



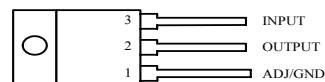
# SP1085

## 3A Low Dropout Linear Regulator

### Features

- Low Dropout Voltage: Typical 1.3V at 3A
- Current Limiting and Thermal Protection
- Output Current: 3A
- Current Limit: 4.5A
- Operating Junction Temperature: 0 to 125°C
- Line Regulation: 0.015% (Typical)
- Load Regulation: 0.1% (Typical)
- Available in RoHS Compliant, Lead Free Packaging

TO-220



### Applications

- High Efficiency Linear Regulators
- Battery Charger
- Post Regulation for Switching Supplies
- Microprocessor Supply
- Mother Board Power Supplies
- DVD - Video Player
- Telecom Equipment
- Set Top Boxes and Web Box Modular Supplies

### General Description

The SP1085 is a series of low dropout positive voltage regulators with a maximum dropout of 1.5V at 3A of load current. The series features on-chip thermal shutdown. It also includes a bandgap reference and a current limiting circuit. The SP1085 is available in 1.5V, 1.8V, 2.5V, 2.85V, 3.3V, 5.0V and adjustable versions. The fixed versions integrate the adjust resistors. The adjustable version can set the output voltage with two external resistors. The SP1085 series is available in standard packages of TO-263-3L, TO-220 and TO-252.

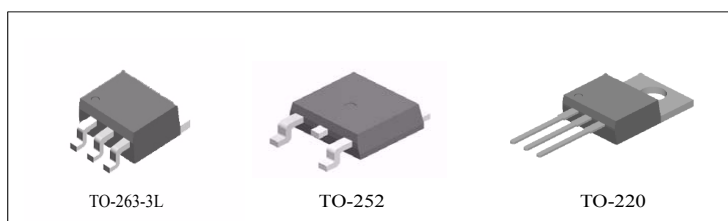


Figure 1. Package Types of SP1085

## Pin Configuration

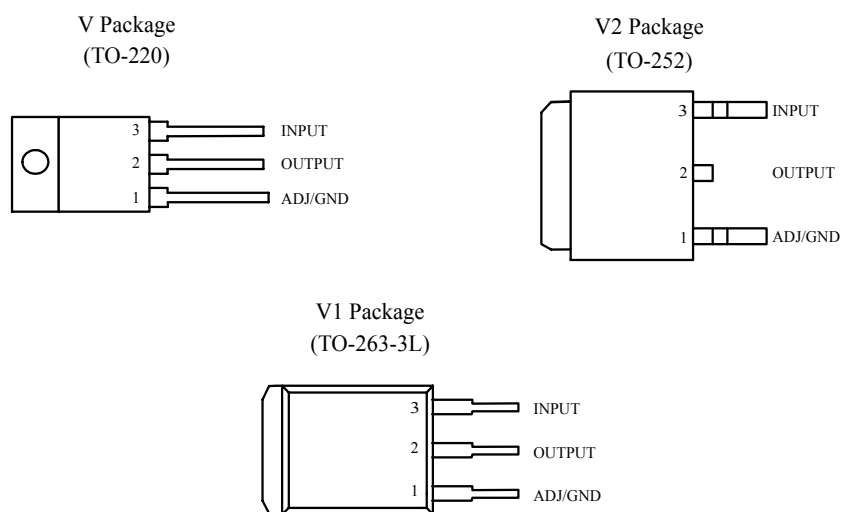


Figure 2. Pin Configuration of SP1085 (Top View)

## Functional Block Diagram

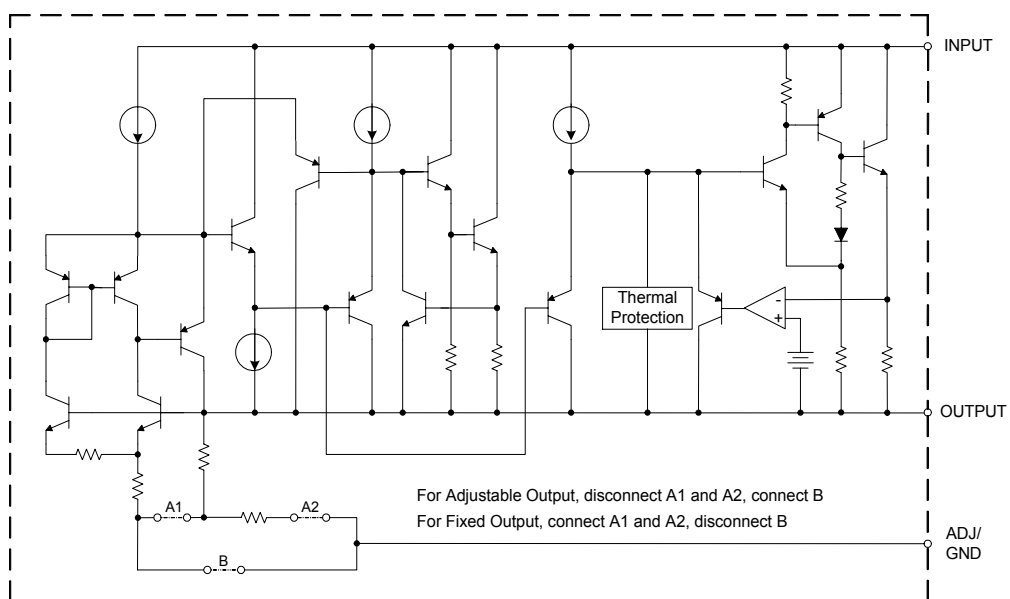


Figure 3. Functional Block Diagram of SP1085

## Absolute Maximum Ratings (Note 1)

| Parameter                             | Symbol            | Min | Max  | Unit               |
|---------------------------------------|-------------------|-----|------|--------------------|
| Operating Junction Temperature        | $T_J$             |     | 150  | $^{\circ}\text{C}$ |
| Storage Temperature                   | $T_S$             | -65 | 150  | $^{\circ}\text{C}$ |
| Lead Temperature (Soldering, 10 sec.) | $T_{\text{LEAD}}$ |     | 300  | $^{\circ}\text{C}$ |
| ESD (Human Body Model)                | ESD               |     | 2000 | V                  |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

## Recommended Operating Conditions

| Parameter                            | Symbol          | Min | Max | Unit               |
|--------------------------------------|-----------------|-----|-----|--------------------|
| Input Voltage                        | $V_{\text{IN}}$ |     | 12  | V                  |
| Operating Junction Temperature Range | $T_J$           | 0   | 125 | $^{\circ}\text{C}$ |

## Electrical Characteristics

Typicals and limits appearing in normal type apply for  $T_J = 25^\circ\text{C}$ . Limits appearing in **Boldface** type apply over the entire operating junction temperature range 0 to  $125^\circ\text{C}$ .

| Parameter         | Symbol                  | Conditions                                                                                                                                                                                                                                   | Min                   | Typ                   | Max                   | Unit |
|-------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|------|
| Reference Voltage | $V_{\text{REF}}$        | SP1085-ADJ,<br>$I_{\text{OUT}}=10\text{mA}$ , $V_{\text{IN}}-V_{\text{OUT}} = 3\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $1.5\text{V} \leq V_{\text{IN}} - V_{\text{OUT}} \leq 5\text{V}$ | 1.238<br><b>1.225</b> | 1.250<br><b>1.250</b> | 1.262<br><b>1.275</b> | V    |
| Output Voltage    | $V_{\text{OUT}}$        | SP1085-1.5,<br>$I_{\text{OUT}}=0\text{mA}$ , $V_{\text{IN}} = 4.5\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $3.1\text{V} \leq V_{\text{IN}} \leq 6\text{V}$                                | 1.485<br><b>1.47</b>  | 1.5<br><b>1.5</b>     | 1.515<br><b>1.53</b>  | V    |
|                   |                         | SP1085-1.8,<br>$I_{\text{OUT}} = 0\text{mA}$ , $V_{\text{IN}} = 4.8\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $3.4\text{V} \leq V_{\text{IN}} \leq 7\text{V}$                              | 1.782<br><b>1.764</b> | 1.8<br><b>1.8</b>     | 1.818<br><b>1.836</b> | V    |
|                   |                         | SP1085-2.5,<br>$I_{\text{OUT}} = 0\text{mA}$ , $V_{\text{IN}} = 5.5\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $4.1\text{V} \leq V_{\text{IN}} \leq 7\text{V}$                              | 2.475<br><b>2.45</b>  | 2.5<br><b>2.5</b>     | 2.525<br><b>2.55</b>  | V    |
|                   |                         | SP1085-2.85,<br>$I_{\text{OUT}} = 0\text{mA}$ , $V_{\text{IN}} = 6\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $4.5\text{V} \leq V_{\text{IN}} \leq 8\text{V}$                               | 2.821<br><b>2.793</b> | 2.85<br><b>2.85</b>   | 2.879<br><b>2.907</b> | V    |
|                   |                         | SP1085-3.3,<br>$I_{\text{OUT}} = 0\text{mA}$ , $V_{\text{IN}} = 6.3\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $4.9\text{V} \leq V_{\text{IN}} \leq 8\text{V}$                              | 3.267<br><b>3.234</b> | 3.3<br><b>3.3</b>     | 3.333<br><b>3.366</b> | V    |
|                   |                         | SP1085-5.0,<br>$I_{\text{OUT}} = 0\text{mA}$ , $V_{\text{IN}} = 8\text{V}$ , $T_J = 25^\circ\text{C}$ ,<br>$10\text{mA} \leq I_{\text{OUT}} \leq 3\text{A}$ , $6.6\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                               | 4.95<br><b>4.9</b>    | 5<br><b>5</b>         | 5.05<br><b>5.1</b>    | V    |
| Line Regulation   | $\Delta V_{\text{OUT}}$ | SP1085-ADJ, $I_{\text{OUT}} = 10\text{mA}$ ,<br>$2.85\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                                                                                                                                            |                       | 0.015<br><b>0.035</b> | 0.2<br><b>0.2</b>     | %    |
|                   |                         | SP1085-1.5, $I_{\text{OUT}} = 10\text{mA}$ ,<br>$3.1\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                                                                                                                                             |                       | 0.5<br><b>1</b>       | 6<br><b>6</b>         | mV   |
|                   |                         | SP1085-1.8, $I_{\text{OUT}} = 10\text{mA}$ ,<br>$3.4\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                                                                                                                                             |                       | 0.5<br><b>1</b>       | 6<br><b>6</b>         | mV   |
|                   |                         | SP1085-2.5, $I_{\text{OUT}} = 10\text{mA}$ ,<br>$4.1\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                                                                                                                                             |                       | 0.5<br><b>1</b>       | 6<br><b>6</b>         | mV   |
|                   |                         | SP1085-2.85, $I_{\text{OUT}} = 10\text{mA}$ ,<br>$4.5\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                                                                                                                                            |                       | 0.5<br><b>1</b>       | 6<br><b>6</b>         | mV   |
|                   |                         | SP1085-3.3, $I_{\text{OUT}} = 10\text{mA}$ ,<br>$4.9\text{V} \leq V_{\text{IN}} \leq 10\text{V}$                                                                                                                                             |                       | 0.5<br><b>1</b>       | 6<br><b>6</b>         | mV   |

## Electrical Characteristics (Continued)

Typicals and limits appearing in normal type apply for  $T_J = 25^\circ\text{C}$ . Limits appearing in **Boldface** type apply over the entire operating junction temperature range 0 to  $125^\circ\text{C}$ .

| Parameter                              | Symbol           | Conditions                                                                                                                  | Min       | Typ               | Max               | Unit                        |
|----------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|-------------------|-----------------------------|
|                                        |                  | SP1085-5.0, $I_{OUT} = 10\text{mA}$ ,<br>$6.6\text{V} \leq V_{IN} \leq 10\text{V}$                                          |           | 0.5<br><b>1</b>   | 10<br><b>10</b>   | mV                          |
| Load Regulation                        | $\Delta V_{OUT}$ | SP1085-ADJ, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                    |           | 0.1<br><b>0.2</b> | 0.3<br><b>0.4</b> | %                           |
|                                        |                  | SP1085-1.5, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                    |           | 3<br><b>7</b>     | 15<br><b>20</b>   | mV                          |
|                                        |                  | SP1085-1.8, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                    |           | 3<br><b>7</b>     | 15<br><b>20</b>   | mV                          |
|                                        |                  | SP1085-2.5, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                    |           | 3<br><b>7</b>     | 15<br><b>20</b>   | mV                          |
|                                        |                  | SP1085-2.85, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                   |           | 3<br><b>7</b>     | 15<br><b>20</b>   | mV                          |
|                                        |                  | SP1085-3.3, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                    |           | 3<br><b>7</b>     | 15<br><b>20</b>   | mV                          |
|                                        |                  | SP1085-5.0, $0\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$V_{IN} - V_{OUT} = 3\text{V}$                                    |           | 5<br><b>10</b>    | 20<br><b>35</b>   | mV                          |
| Dropout Voltage                        |                  | $I_O = 3\text{A}$ , $\Delta V_{REF}$ , $\Delta V_{OUT} = 1\%$                                                               |           | 1.3               | 1.5               | V                           |
| Current Limit                          | $I_{LIMIT}$      | $V_{IN} - V_{OUT} = 3\text{V}$ ,                                                                                            | 3.2       | 4.5               |                   | A                           |
| Minimum Load Current                   |                  | $V_{IN} = 10\text{V}$ (SP1085-ADJ)                                                                                          |           | <b>3</b>          | <b>10</b>         | mA                          |
| Quiescent Current                      |                  | $V_{IN} = 10\text{V}$ (SP1085)                                                                                              |           | <b>5</b>          | <b>10</b>         | mA                          |
| Ripple Rejection                       |                  | $f_{RIPPLE} = 120\text{Hz}$ , $C_{OUT} = 25\mu\text{F}$ Tantalum,<br>$I_{OUT} = 3\text{A}$ , $V_{IN} - V_{OUT} = 3\text{V}$ | <b>60</b> | <b>72</b>         |                   | dB                          |
| Adjust Pin Current                     |                  | $V_{IN} = 4.25\text{V}$ , $I_{OUT} = 10\text{mA}$                                                                           |           | 55                | <b>120</b>        | $\mu\text{A}$               |
| Adjust Pin Current Change              |                  | $10\text{mA} \leq I_{OUT} \leq 3\text{A}$ ,<br>$1.5\text{V} \leq V_{IN} - V_{OUT} \leq 6\text{V}$                           |           | <b>0.2</b>        | <b>5</b>          | $\mu\text{A}$               |
| Long Term Stability                    |                  | $T_A = 125^\circ\text{C}$ , 1000Hrs                                                                                         |           | 0.5               |                   | %                           |
| Temperature Stability                  |                  | $I_{OUT} = 10\text{mA}$ , $V_{IN} - V_{OUT} = 1.5\text{V}$                                                                  |           | <b>0.5</b>        |                   | %                           |
| RMS Noise<br>(% of $V_{OUT}$ )         |                  | $T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                                                           |           | 0.003             |                   | %                           |
| Thermal Resistance<br>Junction-to-Case | $\theta_{JC}$    | TO-263<br>TO-220<br>TO-252                                                                                                  |           | 3<br>3<br>4       |                   | $^\circ\text{C} / \text{W}$ |

## Typical Performance Characteristics

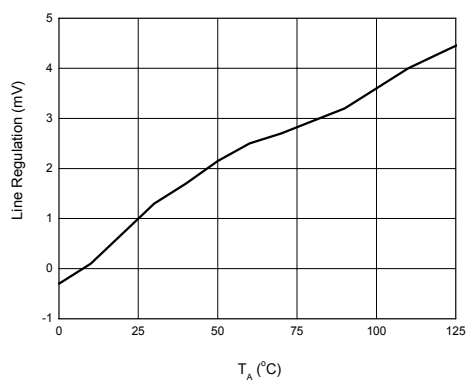


Figure 4. Line Regulation vs. Temperature

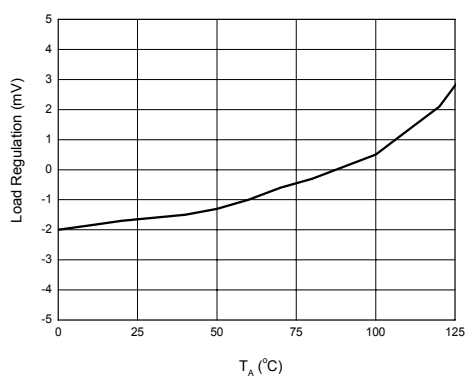


Figure 5. Load Regulation vs. Temperature

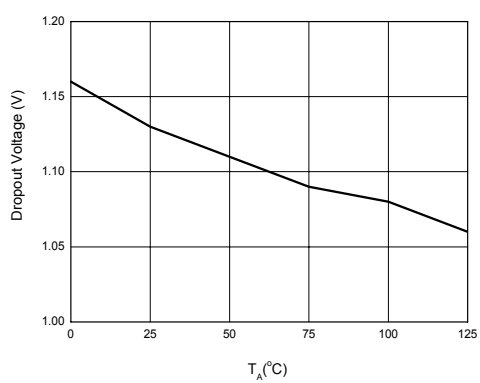


Figure 6. Dropout Voltage vs. Temperature

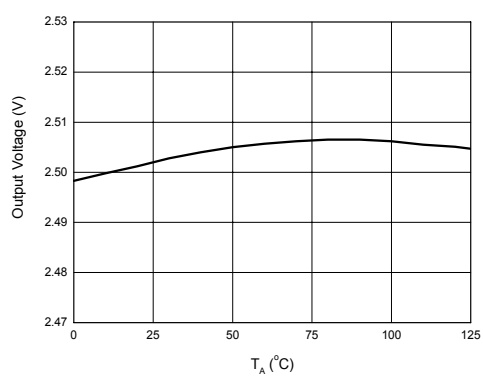


Figure 7. Output Voltage vs. Temperature

## Typical Performance Characteristics (Continued)

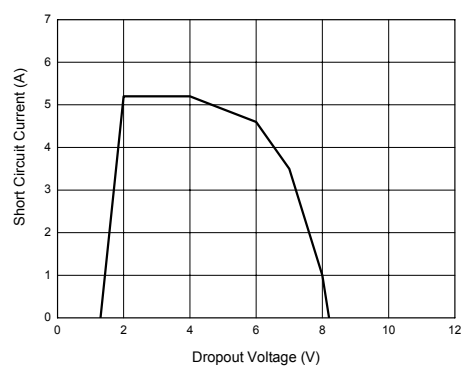


Figure 8. Short Circuit Current vs. Dropout Voltage

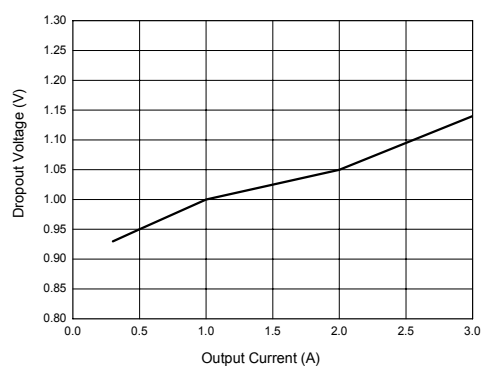


Figure 9. Dropout Voltage vs. Output Current

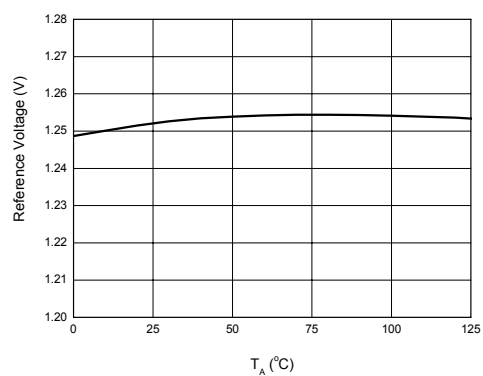


Figure 10. Reference Voltage vs. Temperature

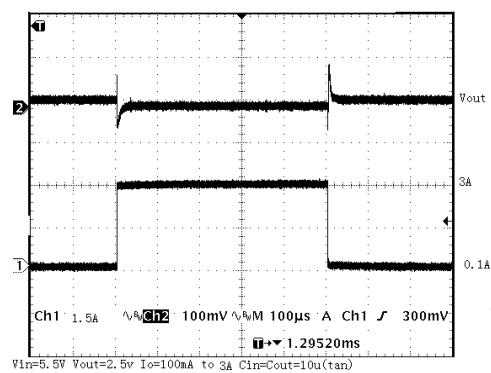


Figure 11. Load Transient Response

## Typical Performance Characteristics (Continued)

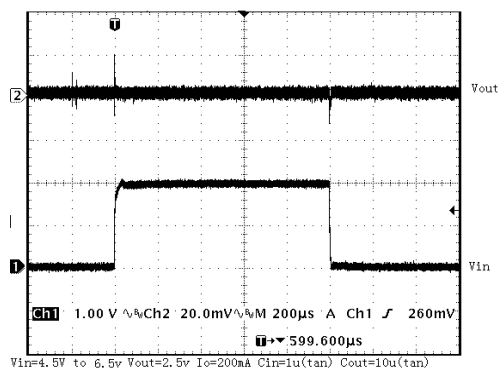


Figure 12. Line Transient Response

## Typical Application

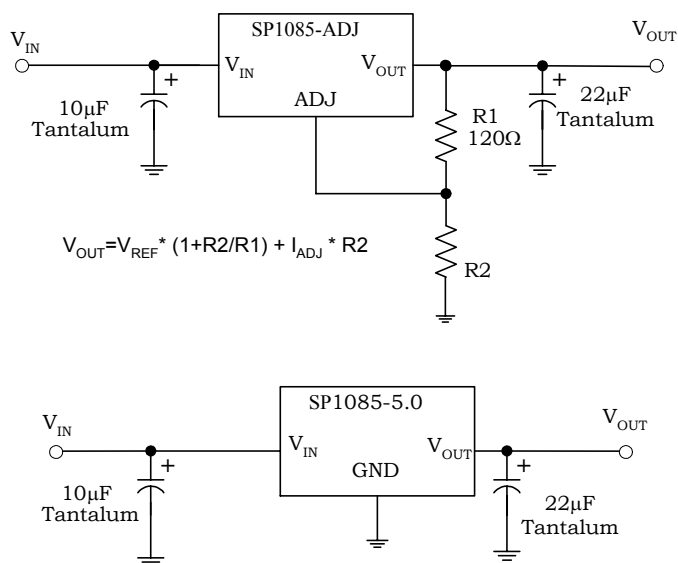
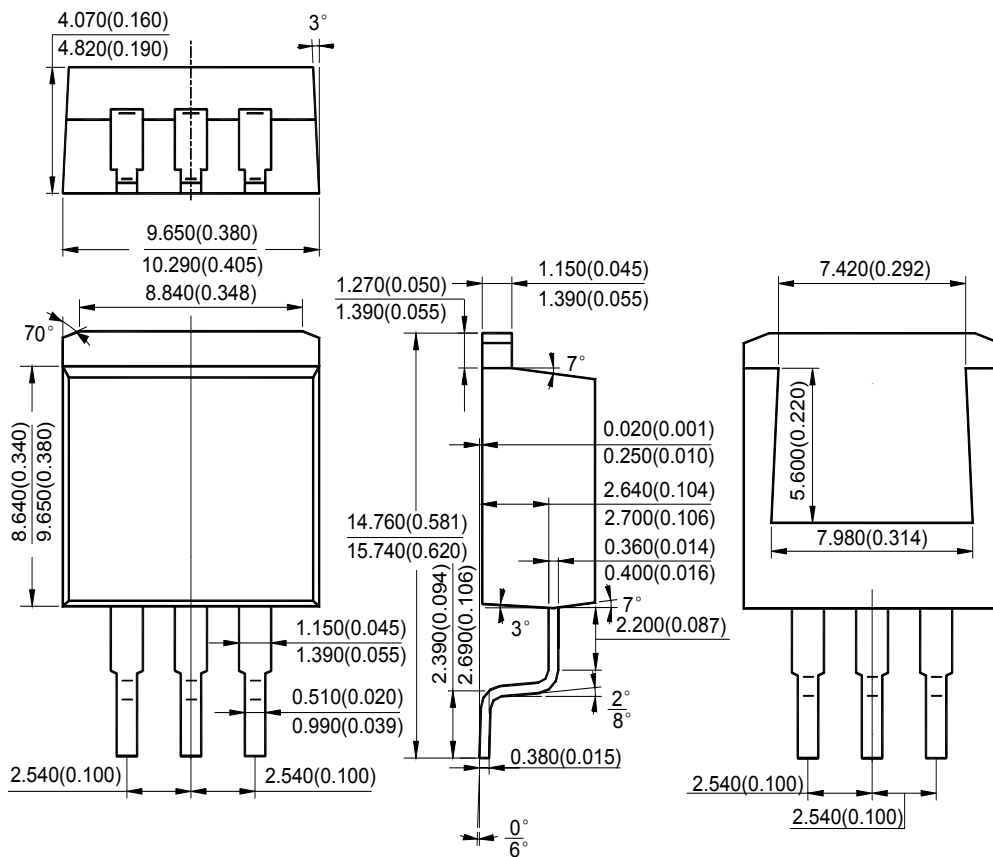


Figure 13. Typical Applications of SP1085

# Mechanical Dimensions (Continued)

TO-263-3L

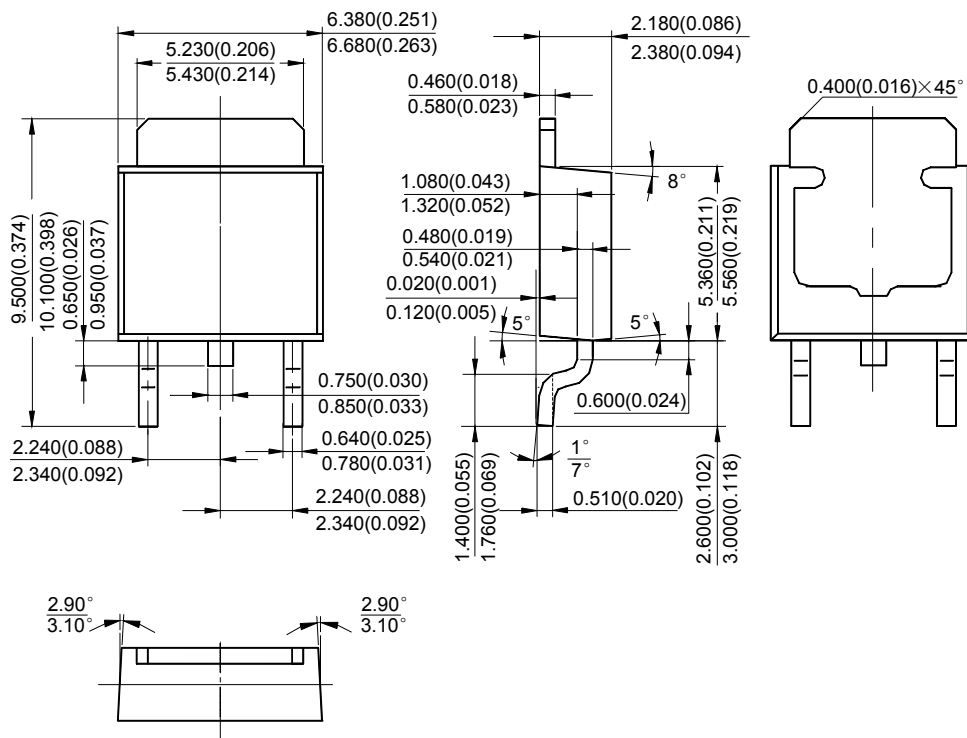
Unit: mm(inch)



Mechanical Dimensions (Continued)

TO-252

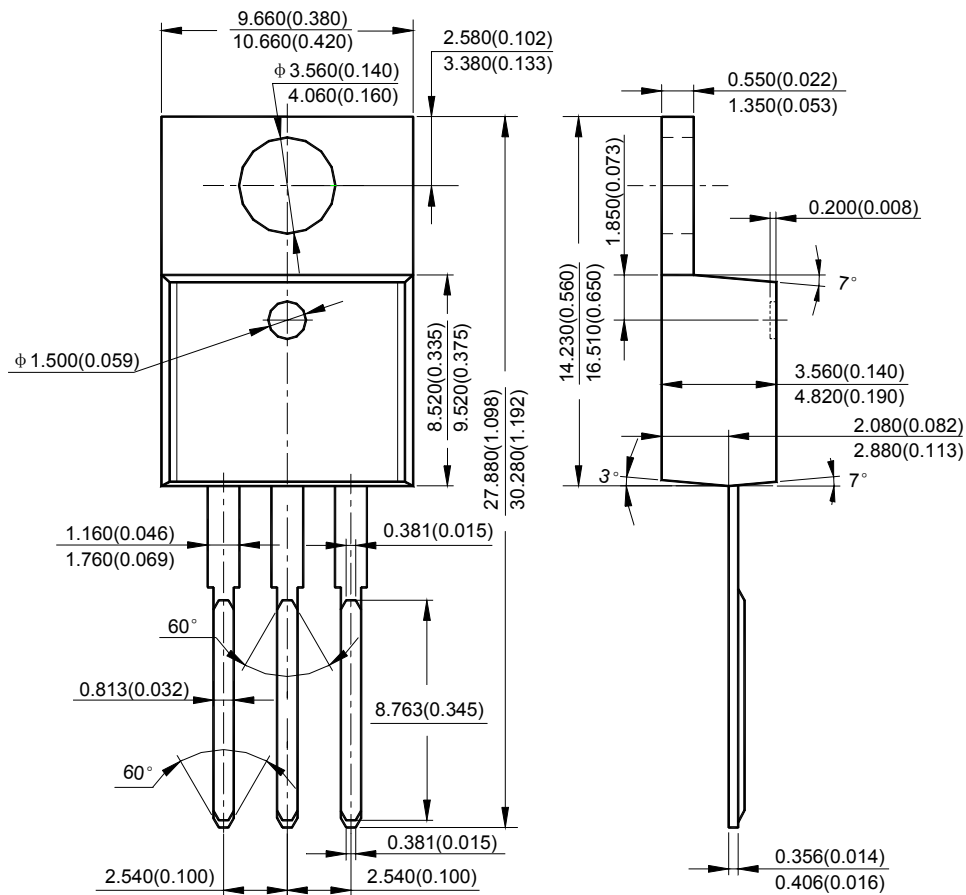
Unit: mm(inch)



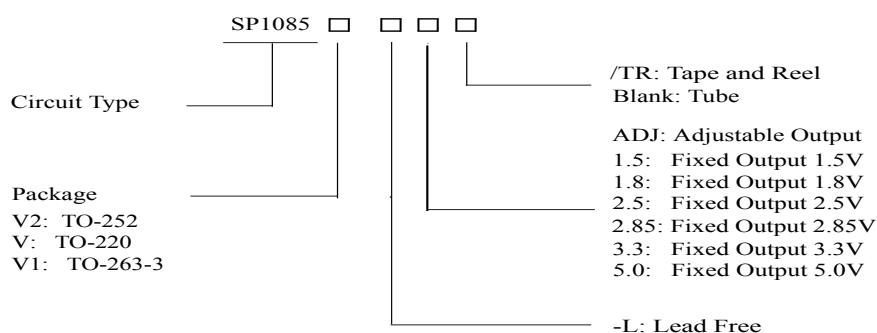
## Mechanical Dimensions

TO-220

Unit: mm(inch)



## ORDERING INFORMATION



| Part Number        | Voltage Range | Voltage Accuracy | Temperature Range | Package | Pin Count | Pack Qty |
|--------------------|---------------|------------------|-------------------|---------|-----------|----------|
| SP1085V2-L/TR      | Adj           | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V2-L-1-5/TR  | 1.5V          | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V2-L-1-8/TR  | 1.8V          | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V2-L-2-5/TR  | 2.5V          | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V2-L-2-85/TR | 2.85V         | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V2-L-3-3/TR  | 3.3V          | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V2-L-5-0/TR  | 5V            | ±2%              | 0°C to +125°C     | TO-252  | 3         | 2,500/TR |
| SP1085V1-L/TR      | Adj           | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V1-L-1-5/TR  | 1.5V          | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V1-L-1-8/TR  | 1.8V          | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V1-L-2-5/TR  | 2.5V          | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V1-L-2-85/TR | 2.85V         | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V1-L-3-3/TR  | 3.3V          | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V1-L-5-0/TR  | 5V            | ±2%              | 0°C to +125°C     | TO-263  | 3         | 800/TR   |
| SP1085V-L          | Adj           | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |
| SP1085V-L-1-5      | 1.5V          | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |
| SP1085V-L-1-8      | 1.8V          | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |
| SP1085V-L-2-5      | 2.5V          | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |
| SP1085V-L-2-85     | 2.85V         | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |
| SP1085V-L-3-3      | 3.3V          | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |
| SP1085V-L-5-0      | 5V            | ±2%              | 0°C to +125°C     | TO-220  | 3         | 50/TUBE  |



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