

## 600mA LOW DROPOUT LINEAR REGULATOR

AP2317

### General Description

The AP2317 is a series of low dropout three-terminal regulators with a dropout of 1.1V at 600mA output current.

This product has been optimized for low voltage where transient response and minimum input voltage are critical. The AP2317 provides current limit and thermal shutdown. Its circuit includes a trimmed bandgap reference to assure output voltage accuracy to be within  $\pm 1\%$ . On-chip thermal shutdown provides protection against any combination of overload and ambient temperatures that would create excessive junction temperatures.

The AP2317 is available in 2.5V and 3.3V versions. The fixed versions integrate the adjust resistors. It is also available in an adjustable version which can set the output voltage with two external resistors.

The AP2317 series regulators are available in the industry standard SOT-89-3, SOT-223 and TO-263-3 (for 3.3V only) power packages.

### Features

- Low Dropout Voltage: 1.1V at 600mA Output Current
- Output Noise from 10Hz to 10KHz: 0.003%
- PSRR at  $I_{OUT}=300mA$  and  $f=120Hz$ : 75dB
- Output Voltage Accuracy:  $\pm 1\%$
- On-chip Thermal Shutdown
- Maximum Quiescent Current:  $I_{QMAX}=5mA$
- ESD (Human Body Model): 3.5KV
- Operation Junction Temperature:  $-40$  to  $125^{\circ}C$

### Applications

- DVD/CD-ROM
- USB Device
- Add-on Card
- DVD Player
- PC Motherboard

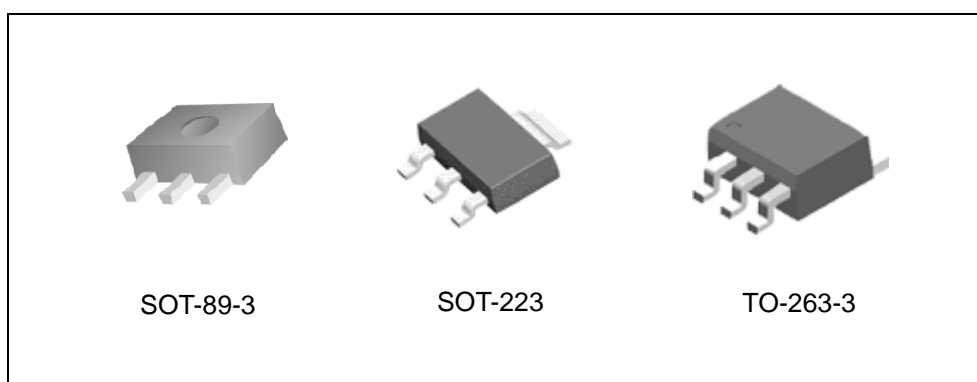


Figure 1. Package Types of AP2317

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## Pin Configuration

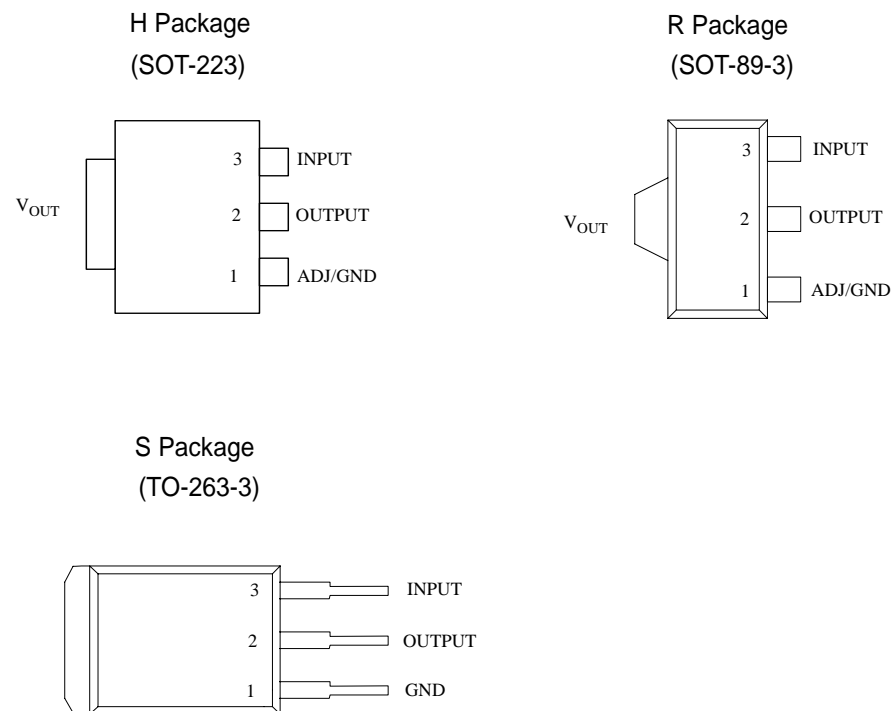


Figure 2. Pin Configuration of AP2317 (Top View)

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## Functional Block Diagram

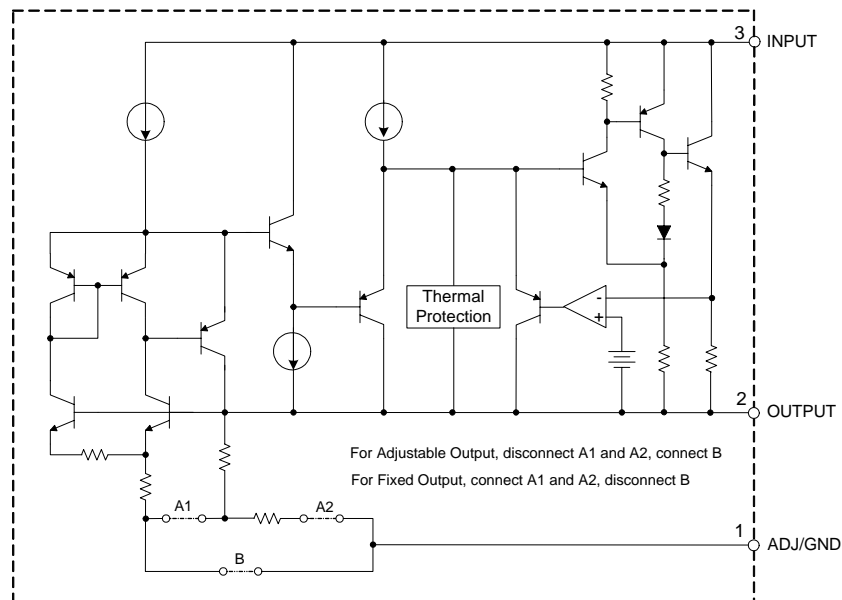


Figure 3. Functional Block Diagram of AP2317

## Ordering Information

	AP2317				
Circuit Type					E1: Lead Free Blank: Tin Lead
Package					TR: Tape and Reel Blank: Tube
H: SOT-223					ADJ: Adjustable Output
R: SOT-89-3					2.5: Fixed Output 2.5V
S: TO-263-3					3.3: Fixed Output 3.3V

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### Ordering Information (Continued)

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOT-89-3	-40 to 125°C	AP2317R-ADJTR	AP2317R-ADJTRE1	R27A	E27A	Tape & Reel
		AP2317R-2.5TR	AP2317R-2.5TRE1	R27B	E27B	Tape & Reel
		AP2317R-3.3TR	AP2317R-3.3TRE1	R27C	E27C	Tape & Reel
SOT-223	-40 to 125°C	AP2317H-ADJTR	AP2317H-ADJTRE1	H27A	EH27A	Tape & Reel
		AP2317H-2.5TR	AP2317H-2.5TRE1	H27B	EH27B	Tape & Reel
		AP2317H-3.3TR	AP2317H-3.3TRE1	H27C	EH27C	Tape & Reel
TO-263-3	-40 to 125°C	AP2317S-3.3	AP2317S-3.3E1	AP2317S-3.3	AP2317S-3.3E1	Tube
		AP2317S-3.3TR	AP2317S-3.3TRE1	AP2317S-3.3	AP2317S-3.3E1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

### Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Input Voltage	$V_{IN}$	15	V
Operating Junction Temperature Range	$T_J$	150	°C
Storage Temperature Range	$T_{STG}$	-65 to 150	°C
Lead Temperature (Soldering, 10sec)	$T_{LEAD}$	300	°C
ESD (Human Body Model)	ESD	3500	V
ESD (Machine Model)	ESD	400	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	$V_{IN}$		12	V
Operating Junction Temperature Range	$T_J$	-40	125	°C
Storage Temperature Range	$T_{STG}$	-65	150	°C


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**Electrical Characteristics**

Operating Conditions:  $V_{IN} \leq 10V$ ,  $T_J = 25^\circ C$ , unless otherwise specified. ( $P \leq$  maximum power dissipation)

Limits appearing in **Boldface** type apply over the entire junction temperature range for operation,  $-40^\circ C$  to  $125^\circ C$ 

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reference Voltage	$V_{REF}$	AP2317-ADJ $I_{OUT} = 10mA$ , $V_{IN} - V_{OUT} = 2V$ , $T_J = 25^\circ C$ $10mA \leq I_{OUT} \leq 600mA$ , $1.4V \leq V_{IN} - V_{OUT} \leq 8V$ $P \leq$ maximum power dissipation	1.238 <b>1.225</b>	1.250 1.250	1.262 <b>1.270</b>	V
Output Voltage	$V_{OUT}$	AP2317-2.5 $I_{OUT} = 10mA$ , $V_{IN} = 4.5V$ , $T_J = 25^\circ C$ $10mA \leq I_{OUT} \leq 600mA$ , $3.9V \leq V_{IN} \leq 10V$	2.475 <b>2.450</b>	2.5 2.5	2.525 <b>2.550</b>	V
		AP2317-3.3 $I_{OUT} = 10mA$ , $V_{IN} = 5.0V$ , $T_J = 25^\circ C$ $10mA \leq I_{OUT} \leq 600mA$ , $4.75V \leq V_{IN} \leq 10V$	3.267 <b>3.235</b>	3.3 3.3	3.333 <b>3.365</b>	V
Line Regulation	$\Delta V_{OUT}$	AP2317-ADJ $I_{OUT} = 10mA$ , $1.5V \leq V_{IN} - V_{OUT} \leq 10V$		0.035	<b>0.2</b>	%
		AP2317-2.5 $I_{OUT} = 10mA$ , $1.5V \leq V_{IN} - V_{OUT} \leq 10V$		1	<b>6</b>	mV
		AP2317-3.3 $I_{OUT} = 10mA$ , $1.5V \leq V_{IN} - V_{OUT} \leq 10V$		1	<b>6</b>	mV
Load Regulation	$\Delta V_{OUT}$	AP2317-ADJ $(V_{IN} - V_{OUT}) = 2V$ , $10mA \leq I_{OUT} \leq 600mA$		0.2	<b>0.4</b>	%
		AP2317-2.5 $(V_{IN} - V_{OUT}) = 2V$ , $10mA \leq I_{OUT} \leq 600mA$		1	<b>10</b>	mV
		AP2317-3.3 $(V_{IN} - V_{OUT}) = 2V$ , $10mA \leq I_{OUT} \leq 600mA$		1	<b>10</b>	mV
Dropout Voltage		$\Delta V_{REF} = 1\%$ , $I_{OUT} = 0.6A$		1.1	<b>1.3</b>	V
Current Limit	$I_{LIMIT}$	$(V_{IN} - V_{OUT}) = 2V$	0.75	0.9		A
Adjust Pin Current				60	<b>120</b>	$\mu A$
Adjust Pin Current Change		$1.4V \leq (V_{IN} - V_{OUT}) \leq 10$ , $10mA \leq I_{OUT} \leq 600mA$		0.2	<b>5</b>	$\mu A$
Minimum Load Current		$1.5V \leq (V_{IN} - V_{OUT}) \leq 10V$ (ADJ only)		<b>1.7</b>	<b>5</b>	mA
Quiescent Current		$V_{IN} = V_{OUT} + 1.25V$			<b>5</b>	mA
Ripple Rejection		$f = 120Hz$ , $C_{OUT} = 22\mu F$ Tantalum $(V_{IN} - V_{OUT}) = 3V$ , $I_{OUT} = 300mA$	<b>60</b>	75		dB
Temperature Stability				0.5		%
Long-Term Stability		$T_A = 125^\circ C$ , 1000hrs.		0.3		%
RMS Output Noise		$T_A = 25^\circ C$ , $10Hz \leq f \leq 10KHz$		0.003		%
Thermal Shutdown		Junction Temperature		150		$^\circ C$
Thermal Shutdown Hysteresis				25		$^\circ C$
Thermal Resistance	$\theta_{JC}$	SOT-89-3		37		$^\circ C/W$
		SOT-223		33		
		TO-263-3		7		

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## Typical Performance Characteristics

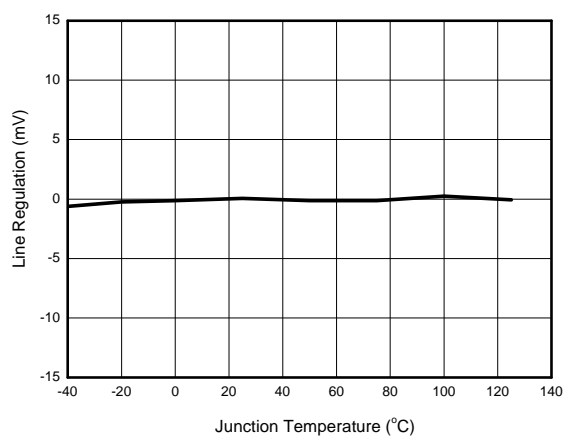


Figure 4. Line Regulation vs. Junction Temperature

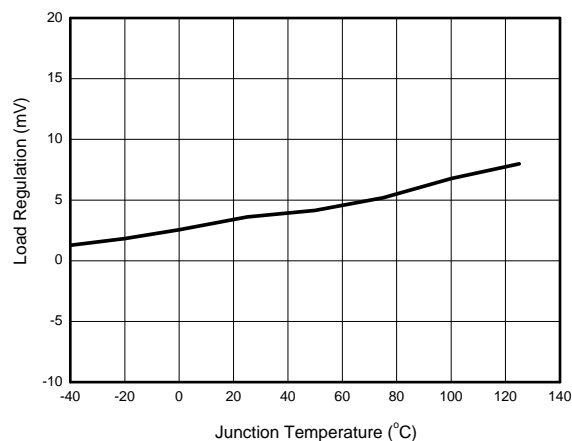


Figure 5. Load Regulation vs. Junction Temperature

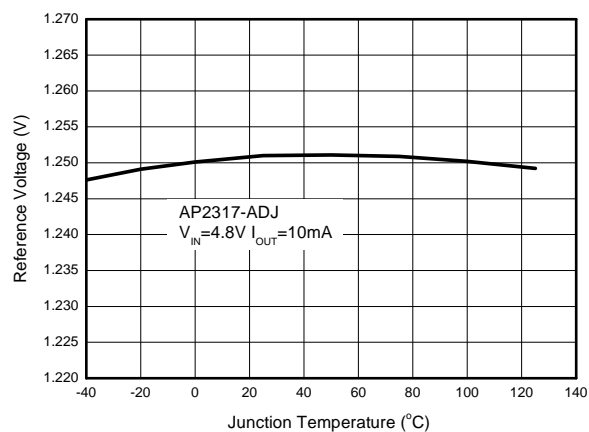


Figure 6. Reference Voltage vs. Junction Temperature

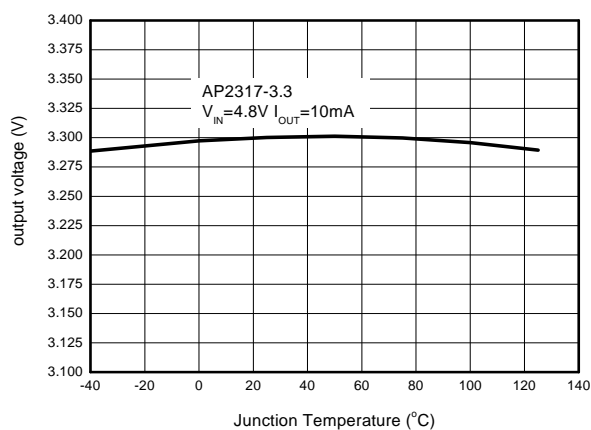


Figure 7. Output Voltage vs. Junction Temperature

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## Typical Performance Characteristics (Continued)

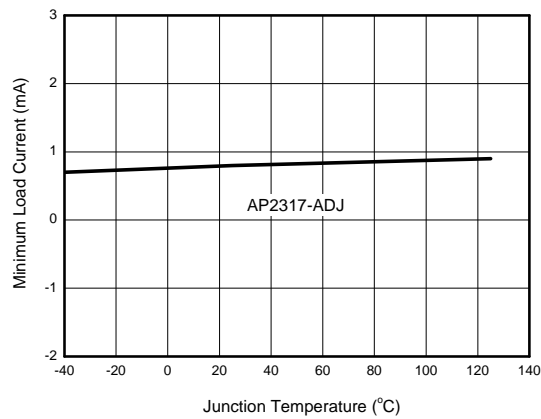


Figure 8. Minimum Load Current vs. Junction Temperature

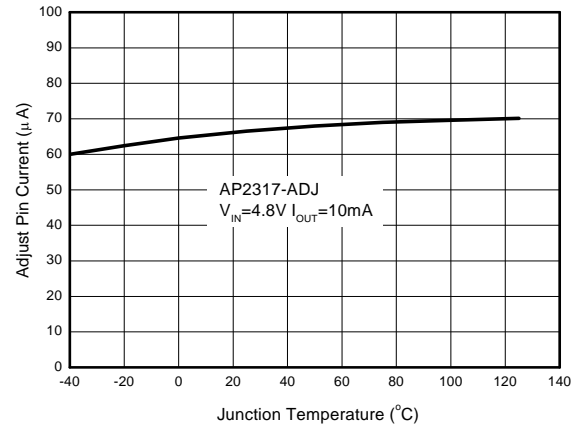


Figure 9. Adjust Pin Current vs. Junction Temperature

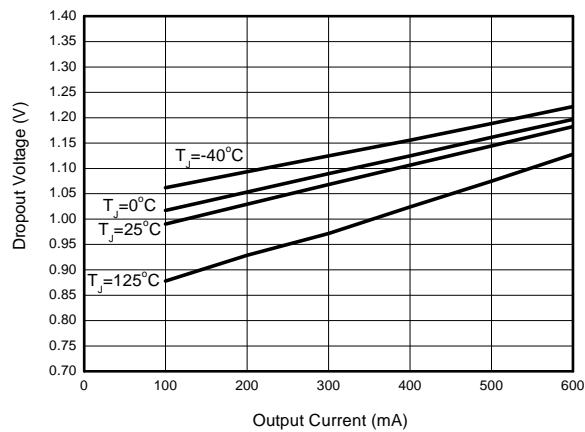


Figure 10. Dropout Voltage vs. Output Current

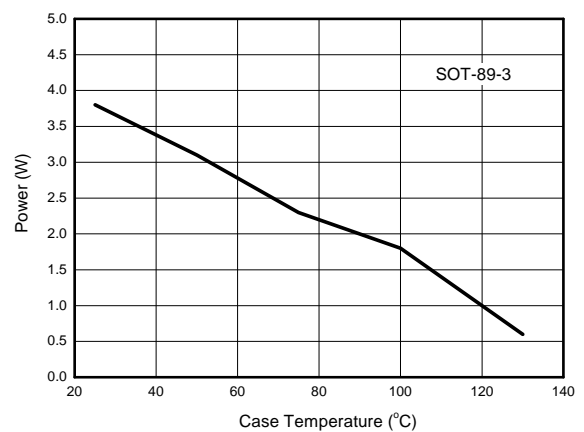


Figure 11. Maximum Power Dissipation

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## Typical Performance Characteristics (Continued)

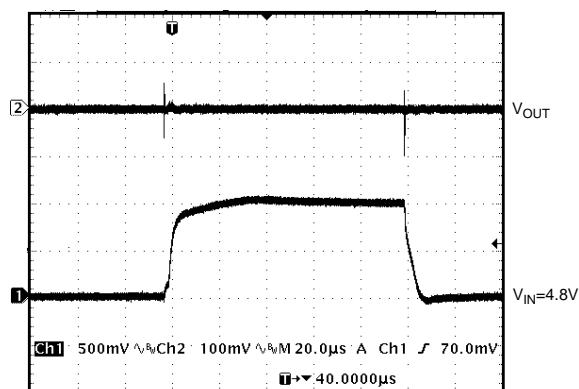


Figure 12. Line Transient Response

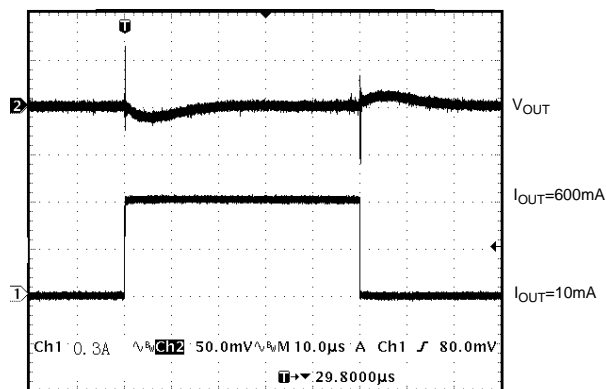


Figure 13. Load Transient Response

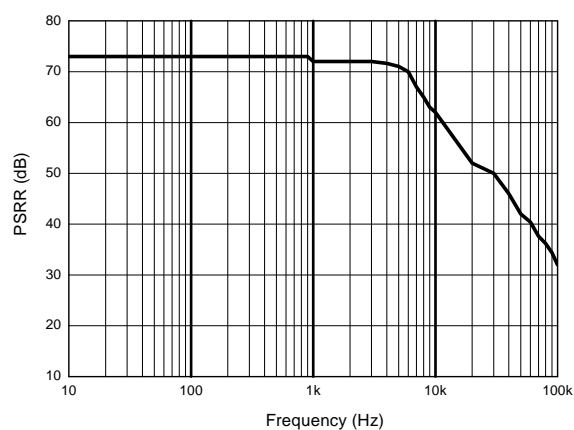


Figure 14. PSRR vs. Frequency

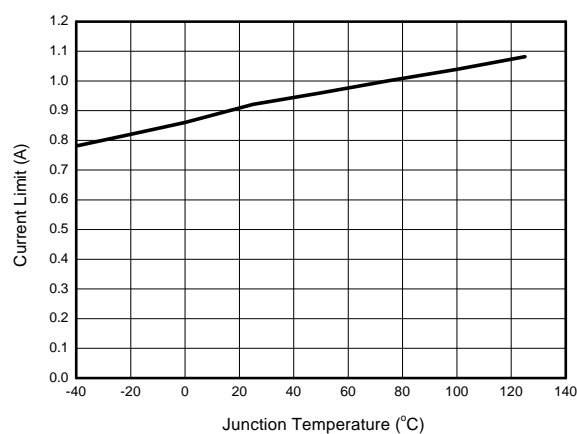


Figure 15. Current Limit vs. Junction Temperature

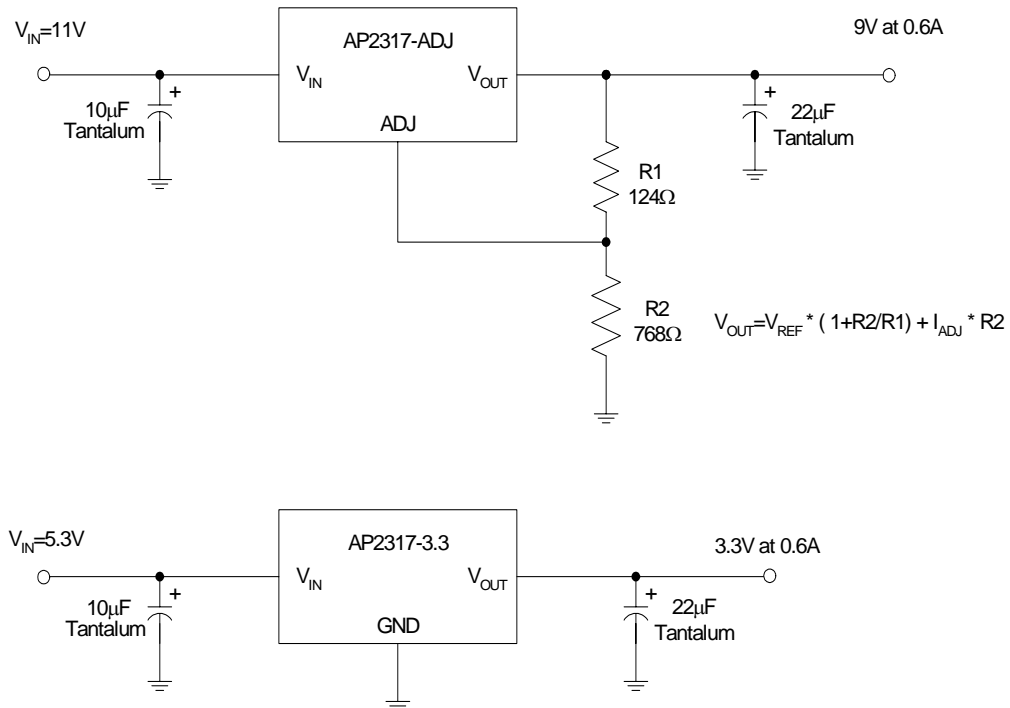
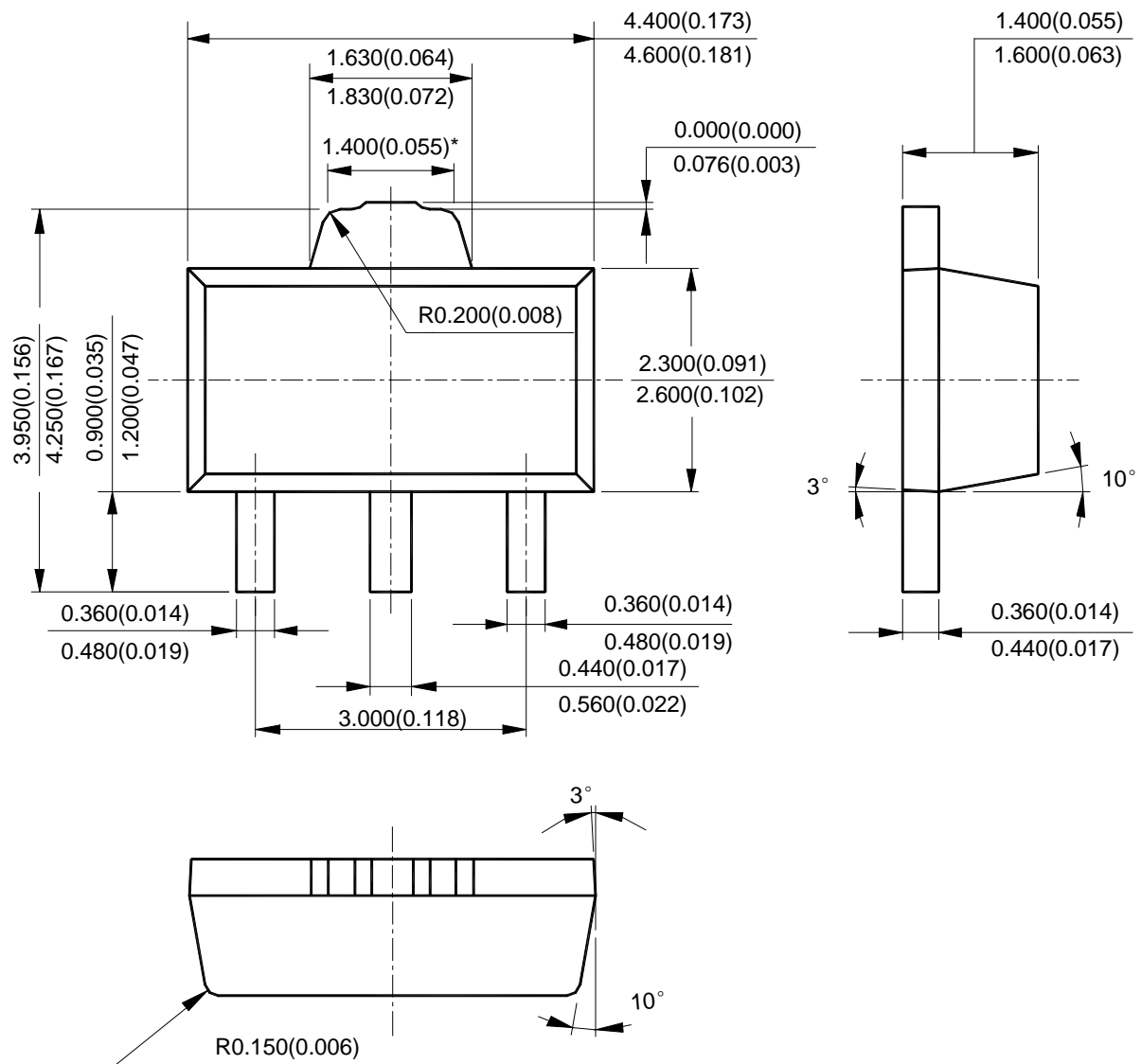
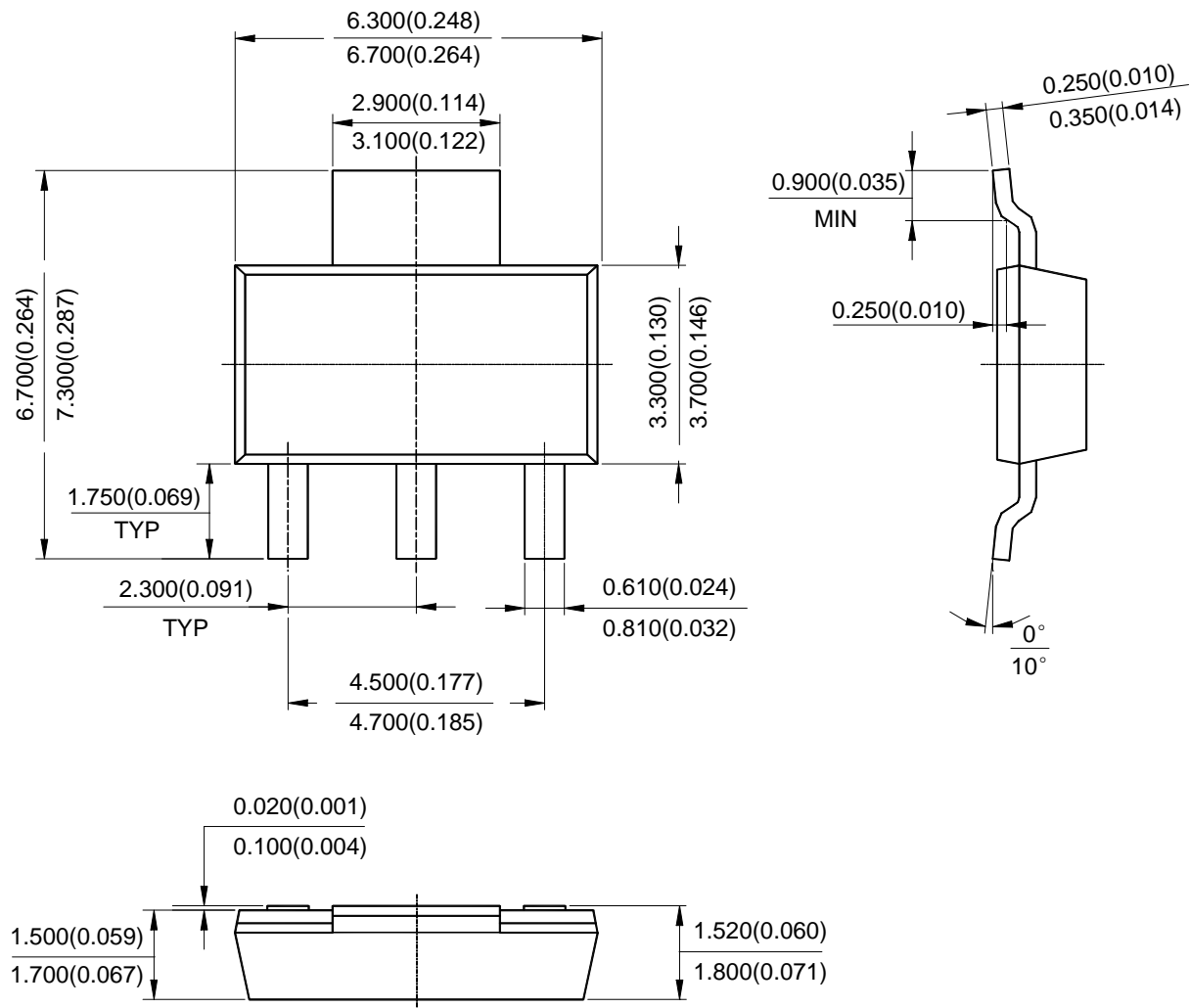
**600mA LOW DROPOUT LINEAR REGULATOR****AP2317****Typical Applications**

Figure 16. Typical Applications of AP2317

**600mA LOW DROPOUT LINEAR REGULATOR****AP2317****Mechanical Dimensions****SOT-89-3****Unit: mm(inch)**

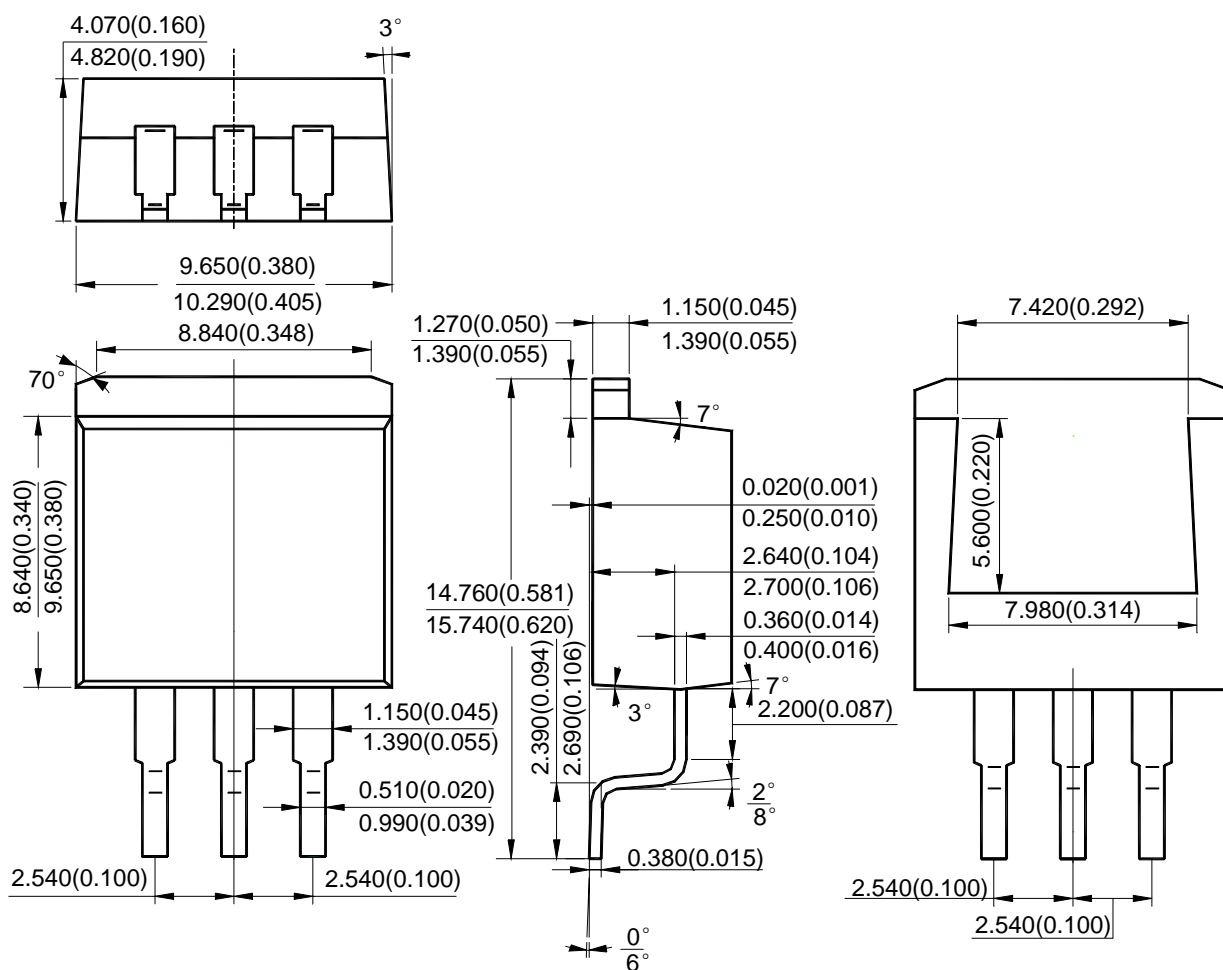
**600mA LOW DROPOUT LINEAR REGULATOR****AP2317****Mechanical Dimensions (Continued)****SOT- 223****Unit: mm(inch)**



### Mechanical Dimensions (Continued)

**TO-263-3**

Unit: mm(inch)





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