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.

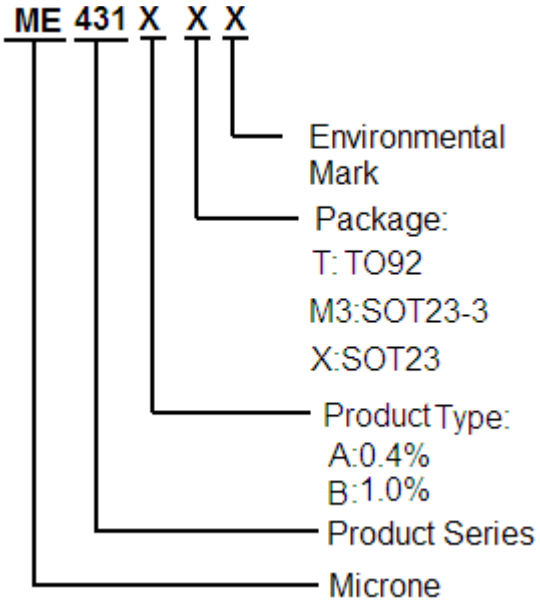
The ME431 voltage type is 40V. The output voltage can be set to any value between V_{REF} (2.5V) and the corresponding maximum cathode voltage.

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/℃ 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℃
- ●TO-92, SOT23-3, SOT23 package

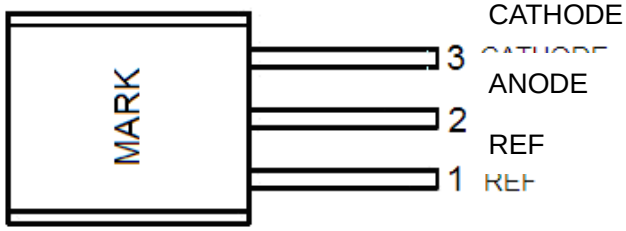
Selection Guide



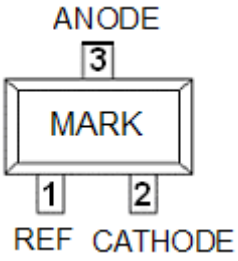
Typical Application

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

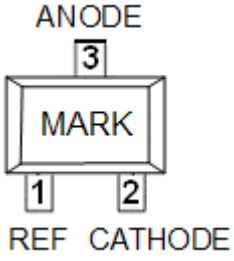
PIN Configuration



TO-92

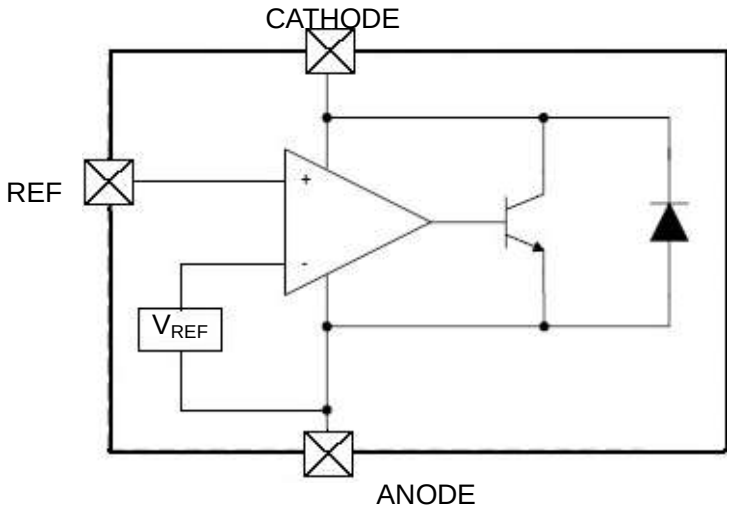


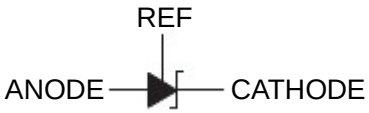
SOT23



SOT23-3

Block Diagram and symbol





Absolute Maximum Ratings

PARAMETER	SYMBAL	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	℃
Storage Temperature range	T_{STG}	-65~+150	℃
Package thermal impedance	θ_{JA}	TO-92 package:150	℃/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.

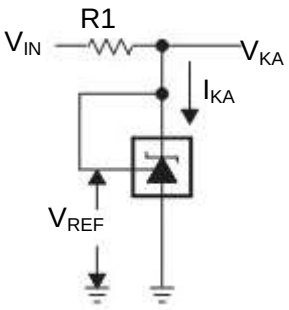
Recommended Operating Conditions

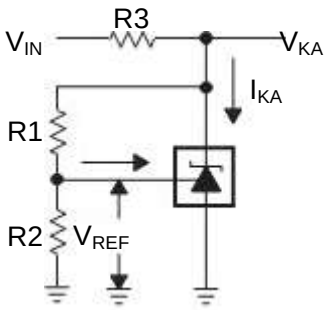
Parameter	Symbol	Min	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current	I_{KA}	1.0	100	mA
Operating Ambient Temperature Range		-40	125	℃

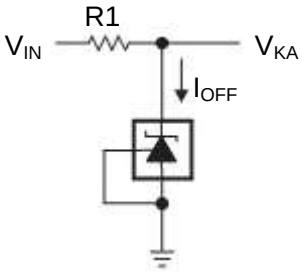
Electrical Characteristics (T_A=25℃ ,unless otherwise noted)

Parameter		Symbol	Conditions		Min	Typ.	Max	Unit	Test circuit
Reference voltage	0.4%	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA		2.490	2.50	2.510	V	Fig.1
	1.0%				2.475	2.50	2.525		
Deviation of reference voltage over-temperature		ΔV_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA	0 to 70℃	-	3	10	mV	Fig.1
				-40 to 150℃	-	3	15		
Dynamic impedance		$\lvert Z_{KA} \rvert$	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA, f≤1.0KHz		-	0.15	0.5	Ω	Fig.1
Minimum cathode current for regulation		I_{KA} (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	ΔV_{KA} =10V to V_{REF}	-	-0.8	-2.5	mV/V	Fig.2
				ΔV_{KA} =36V to 10V	-	-0.6	-1.5		
Reference current		I_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∝			0.7	3	μA	Fig.2
Deviation of reference over full temperature range		ΔI_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∝, T_A=40 to 150℃			0.1	1.2	μA	Fig.2
Off-state cathode current		I_{KA} (OFF)	V_{KA}=36V, V_{REF}=0			0.03	0.3	μA	Fig.3

Note: The dynamic impedance is defined as: $\lvert Z_{KA} \rvert = \triangle V_{KA} / \triangle I_{KA}$





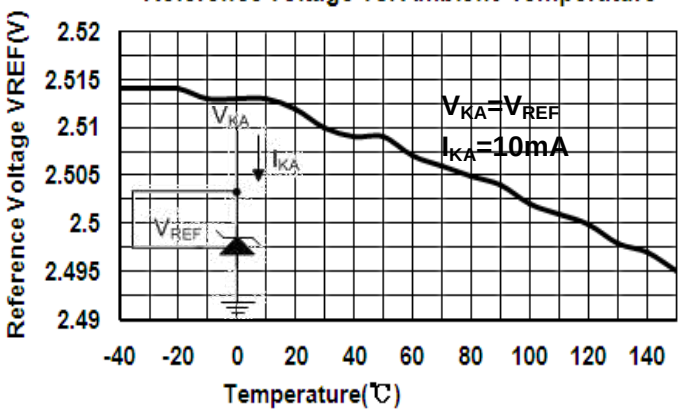


$$V_{KA} = V_{REF}(1 + R1/R2) + I_{REF} R1$$

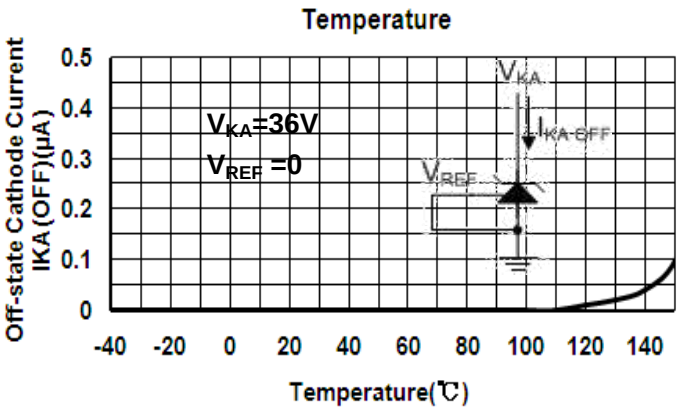
Fig.1: for V_{KA}= V_{REF} **Fig.2: for V_{KA}> V_{REF}** **Fig.3: for I_{OFF}**

Typical Performance Characteristics

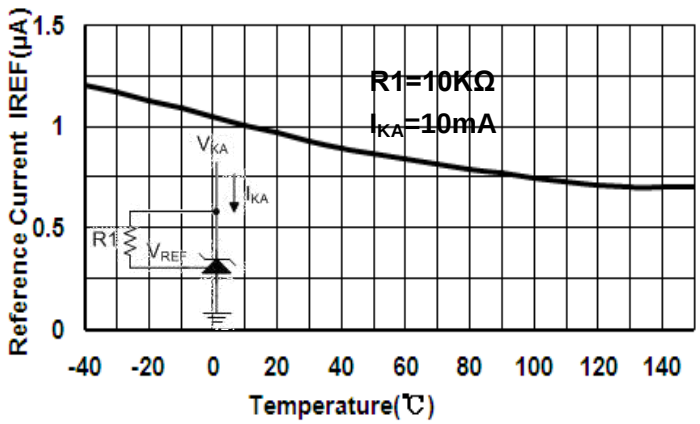
Reference voltage vs. Ambient Temperature



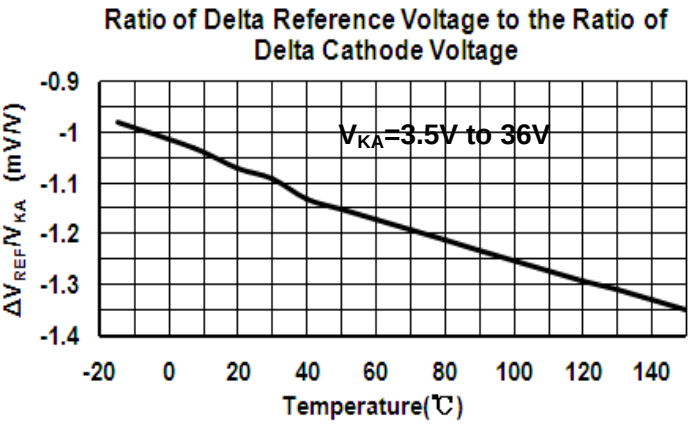
Off-state Cathode Current vs. Ambient Temperature



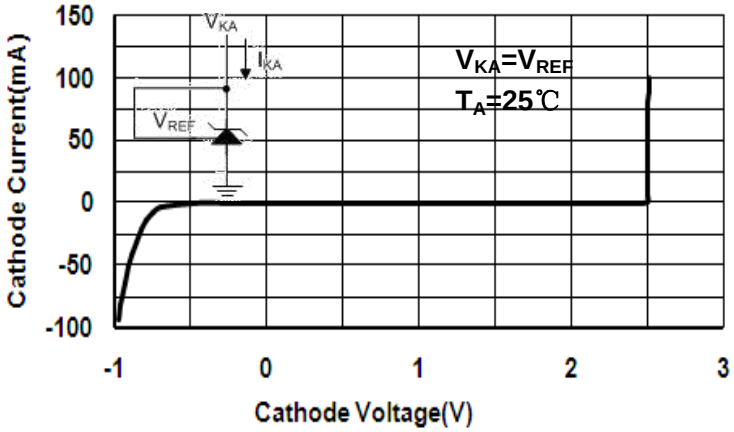
Reference Current vs. Ambient Temperature



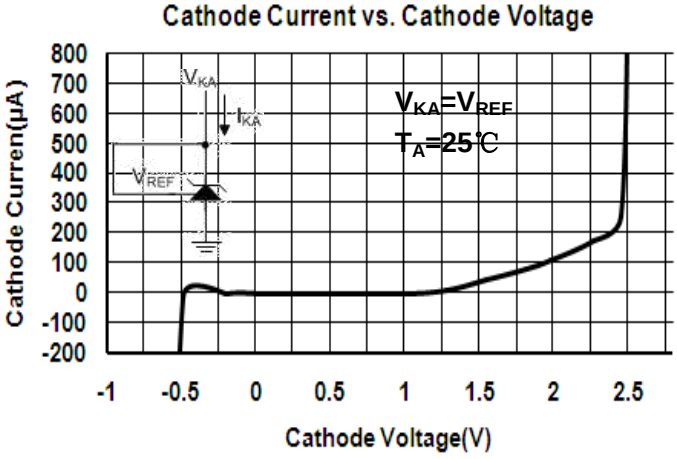
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



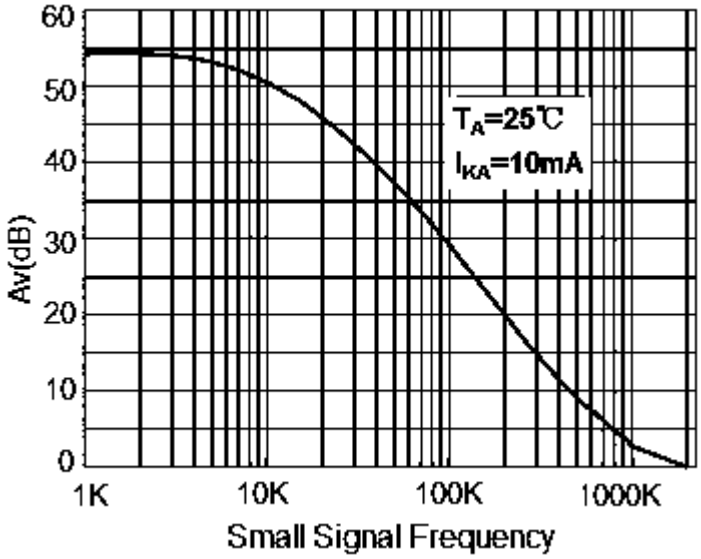
Cathode Current vs. Cathode Voltage

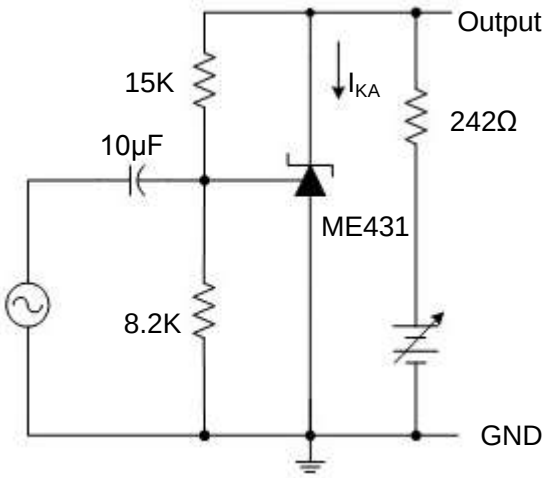


Cathode Current vs. Cathode Voltage

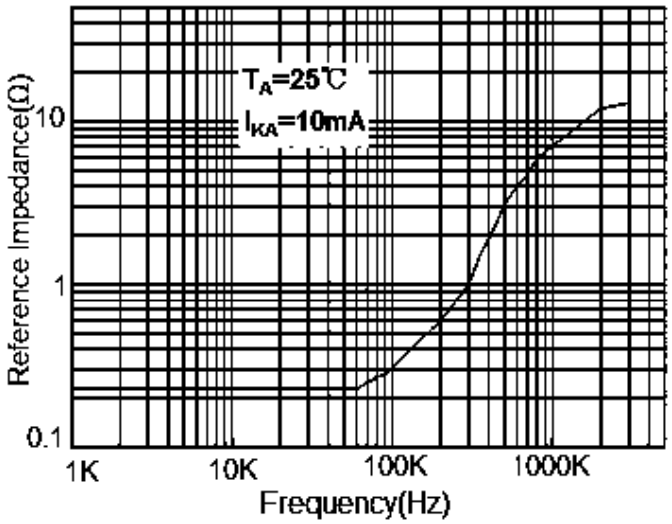


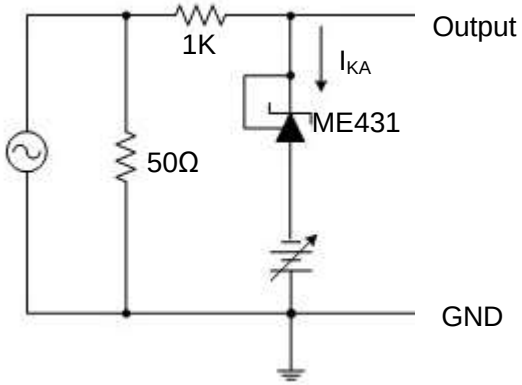
Small Signal Voltage Gain vs. Frequency



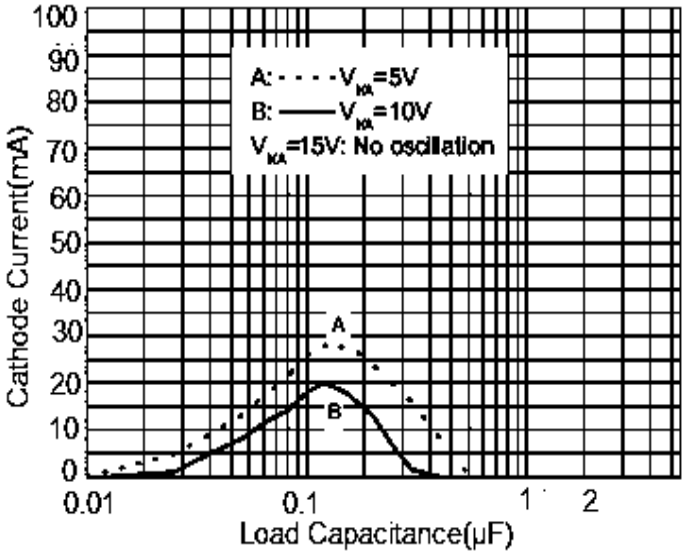


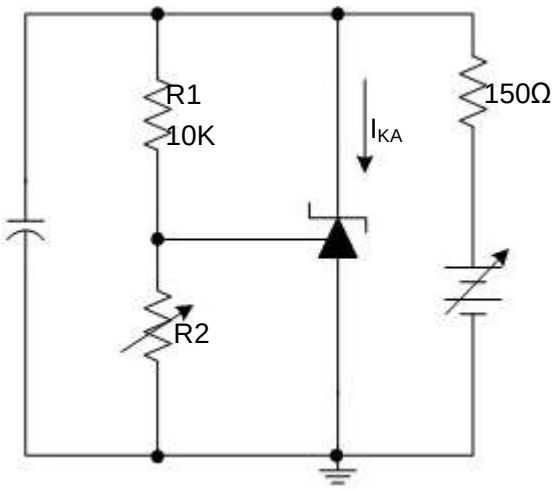
Reference Impedance vs. Frequency



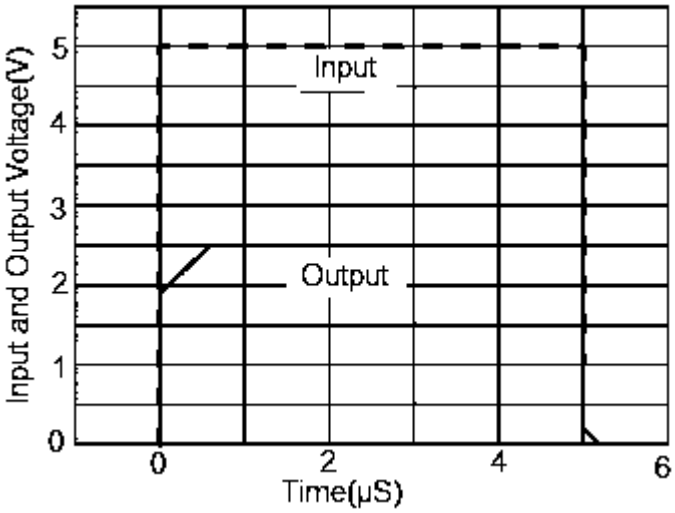


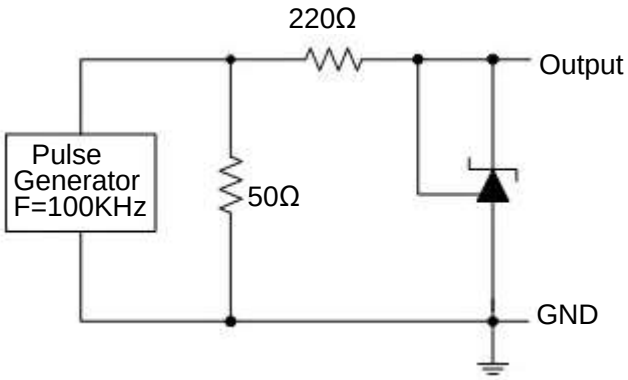
Stability Boundary Conditions vs. Load Capacitance



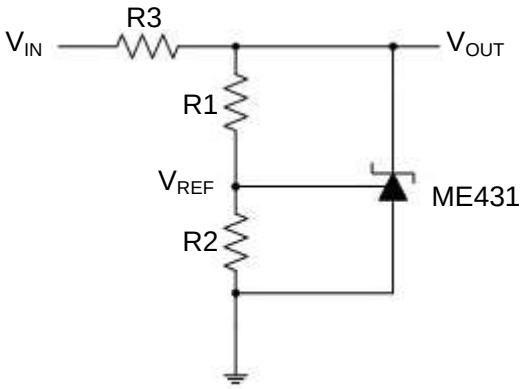


Pulse Response of Input and Output Voltage



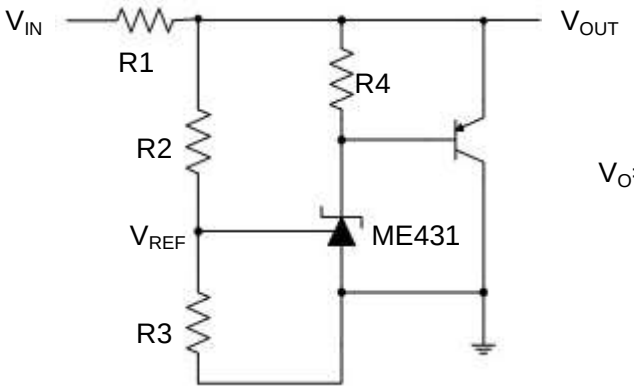


Typical Application



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

Fig.4: Shunt Regulator



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

Fig.5: High Current Shunt Regulator

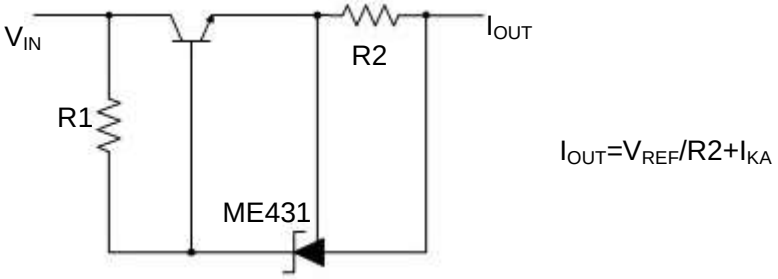


Fig.6: Current Source or Current Limit

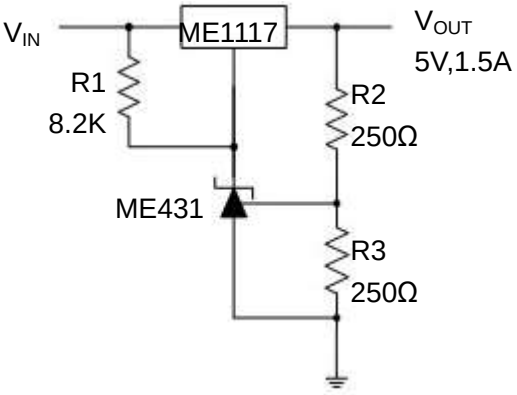
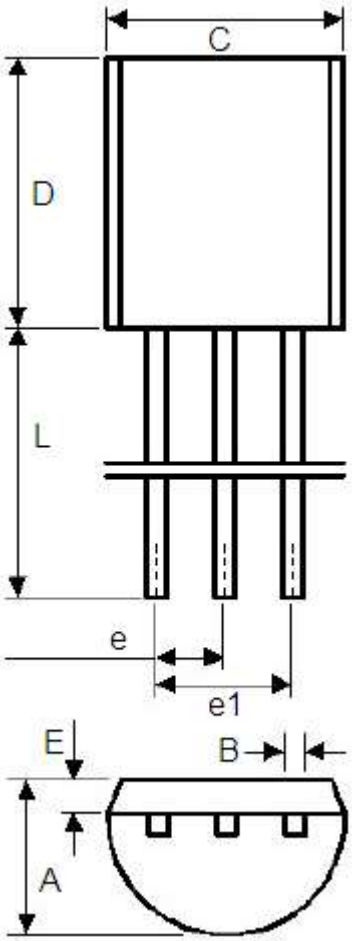


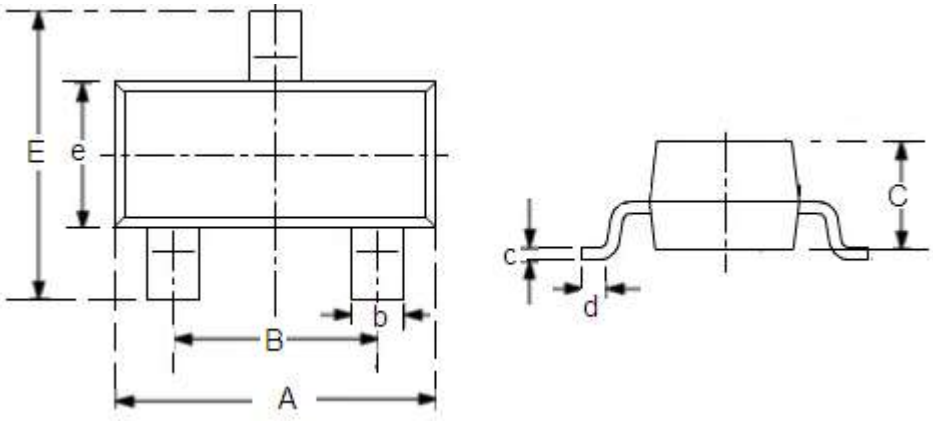
Fig.7: Precision 5V 1.5A Regulator

Packaging Type: TO-92



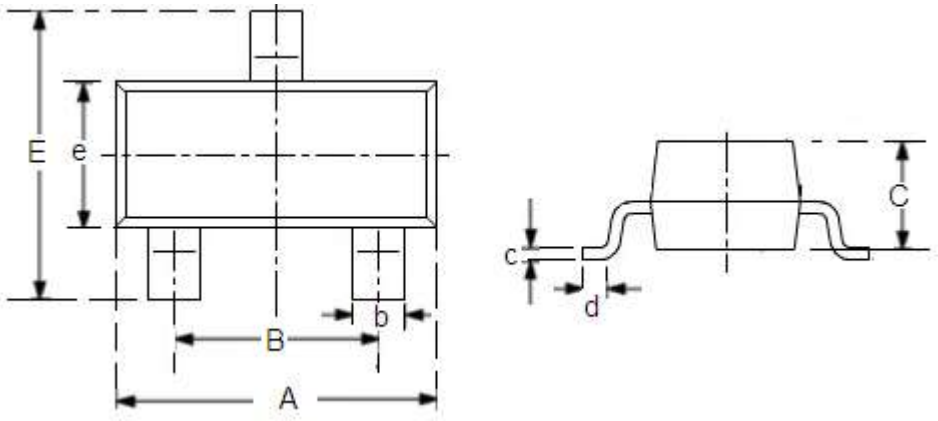
	Min	Max	Min	Max
A	3.4	3.8	0.13386	0.1496
B	0.3	0.5	0.0118	0.0197
C	4.4	4.8	0.1732	0.189
D	4.4	4.8	0.1732	0.189
E	0.9	1.5	0.0354	0.059
e	1.17	1.37	0.046	0.0539
e1	2.39	2.69	0.094	0.1059
L	12	16	0.4724	0.6299

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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