LOW DROPOUT LINEAR REGULATOR WITH INDUSTRIAL TEMPERATURE RANGE

Description

The DIODES™ AZ1117I is a low dropout three-terminal regulator optimized for a low voltage where transient response and minimum input voltage are critical. The device provides current-limit and thermal-shutdown features. Its circuit includes a trimmed bandgap reference to assure an output voltage accuracy of within ±1%. On-chip thermal shutdown provides protection against a combination of high current and ambient temperature that may create excessive junction temperature.

The AZ1117I is available in 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V fixed output voltage versions and an 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.

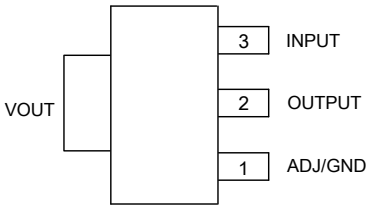
The AZ1117I is available in the industry-standard SOT223 and TO252-2 packages.

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: ±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°C to +125°C
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

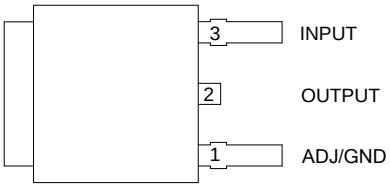
Pin Assignments

(Top View)



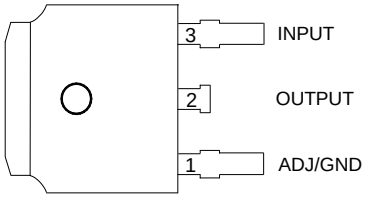
SOT223

(Top View)



TO252-2

(Top View)



TO252 (Type CJ)

Applications

- USB devices
- Add-on cards
- DVD players
- PC motherboards

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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.

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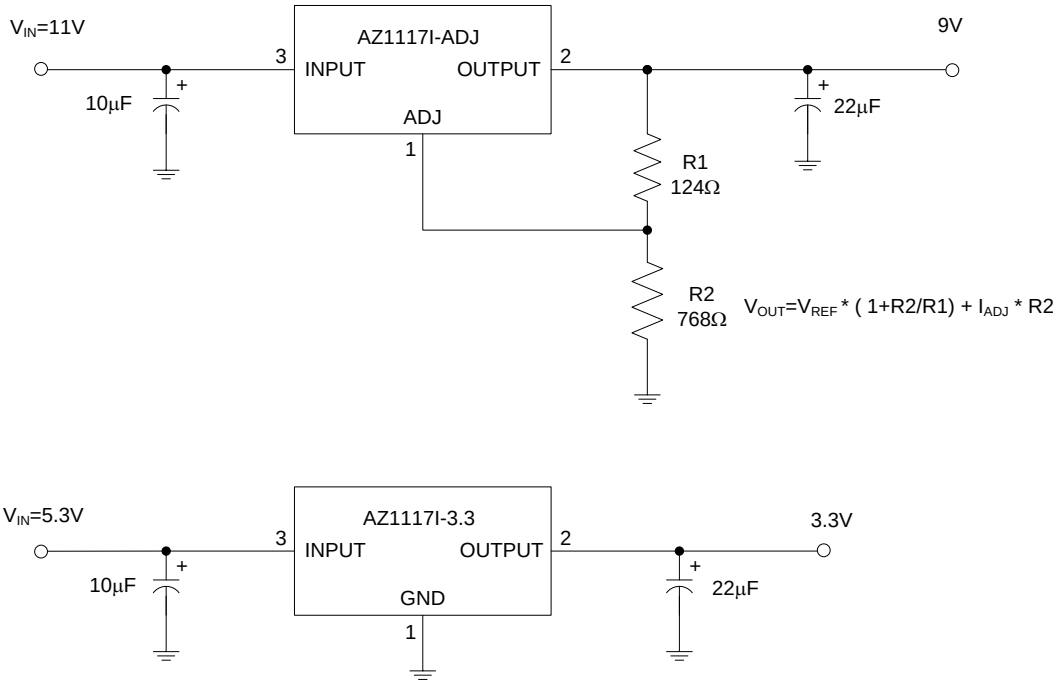
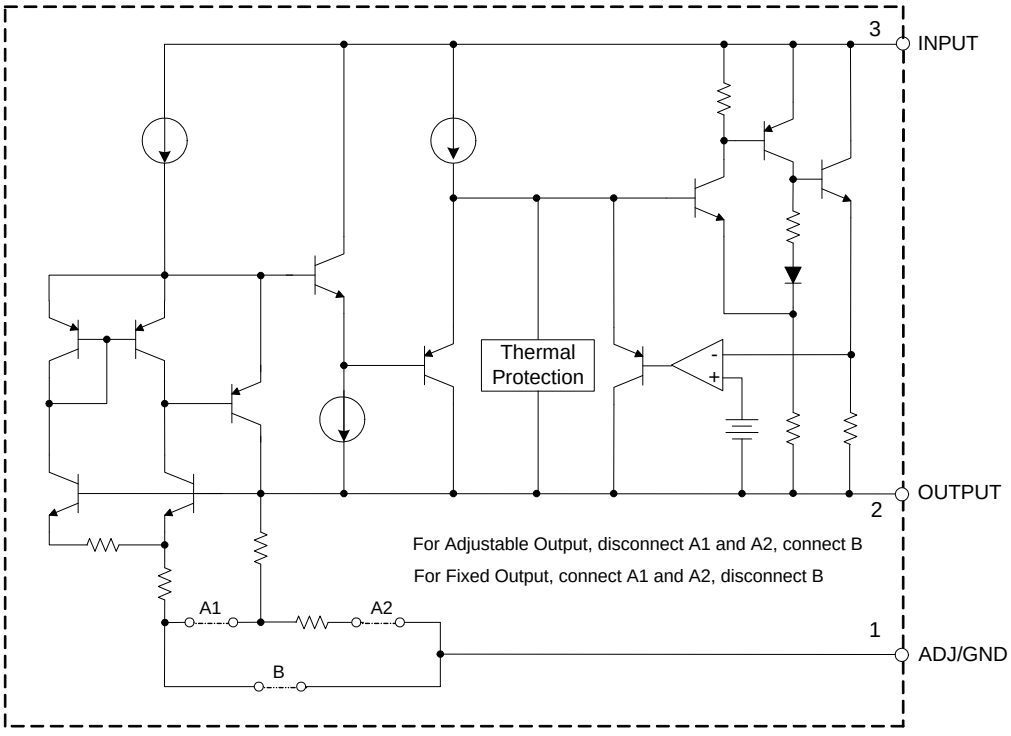
Typical Applications Circuit (Note 4)



Note: 4. The AZ1117I is compatible with low ESR ceramic capacitor. The ESR of the output capacitors must be less than 20Ω. A minimum of 10μF output capacitor is required.

Functional Block Diagram



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Absolute Maximum Ratings (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating		Unit
V_{IN}	Input Voltage	18		V
T_J	Operating Junction Temperature Range	+150		°C
T_{STG}	Storage Temperature Range	-65 to +150		°C
θ_{JA}	Thermal Resistance (Without Heatsink)	SOT223	125	°C/W
		TO252-2	100	
θ_{JA}	Thermal Resistance (With Heatsink) (Note 6)	SOT223	100	°C/W
		TO252-2	70	
T_{LEAD}	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^2(10mm*10mm) copper (top side solder mask) on 2oz.2 layers FR-4 PCB with 8*0.5mm vias.

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	–	15	V
T_J	Operating Junction Temperature Range	-40	+125	°C

Electrical Characteristics AZ1117I-ADJ

(Operating Conditions: $V_{IN} = V_{OUT}$+2V, I_{OUT} = 10mA, T_J = +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_{REF}	Reference Voltage	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		1.238	1.250	1.262	V
				1.225	1.250	**1.275**	
V_{RLINE}	Line Regulation	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		—	0.001	0.1	%
				—	—	**0.2**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}$+2V 1mA ≤ I_{OUT} ≤ 1A		—	0.4	1.0	%
V_{DROP}	Dropout Voltage	ΔV_{REF} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
—	Adjust Pin Current	—		—	60	**120**	µA
—	Adjust Pin Current Change	1.5 ≤ (V_{IN}-V_{OUT}) ≤ 10V		—	0.2	**5**	µA
—	Minimum Load Current	1.5 ≤ (V_{IN}-V_{OUT}) ≤ 10V		—	1.7	**5**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF (V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

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Electrical Characteristics AZ1117I-1.2

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +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_{OUT}	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		1.176	1.2	1.224	V
				1.152	1.2	**1.248**	
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ $1mA \leq I_{OUT} \leq 1A$		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics AZ1117I-1.5

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +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_{OUT}	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		1.485	1.5	1.515	V
				1.47	1.5	**1.53**	
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ $1mA \leq I_{OUT} \leq 1A$		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

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Electrical Characteristics AZ1117I-1.8

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +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_{OUT}	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		1.782	1.8	1.818	V
				1.764	1.8	**1.836**	
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ 1mA ≤ $I_{OUT} \leq 1A$		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics AZ1117I-2.5

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +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_{OUT}	Output Voltage	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		2.475	2.5	2.525	V
				2.455	**2.5**	**2.545**	
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT}+2V$ 1mA ≤ $I_{OUT} \leq 1A$		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF ($V_{IN}-V_{OUT}$) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

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Electrical Characteristics AZ1117I-3.3

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +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_{OUT}	Output Voltage	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		3.267	3.3	3.333	V
				3.235	3.3	**3.365**	
V_{RLINE}	Line Regulation	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	V_{IN} = V_{OUT}+2V 1mA ≤ I_{OUT} ≤ 1A		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF (V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25ºC, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
				—		—	
		TO252-2		—	10	—	

Electrical Characteristics AZ1117I-5.0

(Operating Conditions: $V_{IN} \leq 10V$, I_{OUT} = 10mA, T_J = +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_{OUT}	Output Voltage	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		4.950	5.0	5.050	V
				4.900	5.0	**5.100**	
V_{RLINE}	Line Regulation	1.5V ≤ V_{IN}-V_{OUT} ≤ 10V		—	0.5	6	mV
				—	—	**10**	
V_{RLOAD}	Load Regulation	V_{IN} = V_{OUT}+2V 1mA ≤ I_{OUT} ≤ 1A		—	2	15	mV
V_{DROP}	Dropout Voltage	ΔV_{OUT} = 1%, I_{OUT} = 0.8A	SOT223	—	1.2	1.3	V
			TO252-2	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—		1	1.35	—	A
I_Q	Quiescent Current	I_{OUT} = 0		—	4	**6**	mA
PSRR	Ripple Rejection	f = 120Hz, C_{OUT} = 22µF (V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA		—	70	—	dB
—	Temperature Stability	—		—	0.5	—	%
—	RMS Output Noise (% of V_{OUT})	T_A = +25°C, 10Hz ≤ f ≤ 10KHz		—	0.003	—	%
—	Thermal Shutdown	Junction Temperature		—	+160	—	°C
—	Thermal Shutdown Hysteresis	—		—	+16	—	°C
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223		—	15	—	°C/W
		TO252-2		—	10	—	

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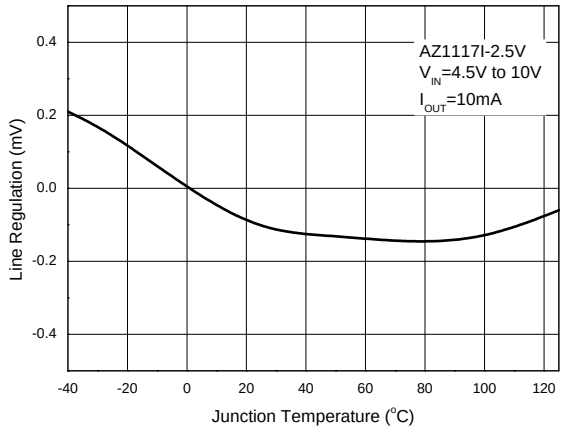
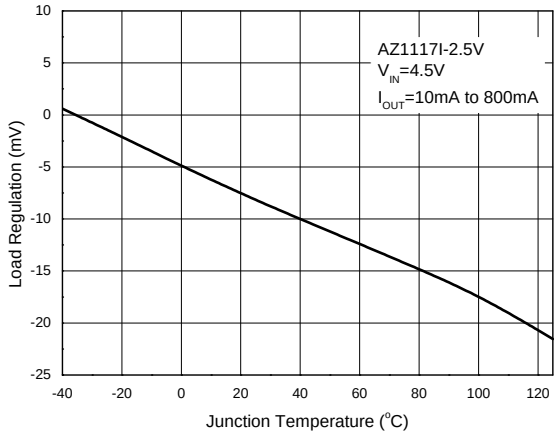
Performance Characteristics

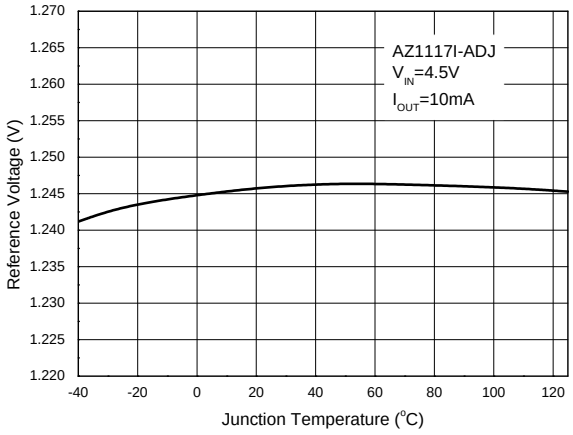
Line Regulation vs. Temperature



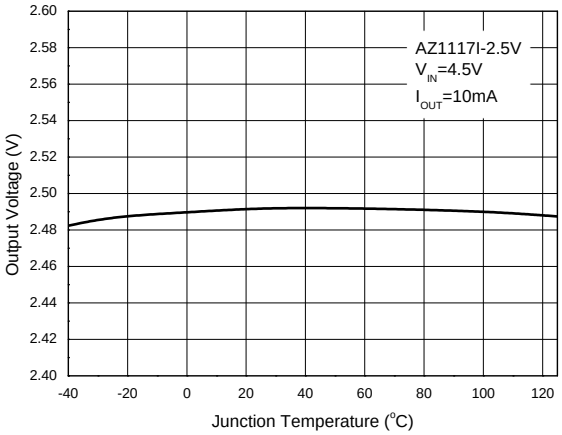
Load Regulation vs. Temperature



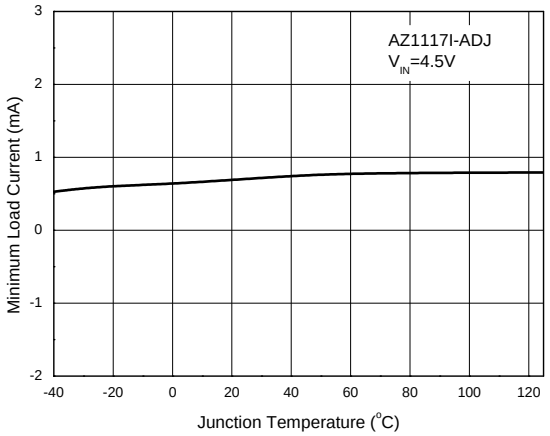
Reference Voltage vs. Temperature



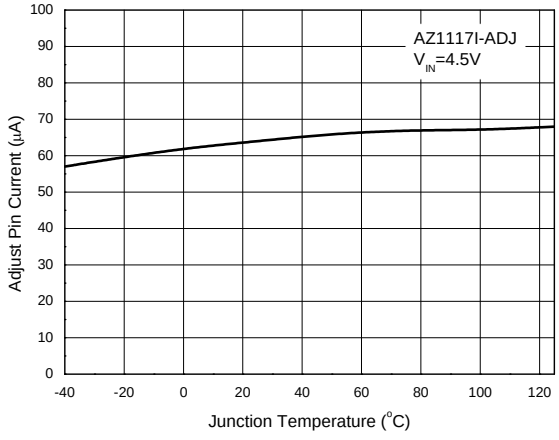
Output Voltage vs. Temperature



Minimum Load Current vs. Temperature



Adjust Pin Current vs. Temperature



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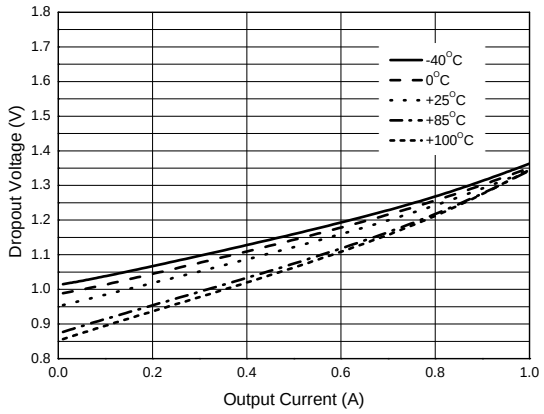
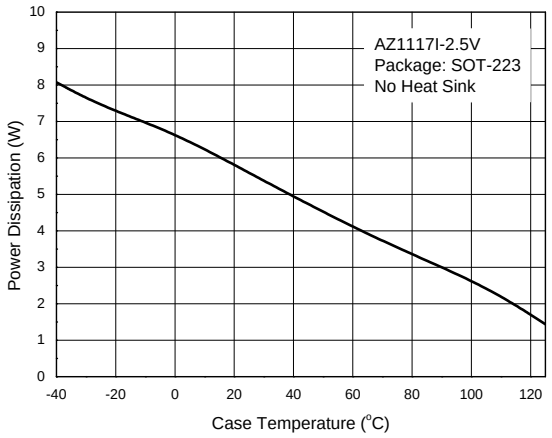
Performance Characteristics (continued)

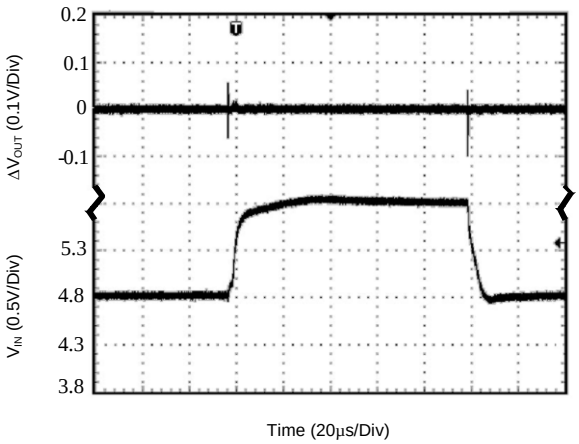
Dropout Voltage vs. Output Current



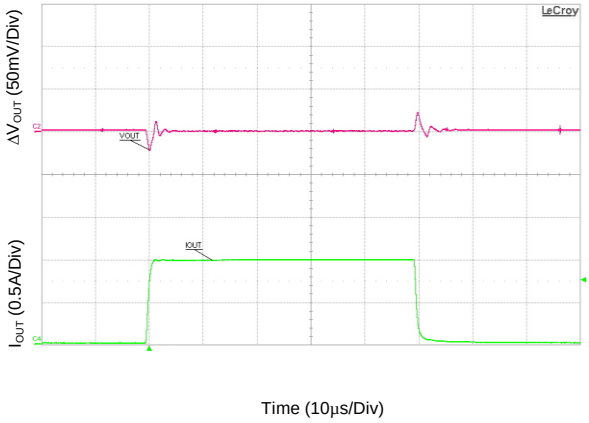
Power Dissipation vs. Temperature



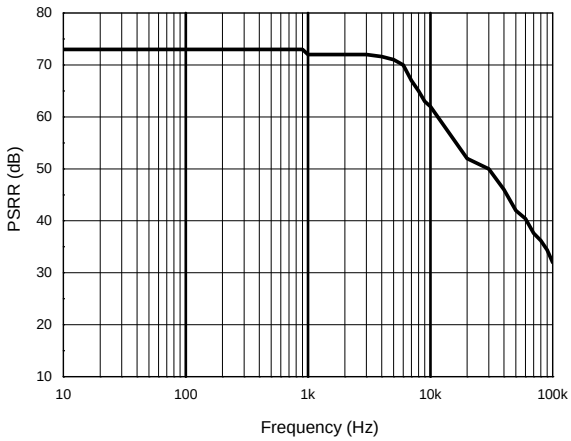
Line Transient Response



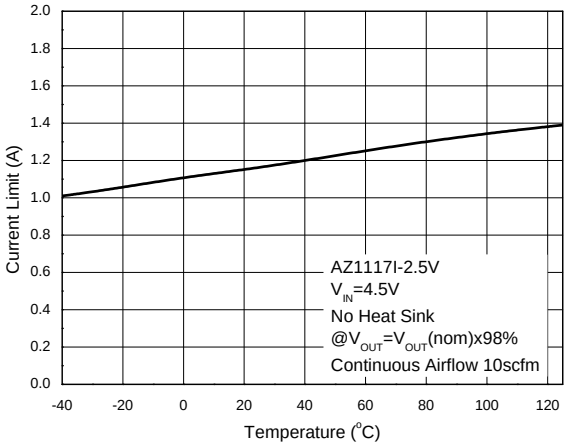
Load Transient Response



PSRR vs. Frequency



Current Limit vs. Temperature



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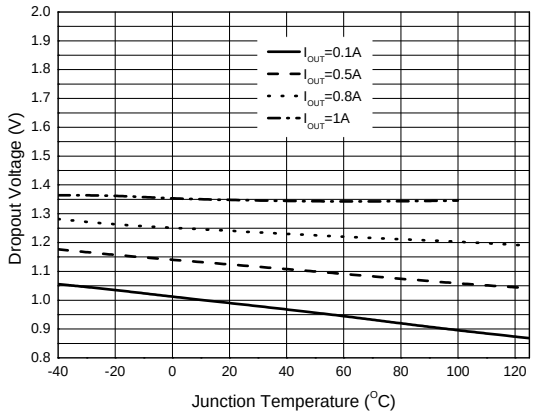
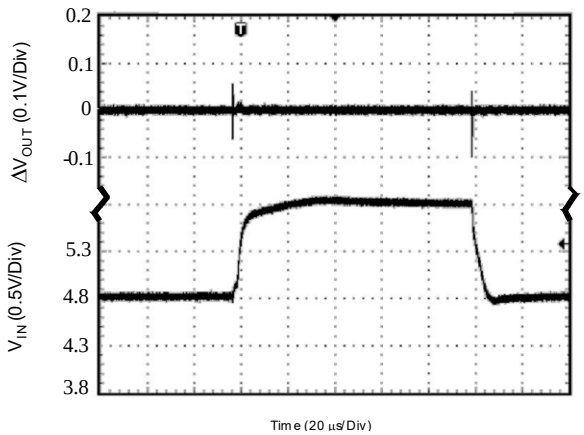
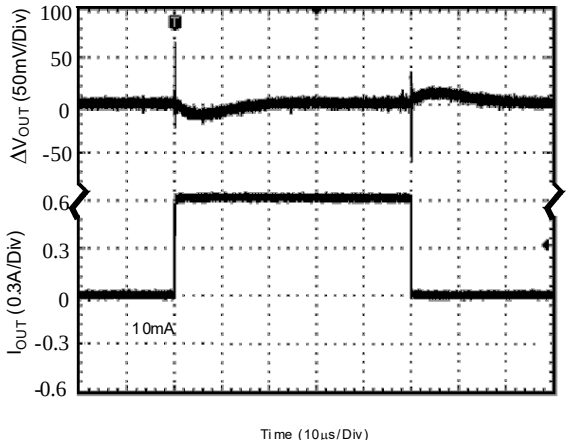
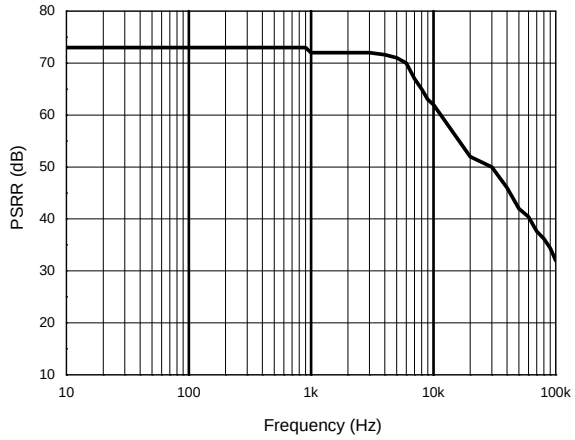
Performance Characteristics (continued)

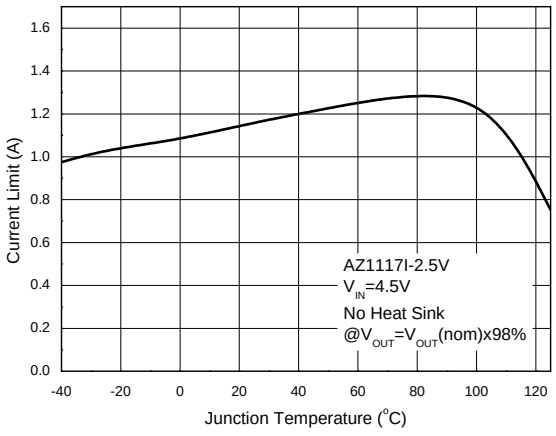
Dropout Voltage vs. Temperature











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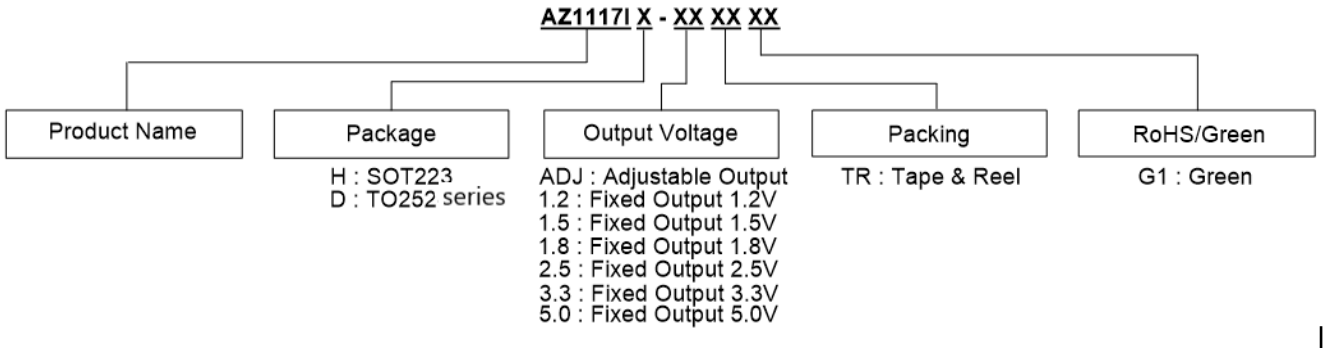
Ordering Information



Package	Temperature Range	Orderable Part Number	Marking ID	Packing	
				Qty.	Carrier
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 TO252 (Type CJ)		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

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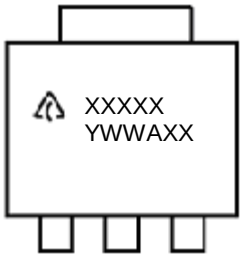
Marking Information

(1) SOT223

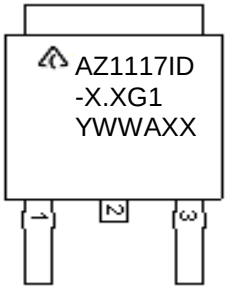
(Top View)



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: 7th and 8th Digits of Batch Number

(2) TO252-2 /TO252 (Type CJ)

(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: 7th and 8th Digits of Batch Number

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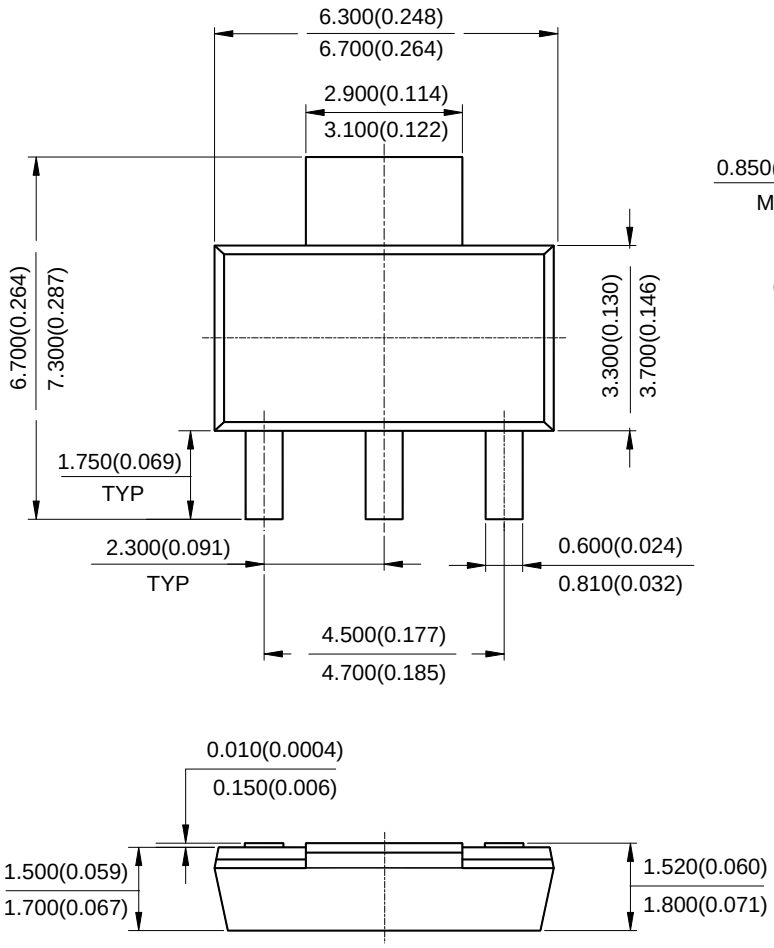
Package Outline Dimensions (All dimensions in mm)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SOT223



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Package Outline Dimensions (All dimensions in mm) (continued)

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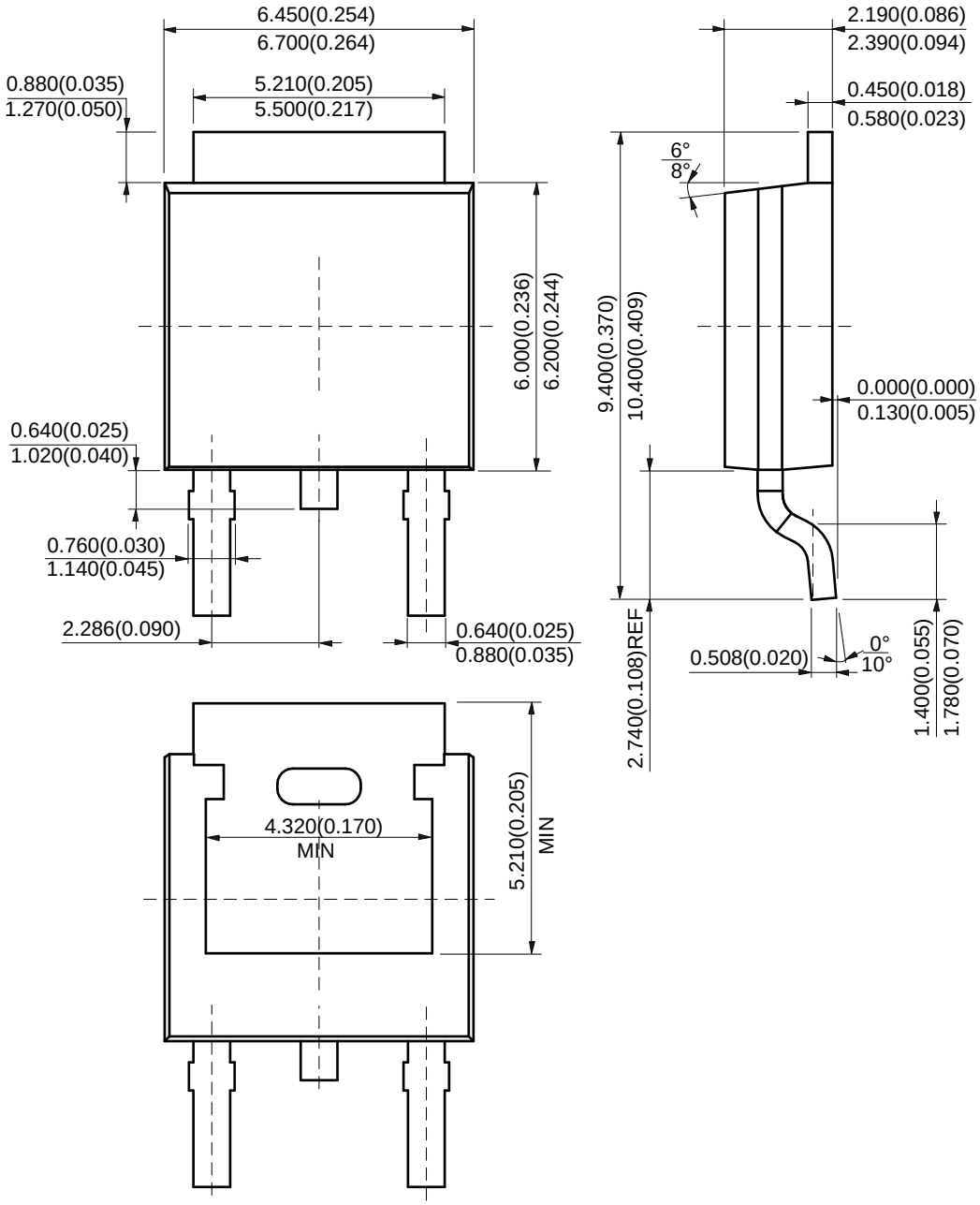
(2) Package Type: TO252-2 (5)



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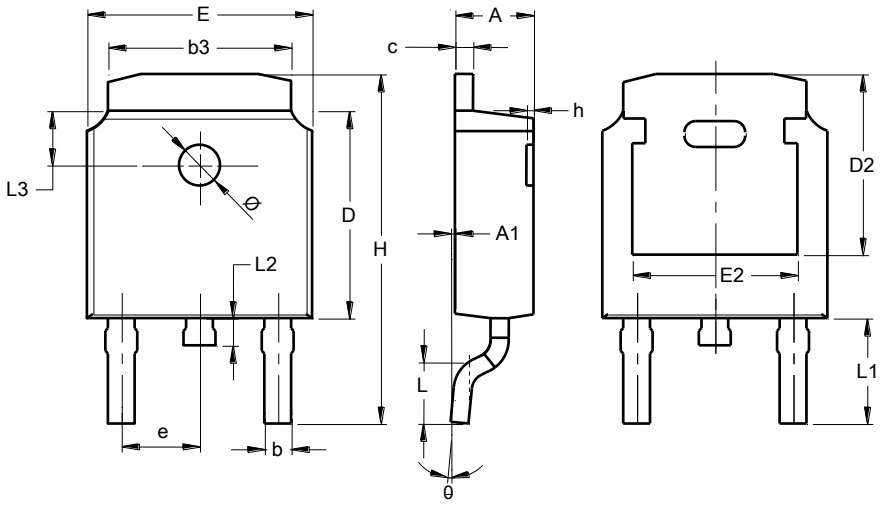
Package Outline Dimensions (All dimensions in mm) (continued)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(3) Package Type : TO252 (Type CJ)



TO252 (Type CJ)			
Dim	**Min**	**Max**	**Typ**
A	2.200	2.400	--
A1	0.000	0.127	--
b	0.635	0.770	--
b3	5.100	5.460	--
c	0.460	0.580	--
D	6.000	6.200	--
D2	5.250 REF		
E	6.500	6.700	--
E2	4.830 REF		
e	2.186	2.386	--
h	0.000	0.300	--
H	9.712	10.312	--
L	1.400	1.700	--
L1	2.900 REF		
L2	0.600	1.000	--
L3	1.600 REF		
Ø	1.100	1.300	--
θ	0°	8°	--
All Dimensions in mm			

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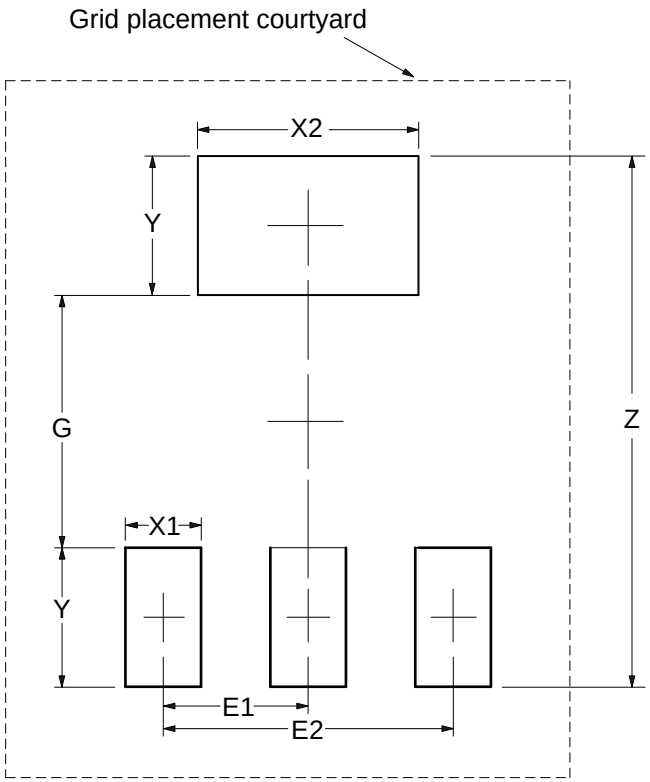
Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

(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

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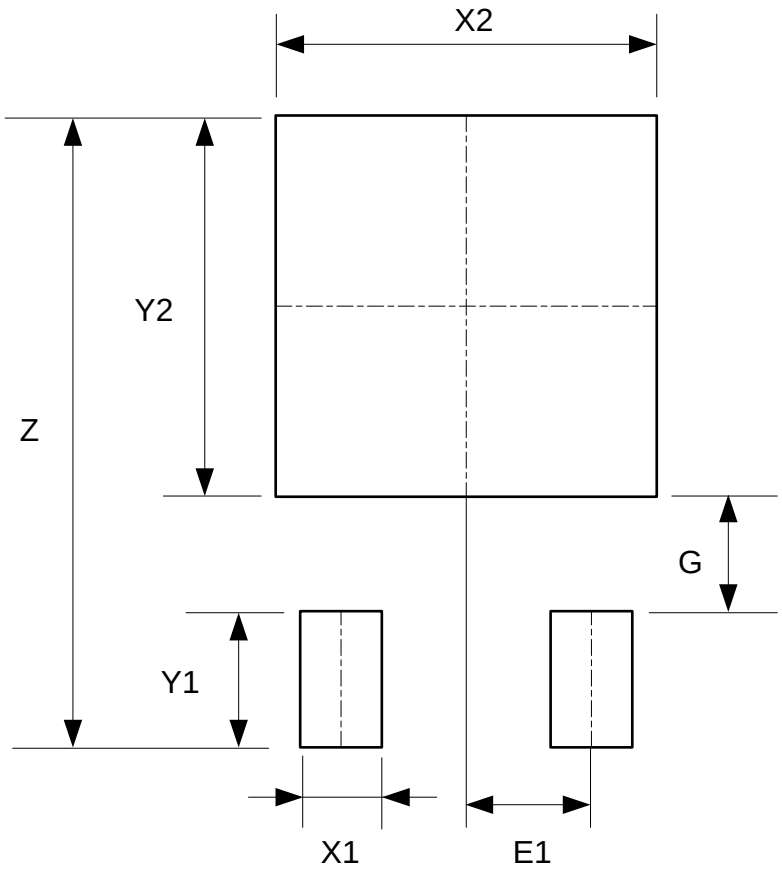
Suggested Pad Layout (continued)

Please see http://www.diodes.com/package-outlines.html for the latest version.

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



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

Mechanical Data

- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish— Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight:
  - TO-252-2 / TO252 (Type CJ): 0.312 grams (Approximate)
  - SOT-223: 0.116 grams (Approximate)

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