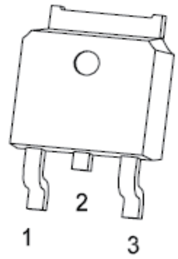
Low Dropout Linear Regulator

LMU1117 (LMU1117)

■ Features

- 1.4V maximum dropout at full load current
- Fast transient response
- Output current limiting
- Built-in thermal shutdown
- Good noise rejection
- 3-Terminal Adjustable or Fixed
  1.5V, 1.8V, 2.5V, 2.85V, 3.3V, 5.0V

TO-252



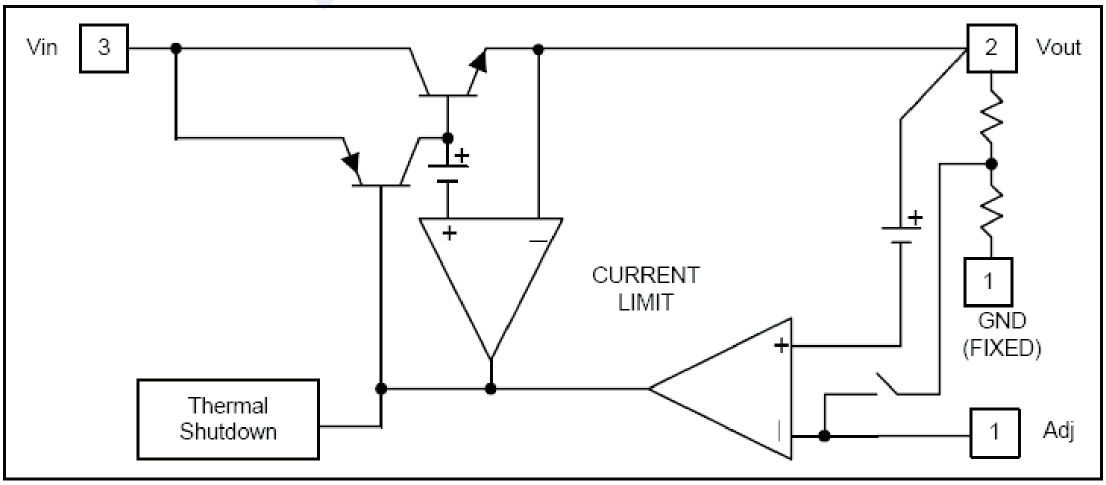
1 Adj(GND)
2 Vout
3 Vin

■ Absolute Maximum Ratings Ta = 25℃

Parameter	Symbol	Rating	Unit
DC Supply Voltage	V_{in}	-0.3 to 18	V
Power Dissipation	P_D	Internally Limited	
Thermal Resistance Junction-to-Ambient	$R\theta_{JA}$	92	℃/W
Thermal Resistance Junction-to-Case *	$R\theta_{JC}$	10	℃/W
Operating Junction Temperature Range	T_{opr}	0 to +150	℃
Storage Temperature	T_{stg}	-55 to +150	℃

* Control Circuitry/Power Transistor

■ Block Diagram



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■ Electrical Characteristics Ta = 25℃

Parameter		Testconditons	Min	Typ	Max	Unit
Reference Voltage	LMU1117-ADJ	T_J=25℃,(V_{IN}-O_{UT})=1.5V,I_O=10mA	1.225	1.250	1.275	V
Output Voltage	LMU1117-1.5	I_{OUT} = 10mA, T_J = 25℃, 3V≤V_{IN}≤12V	1.470	1.500	1.530	V
	LMU1117-1.8	I_{OUT} = 10mA, T_J = 25℃, 3.3V≤V_{IN}≤12V	1.764	1.800	1.836	V
	LMU1117-1.9	I_{OUT} = 10mA, T_J = 25℃, 3.3V≤V_{IN}≤12V	1.862	1.900	1.938	V
	LMU1117-2.5	I_{OUT} = 10mA, T_J = 25℃, 4V≤V_{IN}≤12V	2.450	2.500	2.550	V
	LMU1117-3.3	I_{OUT} = 10mA, T_J = 25℃, 4.8V≤V_{IN}≤12V	3.235	3.300	3.365	V
	LMU1117-5.0	I_{OUT} = 10mA, T_J = 25℃, 6.5V≤V_{IN}≤12V	4.900	5.000	5.100	V
Line Regulation	LMU1117-XXX	I_O=10mA,V_{OUT}+1.5V<V_{IN}<12V, T_J=25℃			0.2	%
Load Regulation	LMU1117-ADJ	V_{IN}=3.3V,V_{adj}=0,0mA<I_o<1A,T_J=25℃			1	%
	LMU1117-1.5	V_{IN}=3V,0mA<I_o<1A,T_J=25℃		12	15	mV
	LMU1117-1.8	V_{IN}=3.3V,0mA<I_o<1A,T_J=25℃		15	18	mV
	LMU1117-1.9	V_{IN}=3.3V,0mA<I_o<1A,T_J=25℃		16	19	mV
	LMU1117-2.5	V_{IN}=4V,0mA<I_o<1A,T_J=25℃		20	25	mV
	LMU1117-3.3	V_{IN}=5V,0mA≤I_o≤1A,T_J=25℃		26	33	mV
	LMU1117-5.0	V_{IN}=8V,0mA≤I_o≤1A,T_J=25℃		40	50	mV
Dropout Voltage (V_{IN}-V_{OUT})	LMU1117-XXX	I_{OUT} = 1A ,△V_{OUT}=0.1%V_{OUT}		1.3	1.4	V
Current Limit	KMU1117-XXX	(V_{IN}-V_{OUT}) = 5V	1. 1			A
Minimum Load Current	LMU1117-XXX	0℃≤Tj≤125℃		5	10	mA
Thermal Regulation		T_A=25℃, 30ms pulse		0.008	0.04	%/W
Ripple Rejection	F=120Hz,C_{OUT}=25uF Tantalum, I_{OUT}=1A					
	LMU1117-XXX	V_{IN}=V_{OUT}+3V		60	70	dB
Temperature Stability		I_O=10mA		0.5		%

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■ Typical Characteristics

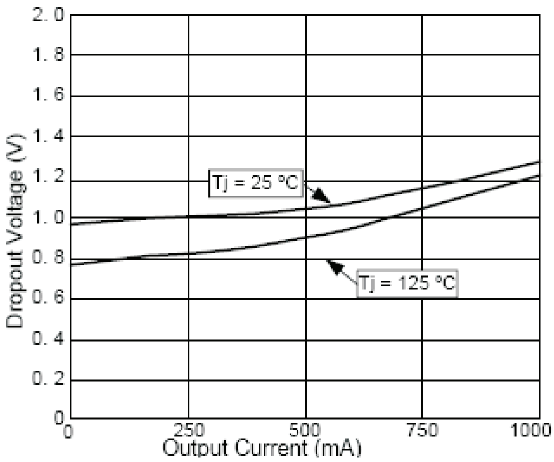

Fig.1 Dropout Voltage vs Output Current

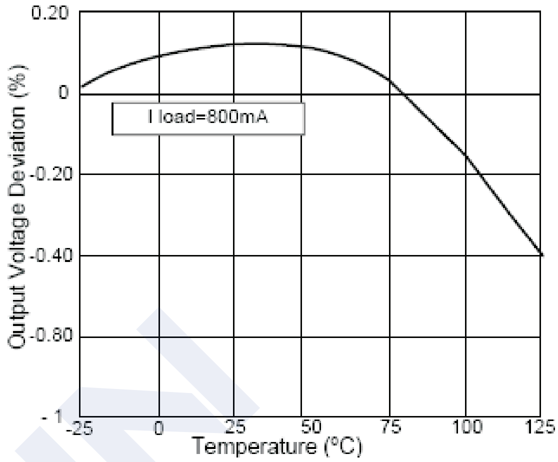

Fig.2 Load Regulation vs Temperature

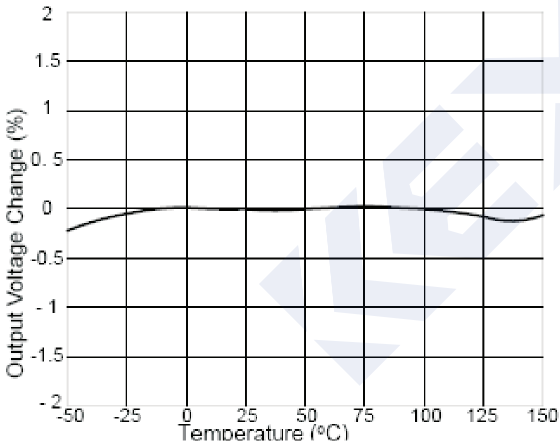

Fig.3 Percent Change in Output Voltage vs Temperature

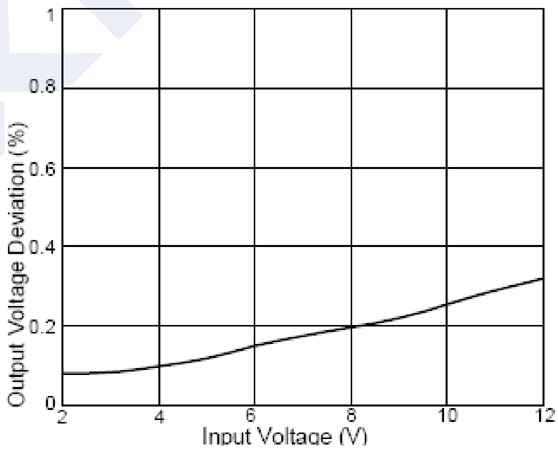

Fig.4 Line Regulation

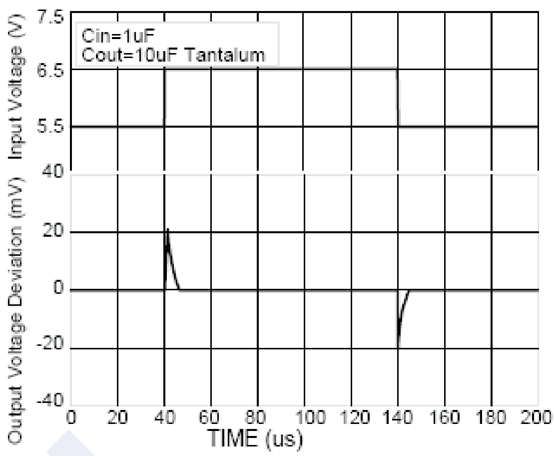

Fig.5 Line Transient Response

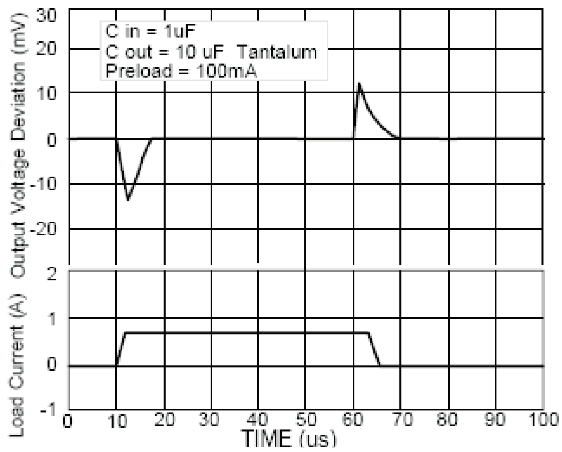

Fig.6 Load Transient Response

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■ Application and Implementation

● Application Information

The LMU1117 is a versatile and high performance linear regulator with a wide temperature range and tight line/load regulation operation. An output capacitor is required to further improve transient response and stability. For the adjustable option, the ADJ pin can also be bypassed to achieve very high ripple-rejection ratios. The LMU1117 is versatile in its applications, including its uses as a post regulator for DC/DC converters, battery chargers, and microprocessor supplies.

●Typical Application

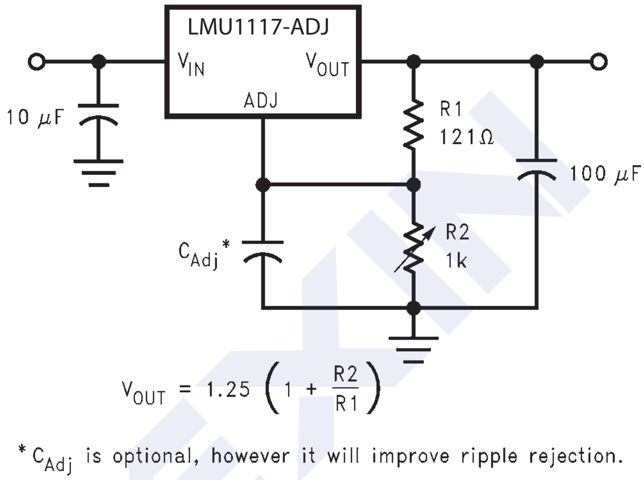

Figure 7.1.25-V to 10-V Adjustable Regulator With Improved Ripple Rejection

● Design Requirements

The device component count is very minimal, employing two resistors as part of a voltage divider circuit and an output capacitor for load regulation. A 10-μF tantalum on the input is a suitable input capacitor for almost all applications. An optional bypass capacitor across R2 can also be used to improve PSRR.

● Detailed Design Procedure

The output voltage is set based on the selection of the two resistors, R1 and R2.

●*External Capacitors*

●Input Bypass Capacitor

An input capacitor is recommended. A 10-μF tantalum on the input is a suitable input capacitor for almost all applications.

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Typical Application (continued)

● **Adjust Terminal Bypass Capacitor**

The adjust terminal can be bypassed to ground with a bypass capacitor (C_{ADJ}) to improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. At any ripple frequency, the impedance of the C_{ADJ} should be less than R1 to prevent the ripple from being amplified:

$$1/(2\pi \times f_{RIPPLE} \times C_{ADJ}) < R1 \qquad (1)$$

The R1 is the resistor between the output and the adjust pin. Its value is normally in the range of 100-200Ω. For example, with R1 = 124Ω and f_{RIPPLE} = 120Hz, the C_{ADJ} should be > 11µF.

● **Output Capacitor**

The output capacitor is critical in maintaining regulator stability, and must meet the required conditions for both minimum amount of capacitance and equivalent series resistance (ESR). The minimum output capacitance required by the LMU1117 is 10 µF, if a tantalum capacitor is used. Any increase of the output capacitance will merely improve the loop stability and transient response. The ESR of the output capacitor should range between 0.3 Ω to 22 Ω. In the case of the adjustable regulator, when the C_{ADJ} is used, a larger output capacitance (22-µF tantalum) is required.

●**Application Curve**

As shown in Figure 8 , the dropout voltage will vary with output current and temperature. Care should be taken during design to ensure the dropout voltage requirement is met across the entire operating temperature and output current range.

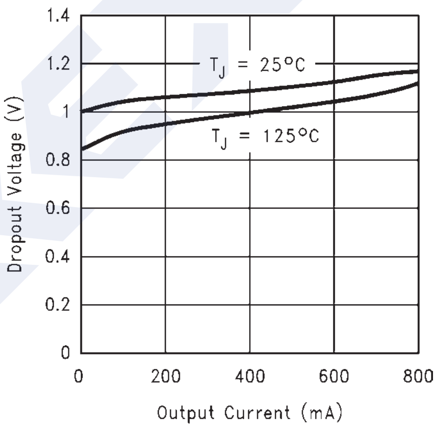

Figure 8. Dropout Voltage (V_{IN} – V_{OUT})

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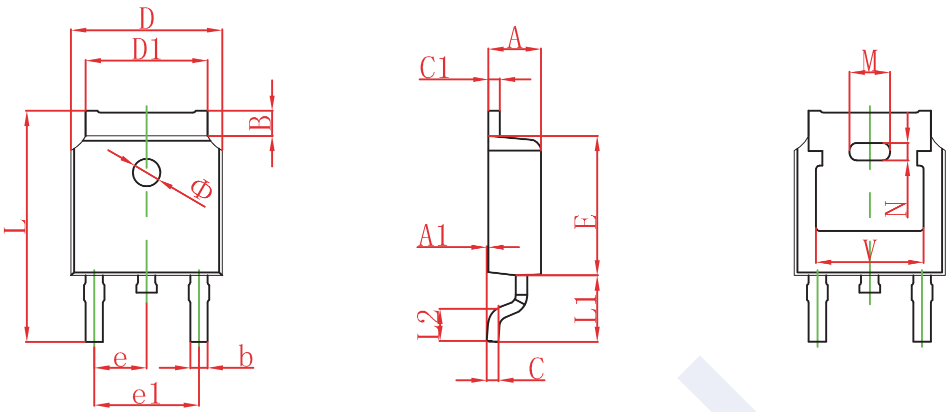
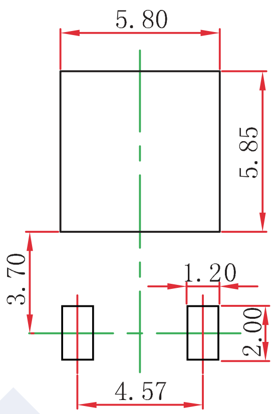
■ TO-252 Package Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.380	0.087	0.094
A1	0.000	0.100	0.000	0.004
B	0.800	1.400	0.031	0.055
b	0.710	0.810	0.028	0.032
c	0.460	0.560	0.018	0.022
c1	0.460	0.560	0.018	0.022
D	6.500	6.700	0.256	0.264
D1	5.130	5.460	0.202	0.215
E	6.000	6.200	0.236	0.244
e	2.286 TYP.		0.090 TYP.	
e1	4.327	4.727	0.170	0.186
M	1.778REF.		0.070REF.	
N	0.762REF.		0.018REF.	
L	9.800	10.400	0.386	0.409
L1	2.9REF.		0.114REF.	
L2	1.400	1.700	0.055	0.067
V	4.830 REF.		0.190 REF.	
Φ	1.100	1.300	0.043	0.051

■ TO-252 Suggested Pad Layout



Note:
1. Controlling dimension: in millimeters.
2. General tolerance: ±0.05mm.
3. The pad layout is for reference purposes only.