1.0A Adjustable Voltage High Speed LDO Regulators ME1117 Series

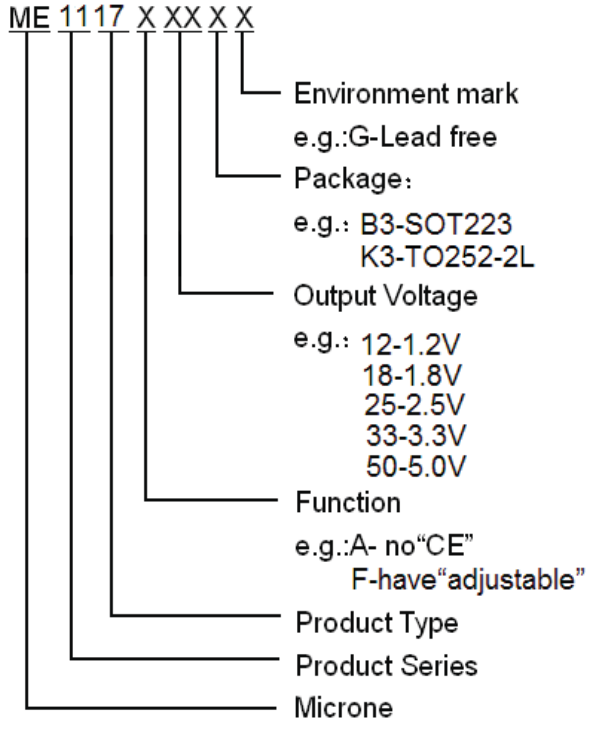
General Description

The ME1117 series are highly accurate, low noise, LDO Voltage Regulators that are capable of providing an output current that is in excess of 1.0 A with a maximum dropout voltage of 1.3 V at 1.0A. This series contains six fixed output voltages of 1.2 V, 1.8 V, 2.5 V, 3.3 V, and 5.0 V that have no minimum load requirement to maintain regulation. Also included is an adjustable output version that can be programmed from 1.25 V to 15 V with two external resistors. On chip trimming adjusts the reference/output voltage to within ±2.0% accuracy. Internal protection features consist of output current limiting, safe operating area compensation, and thermal shutdown. The ME1117 series can operate with up to 15 V input. Devices are available in SOT223，TO252-2L .

Features

- Output Current in Excess of 1.0A
- Dropout Voltage：1V@ I_{OUT} =100mA
- Operating Voltage Range：
  4.8V～15V（ME1117A33）
- Highly Accuracy： ±2%
- Adjustable Output Voltage Option
- Standby Current：3mA（TPY.）
- High Ripple Rejection：60dB@1KHz（ME1117A33）
- Line Regulation: 0.1%（TYP.）
- Temperature Stability≤0.5%
- Current Limit（1.3A）
- Thermal Shutdown Protection（160℃）
- Small Packages:SOT223、TO252-2L

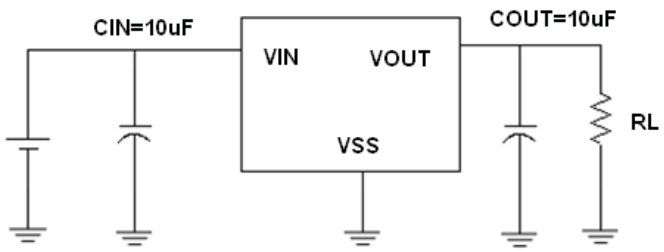
Selection Guide



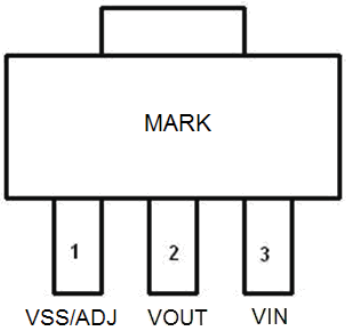
Typical Application

- Consumer and Industrial Equipment Point of Regulation
- Switching Power Supply Post Regulation
- Hard Drive Controllers
- Battery Chargers

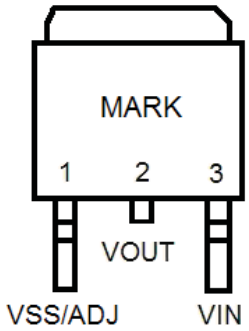
Typical Application Circuit



Pin Configuration



SOT223



TO252-2L

Pin Assignment

ME1117AXX

Pin Number	Pin Name	Functions
1	V_{SS}	Ground
2	V_{OUT}	Output
3	V_{IN}	Power Input

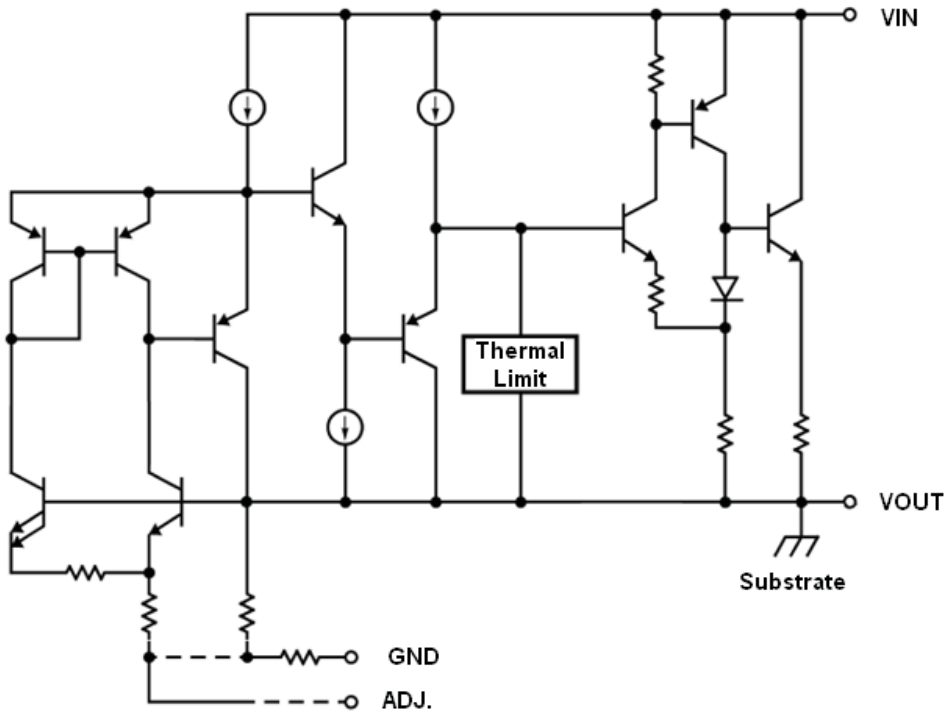
ME1117F

Pin Number	Pin Name	Functions
1	V_{ADJ}	Adjustable Output
2	V_{OUT}	Output
3	V_{IN}	Power Input

Absolute Maximum Ratings

Parameter		Symbol	Ratings	Units
Input Voltage		V_{IN}	20	V
Output Current		I_{OUT}	1.3	A
Output Voltage		V_{OUT}	Vss-0.3～V_{IN} +0.3	V
Power Dissipation	SOT223	P_D	750	mW
	TO252-2L		2000	mW
Operating Temperature Range		T_{OPR}	－40～＋125	℃
Storage Temperature Range		T_{STG}	－40～＋150	℃
Junction Temperature Range		T_J	0～＋150	℃
Lead Temperature	SOT223		260℃，4sec	
	TO252-2L		260℃，10sec	
Thermal Resistance Junction-to-Case	SOT223		15	°C/W
	TO252-2L		10	°C/W
Thermal Resistance Junction-to-Ambient (No heat sink; No air flow)	SOT223		136	°C/W
	TO252-2L		92	°C/W

Block Diagram



Electrical Characteristics

ME1117F

(V_{IN}= V_{OUT}+1.5V，C_{IN}=C_L=10uF，Ta=25°C ,unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Reference Voltage	V_{REF}	V_{IN}= V_{OUT}+1.5V，I_{OUT} =10mA 10mA≤I_{OUT}≤1A ， V_{OUT}+1.5V ≤V_{IN}≤15V	×0.98 ×0.98	1.25 1.25	×1.02 ×1.02	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1.5V		1000		mA
Minimum Output Current	I_{OUTMIN}	V_{IN}= V_{OUT}+1.5V		2		mA
Line Regulation	$\Delta V_{REF-LINE}$	I_{OUT} =10mA V_{OUT}+1.5V ≤V_{IN}≤15V		0.03	0.2	%
Load Regulation	$\Delta V_{REF-LOAD}$	V_{IN}= V_{OUT}+1.5V ,0mA≤I_{OUT}≤1A		0.2	0.4	%
Adjustment Pin Current	I_{ADJ}	V_{IN}= V_{OUT}+1.5V		12	30	uA
Adjust Pin Current Change		10mA≤ I_{OUT}≤ 1A, 1.5V ≤ V_{IN}-V_{OUT} ≤ 15V		0.2	5	uA
Thermal Shutdown		Junction Temperature		150		℃

ME1117A12

(V_{IN}= V_{OUT}+1.5V，C_{IN}=C_L=10uF，Ta=25°C ,unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Voltage	V_{OUT}	I_{OUT}=10mA,V_{IN}= V_{OUT}+1.5V 10mA≤I_{OUT}≤1A， V_{OUT}+1.5V ≤V_{IN}≤15V	×0.98 ×0.98	1.2 1.2	×1.02 ×1.02	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1.5V		1000		mA
Load Regulation	$\Delta V_{OUT-LOAD}$	V_{IN}= V_{OUT}+1.5V , 0mA≤I_{OUT}≤1A		2	15	mV
Dropout Voltage (Note 1)	V_{DIF1}	I_{OUT} =100mA		1.05	1.10	V
	V_{DIF2}	I_{OUT} =500mA		1.20	1.30	V
	V_{DIF3}	I_{OUT} =1A		1.30	1.40	V
Quiescent Current	I_{SS}	V_{IN}= V_{OUT}+1.5V		2.8	8	mA
Line Regulation	$\Delta V_{OUT-LINE}$	I_{OUT} =10mA， V_{OUT}+1.5V ≤V_{IN}≤15V		1	6	mV
Ripple Rejection Rate	PSRR	V_{IN} = 12V +1Vp-pAC; I_{OUT}=10mA,1k HZ		65		dB
		V_{IN} = 12V +1Vp-pAC; I_{OUT}=100mA,1 kHZ		60		
Thermal Shutdown	TJ	Junction Temperature		150		℃

ME1117A18

(V_{IN}= V_{OUT}+1.5V，C_{IN}=C_L=10uF，Ta=25°C ,unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Voltage	V_{OUT}	I_{OUT}=10mA,V_{IN}= V_{OUT}+1.5V 10mA≤I_{OUT}≤1A， V_{OUT}+1.5V ≤V_{IN}≤15V	×0.98 ×0.98	1.8 1.8	×1.02 ×1.02	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1.5V		1000		mA
Load Regulation	$\Delta V_{OUT-LOAD}$	V_{IN}= V_{OUT}+1.5V , 0mA≤I_{OUT}≤1A		2	10	mV
Dropout Voltage (Note 1)	V_{DIF1}	I_{OUT} =100mA		1.05	1.10	V
	V_{DIF2}	I_{OUT} =500mA		1.20	1.30	V
	V_{DIF3}	I_{OUT} =1A		1.30	1.40	V
Quiescent Current	I_{SS}	V_{IN}= V_{OUT}+1.5V		2.2	8	mA
Line Regulation	$\Delta V_{OUT-LINE}$	I_{OUT} =10mA， V_{OUT}+1.5V ≤V_{IN}≤15V		1	6	mV
Ripple Rejection Rate	PSRR	V_{IN} = 12V +1Vp-pAC; I_{OUT}=10mA,1kHZ		65		dB
		V_{IN} = 12V +1Vp-pAC; I_{OUT}=100mA,1kHZ		60		
Thermal Shutdown		Junction Temperature		150		℃

ME1117A25

(V_{IN}= V_{OUT}+1.5V，C_{IN}=C_L=10uF，Ta=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Voltage	V_{OUT}	I_{OUT}=10mA,V_{IN}= V_{OUT}+1.5V 10mA≤I_{OUT}≤1A， V_{OUT}+1.5V ≤V_{IN}≤15V	×0.98 ×0.98	2.5 2.5	×1.02 ×1.02	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1.5V		1000		mA
Load Regulation	$\Delta V_{OUT-LOAD}$	V_{IN}=V_{OUT}+1.5V ， 0mA≤I_{OUT}≤1000mA		1	10	mV
Dropout Voltage (Note 1)	V_{DIF1}	I_{OUT} =100mA		1.05	1.10	V
	V_{DIF2}	I_{OUT} =800mA		1.20	1.30	V
	V_{DIF3}	I_{OUT} =1A		1.30	1.40	V
Quiescent Current	I_{SS}	V_{IN}= V_{OUT}+1.5V		2.2	5	mA
Line Regulation	$\Delta V_{OUT-LINE}$	I_{OUT} =10mA， V_{OUT}+1.5V ≤V_{IN}≤15V		2	6	mV
Ripple Rejection Rate	PSRR	V_{IN} = 12V +1Vp-pAC, I_{OUT}=10mA,1kHZ		65		dB
		V_{IN} = 12V +1Vp-pAC, I_{OUT}=100mA,1kHZ		60		
Thermal Shutdown		Junction Temperature		150		℃

ME1117A33

(V_{IN}= V_{OUT}+1.5V，C_{IN}=C_L=10uF，Ta=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Voltage	V_{OUT}	I_{OUT}=10mA,V_{IN}= V_{OUT}+1.5V 10mA≤I_{OUT}≤1A， V_{OUT}+1.5V ≤V_{IN}≤15V	×0.98 ×0.98	3.3 3.3	×1.02 ×1.02	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1.5V		1000		mA
Load Regulation	$\Delta V_{OUT-LOAD}$	V_{IN}= V_{OUT}+1.5V , 0mA≤I_{OUT}≤1A		2	10	mV
Dropout Voltage (Note 1)	V_{DIF1}	I_{OUT} =100mA		1.05	1.10	V
	V_{DIF2}	I_{OUT} =800mA		1.20	1.30	V
	V_{DIF3}	I_{OUT} =1A		1.30	1.40	V
Quiescent Current	I_{SS}	V_{IN}= V_{OUT}+1.5V		3	10	mA
Line Regulation	$\Delta V_{OUT-LINE}$	I_{OUT} =10mA， V_{OUT}+1.5V ≤V_{IN}≤15V		2	6	mV
Ripple Rejection Rate	PSRR	V_{IN} = 12V +1Vp-pAC, I_{OUT}=10mA,1kHZ		65		dB
		V_{IN} = 12V +1Vp-pAC, I_{OUT}=100mA,1kHZ		60		
Thermal Shutdown		Junction Temperature		150		℃

ME1117A50

(V_{IN}= V_{OUT}+1.5V，C_{IN}=C_L=10uF，Ta=25^{O}C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Voltage	V_{OUT}	I_{OUT}=10mA,V_{IN}= V_{OUT}+1.5V 10mA≤I_{OUT}≤1A， V_{OUT}+1.5V ≤V_{IN}≤15V	×0.98 ×0.98	5.0 5.0	×1.02 ×1.02	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1.5V		1000		mA
Load Regulation	$\Delta V_{OUT-LOAD}$	V_{IN}= V_{OUT}+1.5V , 0mA≤I_{OUT}≤1A		8	15	mV
Dropout Voltage (Note 1)	V_{DIF1}	I_{OUT} =100mA		1.05	1.10	V
	V_{DIF2}	I_{OUT} =800mA		1.20	1.30	V
	V_{DIF3}	I_{OUT} =1A		1.30	1.40	V
Quiescent Current	I_{SS}	V_{IN}= V_{OUT}+1.5V		4.7	10	mA
Line Regulation	$\Delta V_{OUT-LINE}$	I_{OUT} =10mA V_{OUT}+1.5V ≤V_{IN}≤15V		2	10	mV
Ripple Rejection Rate	PSRR	V_{IN} = 12V +1Vp-pAC, I_{OUT}=10mA,1kHZ		65		dB
		I_{OUT}=100mA,1kHZ		60		
Thermal Shutdown		Junction Temperature		150		℃

Note ：

1 .V_{DIF}：V_{IN1} –V_{OUT} (E)’

V_{IN1} ： The input voltage when V_{OUT}(E)’ appears as input voltage is gradually decreased.

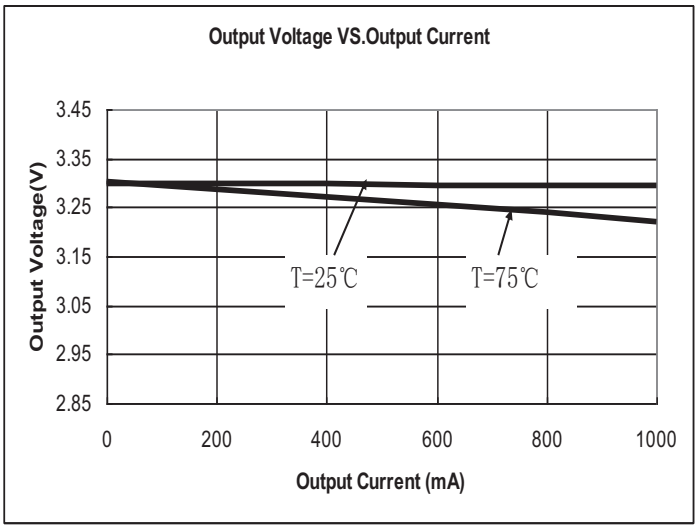
V_{OUT} (E)’=A voltage equal to 99% of the output voltage whenever an amply stabilized Iout and {V_{OUT} (T)+1.5V} is input.

Type Characteristics

（1） Output Voltage VS. Output Current

（V_{IN}=V_{OUT}+1.5V）

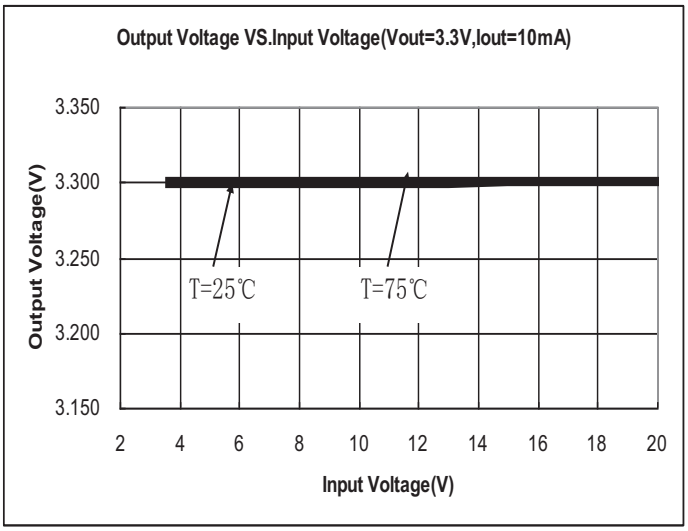
ME1117A33



（2） Output Voltage VS. Iutput Voltage

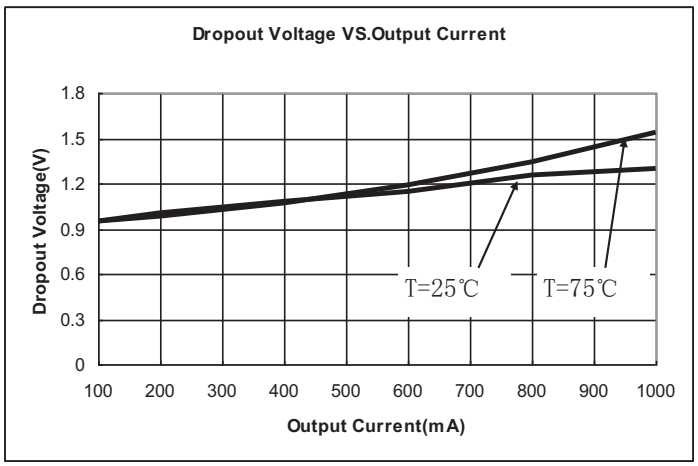
（Vout=3.3V , I_{OUT}=10mA）

ME1117A33



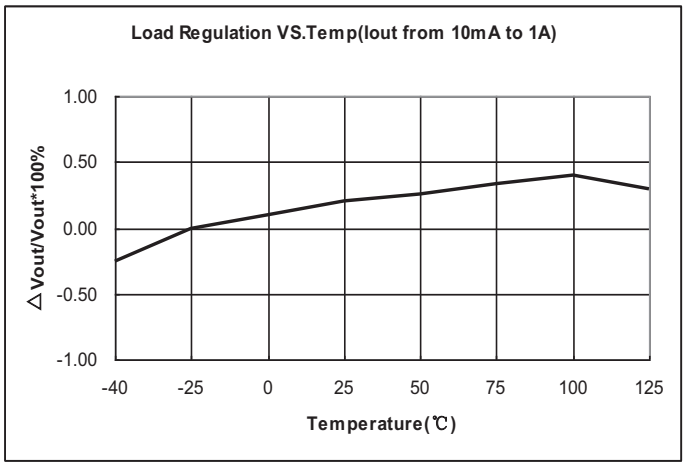
（3） Dropout Voltage VS. Output Current

ME1117A33



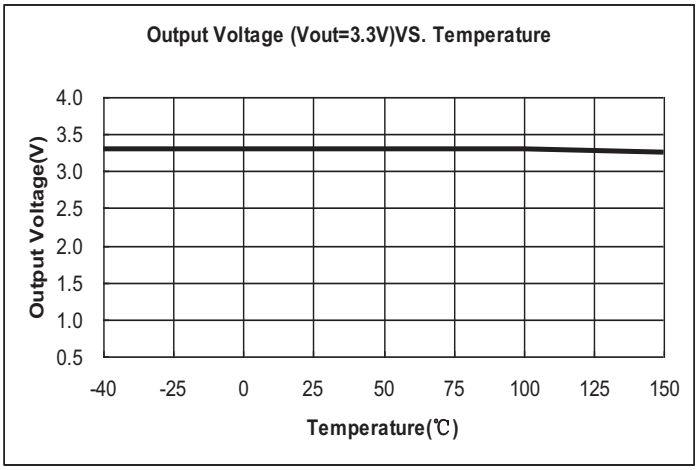
（4）Load Regulation VS.Temp(Iout from 10mA to 1A)

ME1117A33



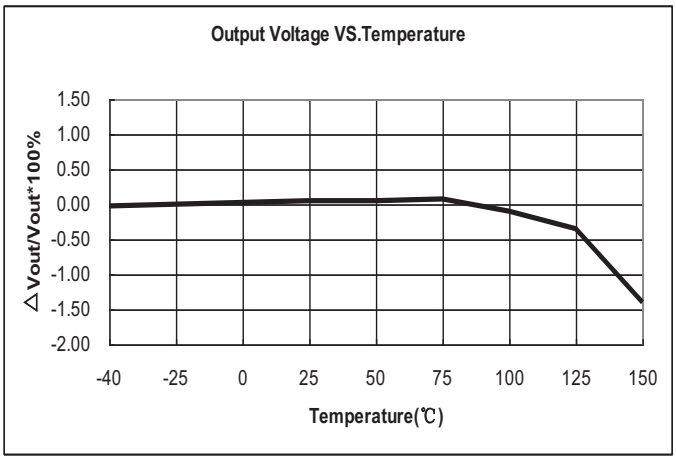
（5）Output Voltage VS. Temperature

ME1117A33



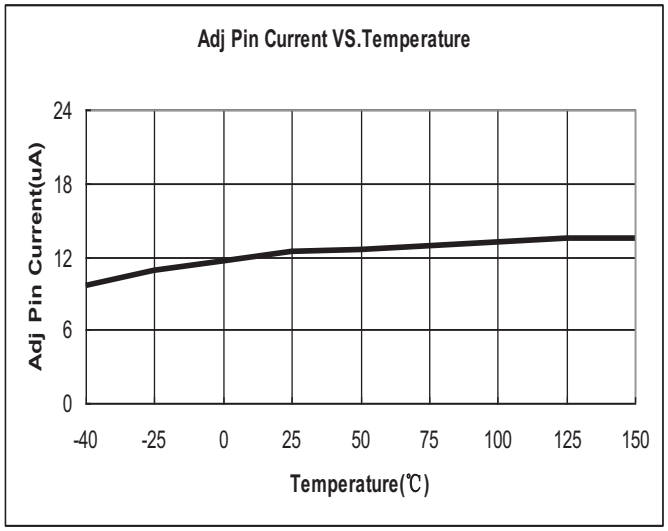
（6）Output Voltage Change VS. Temperature

ME1117A33



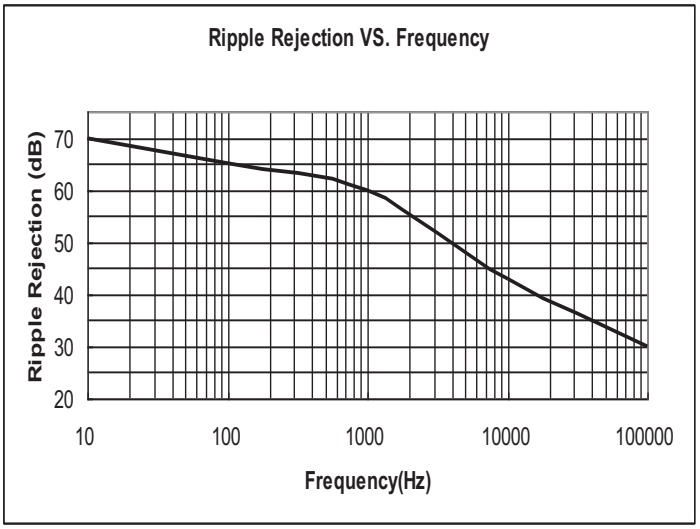
（7）Adj Pin Current VS.Temperature

ME1117F



（8）Ripple Rejection vs. Frequency

ME1117A33

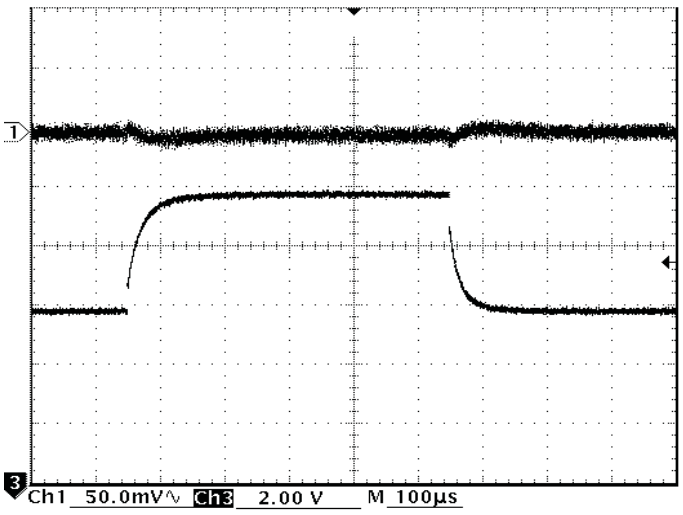


（9）Line Transient Response

ME1117A33

Ch1：Output Voltage　Ch3：Input Voltage

V_{IN}=8V～12V,I_{OUT}=0mA,Ta = 25 °C

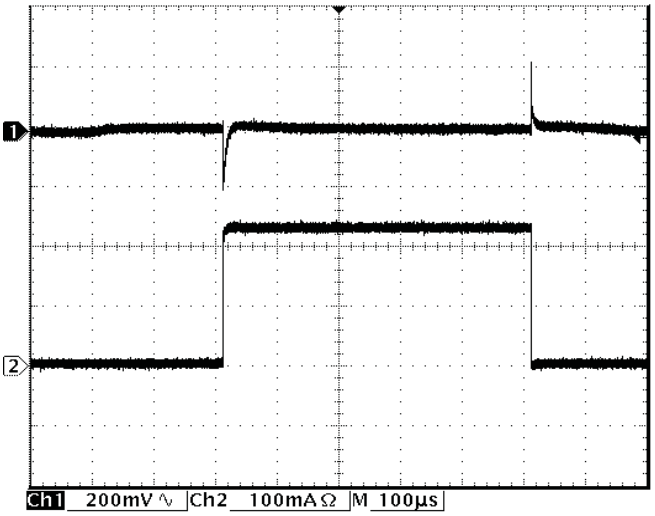


（10）Load Transient Response

ME1117A33

Ch1：Output Voltage　Ch2：Load Current

V_{IN}=4.8V, I_{OUT}=0mA ～240mA,Ta = 25 °C



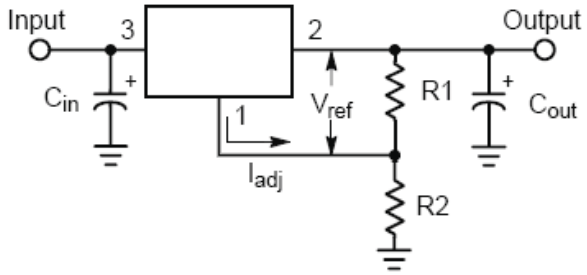
Applications Information

➢ Introduction

The ME1117 features a significant reduction in dropout voltage along with enhanced output voltage accuracy and temperature stability when compared to older industry standard three−terminal adjustable regulators.

➢ Output Voltage

The typical application circuit for adjustable output regulator is shown in following Figure. They develop and maintain the nominal 1.25 V reference voltage between the output and adjust pins. The reference voltage is programmed to a constant current source by resistor R1, and this current flows through R2 to ground to set the output voltage. The programmed current level is usually selected to be greater than the specified 3.0mA minimum that is required for regulation. Since the adjust pin current, I_{ADJ}, is significantly lower and constant with respect to the programmed load current, it generates a small output voltage error that can usually be ignored.



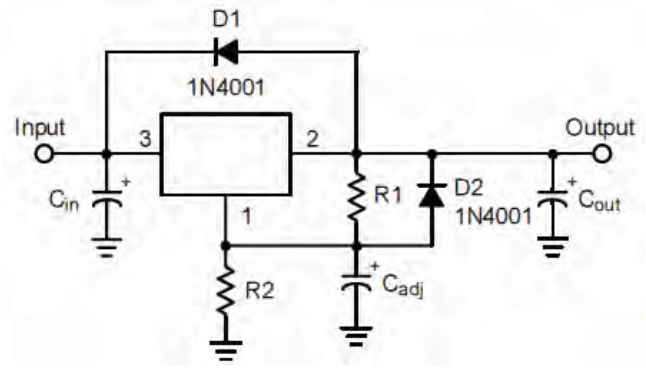
$$V_{out} = V_{ref}\left(1 + \frac{R2}{R1}\right) + I_{adj}\,R2$$

➢ External Capacitors

Input bypass capacitor C_{IN} may be required for regulator stability. This capacitor will reduce the circuit's sensitivity when powered from a complex source. A 10uF ceramic or tantalum capacitor should be adequate for most applications. Frequency compensation for the regulator is provided by capacitor C_{OUT} and its use is mandatory to ensure output stability. A minimum capacitance value of 4.7uF with an equivalent series resistance (ESR) that is within the limits of 0.25 ohm to 2.2 ohm is required. Higher values of output capacitance can be used to enhance loop stability and transient response with the additional benefit of reducing output noise. The output ripple will increase linearly for fixed and adjustable devices as the ratio of output voltage to the reference voltage increases.

➢ Protection Diodes

The ME1117 has two internal low impedance diode paths that normally do not require protection when used in the typical regulator applications. The first path connects between V_{OUT} and V_{IN} , and it can withstand a peak surge current of about 15 A. Only when V_{IN} is shorted to ground and C_{OUT} is greater than 100uF, it becomes possible for device damage to occur. Under these conditions, diode D1 is required to protect the device. The second path connects between C_{ADJ} and V_{OUT}, and it can withstand a peak surge current of about 150mA. Protection diode D2 is required if the output is shorted to ground and C_{ADJ} is greater than 10uF.

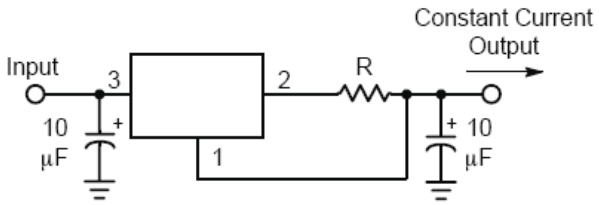


➢ Thermal Considerations

This series contains an internal thermal limiting circuit that is designed to protect the regulator in the event that the maximum junction temperature is exceeded. When activated, typically at 175°C, the regulator output switches off and then back on as the die cools.

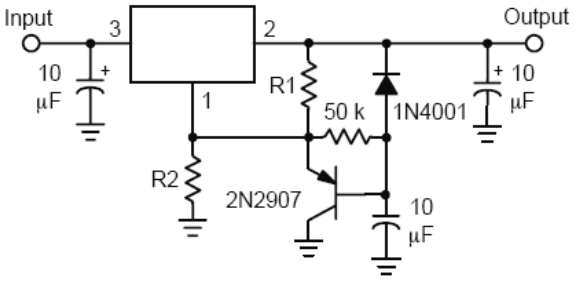
Other Application Circuit

（1） Constant Current Regulator

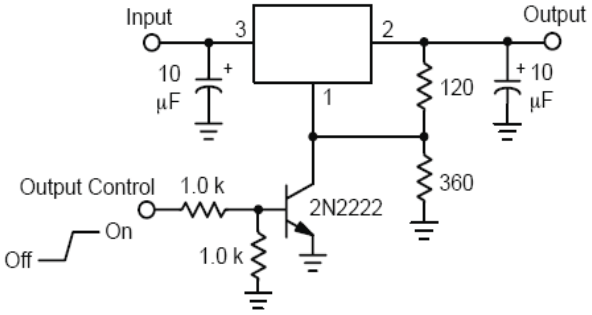


$$I_{out} = \frac{V_{ref}}{R} + I_{adj}$$

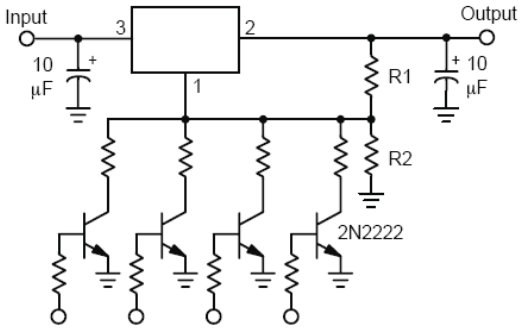
（2）Slow Turn−On Regulator



（3）Regulator with Shutdown

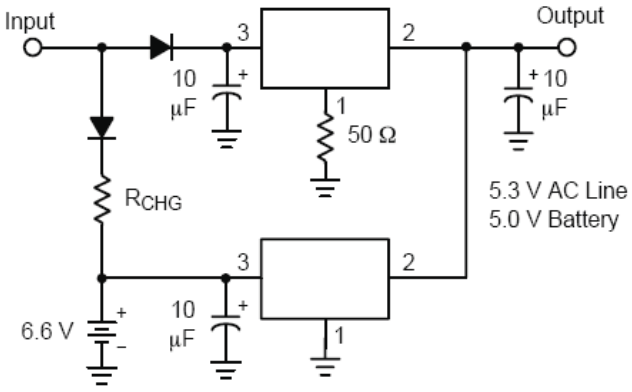


（4）Digitally Controlled Regulator



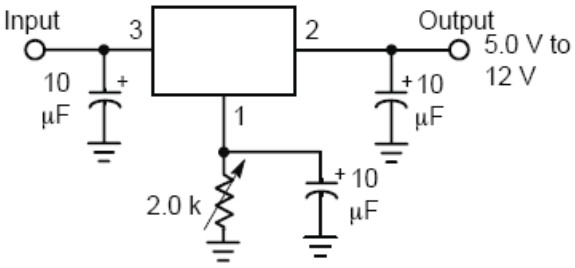
Resistor R2 sets the maximum output voltage. Each transistor reduces the output voltage when turned on.

（5）Battery Backed−Up Power Supply



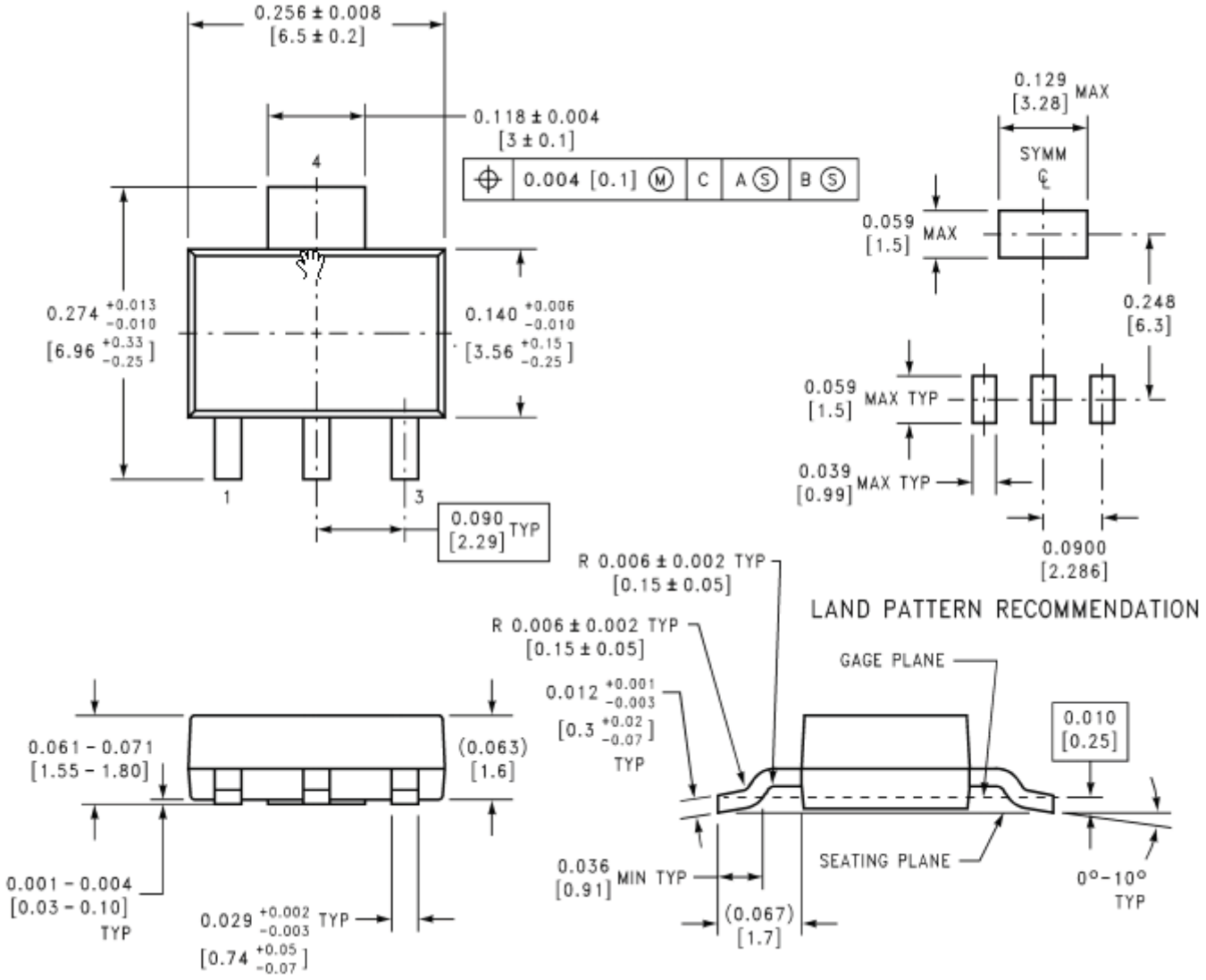
The 50 ohm resistor that is in series with the ground pin of the upper regulator level shifts its output 300 mV higher than the lower regulator. This keeps the lower regulator off until the input source is removed.

（6）Adjusting Output of Fixed Voltage Regulators

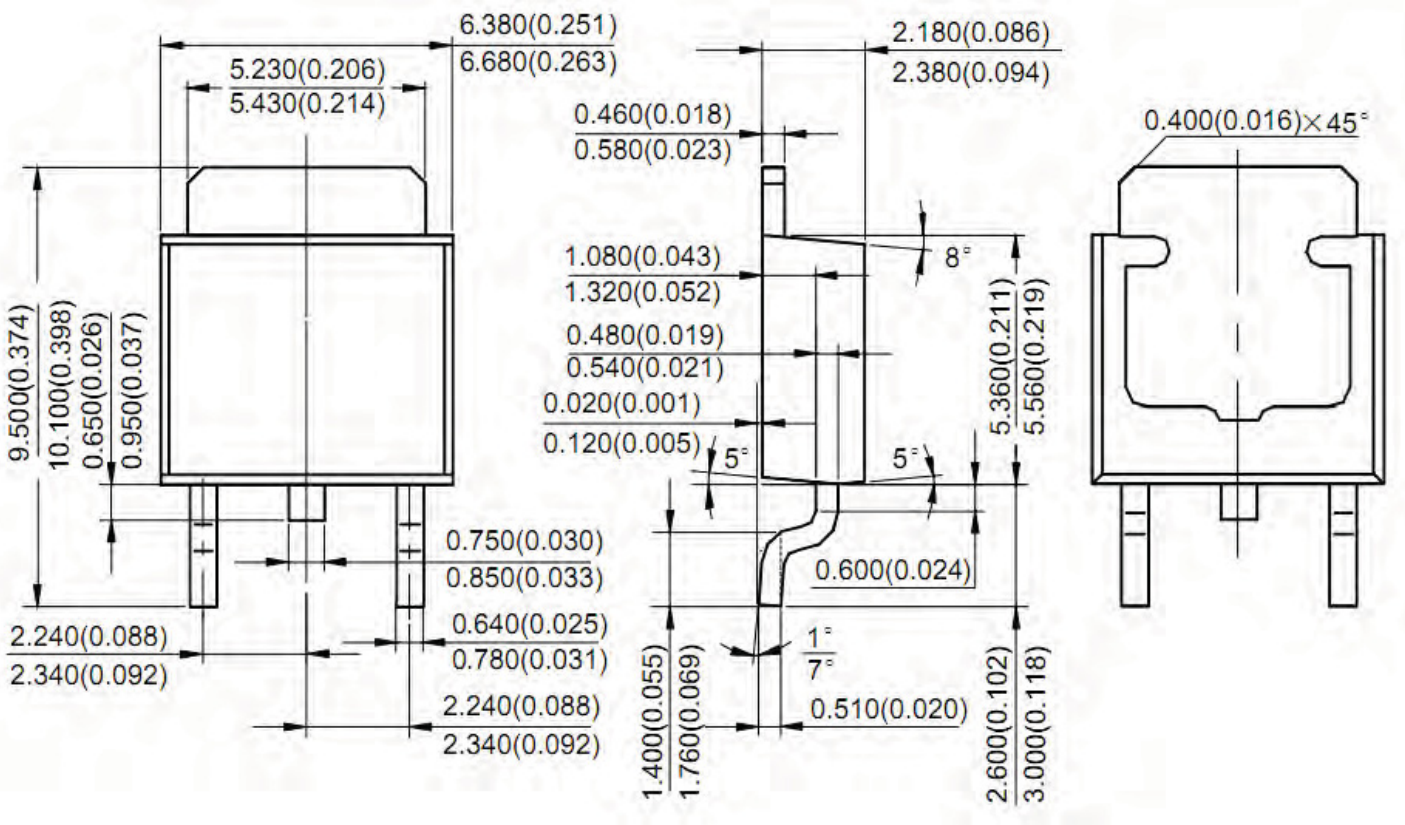


Packaging Information

● **SOT223**



● **TO252-2L**


6.380(0.251)
6.680(0.263)
5.230(0.206)
5.430(0.214)
9.500(0.374)
10.100(0.398)
0.650(0.026)
0.950(0.037)
0.750(0.030)
0.850(0.033)
2.240(0.088)
2.340(0.092)
0.640(0.025)
0.780(0.031)
2.240(0.088)
2.340(0.092)
2.180(0.086)
2.380(0.094)
0.460(0.018)
0.580(0.023)
1.080(0.043)
1.320(0.052)
0.480(0.019)
0.540(0.021)
0.020(0.001)
0.120(0.005)
8°
5°
5°
5.360(0.211)
5.560(0.219)
0.600(0.024)
1°
7°
0.510(0.020)
1.400(0.055)
1.760(0.069)
2.600(0.102)
3.000(0.118)
0.400(0.016)×45°

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