

REG1117
REG1117A

800mA and 1A Low Dropout Positive Regulator 2.85V, 3V, 3.3V, 5V, and Adjustable

FEATURES

- 2.85V, 3V, 3.3V, 5V, and ADJUSTABLE VERSIONS
- 2.85V MODEL FOR SCSI-2 ACTIVE TERMINATION
- OUTPUT CURRENT:
REG1117: 800mA max
REG1117A: 1A max
- OUTPUT TOLERANCE: $\pm 1\%$ max
- DROPOUT VOLTAGE:
REG1117: 1.2V max at $I_o = 800\text{mA}$
REG1117A: 1.3V max at $I_o = 1\text{A}$
- INTERNAL CURRENT LIMIT
- THERMAL OVERLOAD PROTECTION
- SOT-223 SURFACE MOUNT PACKAGE

DESCRIPTION

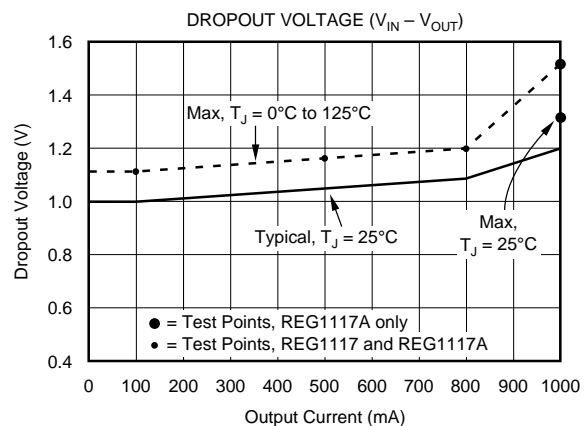
The REG1117 is a family of three-terminal voltage regulators capable of up to 800mA output. Fixed output models include 2.85V, 3V, 3.3V and 5V versions. The REG1117A provides 1A of output current in an adjustable version. Output voltage of the adjustable versions is set with two external resistors. The REG1117's low dropout voltage allows its use with as little as 1V input-output voltage differential.

Laser trimming assures excellent output voltage accuracy without adjustment. An NPN output stage allows output stage drive to contribute to the load current for maximum efficiency.

REG1117 and REG1117A are packaged in an SOT-223 surface-mount package, suitable for reflow soldering techniques.

APPLICATIONS

- SCSI-2 ACTIVE TERMINATION
- HAND-HELD DATA COLLECTION DEVICES
- HIGH EFFICIENCY LINEAR REGULATORS
- 5V LINEAR REGULATORS
- BATTERY POWERED INSTRUMENTATION
- BATTERY MANAGEMENT CIRCUITS FOR NOTEBOOK AND PALMTOP PCs



SPECIFICATIONS

At $T_J = +25^\circ\text{C}$, unless otherwise noted.

PARAMETER	CONDITIONS	REG1117, REG1117A			UNITS
		MIN	TYP	MAX	
OUTPUT VOLTAGE					
REG1117-2.85	$I_O = 10\text{mA}, V_{IN} = 4.85\text{V}$	2.82	2.85	2.88	V
Note 1	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 4.05 \text{ to } 10\text{V}$	2.79	2.85	2.91	V
REG1117-3	$I_O = 10\text{mA}, V_{IN} = 5\text{V}$	2.97	3.00	3.03	V
Note 1	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 4.5 \text{ to } 10\text{V}$	2.94	3.00	3.06	V
REG1117-3.3	$I_O = 10\text{mA}, V_{IN} = 5.3\text{V}$	3.27	3.30	3.33	V
Note 1	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 4.8 \text{ to } 10\text{V}$	3.24	3.30	3.36	V
REG1117-5	$I_O = 10\text{mA}, V_{IN} = 7\text{V}$	4.95	5.00	5.05	V
Note 1	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 6.5 \text{ to } 10\text{V}$	4.90	5.00	5.10	V
REFERENCE VOLTAGE					
REG1117 (Adjustable)	$I_O = 10\text{mA}, V_{IN} - V_O = 2\text{V}$	1.238	1.250	1.262	V
Note 1	$I_O = 10 \text{ to } 800\text{mA}, V_{IN} - V_O = 1.4 \text{ to } 10\text{V}$	1.225	1.250	1.280	V
REG1117A (Adjustable)	$I_O = 10\text{mA}, V_{IN} - V_O = 2\text{V}$	1.238	1.250	1.262	V
Note 1	$I_O = 10\text{mA} \text{ to } 1\text{A}, V_{IN} - V_O = 1.4 \text{ to } 10\text{V}$	1.225	1.250	1.280	V
LINE REGULATION					
REG1117-2.85	$I_O = 0, V_{IN} = 4.25 \text{ to } 10\text{V}$		1	7	mV
Note 1					
REG1117-3	$I_O = 0, V_{IN} = 4.5 \text{ to } 10\text{V}$		2	7	mV
Note 1					
REG1117-3.3	$I_O = 0, V_{IN} = 4.8 \text{ to } 10\text{V}$		2	7	mV
Note 1					
REG1117-5	$I_O = 0, V_{IN} = 6.5 \text{ to } 15\text{V}$		3	10	mV
Note 1					
REG1117 (Adjustable)	$I_O = 10\text{mA}, V_{IN} - V_O = 1.5 \text{ to } 13.75\text{V}$		0.1	0.4	%
Note 1					
REG1117A (Adjustable)	$I_O = 10\text{mA}, V_{IN} - V_O = 1.5 \text{ to } 13.75\text{V}$		0.1	0.4	%
Note 1					
LOAD REGULATION					
REG1117-2.85	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 4.25\text{V}$		2	10	mV
Note 1					
REG1117-3	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 4.5\text{V}$		2	12	mV
Note 1					
REG1117-3.3	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 4.8\text{V}$		3	12	mV
Note 1					
REG1117-5	$I_O = 0 \text{ to } 800\text{mA}, V_{IN} = 6.5\text{V}$		3	15	mV
Note 1					
REG1117 (Adjustable)	$I_O = 10 \text{ to } 800\text{mA}, V_{IN} - V_O = 3\text{V}$		0.1	0.4	%
Note 1, 2					
REG1117A (Adjustable)	$I_O = 10\text{mA} \text{ to } 1\text{A}, V_{IN} - V_O = 3\text{V}$		0.1	0.4	%
Note 1, 2					
DROPOUT VOLTAGE					
All Models	$I_O = 100\text{mA}$		1.00	1.10	V
Note 1					
	$I_O = 500\text{mA}$		1.05	1.15	V
Note 1					
REG1117 Models	$I_O = 800\text{mA}$		1.10	1.20	V
Note 1					
REG1117A	$I_O = 1\text{A}$		1.2	1.30	V
Note 1	$I_O = 1\text{A}$		1.2	1.55	V
CURRENT LIMIT					
REG1117 Models	$V_{IN} - V_O = 5\text{V}$	800	950	1200	mA
REG1117A	$V_{IN} - V_O = 5\text{V}$	1000	1250	1600	mA
MINIMUM LOAD CURRENT					
Adjustable Models	$V_{IN} - V_O = 13.75\text{V}$		1.7	5	mA
Note 1, 2					
QUIESCENT CURRENT					
Fixed-Voltage Models	$V_{IN} - V_O = 5\text{V}$		4	10	mA
Note 1					
Adjust Pin Current	$I_O = 10\text{mA}, V_{IN} - V_O = 1.4 \text{ to } 10\text{V}$		50	120	μA
Note 1, 2					
vs Load Current, REG1117	$I_O = 10\text{mA} \text{ to } 800\text{mA}, V_{IN} - V_O = 1.4 \text{ to } 10\text{V}$		0.5	5	μA
Note 1					
vs Load Current, REG1117A	$I_O = 10\text{mA} \text{ to } 1\text{A}, V_{IN} - V_O = 1.4 \text{ to } 10\text{V}$		0.5	5	μA
Note 1					
THERMAL REGULATION					
All Models	30ms Pulse		0.01	0.1	%/W
Note 4					
RIPPLE REJECTION					
All Models	$f = 120\text{Hz}, V_{IN} - V_{OUT} = 3\text{V} + 1V_{PP}$ Ripple		62		dB
TEMPERATURE DRIFT					
Fixed-Voltage Models	$T_J = 0^\circ\text{C} \text{ to } +125^\circ\text{C}$		0.5		%
Adjustable Models	$T_J = 0^\circ\text{C} \text{ to } +125^\circ\text{C}$		2		%
LONG-TERM STABILITY					
All Models	$T_A = +125^\circ\text{C}, 1000\text{Hr}$		0.3		%
OUTPUT NOISE					
RMS noise All Models	$f = 10\text{Hz} \text{ to } 10\text{kHz}$		0.003		%
THERMAL RESISTANCE					
Operating Junction Temperature Range		0		+125	$^\circ\text{C}$
Storage Range		-55		+125	$^\circ\text{C}$
Thermal Resistance, θ_{JC}					
3-Lead SOT-223 Surface-Mount	(Junction-to-Case at Tab)		15		$^\circ\text{C}/\text{W}$

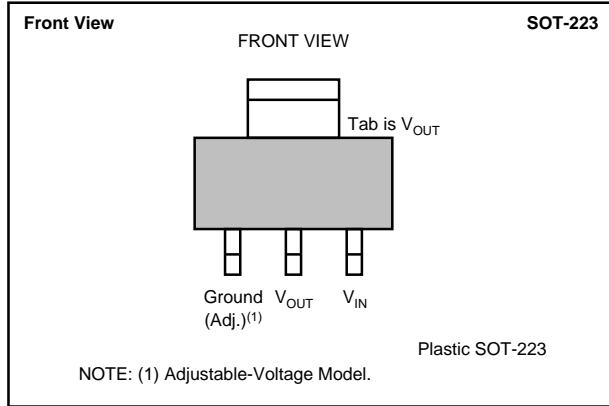
NOTES: (1) Specification applies over the full operating Junction temperature range, 0°C to 125°C . (2) REG1117 and REG1117A adjustable versions require a minimum load current for $\pm 3\%$ regulation. (3) Dropout voltage is the Input voltage minus output voltage that produces a 1% decrease in output voltage. (4) Percentage change in unloaded output voltage before vs after a 30ms power pulse of $I_O = 800\text{mA}$ (REG1117 models), $I_O = 1\text{A}$ (REG1117A), $V_{IN} - V_O = 1.4\text{V}$ (Reading taken 10ms after pulse).

ABSOLUTE MAXIMUM RATINGS

Power Dissipation	Internally Limited
Input Voltage	15V
Operating Junction Temperature Range	0°C to +125°C
Storage Temperature Range	-40°C to +150°C
Lead Temperature (soldering, 10s) ⁽¹⁾	+300°C

NOTE: (1) See "Soldering Methods."

CONNECTION DIAGRAM



ORDERING INFORMATION

PRODUCT ⁽¹⁾	PART MARKING	PACKAGE
800mA Current Out		
REG1117-2.85	BB11172	Plastic SOT-223
REG1117-3	BB11173	Plastic SOT-223
REG1117-3.3	BB11174	Plastic SOT-223
REG1117-5	BB11175	Plastic SOT-223
REG1117	BB1117	Plastic SOT-223
1A Current Out		
REG1117A	BB1117A	Plastic SOT-223

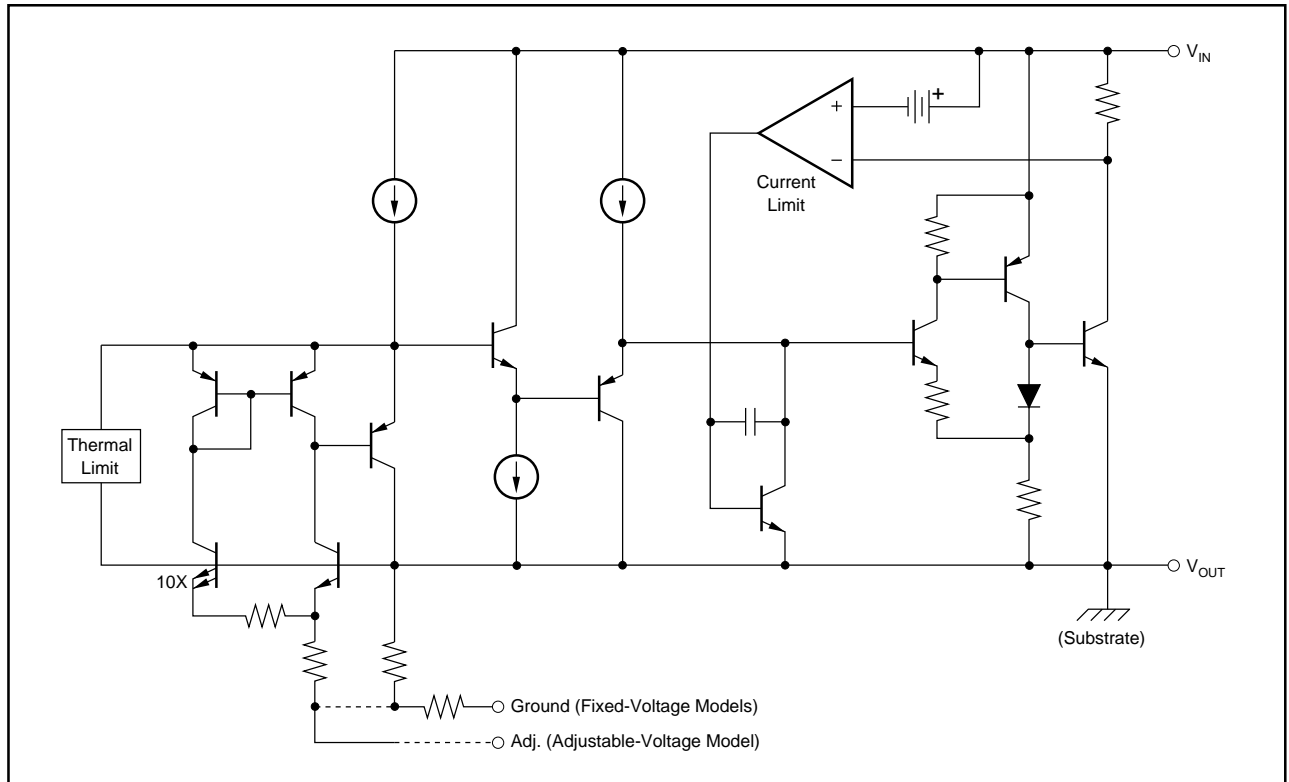
NOTE: (1) Available in Tape and Reel, add -TR to Model Number.

PACKAGE INFORMATION

PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER ⁽¹⁾
800mA Current Out		
REG1117-2.85	Plastic SOT-223	311
REG1117-3	Plastic SOT-223	311
REG1117-3.3	Plastic SOT-223	311
REG1117-5	Plastic SOT-223	311
REG1117	Plastic SOT-223	311
1A Current Out		
REG1117A	Plastic SOT-223	311

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book.

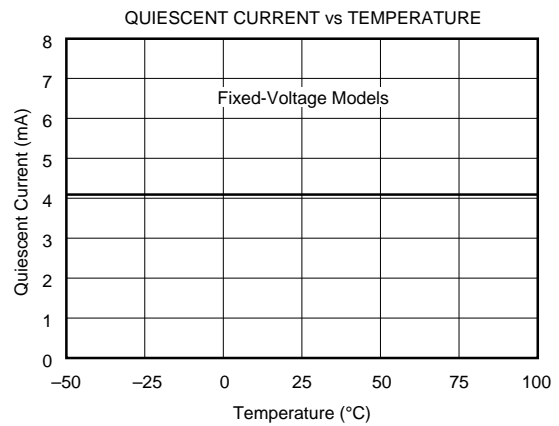
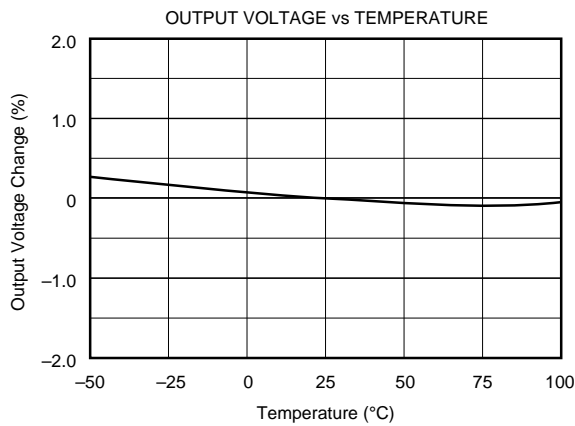
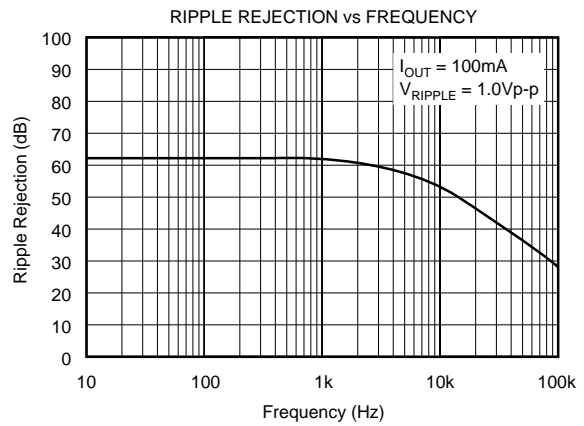
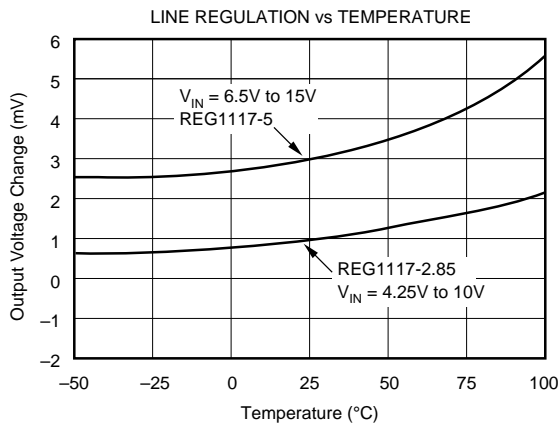
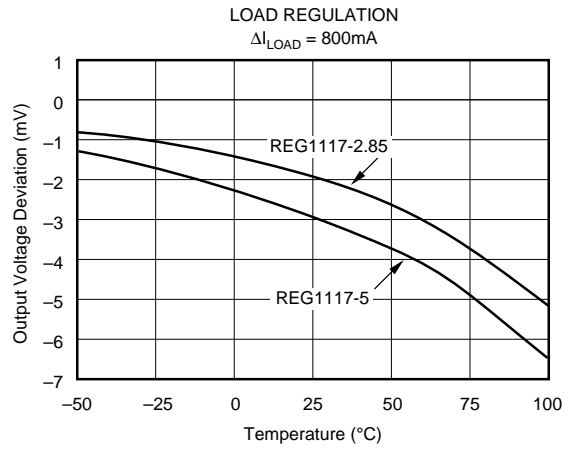
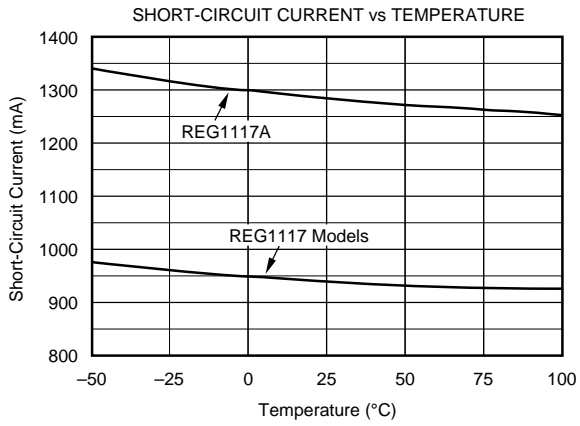
SIMPLIFIED SCHEMATIC



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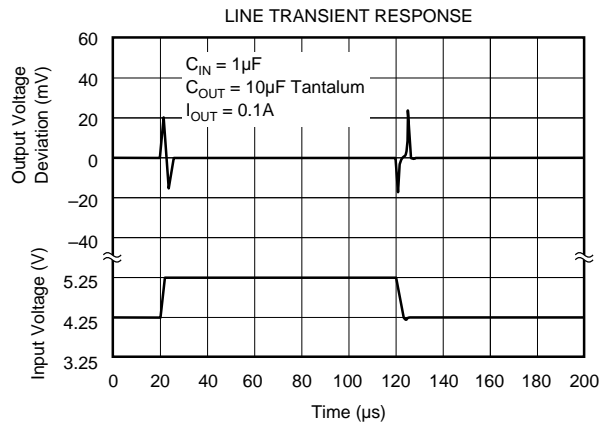
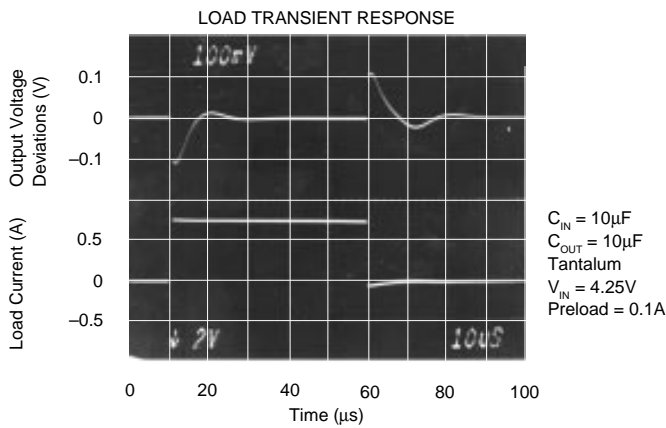
TYPICAL PERFORMANCE CURVE

At $T_J = +25^\circ\text{C}$, unless otherwise specified.



TYPICAL PERFORMANCE CURVE (CONT)

At $T_j = +25^\circ\text{C}$, unless otherwise specified.



APPLICATIONS INFORMATION

Figure 1 shows the basic hookup diagram for fixed-voltage models. All models require an output capacitor for proper operation and to improve high frequency load regulation. A $10\mu\text{F}$ tantalum capacitor is recommended. Aluminum electrolytic types of $50\mu\text{F}$ or greater can also be used. A high quality capacitor should be used to assure that the ESR (effective series resistance) is less than 0.5Ω .

Figure 2 shows a the hookup diagram for the adjustable voltage model. Resistor values are shown for some commonly used output voltages. Values for other voltages can be calculated from the equation shown in Figure 2. For best load regulation, connect R_1 close to the output pin and R_2 close to the ground side of the load as shown.

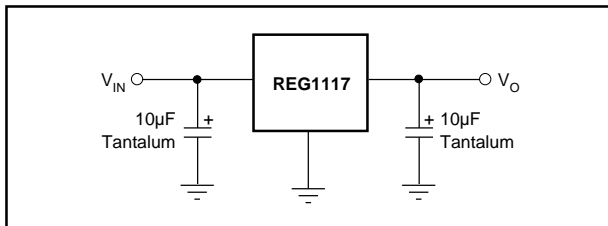


FIGURE 1. Fixed-Voltage Model—Basic Connections.

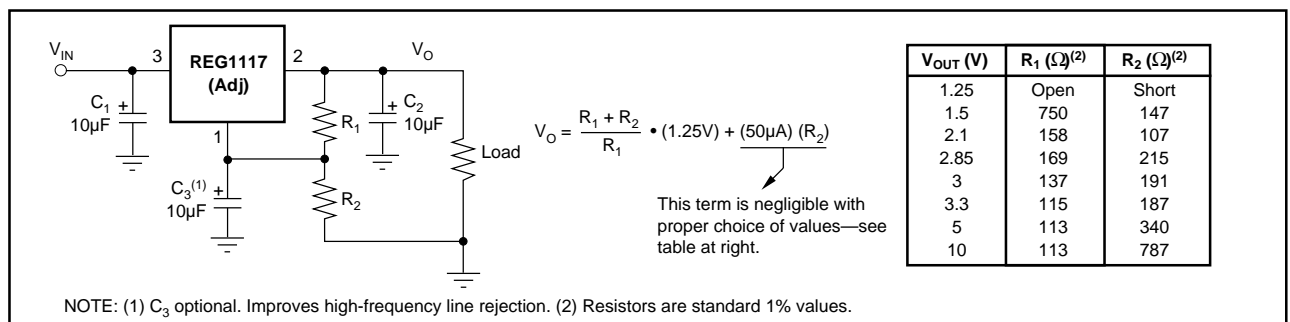


FIGURE 2. Adjustable-Voltage Model—Basic Connections.

THERMAL CONSIDERATIONS

The REG1117 has current limit and thermal shutdown circuits that protect it from overload. The thermal shutdown activates at approximately $T_j = 165^\circ\text{C}$. For continuous operation, however, the junction temperature should not be allowed to exceed 125°C . Any tendency to activate the thermal shutdown in normal use is an indication of an inadequate heat sink or excessive power dissipation. The power dissipation is equal to:

$$P_D = (V_{IN} - V_{OUT}) I_{OUT}$$

The junction temperature can be calculated by:

$$T_J = T_A + P_D (\theta_{JA})$$

where T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance

The REG1117 derives heat sinking from conduction through its copper leads, especially the large mounting tab. These must be soldered to a circuit board with a substantial amount of copper remaining (see Figure 3). Circuit board traces connecting to the tab and the leads should be made as large as practical. Other nearby circuit traces, including those on the back side of the circuit board, help conduct heat away

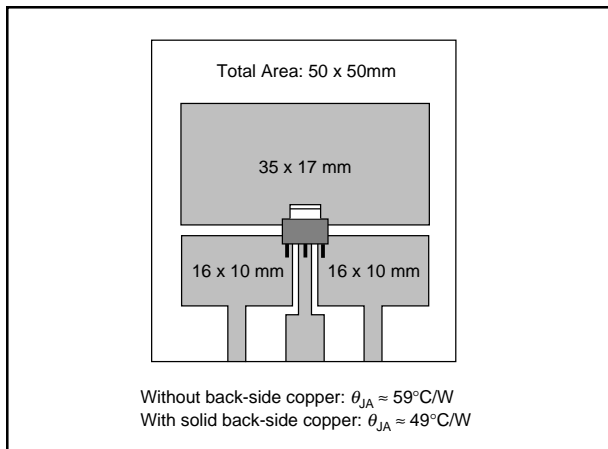


FIGURE 3. Circuit Board Layout Example.

from the device, even though they are not electrically connected. Make all nearby copper traces as wide as possible and leave only narrow gaps between traces.

Table I shows approximate values of θ_{JA} for various circuit board and copper areas. Nearby heat dissipating components, circuit board mounting conditions and ventilation can dramatically affect the actual θ_{JA} .

A simple experiment will determine whether the maximum recommended junction temperature is exceeded in an actual circuit board and mounting configuration: Increase the ambient temperature above that expected in normal operation until the device's thermal shutdown is activated. If this occurs at more than 40°C above the maximum expected ambient temperature, then the T_J will be less than 125°C during normal operation.

SOLDERING METHODS

The REG1117 package is suitable for infrared reflow and vapor-phase reflow soldering techniques. The high rate of temperature change that occurs with wave soldering, or hand soldering can damage the REG1117.

TOTAL PC BOARD AREA	TOPSIDE ⁽¹⁾ COPPER AREA	BACKSIDE COPPER AREA	THERMAL RESISTANCE JUNCTION-TO-AMBIENT
2500mm ²	2500mm ²	2500mm ²	46°C/W
2500mm ²	1250mm ²	2500mm ²	47°C/W
2500mm ²	950mm ²	2500mm ²	49°C/W
2500mm ²	2500mm ²	0	51°C/W
2500mm ²	1800mm ²	0	53°C/W
1600mm ²	600mm ²	1600mm ²	55°C/W
2500mm ²	1250mm ²	0	58°C/W
2500mm ²	915mm ²	0	59°C/W
1600mm ²	600mm ²	0	67°C/W
900mm ²	340mm ²	900mm ²	72°C/W
900mm ²	340mm ²	0	85°C/W

NOTE: (1) Tab is attached to the topside copper.

TABLE I.

INSPEC Abstract Number: B91007604, C91012627
 Kelly, E.G. "Thermal Characteristics of Surface 5WK9Ω Packages." The Proceedings of SMTCON. Surface Mount Technology Conference and Exposition: *Competitive Surface Mount Technology*, April 3-6, 1990, Atlantic City, NJ, USA. Abstract Publisher: IC Manage, 1990, Chicago, IL, USA.

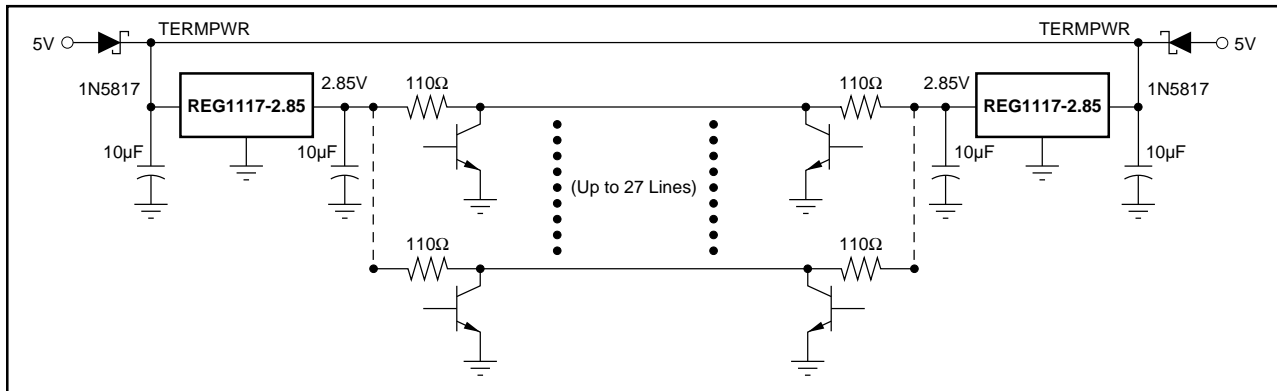


FIGURE 4. SCSI Active Termination Configuration.

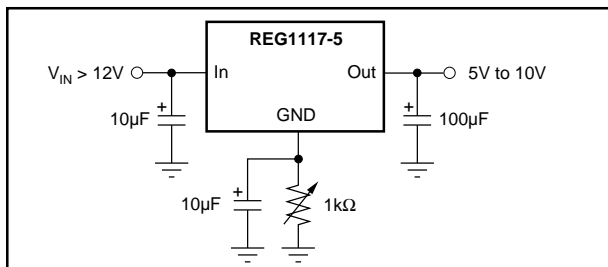


FIGURE 5. Adjusting Output of Fixed Voltage Models.

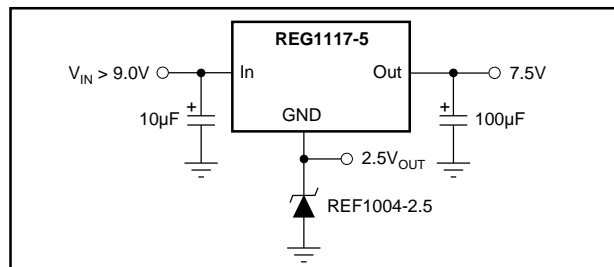


FIGURE 6. Regulator with Reference.

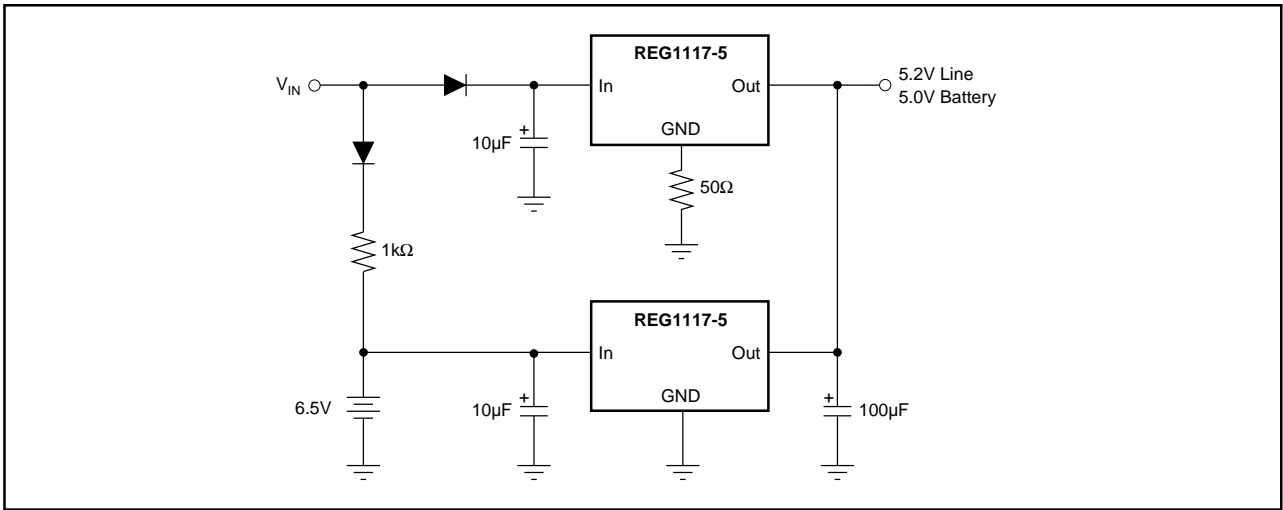


FIGURE 7. Battery Backed-Up Regulated Supply.

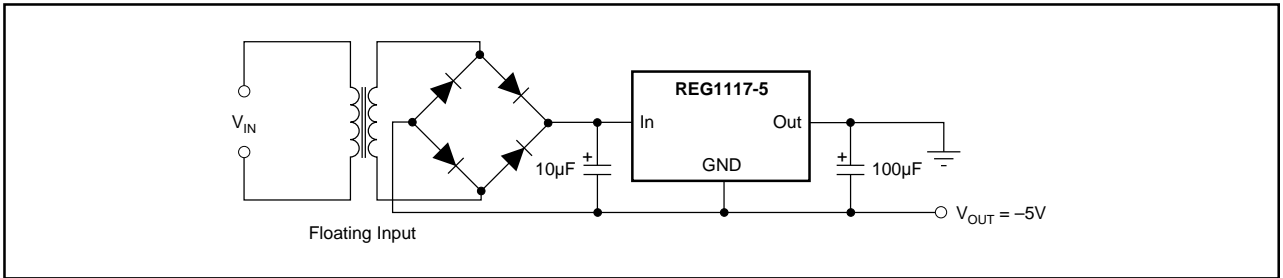


FIGURE 8. Low Dropout Negative Supply.