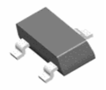
300mA L.D.O VOLTAGE REGULATOR LM1117GSF

FEATURES

- Output Current up to 300mA
- Three Terminal Adjustable (ADJ) or Fixed 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V
- Line Regulation typically at 0.1% typ.
- Load Regulation typically at 0.2% typ.
- Internal Current and Thermal Protection
- Maximum Input Voltage 20V
- Surface Mount Package SOT-23
- Moisture Sensitivity Level 3



SOT-23

ORDERING INFORMATION

Device	Package
LM1117GSF-ADJ	SOT-23-3L
LM1117GSF-x.x	

x.x: Output Voltage = 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V

APPLICATIONS

- Active SCSI Terminators
- Portable/ Plan Top/ Notebook Computers
- High Efficiency Linear Regulators
- SMPS Post Regulators
- Mother B/D Clock Supplies
- Disk Drives
- Battery Chargers

DESCRIPTION

The LM1117GSF is a low power positive-voltage regulator designed to meet 300mA output current. This device is an excellent choice for use in battery-powered applications, as active terminators for the SCSI bus, and portable computers. The LM1117GSF features very low quiescent current and very low dropout voltage of 1.2V at a full load and lower as output current decreases. LM1117GSF is available as an adjustable or fixed 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V output voltages. The LM1117GSF is offered in a 3-pin surface mount package SOT-23.
The output capacitor of 10µF or larger is needed for output stability of LM1117GSF as required by most of the other regulator circuits.

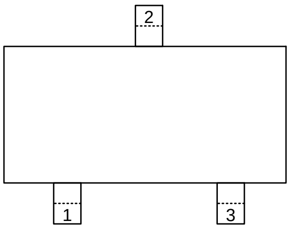
ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
DC Input Voltage	V_{IN}	-	20	V
Lead Temperature (Soldering, 5 seconds)	T_{SOL}	-	260	°C
Operating Junction Temperature Range	T_{OPR}	−40	125	°C
Storage Temperature Range	T_{STG}	−65	150	°C

ORDERING INFORMATION

VOUT	Package	Order No.	Supplied As	Status
ADJ	SOT-23-3L	LM1117GSF-ADJ	Tape & Reel	Active
1.2V	SOT-23-3L	LM1117GSF-1.2	Tape & Reel	Contact us
1.5V	SOT-23-3L	LM1117GSF-1.5	Tape & Reel	Contact us
1.8V	SOT-23-3L	LM1117GSF-1.8	Tape & Reel	Contact us
2.5V	SOT-23-3L	LM1117GSF-2.5	Tape & Reel	Active
3.3V	SOT-23-3L	LM1117GSF-3.3	Tape & Reel	Active
5.0V	SOT-23-3L	LM1117GSF-5.0	Tape & Reel	Active

PIN CONFIGURATION



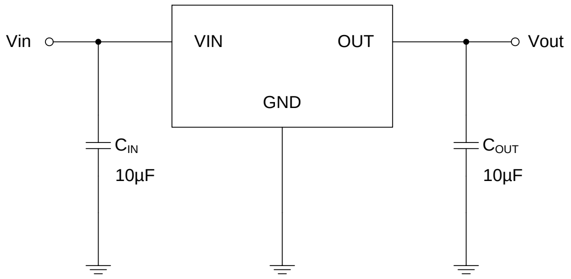
SOT-23

PIN DESCRIPTION

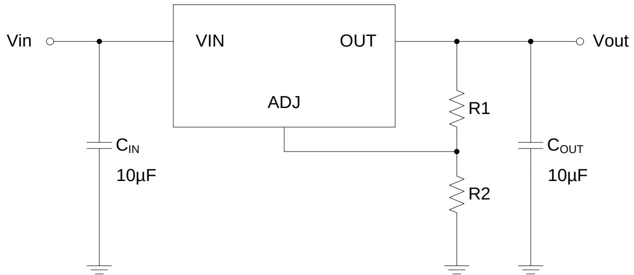
Pin No.	Pin Name	Pin Function
1	GND / ADJ	Ground (Fixed Version) or Adjustable
2	VOUT	Output Voltage
3	VIN	Input Voltage

TYPICAL APPLICATION CIRCUITS

< Fixed Version>



<Adjustable Version>



ELECTRICAL CHARACTERISTICS

For ADJ Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{REF}	Reference Voltage	V_{IN}=5V, I_O=10mA	1.238	1.250	1.262	V
V_{REF}	Reference Voltage	I_O = 10mA to 300mA, V_{IN} - V_{REF} = 1.5V to 13.75V (T_J = 0 ~ 125°C)	1.219		1.281	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} - V_{REF} = 1.5V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 300mA, V_{IN} - V_{REF} = 2 V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{ADJ}	Adjustment pin Current	V_{IN} - V_{REF} = 1.5V to 12V, I_O = 100mA		50	120	µA
ΔI_{ADJ}	Adjustment Pin Current Change	V_{IN} - V_{REF} = 1.5V to 12V, I_O = 100mA to 300mA		0.5	5	µA
$I_{O(MIN)}$	Minimum Load Current	V_{IN} = 5V, V_{REF} = 0V		2	7	mA
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_{REF} = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		0.003		%
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_{REF} = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 1.2V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 2.7V, I_O = 10mA	1.176	1.200	1.224	V
V_O	Output Voltage	V_{IN} = 2.7V to 12V, I_O = 0A to 300mA (T_J = 0 ~ 125°C)	1.152		1.248	V
ΔV_{LINE}	Line Regulation	I_O = 0mA , V_{IN} = 2.7V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 300mA, V_{IN} = 3.2V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		0.003		%
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_O = 1.5V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 1.5V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 3.0V, I_O = 10mA	1.485	1.5	1.515	V
V_O	Output Voltage	V_{IN} = 3.0V to 12V, I_O = 0A to 300mA (T_J = 0 ~ 125°C)	1.470		1.530	V
ΔV_{LINE}	Line Regulation	I_O = 0mA , V_{IN} = 3.0V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 0mA to 300mA, V_{IN} = 3.5 V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 1.8V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 3.3V, I_O = 10mA	1.782	1.8	1.818	V
V_O	Output Voltage	V_{IN} = 3.3V to 12V, I_O = 0A to 300mA (T_J = 0 ~ 125°C)	1.764		1.836	V
ΔV_{LINE}	Line Regulation	I_O = 0mA , V_{IN} = 3.3V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 0mA to 300mA, V_{IN} = 3.8 V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 2.5V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 4.0V, I_O = 10mA	2.475	2.5	2.525	V
V_O	Output Voltage	V_{IN} = 4.0V to 12V, I_O = 0A to 300mA (T_J = 0 ~ 125°C)	2.450		2.550	V
ΔV_{LINE}	Line Regulation	I_O = 0mA , V_{IN} = 4.0V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 0mA to 300mA, V_{IN} = 4.5 V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		uV
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 3.3V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 4.8V, I_O = 10mA	3.267	3.3	3.333	V
V_O	Output Voltage	V_{IN} = 4.8V to 12V, I_O = 0A to 300mA (T_J = 0 ~ 125°C)	3.234		3.366	V
ΔV_{LINE}	Line Regulation	I_O = 0mA , V_{IN} = 4.8V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 0mA to 300mA, V_{IN} = 5.3 V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

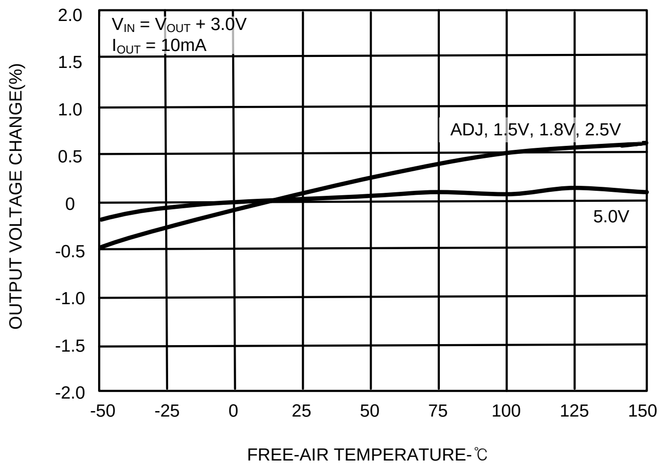
For 5.0V Output Voltage (T_J=25°C, C_{OUT} = 10μF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 6.5V, I_O = 10mA	4.950	5.0	5.050	V
V_O	Output Voltage	V_{IN} = 6.5V to 15V, I_O = 0A to 300mA (T_J = 0 ~ 125°C)	4.900		5.100	V
ΔV_{LINE}	Line Regulation	I_O = 0mA , V_{IN} = 6.5V to 15V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 0mA to 300mA, V_{IN} = 7.0 V		0.2	0.4	%
V_{IN}	Operating Input Voltage				15	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 300mA		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		μV
SVR	Supply Voltage Rejection	I_O = 300mA, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

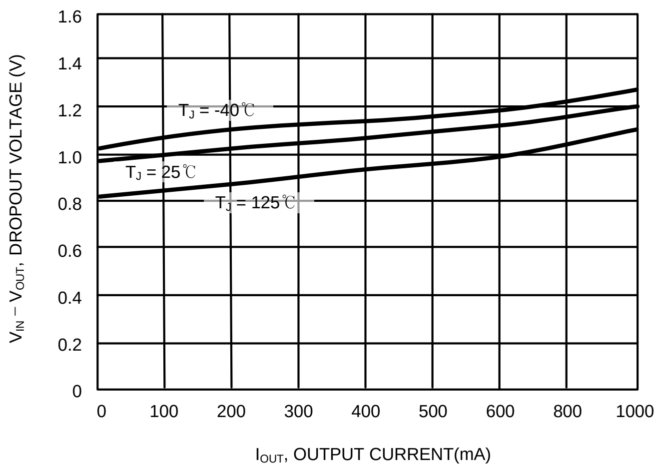
For All Output Voltage (T_J=25°C, C_{OUT} = 10μF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_D	Dropout Voltage	I_O = 300mA		1.2		V
	Temperature Stability			0.5		%
	Long Term Stability	1000 hrs, T_J = 125°C		0.3		%
	Thermal Regulation	T_A = 25°C 30ms Pulse		0.003		%/W

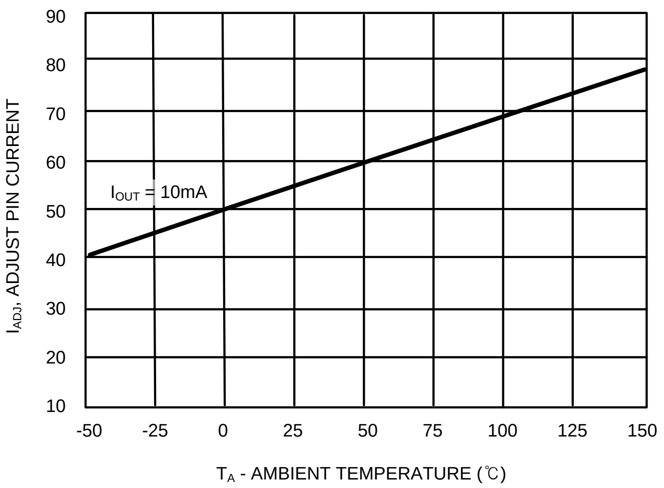
TYPICAL OPERATING CHARACTERISTICS



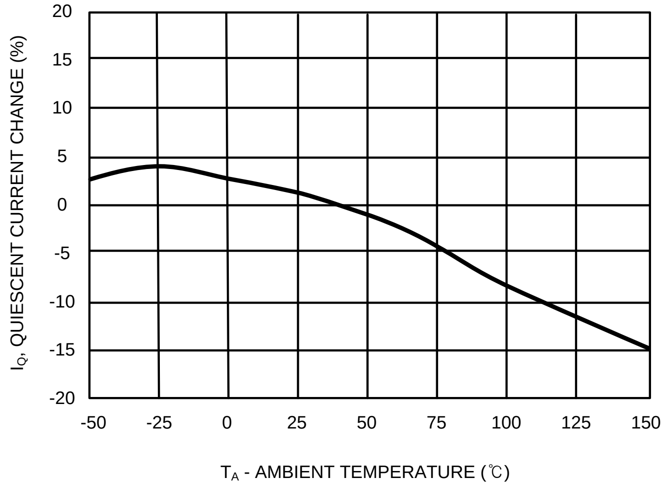
OUTPUT VOLTAGE CHANGE VS TEMPERATURE



DROPOUT VOLTAGE VS OUTPUT CURRENT



ADJ PIN CURRENT VS TEMPERATURE



QUIESCENT CURRENT CHANGE VS TEMPERATURE

APPLICATION CIRCUITS

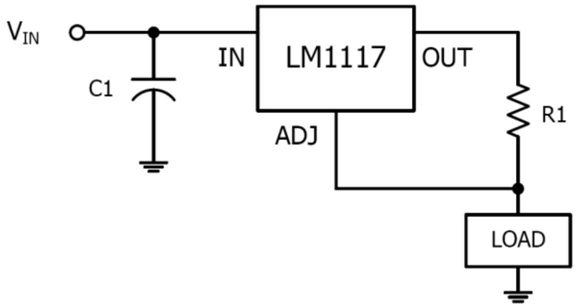


Fig.1 300mA Current Output

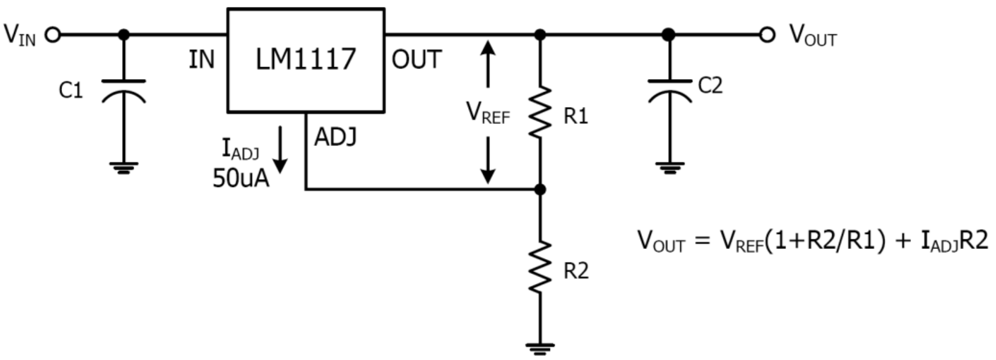


Fig.2 Typical Adjustable Regulator

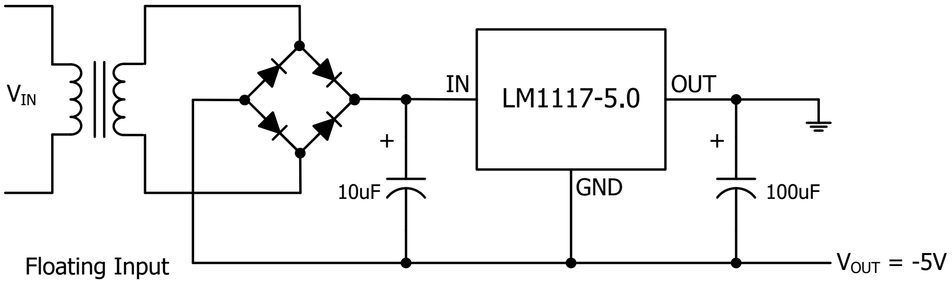


Fig.3 Negative Supply

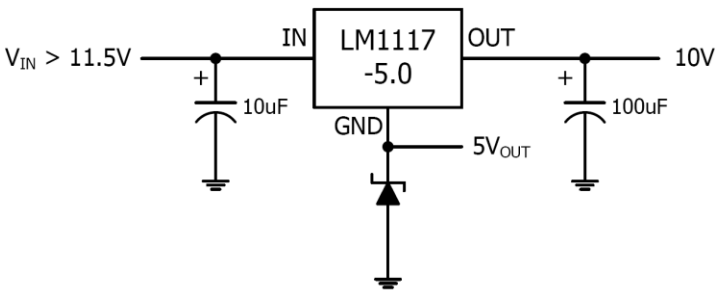


Fig.4 Voltage Regulator with Reference

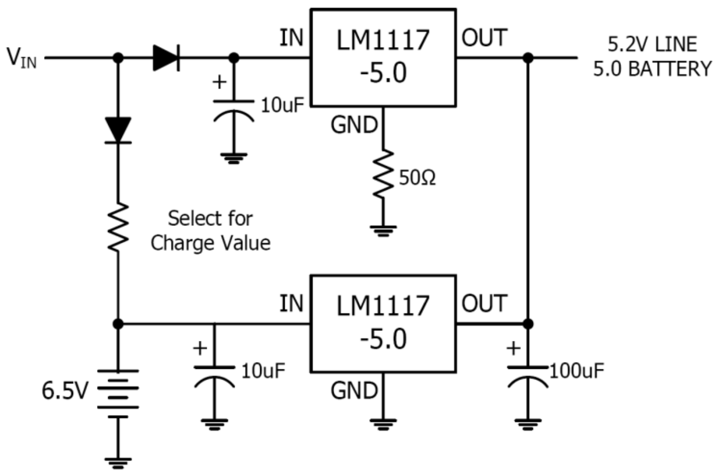


Fig.5 Battery Backed-up Regulated Supply

APPLICATION INFORMATION

The LM1117GSF can deliver a continuous current of 300mA over the full operating junction temperature range. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum output current of 300mA may be still undeliverable due to the restriction of the power dissipation of LM1117GSF. Under all possible conditions, the junction temperature must be within the range specified under operating conditions. The temperatures over the device are given by:

$$T_C = T_A + P_D \times \theta_{CA} \quad / \quad T_J = T_C + P_D \times \theta_{JC} \quad / \quad T_J = T_A + P_D \times \theta_{JA}$$

where T_J is the junction temperature, T_C is the case temperature, T_A is the ambient temperature, P_D is the total power dissipation of the device, θ_{CA} is the thermal resistance of case-to-ambient, θ_{JC} is the thermal resistance of junction-to-case, and θ_{JA} is the thermal resistance of junction to ambient. The total power dissipation of the device is given by:

$$P_D = P_{IN} - P_{OUT} = (V_{IN} \times I_{IN}) - (V_{OUT} \times I_{OUT})$$
$$= (V_{IN} \times (I_{OUT}+I_{GND})) - (V_{OUT} \times I_{OUT}) = (V_{IN} - V_{OUT}) \times I_{OUT} + (V_{IN} \times I_{GND})$$

where I_{GND} is the operating ground current of the device which is specified at the Electrical Characteristics. The maximum allowable temperature rise (T_{Rmax}) depends on the maximum ambient temperature (T_{Amax}) of the application, and the maximum allowable junction temperature (T_{Jmax}):

$$T_{Rmax} = T_{Jmax} - T_{Amax}$$

The maximum allowable value for junction-to-ambient thermal resistance, θ_{JA}, can be calculated using the formula:

$$\theta_{JA} = T_{Rmax} / P_D = (T_{Jmax} - T_{Amax}) / P_D$$

LM1117GSF is available in SOT-23 package. The thermal resistance depends on amount of copper area or heat sink, and on air flow. If the maximum allowable value of θ_{JA} calculated above is over 300°C/W for SOT-23 package, no heat sink is needed since the package can dissipate enough heat to satisfy these requirements. If the value for allowable θ_{JA} falls near or below these limits, a heat sink or proper area of copper plane is required. In summary, the absolute maximum ratings of thermal resistances are as follow:

Characteristic	Symbol	Rating	Unit
Thermal Resistance Junction-to-Ambient / SOT-23	θ_{JA}-SOT-23	300	°C/W

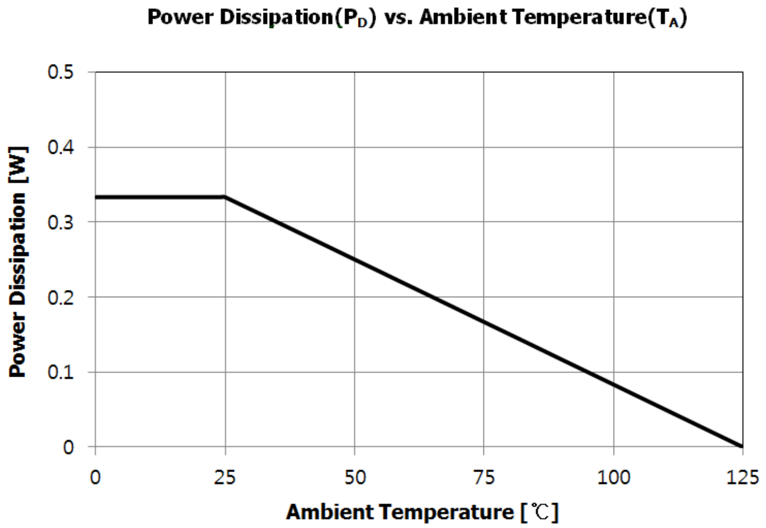
No heat sink / No air flow / No adjacent heat source / 0.066 $inch^2$ copper area. (T_A=25°C)

In case that there is no cooling solution and no heat sink / minimum copper plane area for heat sink, the maximum allowable power dissipation of each package is as follow:

Characteristic	Symbol	Rating	Unit
Maximum Allowable Power Dissipation at T_A=25°C / SOT-23	$P_{DMax-SOT-23}$	0.333	W

Please note that above maximum allowable power dissipation is based on the minimum copper plane area which does not exceed the proper footprint of the package. And the ambient temperature is 25°C.

If proper cooling solution such as heat sink, copper plane area, air flow is applied, the maximum allowable power dissipation could be increased. However, if the ambient temperature is increased, the allowable power dissipation would be decreased.



REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.