BL1117

1A Bipolar Linear Regulator

Description

BL1117 is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. BL1117 features a very low standby current 2mA compared to 5mA of competitor.

Other than a fixed version, V_{OUT} = 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5V, and 12V, BL1117 has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

BL1117 offers thermal shut down and current limit functions, to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within ±2%. Other output voltage accuracy can be customized on demand, such as ±1%.

BL1117 is available in SOT223, TO252-2 power package.

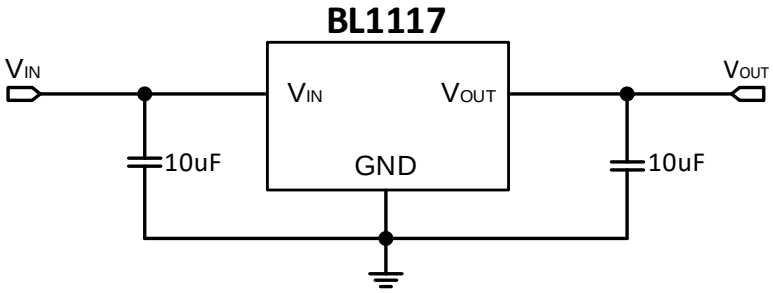
Features

- Other than a fixed version and an adjustable version, output value can be customized on demand.
- Maximum output current is 1A
- Range of operation input voltage: Max 18V
- Standby current: 2mA (typ.)
- Line regulation: 0.1%/V (typ.)
- Load regulation: 10mV (typ.)
- Environment temperature: -40℃~ +125℃
- Compatible with tantalum capacitor, electrolytic capacitor and MLCC

Applications

- Power management for computer mother board, graphic card
- BLD monitor and BLD TV
- DVD decoder board
- ADSL modem
- Post regulators for switching supplies

Typical Application Circuit

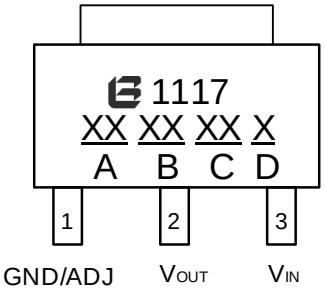


Ordering Information

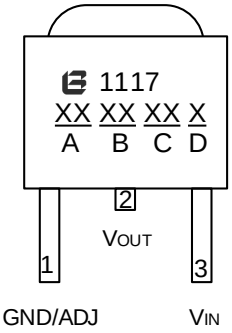
BL1117 XX X X

- Package
  X: SOT223
  Y: TO252-2
- Temp. Range & Rohs Std
  A: 125℃ & Pb-free Rohs Std,
  Output voltage accuracy within ±1%
  C: 125℃ & Pb-free Rohs Std,
  Output voltage accuracy within ±2%
- Output voltage
  12: 1.2V
  15: 1.5V
  18: 1.8V
  25: 2.5V
  33: 3.3V
  50: 5.0V
  Default: Adjustable Version

Pin Configuration



SOT223



TO252-2

Pin No.	Symbol	Function
1	GND/ADJ	Ground/ Adjustable
2	V_{OUT}	Output
3	V_{IN}	Input

A: Means assembly year and week

Year	2020	2021	2022	2023	…
Y	0	1	2	3	…

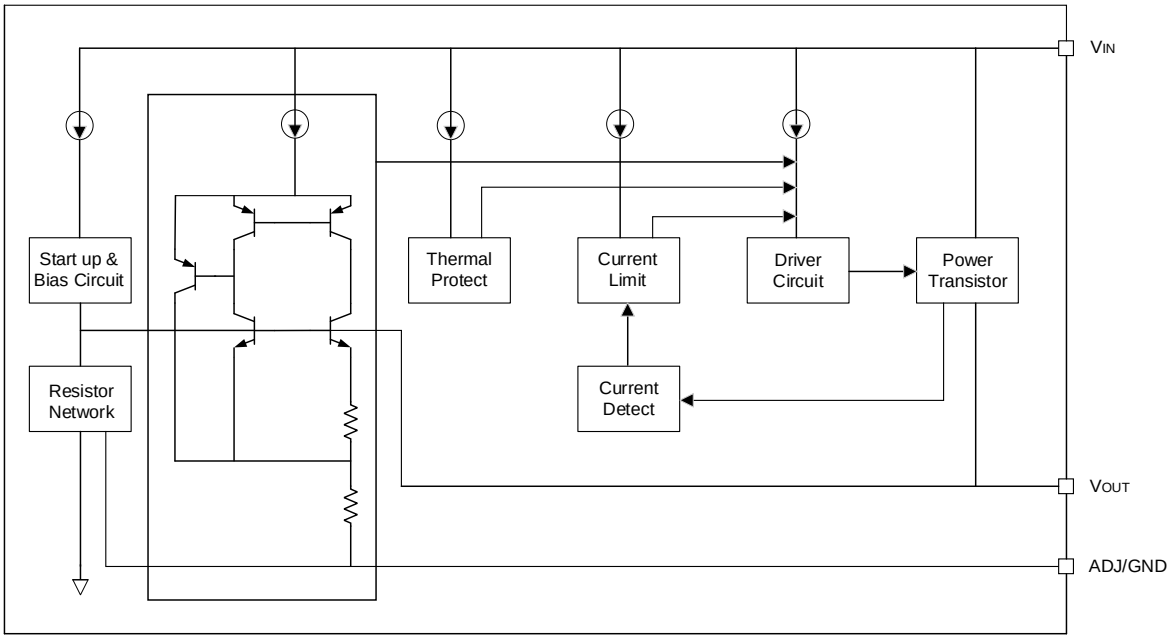
Week	1	2	…	26	27	…	52	53
W	A	B	…	Z	$\overline{A}$	…	$\overline{Z}$	A

B： Means Manufacture LOT No.

C： Means Output Voltage Value

D： Means Temp. Range & Rohs Std.

Block Diagram



Absolute Maximum Rating

Parameter		Value	Unit
Maximum input voltage		18	V
Maximum operating junction temperature (T_J)		150	°C
Ambient temperature (T_A)		-40 ~ +125	°C
Power Dissipation (P_D)	SOT223	1.78	W
	TO252-2	2.23	
Thermal resistance (θ_{JA}) (Junction to ambient)	SOT223	70	°C/W
	TO252-2	56	
Storage temperature		-40 ~ +150	°C
Lead temperature & time		260°C, 10s	

Note:

1. Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product.
2. The maximum allowable power dissipation is a function of the maximum junction temperature $T_{J(MAX)}$, the junction-to-ambient thermal resistance θ_{JA}, and the ambient temperature T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by $P_{D(MAX)}=(T_{J(MAX)}-T_A)/\theta_{JA}$.
3. The θ_{JA} values given in this table are for comparison with other packages only and cannot be used for design purposes. They do not represent the performance achieved in real-world applications.

Recommended Work Conditions

Parameter	Min	Max	Unit
Input voltage range		16	V
Operating ambient temperature(T_A)	-40	125	°C

Note: Exceptional for BL1117-12V, the maximum input voltage for BL1117-12V is 20V.

Electrical Characteristics

T_A=25℃

Parameter	Symbol	Conditions	Min	Typ.	Max	Units
Reference voltage	V_{REF}	BL1117-ADJ 10mA≤I_{OUT}≤1A, V_{IN}=3.25V	1.225	1.25	1.275	V
Output voltage	V_{OUT}	BL1117-1.2V 0≤I_{OUT}≤1A, V_{IN}=3.2V	1.176	1.2	1.224	V
		BL1117-1.5V 0≤I_{OUT}≤1A, V_{IN}=3.5V	1.47	1.5	1.53	V
		BL1117-1.8V 0≤I_{OUT}≤1A, V_{IN}=3.8V	1.764	1.8	1.836	V
		BL1117-2.5V 0≤I_{OUT}≤1A, V_{IN}=4.5V	2.45	2.5	2.55	V
		BL1117-3.3V 0≤I_{OUT}≤1A, V_{IN}=5.3V	3.234	3.3	3.366	V
		BL1117-5.0V 0≤I_{OUT}≤1A, V_{IN}=7.0V	4.9	5	5.1	V
		BL1117-12.0V 0≤I_{OUT}≤1A, V_{IN}=14V	11.76	12	12.24	V
Line regulation	ΔV_{OUT}	BL1117-1.2V I_{OUT}=10mA, 2.7V≤V_{IN}≤10V		0.1	0.2	%/V
		BL1117-ADJ I_{OUT}=10mA, 2.75V≤V_{IN}≤12V		0.1	0.2	%/V
		BL1117-1.5V I_{OUT}=10mA, 3.0V≤V_{IN}≤12V		0.1	0.2	%/V
		BL1117-1.8V I_{OUT}=10mA, 3.3V≤V_{IN}≤12V		0.1	0.2	%/V
		BL1117-2.5V I_{OUT}=10mA, 4.0V≤V_{IN}≤12V		0.1	0.2	%/V
		BL1117-3.3V I_{OUT}=10mA, 4.8V≤V_{IN}≤12V		0.1	0.2	%/V
		BL1117-5.0V I_{OUT}=10mA, 6.5V≤V_{IN}≤12V		0.1	0.2	%/V
		BL1117-12.0V I_{OUT}=10mA, 13.5V≤V_{IN}≤20V		0.1	0.2	%/V

Electrical Characteristics continued

T_A=25℃

Parameter	Symbol	Conditions	Min	Typ.	Max	Units
Load regulation	ΔV_{OUT}	BL1117-1.2V		10	30	mV
		V_{IN}=2.7V, 10mA≤I_{OUT}≤1A				
		BL1117-ADJ		10	30	mV
		V_{IN}=2.75V, 10mA≤I_{OUT}≤1A				
		BL1117-1.5V		10	30	mV
		V_{IN}=3.0V, 10mA≤I_{OUT}≤1A				
		BL1117-1.8V		10	30	mV
		V_{IN}=3.3V, 10mA≤I_{OUT}≤1A				
		BL1117-2.5V		10	30	mV
		V_{IN}=4.0V, 10mA≤I_{OUT}≤1A				
		BL1117-3.3V		10	30	mV
		V_{IN}=4.8V, 10mA≤I_{OUT}≤1A				
		BL1117-5.0V		10	30	mV
		V_{IN}=6.5V, 10mA≤I_{OUT}≤1A				
		BL1117-12.0V		10	30	mV
		V_{IN}=13.5V, 10mA≤I_{OUT}≤1A				
V_{DROP}	Dropout voltage	I_{OUT}=100mA		1.23	1.3	V
		I_{OUT}=1A		1.3	1.5	V
I_{LIMIT}	Current limit	V_{IN}-V_{OUT}=2V, T_J=25°C	1			A
SVR	Supply voltage rejection	f=120Hz, V_{IN}−V_{OUT}=3V+1V_{P-P}		60		dB
I_{MIN}	Minimum load current	BL1117-ADJ		2	10	mA
I_Q	Quiescent current	BL1117-1.2V, V_{IN}=10V		2	5	mA
		BL1117-1.5V, V_{IN}=11V		2	5	mA
		BL1117-1.8V, V_{IN}=12V		2	5	mA
		BL1117-2.5V, V_{IN}=12V		2	5	mA
		BL1117-3.3V, V_{IN}=12V		2	5	mA
		BL1117-5.0V, V_{IN}=12V		2	5	mA
		BL1117-12.0V, V_{IN}=20V		2	5	mA
I_{ADJ}	Adjust pin current	BL1117-ADJ		55	120	uA
		V_{IN}=5V, 10mA≤I_{OUT}≤1A				
I_{CHANGE}	I_{ADJ} change	BL1117-ADJ		0.2	10	uA
		V_{IN}=5V, 10mA≤I_{OUT}≤1A				
ΔV/ΔT	Temperature coefficient			±100		ppm/°C

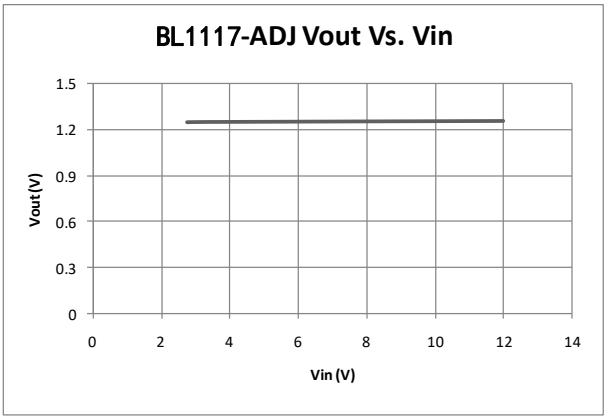
Note:

1. All tests are conducted under ambient temperature 25°C and within a short period of time 20ms.
2. Load current smaller than minimum load current of BL1117-ADJ will lead to unstable or oscillation output.

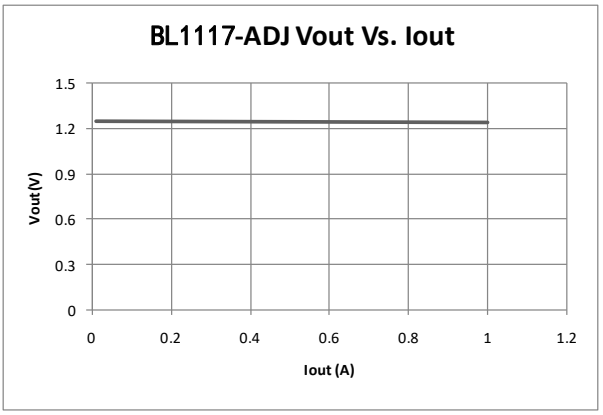
Typical Performance Characteristics

T_A=25℃, unless otherwise specified.

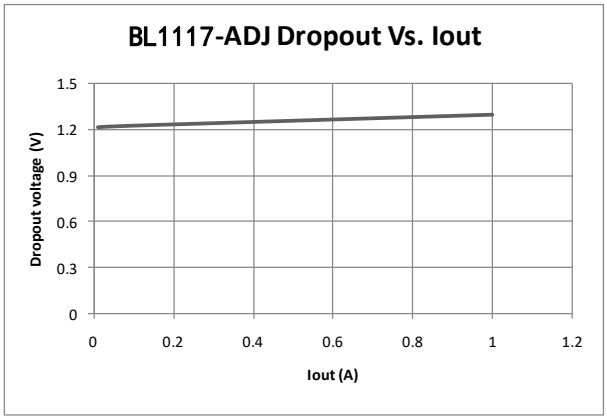
Line Regulation



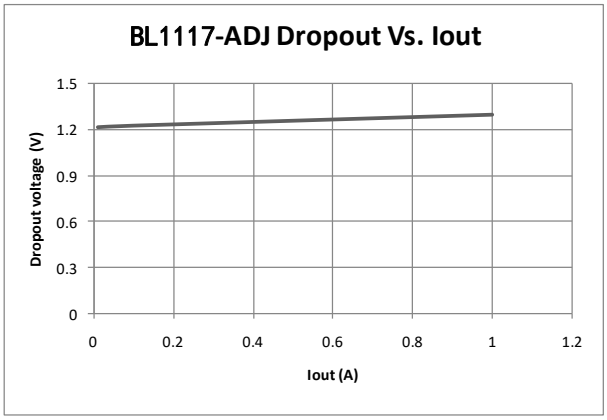
Load Regulation

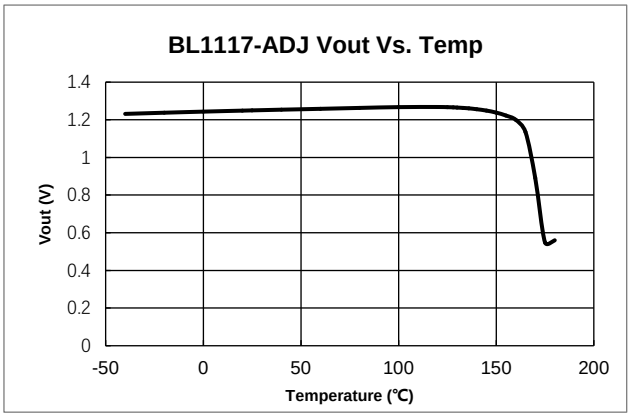


Dropout Voltage



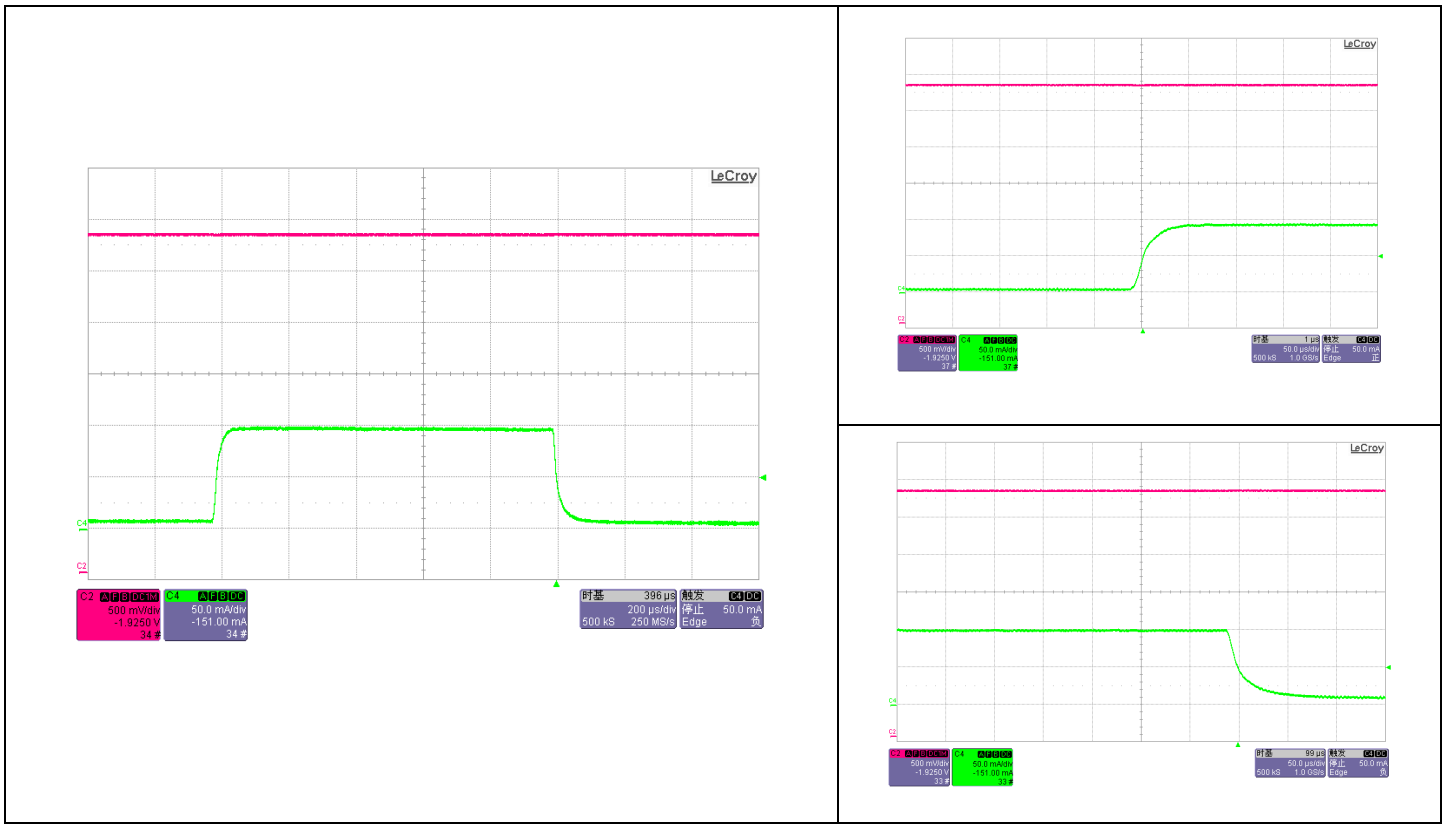
Thermal performance with OTP



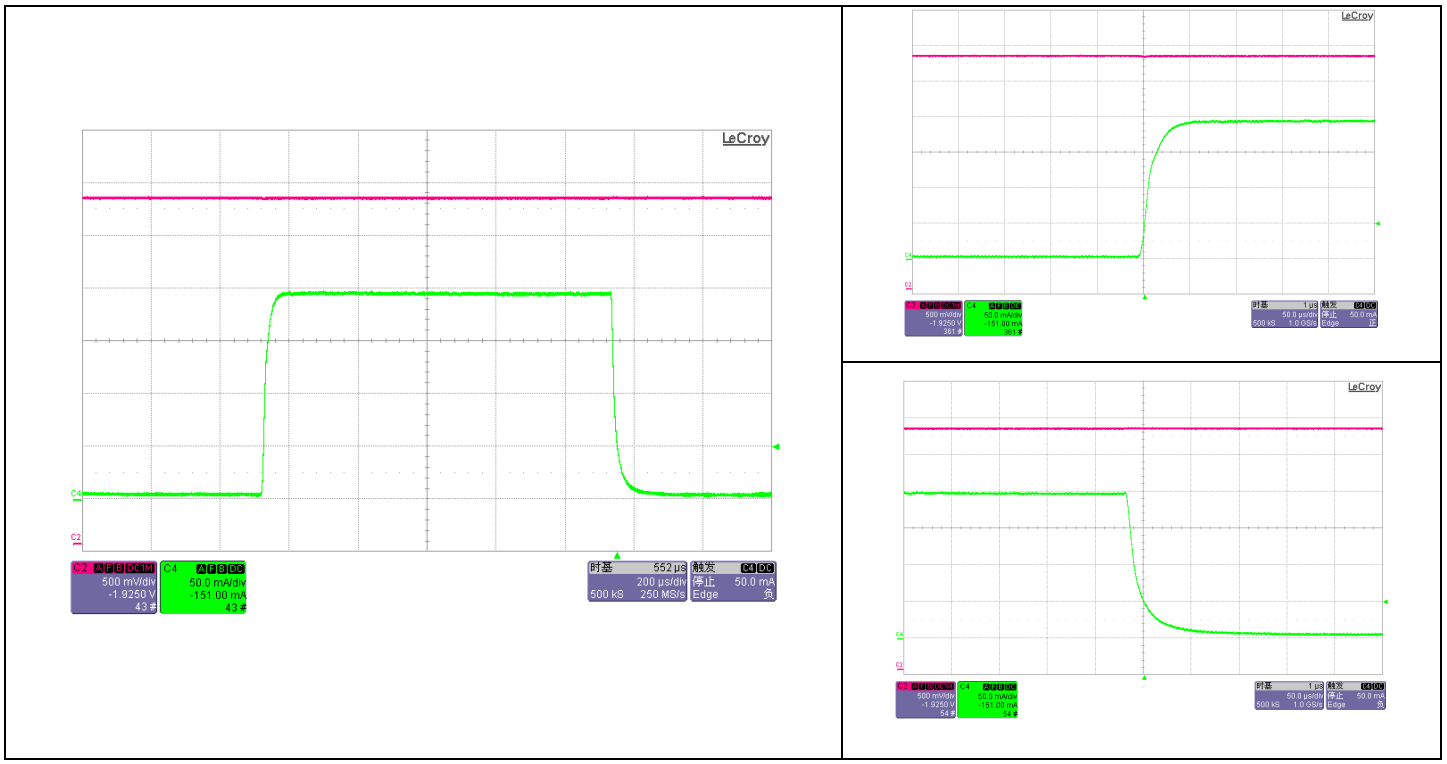


Load Transient Response

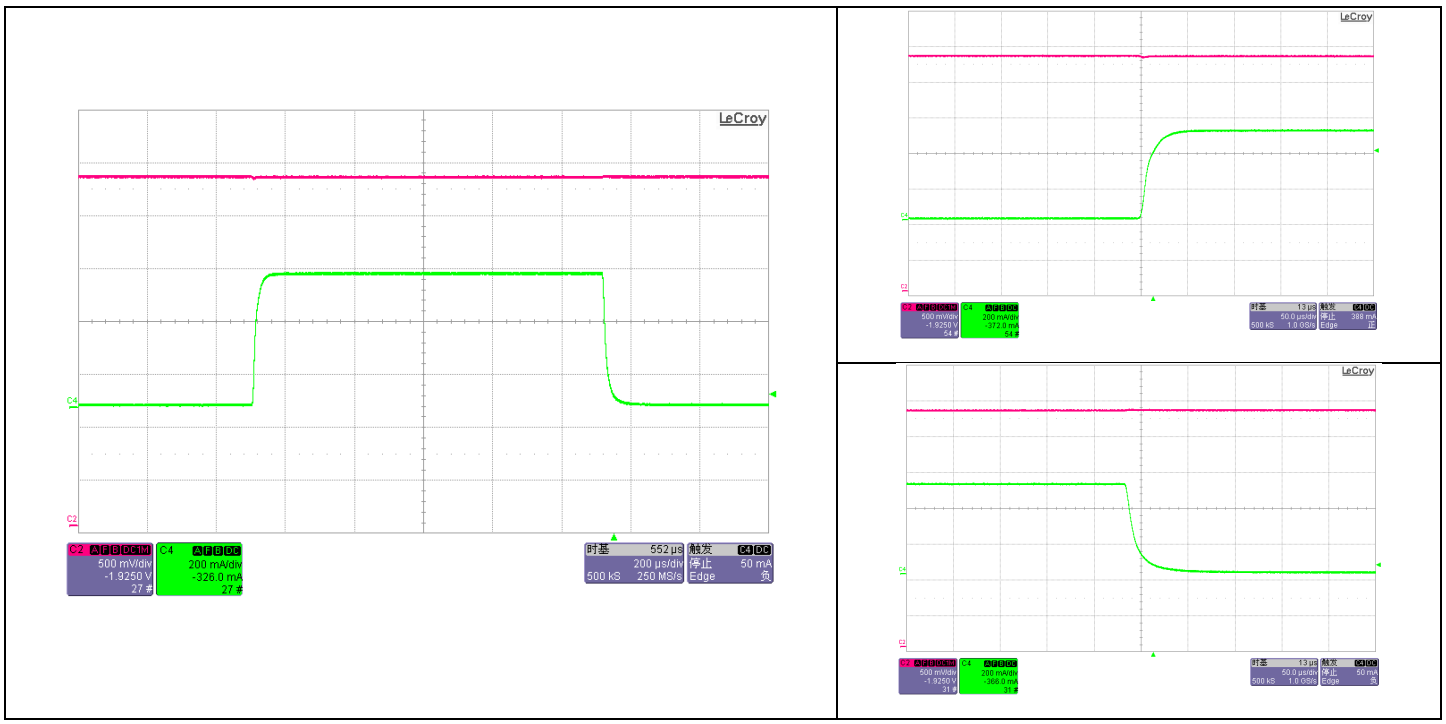
Test Condition: V_{IN}=5V, V_{OUT}=3.3V, C_{IN}=1uF (Ceramic), C_{OUT}=10uF (Ceramic)



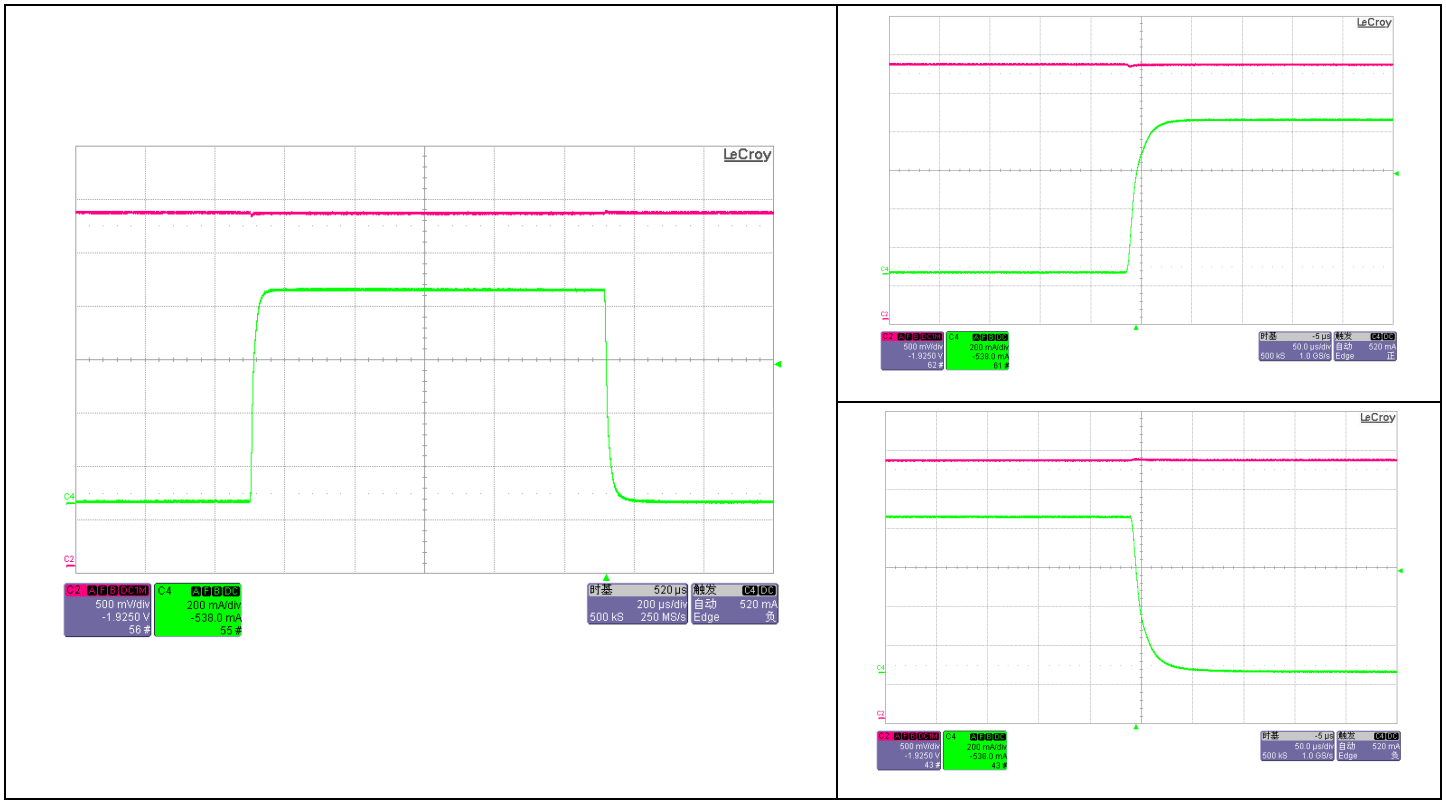
I_{OUT}=10mA~100mA, CH2: Output Voltage (500mV/div, DC), CH4: Output Current (50mA/div)



I_{OUT}=10mA~200mA, CH2: Output Voltage (500mV/div, DC), CH4: Output Current (50mA/div)



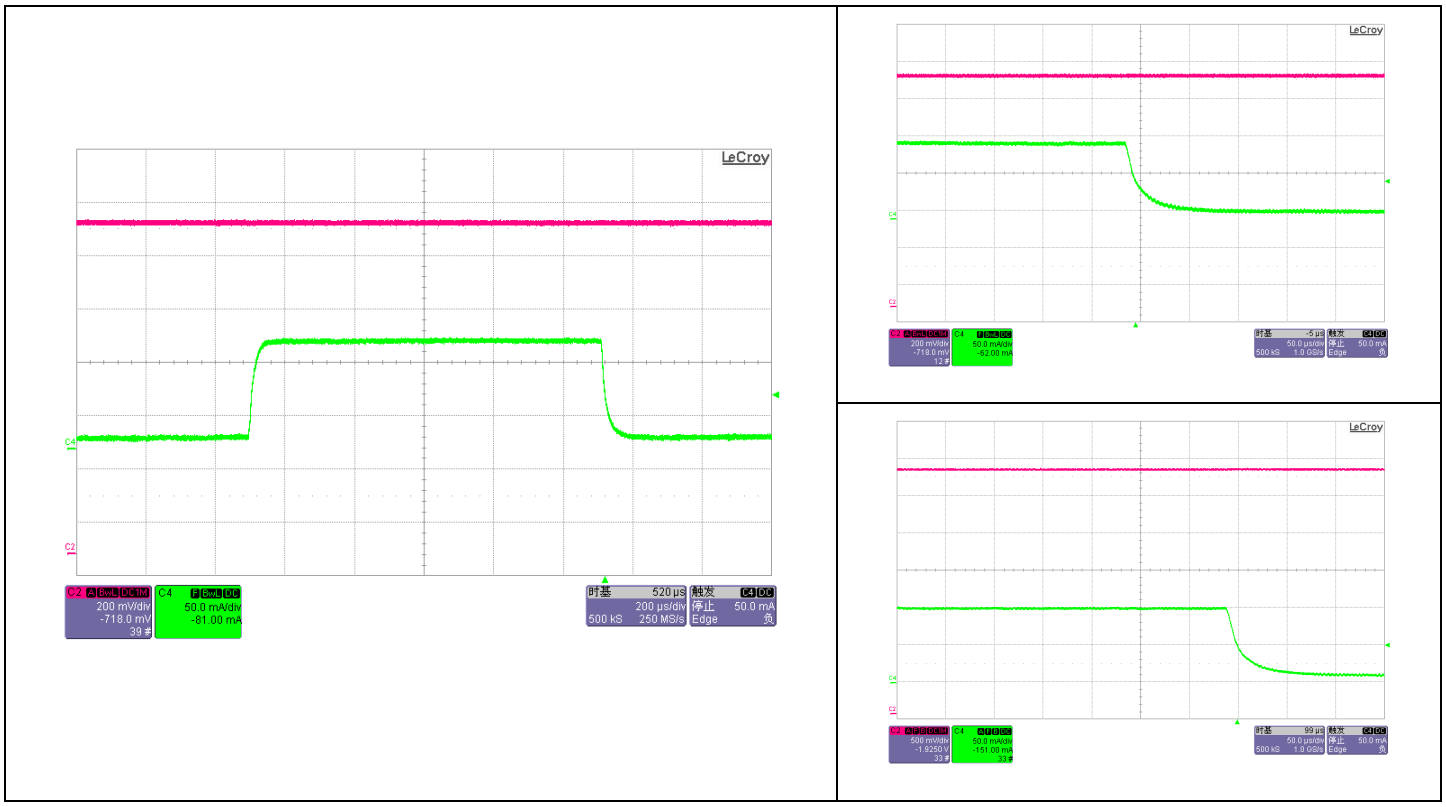
I_{OUT}=10mA~500mA, CH2: Output Voltage (500mV/div, DC), CH4: Output Current (200mA/div)



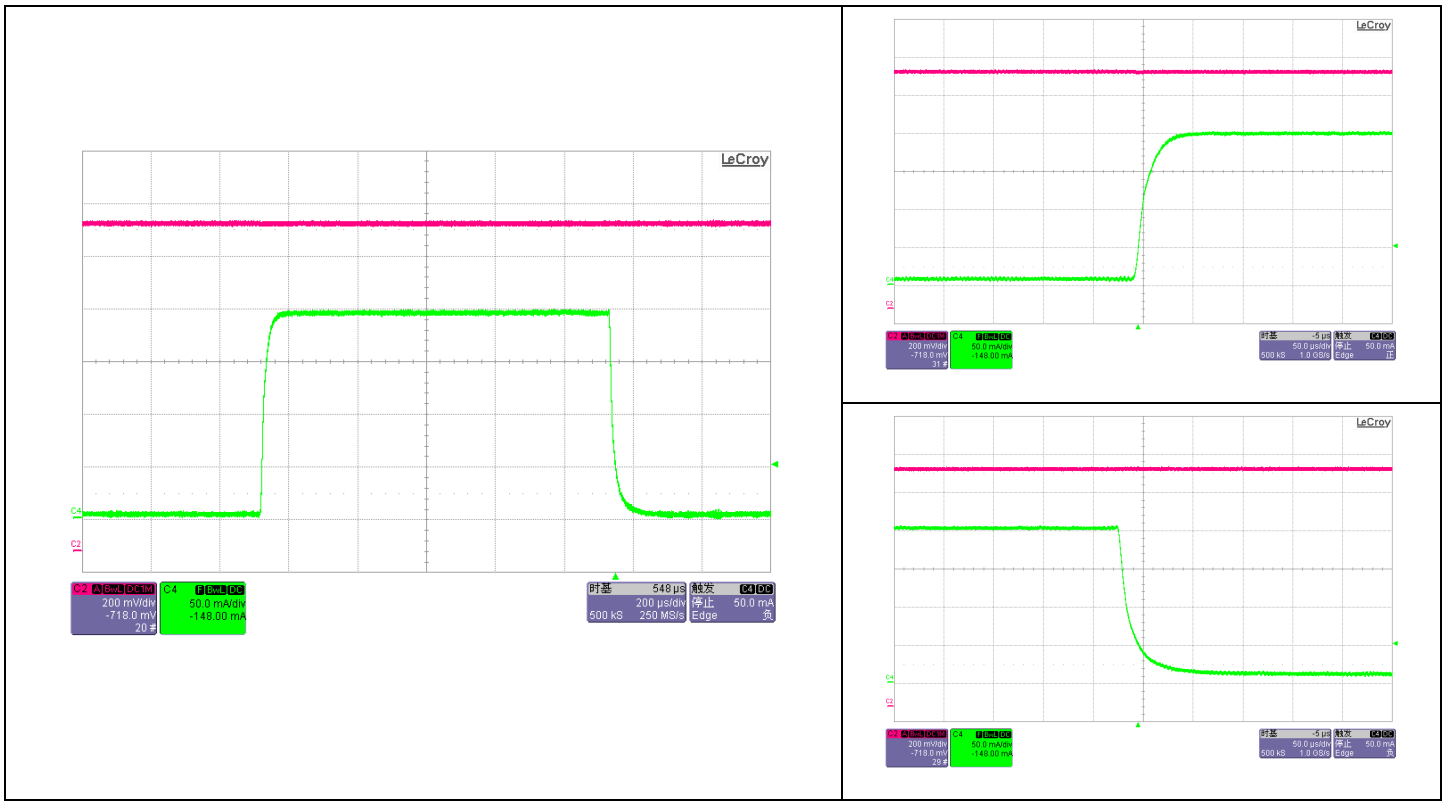
I_{OUT}=10mA~800mA, CH2: Output Voltage (500mV/div, DC), CH4: Output Current (200mA/div)

Load Transient Response

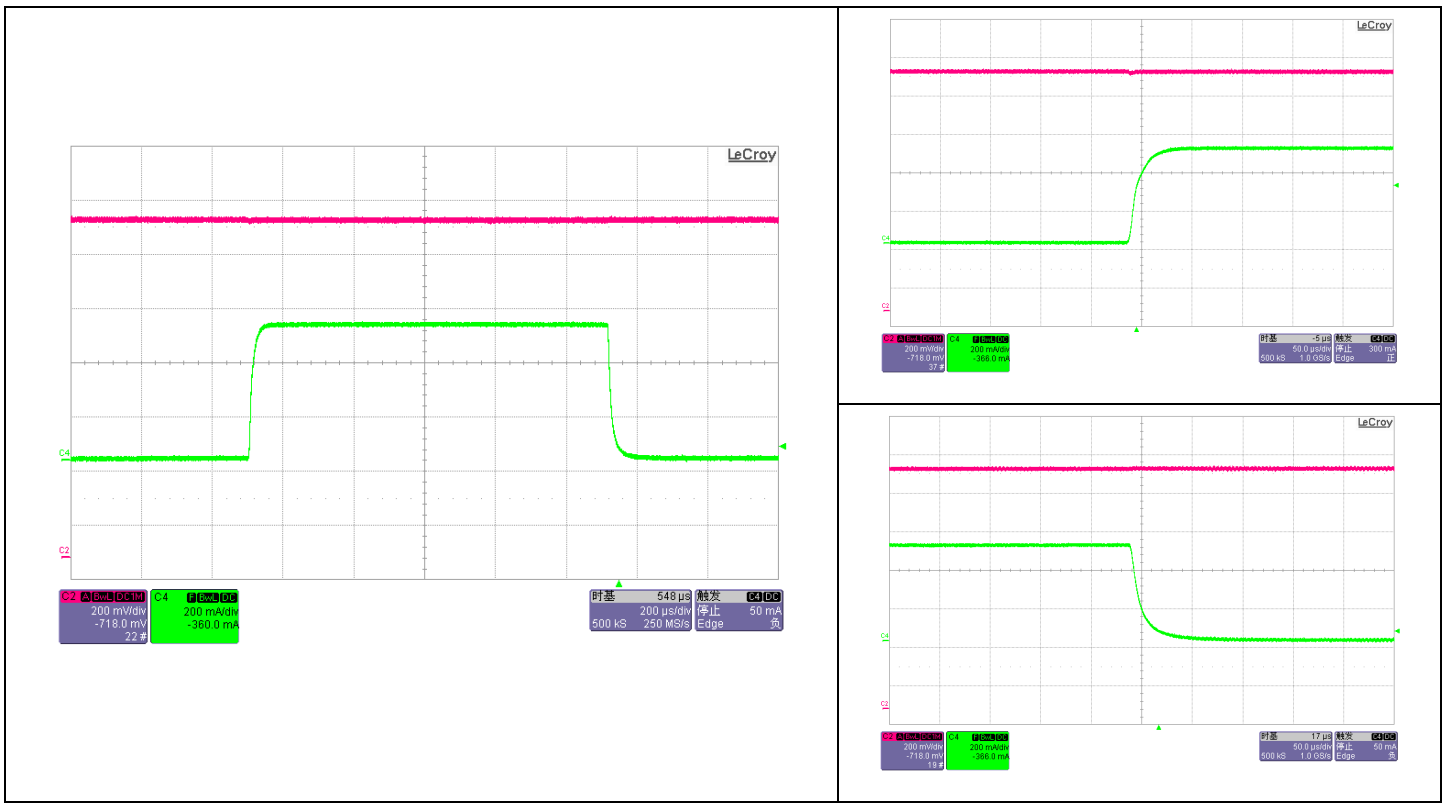
Test Condition: V_{IN}=5V, V_{OUT}=ADJ, C_{IN}=1uF (Ceramic), C_{OUT}=10uF (Ceramic)



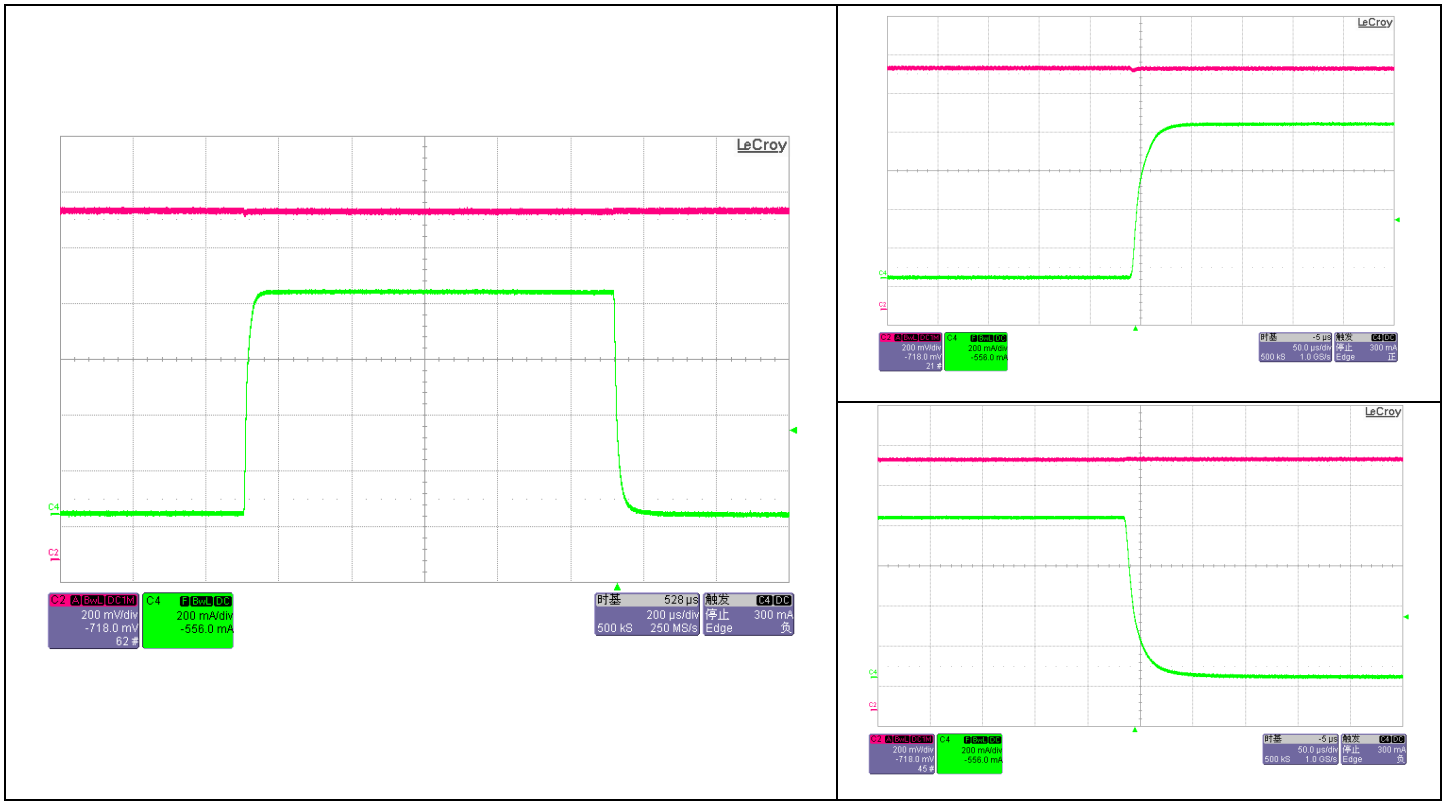
I_{OUT}=10mA~100mA, CH2: Output Voltage (200mV/div, DC), CH4: Output Current (50mA/div)



I_{OUT}=10mA~200mA, CH2: Output Voltage (200mV/div, DC), CH4: Output Current (50mA/div)



I_{OUT}=10mA~500mA, CH2: Output Voltage (200mV/div, DC), CH4: Output Current (200mA/div)



I_{OUT}=10mA~800mA, CH2: Output Voltage (200mV/div, DC), CH4: Output Current (200mA/div)

Detailed Description

BL1117 is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, current limit, power transistors and its driver circuit and so on.

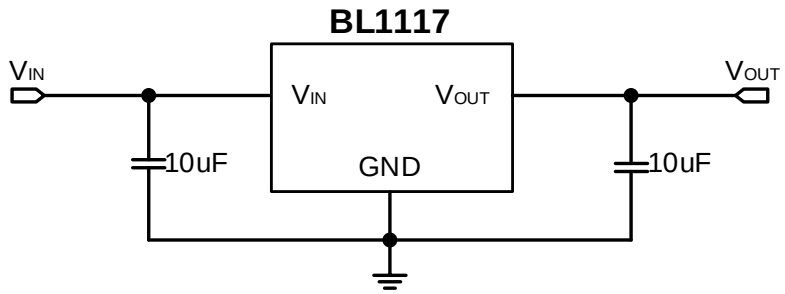
The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140°C.

The bandgap module provides stable reference voltage, whose temperature coefficient is compensated by careful design considerations. The temperature coefficient is under 100 ppm/°C. And the accuracy of output voltage is guaranteed by trimming technique.

Application Information

BL1117 has an adjustable version and seven fixed versions (1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5V and 12V).

Fixed Output Voltage Version

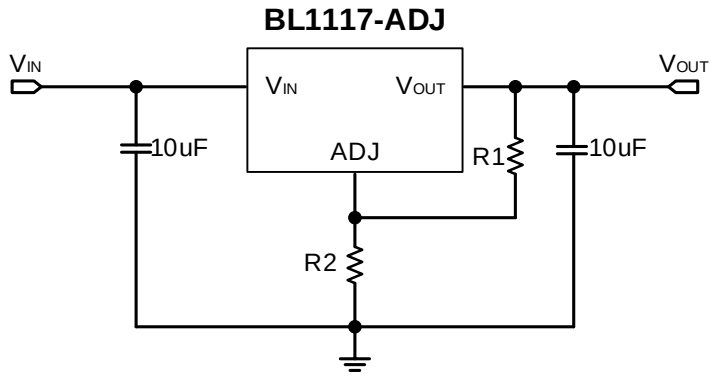


Note:

1. Recommend using 10uF tan capacitor or MLCC capacitor as bypass capacitor (C1) for all application circuit.
2. Recommend using 10uF tan capacitor or MLCC capacitor to assure circuit stability.
3. Capacitor ESR range: 3mΩ~22Ω.

Adjustable Output Voltage Version

BL1117-ADJ provides a 1.25V reference voltage. Any output voltage between 1.25V~12V can be achievable by choosing two external resistors (schematic is shown below), R1 and R2



The output voltage of adjustable version follows the equation:

$$V_{OUT} = 1.25 \times \left(1 + \frac{R2}{R1}\right) + I_{ADJ} \times R2$$

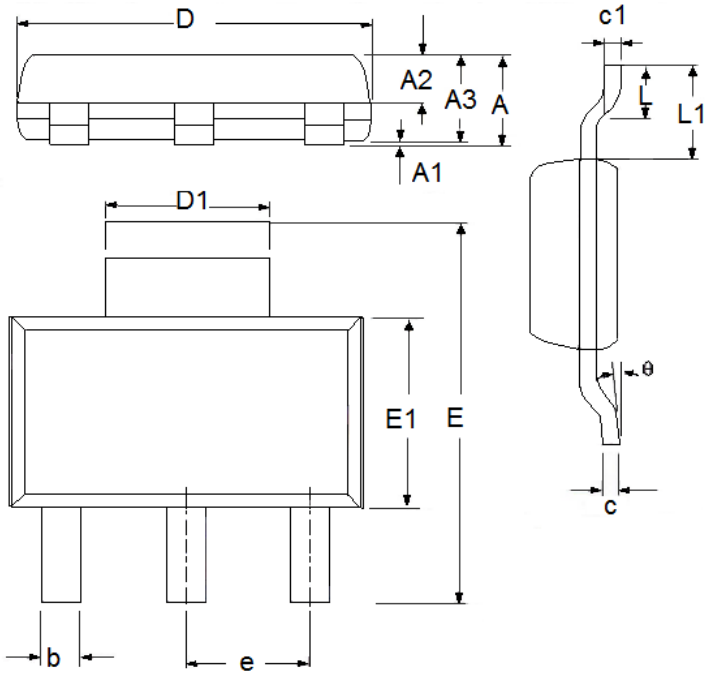
We can ignore I_{ADJ} because I_{ADJ} (about 50uA) is much less than the current of R1 (about 2~10mA).

Note:

1. To meet the minimum load current (>10mA) requirement, R1 is recommended to be 125ohm or lower. As BL1117-ADJ can keep itself stable at load current about 2mA, R1 is not allowed to be higher than 625ohm.
2. Using a bypass capacitor (C_{ADJ}) between the ADJ pin and ground can improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of C_{ADJ} should be less than R1 to prevent ripple from being amplified. As R1 is normally in the range of 100Ω~500Ω, the value of C_{ADJ} should satisfy this equation: $\frac{1}{2\pi \times f_{ripple} \times C_{ADJ}} < R1$.

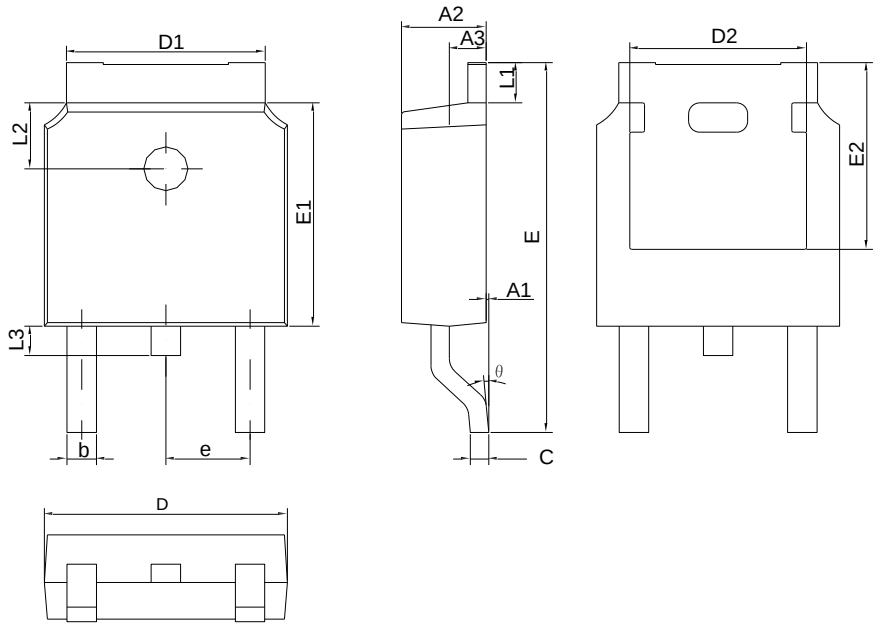
Package Information

Package	SOT223	Devices per reel	3000 pcs



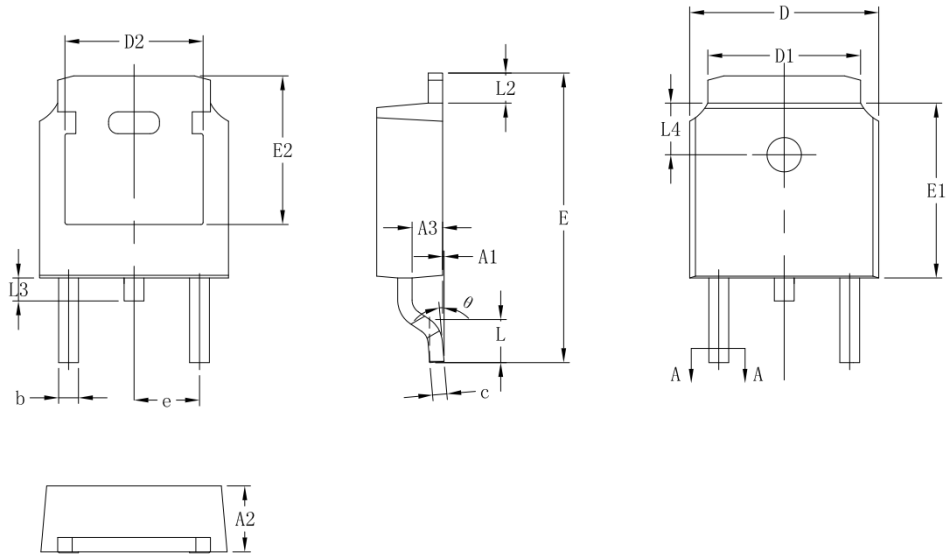
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.48	1.8	0.0583	0.0709
A1	0	0.15	0.0000	0.0059
A2	0.6	0.95	0.0236	0.0374
A3	1.45	1.75	0.0571	0.0689
b	0.6	0.82	0.0236	0.0323
c	0.2	0.35	0.0079	0.0138
D	6.2	6.6	0.2441	0.2598
D1	2.9	3.1	0.1142	0.1220
E	6.7	7.3	0.2638	0.2784
E1	3.3	3.7	0.1299	0.1457
e	2.3(TYP)		0.0906(TYP)	
L	0.76	1.16	0.0299	0.0457
L1	1.75(TYP)		0.0689(TYP)	
θ	0	10°	0.0000	10°
c1	0.25(TYP)		0.0098(TYP)	

Package	TO252-2	Devices per reel	2500 pcs



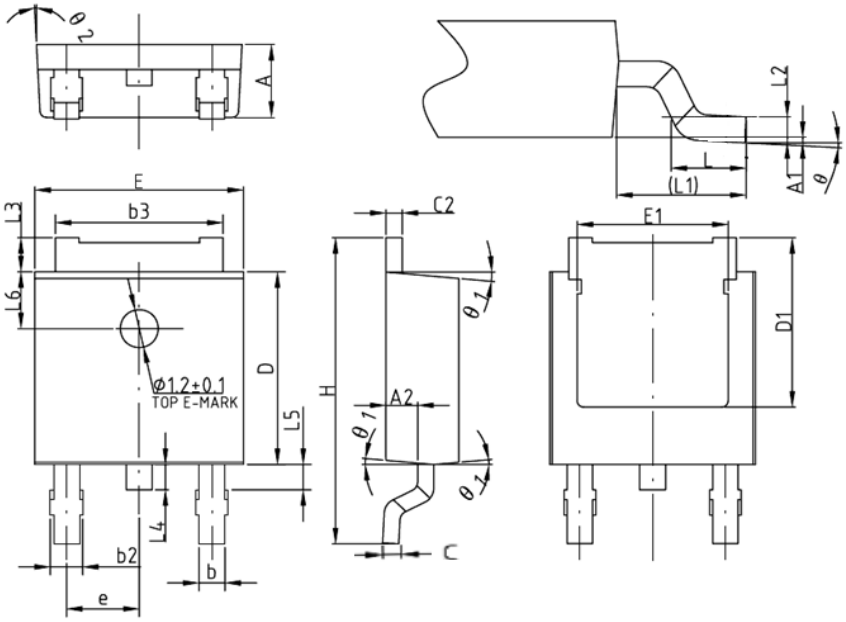
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A1	0	0.13	0	0.0051
A2	2.18	2.39	0.0858	0.0941
A3	0.9	1.1	0.0354	0.0433
b	0.65	0.85	0.0256	0.0335
c	0.46	0.61	0.0181	0.0240
D	6.35	6.73	0.2500	0.2650
D1	4.95	5.46	0.1949	0.2150
D2	4.7	4.9	0.1850	0.1929
E	9.4	10.41	0.3701	0.4098
E1	5.97	6.22	0.2350	0.2449
E2	5.21	5.4	0.2051	0.2126
e	2.286BSC		0.090BSC	
L1	0.89	1.27	0.0350	0.0500
L2	1.7	1.9	0.0669	0.0748
L3	0.6	1	0.0236	0.0394
θ	0	8°	0	8°

Package	TO252-2	Devices per reel	2500 pcs



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A1	0	0.1	0	0.0039
A2	2.2	2.4	0.0866	0.0945
A3	1.02	1.12	0.0402	0.0441
b	0.65	0.77	0.0256	0.0303
c	0.51	0.55	0.0201	0.0217
D	6.5	6.7	0.2559	0.2638
D1	5.33 REF		0.2098 REF	
D2	4.83 REF		0.1902 REF	
E	9.9	10.3	0.3898	0.4055
E1	6	6.2	0.2362	0.2441
E2	5.3 REF		0.2087 REF	
e	2.286 BSC		0.0900 BSC	
L	1.4	1.6	0.0551	0.0630
L2	0.9	1.25	0.0354	0.0492
L3	0.6	1	0.0236	0.0394
L4	1.7	1.9	0.0669	0.0748
θ	0	8°	0	8°

Package	TO252-2	Devices per reel	2500 pcs



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	2.2	2.38	0.0866	0.0937
A1	0	0.1	0.0000	0.0039
A2	0.9	1.1	0.0354	0.0433
b	0.77	0.89	0.0303	0.0350
b2	0.77	1.1	0.0303	0.0433
b3	5.23	5.43	0.2059	0.2138
c	0.47	0.6	0.0185	0.0236
c2	0.47	0.6	0.0185	0.0236
D	6	6.2	0.2362	0.2441
D1	5.25	-	0.2067	-
E	6.5	6.7	0.2559	0.2638
E1	4.7	-	0.1850	-
e	2.28 BSC		0.0898 BSC	
H	9.8	10.4	0.3858	0.4094
L	1.4	1.7	0.0551	0.0669
L1	2.9 REF		0.1142 REF	
L2	0.51 BSC		0.0201 BSC	
L3	0.9	1.25	0.0354	0.0492
L4	0.6	1	0.0236	0.0394
L5	0.9	1.5	0.0354	0.0591
L6	1.8 REF		0.0709 REF	
θ	0	8°	0	8°
θ1	3°	7°	3°	7°
θ2	1°	5°	1°	5°