

**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**
**AZ39150**
**General Description**

The AZ39150 is low dropout three-terminal regulator with a typical dropout of 375mV at 1.5A output current.

The AZ39150 provides current limit and thermal shutdown. On-chip thermal shutdown provides protection against any combination of high current and ambient temperature that would create excessive junction temperatures.

The AZ39150 is available for 3.3V, 5.0V and 12V versions now. It is available in the industry standard TO-220-3, TO-263-3, TO-252-2(1), TO-252-2(2), TO-252-2(3) and TO-252-2(4) power packages.

**Features**

- Minimum Guaranteed Output Current: 1.5A
- Dropout Voltage: 375mV at  $I_{OUT}=1.5A$
- Output Accuracy: 1%
- Low Ground Current
- Internal Current Limit and Thermal Protection
- Reversed-battery and Reversed-lead Insertion Protection
- Fast Transient Response

**Applications**

- LCD TV
- Set Top Box
- LCD Monitor
- SMPS Post Regulator
- Laptop, Palmtop and Notebook
- Portable Instrumentation
- USB Power Supply

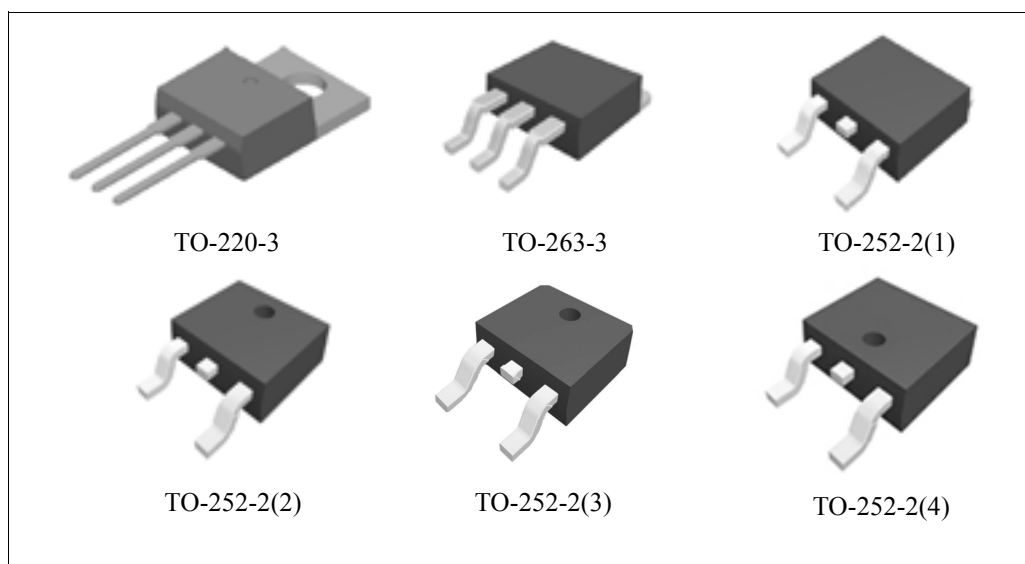


Figure 1. Package Types of AZ39150

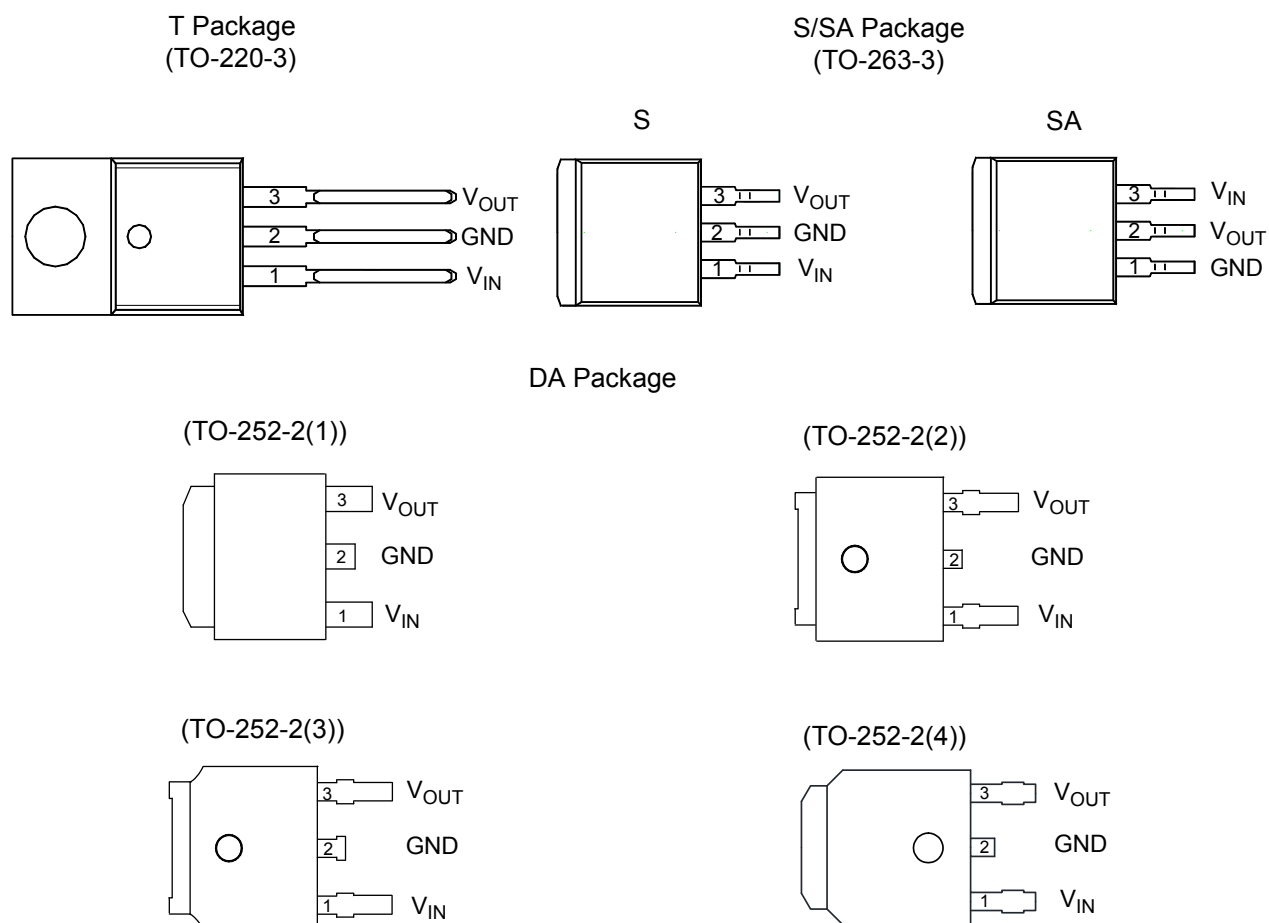
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**
**AZ39150**
**Pin Configuration**


Figure 2. Pin Configuration of AZ39150 (Top View)

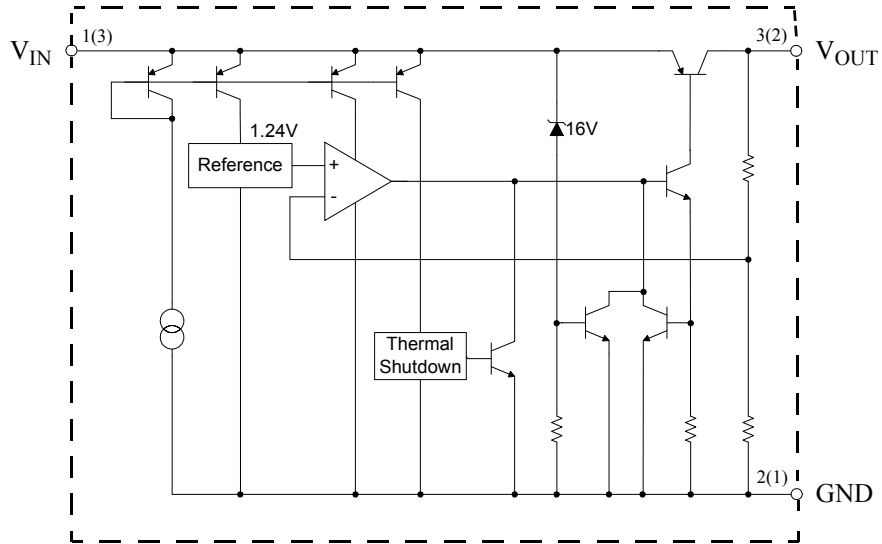
**Pin Description**

| Pin Number                                      |              | Pin Name  | Function   |
|---|--------------|-----------|--|
| TO-220-3/TO-263-3(S)<br>TO-252-2(1)/(2)/(3)/(4) | TO-263-3(SA) |           |  |
| 1   | 3            | $V_{IN}$  | Unregulated input.   |
| 2   | 1            | GND       | The ground pin. This pin and TAB are internally connected. |
| 3   | 2            | $V_{OUT}$ | Regulated Output.  |

**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

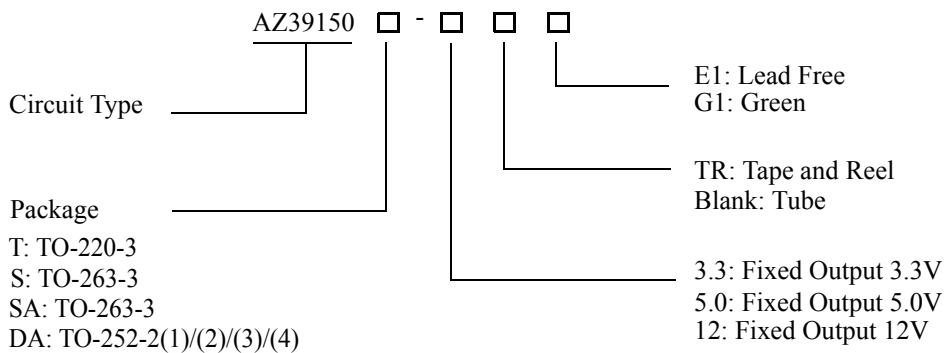
**Functional Block Diagram**



A(B)  
 A: TO-220-3, TO-263-3(S), TO-252-2(1)/(2)/(3)/(4)  
 B: TO-263-3(SA)

Figure 3. Functional Block Diagram of AZ39150

**Ordering Information**





**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR AZ39150**

**Ordering Information (Continued)**

| Package                  | Temperature Range | Part Number      |                   | Marking ID     |                 | Packing Type |
|--------------------------|-------------------|------------------|-------------------|----------------|-----------------|--------------|
|                          |                   | Lead Free        | Green             | Lead Free      | Green           |              |
| TO-220-3                 | -40 to 125°C      | AZ39150T-3.3E1   | AZ39150T-3.3G1    | AZ39150T-3.3E1 | AZ39150T-3.3G1  | Tube         |
|                          |                   | AZ39150T-5.0E1   | AZ39150T-5.0G1    | AZ39150T-5.0E1 | AZ39150T-5.0G1  | Tube         |
|                          |                   | AZ39150T-12E1    |                   | AZ39150T-12E1  |                 | Tube         |
| TO-263-3 (S)             | -40 to 125°C      | AZ39150S-3.3E1   | AZ39150S-3.3G1    | AZ39150S-3.3E1 | AZ39150S-3.3G1  | Tube         |
|                          |                   | AZ39150S-3.3TRE1 | AZ39150S-3.3TRG1  | AZ39150S-3.3E1 | AZ39150S-3.3G1  | Tape & Reel  |
|                          |                   | AZ39150S-5.0E1   | AZ39150S-5.0G1    | AZ39150S-5.0E1 | AZ39150S-5.0G1  | Tube         |
|                          |                   | AZ39150S-5.0TRE1 | AZ39150S-5.0TRG1  | AZ39150S-5.0E1 | AZ39150S-5.0G1  | Tape & Reel  |
|                          |                   | AZ39150S-12E1    |                   | AZ39150S-12E1  |                 | Tube         |
|                          |                   | AZ39150S-12TRE1  |                   | AZ39150S-12E1  |                 | Tape & Reel  |
| TO-263-3 (SA)            | -40 to 125°C      |                  | AZ39150SA-3.3TRG1 |                | AZ39150SA-3.3G1 | Tape & Reel  |
|                          |                   |                  | AZ39150SA-5.0TRG1 |                | AZ39150SA-5.0G1 | Tape & Reel  |
|                          |                   |                  | AZ39150SA-12TRG1  |                | AZ39150SA-12G1  | Tape & Reel  |
| TO-252-2 (1)/(2)/(3)/(4) | -40 to 125°C      |                  | AZ39150DA-3.3TRG1 |                | AZ39150DA-3.3G1 | Tape & Reel  |
|                          |                   |                  | AZ39150DA-5.0TRG1 |                | AZ39150DA-5.0G1 | Tape & Reel  |
|                          |                   |                  | AZ39150DA-12TRG1  |                | AZ39150DA-12G1  | 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 ULTRA LOW DROPOUT LINEAR REGULATOR****AZ39150****Absolute Maximum Ratings (Note 1)**

| Parameter                              | Symbol     | Value      | Unit |
|--|------------|------------|------|
| Supply Voltage                         | $V_{IN}$   | 15         | V    |
| Maximum Operating Junction Temperature | $T_J$      | 150        | °C   |
| Storage Temperature Range              | $T_{STG}$  | -65 to 150 | °C   |
| Lead Temperature (Soldering, 10sec)    | $T_{LEAD}$ | 300        | °C   |
| ESD (Machine Model)                    |            | 300        | 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 |
|--------------------------------|----------|-----|------|------|
| Supply Voltage                 | $V_{IN}$ |     | 13.2 | V    |
| Operating Junction Temperature | $T_J$    | -40 | 125  | °C   |

**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR****AZ39150****Electrical Characteristics****AZ39150-3.3V Electrical Characteristics**

Operating Conditions:  $V_{IN}=4.3V$ ,  $I_{OUT}=10mA$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=10\mu F$ ,  $T_J=25^\circ C$ , unless otherwise specified. The **Boldface** applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ .

| Parameter                              | Symbol                    | Condition  | Min             | Typ        | Max         | Unit             |    |
|--|---------------------------|--|-----------------|------------|-------------|------------------|----|
| Output Voltage                         | $V_{OUT}$                 | $I_{OUT}=10mA$   | 3.27            | 3.3        | 3.33        | V                |    |
|  |                           | $10mA \leq I_{OUT} \leq 1.5A$ , $4.3V \leq V_{IN} \leq 8V$ | <b>3.23</b>     | <b>3.3</b> | <b>3.37</b> | V                |    |
| Line Regulation                        | $V_{RLINE}$               | $I_{OUT}=10mA$ , $4.3V \leq V_{IN} \leq 8V$                |                 | 2          | 17          | mV               |    |
| Load Regulation                        | $V_{RLOAD}$               | $V_{IN}=4.3V$ , $10mA \leq I_{OUT} \leq 1.5A$              |                 | 6.6        | <b>33</b>   | mV               |    |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=10mA$   |                 | <b>66</b>  | <b>330</b>  | $\mu V/^\circ C$ |    |
| Dropout Voltage (Note 2)               | $V_{DROP}$                | $\Delta V_{OUT}=1\%$                                       | $I_{OUT}=100mA$ |            | 80          | <b>200</b>       | mV |
|  |                           |  | $I_{OUT}=750mA$ |            | 260         |                  | mV |
|  |                           |  | $I_{OUT}=1.5A$  |            | 375         | 500              | mV |
| Ground Current                         | $I_{GND}$                 | $I_{OUT}=750mA$ , $V_{IN}=4.3V$                            |                 | 4          | <b>20</b>   | mA               |    |
|  |                           | $I_{OUT}=1.5A$ , $V_{IN}=4.3V$                             |                 | 17         |             | mA               |    |
| Current Limit                          | $I_{LIMIT}$               | $V_{OUT}=0V$ (Note 3)                                      | 2.0             | 2.8        |             | A                |    |
| Minimum Load Current                   | $I_{LOAD (MIN)}$          |  |                 | 7          | 10          | mA               |    |
| Output Noise Voltage (rms)             |                           | 10Hz to 100KHz, $I_{OUT}=100mA$ ,<br>$C_{OUT}=10\mu F$     |                 | 400        |             | $\mu V$          |    |

Note 2: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at  $V_{OUT}+1V$  applied to  $V_{IN}$ .

Note 3:  $V_{IN}=V_{OUT(NOMINAL)}+1V$ .

**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR****AZ39150****Electrical Characteristics (Continued)****AZ39150-5.0V Electrical Characteristics**Operating Conditions:  $V_{IN}=6V$ ,  $I_{OUT}=10mA$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=10\mu F$ ,  $T_J=25^\circ C$ , unless otherwise specified. The**Boldface** applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ .

| Parameter                              | Symbol                    | Condition  | Min             | Typ        | Max         | Unit             |    |
|--|---------------------------|--|-----------------|------------|-------------|------------------|----|
| Output Voltage                         | $V_{OUT}$                 | $I_{OUT}=10mA$   | 4.95            | 5.0        | 5.05        | V                |    |
|  |                           | $10mA \leq I_{OUT} \leq 1.5A$ , $6V \leq V_{IN} \leq 8V$ | <b>4.90</b>     | <b>5.0</b> | <b>5.10</b> | V                |    |
| Line Regulation                        | $V_{RLINE}$               | $I_{OUT}=10mA$ , $6V \leq V_{IN} \leq 8V$                |                 | 3          | 25          | mV               |    |
| Load Regulation                        | $V_{RLOAD}$               | $V_{IN}=6V$ , $10mA \leq I_{OUT} \leq 1.5A$              |                 | 10         | <b>50</b>   | mV               |    |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=10mA$   |                 | <b>100</b> | <b>500</b>  | $\mu V/^\circ C$ |    |
| Dropout Voltage (Note 2)               | $V_{DROP}$                | $\Delta V_{OUT}=1\%$                                     | $I_{OUT}=100mA$ |            | 80          | <b>200</b>       | mV |
|  |                           |  | $I_{OUT}=750mA$ |            | 260         |                  | mV |
|  |                           |  | $I_{OUT}=1.5A$  |            | 375         | 500              | mV |
| Ground Current                         | $I_{GND}$                 | $I_{OUT}=750mA$ , $V_{IN}=6V$                            |                 | 4          | <b>20</b>   | mA               |    |
|  |                           | $I_{OUT}=1.5A$ , $V_{IN}=6V$                             |                 | 17         |             | mA               |    |
| Current Limit                          | $I_{LIMIT}$               | $V_{OUT}=0V$ (Note 3)                                    | 2.0             | 2.8        |             | A                |    |
| Minimum Load Current                   | $I_{LOAD (MIN)}$          |  |                 | 7          | 10          | mA               |    |
| Output Noise Voltage (rms)             |                           | 10Hz to 100KHz, $I_{OUT}=100mA$ ,<br>$C_{OUT}=10\mu F$   |                 | 400        |             | $\mu V$          |    |

Note 2: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at  $V_{OUT}+1V$  applied to  $V_{IN}$ .

Note 3:  $V_{IN}=V_{OUT(NOMINAL)}+1V$ .



**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR** **AZ39150**

**Electrical Characteristics (Continued)**

**AZ39150-12V Electrical Characteristics**

Operating Conditions:  $V_{IN}=13V$ ,  $I_{OUT}=10mA$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=10\mu F$ ,  $T_J=25^\circ C$ , unless otherwise specified. The **Boldface** applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ .

| Parameter                              | Symbol                    | Condition  | Min             | Typ         | Max          | Unit             |    |
|--|---------------------------|--|-----------------|-------------|--------------|------------------|----|
| Output Voltage                         | $V_{OUT}$                 | $I_{OUT}=10mA$   | 11.88           | 12.0        | 12.12        | V                |    |
|  |                           | $10mA \leq I_{OUT} \leq 1.5A$ , $13V \leq V_{IN} \leq 15V$ | <b>11.76</b>    | <b>12.0</b> | <b>12.24</b> | V                |    |
| Line Regulation                        | $V_{RLINE}$               | $I_{OUT}=10mA$ , $13V \leq V_{IN} \leq 15V$                |                 | 3           | 25           | mV               |    |
| Load Regulation                        | $V_{RLOAD}$               | $V_{IN}=13V$ , $10mA \leq I_{OUT} \leq 1.5A$               |                 | 10          | <b>50</b>    | mV               |    |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=10mA$   |                 | <b>100</b>  | <b>500</b>   | $\mu V/^\circ C$ |    |
| Dropout Voltage (Note 2)               | $V_{DROP}$                | $\Delta V_{OUT}=1\%$                                       | $I_{OUT}=100mA$ |             | 80           | <b>200</b>       | mV |
|  |                           |  | $I_{OUT}=750mA$ |             | 260          |                  | mV |
|  |                           |  | $I_{OUT}=1.5A$  |             | 375          | 500              | mV |
| Ground Current                         | $I_{GND}$                 | $I_{OUT}=750mA$ , $V_{IN}=13V$                             |                 | 4           | <b>20</b>    | mA               |    |
|  |                           | $I_{OUT}=1.5A$ , $V_{IN}=13V$                              |                 | 17          |              | mA               |    |
| Current Limit                          | $I_{LIMIT}$               | $V_{OUT}=0V$ (Note 3)                                      | 2.0             | 2.8         |              | A                |    |
| Minimum Load Current                   | $I_{LOAD (MIN)}$          |  |                 | 7           | 10           | mA               |    |
| Output Noise Voltage (rms)             |                           | 10Hz to 100KHz, $I_{OUT}=100mA$ , $C_{OUT}=10\mu F$        |                 | 400         |              | $\mu V$          |    |

Note 2: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at  $V_{OUT}+1V$  applied to  $V_{IN}$ .

Note 3:  $V_{IN}=V_{OUT(NOMINAL)}+1V$ .





1.5A ULTRA LOW DROPOUT LINEAR REGULATOR

AZ39150

Typical Performance Characteristics

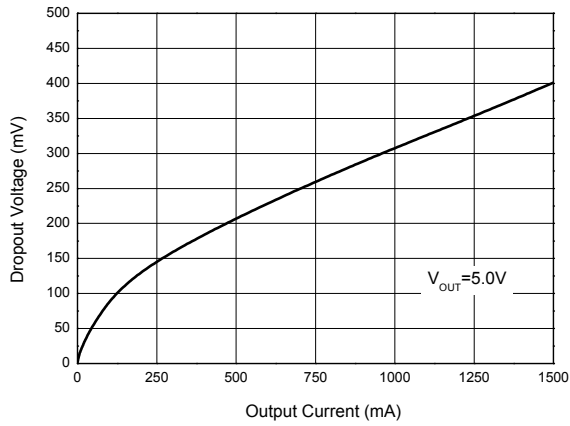


Figure 4. Dropout Voltage vs. Output Current

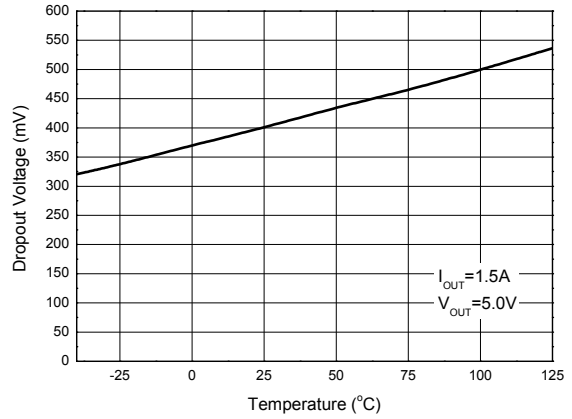


Figure 5. Dropout Voltage vs. Temperature

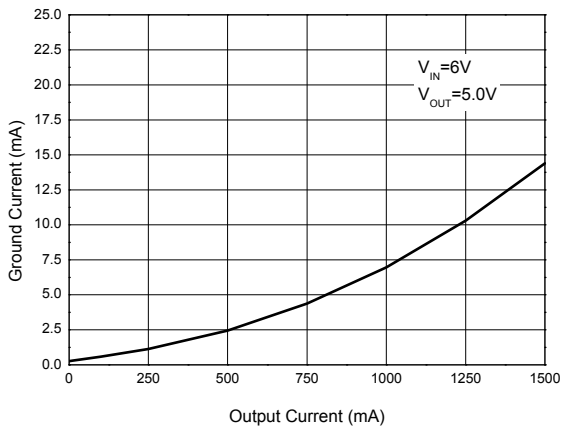


Figure 6. Ground Current vs. Output Current

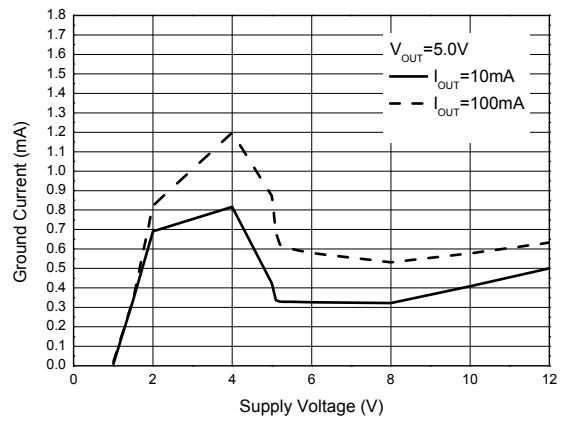


Figure 7. Ground Current vs. Supply Voltage



1.5A ULTRA LOW DROPOUT LINEAR REGULATOR

AZ39150

Typical Performance Characteristics (Continued)

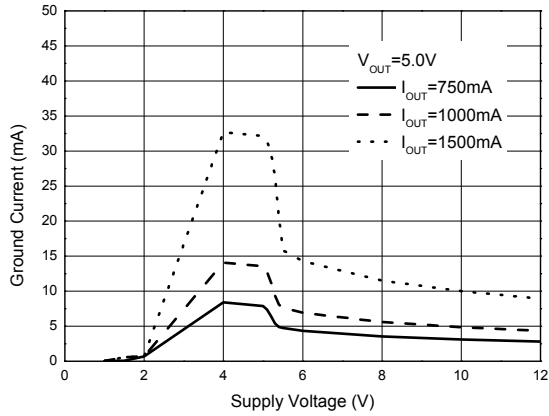


Figure 8. Ground Current vs. Supply Voltage

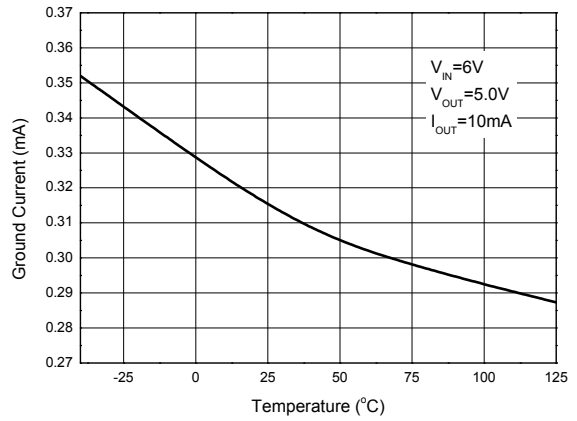


Figure 9. Ground Current vs. Temperature

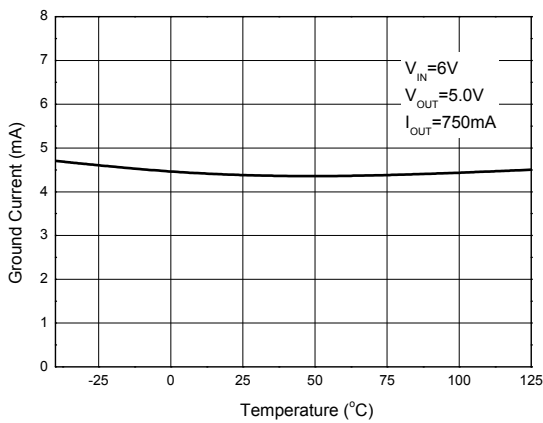


Figure 10. Ground Current vs. Temperature

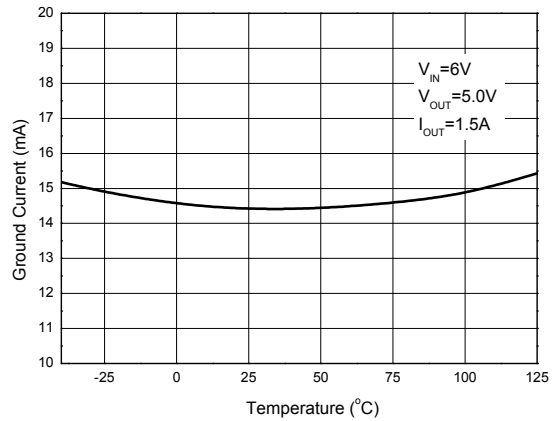


Figure 11. Ground Current vs. Temperature



1.5A ULTRA LOW DROPOUT LINEAR REGULATOR

AZ39150

Typical Performance Characteristics (Continued)

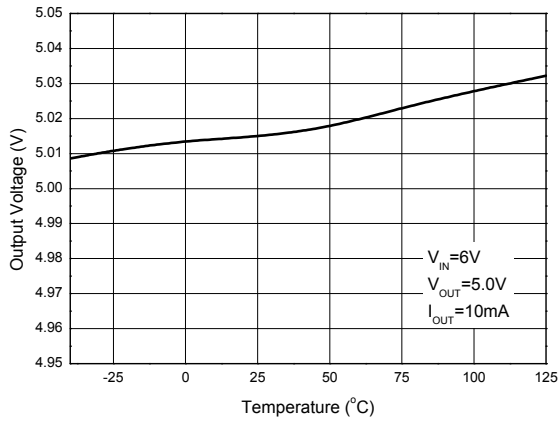


Figure 12. Output Voltage vs. Temperature

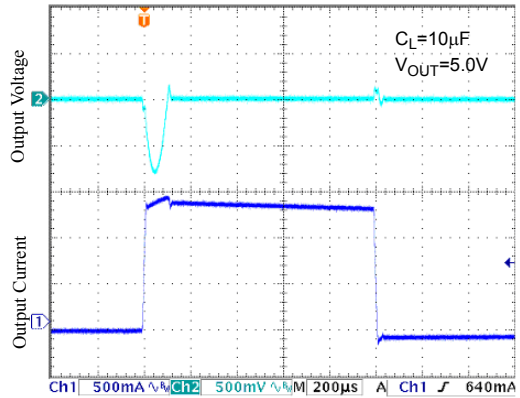


Figure 13. Load Transient

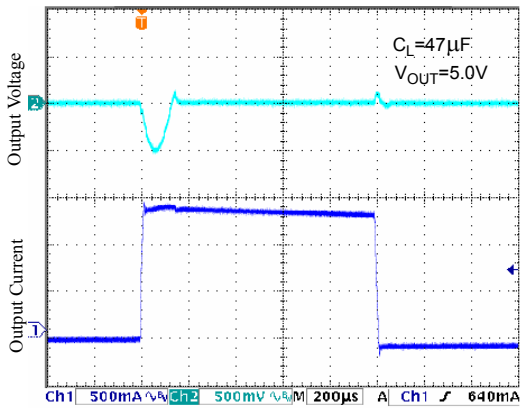


Figure 14. Load Transient

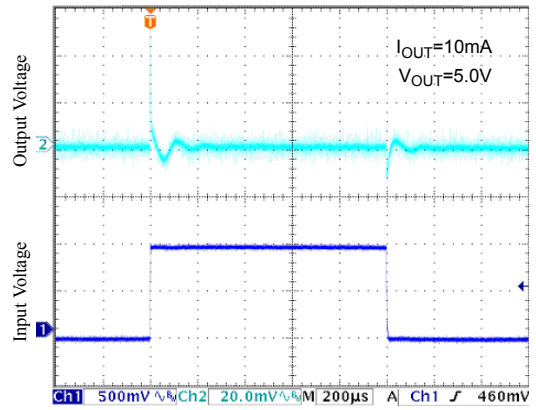
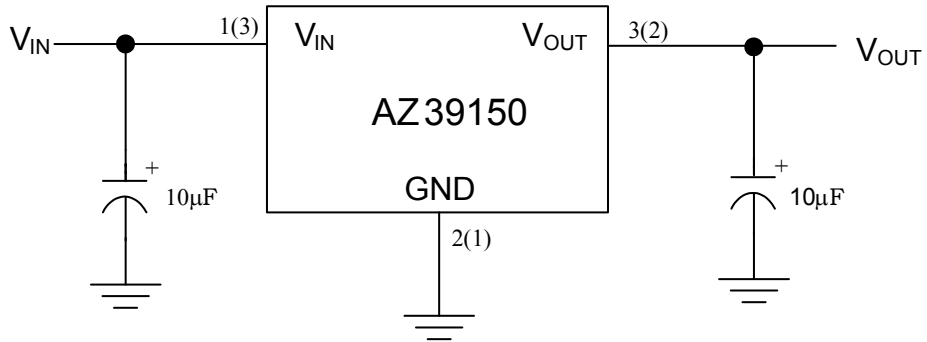


Figure 15. Line Transient

**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Typical Application**



A(B)  
 A: TO-220-3, TO-263-3(S), TO-252-2(1)/(2)/(3)/(4)  
 B: TO-263-3(SA)

Figure 16. Typical Application of AZ39150



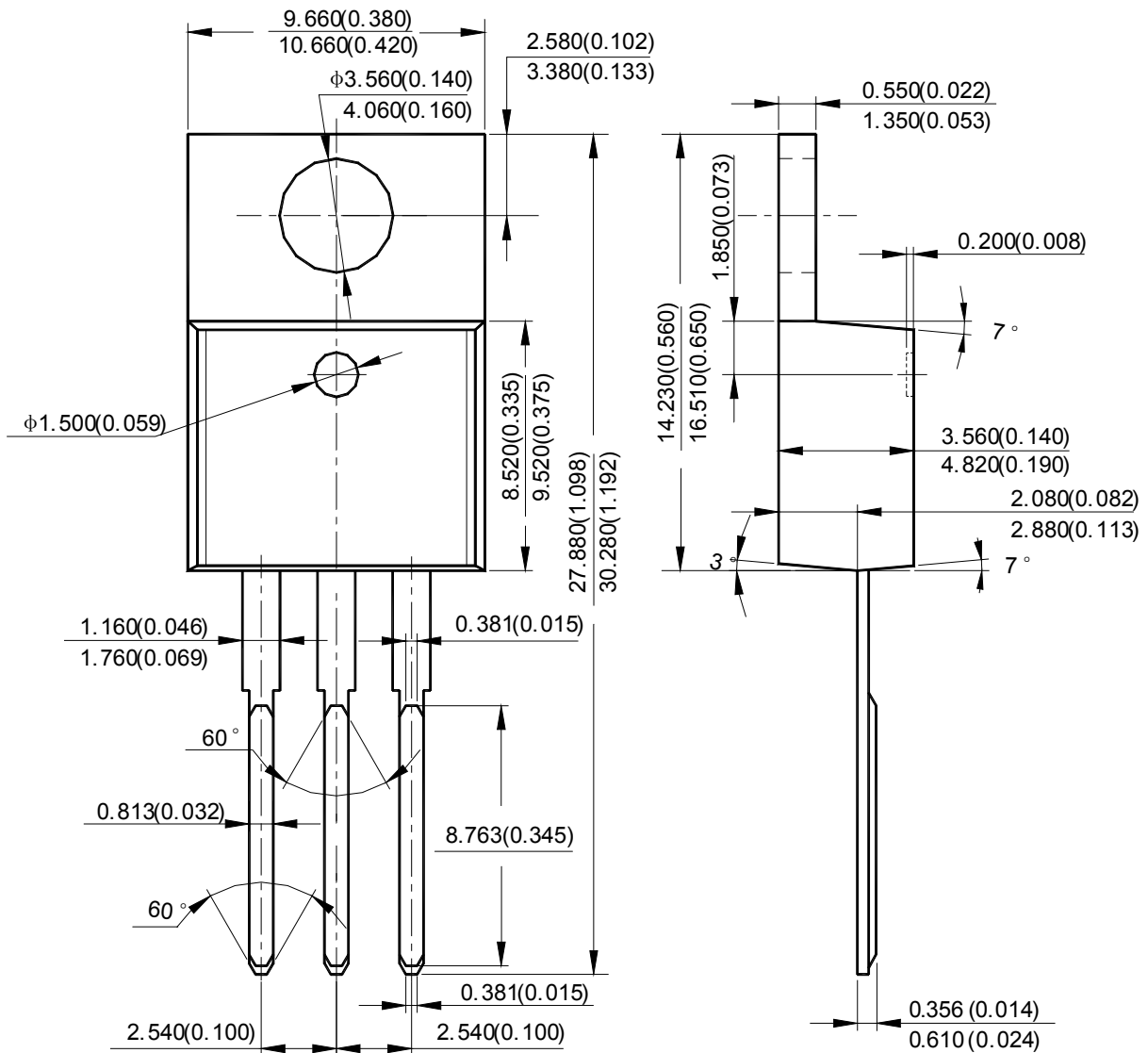
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Mechanical Dimensions**

**TO-220-3**

**Unit: mm(inch)**





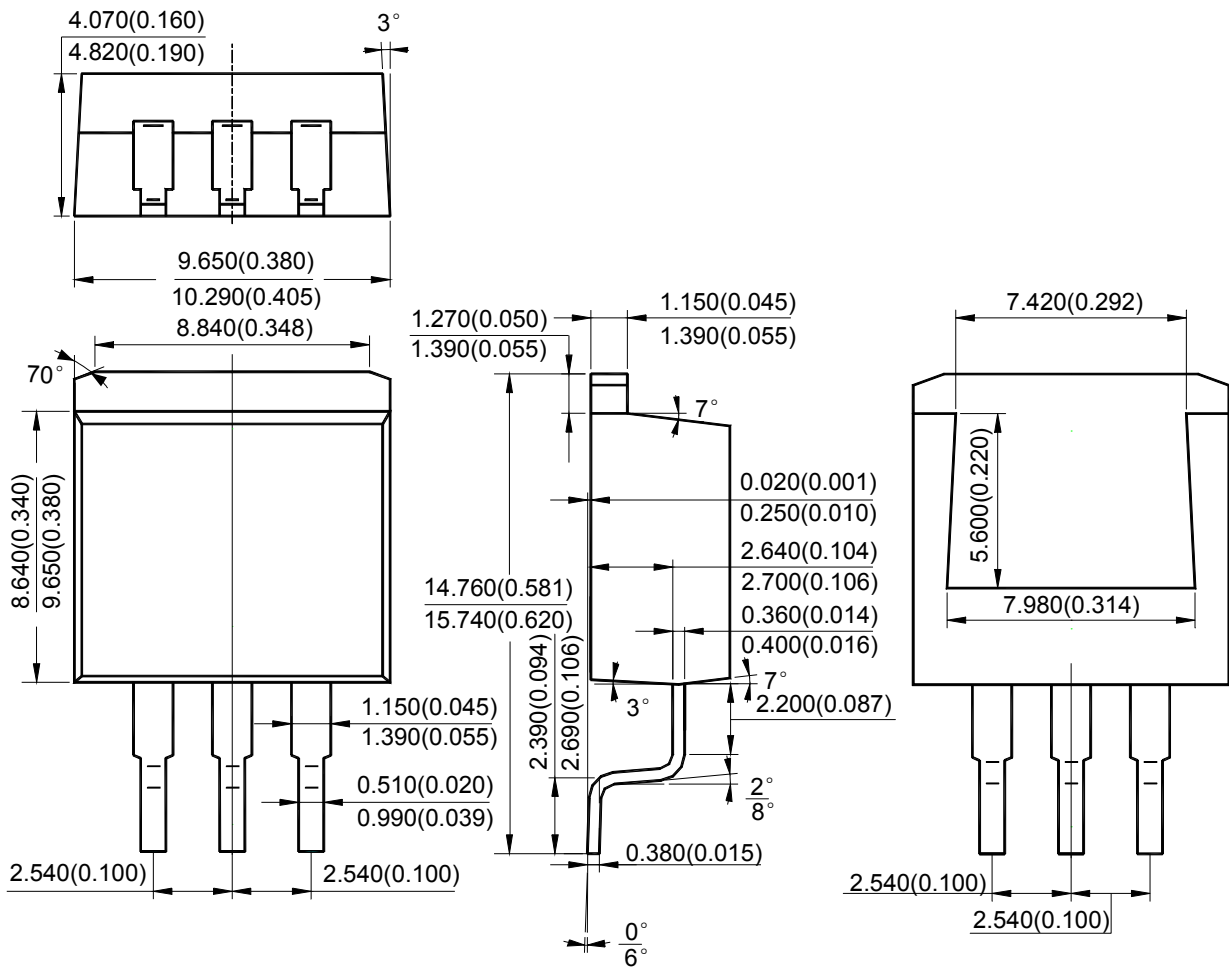
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Mechanical Dimensions (Continued)**

**TO-263-3**

**Unit: mm(inch)**





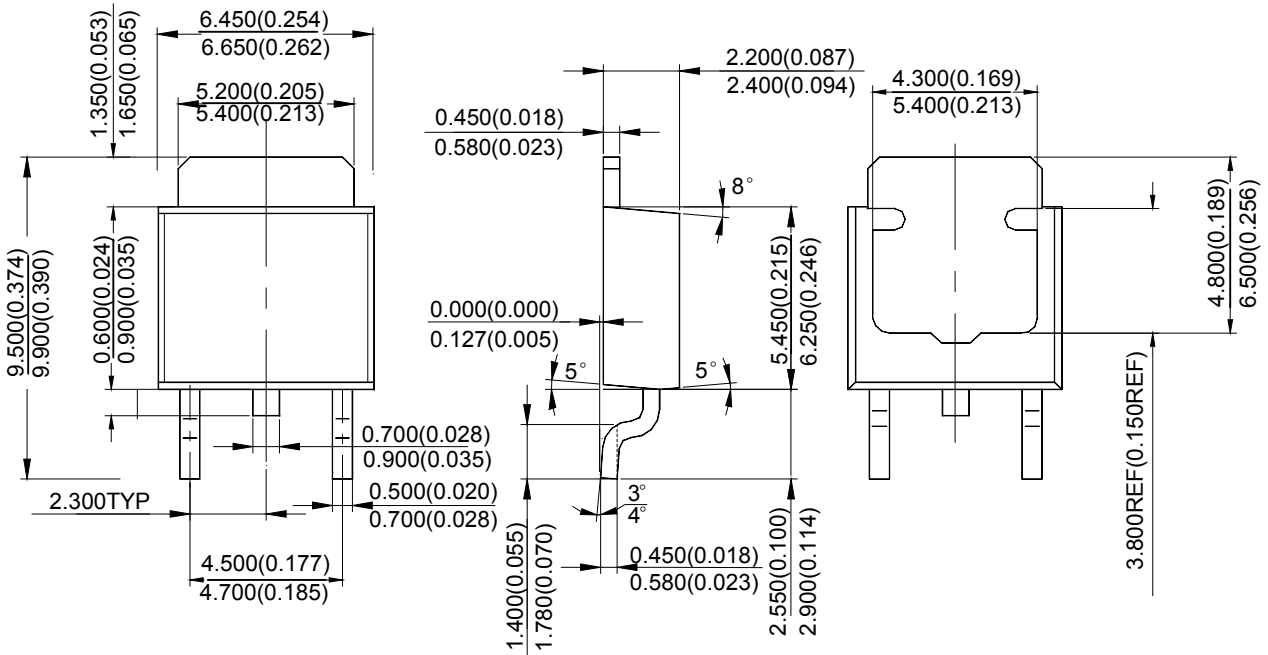
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Mechanical Dimensions (Continued)**

**TO-252-2(1)**

**Unit: mm(inch)**





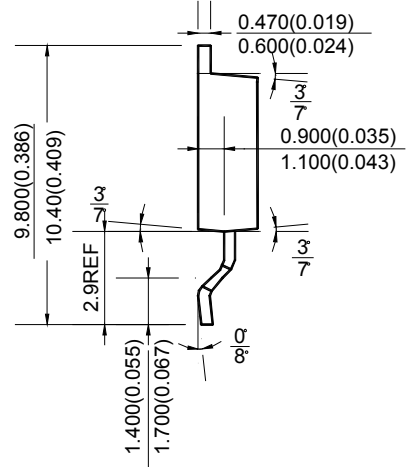
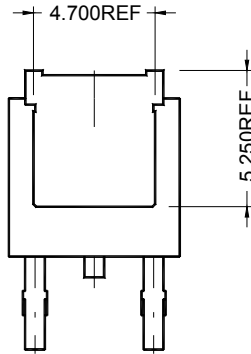
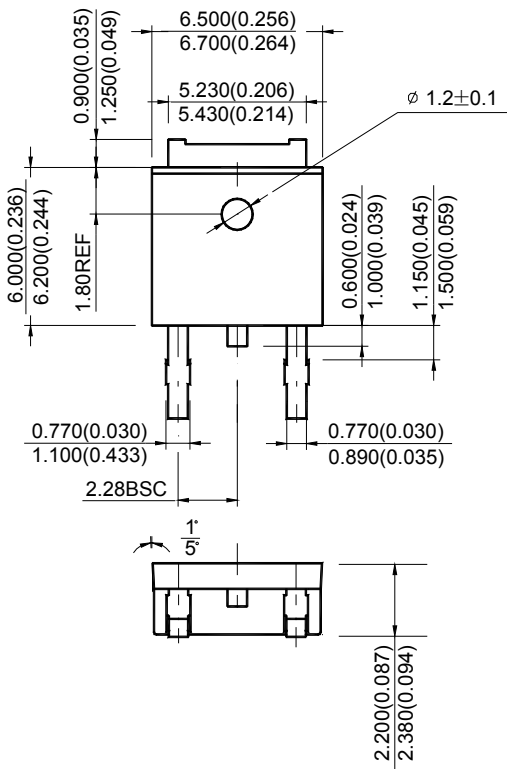
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Mechanical Dimensions (Continued)**

**TO-252-2(2)**

**Unit: mm(inch)**







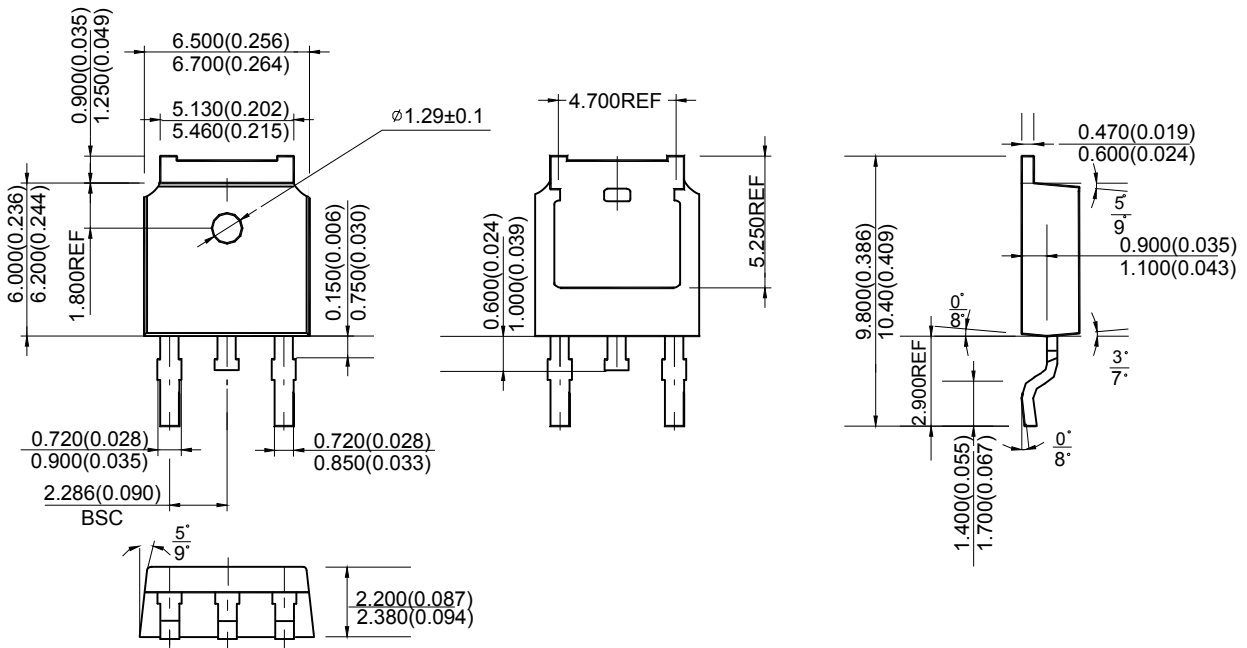
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Mechanical Dimensions (Continued)**

**TO-252-2(3)**

**Unit: mm(inch)**





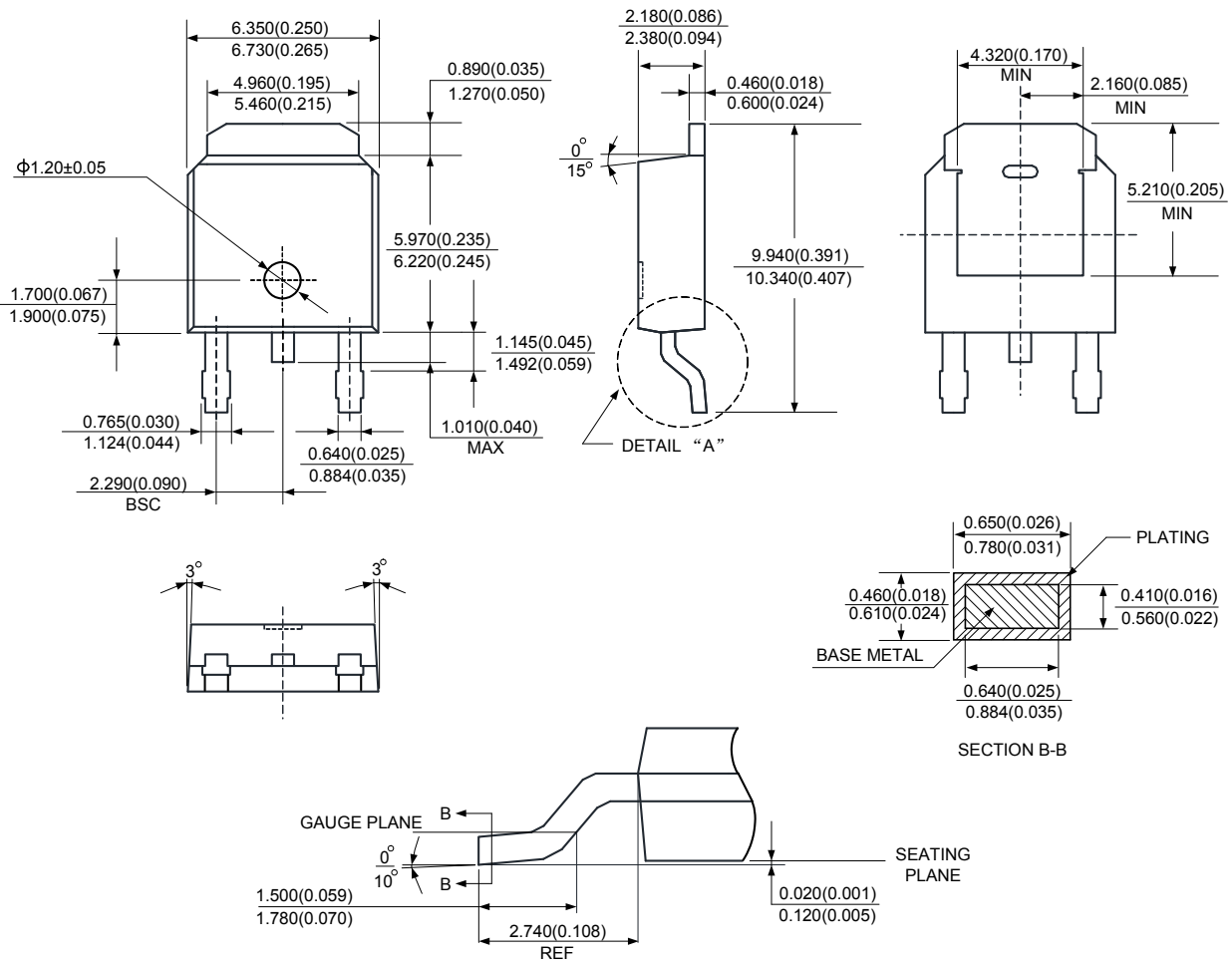
**1.5A ULTRA LOW DROPOUT LINEAR REGULATOR**

**AZ39150**

**Mechanical Dimensions (Continued)**

**TO-252-2(4)**

**Unit: mm(inch)**





## **BCD Semiconductor Manufacturing Limited**

<http://www.bcdsemi.com>

### **IMPORTANT NOTICE**

BCD Semiconductor Manufacturing Limited reserves the right to make changes without further notice to any products or specifications herein. BCD Semiconductor Manufacturing Limited does not assume any responsibility for use of any its products for any particular purpose, nor does BCD Semiconductor Manufacturing Limited assume any liability arising out of the application or use of any its products or circuits. BCD Semiconductor Manufacturing Limited does not convey any license under its patent rights or other rights nor the rights of others.

---

#### **MAIN SITE**

##### **- Headquarters**

##### **BCD Semiconductor Manufacturing Limited**

No. 1600, Zi Xing Road, Shanghai Zizhu Science-based Industrial Park, 200241, China  
Tel: +86-21-24162266, Fax: +86-21-24162277

##### **- Wafer Fab**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.**

800 Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

#### **REGIONAL SALES OFFICE**

##### **Shenzhen Office**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office**

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave. 1.S., Nanshan District, Shenzhen, China  
Tel: +86-755-8826 7951  
Fax: +86-755-8826 7865

##### **Taiwan Office**

##### **BCD Semiconductor (Taiwan) Company Limited**

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan  
Tel: +886-2-2656 2808  
Fax: +886-2-2656 2806

##### **USA Office**

##### **BCD Semiconductor Corp.**

30920 Huntwood Ave. Hayward, CA 94544, USA  
Tel : +1-510-324-2988  
Fax: +1-510-324-2788