

## Description

The AZ1117I is available in industrial temperature range low dropout three-terminal regulator.

The AZ1117I is optimized for low voltage where transient response and minimum input voltage are critical. It 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 a combination of high current and ambient temperature that would create excessive junction temperature.

The AZ1117I is available in 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V fixed output voltage versions and ADJ output voltage version. 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 AZ1117I is available in the industry-standard SOT223 and TO252-2 power packages.

## Features

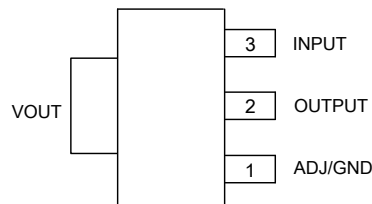
- Current Limit: 1.35A (Typ)
- Output Noise from 10Hz to 10KHz: 0.003% of  $V_{OUT}$
- PSRR at  $I_{OUT} = 300mA$  and  $f = 120Hz$ : 70dB
- Output Voltage Accuracy:  $\pm 1\%$  (Except 1.2V Version)
- On-chip Thermal Shutdown
- Maximum Quiescent Current:  $I_{QMAX} = 6mA$
- Compatible with Low ESR Ceramic Capacitor
- Operation Junction Temperature:  $-40^{\circ}C$  to  $+125^{\circ}C$
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

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](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.

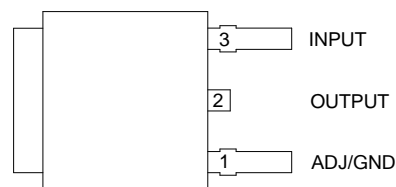
## Pin Assignments

(Top View)



**SOT223**

(Top View)

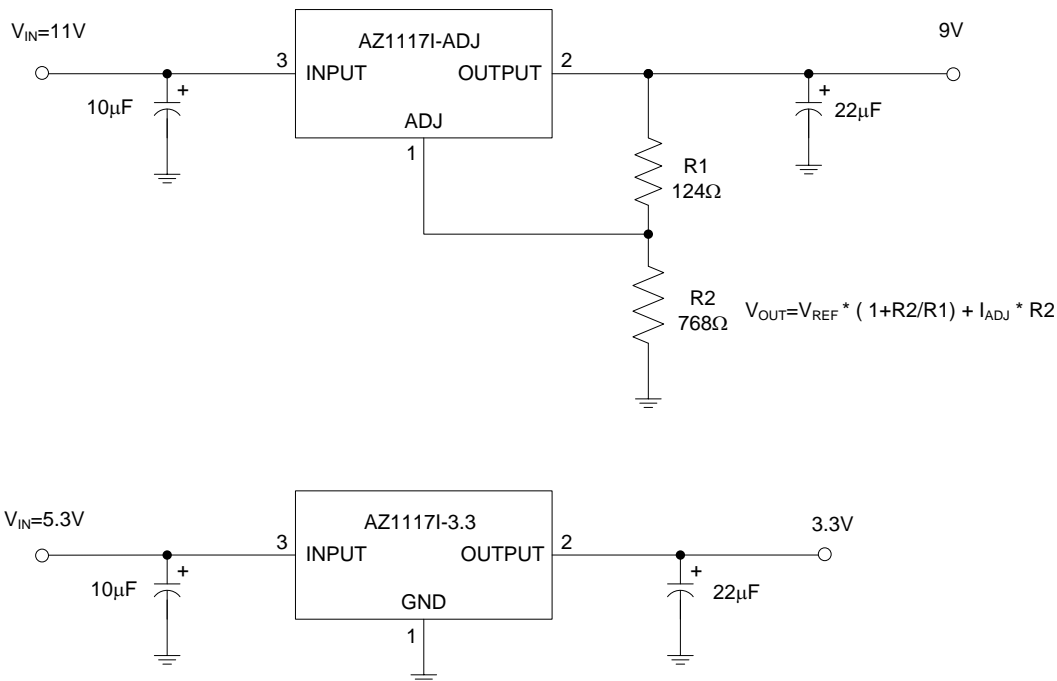


**TO252-2**

## Applications

- USB Device
- Add-on Card
- DVD Player
- PC Motherboard

# Typical Applications Circuit (Note 4)

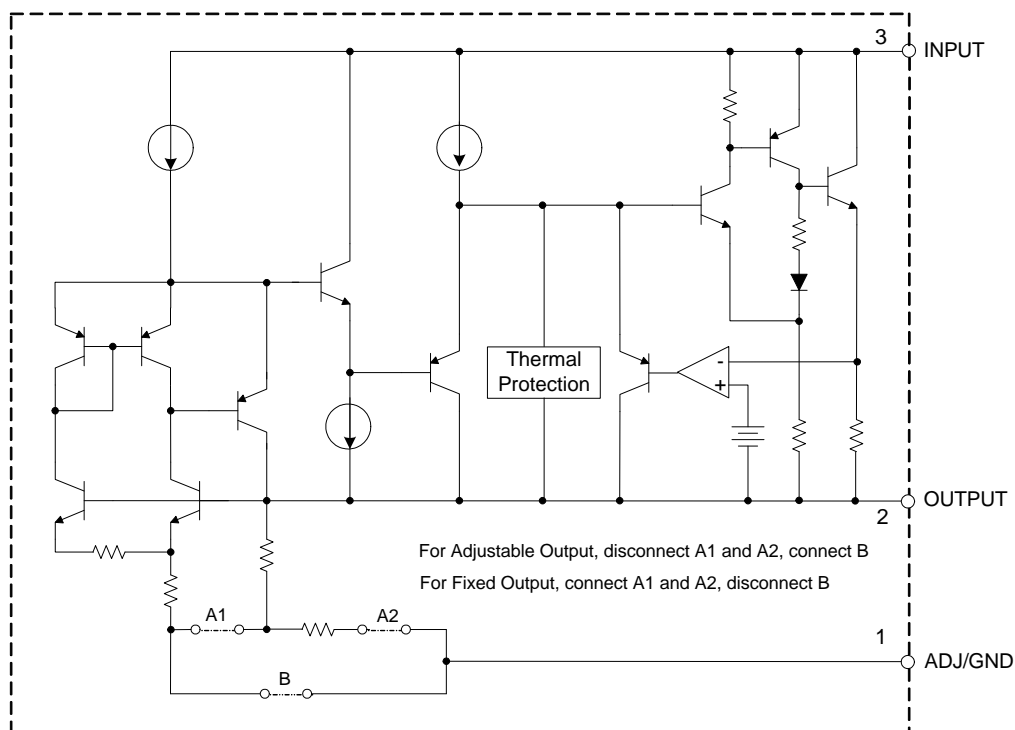


Note 4: The AZ1117I is compatible with low ESR ceramic capacitor.

The ESR of the output capacitors must be less than 200Ω.

A minimum of 10µF output capacitor is required.

# Functional Block Diagram



## Absolute Maximum Ratings (Note 5) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating		Unit
V <sub>IN</sub>	Input Voltage	18		V
T <sub>J</sub>	Operating Junction Temperature Range	+150		°C
T <sub>STG</sub>	Storage Temperature Range	-65 to +150		°C
θ <sub>JA</sub>	Thermal Resistance (Without Heatsink)	SOT223	125	°C/W
		TO252-2	100	
θ <sub>JA</sub>	Thermal Resistance (With Heatsink) (Note 6)	SOT223	100	°C/W
		TO252-2	70	
T <sub>LEAD</sub>	Lead Temperature (Soldering, 10sec)	+260		°C

Notes: 5. 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.  
6. Chip is soldered to 100mm<sup>2</sup> (10mm\*10mm) copper (top side solder mask) on 2oz.2 layers FR-4 PCB with 8\*0.5mm vias.

## Recommended Operating Conditions (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V <sub>IN</sub>	Input Voltage	—	15	V
T <sub>J</sub>	Operating Junction Temperature Range	-40	+125	°C

## Electrical Characteristics AZ1117I-ADJ

(Operating Conditions: V<sub>IN</sub> = V<sub>OUT</sub> + 2V, I<sub>OUT</sub> = 10mA, T<sub>J</sub> = +25°C, unless otherwise specified. (P ≤ maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>REF</sub>	Reference Voltage	1.5V ≤ V <sub>IN</sub> - V <sub>OUT</sub> ≤ 10V	1.238 <b>1.225</b>	1.250	1.262 <b>1.275</b>	V
V <sub>RLINE</sub>	Line Regulation	1.5V ≤ V <sub>IN</sub> - V <sub>OUT</sub> ≤ 10V	— —	0.001 —	0.1 <b>0.2</b>	%
V <sub>RLOAD</sub>	Load Regulation	V <sub>IN</sub> = V <sub>OUT</sub> + 2V 1mA ≤ I <sub>OUT</sub> ≤ 1A	—	0.4	1.0	%
V <sub>DROP</sub>	Dropout Voltage	ΔV <sub>REF</sub> = 1%, I <sub>OUT</sub> = 0.8A	SOT223	1.2	1.3	V
			TO252-2	1.3	1.4	V
I <sub>LIMIT</sub>	Current Limit	—	1	1.35	—	A
—	Adjust Pin Current	—	—	60	<b>120</b>	μA
—	Adjust Pin Current Change	1.5 ≤ (V <sub>IN</sub> - V <sub>OUT</sub> ) ≤ 10V	—	0.2	<b>5</b>	μA
—	Minimum Load Current	1.5 ≤ (V <sub>IN</sub> - V <sub>OUT</sub> ) ≤ 10V	—	1.7	<b>5</b>	mA
PSRR	Ripple Rejection	f = 120Hz, C <sub>OUT</sub> = 22μF (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, I <sub>OUT</sub> = 300mA	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of V <sub>OUT</sub> )	T <sub>A</sub> = +25°C, 10Hz ≤ f ≤ 10KHz	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	°C
—	Thermal Shutdown Hysteresis	—	—	+16	—	°C
θ <sub>JC</sub>	Thermal Resistance (Junction to Case)	SOT223	— —	15	— —	°C/W
		TO252-2	—	10	—	

**Electrical Characteristics AZ1117I-1.2 (Cont.)**

(Operating Conditions:  $V_{IN} \leq 10V$ ,  $I_{OUT} = 10mA$ ,  $T_J = +25^\circ C$ , 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  $+125^\circ C$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	1.176 <b>1.152</b>	1.2	1.224 <b>1.248</b>	V
$V_{RLINE}$	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	— —	0.5 —	6 <b>10</b>	mV
$V_{RLOAD}$	Load Regulation	$V_{IN} = V_{OUT} + 2V$ $1mA \leq I_{OUT} \leq 1A$	—	2	15	mV
$V_{DROP}$	Dropout Voltage	$\Delta V_{OUT} = 1\%$ , $I_{OUT} = 0.8A$	—	1.2	1.3	V
		SOT223 TO252-2	—	1.3	1.4	V
$I_{LIMIT}$	Current Limit	—	1	1.35	—	A
$I_Q$	Quiescent Current	$I_{OUT} = 0$	—	4	<b>6</b>	mA
PSRR	Ripple Rejection	$f = 120Hz$ , $C_{OUT} = 22\mu F$ ( $V_{IN} - V_{OUT}$ ) = 3V, $I_{OUT} = 300mA$	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of $V_{OUT}$ )	$T_A = +25^\circ C$ , $10Hz \leq f \leq 10KHz$	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	$^\circ C$
—	Thermal Shutdown Hysteresis	—	—	+16	—	$^\circ C$
$\theta_{JC}$	Thermal Resistance (Junction to Case)	SOT223	— —	15	—	$^\circ C/W$
		TO252-2	—	10	—	

**Electrical Characteristics AZ1117I-1.5 (Cont.)**

(Operating Conditions:  $V_{IN} \leq 10V$ ,  $I_{OUT} = 10mA$ ,  $T_J = +25^\circ C$ , 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  $+125^\circ C$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	1.485 <b>1.47</b>	1.5	1.515 <b>1.53</b>	V
$V_{RLINE}$	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	— —	0.5 —	6 <b>10</b>	mV
$V_{RLOAD}$	Load Regulation	$V_{IN} = V_{OUT} + 2V$ $1mA \leq I_{OUT} \leq 1A$	—	2	15	mV
$V_{DROP}$	Dropout Voltage	$\Delta V_{OUT} = 1\%$ , $I_{OUT} = 0.8A$	—	1.2	1.3	V
		SOT223 TO252-2	—	1.3	1.4	V
$I_{LIMIT}$	Current Limit	—	1	1.35	—	A
$I_Q$	Quiescent Current	$I_{OUT} = 0$	—	4	<b>6</b>	mA
PSRR	Ripple Rejection	$f = 120Hz$ , $C_{OUT} = 22\mu F$ ( $V_{IN} - V_{OUT}$ ) = 3V, $I_{OUT} = 300mA$	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of $V_{OUT}$ )	$T_A = +25^\circ C$ , $10Hz \leq f \leq 10KHz$	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	$^\circ C$
—	Thermal Shutdown Hysteresis	—	—	+16	—	$^\circ C$
$\theta_{JC}$	Thermal Resistance (Junction to Case)	SOT223	— —	15	—	$^\circ C/W$
		TO252-2	—	10	—	

**Electrical Characteristics AZ1117I-1.8 (Cont.)**

(Operating Conditions:  $V_{IN} \leq 10V$ ,  $I_{OUT} = 10mA$ ,  $T_J = +25^\circ C$ , 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  $+125^\circ C$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	1.782 <b>1.764</b>	1.8	1.818 <b>1.836</b>	V
$V_{RLINE}$	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	— —	0.5 —	6 <b>10</b>	mV
$V_{RLOAD}$	Load Regulation	$V_{IN} = V_{OUT} + 2V$ $1mA \leq I_{OUT} \leq 1A$	—	2	15	mV
$V_{DROP}$	Dropout Voltage	$\Delta V_{OUT} = 1\%$ , $I_{OUT} = 0.8A$	—	1.2	1.3	V
		SOT223	—	1.3	1.4	V
		TO252-2	—	1.3	1.4	V
$I_{LIMIT}$	Current Limit	—	1	1.35	—	A
$I_Q$	Quiescent Current	$I_{OUT} = 0$	—	4	<b>6</b>	mA
PSRR	Ripple Rejection	$f = 120Hz$ , $C_{OUT} = 22\mu F$ $(V_{IN} - V_{OUT}) = 3V$ , $I_{OUT} = 300mA$	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of $V_{OUT}$ )	$T_A = +25^\circ C$ , $10Hz \leq f \leq 10KHz$	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	$^\circ C$
—	Thermal Shutdown Hysteresis	—	—	+16	—	$^\circ C$
$\theta_{JC}$	Thermal Resistance (Junction to Case)	SOT223	— —	15	— —	$^\circ C/W$
		TO252-2	—	10	—	

**Electrical Characteristics AZ1117I-2.5 (Cont.)**

(Operating Conditions:  $V_{IN} \leq 10V$ ,  $I_{OUT} = 10mA$ ,  $T_J = +25^\circ C$ , 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  $+125^\circ C$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	2.475 <b>2.455</b>	2.5	2.525 <b>2.545</b>	V
$V_{RLINE}$	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	— —	0.5 —	6 <b>10</b>	mV
$V_{RLOAD}$	Load Regulation	$V_{IN} = V_{OUT} + 2V$ $1mA \leq I_{OUT} \leq 1A$	—	2	15	mV
$V_{DROP}$	Dropout Voltage	$\Delta V_{OUT} = 1\%$ , $I_{OUT} = 0.8A$	—	1.2	1.3	V
		SOT223	—	1.3	1.4	V
		TO252-2	—	1.3	1.4	V
$I_{LIMIT}$	Current Limit	—	1	1.35	—	A
$I_Q$	Quiescent Current	$I_{OUT} = 0$	—	4	<b>6</b>	mA
PSRR	Ripple Rejection	$f = 120Hz$ , $C_{OUT} = 22\mu F$ $(V_{IN} - V_{OUT}) = 3V$ , $I_{OUT} = 300mA$	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of $V_{OUT}$ )	$T_A = +25^\circ C$ , $10Hz \leq f \leq 10KHz$	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	$^\circ C$
—	Thermal Shutdown Hysteresis	—	—	+16	—	$^\circ C$
$\theta_{JC}$	Thermal Resistance (Junction to Case)	SOT223	— —	15	— —	$^\circ C/W$
		TO252-2	—	10	—	

**Electrical Characteristics AZ1117I-3.3 (Cont.)**

(Operating Conditions:  $V_{IN} \leq 10V$ ,  $I_{OUT} = 10mA$ ,  $T_J = +25^\circ C$ , 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  $+125^\circ C$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$	3.267 <b>3.235</b>	3.3 3.3	3.333 <b>3.365</b>	V
$V_{RLINE}$	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$	— —	0.5 —	6 <b>10</b>	mV
$V_{RLOAD}$	Load Regulation	$V_{IN} = V_{OUT}+2V$ $1mA \leq I_{OUT} \leq 1A$	—	2	15	mV
$V_{DROP}$	Dropout Voltage	$\Delta V_{OUT} = 1\%$ , $I_{OUT} = 0.8A$	—	1.2	1.3	V
		SOT223	—	1.3	1.4	V
		TO252-2	—	1.3	1.4	V
$I_{LIMIT}$	Current Limit	—	1	1.35	—	A
$I_Q$	Quiescent Current	$I_{OUT} = 0$	—	4	<b>6</b>	mA
PSRR	Ripple Rejection	$f = 120Hz$ , $C_{OUT} = 22\mu F$ ( $V_{IN}-V_{OUT}$ ) = 3V, $I_{OUT} = 300mA$	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of $V_{OUT}$ )	$T_A = +25^\circ C$ , $10Hz \leq f \leq 10KHz$	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	$^\circ C$
—	Thermal Shutdown Hysteresis	—	—	+16	—	$^\circ C$
$\theta_{JC}$	Thermal Resistance (Junction to Case)	SOT223	— —	15	— —	$^\circ C/W$
		TO252-2	—	10	—	

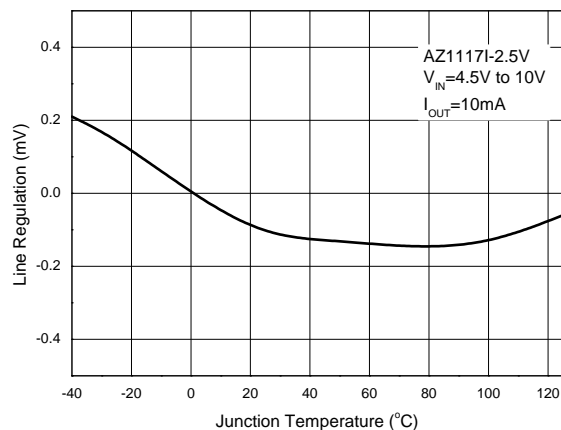
**Electrical Characteristics AZ1117I-5.0 (Cont.)**

(Operating Conditions:  $V_{IN} \leq 10V$ ,  $I_{OUT} = 10mA$ ,  $T_J = +25^\circ C$ , 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  $+125^\circ C$ .)

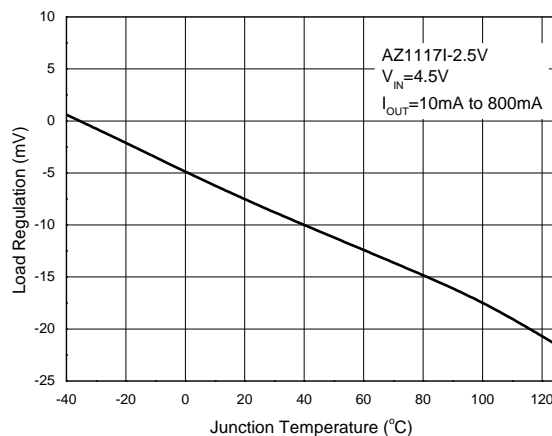
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$	4.950 <b>4.900</b>	5.0 5.0	5.050 <b>5.100</b>	V
$V_{RLINE}$	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$	— —	0.5 —	6 <b>10</b>	mV
$V_{RLOAD}$	Load Regulation	$V_{IN} = V_{OUT}+2V$ $1mA \leq I_{OUT} \leq 1A$	—	2	15	mV
$V_{DROP}$	Dropout Voltage	$\Delta V_{OUT} = 1\%$ , $I_{OUT} = 0.8A$	—	1.2	1.3	V
		SOT223	—	1.3	1.4	V
		TO252-2	—	1.3	1.4	V
$I_{LIMIT}$	Current Limit	—	1	1.35	—	A
$I_Q$	Quiescent Current	$I_{OUT} = 0$	—	4	<b>6</b>	mA
PSRR	Ripple Rejection	$f = 120Hz$ , $C_{OUT} = 22\mu F$ ( $V_{IN}-V_{OUT}$ ) = 3V, $I_{OUT} = 300mA$	—	70	—	dB
—	Temperature Stability	—	—	0.5	—	%
—	RMS Output Noise (% of $V_{OUT}$ )	$T_A = +25^\circ C$ , $10Hz \leq f \leq 10KHz$	—	0.003	—	%
—	Thermal Shutdown	Junction Temperature	—	+160	—	$^\circ C$
—	Thermal Shutdown Hysteresis	—	—	+16	—	$^\circ C$
$\theta_{JC}$	Thermal Resistance (Junction to Case)	SOT223	— —	15	— —	$^\circ C/W$
		TO252-2	—	10	—	

## Performance Characteristics

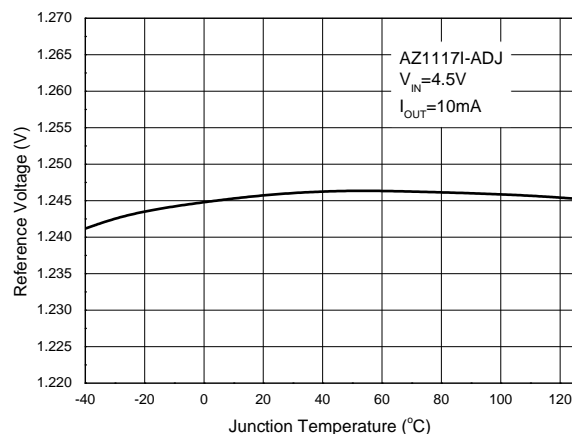
**Line Regulation vs. Temperature**



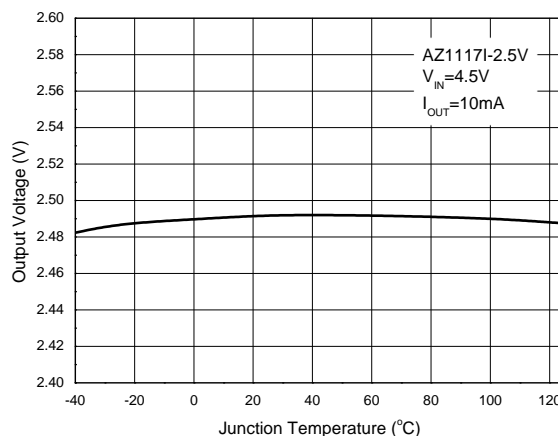
**Load Regulation vs. Temperature**



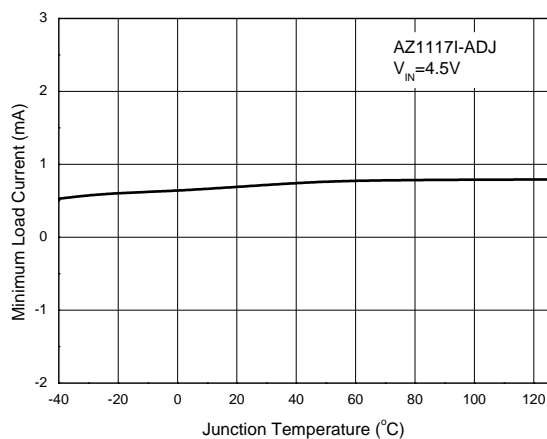
**Reference Voltage vs. Temperature**



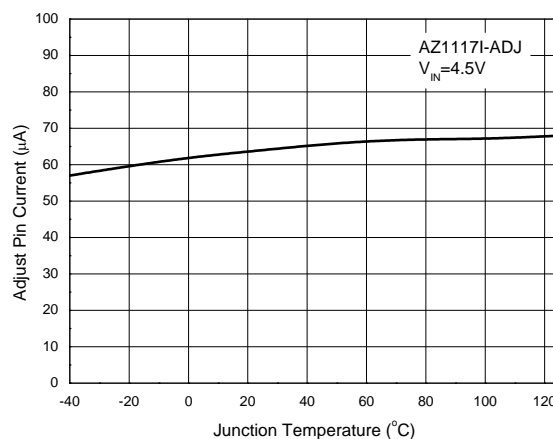
**Output Voltage vs. Temperature**



**Minimum Load Current vs. Temperature**

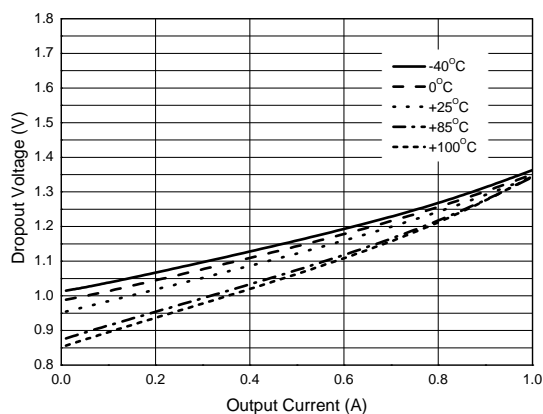


**Adjust Pin Current vs. Temperature**

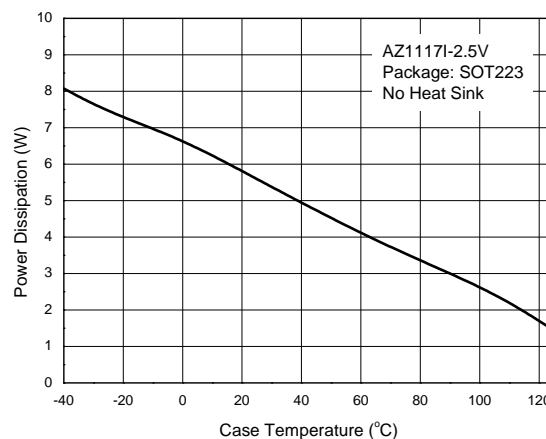


**Performance Characteristics (Cont.)**

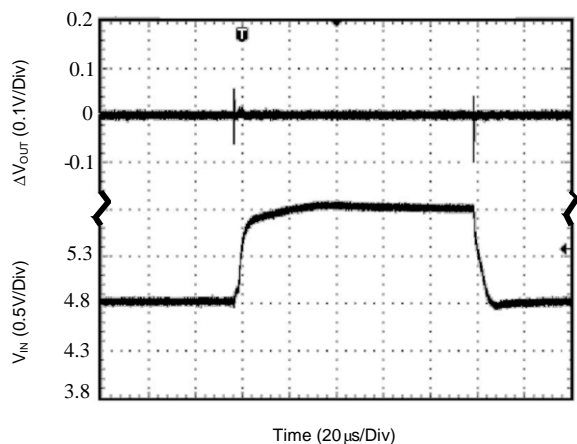
**Dropout Voltage vs. Output Current**



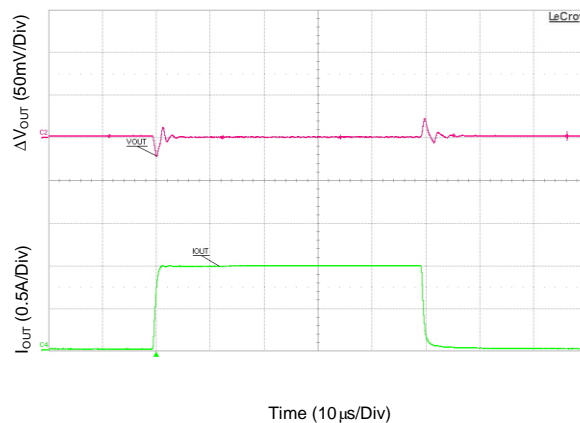
**Power Dissipation vs. Temperature**



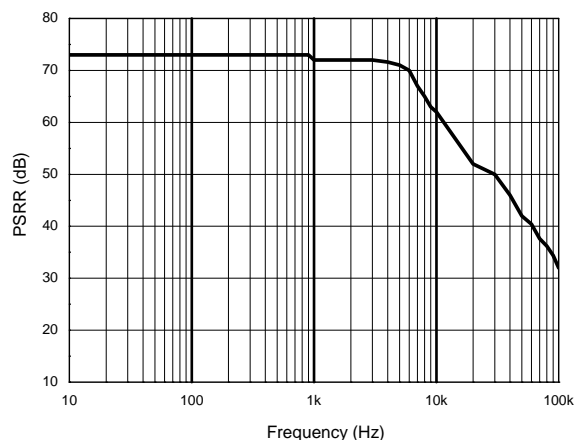
**Line Transient Response**



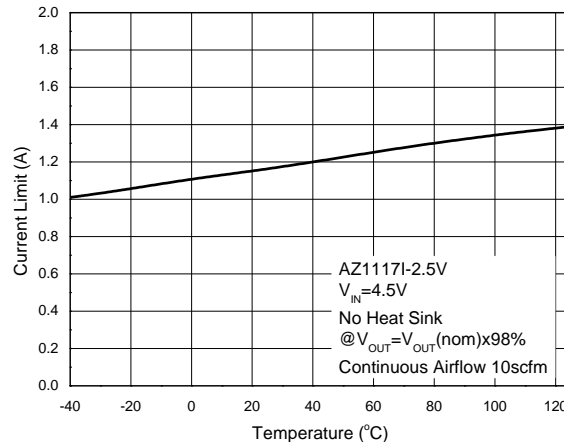
**Load Transient Response**



**PSRR vs. Frequency**



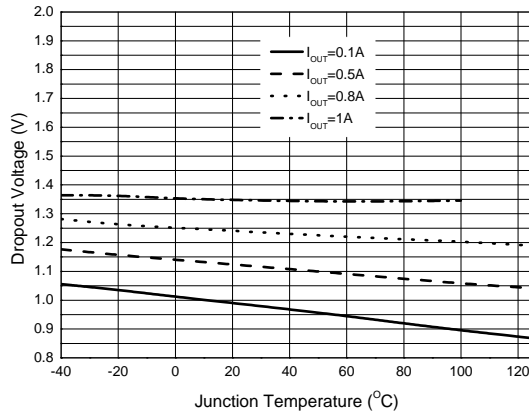
**Current Limit vs. Temperature**



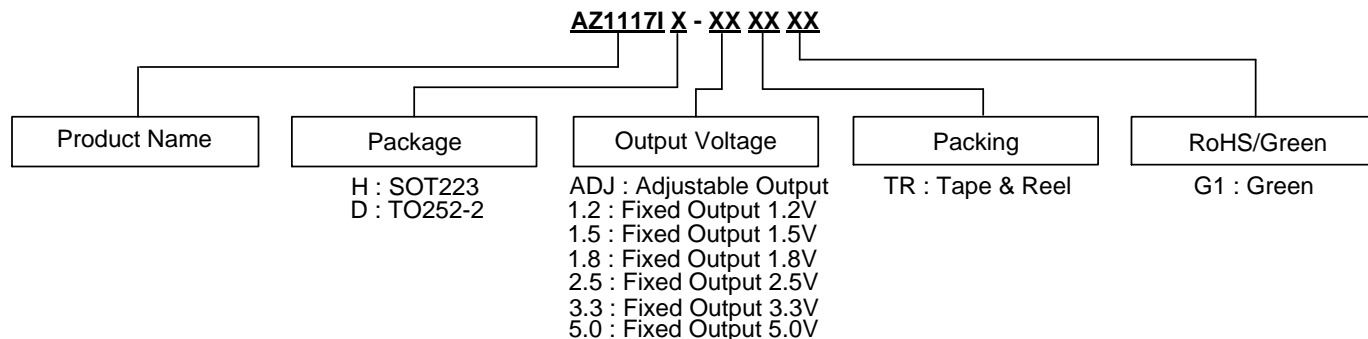


**Performance Characteristics** (Cont.)

**Dropout Voltage vs. Temperature**



## Ordering Information

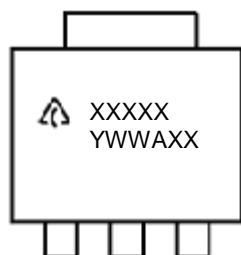


Package	Temperature Range	Part Number	Marking ID	Packing
SOT223	-40°C to +125°C	AZ1117IH-ADJTRG1	GH86J	4000/Tape & Reel
		AZ1117IH-1.2TRG1	GH86K	4000/Tape & Reel
		AZ1117IH-1.5TRG1	GH86L	4000/Tape & Reel
		AZ1117IH-1.8TRG1	GH86M	4000/Tape & Reel
		AZ1117IH-2.5TRG1	GH86N	4000/Tape & Reel
		AZ1117IH-3.3TRG1	GH86P	4000/Tape & Reel
		AZ1117IH-5.0TRG1	GH86Q	4000/Tape & Reel
TO252-2		AZ1117ID-ADJTRG1	AZ1117ID-ADJG1	2500/Tape & Reel
		AZ1117ID-1.2TRG1	AZ1117ID-1.2G1	2500/Tape & Reel
		AZ1117ID-1.5TRG1	AZ1117ID-1.5G1	2500/Tape & Reel
		AZ1117ID-1.8TRG1	AZ1117ID-1.8G1	2500/Tape & Reel
		AZ1117ID-2.5TRG1	AZ1117ID-2.5G1	2500/Tape & Reel
		AZ1117ID-3.3TRG1	AZ1117ID-3.3G1	2500/Tape & Reel
		AZ1117ID-5.0TRG1	AZ1117ID-5.0G1	2500/Tape & Reel

## Marking Information

(1) SOT223

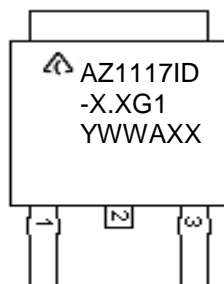
(Top View)



First Line: Logo and Marking ID  
(See Ordering Information)  
Second Line: Date Code  
Y: Year  
WW: Work Week of Molding  
A: Assembly House Code  
XX: 7<sup>th</sup> and 8<sup>th</sup> Digits of Batch Number

(2) TO252-2

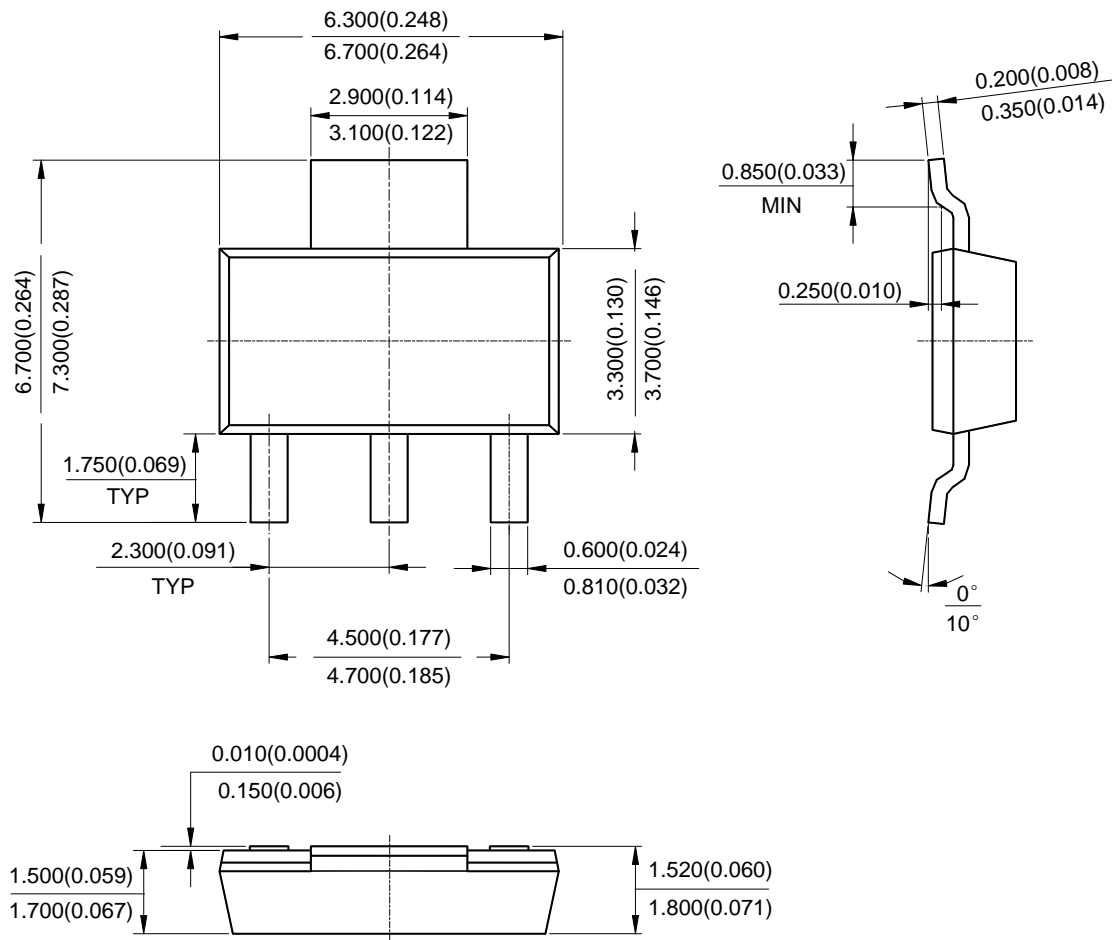
(Top View)



First and Second Lines: Logo and Marking ID  
(See Ordering Information)  
Third Line: Date Code  
Y: Year  
WW: Work Week of Molding  
A: Assembly House Code  
XX: 7<sup>th</sup> and 8<sup>th</sup> Digits of Batch Number

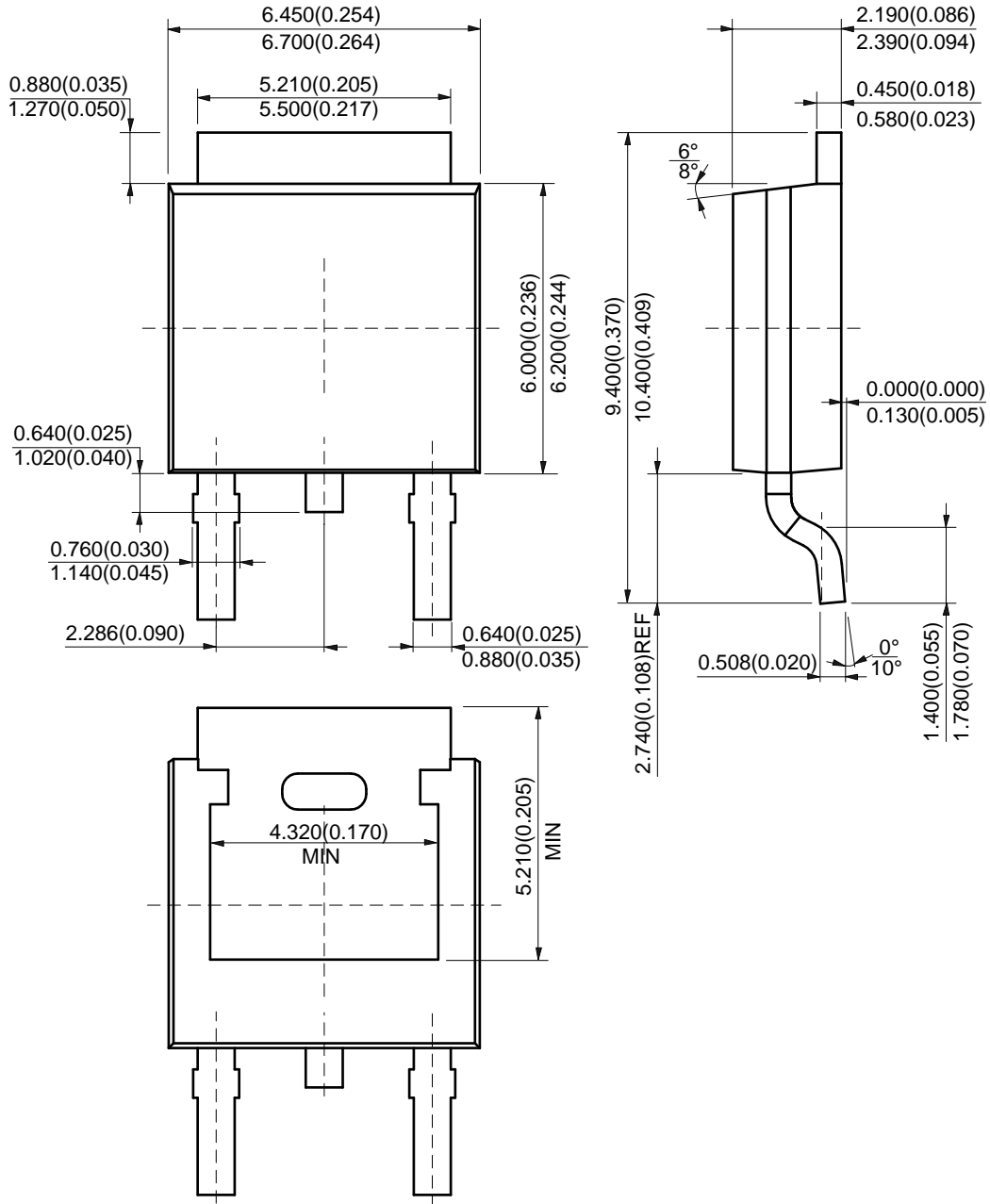
**Package Outline Dimensions** (All dimensions in mm.)

(1) Package Type: SOT223



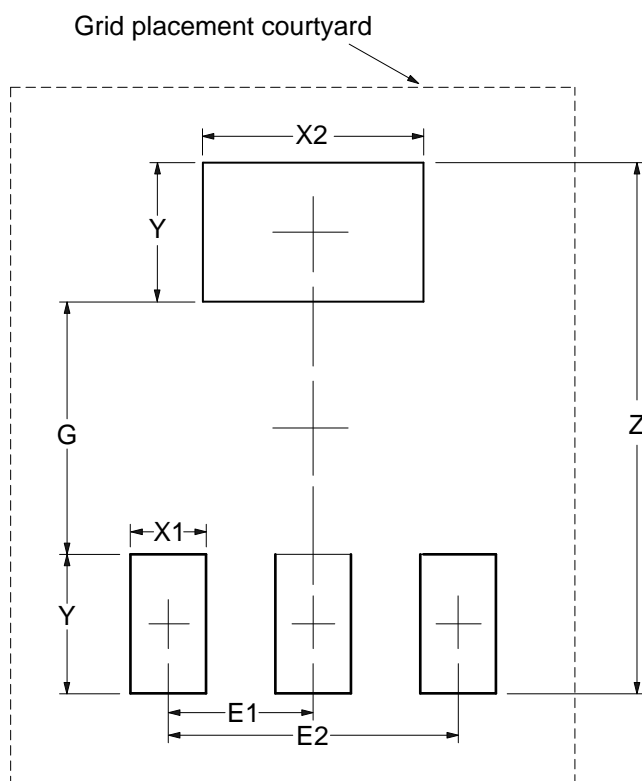
**Package Outline Dimensions** (All dimensions in mm.) (Cont.)

(2) Package Type: TO252-2 (5)



## Suggested Pad Layout

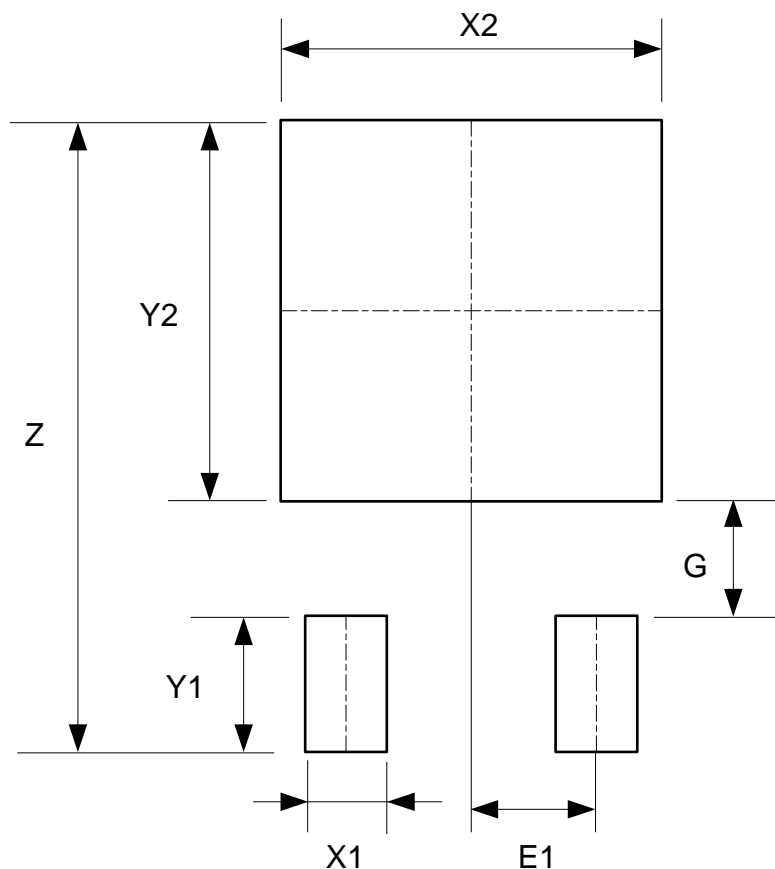
(1) Package Type: SOT223



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X1 (mm)/(inch)	X2 (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	8.400/0.331	4.000/0.157	1.200/0.047	3.500/0.138	2.200/0.087	2.300/0.091	4.600/0.181

**Suggested Pad Layout** (Cont.)

(2) Package Type: TO252-2 (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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