■ General Description

The AME1117 is a 1A low-dropout positive voltage regulator. It is available in fixed and adjustable output voltage versions. Overcurrent and thermal protection are integrated onto the chip. Output current will limit as while it reaches the pre-set current or temperature limit. The dropout voltage is specified at 1.4V Maximum at full rated output current. The AME1117 series provides excellent regulation over line, load and temperature variations.

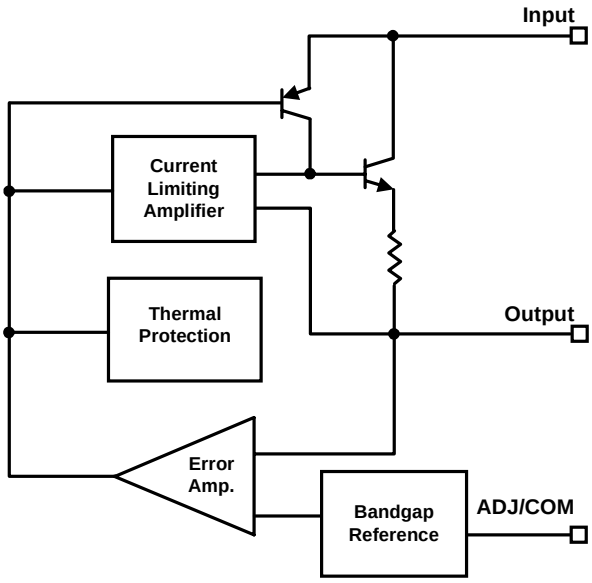
■ Features

- Low dropout voltage ----- 1.2V at 1A
- Adjustable or fixed voltages: 1.8V,2.5V, 3.3V, 5.0V
- Typical line regulation ----- 0.04%
- Typical load regulation ----- 0.1%
- Adjust pin current less than 120μA
- Overcurrent protection
- Thermal protection
- Available in TO-220, TO-252, SOT-223

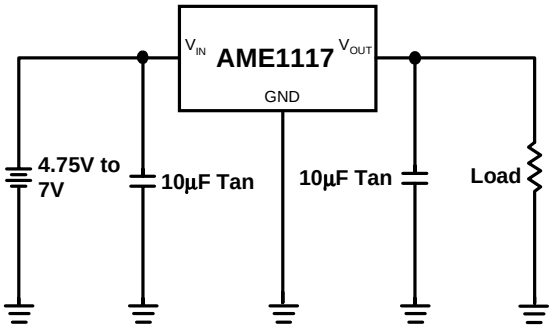
■ Applications

- High Efficiency Linear Regulators
- Post Regulators for Switching Supplies
- 5V to 3.3V Voltage Converter
- Battery Charger

■ Functional Block Diagram



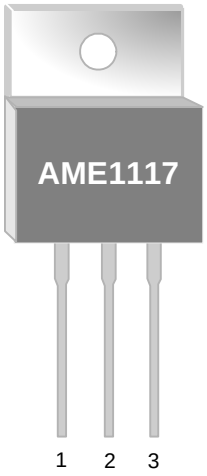
■ Typical Application



* Input range depends on V_{OUT}
Please refer to electrical characteristics.

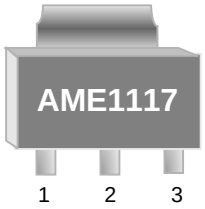
■ Pin Configuration

TO-220
Front View



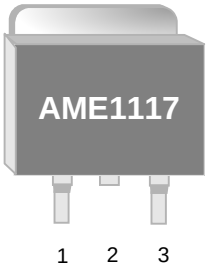
AME1117
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

SOT-223
Front View



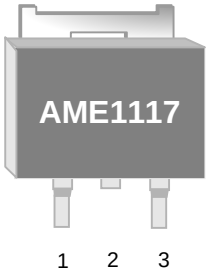
AME1117
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

TO-252 (DPAK-2)
Front View



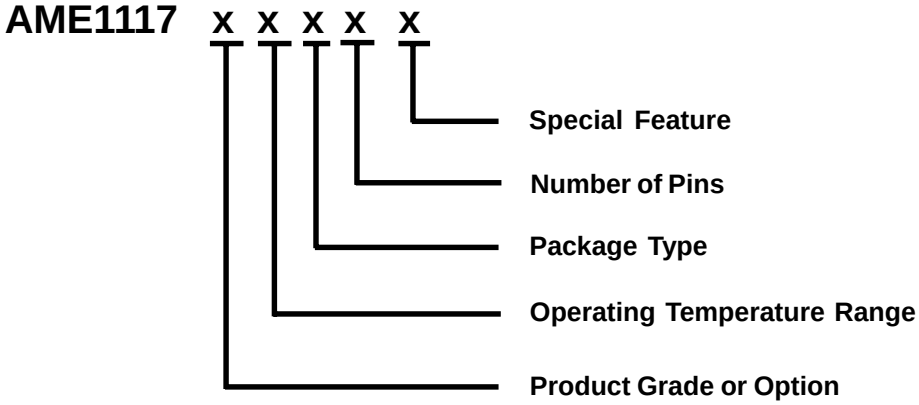
AME1117
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

TO-252 (DPAK-2)
Front View



AME1117
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

■ Ordering Information



Product Grade or Option	Operating Temperature Range	Package Type	Number of Pins	Special Feature
A: ADJ B: 2.5V C: 3.3V D: 5.0V E: 1.8V	C: 0^{O}C to 70^{O}C	B: TO-220 C: TO-252 (D PACK) G: SOT-223	T: 3	Z: Lead Free

■ Ordering Information (contd.)

Part Number	Marking	Output Voltage	Package	Operating Temp. Range
AME1117ACGT	ABEyww	ADJ	SOT-223	0°C to 70°C
AME1117BCGT	AKEyww	2.5	SOT-223	0°C to 70°C
AME1117CCGT	ABFyww	3.3	SOT-223	0°C to 70°C
AME1117DCGT	AKFyww	5.0	SOT-223	0°C to 70°C
AME1117ECGT	AXHww	1.8	SOT-223	0°C to 70°C
AME1117ACCT	AME1117 ACCT yyww	ADJ	TO-252 (DPAK-2)	0°C to 70°C
AME1117BCCT	AME1117 BCCT yyww	2.5	TO-252 (DPAK-2)	0°C to 70°C
AME1117CCCT	AME1117 CCCT yyww	3.3	TO-252 (DPAK-2)	0°C to 70°C
AME1117DCCT	AME1117 DCCT yyww	5.0	TO-252 (DPAK-2)	0°C to 70°C
AME1117ACBT	AME1117 ACBT yyww	ADJ	TO-220	0°C to 70°C
AME1117BCBT	AME1117 BCBT yyww	2.5	TO-220	0°C to 70°C
AME1117CCBT	AME1117 CCBT yyww	3.3	TO-220	0°C to 70°C
AME1117DCBT	AME1117 DCBT yyww	5.0	TO-220	0°C to 70°C

Please consult AME sales office or authorized Rep./Distributor for other output voltage and package type availability.

■ Absolute Maximum Ratings

Parameter		Symbol	Maximum	Unit
Input Voltage	V_{OUT}=5.0V	V_{IN}	10	V
	Others		7	
Thermal Resistance (Junction to Case)	TO-220	θ_{JC}	2.5	°C/W
	TO-252		5	
	SOT-223		15	
Thermal Resistance (Junction to Ambient)	TO-220	θ_{JA}	50	
	TO-252		90	
	SOT-223		160	
Operating Junction Temperature Range		T_J	0 to 125	°C
Storage Temperature Range		T_{STG}	- 65 to 150	
Lead Temperature (10 Sec)		T_{LEAD}	260	
Internal Power Dissipation ($\Delta T = 100^oC$)	TO-220	P_D	3000	mW
	TO-252		1200	
	TO-223		625	

Caution: Stress above the listed absolute maximum rating may cause permanent damage to the device

■ Electrical Specifications

AME1117Exxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage	V_O	V_{IN} = 5V, I_O = 0A	T_J = 25°C	1.782		1.818	V
			Over Temp.				
Line regulation	Reg_{LINE}	V_{IN} = 4.75~7V, I_O = 0A	T_J = 25°C	-	-	0.3	%
Load regulation	Reg_{LOAD}	V_{IN} = 5V, I_O = 0A~1A	T_J = 25°C	-	0.1	1.0	
			Over Temp.	-	0.2	1.2	
Dropout voltage	V_D	I_O = 1A, ΔVo = ±1%	T_J = 25°C	-	1.2	1.4	V
			Over Temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 4.75~7V, Over Temp.		1.0	1.5	-	A
Quiescent Current	I_Q	V_{IN} = 5V, I_O = 0A~1A, Over Temp.		-	6	13	mA
Temp. Coefficient	T_C	V_{IN} = 4.75~7V, I_O = 0A~1A		-	0.005	-	%/"C
Temperature stability	T_S	V_{IN} = 5V, I_O = 100mA, Over Temp.		-	0.5	-	%
RMS output noise	V_N	T_J = 25°C, $10H_Z$<= f <=$10KH_Z$		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 1A, Over Temp.		60	72	-	dB

AME1117Dxxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage	V_O	V_{IN} = 7V, I_O = 0A	T_J = 25°C	4.950	5.000	5.050	V
			Over Temp.	4.900	5.000	5.100	
Line regulation	Reg_{LINE}	V_{IN} = 7~9V, I_O = 0A	T_J = 25°C	-	-	0.3	%
			Over Temp.	-	-	0.4	
Load regulation	Reg_{LOAD}	V_{IN} = 7V, I_O = 0A~1A	T_J = 25°C	-	0.1	0.3	
			Over Temp.	-	0.2	0.4	
Dropout voltage	V_D	I_O = 0A~1A, ΔVo = ±1%	T_J = 25°C	-	1.2	1.4	V
			Over Temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 7~10V, Over Temp.		1.0	1.5	-	A
Quiescent Current	I_Q	V_{IN} = 7V, I_O = 0A~1A, Over Temp.		-	6	13	mA
Temp. coefficient	T_C	V_{IN} = 7~10V, I_O = 0A~1A		-	0.005	-	%/"C
Temperature stability	T_S	V_{IN} = 7V, I_O = 100mA, Over Temp.		-	0.5	-	%
RMS output noise	V_N	T_J = 25°C, $10H_Z$<= f <=$10KH_Z$		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 7V, I_O = 1A, Over Temp.		60	72	-	dB

■ Electrical Specifications

AME1117Cxxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage	V_O	V_{IN} = 5V, I_O = 0A	T_J = 25°C	3.270	3.300	3.330	V
			Over Temp.	3.234	3.300	3.366	
Line regulation	Reg_{LINE}	V_{IN} = 4.75~7V, I_O = 0A	T_J = 25°C	-	-	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = 5V, I_O = 0A~1A	T_J = 25°C	-	0.1	0.3	
			Over Temp.	-	0.2	0.4	
Dropout voltage	V_D	I_O = 0A~1A, ΔVo = ±1%	T_J = 25°C	-	1.2	1.4	V
			Over Temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 4.75~7V, Over Temp.		1.0	1.5	-	A
Quiescent Current	I_Q	V_{IN} = 5V, I_O = 0A~1A, Over Temp.		-	6	13	mA
Temp. coefficient	T_C	V_{IN} = 4.75~7V, I_O = 0A~1A		-	0.005	-	%/"C
Temperature stability	T_S	V_{IN} = 5V, I_O = 100mA, Over Temp.		-	0.5	-	%
RMS output noise	V_N	T_J = 25°C, $10H_Z$<= f <=$10KH_Z$		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 1A, Over Temp.		60	72	-	dB

AME1117Bxxx

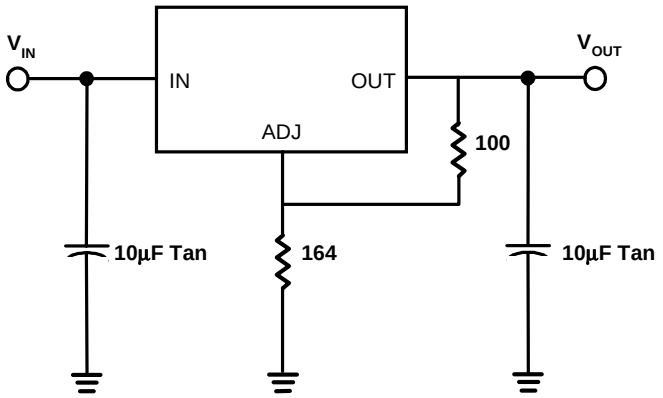
Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage	V_O	V_{IN} = 5V, I_O = 0A	T_J = 25°C	2.475	2.500	2.525	V
			Over Temp.	2.450	2.500	2.550	
Line regulation	Reg_{LINE}	V_{IN} = 4.75~7V, I_O = 0A	T_J = 25°C	-	-	0.3	%
Load regulation	Reg_{LOAD}	V_{IN} = 5V, I_O = 0A~1A	T_J = 25°C	-	0.1	1.0	
			Over Temp.	-	0.2	1.2	
Dropout voltage	V_D	I_O = 0A~1A, ΔVo = ±1%	T_J = 25°C	-	1.2	1.4	V
			Over Temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 4.75~7V, Over Temp.		1.0	1.5	-	A
Quiescent Current	I_Q	V_{IN} = 5V, I_O = 0A~1A, Over Temp.		-	6	13	mA
Temp. Coefficient	T_C	V_{IN} = 4.75~7V, I_O = 0A~1A		-	0.005	-	%/"C
Temperature stability	T_S	V_{IN} = 5V, I_O = 100mA, Over Temp.		-	0.5	-	%
RMS output noise	V_N	T_J = 25°C, $10H_Z$<= f <=$10KH_Z$		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 1A, Over Temp.		60	72	-	dB

■ Electrical Specifications

AME1117Axxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Reference voltage	V_{REF}	V_{IN} = 5V, I_O = 10mA	T_J = 25°C	1.238	1.250	1.262	V
			Over Temp.	1.225	1.250	1.275	
Line regulation *	Reg_{LINE}	V_{IN} = 4.75~7V, I_O = 10mA	T_J = 25°C	-	-	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = 5V, I_O = 10mA~1A	T_J = 25°C	-	0.1	0.3	
			Over Temp.	-	0.2	0.4	
Dropout voltage	V_D	I_O = 10mA~1A, ΔVo = ±1%	T_J = 25°C	-	1.2	1.4	V
			Over Temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 2.75~7V	Over Temp.	1.0	1.5	-	A
Temp. coefficient	T_C	V_{IN} = 2.75~7V, I_O = 10mA~1A		-	0.005	-	%/"C
Adjust pin current	I_{ADJ}	V_{IN} = 2.75~7V, I_O = 10mA~1A	T_J = 25°C	-	55	-	µA
			Over Temp.	-	-	120	
Adjust pin current change	ΔI_{ADJ}	V_{IN} = 2.75~7V, I_O = 10mA~1A, Over Temp.		-	0.2	5	
Temperature stability	T_S	V_{IN} = 5V, I_O = 100mA, Over Temp.		-	0.5		%
Minimum load current	I_O	V_{IN} = 5V		-	5	10	mA
RMS output noise	V_N	T_J = 25°C, $10H_Z$<= f <=$10KH_Z$		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 1A, Over Temp.		60	72	-	dB

***Line regulation test circuit**



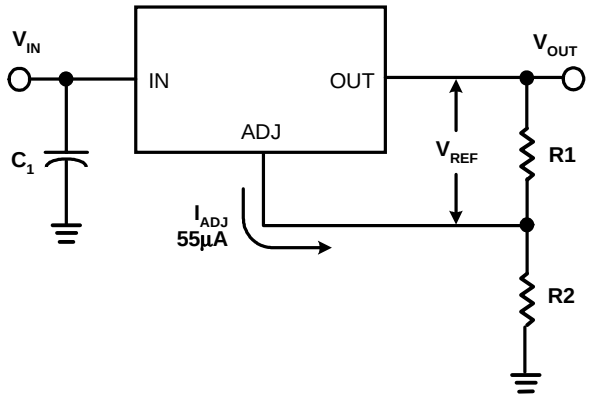
■ Application Description

1. Output voltage adjustment

Like most regulators, the AME1117 regulates the output by comparing the output voltage to an internally generated reference voltage. On the adjustable version, the V_{REF} is available externally as 1.25V between V_{OUT} 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:

$$V_{OUT} = V_{REF} \left(1 + \frac{R2}{R1} \right) + I_{ADJ} \times R2$$

On fixed versions of AME1117, the voltage divider is provided internally.



$$V_{OUT} = V_{REF} \left(1+\frac{R2}{R1}\right) + I_{ADJ} \times R2$$

2. Thermal protection

AME1117 has thermal protection which limits junction temperature to 150°C. However, device functionality is only guaranteed to a maximum junction temperature of +125°C.

The power dissipation and junction temperature for AME1117 in DPAK package are given by

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

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

Note: $T_{JUNCTION}$ must not exceed 125°C

3. Current limit protection

AME1117 is protected against overload conditions. Current protection is triggered at typically 1.5A.

4. Stability and load regulation

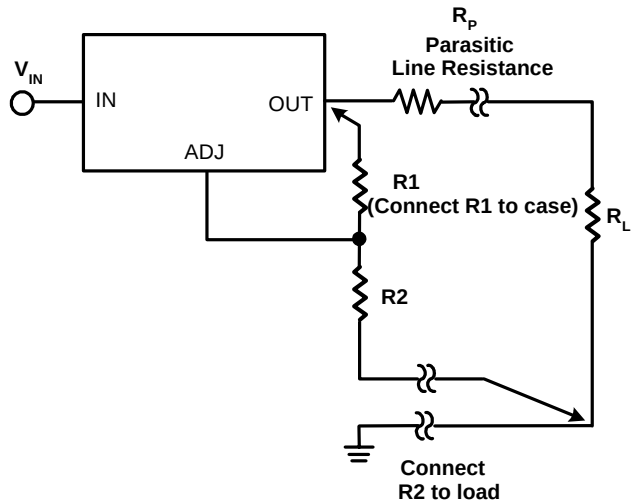
AME1117 requires a capacitor from V_{OUT} to GND to provide compensation feedback to the internal gain stage. This is to ensure stability at the output terminal. Typically, a 10µF tantalum or 50µF aluminum electrolytic is sufficient.

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

The output capacitor does not have a theoretical upper limit and increasing its value will increase stability. C_{OUT} = 100µF or more is typical for high current regulator design.

For the adjustable version, the best load regulation is accomplished when the top of the resistor divider (R1) is connected directly to the output pin of the AME1117. When so connected, R_P is not multiplied by the divider ratio.

For fixed output versions, the top of R1 is internally connected to the output. The ground pin can be connected to the low side of the load in order to eliminate ground loop errors.



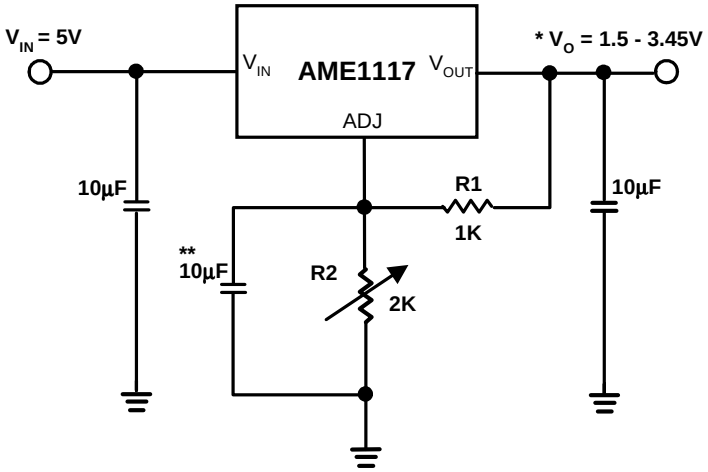
5. Thermal consideration

The AME1117 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 mentioned 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 product series is electrically connected to the output. Therefore, if the case of the device must be electrically isolated, a thermally conductive spacer is recommended.

■ Advanced Applications

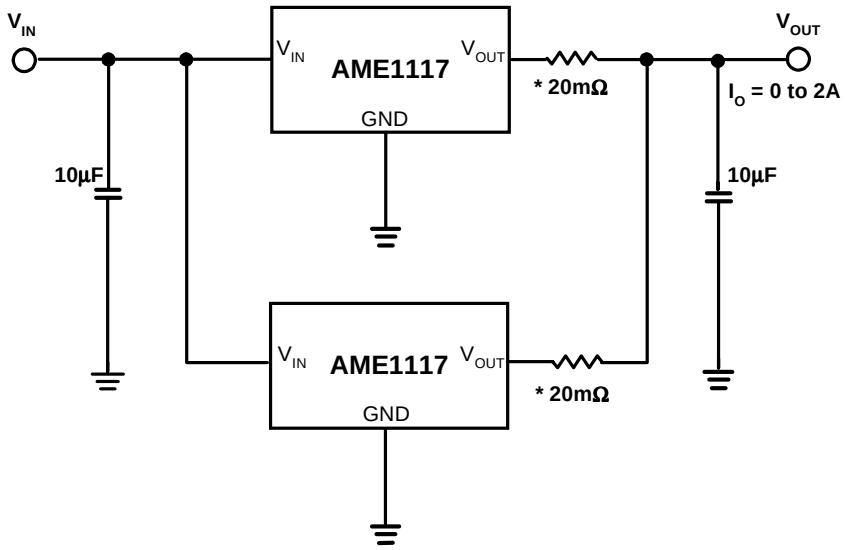
Adjustable Output Voltage



Note: * $V_{OUT} = V_{REF} (1 + \frac{R2}{R1}) + I_{ADJ} \times R2$

** Optional for improved ripple rejection

Paralleling Regulators

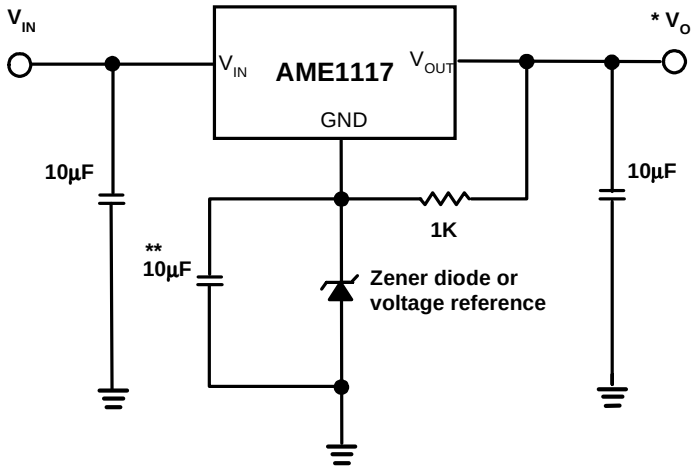


Note: * 20mΩ is ballast resistance

The inter - connection of #18 wire could act as ballast resistance

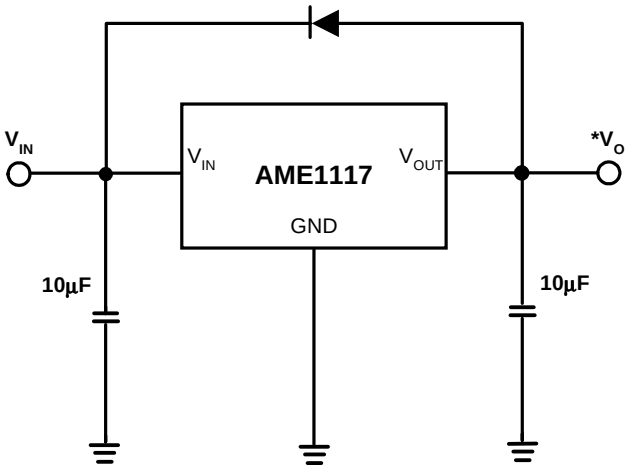
■ Advanced Applications (contd.)

Regulator with Reference

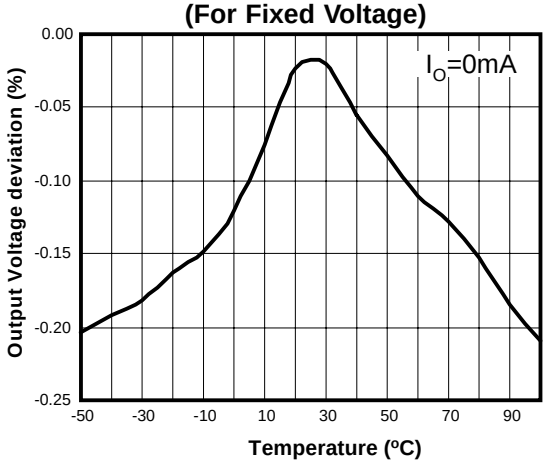


Note: * $V_O = V_{REF} + V_Z$ (V_Z: breakdown voltage of Zener diode)
** Optional for improved ripple rejection

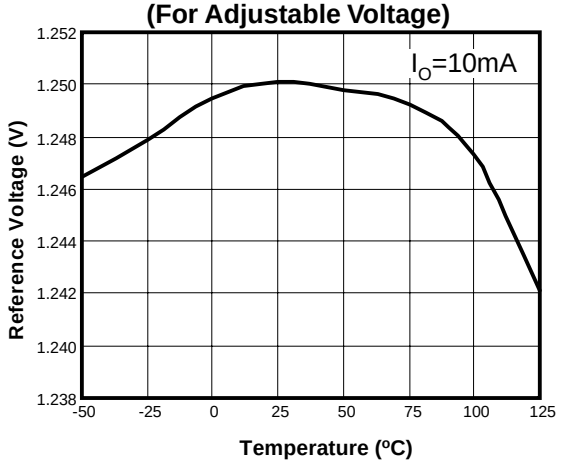
Regulator with Reverse Diode Protection



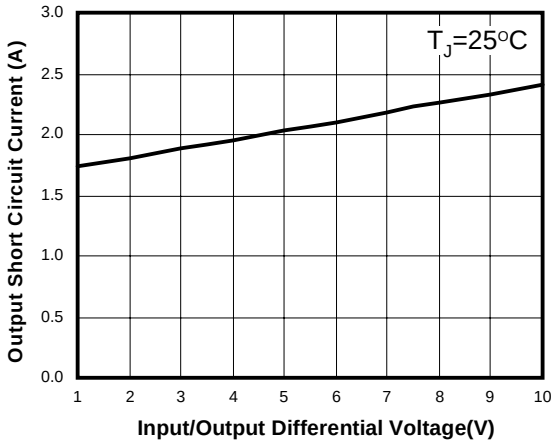
Temperature Stability (For Fixed Voltage)



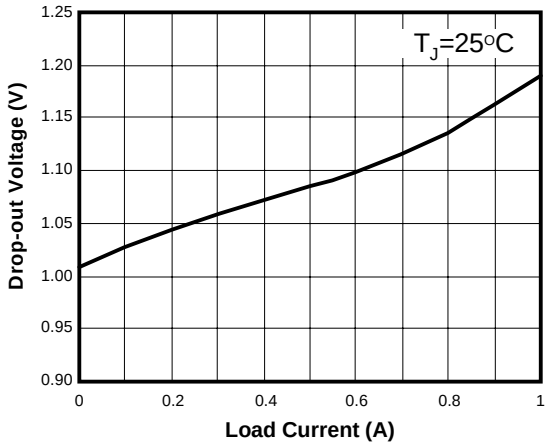
Temperature Stability (For Adjustable Voltage)



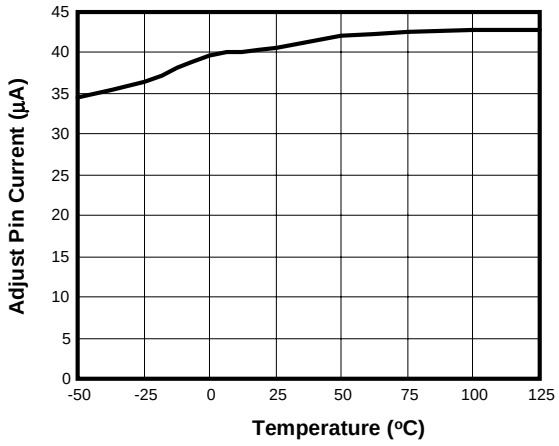
Short Circuit Current



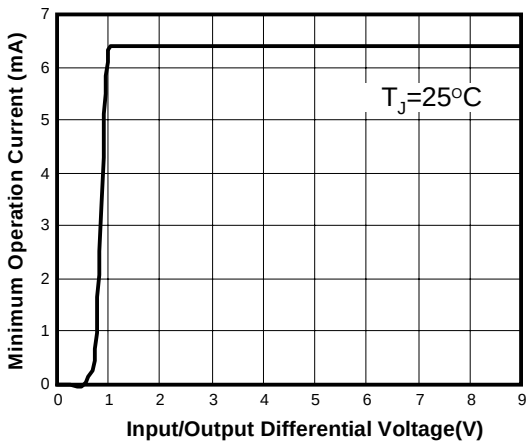
Dropout Voltage



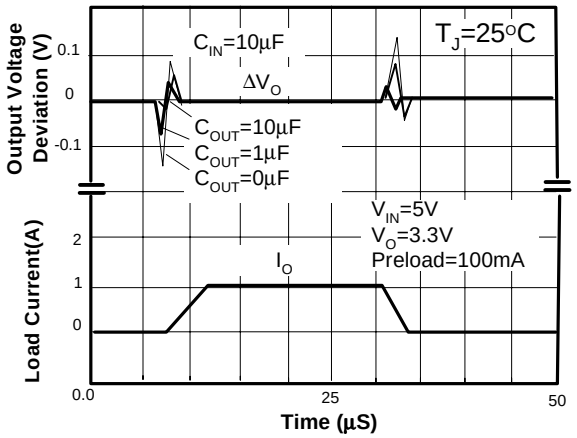
Adjust Pin Current



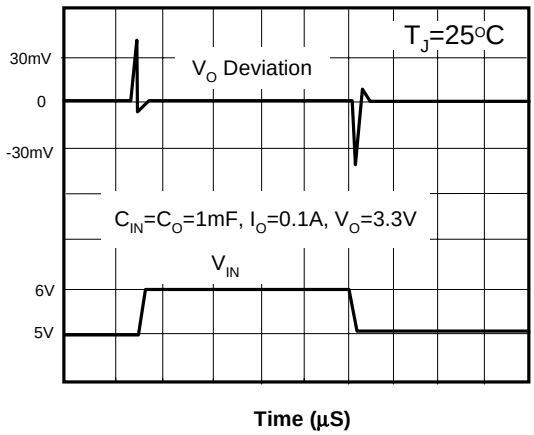
Minimum Operating Current



Load Transient Response

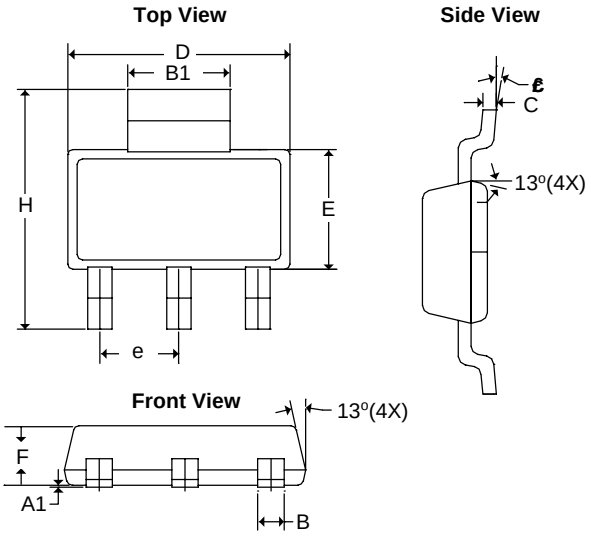


Line Transient Response



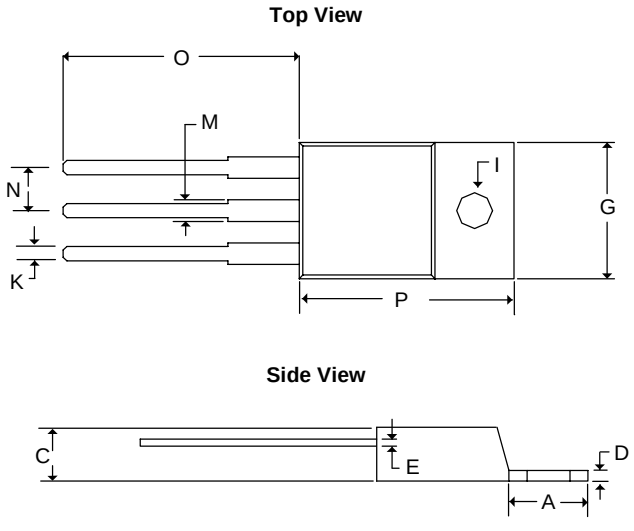
■ Package Dimension

SOT-223



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A_1	0.02	0.10	0.0008	0.0039
B	0.60	0.84	0.0236	0.0330
B_1	2.90	3.15	0.1140	0.1240
C	0.24	0.38	0.0094	0.0150
D	6.30	6.71	0.2480	0.2640
E	3.30	3.71	0.1299	0.1460
e	2.30 BSC		0.0906 BSC	
F	1.40	1.80	0.0560	0.0702
H	6.70	7.30	0.2638	0.2874
θ	0°	10°	0°	10°

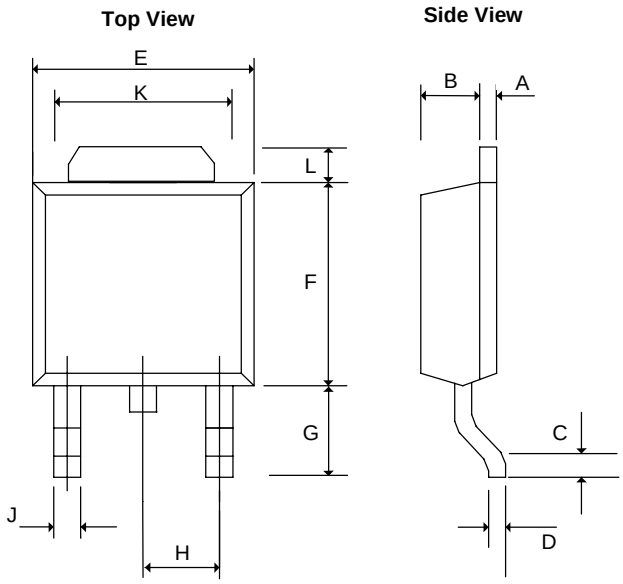
TO-220



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.58	7.49	0.2197	0.2949
C	3.55	4.83	0.1398	0.1900
D	0.50	1.40	0.0197	0.0550
E	0.30	1.15	0.0118	0.0453
G	9.65	10.67	0.3799	0.4200
I	3.53	4.09	0.1390	0.1610
K	0.50	1.15	0.0197	0.0453
M	1.14	1.78	0.0449	0.0700
N	2.28	2.80	0.0898	0.1102
O	12.70	14.74	0.5000	0.5803
P	14.22	16.51	0.5600	0.6500

■ Package Dimension

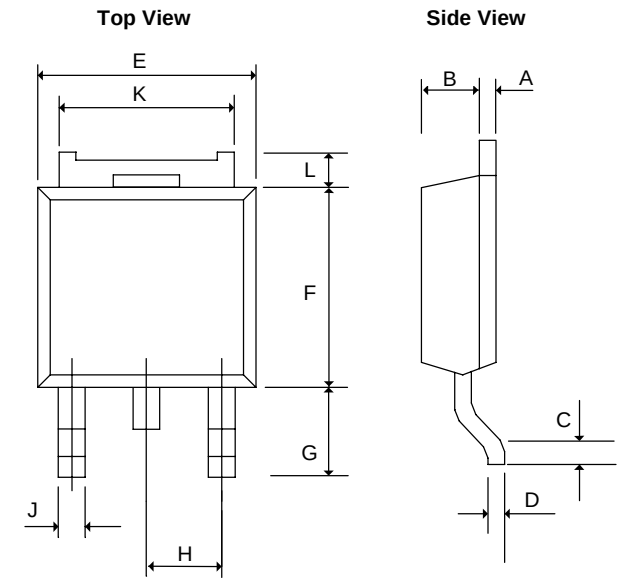
TO-252(DPAK)-EIAJ



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.45	0.58	0.0177	0.0230
B	1.60	1.95	0.0630	0.0768
C	0.51	1.50	0.0201	0.0591
D	0.45	0.60	0.0177	0.0236
E	6.40	6.80	0.2520	0.2677
F	5.40	7.20	0.2126	0.2835
G	2.20	2.85	0.0866	0.1122
H	-	* 2.30	-	* 0.0906
J	-	0.97	-	0.0380
K	5.20	5.50	0.2047	0.2165
L	1.40REF		0.055REF	

***: Typical Value**
Notes:
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness Minimum lead thickness is the minimum thickness of base material.

TO-252(DPAK)-JEDC



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.49	0.51	0.0192	0.0201
B	1.79	1.81	0.0704	0.0713
C	0.55	-	0.0216	-
D	0.49	0.51	0.0192	0.0201
E	6.58	6.62	0.259	0.2606
F	6.08	6.12	0.2393	0.2409
G	2.68	2.72	0.1055	0.1071
H	* 2.30REF		* 0.0906REF	
J	0.96		0.0377	
K	5.31	5.37	0.2090	0.2114
L	0.68	0.72	0.0267	0.0283

***: Typical Value**
Notes:
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness Minimum lead thickness is the minimum thickness of base material.

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