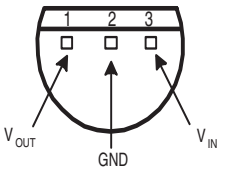
Low Dropout Voltage Three Terminal Regulator

FEATURES

- 3.3V and 3.5V Versions
- Output Current in Excess of 100 mA
- Input-Output Differential of 0.3V at 100mA
- Mirror-Image Insertion Protection
- Internal Thermal Protection
- Available in TO-92 and SOT-89 Packages
- Reverse Battery, Internal Short Circuit, Reverse Transient and Load Dump Protection
- Output Accuracy 3% at 25°C
- Direct Replacement for TK116

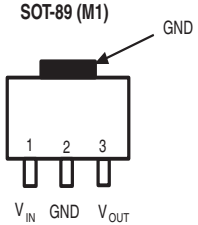
Now Available in Lead Free Packaging

TO-92 (N)



Bottom View

SOT-89 (M1)



Top View

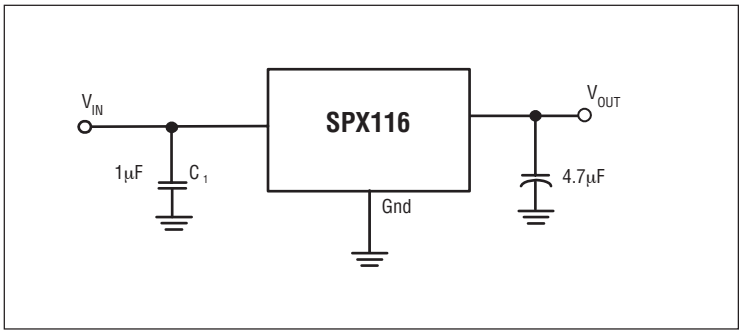
APPLICATIONS

- Portable Instrumentation
- Cordless Telephones
- Radio Control Systems
- Battery Powered Systems
- Portable Consumer Devices
- Pagers
- Cellular Phones
- Low Voltage Systems

DESCRIPTION

The SPX116 is a low power, positive voltage regulator. This device is an excellent choice for use in battery-powered applications such as cordless telephones, radio control systems, and portable computers. The SPX116 features very low quiescent currents (0.4 mA), and very low drop output voltage (50 mV at light load and 300 mV at 100 mA). The SPX116 is a direct replacement for the TK116. The SPX116 is offered in a 3-pin TO-92 and SOT-89 package.

TYPICAL APPLICATION



ABSOLUTE MAXIMUM RATINGS

Power Dissipation (Note 3) ..... Internally Limited
Lead Temperature (soldering, 5 seconds) ..... 260°C
Storage Temperature Range ..... -65°C to +150°C
Maximum Junction Temperature ..... +125°C
Input Supply Voltage Range ..... -0.3 to +30V
ESD Rating (Note: 4) ..... 2kV min

RECOMMENDED OPERATING CONDITIONS

Input Supply Voltage Range ..... 3.0 to 14V
Maximum Load Current 180mA
Operation Junction Temperature Range ..... -40°C to 125°C
TO-92 Θ_{JA} ..... 131.9°C/W
SOT-89 Θ_{JA} ..... 107.0°C/W

ELECTRICAL CHARACTERISTICS

at V_{IN} = 6V, T_A = 25°C, I_O = 1mA, C_{OUT} = 4.7µF, unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
			SPX116		
Output Voltage (note 2)	4V < V_{IN}< 14V, I_O = 10 mA	3.201	3.300	3.399	V
Output Voltage (note 2)	4V < V_{IN}< 14V, I_O = 10 mA	3.395	3.500	3.605	V
Line Regulation	9V < V_{IN} < 14V 4.5V < V_{IN} < 14V		4.0		mV
Load Regulation	10 mA < I_O < 100 mA		14		mV
Dropout Voltage	I_O =10 mA I_O =100 mA		0.05 0.3		V
Quiescent Current	I_O < 10 mA, 4.5V < V_{IN} < 26V I_O = 100 mA, V_{IN} = 14V		0.4 15		mA
Output Noise Voltage	10Hz-100kHz, C_{OUT}=100µF		500		µVrms
Ripple Rejection	F_O = 120Hz		80		dB
Maximum Operational Input Voltage		14			V
Current Limit		150	400		mA

NOTES:
Note 1: See TYPICAL APPLICATIONS notes to ensure constant junction temperature, low duty cycle pulse testing used.
Note 2: All limits are at 25°C; operation is guaranteed over the full operating junction temperature range of -40°C to +125°C.
Note 3: The maximum power dissipation is a function of maximum junction temperature, total thermal resistance, and ambient temperature.
Note 4: Human body model, 100 pF discharged through 1.5 kΩ.

TYPICAL PERFORMANCE CHARACTERISTICS

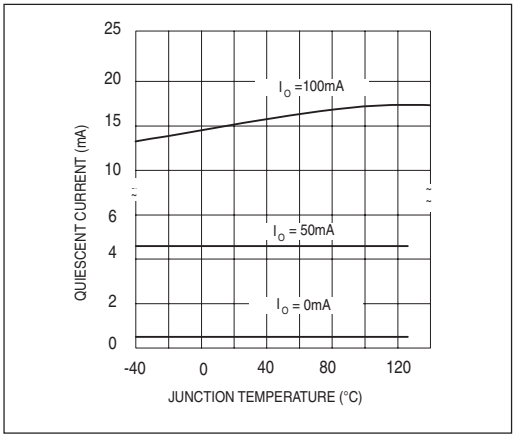


Figure 1. Quiescent Current

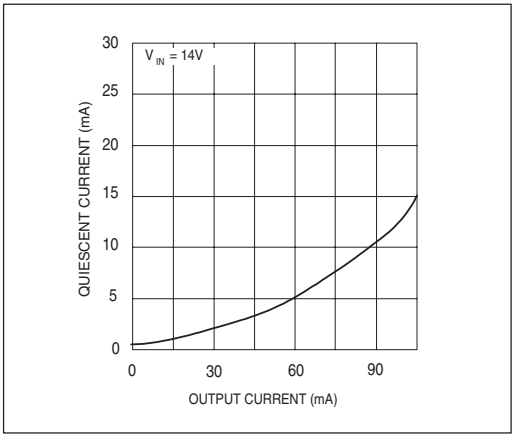


Figure 2. Quiescent Current

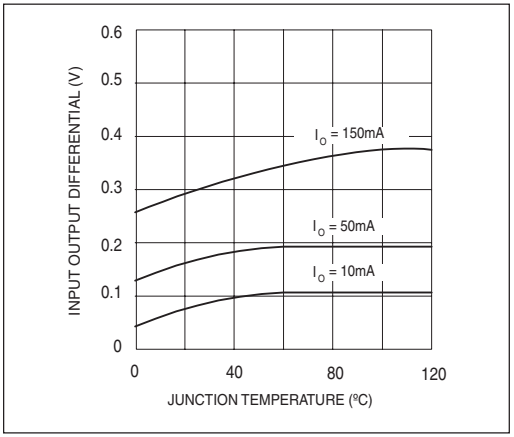


Figure 3. Dropout Voltage

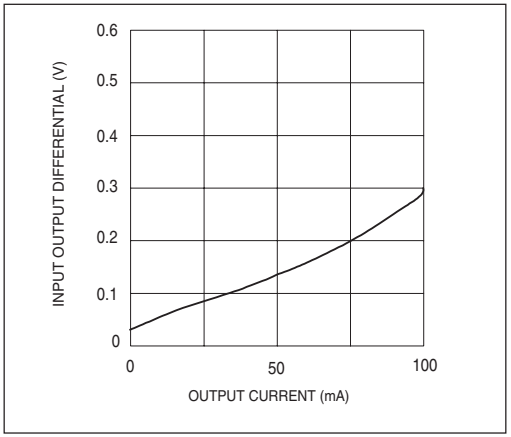


Figure 4. Dropout Voltage

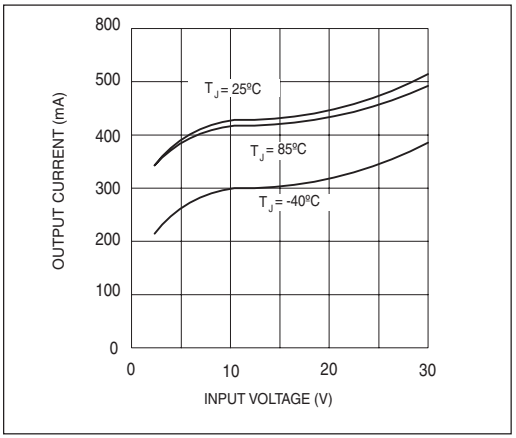


Figure 5. Peak Output Current

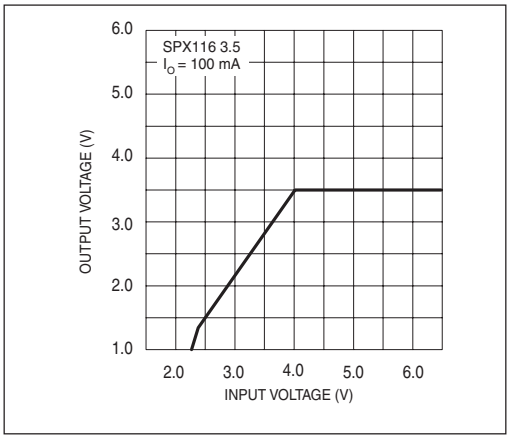


Figure 6. Low Voltage Behavior

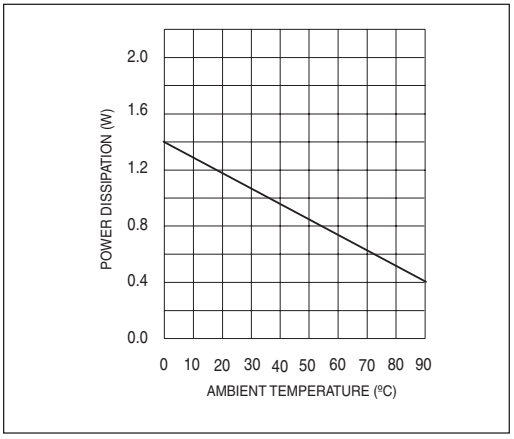


Figure 7. Maximum Power dissipation (SOT89)

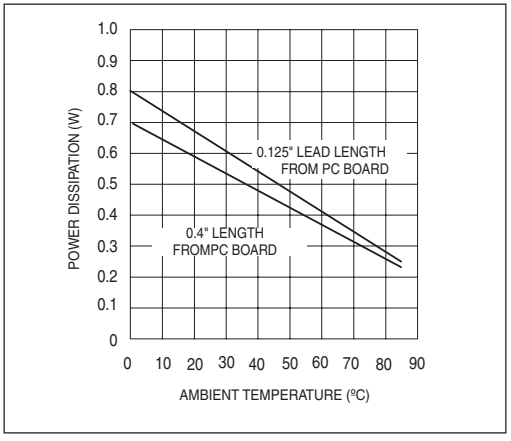


Figure 8. Maximum Power Dissipation (TO-92)

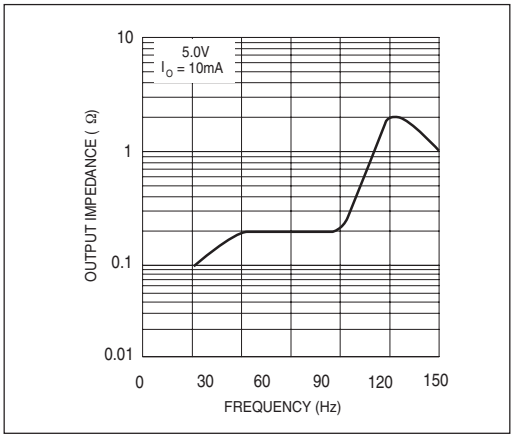


Figure 9. Output Impedance

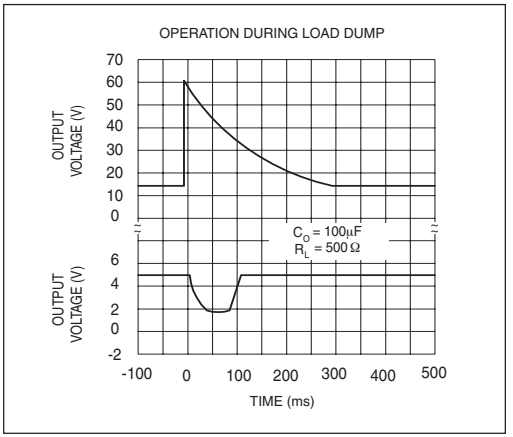


Figure 10. Operation During Load Dump

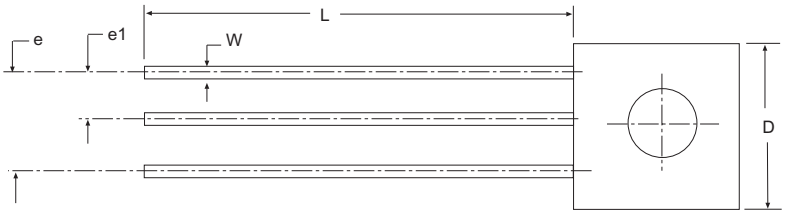
APPLICATION INFORMATION

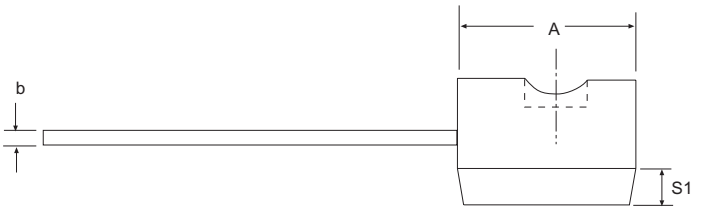
The SPX116 requires an output capacitor for device stability. The capacitor value required varies greatly depending upon the application circuit and other factors. The high frequency characteristics of electrolytic capacitors depend greatly on the type and also on the manufacturer. Sometimes bench testing is the only means to determine the proper capacitor type and value. Stability can be obtained with a tantalum or ceramic capacitor value of 4.7 µF or greater.

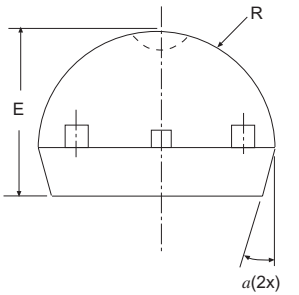
Another critical point of electrolytic characteristics is the performance over temperature. The SPX116 is designed to operate starting at -40°C which may not be true in the case of electrolytic components. Higher temperatures generally present no problems for electrolytics. The electrolytic type in aluminum will freeze at about -30°C. This could cause an oscillation at the output of the regulator. At a lower temperature requirement by many applications the capacitor should maintain its performance. So as a result, for an application in which the regulator junction temperature does not exceed 25°C, the output capacitor can be reduced by a factor of two over the value needed for the entire temperature range.

In most applications the SPX116 is operating at a few milliamps. In these applications, the output capacitance can be further reduced. For example, when the regulator is running at 10mA output current, the output capacitance value is half compared to the same regulator that is running at 100mA. The value decreases with higher output voltages, since the internal loop gain is reduced.

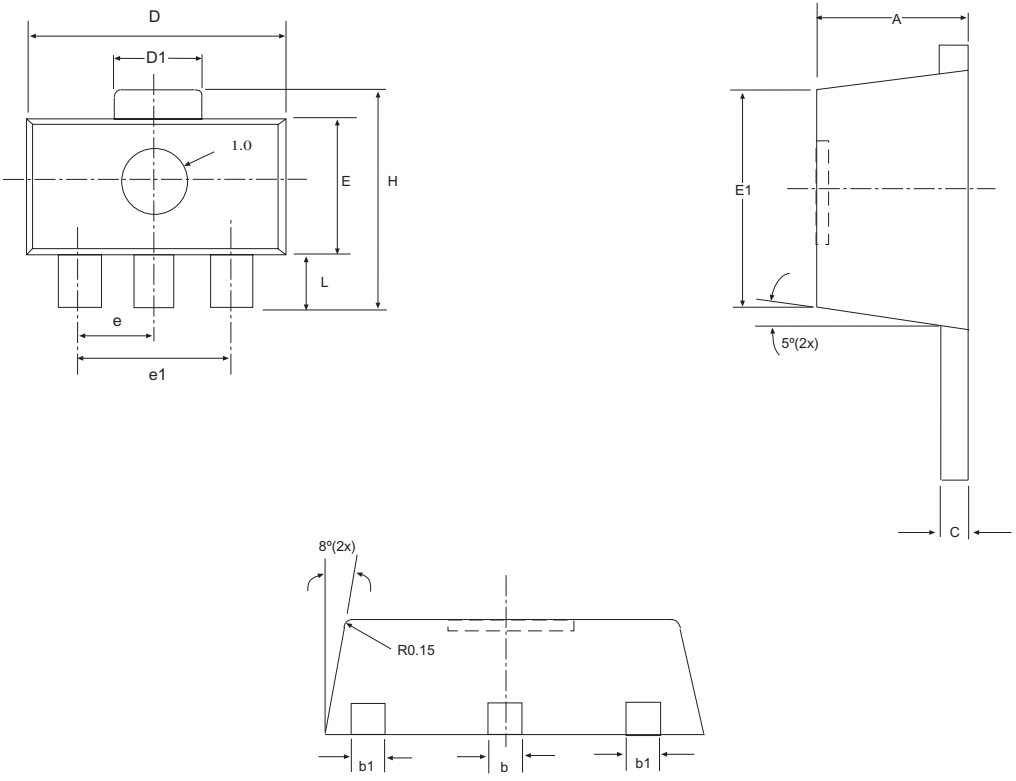
The worst case occurs at the lower temperature and maximum operating currents; the entire circuit and the electrolytic should be cooled down to the minimum temperature. The minimum of 0.6 volts is required at the input of the regulator above the output to keep the power dissipation and die heating to its minimum. After the value for the capacitor has been determined for actual use, the value should be doubled.







3 Pin TO-92						
SYMBOL	Dimensions in Inches: Controlling Dimension			Dimensions in Millimeters Conversion Factor: 1 Inch = 25.40 mm		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.170	-	0.195	4.32	-	4.95
b	0.014	-	0.020	0.36	-	0.51
E	0.130	-	0.155	3.30	-	3.94
e	0.095	-	0.105	2.41	-	2.67
e1	0.045	-	0.055	1.14	-	1.40
L	0.500	-	0.610	12.70	-	15.49
R	0.085	-	0.095	2.16	-	2.41
S1	0.045	-	0.060	1.14	-	1.52
W	0.016	-	0.022	0.41	-	0.56
D	0.175	-	0.195	4.45	-	4.95
α	4º	-	6º	4º	-	6º
SIPEX Pkg Signoff Date/Rev:				JL Sept23-05 / RevA		



3 Pin SOT-89	JEDEC TO-243			Variation AA		
SYMBOL	Dimensions in Millimeters: Controlling Dimension			Dimensions in Inches Conversion Factor: 1 Inch = 25.40 mm		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	-	1.60	0.055	-	0.063
B	0.44	-	0.56	0.017	-	0.022
B1	0.36	-	0.48	0.014	-	0.019
C	0.35	-	0.44	0.014	-	0.017
D	4.40	-	4.60	0.173	-	0.181
D1	1.62	-	1.83	0.064	-	0.072
E	2.29	-	2.60	0.090	-	0.102
E1	2.13	-	2.29	0.084	-	0.090
e	1.50 BSC			0.059 BSC		
e1	3.00 BSC			0.118 BSC		
H	3.94	-	4.25	0.155	-	0.167
L	0.89	-	1.20	0.035	-	0.047
SIPEX Pkg Signoff Date/Rev:				JL Feb2-06/ RevA		

PART NUMBER	ACCURACY	OUTPUT VOLTAGE	PACKAGE
SPX116M1-3-3	3%	3.3V	3 lead SOT-89
SPX116M1-3-5	3%	3.5V	3 lead SOT-89
SPX116N-3-3	3%	3.3V	3 lead TO-92
SPX116N-3-5	3%	3.5V	3 lead TO-92

Please consult the factory for pricing and availability on a Tape-On-Reel option.

Available in lead free packaging. To order, add “-L” suffix to the part number.
Example: SPX116N-3-3 = standard; SPX116N-L-3-3/TR = lead free.

Solved by Sipex™

Sipex Corporation

Headquarters and Sales Office
233 South Hillview Drive
Milpitas, CA 95035
TEL: (408) 934-7500
FAX: (408) 935-7600

