## GENERAL DESCRIPTION

The SPX3819 is a positive voltage regulator with a low dropout voltage and low noise output. In addition, this device offers a very low ground current of 800µA at 100mA output. The SPX3819 has an initial tolerance of less than 1% max and a logic compatible ON/OFF switched input. When disabled, power consumption drops to nearly zero. Other key features include reverse battery protection, current limit, and thermal shutdown. The SPX3819 includes a reference bypass pin for optimal low noise output performance. With its very low output temperature coefficient, this device also makes a superior low power voltage reference.

The SPX3819 is an excellent choice for use in battery-powered applications such as cordless telephones, radio control systems, and portable computers. It is available in several fixed output voltage options or with an adjustable output voltage.

This device is offered in 8 pin NSOIC, 8 pin DFN and 5-pin SOT-23 packages.

## APPLICATIONS

- **Portable Consumer Equipment**
- **Portable Instrumentation**
- **Industrial Equipment**
- **SMPS Post Regulators**

## FEATURES

- **Low Noise: 40µV Possible**
- **High Accuracy: 1%**
- **Reverse Battery Protection**
- **Low Dropout: 340mV at Full Load**
- **Low Quiescent Current: 90µA**
- **Zero Off-Mode Current**
- **Fixed & Adjustable Output Voltages:**
  - 1.2V, 1.5V, 1.8V, 2.5V, 3.0V, 3.3V & 5.0V Fixed Output Voltages
  - ≥1.235V Adjustable Output Voltages
- **Available in RoHS Compliant, Lead Free Packages:**
  - 5-pin SOT-23, 8-pin SOIC and 8-pin DFN

## TYPICAL APPLICATION DIAGRAM

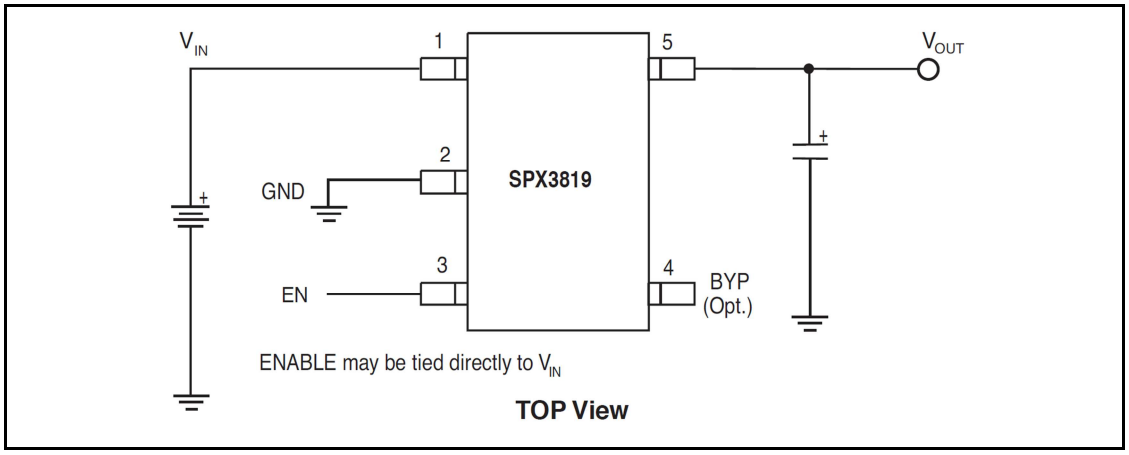



Fig. 1: SPX3819 Application Circuit

## ABSOLUTE MAXIMUM RATINGS

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 specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

$V_{IN}$, EN ..... -20V to +20V
Storage Temperature ..... -65°C to 150°C
Junction Temperature ..... 150°C
Power Dissipation ..... Internally Limited
Lead Temperature (Soldering, 5 sec) ..... 260°C
ESD Rating (HBM - Human Body Model) ..... 2kV

## OPERATING RATINGS

Input Voltage Range $V_{IN}$ ..... 2.5V to 16V
Enable Pin EN ..... 0.0V to $V_{IN}$
Junction Temperature Range ..... -40°C to +125°C
Thermal Resistance[1] .....
$\theta_{JA}$ (SOT23-5) ..... 191°C/W
$\theta_{JA}$ (NSOIC-8) ..... 128.4°C/W
$\theta_{JA}$ (DFN-8) ..... 59°C/W

Note 1: The maximum allowable power dissipation is a function of maximum operating junction temperature, $T_{J(max)}$ the junction to ambient thermal resistance, and the ambient $\theta_{JA}$, and the ambient temperature $T_A$. The maximum allowable power dissipation at any ambient temperature is given: $P_{D(max)} = (T_{J(max)}-T_A)/\theta_{JA}$, exceeding the maximum allowable power limit will result in excessive die temperature; thus, the regulator will go into thermal shutdown

## ELECTRICAL SPECIFICATIONS

Specifications with standard type are for an Operating Junction Temperature of $T_J$ = 25°C only; limits applying over the full Operating Junction Temperature range are denoted by a "•". Minimum and Maximum limits are guaranteed through test, design, or statistical correlation. Typical values represent the most likely parametric norm at $T_J$ = 25°C, and are provided for reference purposes only. Unless otherwise indicated, $V_{IN}$ = $V_{OUT}$ + 1V ($V_{IN}$ = $V_{OUT}$ + 1.2V for 1.2V option), $I_L$ = 100µA, $C_L$ = 1µF, $V_{EN}$ ≥ 2.5V, $T_A$= $T_J$ = 25°C.

| Parameter | Min. | Typ. | Max. | Units | | Conditions |
|---|---|---|---|---|---|---|
| Output Voltage Tolerance | -1 | | +1 | % | | |
| | -2 | | +2 | | • | |
| Output Voltage Temperature Coefficient | | 57 | | ppm/°C | | |
| Line Regulation | | 0.04 | 0.1 | %/V | | $V_{IN}$ = $V_{OUT}$ +1 to 16V and $V_{EN}$ ≤ 6V |
| | | | 0.2 | | • | $V_{IN}$ = $V_{EN}$ = $V_{OUT}$ +1 ≤ 8V |
| | | | 0.2 | | | $V_{IN}$ = $V_{EN}$ = $V_{OUT}$ +1 ≤16V<br>$T_A$ = 25°C to 85°C |
| Load Regulation | | 0.05 | 0.4 | % | | $I_L$ = 0.1mA to 500mA |
| Dropout Voltage ($V_{IN}$-$V_{OUT}$) [2] | | 10 | 60 | mV | | $I_L$ = 100µA |
| | | | 80 | | • | |
| | | 125 | 175 | | | $I_L$ = 50mA |
| | | | 250 | | • | |
| | | 180 | 350 | | | $I_L$ = 150mA |
| | | | 450 | | • | |
| | | 340 | 550 | | | $I_L$ = 500mA |
| | | | 700 | | • | |
| Quiescent Current ($I_{GND}$) | | 0.05 | 3 | µA | | $V_{ENABLE}$ ≤ 0.4V |
| | | | 8 | | • | $V_{ENABLE}$ = 0.25V |
| Ground Pin Current ($I_{GND}$) | | 90 | 150 | µA | | $I_L$ = 100µA |
| | | | 190 | | • | |
| | | 250 | 650 | | | $I_L$ = 50mA |
| | | | 900 | | • | |
| | | 1.0 | 2.0 | mA | | $I_L$ = 150mA |
| | | | 2.5 | | • | |
| | | 6.5 | 25.0 | | | $I_L$ = 500mA |
| | | | 30.0 | | • | |
| Ripple Rejection (PSRR) | | 70 | | dB | | |
| | | | | | | |

| Parameter | Min. | Typ. | Max. | Units | | Conditions |
|---|---|---|---|---|---|---|
| Current Limit ($I_{LIMIT}$) | | 800 | | mA | | $V_{OUT}$=0V |
| | | | 950 | | • | |
| Output Noise ($e_{NO}$) | | 300 | | $\mu V_{RMS}$ | | $I_L$ = 10mA, $C_L$ = 1.0µF, $C_{IN}$ = 1µF, (10Hz – 100kHz) |
| | | 40 | | $\mu V_{RMS}$ | | $I_L$ = 10mA, $C_L$ = 1.0µF, $C_{BYP}$ = 1µF, $C_{IN}$ = 1µF, (10Hz – 100kHz) |
| Input Voltage Level Logic Low ($V_{IL}$) | | | 0.4 | V | | OFF |
| Input Voltage Level Logic High ($V_{IH}$) | 2 | | | V | | ON |
| ENABLE Input Current | | 0.01 | 2 | µA | | VIL ≤ 0.4V |
| | | 3 | 20 | | | VIH ≥ 2.0V |

Note 2: Not applicable to output voltage 2V or less.

## PIN ASSIGNMENT

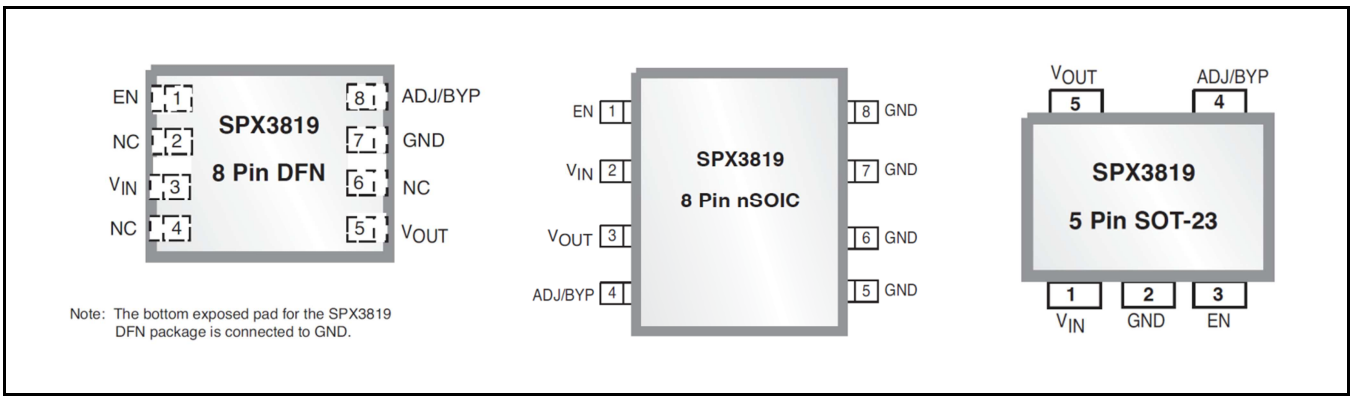



Fig. 2: SPX3819 Pin Assignment

## PIN DESCRIPTION

| Name | Pin # nSOIC | Pin # DFN | Pin # SOT-23 | Description |
|---|---|---|---|---|
| VIN | 2 | 3 | 1 | Supply Input |
| GND | 5, 6, 7, 8 | 7 | 2 | Ground |
| VOUT | 3 | 5 | 5 | Regulator Output |
| EN | 1 | 1 | 3 | Enable(input). CMOS compatible control input. Logic high – enable; logic low or open = shutdown |
| ADJ/BYP | 4 | 8 | 4 | Adjust(input). Feedback input. Connect to resistive voltage-divider network |
| NC | - | 2, 4, 6 | - | No Connect |

## ORDERING INFORMATION

| Part Number | Temperature Range | Marking | Package | Packing Quantity | Note 1 | Note 2 |
|---|---|---|---|---|---|---|
| SPX3819M5-L | -40°C≤$T_J$≤+125°C | G1WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-1-2 | -40°C≤$T_J$≤+125°C | A4WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-1-2/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-1-5 | -40°C≤$T_J$≤+125°C | W3WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-1-5/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-1-8 | -40°C≤$T_J$≤+125°C | G3WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-1-8/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-2-5 | -40°C≤$T_J$≤+125°C | H3WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-2-5/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-3-0 | -40°C≤$T_J$≤+125°C | J3WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-3-0/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-3-3 | -40°C≤$T_J$≤+125°C | L3WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-3-3/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819M5-L-5-0 | -40°C≤$T_J$≤+125°C | M3WW | SOT-23-5 | Bulk | Halogen free | |
| SPX3819M5-L-5-0/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819R2-L | -40°C≤$T_J$≤+125°C | L0L<br>YWW<br>XX | DFN-8 | Bulk | Halogen free | |
| SPX3819R2-L/TR | | | | 3.0K/Tape & Reel | | |
| SPX3819R2-L-1-2 | -40°C≤$T_J$≤+125°C | M0L<br>YWW<br>XX | DFN-8 | Bulk | Halogen free | |
| SPX3819R2-L-1-2/TR | | | | 3.0K/Tape & Reel | | |
| SPX3819R2-L-1-8 | -40°C≤$T_J$≤+125°C | N0L<br>YWW<br>XX | DFN-8 | Bulk | Halogen free | |
| SPX3819R2-L-1-8/TR | | | | 3.0K/Tape & Reel | | |
| SPX3819S-L | -40°C≤$T_J$≤+125°C | SPX3819<br>YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819S-L-1-2 | -40°C≤$T_J$≤+125°C | SPX3819<br>12YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L-1-2/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819S-L-1-5 | -40°C≤$T_J$≤+125°C | SPX3819<br>15YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L-1-5/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819S-L-1-8 | -40°C≤$T_J$≤+125°C | SPX3819<br>18YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L-1-8/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819S-L-2-5 | -40°C≤$T_J$≤+125°C | SPX3819<br>25YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L-2-5/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819S-L-3-3 | -40°C≤$T_J$≤+125°C | SPX3819<br>33YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L-3-3/TR | | | | 2.5K/Tape & Reel | | |
| SPX3819S-L-5-0 | -40°C≤$T_J$≤+125°C | SPX3819<br>50YYWWL<br>XXX | NSOIC-8 | Bulk | Halogen free | |
| SPX3819S-L-5-0/TR | | | | 2.5K/Tape & Reel | | |

"YY" = Year – "WW" = Work Week – "X" = Lot Number; when applicable.

## TYPICAL PERFORMANCE CHARACTERISTICS

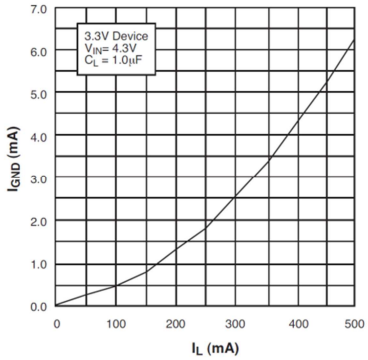



Fig. 3: Ground Current vs Load Current

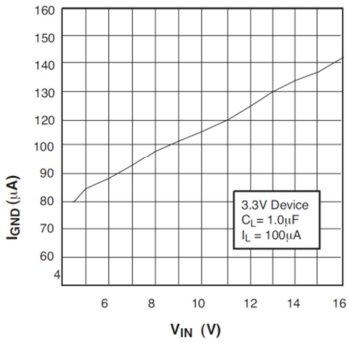



Fig. 4: Ground Current vs Input Voltage

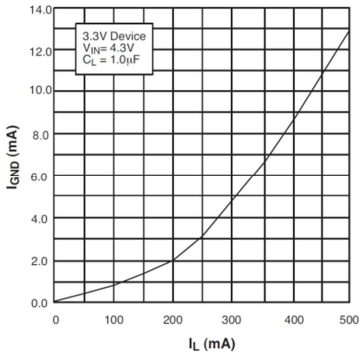



Fig. 5 Ground Current vs Load Current in Dropout

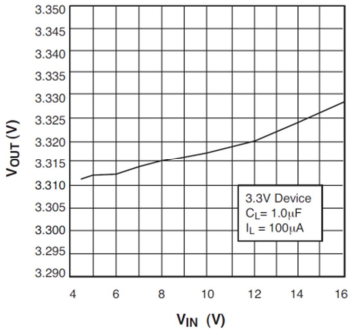



Fig. 6 Output Voltage vs Input Voltage

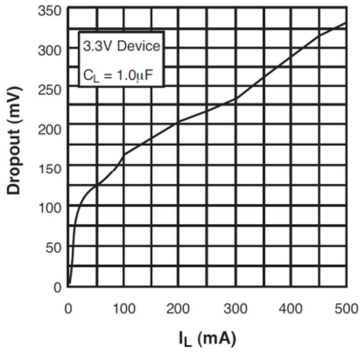



Fig. 7 Dropout Voltage vs Load Current

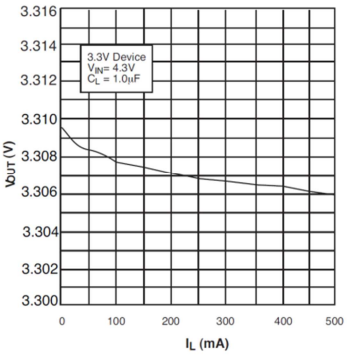



Fig. 8 Output Voltage vs Load Current

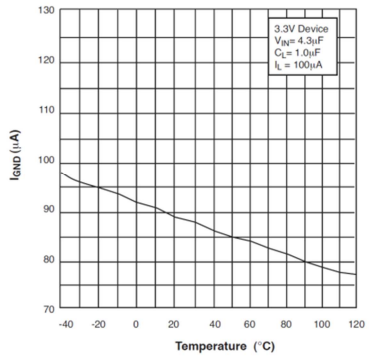



Fig. 9 Ground Current vs Temperature with 100µA Load

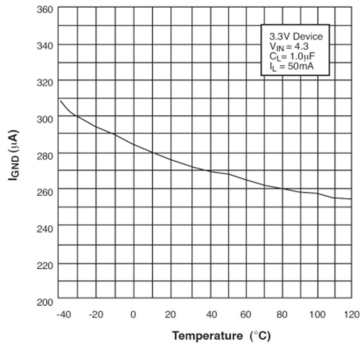



Fig. 10 Ground Current vs Temperature with 50mA Load

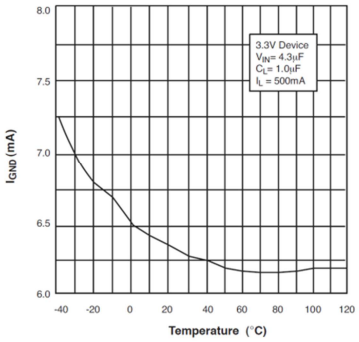



Fig. 11 Ground Current vs Temperature with 500mA Load

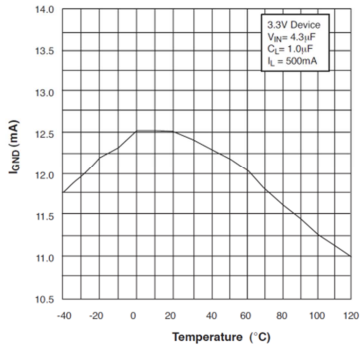



Fig. 12 Ground Current vs Temperature in Dropout

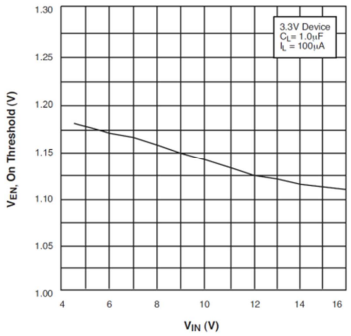



Fig. 13 ENABLE Voltage, ON threshold, vs Input Voltage

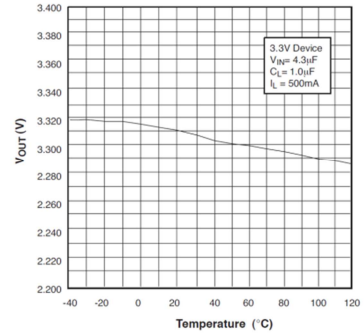



Fig. 14 Output Voltage vs Temperature

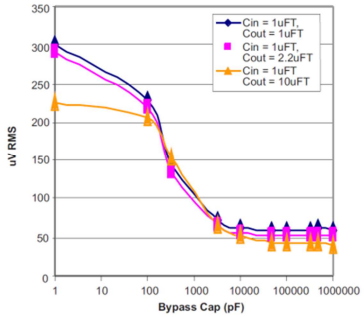



Fig. 15 Output Noise vs Bypass Capacitor Value IL = 10mA, 10Hz - 100kHz

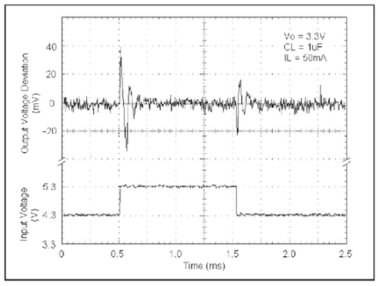



Fig. 16 Line Transient Response for 3.3V Device

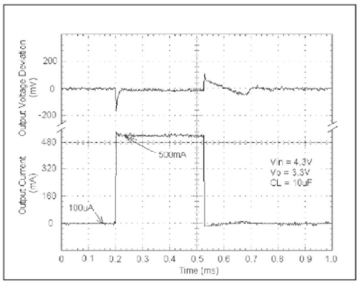



Fig. 17 Load Transient Response for 3.3V Device

## APPLICATION INFORMATION

The SPX3819 requires an output capacitor for device stability. Its value depends upon the application circuit. In general, linear regulator stability decreases with higher output currents. In applications where the SPX3819 is sourcing less current, a lower output capacitance may be sufficient. For example, a regulator outputting only 10mA, requires approximately half the capacitance as the same regulator sourcing 150mA.

Bench testing is the best method for determining the proper type and value of the capacitor since the high frequency characteristics of electrolytic capacitors vary widely, depending on type and manufacturer. A high quality 2.2µF aluminum electrolytic capacitor works in most application circuits, but the same stability often can be obtained with a 1µF tantalum electrolytic.

With the SPX3819 adjustable version, the minimum value of output capacitance is a function of the output voltage. The value decreases with higher output voltages, since closed loop gain is increased.

### TYPICAL APPLICATIONS CIRCUITS

A 10nF capacitor on the BYP pin will significantly reduce output noise, but it may be left unconnected if the output noise is not a major concern. The SPX3819 start-up speed is inversely proportional to the size of the BYP capacitor. Applications requiring a slow rampup of the output voltage should use a larger CBYP. However, if a rapid turn-on is necessary, the BYP capacitor can be omitted.

The SPX3819's internal reference is available through the BYP pin.

Figure 18 represents a SPX3819 standard application circuit. The EN (enable) pin is pulled high (>2.0V) to enable the regulator. To disable the regulator, EN < 0.4V.

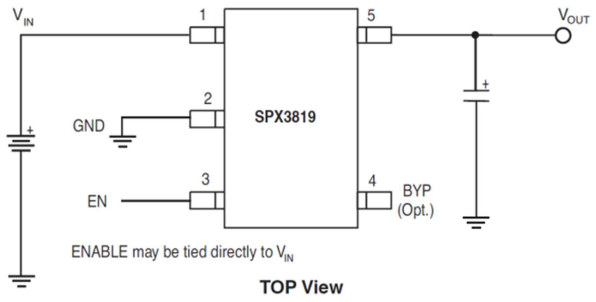



Fig. 18: Standard Application Circuit

The SPX3819 in Figure 19 illustrates a typical adjustable output voltage configuration. Two resistors (R1 and R2) set the output voltage.

The output voltage is calculated using the formula:

$$VOUT = 1.235V \times [1 + R1/R2]$$

R2 must be >10kΩ and for best results, R2 should be between 22kΩ and 47kΩ.

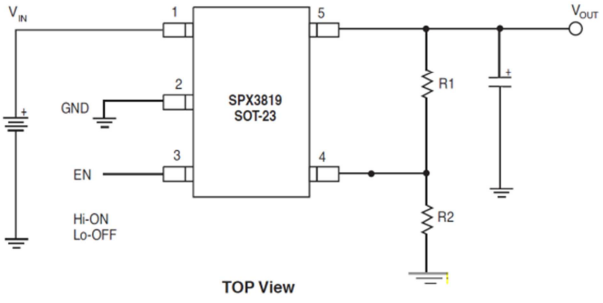
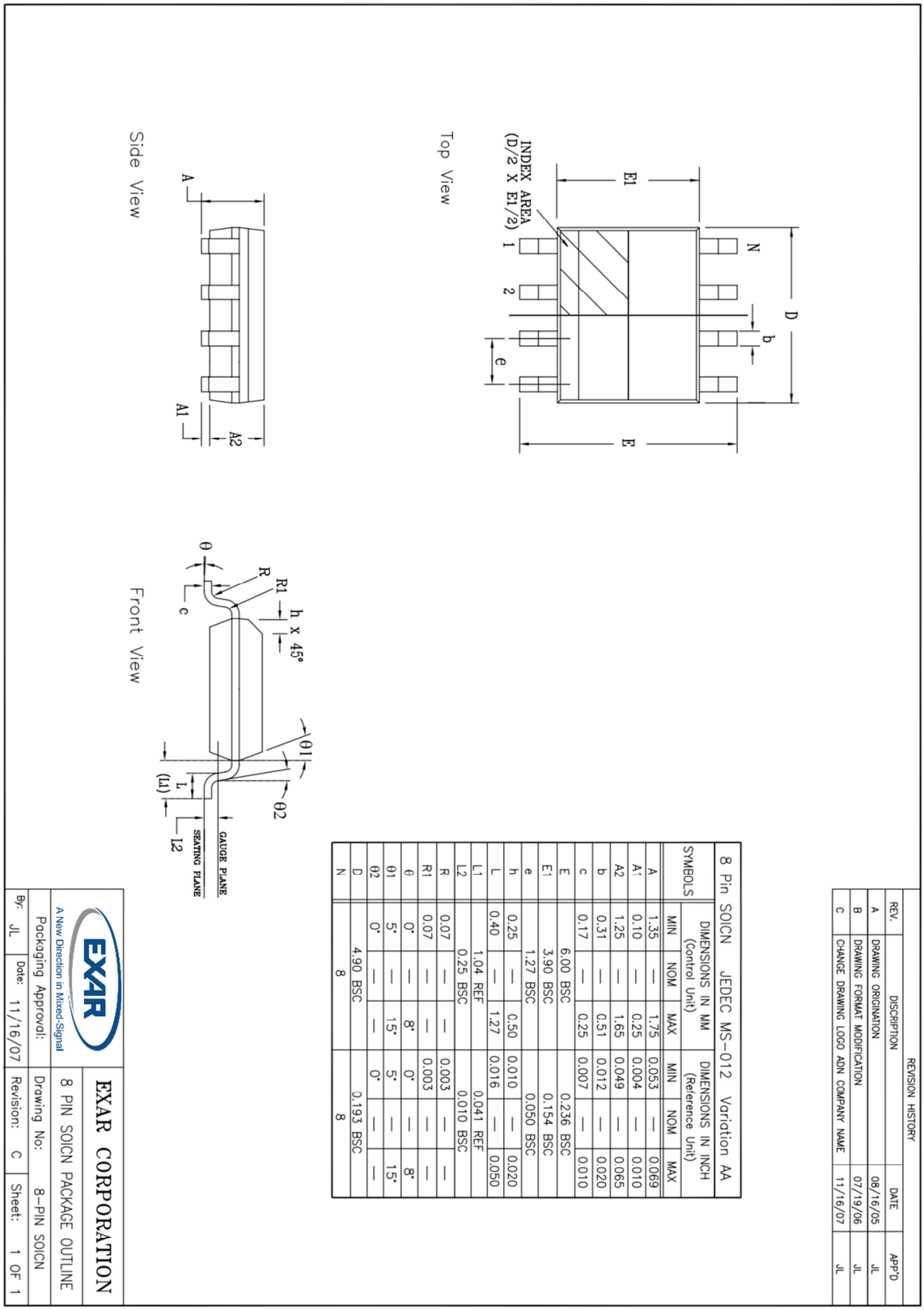



Fig. 19: Typical Adjustable Output Voltage Configuration

## PACKAGE SPECIFICATION

## 8-PIN SOICN




REVISION HISTORY

| REV. | DESCRIPTION | DATE | APP'D |
|---|---|---|---|
| A | DRAWING ORIGINATION | 08/16/05 | JL |
| B | DRAWING FORMAT MODIFICATION | 07/19/06 | JL |
| C | CHANGE DRAWING LOGO ADN COMPANY NAME | 11/16/07 | JL |

8 Pin SOICN JEDEC MS-012 Variation AA

| SYMBOLS | DIMENSIONS IN MM (Control Unit) | | | DIMENSIONS IN INCH (Reference Unit) | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.35 | — | 1.75 | 0.053 | — | 0.069 |
| A1 | 0.10 | — | 0.25 | 0.004 | — | 0.010 |
| A2 | 1.25 | — | 1.65 | 0.049 | — | 0.065 |
| b | 0.31 | — | 0.51 | 0.012 | — | 0.020 |
| c | 0.17 | — | 0.25 | 0.007 | — | 0.010 |
| E | 6.00 BSC | | | 0.236 BSC | | |
| E1 | 3.90 BSC | | | 0.154 BSC | | |
| e | 1.27 BSC | | | 0.050 BSC | | |
| h | 0.25 | — | 0.50 | 0.010 | — | 0.020 |
| L | 0.40 | — | 1.27 | 0.016 | — | 0.050 |
| L1 | 1.04 REF | | | 0.041 REF | | |
| L2 | 0.25 BSC | | | 0.010 BSC | | |
| R | 0.07 | — | — | 0.003 | — | — |
| R1 | 0.07 | — | — | 0.003 | — | — |
| θ | 0° | — | 8° | 0° | — | 8° |
| θ1 | 5° | — | 15° | 5° | — | 15° |
| θ2 | 0° | — | — | 0° | — | — |
| D | 4.90 BSC | | | 0.193 BSC | | |
| N | 8 | | | 8 | | |

EXAR CORPORATION

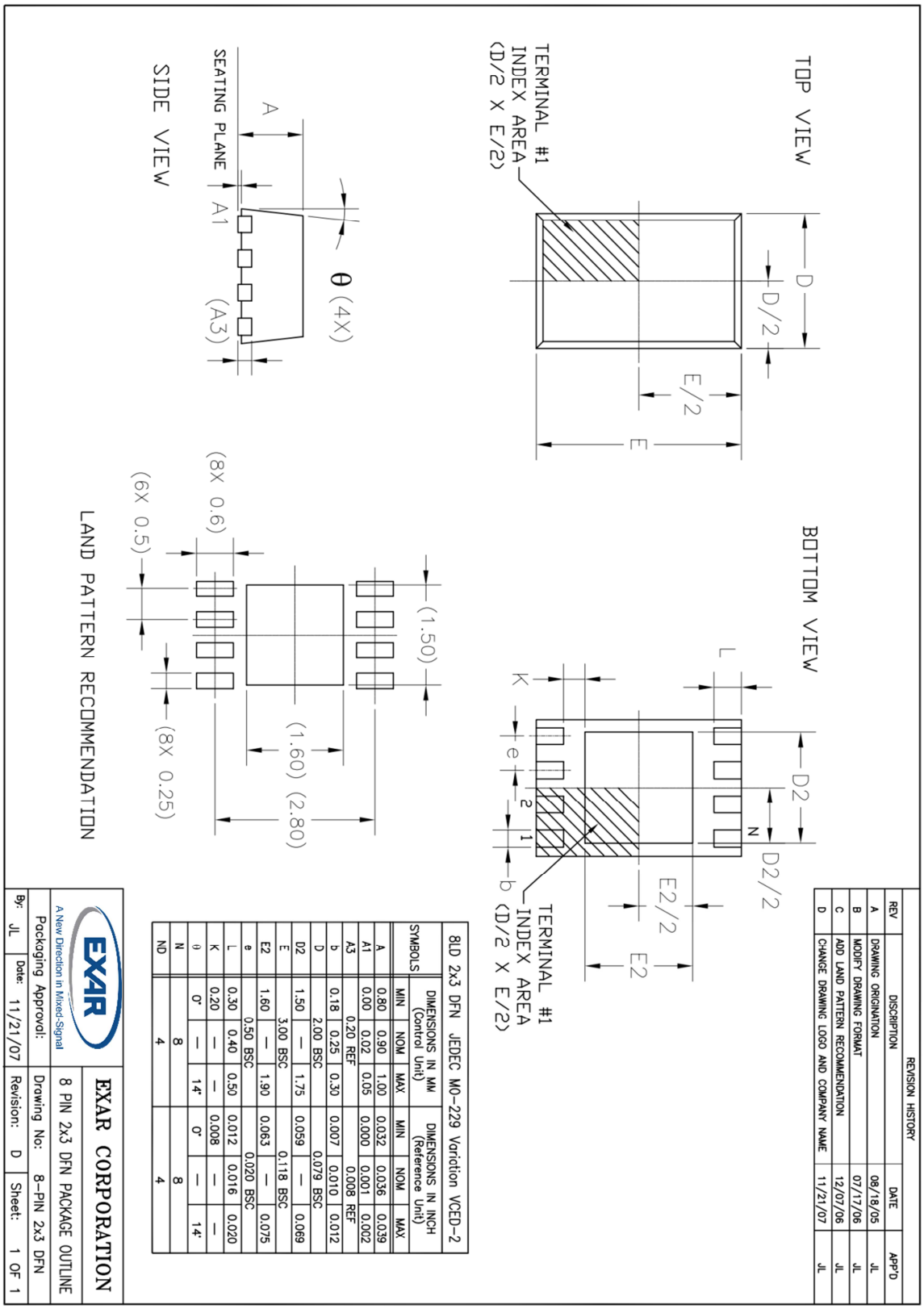
A New Direction in Mixed-Signal

8 PIN SOICN PACKAGE OUTLINE

Packaging Approval: Drawing No: 8-PIN SOICN

By: JL Date: 11/16/07 Revision: C Sheet: 1 OF 1

## 8-PIN 2X3 DFN




REVISION HISTORY

| REV | DISCRIPTION | DATE | APP'D |
|---|---|---|---|
| A | DRAWING ORIGINATION | 08/18/05 | JL |
| B | MODIFY DRAWING FORMAT | 07/17/06 | JL |
| C | ADD LAND PATTERN RECOMMENDATION | 12/07/06 | JL |
| D | CHANGE DRAWING LOGO AND COMPANY NAME | 11/21/07 | JL |

8LD 2x3 DFN JEDEC MO-229 Variation VCED-2

| SYMBOLS | DIMENSIONS IN MM (Control Unit) | | | DIMENSIONS IN INCH (Reference Unit) | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.80 | 0.90 | 1.00 | 0.032 | 0.036 | 0.039 |
| A1 | 0.00 | 0.02 | 0.05 | 0.000 | 0.001 | 0.002 |
| A3 | | 0.20 REF | | | 0.008 REF | |
| b | 0.18 | 0.25 | 0.30 | 0.007 | 0.010 | 0.012 |
| D | | 2.00 BSC | | | 0.079 BSC | |
| D2 | 1.50 | — | 1.75 | 0.059 | — | 0.069 |
| E | | 3.00 BSC | | | 0.118 BSC | |
| E2 | 1.60 | — | 1.90 | 0.063 | — | 0.075 |
| e | | 0.50 BSC | | | 0.020 BSC | |
| L | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| K | 0.20 | — | — | 0.008 | — | — |
| θ | 0° | — | 14° | 0° | — | 14° |
| N | | 8 | | | 8 | |
| ND | | 4 | | | 4 | |

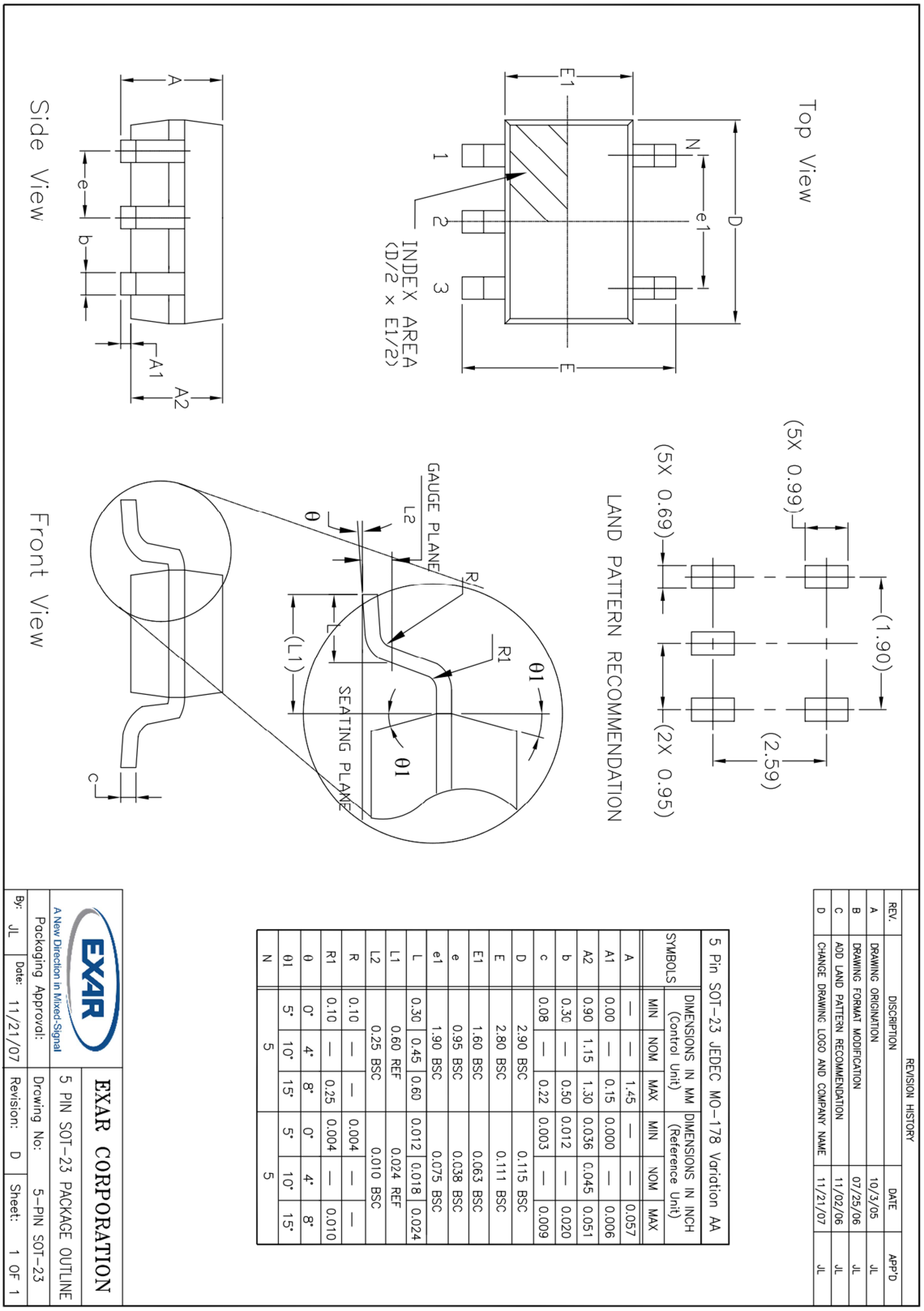
EXAR CORPORATION

A New Direction in Mixed-Signal

8 PIN 2x3 DFN PACKAGE OUTLINE

| Packaging Approval: | Drawing No: 8-PIN 2x3 DFN |
|---|---|
| By: JL Date: 11/21/07 | Revision: D Sheet: 1 OF 1 |

## 5-PIN SOT-23




REVISION HISTORY

| REV. | DISCRIPTION | DATE | APP'D |
|---|---|---|---|
| A | DRAWING ORIGINATION | 10/3/05 | JL |
| B | DRAWING FORMAT MODIFICATION | 07/25/06 | JL |
| C | ADD LAND PATTERN RECOMMENDATION | 11/02/06 | JL |
| D | CHANGE DRAWING LOGO AND COMPANY NAME | 11/21/07 | JL |

5 Pin SOT-23 JEDEC MO-178 Variation AA

| SYMBOLS | DIMENSIONS IN MM (Control Unit) | | | DIMENSIONS IN INCH (Reference Unit) | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | — | — | 1.45 | — | — | 0.057 |
| A1 | 0.00 | — | 0.15 | 0.000 | — | 0.006 |
| A2 | 0.90 | 1.15 | 1.30 | 0.036 | 0.045 | 0.051 |
| b | 0.30 | — | 0.50 | 0.012 | — | 0.020 |
| c | 0.08 | — | 0.22 | 0.003 | — | 0.009 |
| D | 2.90 BSC | | | 0.115 BSC | | |
| E | 2.80 BSC | | | 0.111 BSC | | |
| E1 | 1.60 BSC | | | 0.063 BSC | | |
| e | 0.95 BSC | | | 0.038 BSC | | |
| e1 | 1.90 BSC | | | 0.075 BSC | | |
| L | 0.30 | 0.45 | 0.60 | 0.012 | 0.018 | 0.024 |
| L1 | 0.60 REF | | | 0.024 REF | | |
| L2 | 0.25 BSC | | | 0.010 BSC | | |
| R | 0.10 | — | — | 0.004 | — | — |
| R1 | 0.10 | — | 0.25 | 0.004 | — | 0.010 |
| θ | 0° | 4° | 8° | 0° | 4° | 8° |
| θ1 | 5° | 10° | 15° | 5° | 10° | 15° |
| N | 5 | | | 5 | | |

EXAR CORPORATION

A New Direction in Mixed-Signal

5 PIN SOT-23 PACKAGE OUTLINE

| Packaging Approval: | Drawing No: | 5-PIN SOT-23 |
|---|---|---|
| By: JL Date: 11/21/07 | Revision: D | Sheet: 1 OF 1 |

## REVISION HISTORY

| Revision | Date | Description |
|---|---|---|
| 2.0.0 | 08/23/12 | Reformat of Datasheet<br>Addition of SPX3819R2-L and SPX3819R2-L/TR part numbers |
| 2.0.1 | 12/02/13 | Added Storage Temperature Range and Junction Temperature in ABS MAX Ratings. |
| 2.0.2 | 05/20/14 | Updated package drawings and corrected DFN-8 package marking information<br>[ECN 1423-03 6/3/14] |

## FOR FURTHER ASSISTANCE

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