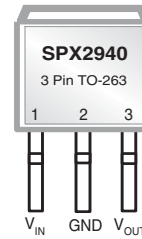


FEATURES

- 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 LM2940, MIC2940A, AS2940
- Standard TO-220 and TO-263 packages



Now Available in Lead Free Packaging

APPLICATIONS

- Powering VGA & Sound Card
- LCD Monitors
- USB Power Supply
- Power PC™ Supplies
- SMPS Post-Regulator
- PDA or Notebook Computer
- High Efficiency Linear Power Supplies
- Portable Instrumentation
- Constant Current Regulators
- Cordless Telephones
- Automotive Electronics

DESCRIPTION

The SPX2940 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 SPX2940 is offered in 3-pin TO-220 & TO-263 packages. For a 3A version, refer to the SPX29300 data sheet.

TYPICAL APPLICATIONS CIRCUIT

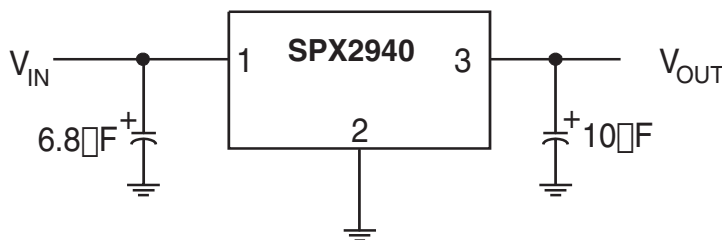


Figure 1. Fixed Output Linear Regulator.

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 $I_{OUT} = 10mA$, $C_{IN} = 6.8\mu F$, $C_{OUT} = 10\mu F$; $T_A = 25^\circ C$, unless otherwise specified. The Boldface applies over the junction temperature range. Adjustable versions are set at 5.0V.

| PARAMETER | CONDITIONS | TYP | MIN | MAX | UNITS |
|----------------------------------------------------------|-----------------------------------------------------------------------------|-------------------|-----------------------|-----------------------|---------------|
| 1.8V Version | | | | | |
| Output Voltage | $I_{OUT} = 10mA$ $10mA \leq I_{OUT} \leq 1A$, $6V \leq V_{IN} \leq 16V$ | 1.8 1.8 | 1.746 1.710 | 1.854 1.890 | V |
| 2.5V Version | | | | | |
| Output Voltage | $I_{OUT} = 10mA$ $10mA \leq I_{OUT} \leq 1A$, $6V \leq V_{IN} \leq 16V$ | 2.5 2.5 | 2.425 2.375 | 2.575 2.625 | V |
| 3.3V Version | | | | | |
| Output Voltage | $I_{OUT} = 10mA$ $10mA \leq I_{OUT} \leq 1A$, $6V \leq V_{IN} \leq 16V$ | 3.3 3.3 | 3.201 3.135 | 3.399 3.465 | V |
| 5.0V Version | | | | | |
| Output Voltage | $I_{OUT} = 10mA$ $10mA \leq I_{OUT} \leq 1A$, $6V \leq V_{IN} \leq 16V$ | 5.0 5.0 | 4.850 4.750 | 5.150 5.250 | V |
| All Voltage Options | | | | | |
| Line Regulation | $I_O = 10mA$, $(V_{OUT} + 1V) \leq V_{IN} \leq 16V$ | 0.2 | | 1.0 | % |
| Load Regulation | $V_{IN} = V_{OUT} + 1V$, $10mA \leq I_{OUT} \leq 1A$ | 0.3 | | 1.5 | % |
| $\frac{\Delta V}{\Delta T}$ | Output Voltage Temperature Coef. | 20 | | 100 | ppm/°C |
| Dropout Voltage (Note 1) (except 1.8V version) | $I_O = 100mA$ | 70 | | 200 | mV |
| | $I_O = 1A$ | 280 | | 550 | |
| Ground Current (Note 3) | $I_O = 750mA$, $V_{IN} = V_{OUT} + 1V$ | 12 | | 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 | | A |
| Output Noise Voltage 10Hz to 100kHz) $I_L = 100mA$ | $C_L = 10\mu F$ | 400 | | | μV_{RMS} |
| | $C_L = 33\mu F$ | 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 | | | |
| | TO-263 Junction to Ambient | 60 | | | |

NOTES:

Note 1: Dropout voltage is defined as the input to output differential when the output voltage drops to 99% of its normal value.

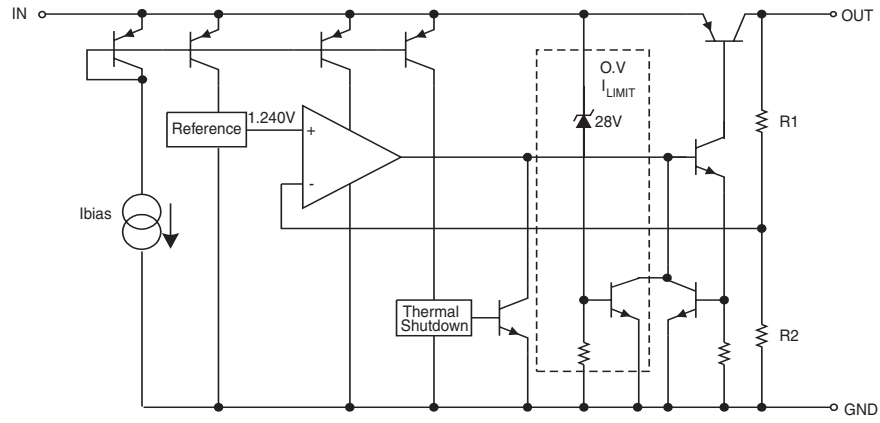
Note 2: $V_{IN} = V_{OUT (NOMINAL)} + 1V$. For example, use $V_{IN} = 4.3V$ for a 3.3V regulator. Employ pulse-testing procedures to minimize temperature rise.

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.

BLOCK DIAGRAM



TYPICAL PERFORMANCE CHARACTERISTICS

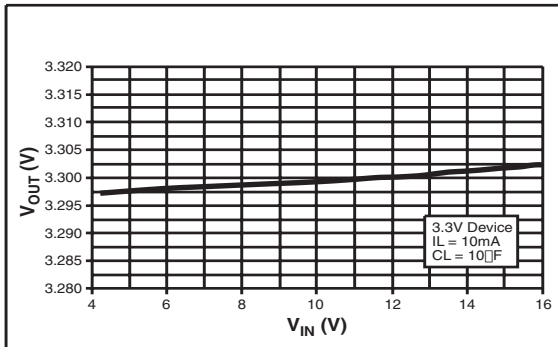


Figure 2. Line Regulation

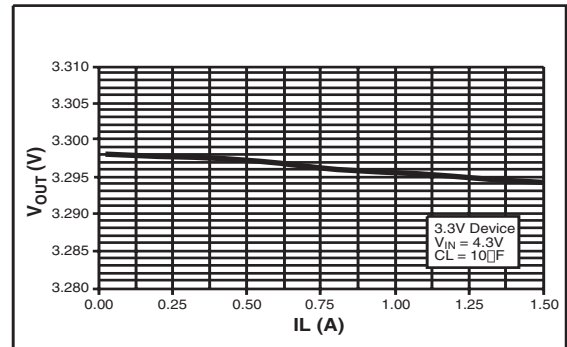


Figure 3. Load Regulation

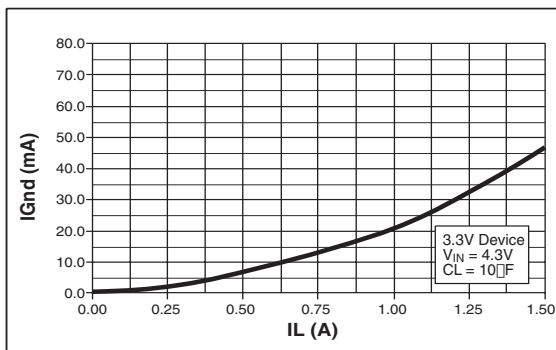


Figure 4. Ground Current vs Load Current

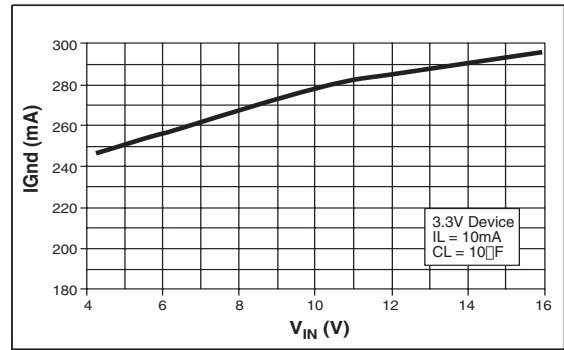


Figure 5. Ground Current vs Input Voltage

TYPICAL PERFORMANCE CHARACTERISTICS

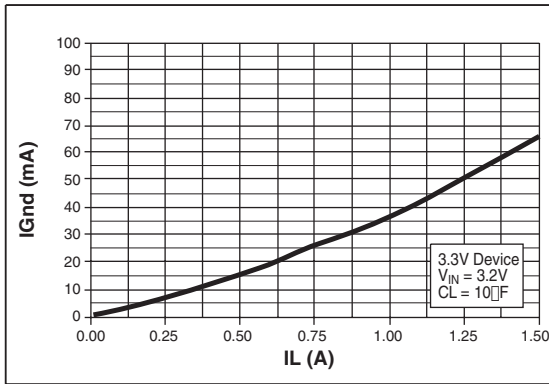


Figure 6. Ground Current vs Current in Dropout

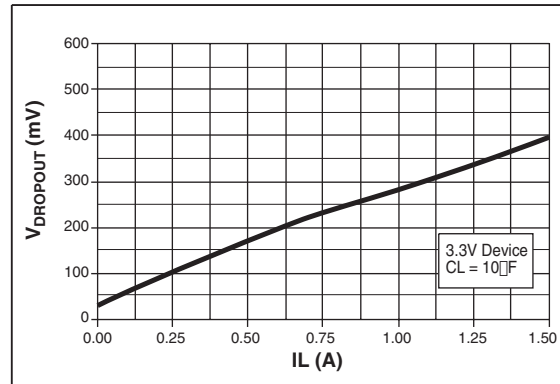


Figure 7. Dropout Voltage vs Load Current

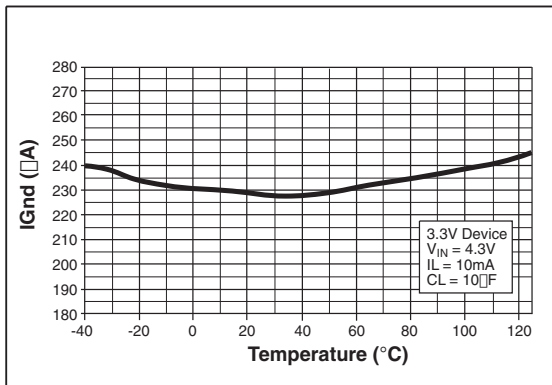


Figure 8. Ground Current vs Temperature at $I_{LOAD} = 10mA$

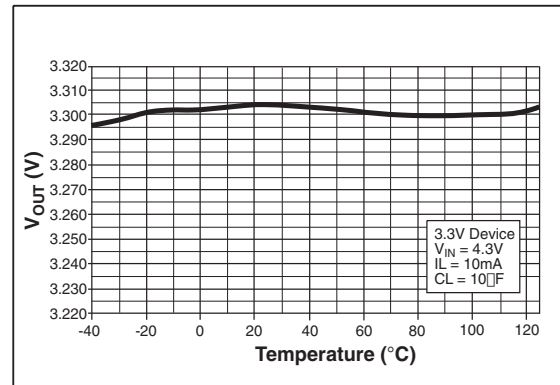


Figure 9. Output Voltage vs Temperature at $I_{LOAD} = 10mA$

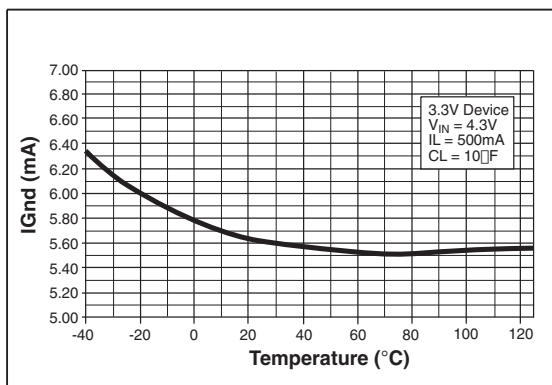


Figure 10. Ground Current vs Temperature at $I_{LOAD} = 500mA$

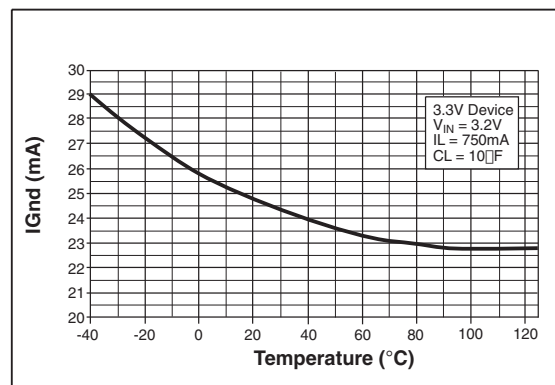


Figure 11. Ground Current vs Temperature in Dropout at $I_{LOAD} = 750mA$

TYPICAL PERFORMANCE CHARACTERISTICS

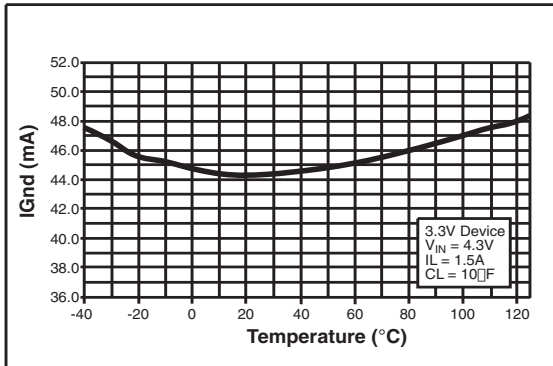


Figure 12. Ground Current vs Temperature at $I_{LOAD} = 1.5A$

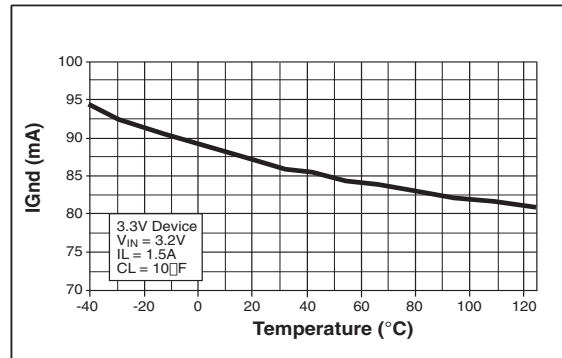


Figure 13. Ground Current vs Temperature in Dropout at $I_{LOAD} = 1.5A$

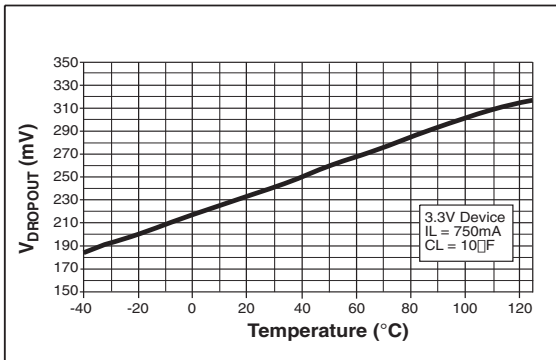


Figure 14. Dropout Voltage vs Temperature at $I_{LOAD} = 750mA$

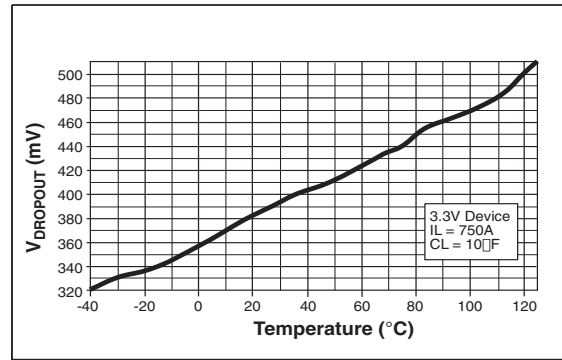


Figure 15. Dropout Voltage vs Temperature at $I_{LOAD} = 1.5mA$

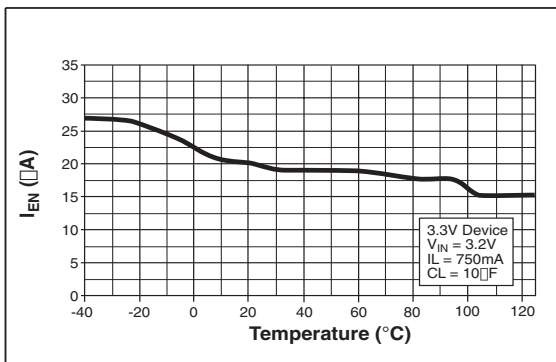


Figure 16. Enable Current vs Temperature for $V_{EN} = 16V$

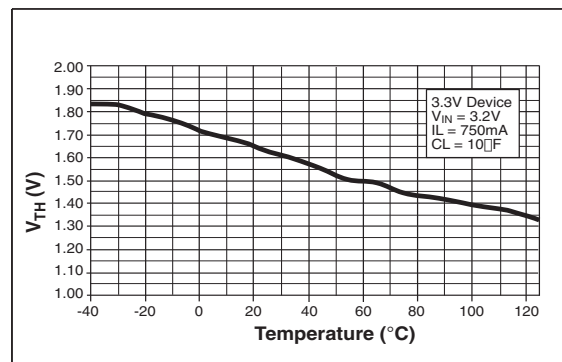


Figure 17. Enable Threshold vs Temperature

APPLICATION INFORMATION

The SPX2940 incorporates protection against over-current faults, reversed load insertion, over temperature operation, and positive and negative transient voltage.

Thermal Considerations

Although the SPX2940 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 $V_{IN} = 10V$, $V_{OUT} = 5V$, $I_{OUT} = 1.5A$, $T_A = 50^{\circ}C/W$, $\theta_{HA} = 1^{\circ}C/W$, $\theta_{CH} = 2^{\circ}C/W$, and $\theta_{JC} = 3^{\circ}C/W$.

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
 $T_J = 50 + 7.5 * (1 + 2 + 3) = 95^{\circ}C$

Reliable operation is insured.

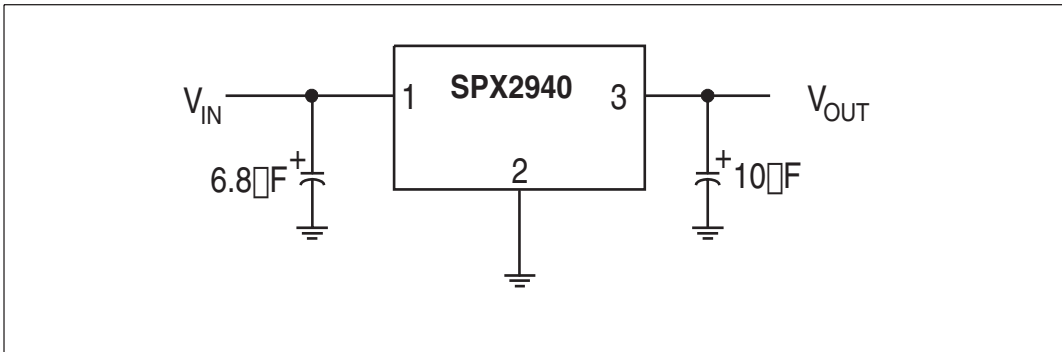


Figure 18. Fixed Output Linear Regulator.

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 SPX2940 is required.

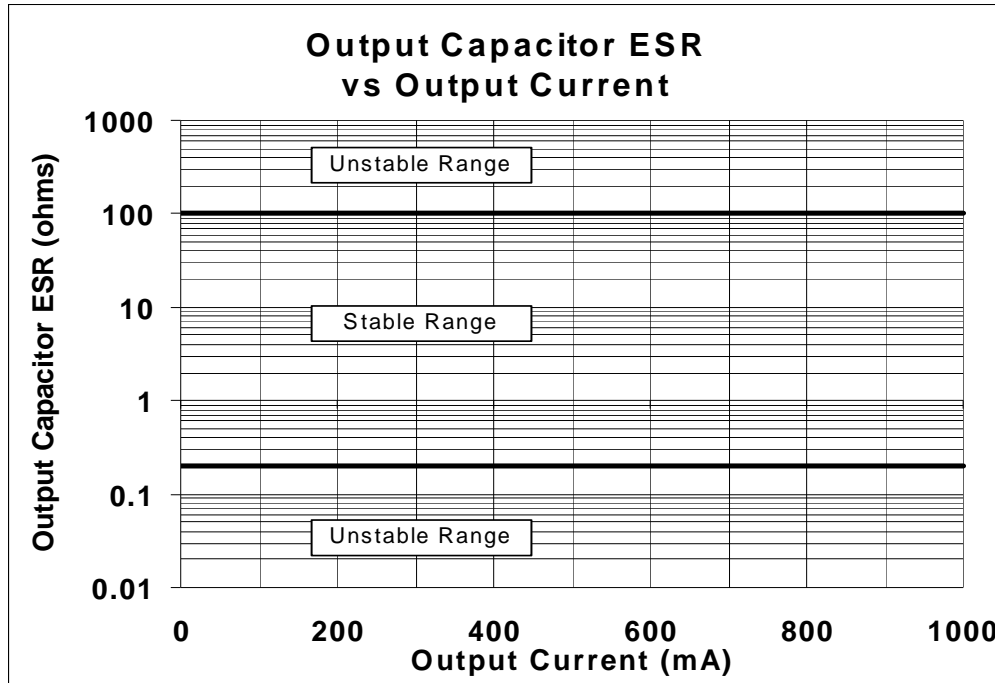


Figure 19. Output Cap ESR vs. I_{out} .

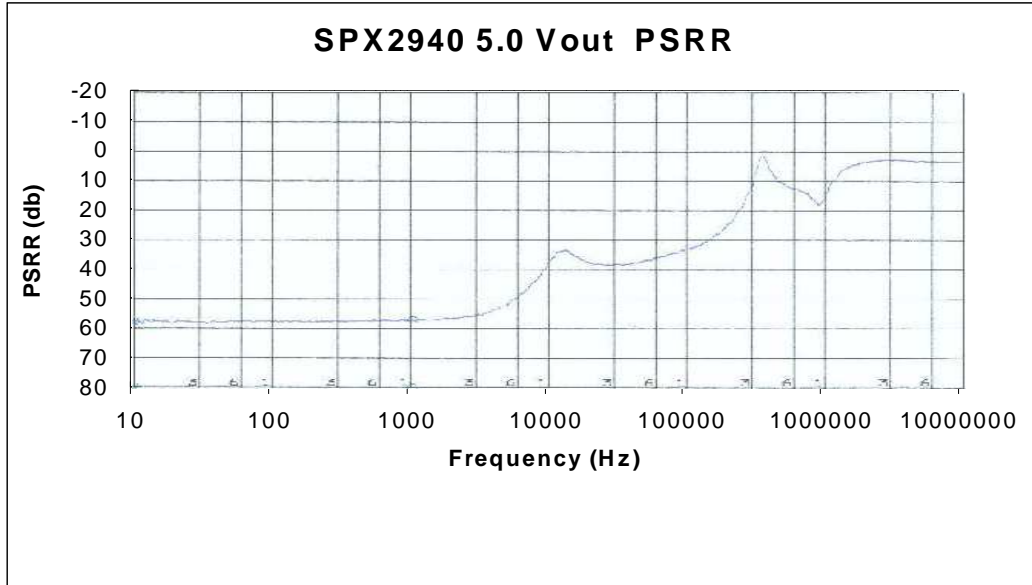
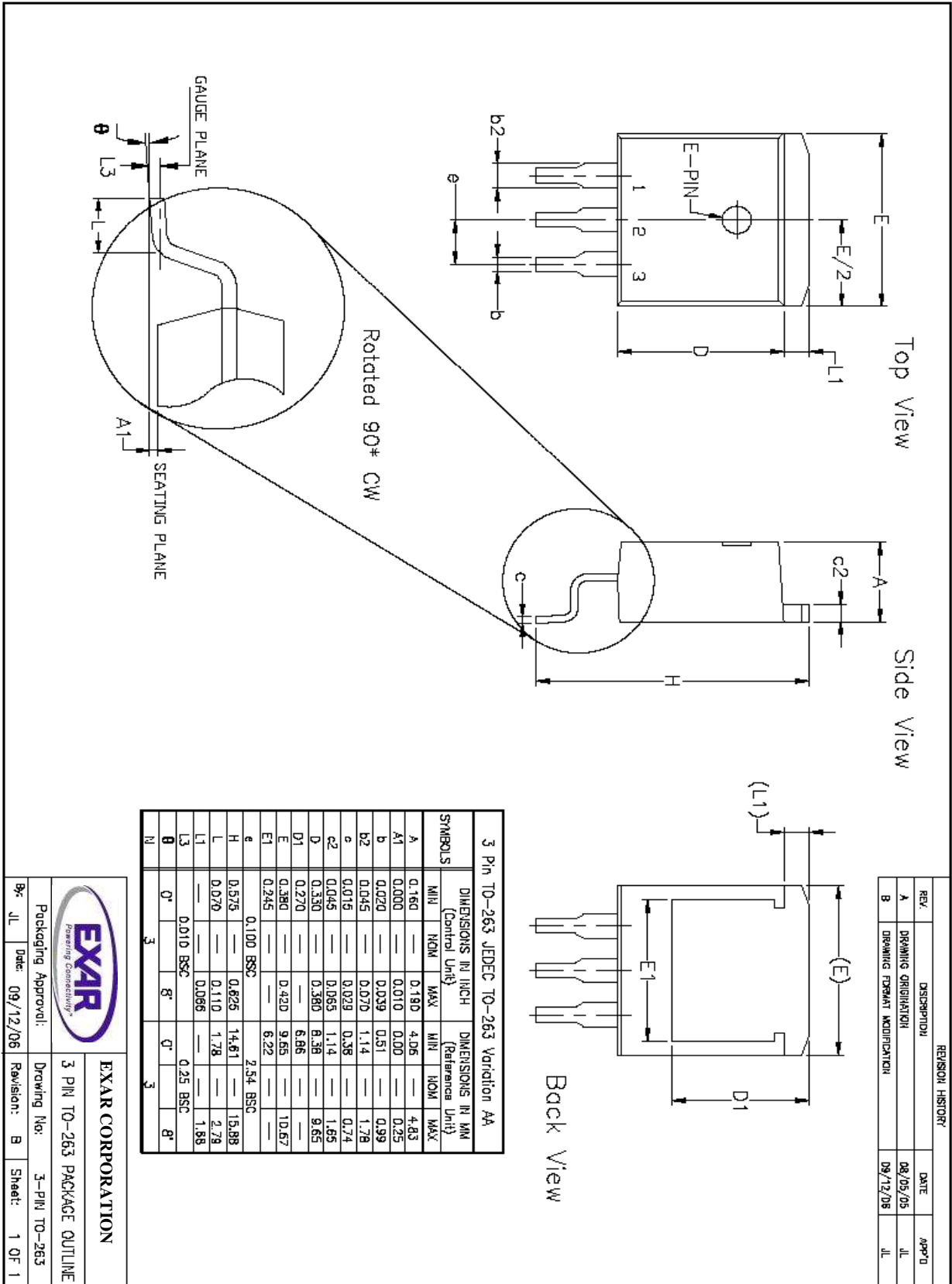
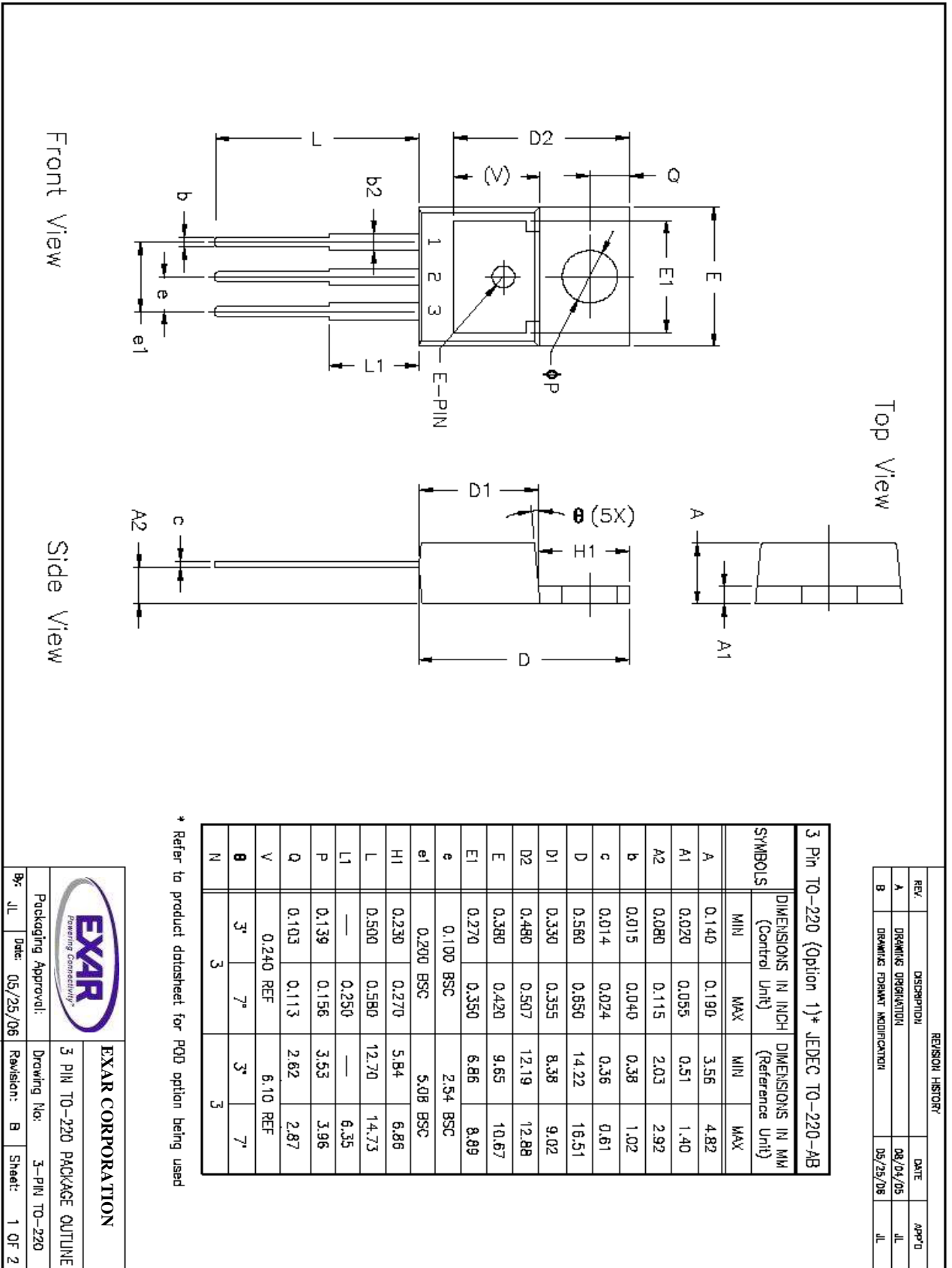


Figure 20. 5Vout PSRR. $V_{in}=10V$, $V_{out}=5V$, $C_{out}=22\mu F$, $I_{out}=10mA$.





| REVISION HISTORY | | | |
|------------------|-----------------------------|----------|-------|
| REV. | DESCRIPTION | DATE | APPRO |
| A | DRAWING ORIGINATOR | 08/04/05 | JL |
| B | DRAWING FORMAT MODIFICATION | 05/25/06 | JL |

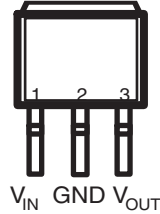
| 3 Pin TO-220 (Option 1)* JEDEC TO-220-AB | | | | |
|------------------------------------------|--------------------------------------|-------|--------------------------------------|-------|
| SYMBOLS | DIMENSIONS IN INCH (Control Unit) | | DIMENSIONS IN MM (Reference Unit) | |
| | MIN | MAX | MIN | MAX |
| A | 0.140 | 0.190 | 3.56 | 4.82 |
| A1 | 0.020 | 0.055 | 0.51 | 1.40 |
| A2 | 0.080 | 0.115 | 2.03 | 2.92 |
| b | 0.015 | 0.040 | 0.38 | 1.02 |
| c | 0.014 | 0.024 | 0.36 | 0.61 |
| D | 0.560 | 0.650 | 14.22 | 16.51 |
| D1 | 0.330 | 0.355 | 8.38 | 9.02 |
| D2 | 0.480 | 0.507 | 12.19 | 12.88 |
| E | 0.380 | 0.420 | 9.65 | 10.67 |
| E1 | 0.270 | 0.350 | 6.86 | 8.89 |
| e | 0.100 BSC | | 2.54 BSC | |
| e1 | 0.200 BSC | | 5.08 BSC | |
| H1 | 0.230 | 0.270 | 5.84 | 6.86 |
| L | 0.500 | 0.580 | 12.70 | 14.73 |
| L1 | — | 0.250 | — | 6.35 |
| P | 0.139 | 0.156 | 3.53 | 3.96 |
| Q | 0.103 | 0.113 | 2.62 | 2.87 |
| V | 0.240 REF | | 6.10 REF | |
| θ | 3° | 7° | 3° | 7° |
| N | 3 | | 3 | |

* Refer to product datasheet for PDD option being used

| | | | |
|---------------------|--------------|------------------------------|--------|
| | | EXAR CORPORATION | |
| Packaging Approval: | | 3 Pin TO-220 PACKAGE OUTLINE | |
| Drawing No: | 3-PIN TO-220 | Revision: | B |
| Date: | 05/25/06 | Sheet: | 1 OF 2 |

PACKAGE PINOUTS

TO-263-3 Package (T)



V_{IN} GND V_{OUT}

Front View
TAB = GND

TO-220-3 Package (U)



V_{IN} GND V_{OUT}

Front View
TAB = GND

ORDERING INFORMATION

| PART NUMBER | ACC. | OUTPUT VOLTAGE | PACKAGE |
|-----------------|------|----------------|---------------|
| SPX2940U-1-8 | 3% | 1.8V | 3 Lead TO-220 |
| SPX2940U-2-5 | 3% | 2.5V | 3 Lead TO-220 |
| SPX2940U-3-3 | 3% | 3.3V | 3 Lead TO-220 |
| SPX2940U-5-0 | 3% | 5.0V | 3 Lead TO-220 |
| SPX2940T-1-8 | 3% | 1.8V | 3 Lead TO-263 |
| SPX2940T-1-8/TR | 3% | 1.8V | 3 Lead TO-263 |
| SPX2940T-2-5 | 3% | 2.5V | 3 Lead TO-263 |
| SPX2940T-2-5/TR | 3% | 2.5V | 3 Lead TO-263 |
| SPX2940T-3-3 | 3% | 3.3V | 3 Lead TO-263 |
| SPX2940T-3-3/TR | 3% | 3.3V | 3 Lead TO-263 |
| SPX2940T-5-0 | 3% | 5.0V | 3 Lead TO-263 |
| SPX2940T-5-0/TR | 3% | 5.0V | 3 Lead TO-263 |

Available in lead free packaging. To order add "-L" suffix to part number.

Example: SPX2940T-3-3/TR = standard; SPX2940T-L-3-3/TR = lead free

/TR = Tape and Reel

Pack quantity is 500 for TO-263.

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Datasheet November 2007.