SPX3940

1A Low Dropout Voltage Regulator

Fixed Output, Fast Response

FEATURES

- 1% Output Accuracy SPX3940A
- Guaranteed 1.5A Peak Current
- Low Quiescent Current
- Low Dropout Voltage of 280mV at 1A
- Extremely Tight Load and Line Regulation
- Extremely Fast Transient Response
- Reverse-battery Protection
- Internal Thermal Protection
- Internal Short Circuit Current Limit
- Replacement for LM3940
- Standard SOT-223, TO-220 and TO-263 packages

APPLICATIONS

- Powering VGA & Sound Card
- Automotive Electronics
- LCD Monitors
- Cordless Telephones
- Power PC™ Supplies
- SMPS Post-Regulator
- Laptop, Palmtop, and Notebook Computer
- High Efficiency Linear Power Supplies
- Portable Instrumentation
- Constant Current Regulators

DESCRIPTION

The SPX3940 is a 1A, accurate voltage regulators with a low drop out voltage of 280mV(typical) at 1A. These regulators are specifically designed for low voltage applications that require a low dropout voltage and a fast transient response. They are fully fault protected against over-current, reverse battery, and positive and negative voltage transients.

The SPX3940 is offered in 3-pin SOT-223, TO-220 & TO-263 packages. For a 3A version, refer to the SPX29300 data sheet.

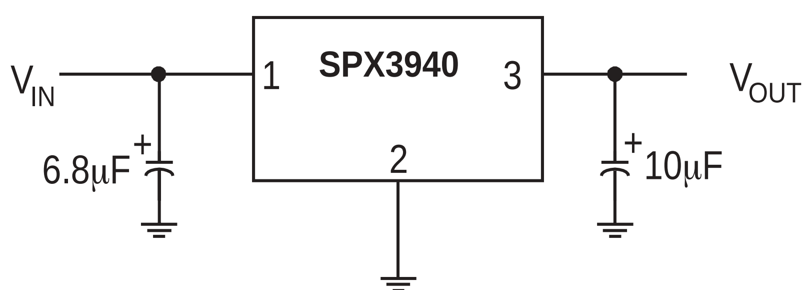

Figure 1. Fixed Output Linear Regulator.

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ABSOLUTE MAXIMUM RATINGS

Lead Temperature (soldering, 5 seconds) .... 260°C
Storage Temperature Range .... -65°C to +150°C
Operating Junction Temperature Range .... -40°C to +125°C
Input Voltage (Note 5) 16V

ELECTRICAL CHARACTERISTICS

At V_{IN}=V_{OUT} + 1V and I_{OUT} = 10 mA, C_{IN} = 6.8 µF, C_{OUT} = 10µF; T_A= 25°C, unless otherwise specified.
The Boldface applies over the junction temperature range. Adjustable versions are set at 5.0V.

PARAMETER	CONDITIONS	TYP	MIN	MAX	MIN	MAX	UNITS
			SPX3940A (1%)		SP3940 (2%)		
1.8V Version							
Output Voltage	I_{OUT} = 10mA	1.8	1.782	1.818	1.764	1.836	V
	10mA≤I_{OUT}≤1A, 6V≤V_{IN}≤16V	**1.8**	**1.755**	**1.845**	**1.737**	**1.863**	
2.5V Version							
Output Voltage	I_{OUT} = 10mA	2.5	2.475	2.525	2.450	2.550	V
	10mA≤I_{OUT} ≤1A, 6V≤V_{IN}≤16V	**2.5**	**2.437**	**2.563**	2.412	2.588	
3.3V Version							
Output Voltage	I_{OUT} = 10mA	3.3	3.267	3.333	3.234	3.366	V
	10mA≤I_{OUT} ≤1A, 6V≤V_{IN}≤16V	**3.3**	**3.217**	**3.383**	**3.184**	**3.416**	
5.0V Version							
Output Voltage	I_{OUT} = 10mA	5.0	4.950	5.050	4.900	5.100	V
	10mA≤I_{OUT} ≤1A, 6V≤V_{IN}≤16V	**5.0**	**4.875**	**5.125**	4.825	**5.175**	
All Voltage Options							
Line Regulation	I_O=10mA, (V_{OUT}+1V)≤V_{IN}≤16V	0.2		1.0		1.0	%
Load Regulation	V_{IN}=V_{OUT}+1V, 10mA≤I_{OUT}≤1A	0.3		1.5		1.5	%
ΔV ΔT	Output Voltage Temperature Coef.	20		**100**		**100**	ppm/°C
Dropout Voltage (Note 1)	I_O =100mA	70		**200**		**200**	mV
(except 1.8V version)	I_O =1A	280		**550**		**550**	
Ground Current (Note 3)	I_O =750mA, V_{IN}=V_{OUT}, + 1V	12		**25**		**25**	mA
	I_O =1A	18					
I_{GNDDO} Ground Pin Current at Dropout	V_{IN}=0.1V less than specified V_{OUT} I_{OUT}= 10mA	1.2					mA
Current Limit	V_{OUT}=0V (Note 2)	2.2	1.5		1.5		A
Output Noise Voltage (10Hz to 100kHz) I_L=100mA	C_L= 10µF	400					μV_{RMS}
	C_L=33µF	260					
Thermal Resistance	TO-220 Junction to Case, at Tab	3					°C/W
	TO-220 Junction to Ambient	60					
	TO-263 Junction to Case, at Tab	3					°C/W
	TO-263 Junction to Ambient	60					
	SOT-223 Junction to Case, at Tab	15					°C/W
	SOT-223 Junction to Ambient	150					

NOTES:
Note 1: Dropout voltage is defined as the input to output differential when the output voltage drops to 99% of its normal value.
Note 2: V_{IN}=$V_{OUT\ (NOMINAL)}$ + 1V. For example, use V_{IN}=4.3V for a 3.3V regulator. Employ pulse-testing procedures to minimize temperature rise.
Note 3: Ground pin current is the regulator quiescent current. The total current drawn from the source is the sum of the load current to the ground current.
Note 4: Thermal regulation is defined as the change in the output voltage at a time T after a change in power dissipation is applied, excluding load or line regulation effects.
Note 5: Maximum positive supply voltage of 20V must be of limited duration (<100ms) and duty cycle (<1%). The maximum continuous supply voltage is 16V.

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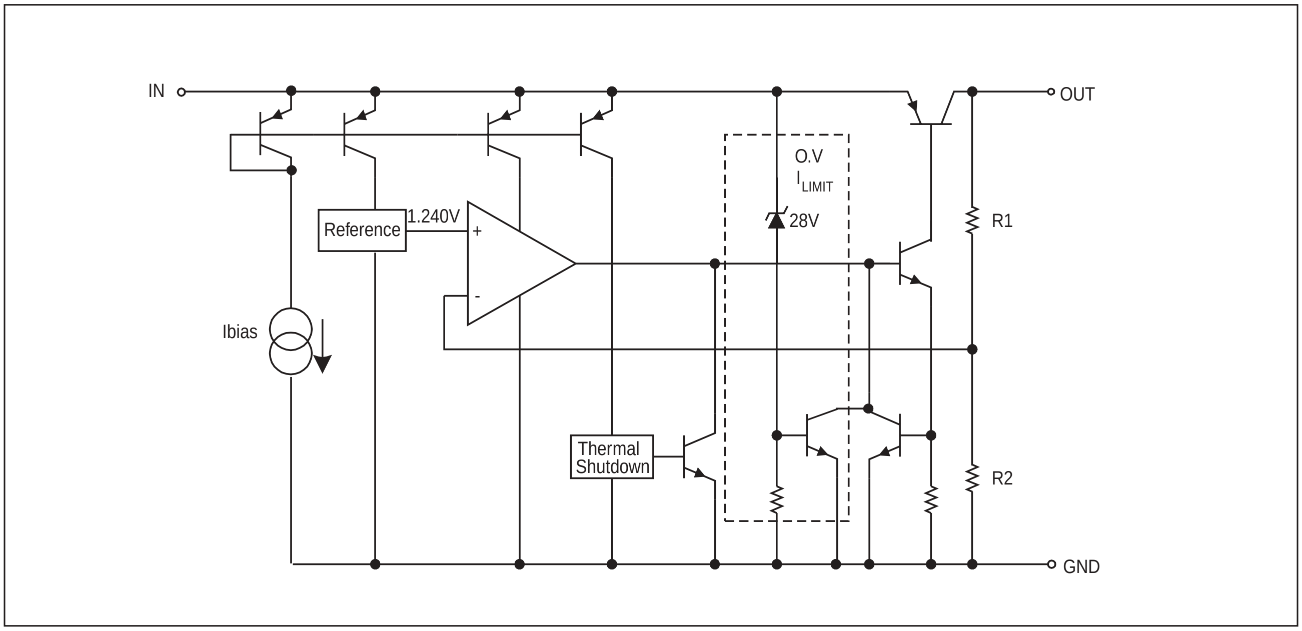
BLOCK DIAGRAM



TYPICAL PERFORMANCE CHARACTERISTICS

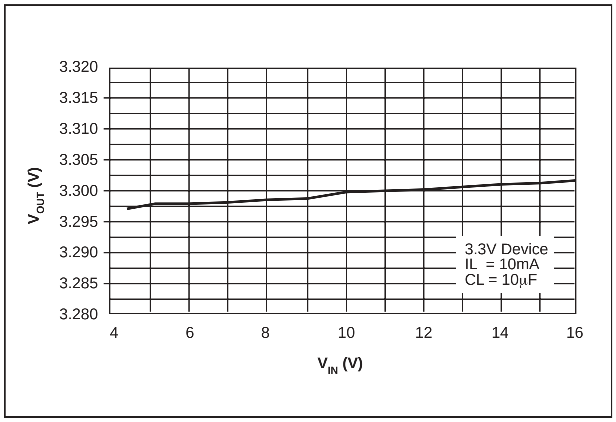


Figure 2. Line Regulation

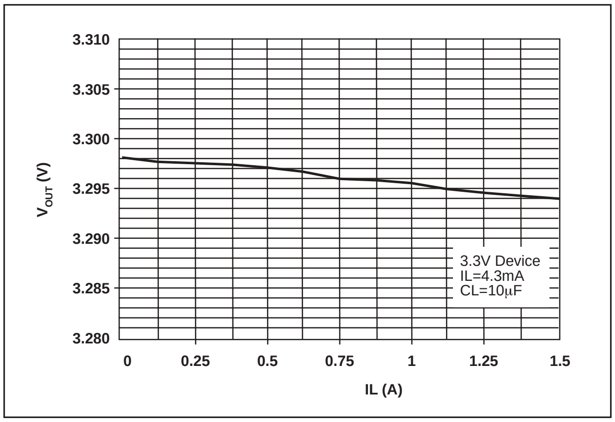


Figure 3. Load Regulation

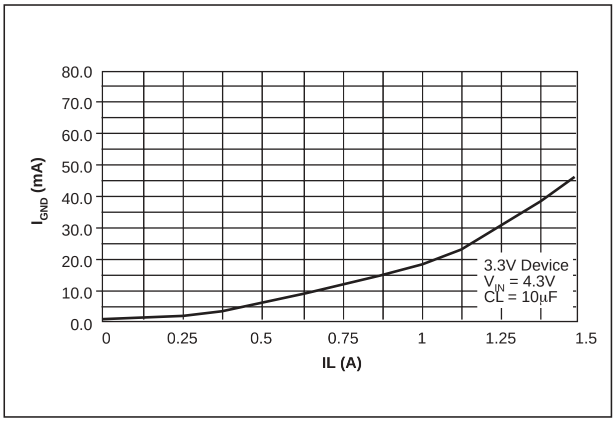


Figure 4. Ground Current vs Load Current

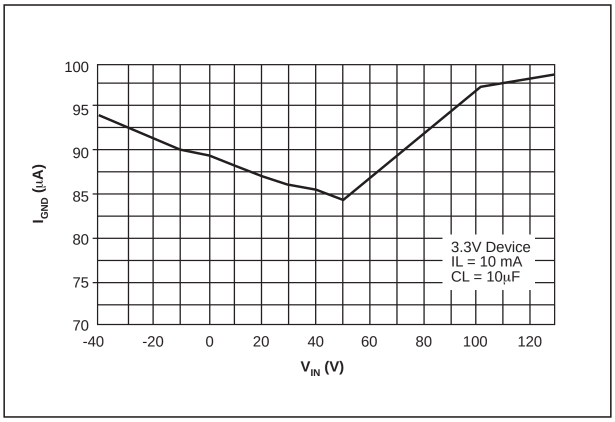


Figure 5. Ground Current vs Input Voltage

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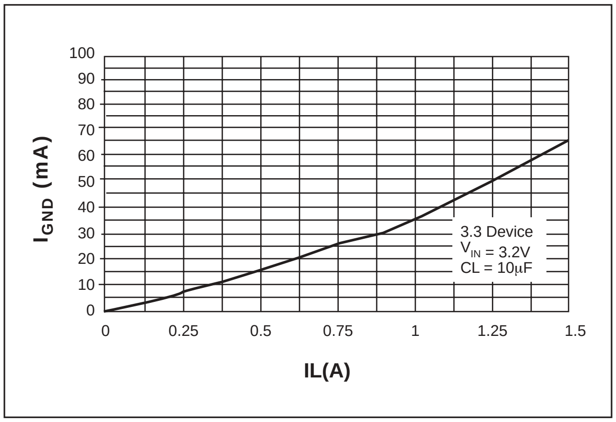

Figure 6. Ground Current vs Load Current in Dropout

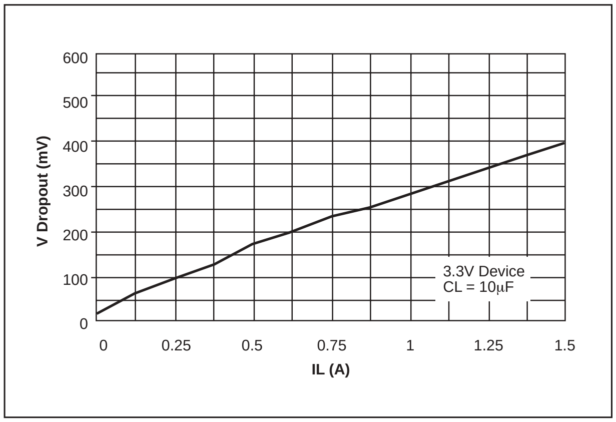

Figure 7. Dropout Voltage vs Load Current

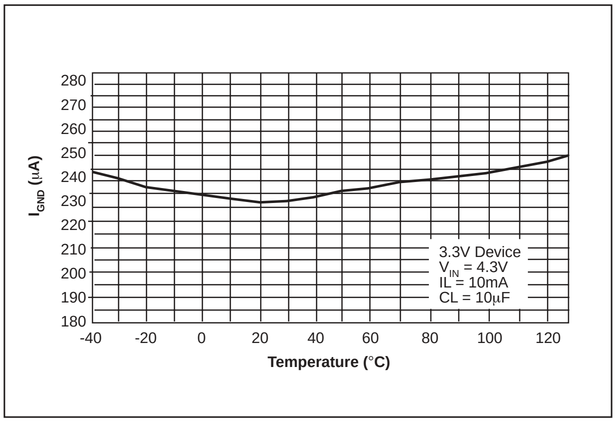

Figure 8. Ground Current vs Temperature at I_{LOAD} = 10mA

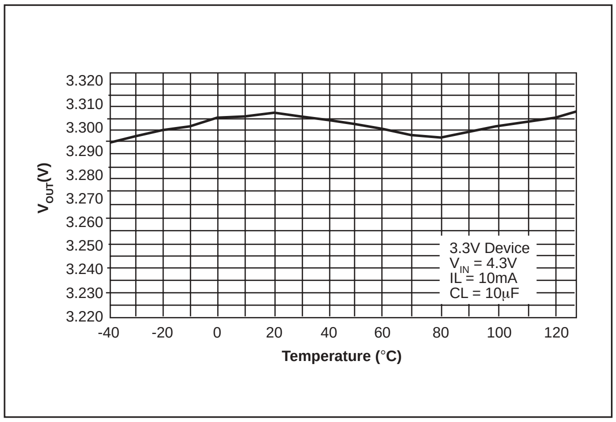

Figure 9. Output Voltage vs Temperature at I_{LOAD}=10mA

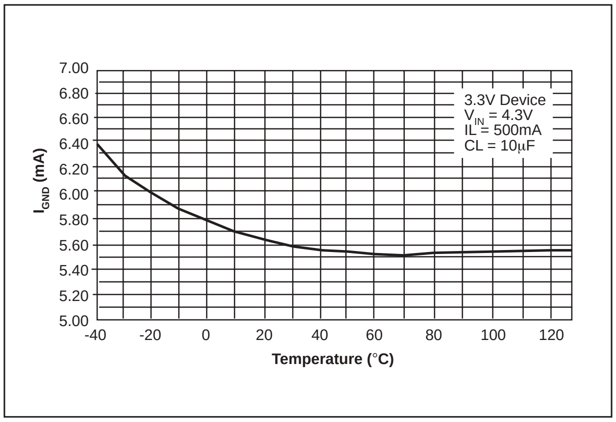

Figure 10. Ground Current vs Temperature at I_{LOAD}=500mA

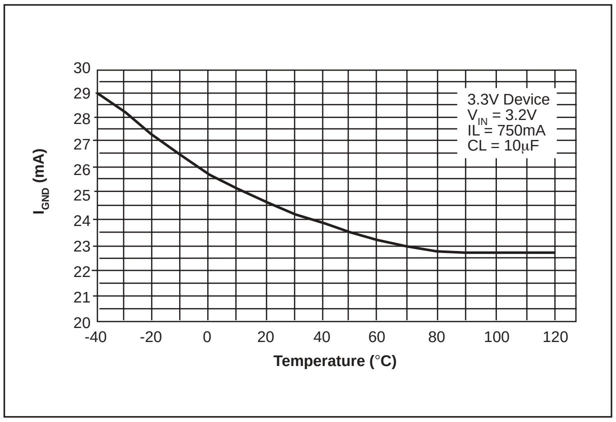

Figure 11. Ground Current vs Temperature in Dropout at I_{LOAD}=750mA

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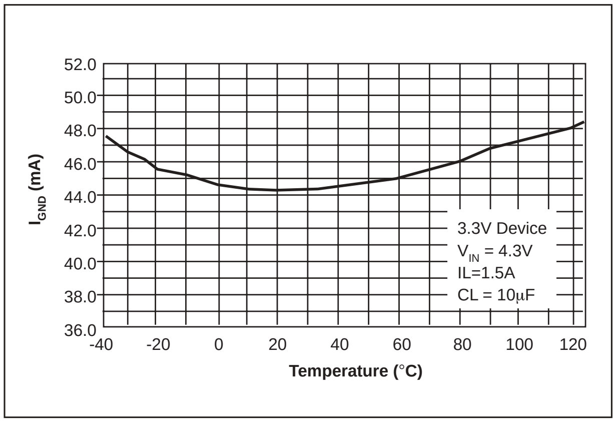

Figure 12. Ground Current vs Temperature at I_{LOAD}= 1.5A

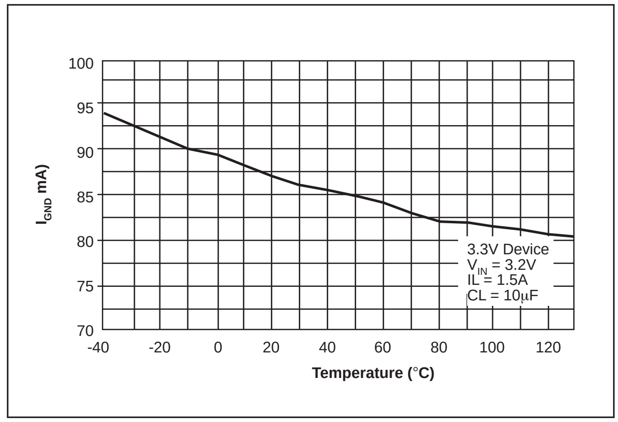

Figure 13. Ground Current vs Temperature in Dropout at I_{LOAD}=1.5A

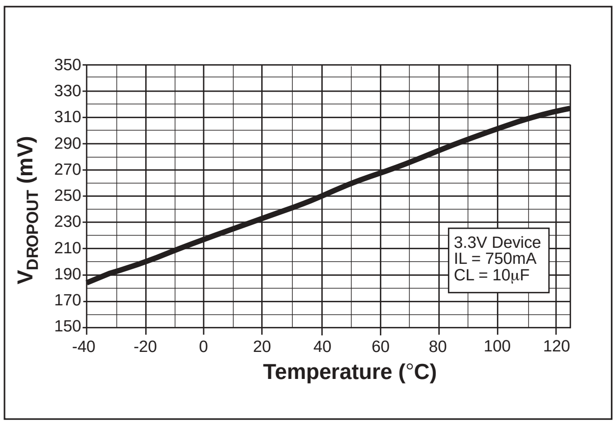

Figure 14. Dropout Voltage vs Temperature at I_{LOAD}= 750mA

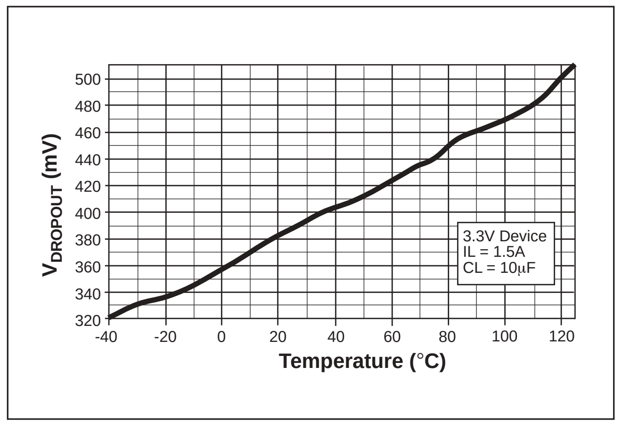

Figure 15. Dropout Voltage vs Temperature at I_{LOAD}= 1.5mA

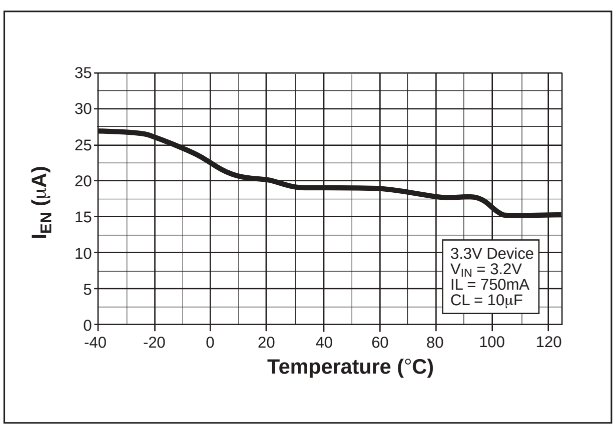

Figure 16. Enable Current vs Temperature for V_{EN}= 16V

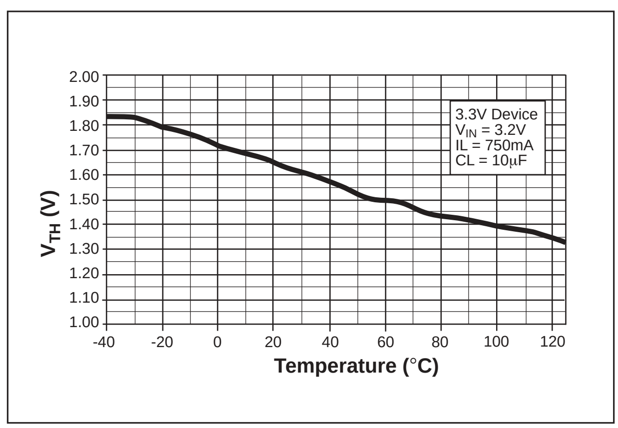

Figure 17. Enable Threshold vs Temperature

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APPLICATION INFORMATION

The SPX3940 incorporates protection against over-current faults, reversed load insertion, over temperature operation, and positive and negative transient voltage.

Thermal Considerations

Although the SPX3940 offers limiting circuitry for overload conditions, it is still necessary to insure that the maximum junction temperature is not exceeded in the application. Heat will flow through the lowest resistance path, the junction-to-case path. In order to insure the best thermal flow of the component, proper mounting is required. Consult heatsink manufacturer for thermal resistance and design of heatsink.

For example, TO-220 design:
Assume that V_{IN} = 10V, V_{OUT} = 5V, I_{OUT} = 1.5A, T_A = 50°C/W, θ_{HA} = 1°C/W, θ_{CH} = 2°C/W, and θ_{JC} = 3°C/W.
Where TA = ambient temperature
θ_{HA} = heatsink to ambient thermal resistance
θ_{CH} = case to heatsink thermal resistance
θ_{JC} = junction to case thermal resistance

The power calculated under these conditions is:
$P_D = (V_{IN} - V_{OUT}) * I_{OUT} = 7.5W$.

And the junction temperature is calculated as
$T_J = T_A + P_D * (\theta_{HA} + \theta_{CH} + \theta_{JC})$ or
$T_J = 50 + 7.5 * (1 + 2 + 3) = 95°C$

Reliable operation is insured.

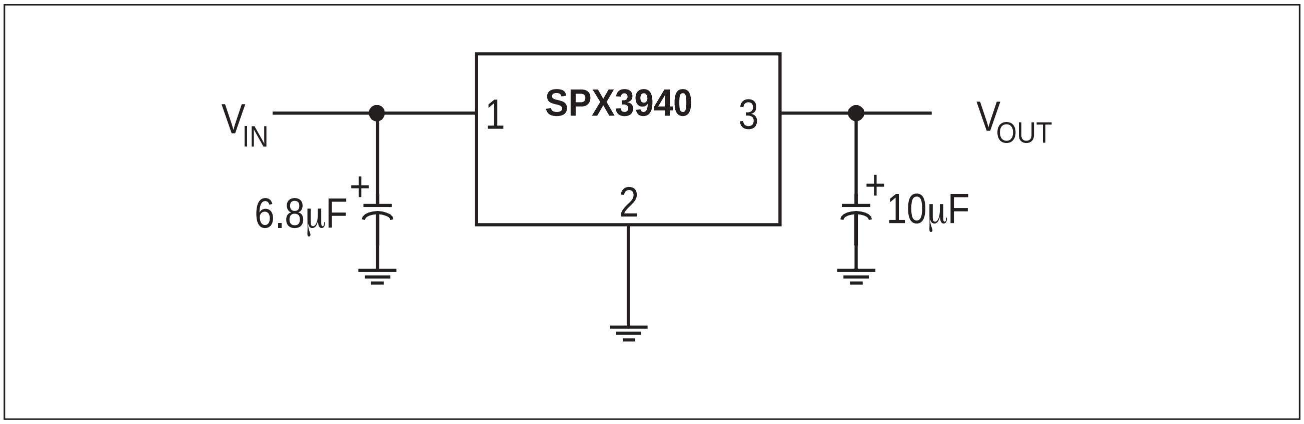

Figure 18. Fixed Output Linear Regulator.

Capacitor Requirements

The output capacitor is needed to insure stability and minimize the output noise. The value of the capacitor varies with the load. However, a minimum value of 10µF aluminum capacitor will guarantee stability over all load conditions. A tantalum capacitor is recommended if a faster load transient response is needed.

If the power source has a high AC impedance, a 0.1µF ceramic capacitor between input & ground is recommended.

Minimum Load Current

To ensure a proper behavior of the regulator under light load, a minimum load of 5mA for SPX3940 is required.

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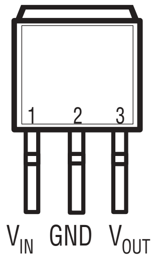
PACKAGES

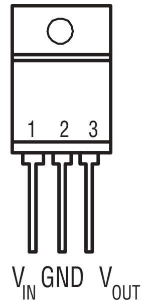
TO-263-3 Package (T)



Front View

TAB=GND

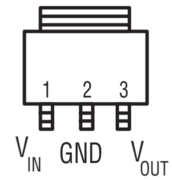
TO-220-3 Package (U)



Front View

TAB=GND

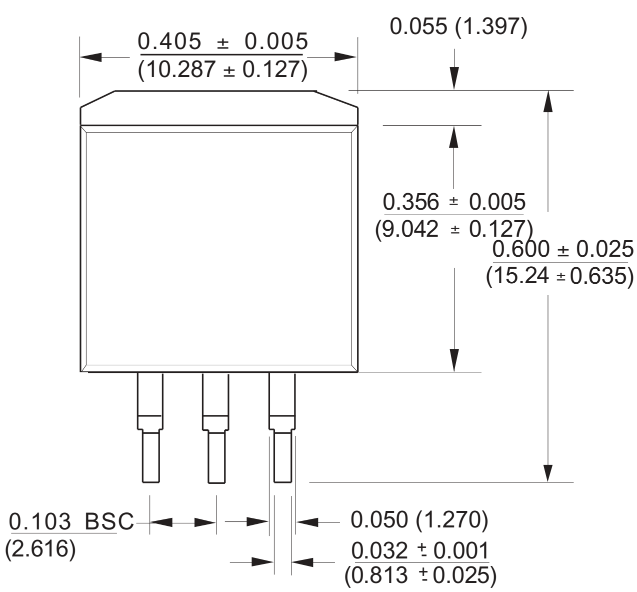
SOT-223 (M3)

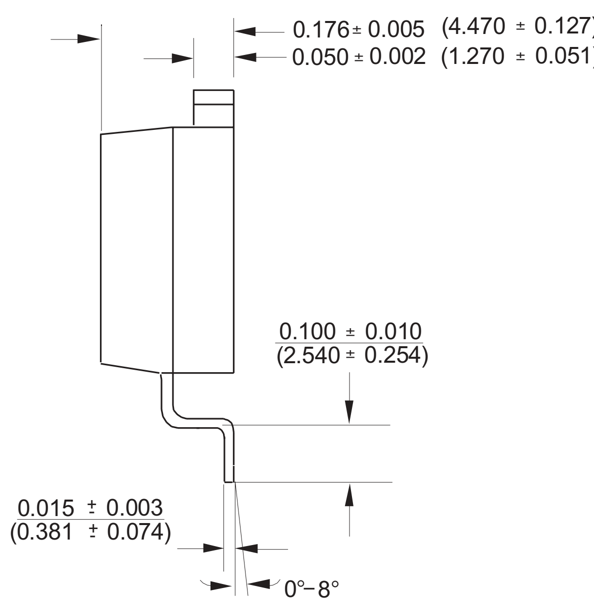


Top View

TAB=GND

PACKAGE: 3 Lead TO-263





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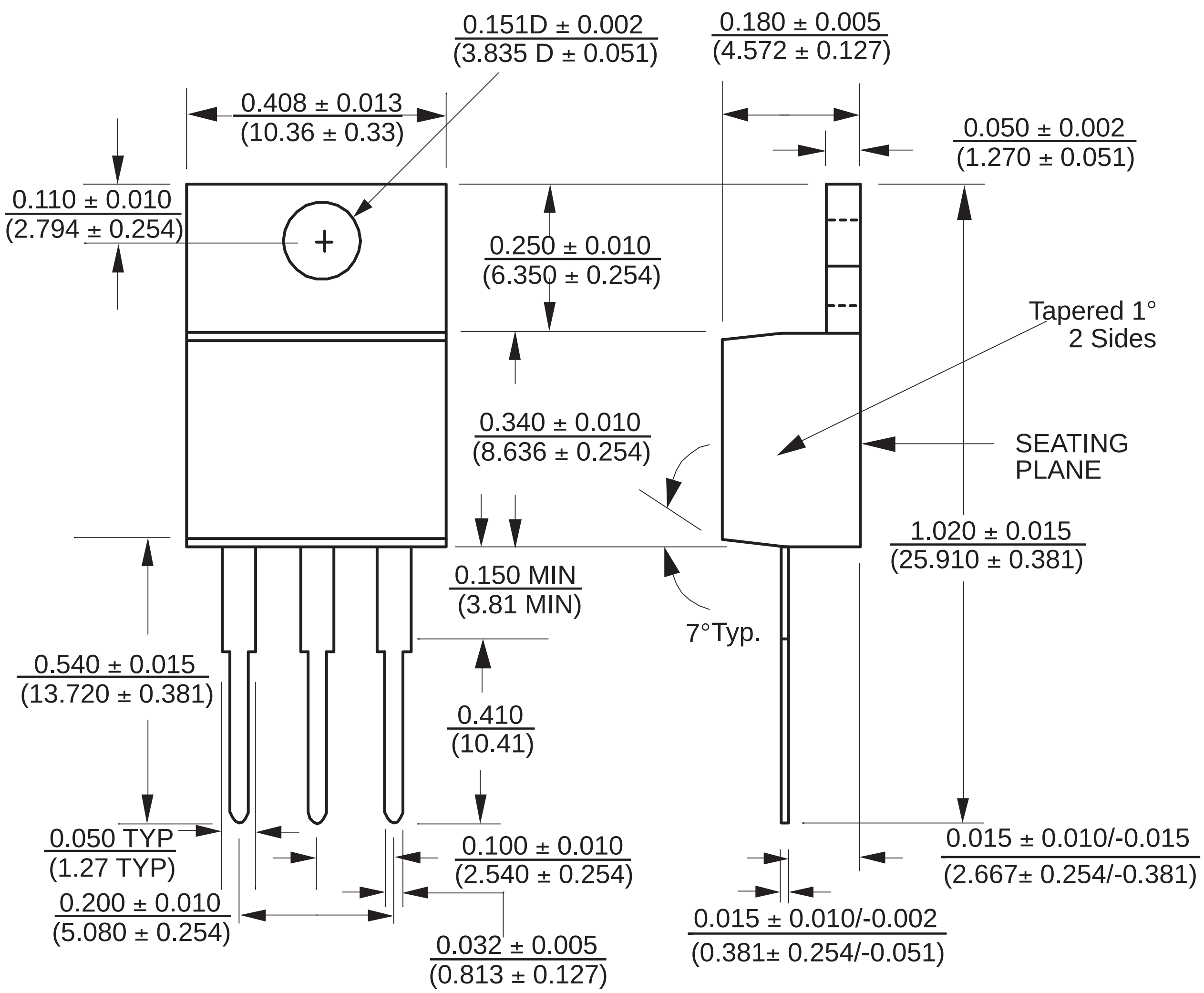
PACKAGE: 3 Lead TO-220



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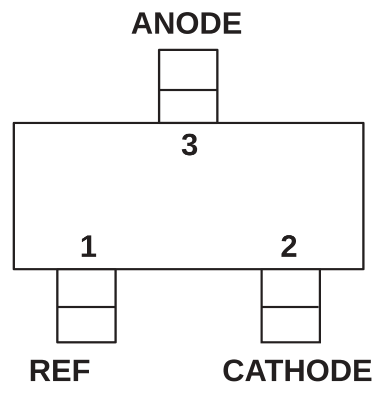
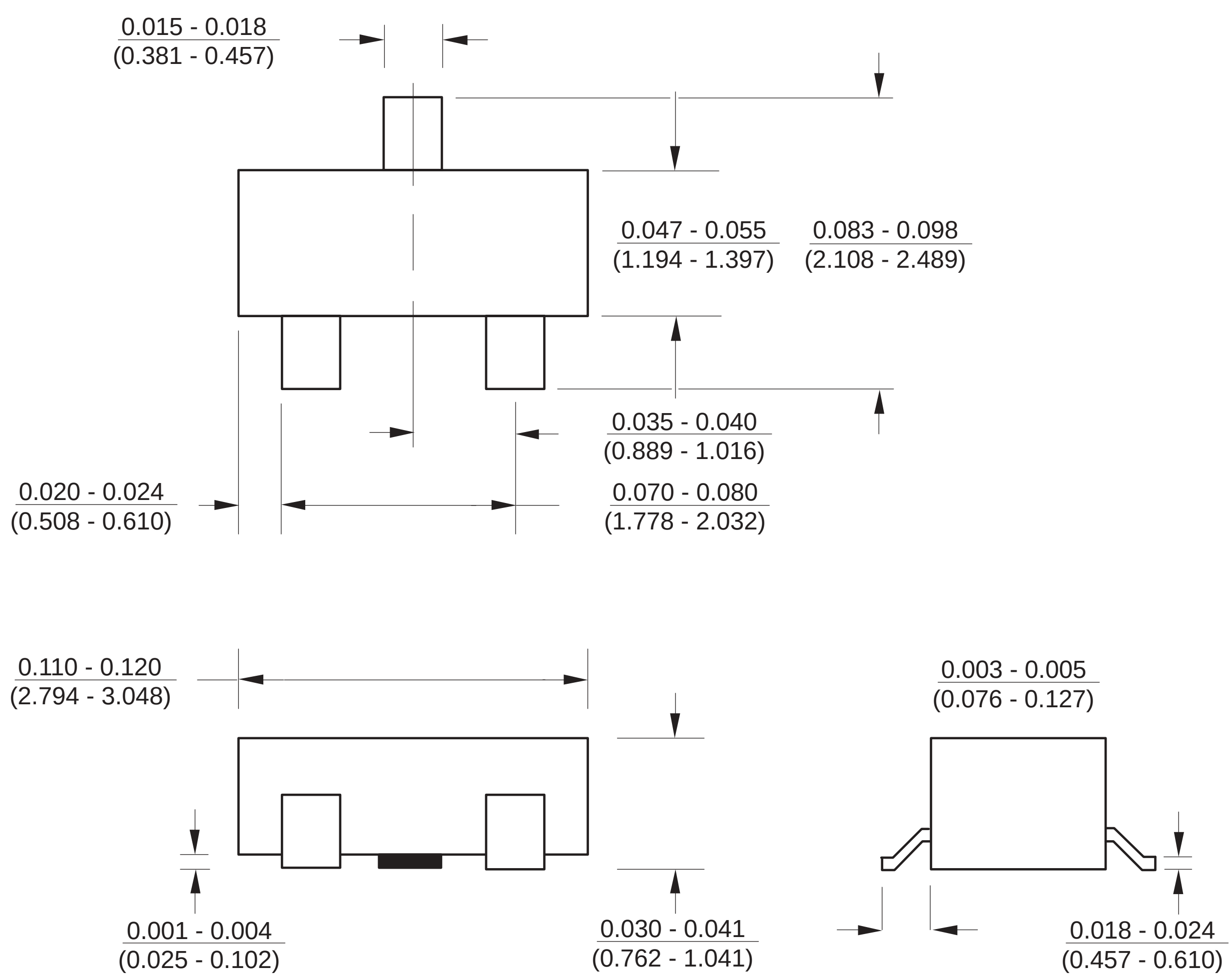
PACKAGE: SOT23-3 (M)



Top View



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ORDERING INFORMATION

PART NUMBER	ACC.	OUTPUT VOLTAGE	PACKAGE
SPX3940AU-1.8	1%	1.8V	3 lead TO-220
SPX3940AU-2.5	1%	2.5V	3 lead TO-220
SPX3940AU-3.3	1%	3.3V	3 lead TO-220
SPX3940AU-5.0	1%	5.0V	3 lead TO-220
SPX3940AT-1.8	1%	1.8V	3 lead TO-263
SPX3940AT-2.5	1%	2.5V	3 lead TO-263
SPX3940AT-3.3	1%	3.3V	3 lead TO-263
SPX3940AT-5.0	1%	5.0V	3 lead TO-263
SPX3940U-1.8	2%	1.8V	3 lead TO-220
SPX3940U-2.5	2%	2.5V	3 lead TO-220
SPX3940U-3.3	2%	3.3V	3 lead TO-220
SPX3940U-5.0	2%	5.0V	3 lead TO-220
SPX3940T-1.8	2%	1.8V	3 lead TO-263
SPX3940T-2.5	2%	2.5V	3 lead TO-263
SPX3940T-3.3	2%	3.3V	3 lead TO-263
SPX3940T-5.0	2%	5.0V	3 lead TO-263
SPX3940AM3-1.8	1%	1.8V	3 lead SOT-223
SPX3940AM3-2.5	1%	2.5V	3 lead SOT-223
SPX3940AM3-3.3	1%	3.3V	3 lead SOT-223
SPX3940AM3-5.0	1%	5.0V	3 lead SOT-223
SPX3940M3-1.8	2%	1.8V	3 lead SOT-223
SPX3940M3-2.5	2%	2.5V	3 lead SOT-223
SPX3940M3-3.3	2%	3.3V	3 lead SOT-223
SPX3940M3-5.0	2%	5.0V	3 lead SOT-223

SIGNAL PROCESSING EXCELLENCE

Sipex Corporation

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

Sales Office
22 Linnell Circle
Billerica, MA 01821
TEL: (978) 667-8700
FAX: (978) 670-9001
e-mail: sales@sipex.com

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