

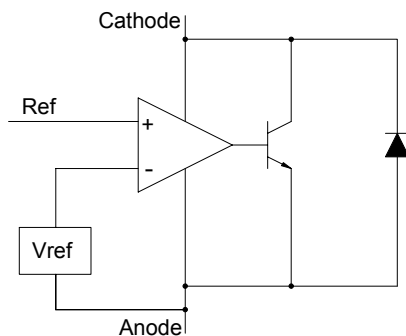


## Description

The SE431 is a low voltage three terminal adjustable shunt regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage can be set to any value between  $V_{REF}$  (approximately 2.5 V) to 18V with two external resistors. This device has a typical output impedance of  $0.2\Omega$ . Active output circuitry provides a very sharp turn on characteristic, making this device excellent replacement for Zener diodes in many applications.

The SE431 is characterized for operation from  $0^{\circ}\text{C}$  to  $105^{\circ}\text{C}$ , and five package options (SOT-23-3, SOT-23-5, SOP-8, TO-92 and SOT-89) allow the designer the opportunity to select the proper package for their applications.

## Block Diagram



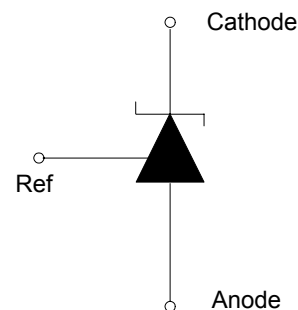
## Features

- Low voltage operation (2.5V)
- Adjustable output voltage  $V_0 = V_{REF}$  to 18V
- Wide operating current range  $120\mu\text{A}$  to 100mA
- Low dynamic output impedance  $0.2\Omega$  (Typ.).
- Trimmed bandgap design up to  $\pm 0.5\%$ .
- ESD rating is 5.5KV(Per MIL-STD-883D).
- Available in Lead Free Packages.

## Application

- Linear Regulators
- Adjustable Supplies
- Switching Power Supplies
- Battery Operated Computers
- Instrumentation
- Computer Disk Drives

## Symbol Diagram

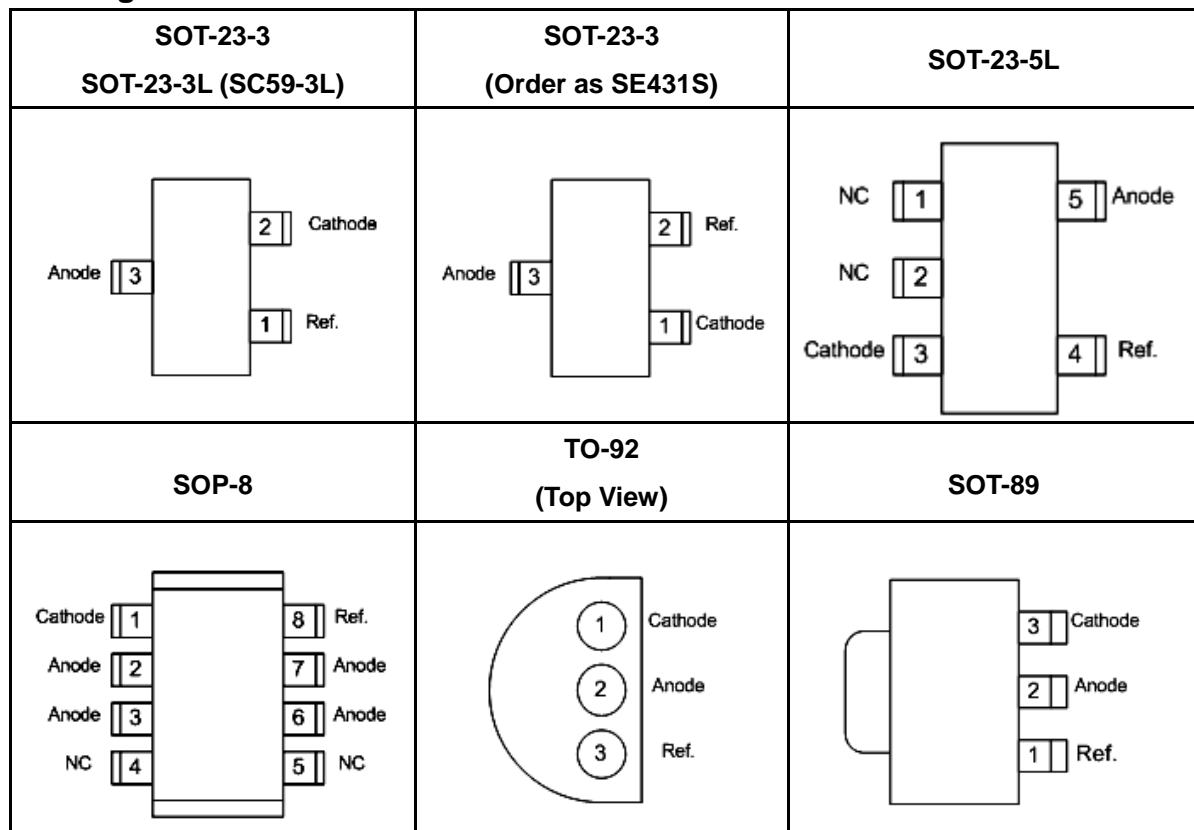




**Marking Information**

Package	Marking	Production Year Code	Production Week Code	Lead-Free Package
SOT-23-3 SC59-3L	SE431W	Starting with S, a bar on top of S is for production year 2001, and underlined S is for year 2002.	A-Z: 1-26 a-z: 27-52	Lead-free package is indicated by a dot on top of the week code.
SOT-23-3	S431W (SE431S)	The next character is marked on top for 2003, and underlined for 2004. The naming pattern continues		
SOT-23-5L	SE431W	with consecutive characters for later years.		
SOP-8	SE431 YYWW	YY is the year of production. 04 means the product is manufactured in year of 2004.	WW is the week of production. 26 means the product is manufactured in the 26 <sup>th</sup> week.	Lead-free package is indicated by LF after YYWW.
SOT-89	SE431 YYWW			
TO-92	SE431 YYWW			

**Pin Configuration**





**Absolute Maximum Ratings**

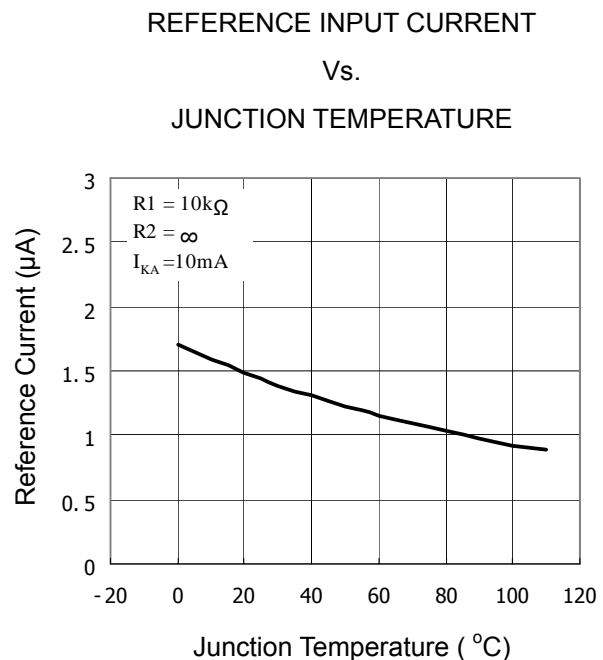
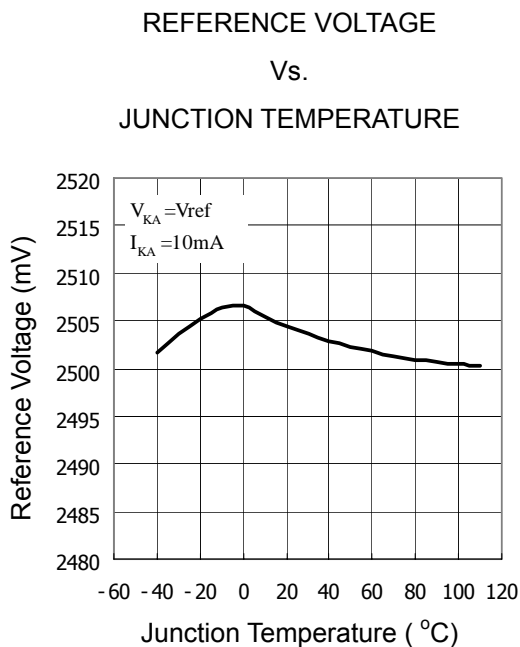
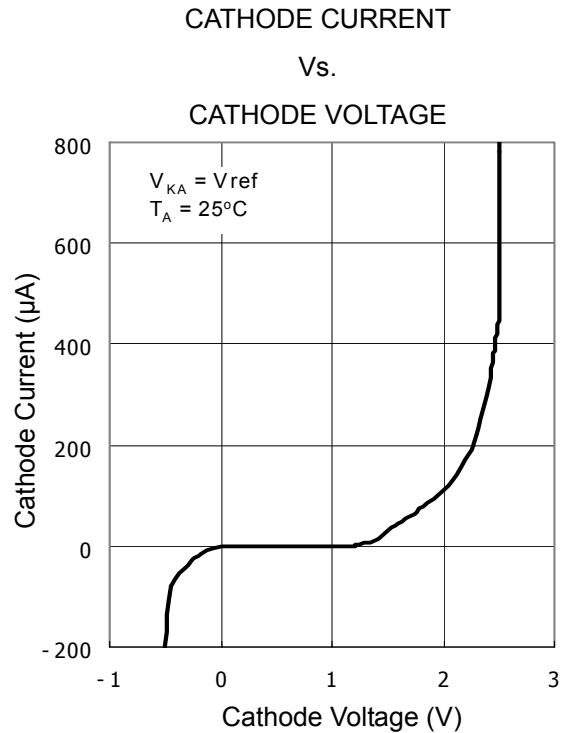
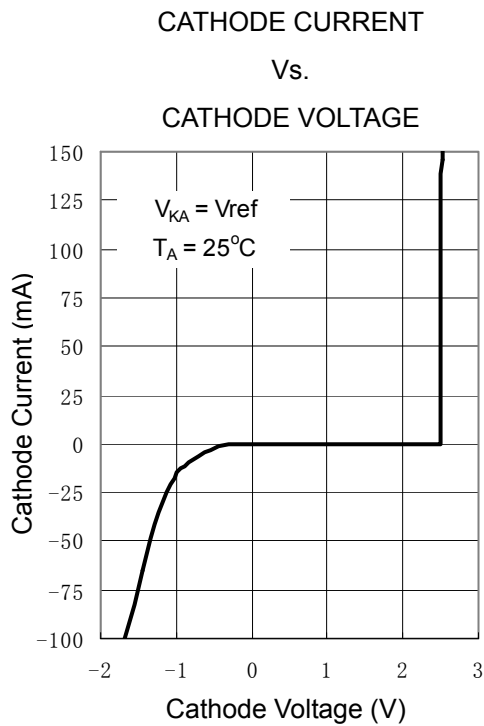
Parameter	Symbol	Maximum	Units
Cathode Voltage	$V_{KA}$	18	V
Continuous Cathode Current	$I_{KA}$	150	mA
Reference Current	$I_{REF}$	10	mA
Operating Junction Temperature Range	$T_J$	150	°C
Storage Temperature Range	$T_{STG}$	-65 to 150	°C
Thermal Resistance	$\theta_{JA}$	120 (SOT-89)	°C/W
		230 (SOT-23-3)	
		230 (SOT-23-5L)	
		150 (SOP-8)	
		220 (TO-92)	
Lead Temperature (Soldering) 10 seconds	$T_{LEAD}$	260	°C

**Electrical Characteristics**

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Voltage	$V_{REF}$	1	$V_{KA} = V_{REF}, I_{KA} = 10mA$	2483	2495	2507	mV
				2470	2495	2520	
				2445	2495	2545	
Deviation of reference voltage over full temperature range	$V_{I(dev)}$	1	$V_{KA} = V_{REF}, I_{KA} = 10mA$ $T_A = 0^\circ C \text{ to } 105^\circ C$	--	4	25	mV
Ratio of change in reference voltage to the change in cathode voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	2	$I_{KA} = 10mA,$ $\Delta V_{KA} = 10V - V_{REF}$	--	-1.4	-2.7	mV/V
Reference current	$I_{REF}$	2	$I_{KA} = 10mA,$ $R1=10k\Omega, R2 = \infty$	--	2	4	$\mu A$
Deviation of Reference current over full temperature range	$I_{I(dev)}$	2	$I_{KA} = 10mA, R1=10k\Omega,$ $R2 = \infty, T_A = 0^\circ C \text{ to } 105^\circ C$	--	0.4	1.2	$\mu A$
Minimum cathode current for regulation	$I_{MIN}$	1	$V_{KA} = V_{REF}$	--	0.2	1	mA
Off-state cathode current	$I_{OFF}$	3	$V_{KA} = 18V, V_{REF} = 0$	--	0.1	1	$\mu A$
Dynamic impedance	$Z_{KA}$	1	$I_{KA} = 1mA \text{ to } 100mA, V_{KA} = V_{REF}, f \leq 1kHz$	--	0.2	0.7	$\Omega$



Typical Performance Characteristics

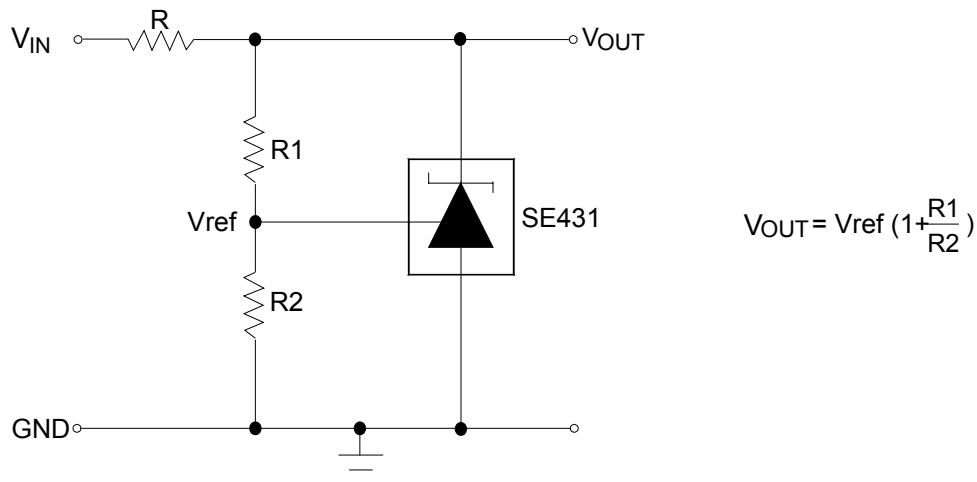




**Test Circuits**

<p><b>Test Circuit 1:</b> <math>V_{KA} = V_{REF}</math></p>	<p><b>Test Circuit 2:</b> <math>V_{KA} &gt; V_{REF}</math></p>	<p><b>Test Circuit 3:</b> <b>Off State Current</b></p>

**Application Diagram**



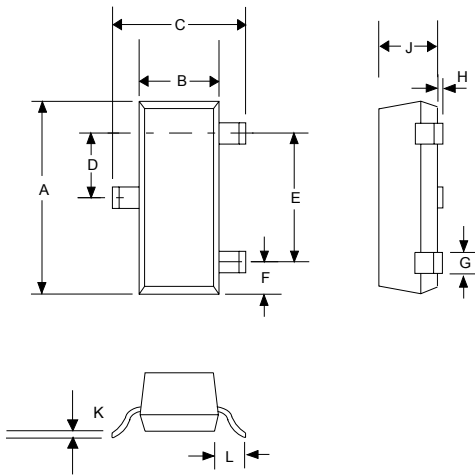
**Thermal Consideration**

Package	Power Rating ( $T_A=25^\circ\text{C}$ )	Power Rating ( $T_A=50^\circ\text{C}$ )	Power Rating ( $T_A=70^\circ\text{C}$ )
SOT-23-3 ( $\theta_{JA}=230^\circ\text{C/W}$ )	435mW	326mW	239mW
SOT-23-5L ( $\theta_{JA}=230^\circ\text{C/W}$ )	435mW	326mW	239mW
TO-92 ( $\theta_{JA}=220^\circ\text{C/W}$ )	455mW	341mW	250mW

1. Maximum junction temperature is  $125^\circ\text{C}$
2.  $\theta_{JA}$  is measured with packages mounted onboard under still-air condition with 1W power applied.
3. Power rating is calculated using  $P_D = (T_J - T_A) / \theta_{JA}$ , where  $T_J$  denotes junction temperature and  $T_A$  denotes ambient temperature.

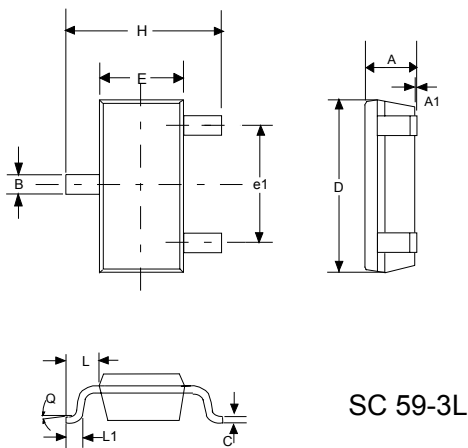


**OUTLINE DRAWING SOT-23-3**



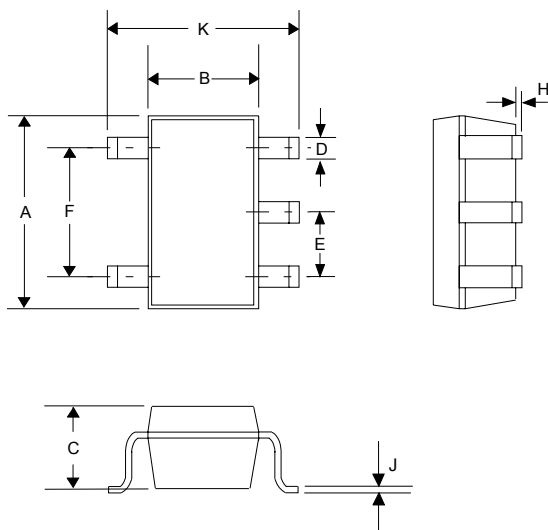
DIMENSIONS				
DIM <sup>N</sup>	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.110	0.120	2.80	3.04
B	0.047	0.055	1.20	1.40
C	0.083	0.104	2.10	2.64
D	0.035	0.040	0.89	1.03
E	0.070	0.080	1.78	2.05
F	0.018	0.024	0.45	0.60
G	0.015	0.020	0.37	0.51
H	0.0005	0.004	0.013	0.10
J	0.034	0.040	0.887	1.02
K	0.003	0.007	0.085	0.18
L	-	0.027	-	0.69

**OUTLINE DRAWING SC59-3L (SOT-23-3L)**



DIMENSIONS				
DIM <sup>N</sup>	INCHE		MM	
	MIN	MAX	MIN	MAX
A	0.035	0.043	0.90	1.10
A1	0.0004	0.005	0.01	0.13
B	0.012	0.020	0.30	0.50
C	0.004	0.008	0.09	0.20
D	0.110	0.122	2.80	3.10
H	0.098	0.122	2.50	3.10
E	0.059	0.067	1.50	1.70
e	0.037REF		0.95REF	
e1	0.075REF		1.90REF	
L1	0.008	0.022	0.20	0.55
L	0.014	0.031	0.35	0.80
Q	0°C	10°C	0°C	10°C

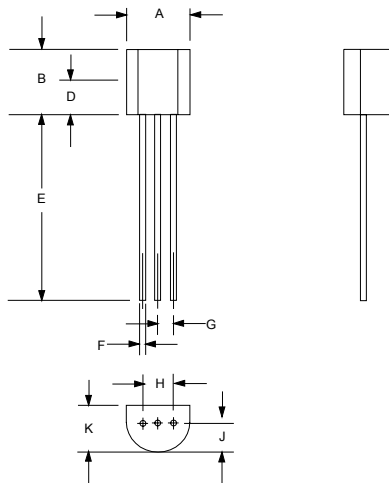
**OUTLINE DRAWING SOT-23-5L**



DIMENSIONS				
DIM <sup>N</sup>	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.110	0.120	2.80	3.05
B	0.059	0.070	1.50	1.75
C	0.036	0.051	0.90	1.30
D	0.014	0.020	0.35	0.50
E	-	0.037	-	0.95
F	-	0.075	-	1.90
H	-	0.006	-	0.15
J	0.0035	0.008	0.090	0.20
K	0.102	0.118	2.60	3.00

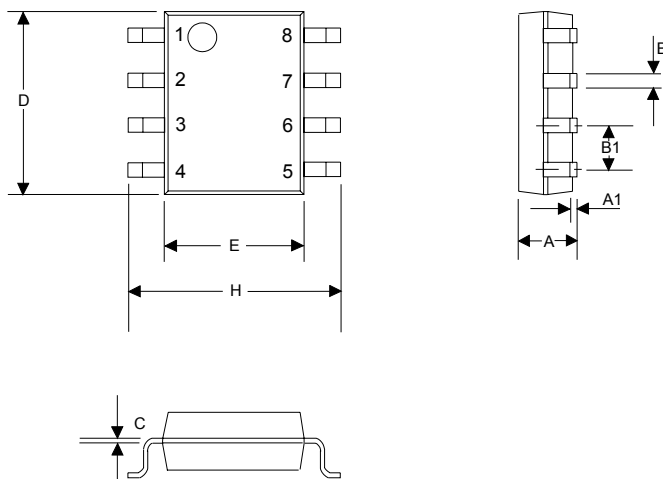


**OUTLINE DRAWING TO-92**



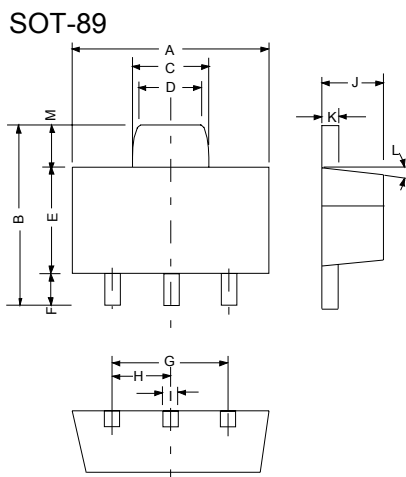
DIMENSIONS				
DIM <sup>N</sup>	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.445	5.207
B	0.170	0.210	4.318	5.334
E	0.500	0.610	12.70	15.50
F	0.016	0.021	0.407	0.533
G	0.045	0.055	1.143	1.397
H	0.095	0.105	2.413	2.667
J	0.080	0.105	2.032	2.667
K	0.125	0.165	3.175	4.191

**OUTLINE DRAWING SOP-8**



DIMENSIONS				
DIM <sup>N</sup>	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.0532	0.0688	1.35	1.75
A1	0.0040	0.0098	0.10	0.25
B	0.0130	0.0200	0.33	0.51
B1	0.050 BSC		1.27 BSC	
C	0.0075	0.0098	0.19	0.25
D	0.1890	0.1968	4.80	5.00
H	0.2284	0.2440	5.80	6.20
E	0.1497	0.1574	3.80	4.00

**OUTLINE DRAWING SOT-89**



DIMENSIONS				
DIM <sup>N</sup>	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.173	0.181	4.400	4.600
B	0.159	0.167	4.050	4.250
C	0.067	0.075	1.700	1.900
D	0.051	0.059	1.300	1.500
E	0.094	0.102	2.400	2.600
F	0.035	0.047	0.890	1.200
G	0.118REF		3.00REF	
H	0.059REF		1.50REF	
I	0.016	0.020	0.400	0.520
J	0.055	0.063	1.400	1.600
K	0.014	0.016	0.350	0.410
L	10°TYP		10°TYP	
M	0.028REF		0.70REF	



## **Customer Support**

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