AMS1117

800mA LOW DROPOUT VOLTAGE REGULATOR

FEATURES

- **Three Terminal Adjustable or Fixed Voltages***
  1.5V, 1.8V, 2.5V, 2.85V, 3.3V and 5.0V
- **Output Current of 800mA**
- **Operates Down to 1V Dropout**
- **Line Regulation: 0.2% Max.**
- **Load Regulation: 0.4% Max.**

APPLICATIONS

- **High Efficiency Linear Regulators**
- **Post Regulators for Switching Supplies**
- **5V to 3.3V Linear Regulator**
- **Battery Chargers**
- **Active SCSI Terminators**
- **Power Management for Notebook**
- **Battery Powered Instrumentation**

GENERAL DESCRIPTION

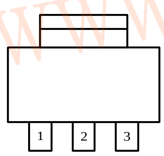
The AMS1117 series of adjustable and fixed voltage regulators are designed to provide 800mA output current and to operate down to 1V input-to-output differential. The dropout voltage of the device is guaranteed maximum 1.3V at maximum output current, decreasing at lower load currents.

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.

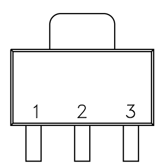
The AMS1117 devices are pin compatible with other three-terminal SCSI regulators and are offered in the low profile surface mount SOT-223 package.

ORDERING INFORMATION:

SOT-223 Top View



SOT- 89 Top View



PIN CONNECTIONS

FIXED VERSION	ADJUSTABLE VERSION
1- Ground	1- Adjust
2- V_{OUT}	2- V_{OUT}
3- V_{IN}	3- V_{IN}

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ABSOLUTE MAXIMUM RATINGS (Note 1)

Power Dissipation	Internally limited
Input Voltage	15V
Operating Junction Temperature	
Control Section	0°C to 125°C
Power Transistor	0°C to 150°C
Storage temperature	- 65°C to +150°C

Soldering information

Lead Temperature (10 sec)	300°C

Thermal Resistance

SOT-223 package	φ_{JA}= 90°C/W*

* 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.

ELECTRICAL CHARACTERISTICS

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

Parameter	**Device**	**Conditions**	**Min**	**Typ**	**Max**	**Units**
Reference Voltage (Note 2)	AMS1117	I_{OUT} = 10 mA 10mA ≤ I_{OUT} ≤ 800mA, 1.5V≤ (V_{IN} - V_{OUT}) ≤ 12V	1.238 **1.225**	1.250 **1.250**	1.262 **1.270**	V V
Output Voltage (Note 2)	AMS1117-1.5	0 ≤ I_{OUT} ≤ 800mA , 3.0V≤ V_{IN} ≤ 12V	1.485 **1.476**	1.500 **1.500**	1.515 **1.524**	V V
	AMS1117-1.8	0 ≤ I_{OUT} ≤ 800mA , 3.3V≤ V_{IN} ≤ 12V	1.782 **1.773**	1.800 **1.800**	1.818 **1.827**	V V
	AMS1117-2.5	0 ≤ I_{OUT} ≤ 800mA , 4.0V≤ V_{IN} ≤ 12V	2.475 **2.460**	2.500 **2.500**	2.525 **2.560**	V V
	AMS1117-2.85	0 ≤ I_{OUT} ≤ 800mA , 4.35V≤ V_{IN} ≤ 12V	2.82 **2.79**	2.850 **2.850**	2.88 **2.91**	V V
	AMS1117-3.3	0 ≤ I_{OUT} ≤ 800mA , 4.75V ≤ V_{IN} ≤ 12V	3.267 **3.235**	3.300 **3.300**	3.333 **3.365**	V V
	AMS1117-5.0	0 ≤ I_{OUT} ≤ 800mA , 6.5V ≤ V_{IN} ≤ 12V	4.950 **4.900**	5.000 **5.000**	5.050 **5.100**	V V
Line Regulation	AMS1117	I_{LOAD} = 10 mA , 1.5V≤ (V_{IN} - V_{OUT}) ≤ 12V		0.015 **0.035**	0.2 **0.2**	% %
	AMS1117-1.5	3.0V≤ V_{IN} ≤ 12V		0.3 **0.6**	5 **6**	mV mV
	AMS1117-1.8	3.3V≤ V_{IN} ≤ 12V		0.3 **0.6**	5 **6**	mV mV
	AMS1117-2.5	4.0V≤ V_{IN} ≤ 12V		0.3 **0.6**	6 **6**	mV mV
	AMS1117-2.85	4.35V≤ V_{IN} ≤ 12V		0.3 **0.6**	6 **6**	mV mV
	AMS1117-3.3	4.75V≤ V_{IN} ≤ 12V		0.5 **1.0**	10 **10**	mV mV
	AMS1117-5.0	6.5V≤ V_{IN} ≤ 12V		0.5 **1.0**	10 **10**	mV mV
Load Regulation (Notes 2, 3)	AMS1117	(V_{IN} - V_{OUT}) =3V, 10mA ≤ I_{OUT} ≤ 800mA		0.1 **0.2**	0.3 **0.4**	% %
	AMS1117-1.5	V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 800mA		3 **6**	10 **20**	mV mV
	AMS1117-1.8	V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 800mA		3 **6**	10 **20**	mV mV
	AMS1117-2.5	V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 800mA		3 **6**	12 **20**	mV mV

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ELECTRICAL CHARACTERISTICS

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

Parameter	**Device**	**Conditions**	**Min**	**Typ**	**Max**	**Units**
Load Regulation (Notes 2, 3)	AMS1117-2.85	V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 800mA		3 **6**	12 **20**	mV mV
	AMS1117-3.3	V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 800mA		3 **7**	15 **25**	mV mV
	AMS1117-5.0	V_{IN} = 8V, 0 ≤ I_{OUT} ≤ 800mA		5 **10**	20 **35**	mV mV
Dropout Voltage (V_{IN} - V_{OUT})	AMS1117-1.5/-1.8/-2.5/-2.85/-3.3/-5.0	ΔV_{OUT}, ΔV_{REF} = 1%, I_{OUT} = 800mA (Note 4)		**1.1**	**1.3**	V
Current Limit	AMS1117-1.5/-1.8/-2.5/-2.85/-3.3/-5.0	(V_{IN} - V_{OUT}) = 5V TJ = 25°C	**900**	**1,100**	**1,500**	mA
Minimum Load Current	AMS1117	(V_{IN} - V_{OUT}) = 12V (Note 5)		**5**	**10**	mA
Quiescent Current	AMS1117-1.5/-1.8/-2.5/-2.85/-3.3/-5.0	V_{IN} ≤ 12V		**5**	**10**	mA
Ripple Rejection	AMS1117	f =120Hz, C_{OUT} = 22µF Tantalum, I_{OUT} = 800mA, (V_{IN}-V_{OUT}) = 3V, C_{ADJ} =10µF	**60**	**75**		dB
	AMS1117-1.5/-1.8/-2.5/-2.85	f =120Hz, C_{OUT} = 22µF Tantalum, I_{OUT} = 800mA, V_{IN} = 6V	**60**	**72**		dB
	AMS1117-3.3	f =120Hz, C_{OUT} = 22µF Tantalum, I_{OUT} = 800mA V_{IN} = 6.3V	**60**	**72**		dB
	AMS1117-5.0	f =120Hz, C_{OUT} = 22µF Tantalum, I_{OUT} = 800mA V_{IN} = 8V	**60**	**68**		dB
Thermal Regulation	AMS1117	T_A = 25°C, 30ms pulse		0.008	0.04	%W
Adjust Pin Current	AMS1117	10mA ≤ I_{OUT} ≤ 800mA, 1.5V≤ (V_{IN} - V_{OUT}) ≤ 12V		55	 **120**	µA µA
Adjust Pin Current Change	AMS1117	10mA ≤ I_{OUT} ≤ 800mA, 1.5V≤ (V_{IN} - V_{OUT}) ≤ 12V		**0.2**	**5**	µA
Temperature Stability				**0.5**		%
Long Term Stability		T_A =125°C, 1000Hrs		0.3	1	%
RMS Output Noise (% of V_{OUT})		T_A = 25°C, 10Hz ≤ f ≤ 10kHz		0.003		%
Thermal Resistance Junction-to-Case					15	°C/W

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APPLICATION HINTS

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 with temperature.

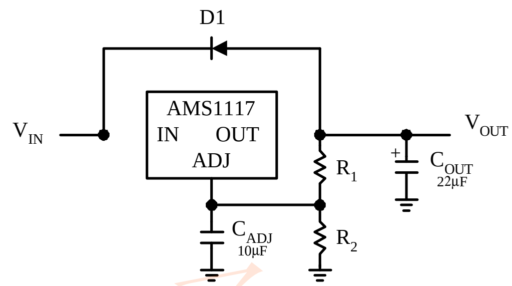


Figure 1.

Stability

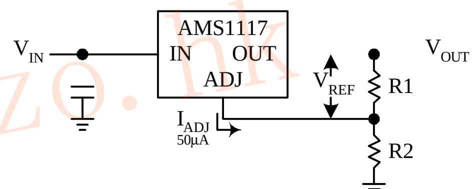
The circuit design used in the AMS1117 series requires the use of an output capacitor as part of the device frequency compensation. The addition of 22µF solid tantalum on the output will ensure stability for all operating conditions.
When the adjustment terminal is bypassed with a capacitor to improve 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

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).

Output Voltage

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 I_{ADJ} is very small and constant it represents a small error and it can usually be ignored.



$$V_{OUT} = V_{REF}(1 + R2/R1) + I_{ADJ}R2$$

Figure 2. Basic Adjustable Regulator

Load Regulation

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.
The best load regulation is obtained when the top of the resistor divider R1 is connected directly to the case not to the load. If R1 were connected to the load, the effective resistance between the regulator and the load would be:

$$R_P \times \left(\frac{R2+R1}{R1}\right), \quad R_P = \text{Parasitic Line Resistance}$$