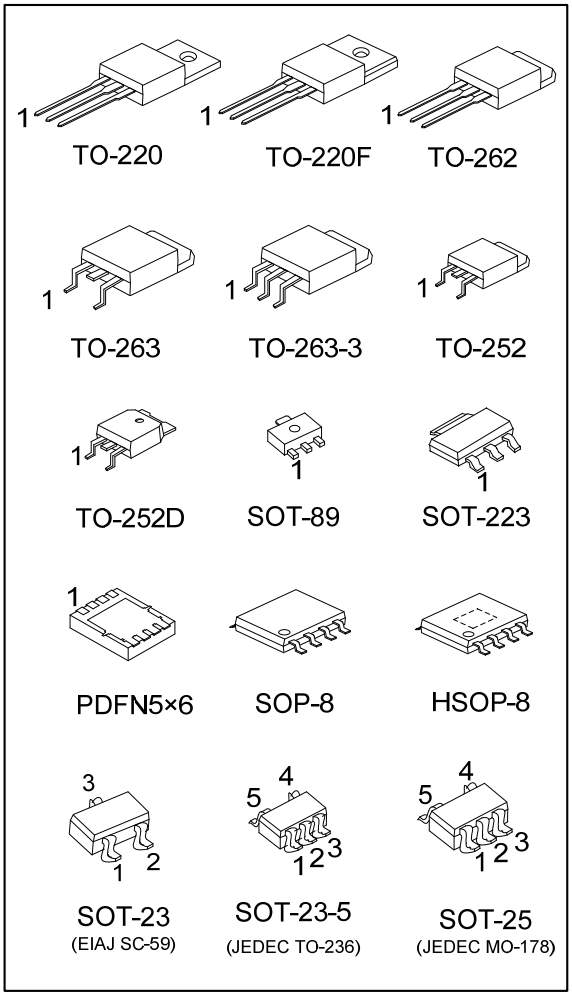
LL1117/A

LINEAR INTEGRATED CIRCUIT

LOW DROP FIXED AND ADJUSTABLE POSITIVE VOLTAGE REGULATORS



■ DESCRIPTION

The UTC **LL1117/A** is a low dropout, 3-terminal positive voltage regulator designed to provide output current up to 800mA/1A, There are adjustable version (V_{REF}=1.25V) and various fixed versions.

■ FEATURES

* Low dropout voltage
* Output current up to 0.8A for **LL1117** and 1.0A for **LL1117A**
* Built-in current limit and over temperature protection
* Low current consumption
* No short-circuit protection
* Support MLCC

■ ORDERING INFORMATION

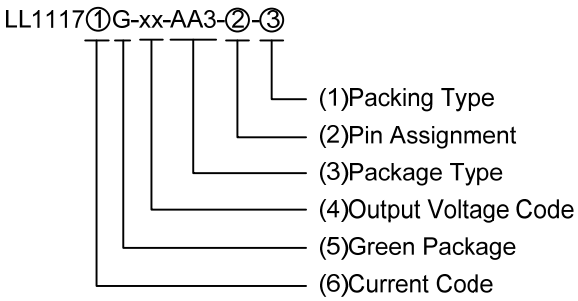
Ordering Number		Package	② Pin Assignment	③ Packing
Lead Free	Halogen Free			
LL1117①L-xx-AA3-②-③	LL1117①G-xx-AA3-②-③	SOT-223		R: Tape Reel T: Tube
LL1117①L-xx-AB3-②-③	LL1117①G-xx-AB3-②-③	SOT-89		
LL1117①L-xx-TA3-②-③	LL1117①G-xx-TA3-②-③	TO-220		
LL1117①L-xx-TF3-②-③	LL1117①G-xx-TF3-②-③	TO-220F		
LL1117①L-xx-TN3-②-③	LL1117①G-xx-TN3-②-③	TO-252		
LL1117①L-xx-TND-②-③	LL1117①G-xx-TND-②-③	TO-252D		
LL1117①L-xx-T2Q-②-③	LL1117①G-xx-T2Q-②-③	TO-262		
LL1117①L-xx-TQ2-②-③	LL1117①G-xx-TQ2-②-③	TO-263		
LL1117①L-xx-TQ3-②-③	LL1117①G-xx-TQ3-②-③	TO-263-3		
LL1117①L-xx-AE3-②-③	LL1117①G-xx-AE3-②-③	SOT-23		
LL1117①L-xx-AE5-②-③	LL1117①G-xx-AE5-②-③	SOT-23-5		
LL1117①L-xx-AF5-②-③	LL1117①G-xx-AF5-②-③	SOT-25		
LL1117①L-xx-S08-③	LL1117①G-xx-S08-③	SOP-8	GOOIxOOx	
LL1117①L-xx-SH2-③	LL1117①G-xx-SH2-③	HSOP-8	GOOIxOOx	
LL1117①L-xx-P5060-A-R	LL1117①G-xx-P5060-A-R	PDFN5×6	GGGIOOOO	Tape Reel

Pin Code	1	2	3
A	G	O	I
B	O	G	I
C	G	I	O
D	I	G	O

Pin Code	1	2	3
1	G	I	O

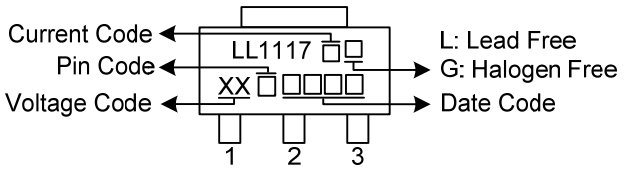
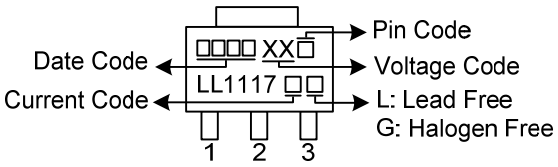
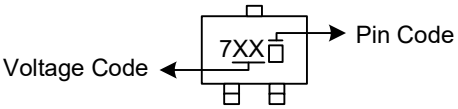
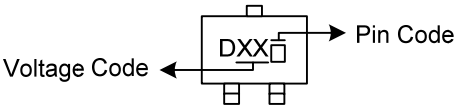
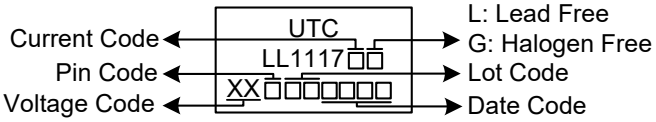
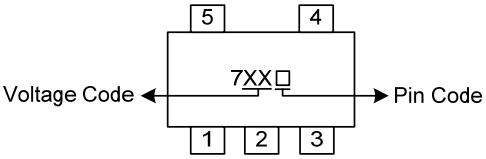
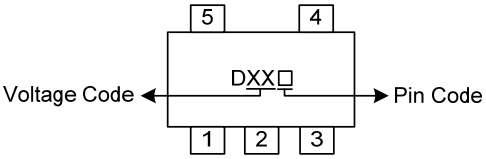
Pin Code	1	2	3	4	5
G	G	O	I	N	N

Notes: 1. ① : Current code: Blank: 800mA A: 1A
2. Pin Assignment: I: V_{IN} O: V_{OUT} G: GND/ADJ
3. xx: Output Voltage, Refer to Marking Information.



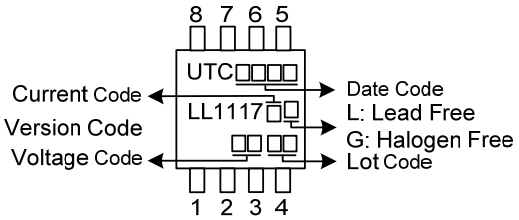
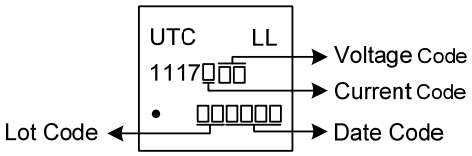
(1) R: Tape Reel, T: Tube
(2) refer to Pin Assignment
(3) AA3: SOT-223, AB3: SOT-89, AE3: SOT-23
TA3:TO-220, TF3: TO-220F, TN3: TO-252,
TND: TO-252D, T2Q: TO-262, TQ2: TO-263,
TQ3: TO-263-3, AE5: SOT-23-5, AF5: SOT-25,
S08: SOP-8, SH2: HSOP-8, P5060: PDFN5×6
(4) xx: refer to Marking Information
(5) G: Halogen Free and Lead Free, L: Lead Free
(6) Blank: 800mA, A: 1A

■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	12 :1.2V 15 :1.5V 18 :1.8V 25 :2.5V 30 :3.0V 33 :3.3V 50 :5.0V AD :ADJ	
SOT-89		
SOT-23 (LL1117)		
SOT-23 (LL1117A)		
TO-220 TO-220F TO-252 TO-252D TO-262 TO-263 TO-263-3		
SOT-23-5 SOT-25 (LL1117)		
SOT-23-5 SOT-25 (LL1117A)		

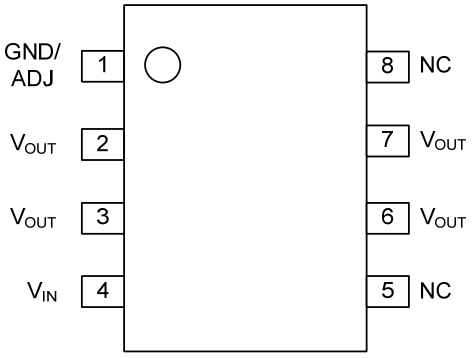
Note: Current code: Blank: 0.8A A: 1A

■ MARKING INFORMATION (Cont.)

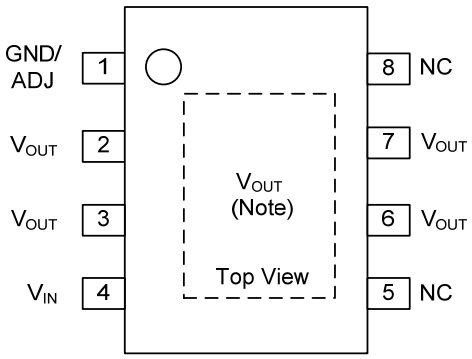
PACKAGE	VOLTAGE CODE	MARKING
SOP-8 HSOP-8	12 :1.2V 15 :1.5V 18 :1.8V 25 :2.5V 30 :3.0V 33 :3.3V 50 :5.0V AD :ADJ	
PDFN5x6		

Note: Current code: Blank: 0.8A A: 1A

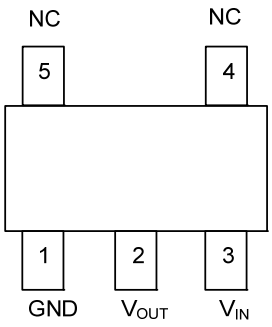
■ PIN CONFIGURATION



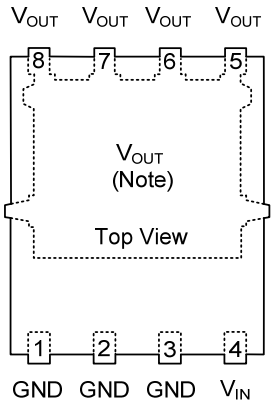
SOP-8



HSOP-8



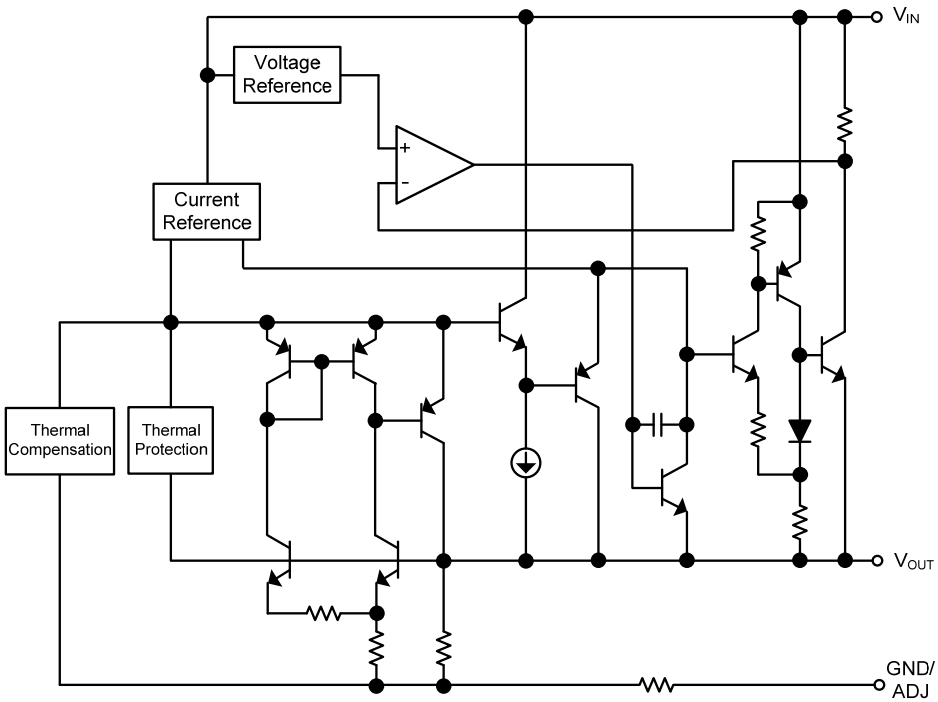
SOT-23-5 / SOT-25



PDFN5×6
(LL1117/A-A)

Note: Connect exposed pad to V_{OUT}.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
DC Input Voltage	V_{IN}	18	V
Power Dissipation	P_D	Internally limited	
Junction Temperature	T_J	+125	°C
Operating Temperature (Note 2)	T_{OPR}	-40 ~ +125	°C
Storage temperature	T_{STG}	-40 ~ +125	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. This condition is only determined from design. It can't be 100% tested in mass production.

■ RECOMMENDED OPERATING RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	15	V

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-89	θ_{JA}	180	°C/W
	SOT-223		165	°C/W
	SOT-23		300	°C/W
	SOT-23-5/SOT-25		280	°C/W
	SOP-8/HSOP-8		150	°C/W
	TO-252/TO-252D		112	°C/W
	TO-220		54	°C/W
	TO-262/TO-263		64	°C/W
	PDFN5×6		38	°C/W
Junction to Case	SOT-89	θ_{JC}	50	°C/W
	SOT-223		15	°C/W
	SOT-23		120	°C/W
	SOT-23-5/SOT-25		90	°C/W
	SOP-8/HSOP-8		20	°C/W
	TO-252/TO-252D		12	°C/W
	TO-220/TO-262 TO-263		4	°C/W
	PDFN5×6		15.6	°C/W

■ ELECTRICAL CHARACTERISTICS

(T_A=25°C, refer to the test circuits, C_O=10μF unless otherwise specified)

For LL1117/A-1.2

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	V_{IN}=3.2V, I_{OUT}=10mA, T_J=25°C		1.176	1.200	1.224	V
Output Voltage	V_{OUT}	V_{IN}=2.7 to 8V LL1117 : I_{OUT}=10~800mA LL1117A : I_{OUT}=10~1000mA		1.176	1.200	1.224	V
Line Regulation	ΔV_{OUT}	V_{IN}=2.7 to 8V, I_{OUT}=10mA				10	mV
Load Regulation	ΔV_{OUT}	V_{IN}=2.7V, I_{OUT}=10~800mA				10	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤10V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=6.2V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

For LL1117/A-1.5

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	V_{IN}=3.5V, I_{OUT}=10mA, T_J=25°C		1.470	1.500	1.530	V
Output Voltage	V_{OUT}	V_{IN}=3 to 8V LL1117 : I_{OUT}=0~800mA LL1117A : I_{OUT}=0~1000mA		1.470	1.500	1.530	V
Line Regulation	ΔV_{OUT}	V_{IN}=3 to 8V, I_{OUT}=0mA				15	mV
Load Regulation	ΔV_{OUT}	V_{IN}=3V, I_{OUT}=0~800mA				10	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤10V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=6.5V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

For LL1117/A-1.8

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	V_{IN}=3.8V, I_{OUT}=10mA, T_J=25°C		1.764	1.800	1.836	V
Output Voltage	V_{OUT}	V_{IN}=3.3 to 8V LL1117 : I_{OUT}=0~800mA LL1117A : I_{OUT}=0~1000mA		1.764	1.800	1.836	V
Line Regulation	ΔV_{OUT}	V_{IN}=3.3 to 8V, I_{OUT}=0mA				15	mV
Load Regulation	ΔV_{OUT}	V_{IN}=3.3V, I_{OUT}=0~800mA				10	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤10V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=6.8V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For LL1117/A-2.5

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	V_{IN}=4.5V, I_{OUT}=10mA, T_J=25°C		2.450	2.500	2.550	V
Output Voltage	V_{OUT}	V_{IN}=3.9 to 10V LL1117 : I_{OUT}=0~800mA LL1117A : I_{OUT}=0~1000mA		2.450	2.500	2.550	V
Line Regulation	ΔV_{OUT}	V_{IN}=3.9 to 10V, I_{OUT}=0mA				20	mV
Load Regulation	ΔV_{OUT}	V_{IN}=3.9V, I_{OUT}=0~800mA				10	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤10V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=7.5V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

For LL1117/A-3.0

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	V_{IN}=5V, I_{OUT}=10mA, T_J=25°C		2.940	3.000	3.060	V
Output Voltage	V_{OUT}	V_{IN}=4.5 to 10V LL1117 : I_{OUT}=0~800mA LL1117A : I_{OUT}=0~1000mA		2.940	3.000	3.060	V
Line Regulation	ΔV_{OUT}	V_{IN}=4.5 to 12V, I_{OUT}=0mA				20	mV
Load Regulation	ΔV_{OUT}	V_{IN}=4.5V, I_{OUT}=0~800mA				10	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤15V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=8V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

For LL1117/A-3.3

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	V_{IN}=5.3V, I_{OUT}=10mA, T_J=25°C		3.234	3.300	3.366	V
Output Voltage	V_{OUT}	V_{IN}=4.75 to 10V LL1117 : I_{OUT}=0~800mA LL1117A : I_{OUT}=0~1000mA		3.234	3.300	3.366	V
Line Regulation	ΔV_{OUT}	V_{IN}=4.75 to 15V, I_{OUT}=0mA				25	mV
Load Regulation	ΔV_{OUT}	V_{IN}=4.75V, I_{OUT}=0~800mA				15	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤15V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=8.3V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For LL1117/A-5.0

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	V_{IN}=7V, I_{OUT}=10mA, T_J=25°C		4.900	5.000	5.100	V
Output Voltage	V_{OUT}	V_{IN}=6.5 to 15V LL1117 : I_{OUT}=0~800mA LL1117A : I_{OUT}=0~1.0A		4.900	5.000	5.100	V
Line Regulation	ΔV_{OUT}	V_{IN}=6.5 to 15V, I_{OUT}=0mA				30	mV
Load Regulation	ΔV_{OUT}	V_{IN}=6.5V, I_{OUT}=0~800mA				20	mV
Operating Input Voltage	V_{IN}	I_{OUT}=100mA				15	V
Quiescent Current	I_Q	V_{IN}≤15V				10	mA
Current Limit	I_{LIMIT}	V_{IN}=10V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

For LL1117/A-ADJ

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Voltage	V_{REF}	V_{IN}-V_{OUT}=2V, I_{OUT}=10mA, T_J=25°C		1.225	1.25	1.275	V
Reference Voltage	V_{REF}	V_{IN}-V_{OUT}=1.4 to 10V LL1117 : I_{OUT}=10~800mA LL1117A : I_{OUT}=10~1000mA		1.225	1.25	1.275	V
Line Regulation	ΔV_{OUT}	V_{IN}-V_{OUT}=1.5 to 13.75V, I_{OUT}=10mA				30	mV
Load Regulation	ΔV_{OUT}	V_{IN}-V_{OUT}=3V LL1117 : I_{OUT}=10~800mA LL1117A : I_{OUT}=10~1000mA				30	mV
Operating Input Voltage	V_{IN}					15	V
Adjustment Pin Current	I_{ADJ}	V_{IN}≤15V			70	120	μA
Adjustment Pin Current Change	ΔI_{ADJ}	V_{IN}-V_{OUT}=1.4 to 10V, LL1117 : I_{OUT}=10~800mA LL1117A : I_{OUT}=10~1000mA			1	5	μA
Minimum Load Current	$I_{O(MIN)}$	V_{IN}=15V				10	mA
Current Limit	I_{LIMIT}	V_{IN}-V_{OUT}=5V, T_J=25°C	LL1117	800			mA
			LL1117A	1000			
Dropout Voltage	V_D	I_{OUT}=100mA				1.25	V
		I_{OUT}=500mA				1.30	V
		I_{OUT}=800mA				1.35	V
		I_{OUT}=1A				1.40	V

■ TYPICAL APPLICATIONS

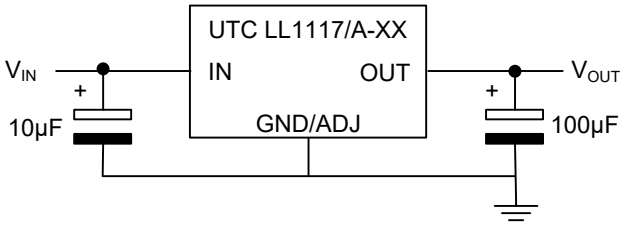


Fig.1 Tyncal Application Circuit

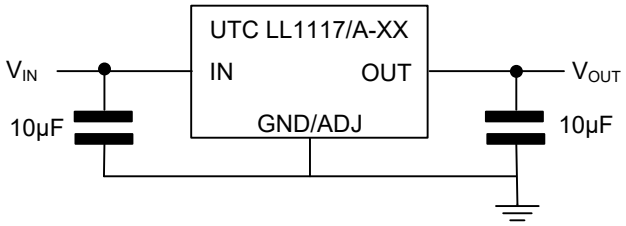


Fig.2 Tyncal Application Circuit (FOR MLCC)

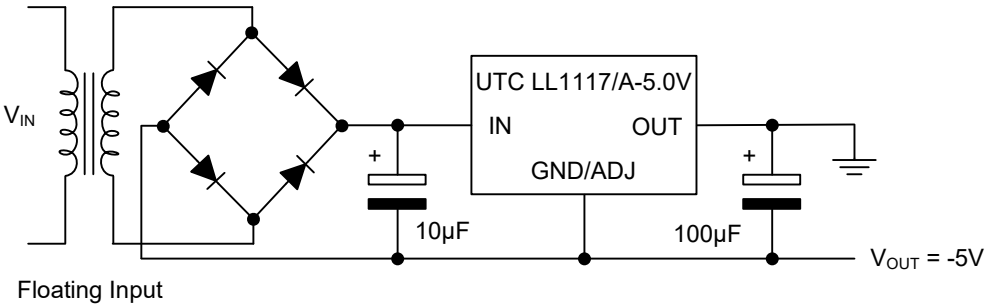


Fig.3 Negative Supply

■ TYPICAL APPLICATIONS (Cont.)

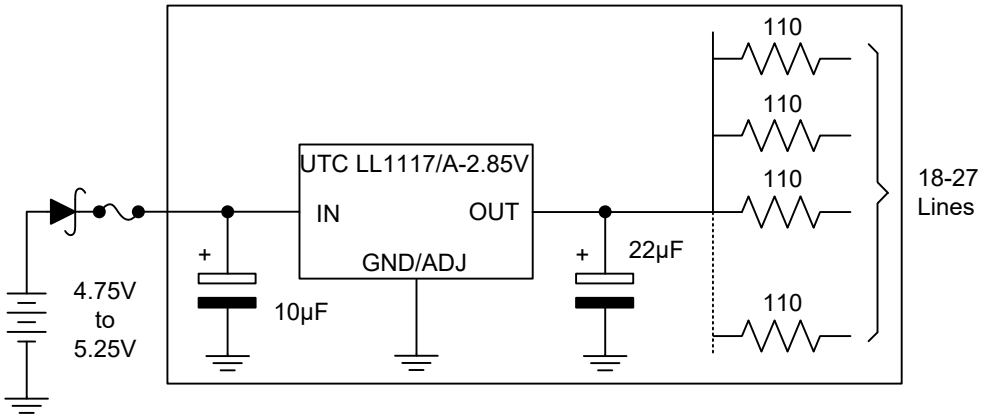


Fig.4 Active Terminator for SCSI-2 BUS

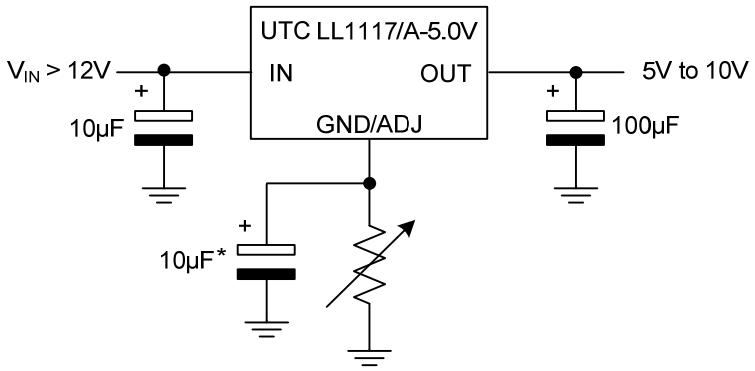


Fig.5 Circuit for Increasing Output Voltage

■ APPLICATION NOTE

The **LL1117/A** adjustable has a reference voltage of between the OUT and ADJ/GND pins. I_{ADJ} is 60μA typ. (120μA max.) and ΔI_{ADJ} is 1μA typ. (5μA max.).

R_1 is normally fixed to 120Ω.

From figure 1 we obtain:

$V_{OUT}=V_{REF}+R_2(I_{ADJ}+I_{R1})=V_{REF} + R_2(I_{ADJ}+V_{REF}/R_1)=V_{REF}(1+R_2/R_1) + R_2 \times I_{ADJ}$.

Usually R_2 value is in the range of few KΩ, so the R_2 X I_{ADJ} product could be neglected; then the above expression becomes: $V_{OUT}=V_{REF}(1+R_2/R_1)$

For better load regulation, realize a good Kelvin connection of R_1 and R_2 is important. Particularly R_1 connection must be realized very close to OUT and ADJ/GND pin, while R_2 ground connection must be placed as near as possible to the negative Load pin. Ripple rejection can be improved by introducing a 10μF electrolytic capacitor placed in parallel to the R_2 resistor (See Fig. 3)

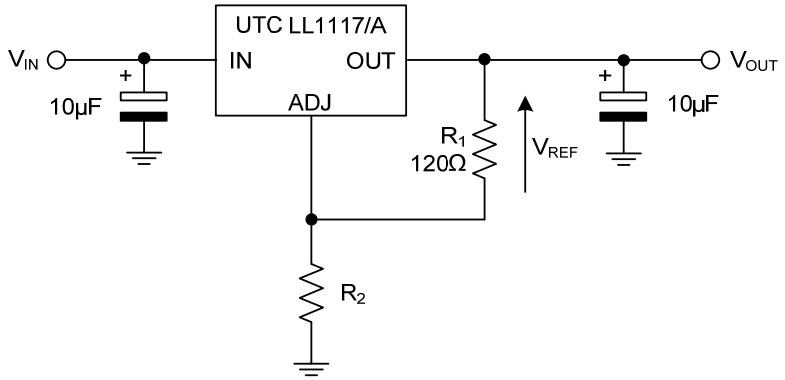


Fig.1 Adjustable Output Voltage Application Circuit

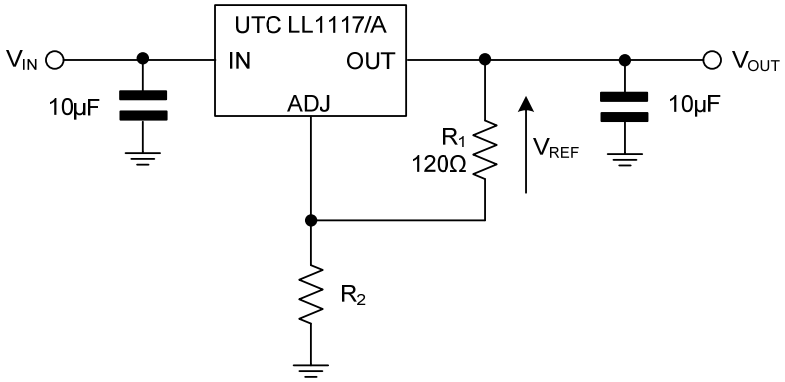


Fig.2 Adjustable Output Voltage Application Circuit (FOR MLCC)

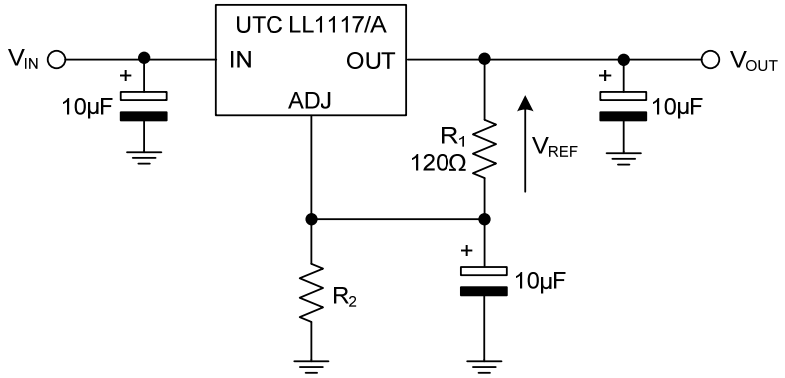
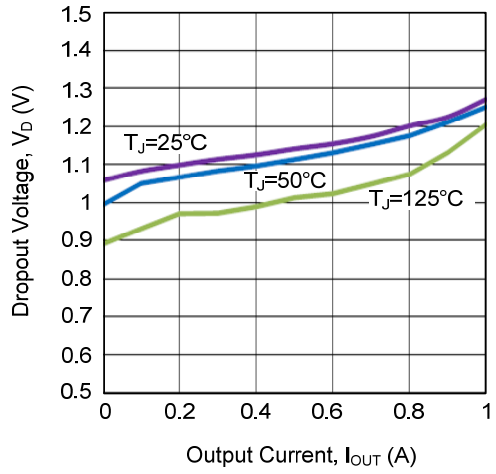


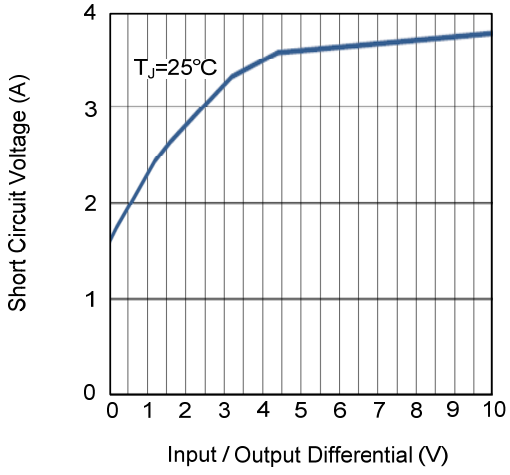
Fig.3 Adjustable Output Voltage Application with improved Ripple Rejection.

■ TYPICAL CHARACTERISTICS

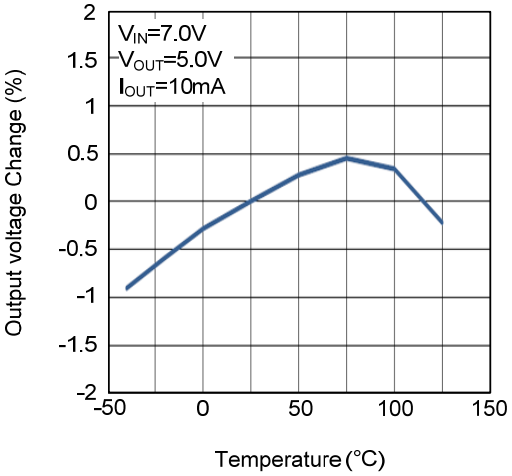
Dropout Voltage (V_{IN}-V_{OUT})



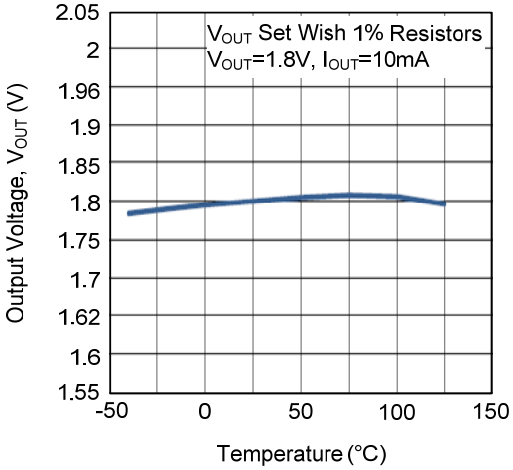
Short-Circuit Current



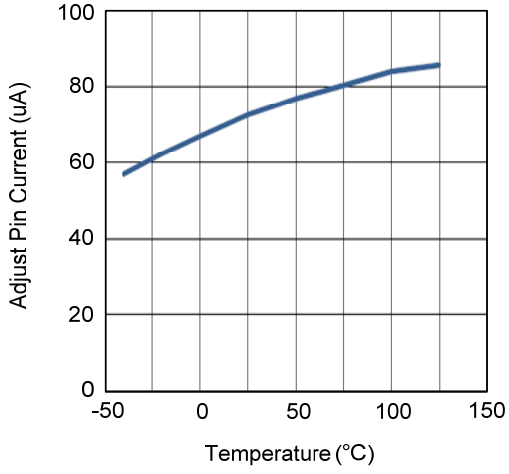
Temperautre Stability



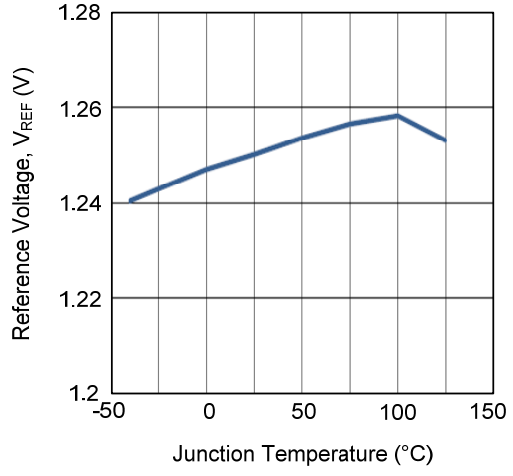
Output Voltage vs. Temperature



Adjust Pin Current

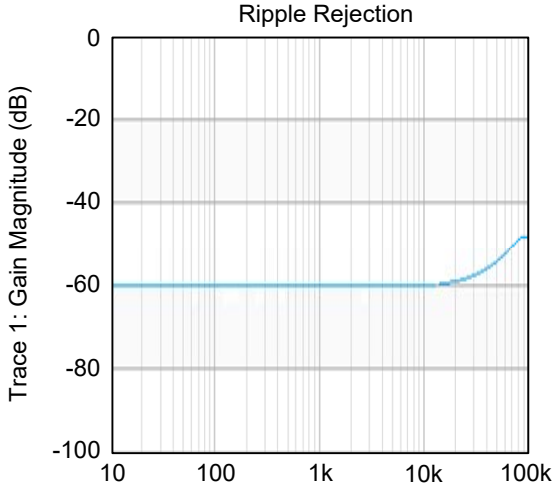


Reference Voltge vs. Temperature

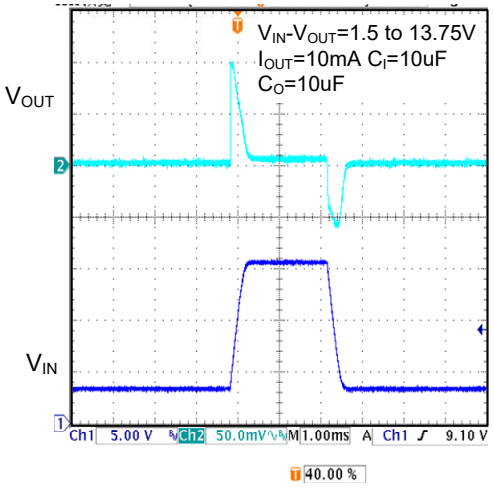


■ TYPICAL CHARACTERISTICS (Cont.)

Ripple Rejection



Line Transient Response



Load Transient Response