



YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

0755-83047638

ysbdt@szyoushang.cn

www.szyoushang.cn



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Description

The DIODES™ NK-AZ1117C 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 output voltage accuracy of 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 NK-AZ1117C 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 NK-AZ1117C is available in the industry-standard TO252-2 Series (including TO252-2 (3), TO252-2 (4), and TO252-2 (5)), SOT89, and SOT223 packages.

Features

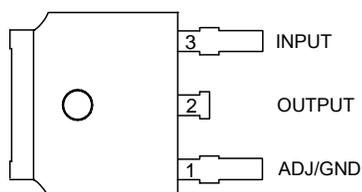
- Current Limit: 1.35A (Typ)
- Output Noise from 10Hz to 10kHz: 0.003% of V_{OUT}
- PSRR at $I_{OUT} = 300\text{mA}$ and $f = 120\text{Hz}$: 70dB
- Output Voltage Accuracy: $\pm 1\%$ (Except 1.2V Version)
- On-Chip Thermal Shutdown
- Maximum Quiescent Current: $I_{QMAX} = 6\text{mA}$
- Compatible with Low ESR Ceramic Capacitor
- Operation Junction Temperature: -20°C to $+125^{\circ}\text{C}$

Applications

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

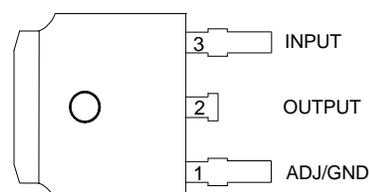
Pin Assignments

(Top View)



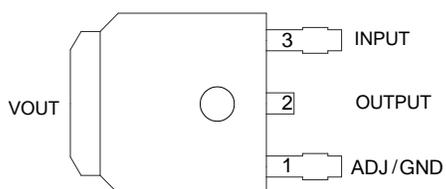
TO252-2 (3) Option 1

(Top View)



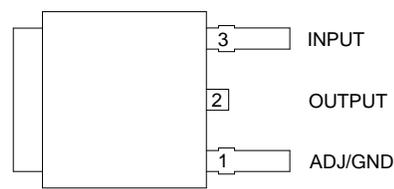
TO252-2 (3) Option 2 / TO252 (Type CJ)

(Top View)



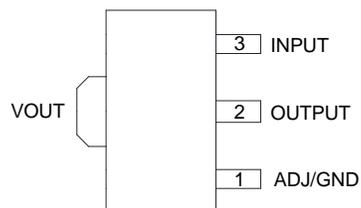
TO252-2 (4)

(Top View)



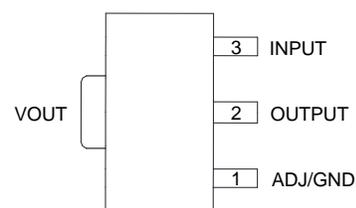
TO252-2 (5)

(Top View)



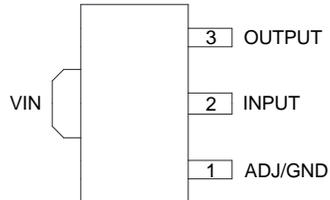
SOT89 Option 1 / R Package

(Top View)



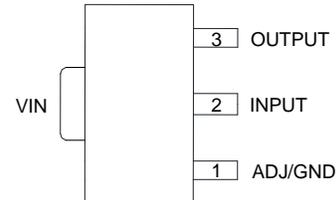
SOT89 Option 2 / R Package

(Top View)



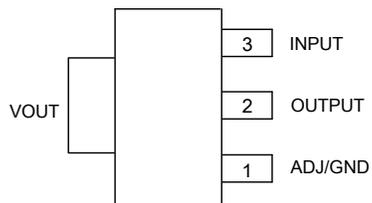
SOT89 Option 1 / R2 Package

(Top View)



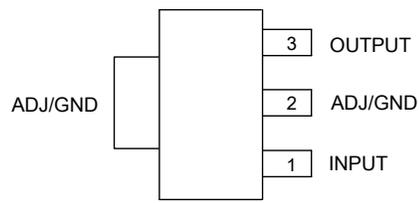
SOT89 Option 2 / R2 Package

(Top View)



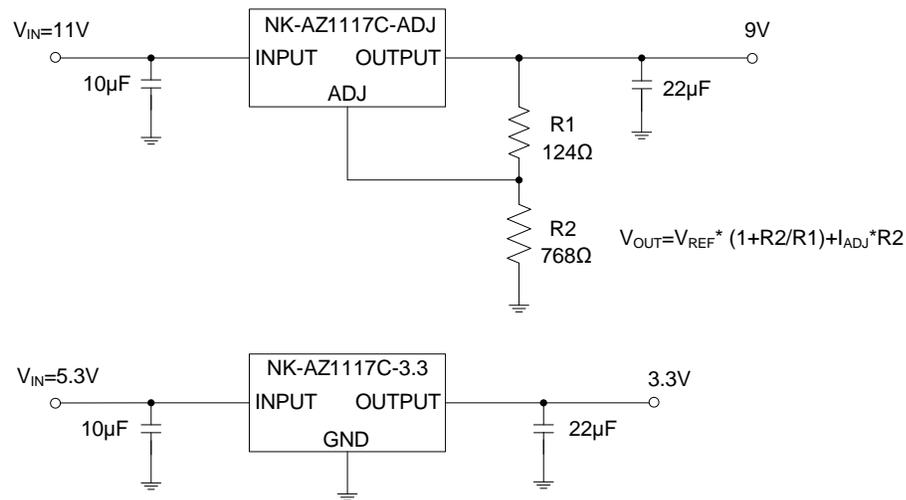
SOT223/ H Package

(Top View)



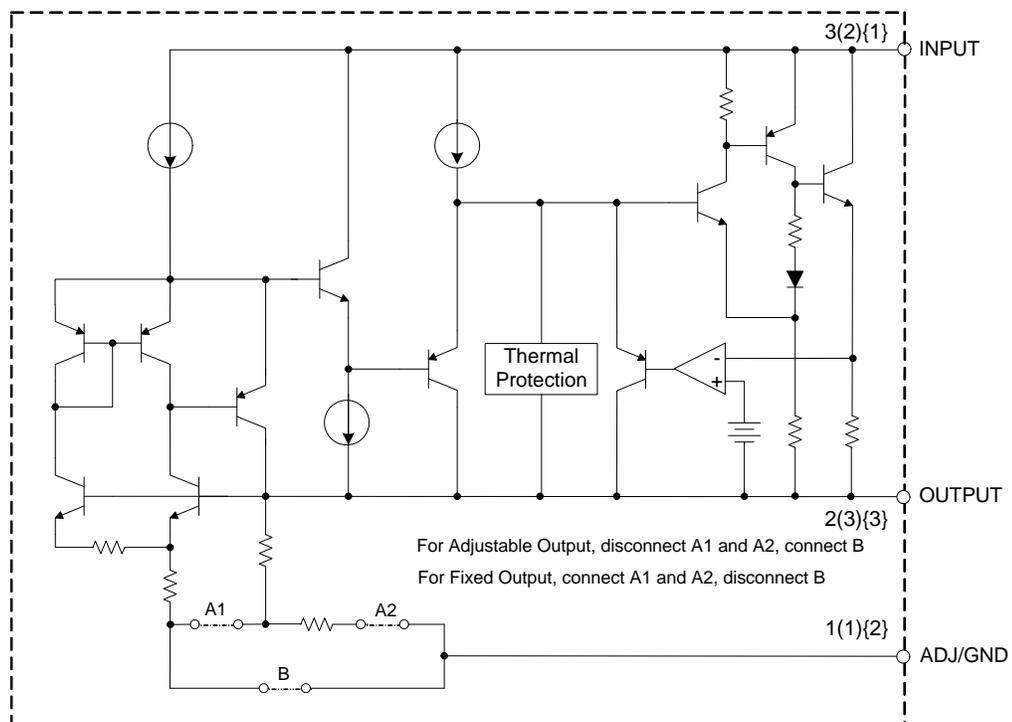
SOT223/ H2 Package

Typical Applications Circuit (Note 4)



Note: 4. The NK-AZ1117C 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



A(B){C}
 A for TO252-2 Series/SOT223 (H)/SOT89 (R)
 B for SOT89 (R2)
 C for SOT223 (H2)

Absolute Maximum Ratings (Note 5)

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)	SOT89	170	°C/W
		SOT223	125	
		TO252-2 Series	100	
θ_{JA}	Thermal Resistance (With Heatsink) (Note 6)	SOT89	150	°C/W
		SOT223	100	
		TO252-2 Series	70	
T_{LEAD}	Lead Temperature (Soldering, 10sec)	+260		°C
—	ESD (Human Body Model)	4000		V

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

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	—	15	V
T_J	Operating Junction Temperature Range	-20	+125	°C

Electrical Characteristics NK-AZ1117C-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, $-20^\circ C$ to $+125^\circ C$.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
V_{REF}	Reference Voltage	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	1.238	1.250	1.262	V	
			1.225	1.250	1.270		
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	—	0.001	0.1	%	
			—	—	0.2		
V_{RLOAD}	Load Regulation	—	—	0.4	1.0	%	
V_{DROP}	Dropout Voltage	$\Delta V_{REF} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	1.3	1.4	V
I_{LIMIT}	Current Limit	—	1	1.35	—	A	
—	Adjust Pin Current	—	—	60	120	μA	
—	Adjust Pin Current Change	$1.5 \leq (V_{IN} - V_{OUT}) \leq 10V$	—	0.2	5	μA	
—	Minimum Load Current	$1.5 \leq (V_{IN} - V_{OUT}) \leq 10V$	—	1.7	5	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	—	°C	
—	Thermal Shutdown Hysteresis	—	—	+16	—	°C	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	°C/W	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

Electrical Characteristics NK-AZ1117C-1.2

(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, $-20^\circ C$ 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	1.2	1.224	V	
			1.152	1.2	1.228		
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$	—	0.5	6	mV	
			—	—	10		
V_{RLOAD}	Load Regulation	—	—	2	15	mV	
V_{DROP}	Dropout Voltage	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	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	$f = 120Hz$, $C_{OUT} = 22\mu F$ $(V_{IN}-V_{OUT}) = 3V$, $I_{OUT} = 300mA$	—	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	—	$^\circ C$	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	$^\circ C/W$	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

Electrical Characteristics NK-AZ1117C-1.5

(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, $-20^\circ C$ 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	1.5	1.515	V	
			1.470	1.5	1.530		
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN}-V_{OUT} \leq 10V$	—	0.5	6	mV	
			—	—	10		
V_{RLOAD}	Load Regulation	—	—	2	15	mV	
V_{DROP}	Dropout Voltage	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	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	$f = 120Hz$, $C_{OUT} = 22\mu F$ $(V_{IN}-V_{OUT}) = 3V$, $I_{OUT} = 300mA$	—	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	—	$^\circ C$	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	$^\circ C/W$	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

Electrical Characteristics NK-AZ1117C-1.8

(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, $-20^\circ C$ 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	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	—	—	2	15	mV	
V_{DROP}	Dropout Voltage	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	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	$f = 120Hz$, $C_{OUT} = 22\mu F$ $(V_{IN}-V_{OUT}) = 3V$, $I_{OUT} = 300mA$	—	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	—	$^\circ C$	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	$^\circ C/W$	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

Electrical Characteristics NK-AZ1117C-2.5

(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, $-20^\circ C$ 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	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	—	—	2	15	mV	
V_{DROP}	Dropout Voltage	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	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	$f = 120Hz$, $C_{OUT} = 22\mu F$ $(V_{IN}-V_{OUT}) = 3V$, $I_{OUT} = 300mA$	—	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	—	$^\circ C$	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	$^\circ C/W$	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

Electrical Characteristics NK-AZ1117C-3.3

(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, $-20^\circ C$ 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	3.3	3.333	V	
			3.235	3.3	3.365		
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	—	0.5	6	mV	
			—	—	10		
V_{RLOAD}	Load Regulation	—	—	2	15	mV	
V_{DROP}	Dropout Voltage	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	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	$f = 120Hz$, $C_{OUT} = 22\mu F$ $(V_{IN} - V_{OUT}) = 3V$, $I_{OUT} = 300mA$	—	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	—	$^\circ C$	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	$^\circ C/W$	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

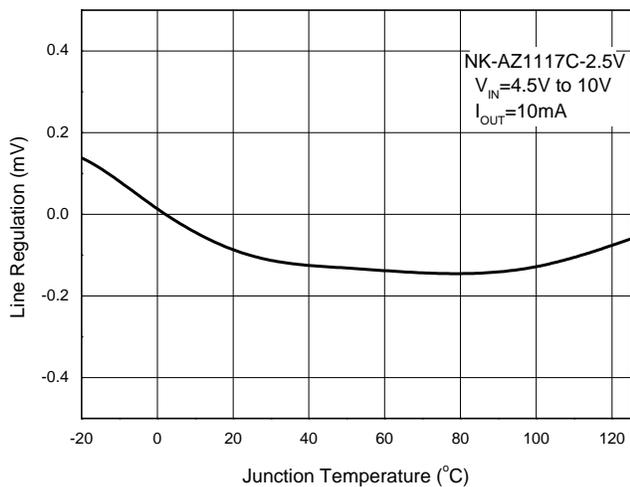
Electrical Characteristics NK-AZ1117C-5.0

(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, $-20^\circ C$ to $+125^\circ C$.)

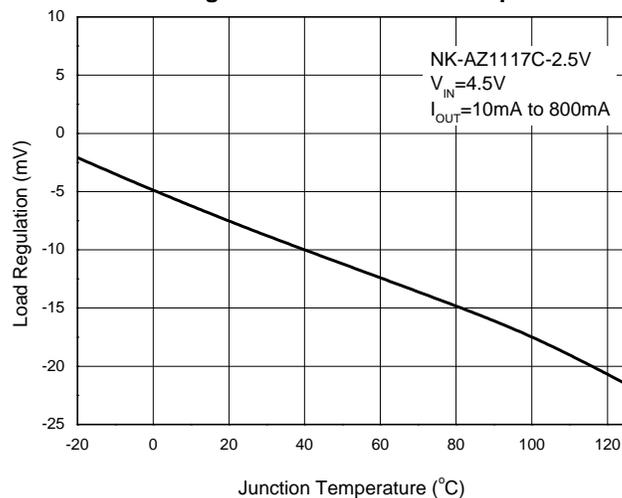
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
V_{OUT}	Output Voltage	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	4.950	5.0	5.050	V	
			4.900	5.0	5.100		
V_{RLINE}	Line Regulation	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	—	0.5	6	mV	
			—	—	10		
V_{RLOAD}	Load Regulation	—	—	2	15	mV	
V_{DROP}	Dropout Voltage	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 0.8A$	SOT223	—	1.2	1.3	V
			TO252-2 Series	—	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	$f = 120Hz$, $C_{OUT} = 22\mu F$ $(V_{IN} - V_{OUT}) = 3V$, $I_{OUT} = 300mA$	—	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	—	$^\circ C$	
θ_{JC}	Thermal Resistance (Junction to Case)	SOT89	—	30	—	$^\circ C/W$	
		SOT223	—	15	—		
		TO252-2 Series	—	10	—		

Performance Characteristics

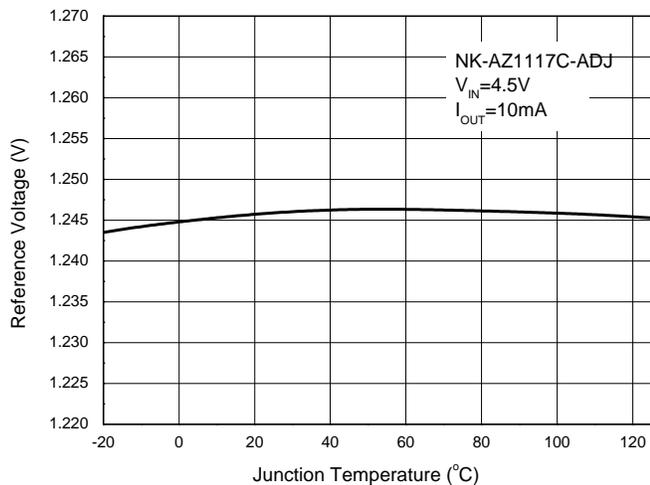
Line Regulation vs. Junction Temperature



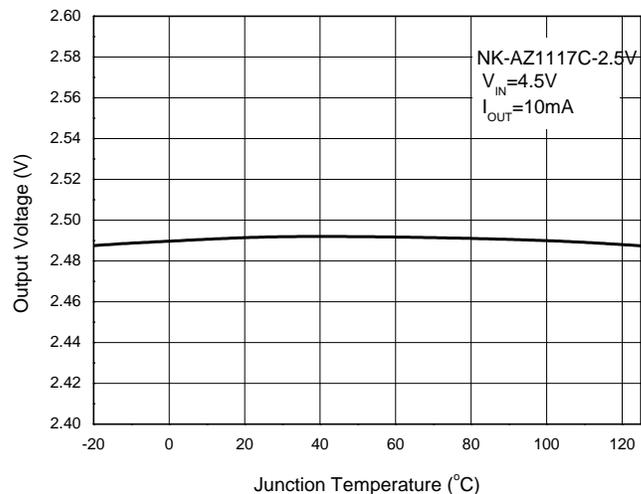
Load Regulation vs. Junction Temperature



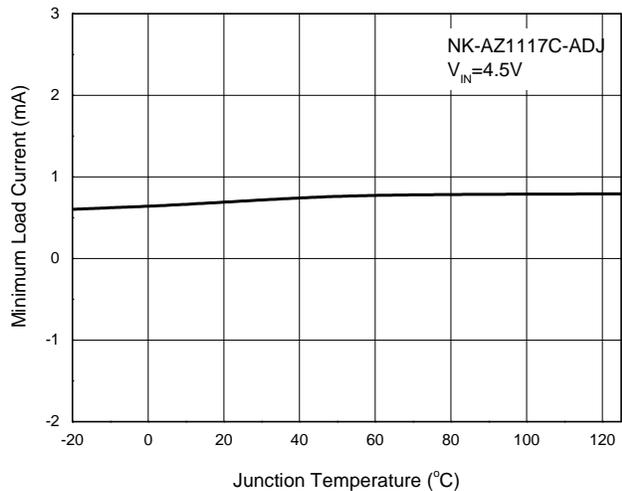
Reference Voltage vs. Junction Temperature



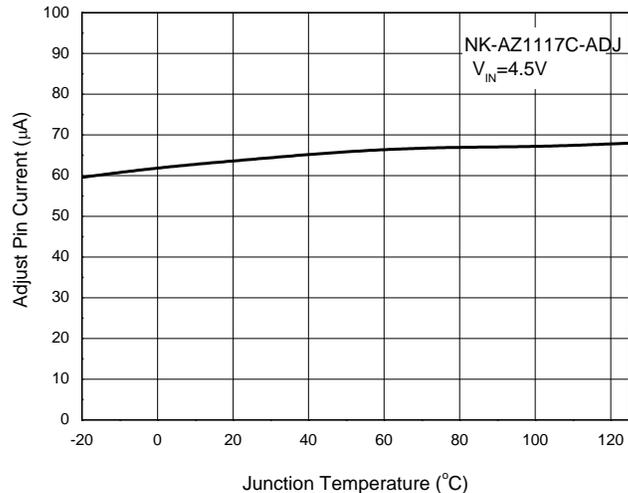
Output Voltage vs. Junction Temperature



Minimum Load Current vs. Junction Temperature

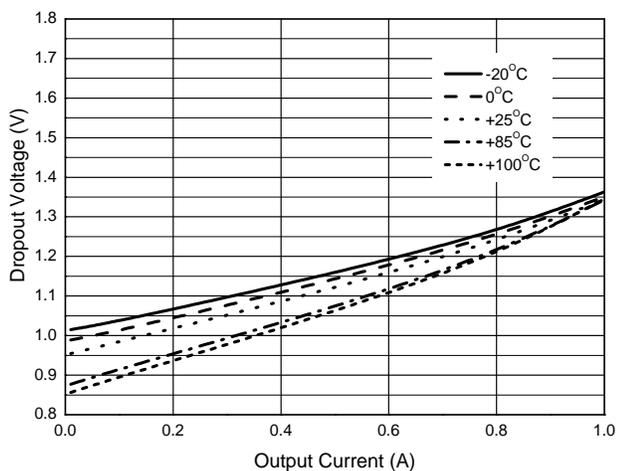


Adjust Pin Current vs. Junction Temperature

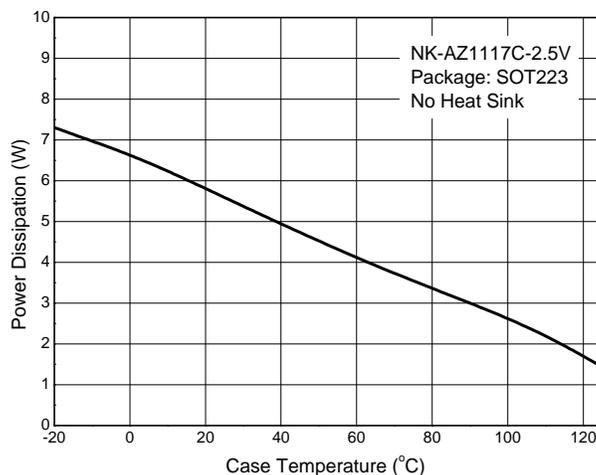


Performance Characteristics (continued)

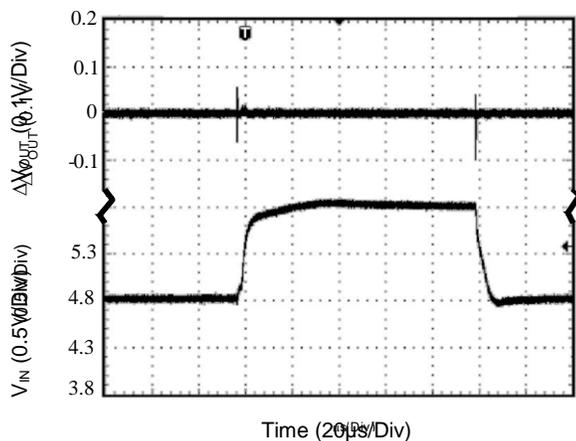
Dropout Voltage vs. Output Current



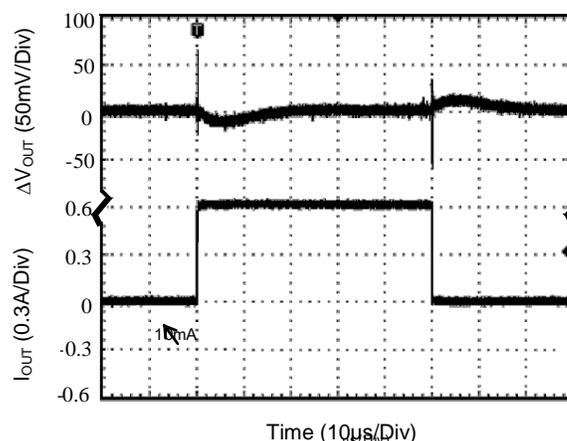
Power Dissipation vs. Case Temperature



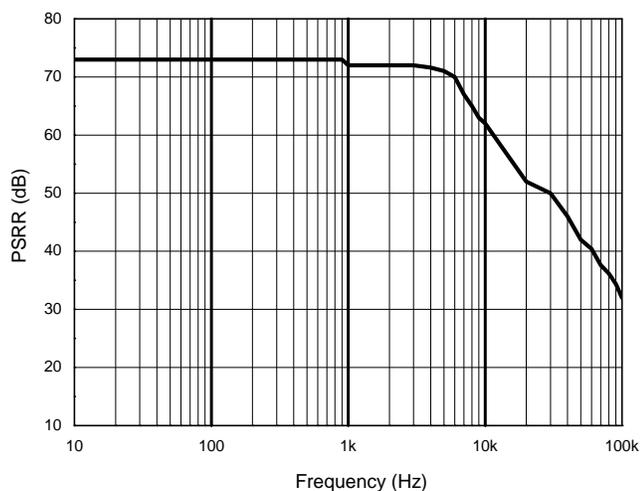
Line Transient Response



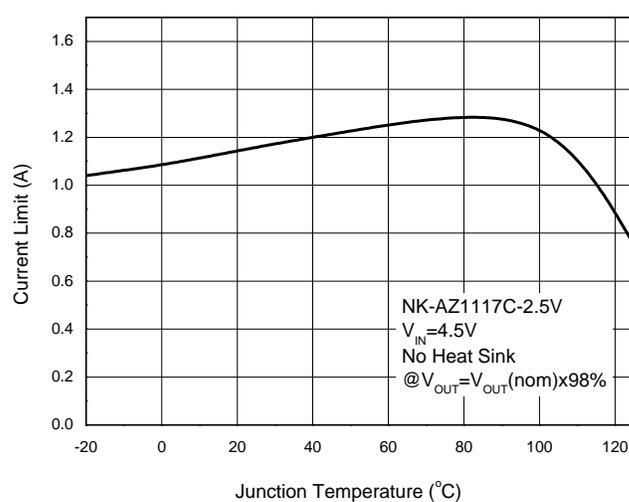
Load Transient Response



PSRR vs. Frequency

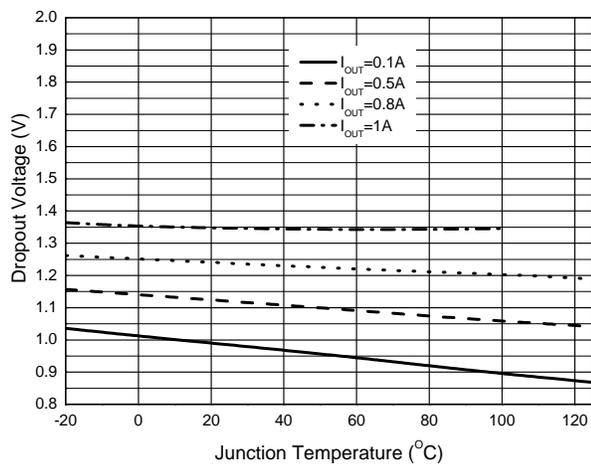


Current Limit vs. Junction Temperature



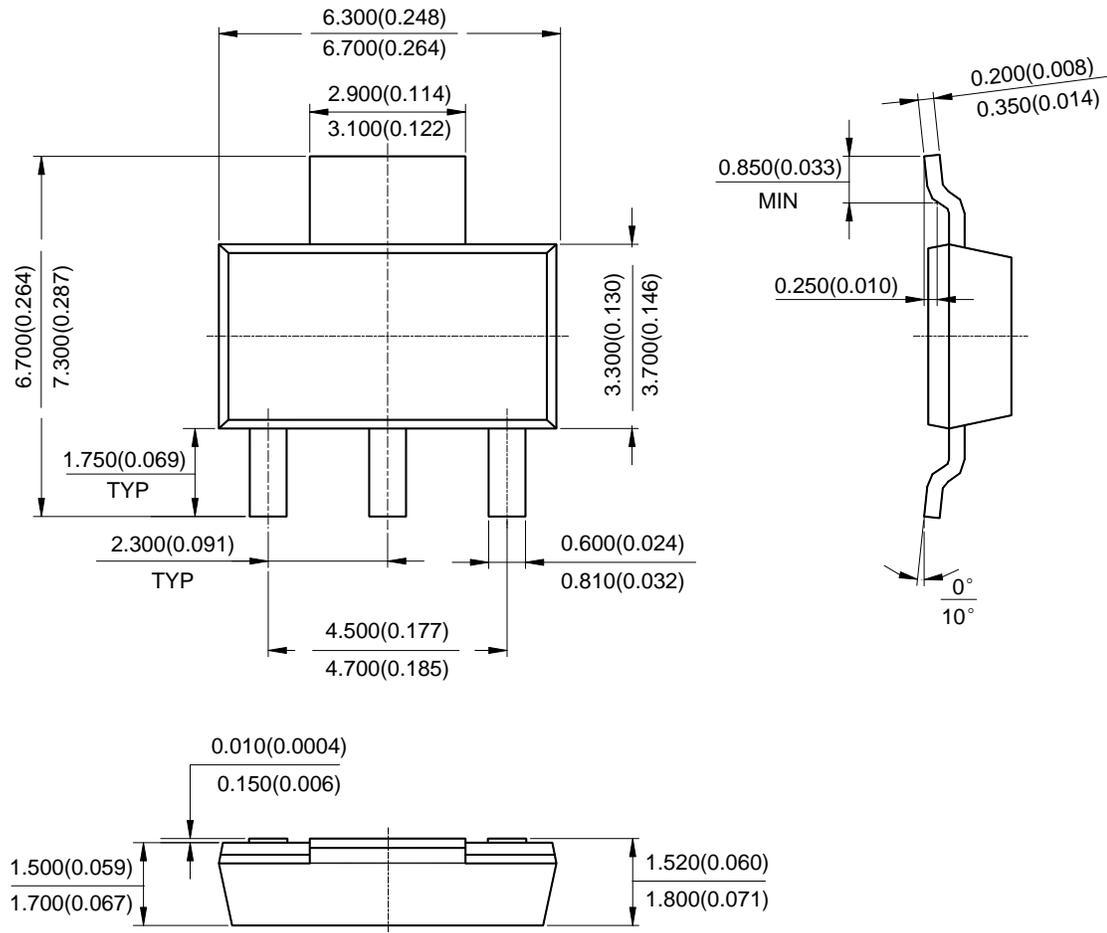
Performance Characteristics (continued)

Dropout Voltage vs. Junction Temperature



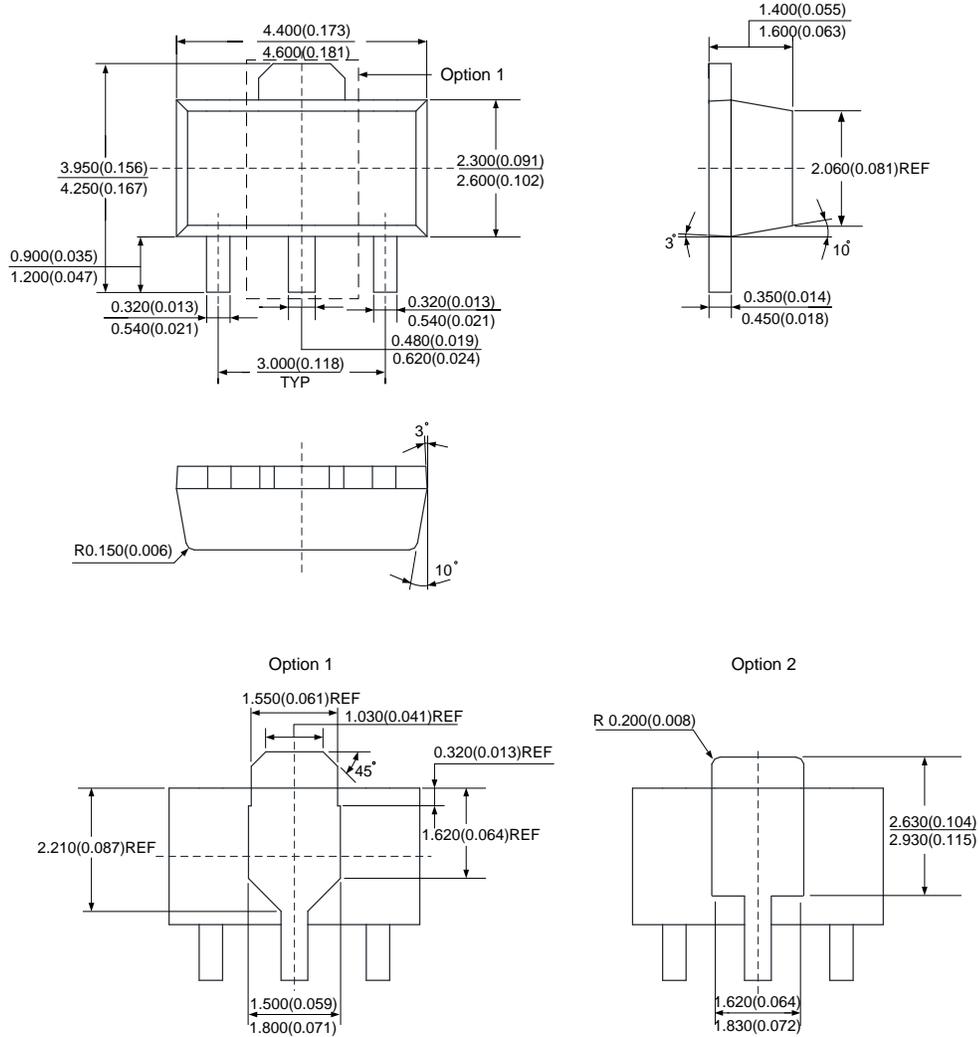
Package Outline Dimensions (All dimensions in mm)

(1) Package Type: SOT223



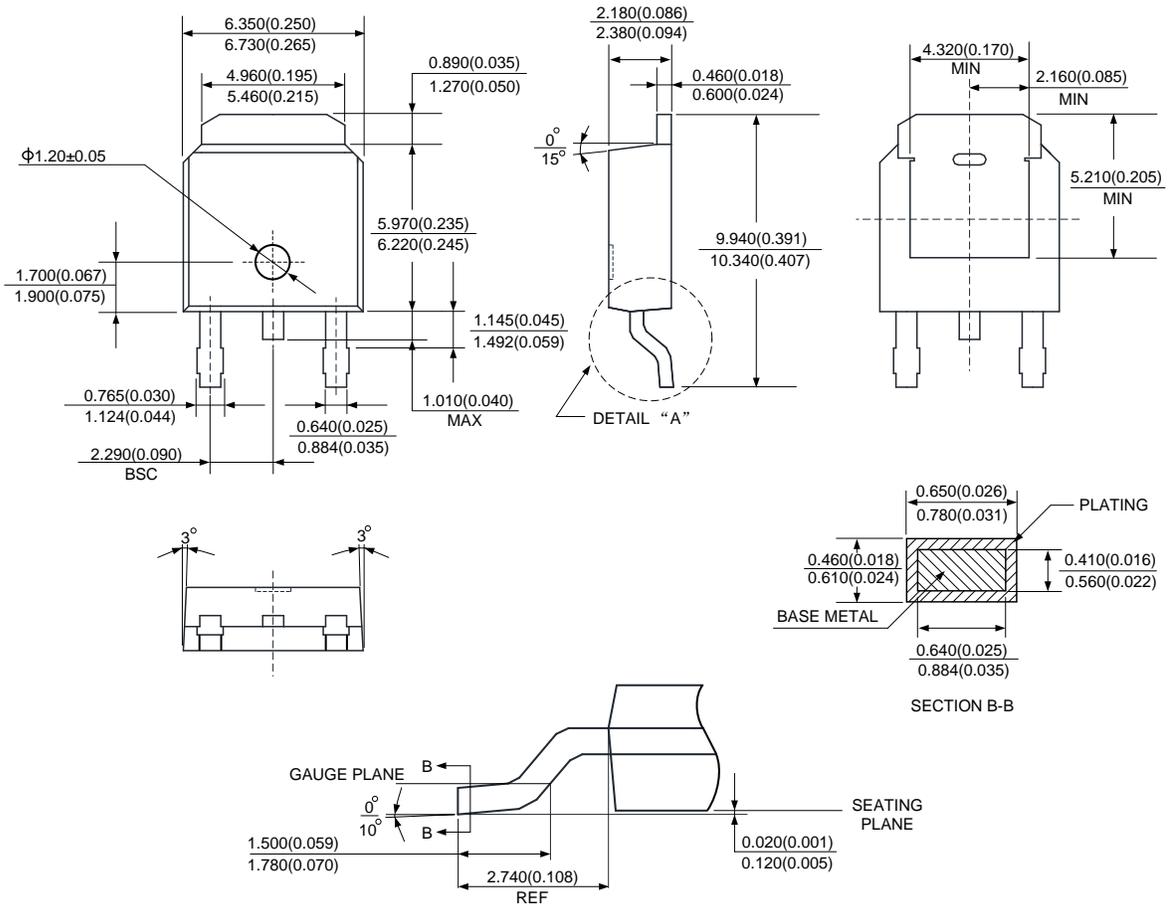
Package Outline Dimensions (All dimensions in mm) (continued)

(2) Package Type: SOT89



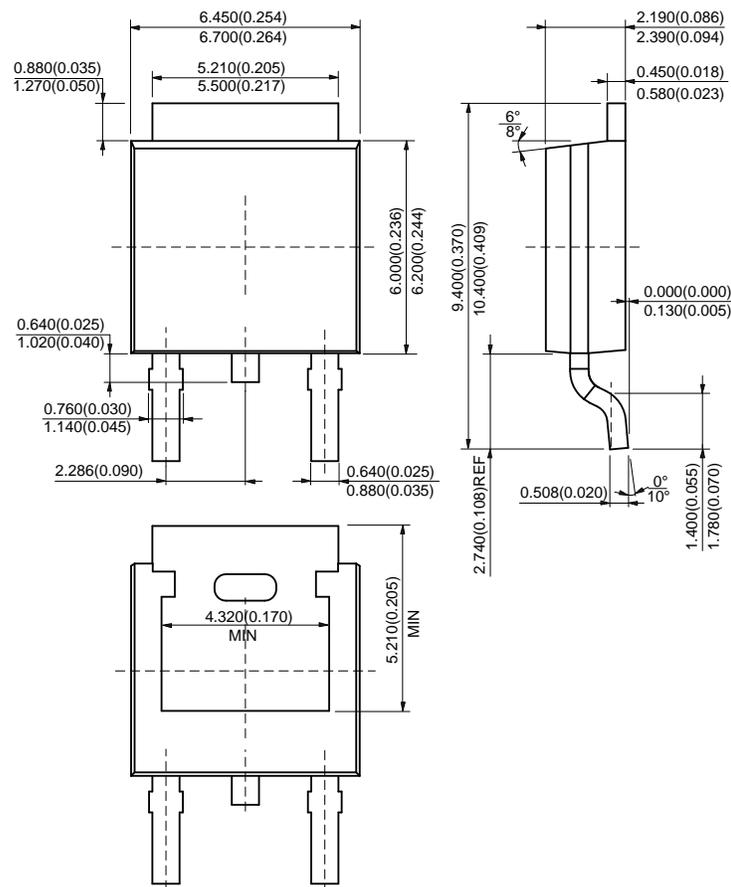
Package Outline Dimensions (All dimensions in mm) (continued)

(4) Package Type: TO252-2 (4)



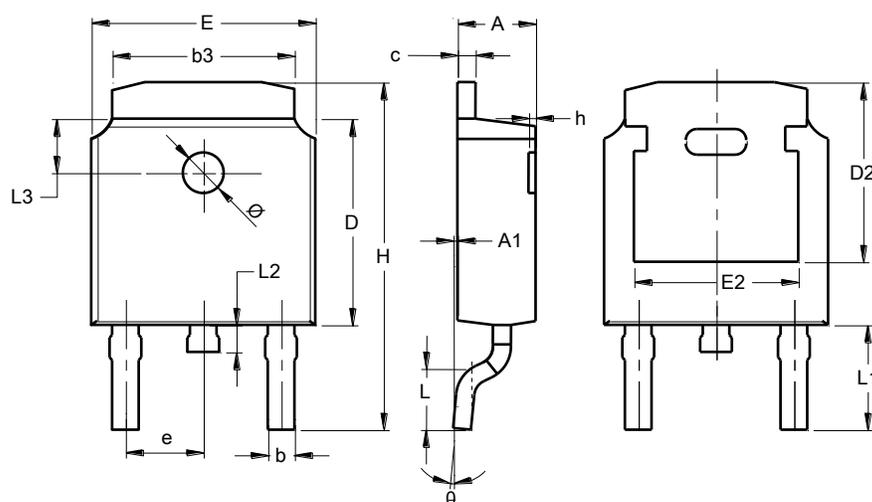
Package Outline Dimensions (All dimensions in mm) (continued)

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



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

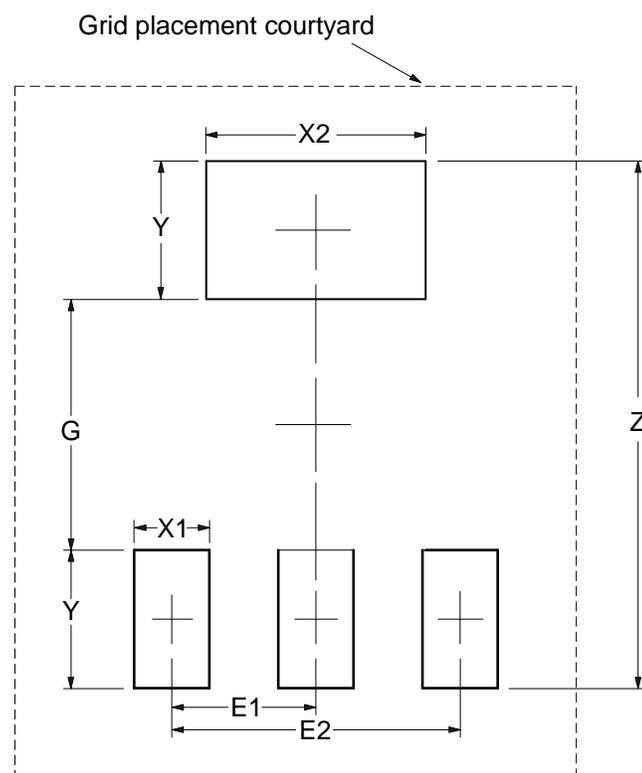
(6) Package Type : TO252 (Type CJ)



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		
∅	1.100	1.300	--
θ	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

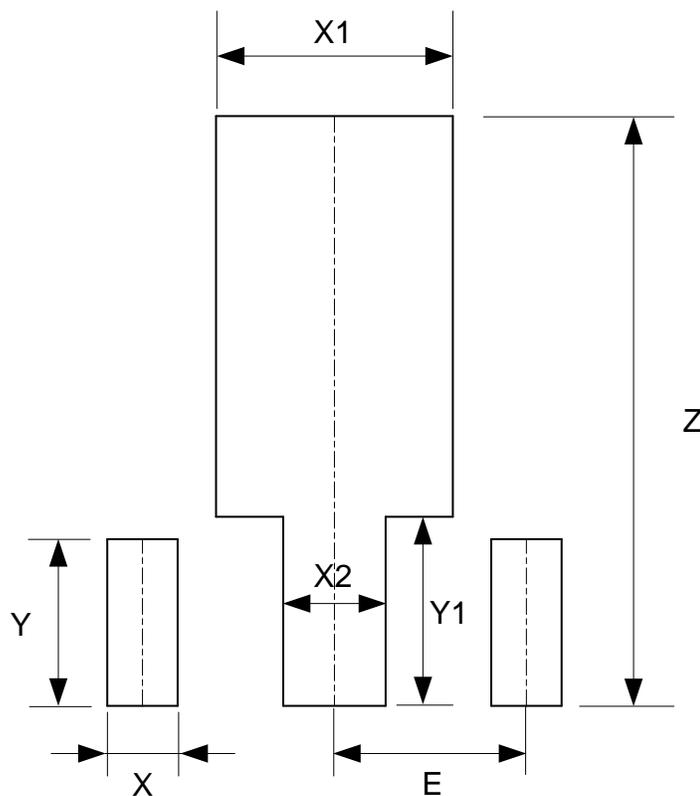
(1) Package Type: SOT223



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 (continued)

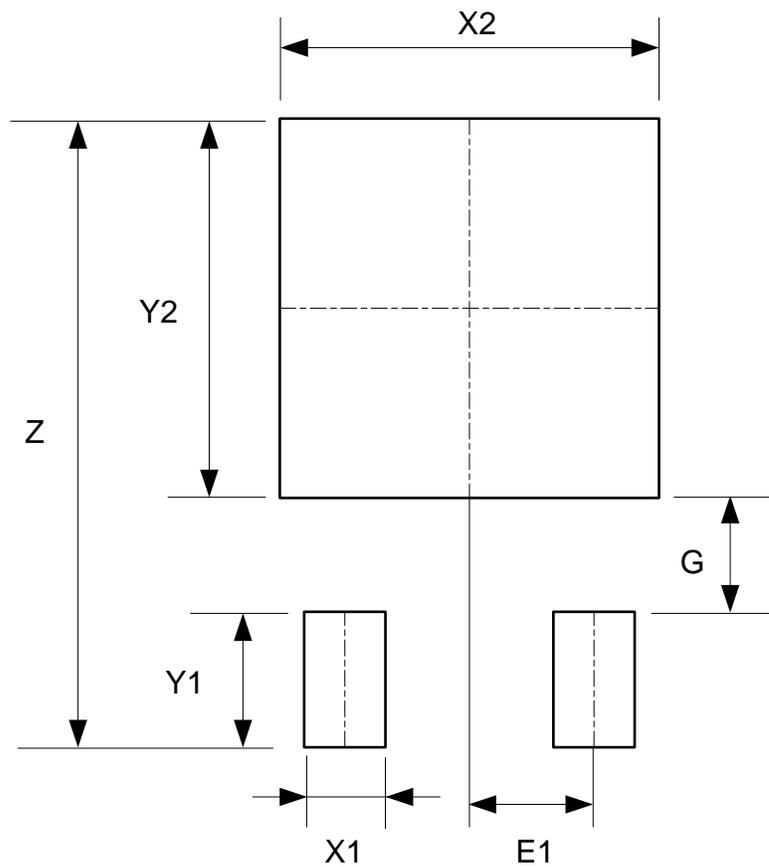
(2) Package Type: SOT89



Dimensions	Z (mm)/(inch)	X (mm)/(inch)	X1 (mm)/(inch)	X2 (mm)/(inch)	Y (mm)/(inch)	Y1 (mm)/(inch)	E (mm)/(inch)
Value	4.600/0.181	0.550/0.022	1.850/0.073	0.800/0.031	1.300/0.051	1.475/0.058	1.500/0.059

Suggested Pad Layout (continued)

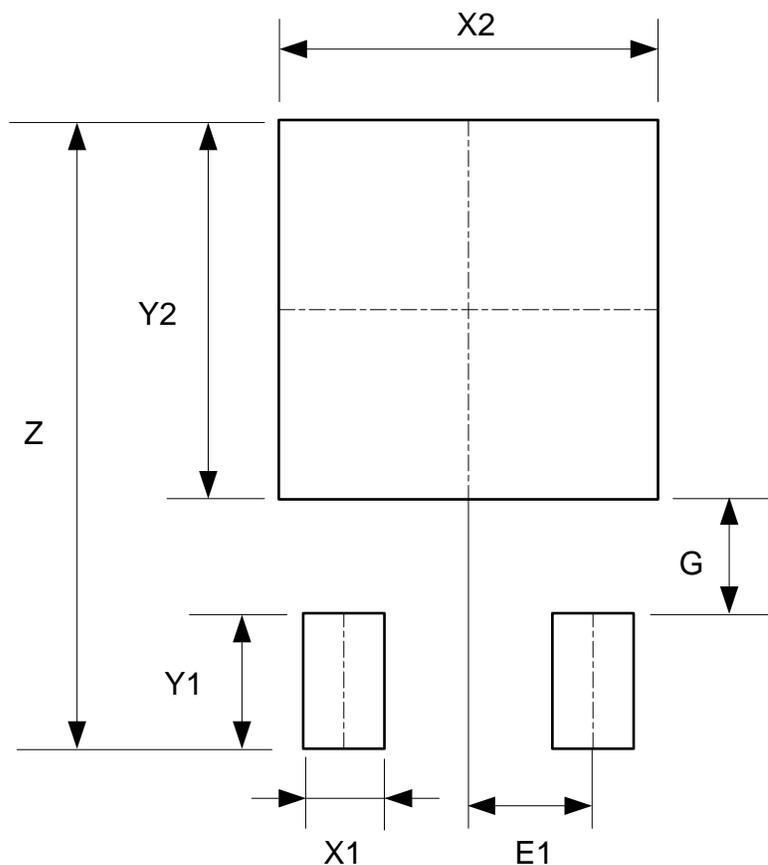
(3) Package Type: TO252-2 (3) / TO252 (Type CJ)



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

Suggested Pad Layout (continued)

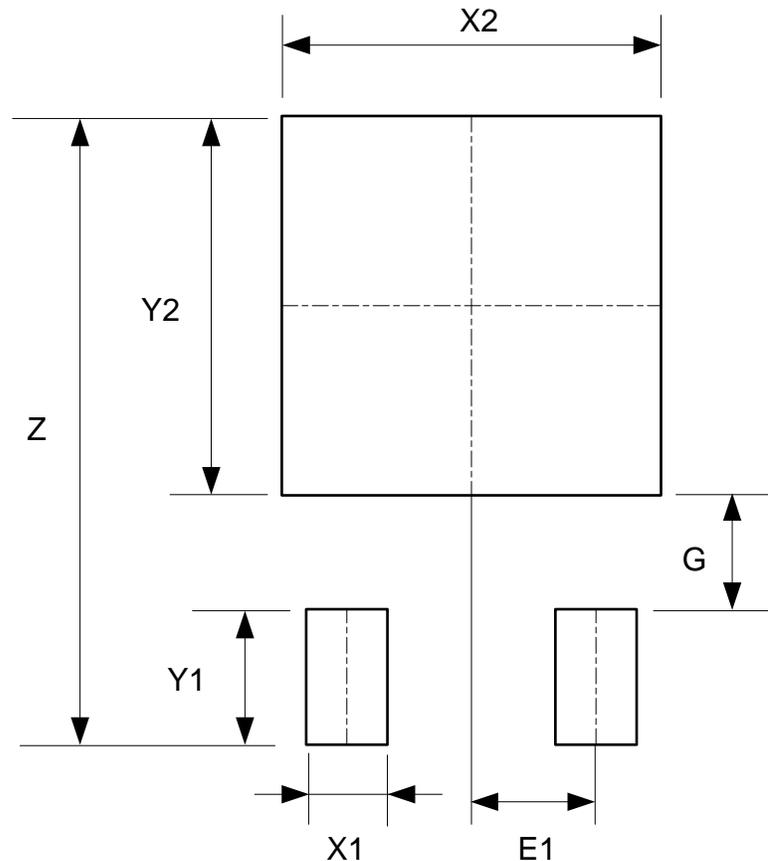
(4) Package Type: TO252-2 (4)



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

Suggested Pad Layout (continued)

(5) 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

Mechanical Data

- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish— Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ③
- Weight:
 - TO252-2 (3)/(4)/(5) /TO252 (Type CJ): 0.312 grams (Approximate)
 - SOT-223: 0.116 grams (Approximate)
 - SOT89: 0.055 grams (Approximate)