LOW DROPOUT LINEAR REGULATOR WITH INDUSTRIAL TEMPERATURE RANGE

Description

The GS1117 is available in industrial temperature range low dropout three-terminal regulator.

The GS1117 is optimized for low voltage where transient response and minimum input voltage are critical. It provides current limit and thermal shutdown. Its circuit includes a trimmed bandgap reference to assure output voltage accuracy to be within ±1%. On-chip thermal shutdown provides protection against a combination of high current and ambient temperature that would create excessive junction temperature.

The GS1117 is available in 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V fixed output voltage versions and ADJ output voltage version. The fixed versions integrate the adjust resistors. It is also available in an adjustable version which can set the output voltage with two external resistors.

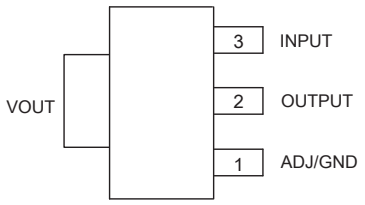
The GS1117 is available in the industry-standard SOT223 and TO252-2 power packages.

Features

- Current Limit: 1.35A (Typ)
- Output Noise from 10Hz to 10KHz: 0.003% of V_{OUT}
- PSRR at I_{OUT} = 300mA and f = 120Hz: 70dB
- Output Voltage Accuracy: ±1% (Except 1.2V Version)
- On-chip Thermal Shutdown
- Maximum Quiescent Current: I_{QMAX} = 6mA
- Compatible with Low ESR Ceramic Capacitor
- Operation Junction Temperature: -40°C to +125°C

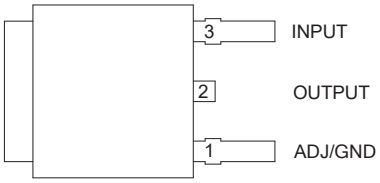
Pin Assignments

(Top View)



SOT223

(Top View)

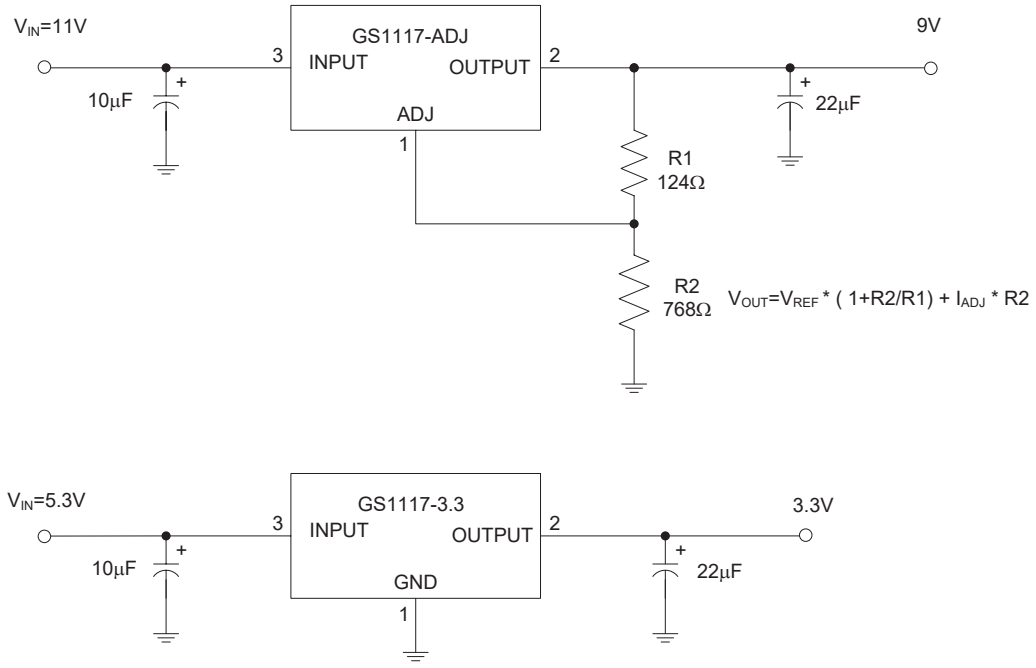


TO252-2

Applications

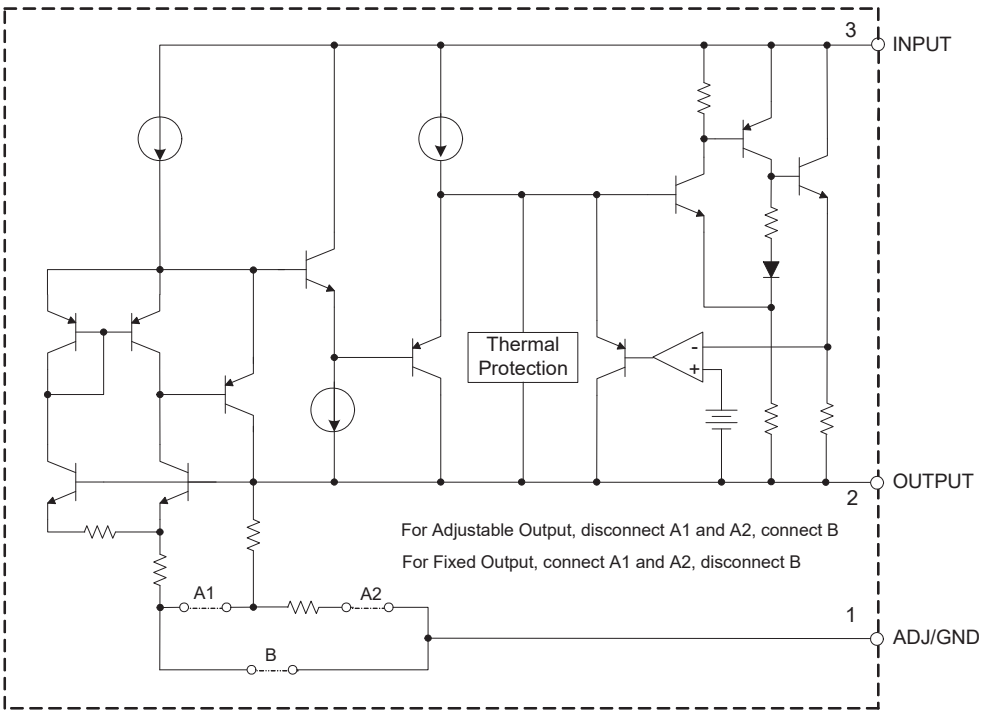
- USB Device
- Add-on Card
- DVD Player
- PC Motherboard

Typical Applications Circuit (Note 1)



Note 1: The GS1117 is compatible with low ESR ceramic capacitor. The ESR of the output capacitors must be less than 20Ω. A minimum of 10μF output capacitor is required.

Functional Block Diagram



Absolute Maximum Ratings (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating		Unit
V_{IN}	Input Voltage	18		V
T_J	Operating Junction Temperature Range	+150		°C
T_{STG}	Storage Temperature Range	-65 to +150		°C
θ_{JA}	Thermal Resistance (Without Heatsink)	SOT223	125	°C/W
		TO252-2	100	
θ_{JA}	Thermal Resistance (With Heatsink) (Note 6)	SOT223	100	°C/W
		TO252-2	70	
T_{LEAD}	Lead Temperature (Soldering, 10sec)	+260		°C

Notes: 2.Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.
3.Chip is soldered to 100mm2(10mm*10mm) copper (top side solder mask) on 2oz.2 layers FR-4 PCB with 8*0.5mm vias.

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	–	15	V
T_J	Operating Junction Temperature Range	-40	+125	°C

Electrical Characteristics GS1117-ADJ

(Operating Conditions: $V_{IN} = V_{OUT}+2V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{REF}	Reference Voltage	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		1.238	1.250	1.262	V
				1.225	1.250	**1.275**	
V_{RLINE}	Line Regulation	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		—	0.001	0.1	%
				—	—	**0.2**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ 1mA ≤ I_{OUT} ≤ 1A		—	0.4	1.0	%
V_{DROP}	Dropout Voltage	ΔV_{REF} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
—	Adjust Pin Current	—		—	60	**120**	μA
—	Adjust Pin Current Change	1.5 ≤ (V_{IN}-V_{OUT}) ≤ 10V		—	0.2	**5**	μA
—	Minimum Load Current	1.5 ≤ (V_{IN}-V_{OUT}) ≤ 10V		—	1.7	**5**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF (V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics GS1117-1.2 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	$1.5V \le V_{IN}-V_{OUT} \le 10V$		1.176	1.2	1.224	V
				1.152	1.2	**1.248**	
V_{RLINE}	Line Regulation	$1.5V \le V_{IN}-V_{OUT} \le 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ 1mA ≤ I_{OUT} ≤ 1A		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics GS1117-1.5 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	$1.5V \le V_{IN}-V_{OUT} \le 10V$		1.485	1.5	1.515	V
				1.47	1.5	**1.53**	
V_{RLINE}	Line Regulation	$1.5V \le V_{IN}-V_{OUT} \le 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ 1mA ≤ I_{OUT} ≤ 1A		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics GS1117-1.8 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		1.782	1.8	1.818	V
				1.764	1.8	**1.836**	
V_{RLINE}	Line Regulation	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	V_{IN} = V_{OUT}+2V 1mA ≤ I_{OUT} ≤ 1A		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF (V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics GS1117-2.5 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		2.475	2.5	2.525	V
				2.455	**2.5**	**2.545**	
V_{RLINE}	Line Regulation	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	V_{IN} = V_{OUT}+2V 1mA ≤ I_{OUT} ≤ 1A		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF (V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics GS1117-3.3 (Cont.)

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		3.267	3.3	3.333	V
				3.235	3.3	**3.365**	
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ $1mA \leq I_{OUT} \leq 1A$		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25ºC, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

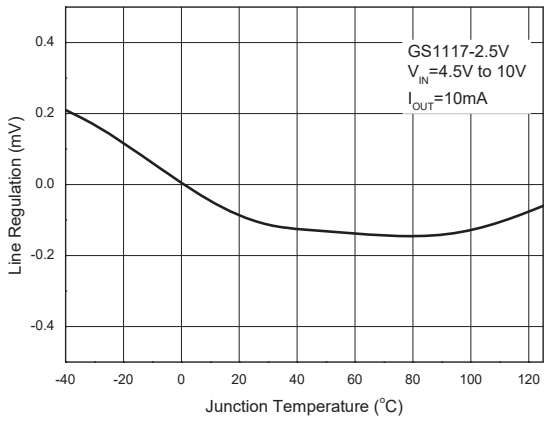
Electrical Characteristics GS1117-5.0 (Cont.)

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

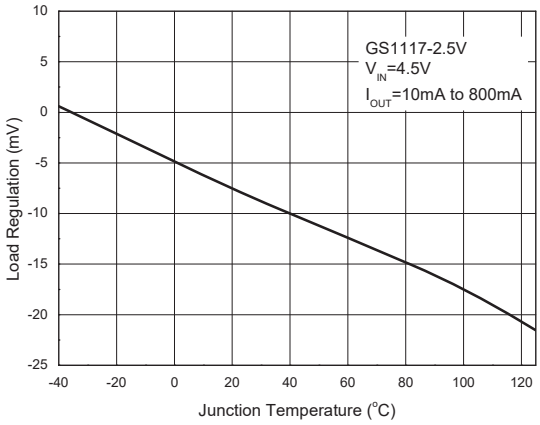
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		4.950	5.0	5.050	V
				4.900	5.0	**5.100**	
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ $1mA \leq I_{OUT} \leq 1A$		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22μF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
		TO252-2		—	10	—	

Performance Characteristics

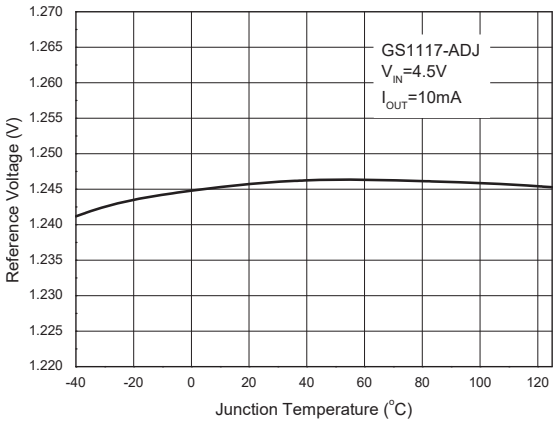
Line Regulation vs. Temperature



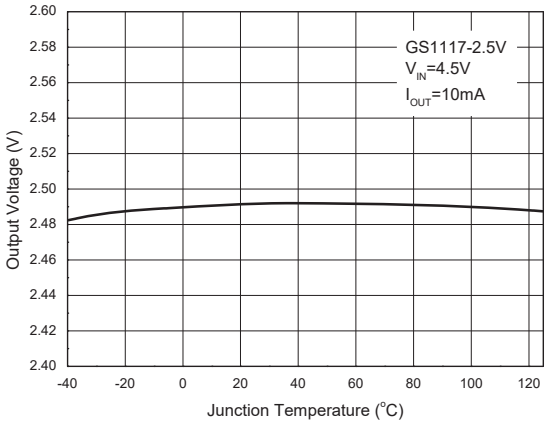
Load Regulation vs. Temperature



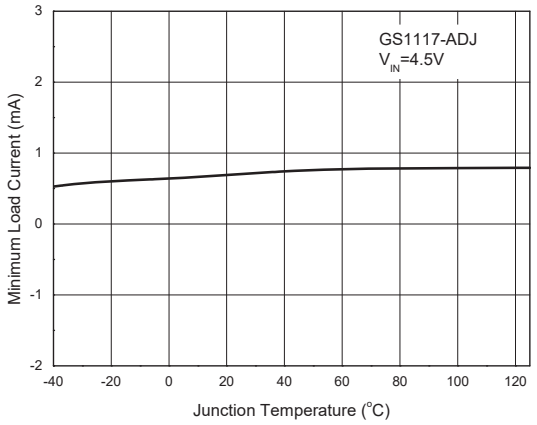
Reference Voltage vs. Temperature



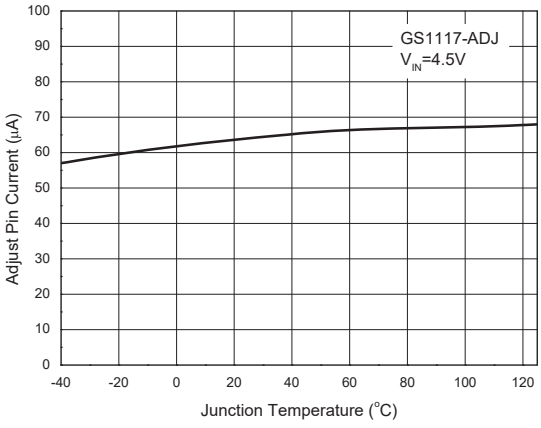
Output Voltage vs. Temperature



Minimum Load Current vs. Temperature

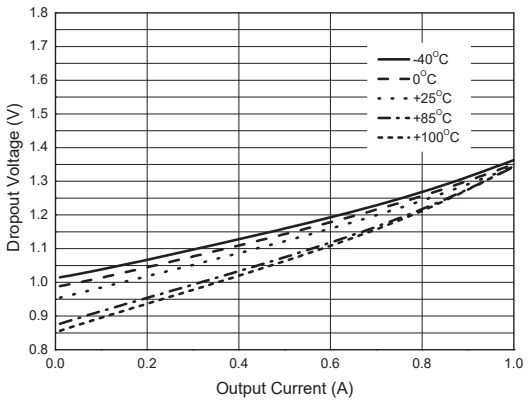


Adjust Pin Current vs. Temperature

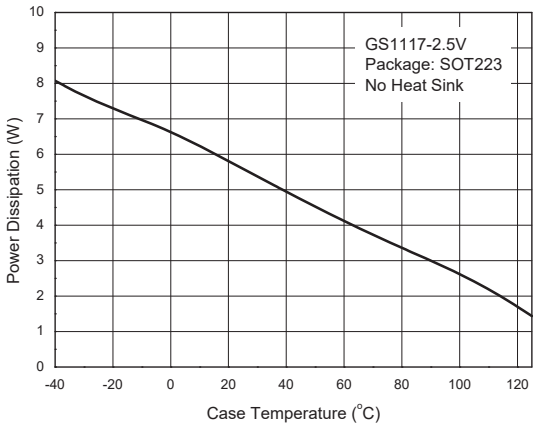


Performance Characteristics (Cont.)

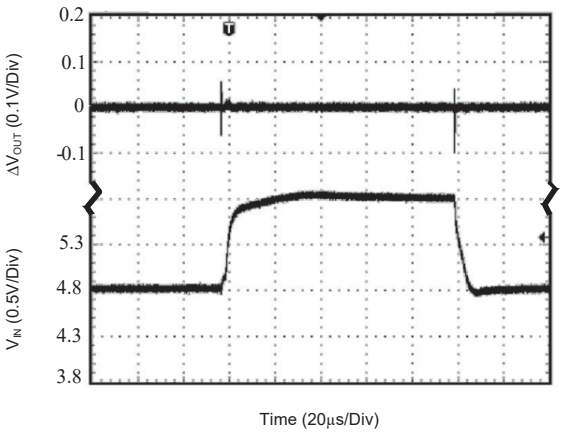
Dropout Voltage vs. Output Current



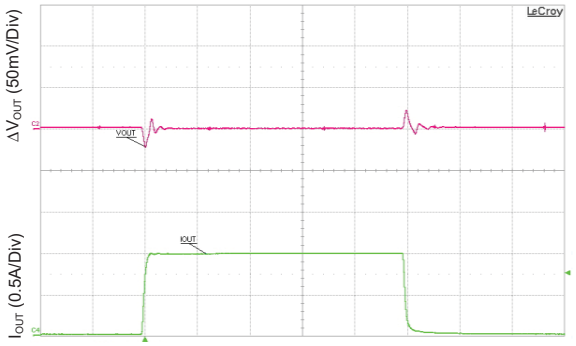
Power Dissipation vs. Temperature



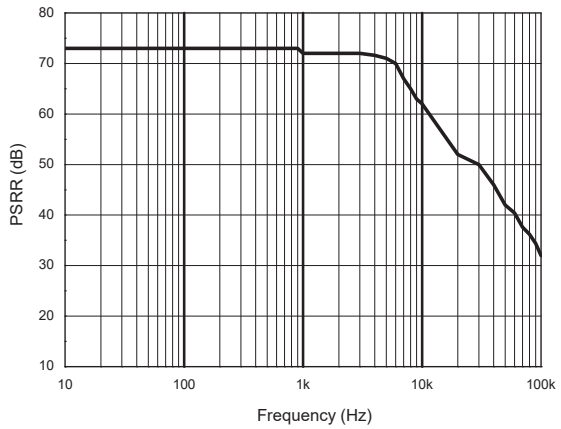
Line Transient Response



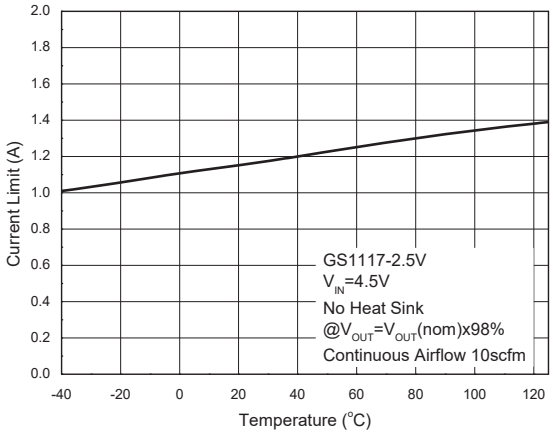
Load Transient Response



PSRR vs. Frequency

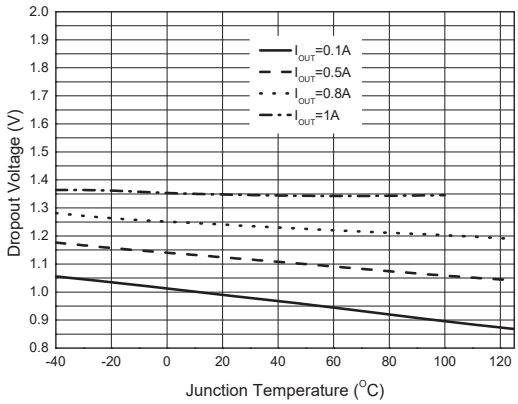


Current Limit vs. Temperature



Performance Characteristics (Cont.)

Dropout Voltage vs. Temperature

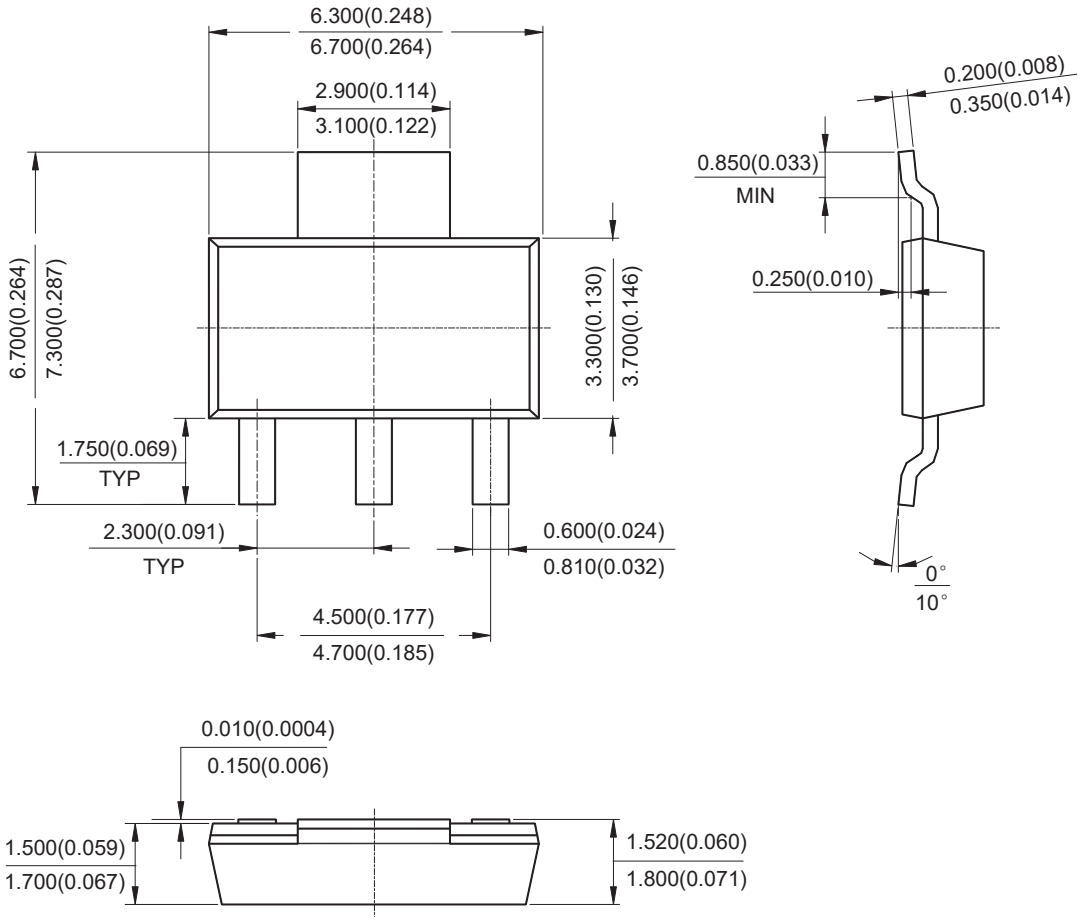


Ordering Information

MODEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
GS1117	GS1117-XXCTR3	SOT223-3	Tape and Reel,3000	GS1117
GS1117	GS1117-XXDTR3	TO252-2	Tape and Reel,2500	GS1117

Package Outline Dimensions (All dimensions in mm.)

Package Type: SOT223



Package Outline Dimensions (All dimensions in mm.) (Cont.)

Package Type: TO252-2