

## 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

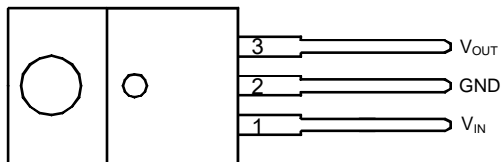
- Minimum Guaranteed Output Current: 1.5A
- Dropout Voltage: 375mV at  $I_{OUT} = 1.5A$
- Output Accuracy: 1%
- Low Ground Current
- Internal Current Limit and Thermal Protection
- Reversed-battery and Reversed-lead Insertion Protection
- Fast Transient Response

## Applications

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

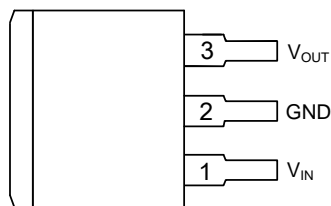
## Pin Assignments

(Top View)



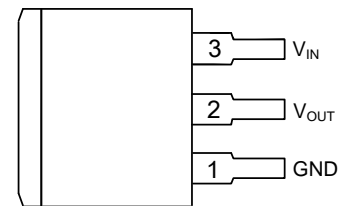
TO-220-3

(Top View)



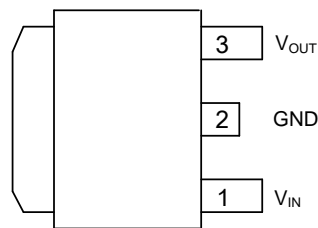
TO-263-3 (S Package)

(Top View)



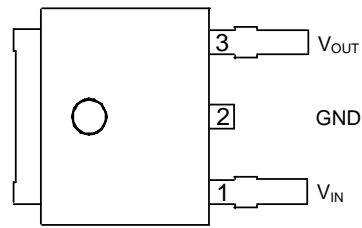
TO-263-3 (SA Package)

(Top View)



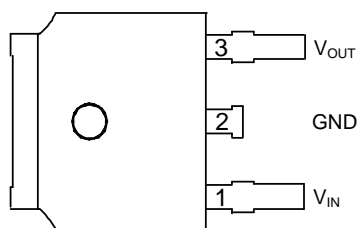
TO-252-2 (1)

(Top View)



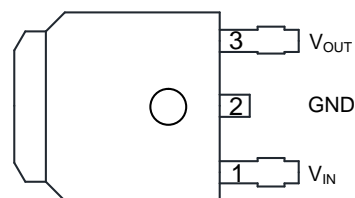
TO-252-2 (2)

(Top View)



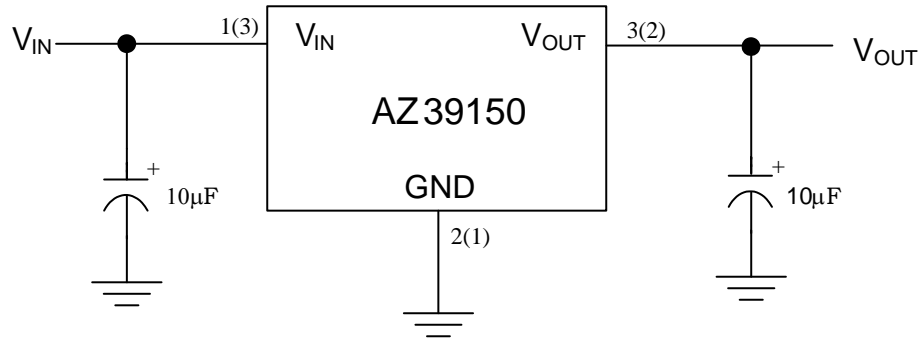
TO-252-2 (3)

(Top View)



TO-252-2 (4)

**Typical Applications Circuit**

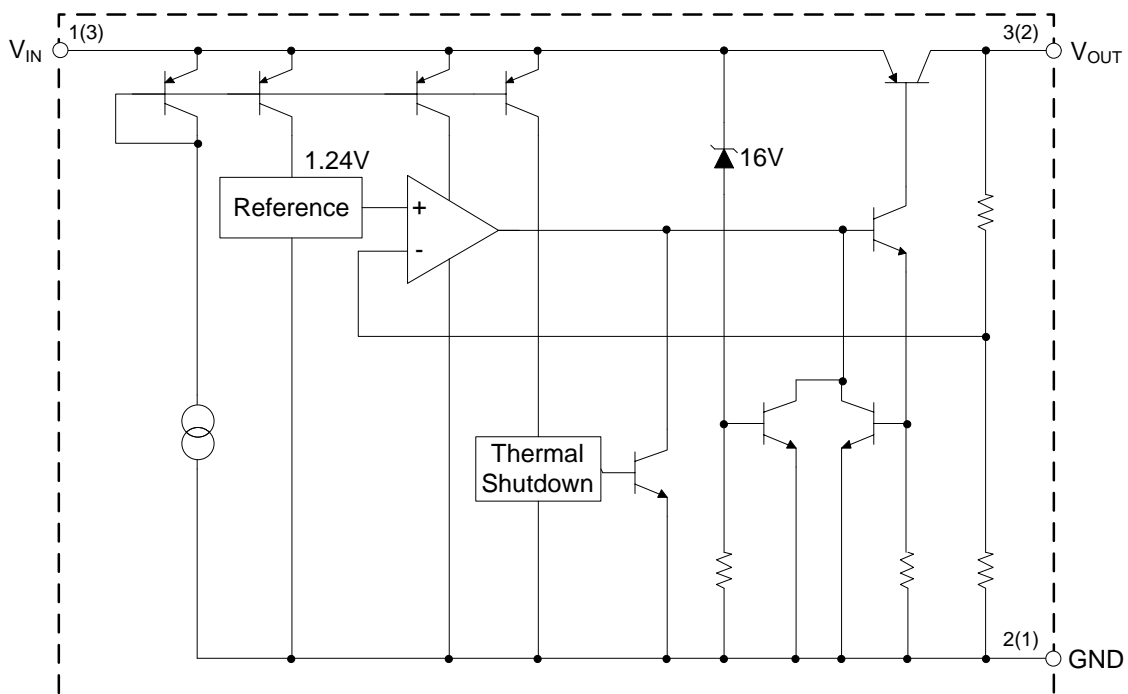


A(B)  
A: TO-220-3, TO-263-3 (S), TO-252-2 (1)/(2)/(3)/(4)  
B: TO-263-3 (SA)

**Pin Description**

Pin Number		Pin Name	Function
TO-220-3 / TO-263-3 (S) TO-252-2 (1)/(2)/(3)/(4)	TO-263-3 (SA)		
1	3	V <sub>IN</sub>	Unregulated input.
2	1	GND	The ground pin. This pin and TAB are internally connected.
3	2	V <sub>OUT</sub>	Regulated output.

**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)

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## Absolute Maximum Ratings (Note 1)

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Symbol	Parameter	Rating	Unit
$V_{IN}$	Supply Voltage	15	V
$T_J$	Maximum Operating Junction Temperature	+150	°C
$T_{STG}$	Storage Temperature Range	-65 to +150	°C
$T_{LEAD}$	Lead Temperature (Soldering, 10sec)	+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.

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## Recommended Operating Conditions

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Symbol	Parameter	Min	Max	Unit
$V_{IN}$	Supply Voltage	—	13.2	V
$T_J$	Operating Junction Temperature	-40	+125	°C

**Electrical Characteristics-3.3V** (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  $-40^\circ C \leq T_J \leq +125^\circ C$ .)

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

- Notes:
- 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  $V_{IN}$ .
  - $V_{IN} = V_{OUT(NOMINAL)} + 1V$ .

**Electrical Characteristics-5.0V** (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  $-40^\circ C \leq T_J \leq +125^\circ C$ .)

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

- Notes:
- 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  $V_{IN}$ .
  - $V_{IN} = V_{OUT(NOMINAL)} + 1V$ .

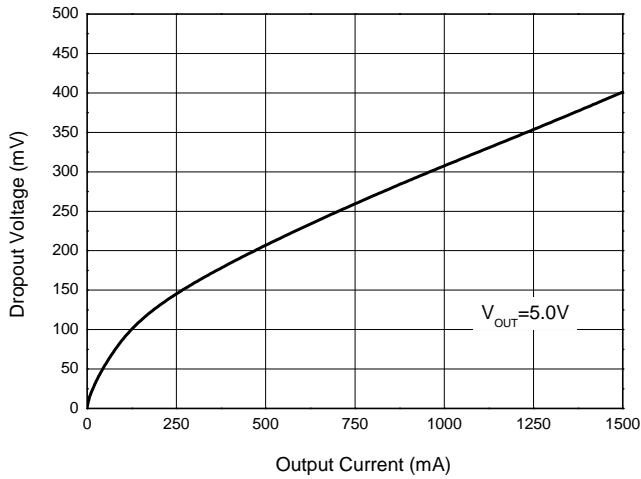
**Electrical Characteristics-12V** (Operating Conditions:  $V_{IN} = 13V$ ,  $I_{OUT} = 10mA$ ,  $C_{IN} = 10\mu F$ ,  $C_{OUT} = 10\mu F$ ,  $T_J = +25^\circ C$ , unless otherwise specified. The **Boldface** applies over  $-40^\circ C \leq T_J \leq +125^\circ C$ .)

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

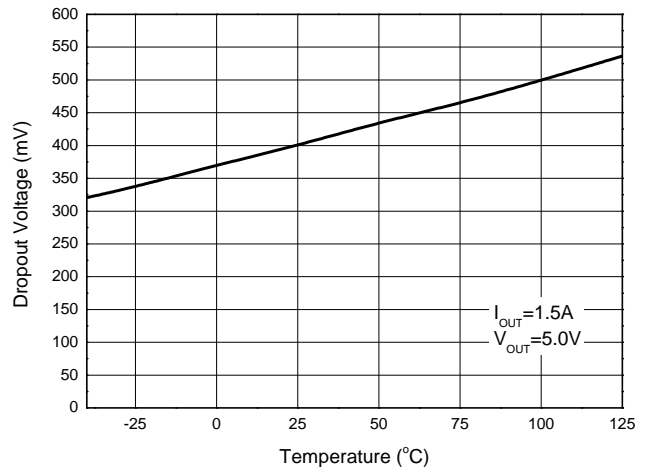
- Notes:
- Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at  $V_{OUT}+1V$  applied to  $V_{IN}$ .
  - $V_{IN} = V_{OUT(NOMINAL)} + 1V$ .

**Performance Characteristics**

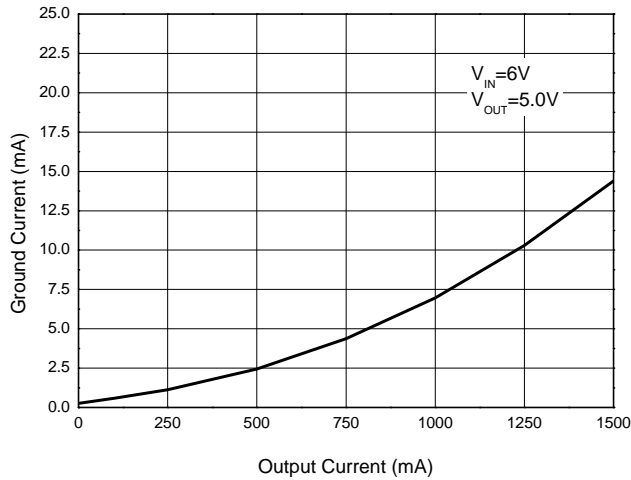
**Dropout Voltage vs. Output Current**



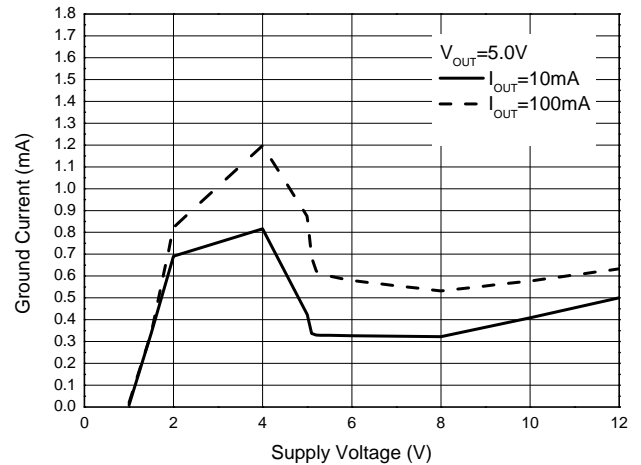
**Dropout Voltage vs. Temperature**



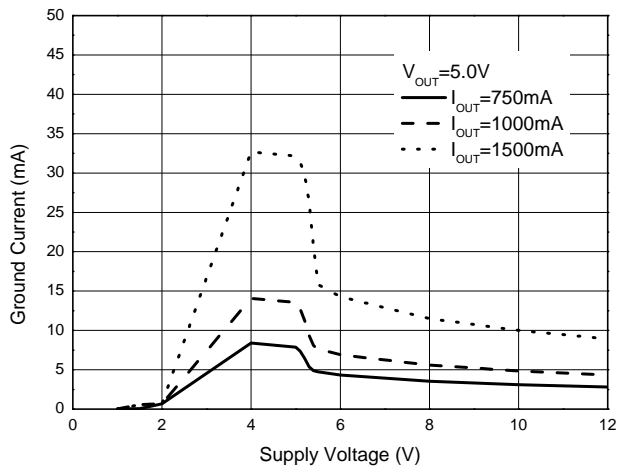
**Ground Current vs. Output Current**



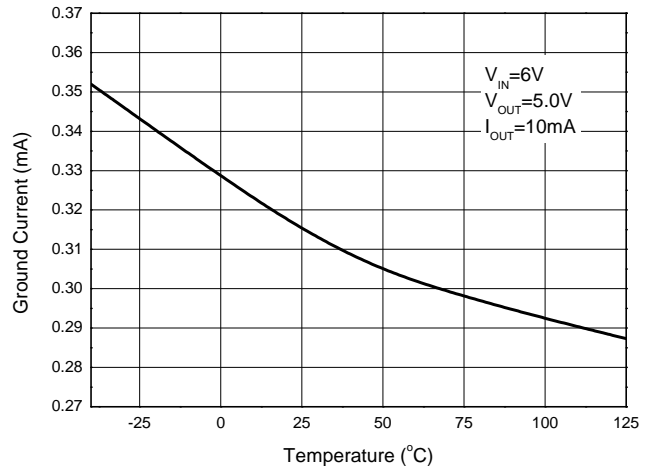
**Ground Current vs. Supply Voltage**



**Ground Current vs. Supply Voltage**

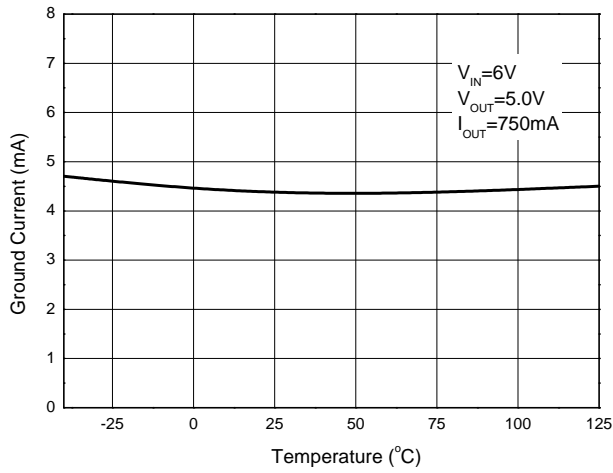


**Ground Current vs. Temperature**

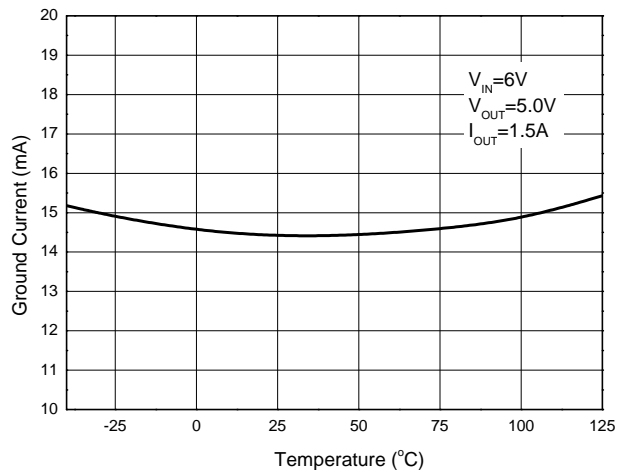


**Performance Characteristics (Cont.)**

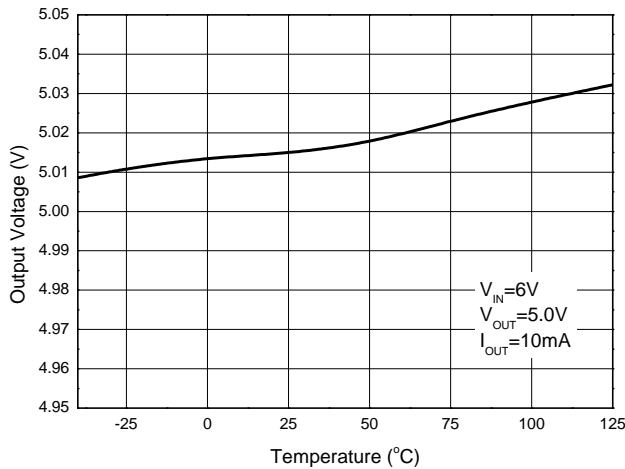
**Ground Current vs. Temperature**



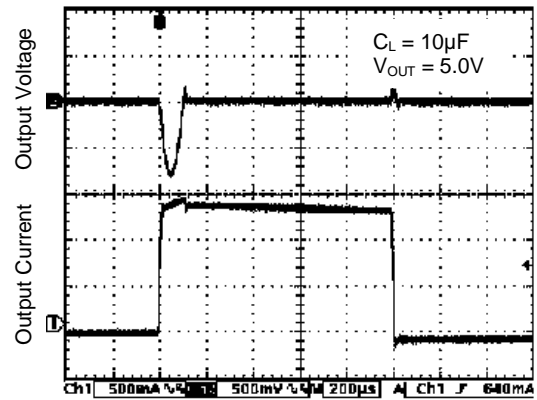
**Ground Current vs. Temperature**



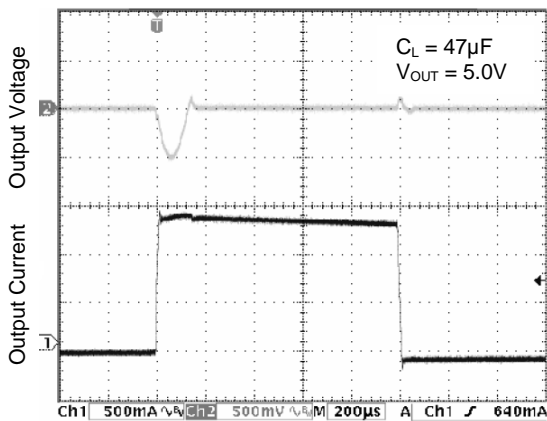
**Output Voltage vs. Temperature**



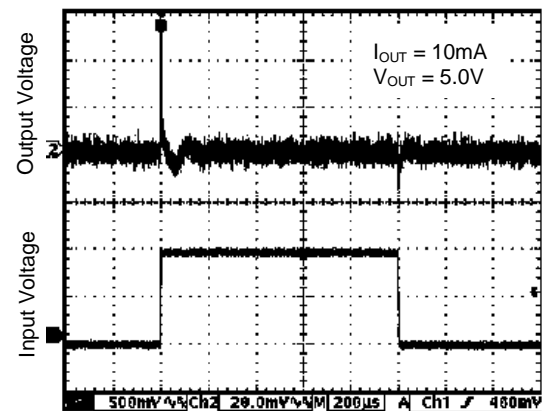
**Load Transient**



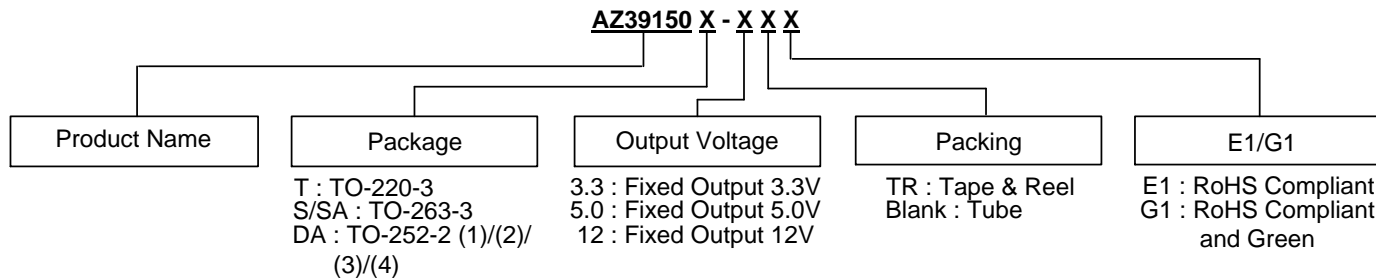
**Load Transient**



**Line Transient**



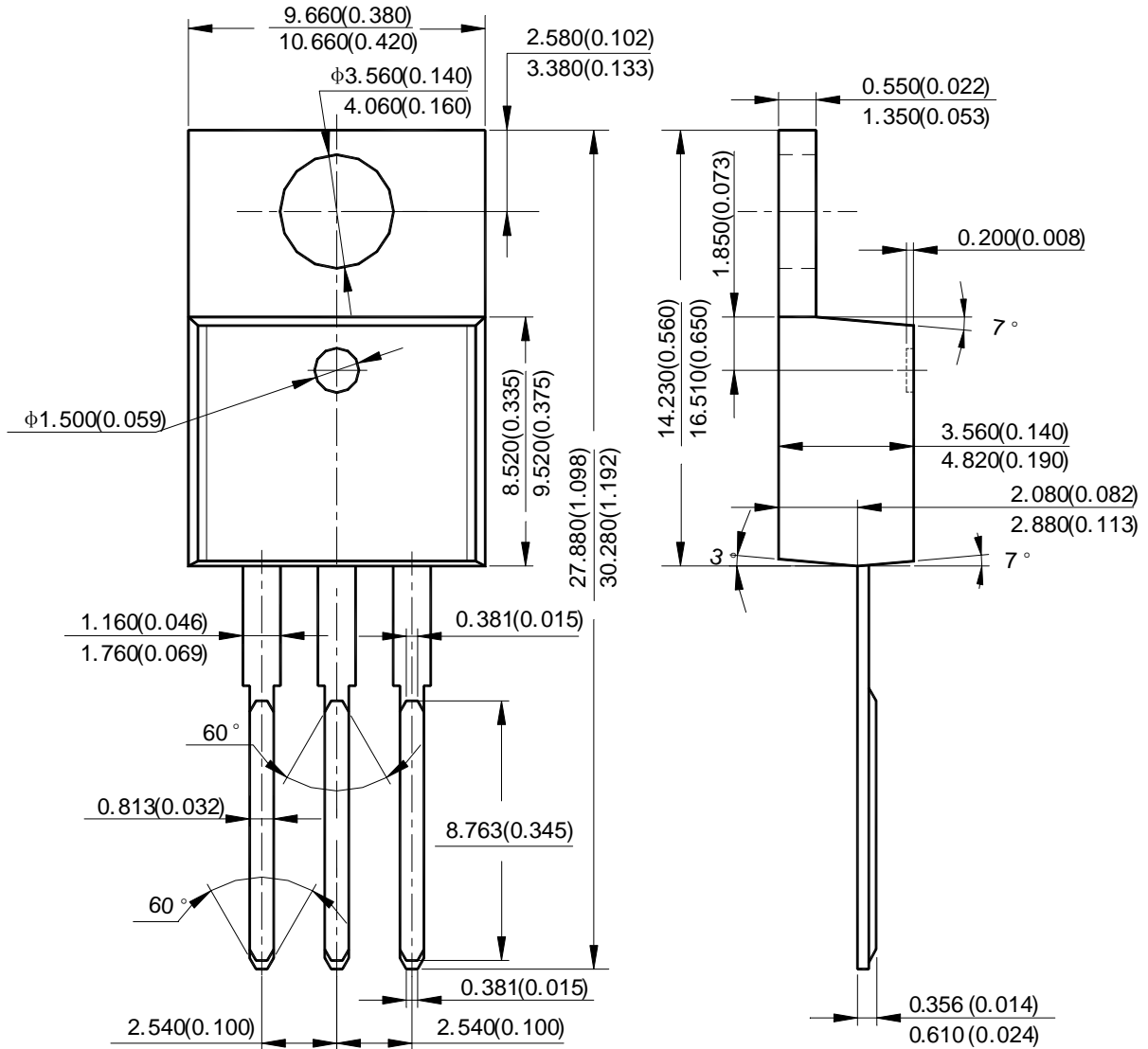


**Ordering Information**


Package	Temperature Range	Part Number		Marking ID		Packing
		RoHS Compliant	RoHS Compliant and Green	RoHS Compliant	RoHS Compliant and 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

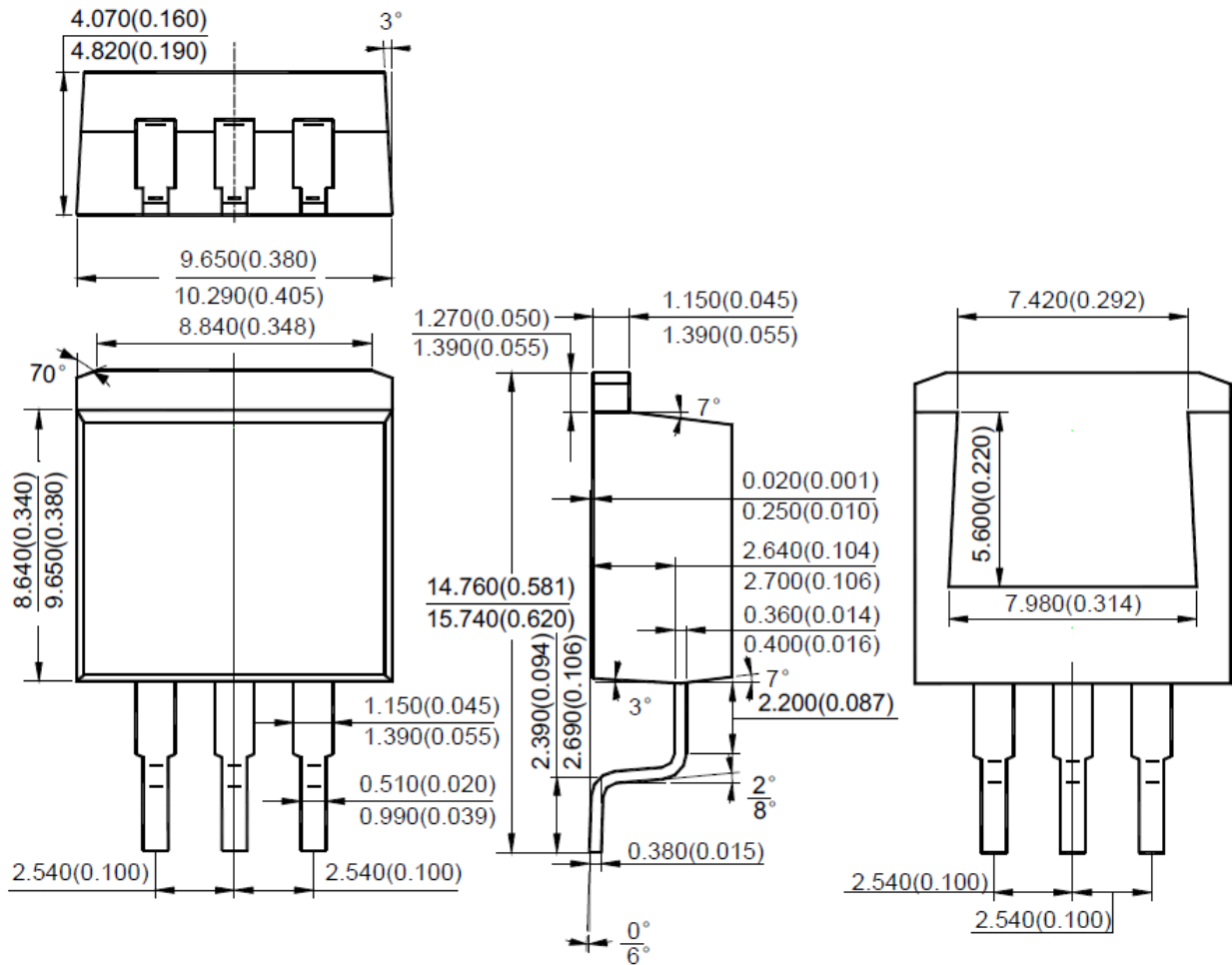
**Package Outline Dimensions** (All dimensions in mm(inch).)

(1) Package Type: TO-220-3



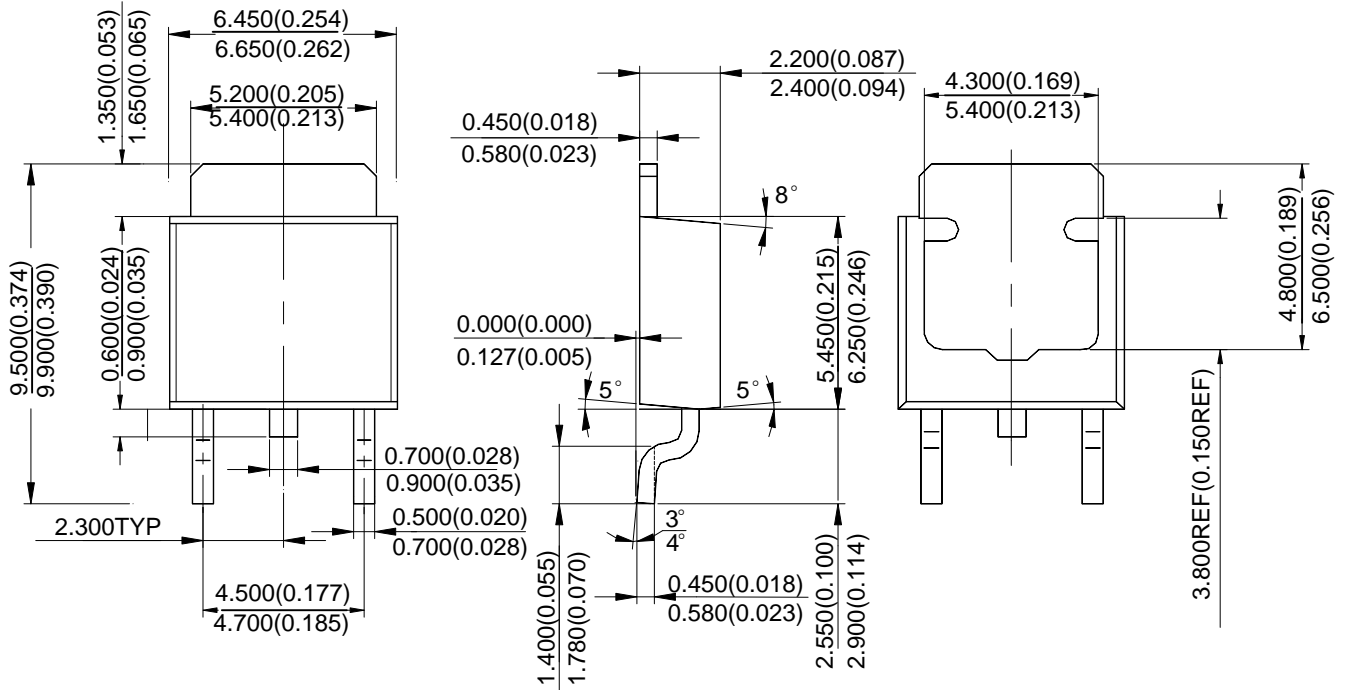
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(2) Package Type: TO-263-3



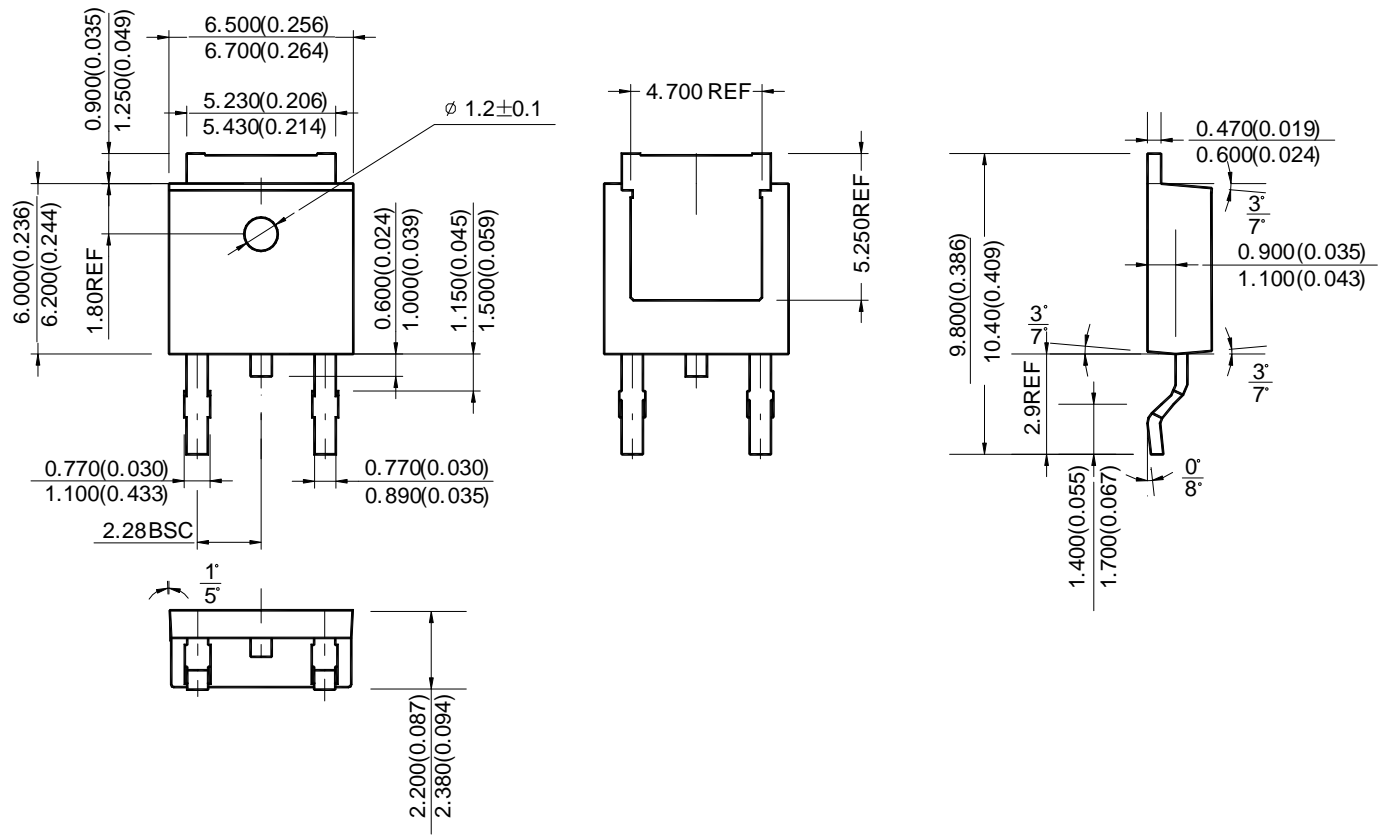
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(3) Package Type: TO-252-2 (1)



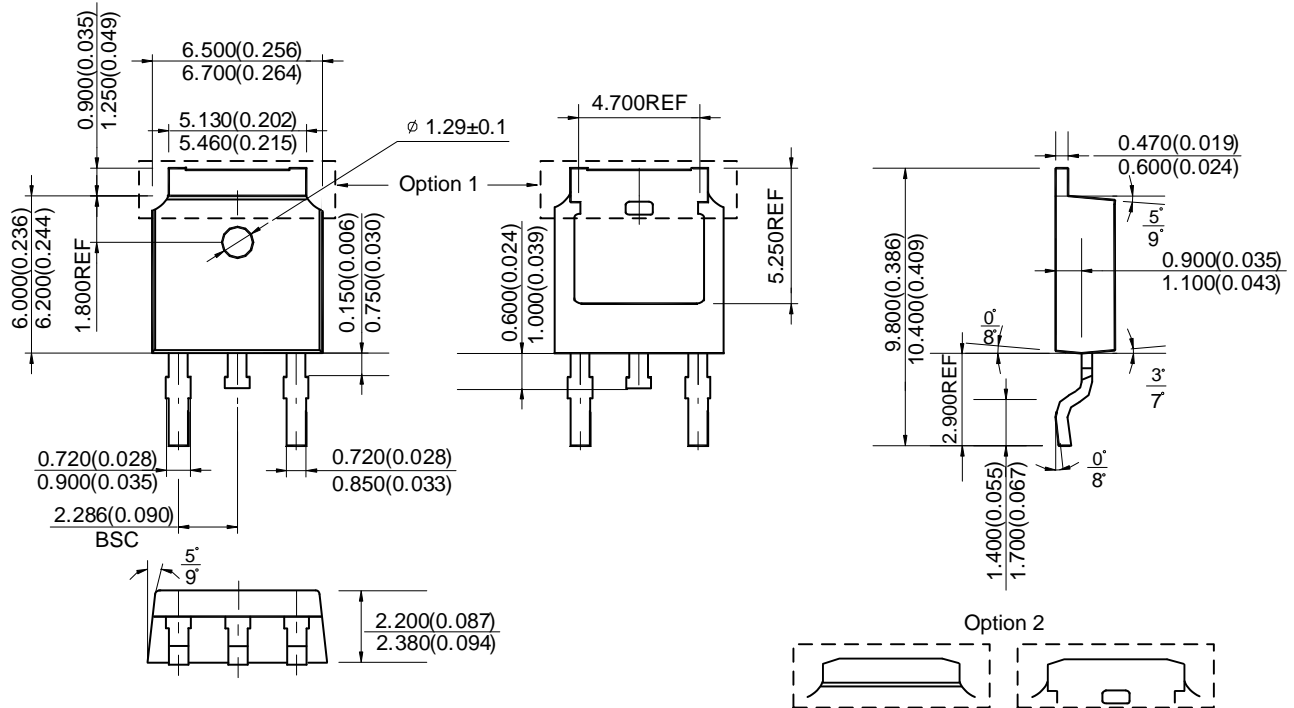
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(4) Package Type: TO-252-2 (2)



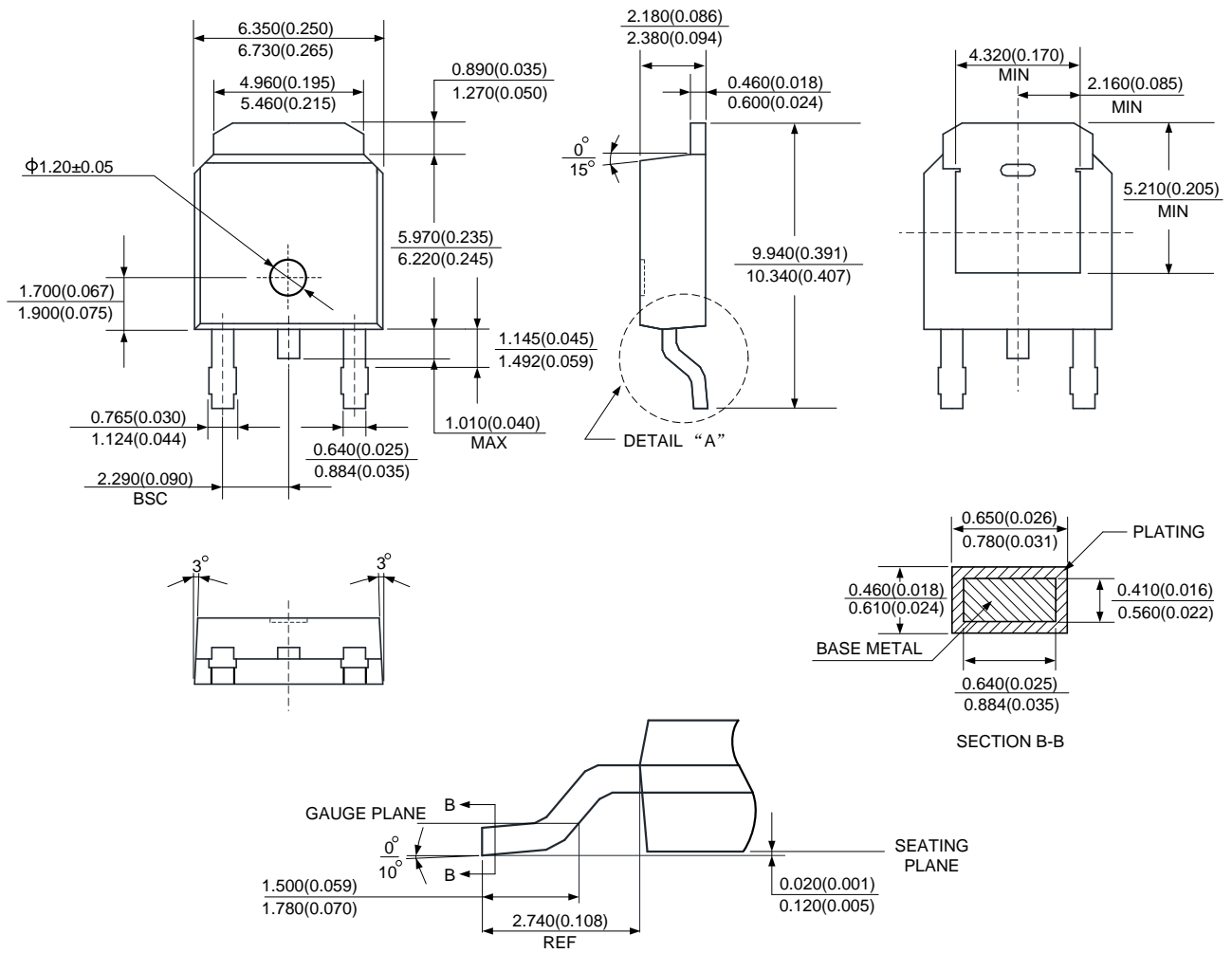
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(5) Package Type: TO-252-2 (3)



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

(6) Package Type: TO-252-2 (4)



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