LOW VOLTAGE (1.25V) ADJUSTABLE PRECISION SHUNT REGULATOR AZ432

General Description

The AZ432 series ICs are low voltage three-terminal adjustable regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger, motherboard and other adjustable regulators.

The output voltage can be set to any value between 1.25V and 18V with two external resistors.

The AZ432 precision reference is offered in two band-gap tolerance: 0.5% and 1%.

These ICs are available in 4 packages: TO-92, SOT-23-3, SOT-23-5, SOT-89.

Features

- Wide Programmable Precise Output Voltage from 1.25V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-Range Temperature Coefficient: 20PPM/^{o}C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 55μA to 100 mA
- Low Output Noise
- Wide Operating Range of -40 to 125^{o}C

Applications

- Graphic Card
- PC Motherboard
- Voltage Adapter
- Switching Power Supply
- Charger

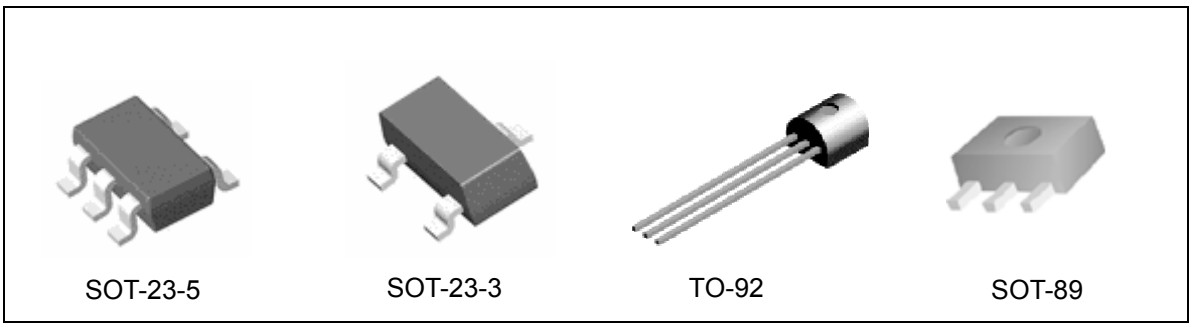


Figure 1. Package Types of AZ432

Pin Configuration

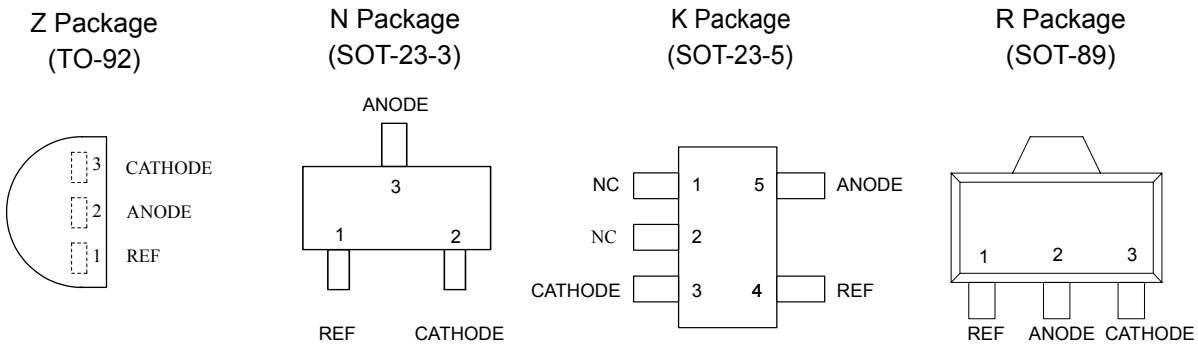


Figure 2. Pin Configuration of AZ432 (Top View)

Functional Block Diagram

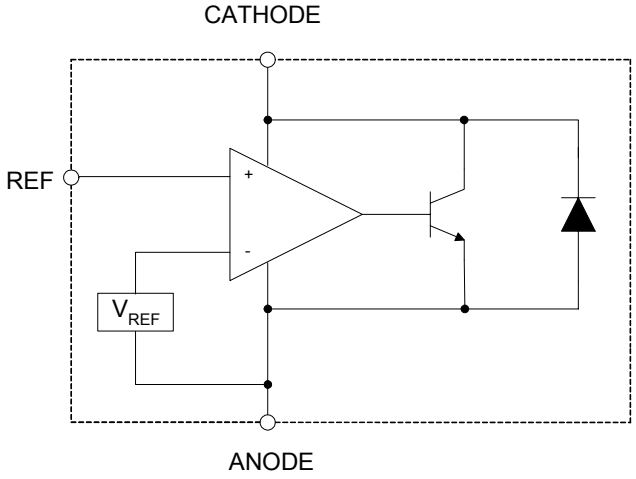
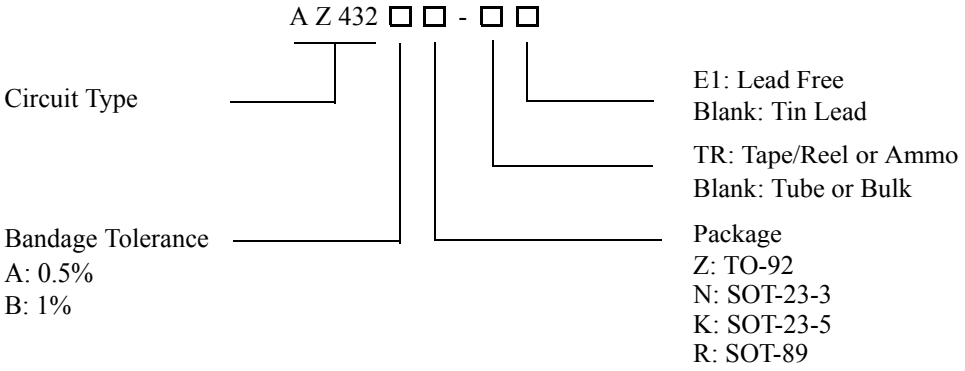


Figure 3. Functional Block Diagram of AZ432

Ordering Information



Package	Tempera-ture Range	Voltage Tolerance	Part Number		Marking ID		Packing Type
			Tin Lead	Lead Free	Tin Lead	Lead Free	
TO-92	-40 to 125°C	0.50%	AZ432AZ	AZ432AZ-E1	AZ432AZ	AZ432AZ-E1	Bulk
		0.50%	AZ432AZTR	AZ432AZTR-E1	AZ432AZ	AZ432AZ-E1	Ammo
		1%	AZ432BZ	AZ432BZ-E1	AZ432BZ	AZ432BZ-E1	Bulk
		1%	AZ432BZTR	AZ432BZTR-E1	AZ432BZ	AZ432BZ-E1	Ammo
SOT-23-3	-40 to 125°C	0.50%	AZ432ANTR	AZ432ANTR-E1	N48	EA8	Tape/Reel
		1%	AZ432BNTR	AZ432BNTR-E1	N49	EA9	Tape/Reel
SOT-23-5	-40 to 125°C	0.50%	AZ432AKTR	AZ432AKTR-E1	K43	E7A	Tape/Reel
		1%	AZ432BKTR	AZ432BKTR-E1	K44	E8A	Tape/Reel
SOT-89	-40 to 125°C	0.50%	AZ432ARTR	AZ432ARTR-E1	R42A	E42A	Tape/Reel
		1%	AZ432BRTR	AZ432BRTR-E1	R42B	E42B	Tape/Reel

The listed part numbers are used during the transition to lead-free products. After the transition completed, lead-free products will be considered as the "standard" and we will resume the original part numbers.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Cathode Voltage	V_{KA}	20		V
Cathode Current Range (Continuous)	I_{KA}	-100 to 100		mA
Reference Input Current Range	I_{REF}	10		mA
Power Dissipation	P_D	Z,R Package	770	mW
		N,K Package	370	
Storage Temperature Range	T_{STG}	-65 to 150		°C
Package Thermal Impedance	Q_{JA}	TO-92	130	°C/W
		SOT-23-3	330	
		SOT-23-5	250	
		SOT-89	100	

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.

Recommended Operation Ratings

Parameter	Symbol	Min	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	18	V
Cathode Current	I_{KA}	0.1	100	mA
Operating Ambient Temperature Range		-40	125	°C

Electrical Characteristics

(Typical and limits apply for T_J=25°C unless otherwise noted.)

Parameter		Test Circuit	Sym-bol	Conditions		Min	Typ	Max	Unit
Reference Voltage	0.5%	4	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA		1.244	1.250	1.256	V
	1%					1.238	1.250	1.262	
Deviation of Reference Voltage Over-Temperature		4	ΔV_{REF}	$V_{KA}=V_{REF}$ I_{KA}=10mA	0 to 70°C		2	10	mV
					-40 to 85°C		3	10	
Ratio of Change in V_{REF} to the Change in Cathode Voltage		5	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I_{KA}=10mA, ΔV_{KA}: V_{REF} to 16V			-0.5	-1.5	mV/V
Reference Input Current		5	I_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∞			0.15	0.4	μA
Deviation of Reference Current Over Full Temperature Range		5	ΔI_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∞ T_A=-40 to 85°C			0.1	0.4	μA
Minimum Cathode Current for Regulation		4	I_{KA} (MIN)	$V_{KA}=V_{REF}$			55	80	μA
Off-State Cathode Current		6	I_{KA} (OFF)	V_{REF}=0, V_{KA}=18V			0.04	0.10	μA
				V_{KA}=6V, V_{REF}=0			0.01	0.05	
Dynamic Impedance		4	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA f≤1.0kHz			0.05	0.15	Ω

Electrical Characteristics (Continued)

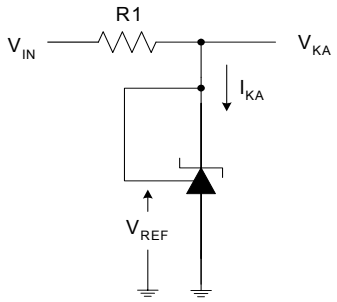


Figure 4. Test Circuit 4 for $V_{KA}=V_{REF}$

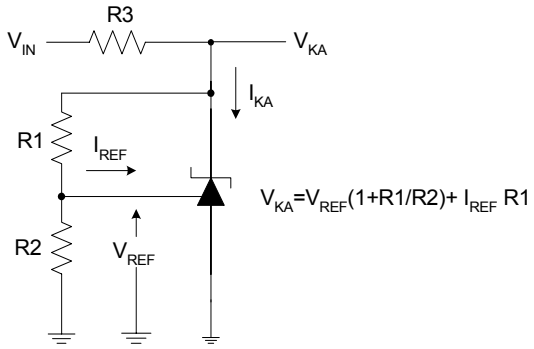


Figure 5. Test Circuit 5 for $V_{KA}>V_{REF}$

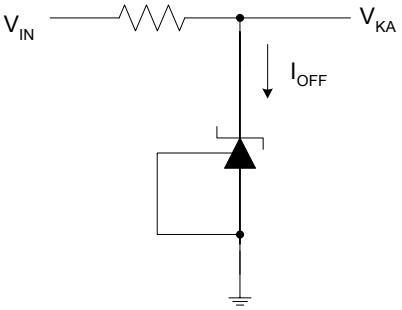


Figure 6. Test Circuit 6 for I_{OFF}

Typical Performance Characteristics

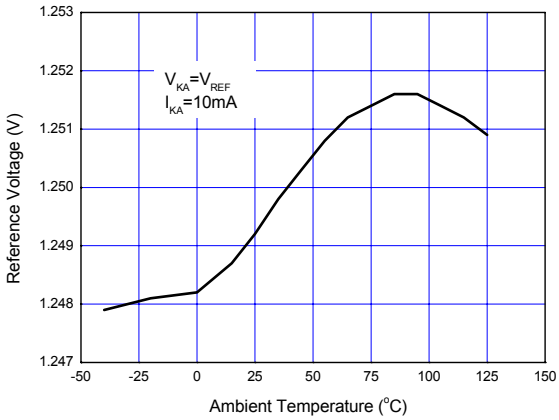


Figure 7. Reference Voltage vs. Ambient Temperature

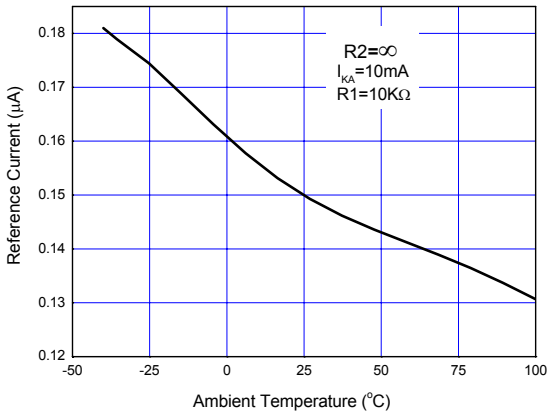


Figure 8. Reference Current vs. Ambient Temperature

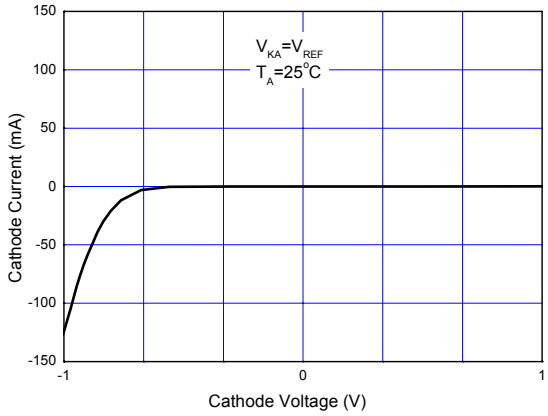


Figure 9. Cathode Current vs. Cathode Voltage

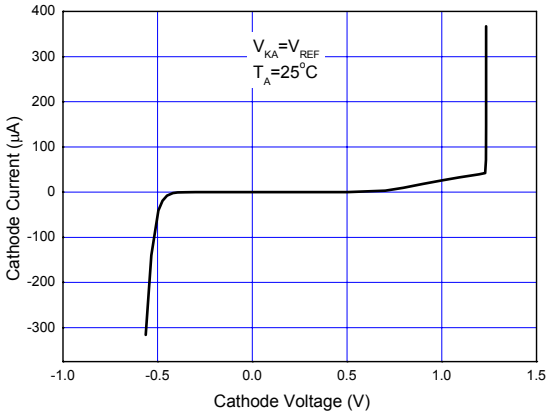


Figure 10. Current vs. cathode Voltage

Typical Performance Characteristics (Continued)

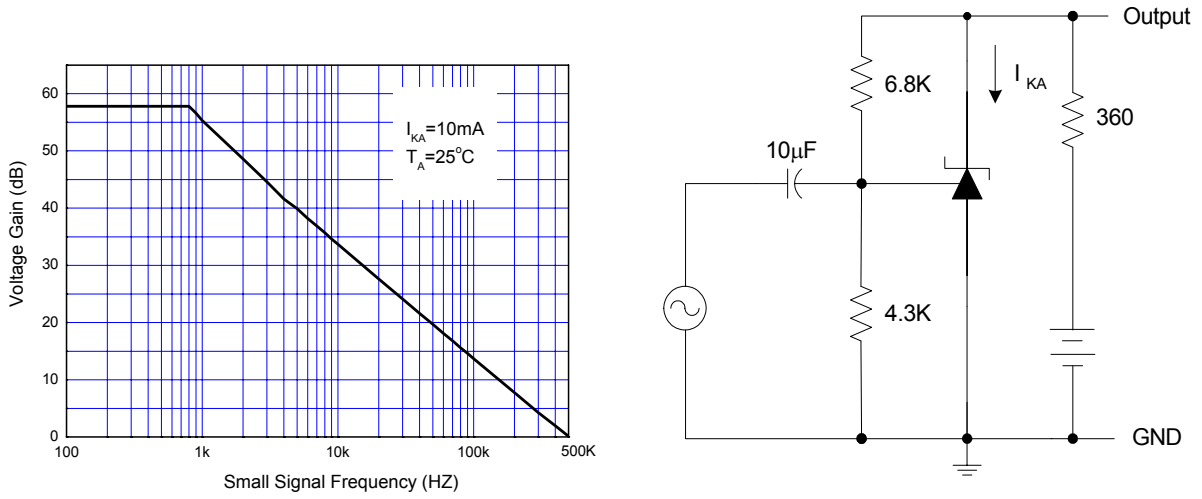


Figure 11. Small Signal Voltage Gain vs. Frequency

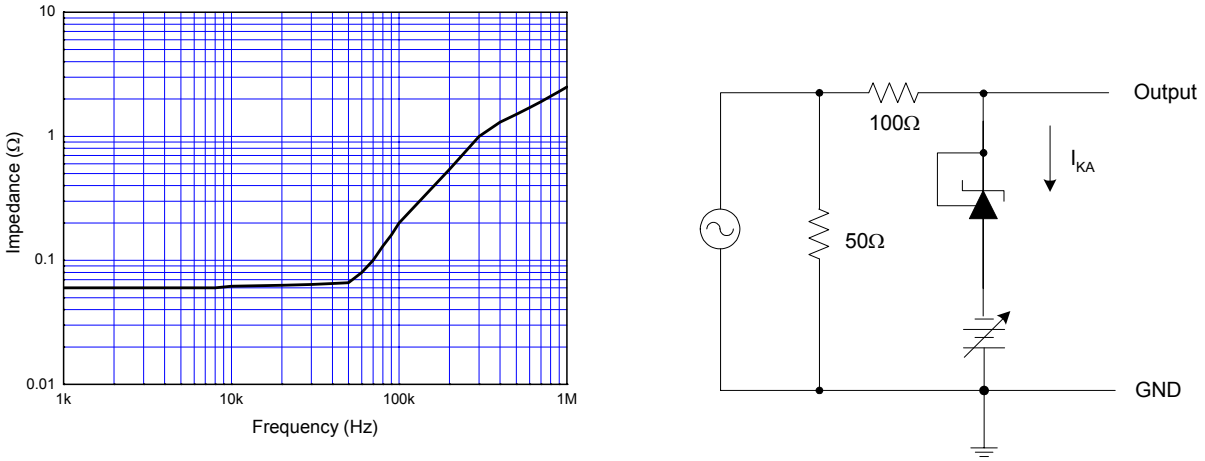


Figure 12. Dynamic Impedance vs. Frequency

Typical Performance Characteristics (Continued)

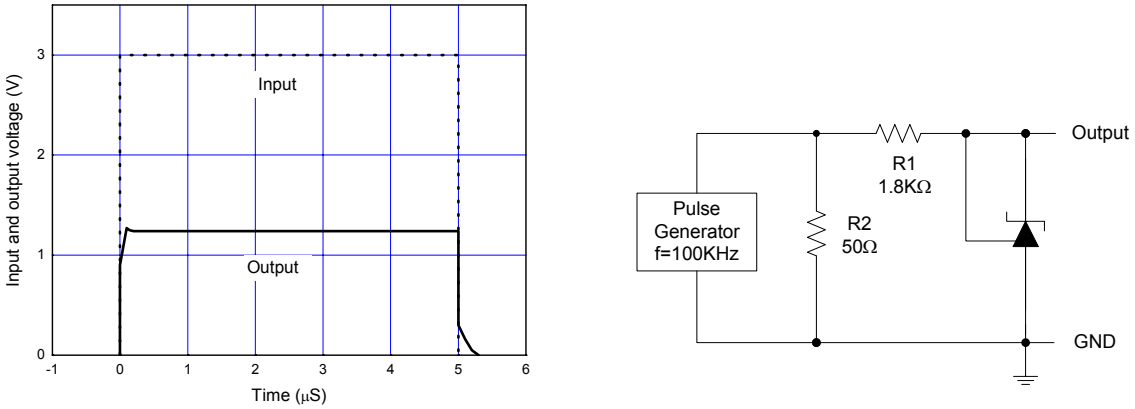


Figure 13. Pulse Response of Input and Output Voltage

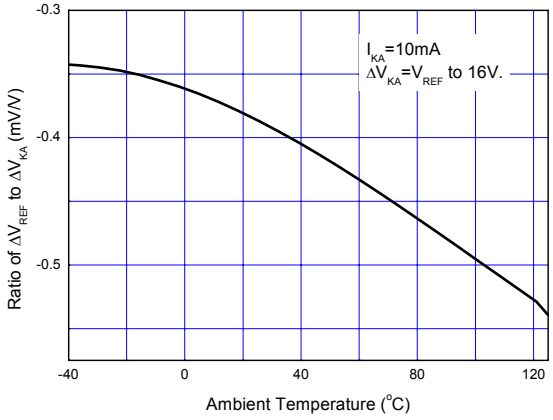
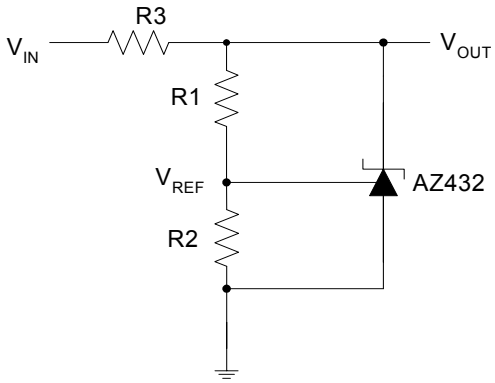


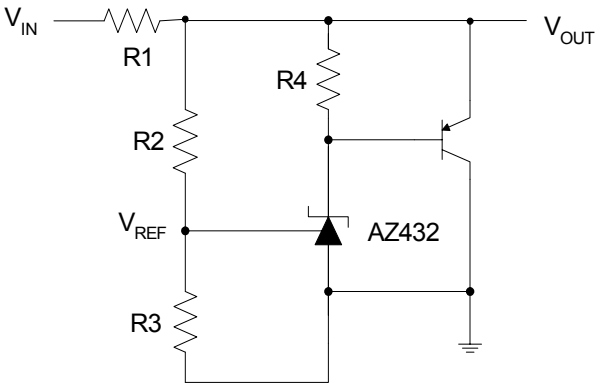
Figure 14. Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage vs. Ambient Temperature

Typical Applications



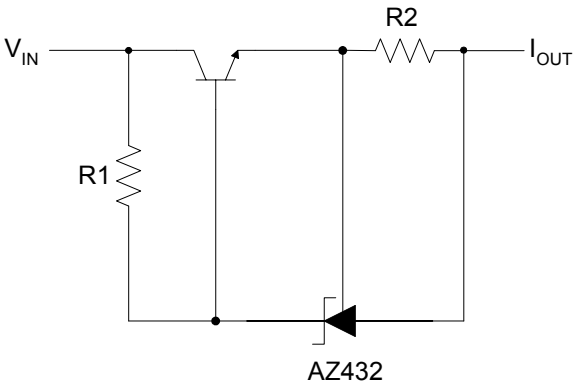
$V_O=(1+R1/R2)\ V_{REF}$

Figure 15: Shunt Regulator



$V_O=(1+R2/R3)\ V_{REF}$

Figure 16: High Current Shunt Regulator



$I_{OUT} = V_{REF}/R2 + I_{KA}$

Figure17: Current Source or Current Limit

Typical Applications (Continued)

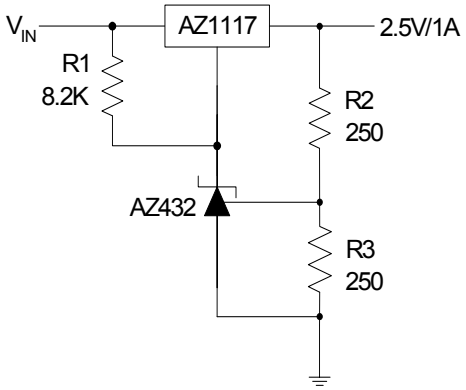


Figure18: Precision 2.5V/1A Regulator

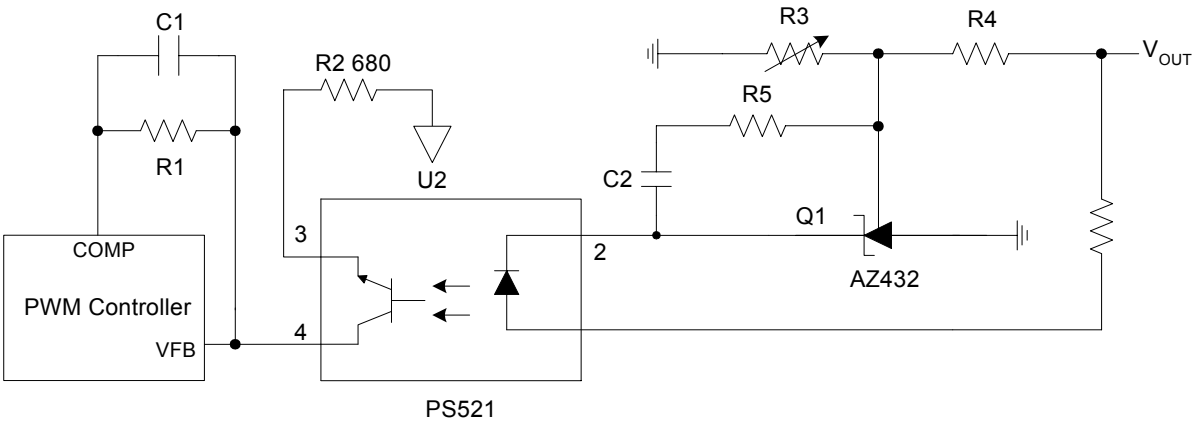
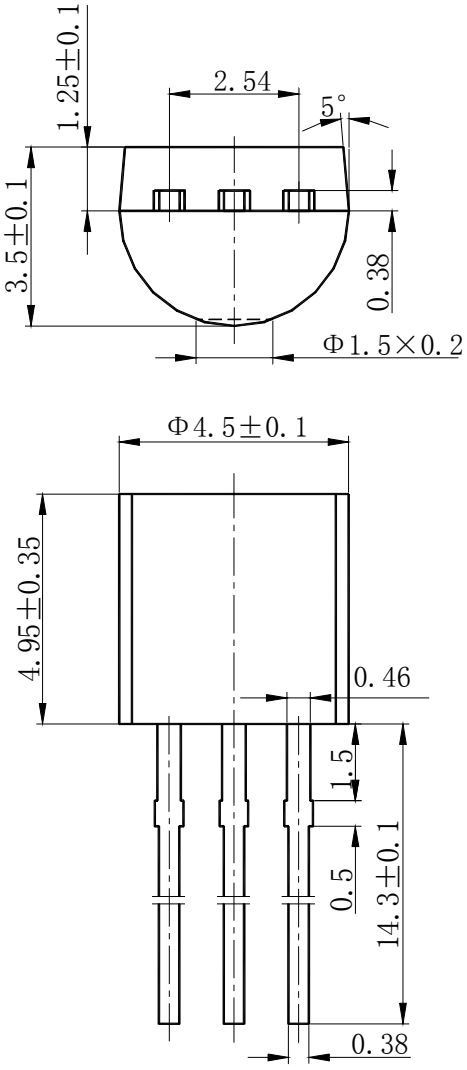


Figure 19: PWM Converter with Reference

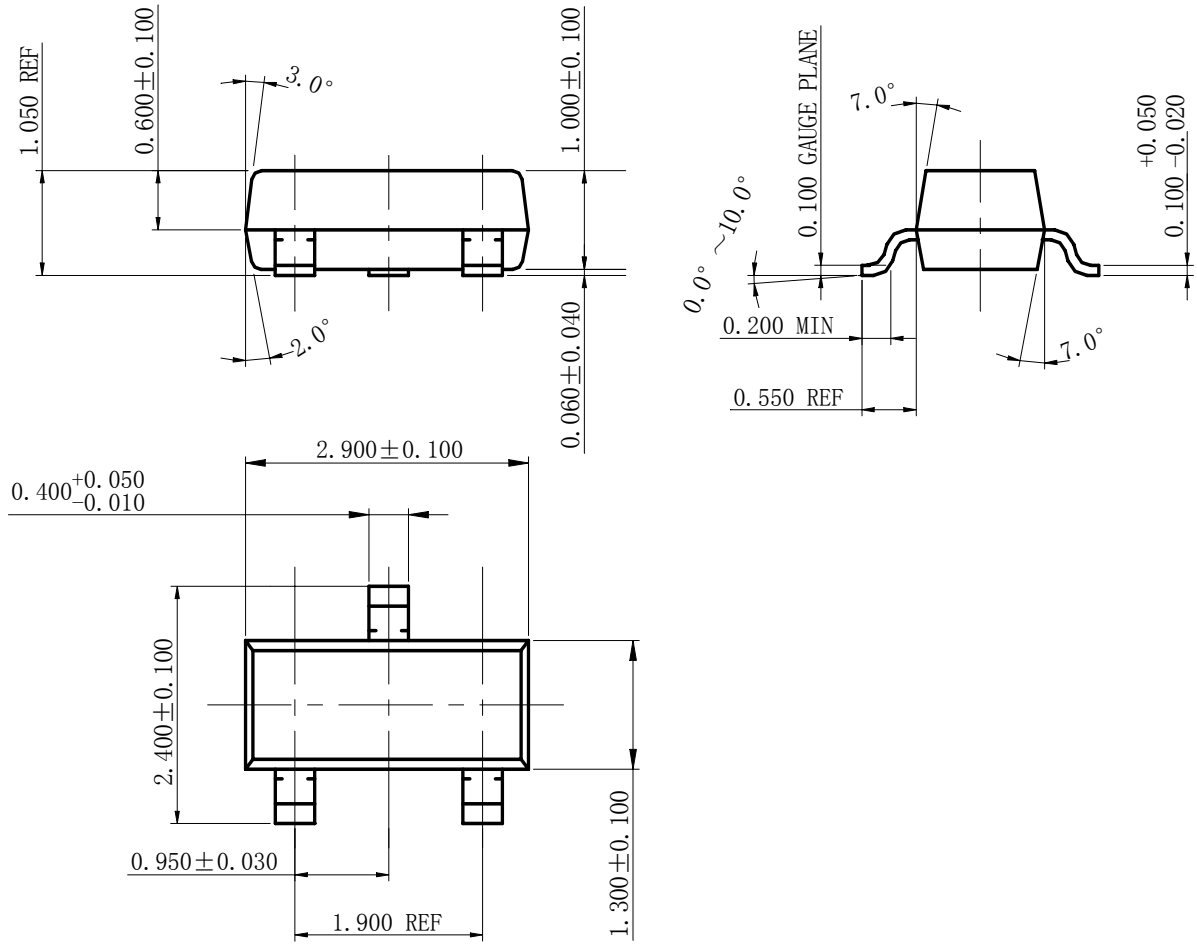
Mechanical Dimensions

TO - 92 **Unit: mm**



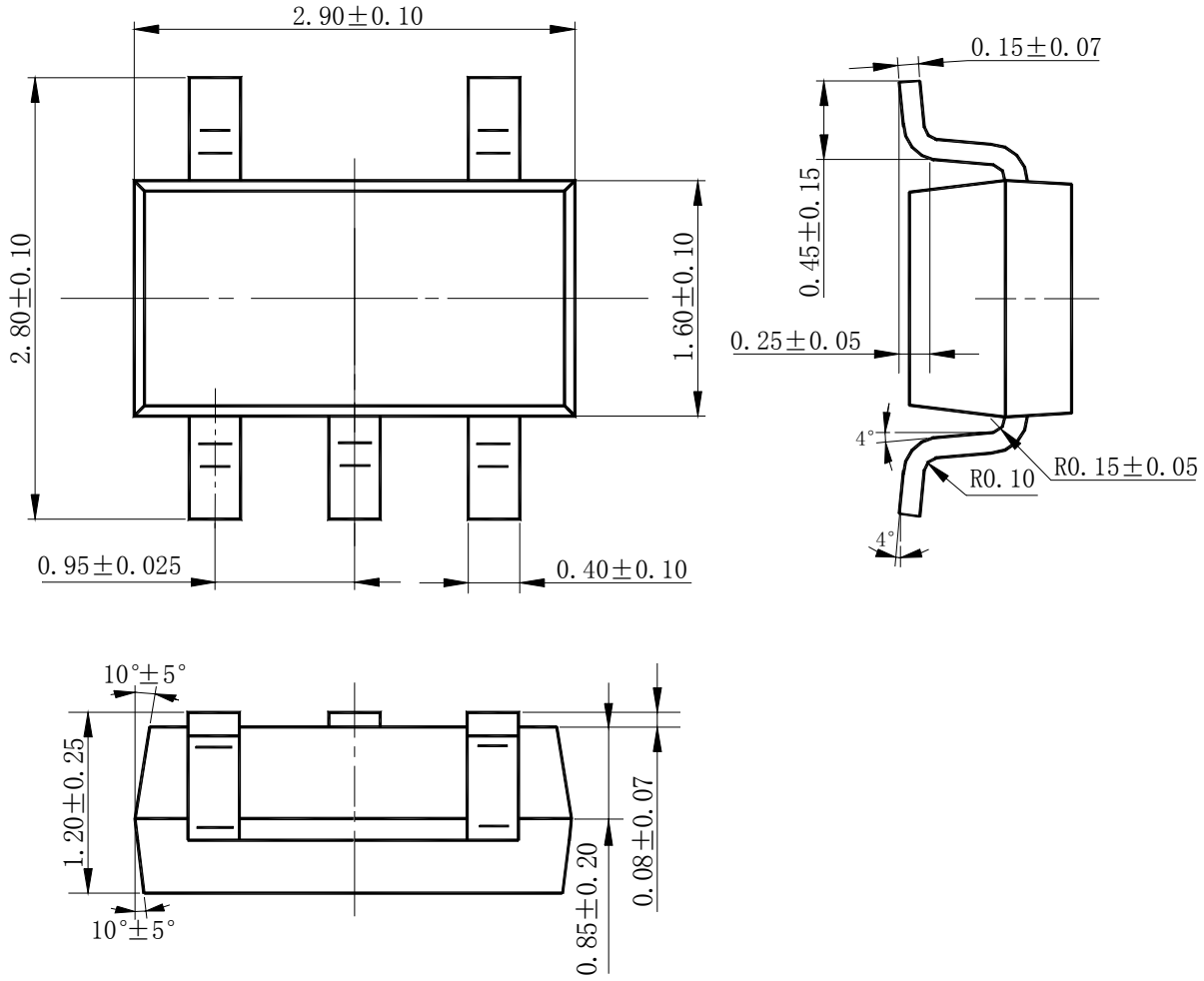
Mechanical Dimensions (Continued)

SOT - 23-3 **Unit: mm**



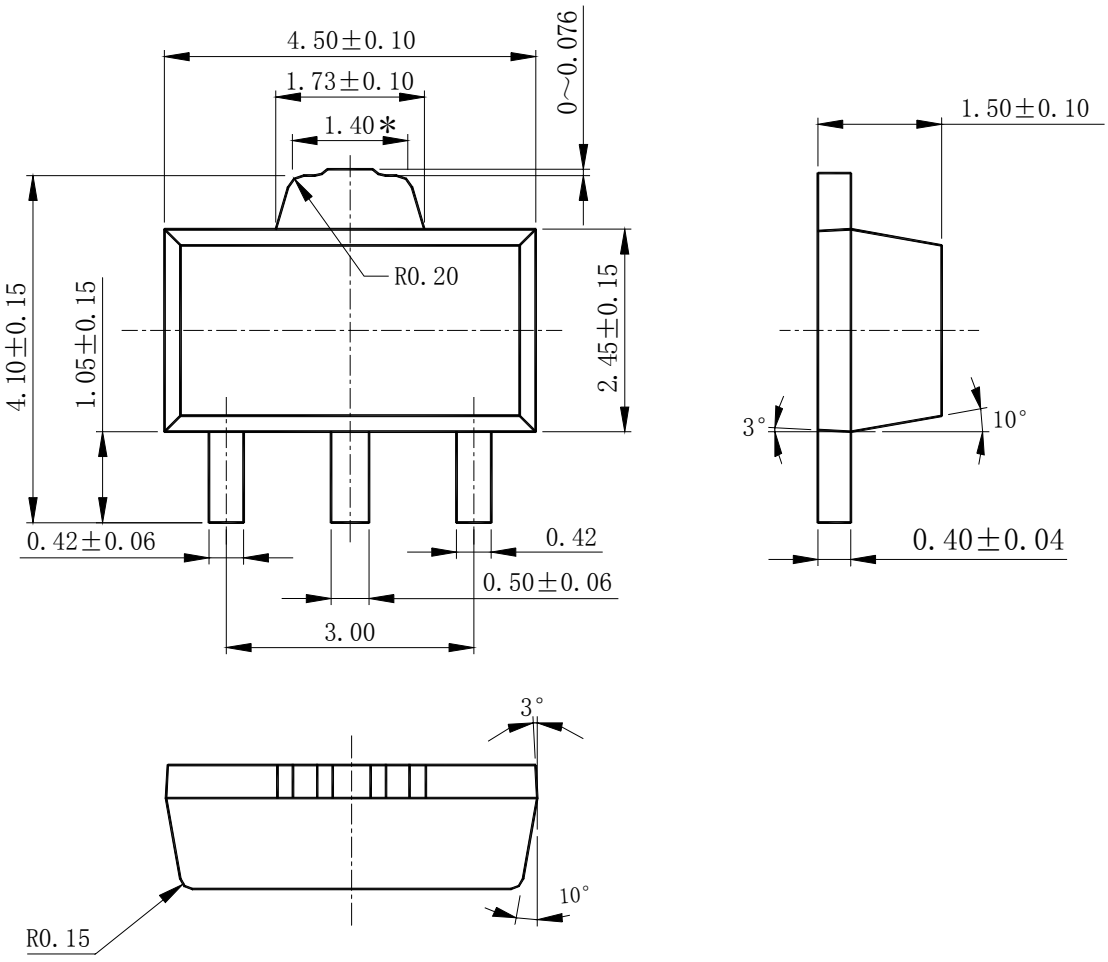
Mechanical Dimensions (Continued)

SOT - 23 - 5 **Unit: mm**



Mechanical Dimensions (Continued)

SOT - 89 **Unit: mm**



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