

5A LOW DROPOUT LINEAR REGULATOR

Description

The AZ1084 is a series of low dropout positive voltage regulators with a maximum dropout of 1.5V at 5A of load current.

The series features on-chip thermal limiting which provides protection against any combination of overload and ambient temperatures that would create excessive junction temperatures. It also includes a trimmed band-gap reference and a current limiting circuit.

The AZ1084 is available in 1.5V, 1.8V, 2.5V, 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 two external resistors.

The AZ1084 series is available in standard packages of TO263, TO-263-2, TO-220-3, TO-252-2 (3), TO-252-2 (4) and TO-252-2 (5).

Features

- Low Dropout Voltage: 1.3V Typical at 5A
- Current Limiting and Thermal Protection
- Output Current: 5A
- Current Limit: 6.5A
- Operating Junction Temperature Range: 0 to +125°C
- Line Regulation (Adj Version): 0.015% (Typical)
- Load Regulation (Adj Version): 0.1% (Typical)
- Lead-Free Packages: TO263, TO-263-2, TO-220-3, TO-252-2 (3), TO-252-2 (4), TO-252-2 (5)
 - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in "Green" Molding Compound: TO263, TO-263-2, TO-220-3, TO-252-2 (3), TO-252-2 (4), TO-252-2 (5)
 - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
 - **Halogen and Antimony Free. "Green" Device (Note 3)**

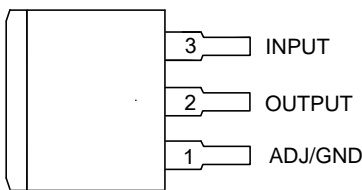
Applications

- High Efficiency Linear Regulators
- Battery Chargers
- Post Regulation for Switching Supply
- Microprocessor Supply
- Desktop PCs, RISC and Embedded Processors' Supply

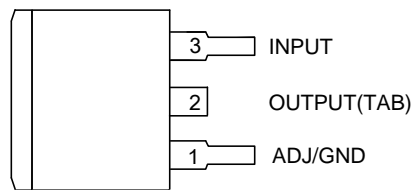
Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Assignments

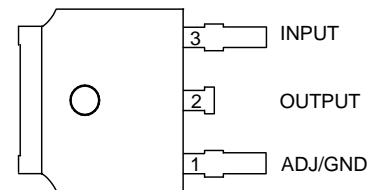
S Package
(TO263)



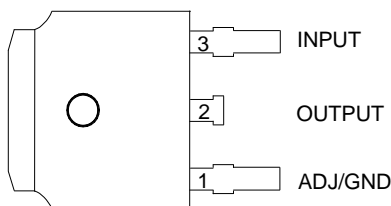
S2 Package
(TO-263-2)



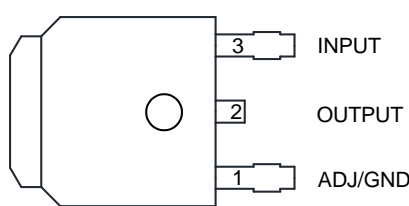
D Package
(TO-252-2 (3) (Option 1))



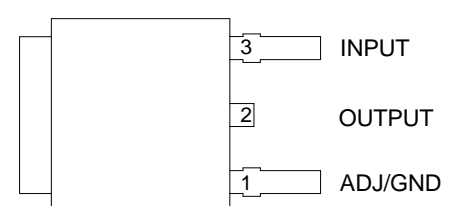
(TO-252-2 (3) (Option 2))



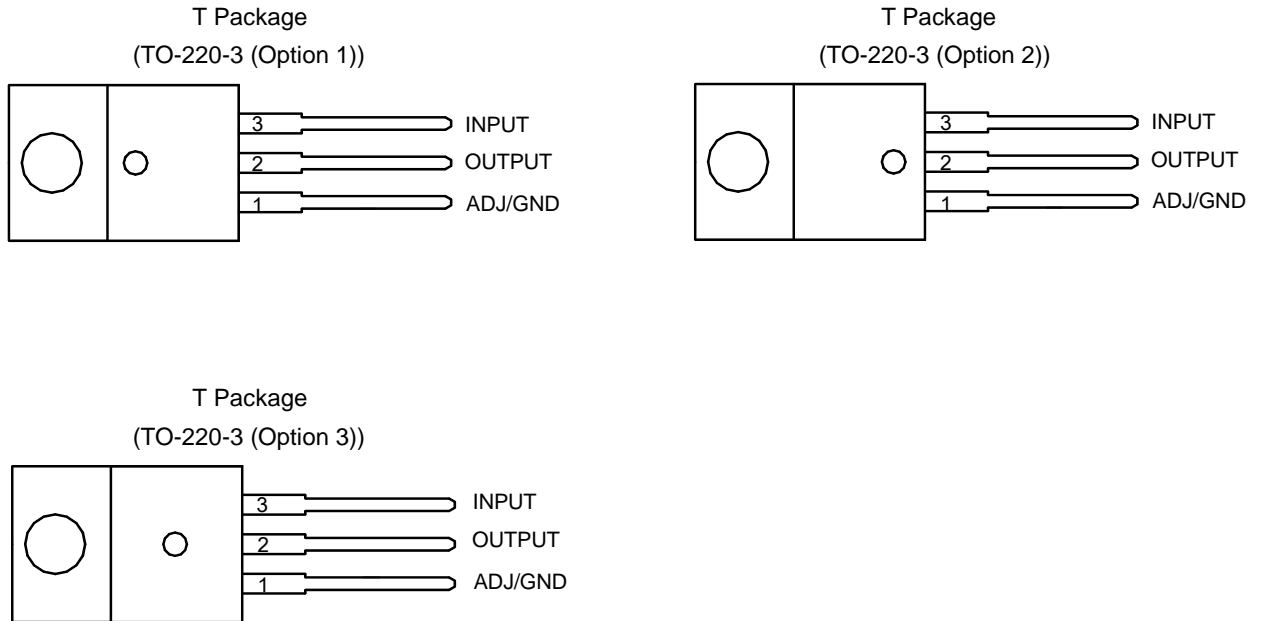
D Packages
(TO-252-2 (4))



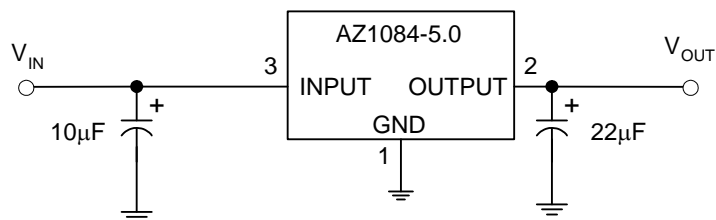
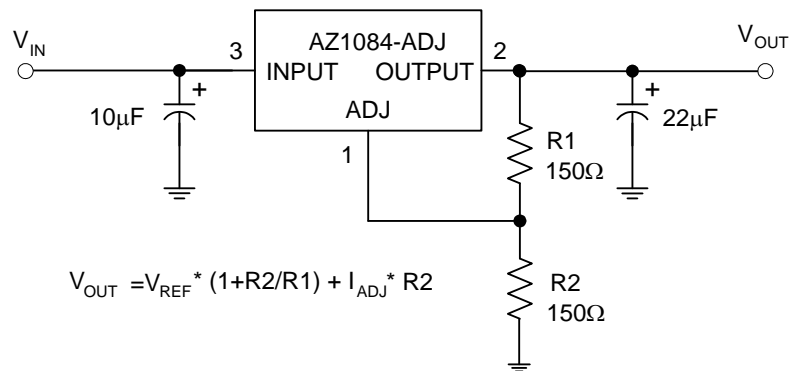
(TO-252-2 (5))



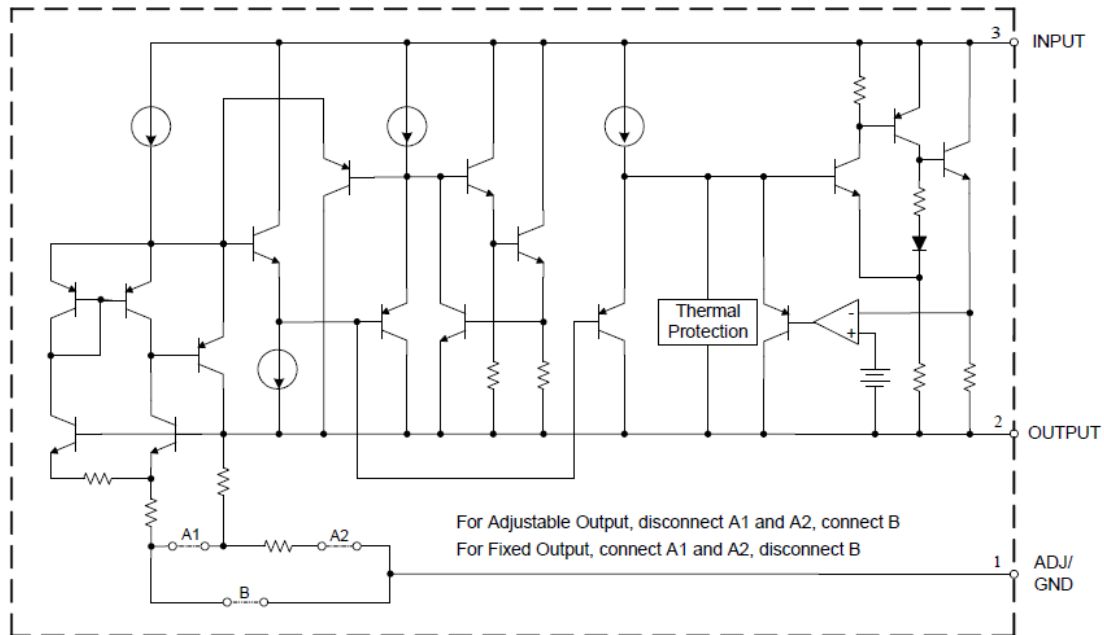
Pin Assignments (Cont.)



Typical Applications Circuit



Functional Block Diagram



Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | Rating | | Unit |
|-------------------|---------------------------------------|--|-----|------|
| T _J | Operating Junction Temperature | +150 | | °C |
| T _{STG} | Storage Temperature Range | -65 to +150 | | °C |
| T _{LEAD} | Lead Temperature (Soldering, 10 sec.) | +260 | | °C |
| θ _{JA} | Thermal Resistance (Note 5) | TO-263-2 | 60 | °C/W |
| | | TO263 | 60 | |
| | | TO-220-3 | 60 | |
| | | TO-252-2 (3)/TO-252-2 (4)/TO-252-2 (5) | 100 | |
| ESD | ESD (Human Body Model) | 2000 | | V |
| ESD | ESD (Machine Model) | 400 | | V |

- Notes
- 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.
 - 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)/θ_{JA}. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|----------|--------------------------------------|-----|------|------|
| V_{IN} | Input Voltage | – | 12 | V |
| T_J | Operating Junction Temperature Range | 0 | +125 | °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.)

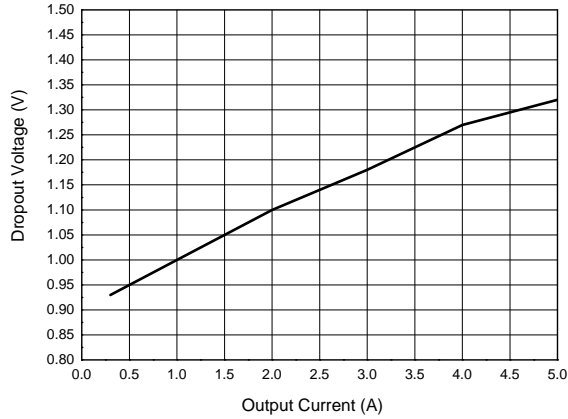
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|-------------------|---|-----------------------|-----------------------|-----------------------|------|
| V_{REF} | Reference Voltage | AZ1084-ADJ, $I_{OUT} = 10\text{mA}$, $V_{IN}-V_{OUT} = 3\text{V}$, $10\text{mA} \leq I_{OUT} \leq 5\text{A}$, $1.5\text{V} \leq V_{IN}-V_{OUT} \leq 5\text{V}$ | 1.238 1.225 | 1.250 1.250 | 1.262 1.270 | V |
| V_{OUT} | Output Voltage | AZ1084-1.5, $I_{OUT} = 0\text{mA}$, $V_{IN} = 4.5\text{V}$, $10\text{mA} \leq I_{OUT} \leq 5\text{A}$, $3.0\text{V} \leq V_{IN} \leq 6\text{V}$ | 1.485 1.47 | 1.5 1.5 | 1.515 1.53 | V |
| | | AZ1084-1.8, $I_{OUT} = 0\text{mA}$, $V_{IN} = 4.8\text{V}$, $10\text{mA} \leq I_{OUT} \leq 5\text{A}$, $3.3\text{V} \leq V_{IN} \leq 6\text{V}$ | 1.782 1.764 | 1.8 1.8 | 1.818 1.836 | V |
| | | AZ1084-2.5, $I_{OUT} = 0\text{mA}$, $V_{IN} = 5.5\text{V}$, $10\text{mA} \leq I_{OUT} \leq 5\text{A}$, $4.0\text{V} \leq V_{IN} \leq 7\text{V}$ | 2.475 2.45 | 2.5 2.5 | 2.525 2.55 | V |
| | | AZ1084-3.3, $I_{OUT} = 0\text{mA}$, $V_{IN} = 6.3\text{V}$, $10\text{mA} \leq I_{OUT} \leq 5\text{A}$, $4.8\text{V} \leq V_{IN} \leq 8\text{V}$ | 3.267 3.234 | 3.3 3.3 | 3.333 3.366 | V |
| | | AZ1084-5.0, $I_{OUT} = 0\text{mA}$, $V_{IN} = 8\text{V}$, $10\text{mA} \leq I_{OUT} \leq 5\text{A}$, $6.5\text{V} \leq V_{IN} \leq 10\text{V}$ | 4.95 4.9 | 5 5 | 5.05 5.1 | V |
| ΔV_{OUT} | Line Regulation | AZ1084-ADJ, $I_{OUT} = 10\text{mA}$, $2.85\text{V} \leq V_{IN} \leq 10\text{V}$ | – | 0.015 0.035 | 0.2 0.2 | % |
| | | AZ1084-1.5, $I_{OUT} = 10\text{mA}$, $3.0\text{V} \leq V_{IN} \leq 10\text{V}$ | – | 0.5 1 | 6 6 | mV |
| | | AZ1084-1.8, $I_{OUT} = 10\text{mA}$, $3.3\text{V} \leq V_{IN} \leq 10\text{V}$ | – | 0.5 1 | 6 6 | mV |
| | | AZ1084-2.5, $I_{OUT} = 10\text{mA}$, $4.0\text{V} \leq V_{IN} \leq 10\text{V}$ | – | 0.5 1 | 6 6 | mV |
| | | AZ1084-3.3, $I_{OUT} = 10\text{mA}$, $4.8\text{V} \leq V_{IN} \leq 10\text{V}$ | – | 0.5 1 | 6 6 | mV |
| | | AZ1084-5.0, $I_{OUT} = 10\text{mA}$, $6.5\text{V} \leq V_{IN} \leq 10\text{V}$ | – | 0.5 1 | 10 10 | mV |
| ΔV_{OUT} | Load Regulation | AZ1084-ADJ, $0\text{mA} \leq I_{OUT} \leq 5\text{A}$, $V_{IN}-V_{OUT} = 3\text{V}$ | – | 0.1 0.2 | 0.3 0.4 | % |
| | | AZ1084-1.5, $0\text{mA} \leq I_{OUT} \leq 5\text{A}$, $V_{IN}-V_{OUT} = 3\text{V}$ | – | 3 7 | 15 20 | mV |
| | | AZ1084-1.8, $0\text{mA} \leq I_{OUT} \leq 5\text{A}$, $V_{IN}-V_{OUT} = 3\text{V}$ | – | 3 7 | 15 20 | mV |
| | | AZ1084-2.5, $0\text{mA} \leq I_{OUT} \leq 5\text{A}$, $V_{IN}-V_{OUT} = 3\text{V}$ | – | 3 7 | 15 20 | mV |
| | | AZ1084-3.3, $0\text{mA} \leq I_{OUT} \leq 5\text{A}$, $V_{IN}-V_{OUT} = 3\text{V}$ | – | 3 7 | 15 20 | mV |
| | | AZ1084-5.0, $0\text{mA} \leq I_{OUT} \leq 5\text{A}$, $V_{IN}-V_{OUT} = 3\text{V}$ | – | 5 10 | 20 35 | mV |

Electrical Characteristics (Cont. 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.)

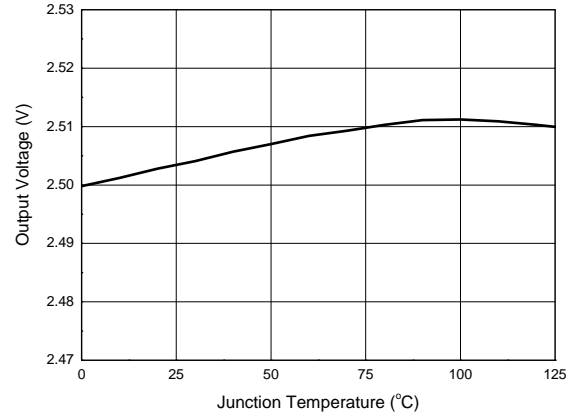
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------|------------------------------------|--|-----------|------------|------------|--------------------|
| V_{DROP} | Dropout Voltage | $I_{\text{OUT}} = 5\text{A}$, ΔV_{REF} , $\Delta V_{\text{OUT}} = 1\%$ | – | 1.3 | 1.5 | V |
| θ_{JC} | Thermal Resistance | TO-220-3 | – | 4.15 | – | $^\circ\text{C/W}$ |
| | | TO-252-2 (3)/TO-252-2 (4)/TO-252-2 (5) | – | 7.36 | – | |
| | | TO263 | – | 4.15 | – | |
| | | TO-263-2 | – | 4.15 | – | |
| I_{LIMIT} | Current Limit | $V_{\text{IN}} - V_{\text{OUT}} = 3\text{V}$ | 5.5 | 6.5 | – | A |
| $I_{\text{LOAD (MIN)}}$ | Minimum Load Current | $V_{\text{IN}} = 10\text{V}$ (AZ1084-ADJ) | – | 3 | 10 | mA |
| I_{Q} | Quiescent Current | $V_{\text{IN}} = 10\text{V}$ (AZ1084) | – | 5 | 10 | mA |
| PSRR | Ripple Rejection | $f_{\text{RIPPLE}} = 120\text{Hz}$, $C_{\text{OUT}} = 25\mu\text{F}$ Tantalum, $I_{\text{OUT}} = 5\text{A}$, $V_{\text{IN}} - V_{\text{OUT}} = 3\text{V}$ | 60 | 72 | – | dB |
| I_{ADJ} | Adjust Pin Current | $V_{\text{IN}} = 4.25\text{V}$, $I_{\text{OUT}} = 10\text{mA}$ | – | 55 | 120 | μA |
| ΔI_{ADJ} | Adjust Pin Current Change | $10\text{mA} \leq I_{\text{OUT}} \leq 5\text{A}$, $1.5\text{V} \leq (V_{\text{IN}} - V_{\text{OUT}}) \leq 4.5\text{V}$ | – | 0.2 | 5 | μA |
| – | Temperature Stability | $I_{\text{OUT}} = 10\text{mA}$, $V_{\text{IN}} - V_{\text{OUT}} = 1.5$ | – | 0.5 | – | % |
| – | Long Term Stability | $T_{\text{A}} = 125^\circ\text{C}$, 1000Hrs | – | 0.5 | – | % |
| – | RMS Noise (% of V_{OUT}) | $10\text{Hz} \leq f \leq 10\text{kHz}$ | – | 0.003 | – | % |

Typical Performance Characteristics

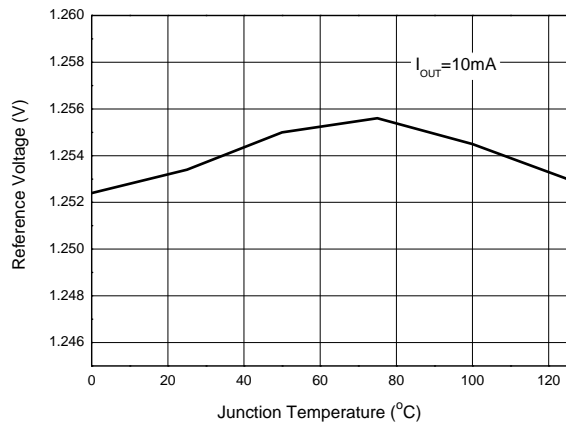
Dropout Voltage vs. Output Current



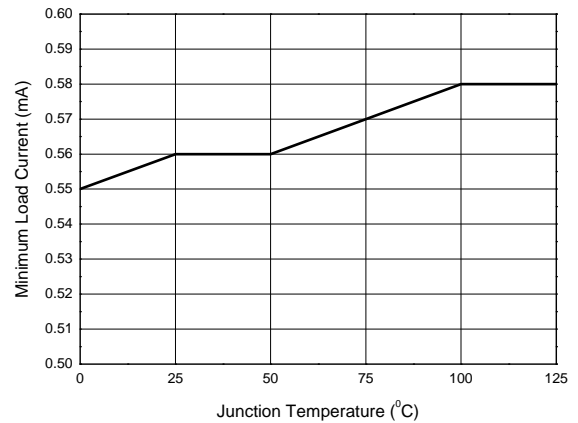
Output Voltage vs. Junction Temperature



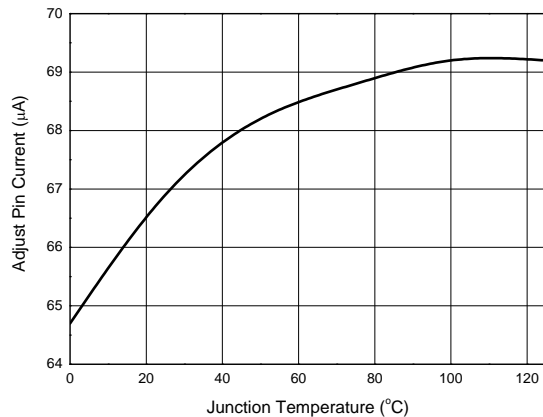
Reference Voltage vs. Junction Temperature



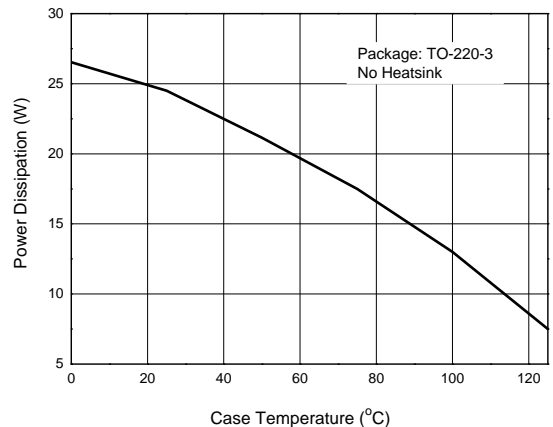
Minimum Load Current vs. Junction Temperature



Adjust Pin Current vs. Junction Temperature

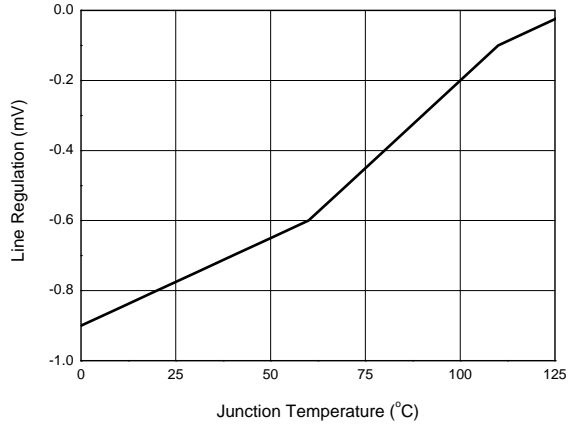


Power Dissipation vs. Case Temperature

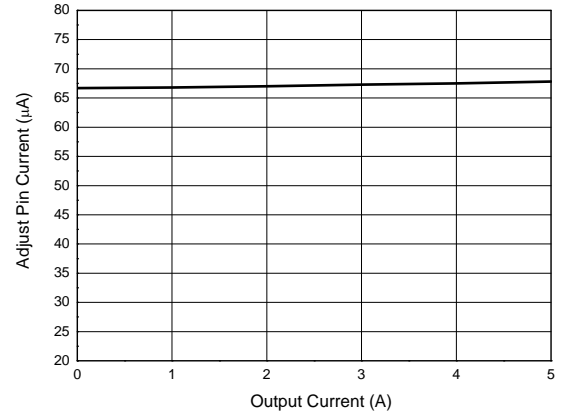


Performance Characteristics (Cont.)

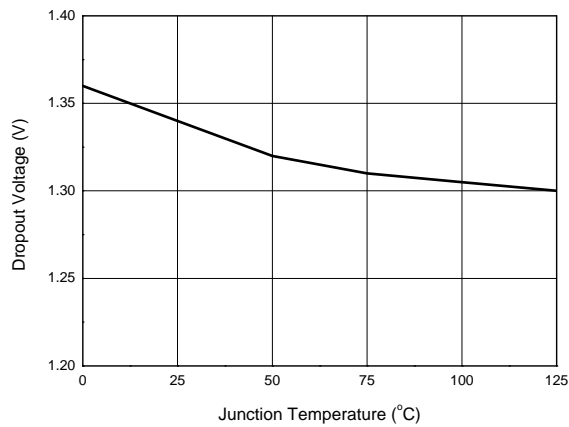
Line Regulation vs. Junction Temperature



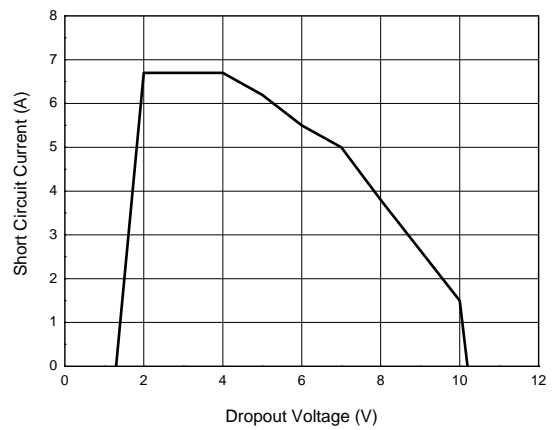
Adjust Pin Current vs. Output Current



Dropout Voltage vs. Junction Temperature

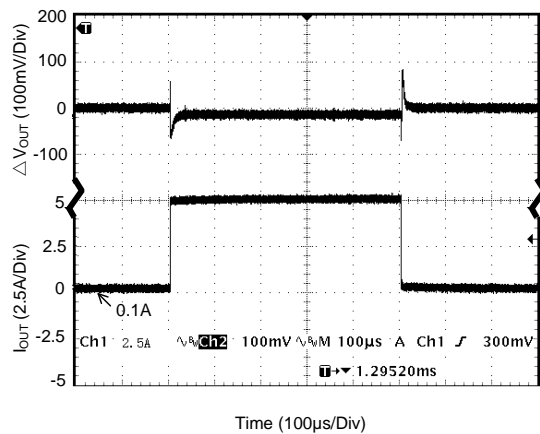


Short Circuit Current vs. Dropout Voltage



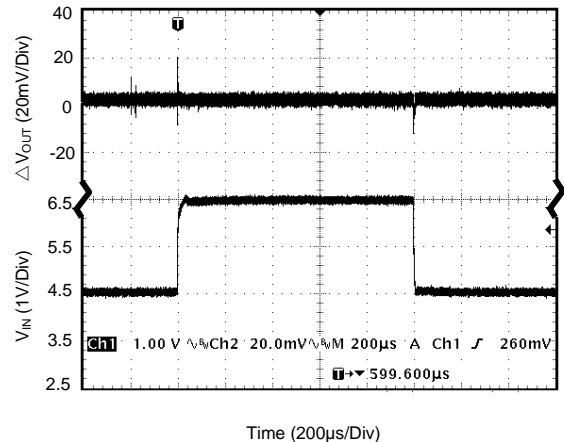
Load Transient Response

(Conditions: $V_{IN} = 5.5V$, $V_{OUT} = 2.5V$, $I_{OUT} = 10mA$ to $5A$
 $C_{IN} = 10\mu F$, $C_{OUT} = 10\mu F$)



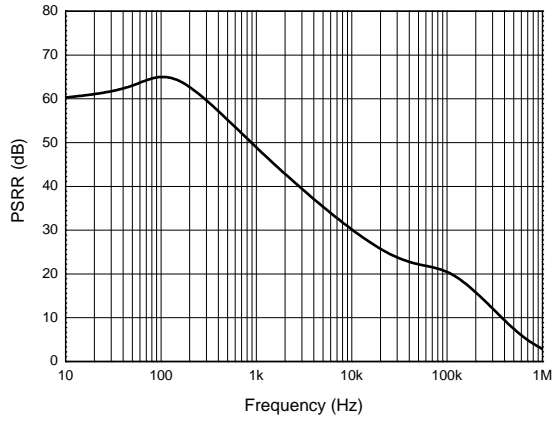
Line Transient Response

(Conditions: $V_{IN} = 4.5V$ to $6.5V$, $V_{OUT} = 2.5V$,
 $I_{OUT} = 200mA$, $C_{OUT} = 10\mu F$)

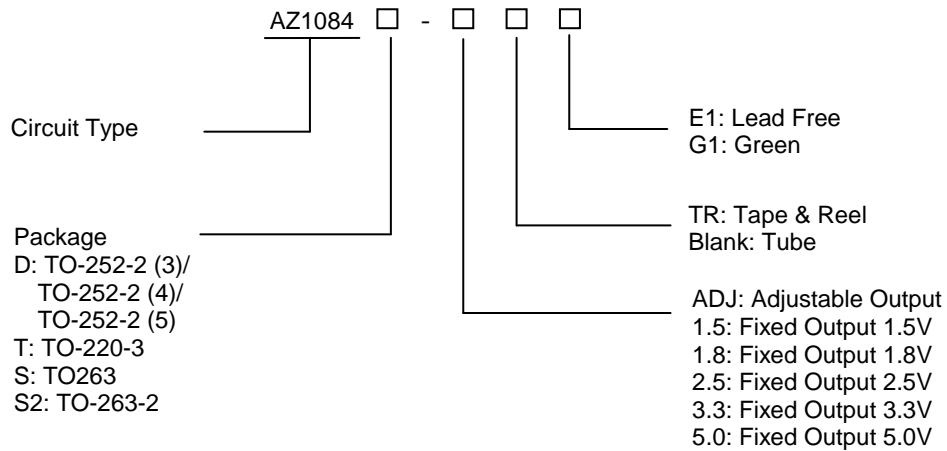


Performance Characteristics (Cont.)

PSRR vs. Frequency



Ordering Information



| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|--|-------------------|-----------------|-----------------|---------------|---------------|--------------|
| | | Lead Free | Green | Lead Free | Green | |
| TO-252-2 (3) /TO-252-2 (4) /TO-252-2 (5) | 0 to +125°C | AZ1084D-ADJTRE1 | AZ1084D-ADJTRG1 | AZ1084D-ADJE1 | AZ1084D-ADJG1 | Tape & Reel |
| | | AZ1084D-1.5TRE1 | AZ1084D-1.5TRG1 | AZ1084D-1.5E1 | AZ1084D-1.5G1 | Tape & Reel |
| | | AZ1084D-1.8TRE1 | AZ1084D-1.8TRG1 | AZ1084D-1.8E1 | AZ1084D-1.8G1 | Tape & Reel |
| | | AZ1084D-2.5TRE1 | AZ1084D-2.5TRG1 | AZ1084D-2.5E1 | AZ1084D-2.5G1 | Tape & Reel |
| | | AZ1084D-3.3TRE1 | AZ1084D-3.3TRG1 | AZ1084D-3.3E1 | AZ1084D-3.3G1 | Tape & Reel |
| | | AZ1084D-5.0TRE1 | AZ1084D-5.0TRG1 | AZ1084D-5.0E1 | AZ1084D-5.0G1 | Tape & Reel |
| TO-220-3 | 0 to +125°C | AZ1084T-ADJE1 | AZ1084T-ADJG1 | AZ1084T-ADJE1 | AZ1084T-ADJG1 | Tube |
| | | AZ1084T-1.5E1 | AZ1084T-1.5G1 | AZ1084T-1.5E1 | AZ1084T-1.5G1 | Tube |
| | | AZ1084T-1.8E1 | AZ1084T-1.8G1 | AZ1084T-1.8E1 | AZ1084T-1.8G1 | Tube |
| | | AZ1084T-2.5E1 | AZ1084T-2.5G1 | AZ1084T-2.5E1 | AZ1084T-2.5G1 | Tube |
| | | AZ1084T-3.3E1 | AZ1084T-3.3G1 | AZ1084T-3.3E1 | AZ1084T-3.3G1 | Tube |
| | | AZ1084T-5.0E1 | AZ1084T-5.0G1 | AZ1084T-5.0E1 | AZ1084T-5.0G1 | Tube |

Ordering Information (Cont.)

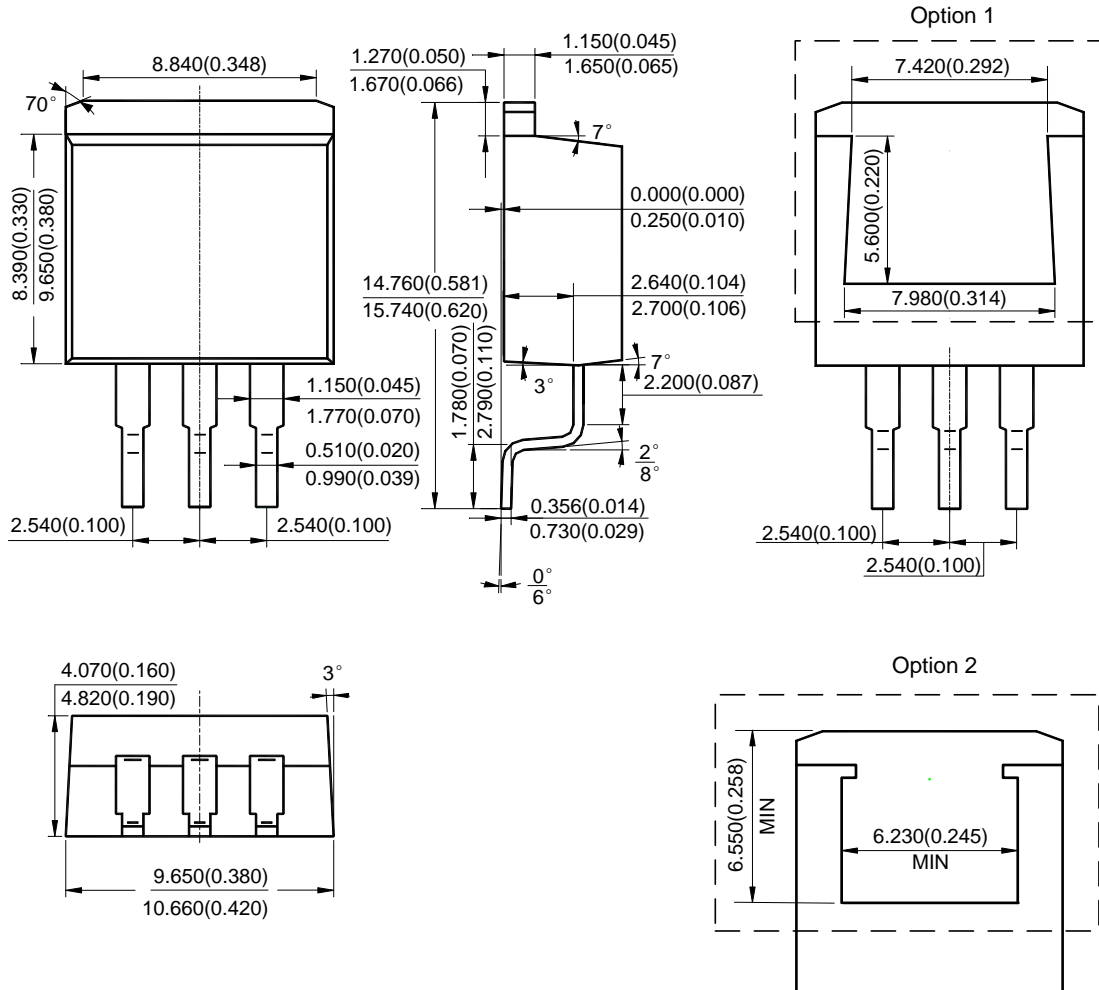


| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|----------|-------------------|------------------|------------------|----------------|----------------|--------------|
| | | Lead Free | Green | Lead Free | Green | |
| TO263 | 0 to +125°C | AZ1084S-ADJTRE1 | AZ1084S-ADJTRG1 | AZ1084S-ADJE1 | AZ1084S-ADJG1 | Tape & Reel |
| | | AZ1084S-1.5TRE1 | AZ1084S-1.5TRG1 | AZ1084S-1.5E1 | AZ1084S-1.5G1 | Tape & Reel |
| | | AZ1084S-1.8TRE1 | AZ1084S-1.8TRG1 | AZ1084S-1.8E1 | AZ1084S-1.8G1 | Tape & Reel |
| | | AZ1084S-2.5TRE1 | AZ1084S-2.5TRG1 | AZ1084S-2.5E1 | AZ1084S-2.5G1 | Tape & Reel |
| | | AZ1084S-3.3TRE1 | AZ1084S-3.3TRG1 | AZ1084S-3.3E1 | AZ1084S-3.3G1 | Tape & Reel |
| | | AZ1084S-5.0TRE1 | AZ1084S-5.0TRG1 | AZ1084S-5.0E1 | AZ1084S-5.0G1 | Tape & Reel |
| TO-263-2 | 0 to +125°C | AZ1084S2-ADJTRE1 | AZ1084S2-ADJTRG1 | AZ1084S2-ADJE1 | AZ1084S2-ADJG1 | Tape & Reel |
| | | AZ1084S2-1.5TRE1 | AZ1084S2-1.5TRG1 | AZ1084S2-1.5E1 | AZ1084S2-1.5G1 | Tape & Reel |
| | | AZ1084S2-1.8TRE1 | AZ1084S2-1.8TRG1 | AZ1084S2-1.8E1 | AZ1084S2-1.8G1 | Tape & Reel |
| | | AZ1084S2-2.5TRE1 | AZ1084S2-2.5TRG1 | AZ1084S2-2.5E1 | AZ1084S2-2.5G1 | Tape & Reel |
| | | AZ1084S2-3.3TRE1 | AZ1084S2-3.3TRG1 | AZ1084S2-3.3E1 | AZ1084S2-3.3G1 | Tape & Reel |
| | | AZ1084S2-5.0TRE1 | AZ1084S2-5.0TRG1 | AZ1084S2-5.0E1 | AZ1084S2-5.0G1 | 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.

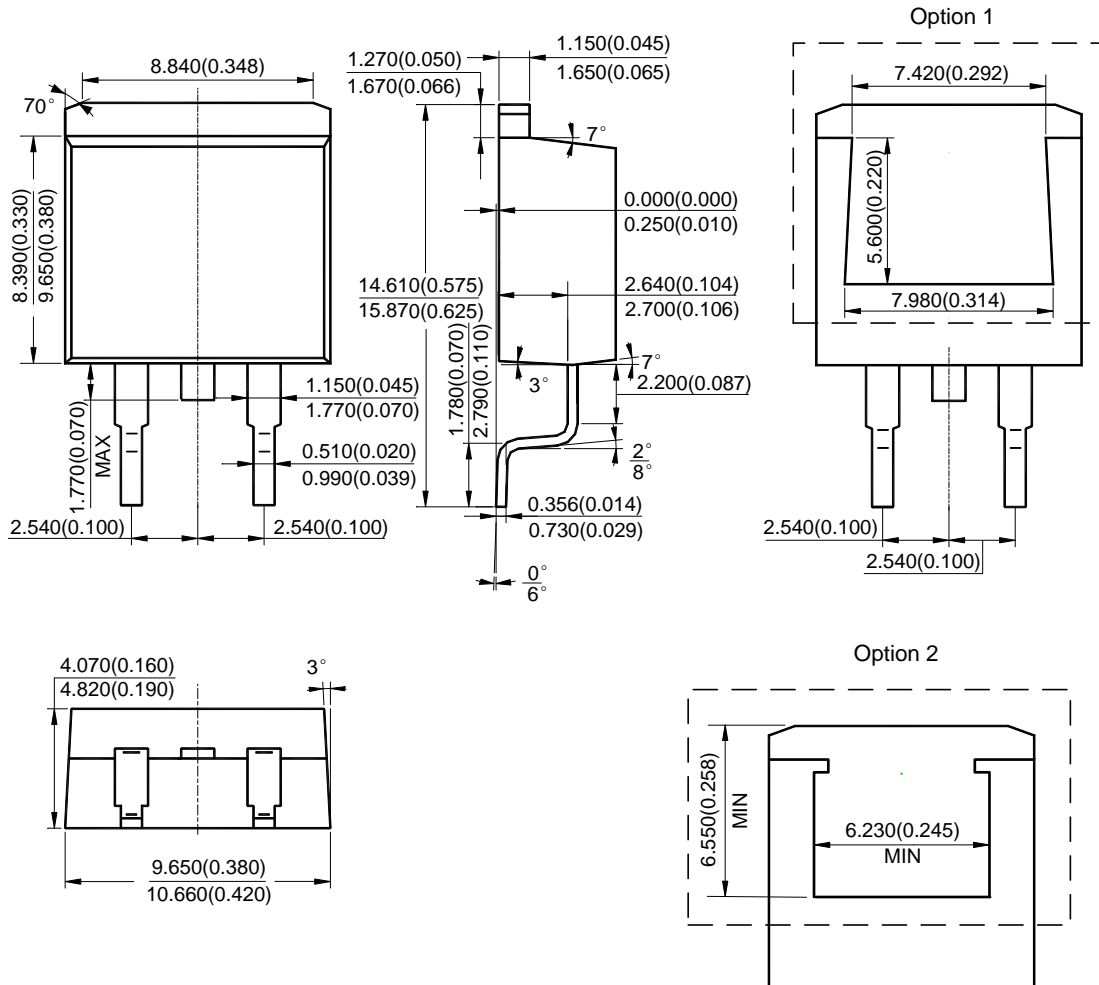
Package Outline Dimensions (All dimensions in mm(inch).)

TO263



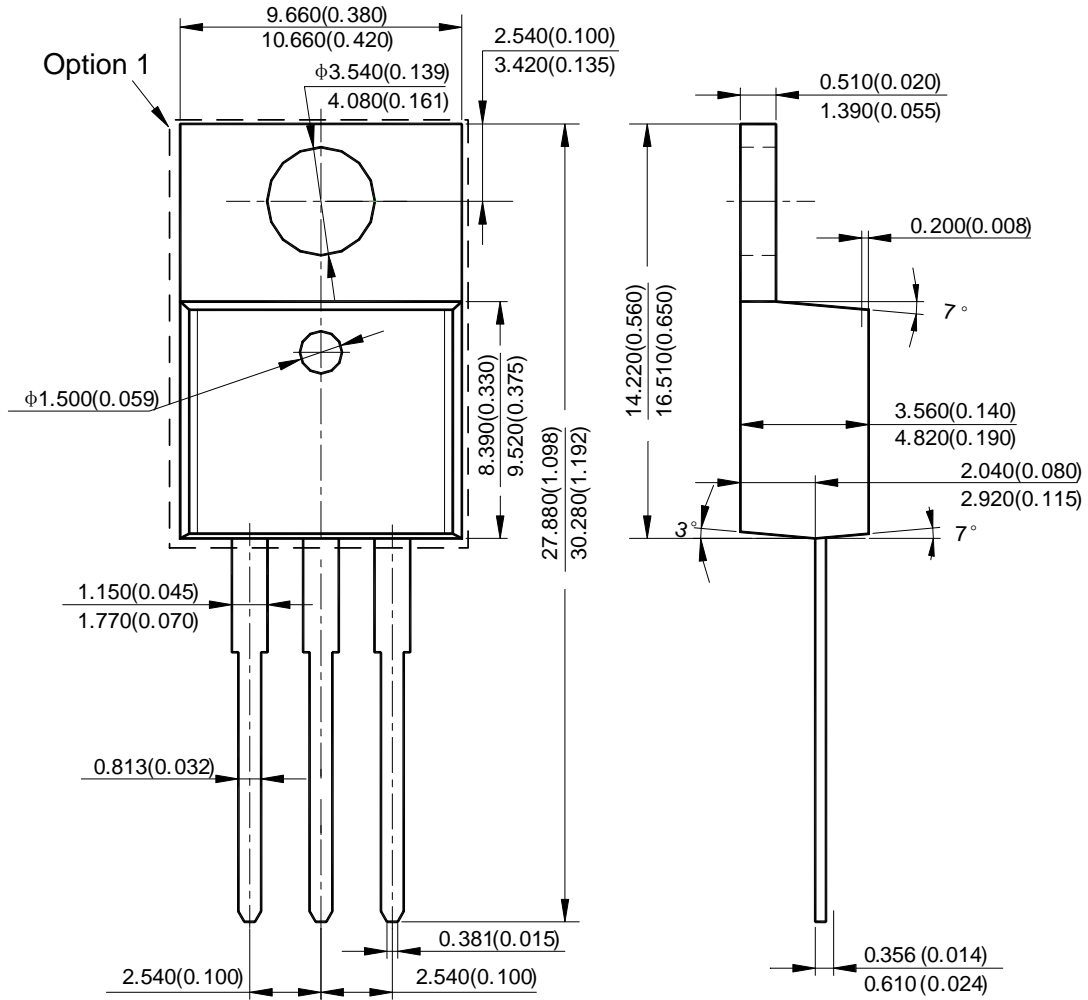
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

TO-263-2

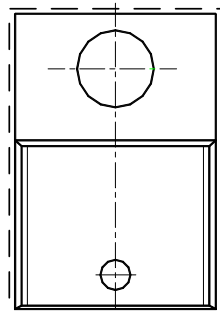


Package Outline Dimensions (Cont. All dimensions in mm(inch).)

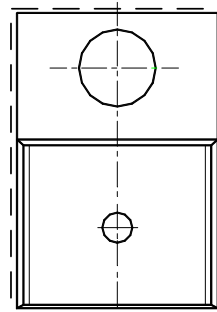
TO-220-3



Option 2

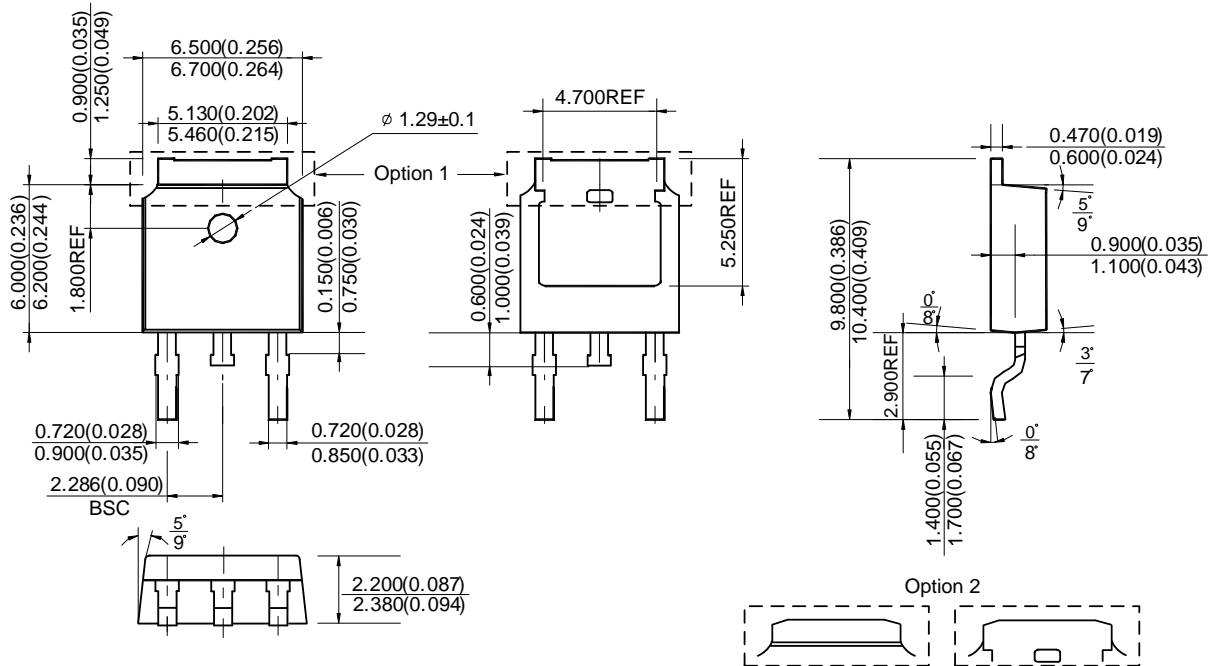


Option 3



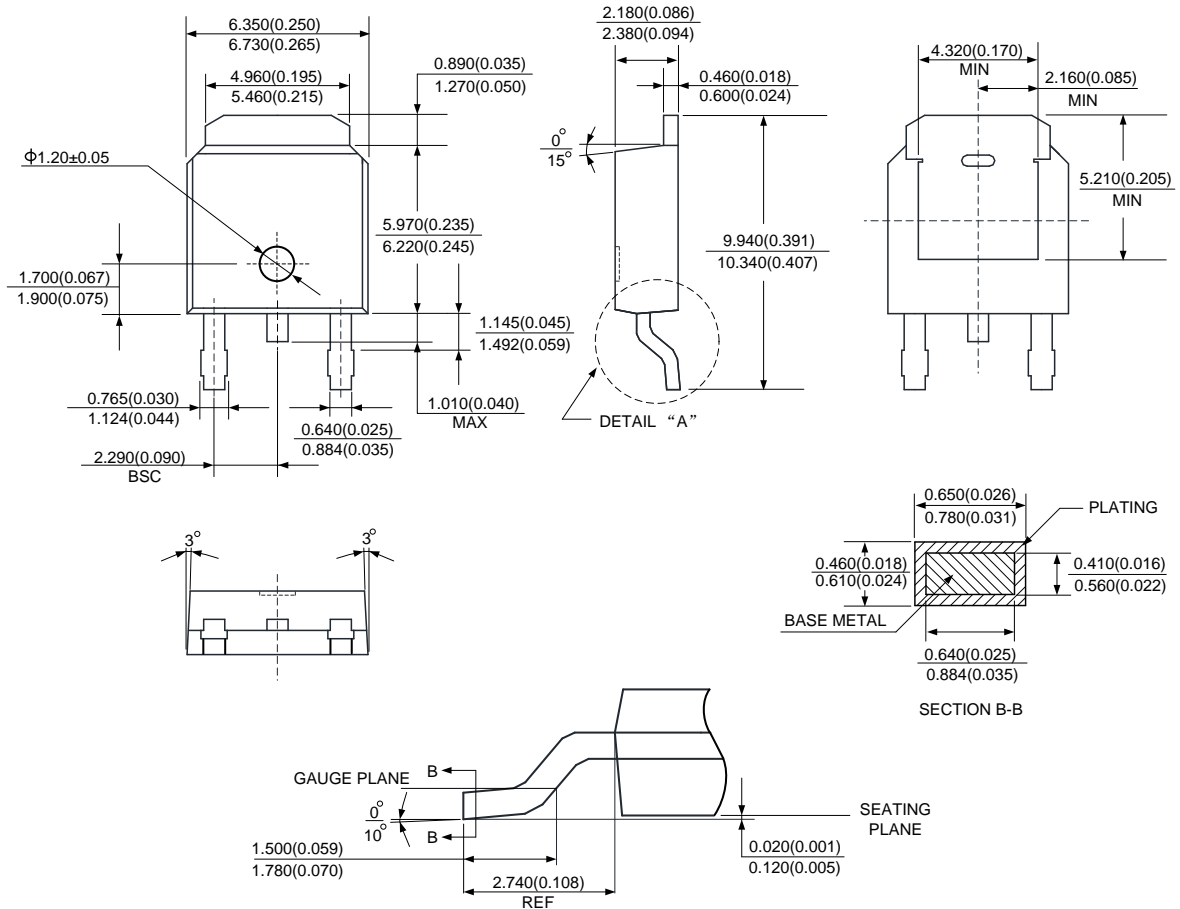
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

TO-252-2 (3)



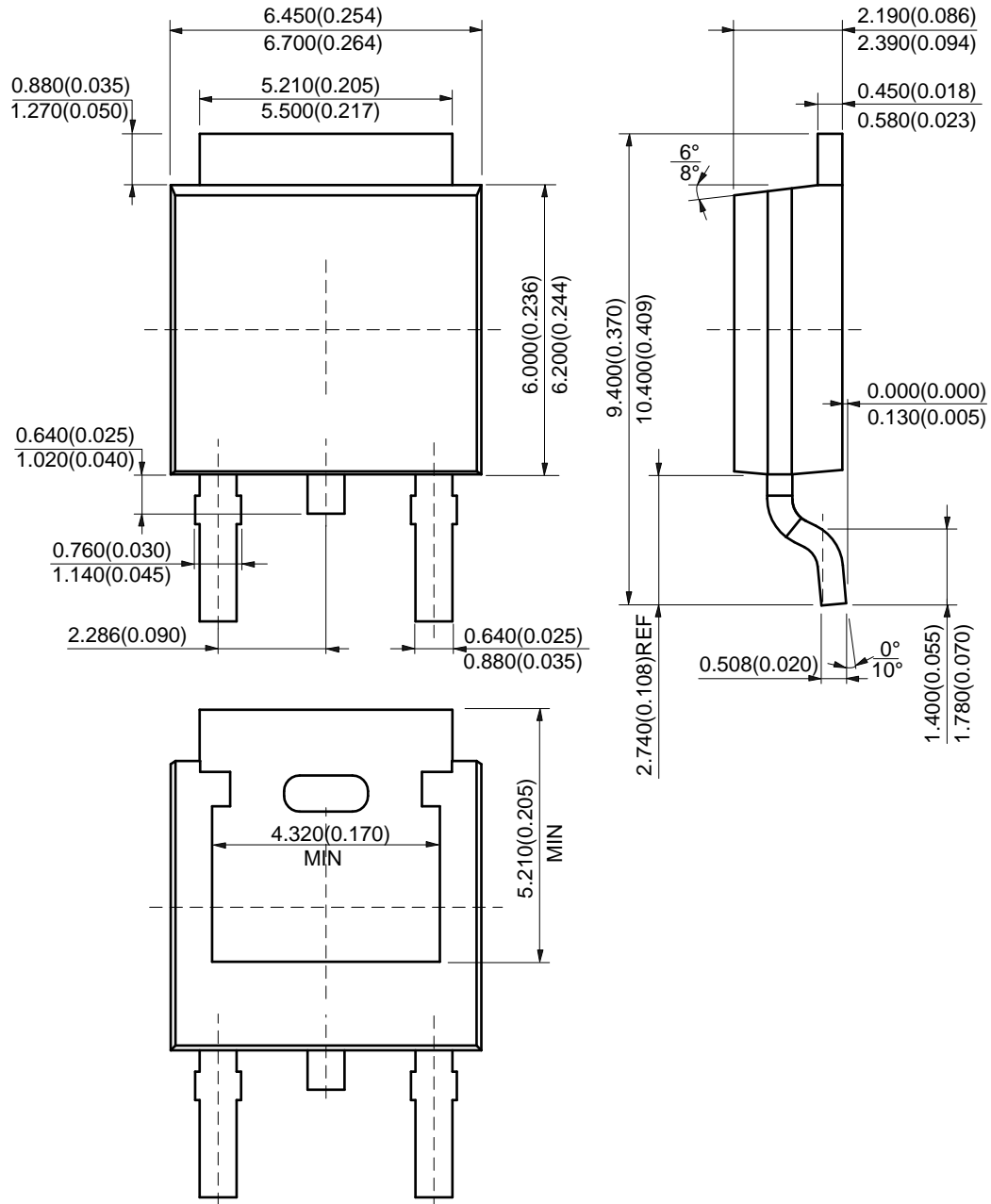
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

TO-252-2 (4)



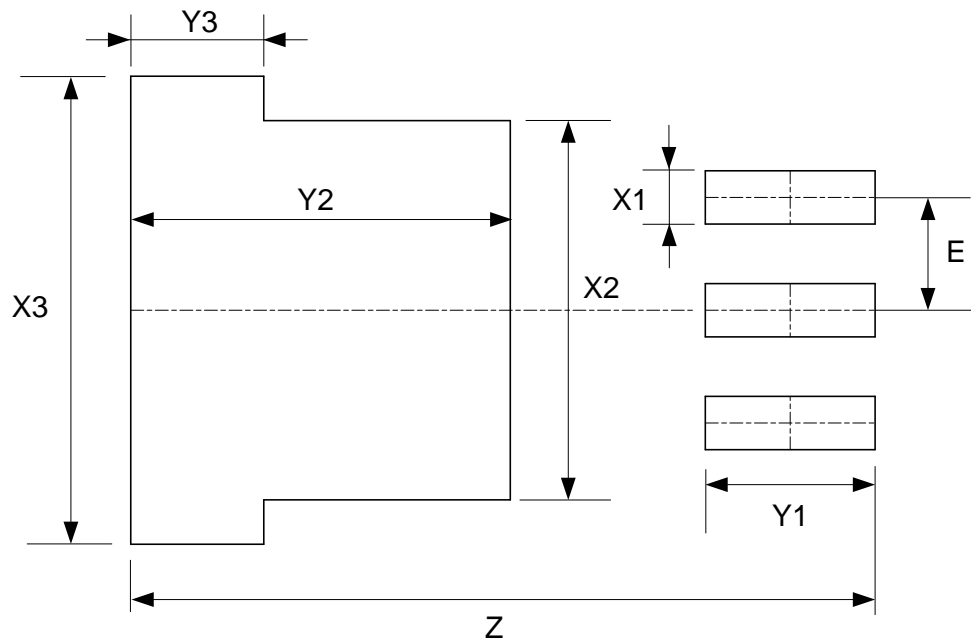
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

TO-252-2 (5)



Suggested Pad Layout

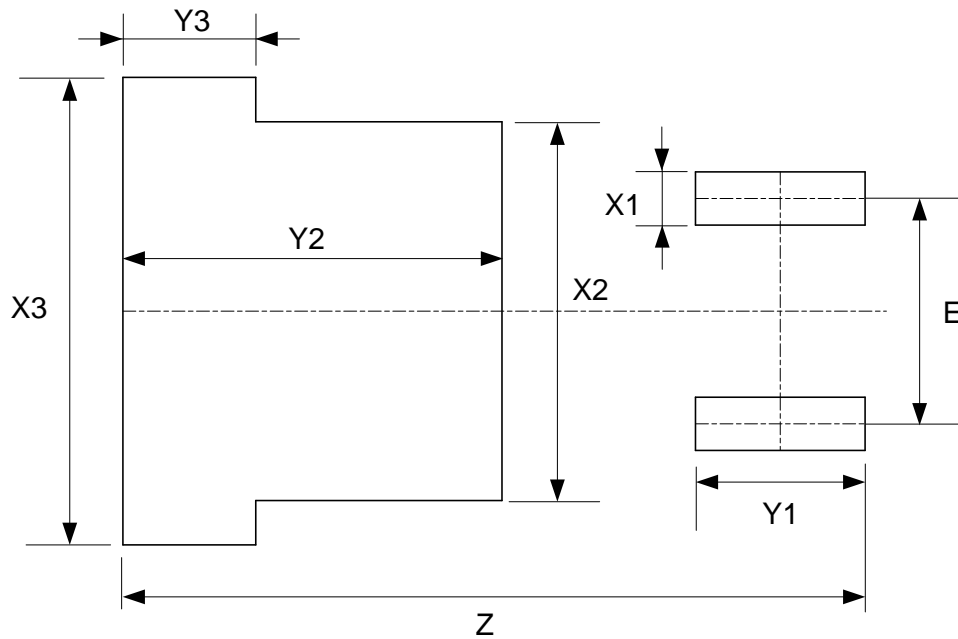
T0263



| | | | | |
|------------|-------------------|-------------------|-------------------|-------------------|
| Dimensions | Z (mm)/(inch) | X1 (mm)/(inch) | X2 (mm)/(inch) | X3 (mm)/(inch) |
| Value | 16.760/0.660 | 1.200/0.047 | 8.540/0.336 | 10.540/0.415 |
| Dimensions | Y1 (mm)/(inch) | Y2 (mm)/(inch) | Y3 (mm)/(inch) | E (mm)/(inch) |
| Value | 3.830/0.151 | 8.560/0.337 | 3.000/0.118 | 2.540/0.100 |

Suggested Pad Layout (Cont.)

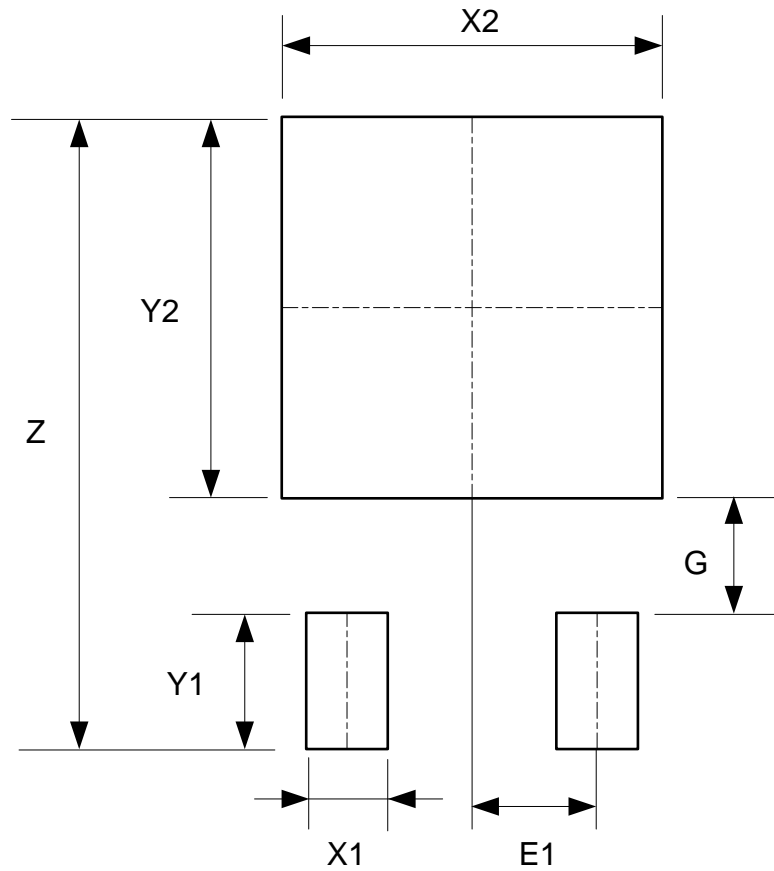
TO-263-2



| | | | | |
|------------|-------------------|-------------------|-------------------|-------------------|
| Dimensions | Z (mm)/(inch) | X1 (mm)/(inch) | X2 (mm)/(inch) | X3 (mm)/(inch) |
| Value | 16.760/0.660 | 1.200/0.047 | 8.540/0.336 | 10.540/0.415 |
| Dimensions | Y1 (mm)/(inch) | Y2 (mm)/(inch) | Y3 (mm)/(inch) | E (mm)/(inch) |
| Value | 3.830/0.151 | 8.560/0.337 | 3.000/0.118 | 5.080/0.200 |

Suggested Pad Layout (Cont.)

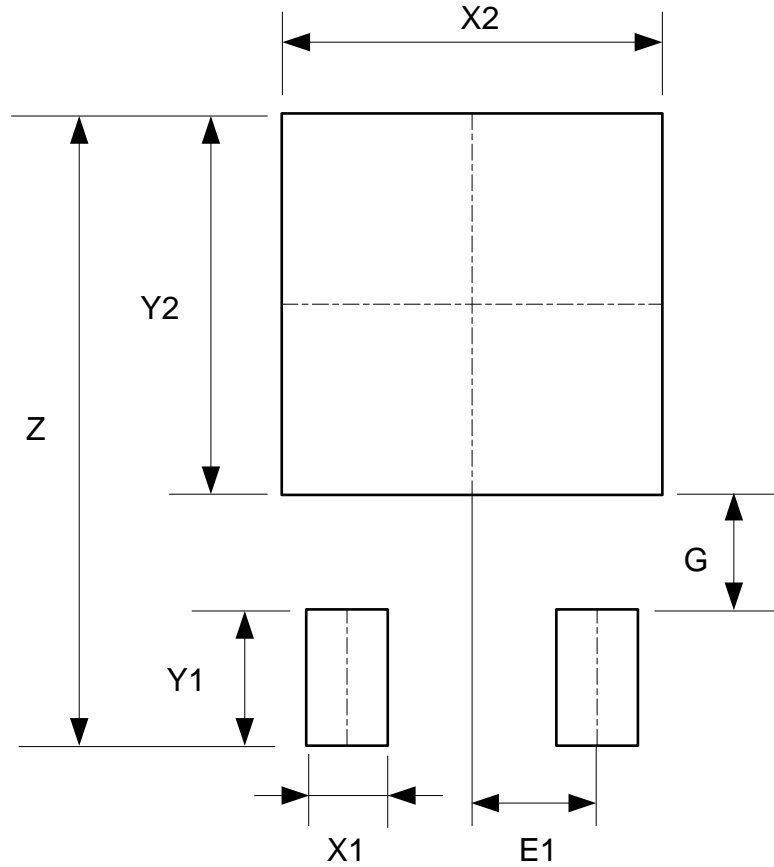
TO-252-2 (3)



| Dimensions | Z (mm)/(inch) | X1 (mm)/(inch) | X2=Y2 (mm)/(inch) | Y1 (mm)/(inch) | G (mm)/(inch) | E1 (mm)/(inch) |
|------------|------------------|-------------------|----------------------|-------------------|------------------|-------------------|
| Value | 11.600/0.457 | 1.500/0.059 | 7.000/0.276 | 2.500/0.098 | 2.100/0.083 | 2.300/0.091 |

Suggested Pad Layout (Cont.)

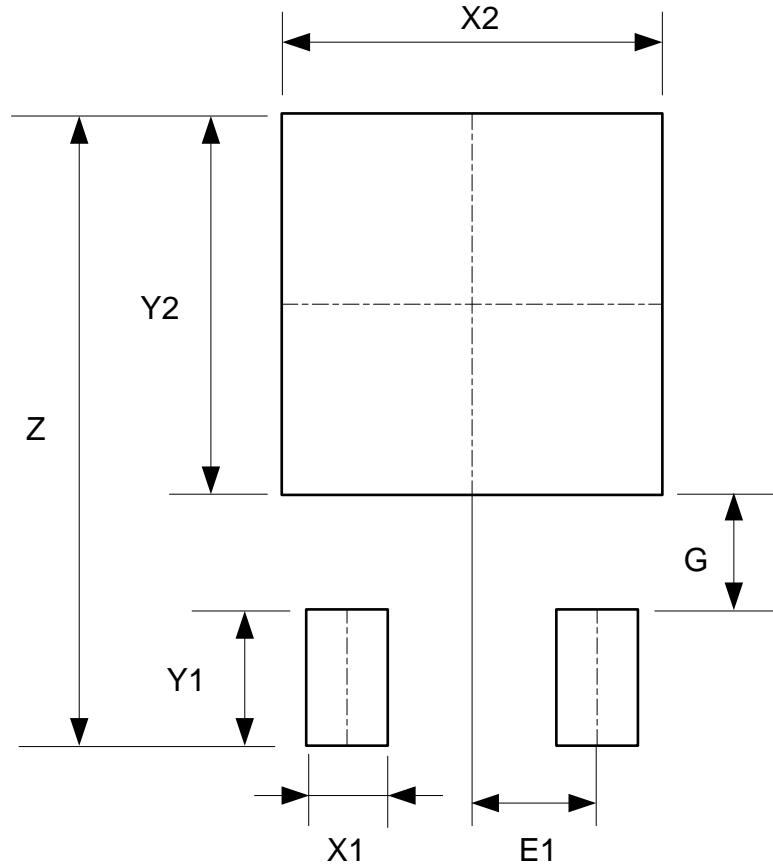
TO-252-2 (4)



| Dimensions | Z (mm)/(inch) | X1 (mm)/(inch) | X2=Y2 (mm)/(inch) | Y1 (mm)/(inch) | G (mm)/(inch) | E1 (mm)/(inch) |
|------------|------------------|-------------------|----------------------|-------------------|------------------|-------------------|
| Value | 11.600/0.457 | 1.500/0.059 | 7.000/0.276 | 2.500/0.098 | 2.100/0.083 | 2.300/0.091 |

Suggested Pad Layout (Cont.)

TO-252-2 (5)



| Dimensions | Z (mm)/(inch) | X1 (mm)/(inch) | X2=Y2 (mm)/(inch) | Y1 (mm)/(inch) | G (mm)/(inch) | E1 (mm)/(inch) |
|------------|------------------|-------------------|----------------------|-------------------|------------------|-------------------|
| Value | 11.600/0.457 | 1.500/0.059 | 7.000/0.276 | 2.500/0.098 | 2.100/0.083 | 2.300/0.091 |

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