

## ■ General Description

The AME431B series ICs are 3-terminal adjustable shunt regulator with guaranteed temperature 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 reference is set to 1.24V for AME431Bxxxxx12 and 2.5V for AME431Bxxxxx25. The output voltage can be set to 1.24V to 16V for  $V_{REF}=1.24V$  part type and 2.5 to 36V for  $V_{REF}=2.5V$  part type with two external resistors.

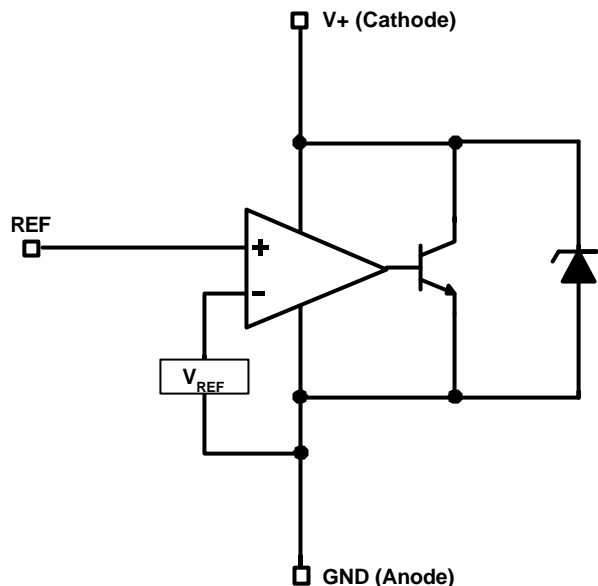
The AME431B precision reference is offered in two reference tolerance: 0.5% and 1.0%

The 5 main packages have low thermal impedance which allows operation over a wide range of  $-40^{\circ}C$  to  $+125^{\circ}C$ .

## ■ Features

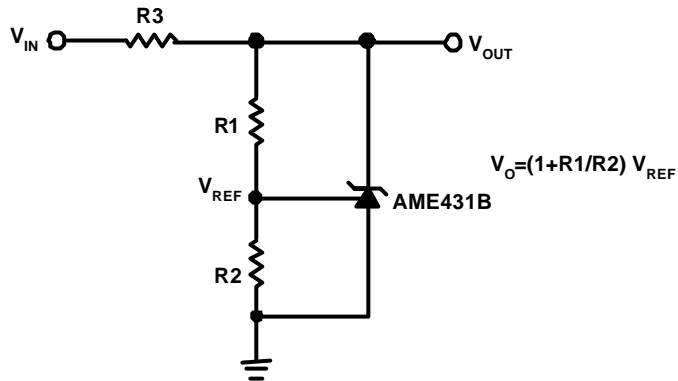
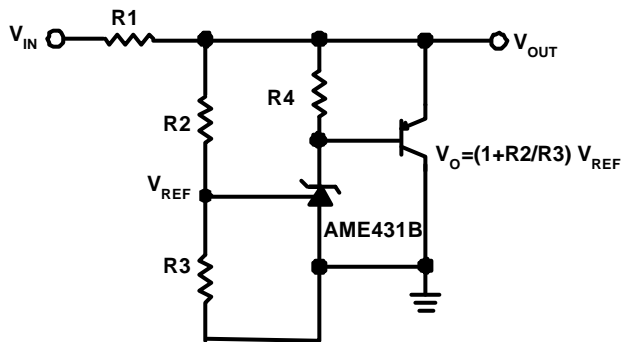
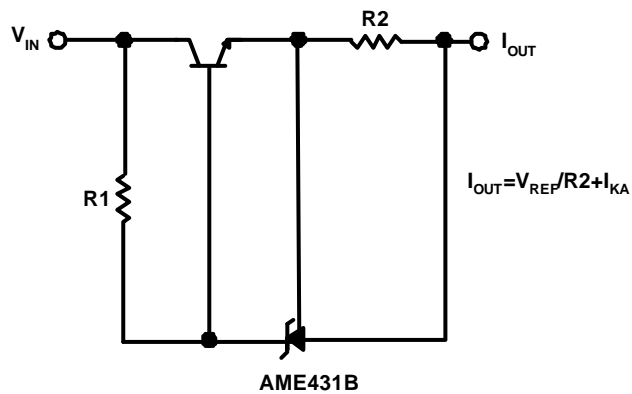
- Very accurate reference voltage : 0.15% typical
- High stability under capacitive load
- Low temperature deviation: 4.5mV typical
- Low equivalent full-range temperature coefficient with 20PPM/ $^{\circ}C$  typical
- Low dynamic output resistance:  $0.2\Omega$  typical
- Sink current capacity from 1mA to 100mA
- Low output noise
- Available in 5 packages: TO-92, SOT-23-3, SOT-89, SO-8 and SOT-25

## ■ Functional Block Diagram



## ■ Applications

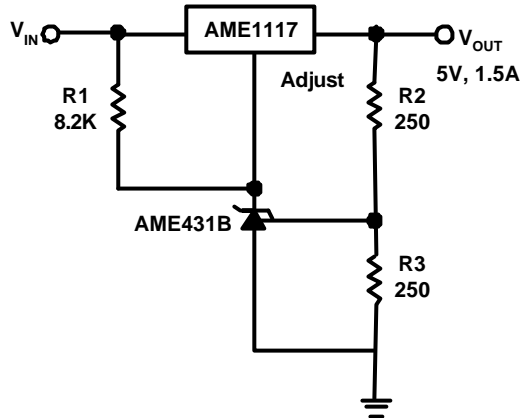
- Adjustable power supplies
- Linear regulators
- Battery operated computer
- Portable electronics
- Instrumentation
- Switching power supply
- Mother board
- LCD monitor
- Note book computer

**■ Typical Applications**
**Shunt Regulator**

**High Current Shunt Regulator**

**Current Source or Current Limit**


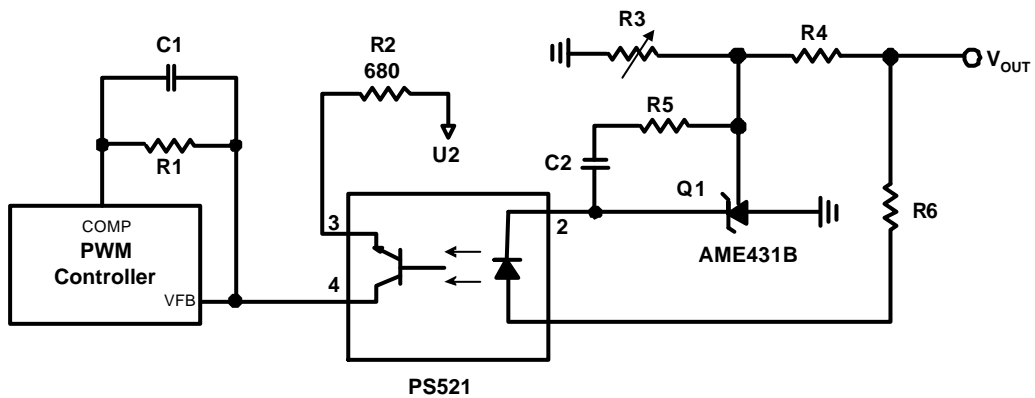


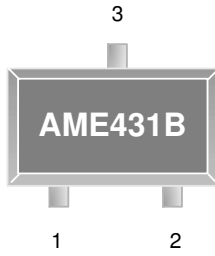
■ Typical Applications (contd.)

Precision 5V 1.5A Regulator

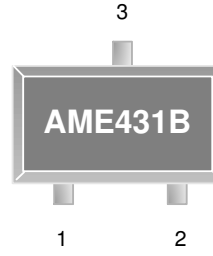


Precision 5V 1.5A Regulator

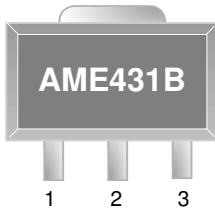


**■ Pin Configuration**
**SOT-23  
Top View**

**AME431BAJETXXXX**

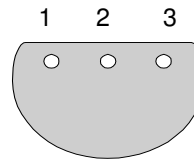
1. Cathode
2. REF
3. Anode

**SOT-23  
Top View**

**AME431BBJETXXXX**

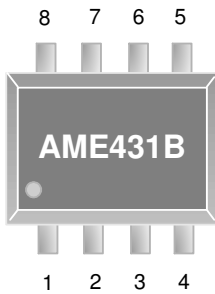
1. REF
2. Cathode
3. Anode

**SOT-89  
Front View**

**AME431BAJFTXXXX**

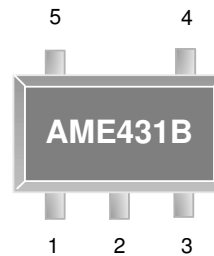
1. REF
2. Anode
3. Cathode

**TO-92-3  
Bottom View**

**AME431BAJATXXXX**

1. REF
2. Anode
3. Cathode

**SO-8  
Top View**

**AME431BAJHAXXXX**

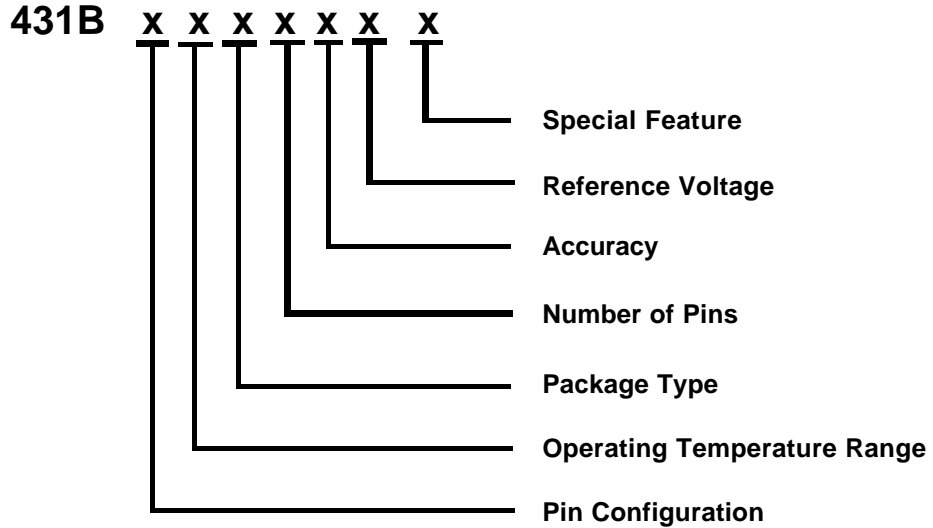
1. Cathode
2. Anode
3. Anode
4. NC
5. NC
6. Anode
7. Anode
8. REF

**SOT-25  
Top View**

**AME431BAJEVXXXX**

1. NC
2. NC
3. Cathode
4. REF
5. Anode



■ Ordering Information



Pin Configuration	Operating Temperature Range	Package Type	Number of Pins	Accuracy	Reference Voltage	Special Feature
A (SOT-23) 1. Cathode 2. REF 3. Anode	J: -40°C to 125°C	A: TO-92 E: SOT-2X F: SOT-89 H: SO-8	A: 8 T: 3 V: 5	A: 0.5% B: 1.0%	12: 1.24V 25: 2.5V	L: Low profile Y: Lead free & Low profile Z: Lead free
B (SOT-23) 1. REF 2. Cathode 3. Anode						
A (SOT-89) 1. REF 2. Anode 3. Cathode						
A (TO-92-3) 1. REF 2. Anode 3. Cathode						
A (SO-8) 1. Cathode 2. Anode 3. Anode 4. NC 5. NC 6. Anode 7. Anode 8. REF						
A (SOT-25) 1. NC 2. NC 3. Cathode 4. REF 5. Anode						



**■ Ordering Information (contd.)**

<b>Part Number</b>	<b>Marking*</b>	<b>Reference Voltage</b>	<b>Accuracy</b>	<b>Package</b>	<b>Temp. Range</b>
AME431BAJETA12	AZNww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BAJETA12L	AZNww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BAJETA12Y	AZNww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BAJETA12Z	AZNww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BAJETB12	AZOww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BAJETB12L	AZOww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BAJETB12Y	AZOww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BAJETB12Z	AZOww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BBJETA12	AZPww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BBJETA12L	AZPww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BBJETA12Y	AZPww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BBJETA12Z	AZPww	1.24V	0.5%	SOT-23	- 40°C to + 125°C
AME431BBJETB12	AZQww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BBJETB12L	AZQww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BBJETB12Y	AZQww	1.24V	1.0%	SOT-23	- 40°C to + 125°C
AME431BBJETB12Z	AZQww	1.24V	1.0%	SOT-23	- 40°C to + 125°C

**\* Package Options**

<b>Part Number</b>	<b>Package</b>	<b>Lead Pitch</b>
AME431BXEAX	TO-92 Taping	5.04mm
AME431BXEAX-1	TO-92 Bulk	2.54mm

Note: yyww & ww represents the date code

\* A line on top of the first letter represents lead free plating such as  $\bar{A}$ ZN

Please consult AME sales office or authorized Rep./Distributor for output voltage and package type availability.

**■ Ordering Information (contd.)**

Part Number	Marking*	Reference Voltage	Accuracy	Package	Temp. Range
AME431BAJATA12	AME12 431B AJATA yyww	1.24V	0.5%	TO92-3	- 40°C to + 125°C
AME431BAJATA12Z	AME12 431B AJATA yyww	1.24V	0.5%	TO92-3	- 40°C to + 125°C
AME431BAJATB12	AME12 431B AJATB yyww	1.24V	1.0%	TO92-3	- 40°C to + 125°C
AME431BAJATB12Z	AME12 431B AJATB yyww	1.24V	1.0%	TO92-3	- 40°C to + 125°C
AME431BAJETA25	BAFww	2.5V	0.5%	SOT-23	- 40°C to + 125°C
AME431BAJETA25L	BAFww	2.5V	0.5%	TSOT-23	- 40°C to + 125°C
AME431BAJETA25Z	BAFww	2.5V	0.5%	SOT-23	- 40°C to + 125°C
AME431BAJETA25Y	BAFww	2.5V	0.5%	TSOT-23	- 40°C to + 125°C
AME431BBJETA25	BAGww	2.5V	0.5%	SOT-23	- 40°C to + 125°C
AME431BBJETA25L	BAGww	2.5V	0.5%	TSOT-23	- 40°C to + 125°C
AME431BBJETA25Z	BAGww	2.5V	0.5%	SOT-23	- 40°C to + 125°C
AME431BBJETA25Y	BAGww	2.5V	0.5%	TSOT-23	- 40°C to + 125°C
AME431BAJETB25	AZAww	2.5V	1.0%	SOT-23	- 40°C to + 125°C
AME431BAJETB25L	AZAww	2.5V	1.0%	TSOT-23	- 40°C to + 125°C
AME431BAJETB25Z	AZAww	2.5V	1.0%	SOT-23	- 40°C to + 125°C
AME431BAJETB25Y	AZAww	2.5V	1.0%	TSOT-23	- 40°C to + 125°C
AME431BBJETB25	AZBww	2.5V	1.0%	SOT-23	- 40°C to +125°C
AME431BBJETB25L	AZBww	2.5V	1.0%	TSOT-23	- 40°C to +125°C
AME431BBJETB25Z	AZBww	2.5V	1.0%	SOT-23	- 40°C to +125°C
AME431BBJETB25Y	AZBww	2.5V	1.0%	TSOT-23	- 40°C to +125°C

**■ Ordering Information (contd.)**

Part Number	Marking*	Reference Voltage	Accuracy	Package	Temp. Range
AME431BAJATB25	AME25 431B AJATB yyww	2.5V	1.0%	TO92-3	- 40°C to +125°C
AME431BAJATB25Z	AME25 431B AJATB yyww	2.5V	1.0%	TO92-3	- 40°C to +125°C
AME431BAJATA25	AME25 431B AJATA yyww	2.5V	0.5%	TO92-3	- 40°C to +125°C
AME431BAJATA25Z	AME25 431B AJATA yyww	2.5V	0.5%	TO92-3	- 40°C to +125°C
AME431BAJEVA12	BAWww	1.24V	0.5%	SOT-25	- 40°C to +125°C
AME431BAJEVA12L	BAWww	1.24V	0.5%	TSOT-25	- 40°C to +125°C
AME431BAJEVA12Z	BAWww	1.24V	0.5%	SOT-25	- 40°C to +125°C
AME431BAJEVA12Y	BAWww	1.24V	0.5%	TSOT-25	- 40°C to +125°C
AME431BAJEVB12	BAVww	1.24V	1.0%	SOT-25	- 40°C to +125°C
AME431BAJEVB12L	BAVww	1.24V	1.0%	TSOT-25	- 40°C to +125°C
AME431BAJEVB12Z	BAVww	1.24V	1.0%	SOT-25	- 40°C to +125°C
AME431BAJEVB12Y	BAVww	1.24V	1.0%	TSOT-25	- 40°C to +125°C



**■ Absolute Maximum Ratings**

Parameter	Maximum		Unit
Cathode Current	AME431Bxxxxx12	100	mA
	AME431Bxxxxx25	150	
Cathode Voltage	AME431Bxxxxx12	18	V
	AME431Bxxxxx25	40	

Caution: Stress above the listed absolute maximum rating may cause permanent damage to the device

**■ Recommended Operating Conditions**

Parameter	Rating		Unit
Supply Current	1 ~ 100		mA
Operation Voltage Range	AME431Bxxxxx12	1.24 to 16	V
	AME431Bxxxxx25	2.50 to 36	
Ambient Temperature Range	-40 to +125		°C
Junction Temperature	-40 to +125		°C

**■ Thermal Information**

Parameter	Maximum	Unit
Thermal Resistance	SOT-23	325
	SOT-25	325
	SOT-89	180
	TO-92	180
	SO-8	124
Maximum Junction Temperature	150	°C
Maximum Lead Temperature (10 Sec)	300	°C

**■ Electrical Specifications (AME431Bxxxxx25)**
 $T_A = 25^\circ\text{C}$ ,  $I_{REF} = 10\text{mA}$  unless otherwise specified

Parameter	Test Circuit	Symbol	Test Condition	Min	Typ	Max	Units	
Reference Voltage	0.5%	1	$V_{KA} = V_{REF}$ , $I_{KA} = 10\text{mA}$	2.4875	2.500	2.5125	V	
	1.0%			2.475	2.500	2.525		
Deviation of Reference Voltage Over Temperature	1	$\Delta V_{REF}$	$V_{KA} = V_{REF}$ $I_{KA} = 10\text{mA}$	$0^\circ\text{C} \sim +70^\circ\text{C}$	-	4.5	8	mV
				$-40^\circ\text{C} \sim +125^\circ\text{C}$	-	4.5	10	
Ratio of Change in Reference Voltage to the Change in Cathode Voltage	2	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_{KA} = 10\text{mA}$	$\Delta V_{KA} = 10\text{V to } V_{REF}$	-	-1.0	-2.7	mV/V
				$\Delta V_{KA} = 36\text{V to } 10\text{V}$	-	-0.5	-2.0	
Reference Current	2	$I_{REF}$	$I_{KA} = 10\text{mA}$ $R1 = 10\text{K}\Omega$ , $R2 = \infty$	-	0.7	4.0	$\mu\text{A}$	
Deviation of Reference Current Over Full Temperature Range	2	$\Delta I_{REF}$	$R1 = 10\text{K}\Omega$ , $R2 = \infty$ $I_{KA} = 10\text{mA}$ $T_A = -40^\circ\text{C} \sim +125^\circ\text{C}$	-	0.4	1.2	$\mu\text{A}$	
Minimum Cathode Current for Regulation	1	$I_{KA}$ (MIN)	$V_{KA} = V_{REF}$	-	0.4	1.0	mA	
Off-State Cathode Current	3	$I_{KA}$ (OFF)	$V_{KA} = 36\text{V}$ , $V_{REF} = 0\text{V}$	-	0.05	1.0	$\mu\text{A}$	
Dynamic Impedance	1	$Z_{KA}$	$V_{KA} = V_{REF}$ , $I_{KA} = 1 \text{ to } 100\text{mA}$ $F \leq 1\text{KHz}$	-	0.15	0.5	$\Omega$	

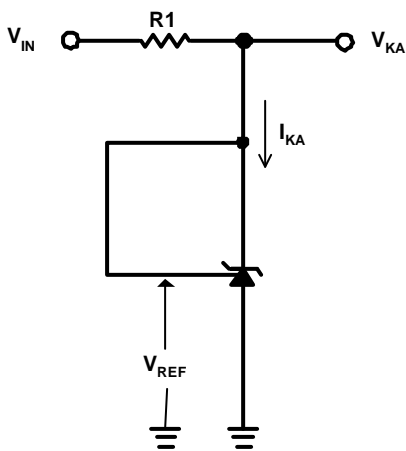


Figure1.  
Test Circuit4 for  $V_{KA} = V_{REF}$

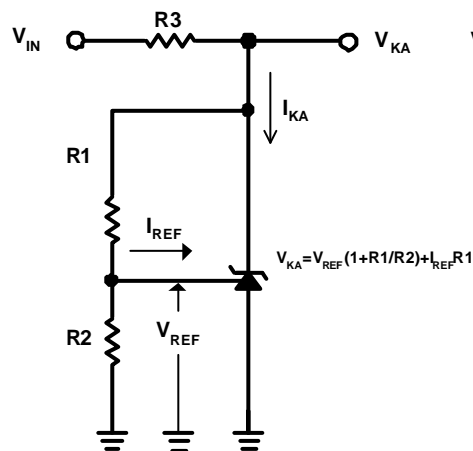


Figure2.  
Test Circuit for  $V_{KA} > V_{REF}$

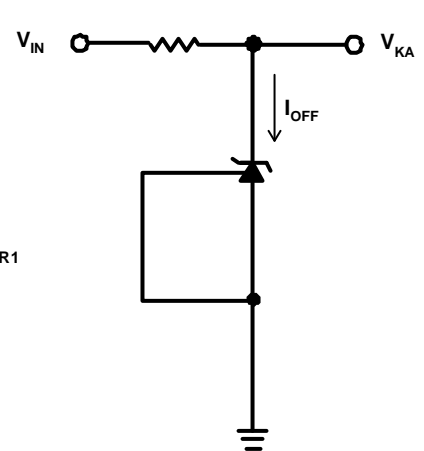


Figure3.  
Test Circuit for  $I_{OFF}$

**■ Electrical Specifications (AME431Bxxxxx12)**

 TA = 25°C, I<sub>REF</sub>=10mA unless otherwise specified

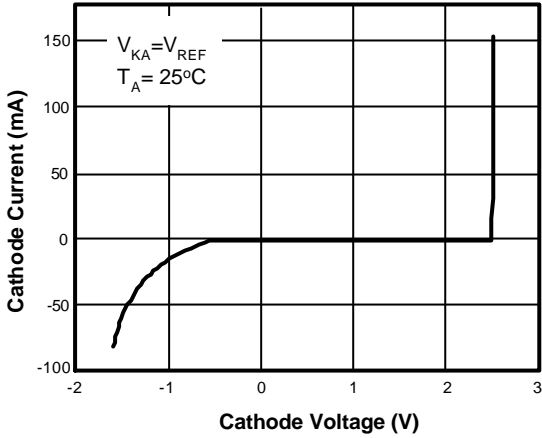
Parameter	Test Circuit	Symbol	Test Condition	Min	Typ	Max	Units	
Reference Voltage	0.5%	1	V <sub>REF</sub>	V <sub>KA</sub> - V <sub>REF</sub> , I <sub>KA</sub> =10mA	1.234	1.240	1.246	V
	1.0%				1.228	1.240	1.252	
Deviation of Reference Voltage Over Temperature	1	ΔV <sub>REF</sub>	V <sub>KA</sub> = V <sub>REF</sub> I <sub>KA</sub> =10mA	0°C ~ +70°C	-	2	10	mV
				-40°C ~ +85°C	-	3	10	
Ratio of Change in Reference Voltage to the Change in Cathode Voltage	2	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I <sub>KA</sub> =10mA	ΔV <sub>KA</sub> = 5V to V <sub>REF</sub>	-	-0.5	-1.5	mV/V
				ΔV <sub>KA</sub> = 16V to 5V	-	-0.5	-1.5	
Reference Input Current	2	I <sub>REF</sub>	I <sub>KA</sub> =10mA R1=10KΩ, R2=∞	-	0.15	0.4	μA	
Deviation of Reference Current Over Full Temperature Range	2	ΔI <sub>REF</sub>	R1=10KΩ, R2=∞ I <sub>KA</sub> =10mA T <sub>A</sub> = -40°C ~ +85°C	-	0.1	0.4	μA	
Minimum Cathode Current for Regulation	1	I <sub>KA</sub> (MIN)	V <sub>KA</sub> =V <sub>REF</sub>	-	55	80	μA	
Off-State Cathode Current	3	I <sub>KA</sub> (OFF)	V <sub>KA</sub> =18V, V <sub>REF</sub> =0V	-	0.04	0.1	μA	
Dynamic Impedance	1	Z <sub>KA</sub>	V <sub>KA</sub> = V <sub>REF</sub> , I <sub>KA</sub> =1 to 100mA F≤1KHz	-	0.05	0.15	Ω	



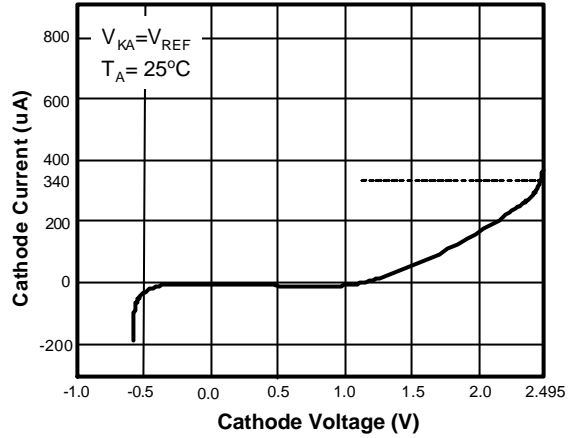
AME431B

Adjustable Precision Shunt Regulator

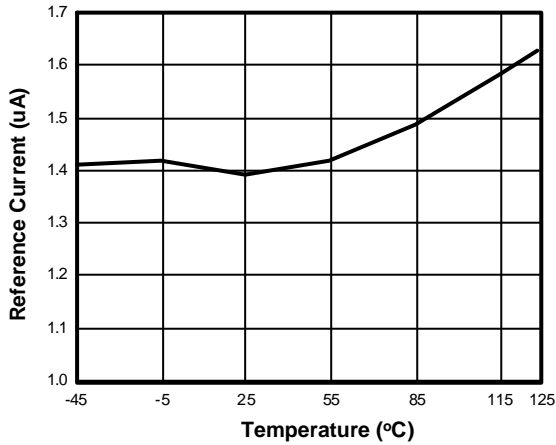
Cathode Current vs. Cathode Voltage



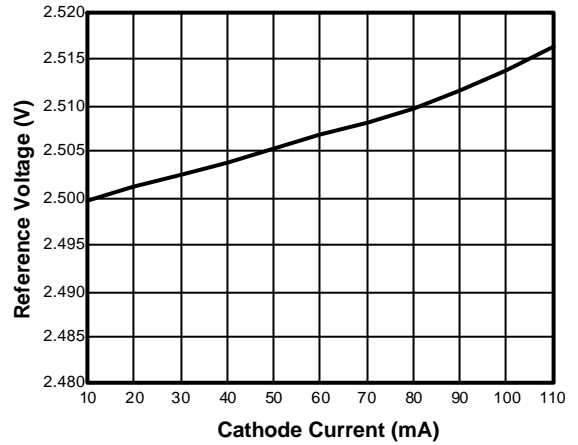
Current vs. Cathode Voltage



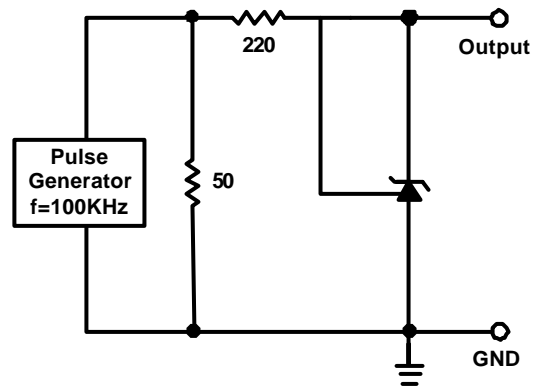
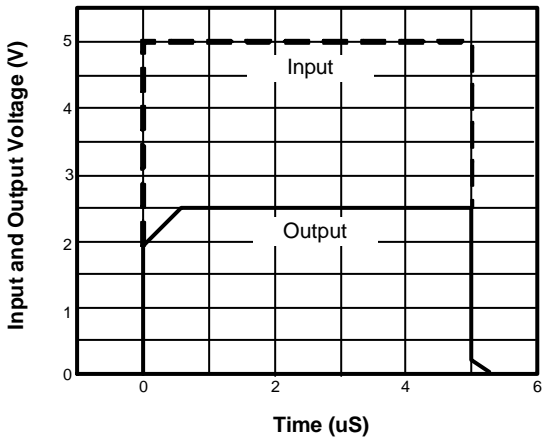
Reference Current vs. Temperature



Reference Voltage vs. Cathode Current



Small Signal Voltage Gain vs. Frequency

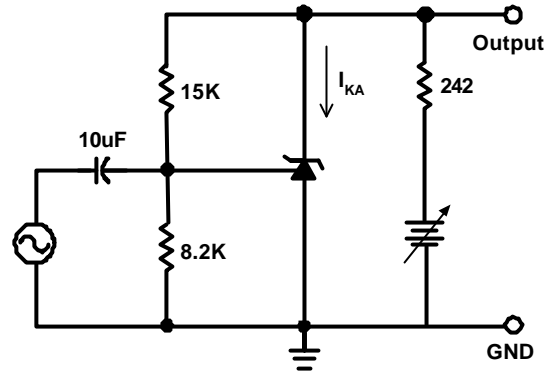
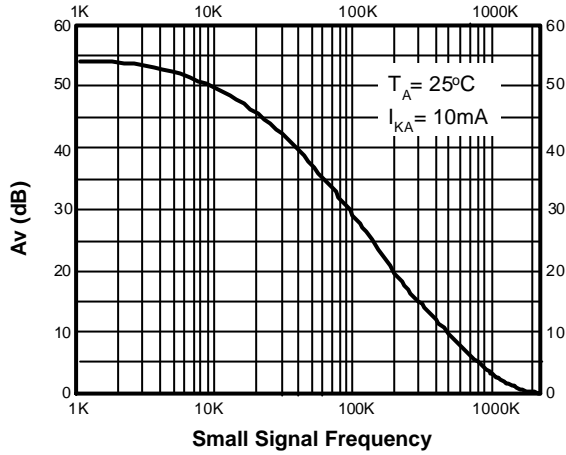




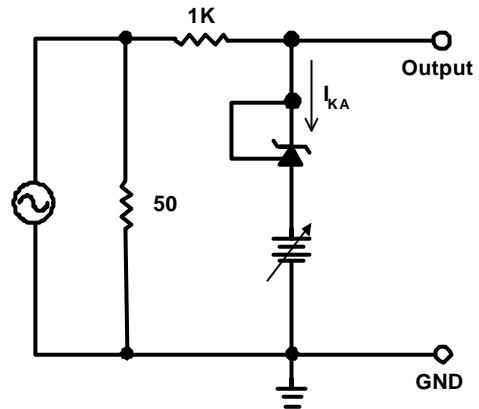
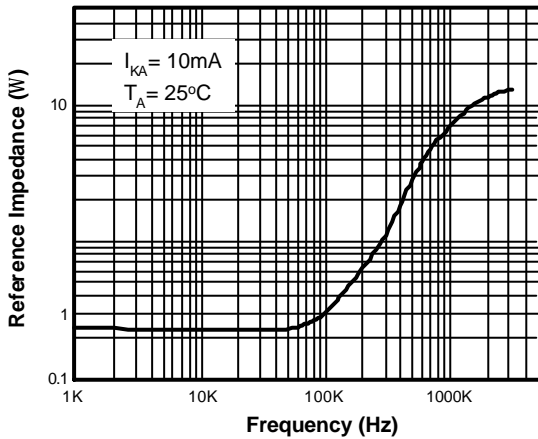
AME431B

Adjustable Precision Shunt Regulator

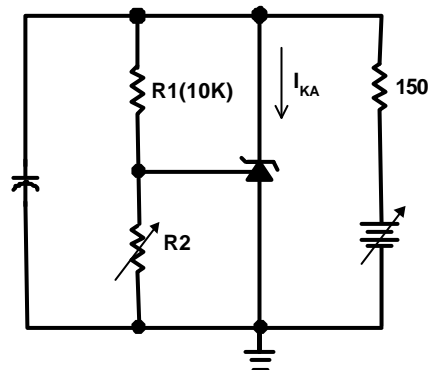
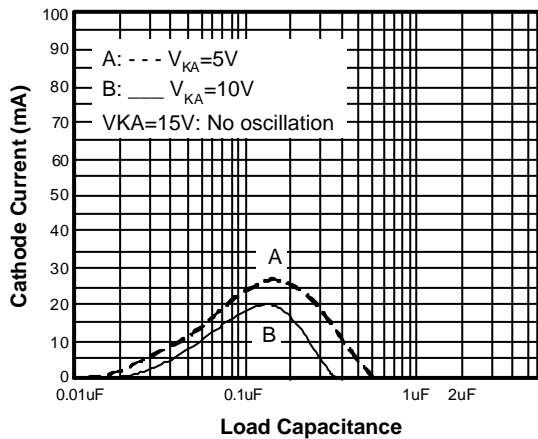
Small Signal Voltage Gain vs. Frequency



Reference Impedance vs. Frequency



Stability Boundary Conditions vs. Load Capacitance

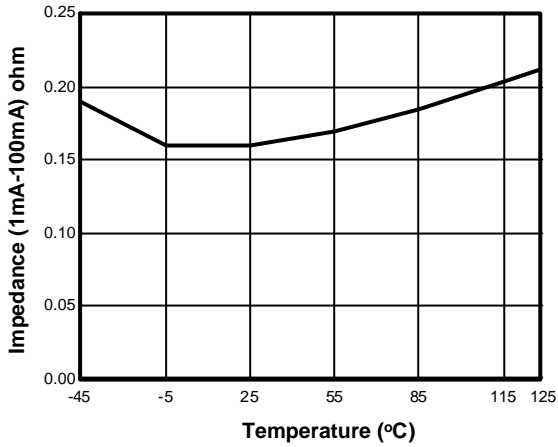




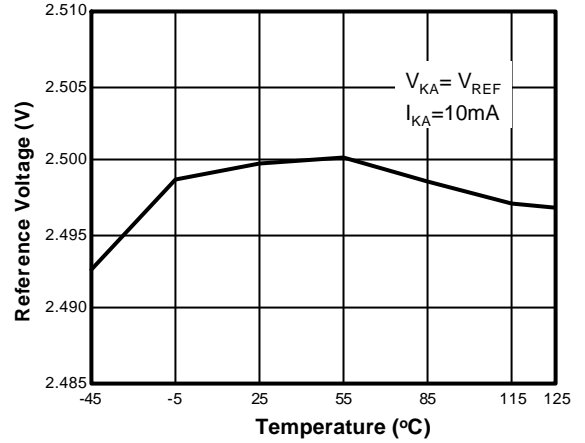
AME431B

Adjustable Precision Shunt Regulator

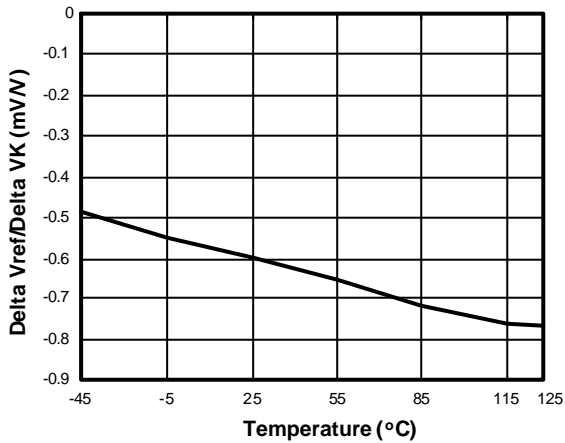
Impedance vs. Temperature



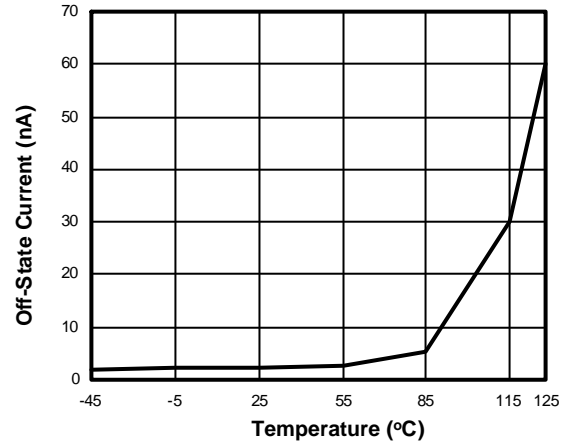
Reference Voltage vs. Temperature



Delta Reference Voltage vs. Temperature



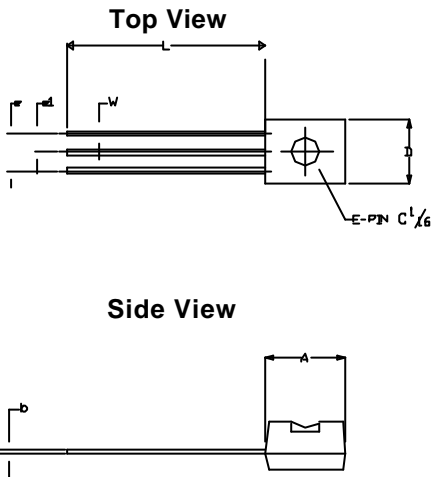
Off-State Current vs. Temperature





■ Package Dimension

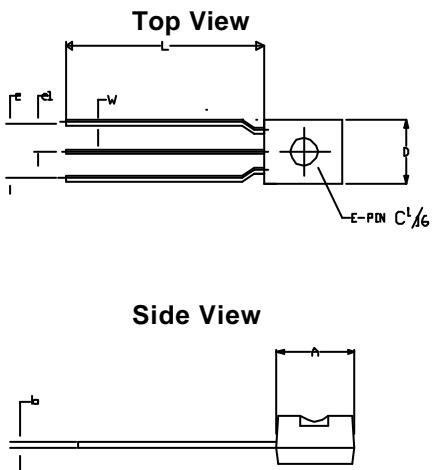
TO-92-3 (bulk pack)



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
<b>A</b>	4.32	4.95	0.1701	0.1949
<b>b</b>	0.36	0.51	0.0142	0.0201
<b>E</b>	3.30	3.94	0.1299	0.1551
<b>e</b>	2.41	2.67	0.0949	0.1051
<b>e1</b>	1.14	1.40	0.0449	0.0551
<b>L</b>	12.70	15.49	0.5000	0.6098
<b>R</b>	2.16	2.41	0.0850	0.0949
<b>W</b>	0.41	0.56	0.0161	0.0220
<b>D</b>	4.45	4.95	0.1752	0.1949

- Notes:
1. Package outline exclusive of any mold flashes dimension.
  2. Package outline exclusive of burr dimension.
  3. Lead pitch=2.54mm is bulk pack.
  4. Lead pitch=5.08mm is tape pack.

TO-92-3 (tape pack)



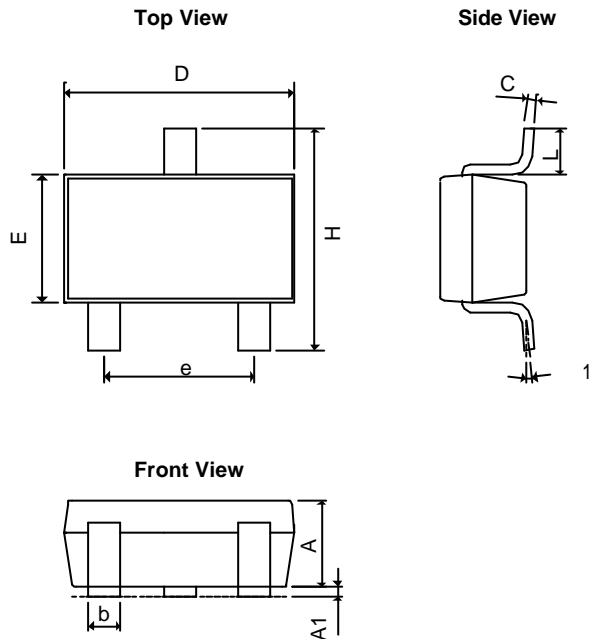
SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
<b>A</b>	4.32	4.95	0.1701	0.1949
<b>b</b>	0.36	0.51	0.0142	0.0201
<b>E</b>	3.30	3.94	0.1299	0.1551
<b>e</b>	4.98	5.08	0.1961	0.2000
<b>e1</b>	2.49	2.54	0.0980	0.1000
<b>L</b>	12.70	15.49	0.5000	0.6098
<b>R</b>	2.16	2.41	0.0850	0.0949
<b>W</b>	0.41	0.56	0.0161	0.0220
<b>D</b>	4.45	4.95	0.1752	0.1949

- Notes:
1. Package outline exclusive of any mold flashes.
  2. Package outline exclusive of burr dimension.
  3. Lead pitch=2.54mm is bulk pack.
  4. Lead pitch=5.08mm is tape pack.



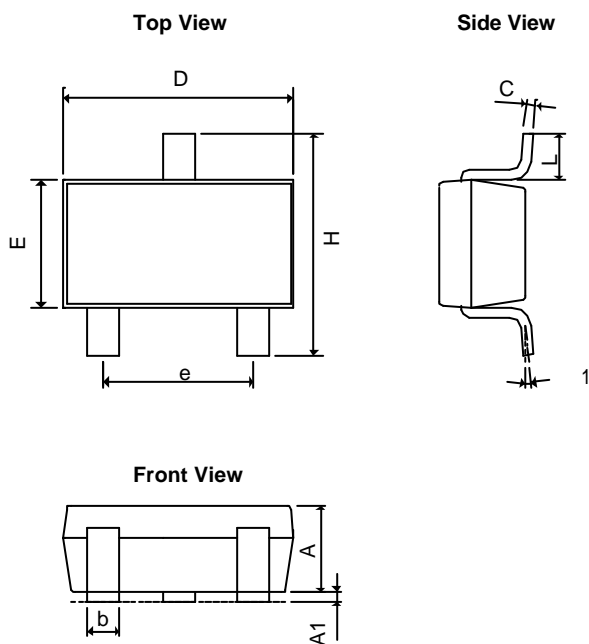
■ Package Dimension

SOT-23



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.00	1.40	0.0394	0.0551
A <sub>1</sub>	0.00	0.15	0.0000	0.0059
b	0.35	0.50	0.0138	0.0197
C	0.09	0.25	0.0035	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.0748 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
?1	0°	10°	0°	10°

TSOT-23



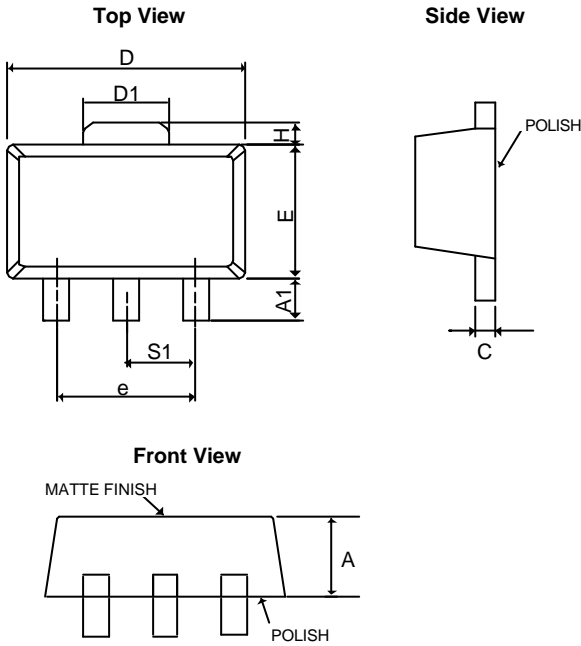
SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A+A <sub>1</sub>	0.80	1.30	0.0315	0.0512
b	0.35	0.50	0.0138	0.0197
C	0.08	0.25	0.0031	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.20	1.80	0.0472	0.0709
e	1.90 BSC		0.0748 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
q1	0°	10°	0°	10°





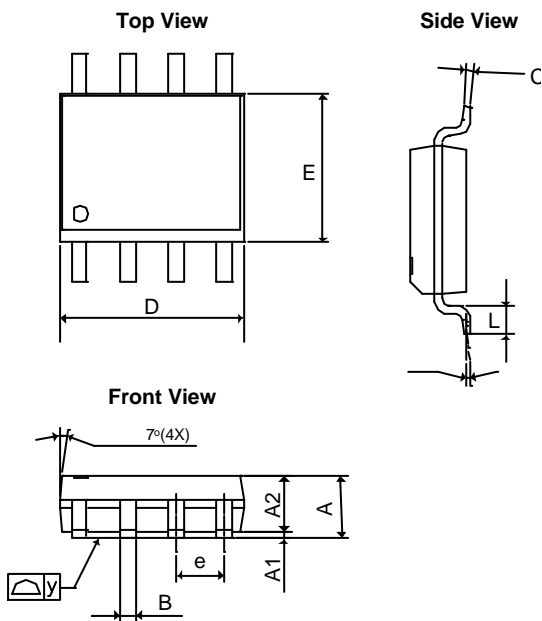
■ Package Dimension

SOT-89



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.39	1.60	0.05472	0.06299
A <sub>1</sub>	0.8REF		0.0315REF	
C	0.35	0.44	0.01378	0.01732
D	4.39	4.60	0.17283	0.1811
D <sub>1</sub>	1.35	1.83	0.05315	0.07205
E	2.28	3.60	0.08976	0.14173
e	3.00REF		0.1181REF	
H	0.70REF		0.0276REF	
S1	1.50REF		0.0590REF	

SO-8



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.58	7.49	0.2197	0.2949
C	3.55	4.83	0.1398	0.1900
D	0.50	1.40	0.0197	0.0550
E	0.30	1.15	0.0118	0.0453
G	9.65	10.67	0.3799	0.4200
I	3.53	4.09	0.1390	0.1610
K	0.50	1.15	0.0197	0.0453
M	1.14	1.78	0.0449	0.0700
N	2.28	2.80	0.0898	0.1102
O	12.70	14.74	0.5000	0.5803
P	14.22	16.51	0.5600	0.6500

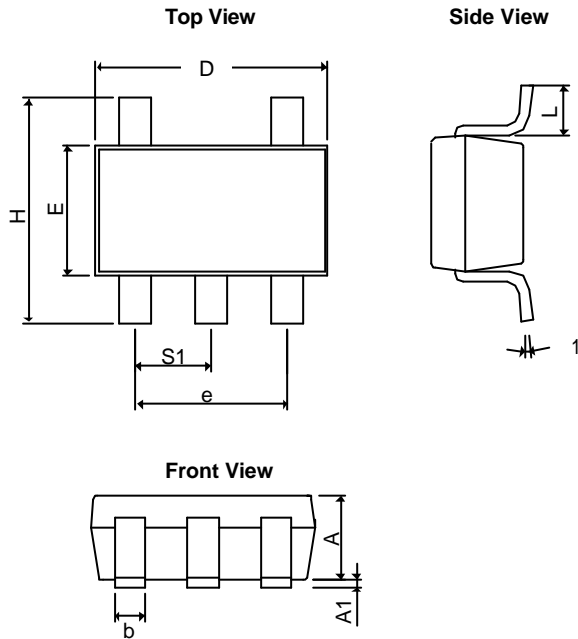


AME431B

Adjustable Precision Shunt Regulator

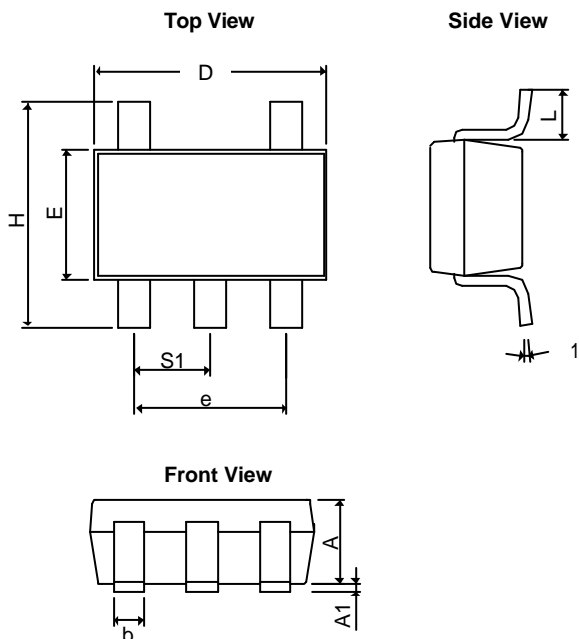
■ Package Dimension

SOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.20REF		0.0472REF	
A <sub>1</sub>	0.00	0.15	0.0000	0.0059
b	0.30	0.55	0.0118	0.0217
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.60	3.00	0.10236	0.11811
L	0.37BSC		0.0146BSC	
q1	0°	10°	0°	10°
S <sub>1</sub>	0.95BSC		0.0374BSC	

TSOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A+A <sub>1</sub>	0.90	1.25	0.0354	0.0492
b	0.30	0.50	0.0118	0.0197
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
q1	0°	10°	0°	10°
S <sub>1</sub>	0.95BSC		0.0374BSC	



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