AMC Doc. #: AMC1117_B
March 2002

ADD MICROTECH CORP.

AMC1117

1A Low Dropout Positive Regulator

DESCRIPTION

The AMC1117 series of positive adjustable and fixed regulators is designed to provide 1A for applications requiring high efficiency. All internal circuitry is designed to operated down to 800mV input to output differential and the dropout voltage is fully specified as a function of load current.

The AMC1117 offers current limiting and thermal protection. The on chip trimming adjusts the reference voltage accuracy to 1%.

FEATURES

- **Output current of 1A typical**
- **Three-terminal adjustable or fixed 1.8V,2.5V, 2.85V, 3.3V, 5.0V outputs**
- **Low dropout of typical 800mV**
- **Thermal protection built in**
- **Typical 0.015% line regulation**
- **Typical 0.01% load regulation**
- Fast transient response
- Available in SOT-223 and TO-252 packages
- Pin assignment identical to earlier LT1117 series

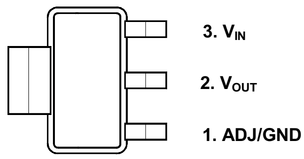
APPLICATIONS

- 2.85V Model for SCSI-2 Active Termination
- Battery Charger
- High Efficiency Linear Regulators
- Battery Powered Instrumentation
- Post Regulator for Switching DC/DC Converter

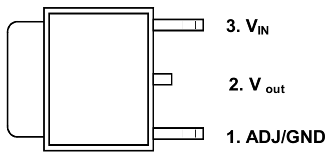
Voltage Options

AMC1117-1.8	– 1.8V Fixed
AMC1117-2.5	– 2.5V Fixed
AMC1117-2.85	– 2.85V Fixed
AMC1117-3.3	– 3.3V Fixed
AMC1117-5.0	– 5.0V Fixed
AMC1117	– Adjustable Output

PACKAGE PIN OUT



3-Pin Plastic SOT-223
Surface Mount
(Top View)



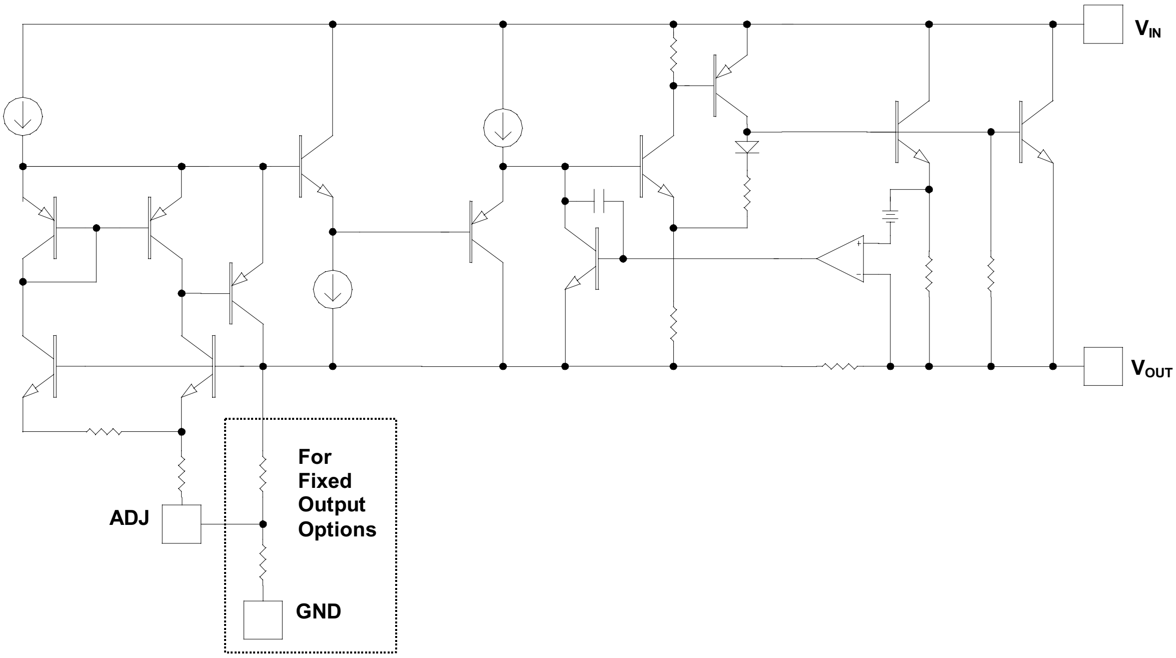
3-Pin Plastic TO-252
Surface Mount
(Top View)

ORDER INFORMATION

T_A (°C)	SK	SOT223 3-pin	SJ	TO-252 3-pin
0 to 70	AMC1117-X.XSK		AMC1117-X.XSJ	
	AMC1117SK		AMC1117SJ	

Note: All surface-mount packages are available in Tape & Reel. Append the letter "T" to part number (i.e. AMC1117-X.XSJT).

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)	
Input Voltage	13V
Operating Junction Temperature Range, T_J	0℃ to 150℃
Storage Temperature Range	-65℃ to 150℃
Lead Temperature (soldiering, 10 seconds)	260℃

Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

POWER DISSIPATION TABLE

Package	θ_{JA} (℃/W)	Derating factor (mW/℃) $T_A \geqq 25$℃	$T_A \leqq 25$℃ Power rating(mW)	T_A=70℃ Power rating(mW)	T_A= 85℃ Power rating (mW)
SK	136	7.35	919	588	478
SJ	80	12.5	1562	1000	812

Note :

1. θ_{JA}: Thermal Resistance-Junction to Ambient, D_F : Derating factor, Po: Power consumption.
   Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$, $Po = D_F \times (T_J - T_A)$
   The θ_{JA} numbers are guidelines for the thermal performance of the device/PC-board system.
   All of the above assume no ambient airflow.

2. θ_{JT}: Thermal Resistance-Junction to Ambient, T_C: case(Tab) temperature, $T_J = T_C + (P_D \times \theta_{JT})$
   For SK package, θ_{JT} = 15.0℃/W.
   For SJ package, θ_{JT} = 7.0℃/W.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Recommended Operating Conditions			Units
		Min.	Typ.	Max.	
Input Voltage	V_{IN}	2.7		12	V
Load Current (with adequate heatsinking)	I_O	5			mA
Input Capacitor (V_{IN} to GND)		1.0			µF
Output Capacitor with ESR of 10Ω max., (V_{OUT} to GND)		4.7			µF
Junction temperature	T_J			125	℃

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $V_{IN} = V_{OUT}$ +2V, I_O =10mA, and T_J = 25℃.

Parameter		Symbol	Test Conditions	AMC1117			Units
				Min	Typ	Max	
Reference Voltage	AMC1117	V_{REF}	I_O = 10mA, $V_{IN} - V_{OUT}$ = 2V	1.238	1.250	1.262	V
			10mA ≤ I_O ≤ 1A, V_{OUT} +1.5V ≤ V_{IN} ≤ 12V	1.230	1.250	1.270	
Output Voltage	AMC1117-1.8	V_{OUT}	I_O = 10mA, V_{IN} = 3.8V	1.782	1.8	1.818	V
			10mA ≤ I_O ≤ 1A, 3.2V ≤ V_{IN} ≤ 12V	1.764	1.8	1.836	
	AMC1117-2.5		I_O = 10mA, V_{IN} = 4.5V	2.475	2.500	2.525	
			10mA ≤ I_O ≤ 1A, 4.25V ≤ V_{IN} ≤ 12V	2.450	2.500	2.550	
	AMC1117-2.85		I_O = 10mA, V_{IN} = 4.85V	2.821	2.850	2.879	
			10mA ≤ I_O ≤ 1A, 4.25V ≤ V_{IN} ≤ 12V	2.805	2.850	2.895	
	AMC1117-3.3		I_O = 10mA, V_{IN} = 5.0V	3.267	3.300	3.333	
			10mA ≤ I_O ≤ 1A, 4.75V ≤ V_{IN} ≤ 12V	3.235	3.300	3.365	
	AMC1117-5.0		I_O = 10mA, V_{IN} = 7.0V	4.950	5.000	5.050	
			10mA ≤ I_O ≤ 1A, 6.5V ≤ V_{IN} ≤ 12V	4.900	5.000	5.100	
Line Regulation	AMC1117	ΔV_{OI}	I_O = 10mA, V_{OUT} +1.5V ≤ V_{IN} ≤ 12V		0.04	0.20	%
	AMC1117-X.X		I_O = 10mA, V_{OUT} +1.5V ≤ V_{IN} ≤ 12V		1.0	6.0	mV
Load Regulation	AMC1117	ΔV_{OL}	10mA ≤ I_O ≤ 1A, $V_{IN} - V_{OUT}$ = 3V		0.10	0.40	%
	AMC1117-X.X		10mA ≤ I_O ≤ 1A, $V_{IN} = V_{OUT}$ +1.5V		1.0	10.0	mV
Dropout Voltage		ΔV	I_O = 10mA		0.8	1.15	V
			I_O = 1A		0.8	1.30	
Minimum Load Current (Note 1)			V_{IN} ≤ 12V		1.7	5	mA
Quiescent Current	AMC1117-X.X	I_Q	V_{IN} ≤ 12V		6	10	mA
Current Limit		I_{CL}	$V_{IN} - V_{OUT}$ = 3V	1	1.2		A
Adjust Pin Current			I_O = 10mA, $V_{IN} - V_{OUT}$ = 2V		50	120	μA
Thermal Regulation (Note 2)			T_A = 25℃, 30 ms pulse		0.01	0.1	%/W
Ripple rejection (Note 2)		R_R	f_O = 120Hz, 1V_{RMS}, I_O = 400mA, $V_{IN} - V_{OUT}$ = 3V	60	75		dB

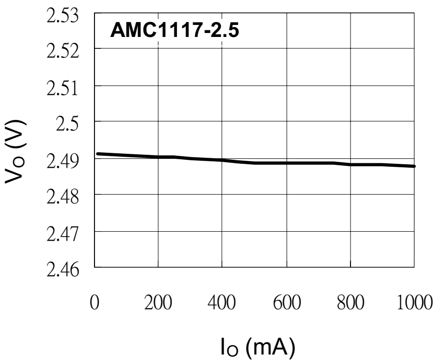
Note 1: For the adjustable device, the minimum load current is the minimum current required to maintain regulation. Normally the current in the resistor divider used to set the output voltage is selected to meet the minimum load current requirement.

Note 2: These parameters, although guaranteed, are not tested in production.

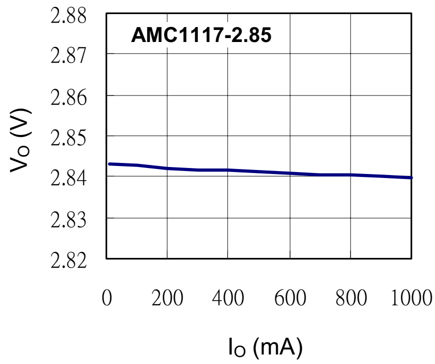
Characterization Curves

Unless otherwise specified, $V_{IN}= V_{OUT}+2V$，$C_{IN}=1\mu F$，$C_{OUT}=4.7\mu F$，$T_A=25℃$

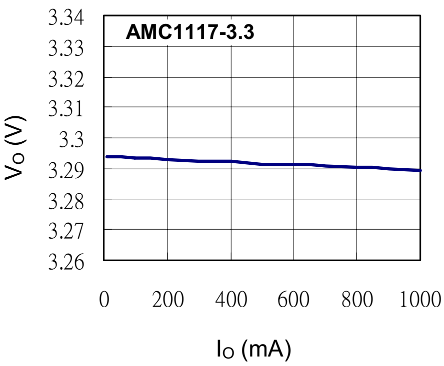
Load Regulation



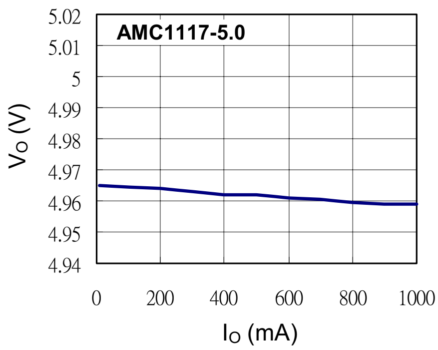
Load Regulation



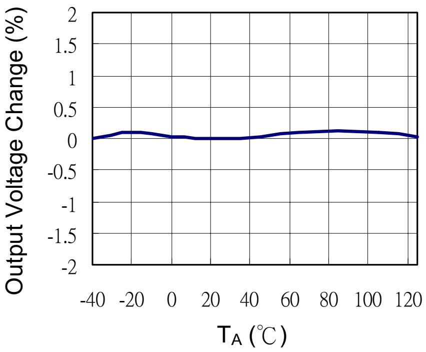
Load Regulation



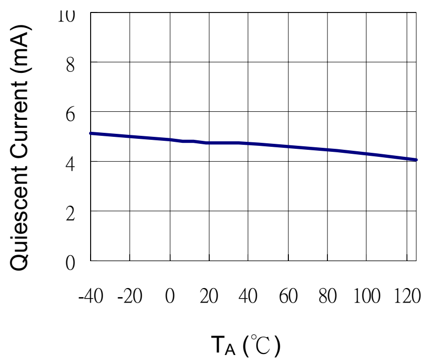
Load Regulation



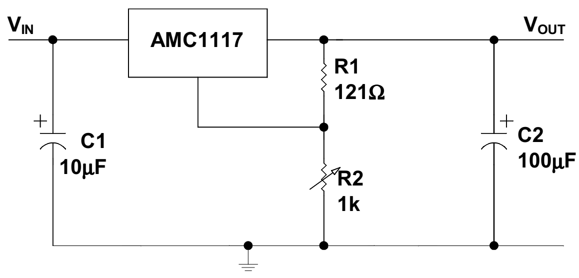
Temperature Stability



Quiescent Current vs. Temperature

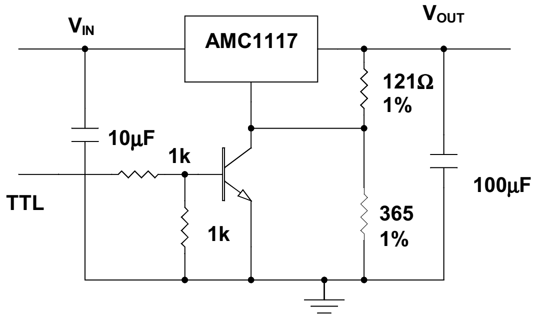


APPLICATION INFORMATION

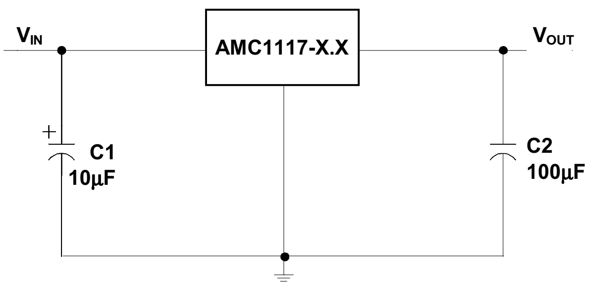


Adjustable Regulator

$$V_{OUT} = 1.25V \left(1 + \frac{R2}{R1} \right)$$



5V Regulator with Shutdown



Fixed Voltage Regulator

Application Note:

Maximum Power Calculation:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_{A(MAX)}}{\theta_{JA}}$$

$T_J(^oC)$: Maximum recommended junction temperature
$T_A(^oC)$: Ambient temperature of the application
$\theta_{JA}(^oC/W)$: Junction-to-junction temperature thermal resistance of the package, and other heat dissipating materials.

The maximum power dissipation of a single-output regulator :

$$P_{D(MAX)} = [(V_{IN(MAX)} - V_{OUT(NOM)})] \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_Q$$

Where: $V_{OUT(NOM)}$ = the nominal output voltage
$I_{OUT(NOM)}$ = the nominal output current, and
I_Q = the quiescent current the regulator consumes at $I_{OUT(MAX)}$
$V_{IN(MAX)}$ = the maximum input voltage
Then $\theta_{JA} = (150\,^oC - T_A)/P_D$

Thermal consideration:

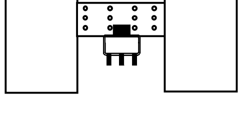
When power consumption is over about 404 mW (for SOT-223 package, 687mW for TO-252 package, at T_A=70℃), additional heat sink is required to control the junction temperature below 125℃.

The junction temperature is: $T_J = P_D\,(\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$
$P_D \equiv$ Dissipated power.
$\theta_{JT} \equiv$ Thermal resistance from the junction to the mounting tab of the package.
$\theta_{CS} \equiv$ Thermal resistance through the interface between the IC and the surface on which it is mounted. (typically, $\theta_{CS} < 1.0°C/W$)
$\theta_{SA} \equiv$ Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

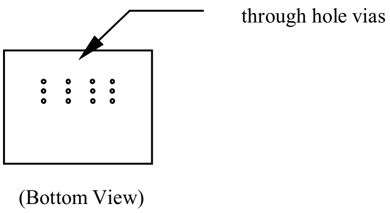
If PC Board copper is going to be used as a heat sink, below table can be used to determine the appropriate size of copper foil required. For multi-layered PCB, these layers can also be used as a heat sink. They can be connected with several through hole vias.

PCB θ_{SA} ($^oC/W$)	59	45	38	33	27	24	21
PCB heat sink size (mm^2)	500	1000	1500	2000	3000	4000	5000

Recommended figure of PCB area used as a heat sink.

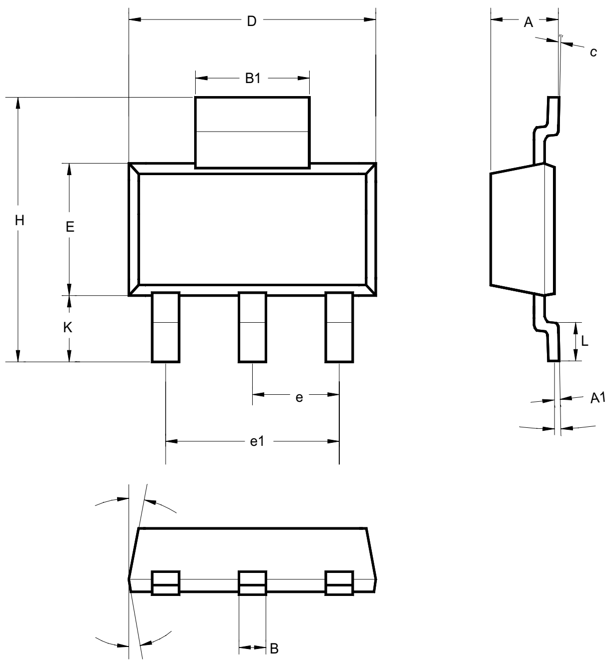


(Top View)



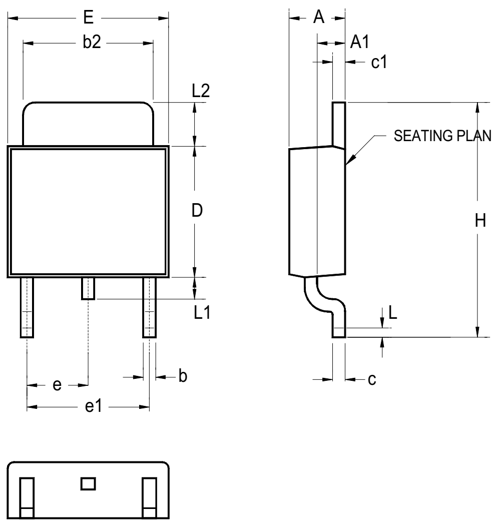
(Bottom View)

3-Pin Surface Mount SOT-223 (SK)



	MILLIMETERS		
	MIN	TYP	MAX
A	1.50	1.65	1.80
A1	0.02	0.05	0.08
B	0.60	0.70	0.80
B1	2.90	-	3.15
c	0.28	0.30	0.32
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.3 BSC		
e1	4.6 BSC		
H	6.70	7.00	7.30
L	0.91	1.00	1.10
K	1.50	1.75	2.00
α	0°	5°	10°
β		3°	

3-Pin Surface Mount TO-252 (SJ)



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.086	-	0.094	2.18	-	2.39
A1	0.040	-	0.050	1.02	-	1.27
b	-	0.024	-	-	0.61	-
b2	0.205	-	0.215	5.21	-	5.46
c	0.018	-	0.023	0.46	-	0.58
c1	0.018	-	0.023	0.46	-	0.58
D	0.210	-	0.220	5.33	-	5.59
E	0.250	-	0.265	6.35	-	6.73
e	0.090 BSC			2.29 BSC		
e1	0.180 BSC			4.58 BSC		
H	0.370	-	0.410	9.40	-	10.41
L	0.020	-	-	0.51	-	-
L1	0.025	-	0.040	0.64	-	1.02
L2	0.060	-	0.080	1.52	-	2.03

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