Advanced Monolithic Systems

AMS1117

800mA LOW DROPOUT VOLTAGE REGULATOR

800mA低压差稳压器

FEATURES特点

- Three Terminal Adjustable or Fixed Voltages* =端可调或固定电压 High Efficiency Linear Regulators高效率的线性稳压器 1.5V, 1.8V, 2.5V, 2.85V, 3.3V and 5.0V
- Output Current of 800mA输出电流800毫安
- Operates Down to 1V Dropout 经营低至1V的压差
- Line Regulation: 0.2% Max. 线路调整率: 0.2%最大
- Load Regulation: 0.4% Max.负载调整率: 0.4%最大
- SOT-223 and TO-252 package available SOT-223和TO 252封装

APPLICATIONS应用

- Post Regulators for Switching Supplies发表开关电源的稳压器
- 5V to 3.3V Linear Regulator 5 ∨ 到3.3 V 线性稳压器

- Power Management for Notebook 笔记本电源管理
- Battery Powered Instrumentation 电池供电仪表

GENERAL DESCRIPTION 概述

The AMS1117 series of adjustable and fixed voltage regulators are designed to provide 800mA output current and to operate down to 1V input-to-output differential. The dropout voltage of the device is guaranteed maximum 1.3V at maximum output current, decreasing at lower load currents.

On-chip trimming adjusts the reference voltage to 1%. Current limit is also trimmed, minimizing the stress under overload conditions on both the regulator and power source circuitry.

The AMS1117 devices are pin compatible with other three-terminal SCSI regulators and are offered in the low profile surface mount SOT-223 package and in the TO-252 (DPAK) plastic package. AMS1117系列可调和固定电压调节器的设计提供800mA的输出电流和

ORDERING INFORMATION: 订购信息:

操作下降到1V的输入至差分输出。保证设备的电压差在最大输出电流最大1.3V,在低负载电流下降。片上的微调,调整的参考电压为1%。电流限制也修剪,尽量减少过载条件下稳压器和电源电路上的压力。 AMS1117设备与其他三端SCSI监管机构的引脚兼容,并在低调表面 贴装的SOT- 223封装, TO- 252 (DPAK) 塑料封装提供。

	封装类型 PACKA(GE TYPE	OPERATING JUNCTION	
	TO-252	SOT-223	TEMPERATURE RANGE	工作结温范围
	AMS1117CD	AMS1117	0 to 125° C	
	AMS1117CD-1.5	AMS1117-1.5	0 to 125° C	
	AMS1117CD-1.8	AMS1117-1.8	0 to 125° C	
	AMS1117CD-2.5	AMS1117-2.5	0 to 125° C	
	AMS1117CD-2.85	AMS1117-2.85	0 to 125° C	
	AMS1117CD-3.3	AMS1117-3.3	0 to 125° C	
	AMS1117CD-5.0	AMS1117-5.0	0 to 125° C	
-	AMS1117CD AMS1117CD-1.5 AMS1117CD-1.8 AMS1117CD-2.5 AMS1117CD-2.85 AMS1117CD-3.3 AMS1117CD-5.0	AMS1117 AMS1117-1.5 AMS1117-1.8 AMS1117-2.5 AMS1117-2.85 AMS1117-3.3	0 to 125° C	工作结温范围

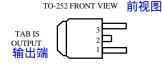
^{*}For additional available fixed voltages contact factory. 额外提供的固定电压请与工厂联系。

PIN CONNECTIONS引脚连接

FIXED VERSION 固定版本ADJUSTABLE VERSION 可调版本

1- Ground_{1 - 接地} 1- Adjust i周整 $2-V_{OUT}$ $2-V_{OUT}$ $3-V_{IN}$ $3-V_{\rm IN}$





ABSOLUTE MAXIMUM RATINGS (Note 1) 绝对最大额定值

Power Dissipation 功率耗散 Internally limited內部限制

Input Voltage輸入电压 15V

Operating Junction Temperature工作温度范围

Control Section 管制组 0°C to 125°C Power Transistor功率晶体管 0°C to 150°C Storage temperature 存储温度 - 65°C to +150°C

Soldering information焊接信息

Lead Temperature (10 sec)引线温度 300°C

Thermal Resistance 热阻

TO-252 package $\phi_{JA} = 80^{\circ}\text{C/W}$ SOT-223 package $\phi_{JA} = 90^{\circ}\text{C/W}^*$ * With package soldering to copper area over backside

* With package soldering to copper area over backside ground plane or internal power plane φ _{JA} can vary from 46°C/W to >90°C/W depending on mounting technique and

the size of the copper area. 包焊接铜面积超过背面接地层或内部电源平面j JA可以从46° C / W , 90° C / W的安装技术和铜的面积大小而定。

ELECTRICAL CHARACTERISTICS 电气特性IOUT= 0毫安,和TJ=25°C,除非另有规定

Electrical Characteristics at $I_{OUT} = 0$ mA, and $T_J = +25$ °C unless otherwise specified.

Parameter	Device 设备	Conditions条件	Min	Тур	Max	Units
Reference Voltage (Note 2) 参考电压	AMS1117	$I_{OUT} = 10 \text{ mA}$ $10\text{mA} \le I_{OUT} \le 800\text{mA}, 1.5\text{V} \le (V_{IN} - V_{OUT}) \le 12\text{V}$	1.238 1.225	1.250 1.250	1.262 1.270	V V
Output Voltage (Note 2)输出电压	AMS1117-1.5	$0 \le I_{OUT} \le 800 \text{mA}$, $3.0 \text{V} \le V_{IN} \le 12 \text{V}$	1.485 1.476	1.500 1.500	1.515 1.524	V V
	AMS1117-1.8	$0 \leq I_{OUT} \leq 800 mA$, $3.3 V \leq V_{IN} \leq 12 V$	1.782 1.773	1.800 1.800	1.818 1.827	V V
	AMS1117-2.5	$0 \le I_{OUT} \le 800 \text{mA}$, $4.0 \text{V} \le V_{IN} \le 12 \text{V}$	2.475 2.460	2.500 2.500	2.525 2.560	V V
	AMS1117-2.85	$0 \le I_{OUT} \le 800 \text{mA}$, $4.35 \text{V} \le V_{IN} \le 12 \text{V}$	2.82 2.79	2.850 2.850	2.88 2.91	V V
	AMS1117-3.3	$0 \le I_{OUT} \le 800 \text{mA}$, $4.75 \text{V} \le V_{IN} \le 12 \text{V}$	3.267 3.235	3.300 3.300	3.333 3.365	V V
	AMS1117-5.0	$0 \le I_{OUT} \le 800 \text{mA}$, $6.5 \text{V} \le V_{IN} \le 12 \text{V}$	4.950 4.900	5.000 5.000	5.050 5.100	V V
Line Regulation 线路调整	AMS1117	$I_{LOAD} = 10 \text{ mA}, 1.5\text{V} \le (V_{IN} - V_{OUT}) \le 12\text{V}$		0.015 0.035	0.2 0.2	% %
	AMS1117-1.5	$3.0V \le V_{IN} \le 12V$		0.3 0.6	5 6	mV mV
	AMS1117-1.8	$3.3V \le V_{IN} \le 12V$		0.3 0.6	5 6	mV mV
	AMS1117-2.5	$4.0V \le V_{\rm IN} \le 12V$		0.3 0.6	6 6	mV mV
	AMS1117-2.85	$4.35V \le V_{\rm IN} \le 12V$		0.3 0.6	6 6	mV mV
	AMS1117-3.3	$4.75V \le V_{\rm IN} \le 12V$		0.5 1.0	10 10	mV mV
	AMS1117-5.0	$6.5 \text{V} \leq \text{V}_{\text{IN}} \leq 12 \text{V}$		0.5 1.0	10 10	mV mV
Load Regulation (Notes 2, 3) 负载调节	AMS1117	$(V_{IN} - V_{OUT}) = 3V, 10mA \le I_{OUT} \le 800mA$		0.1 0.2	0.3 0.4	% %
	AMS1117-1.5	$V_{\rm IN} = 5V, 0 \le I_{\rm OUT} \le 800 \rm mA$		3 6	10 20	mV mV
	AMS1117-1.8	$V_{IN} = 5V$, $0 \le I_{OUT} \le 800$ mA		3 6	10 20	mV mV
	AMS1117-2.5	$V_{IN} = 5V$, $0 \le I_{OUT} \le 800$ mA		3 6	12 20	mV mV

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at $I_{OUT} = 0$ mA, and $T_J = +25$ °C unless otherwise specified.

Parameter	Device	Conditions	Min	Тур	Max	Units
Load Regulation (Notes 2, 3)	AMS1117-2.85	$V_{IN} = 5V, \ 0 \le I_{OUT} \le 800mA$		3 6	12 20	mV mV
	AMS1117-3.3	$V_{IN} = 5V, \ 0 \le I_{OUT} \le 800 \text{mA}$		3 7	15 25	mV mV
	AMS1117-5.0	$V_{IN} = 8V, \ 0 \le I_{OUT} \le 800 \text{mA}$		5 10	20 35	mV mV
Dropout Voltage电压差 (V _{IN} - V _{OUT})	AMS1117-1.5/-1.8/-2.5/- 2.85/-3.3/-5.0	ΔV_{OUT} , $\Delta V_{REF} = 1\%$, $I_{OUT} = 800$ mA (Note 4)		1.1	1.3	V
Current Limit 电流限制	AMS1117-1.5/-1.8/-2.5/- 2.85/-3.3/-5.0	$(V_{IN} - V_{OUT}) = 5V$	900	1,100	1,500	mA
Minimum Load Current最小角裁由流	AMS1117	$(V_{IN} - V_{OUT}) = 12V \text{ (Note 5)}$		5	10	mA
Quiescent Current 静态电流	AMS1117-1.5/-1.8/-2.5/- 2.85/-3.3/-5.0	$V_{IN} \le 12V$		5	10	mA
Ripple Rejection 纹波抑制	AMS1117	$\begin{aligned} f=&120Hz\;,\;C_{OUT}=22\mu F\;Tantalum,\;I_{OUT}=800mA,\\ (V_{IN}-V_{OUT})=&3V,\;C_{ADJ}=&10\mu F \end{aligned}$	60	75		dB
	AMS1117-1.5/-1.8/-2.5/- 2.85	f =120Hz , C_{OUT} = 22 μF Tantalum, I_{OUT} = 800mA, V_{IN} = 6 V	60	72		dB
	AMS1117-3.3	$f\!=\!120 Hz$, $C_{OUT}\!=22 \mu F$ Tantalum, $I_{OUT}\!=\!800 mA$ $V_{IN}=6.3 V$	60	72		dB
	AMS1117-5.0	$f\!=\!120 Hz$, $C_{OUT}\!=22 \mu F$ Tantalum, $I_{OUT}\!=\!800 mA$ $V_{IN}=8V$	60	68		dB
Thermal Regulation	AMS1117	$T_A = 25^{\circ}C$, 30ms pulse		0.008	0.04	%W
Adjust Pin Current 调整引脚电流	AMS1117	$10\text{mA} \le I_{\text{OUT}} \le 800\text{mA}$, $1.5\text{V} \le (V_{\text{IN}} - V_{\text{OUT}}) \le 12\text{V}$		55	120	μΑ μΑ
Adjust Pin Current Change 调整引脚电流	AMS1117 变化	$10\text{mA} \le I_{\text{OUT}} \le 800\text{mA}$, $1.5\text{V} \le (V_{\text{IN}} - V_{\text{OUT}}) \le 12\text{V}$		0.2	5	μΑ
Temperature Stability	度稳定性			0.5		%
Long Term Stability +		T _A =125°C, 1000Hrs		0.3	1	%
RMS Output Noise RM (% of V _{OUT})		$T_A = 25^{\circ}\text{C}$, $10\text{Hz} \le f \le 10\text{kHz}$		0.003		%
Thermal Resistance 热厚 Junction-to-Case	 且结到外壳				15	°C/W

Parameters identified with **boldface type** apply over the full operating temperature range.黑体字标识的rameters适用于在整个工作温度范围。

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

Note 2: Line and Load regulation are guaranteed up to the maximum power dissipation of 1.2 W. Power dissipation is determined by the input/output differential and the output current. Guaranteed maximum power dissipation will not be available over the full input/output range.

Note 3: See thermal regulation specifications for changes in output voltage due to heating effects. Line and load regulation are measured at a constant junction temperature by low duty cycle pulse testing. Load regulation is measured at the output lead $\sim 1/8$ " from the package.

Note 4: Dropout voltage is specified over the full output current range of the device. 注4:电压差在整个输出设备的电流范围内指定。

Note 5: Minimum load current is defined as the minimum output current required to maintain regulation. When $1.5V \le (V_{IN} - V_{OUT}) \le 12V$ the device is guaranteed to regulate if the output current is greater than 10mA.

注1:绝对最大额定值表明限制,超出该设备损坏,可能会出现。规格保证和测试条件,见电气特性。保证规格仅适用于列出的测试条件。

注2:线路和负载调节保证最大功耗1.2瓦功耗是由输入/输出差分和输出电流。保证最高功耗将不提供较完整的输入/输出范围。

注3:热调节规格的热效应引起的输出电压的变化。在结温恒定温度低占空比脉冲测试测量线路和负载调节。负载调整率是在输出引线从包~1 / 8 " 。 注5:最小负载电流所需的最小输出电流,保持监管的定义。当1.5V英镑(VIN - VOUT)英镑12V设备是保证规范,如果输出电流大于10mA更大

热调节

APPLICATION HINTS 应用提示

The AMS1117 series of adjustable and fixed regulators are easy to use and are protected against short circuit and thermal overloads. Thermal protection circuitry will shut-down the regulator should the junction temperature exceed 165°C at the sense point.

Pin compatible with older three terminal adjustable regulators, these devices offer the advantage of a lower dropout voltage, more precise reference tolerance and improved reference stability

了稳定性和瞬态响应这些设备可用于较大的输出电容值。 The circuit design used in the AMS1117 series requires the use of an output capacitor as part of the device frequency compensation. The addition of 22µF solid tantalum on the output will ensure stability for all operating conditions.

When the adjustment terminal is bypassed with a capacitor to improve the ripple rejection, the requirement for an output capacitor increases. The value of 22µF tantalum covers all cases of bypassing the adjustment terminal. Without bypassing the adjustment terminal smaller capacitors can be used with equally good results.

To ensure good transient response with heavy load current changes capacitor values on the order of 100µF are used in the output of many regulators. To further improve stability and transient response of these devices larger values of output capacitor can be used.

Protection Diodes 保护二极管

Unlike older regulators, the AMS1117 family does not need any protection diodes between the adjustment pin and the output and from the output to the input to prevent over-stressing the die. Internal resistors are limiting the internal current paths on the AMS1117 adjustment pin, therefore even with capacitors on the adjustment pin no protection diode is needed to ensure device safety under short-circuit conditions.

Diodes between the input and output are not usually needed. Microsecond surge currents of 50A to 100A can be handled by the internal diode between the input and output pins of the device. In normal operations it is difficult to get those values of surge currents even with the use of large output capacitances. If high value output capacitors are used, such as 1000µF to 5000µF and the input pin is instantaneously shorted to ground, damage can occur. A diode from output to input is recommended, when a crowbar circuit at the input of the AMS1117 is used (Figure 1).

不同于旧的监管机构,AMS1117的家庭并不需要调整引脚和输出以及从输 出的任何保护二极管的输入,以防止过分强调的死。内部电阻限制AMS1117 面的任何保护二极官的输入,以防止过分强调的死。内部电阻限制AMSTTT/
调整引脚上的内部电流路径,因此,即使需要调整引脚上没有保护二极管,
电容,短路条件下,以确保设备的安全。通常并不需要输入和输出之间的二极管。 divider R1 is connected directly to the case not to the load. If R1 可以处理的设备之间的输入和输出引脚的内部二极管微秒的浪涌电流为50A至100Awere connected to the load, the effective resistance between the 。在正常运作,它是很难得到,即使使用较大的输出电容浪涌电流的值。如果使用 regulator and the load would be: 个从输出到输入的二极管建议,当 使用撬棍AMS1117输入电路(图1)。

可调和固定稳压器AMS1117系列是易于使用,并针对短路和热过载保护 热保护电路将关机监管机构应结温超过165 检测点。与老式三端可调稳压器 引脚兼容,这些器件具有较低的电压差,更精确的参考性和改进的参考稳定 , 随温度的优势。

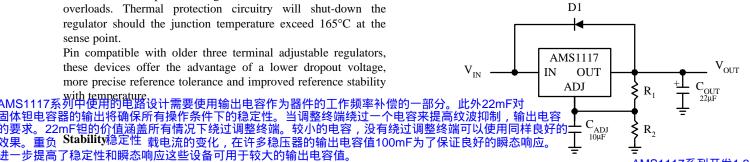


Figure 1.

AMS1117系列开发1.25V参考电压 输出和调整终端之间。配售这两个端子之间的电阻会导致一个恒定电流流通过R1和向下通过R2设置的 整体输出电压。该电流通常规定的 最小负载电流为10mA。因为 IADJ是非常小的和不断的,它代表 了一个小错误,它通常可以被忽略

Output Voltage 输出电流

The AMS1117 series develops a 1.25V reference voltage between the output and the adjust terminal. Placing a resistor between these two terminals causes a constant current to flow through R1 and down through R2 to set the overall output voltage. This current is normally the specified minimum load current of 10mA. Because IADJ is very small and constant it represents a small error and it can usually be ignored.

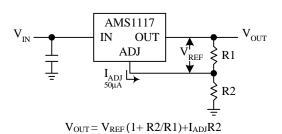


Figure 2. Basic Adjustable Regulator 基本可调稳压器

Load Regulation 负载调节

True remote load sensing it is not possible to provide, because the AMS1117 is a three terminal device. The resistance of the wire connecting the regulator to the load will limit the load regulation. The data sheet specification for load regulation is measured at the bottom of the package. Negative side sensing is a true Kelvin connection, with the bottom of the output divider returned to the negative side of the load.

寄生线电阻 $R_P \times (R2+R1)$, $R_P = Parasitic Line Resistance$

真正的远程负载传感无法提供,因为AMS1117是R1个三终端设备。负载的稳压器连接线的电阻会限制负载规管。在包的底部测量数据表规格为负载调节。消极的一面检测与输出分频器的底部是一个真正的Kelvin连接,返回到负载负端。电阻分压器R1的顶部是直接连接到没有负载的情况下,获得最佳的 多数调节ie如果品被连接船负载,绿乐器和船就交通的有效的板材将最(925)556-9140

APPLICATION HINTS

CONNECT R2 TO LOAD

Connected as shown , RP is not multiplied by the divider ratio 总从结点到环he total thermal resistance from junction to ambient can be as 境的热阻可 low as 45°C/W. This requires a reasonable sized PC board with

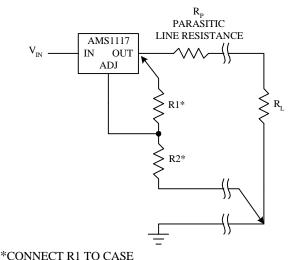


Figure 3. Connections for Best Load Regulation

In the case of fixed voltage devices the top of R1 is connected Kelvin internally, and the ground pin can be used for negative side sensing.

低45°C/W as 45°C/W. This requires a reasonable sized PC board with 对于每个低45°C/W at least on layer of copper to spread the heat across the board and 应用程序这需要一个合couple it into the surrounding air. AT PC板铜层Experiments have shown that the heat spreading copper layer 蔓延全does not need to be electrically connected to the tab of the device. 夫妇到周Fhe PC material can be very effective at transmitting heat spetween the pad area, attached to the pad of the device, and a 散热铜层, Tierround plane layer either inside or on the opposite side of the 接的设备选项eard. Although the actual thermal resistance of the PC material PC材料可以 is high, the Length/Area ratio of the thermal resistance between 常有效的, layers is small. The data in Table 1, was taken using 1/16" FR-4 board with 1 oz. copper foil, and it can be used as a rough 整直积 , guideline for estimating thermal resistance. For each application the thermal resistance will be affected by 会分面hermal interactions with other components on the board. To 虽然PC材料 determine the actual value some experimentation will be AMS1117的功耗等于: PD=(VIN-VOUT) 度/面积的 The power dissipation of the AMS1117 is equal to: l层与层之间的比例是 表1中的Po=(V_{IN}-V_{OUT})(I_{OUT}) : TJ = TA (max) +PD(热阻大结温不能 数据,是用 Maximum junction temperature will be equal to: 超过125°C。 1盎司。铜箔 T_J = T_{A(MAX)} + P_D(Thermal Resistance (junction-to-ambient)) 它可以被用系

K作为一个組織的指列 Maximum junction temperature must not exceed 125°C.

Ripple Rejection纹波抑持 纹波抑制值测量与调整引脚绕过 在石激起干层泿调

一个适当的路和结涡把制率接近alues are measured with the adjustment pin bypassed. The impedance of the adjust pin capacitor at the ripple frequency should be less than the value of R1 (normally 100Ω to 200Ω) for a proper bypassing and ripple rejection approaching the values shown. The size of the required adjust pin capacitor is a function of the input ripple frequency. If R1=100 Ω at 120Hz the adjust pin capacitor should be >13µF. At 10kHz only 0.16µF is needed.

中包容的阻抗频率应小于R1的值

The ripple rejection will be a function of output voltage, in circuits without an adjust pin bypass capacitor. The output ripple will increase directly as a ratio of the output voltage to the reference voltage (V_{OUT}/V_{REF}). 值显示。所需的调整引脚电容的大小是输

入纹波频率的功能。如果R1 =100 的 120Hz的调节引脚电容应大于13µF。在 10kHz只0.16µF需要。纹波抑制将是 输出电压的功能,没有调整引脚的旁路电容的电路。输出纹波作为输出电压的比例 将增加直接向参考电压(VOUT/VREF

AMS1117系**Thermal Considerations**散热注意事项(通常为100 200

The AMS1117 series have internal power and thermal limiting circuitry designed to protect the device under overload conditions. •However maximum junction temperature ratings of 125°C should not be exceeded under continuous normal load conditions.

Careful consideration must be given to all sources of thermal resistance from junction to ambient. For the surface mount package SOT-223 additional heat sources mounted near the device must be considered. The heat dissipation capability of the PC board and its copper traces is used as a heat sink for the device. The thermal resistance from the junction to the tab for the AMS1117 is 15°C/W. Thermal resistance from tab to ambient can be as low as 30°C/W.

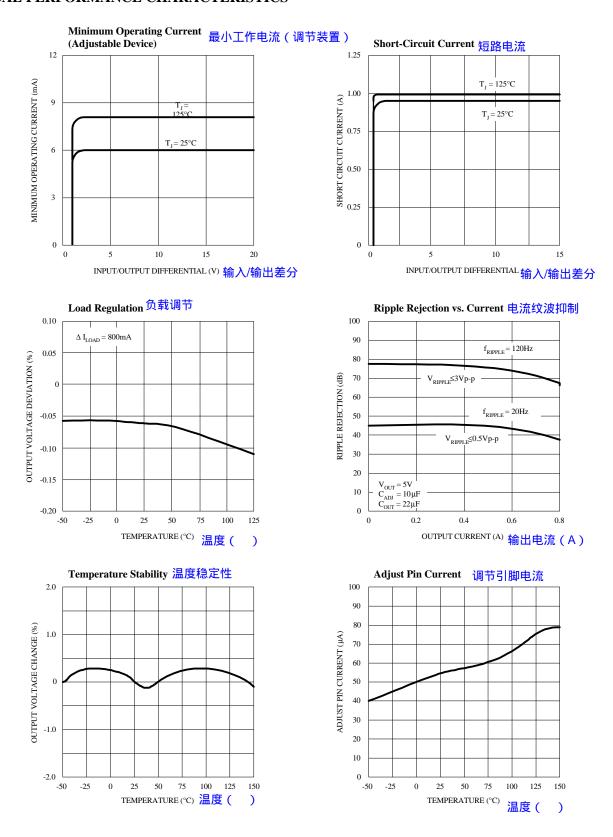
Table 1.

PC的

•	, 14010 11							
ับ	COPPER AREA			THERMAL RESISTANCE				
	TOP SIDE* BACK SIDE		BOARD AREA	(JUNCTION-TO-AMBIENT)				
	2500 Sq. mm 2500 Sq. mm		2500 Sq. mm	45°C/W				
	1000 Sq. mm	2500 Sq. mm	2500 Sq. mm	45°C/W				
	225 Sq. mm	2500 Sq. mm	2500 Sq. mm	53°C/W				
ı	100 Sq. mm	2500 Sq. mm	2500 Sq. mm	59°C/W				
,	1000 Sq. mm	1000 Sq. mm	1000 Sq. mm	52°C/W				
۷	V 1000 Sq. mm	0	1000 Sq. mm	55°C/W				

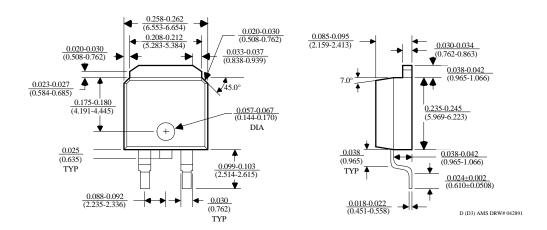
从选项下到 * Tab of device attached to topside copper. 环境的热阻低 至30°C/W

TYPICAL PERFORMANCE CHARACTERISTICS $^{\text{\tiny phyle}}$



PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

TO-252 PLASTIC PACKAGE (D)



3 LEAD SOT-223 PLASTIC PACKAGE

