ADJUSTABLE PRECISION SHUNT REGULATORS AN431

General Description

The AN431 series ICs are three-terminal adjustable shunt 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 and other adjustable regulators.

The output voltage of these ICs can be set to any value between V_{REF} (2.5V) and the maximum cathode voltage (36V).

The AN431 precision reference is offered in two voltage tolerance: 0.5% and 1.0%.

These ICs are available in SOT-23 package.

Features

- Programmable Precise Output Voltage from 2.5V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 4.5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/^{o}C Typical
- Low Dynamic Output Resistance: 0.15Ω Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to 125^{o}C

Applications

- Charger
- Voltage Adapter
- Switching Power Supply
- Graphic Card
- Precision Voltage Reference

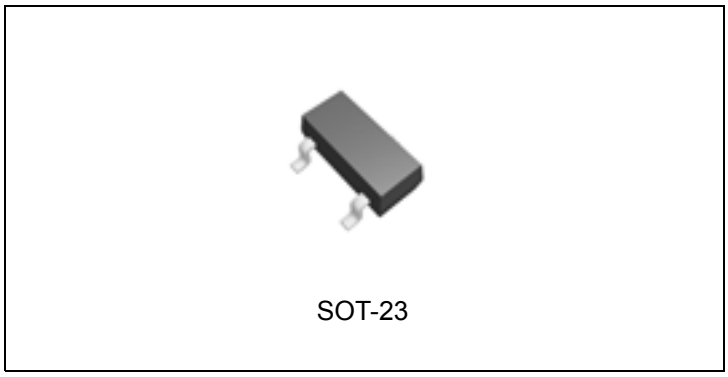


Figure 1. Package Type of AN431

Pin Configuration

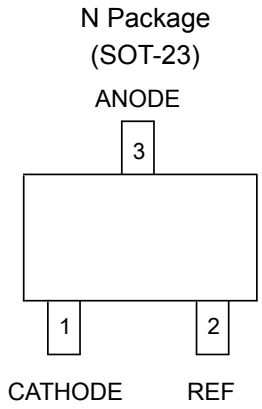


Figure 2. Pin Configuration of AN431 (Top View)

Functional Block Diagram

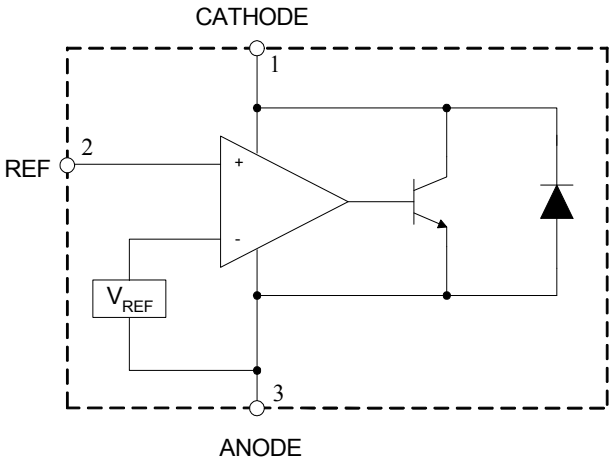
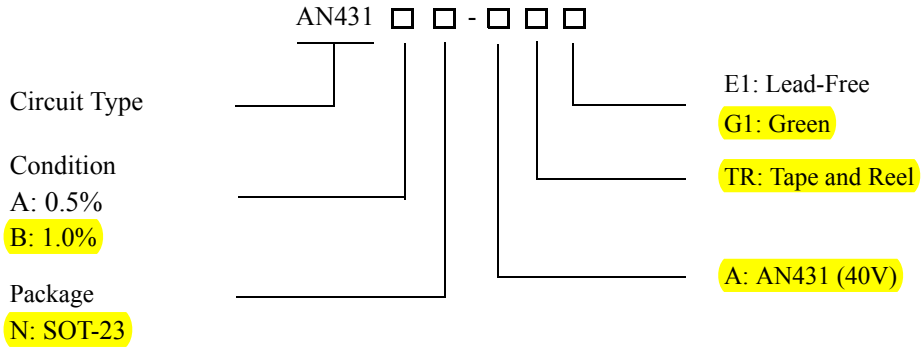


Figure 3. Functional Block Diagram of AN431

Ordering Information



Package	Temperature Range	Condition	Part Number		Marking ID		Packing Type
			Lead Free	Green	Lead Free	Green	
SOT-23	-40 to 125°C	0.5%	AN431AN-ATRE1	AN431AN-ATRG1	EB1	GB1	Tape & Reel
		1.0%	AN431BN-ATRE1	AN431BN-ATRG1	EB2	GB2	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Cathode Voltage	V_{KA}	40	V
Cathode Current Range (Continuous)	I_{KA}	-100 to 150	mA
Reference Input Current Range	I_{REF}	10	mA
Power Dissipation	P_D	370	mW
Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
ESD (Human Body Model)	ESD	2000	V

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 Operating Conditions

Parameter	Symbol	Min	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current	I_{KA}	1.0	100	mA
Operating Ambient Temperature Range		-40	125	°C

Electrical Characteristics

Operating Conditions: T_A=25°C, unless otherwise specified.

Parameter		Test Circuit	Symbol	Conditions		Min	Typ	Max	Unit
Reference Voltage	0.5%	4	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA		2.487	2.500	2.512	V
	1.0%					2.475	2.500	2.525	
Deviation of Reference Voltage Over Full Temperature Range		4	ΔV_{REF}	$V_{KA}=V_{REF}$ I_{KA}=10mA	0 to 70°C		4.5	8	mV
					-40 to 85°C		4.5	10	
					-40 to 125°C		4.5	16	
Ratio of Change in Reference Voltage to the Change in Cathode Voltage		5	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I_{KA}=10mA	ΔV_{KA}= 10V to V_{REF}		-1.0	-2.7	mV/V
					ΔV_{KA}= 36V to 10V		-0.5	-2.0	
Reference Current		5	I_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∞			0.7	4	μA
Deviation of Reference Current Over Full Temperature Range		5	ΔI_{REF}	I_{KA}=10mA, R1=10KΩ R2=∞, T_A=-40 to 125°C			0.4	1.2	μA
Minimum Cathode Current for Regulation		4	I_{KA} (Min)	$V_{KA}=V_{REF}$			0.4	1.0	mA
Off-state Cathode Current		6	I_{KA} (Off)	V_{KA}=36V, V_{REF}=0			0.05	1.0	μA
Dynamic Impedance		4	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA, f ≤ 1.0kHz			0.15	0.5	Ω
Thermal Resistance			θ_{JC}	SOT-23			135		°C/W

Electrical Characteristics (Continued)

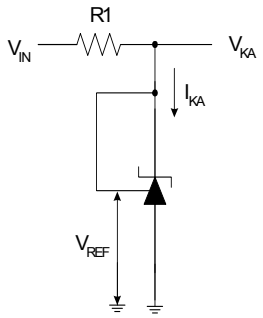


Figure 4. Test Circuit 4 for $V_{KA}=V_{REF}$

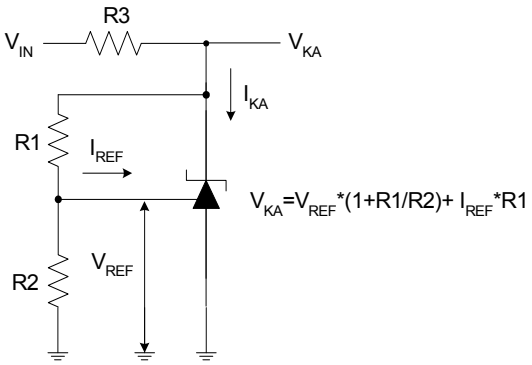


Figure 5. Test Circuit 5 for $V_{KA}>V_{REF}$

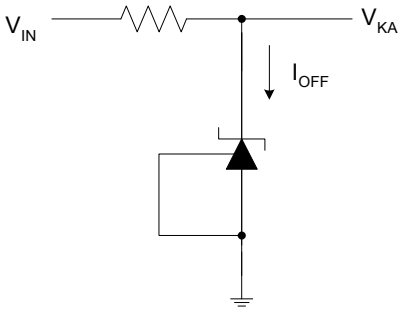


Figure 6. Test Circuit 6 for I_{OFF}

Typical Performance Characteristics

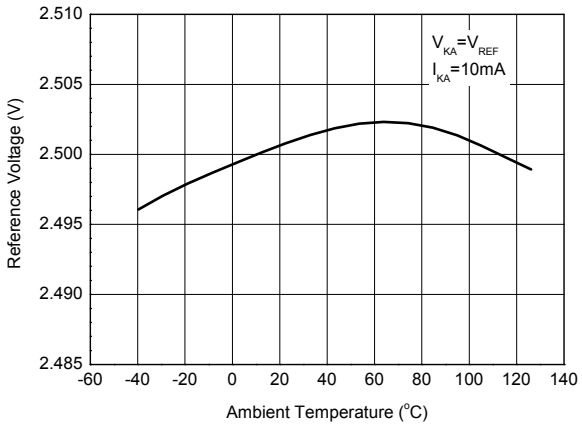


Figure 7. Reference Voltage vs. Ambient Temperature

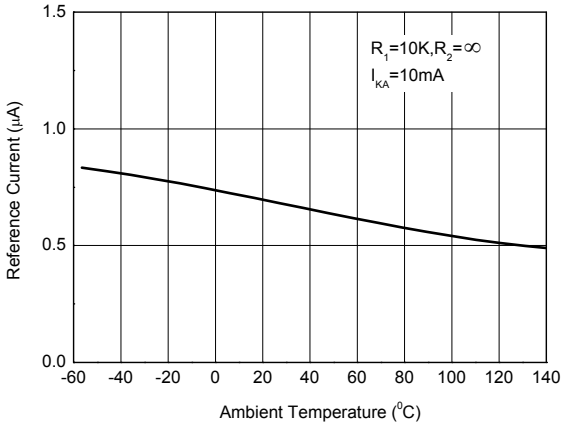


Figure 8. Reference Current vs. Ambient Temperature

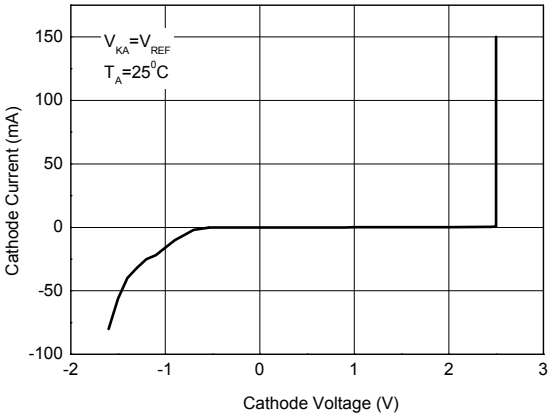


Figure 9. Cathode Current vs. Cathode Voltage

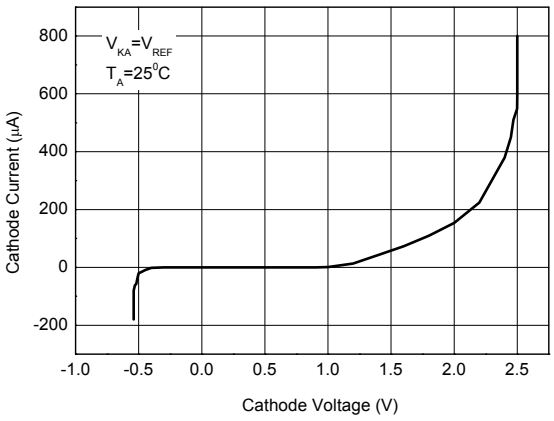


Figure 10. Cathode Current vs. Cathode Voltage

Typical Performance Characteristics (Continued)

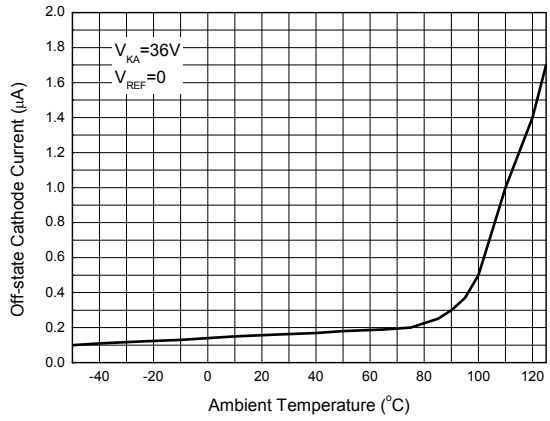


Figure 11. Off-state Cathode Current vs. Ambient Temperature

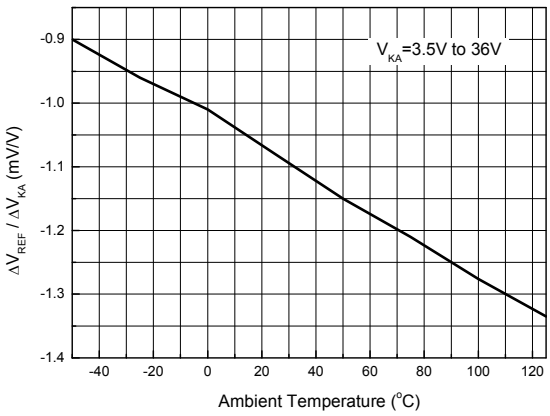
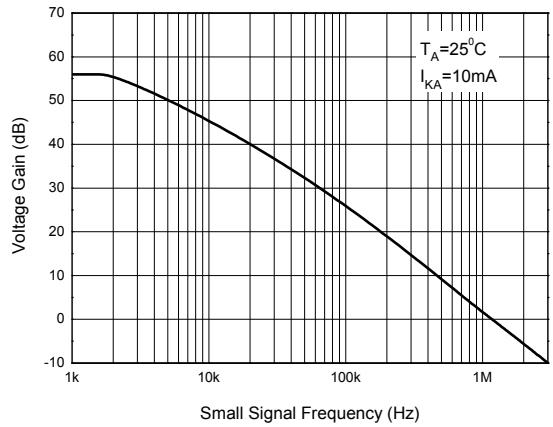


Figure 12. Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



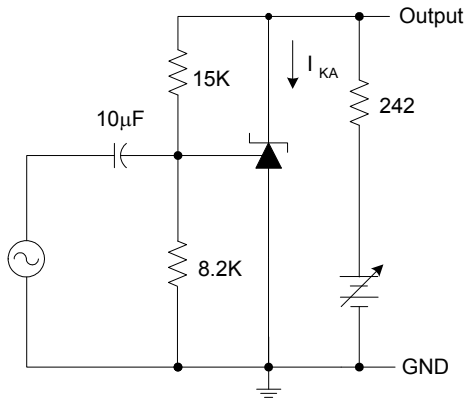


Figure 13. Small Signal Voltage Gain vs. Frequency

Typical Performance Characteristics (Continued)

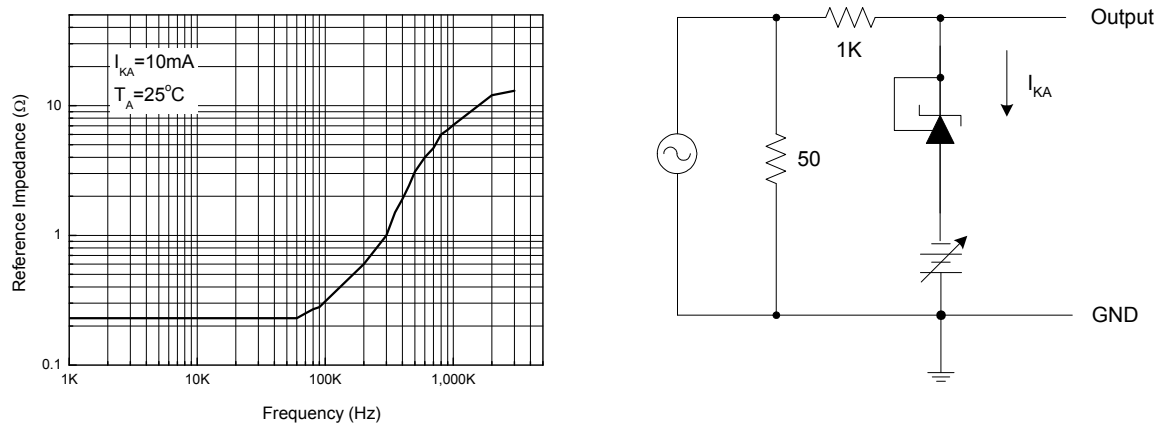


Figure 14. Reference Impedance vs. Frequency

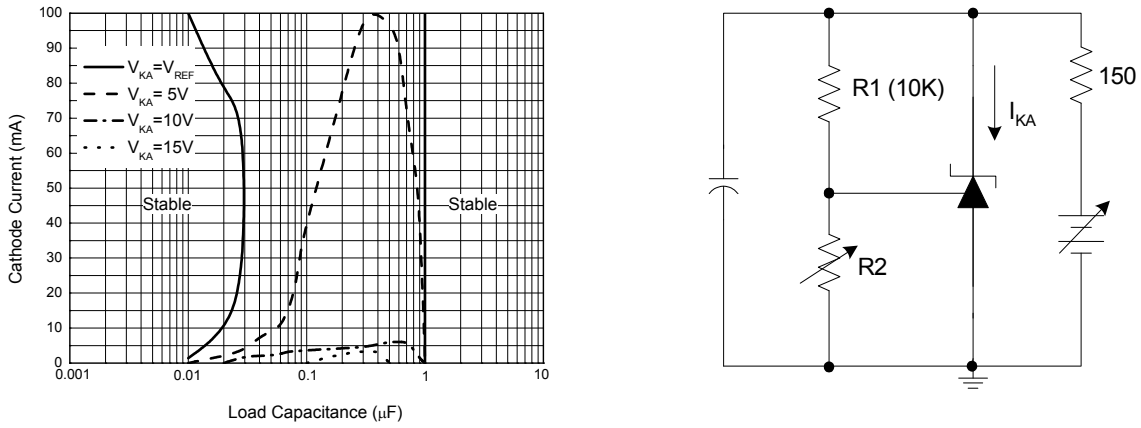


Figure 15. Stability Boundary Conditions vs. Load Capacitance

Typical Performance Characteristics (Continued)

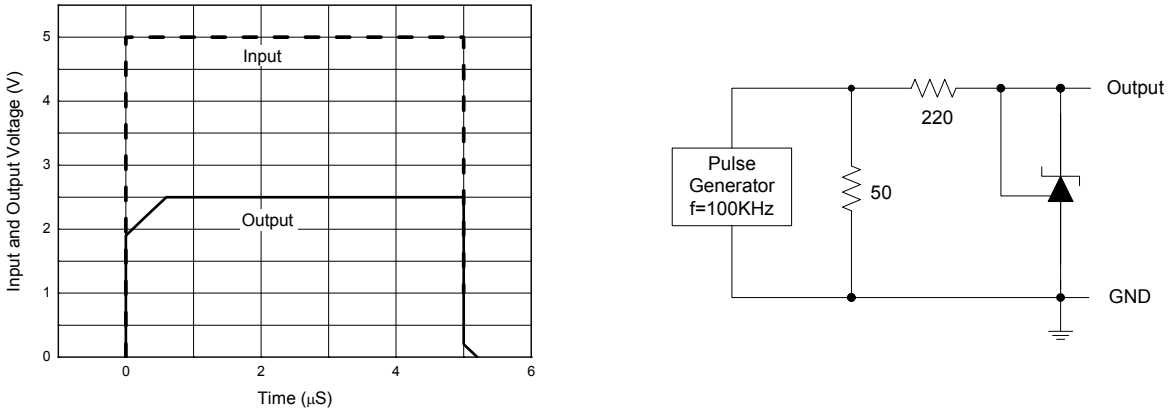


Figure 16. Pulse Response of Input and Output Voltage

Typical Application

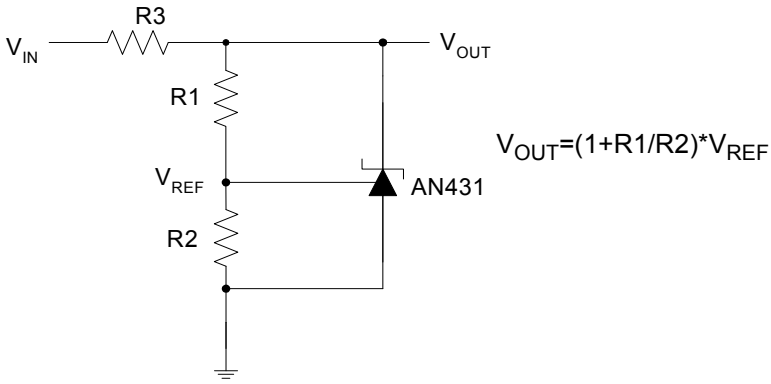


Figure 17. Shunt Regulator

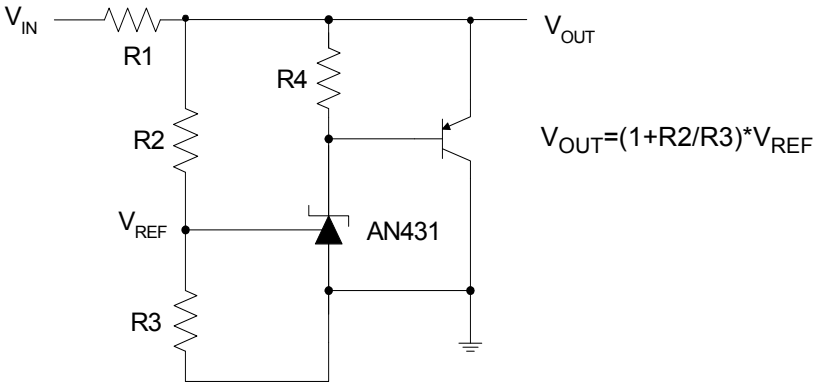


Figure 18. High Current Shunt Regulator

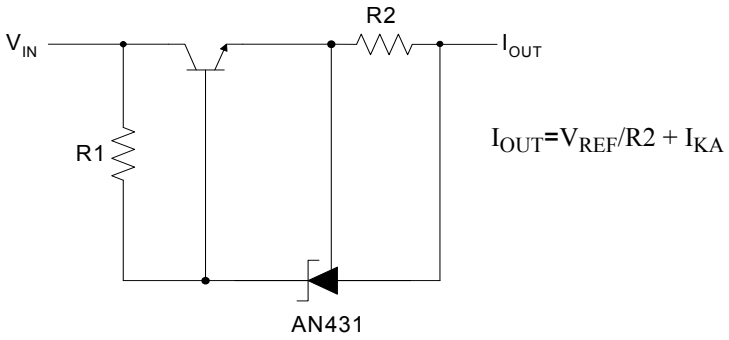


Figure 19. Current Source or Current Limit

Typical Application (Continued)

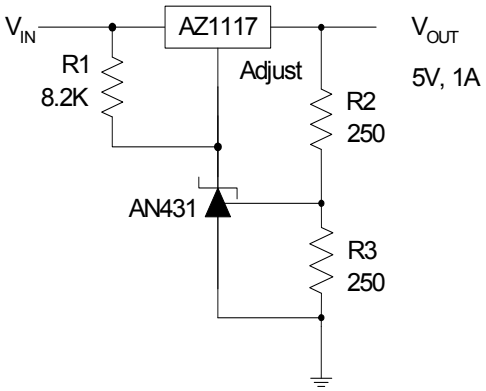


Figure 20. Precision 5V 1A Regulator

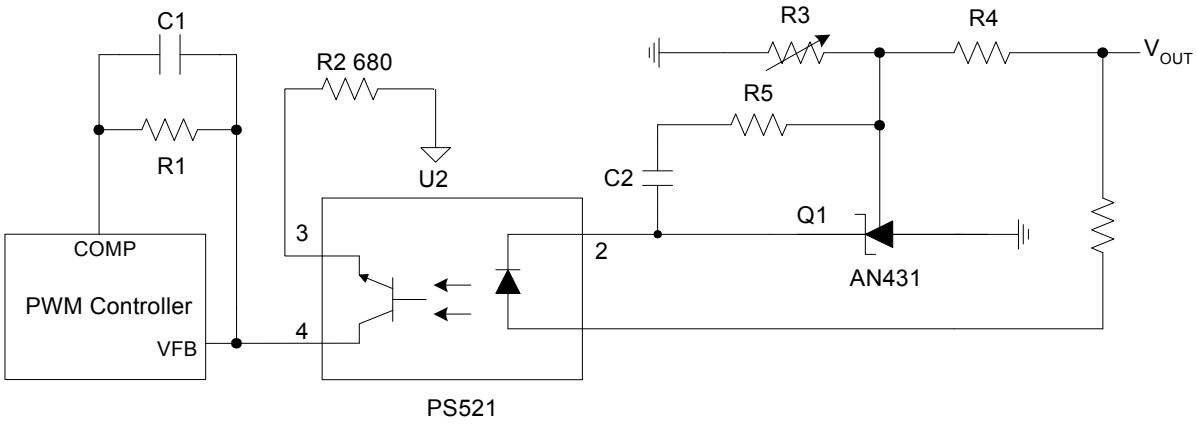
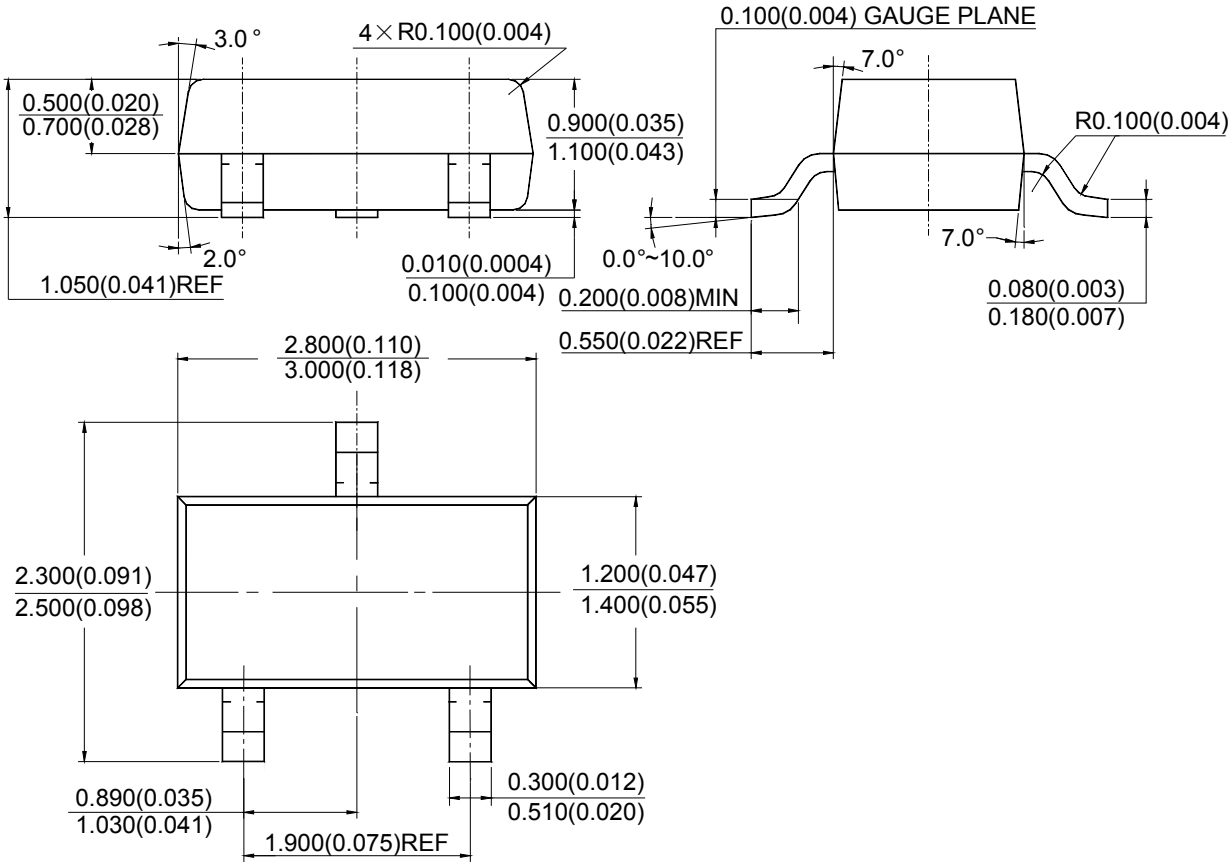


Figure 21. PWM Converter with Reference

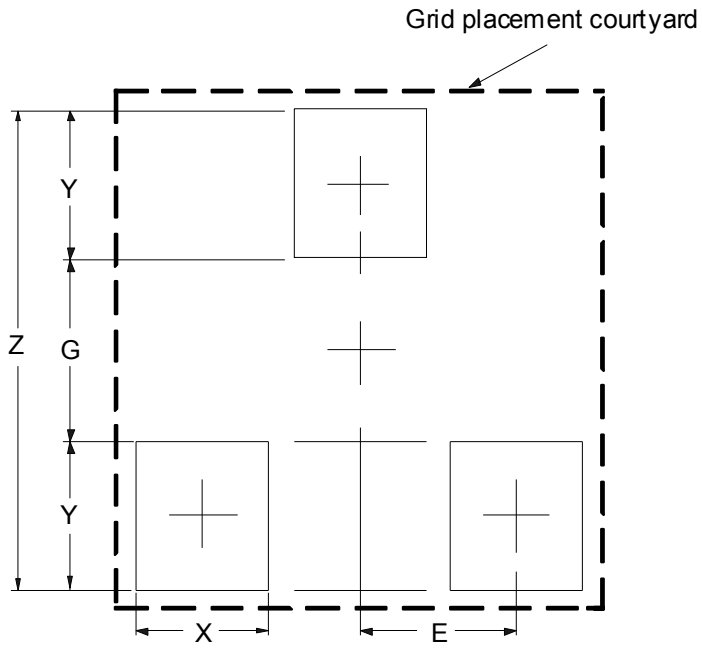
Mechanical Dimensions

SOT-23 **Unit: mm(inch)**



Mounting Pad Layout

SOT-23



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	2.900/0.114	1.100/0.043	0.800/0.031	0.900/0.035	0.950/0.037



BCD Semiconductor Manufacturing Limited

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