

## Adjustable Precision Shunt Regulator

### General Description

The ME431 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.

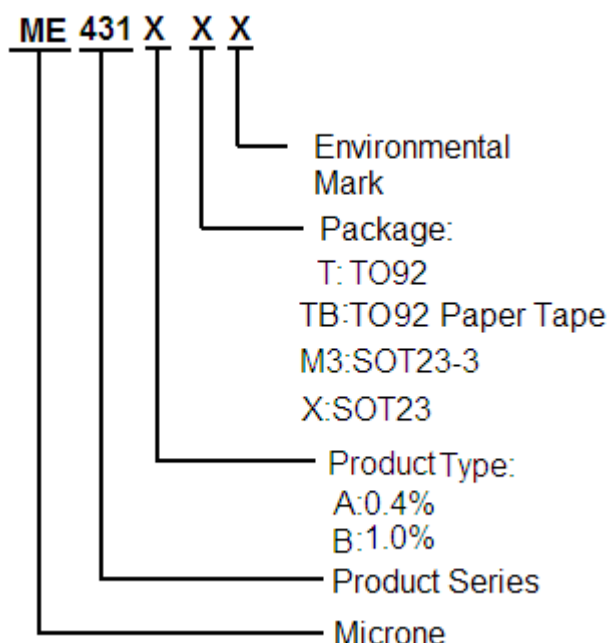
The ME431 voltage type is 40V. The output voltage can be set to any value between  $V_{REF}$  (2.5V) and the corresponding maximum cathode voltage.

The ME431 precision reference is offered in two band gap tolerance: 0.4% and 1.0%.

### Features

- Programmable Precise Output Voltage from 2.5V to 36V
- Very Accurate Reference Voltage: Typical 0.15%
- High Stability under Capacitive Load
- Low Temperature Deviation: Typical 4.5mV
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Low Dynamic Output Resistance: Typical 0.2Ω
- Sink Current Capacity from 1mA to 100 mA
- Low Output Noise
- Wide Operating Range of -40 to 150°C
- TO-92, SOT23-3, SOT23 package

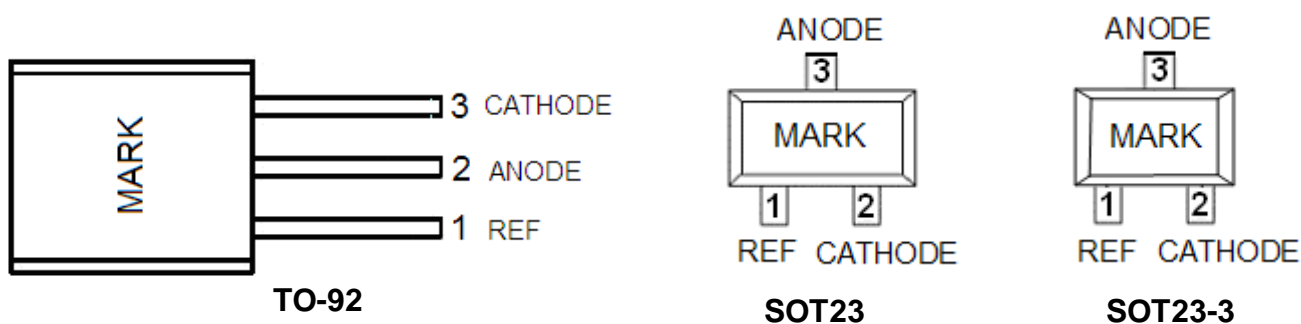
### Selection Guide



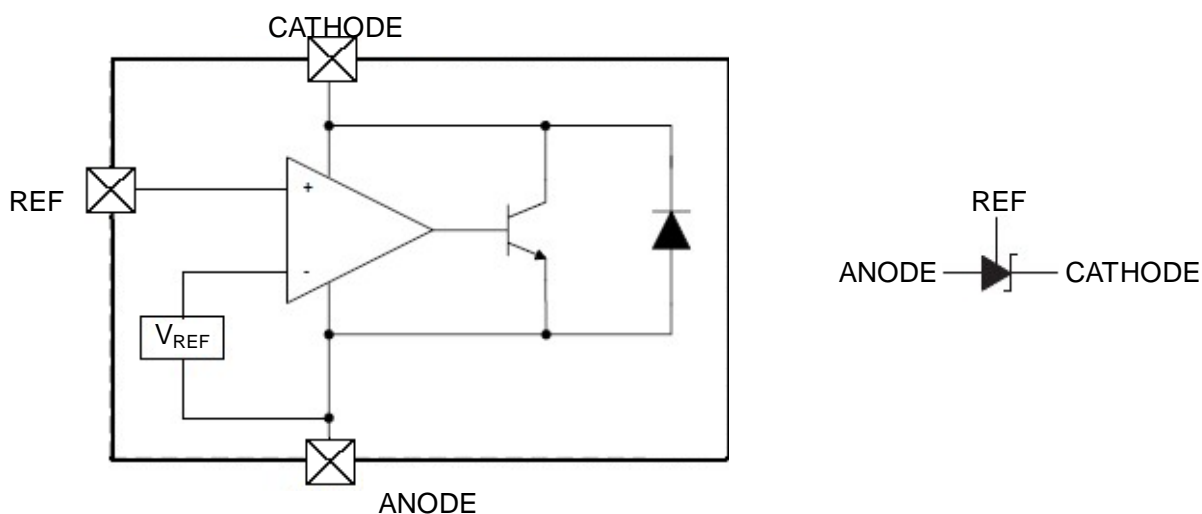
### Typical Application

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

## PIN Configuration



## Block Diagram and symbol



## Absolute Maximum Ratings

PARAMETER	SYMBOL	RATING	UNIT
Cathode voltage	$V_{KA}$	40	V
Cathode current range (continuous)	$I_{KA}$	-100 to +130	mA
Reference input current range	$I_{REF}$	10	mA
Power Dissipation	$P_D$	TO-92 Package: 770	mW
		SOT23-3 Package: 370	
		SOT23 Package: 300	
Junction temperature	$T_J$	160	$^{\circ}\text{C}$
Storage Temperature range	$T_{STG}$	-65~+150	$^{\circ}\text{C}$
Package thermal impedance	$\theta_{JA}$	TO-92 package: 150	$^{\circ}\text{C/W}$
		SOT23-3 package: 330	
		SOT23 package: 350	

**Note:** Use this IC within the stated maximum ratings. Operation beyond these limits may cause degrading or permanent damage to the device.

## 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 (T<sub>A</sub>=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit	Test circuit		
Reference voltage	0.4% 1.0%	$V_{KA}=V_{REF}, I_{KA}=10mA$	$V_{REF}$	2.490	2.50	2.510	V	Fig.1	
				2.475	2.50	2.525			
Deviation of reference voltage over-temperature	$\Delta V_{REF}$	$V_{KA}=V_{REF}, I_{KA}=10mA$	$\Delta V_{REF}$	0 to 70°C	-	3	10	mV	Fig.1
				-40 to 150°C	-	3	15		
Dynamic impedance	$ Z_{KA} $	$V_{KA}=V_{REF}, I_{KA}=1 \text{ to } 100mA, f \leq 1.0KHz$	-	0.15	0.5	$\Omega$	Fig.1		
Minimum cathode current for regulation	$I_{KA} \text{ (MIN)}$	$V_{KA}=V_{REF}$	-	0.4	1.0	mA	Fig.1		
Ratio of change in reference voltage to the change in cathode voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_{KA}=10mA$	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$\Delta V_{KA} = 10V \text{ to } V_{REF}$	-	-0.8	-2.5	mV/V	Fig.2
				$\Delta V_{KA} = 36V \text{ to } 10V$	-	-0.6	-1.5		
Reference current	$I_{REF}$	$I_{KA}=10mA, R1=10K\Omega, R2=\infty$	-	0.7	3	$\mu A$	Fig.2		
Deviation of reference over full temperature range	$\Delta I_{REF}$	$I_{KA}=10mA, R1=10K\Omega, R2=\infty, T_A=40 \text{ to } 150^\circ C$	-	0.1	1.2	$\mu A$	Fig.2		
Off-state cathode current	$I_{KA} \text{ (OFF)}$	$V_{KA}=36V, V_{REF}=0$	-	0.03	0.3	$\mu A$	Fig.3		

**Note:**The dynamic impedance is defined as:  $|Z_{KA}| = \Delta V_{KA} / \Delta I_{KA}$

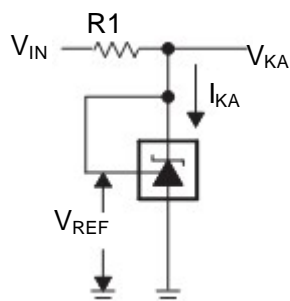
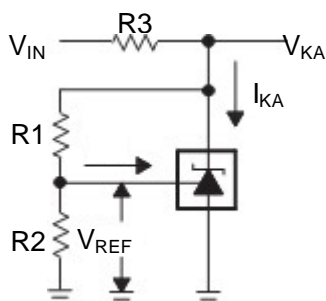


Fig.1: for  $V_{KA} = V_{REF}$



$$V_{KA} = V_{REF} \left( 1 + \frac{R1}{R2} \right) + I_{KA} R3$$

Fig.2: for  $V_{KA} > V_{REF}$

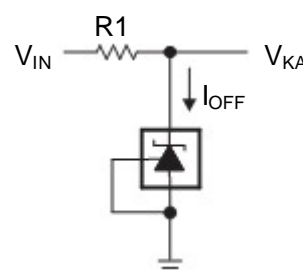
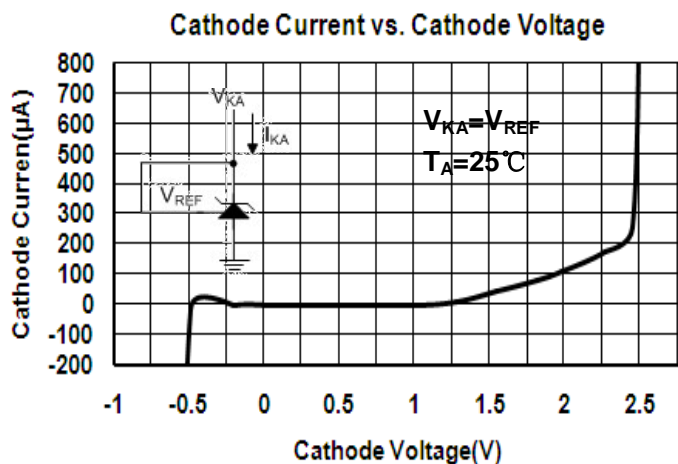
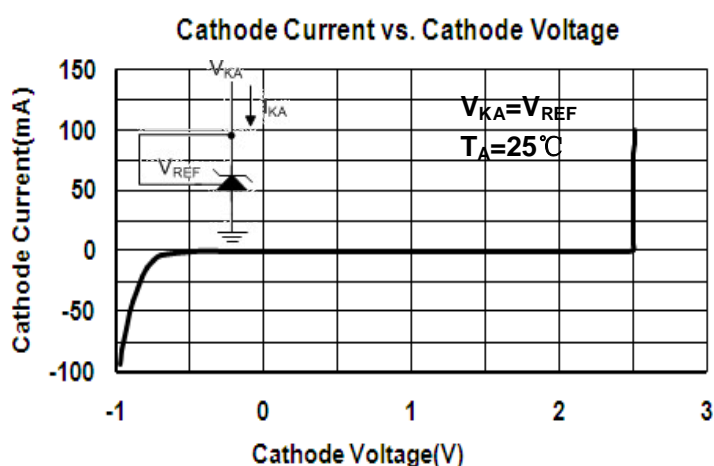
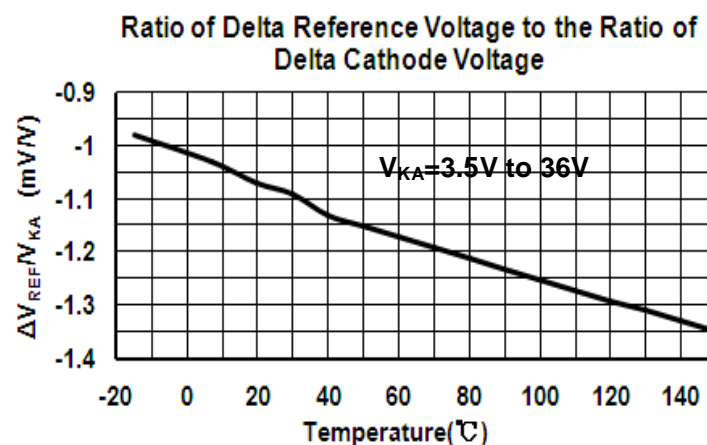
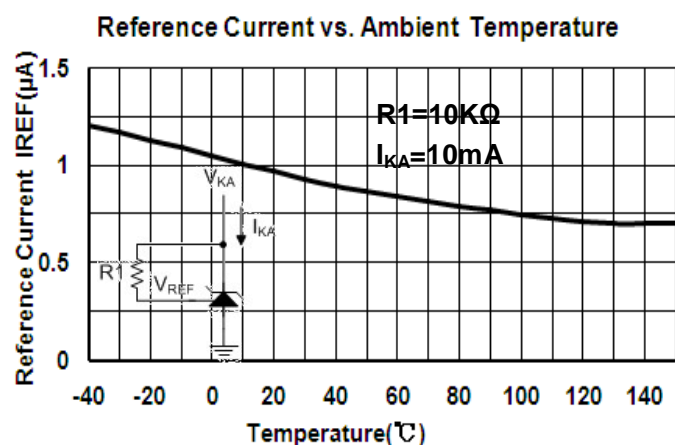
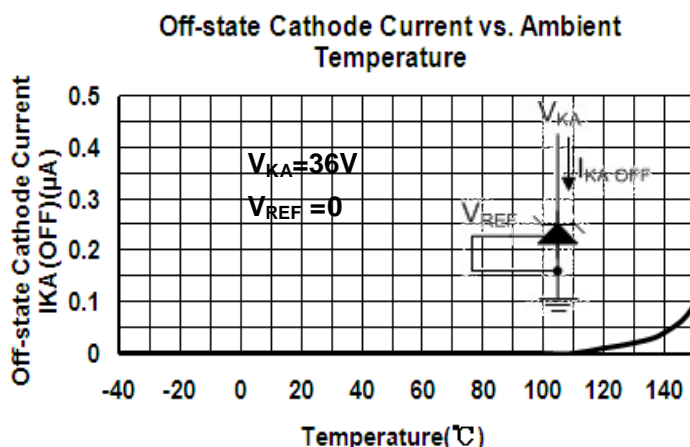
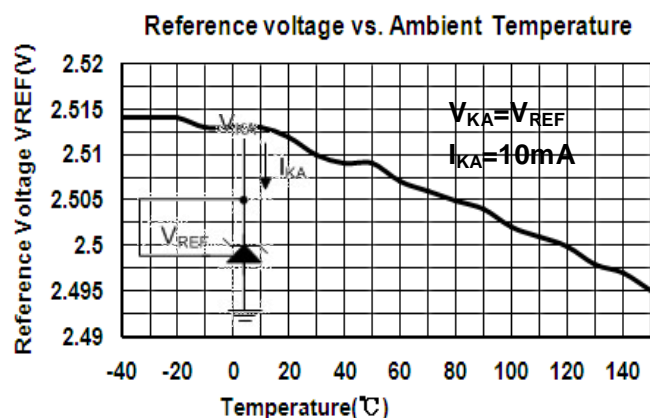
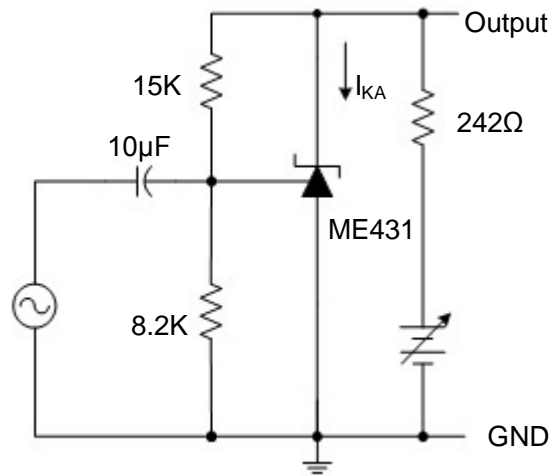
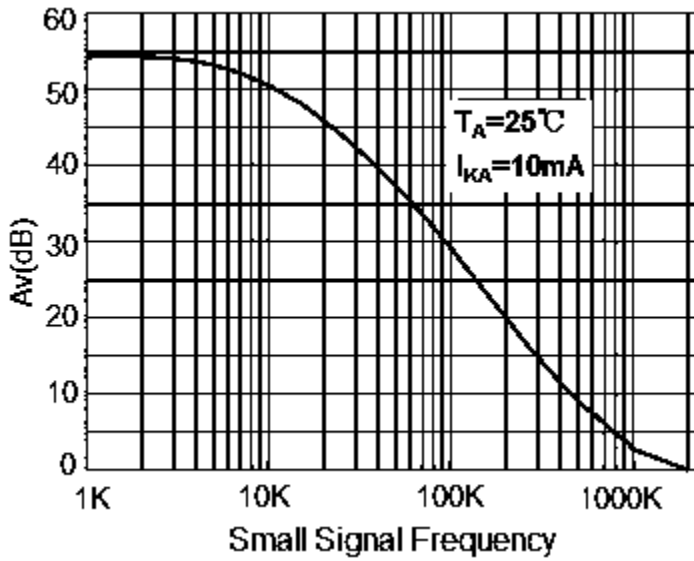


Fig.3: for  $I_{OFF}$

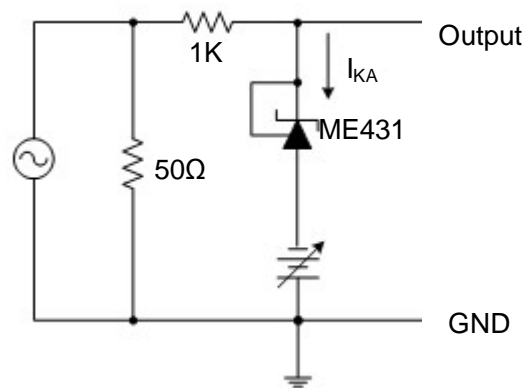
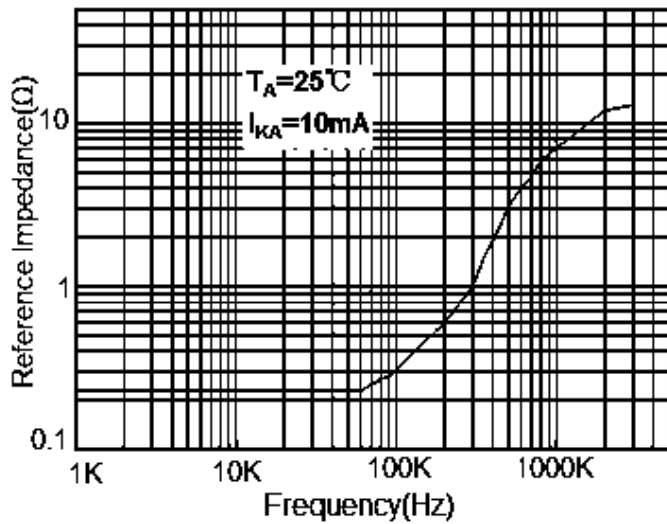
Typical Performance Characteristics



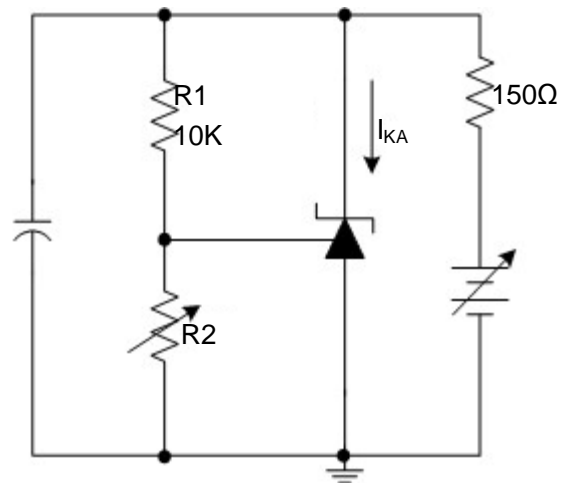
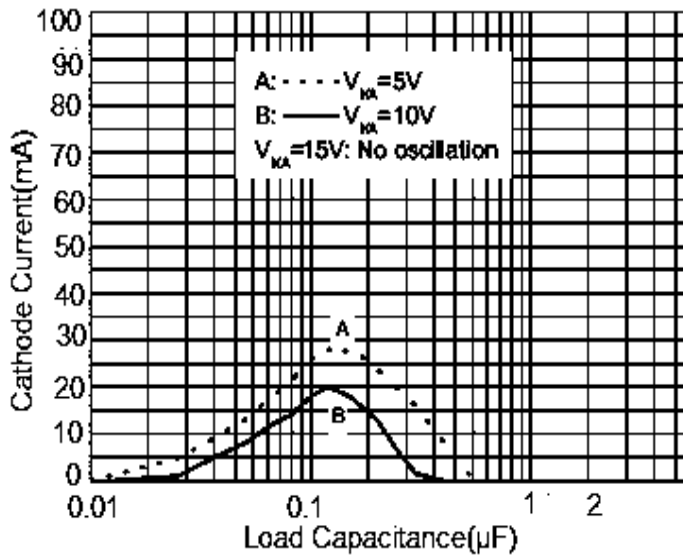
Small Signal Voltage Gain vs. Frequency



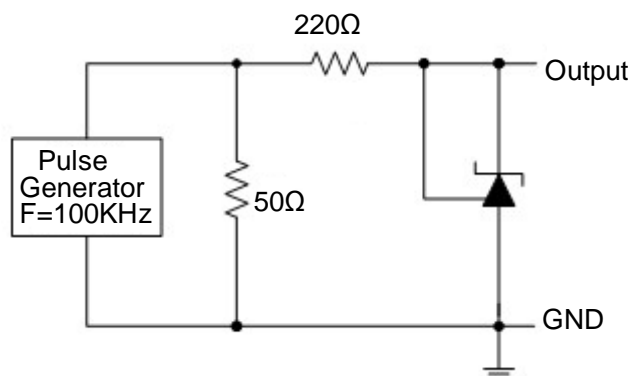
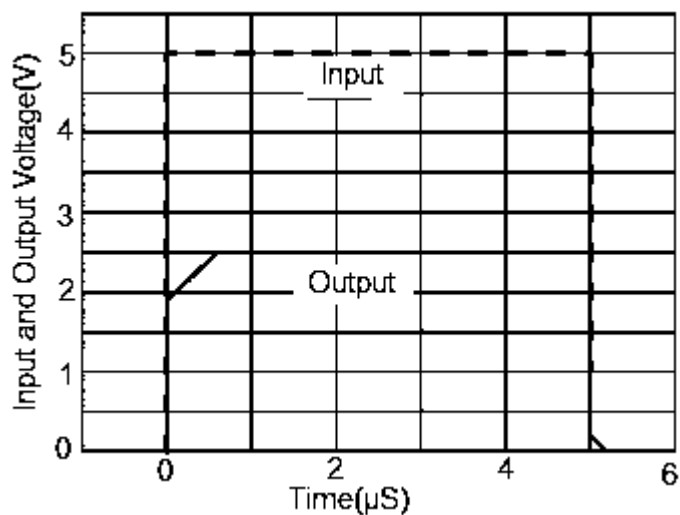
Reference Impedance vs. Frequency



Stability Boundary Conditions vs. Load Capacitance



Pulse Response of Input and Output Voltage



Typical Application

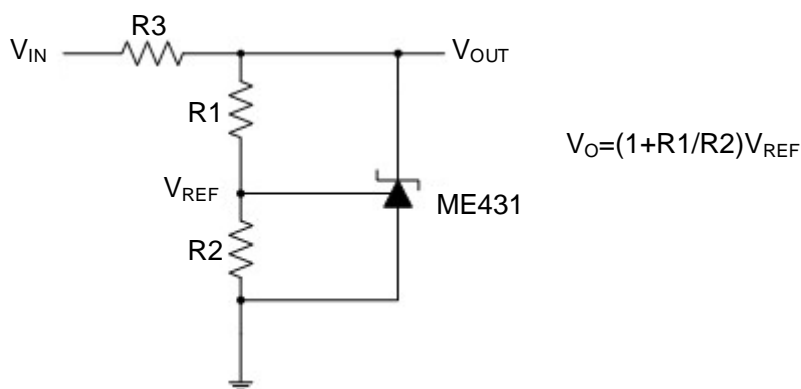


Fig.4: Shunt Regulator

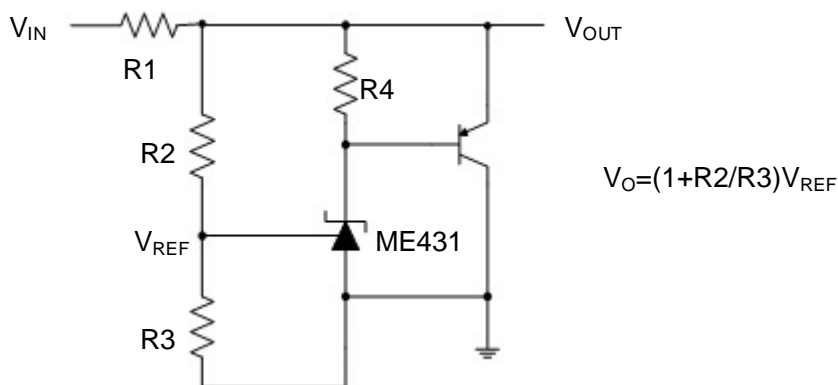


Fig.5: High Current Shunt Regulator

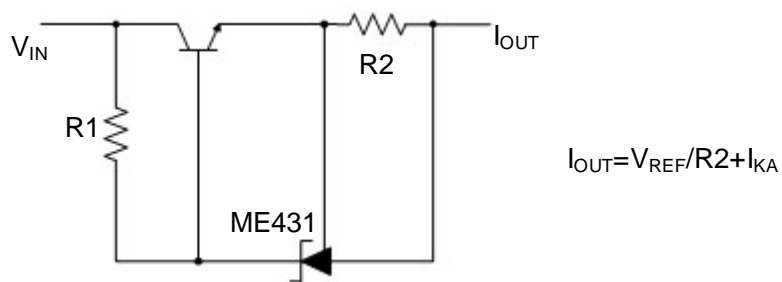


Fig.6: Current Source or Current Limit

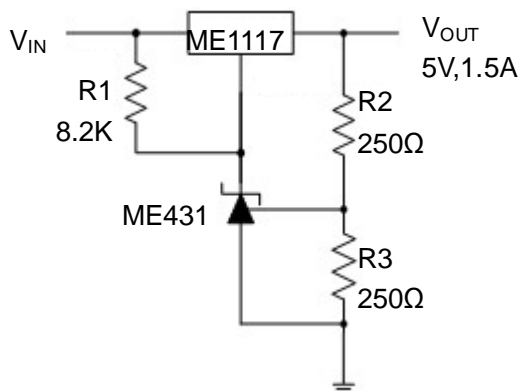
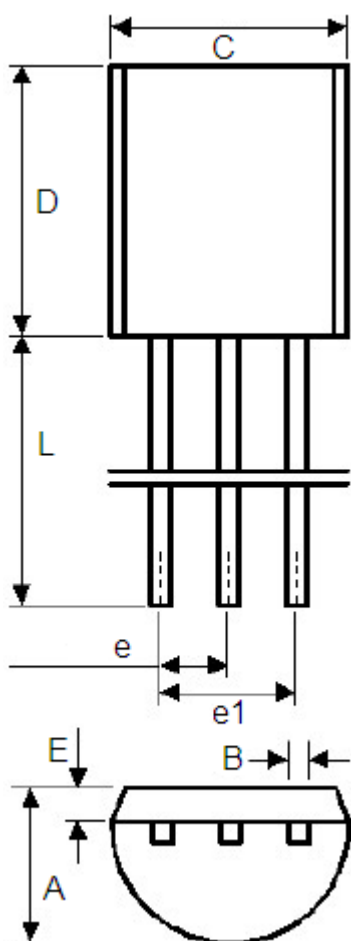


Fig.7: Precision 5V 1.5A Regulator

## Packaging Type: TO-92

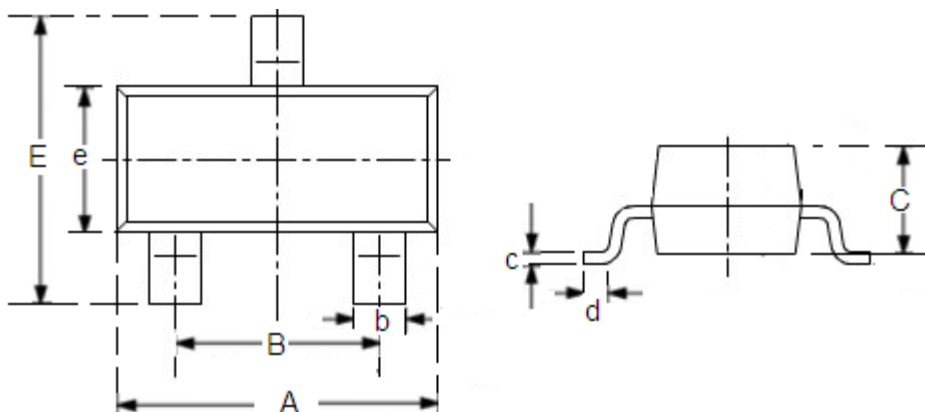


	Min	Max	Min	Max
A	3.4	3.8	0.13386	0.1496
B	0.3	0.5	0.0118	0.0197
C	4.4	4.8	0.1732	0.189
D	4.4	4.8	0.1732	0.189
E	0.9	1.5	0.0354	0.059
e	1.17	1.37	0.046	0.0539
e1	2.39	2.69	0.094	0.1059
L	12	16	0.4724	0.6299



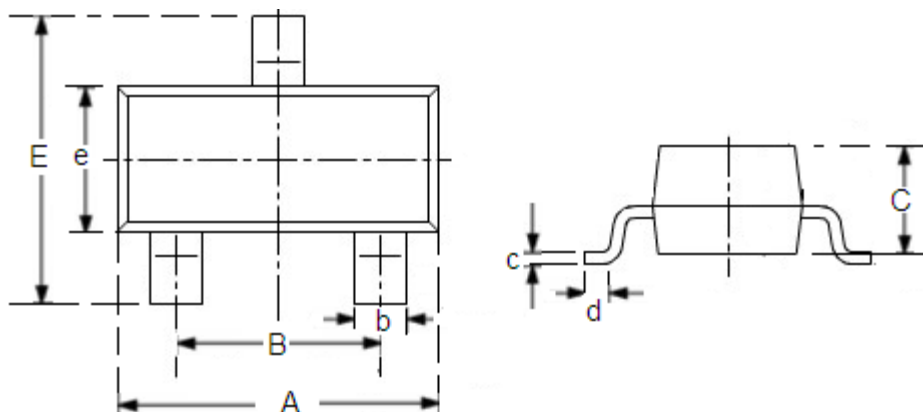


## Packaging Type: SOT23-3



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	2.7	3.1	0.1063	0.122
B	1.7	2.1	0.0669	0.0827
b	0.35	0.5	0.0138	0.0197
C	1.0	1.2	0.0394	0.0472
c	0.1	0.25	0.0039	0.0098
d	0.2	-	0.0079	-
E	2.6	3.0	0.1023	0.1181
e	1.5	1.8	0.059	0.0708

Packaging Type: SOT23



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	2.7	3.1	0.1063	0.122
B	1.7	2.1	0.0669	0.0827
b	0.35	0.5	0.0138	0.0197
C	1.0	1.2	0.0394	0.0472
c	0.1	0.25	0.0039	0.0098
d	0.2	-	0.0079	-
E	2.1	2.64	0.0827	0.1039
e	1.2	1.4	0.0472	0.0551

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