even for normal load conditions, maximum junction temperature ratings must not be exceeded. As mention in thermal protection section, we need to consider all sources of thermal resistance between junction and ambient. It includes junction-to case, case-to-heat-sink interface, and heat sink thermal resistance itself.

Junction-to-case thermal resistance is specified from the IC junction to the bottom of the case directly below the die. Proper mounting is required to ensure the best possible thermal flow from this area of the package to the heat sink. The case of all devices in this series is electrically connected to the output. Therefore, if the case of the device must be electrically isolated, a thermally conductive spacer is recomme

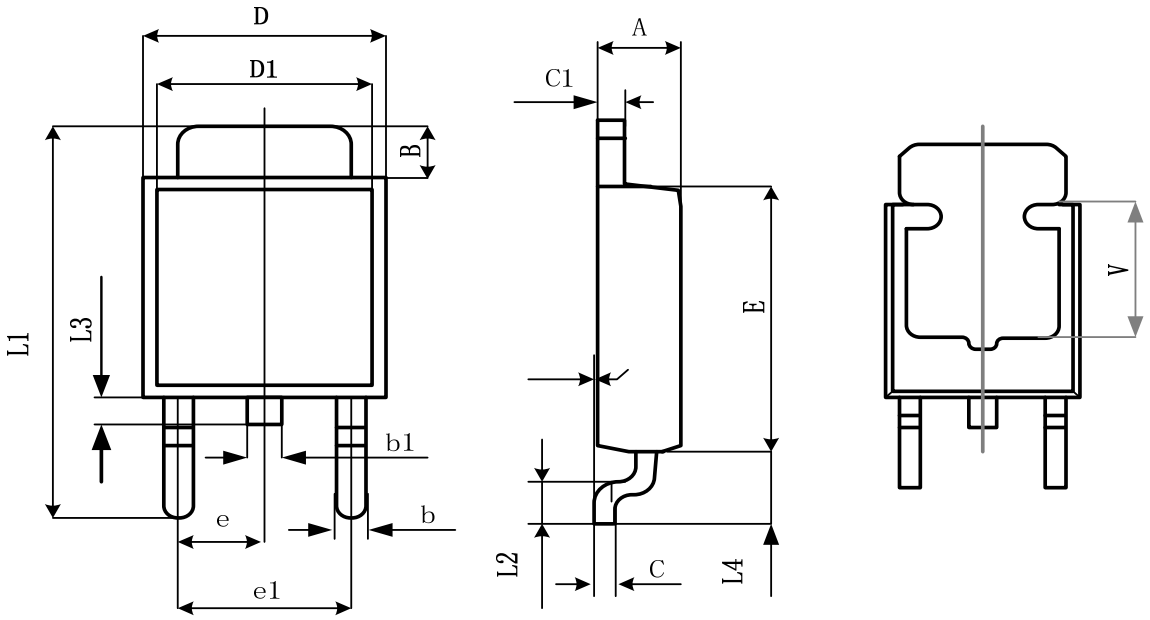
PACKAGE DESCRIPTION

SOT-223 PACKAGE OUTLINE DIMENSIONS



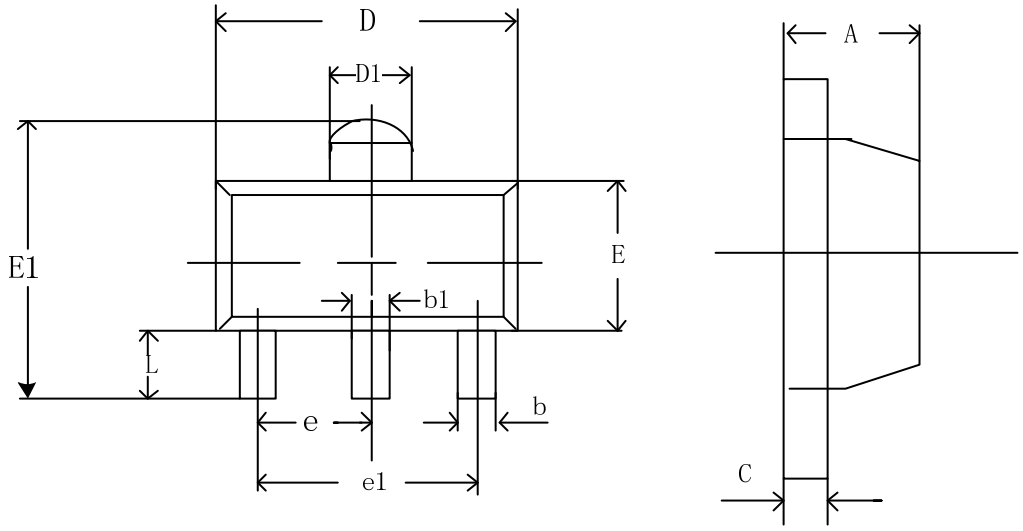
Symbol	Dimensions ln Millimeters		Dimensions ln lnches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.020	0.130	0.001	0.005
A2	1.500	1.700	0.059	0.067
b	0.660	0.840	0.026	0.033
c	0.230	0.350	0.009	0.014
D	6.450	6.850	0.254	0.270
D1	2.900	3.000	0.114	0.122
E	3.450	3.850	0.136	0.152
E1	6.830	7.070	0.269	0.278
e	2.300（BSC）		0.091(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10

TO-252-2L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions ln Millimeters		Dimensions ln lnches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
B	1.200	1.650	0.047	0.065
b	0.500	0.810	0.020	0.032
b1	0.700	0.900	0.028	0.035
c	0.460	0.580	0.018	0.023
c1	0.430	0.580	0.014	0.023
D	6.350	6.700	0.250	0.264
D1	5.200	5.400	0.205	0.213
E	5.400	6.200	0.213	0.244
e	2.300TYP		0.0901TYP	
e1	4.500	4.700	0.177	0.185
L1	9.500	9.900	0.374	0.390
L2	0.950	1.600	0.037	0.063
L3	0.700	1.100	0.028	0.043
L4	2.550	2.900	0.100	0.114
V	3.80REF		0.150REF	

SOT89 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions ln Millimeters		Dimensions ln lnches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.350	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.450	0.014	0.018
D	4.400	4.600	0.173	0.181
D1	1.550	1.750	0.061	0.069
E	2.350	2.600	0.091	0.102
E1	3.720	4.530	0.146	0.178
e	1.500TYP		0.060TYP	
e1	3.000TYP		0.118TYP	
L	0.820	1.100	0.032	0.047

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