GENERAL DESCRIPTION

The SPX3940 is a 1A, accurate voltage regulator 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 respon se. They are fully fault protected against over - current, reverse battery, and positive and negative voltage transients.

The SPX3940 is offered in 3 -pin SOT223 and TO-263 packages. For a 3A version, refer to the SPX29300 data sheet.

APPLICATIONS

- Power Supp lies
- LCD Monitors
- Portable Instrumentation
- Medical and Industrial Equipments

FEATURES

- Guaranteed 1.5A Peak Current
- 1% Output Accuracy SPX3940A
- 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 LM 3940
- Standard SOT223 & TO-263 packages

TYPICAL APPLICATION DIAGRAM

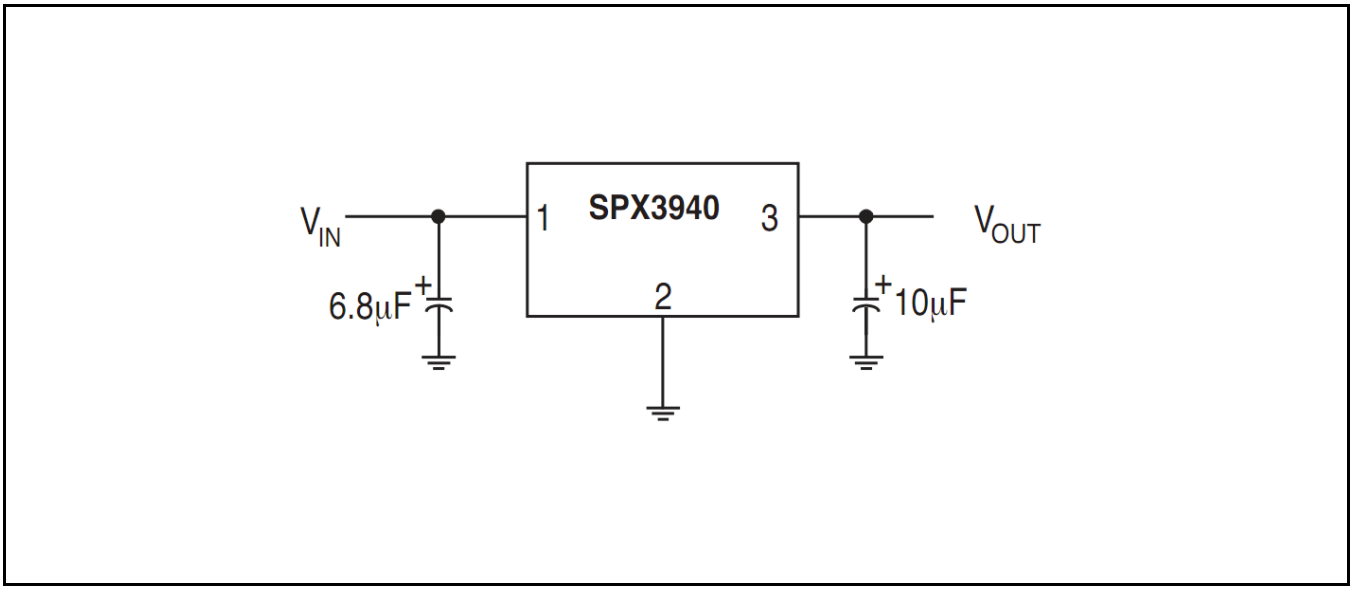


Fig. 1: SPX3940 Application Diagram ï Fixed Output Linear Regulator

ABSOLUTE MAXIMUM RAT INGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specification s below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

Input Voltage V_{IN} .... 20 V[1]
Storage Temperature ..... -65°C to 150°C
Lead Temperature (Soldering, 5 sec) ..... 260°C

OPERATING RATINGS

Input Voltage V_{IN} 16V
Junction Temperature Range ..... -40°C to 125°C
Package s Thermal Resistance
SOT-223 Junction to Case (at T_A) ..... 15°C/W
SOT-223 Junction to Ambient ..... 62.3°C/W
TO-263 Junction to Case (at T_A) ..... 3°C/W
TO-263 Junction to Ambient ..... 31.4 °C/W

Note 1: Maximum positive supply voltage of 20V must be of limited duration (<100ms) and duty cycle (<1%). The maximum continuous supply voltage is 16V.

ELECTRICAL SPECIFICA TIONS

Specifications with standard type are for an Operating Ambient Temperature of T_A = 25°C only; limits a pplying over the full Operating Junction Temperature Åòr.anMgien iamruem daenndo tMeadx ibmyuma lñimits are guara design, or statistical correlation. Typical values represent the most likely parametric norm at T $_A$ = 25°C, and are prov ided for reference purposes only. Unless otherwise indicated, V $_{IN}$ = V_{IN} +1V , I_{OUT} = 10mA, C_{IN} = 6.8 µF, C_{OUT} = 10 µF, T_A = 25°C .

Parameter	Min.	Typ.	Max.	Units		Conditions
1.8V version						
Output Voltage - SPX3940A (1%)	1.782	1.8	1.818	V		I_{OUT}=10mA 10mA ÊI$_{OUT}$ÊÒ 1 A , 6$_{IN}$ÊÒÒ1V6 V
	1.755	1.8	1.845		Å	
Output Voltage - SPX3940 (2%)	1.764	1.8	1.836	V		
	1.737	1.8	1.863		Å	
2.5V version						
Output Voltage - SPX3940A (1%)	2.475	2.5	2.525	V		I_{OUT}=10mA 10mA ÊI$_{OUT}$ÊÒ 1 A , 6$_{IN}$ÊÒÒ1V6 V
	2.437	2.5	2.563		Å	
Output Voltag e - SPX3940 (2%)	2.450	2.5	2.550	V		
	2.412	2.5	2.588		Å	
3.3V version						
Output Voltage - SPX3940A (1%)	3.267	3.3	3.333	V		I_{OUT}=10mA 10mA ÊI$_{OUT}$ÊÒ 1 A , 6$_{IN}$ÊÒÒ1V6 V
	3.217	3.3	3.383		Å	
Output Voltage - SPX3940 (2%)	3.234	3.3	3.366	V		
	3.184	3.3	3.416		Å	
5.0 V version						
Output Voltage - SPX3940A (1%)	4.950	5.0	5.050	V		I_{OUT}=10mA 10mA ÊI$_{OUT}$ÊÒ 1 A , 6$_{IN}$ÊÒÒ1V6 V
	4.875	5.0	5.125		Å	
Output Voltage - SPX3940 (2%)	4.900	5.0	5.100	V		
	4.825	5.0	5.175		Å	
All Voltage Options						
Line Regulation		0.2	1.0	%		I_{OUT}=10mA, (V_{OUT} + 1 V) ÊÒV_{IN}ÊÒ 16 V
Load Regulation		0.3	1.5	%		V_{IN} = V_{OUT} + 1 V , 10 mA ÊÒI_{OUT}ÊÒ 1 A
$\frac{\Delta V}{\Delta T}$ - Output Voltage temperature Coefficient		20	100	ppm/°C	Å	
Dropout Voltage [2] (except 1.8V version)		70	200	mV	Å	I_{OUT}=100mA
		280	550	mV	Å	I_{OUT}=1A
Ground Current [3]		12	25	mA	Å	I_{OUT}=750mA, V_{IN} = V_{OUT} +1V
		18		mA		I_{OUT}=1A
I_{GNDDO} Ground Pin Current at Dropout		1.2		mA		V_{IN} = 0.1V less than specified V_{OUT} I_{OUT}=10mA,
Current Limit	1.5	2.2		A		V_{OUT} = 0V [4]
Output Noise Voltage		400		µV_{RMS}		10Hz - 100KHz, I_L=100mA, C_L=10µF
		260		µV_{RMS}		10Hz - 100KHz, I_L=100mA, C_L=33µF

Note 2: Dropout voltage is defined as the input to output differential when the output voltage drops to 99% of its normal value.
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: $V_{IN}=V_{OUT(NOMINAL)}$ +1V. For example, use V_{IN}=4.3V for a 3.3V regulator. Employ pulse-testing procedures to minimize temperature rise.

BLOCK DIAGRAM

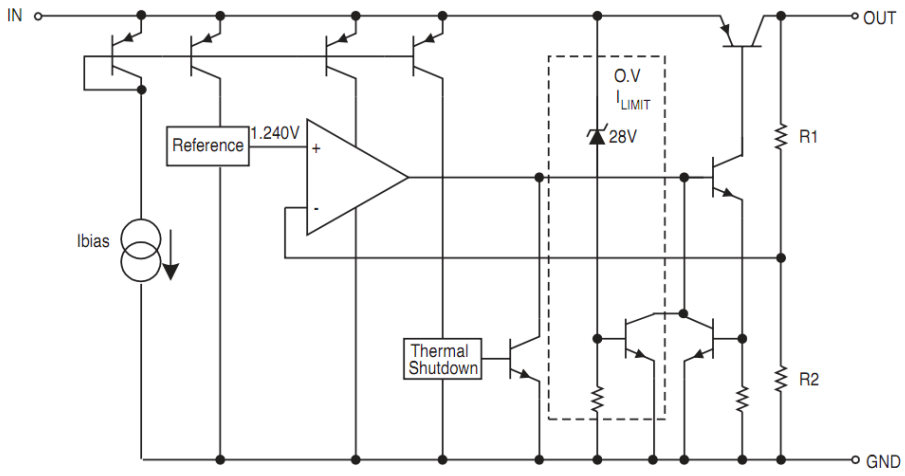


Fig. 2: SPX3940 Block Diagram

PIN ASSIGNMENT

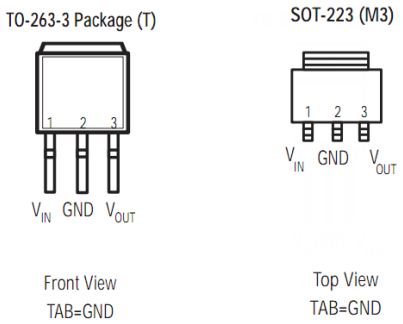


Fig. 3: SPX3940 Pin Assignment

ORDERING INFORMATION

Part Number	Temperature Range	Marking	Package	Packing Quantity	Note 1	Note 2
SPX3940AM3 -L-1-8	-40°C ≤ TJ ≤ +125	3940A 18YYWWL XXX	3-pin SOT-223	2.5K /Tape & Reel	Lead Free	1.8 V Output Voltage ± 1%
SPX3940AM3 -L-1-8/TR				Bulk		
SPX3940AM3 -L-2-5	-40°C ≤ TJ ≤ +125	3940A 25YYWWL XXX	3-pin SOT-223	2.5K/Tape & Reel	Lead Free	2.5V Output Voltage ± 1%
SPX3940AM3 -L-2-5/TR				Bulk		
SPX3940AM3 -L-3-3	-40°C ≤ TJ ≤ +125	3940A 33YYWWL XXX	3-pin SOT-223	2.5K/Tape & Reel	Lead Free	3.3V Output Voltage ± 1%
SPX3940AM3 -L-3-3/TR				Bulk		
SPX3940AM3 -L-5-0	-40°C ≤ TJ ≤ +125	3940A 50YYWWL XXX	3-pin SOT-223	2.5K/Tape & Reel	Lead Free	5.0V Output Voltage ± 1%
SPX3940AM3 -L-5-0/TR				Bulk		
SPX3940AT -L-1-8	-40°C ≤ TJ ≤ +125	SPX3940AT 18YYWWLX	3-pin TO-263	500/Tape & Reel	Lead Free	1.8V Output Voltage ± 1%
SPX3940AT -L-1-8/TR				Bulk		
SPX3940AT -L-3-3	-40°C ≤ TJ ≤ +125	SPX3940AT 33YYWWLX	3-pin TO-263	500/Tape & Reel	Lead Free	3.3V Output Voltage ± 1%
SPX3940AT -L-3-3/TR				Bulk		
SPX3940AT -L-5-0	-40°C ≤ TJ ≤ +125	SPX3940AT 50YYWWLX	3-pin TO-263	500/Tape & Reel	Lead Free	5.0V Output Voltage ± 1%
SPX3940AT -L-5-0/TR				Bulk		
SPX3940M3 -L-2-5	-40°C ≤ TJ ≤ +125	3940M3 25YYWWL	3-pin SOT-223	2.5K/Tape & Reel	Lead Free	2.5V Output Voltage ± 2%
SPX3940M3 -L-2-5/TR				Bulk		
SPX3940M3 -L-3-3	-40°C ≤ TJ ≤ +125	3940M3 33YYWWL	3-pin SOT-223	2.5K/Tape & Reel	Lead Free	3.3V Output Voltage ± 2%
SPX3940M3 -L-3-3/TR				Bulk		
SPX3940M3 -L-5-0	-40°C ≤ TJ ≤ +125	3940M3 50YYWWL	3-pin SOT-223	2.5K/Tape & Reel	Lead Free	5.0V Output Voltage ± 2%
SPX3940M3 -L-5-0/TR				Bulk		
SPX3940T -L-3-3	-40°C ≤ TJ ≤ +125	SPX3940T 33YYWWLX	3-pin TO-263	500/Tape & Reel	Lead Free	3.3V Output Voltage ± 2%
SPX3940T -L-3-3/TR				Bulk		
SPX3940T -L-5-0	-40°C ≤ TJ ≤ +125	SPX3940T 33YYWWLX	3-pin TO-263	500/Tape & Reel	Lead Free	5.0V Output Voltage ± 2%
SPX3940T -L-5-0/TR				Bulk		

YY = Year
WW = Week
X = Lot Number when applicable.

TYPICAL PERFORMANCE CHARACTERISTICS

Schematic and BOM from Application Information section of this datasheet.

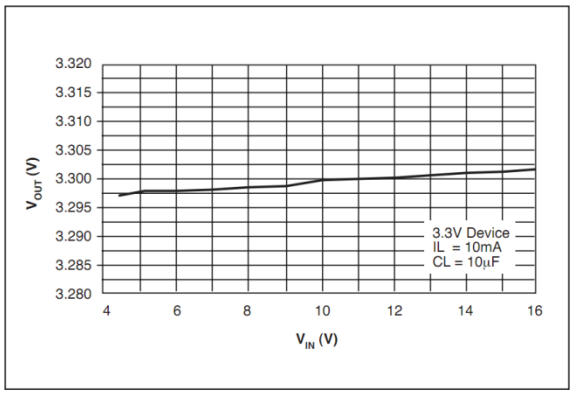


Fig. 4: Line Regulation

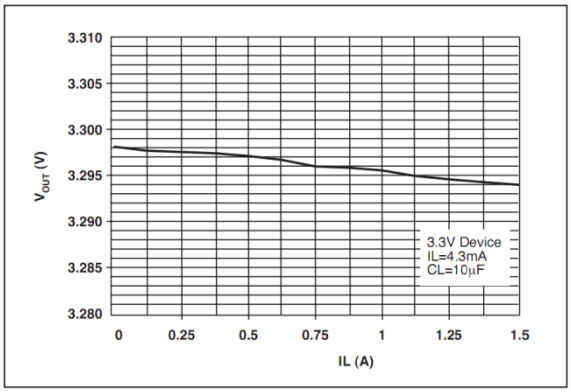


Fig. 5: Load Regulation

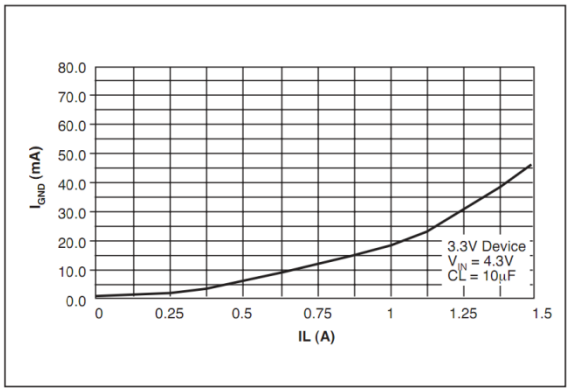


Fig. 6: Ground Current vs Load Current

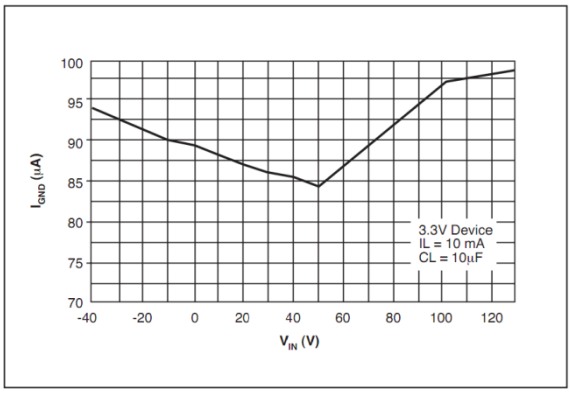


Fig. 7: Ground Current vs Input Voltage

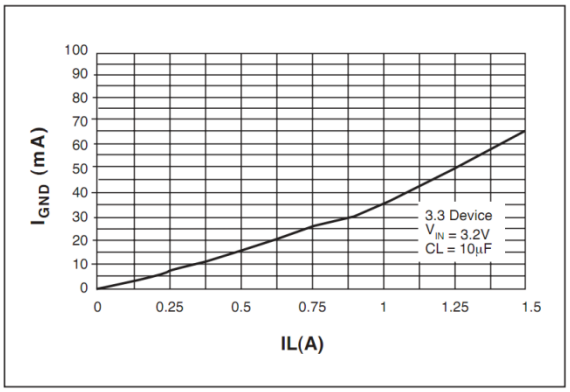


Fig. 8: Ground Current vs Load Current in Dropout

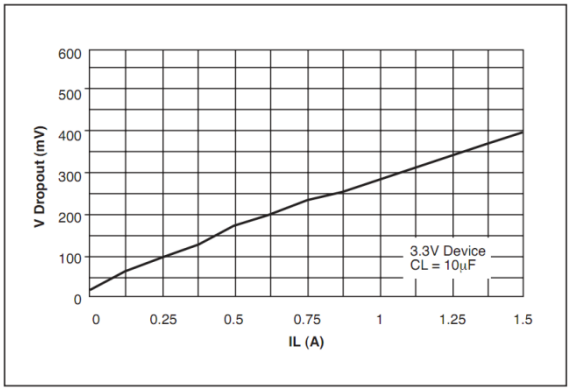


Fig. 9: Dropout Voltage vs Load Current

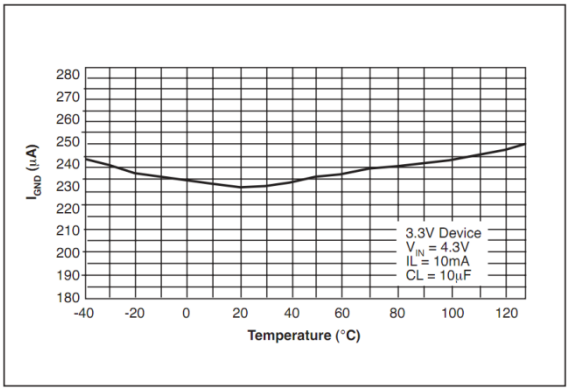


Fig. 10 : Ground Current vs Temperature
I_{LOAD}=100mA

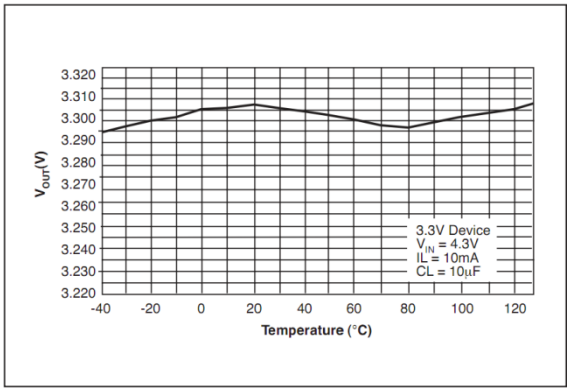


Fig. 11 : Output Voltage vs Temperature
I_{LOAD}=100mA

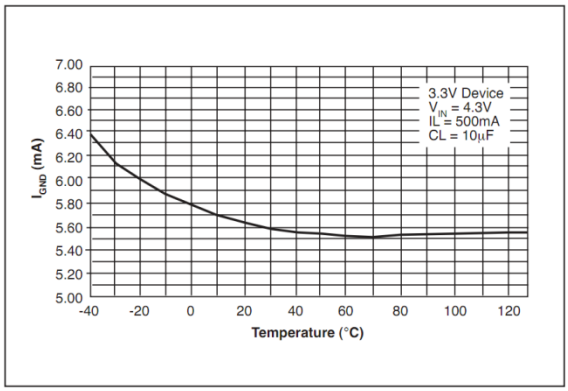


Fig. 12 : Ground Current vs Temperature
I_{LOAD}=500mA

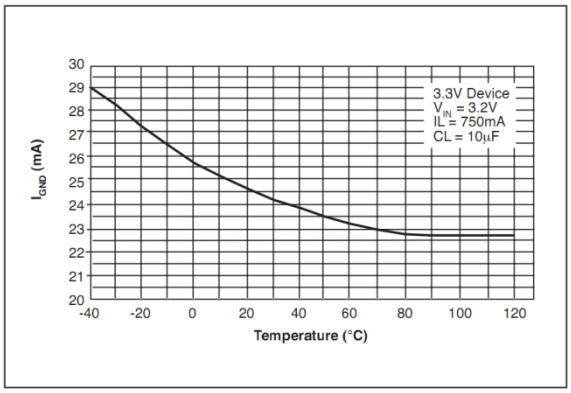


Fig. 13 : Ground Current vs Temperature
Dropout, I_{LOAD}=750mA

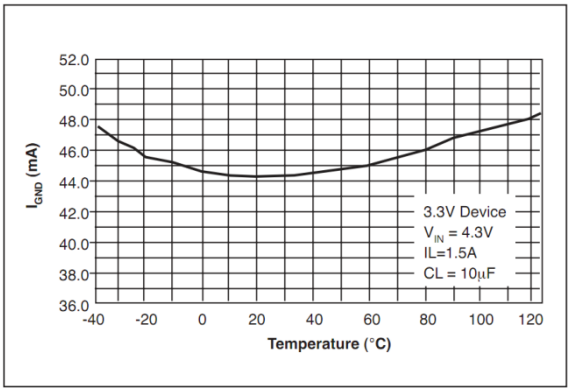


Fig. 14 : Ground Current vs Temperature
I_{LOAD}=1.5A

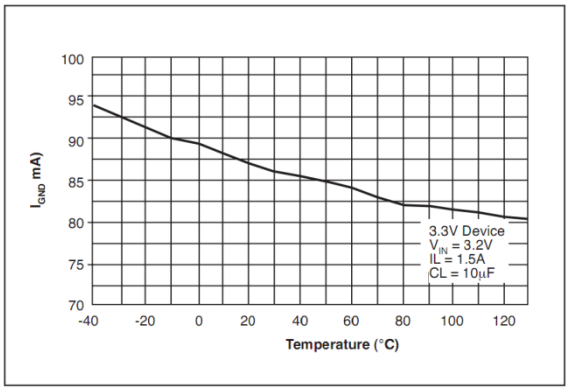


Fig. 15 : Ground Current vs Temperature
Dropout, I_{LOAD}=1.5A

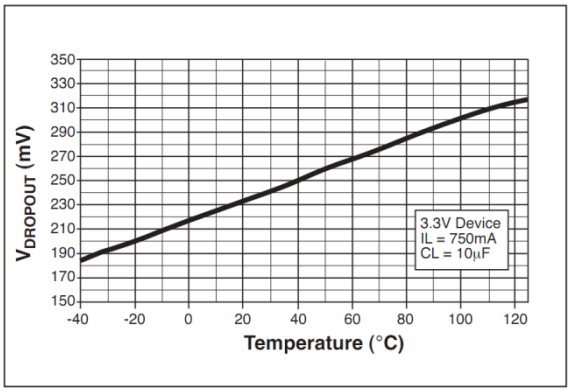


Fig. 16 : Dropout Voltage vs Temperature
I_{LOAD}=750mA

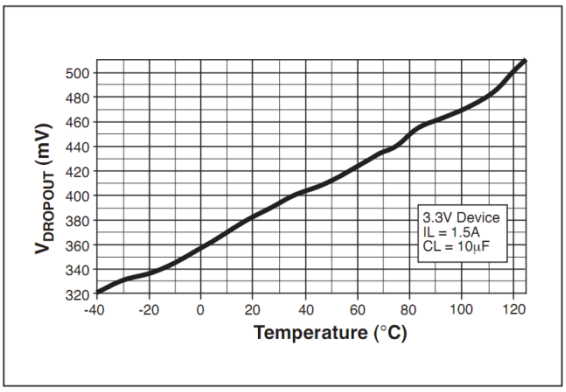


Fig. 17 : Dropout Voltage vs Temperature
I_{LOAD}=1.5A

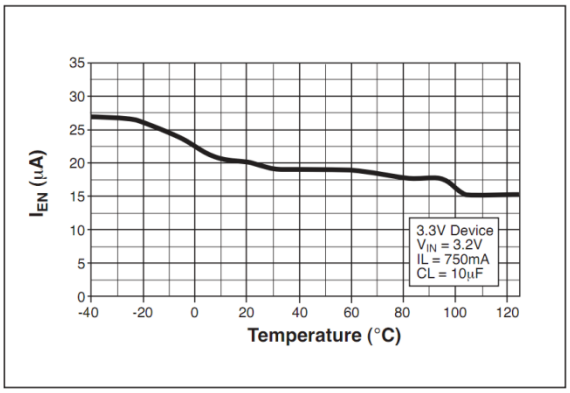


Fig. 18 : Enable Current vs Temperature
V_{EN}=16V

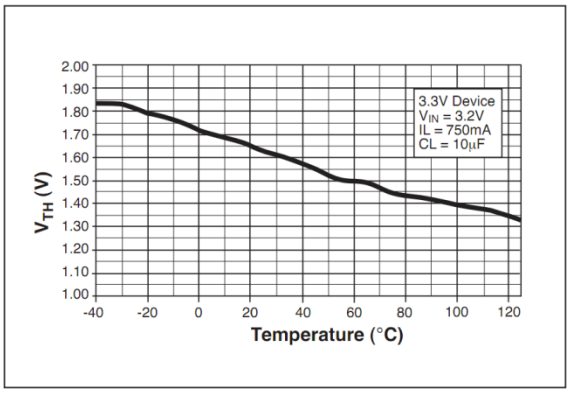


Fig. 19 : Enable Threshold vs Temperature

THEORY OF OPERATION

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.

TO-220 Design Example:

Assume that V_{IN} = 10V, V_{OUT} = 5V, I_{OUT} = 1.5A, T_A = 50°C, θ_{HA} = 1°C/W, θ_{CH} = 2°C/W, θ_{JC} = 3°C/W.

Where T_A = 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.

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 10 µF 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 0.1 µF 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.

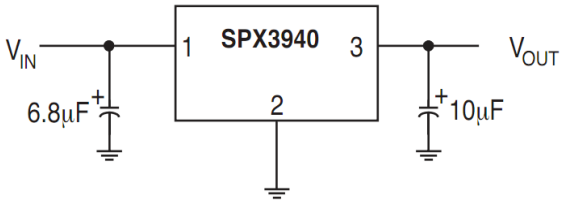
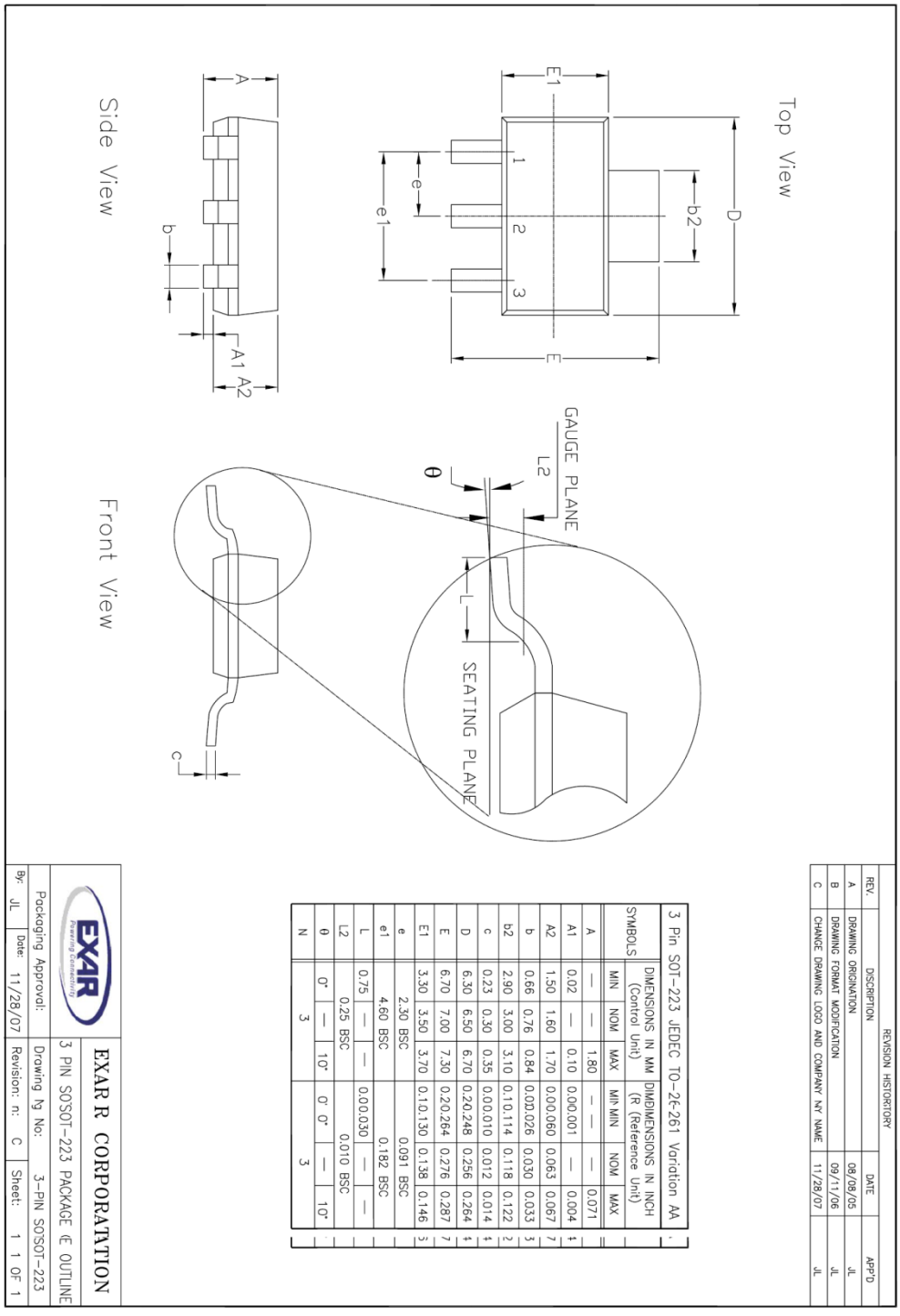


Fig. 20: Fixed Output Linear Regulator

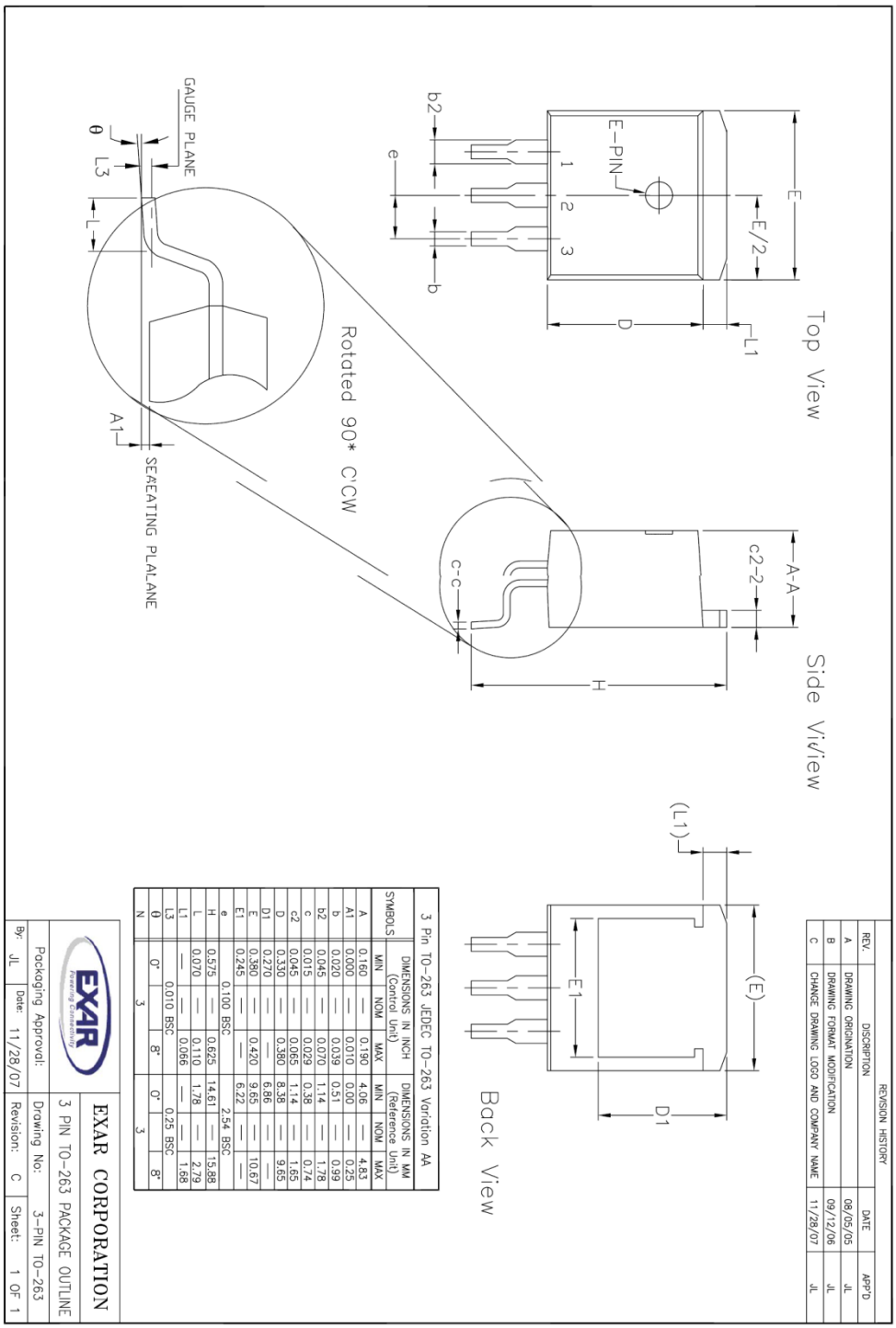
PACKAGE SPECIFICATIO N

3-PIN SOT-223



3 Pin SOT-223 JEDEC TO-26-261 Variation AA						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (R (Reference Unit)		
	MIN	NOM	MAX	MIN MIN	NOM	MAX
A	—	—	1.80	— —	—	0.071
A1	0.02	—	0.10	0.00.001	—	0.004
A2	1.50	1.60	1.70	0.000.060	0.063	0.067
b	0.66	0.76	0.84	0.0D.026	0.030	0.033
b2	2.90	3.00	3.10	0.10.114	0.118	0.122
c	0.23	0.30	0.35	0.000.010	0.012	0.014
D	6.30	6.50	6.70	0.20.248	0.256	0.264
E	6.70	7.00	7.30	0.20.264	0.276	0.287
E1	3.30	3.50	3.70	0.10.130	0.138	0.146
e	2.30 BSC			0.091 BSC		
e1	4.60 BSC			0.182 BSC		
L	0.75	—	—	0.00.030	—	—
L2	0.25 BSC			0.010 BSC		
θ	0°	—	10°	0° 0°	—	10°
N	3			3		

3-PIN TO-263



REV.	DESCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	08/05/05	JL
B	DRAWING FORMAT MODIFICATION	09/12/06	JL
C	CHANGE DRAWING LOGO AND COMPANY NAME	11/28/07	JL

3 Pin TO-263 JEDEC TO-263 Variation AA

SYMBOLS	DIMENSIONS IN INCH (Control Unit)			DIMENSIONS IN MM (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.160	—	0.190	4.06	—	4.83
A1	0.000	—	0.010	0.00	—	0.25
b	0.020	—	0.039	0.51	—	0.99
b2	0.045	—	0.070	1.14	—	1.78
c	0.015	—	0.029	0.38	—	0.74
c2	0.045	—	0.065	1.14	—	1.65
D	0.330	—	0.380	8.38	—	9.65
D1	0.270	—	—	6.86	—	—
E	0.380	—	0.420	9.65	—	10.67
E1	0.245	—	—	6.22	—	—
e		0.100 BSC			2.54 BSC	
H	0.575	—	0.625	14.61	—	15.88
L	0.070	—	0.110	1.78	—	2.79
L1	—	—	0.066	—	—	1.68
L3		0.010 BSC			0.25 BSC	
θ	0°	—	8°	0°	—	8°
N	3			3		

EXAR CORPORATION

3 PIN TO-263 PACKAGE OUTLINE

Packaging Approval:	Drawing No:	3-PIN TO-263
By: JL	Date: 11/28/07	Revision: C
		Sheet: 1 OF 1

REVISION HISTORY

Revision	Date	Description
A	04/14 /200 6	
1.0.0	02/29/2012	Reformat of Datashee t Package drawing corrections

FOR FURTHER ASSISTAN CE

Email: customersupport@exar.com

Exar Technical Documentation: http://www.exar.com/TechDoc/default.aspx?

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NOTICE