



**THE DATASHEET OF
AZ1086S-3.3TRE1**



1.5A LOW DROPOUT LINEAR REGULATOR

AZ1086

General Description

The AZ1086 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 AZ1086 is available in 1.5V, 1.8V, 2.5V, 3.0V, 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 AZ1086 series is available in standard packages of TO-263-3, TO-220-3, SOT-223, TO-252-2 (1), TO-252-2 (3) and TO-252-2 (4).

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)

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

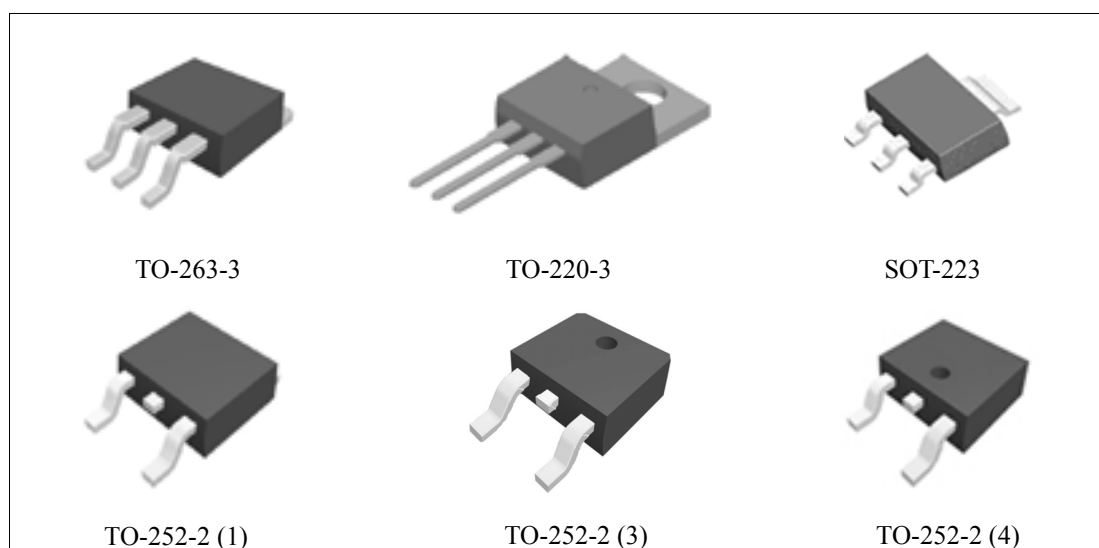


Figure 1. Package Types of AZ1086

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Pin Configuration

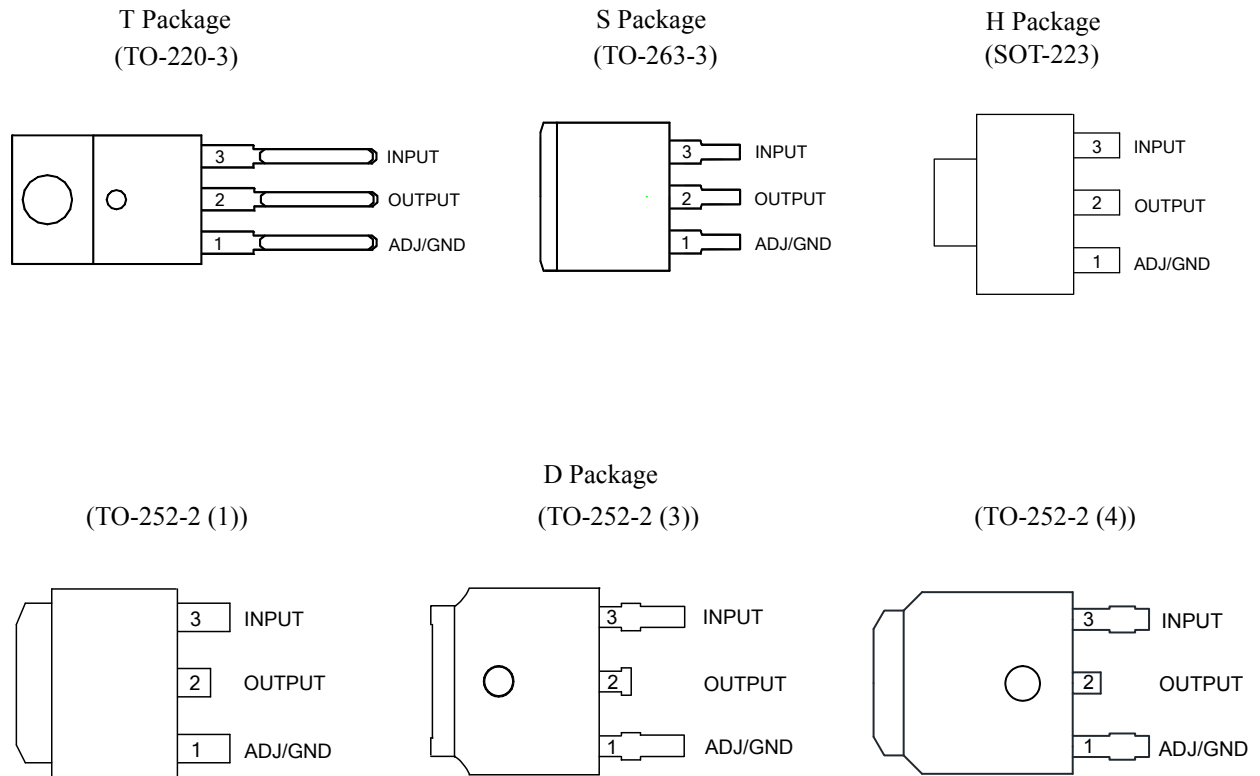


Figure 2. Pin Configuration of AZ1086 (Top View)

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Functional Block Diagram

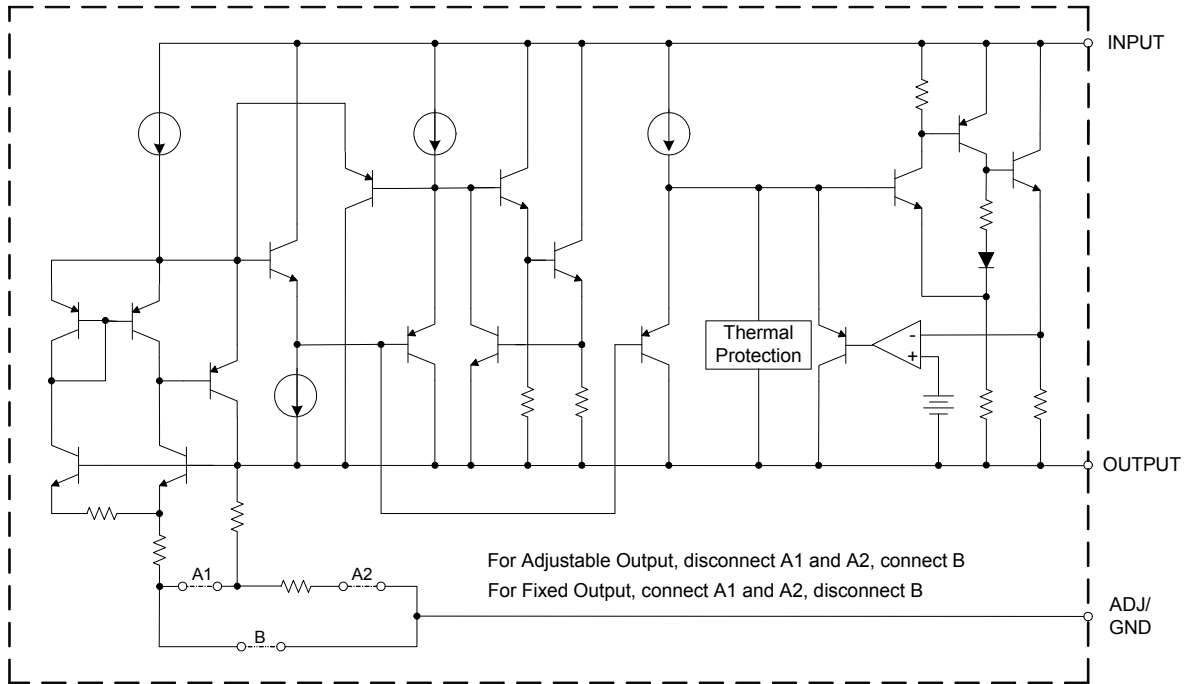


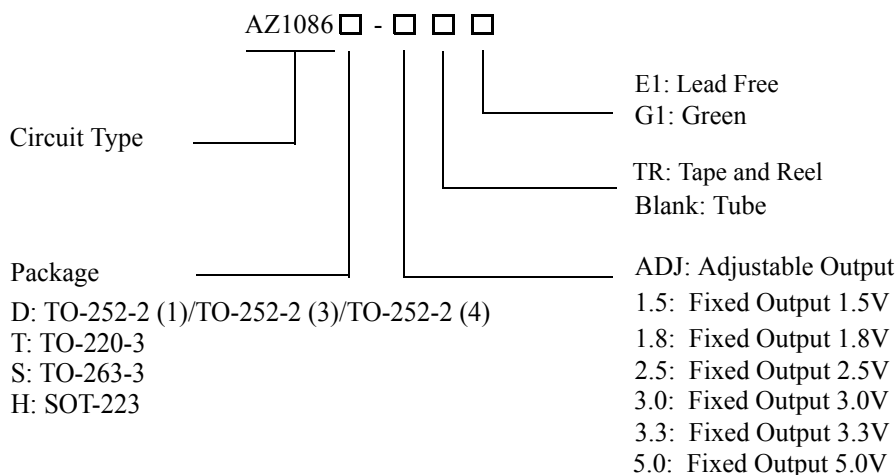
Figure 3. Functional Block Diagram of AZ1086



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Ordering Information



| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|--|-------------------|-----------------|-----------------|---------------|---------------|--------------|
| | | Lead Free | Green | Lead Free | Green | |
| TO-252-2 (1)/ TO-252-2 (3)/ TO-252-2 (4) | 0 to 125°C | AZ1086D-ADJTRE1 | AZ1086D-ADJTRG1 | AZ1086D-ADJE1 | AZ1086D-ADJG1 | Tape & Reel |
| | | AZ1086D-1.5TRE1 | AZ1086D-1.5TRG1 | AZ1086D-1.5E1 | AZ1086D-1.5G1 | Tape & Reel |
| | | AZ1086D-1.8TRE1 | AZ1086D-1.8TRG1 | AZ1086D-1.8E1 | AZ1086D-1.8G1 | Tape & Reel |
| | | AZ1086D-2.5TRE1 | AZ1086D-2.5TRG1 | AZ1086D-2.5E1 | AZ1086D-2.5G1 | Tape & Reel |
| | | AZ1086D-3.0TRE1 | AZ1086D-3.0TRG1 | AZ1086D-3.0E1 | AZ1086D-3.0G1 | Tape & Reel |
| | | AZ1086D-3.3TRE1 | AZ1086D-3.3TRG1 | AZ1086D-3.3E1 | AZ1086D-3.3G1 | Tape & Reel |
| | | AZ1086D-5.0TRE1 | AZ1086D-5.0TRG1 | AZ1086D-5.0E1 | AZ1086D-5.0G1 | Tape & Reel |
| TO-220-3 | 0 to 125°C | AZ1086T-ADJE1 | AZ1086T-ADJG1 | AZ1086T-ADJE1 | AZ1086T-ADJG1 | Tube |
| | | AZ1086T-1.5E1 | AZ1086T-1.5G1 | AZ1086T-1.5E1 | AZ1086T-1.5G1 | Tube |
| | | AZ1086T-1.8E1 | AZ1086T-1.8G1 | AZ1086T-1.8E1 | AZ1086T-1.8G1 | Tube |
| | | AZ1086T-2.5E1 | AZ1086T-2.5G1 | AZ1086T-2.5E1 | AZ1086T-2.5G1 | Tube |
| | | AZ1086T-3.0E1 | AZ1086T-3.0G1 | AZ1086T-3.0E1 | AZ1086T-3.0G1 | Tube |
| | | AZ1086T-3.3E1 | AZ1086T-3.3G1 | AZ1086T-3.3E1 | AZ1086T-3.3G1 | Tube |
| | | AZ1086T-5.0E1 | AZ1086T-5.0G1 | AZ1086T-5.0E1 | AZ1086T-5.0G1 | Tube |



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Ordering Information (Continued)

| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|----------|-------------------|-----------------|-----------------|---------------|---------------|--------------|
| | | Lead Free | Green | Lead Free | Green | |
| TO-263-3 | 0 to 125°C | AZ1086S-ADJE1 | AZ1086S-ADJG1 | AZ1086S-ADJE1 | AZ1086S-ADJG1 | Tube |
| | | AZ1086S-ADJTRE1 | AZ1086S-ADJTRG1 | AZ1086S-ADJE1 | AZ1086S-ADJG1 | Tape & Reel |
| | | AZ1086S-1.5E1 | AZ1086S-1.5G1 | AZ1086S-1.5E1 | AZ1086S-1.5G1 | Tube |
| | | AZ1086S-1.5TRE1 | AZ1086S-1.5TRG1 | AZ1086S-1.5E1 | AZ1086S-1.5G1 | Tape & Reel |
| | | AZ1086S-1.8E1 | AZ1086S-1.8G1 | AZ1086S-1.8E1 | AZ1086S-1.8G1 | Tube |
| | | AZ1086S-1.8TRE1 | AZ1086S-1.8TRG1 | AZ1086S-1.8E1 | AZ1086S-1.8G1 | Tape & Reel |
| | | AZ1086S-2.5E1 | AZ1086S-2.5G1 | AZ1086S-2.5E1 | AZ1086S-2.5G1 | Tube |
| | | AZ1086S-2.5TRE1 | AZ1086S-2.5TRG1 | AZ1086S-2.5E1 | AZ1086S-2.5G1 | Tape & Reel |
| | | AZ1086S-3.0E1 | AZ1086S-3.0G1 | AZ1086S-3.0E1 | AZ1086S-3.0G1 | Tube |
| | | AZ1086S-3.0TRE1 | AZ1086S-3.0TRG1 | AZ1086S-3.0E1 | AZ1086S-3.0G1 | Tape & Reel |
| | | AZ1086S-3.3E1 | AZ1086S-3.3G1 | AZ1086S-3.3E1 | AZ1086S-3.3G1 | Tube |
| | | AZ1086S-3.3TRE1 | AZ1086S-3.3TRG1 | AZ1086S-3.3E1 | AZ1086S-3.3G1 | Tape & Reel |
| | | AZ1086S-5.0E1 | AZ1086S-5.0G1 | AZ1086S-5.0E1 | AZ1086S-5.0G1 | Tube |
| | | AZ1086S-5.0TRE1 | AZ1086S-5.0TRG1 | AZ1086S-5.0E1 | AZ1086S-5.0G1 | Tape & Reel |
| SOT-223 | 0 to 125°C | AZ1086H-ADJTRE1 | AZ1086H-ADJTRG1 | EH86A | GH86A | Tape & Reel |
| | | AZ1086H-1.5TRE1 | AZ1086H-1.5TRG1 | EH86B | GH86B | Tape & Reel |
| | | AZ1086H-1.8TRE1 | AZ1086H-1.8TRG1 | EH86E | GH86E | Tape & Reel |
| | | AZ1086H-2.5TRE1 | AZ1086H-2.5TRG1 | EH86C | GH86C | Tape & Reel |
| | | AZ1086H-3.0TRE1 | AZ1086H-3.0TRG1 | EH86G | GH86G | Tape & Reel |
| | | AZ1086H-3.3TRE1 | AZ1086H-3.3TRG1 | EH86D | GH86D | Tape & Reel |
| | | AZ1086H-5.0TRE1 | AZ1086H-5.0TRG1 | EH86F | GH86F | Tape & Reel |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

**1.5A LOW DROPOUT LINEAR REGULATOR****AZ1086****Absolute Maximum Ratings (Note 1)**

| Parameter | Symbol | Value | | Unit |
|-------------------------------------|---------------|--|-----|------|
| Operating Junction Temperature | T_J | 150 | | °C |
| Storage Temperature Range | T_{STG} | -65 to 150 | | °C |
| Lead Temperature (Soldering, 10sec) | T_{LEAD} | 260 | | °C |
| Thermal Resistance (Note 2) | θ_{JA} | TO-252-2 (1)/ TO-252-2 (3)/ TO-252-2 (4) | 100 | °C/W |
| | | TO-263-3 | 60 | |
| | | TO-220-3 | 60 | |
| | | SOT-223 | 120 | |
| 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.

Note 2: Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its operating ratings. The maximum allowable power dissipation is a function of the maximum junction temperature, $T_{J(max)}$, the junction-to-ambient thermal resistance, θ_{JA} , and the ambient temperature, T_A . The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{D(max)} = (T_{J(max)} - T_A) / \theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|--------------------------------------|----------|-----|-----|------|
| Input Voltage | V_{IN} | | 15 | V |
| Operating Junction Temperature Range | T_J | 0 | 125 | °C |



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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°C to 125°C . ($P_D \leq$ maximum power dissipation, see Note 3.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|------------------|--|-----------------------|-----------------------|-----------------------|---------------------------|
| Reference Voltage | V_{REF} | AZ1086-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 1.225 | 1.250 1.250 | 1.262 1.270 | V |
| Output Voltage | V_{OUT} | AZ1086-1.5, $I_{OUT}=10\text{mA}$, $V_{IN}=3.5\text{V}$, $T_J=25^\circ\text{C}$, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $3\text{V} \leq V_{IN} \leq 10\text{V}$ | 1.485 1.47 | 1.5 1.5 | 1.515 1.53 | V |
| | | AZ1086-1.8, $I_{OUT}=10\text{mA}$, $V_{IN}=3.8\text{V}$, $T_J=25^\circ\text{C}$, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $3.2\text{V} \leq V_{IN} \leq 10\text{V}$ | 1.782 1.746 | 1.8 1.8 | 1.818 1.854 | V |
| | | AZ1086-2.5, $I_{OUT}=10\text{mA}$, $V_{IN}=4.5\text{V}$, $T_J=25^\circ\text{C}$, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $3.9\text{V} \leq V_{IN} \leq 10\text{V}$ | 2.475 2.45 | 2.5 2.5 | 2.525 2.55 | V |
| | | AZ1086-3.0, $I_{OUT}=10\text{mA}$, $V_{IN}=4.5\text{V}$, $T_J=25^\circ\text{C}$, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $4.9\text{V} \leq V_{IN} \leq 10\text{V}$ | 2.97 2.94 | 3.0 3.0 | 3.03 3.06 | V |
| | | AZ1086-3.3, $I_{OUT}=10\text{mA}$, $V_{IN}=5\text{V}$, $T_J=25^\circ\text{C}$, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $4.75\text{V} \leq V_{IN} \leq 10\text{V}$ | 3.267 3.235 | 3.3 3.3 | 3.333 3.365 | V |
| | | AZ1086-5.0, $I_{OUT}=10\text{mA}$, $V_{IN}=7\text{V}$, $T_J=25^\circ\text{C}$, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $6.5\text{V} \leq V_{IN} \leq 10\text{V}$ | 4.95 4.9 | 5 5 | 5.05 5.1 | V |
| Line Regulation | ΔV_{OUT} | AZ1086-ADJ, $I_{OUT} = 10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.015 0.035 | 0.2 0.2 | % |
| | | AZ1086-1.5, $I_{OUT}=10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.3 0.6 | 6 6 | mV |
| | | AZ1086-1.8, $I_{OUT}=10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.3 0.6 | 6 6 | mV |
| | | AZ1086-2.5, $I_{OUT}=10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.3 0.6 | 6 6 | mV |
| | | AZ1086-3.0, $I_{OUT}=10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.3 0.6 | 6 6 | mV |
| | | AZ1086-3.3, $I_{OUT}=10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.5 1 | 10 10 | mV |
| | | AZ1086-5.0, $I_{OUT}=10\text{mA}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 10\text{V}$ | | 0.5 1 | 10 10 | mV |
| Thermal Resistance, Junction to Case | θ_{JC} | TO-220-3 | | 7.22 | | $^\circ\text{C}/\text{W}$ |
| | | TO-252-2 (1)/TO-252-2 (3)/TO-252-2 (4) | | 12.81 | | |
| | | TO-263-3 | | 7.22 | | |
| | | SOT-223 | | 19.35 | | |



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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 junction temperature range for operation, 0°C to 125°C . ($P_D \leq$ maximum power dissipation, see Note 3.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-----------------------------|------------------|---|-----------|-------------------|-------------------|--------------------|
| Load Regulation | ΔV_{OUT} | AZ1086-ADJ, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | 0.1 0.2 | 0.3 0.4 | % |
| | | AZ1086-1.5, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | 3 6 | 12 20 | mV |
| | | AZ1086-1.8, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | 3 6 | 12 20 | mV |
| | | AZ1086-2.5, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | 3 6 | 12 20 | mV |
| | | AZ1086-3.0, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | 3 7 | 15 20 | mV |
| | | AZ1086-3.3, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | 3 7 | 15 20 | mV |
| | | AZ1086-5.0, $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $V_{IN} - V_{OUT} = 2\text{V}$ | | | 5 10 | 20 35 |
| Dropout Voltage | V_{DROP} | $I_{OUT} = 1.5\text{A}$, $\Delta V_{REF} = 1\%$ | | 1.3 | 1.5 | V |
| Current Limit | I_{LIMIT} | $V_{IN} - V_{OUT} = 2\text{V}$ | 1.5 | 2.3 | | A |
| Minimum Load Current | $I_{LOAD(MIN)}$ | $1.4\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$ (For ADJ) | | 2 | 5 | mA |
| Quiescent Current | I_Q | $V_{IN} = V_{OUT} + 1.3\text{V}$ | | 5 | 10 | mA |
| Ripple Rejection | PSRR | $f_{RIPPLE} = 120\text{Hz}$, $C_{OUT} = 25\mu\text{F}$ Tantalum, $I_{OUT} = 1.5\text{A}$, $V_{IN} - V_{OUT} = 3\text{V}$ | 60 | 75 | | dB |
| Adjust Pin Current | I_{ADJ} | | | 60 | 120 | μA |
| Adjust Pin Current Change | ΔI_{ADJ} | $10\text{mA} \leq I_{OUT} \leq 1.5\text{A}$, $1.4\text{V} \leq V_{IN} - V_{OUT} \leq 10\text{V}$ | | 0.2 | 5 | μA |
| Temperature Stability | | | | 0.5 | | % |
| 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 | | $^{\circ}\text{C}$ |

Note 3: Maximum power dissipation see Figure 5.



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Typical Performance Characteristics

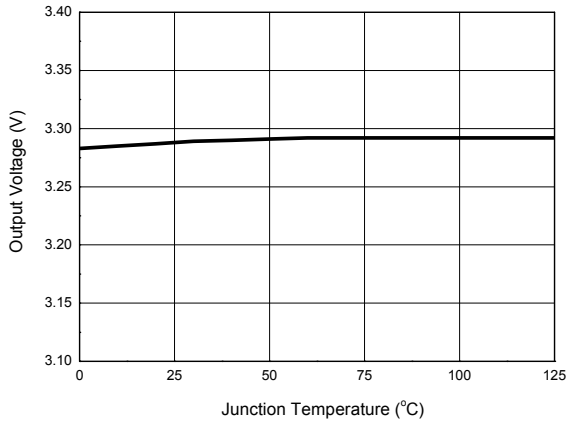


Figure 4. Output Voltage vs. Junction Temperature

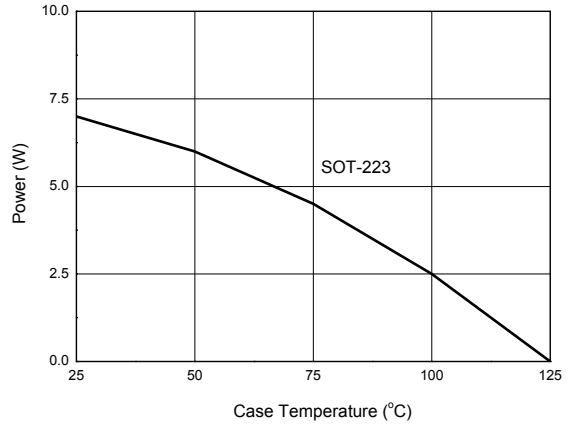


Figure 5. Maximum Power Dissipation

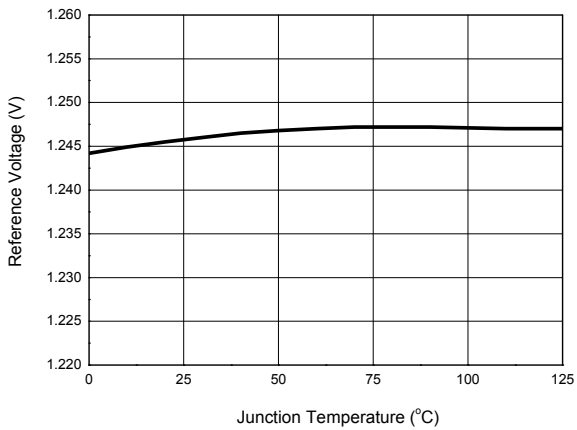


Figure 6. Reference Voltage vs. Junction Temperature

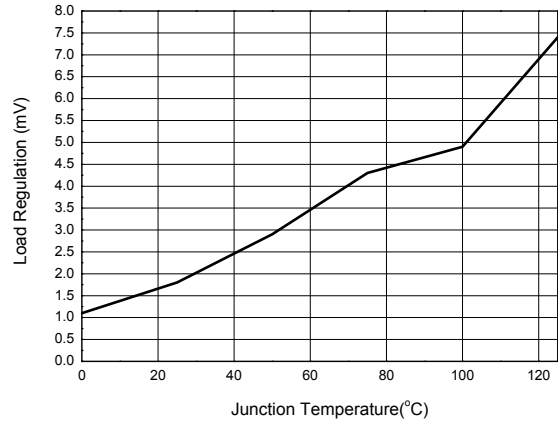


Figure 7. Load Regulation vs. Junction Temperature



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Typical Performance Characteristics (Continued)

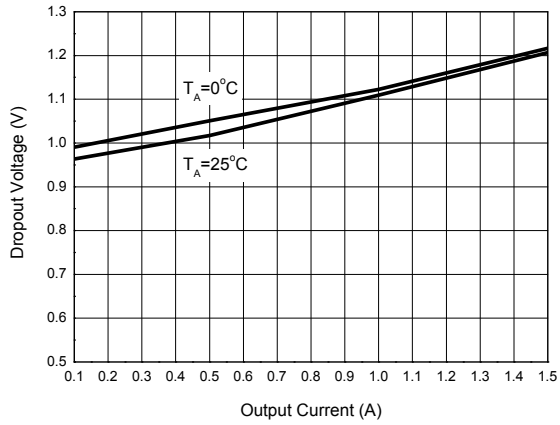


Figure 8. Dropout Voltage vs. Output Current

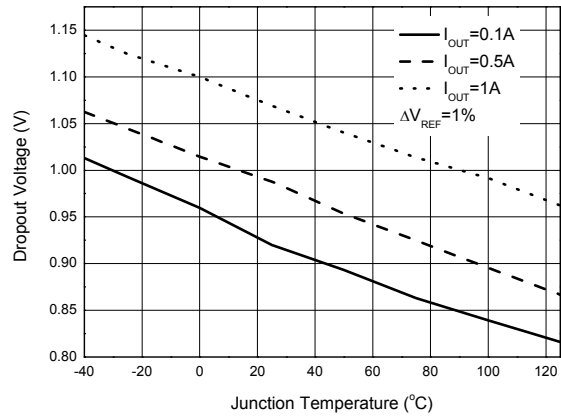


Figure 9. Dropout Voltage vs. Junction Temperature

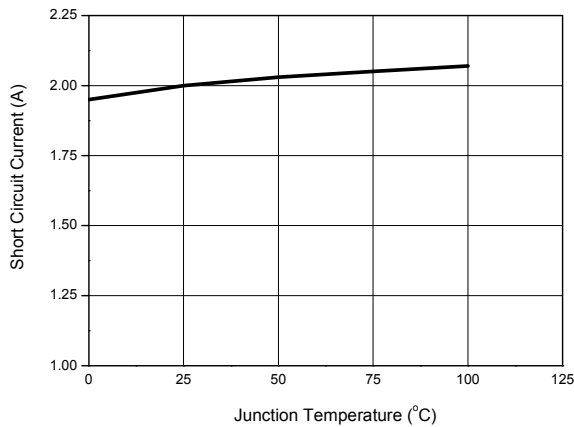


Figure 10. Short Circuit Current vs. Junction Temperature

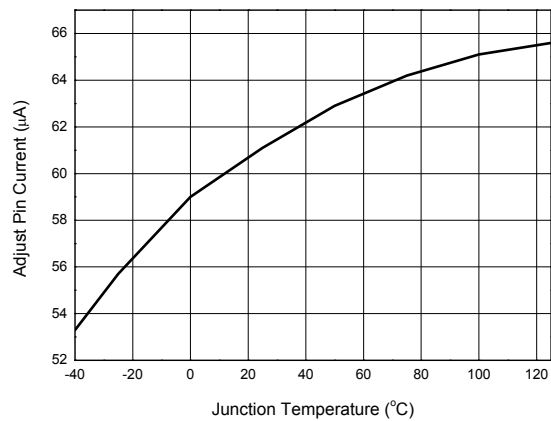


Figure 11. Adjust Pin Current vs. Junction Temperature



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Typical Performance Characteristics (Continued)

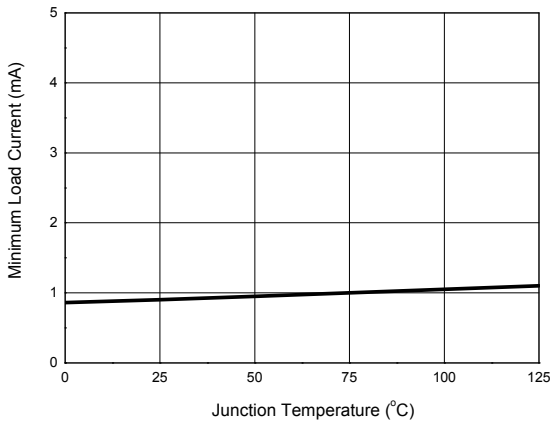


Figure 12. Minimum Load Current vs. Junction Temperature

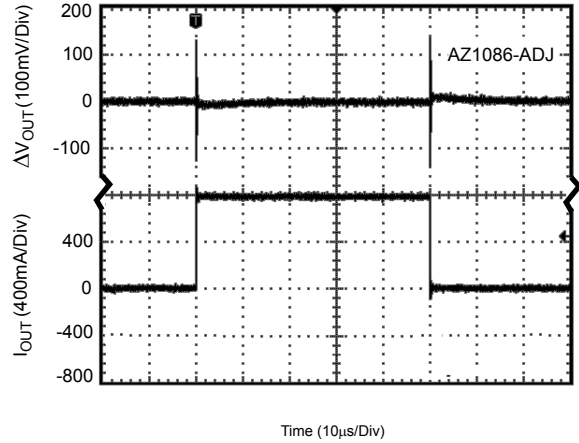


Figure 13. Load Transient Response
(Conditions: $V_{IN}=4.8V$, $V_{OUT}=3.3V$, $I_{OUT}=0.1$ to $0.75A$,
 $C_{IN}=C_{OUT}=10\mu F$)

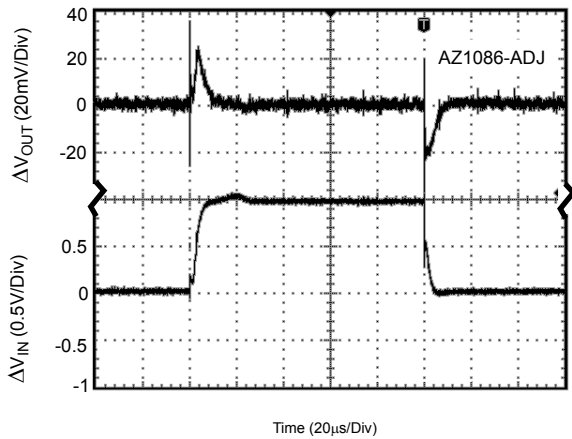


Figure 14. Line Transient Response
(Conditions: $V_{IN}=4.8V$ to $5.8V$, $V_{OUT}=3.3V$, $I_{OUT}=0.1A$,
 $C_{IN}=1\mu F$, $C_{OUT}=10\mu F$)

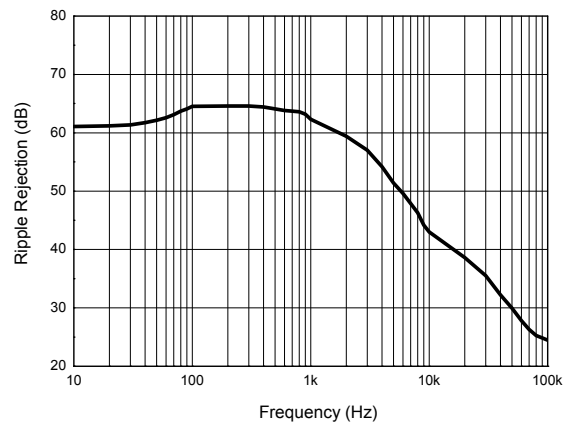


Figure 15. Ripple Rejection vs. Frequency

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Typical Application

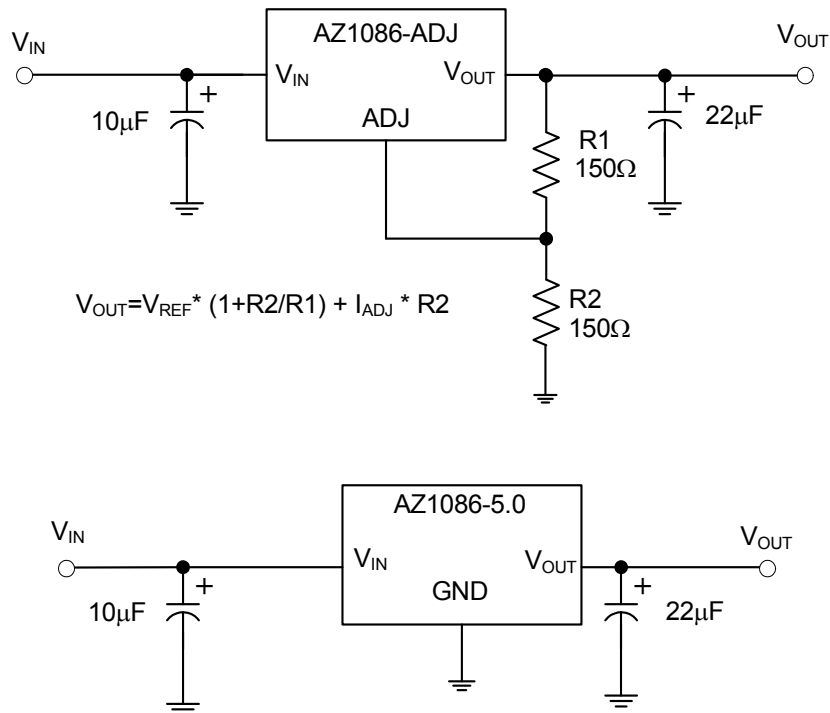


Figure 16. Typical Applications of AZ1086



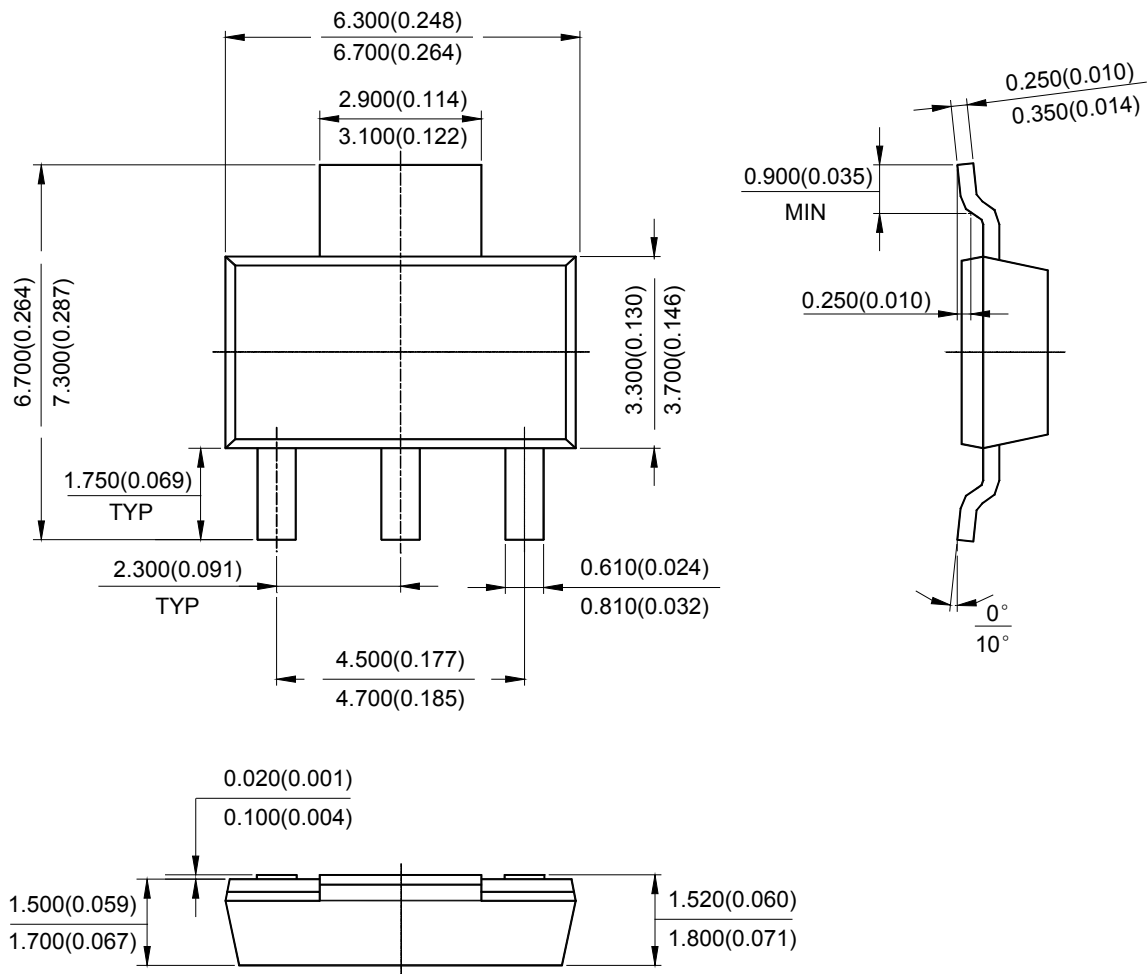
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Mechanical Dimensions (Continued)

SOT-223

Unit: mm(inch)





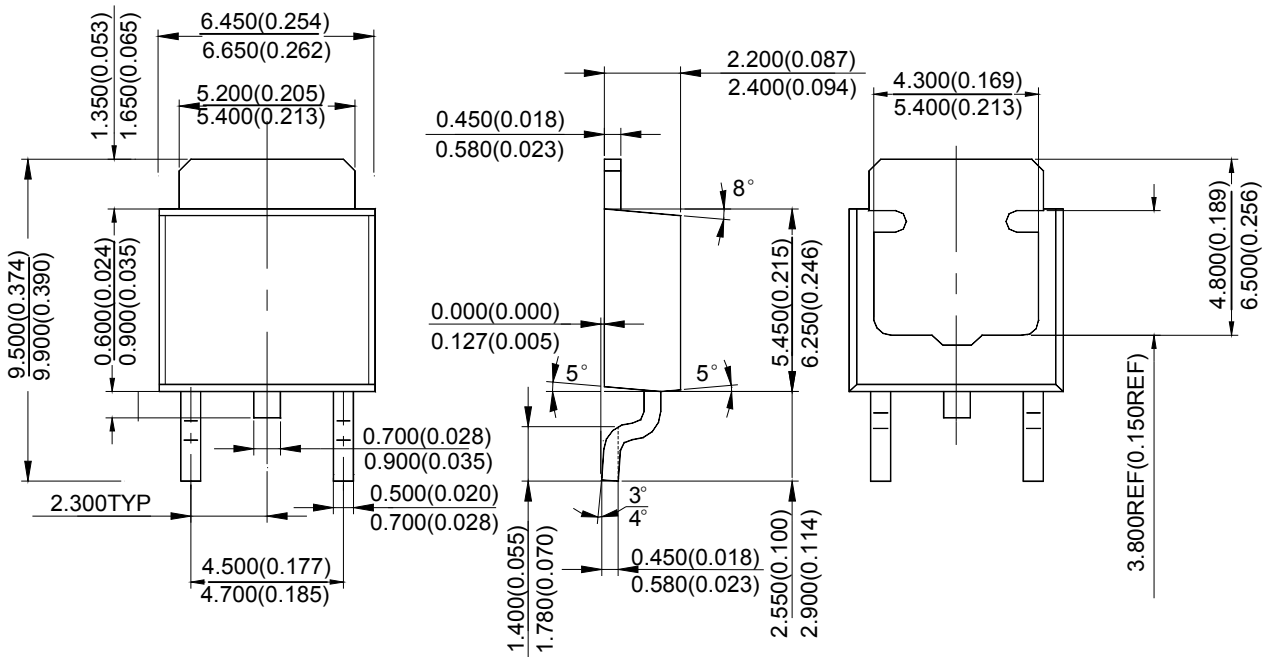
1.5A LOW DROPOUT LINEAR REGULATOR

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Mechanical Dimensions (Continued)

TO-252-2 (1)

Unit: mm(inch)





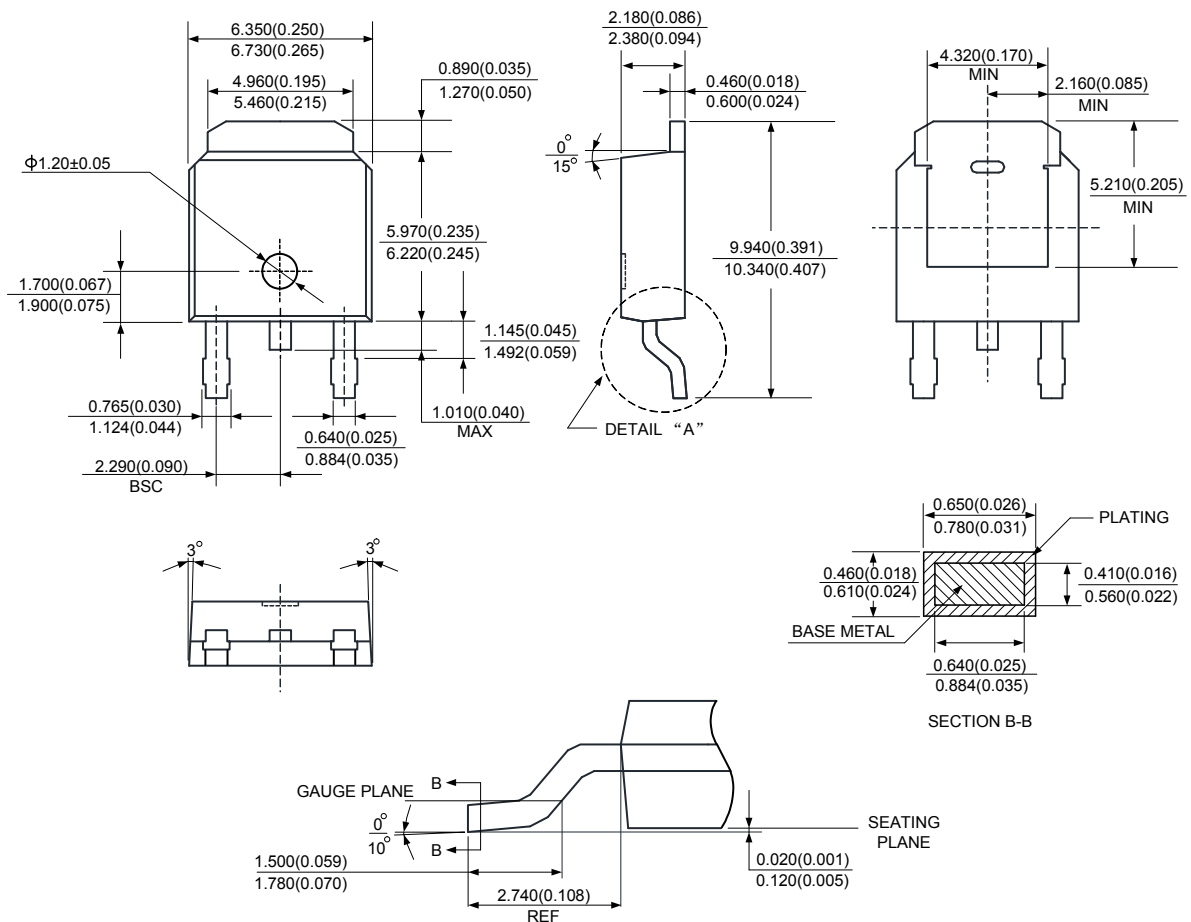
1.5A LOW DROPOUT LINEAR REGULATOR

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Mechanical Dimensions (Continued)

TO-252-2 (4)

Unit: mm(inch)





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