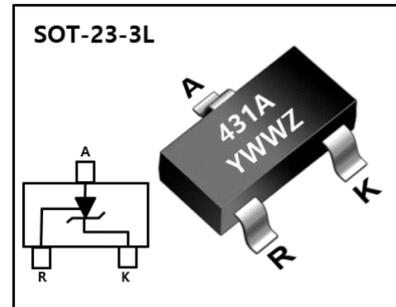




### Programmable Precision Shunt Regulator

#### Features

- Programmable output voltage 2.495V to 36V
- Guaranteed 1% Reference Voltage Tolerance
- Cathode Current Capability, 1mA to 100mA
- Low dynamic output impedance, typical value is 0.2Ω
- Quick Turn-on
- Voltage reference tolerance : **±0.5%(431B), ±1.0%(431A)**



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

Characteristic	Symbol	Rating	Unit
Cathode to Anode Voltage	V <sub>KA</sub>	37	V
Continuous Cathode Current Range	I <sub>K</sub>	-100 to +150	mA
Reference Input Current Range	I <sub>REF</sub>	-0.05 to +10	mA
Power Dissipation	P <sub>D</sub>	300	mW
Junction temperature	T <sub>J</sub>	150	°C
Operating temperature	T <sub>opr</sub>	-40~+85	
Storage temperature range	T <sub>stg</sub>	-55~150	

#### Electrical characteristics (T<sub>a</sub> = 25°C unless otherwise specified)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Reference Voltage	V <sub>ref</sub>	V <sub>KA</sub> = V <sub>ref</sub> , I <sub>K</sub> = 10mA	TL431A	2.470	2.495	2.520	V
			TL431B	2.482		2.508	
Reference input voltage Deviation over temperature	ΔV <sub>ref</sub>	V <sub>KA</sub> = V <sub>ref</sub> , I <sub>K</sub> = 10mA @ -40°C ≤ T <sub>a</sub> ≤ 85°C	-	4.5	17	V	
Ratio of delta reference input voltage to delta cathode voltage	ΔV <sub>ref</sub> / ΔV <sub>KA</sub>	I <sub>K</sub> = 10mA	ΔV <sub>KA</sub> = 10V to V <sub>ref</sub>	-	-1.4	-2.7	mV/V
			ΔV <sub>KA</sub> = 36V to 10V	-	-1.5	-2.0	
Reference current	I <sub>ref</sub>	I <sub>K</sub> = 10mA, R <sub>1</sub> = 10KΩ, R <sub>2</sub> = ∞	-	1.8	4	μA	
Reference input current deviation over temperature	ΔI <sub>ref</sub>	I <sub>K</sub> = 10mA, R <sub>1</sub> = 10KΩ, R <sub>2</sub> = ∞ @ -40°C ≤ T <sub>a</sub> ≤ 85°C	-	0.4	1.2	μA	
Minimum cathode current for regulation	I <sub>K(MIN)</sub>	V <sub>KA</sub> = V <sub>ref</sub>	-	0.5	1.0	mA	
Off-state cathode current	I <sub>K(off)</sub>	V <sub>KA</sub> = 36V, V <sub>ref</sub> = 0V	-	0.05	1.0	μA	
Dynamic impedance	Z <sub>KA</sub>	V <sub>KA</sub> = V <sub>ref</sub> , f ≤ 1.0KHz 1.0mA ≤ I <sub>K</sub> ≤ 100mA	-	0.20	0.5	Ω	

#### Note

1) ΔV<sub>ref</sub> is defined as the difference between the maximum and minimum values obtained over the full temperature range.  
ΔV<sub>ref</sub> = V<sub>ref max.</sub> - V<sub>ref min.</sub>

2) The dynamic Impedance is defined as | Z<sub>KA</sub> | = ΔV<sub>KA</sub> / ΔI<sub>K</sub>



### TEST CIRCUITS

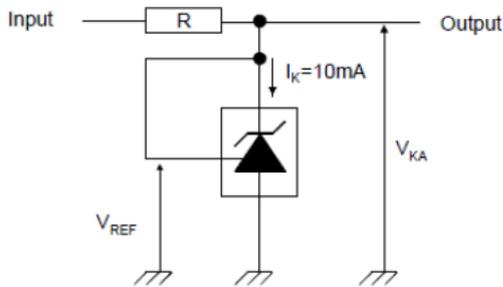


Figure 1 : Test Circuit for  $V_{KA} = V_{REF}$

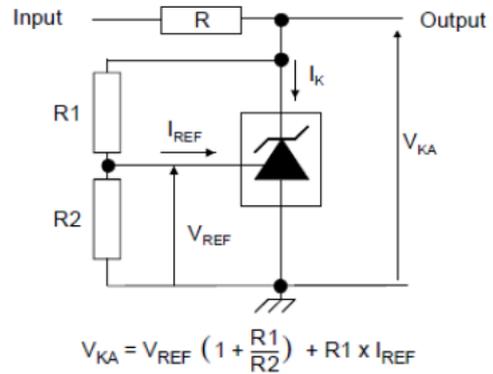


Figure 2 : Test Circuit for  $V_{KA} > V_{REF}$

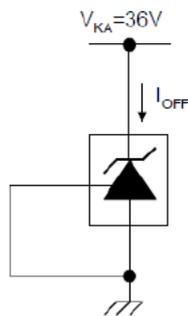


Figure 3 : Test Circuit for  $I_{OFF}$

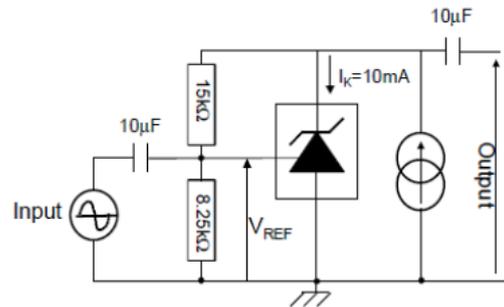


Figure 4 : Test Circuit for Phase Margin and Voltage Gain

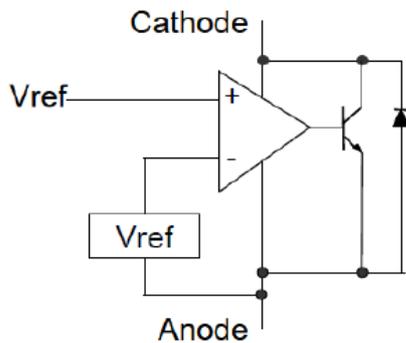


Figure 5 : Block diagram of TL431

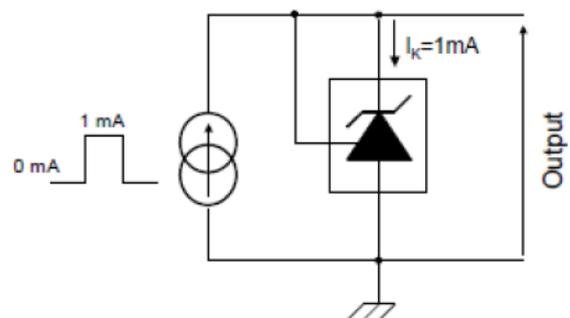


Figure 6 : Test Circuit for Response time



### Electrical Characteristic Curves

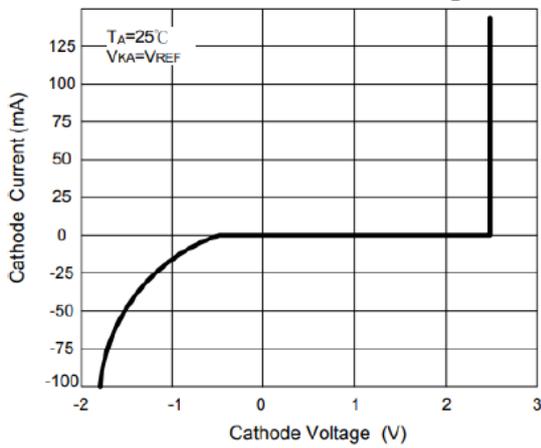


Figure 7. Cathode Current vs. Cathode Voltage

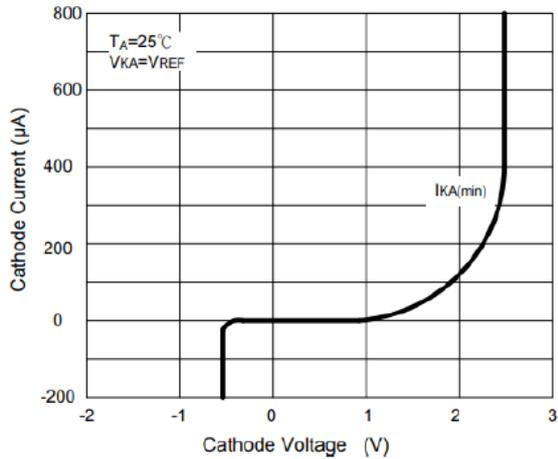


Figure 8. Cathode Current vs. Cathode Voltage

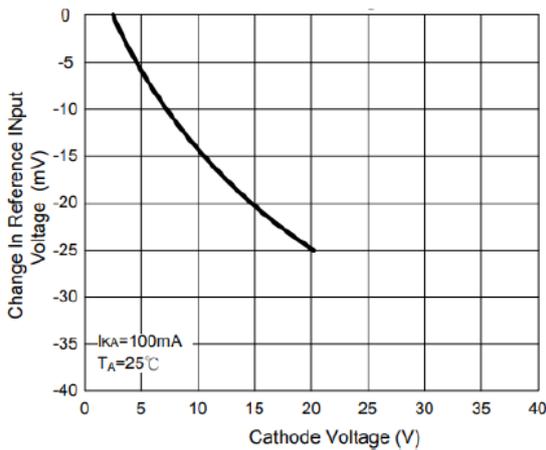


Figure 9. Change In Reference Input Voltage vs. Cathode Voltage

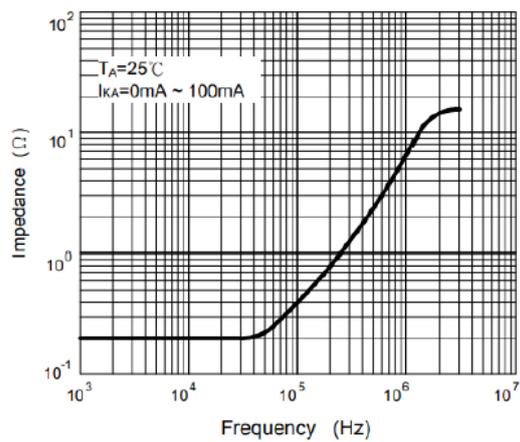


Figure 10. Dynamic Impedance Frequency

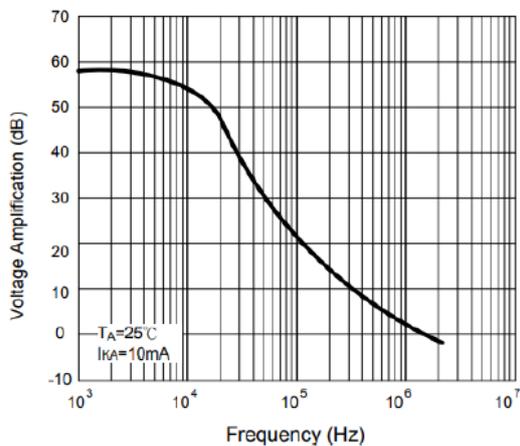


Figure 11. Small Signal Voltage Amplification vs. Frequency

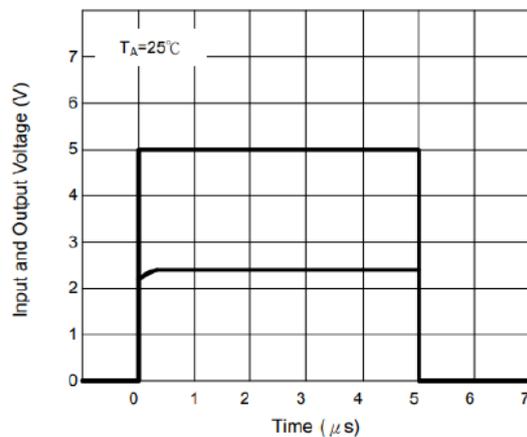


Figure 12. Pulse Response



**Package Dimensions**

**SOT-23 Outline Dimension**

**Unit : mm**

Dim	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.15	0.035	0.045
A1	0.00	0.10	0.000	0.004
A2	0.90	1.05	0.035	0.041
b	0.30	0.50	0.012	0.020
c	0.08	0.15	0.003	0.006
D	2.80	3.00	0.110	0.118
E	1.20	1.40	0.047	0.055
E1	2.25	2.55	0.089	0.100
e	0.90	1.00	0.035	0.039
e1	1.80	2.00	0.071	0.079
L	0.50	0.60	0.020	0.024
L1	0.30	0.50	0.012	0.020

**Ordering Information**

Part No	Package	Marking	Packing	Finish	Halogen	Packing Unit
TL431AS	SOT23-3L	<b>431A</b>	Reel taping 3,000pcs/reel	Sn	Free	30,000pcs
TL431BS	SOT23-3L	<b>431B</b>				10reels



### Revision History

No	Date	Contents
1	2020-01-30	Initial Brief Datasheet Release

<http://www.apsemi.com>

### IMPORTANT NOTICE

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