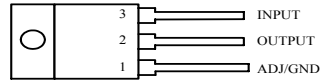


# 1.5A Low Dropout Linear Regulator

## Features

- Low Dropout Voltage: Typical 1.3V at 1.5A
- Current Limiting and Thermal Protection
- Output Current: 1.5A
- Current Limit: 2.3A
- 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 Supply
- Microprocessor Supply
- Motherboard Power Supply
- Cable and ADSL Modem
- DVD-Video Player
- Telecom Equipment
- Set Top Boxes and Web Boxes Modules' Supply

## General Description

The SP1086 is a series of low dropout positive voltage regulators with a maximum dropout of 1.5V at 1.5A of load current. The series features on-chip thermal shutdown. It also includes a bandgap reference and a current limiting circuit. The SP1086 is available in 1.5V, 1.8V, 2.5V, 3V, 3.3V, and 5.0V versions. The fixed versions integrate the adjust resistors. It is also available in an adjustable version, which can set the output voltage with only two external resistors. The SP1086 series is available in standard packages of TO-263-3, TO-220, and TO-252.

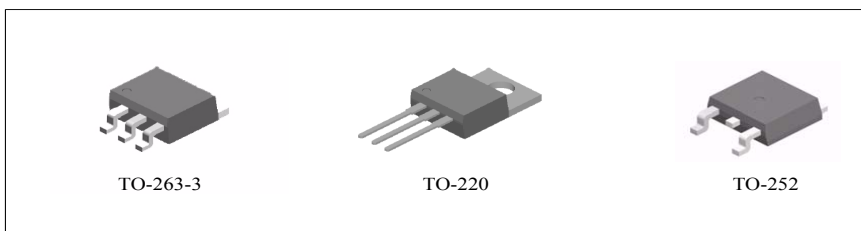


Figure 1. Package Types of SP1086

## Pin Configuration

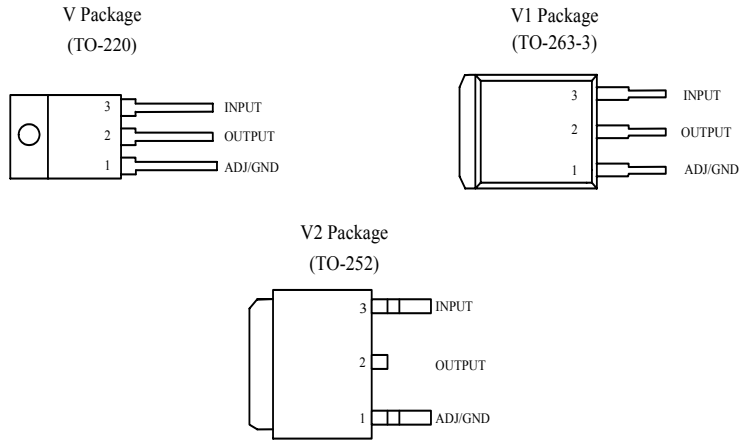


Figure 2. Pin Configuration of SP1086 (Top View)

## Functional Block Diagram

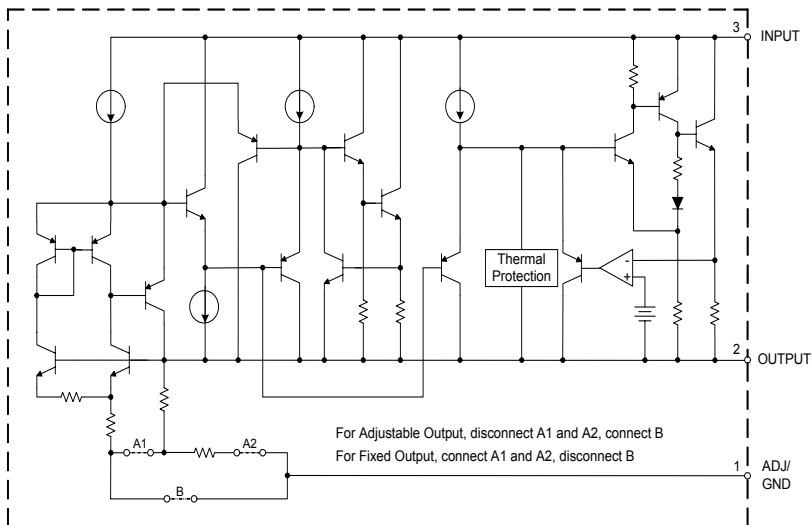


Figure 3. Functional Block Diagram of SP1086

## Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Min	Max	Unit
Operating Junction Temperature Range	$T_J$		150	$^{\circ}\text{C}$
Storage Temperature Range	$T_S$	-65	150	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10sec)	$T_{\text{LEAD}}$		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	$V_{\text{IN}}$		15	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 junction temperature range for operation,  $0^\circ\text{C}$  to  $125^\circ\text{C}$ . ( $P_D \leq$  maximum power dissipation, see Note 2.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reference Voltage	$V_{REF}$	SP1086-ADJ, $I_{OUT} = 10\text{mA}$ , $V_{IN} - V_{OUT} = 2\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $1.4\text{V} \leq V_{IN} - V_{OUT} \leq 6\text{V}$	1.238 <b>1.225</b>	1.250 <b>1.250</b>	1.262 <b>1.270</b>	V
Output Voltage	$V_{OUT}$	SP1086-1.5, $I_{OUT} = 10\text{mA}$ , $V_{IN} = 3.5\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $3\text{V} \leq V_{IN} \leq 10\text{V}$	1.485 <b>1.47</b>	1.5 <b>1.5</b>	1.515 <b>1.53</b>	V
		SP1086-1.8, $I_{OUT} = 10\text{mA}$ , $V_{IN} = 3.8\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $3.2\text{V} \leq V_{IN} \leq 10\text{V}$	1.782 <b>1.746</b>	1.8 <b>1.8</b>	1.818 <b>1.854</b>	V
		SP1086-2.5, $I_{OUT} = 10\text{mA}$ , $V_{IN} = 4.5\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $3.9\text{V} \leq V_{IN} \leq 10\text{V}$	2.475 <b>2.45</b>	2.5 <b>2.5</b>	2.525 <b>2.55</b>	V
		SP1086-3.0, $I_{OUT} = 10\text{mA}$ , $V_{IN} = 4.5\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $4.9\text{V} \leq V_{IN} \leq 10\text{V}$	2.97 <b>2.94</b>	3.0 <b>3.0</b>	3.03 <b>3.06</b>	V
		SP1086-3.3, $I_{OUT} = 10\text{mA}$ , $V_{IN} = 5\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $4.75\text{V} \leq V_{IN} \leq 10\text{V}$	3.267 <b>3.235</b>	3.3 <b>3.3</b>	3.333 <b>3.365</b>	V
		SP1086-5.0, $I_{OUT} = 10\text{mA}$ , $V_{IN} = 7\text{V}$ , $T_J = 25^\circ\text{C}$ , $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $6.5\text{V} \leq V_{IN} \leq 10\text{V}$	4.95 <b>4.9</b>	5 <b>5</b>	5.05 <b>5.1</b>	V
Line Regulation	$\Delta V_{OUT}$	SP1086-ADJ, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.015 <b>0.035</b>	0.2 <b>0.2</b>	%
		SP1086-1.5, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.3 <b>0.6</b>	6 <b>6</b>	mV
		SP1086-1.8, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.3 <b>0.6</b>	6 <b>6</b>	mV
		SP1086-2.5, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.3 <b>0.6</b>	6 <b>6</b>	mV
		SP1086-3.0, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.3 <b>0.6</b>	6 <b>6</b>	mV
		SP1086-3.3, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.5 <b>1</b>	10 <b>10</b>	mV
		SP1086-5.0, $I_{OUT} = 10\text{mA}$ , $1.5\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		0.5 <b>1</b>	10 <b>10</b>	mV

## Electrical Characteristics (Continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Load Regulation	$\Delta V_{OUT}$	SP1086-ADJ, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		0.1 <b>0.2</b>	0.3 <b>0.4</b>	%
		SP1086-1.5, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		3 <b>6</b>	12 <b>20</b>	mV
		SP1086-1.8, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		3 <b>6</b>	12 <b>20</b>	mV
		SP1086-2.5, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		3 <b>6</b>	12 <b>20</b>	mV
		SP1086-3.0, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		3 <b>7</b>	15 <b>20</b>	mV
		SP1086-3.3, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		3 <b>7</b>	15 <b>20</b>	mV
		SP1086-5.0, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $V_{IN} - V_{OUT} = 2\text{V}$		5 <b>10</b>	20 <b>35</b>	mV
Dropout Voltage		$I_O = 1.5\text{A}$ , $\Delta V_{REF} = 1\%$		1.3	1.5	V
Current Limit	$I_{LIMIT}$	$V_{IN} - V_{OUT} = 2\text{V}$ ,	1.5	2.3		A
Minimum Load Current		$1.4\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$ (For ADJ)		<b>2</b>	<b>5</b>	mA
Quiescent Current		$V_{IN} = V_{OUT} + 1.3\text{V}$		<b>5</b>	<b>10</b>	mA
Ripple Rejection		$f_{RIPPLE} = 120\text{Hz}$ , $C_{OUT} = 25\mu\text{F}$ Tantalum, $I_{OUT} = 1.5\text{A}$ , $V_{IN} - V_{OUT} = 3\text{V}$	<b>60</b>	<b>75</b>		dB
Adjust Pin Current				60	<b>120</b>	$\mu\text{A}$
Adjust Pin Current Change		$10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$ , $1.4\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$		<b>0.2</b>	<b>5</b>	$\mu\text{A}$
Temperature Stability				<b>0.5</b>		%
RMS Noise (% of $V_{OUT}$ )		$T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$		0.003		%
Thermal Shutdown		Junction Temperature		165		$^\circ\text{C}$
Thermal Shutdown Hysteresis				30		$^\circ\text{C}$
Thermal Resistance Junction-to-Case	$\theta_{JC}$	TO - 252 TO - 263 TO - 220		4 4 4		$^\circ\text{C}/\text{W}$

Note 2: Maximum power dissipation see Figure 5.

# Typical Performance Characteristics

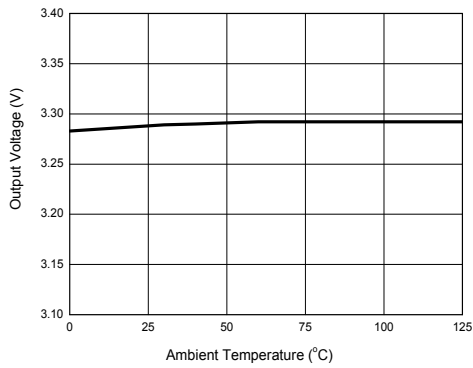


Figure 4. Output Voltage vs. Temperature

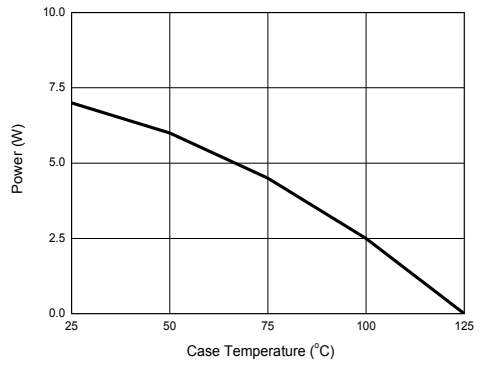


Figure 5. Maximum Power Dissipation

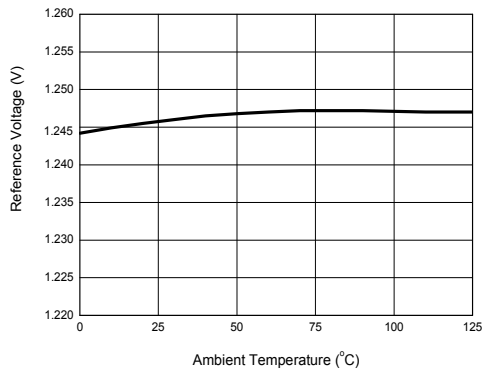


Figure 6. Reference Voltage vs. Temperature

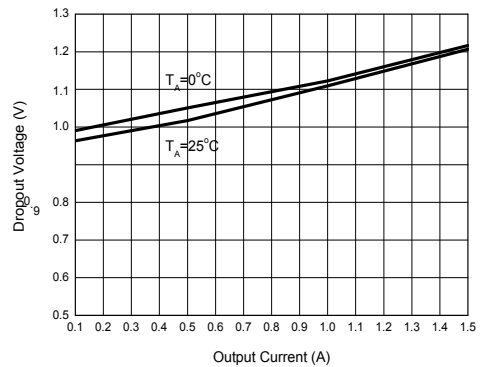


Figure 7. Dropout Voltage vs. Output Current

# Typical Performance Characteristics (Continued)

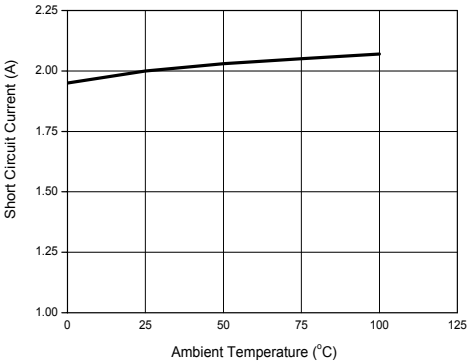


Figure 8. Short Circuit Current vs. Temperature

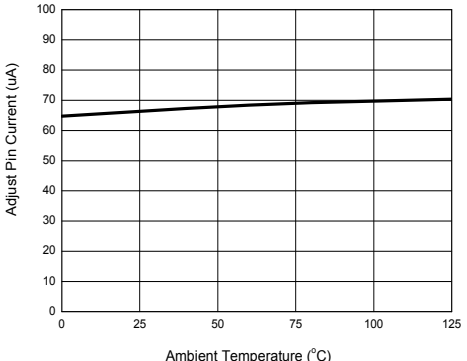


Figure 9. Adjust Pin Current vs. Temperature

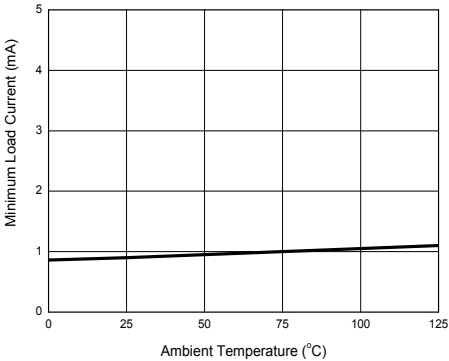


Figure 10. Minimum Load Current vs. Temperature

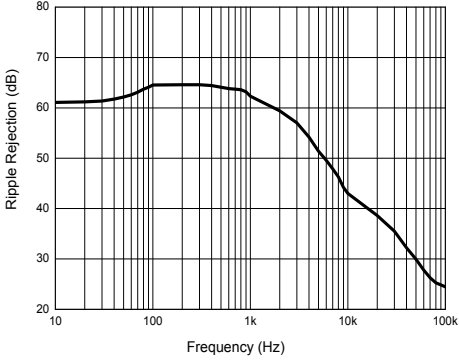
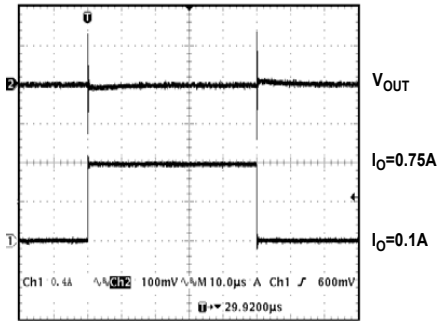


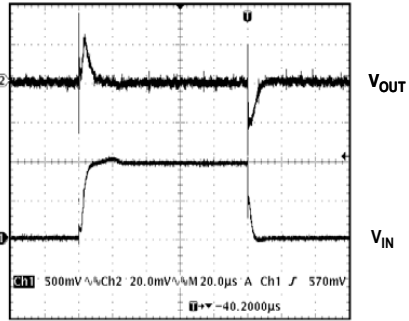
Figure 11. Ripple Rejection vs. Frequency

## Typical Performance Characteristics (Continued)



SP1086V Load transient response

V<sub>IN</sub>=4.8V, V<sub>OUT</sub>=3.3V, I<sub>O</sub>=0.1A to 0.75A, C<sub>IN</sub>=C<sub>OUT</sub>=10μ (tan)



SP1086V Line transient response

V<sub>IN</sub>=4.8V, V<sub>OUT</sub>=3.3V, I<sub>O</sub>=0.1A, C<sub>IN</sub>=1μ (tan), C<sub>OUT</sub>=10μ (tan)

Figure 12. Load Transient Response

Figure 13. Line Transient Response

## Typical Application

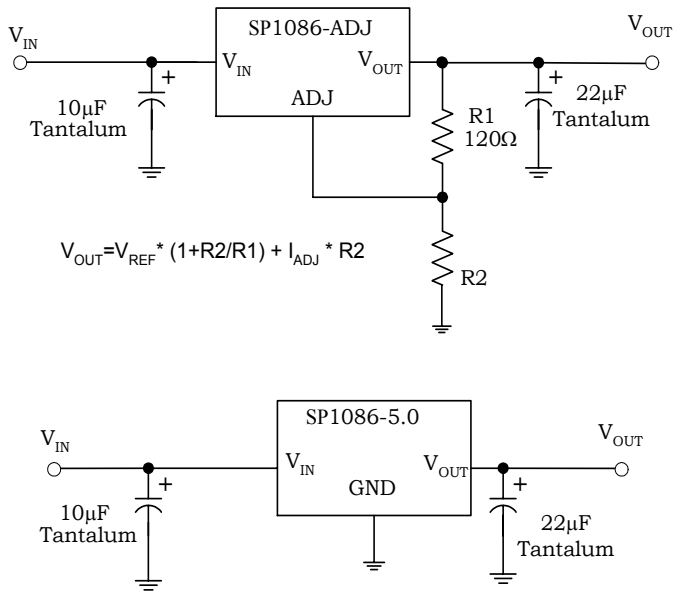


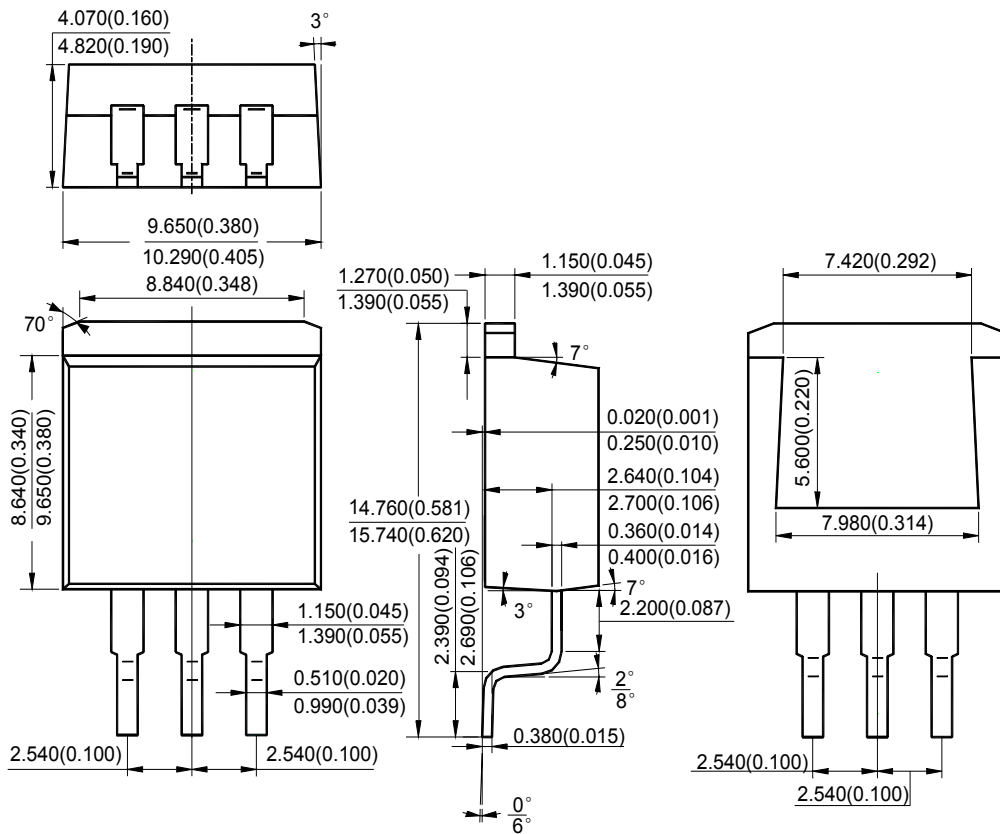
Figure 14. Typical Applications of SP1086



Mechanical Dimensions

TO-263-3

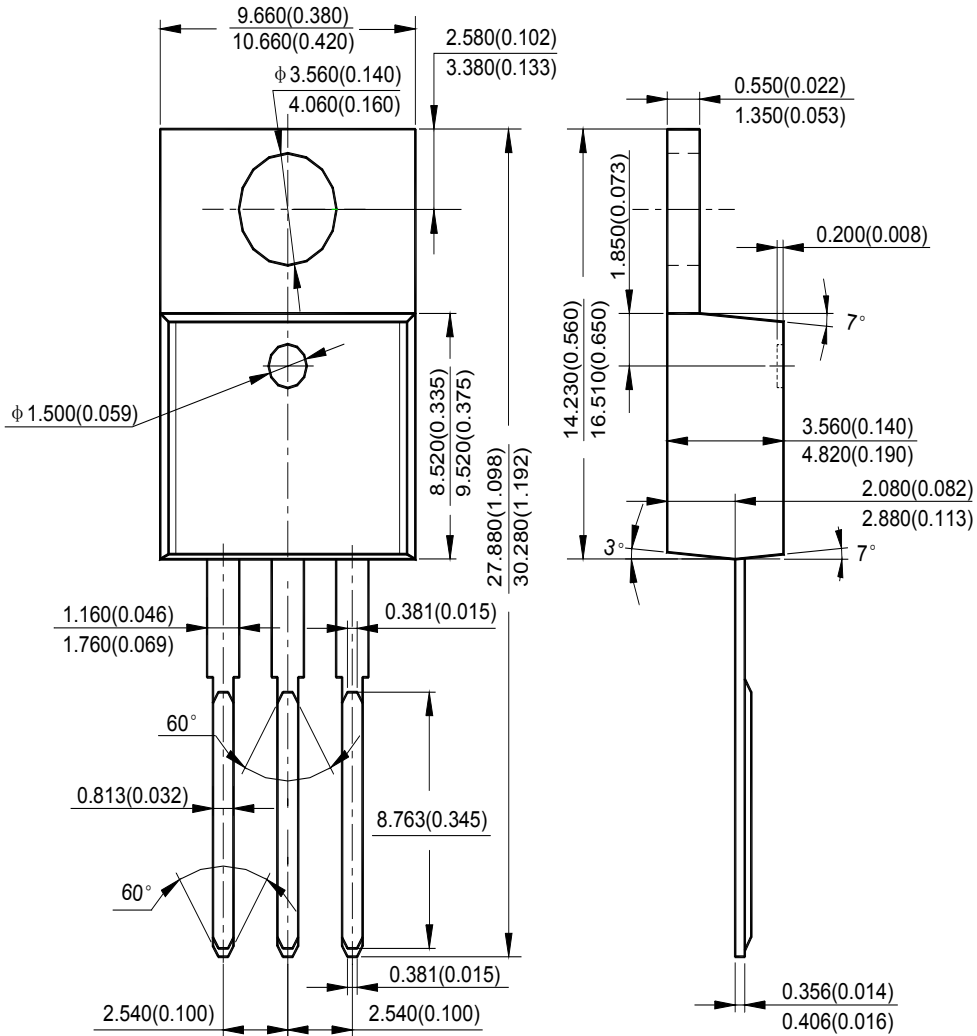
Unit: mm(inch)



Mechanical Dimensions (Continued)

TO-220

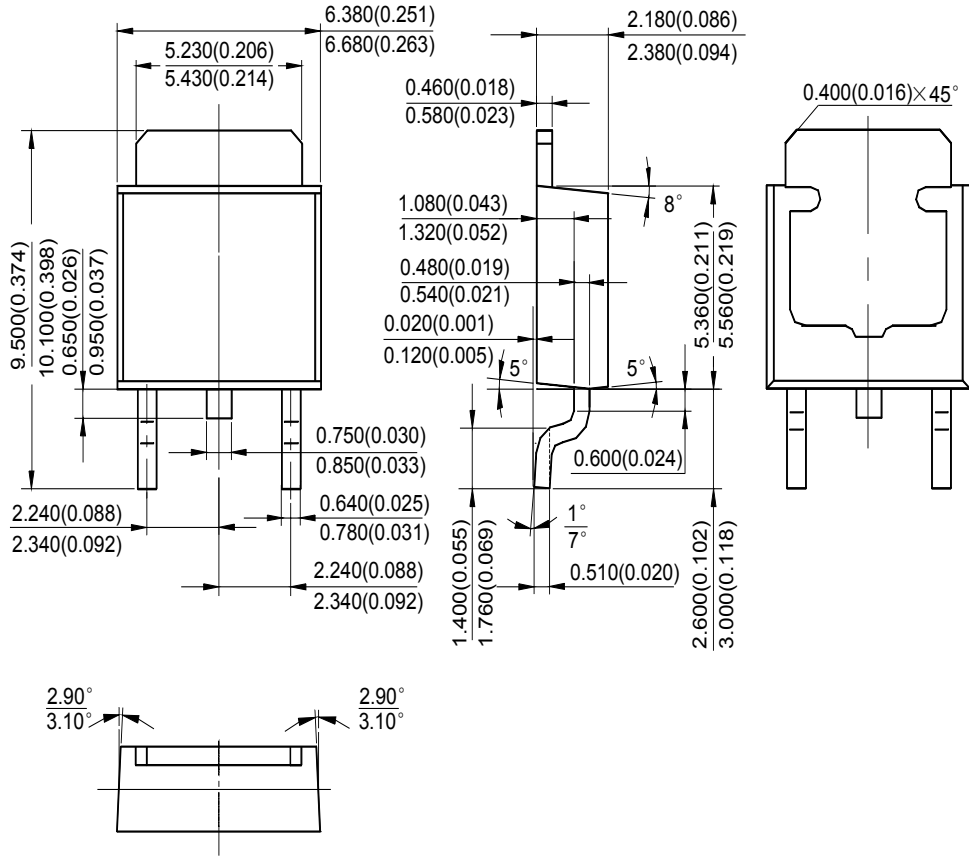
Unit: mm(inch)

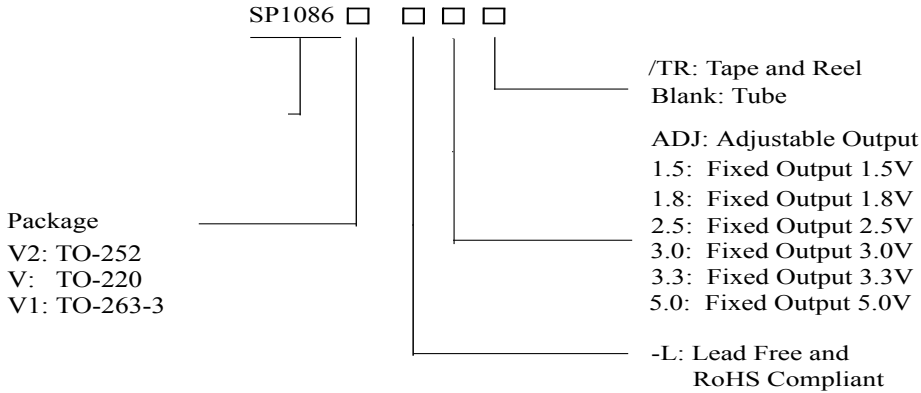


Mechanical Dimensions (Continued)

TO-252

Unit: mm(inch)





Part Number	Voltage Range	Temperature Range	Package	Pin Count	Pack Qty
SP1086V2-L/TR	Adj	0°C to +125°C	TO-252	3	2,500/TR
SP1086V2-L-1-5/TR	1.5V	0°C to +125°C	TO-252	3	2,500/TR
SP1086V2-L-1-8/TR	1.8V	0°C to +125°C	TO-252	3	2,500/TR
SP1086V2-L-2-5/TR	2.5V	0°C to +125°C	TO-252	3	2,500/TR
SP1086V2-L-3-0/TR	3V	0°C to +125°C	TO-252	3	2,500/TR
SP1086V2-L-3-3/TR	3.3V	0°C to +125°C	TO-252	3	2,500/TR
SP1086V2-L-5-0/TR	5V	0°C to +125°C	TO-252	3	2,500/TR
SP1086V1-L/TR	Adj	0°C to +125°C	TO-263	3	800/TR
SP1086V1-L-1-5/TR	1.5V	0°C to +125°C	TO-263	3	800/TR
SP1086V1-L-1-8/TR	1.8V	0°C to +125°C	TO-263	3	800/TR
SP1086V1-L-2-5/TR	2.5V	0°C to +125°C	TO-263	3	800/TR
SP1086V1-L-3-0/TR	3V	0°C to +125°C	TO-263	3	800/TR
SP1086V1-L-3-3/TR	3.3V	0°C to +125°C	TO-263	3	800/TR
SP1086V1-L-5-0/TR	5V	0°C to +125°C	TO-263	3	800/TR
SP1086V-L	Adj	0°C to +125°C	TO-220	3	50/TUBE
SP1086V-L-1-5	1.5V	0°C to +125°C	TO-220	3	50/TUBE
SP1086V-L-1-8	1.8V	0°C to +125°C	TO-220	3	50/TUBE
SP1086V-L-2-5	2.5V	0°C to +125°C	TO-220	3	50/TUBE
SP1086V-L-3-0	3V	0°C to +125°C	TO-220	3	50/TUBE
SP1086V-L-3-3	3.3V	0°C to +125°C	TO-220	3	50/TUBE
SP1086V-L-5-0	5V	0°C to +125°C	TO-220	3	50/TUBE



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