



LOW DROPOUT LINEAR REGULATOR WITH INDUSTRIAL TEMPERATURE RANGE

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 ±1%. On-chip thermal shutdown provides protection against a combination of high current and ambient temperature that would create excessive junction temperature.

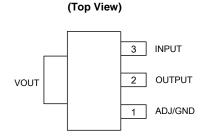
The AZ1117I is available in 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V fixed output voltage versions and ADJ output voltage version. The fixed versions integrate the adjust resistors. It is also available in an adjustable version which can set the output voltage with two external resistors.

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

Features

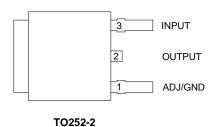
- Current Limit: 1.35A (Typ)
- Output Noise from 10Hz to 10KHz: 0.003% of V_{OUT}
- PSRR at I_{OUT} = 300mA and f = 120Hz: 70dB
- Output Voltage Accuracy: ±1% (Except 1.2V Version)
- On-chip Thermal Shutdown
- Maximum Quiescent Current: IQMAX = 6mA
- Compatible with Low ESR Ceramic Capacitor
- Operation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

Pin Assignments



SOT223

(Top View)



Applications

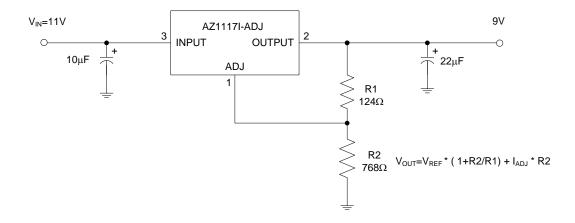
- USB Device
- Add-on Card
- DVD Player
- PC Motherboard

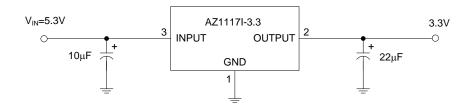
Notes:

- 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
- 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.



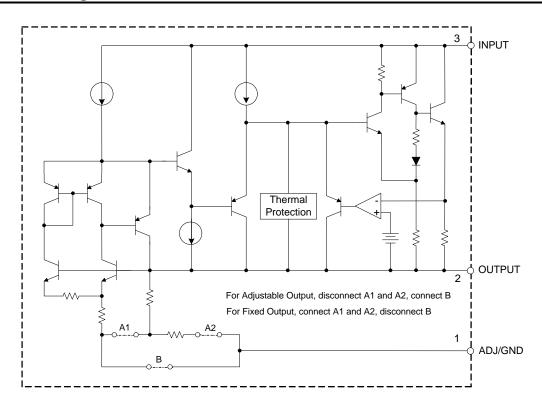
Typical Applications Circuit (Note 4)





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 $10\mu F$ output capacitor is required.

Functional Block Diagram





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 +1	-65 to +150	
θЈΑ	Thermal Resistance (Without Heatsink)	SOT223	125	°C/W
OJA	Thermal resistance (without reatshir)	TO252-2	100	3,777
θ_{JA}	Thermal Resistance (With Heatsink) (Note 6)	SOT223	100	°C/W
OJA	Thermal resistance (With Fleatishing (Note 6)	TO252-2	70	0, 11
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.

Recommended Operating Conditions (@TA = +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: $V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 10mA$, $T_J = +25^{\circ}C$, unless otherwise specified. (P \leq maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Cor	nditions	Min	Тур	Max	Unit
V_{REF}	Reference Voltage	1.5V ≤ V _{IN} -V _{OUT}	< 10\/	1.238	1.250	1.262	V
V REF	Reference voltage	1.5V \(\text{VIN-VOUT}\)	≤ 10V	1.225	1.250	1.275	V
\/	Line Regulation	1.5\/.<.\/\/	< 10\/	_	0.001	0.1	%
V _{RLINE}	Line Regulation	1.5V \(\text{VIN-VOUI}\)	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	0.2	/0
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 2V$	$1mA \le I_{OUT} \le 1A$	_	0.4	1.0	%
\/	Dropout Voltage	$\Delta V_{REF} = 1\%$,	$\Delta V_{REF} = 1\%$, SOT223		1.2	1.3	V
V_{DROP}	Diopout Voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	V
I _{LIMIT}	Current Limit	_	_		1.35	_	Α
_	Adjust Pin Current	_	_		60	120	μA
_	Adjust Pin Current Change	1.5 ≤ (V _{IN} -V _{OUT})	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	$f = 120Hz, C_{OUT}$ $(V_{IN}-V_{OUT}) = 3V,$	•	_	70	_	dB
_	Temperature Stability	_		_	0.5	_	%
_	RMS Output Noise (% of V _{OUT})	T _A = +25°C, 10H	z≤f≤10KHz	_	0.003	_	%
_	Thermal Shutdown	Junction Temper	Junction Temperature		+160	_	°C
_	Thermal Shutdown Hysteresis	_		_	+16	_	°C
	The word Desistance			_		_	
θЈС	Thermal Resistance (Junction to Case)	SOT223	SOT223		15	_	°C/W
	(candidit to case)	TO252-2	TO252-2		10		

Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

6. Chip is soldered to 100mm²(10mm*10mm) copper (top side solder mask) on 2oz.2 layers FR-4 PCB with 8*0.5mm vias.



Electrical Characteristics AZ1117I-1.2 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, $I_{OUT} = 10$ mA, $T_J = +25$ °C, unless otherwise specified. (P \le maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Con	ditions	Min	Тур	Max	Unit
	Output Voltage	451/21/11	< 40) /	1.176	1.2	1.224	V
V _{OUT}	Output Voltage	1.5V ≤ V _{IN} -V _{OUT} ≤	≥ IUV	1.152	1.2	1.248	V
V	Line Regulation	1.5\(< \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \		_	0.5	6	mV
V _{RLINE}	Line Regulation	1.5V \(\sigma\) VIN-VOUT	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	10	IIIV
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 2V$	1mA ≤ I _{OUT} ≤ 1A	_	2	15	mV
V	Dranaut Valtage	$\Delta V_{OUT} = 1\%$,	SOT223	_	1.2	1.3	V
V _{DROP}	Dropout Voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	V
I _{LIMIT}	Current Limit	_	<u> </u>		1.35	_	Α
IQ	Quiescent Current	I _{OUT} = 0	I _{OUT} = 0		4	6	mA
PSRR	Ripple Rejection	$f = 120Hz, C_{OUT} = (V_{IN}-V_{OUT}) = 3V,$	•	_	70	_	dB
_	Temperature Stability	_		_	0.5	_	%
_	RMS Output Noise (% of V _{OUT})	T _A = +25°C, 10Hz	z ≤ f ≤ 10KHz	_	0.003	_	%
_	Thermal Shutdown	Junction Tempera	ature	_	+160	_	°C
_	Thermal Shutdown Hysteresis	_		_	+16	_	°C
	Thormal Desigtance	207222	SOT223			_	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223			15	_	°C/W
	(various)	TO252-2		_	10	_	

Electrical Characteristics AZ1117I-1.5 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, $I_{OUT} = 10$ mA, $T_J = +25$ °C, unless otherwise specified. (P \le maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Con	ditions	Min	Тур	Max	Unit
	Outrast Valtage	451/41/1/	40)/	1.485	1.5	1.515	V
V_{OUT}	Output Voltage	1.5V ≤ V _{IN} -V _{OUT} ≤	10V	1.47	1.5	1.53	V
\/	Line Regulation	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	0.5	6	mV
V_{RLINE}	Line Regulation			_	_	10	IIIV
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 2V$	1mA ≤ I _{OUT} ≤ 1A	_	2	15	mV
M	Dropout Voltage	$\Delta V_{OUT} = 1\%$,	SOT223	_	1.2	1.3	V
V_{DROP}	Diopout voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	V
I _{LIMIT}	Current Limit	_		1	1.35	_	Α
ΙQ	Quiescent Current	$I_{OUT} = 0$		_	4	6	mA
PSRR	Ripple Rejection	$f = 120Hz, C_{OUT} = (V_{IN}-V_{OUT}) = 3V, I$		_	70	_	dB
_	Temperature Stability	_		_	0.5	_	%
_	RMS Output Noise (% of V _{OUT})	T _A = +25°C, 10Hz	2 ≤ f ≤ 10KHz	_	0.003	_	%
	Thermal Shutdown	Junction Tempera	ature	_	+160		°C
	Thermal Shutdown Hysteresis	<u> </u>			+16		°C
	The word Decistors	18		_		_	
θ_{JC}	Thermal Resistance (Junction to Case)	SO1223	SOT223		15	_	°C/W
	(Garioticii to Gase)	TO252-2	TO252-2		10		



Electrical Characteristics AZ1117I-1.8 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, $I_{OUT} = 10$ mA, $T_J = +25$ °C, unless otherwise specified. (P \le maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Con	ditions	Min	Тур	Max	Unit
1/	Output Valtage	451/21/11	40)/	1.782	1.8	1.818	V
V_{OUT}	Output Voltage	1.5V ≤ V _{IN} -V _{OUT} ≤	10V	1.764	1.8	1.836	V
V	Line Regulation	45/3// // 340//		_	0.5	6	mV
V _{RLINE}	Line Regulation	1.5V \(\text{VIN-VOUT} \)	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	10	IIIV
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 2V$	1mA ≤ I _{OUT} ≤ 1A	_	2	15	mV
	Drangut Voltage	$\Delta V_{OUT} = 1\%$,	SOT223	_	1.2	1.3	V
V _{DROP}	Dropout Voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	٧
I _{LIMIT}	Current Limit	_	_		1.35	_	Α
IQ	Quiescent Current	I _{OUT} = 0	I _{OUT} = 0		4	6	mA
PSRR	Ripple Rejection	$f = 120Hz, C_{OUT} = (V_{IN}-V_{OUT}) = 3V, I$	•	_	70	_	dB
_	Temperature Stability	_		_	0.5	_	%
_	RMS Output Noise (% of V _{OUT})	T _A = +25°C, 10Hz	: ≤ f ≤ 10KHz	_	0.003	_	%
_	Thermal Shutdown	Junction Tempera	Junction Temperature		+160	_	°C
_	Thermal Shutdown Hysteresis	 		_	+16	_	°C
	Thermal Desistance	007000		_		_	
θ_{JC}	Thermal Resistance (Junction to Case)	SO1223	SOT223		15	_	°C/W
	(Garioticii to Gase)	TO252-2			10	_	

Electrical Characteristics AZ1117I-2.5 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, $I_{OUT} = 10mA$, $T_J = +25^{\circ}C$, unless otherwise specified. (P \le maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Con	ditions	Min	Тур	Max	Unit
V _{OUT}	Output Voltage	1.5V ≤ V _{IN} -V _{OUT} ≤	: 10\/	2.475	2.5	2.525	V
VOUT	Output voltage	1.5V = VIN-VOUI =	1.5V = VIN VOOI = 10V		2.5	2.545	V
V	Line Regulation	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	0.5	6	mV
V_{RLINE}	Line Regulation	1.5V \(\text{VIN-VOUT}\)	\$ 10V	_	_	10	IIIV
V_{RLOAD}	Load Regulation	V _{IN} = V _{OUT} +2V	1mA ≤ I _{OUT} ≤ 1A	_	2	15	mV
V	Dropout Voltage	$\Delta V_{OUT} = 1\%$,	SOT223	_	1.2	1.3	V
V_{DROP}	Diopout voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	V
I _{LIMIT}	Current Limit	_	_		1.35	_	Α
IQ	Quiescent Current	I _{OUT} = 0	I _{OUT} = 0		4	6	mA
PSRR	Ripple Rejection	$f = 120Hz, C_{OUT} = (V_{IN}-V_{OUT}) = 3V,$	•	_	70	_	dB
_	Temperature Stability	_		_	0.5	_	%
_	RMS Output Noise (% of V _{OUT})	T _A = +25°C, 10Hz	z ≤ f ≤ 10KHz	_	0.003	_	%
_	Thermal Shutdown	Junction Tempera	ature	_	+160	_	°C
_	Thermal Shutdown Hysteresis	<u> </u>		_	+16	_	°C
	The second Desciotance			_		_	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT223	SOT223		15	_	°C/W
	(Junction to Case)		TO252-2		10	_	



Electrical Characteristics AZ1117I-3.3 (Cont.)

(Operating Conditions: $V_{IN} \le 10V$, $I_{OUT} = 10mA$, $T_J = +25^{\circ}C$, unless otherwise specified. (P \le maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Con	ditions	Min	Тур	Max	Unit
V	Output Valtage	45)/3)/	< 401/	3.267	3.3	3.333	V
V _{OUT}	Output Voltage	1.5V ≤ V _{IN} -V _{OUT}	r≤10V	3.235	3.3	3.365	V
\/	Line Regulation	1.5V < V/w Voyz < 10V		_	0.5	6	mV
V _{RLINE}	Line Regulation	1.5V ≥ VIN-VOUT	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	10	IIIV
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 2V$	$1mA \le I_{OUT} \le 1A$	_	2	15	mV
\/	Dropout Voltage	$\Delta V_{OUT} = 1\%$,	SOT223	_	1.2	1.3	V
V _{DROP}	Diopout voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	V
I _{LIMIT}	Current Limit	_			1.35	_	Α
IQ	Quiescent Current	I _{OUT} = 0	I _{OUT} = 0		4	6	mA
PSRR	Ripple Rejection	$f = 120Hz, C_{OUT}$ $(V_{IN}-V_{OUT}) = 3V$	•	_	70	-	dB
	Temperature Stability	_			0.5	_	%
_	RMS Output Noise (% of V _{OUT})	$T_A = +25^{\circ}C$, 10h	Hz ≤ f ≤ 10KHz	_	0.003		%
_	Thermal Shutdown	Junction Tempe	Junction Temperature		+160	_	°C
_	Thermal Shutdown Hysteresis	_	_		+16	_	°C
	Thermal Desistance		SOT223				
θ _{JC}	Thermal Resistance (Junction to Case)	SO1223			15	_	°C/W
	(33.13.1011 to 34.00)	TO252-2		_	10	_	

Electrical Characteristics AZ1117I-5.0 (Cont.)

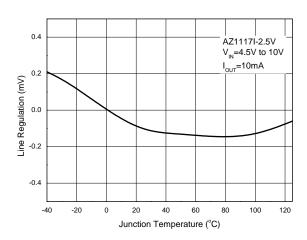
(Operating Conditions: $V_{IN} \le 10V$, $I_{OUT} = 10mA$, $T_J = +25^{\circ}C$, unless otherwise specified. (P \le maximum power dissipation). Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, -40°C to +125°C.)

Symbol	Parameter	Con	ditions	Min	Тур	Max	Unit
	Outrot Valtage	4577477	40)/	4.950	5.0	5.050	V
V_{OUT}	Output Voltage	1.5V ≤ V _{IN} -V _{OUT} ≤	≤ 10V	4.900	5.0	5.100	V
V	Line Regulation	1.5V ≤ V _{IN} -V _{OUT} ≤ 10V		_	0.5	6	mV
V _{RLINE}	Line Regulation			_	_	10	10
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 2V$	1mA ≤ I _{OUT} ≤ 1A	_	2	15	mV
V	Drangut Voltage	$\Delta V_{OUT} = 1\%$,	SOT223	_	1.2	1.3	V
V_{DROP}	V _{DROP} Dropout Voltage	$I_{OUT} = 0.8A$	TO252-2	_	1.3	1.4	V
I _{LIMIT}	Current Limit	_	_		1.35	_	Α
IQ	Quiescent Current	I _{OUT} = 0	I _{OUT} = 0		4	6	mA
PSRR	Ripple Rejection	f = 120Hz, C _{OUT} =	$f = 120Hz, C_{OUT} = 22\mu F$ $(V_{IN}-V_{OUT}) = 3V, I_{OUT} = 300mA$		70		dB
TORK	Rippie Rejection	$(V_{IN}-V_{OUT}) = 3V,$			70	_	ub
_	Temperature Stability	_		_	0.5	_	%
_	RMS Output Noise (% of V _{OUT})	$T_A = +25^{\circ}C$, 10Hz	z ≤ f ≤ 10KHz	_	0.003	_	%
	Thermal Shutdown	Junction Tempera	Junction Temperature		+160	_	°C
_	Thermal Shutdown Hysteresis	_		_	+16	_	°C
θЈС	Thermal Resistance	SOT223	SOT223		15	_	°С/М
0,00	(Junction to Case)	TO252-2	TO252-2		10	_	5/11

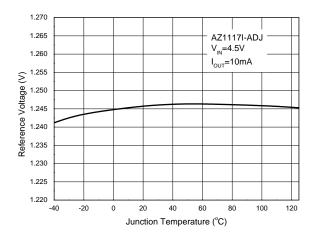


Performance Characteristics

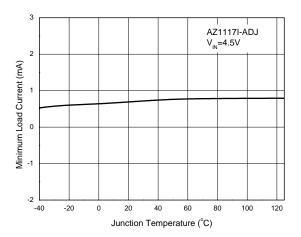
Line Regulation vs. Temperature



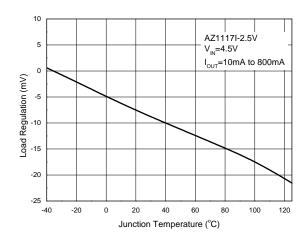
Reference Voltage vs. Temperature



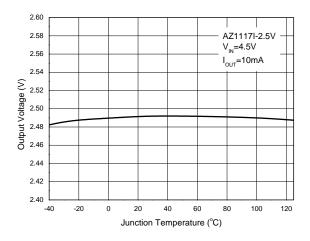
Minimum Load Current vs. Temperature



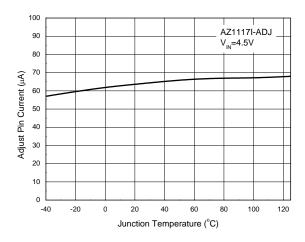
Load Regulation vs. Temperature



Output Voltage vs. Temperature



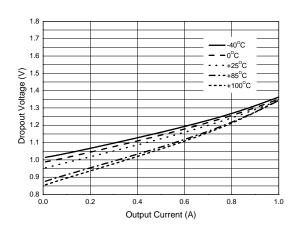
Adjust Pin Current vs. Temperature



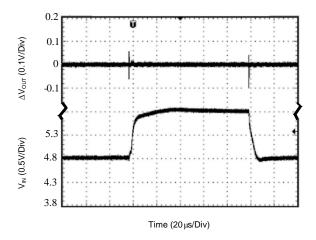


Performance Characteristics (Cont.)

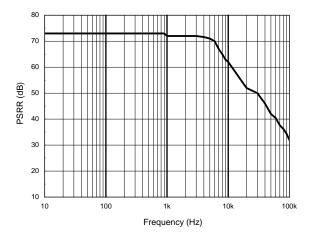
Dropout Voltage vs. Output Current



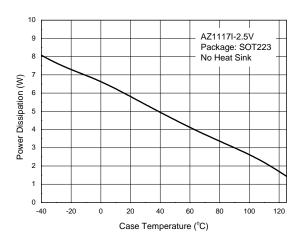
Line Transient Response



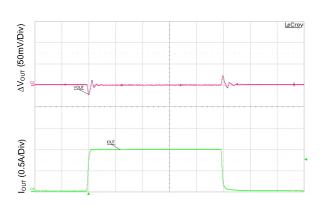
PSRR vs. Frequency



Power Dissipation vs. Temperature

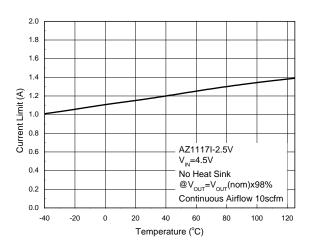


Load Transient Response



Time (10 µs/Div)

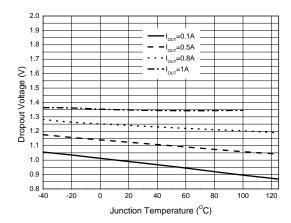
Current Limit vs. Temperature





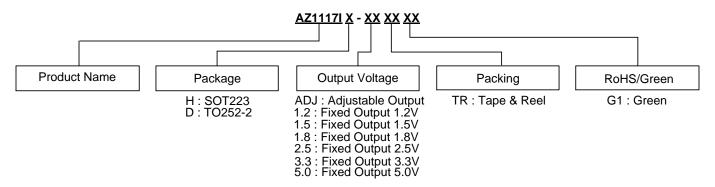
Performance Characteristics (Cont.)

Dropout Voltage vs. Temperature



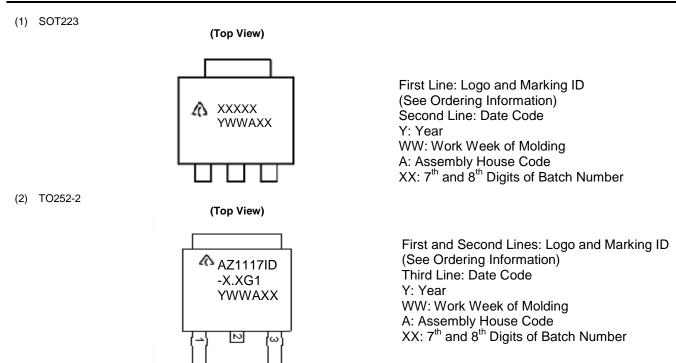


Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing
		AZ1117IH-ADJTRG1	GH86J	4000/Tape & Reel
		AZ1117IH-1.2TRG1	GH86K	4000/Tape & Reel
		AZ1117IH-1.5TRG1	GH86L	4000/Tape & Reel
SOT223		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
	-40°C to +125°C	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
TO252-2		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

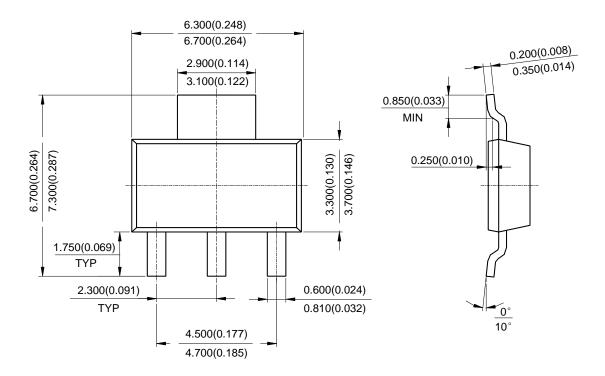
Marking Information

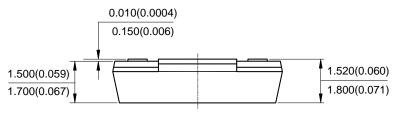




Package Outline Dimensions (All dimensions in mm.)

(1) Package Type: SOT223

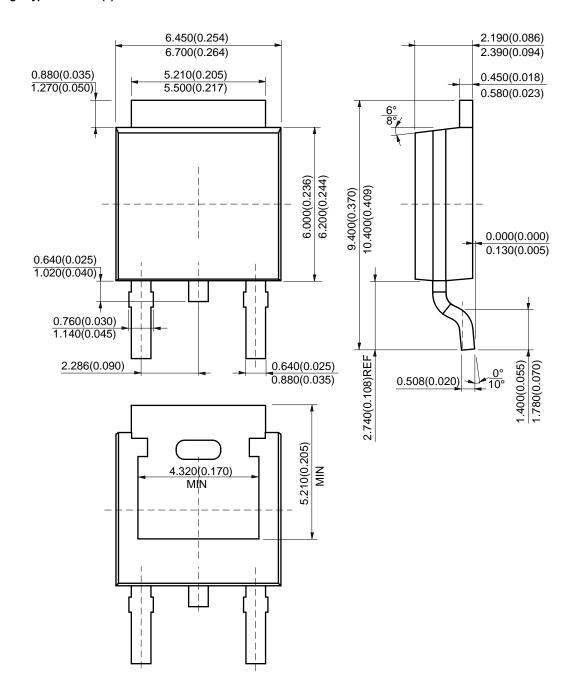






Package Outline Dimensions (All dimensions in mm.) (Cont.)

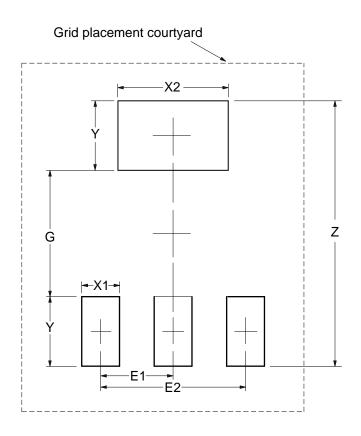
(2) Package Type: TO252-2 (5)





Suggested Pad Layout

(1) Package Type: SOT223

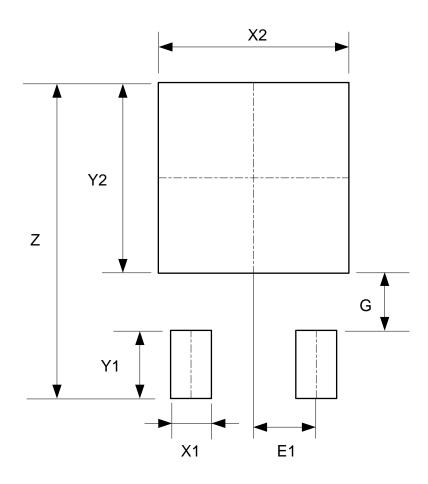


Dimensions	Z	G	X1	X2	Y	E1	E2
	(mm)/(inch)						
Value	8.400/0.331	4.000/0.157	1.200/0.047	3.500/0.138	2.200/0.087	2.300/0.091	4.600/0.181



Suggested Pad Layout (Cont.)

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



Dimensions	Z	X1	X2=Y2	Y1	G	E1
Dimensions	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(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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