

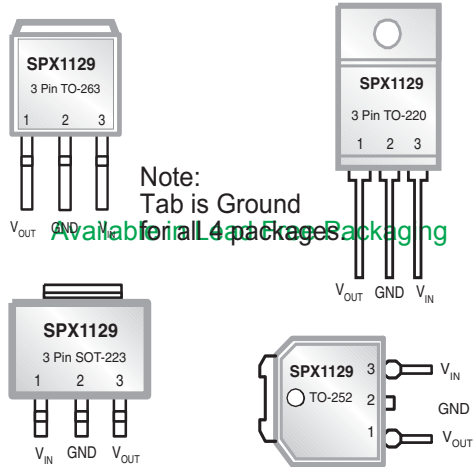
# 400mA Low Dropout Voltage Regulator

## FEATURES

- 1% Output Accuracy 3.3V, 5V, at 500mA Output
- Very Low Quiescent Current
- 0.42V Dropout Voltage at 400mA
- Extremely Tight Load and Line Regulation
- Current & Thermal Limiting
- Reverse Battery Protection
- Equivalent Replacement For LT1129

## APPLICATIONS

- Power Supply
- Communications Equipment
- Computers and Peripherals



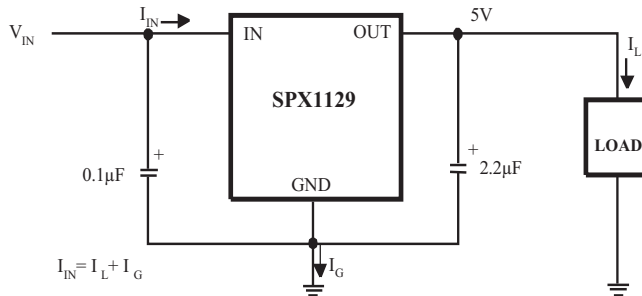
*Now Available in Lead Free Packaging*

## DESCRIPTION

The SPX1129 is a low power 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 SPX1129 features very low quiescent current and very low dropout voltage of 0.42 volts. This includes a tight initial tolerance of  $\pm 1\%$  max, and a very low output temperature coefficient, making the SPX1129 useful as a low-power voltage reference.

The SPX1129 is offered in a SOT-223, TO-220, TO-252 & TO-263 3 lead packages.

## TYPICAL APPLICATION CIRCUIT



## ABSOLUTE MAXIMUM RATINGS

|  |                    |
|--|--------------------|
| Power Dissipation .....                    | Internally Limited |
| Lead Temp. (Soldering, 5 Seconds) .....    | 260°C              |
| Storage Temperature Range .....            | -65°C to +150°C    |
| Operating Junction Temperature Range ..... | -40°C to +125°C    |
| Input Supply Voltage .....                 | -20V to +20V       |
| ESD Rating .....                           | 2kV Min            |

|                                  |          |
|----------------------------------|----------|
| Thermal Resistance $\theta_{JA}$ |          |
| TO-263 .....                     | 31.4°C/W |
| TO-220 .....                     | 29.4°C/W |
| SOT-223 .....                    | 62.3°C/W |

## ELECTRICAL CHARACTERISTICS

Electrical characteristics at  $V_{IN} = 6V$ ,  $I_O = 1mA$ ,  $C_{OUT} = 2.2\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise specified. **Boldface** applies over the full operating temperature range.

| PARAMETER                                 | CONDITIONS<br>(Note 2)   | TYP                  | MIN                   | MAX                   | UNITS   |
|---|--|----------------------|-----------------------|-----------------------|---------|
| <b>3.3V Version</b>                       |  |                      |                       |                       |         |
| Output Voltage                            | $1mA \leq I_L \leq 400mA$  | 3.3<br><b>3.3</b>    | 3.267<br><b>3.217</b> | 3.333<br><b>3.382</b> | V       |
| Reverse Output Current                    | $V_{OUT} = 3.3V, V_{IN} = 0V$  | 16                   |                       | 25                    | $\mu A$ |
| <b>5.0V Version</b>                       |  |                      |                       |                       |         |
| Output Voltage                            | $1mA \leq I_L \leq 400mA$  | 5.0<br><b>5.0</b>    | 4.950<br><b>4.880</b> | 5.050<br><b>5.120</b> | V       |
| Reverse Output Current                    | $V_{OUT} = 5.0V, V_{IN} = 0V$  | 16                   |                       | 25                    | $\mu A$ |
| <b>All Voltage Options</b>                |  |                      |                       |                       |         |
| Output Voltage<br>Temperature Coefficient | (Note1)  | 20                   |                       | <b>100</b>            | ppm/°C  |
| Line Regulation                           | $6V \leq V_{IN} \leq 20V$ (Note 4)   | 1.5                  |                       | <b>10</b>             | mV      |
| Load Regulation (Note 3)                  | $I_L = 1$ to 400mA   | 6                    |                       | 20<br><b>30</b>       | mV      |
| Dropout Voltage (Note 5)                  | $I_L = 1mA$  | 0.13                 |                       | 0.17<br><b>0.25</b>   | V       |
|   | $I_L = 400mA$  | 0.42                 |                       | 0.55<br><b>0.70</b>   |         |
| Ground Current                            | $I_L = 1mA$  | <b>100</b>           |                       | <b>200</b>            | $\mu A$ |
|   | $I_L = 10mA$   | <b>350</b>           |                       | <b>500</b>            |         |
|   | $I_L = 50mA$   | <b>1.5</b>           |                       | <b>3</b>              | mA      |
|   | $I_L = 100mA$<br>$I_L = 400mA$   | <b>2</b><br><b>7</b> |                       | <b>6</b><br><b>25</b> |         |
| Current Limit                             | $V_{OUT} = 0$  | 330                  |                       | <b>800</b>            | mA      |
| Ripple Rejection                          | $V_{IN} - V_{OUT} = 1V(Avg)$ ,<br>$V_{RIPPLE} = 0.5Vp-p, F_{RIPPLE} = 120Hz$ ,<br>$I_{LOAD} = 400mA, T_J = 25^\circ C$ | 58                   | 50                    |                       | dB      |
| Input Reverse Leakage Current             | $V_{IN} = -20V, V_{OUT} = 0V$  |                      |                       | <b>1.0</b>            | mA      |

**Note 1:** Output or reference voltage temperature coefficients defined as the worst case voltage change divided by the total temperature range.

**Note 2:** Unless otherwise specified all limits are guaranteed for  $T_J = 25^\circ C$ ,  $V_{IN} = 6V$ ,  $I_L = 1mA$  and  $C_L = 2.2\mu F$ .

**Note 3:** Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.

**Note 4:** Line regulation for the SPX1129 is tested at  $25^\circ C$  for  $I_L = 1mA$ . For  $T_J = 125^\circ C$ , line regulation is guaranteed by design.

**Note 5:** Dropout voltage is defined as the input to output differential at which the output voltage drops 100 mV below its nominal value measured at  $V_{DIFF} = 100mV$ .

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### **External Capacitors**

The stability of the SPX1129 requires a 2.2 $\mu$ F or greater capacitor between output and ground. Oscillation could occur without this capacitor. Most types of tantalum or aluminum electrolytic works fine here. For operations of below -25°C solid tantalum is recommended since the many aluminum types have electrolytes that freeze at about -30°C. The ESR of about 5 $\Omega$  or less and resonant frequency above 500kHz are the most important parameters in the value of the capacitor. The capacitor value can be increased without limit.

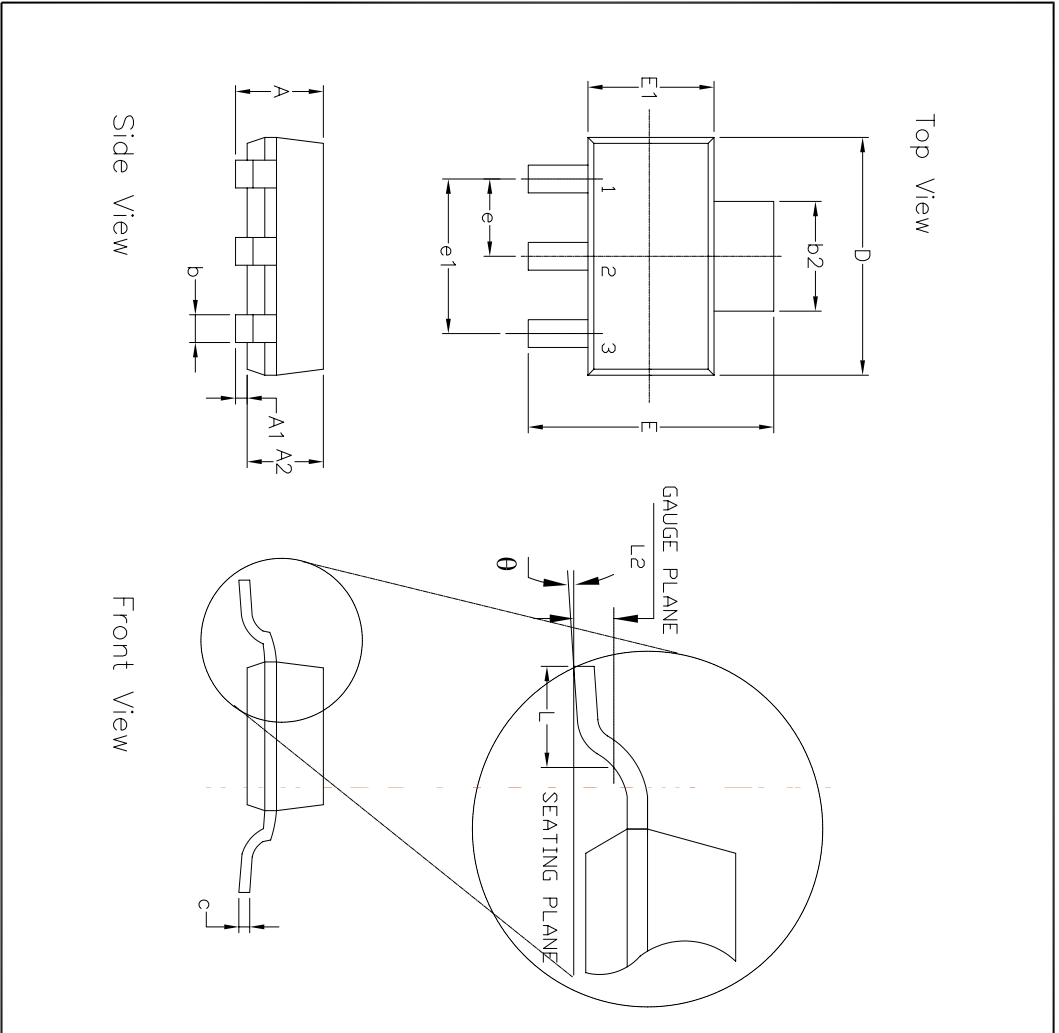
The SPX1129, unlike other low dropout regulators will remain stable and in regulation with no load in addition to the internal voltage divider.

This feature is especially important in applications like CMOS RAM keep-alive.

If there is more than 10 inches of wire between the input and the AC filter capacitor, or if a battery is used as the input, then a 0.1 $\mu$ F tantalum or aluminum electrolytic capacitor should be placed from the input to the ground.

### **Reducing Output Noise**

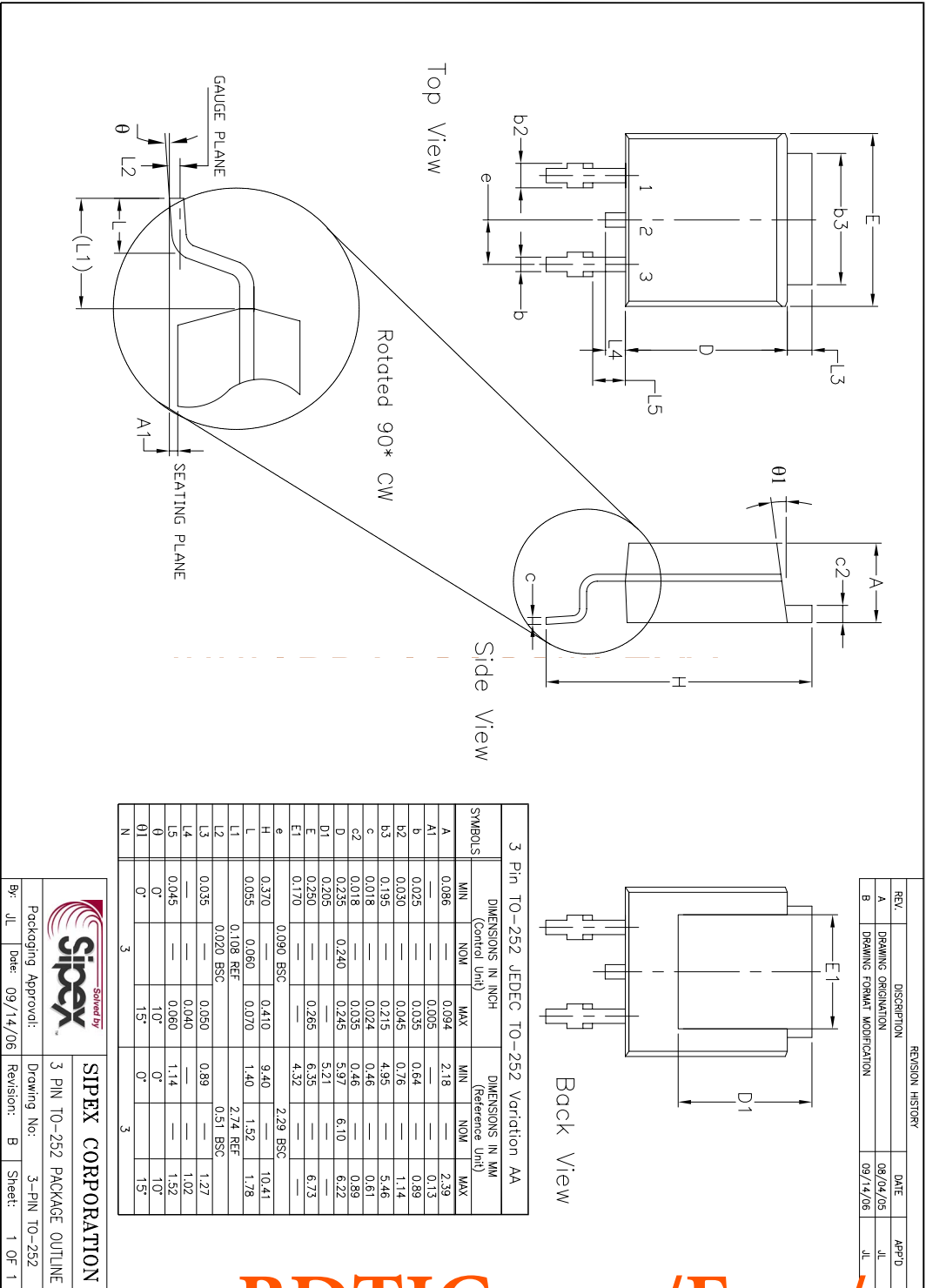
It may be an advantage to reduce the AC noise present at the output. One way is to reduce the regulator bandwidth by increasing the size of the output capacitor. Increasing the capacitor from 1 $\mu$ F to 220 $\mu$ F decreases the noise from 430 $\mu$ V to 160 $\mu$ V rms for a 100kHz bandwidth at 5V output.



| REVISION HISTORY |                             |          |       |
|------------------|-----------------------------|----------|-------|
| REV.             | DESCRIPTION                 | DATE     | APP'D |
| A                | DRAWING ORIGINATION         | 08/09/05 | JL    |
| B                | DRAWING FORMAT MODIFICATION | 09/11/06 | JL    |

| SYMBOLS | DIMENSIONS IN MM<br>(Control Unit) |          |       | DIMENSIONS IN INCH<br>(Reference Unit) |           |       |
|---------|------------------------------------|----------|-------|--|-----------|-------|
|         | MIN                                | NOM      | MAX   | MIN                                    | NOM       | MAX   |
| A       | —                                  | 1.80     | —     | —                                      | —         | 0.071 |
| A1      | 0.02                               | 0.10     | 0.001 | —                                      | —         | 0.004 |
| A2      | 1.50                               | 1.80     | 1.70  | 0.060                                  | 0.063     | 0.067 |
| b       | 0.66                               | 0.76     | 0.84  | 0.026                                  | 0.030     | 0.033 |
| b2      | 2.90                               | 3.00     | 3.10  | 0.114                                  | 0.118     | 0.122 |
| c       | 0.23                               | 0.30     | 0.35  | 0.010                                  | 0.012     | 0.014 |
| D       | 6.30                               | 6.30     | 6.70  | 0.248                                  | 0.256     | 0.264 |
| E       | 6.70                               | 7.00     | 7.30  | 0.264                                  | 0.276     | 0.287 |
| E1      | 3.30                               | 3.50     | 3.70  | 0.130                                  | 0.138     | 0.146 |
| e       | —                                  | 2.30 BSC | —     | —                                      | 0.091 BSC | —     |
| e1      | —                                  | 4.60 BSC | —     | —                                      | 0.182 BSC | —     |
| L       | 0.75                               | —        | —     | 0.030                                  | —         | —     |
| L2      | 0.25 BSC                           | —        | —     | 0.010 BSC                              | —         | —     |
| theta   | 0°                                 | —        | 10°   | 0°                                     | —         | 10°   |
| N       | —                                  | 3        | —     | —                                      | 3         | —     |

|                     |                |                               |               |
|---------------------|----------------|-------------------------------|---------------|
|                     |                | SIPEX CORPORATION             |               |
|                     |                | 3 PIN SOT-223 PACKAGE OUTLINE |               |
| Packaging Approval: | Date: 09/11/06 | Drawing No:                   | 3-PIN SOT-223 |
| By: JL              | Revision: B    | Sheet:                        | 1 OF 1        |



| REVISION HISTORY |                             |          |
|------------------|-----------------------------|----------|
| REV.             | DISCRIPTION                 | DATE     |
| A                | DRAWING ORIGINATION         | 08/04/05 |
| B                | DRAWING FORMAT MODIFICATION | 09/14/06 |

3 Pin TO-252 JEDEC TO-252 Variation AA

| SYMBOLS | DIMENSIONS IN INCH<br>(Control Unit) |           |       | DIMENSIONS IN MM<br>(Reference Unit) |      |       |
|---------|--------------------------------------|-----------|-------|--------------------------------------|------|-------|
|         | MIN                                  | NOM       | MAX   | MIN                                  | NOM  | MAX   |
| A       | 0.086                                | ---       | 0.094 | 2.18                                 | ---  | 2.39  |
| A1      | ---                                  | ---       | 0.005 | ---                                  | ---  | 0.13  |
| b       | 0.025                                | ---       | 0.035 | 0.64                                 | ---  | 0.89  |
| b2      | 0.030                                | ---       | 0.045 | 0.76                                 | ---  | 1.14  |
| b3      | 0.195                                | ---       | 0.215 | 4.95                                 | ---  | 5.46  |
| c       | 0.018                                | ---       | 0.024 | 0.46                                 | ---  | 0.61  |
| c2      | 0.018                                | ---       | 0.035 | 0.46                                 | ---  | 0.89  |
| D       | 0.235                                | 0.240     | 0.245 | 5.97                                 | 6.10 | 6.22  |
| D1      | 0.205                                | ---       | ---   | 5.21                                 | ---  | ---   |
| E       | 0.250                                | ---       | 0.265 | 6.35                                 | ---  | 6.73  |
| E1      | 0.170                                | ---       | ---   | 4.32                                 | ---  | ---   |
| e       | ---                                  | 0.090 BSC | ---   | 2.29 BSC                             | ---  | ---   |
| H       | 0.370                                | ---       | 0.410 | 9.40                                 | ---  | 10.41 |
| L       | 0.095                                | 0.060     | 0.070 | 1.40                                 | 1.52 | 1.78  |
| L1      | ---                                  | 0.108 REF | ---   | 2.74 REF                             | ---  | ---   |
| L2      | ---                                  | 0.020 BSC | ---   | 0.51 BSC                             | ---  | ---   |
| L3      | 0.035                                | ---       | 0.050 | 0.89                                 | ---  | 1.27  |
| L4      | ---                                  | ---       | 0.040 | ---                                  | ---  | 1.02  |
| L5      | 0.045                                | ---       | 0.060 | 1.14                                 | ---  | 1.52  |
| θ       | 0°                                   | ---       | 10°   | 0°                                   | ---  | 10°   |
| θ1      | 0°                                   | ---       | 15°   | 0°                                   | ---  | 15°   |
| N       | ---                                  | 3         | ---   | ---                                  | 3    | ---   |

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3 PIN TO-252 PACKAGE OUTLINE

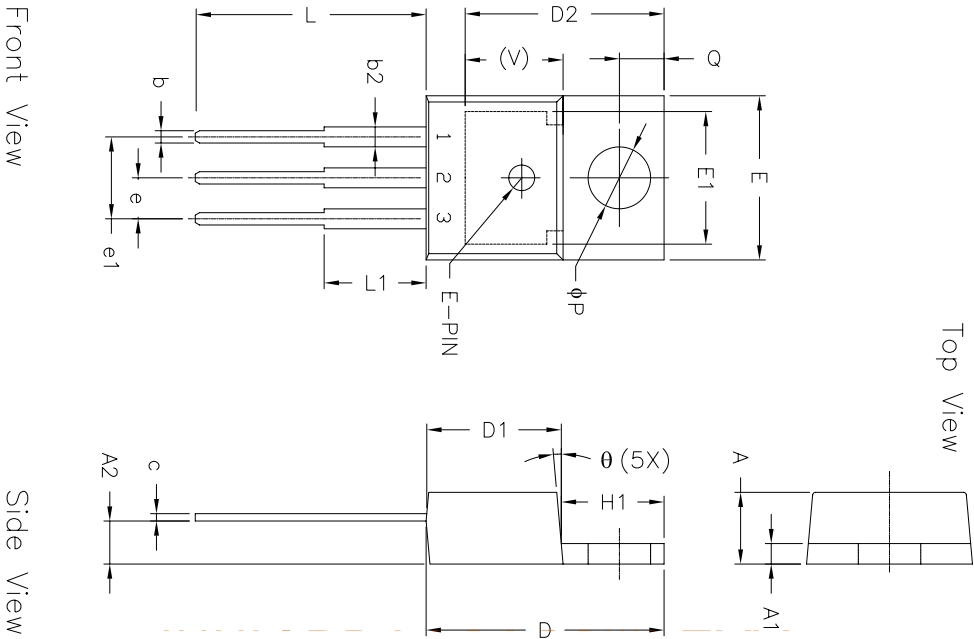
Drawing No: 3-PIN TO-252

Packaging Approval: B

Revision: B

Sheet: 1 OF 1


Date: 09/14/06

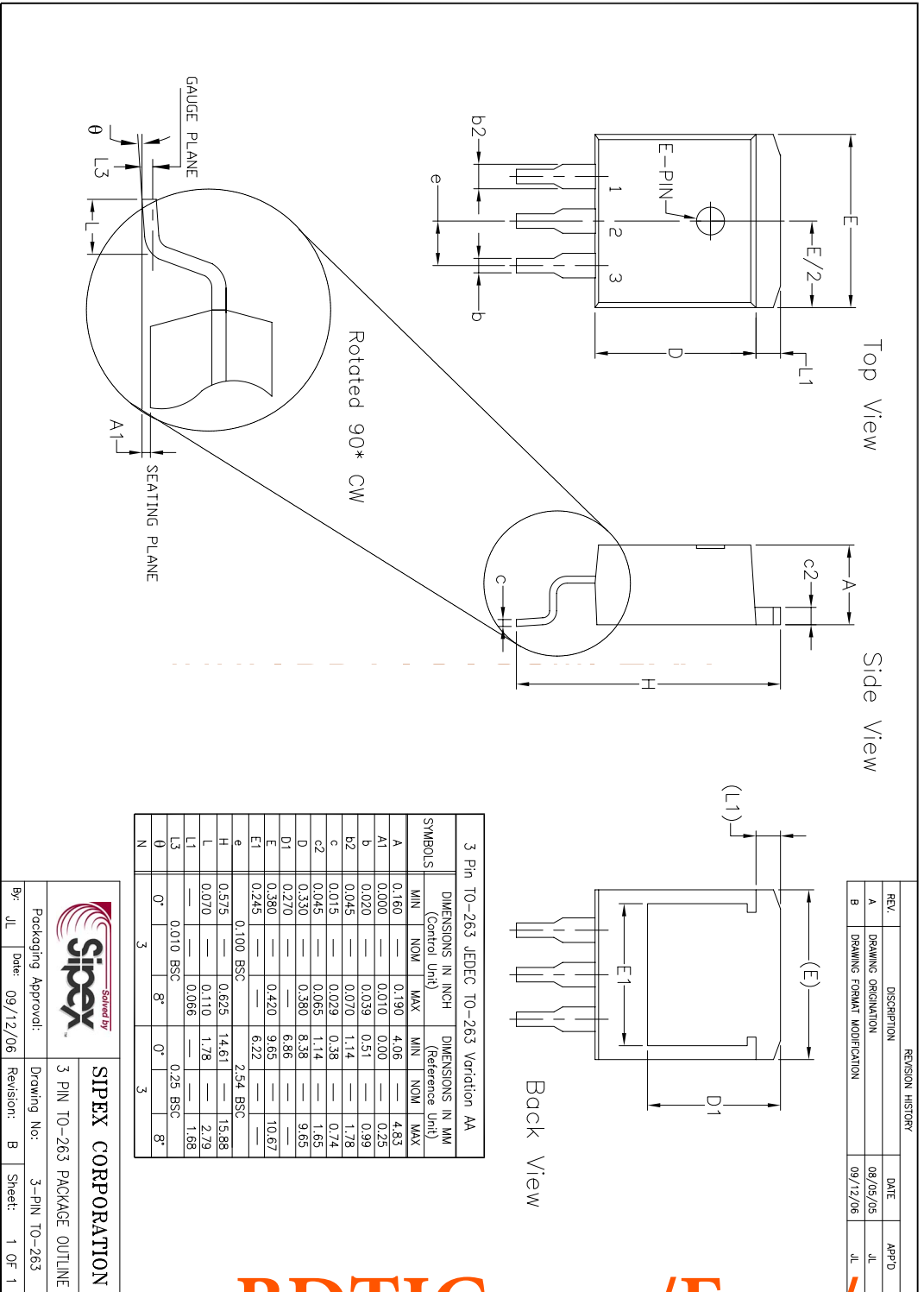


| REVISION HISTORY |                             |          |       |
|------------------|-----------------------------|----------|-------|
| REV.             | DESCRIPTION                 | DATE     | APP'D |
| A                | DRAWING ORIENTATION         | 09/04/05 | JL    |
| B                | 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                          |       |
| theta                                     | 3°                                | 7°    | 3°                                | 7°    |
| N   | 3                                 |       | 3                                 |       |

\* Refer to product datasheet for P0D option being used

|   |        |                           |              |                              |
|---|--------|---------------------------|--------------|------------------------------|
|  |        | <b>SIPLEX CORPORATION</b> |              |                              |
|   |        |                           |              | 3 PIN TO-220 PACKAGE OUTLINE |
| Packaging Approval:   | By: JL | Date: 05/25/06            | Drawing No.: | 3-PIN TO-220                 |
| Revision:   | B      | Sheet:                    | 1 OF 2       |                              |



**ORDERING INFORMATION**

| Part Number        | Package Code | RoHS | Status | Pack Quantity    |
|--------------------|--------------|------|--------|------------------|
| SPX1129M3-3-3      | SOT-223-3    |      | OBS    | Bulk             |
| SPX1129M3-3-3/TR   | SOT-223-3    |      | OBS    | 2500 Tape & Reel |
| SPX1129M3-5-0      | SOT-223-3    |      | OBS    | Bulk             |
| SPX1129M3-5-0/TR   | SOT-223-3    |      | OBS    | 2500 Tape & Reel |
| SPX1129M3-L-3-3    | SOT-223-3    | ▪    | OBS    | Bulk             |
| SPX1129M3-L-3-3/TR | SOT-223-3    | ▪    | OBS    | 2500 Tape & Reel |
| SPX1129M3-L-5-0    | SOT-223-3    | ▪    | OBS    | Bulk             |
| SPX1129M3-L-5-0/TR | SOT-223-3    | ▪    | OBS    | 2500 Tape & Reel |
| SPX1129R-3-3       | TO-252       |      | OBS    | Bulk             |
| SPX1129R-3-3/TR    | TO-252       |      | OBS    | 2000 Tape & Reel |
| SPX1129R-5-0       | TO-252       |      | OBS    | Bulk             |
| SPX1129R-5-0/TR    | TO-252       |      | OBS    | 2000 Tape & Reel |
| SPX1129R-L-3-3     | TO-252       | ▪    | OBS    | Bulk             |
| SPX1129R-L-3-3/TR  | TO-252       | ▪    | OBS    | 2000 Tape & Reel |
| SPX1129R-L-5-0     | TO-252       | ▪    | OBS    | Bulk             |
| SPX1129R-L-5-0/TR  | TO-252       | ▪    | OBS    | 2000 Tape & Reel |
| SPX1129T-3-3       | TO-263-3     |      | OBS    | Bulk             |
| SPX1129T-3-3/TR    | TO-263-3     |      | OBS    | 500 Tape & Reel  |
| SPX1129T-5-0       | TO-263-3     |      | OBS    | Bulk             |
| SPX1129T-5-0/TR    | TO-263-3     |      | OBS    | 500 Tape & Reel  |
| SPX1129T-L-3-3     | TO-263-3     | ▪    | OBS    | Bulk             |
| SPX1129T-L-5-0     | TO-263-3     | ▪    | OBS    | Bulk             |
| SPX1129U-3-3       | TO-220-3     |      | OBS    | Bulk             |
| SPX1129U-5-0       | TO-220-3     |      | OBS    | Bulk             |
| SPX1129U-L-3-3     | TO-220-3     | ▪    | OBS    | Bulk             |
| SPX1129U-L-5-0     | TO-220-3     | ▪    | OBS    | Bulk             |



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