



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 36V. 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 three band gap tolerance: $\pm 0.2\%$ 、 $\pm 0.4\%$ and $\pm 1.0\%$.

Typical Application

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

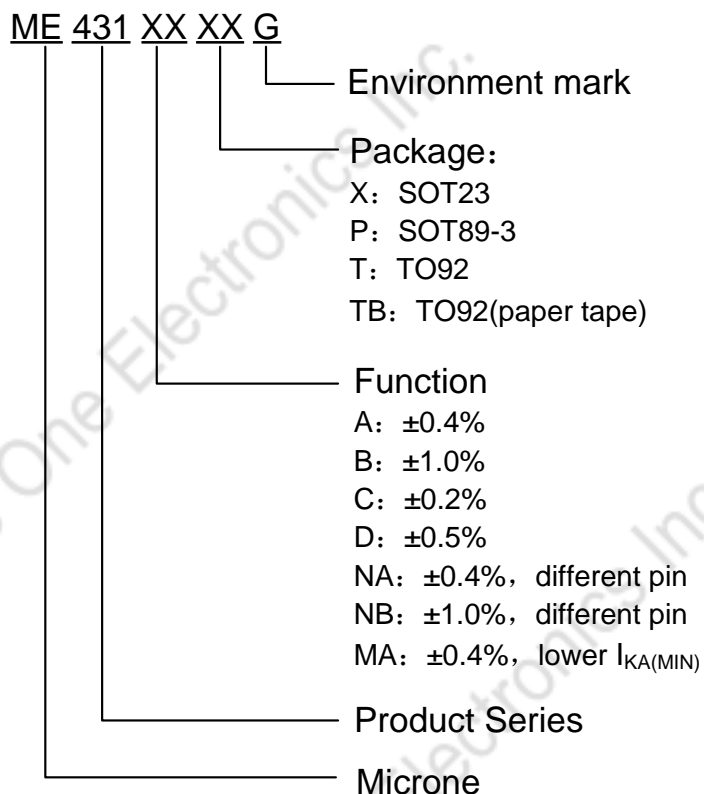
Features

- 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 or from 0.25mA to 100mA (ME431M)
- Low Output Noise
- Wide Operating Range of -40 to 85°C

Package

- 3-pin SOT23、TO92、SOT89-3

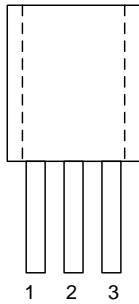
Selection Guide



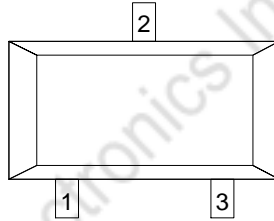
product series	product description
ME431AXG	$V_{REF}=2.5V\pm 0.4\%$; Package: SOT23
ME431BXG	$V_{REF}=2.5V\pm 1.0\%$; Package: SOT23
ME431CXG	$V_{REF}=2.5V\pm 0.2\%$; Package: SOT23
ME431DXG	$V_{REF}=2.55V\pm 0.5\%$; Package: SOT23
ME431APG	$V_{REF}=2.5V\pm 0.4\%$; Package: SOT89-3
ME431ATG	$V_{REF}=2.5V\pm 0.4\%$; Package: TO92
ME431BTG	$V_{REF}=2.5V\pm 1.0\%$; Package: TO92
ME431ATBG	$V_{REF}=2.5V\pm 0.4\%$; Package: TO92; paper tape
ME431BTBG	$V_{REF}=2.5V\pm 1.0\%$; Package: TO92; paper tape
ME431NAXG	$V_{REF}=2.5V\pm 0.4\%$; Package: SOT23; Different pin
ME431NBXG	$V_{REF}=2.5V\pm 1.0\%$; Package: SOT23; Different pin
ME431MAXG	$V_{REF}=2.5V\pm 0.4\%$; Package: SOT23; Lower $I_{KA(MIN)}$

NOTE: If you need other voltage and package, please contact our sales staff.

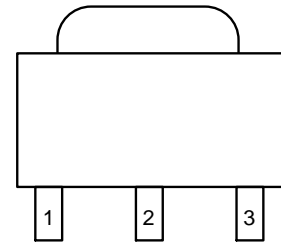
PIN Configuration



TO92



SOT23

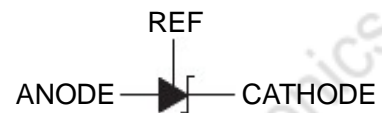
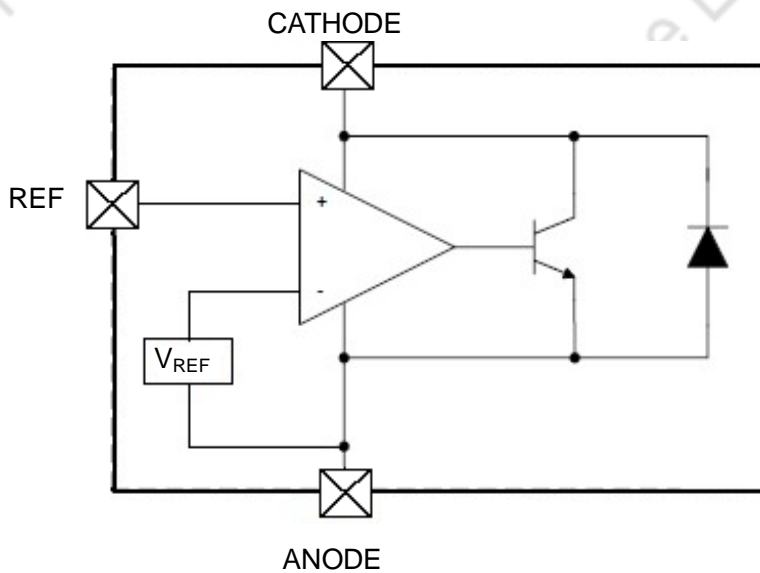


SOT89-3

Pin Assignment

Pin Number		Symbol	Functions
ME431/ME431M	ME431N		
1	3	R	reference
2	2	A	anode
3	1	K	cathode

Block Diagram and symbol



Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Cathode voltage	V_{KA}	36	V
Cathode current range (continuous)	I_{KA}	-100~+130	mA
Reference input current range	I_{REF}	10	mA
Power Dissipation	P_D	TO-92 Package: 0.8	W
		SOT23 Package:0.4	
		SOT89-3 Package:1.25	
Junction temperature	T_J	-40~+150	°C
Storage Temperature range	T_{STG}	-55~+150	°C
Package thermal impedance (Junction to air)	θ_{JA}	TO-92 package:150	°C/W
		SOT23 package:330	
		SOT89-3 Package:100	

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	ME431/ME431N	1.0	100	mA
	ME431M	0.25	100	
Operating Ambient Temperature Range		-40	85	°C

Electrical Characteristics ($T_A=25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit	Test circuit	
Reference voltage	V_{REF}	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$	2.495	2.50	2.505	V	Fig.1	
			2.490	2.50	2.510			
			2.475	2.50	2.525			
			2.537	2.55	2.562			
Deviation of reference voltage over-temperature	ΔV_{REF}	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$	0 to 70°C	-	7	10	mV	Fig.1
			-40 to 150°C	-	25	30		
Dynamic impedance	$ Z_{KA} $	$V_{KA}=V_{REF}, I_{KA}=1$ to 100mA, $f \leq 1.0\text{KHz}$	-	0.15	0.5	Ω	Fig.1	
Minimum cathode current for regulation	I_{KA} (MIN)	$V_{KA}=V_{REF}$	ME431/ME431N	-	0.4	1.0	mA	Fig.1
			ME431M	-	0.22	0.25	mA	Fig.1
Ratio of change in	ΔV_{REF}	$I_{KA}=10\text{mA}$	$\Delta V_{KA}=10\text{V}$ to V_{REF}	-	-0.8	-2.5	mV/V	Fig.2

reference voltage to the change in cathode voltage			$\Delta V_{KA} = 36V$ to $10V$	-	-0.6	-1.5		
Reference current	I_{REF}	$I_{KA}=10mA, R1=10K\Omega, R2=\infty$			0.7	3	μA	Fig.2
Deviation of reference over full temperature range	ΔI_{REF}	$I_{KA}=10mA, R1=10K\Omega, R2=\infty, T_A=40$ to $150^\circ C$			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: $|Z_{KA}| = \Delta V_{KA} / \Delta I_{KA}$

Test Circuit

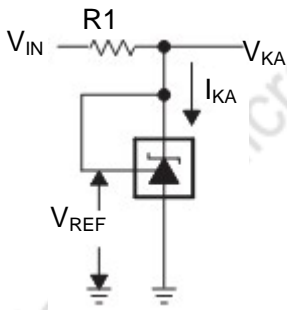
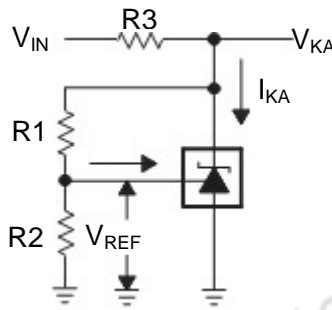


Fig.1: for $V_{KA} = V_{REF}$



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

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

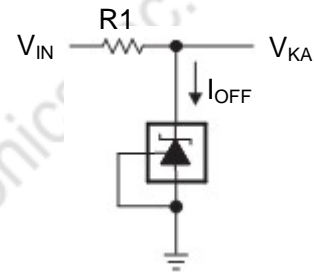
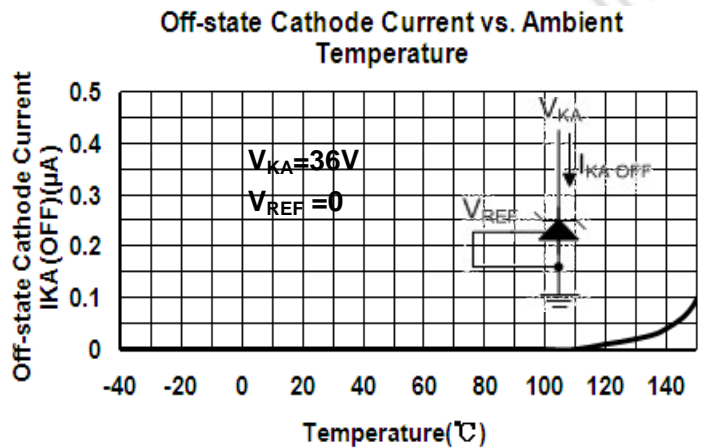
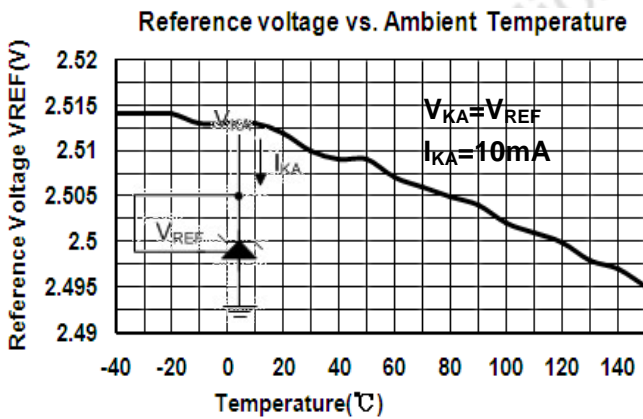
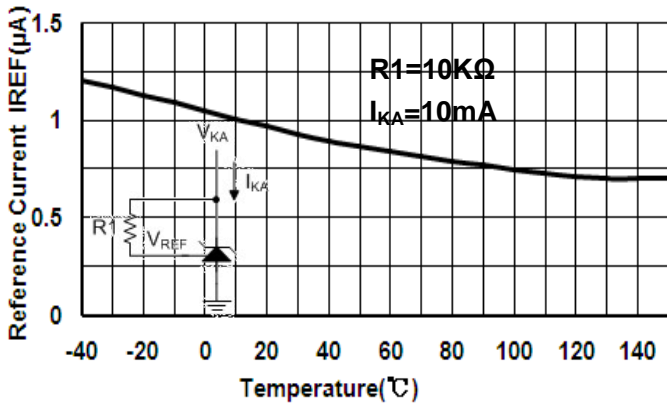


Fig.3: for I_{OFF}

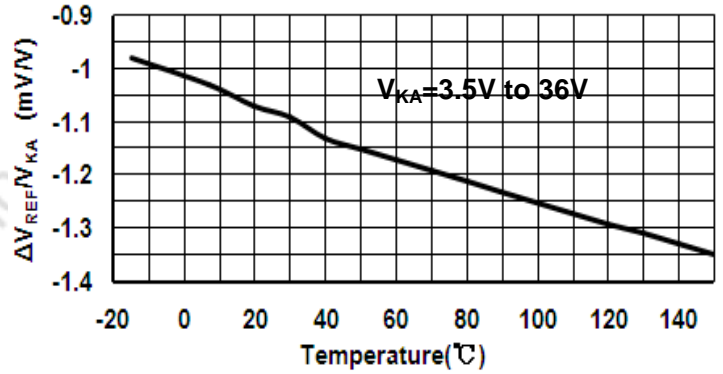
Typical Performance Characteristics



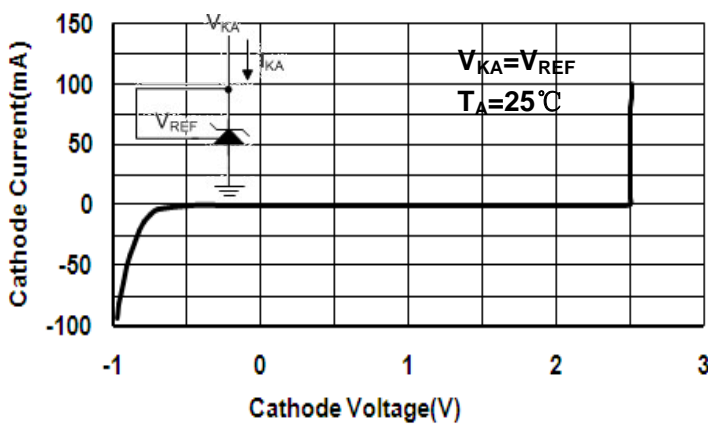
Reference Current vs. Ambient Temperature



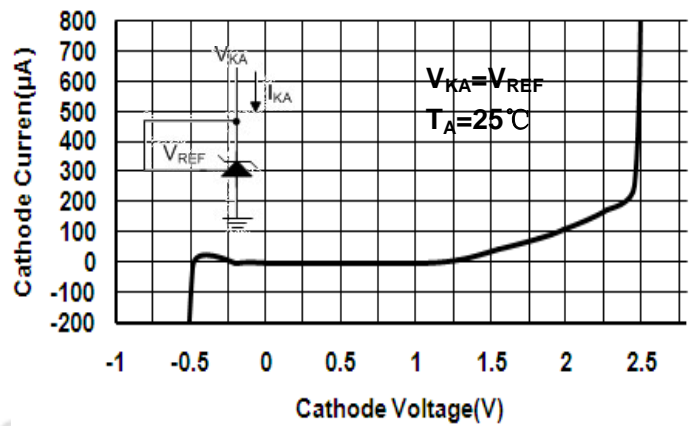
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



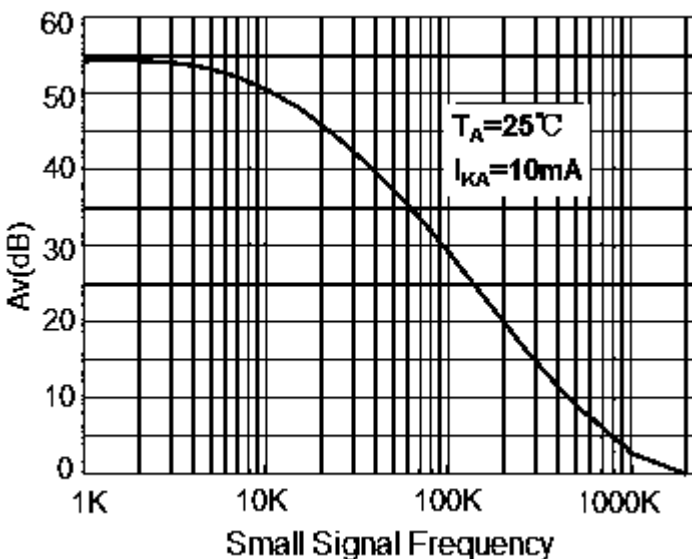
Cathode Current vs. Cathode Voltage



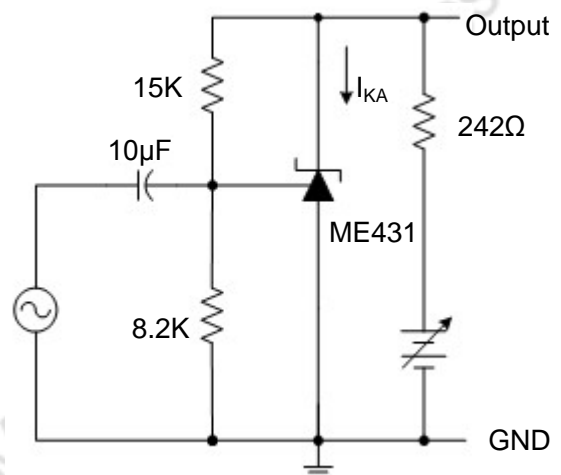
Cathode Current vs. Cathode Voltage

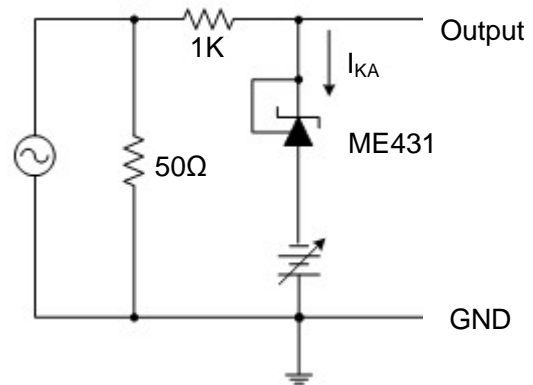
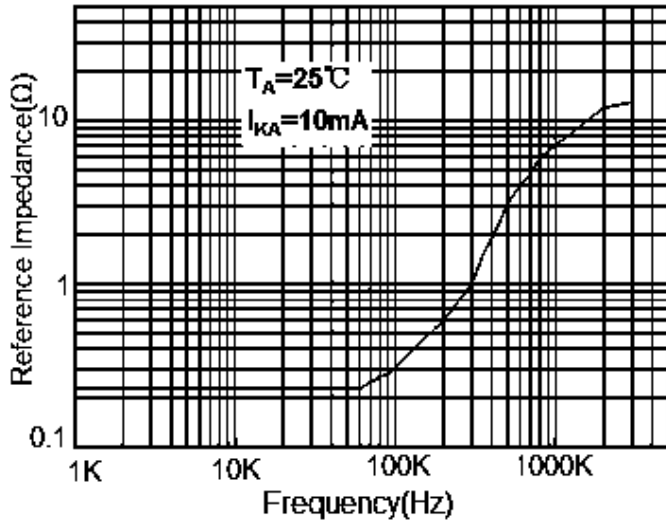


Small Signal Voltage Gain vs. Frequency

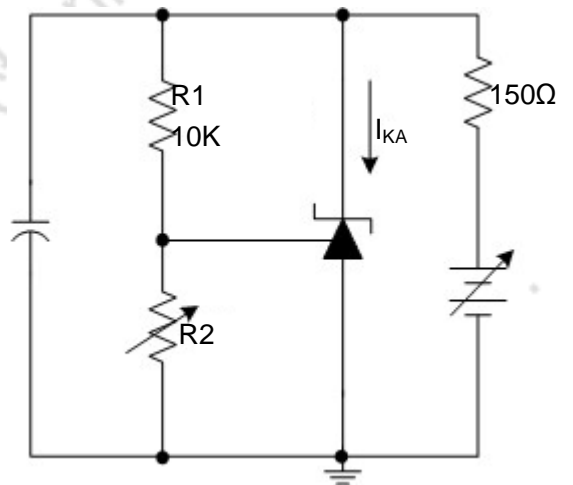
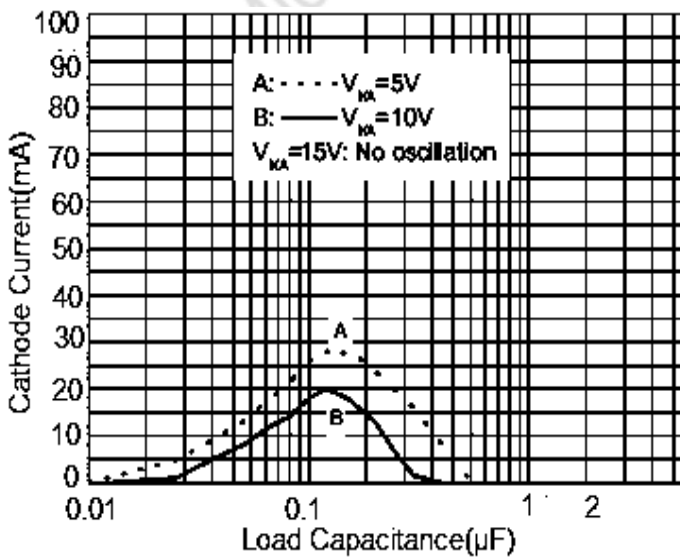


Reference Impedance vs. Frequency

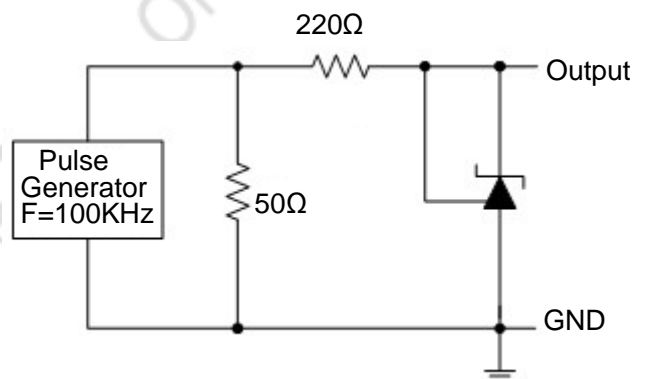
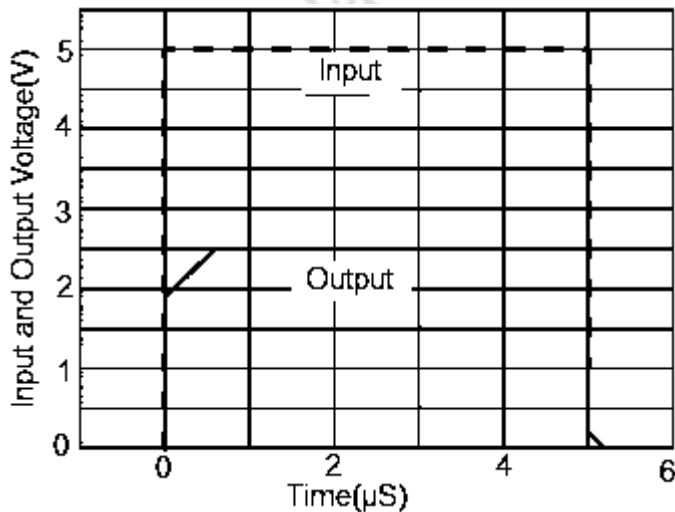




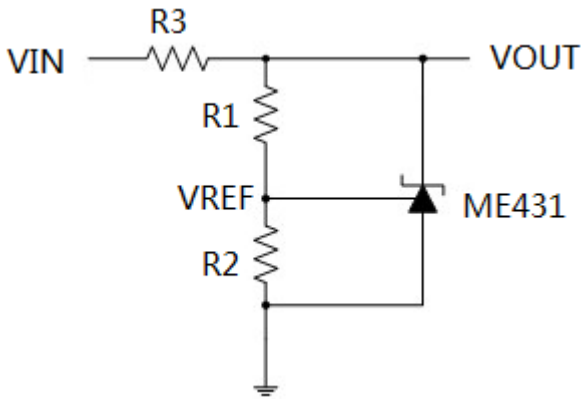
Stability Boundary Conditions vs. Load Capacitance



Pulse Response of Input and Output Voltage

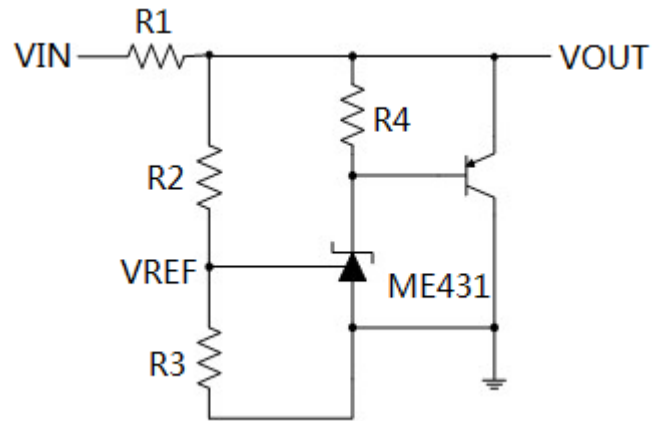


Typical Application



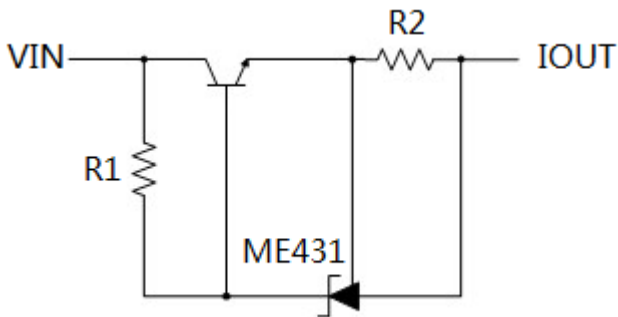
$$V_O = (1 + R1/R2)V_{REF}$$

Fig.4: Shunt Regulator



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

Fig.5: High Current Shunt Regulator



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

Fig.6: Current Source or Current Limit

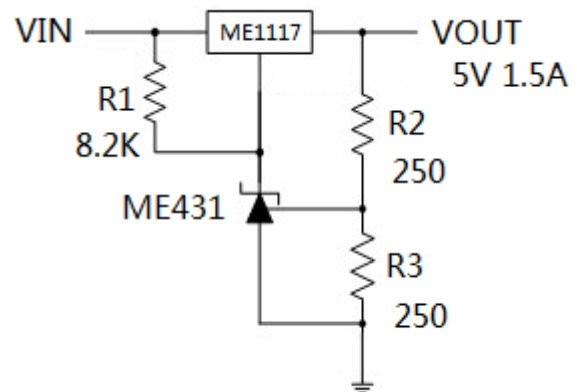
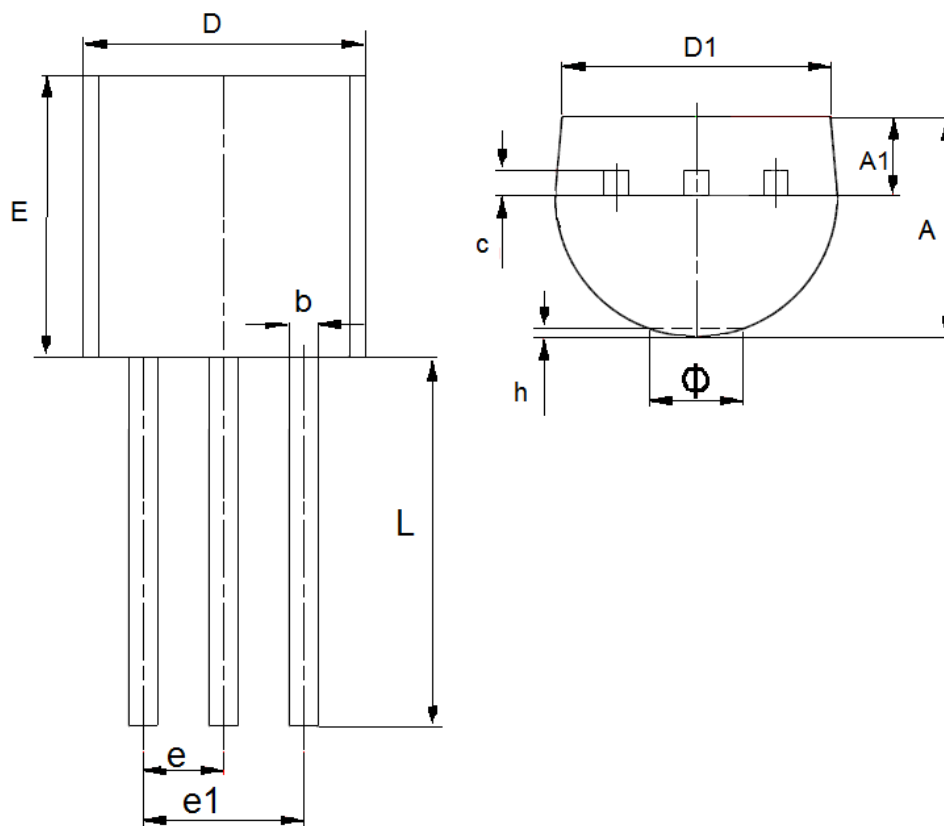


Fig.7: Precision 5V 1.5A Regulator

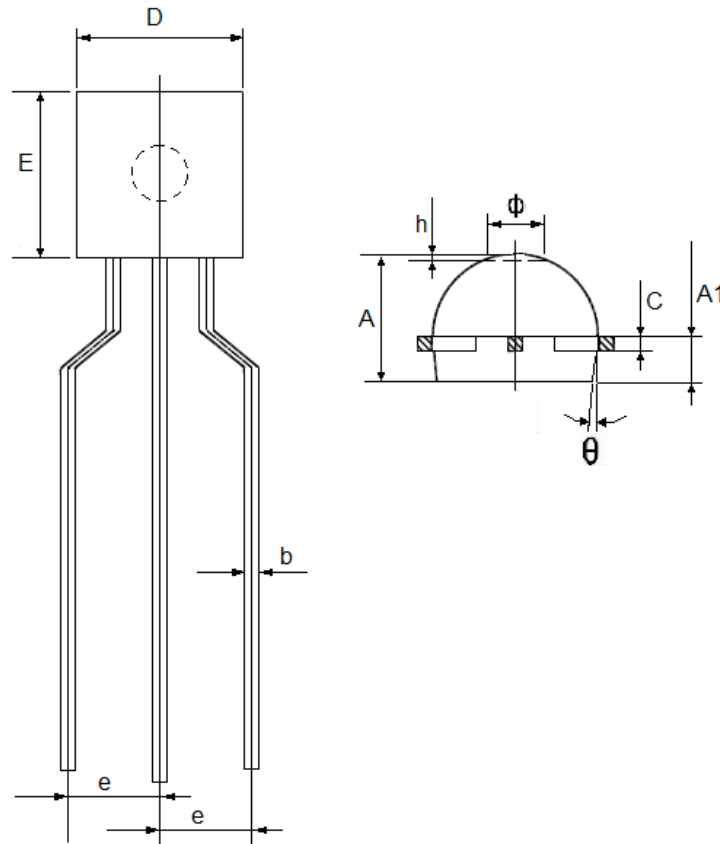
Packaging Type

- TO-92



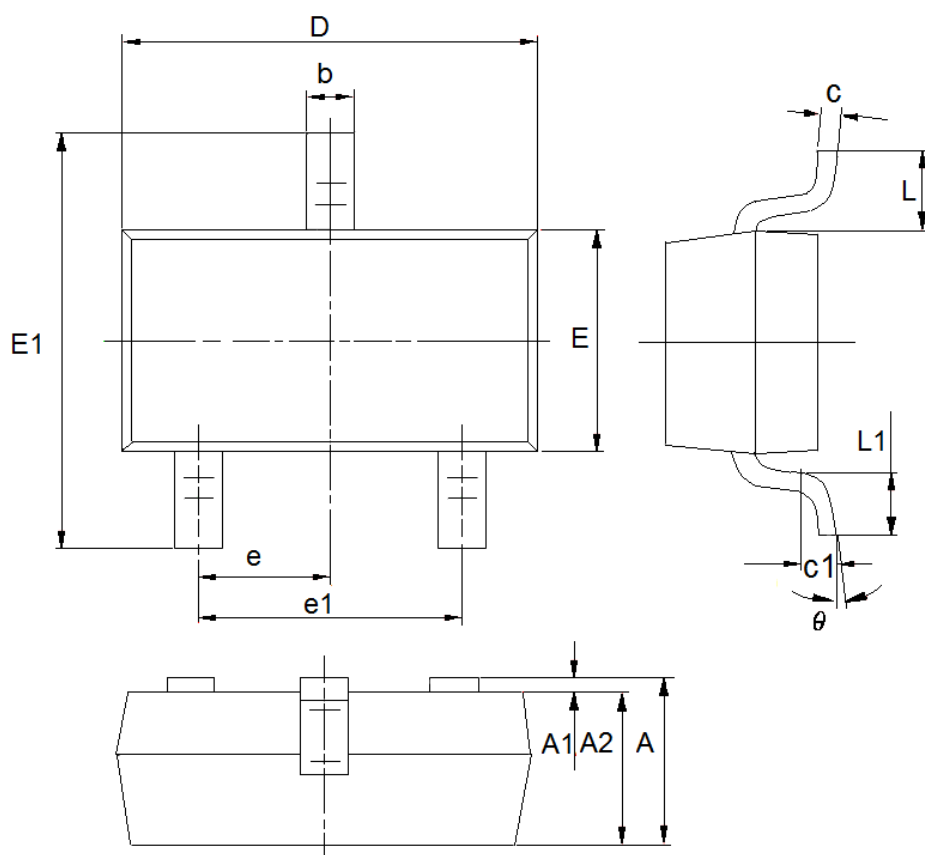
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.3	3.7	0.1299	0.1457
A1	1.1	1.4	0.0433	0.0551
b	0.38	0.55	0.015	0.0217
c	0.36	0.51	0.0142	0.0201
D	4.3	4.7	0.1693	0.185
D1	3.43	—	0.135	—
E	4.3	4.7	0.1693	0.185
e	1.27TYP		0.05TYP	
e1	2.44	2.64	0.0961	0.1039
L	14.1	14.5	0.5551	0.5709
h	0	0.38	0	0.015
Φ	—	1.6	—	0.063

● TO-92 (Paper Tape)



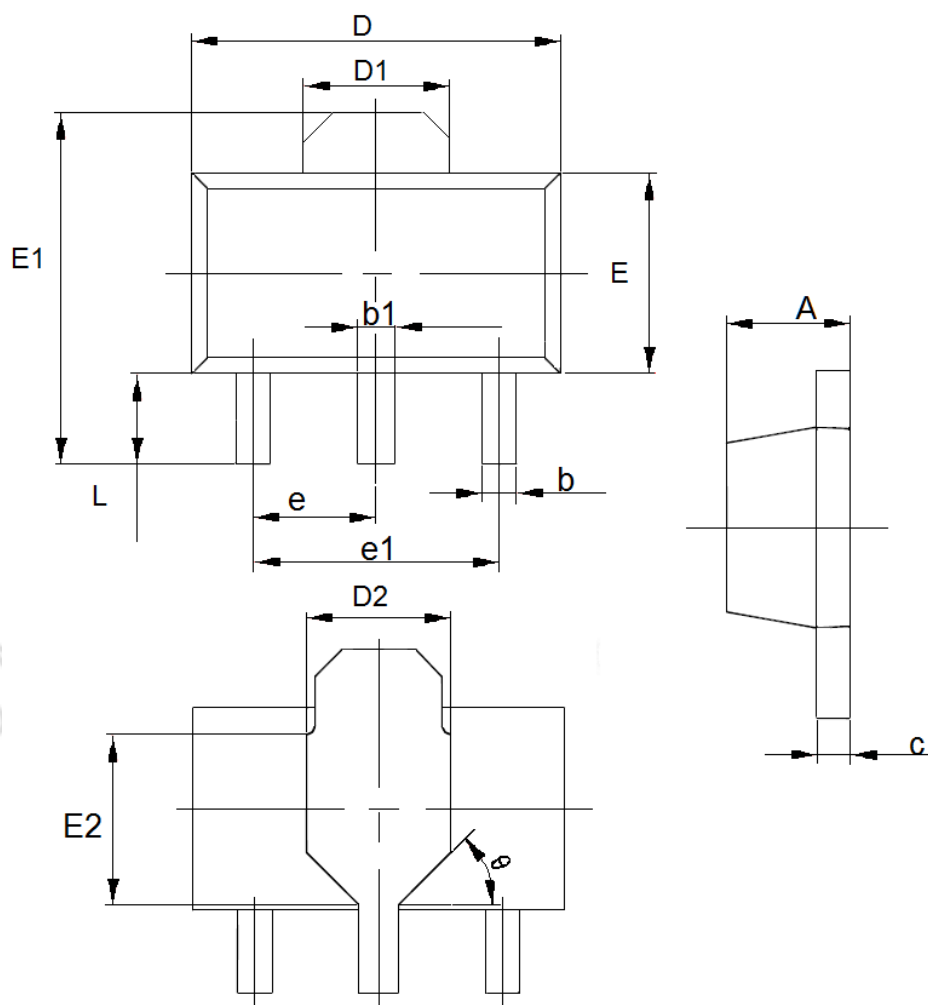
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.4	3.7	0.1339	0.1457
A1	1.15	1.4	0.0453	0.0551
b	0.36	0.5	0.0142	0.0197
c	0.38		0.0150	
D	4.4	4.7	0.1732	0.1850
E	4.4	4.7	0.1732	0.1850
e	2.2	2.8	0.0866	0.1102
Φ	1.5		0.0591	
θ	5°		5°	
h	0.2		0.0079	

● SOT23



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	0.9	1.15	0.0354	0.0453
A1	0	0.14	0.0000	0.0055
A2	0.9	1.05	0.0354	0.0413
b	0.28	0.52	0.0110	0.0205
c	0.07	0.23	0.0028	0.0091
D	2.8	3.0	0.1102	0.1181
e1	1.8	2.0	0.0709	0.0787
E	1.2	1.4	0.0472	0.0551
E1	2.2	2.6	0.0866	0.1024
e	0.95(TYP)		0.0374(TYP)	
L	0.55(TYP)		0.0217(TYP)	
L1	0.25	0.55	0.0098	0.0217
θ	0	8°	0.0000	8°
c1	0.25(TYP)		0.0098(TYP)	

● SOT89-3



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.4	1.6	0.0551	0.0630
b	0.32	0.52	0.0126	0.0205
b1	0.4	0.58	0.0157	0.0228
c	0.35	0.45	0.0138	0.0177
D	4.4	4.6	0.1732	0.1811
D1	1.55(TYP)		0.061(TYP)	
D2	1.75(TYP)		0.0689(TYP)	
e1	3.0(TYP)		0.1181(TYP)	
E	2.3	2.6	0.0906	0.1023
E1	3.94	4.4	0.1551	0.1732
E2	1.9(TYP)		0.0748(TYP)	
e	1.5(TYP)		0.0591(TYP)	
L	0.8	1.2	0.0315	0.0472
θ	45°		45°	

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