GreenPowerSemiconductor, Inc.

GP1117

1A Low Dropout Positive Regulator

DESCRIPTION

The GP1117 is positive low dropout voltage regulator designed to provide 1A output current for applications requiring high efficiency. The device is available in an adjustable and the fixed output voltage versions. The internal circuitry is designed to operate down to 1V input to output differential.

The GP1117 built-in current limiting and thermal protection function made chip easy to use. The on chip trimming adjusts the reference/output voltage accuracy to within 1%.

FEATURES

- **1A Output current**
- **Adjustable or fixed 1.8V, 2.5V, 2.85V, 3.3V, 5.0V outputs**
- **Low dropout of typical 800mV**
- **Thermal protection built-in**
- **Typical 0.04% line regulation**
- **Typical 0.2% load regulation**
- Fast transient response
- Available in SOT-223 and TO-252 packages

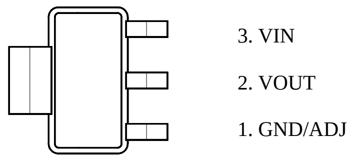
APPLICATIONS

- High Efficiency Linear Regulators
- Battery Powered Instrumentation
- Post Regulator for Switching DC/DC Converter
- DVD Player
- Active SCSI terminators

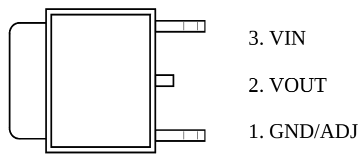
Voltage Options

GP1117-1.8 – 1.8V Fixed
GP1117-2.5 – 2.5V Fixed
GP1117-2.85 – 2.85V Fixed
GP1117-3.3 – 3.3V Fixed
GP1117-5.0 – 5.0V Fixed
GP1117 – Adjustable Output

PACKAGE PIN OUT



3-Pin Plastic SOT-223
Surface Mount
(Top View)

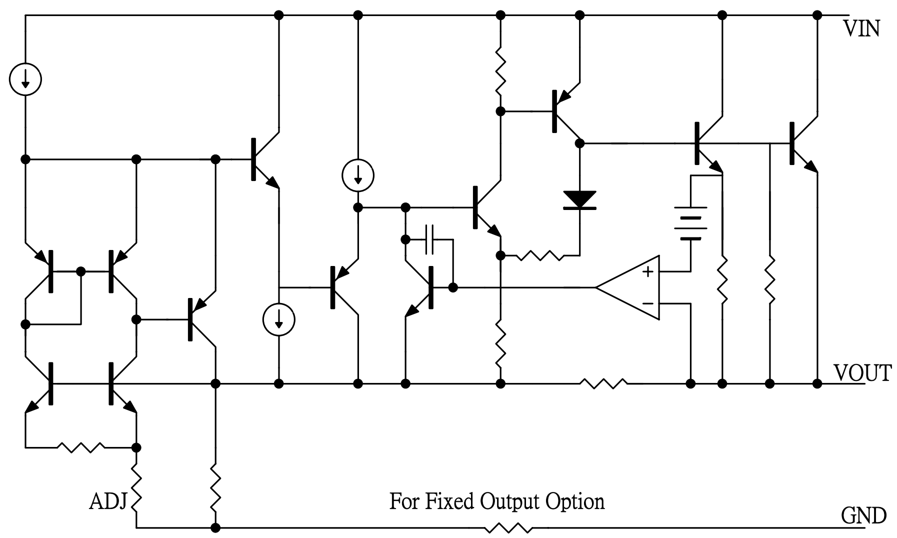


3-Pin Plastic TO-252
Surface Mount
(Top View)

ORDER INFORMATION					
T_A (°C)	ST	SOT223 3-pin	SM	TO-252 3-pin
0 to 70	GP1117-X.XST		GP1117-X.XSM	
	GP1117-X.XSTF (Lead Free)		GP1117-X.XSMF (Lead Free)	
	GP1117ST		GP1117SM	
	GP1117STF (Lead Free)		GP1117SMF (Lead Free)	

Note: Surface-mount packages are available in Tape & Reel. Append the letter “T” to part number (i.e. GP1117-X.XSMT) in order information.
The letter “F” is for Lead Free process .

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note a)	
Input Voltage	7V
Operating Junction Temperature Range, T_J	0°C to 150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (soldiering, 10 seconds)	260°C

Note a: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

POWER DISSIPATION TABLE

Package	θ_{JA} (°C /W)	Derating factor (mW/°C) $T_A \geq 25$°C	$T_A \leq 25$°C Power rating	T_A=70°C Power rating (mW)	T_A= 85°C Power rating (mW)
ST	136	7.35	919	588	478
STF	136	7.35	919	588	478
SM	80	12.5	1562	1000	812
SMF	80	12.5	1562	1000	812

Note :

a. θ_{JA}: Thermal Resistance-Junction to Ambient, D_F : Derating factor, Po: Power consumption.
Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$, $Po = D_F \times (T_J - T_A)$
The θ_{JA} numbers are guidelines for the thermal performance of the device/PC-board system.
All of the above under the condition of no ambient airflow.

b. θ_{JT}: Thermal Resistance-Junction to Ambient, T_C: case (Tab) temperature, $T_J = T_C + (P_D \times \theta_{JT})$
For ST package, θ_{JT} = 15.0°C /W.
For SM package, θ_{JT} = 7.0°C /W.

RECOMMENDED OPERATING CONDITIONS					
Parameter	Symbol	Recommended Operating			Units
		Min.	Typ.	Max.	
Input Voltage	V_{IN}	2.7		7	V
Load Current (with adequate heat sinking)	I_o	5			mA
Input Capacitor (V_{IN} to GND)		1.0			μF
Output Capacitor with ESR of 10Ω max.,		4.7			μF
Junction temperature	T_J			125	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $V_{IN} = V_{OUT}$ +2V, I_O =10mA, and T_J = 25°C.

Parameter		Symbol	Test Conditions	GP1117			Units
				Min	Typ	Max	
Reference Voltage	GP1117	V_{REF}	I_O = 10mA, $V_{IN} - V_{OUT}$ = 2V	1.238	1.250	1.262	V
			10mA ≤ I_O ≤ 1A, V_{OUT} +1.5V ≤ V_{IN} ≤ 7V	1.230	1.250	1.270	
Output Voltage	GP1117-1.8	V_{OUT}	I_O = 10mA, V_{IN} = 3.8V	1.782	1.8	1.818	V
			10mA ≤ I_O ≤ 1A, 3.2V ≤ V_{IN} ≤ 7V	1.764	1.8	1.836	
	GP1117-2.5		I_O = 10mA, V_{IN} = 4.5V	2.475	2.500	2.525	
			10mA ≤ I_O ≤ 1A, 4.25V ≤ V_{IN} ≤ 7V	2.450	2.500	2.550	
	GP1117-2.85		I_O = 10mA, V_{IN} = 4.85V	2.821	2.850	2.879	
			10mA ≤ I_O ≤ 1A, 4.25V ≤ V_{IN} ≤ 7V	2.805	2.850	2.895	
	GP1117-3.3		I_O = 10mA, V_{IN} = 5.0V	3.267	3.300	3.333	
			10mA ≤ I_O ≤ 1A, 4.75V ≤ V_{IN} ≤ 7V	3.235	3.300	3.365	
	GP1117-5.0		I_O = 10mA, V_{IN} = 7.0V	4.950	5.000	5.050	
			10mA ≤ I_O ≤ 1A, 6.5V ≤ V_{IN} ≤ 7V	4.900	5.000	5.100	
Line Regulation	GP1117	ΔV_{OI}	I_O = 10mA, V_{OUT} +1.5V ≤ V_{IN} ≤ 7V		0.04	0.20	%
	GP1117-X.X		I_O = 10mA, V_{OUT} +1.5V ≤ V_{IN} ≤ 7V		1.0	6.0	mV
Load Regulation	GP1117	ΔV_{OL}	10mA ≤ I_O ≤ 1A, $V_{IN} - V_{OUT}$ = 3V		0.10	0.40	%
	GP1117-X.X		10mA ≤ I_O ≤ 1A, $V_{IN} = V_{OUT}$ +1.5V		1.0	10.0	mV
Dropout Voltage		ΔV	I_O = 10mA		0.8	1.15	V
			I_O = 1A		0.8	1.30	
Minimum Load Current (Note a)			V_{IN} ≤ 7V		1.7	5	mA
Quiescent Current	GP1117-X.X	I_Q	V_{IN} ≤ 7V		6	10	mA
Current Limit		I_{CL}	$V_{IN} - V_{OUT}$ = 3V	1	1.2		A
Adjust Pin Current			I_O = 10mA, $V_{IN} - V_{OUT}$ = 2V		50	120	μA

Thermal Regulation(Note b)		T_A = 25°C, 30 ms pulse		0.01	0.1	%/W
Ripple rejection(Note b)	R_R	f_O = 120Hz, 1V_{RMS}, I_O = 400mA, $V_{IN} - V_{OUT}$ = 3V	60	75		dB

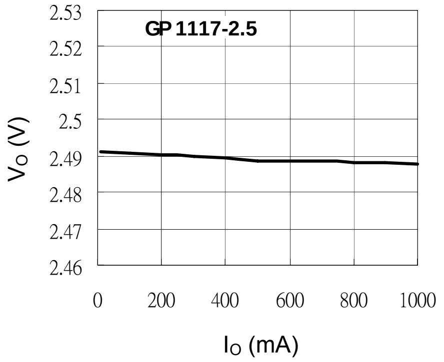
Note a: For the adjustable device, the minimum load current is the minimum current required to maintain regulation. Normally the current in the resistor divider used to set the output voltage is selected to meet the minimum load current requirement.

Note b: These parameters, although guaranteed, are not tested in production.

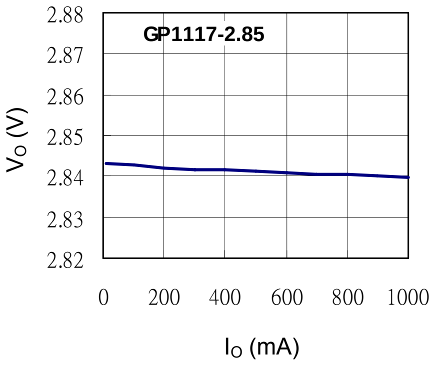
Characterization Curves

Unless otherwise specified, V_{IN}= V_{OUT}+2V，C_{IN}=1μF，C_{OUT}=4.7μF，T_A=25°C

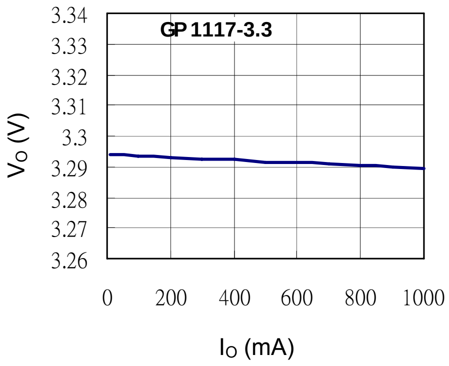
Load Regulation



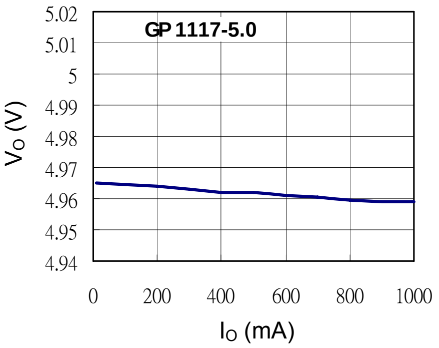
Load Regulation



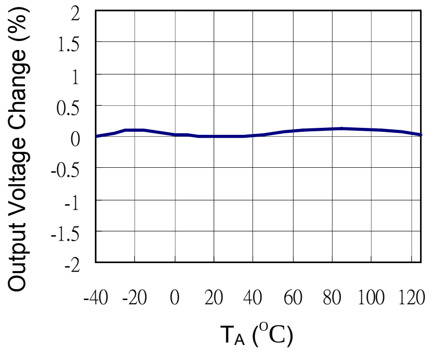
Load Regulation



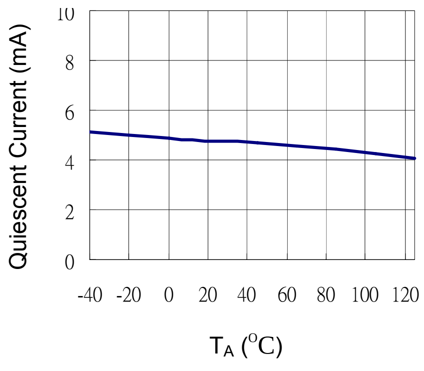
Load Regulation



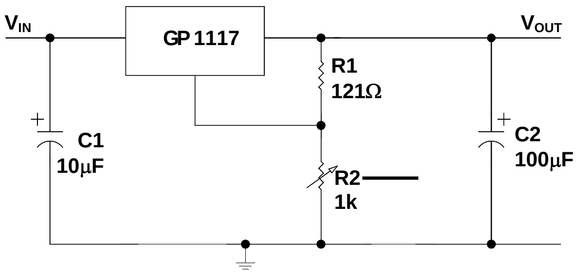
Temperature Stability

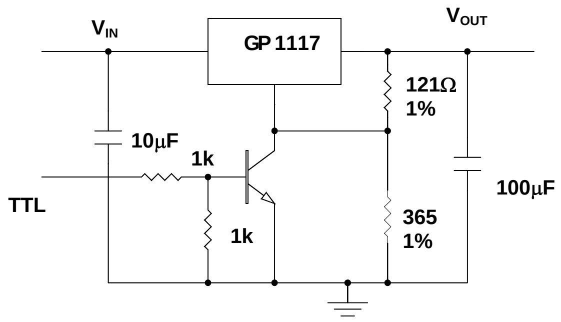


Quiescent Current vs. Temperature



APPLICATION INFORMATION

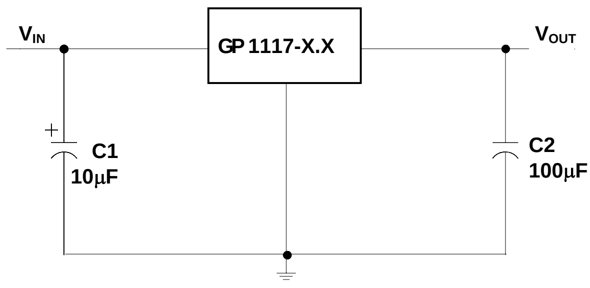




Adjustable Regulator

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

5V Regulator with Shutdown



Fixed Vout Regulator application

Application Note:

Maximum Power Dissipation Calculation:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_{A(MAX)}}{\theta_{JA}}$$

T_J(°C): Maximum recommended junction temperature

T_A(°C): Ambient temperature of the application

θ_{JA}(°C/W): Junction-to-junction temperature thermal resistance of the package, and other heat dissipating materials.

The maximum power dissipation of a fixed-output voltage regulator :

$P_{D(MAX)} = [(V_{IN(MAX)} - V_{OUT(NOM)})] \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_Q$

$V_{OUT(NOM)}$ = the nominal output voltage
$I_{OUT(NOM)}$ = the nominal output current, and
I_Q = the quiescent current the regulator consumes at $I_{OUT(MAX)}$
$V_{IN(MAX)}$ = the maximum input voltage
$\theta_{JA} = (150\,^{\circ}C - T_A)/ P_D$

Thermal consideration:

In the application when power consumption is over about 404 mW for SOT-223 package (687mW for TO-252 package), at T_A=70°C). Additional heat sink is required to remove the excess heat and maintain the chip junction temperature below 125°C.

The chip junction temperature is calculate by the formula : $T_J = P_D (\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$

P_D:Dissipated power.

θ_{JT}:Thermal resistance from the junction to the mounting tab of the package.

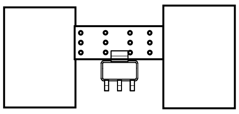
θ_{CS}:Thermal resistance through the interface between the IC and the surface on which it is mounted. (typically, θ_{CS} < 1.0°C/W)

θ_{SA} : Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

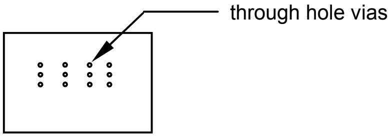
PC Board copper can be used as heat sink, the table below can be referenced to determine the appropriate size of copper area required.

PCB θ_{SA} (°C /W)	59	45	38	33	27	24	21
PCB heat sink size (mm^2)	500	1000	1500	2000	3000	4000	5000

Recommended drawing of PCB area used as a heat sink.

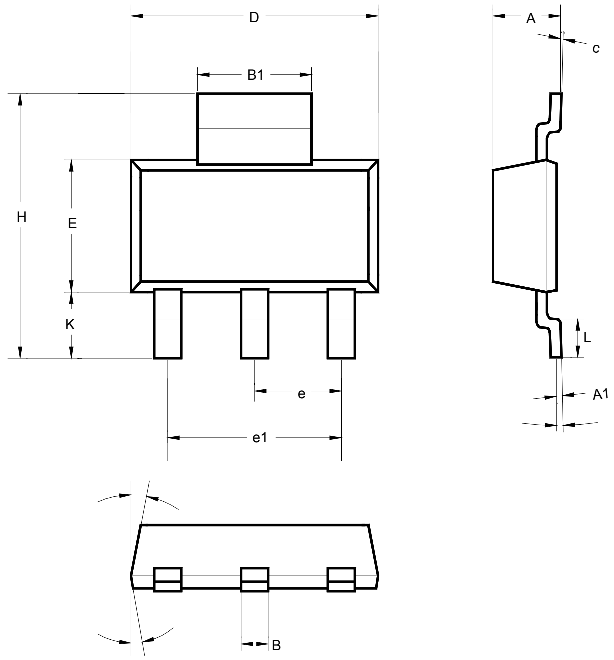


(Top View)



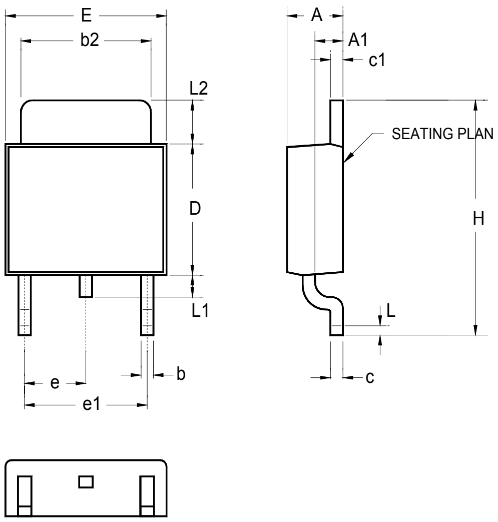
(Bottom View)

3-Pin Surface Mount SOT-223 (ST)



	MILLIMETERS		
	MIN	TYP	MAX
A	1.50	1.65	1.80
A1	0.02	0.05	0.08
B	0.60	0.70	0.80
B1	2.90	-	3.15
c	0.28	0.30	0.32
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.3 BSC		
e1	4.6 BSC		
H	6.70	7.00	7.30
L	0.91	1.00	1.10
K	1.50	1.75	2.00
α	0°	5°	10°
β		3°	

3-Pin Surface Mount TO-252 (SM)



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.086	-	0.094	2.18	-	2.39
A1	0.040	-	0.050	1.02	-	1.27
b	-	0.024	-	-	0.61	-
b2	0.205	-	0.215	5.21	-	5.46
c	0.018	-	0.023	0.46	-	0.58
c1	0.018	-	0.023	0.46	-	0.58
D	0.210	-	0.220	5.33	-	5.59
E	0.250	-	0.265	6.35	-	6.73
e	0.090 BSC			2.29 BSC		
e1	0.180 BSC			4.58 BSC		
H	0.370	-	0.410	9.40	-	10.41
L	0.020	-	-	0.51	-	-
L1	0.025	-	0.040	0.64	-	1.02
L2	0.060	-	0.080	1.52	-	2.03

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