1A L.D.O. VOLTAGE REGULATOR

LM1117S/RS/F

FEATURES

● Output Current up to 1 A
● Low Dropout Voltage (1.2V at 1A Output Current)
● Three Terminal Adjustable(ADJ) or Fixed 1.2V,1.5V, 1.8V, 2.5V, 2.85V, 3.3V, 5.0V
● Line Regulaion typically at 0.1% max
● Load Regulaion typically at 0.2% max
● Internal Current and Terminal Protection
● Maximum Input Voltage – 15V
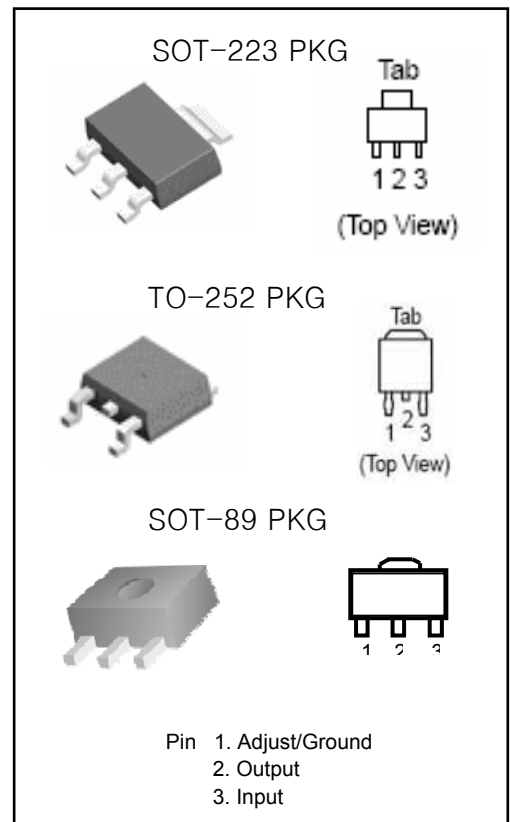● Surface Mount Package SOT–223, TO–252, SOT–89
● 100% Thermal Limit Burn–In

SOT–223 PKG

TO–252 PKG

SOT–89 PKG

Pin 1. Adjust/Ground
      2. Output
      3. Input

APPLICATION

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

ORDERING INFORMATION

Device (Marking)	Package
LM1117S–ADJ	SOT–223
LM1117S–XX	
LM1117RS–ADJ	TO–252
LM1117RS–XX	
LM1117F–ADJ	SOT–89
LM1117F–XX	

(X.X=Output Voltage=1.2V,1.5V, 1.8V, 2.5V, '3.3V, 5.0V, Adjustable=ADJ)

DESCRIPTION

The LM1117 is a low power positive–voltage regulator designed to meet 1A output current and comply with SCSI–II specifications with a fixed output voltage of 2.85V. This device is an excellent choice for use in battery–powered applications, as active terminators for the SCSI bus, and portable computers.
The LM1117 features very low quiescent current and very low dropout voltage of 1V at a full load and lower as output current decreases. LM1117 is available as an adjustable or fixed 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V output voltages.
The LM1117 is offered in a 3–pin surface mount package SOT–223, TO–252 & SOT–89. The output capacitor of $10\mu F$ or larger is needed for output stability of LM1117 as required by most of the other regulator circuits.

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
DC Input Voltage	V_{IN}		15	V
Lead Temperature (Soldering, 5 Seconds)	T_{SOL}		260	℃
Storage Temperature Range	T_{STG}	−65	150	℃
Operating Junction Temperature Range	T_{OPR}	−40	125	℃

THERMAL DATA

PARAMETER	SYMBOL	SOT−223	TO−252	SOT−89	UNIT
Thermal Resistance Junction−Ambient	$R_{\theta JA}$	130	93	315	℃/W

TYPICAL APPLICATION

FIXED OUTPUT VOLTAGE

ELECTRICAL CHARACTERISTICS FOR   LM1117S/RS/F-ADJ(ADJUSTABLE)

(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage	V_{REF}	I_O = 10mA to 1A, $V_{IN} - V_O$ = 1.5 to 13.75V	1.238	1.25	1.262	V
Reference Voltage(TJ=0~125℃)	V_{REF}	I_O = 10mA to 1A, $V_{IN} - V_O$ = 1.5 to 13.75V	1.219		1.281	V
Line Regulation	ΔV_O	I_O = 10mA , $V_{IN} - V_O$ = 1.5 to 13.75V		0.1	0.2	%
Load Regulation	ΔV_O	I_O = 10mA to 1A, $V_{IN} - V_O$ = 2 V		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}				15	V
Adjustment Pin Current	I_{ADJ}	$V_{IN} - V_O$ = 1.5 to 12V I_O = 100mA		50	120	μA
Adjustment Pin Current Change	ΔI_{ADJ}	$V_{IN} - V_O$ = 1.5 to 12V, I_O = 10mA to 1A		0.5	5	μA
Minimum Load Current	$I_{O(MIN)}$	$V_{IN} - V_O$ = 12V		5	10	mA
Current Limit	I_O	$V_{IN} - V_O$ = 5V	1000	1250	1600	mA
Output Noise (%V_O)	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		0.003		%
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ $V_{IN} - V_O$ = 3V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

ELECTRICAL CHARACTERISTICS FOR   LM1117S/RS/F-1.2V

(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 3.2 I_O = 0mA to 1A	1.176	1.20	1.224	V
Output Voltage	V_O	V_{IN}=2.5 to 12V, I_O=0mA to 1A (Tj = 0~125℃)	1.152		1.248	V
Line Regulation	ΔV_O	I_O = 10mA , $V_{IN} - V_O$ = 1.5 to 13.75V		0.1	0.2	%
Load Regulation	ΔV_O	I_O = 10mA to 1A, $V_{IN} - V_O$ = 2 V		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}				15	V
Quiescent Current	I_D	$V_{IN} - Vo$ = 5V		5	10	mA
Current Limit	I_O	$V_{IN} - V_O$ = 5V	1000	1250	1600	mA
Output Noise (%V_O)	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		0.003		%
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ $V_{IN} - V_O$ = 3V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

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ELECTRICAL CHARACTERISTICS FOR LM1117 S/RS/F-1.5
(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 3.0 to 12V, I_O = 0mA to 1A	1.485	1.5	1.515	V
Output Voltage	V_O	V_{IN}=3.0 to 12V, I_O=0mA to 1A (Tj = 0~125℃)	1.470		1.530	V
Line Regulation	ΔV_O	V_{IN} = 3.0 to 12V, I_O = 0mA		0.1	0.2	%
Load Regulation	ΔV_O	V_{IN} = 3.5V, I_O = 0 to 1A		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}	I_O = 100mA			12	V
Quiescent Current	I_D	V_{IN}－Vo = 5V		5	10	mA
Current Limit	I_O	V_{IN}－Vo = 5V	1000	1250	1600	mA
Output Noise Voltage	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		100		μV
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ V_{IN} = 5.5V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

ELECTRICAL CHARACTERISTICS FOR LM1117 S/RS/F-1.8
(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 3.3 to 12V, I_O = 0mA to 1A	1.782	1.8	1.818	V
Output Voltage	V_O	V_{IN}=3.3 to 12V, I_O=0mA to 1A (Tj = 0~125℃)	1.764		1.836	V
Line Regulation	ΔV_O	V_{IN} = 3.3 to 12V, I_O = 10mA		0.1	0.2	mV
Load Regulation	ΔV_O	V_{IN} = 3.8V, I_O = 0 to 1A		0.2	0.4	mV
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}	I_O = 100mA			12	V
Quiescent Current	I_D	V_{IN}－Vo = 5V		5	10	mA
Current Limit	I_O	V_{IN}－Vo = 5V	1000	1250	1600	mA
Output Noise Voltage	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		100		μV
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ V_{IN} = 5.5V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

ELECTRICAL CHARACTERISTICS FOR LM1117 S/RS/F−2.5
(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 4.0 to 12V, I_O = 0mA to 1A	2.475	2.5	2.525	V
Output Voltage	V_O	V_{IN}=4.0 to 12V, I_O=0mA to 1A (Tj = 0~125℃)	2.450		2.550	V
Line Regulation	ΔV_O	V_{IN} = 4.0 to 12V, I_O = 10mA		0.1	0.2	%
Load Regulation	ΔV_O	V_{IN} = 4.5V, I_O = 0 to 1A		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}	I_O = 100mA			12	V
Quiescent Current	I_D	V_{IN} − Vo = 5V		5	10	mA
Current Limit	I_O	V_{IN} − Vo = 5V	1000	1250	1600	mA
Output Noise Voltage	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		100		μV
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ V_{IN} = 5.5V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.01	0.1	%/W

ELECTRICAL CHARACTERISTICS FOR LM1117 S/RS/F−2.85
(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

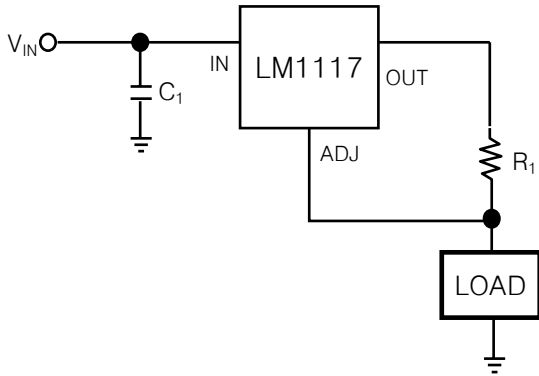| PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 4.4 to 12V, I_O = 0mA to 1A	2.821	2.85	2.878	V
Output Voltage	V_O	V_{IN}=4.4 to 12V, I_O=0mA to 1A (Tj = 0~125℃)	2.793		2.907	V
Line Regulation	ΔV_O	V_{IN} = 4.4 to 12V, I_O = 10mA		0.1	0.2	%
Load Regulation	ΔV_O	V_{IN} = 4.85V, I_O = 0 to 1A		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}	I_O = 100mA			12	V
Quiescent Current	I_D	V_{IN} − Vo = 5V		5	10	mA
Current Limit	I_O	V_{IN} − Vo = 5V	1000	1250	1600	mA
Output Noise Voltage	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		100		μV
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ V_{IN} = 5.85V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

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ELECTRICAL CHARACTERISTICS FOR LM1117 S/RS/F−3.3
(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 4.8 to 12V, I_O = 0mA to 1A	3.267	3.3	3.333	V
Output Voltage	V_O	V_{IN}=4.8 to 12V, I_O=0mA to 1A (Tj = 0~125℃)	3.234		3.366	V
Line Regulation	ΔV_O	V_{IN} = 4.8 to 12V, I_O = 10mA		0.1	0.2	%
Load Regulation	ΔV_O	V_{IN} = 5.3V, I_O = 0 to 1A		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}	I_O = 100mA			12	V
Quiescent Current	I_D	V_{IN} − Vo = 5V		5	10	mA
Current Limit	I_O	V_{IN} − Vo = 5V	1000	1250	1600	mA
Output Noise Voltage	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		100		μV
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ V_{IN} = 6.3V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

ELECTRICAL CHARACTERISTICS FOR LM1117 S/RS/F−5.0
(Refer to the test circuits, T_J=25℃ C_O=10μF unless otherwise specified)

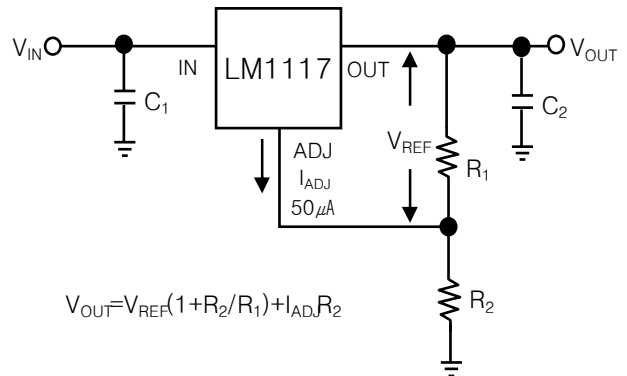| PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	V_{IN} = 6.5 to 15V, I_O = 0mA to 1A	4.950	5.0	5.050	V
Output Voltage	V_O	V_{IN}=6.5 to 15V, I_O=0mA to 1A (Tj = 0~125℃)	4.900		5.100	V
Line Regulation	ΔV_O	V_{IN} = 6.5 to 15V, I_O = 10mA		0.1	0.2	%
Load Regulation	ΔV_O	V_{IN} = 7.0V, I_O = 0 to 1A		0.2	0.4	%
Temperature Stability	ΔV_O			0.5		%
Long Term Stability	ΔV_O	1000 hrs, T_J = 125℃		0.3		%
Operating Input Voltage	V_{IN}	I_O = 100mA			15	V
Quiescent Current	I_D	V_{IN} − Vo = 5V		5	10	mA
Current Limit	I_O	V_{IN} − Vo = 5V	1000	1250	1600	mA
Output Noise Voltage	$_EN$	B = 10Hz to 10kHz, T_J = 25℃		100		μV
Supply Voltage Rejection	SVR	I_O = 40mA , f = 120Hz, T_J = 25℃ V_{IN} = 6.3V, V_{NIPPLE} = 1V_{PP}	60	75		dB
Dropout Voltage	V_D	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
Thermal Regulation		T_A = 25℃ 30ms Pulse		0.003		%/W

APPLICATION CIRCUITS
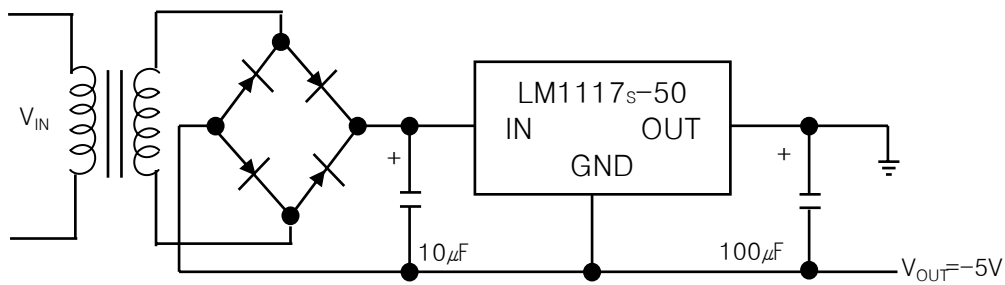
Figure 1.

1A Current Output

Figure 2.

$$V_{OUT} = V_{REF}(1 + R_2/R_1) + I_{ADJ}R_2$$

Typical Adjustable Regulator

Figure 3. Negative Supply

$$V_{OUT} = -5V$$

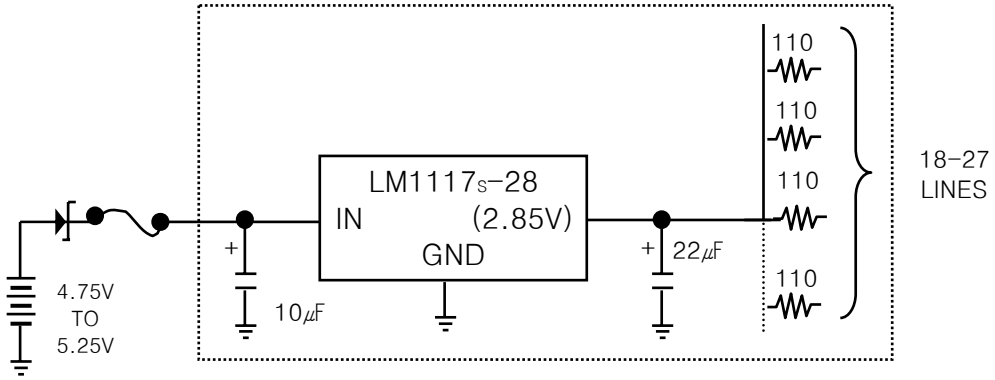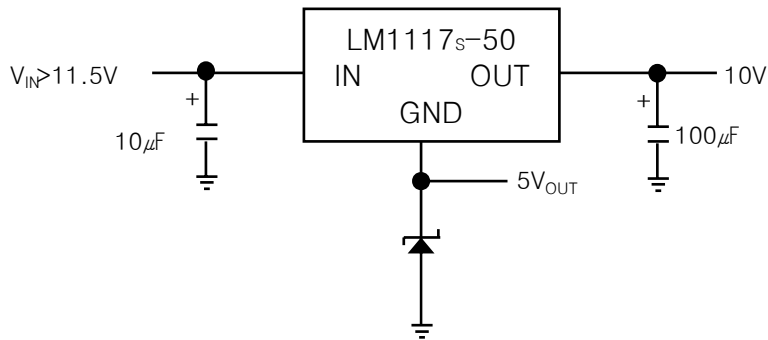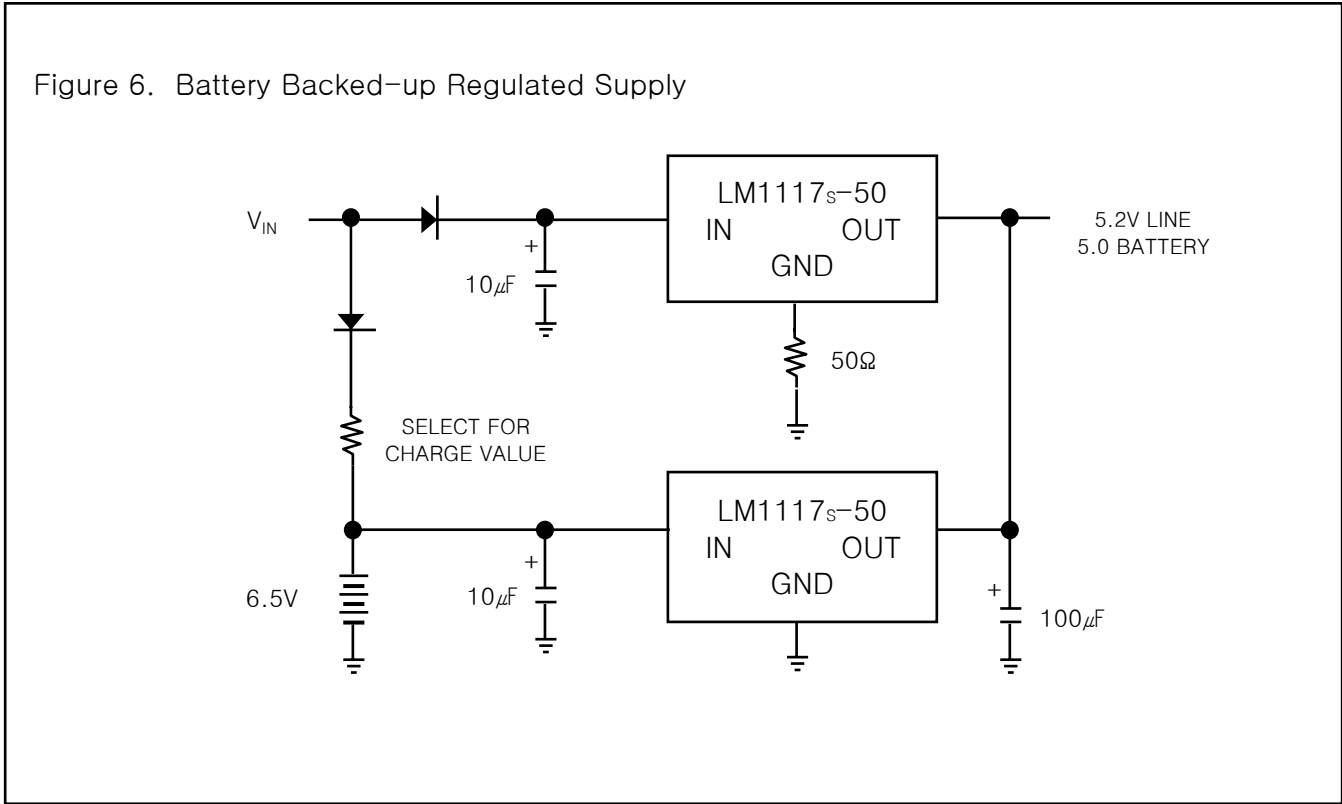FLOATING INPUT

Figure 4. Active Terminator for SCSI−2 BUS

LM1117s−28 (2.85V)

IN   GND

10μF   22μF

110
110
110
110

18−27 LINES

4.75V TO 5.25V

Figure 5. Voltage Regulator With Reference

LM1117s−50

IN   OUT   GND

$V_{IN} > 11.5V$

10μF   100μF

10V

$5V_{OUT}$

Figure 6. Battery Backed−up Regulated Supply

* NOTES : IF ANYTHING WILL BE CHANGED FOR THIS SPECIFICATION,
         TAEJIN TECHNOLOGY MUST INFORM PCC BEFORE THE CHANGE

1A L.D.O. VOLTAGE REGULATOR

LM1117S/RS/F

Typical Performance Characteristics

FIG 1. OUTPUT VOLTAGE CHANGE vs TEMPERATURE(℃)
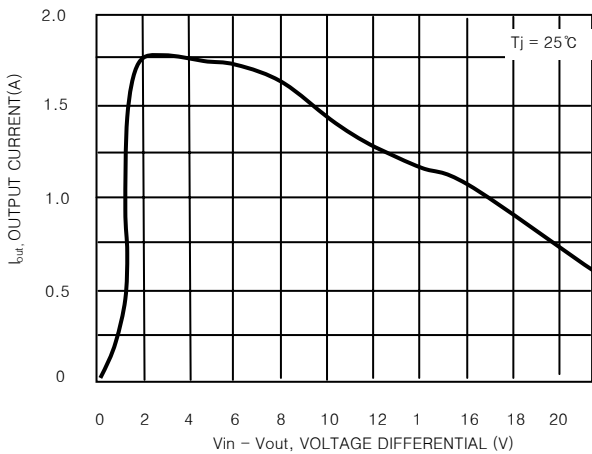
FIG 2. DROPOUT VOLTAGE vs OUTPUT CURRENT

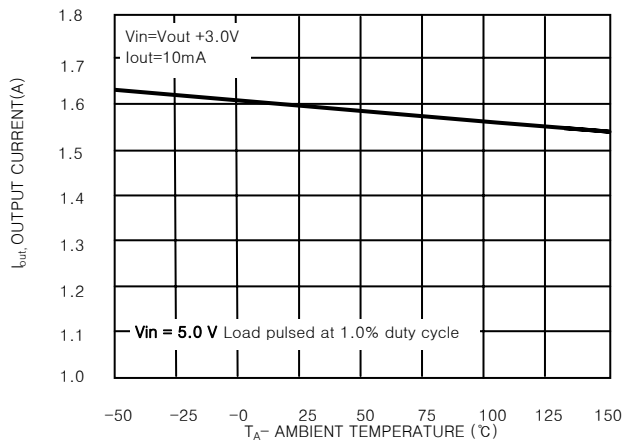FIG 3. OUTPUT SHORT CIRCUIT CURRENT
vs DIFFERENTIAL VOLTAGE
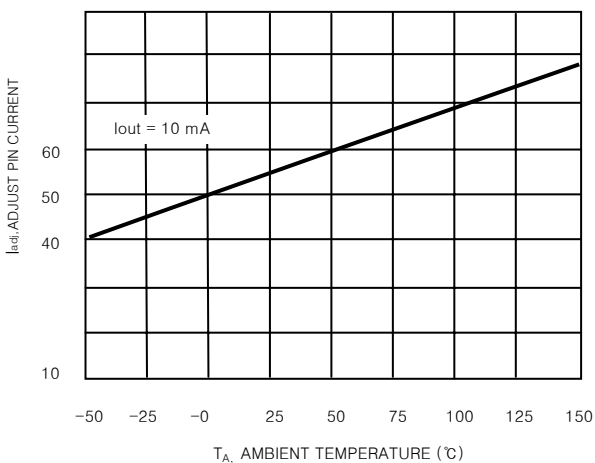
FIG 4. OUTPUT SHORT CIRCUIT CURRENT
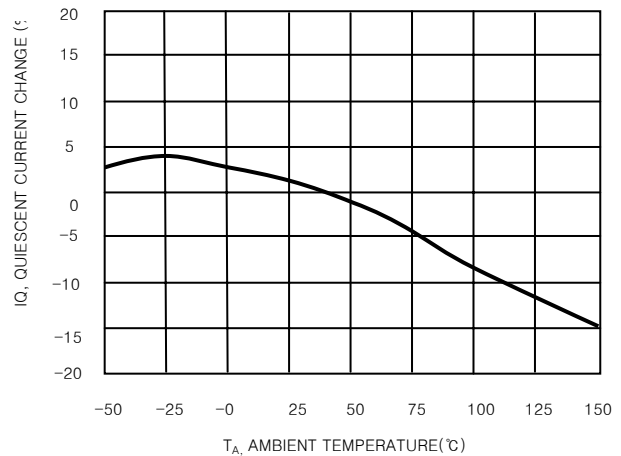vs TEMPERATURE

FIG 5. ADJ PIN CURRENT vs TEMPERATURE (℃)

FIG 6. QUIESCENT CURRENT CHANGE vs TEMPERATURE
(℃)

Maximum Output Current Capability

The LM1117 can deliver a continuous current of 1A over the full operating junction temperature range. However, the 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 th applied package, the maximum output current of 1A may be still undeliverable due to the restriction of the power diss of LM1117. Under all possible conditions, the junction temperature must be within the range specified under operating conditions. The temperatures over the device are given by:

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

T_J is the junction temperature, T_C is the case temperature, T_A is the ambient temperature, P_D is the total power dissi of the device, θCA is the thermal resistance of case-to-ambient, θJC is the thermal resistance of junction-to-case, and θJA 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 max allowable temperature rise (TRmax) depends on the maximum ambient temperature (TAmax) of the application and the maximum allowable junction temperature (TJmax):

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

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

$$\theta_{JA} = T_{Rmax} / P_D$$

LM1117 is available in SOT223, TO252 packages. The thermal resistance depends on amount of copper area or he and on air flow. If the maximum allowable value of θJA calculated above is over 130°C/W for SO-223 package, over for TO252 package, no heat sink is needed since the package can dissipate enough heat to satisfy these requirements. If the value for allowable θJA falls near or below these limits, a heat sink or proper area of cop plane is required. In summary, the absolute maximum ratings of thermal resistances are as follow:

Absolute Maximum Ratings of Thermal Resistance

Characteristic	Symbol	Max. Rating	Unit
Thermal Resistance Junction−To−Ambient / SOT223	θJA−SOT223	130	°C/W
Thermal Resistance Junction−To−Ambient / TO252	θJA−TO252	93	°C/W
Thermal Resistance Junction−To−Ambient / SOT89	θJA−SOT89	315	°C/W

No heat sink / No air flow / No adjacent heat source / 0.066 inch^2 copper area