



**DESCRIPTION**

The GP1109 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 GP1109 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 2%.

**APPLICATIONS**

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

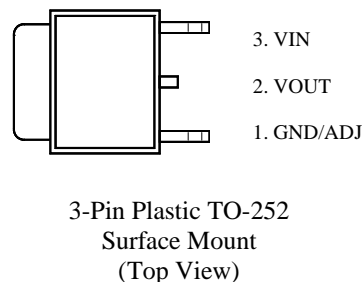
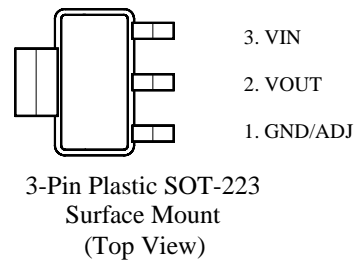
**Voltage Options**

- GP1109-1.8 – 1.8V Fixed
- GP1109-2.5 – 2.5V Fixed
- GP1109-2.85 – 2.85V Fixed
- GP1109-3.3 – 3.3V Fixed
- GP1109-5.0 – 5.0V Fixed
- GP1109 – Adjustable Output

**FEATURES**

- **1A Output current**
- **Adjustable or fixed 1.8V, 2.5V, 2.85V, 3.3V, 5.0V outputs**
- **Low dropout of typical 800mV**
- **Maximum Vin = 15V**
- **Thermal protection built-in**
- **Typical 0.005% line regulation**
- **Typical 0.05% load regulation**
- Fast transient response
- Available in SOT-223 and TO-252 packages

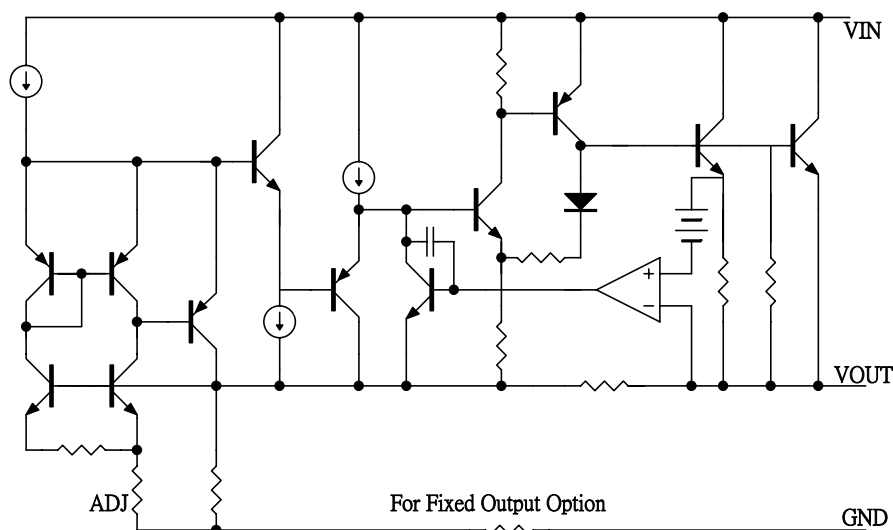
**PACKAGE PIN OUT**



**ORDER INFORMATION**

T <sub>A</sub> (°C)	ST	SOT223	SM	TO-252
		3-pin		3-pin
0 to 70	GP1109-X.XST		GP1109-X.XSM	
	GP1109ST		GP1109SM	
Note: Surface-mount packages are available in Tape & Reel. Append the letter "T" to part number (i.e. GP1109-X.XSMT) in order information.				

## BLOCK DIAGRAM



### ABSOLUTE MAXIMUM RATINGS (Note a)

Input Voltage	18V
Operating Junction Temperature Range, $T_J$	0°C to 150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (soldering, 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	$\theta_{JA}$ (°C/W)	Derating factor (mW/°C) $T_A \geq 25^\circ\text{C}$	$T_A \leq 25^\circ\text{C}$ Power rating	$T_A = 70^\circ\text{C}$ Power rating (mW)	$T_A = 85^\circ\text{C}$ 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 :

- $\theta_{JA}$ : Thermal Resistance-Junction to Ambient,  $D_F$  : Derating factor,  $P_o$ : Power consumption.  
Junction Temperature Calculation:  $T_J = T_A + (P_o \times \theta_{JA})$ ,  $P_o = D_F \times (T_J - T_A)$   
The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/PC-board system.  
All of the above under the condition of no ambient airflow.
- $\theta_{JT}$ : Thermal Resistance-Junction to Ambient,  $T_C$ : case ( $T_{ab}$ ) temperature,  $T_J = T_C + (P_o \times \theta_{JT})$   
For ST package,  $\theta_{JT} = 15.0^\circ\text{C/W}$ .  
For SM package,  $\theta_{JT} = 7.0^\circ\text{C/W}$ .

RECOMMENDED OPERATING CONDITIONS							
Parameter		Symbol	Recommended Operating			Units	
			Min.	Typ.	Max.		
Input Voltage		$V_{IN}$	2.7		15	V	
Load Current (with adequate heat sinking)		$I_o$	5			mA	
Input Capacitor ( $V_{IN}$ to GND)			1.0			$\mu$ F	
Output Capacitor with ESR of $10\Omega$ max.,			4.7			$\mu$ F	
Junction temperature		$T_J$			125	$^{\circ}$ C	
ELECTRICAL CHARACTERISTICS							
Unless otherwise specified, $V_{IN} = V_{OUT} + 2V$ , $I_o = 10mA$ , and $T_J = 25^{\circ}C$ .							
Parameter		Symbol	Test Conditions	GP1109			Units
				Min	Typ	Max	
Reference Voltage	GP1109	$V_{REF}$	$I_o = 10mA$ , $V_{IN} - V_{OUT} = 2V$	1.238	1.250	1.262	V
			$10mA \leq I_o \leq 1A$ , $V_{OUT} + 1.5V \leq V_{IN} \leq 12V$	1.225	1.250	1.275	
Output Voltage	GP1109-1.8	$V_{OUT}$	$I_o = 10mA$ , $V_{IN} = 3.8V$	1.782	1.8	1.818	V
			$10mA \leq I_o \leq 1A$ , $3.2V \leq V_{IN} \leq 8V$	1.764	1.8	1.836	
	GP1109-2.5		$I_o = 10mA$ , $V_{IN} = 4.5V$	2.475	2.500	2.525	
			$10mA \leq I_o \leq 1A$ , $4.25V \leq V_{IN} \leq 8V$	2.450	2.500	2.550	
	GP1109-2.85		$I_o = 10mA$ , $V_{IN} = 4.85V$	2.821	2.850	2.879	
			$10mA \leq I_o \leq 1A$ , $4.25V \leq V_{IN} \leq 10V$	2.793	2.850	2.907	
	GP1109-3.3		$I_o = 10mA$ , $V_{IN} = 5.0V$	3.267	3.300	3.333	
			$10mA \leq I_o \leq 1A$ , $4.75V \leq V_{IN} \leq 10V$	3.234	3.300	3.366	
GP1109-5.0	$I_o = 10mA$ , $V_{IN} = 7.0V$	4.950	5.000	5.050			
	$10mA \leq I_o \leq 1A$ , $6.5V \leq V_{IN} \leq 12V$	4.900	5.000	5.100			
Line Regulation	GP1109	$\Delta V_{OI}$	$I_o = 10mA$ , $V_{OUT} + 1.5V \leq V_{IN} \leq 12V$		0.005	0.20	%
	GP1109-X.X		$I_o = 10mA$ , $V_{OUT} + 1.5V \leq V_{IN} \leq 12V$		1.0	6.0	mV
Load Regulation	GP1109	$\Delta V_{OL}$	$10mA \leq I_o \leq 1A$ , $V_{IN} - V_{OUT} = 3V$		0.05	0.50	%
	GP1109-X.X		$10mA \leq I_o \leq 1A$ , $V_{IN} = V_{OUT} + 1.5V$		1.0	10.0	mV
Dropout Voltage		$\Delta V$	$I_o = 10mA$		1.0	1.15	V
			$I_o = 1A$		1.1	1.20	
Minimum Load Current (Note a)			$V_{IN} \leq 12V$		2	10	mA
Quiescent Current	GP1109-X.X	$I_Q$	$V_{IN} \leq 12V$		4	13	mA
Current Limit		$I_{CL}$	$V_{IN} - V_{OUT} = 3V$	1.1	1.5		A
Adjust Pin Current			$I_o = 10mA$ , $V_{IN} - V_{OUT} = 2V$		35	120	$\mu$ A

Thermal Regulation(Note b)		$T_A = 25^\circ\text{C}$ , 30 ms pulse		0.004	0.02	%/W
Ripple rejection(Note b)	$R_R$	$f_O = 120\text{Hz}$ , $1V_{\text{RMS}}$ , $I_O = 400\text{mA}$ , $V_{\text{IN}} - V_{\text{OUT}} = 3\text{V}$	60	72		dB

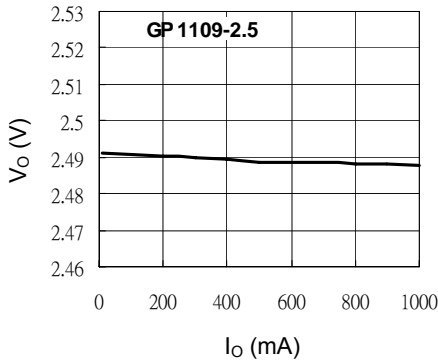
Note a: For the adjustable device, the minimum load current is the minimum current required to maintain regulation. Normally the current in the resistor divider used to set the output voltage is selected to meet the minimum load current requirement.

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

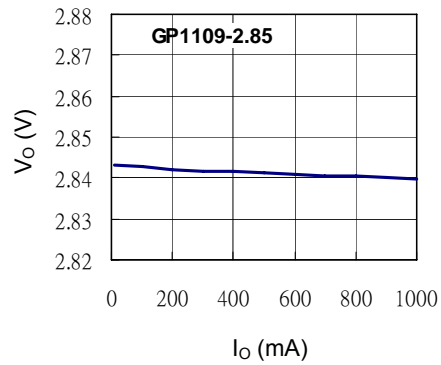
**Characterization Curves**

Unless otherwise specified,  $V_{IN} = V_{OUT} + 2V$ ,  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 4.7\mu F$ ,  $T_A = 25^\circ C$

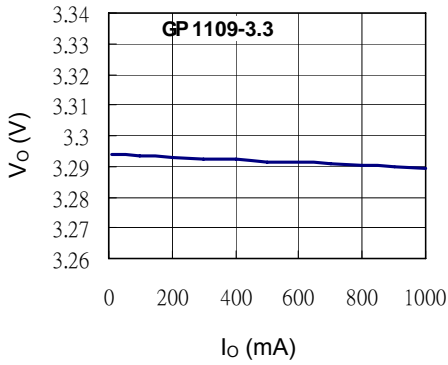
**Load Regulation**



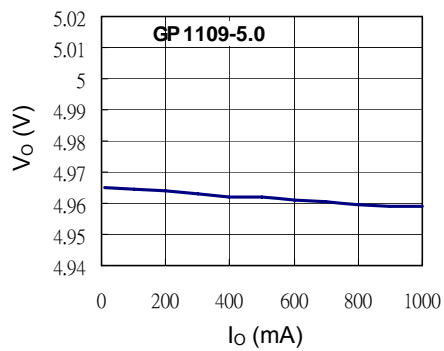
**Load Regulation**



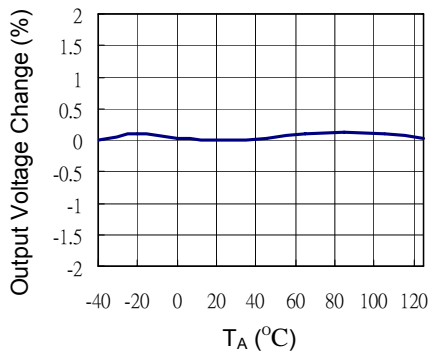
**Load Regulation**



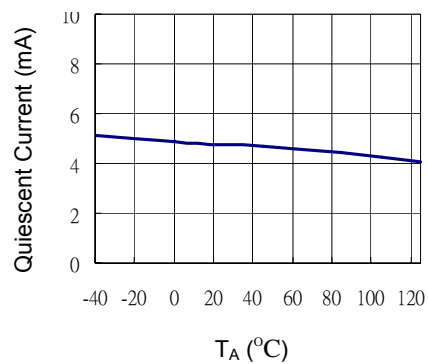
**Load Regulation**



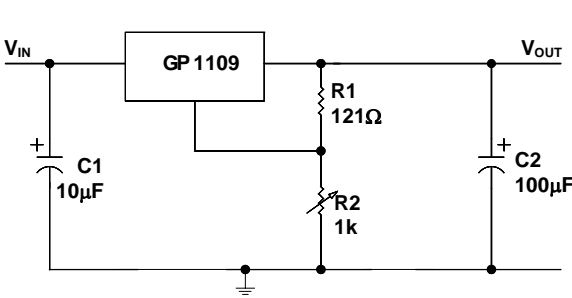
**Temperature Stability**



**Quiescent Current vs. Temperature**

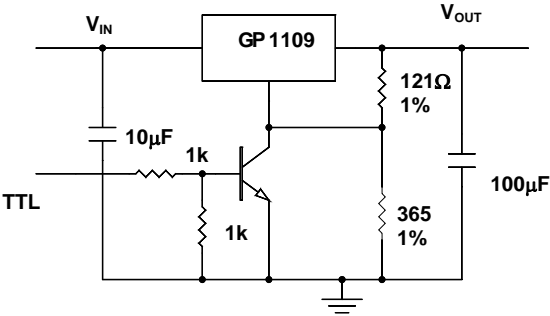


APPLICATION INFORMATION

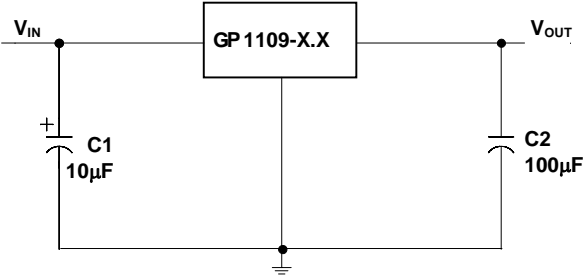


Adjustable Regulator

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



5V Regulator with Shutdown



Fixed Vout Regulator application

**Application Note:**

**Maximum Power Dissipation Calculation:**

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

$T_J(^{\circ}C)$ : Maximum recommended junction temperature

$T_A(^{\circ}C)$ : Ambient temperature of the application

$\theta_{JA}(^{\circ}C/W)$ : Junction-to-ambient 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  $T_A=70^{\circ}C$ ). Additional heat sink is required to remove the excess heat and maintain the chip junction temperature below  $125^{\circ}C$ .

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.

$\theta_{JT}$ :Thermal resistance from the junction to the mounting tab of the package.

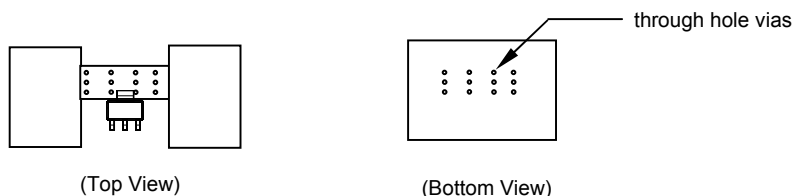
$\theta_{CS}$ :Thermal resistance through the interface between the IC and the surface on which it is mounted. (typically,  $\theta_{CS} < 1.0^{\circ}C/W$ )

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

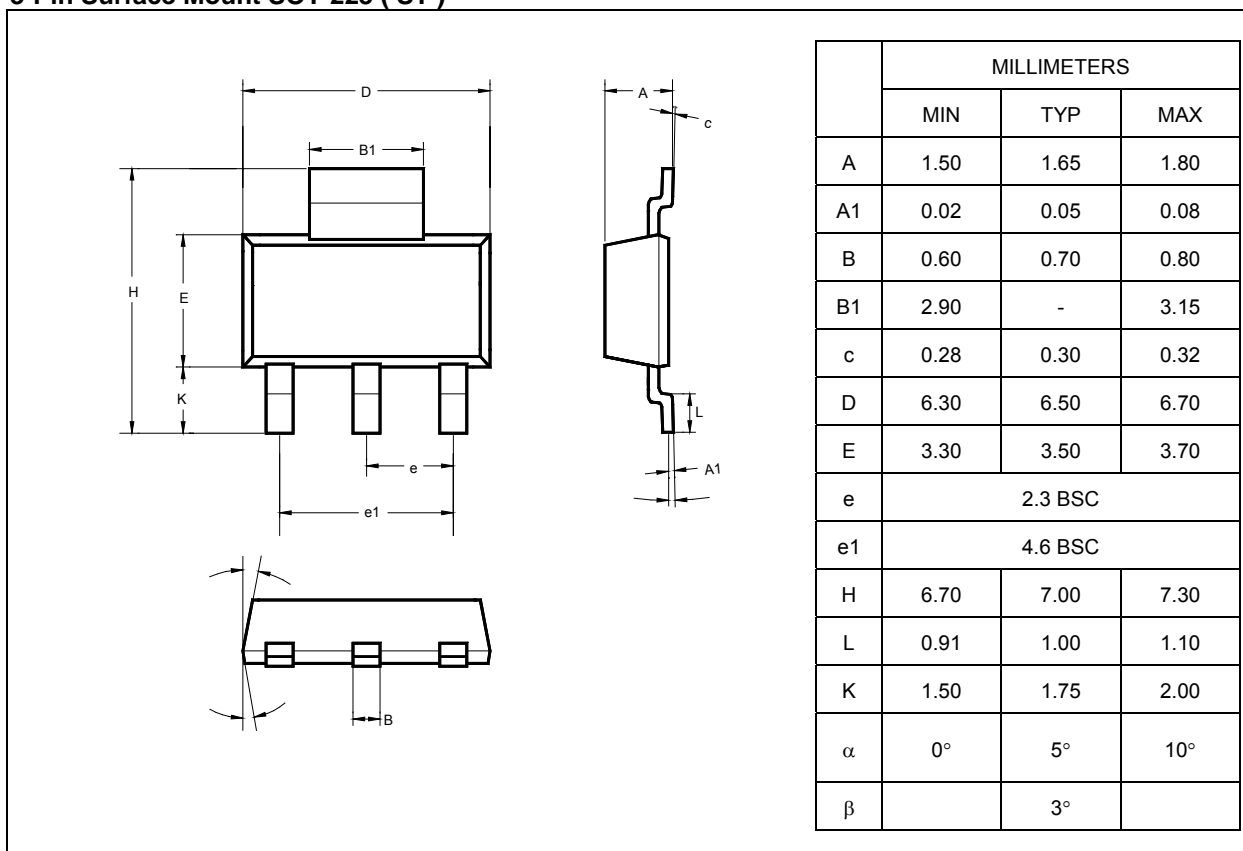
PC Board copper can be used as heat sink, the table below can be referenced to determine the appropriate size of copper area required.

PCB $\theta_{SA}(^{\circ}C / W)$	59	45	38	33	27	24	21
PCB heat sink size (mm <sup>2</sup> )	500	1000	1500	2000	3000	4000	5000

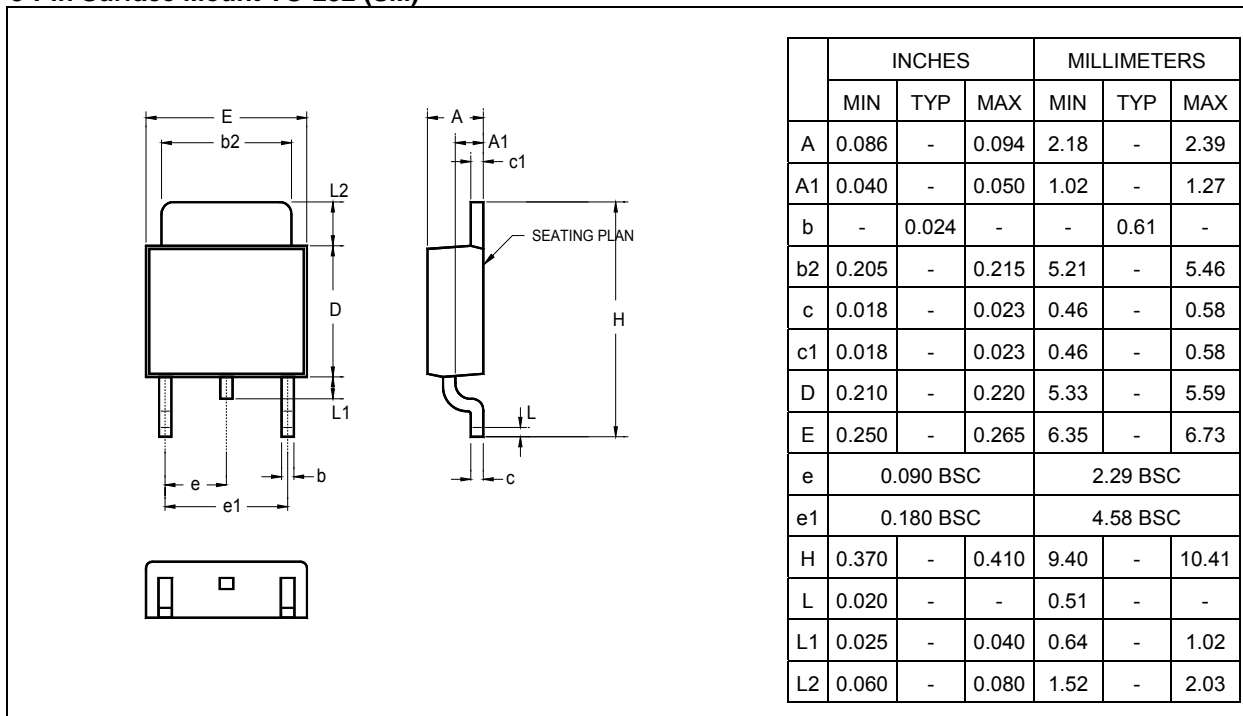
Recommended drawing of PCB area used as a heat sink.



## 3-Pin Surface Mount SOT-223 ( ST )



## 3-Pin Surface Mount TO-252 (SM)





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