WR431

ADJUSTABLE PRECISION SHUNT REGULATORS

1. Description

The WR431 is a high precision, highly stable, three-terminal adjustable shunt regulator with reliable thermal stability.

The output voltage of the WR431 can be set to any value between VREF (2.5V) and the corresponding maximum cathode voltage (36V) by means of two external resistors.

The active output circuitry provides a very sharp turn-on characteristic, making these devices an excellent replacement for Zener diodes in many applications such as on-board regulation, adjustable regulators and switching power supplies.

The low temperature drift and low reference current of the WR431 ensure a highly accurate system. The WR431 precision reference offers two voltage tolerances: 0.4% and 0.8%. The IC is available in 2 packages, SOT23 and SOT89.

The WR431 devices have an operating temperature range of -40°C to 125°C.

2. Features

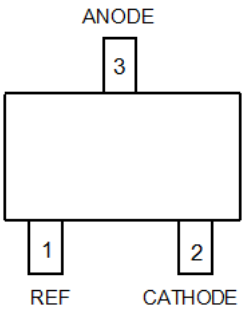
- Adjustable output voltage: V_{ref} to 36V
- Low Temperature Drift: 6mV Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages: SOT23, SOT89
- High Stability under Capacitive Load
- Low Equivalent Full-range Temperature Coefficient with 20 PPM/°C Typical

3. Applications

- Precision voltage and current referencing
- Voltage monitoring
- Switching Power Supply
- Comparator with integrated reference
- Zener replacement

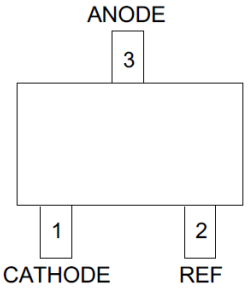
4. Pin Assignments

(Top View)



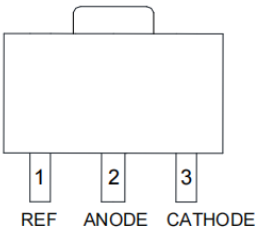
SOT23（S30）

(Top View)



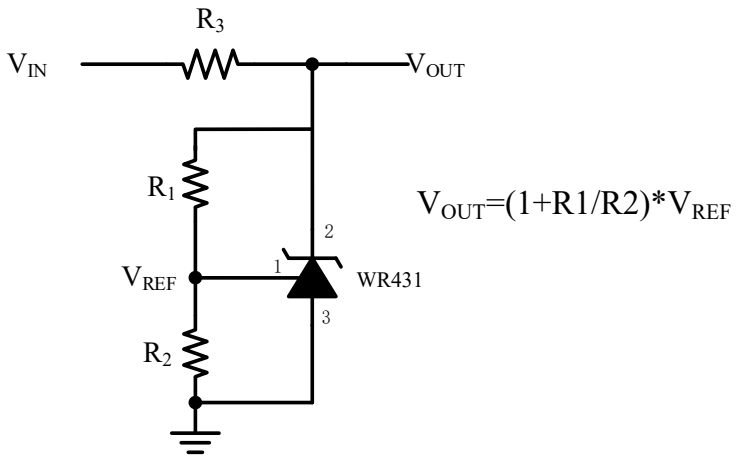
SOT23 (S31)

(Top View)

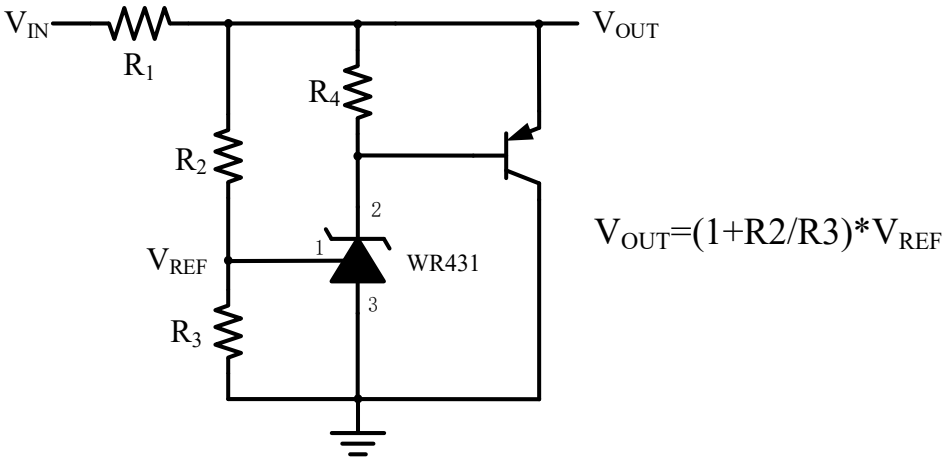


SOT89-3

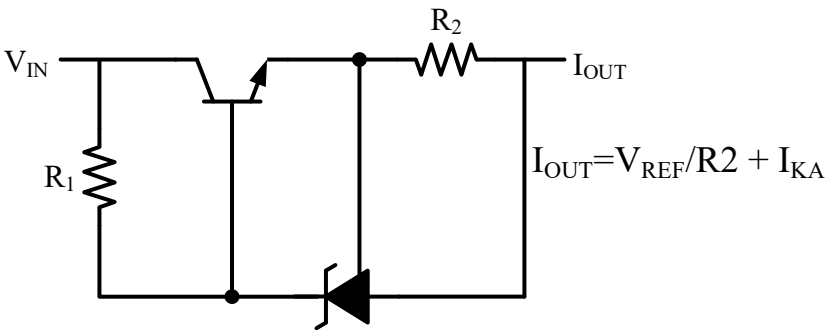
5. Typical Applications Circuit



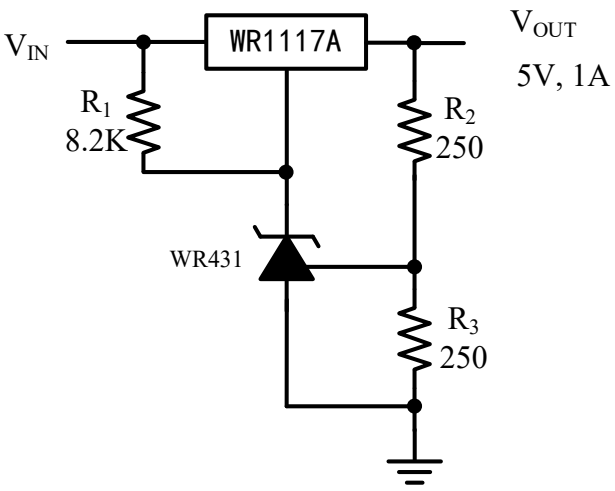
Shunt Regulator



High Current Shunt Regulator

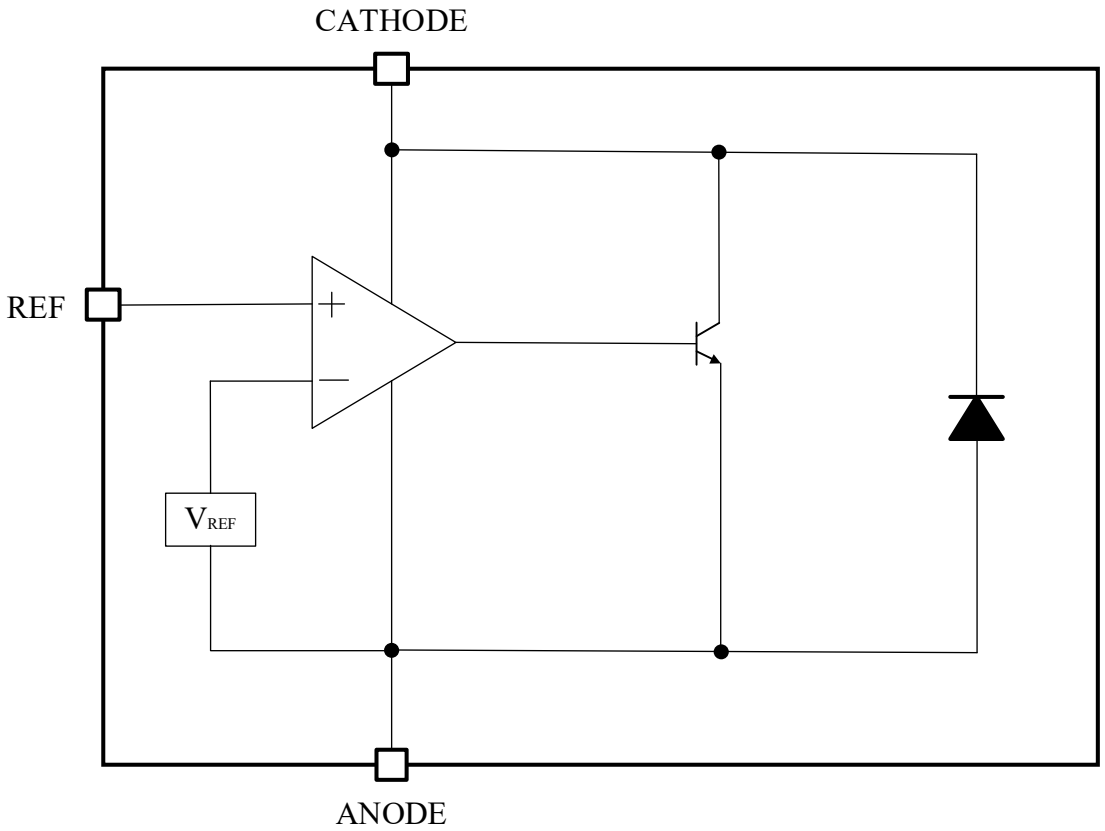


Current Source or Current Limit



Precision 5V 1A Regulator

6. Functional Block Diagram



7. Absolute Maximum Ratings[1]

Symbol	Parameter		Rating	Unit
V_{KA}	Cathode Voltage		40	V
I_{KA}	Cathode Current Range (Continuous)		-100 to 150	mA
I_{REF}	Reference Input Current Range		10	
P_D[2]	Power Dissipation	SOT23	370	mW
	$P_{D(MAX)}$@T_A =25℃	SOT89	770	
θ_{JA} [3]	Junction-to-ambient thermal resistance	SOT23	210	°C/W
		SOT89	55	
θ_{JC}	Junction-to-case (top) thermal resistance	SOT23	80	
		SOT89	20	
T_J	Junction Temperature		+150	°C
T_{STG}	Storage Temperature Range		-65 to +150	
ESD	ESD (Human Body Model)		2000	V

NOTE1: Greater than these given values, the device will be damaged.

NOTE2: Power dissipation is calculate by $P_{D(MAX)} = (T_J - T_A) / R_{\theta JA}$.

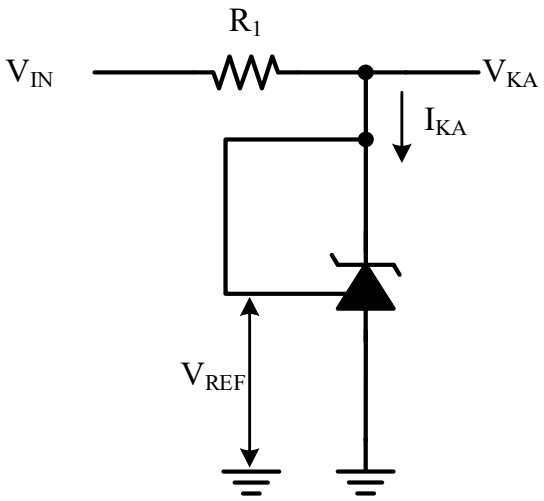
NOTE3: Measured on 2cm x 2cm 2-layer FR4 PCB board, 1 oz copper, no via holes on GND copper.

8. Recommended Operating Conditions

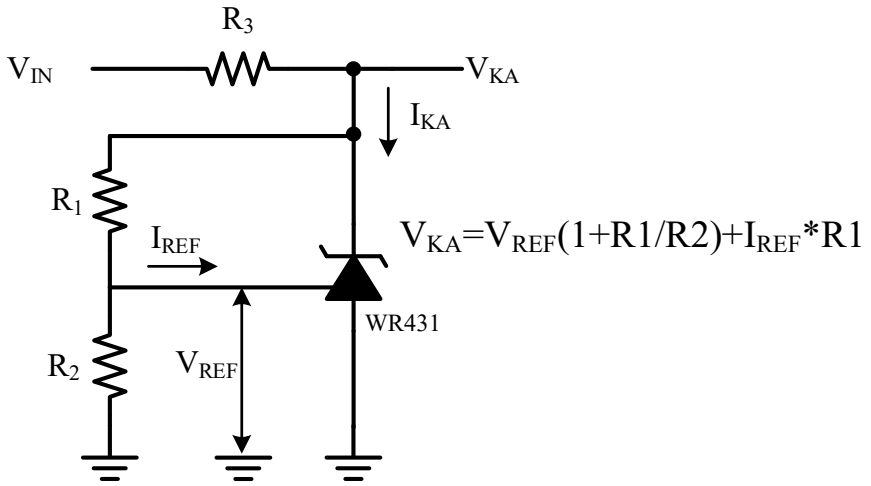
Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	1.0	100	mA
T_A	Operating Ambient Temperature Range	-40	+125	°C

9. Electrical Characteristics (@T_A=+25℃, unless otherwise noted)

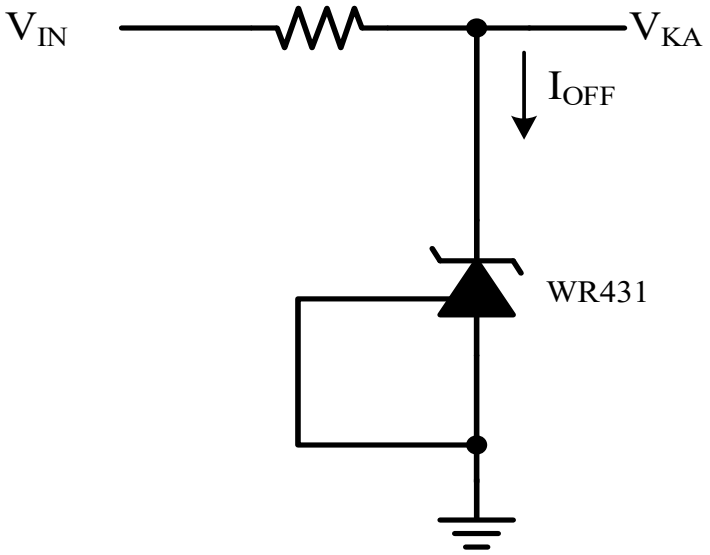
Symbol	Parameter		Conditions		Test Circuit	Min	Typ	Max	Unit
V_{REF}	Reference Voltage	0.4%	V_{KA} = V_{REF}, I_{KA} = 10mA		Test Circuit 1	2.490	2.500	2.510	V
		0.8%				2.480	2.500	2.520	
ΔV_{REF}	Deviation of Reference Voltage Over Full Temperature Range		V_{KA}=V_{REF}, I_{KA} = 10mA	0 to +70°C	Test Circuit 1	—	6	14	mV
				-40 to +85°C		—	7	16	
				-40 to +125°C		—	9	20	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Voltage to the Change in Cathode Voltage		I_{KA} = 10mA	ΔV_{KA} =10V to V_{REF}	Test Circuit 2	—	-1.0	-2.7	mV/V
				ΔV_{KA} = 36V to 10V		—	-0.5	-2.0	
I_{REF}	Reference Current		I_{KA} = 10mA, R1 = 10kΩ, R2 =∞		Test Circuit 2	—	1.0	4	μA
ΔI_{REF}	Deviation of Reference Current Over Full Temperature Range		I_{KA} = 10mA, R1 = 10kΩ R2 = ∞, T_A = -40 to +125°C		Test Circuit 2	—	0.4	1.2	μA
I_{KA} (Min)	Minimum Cathode Current for Regulation		V_{KA} = V_{REF}		Test Circuit 1	—	0.4	1.0	mA
I_{KA} (Off)	Off-state Cathode Current		V_{KA} = 36V, V_{REF} = 0		Test Circuit 3	—	0.04	1.0	μA
Z_{KA}	Dynamic Impedance		V_{KA} = V_{REF}, I_{KA} = 1 to 100mA, f ≤ 1.0kHz		Test Circuit 1	—	0.15	0.5	Ω



Test Circuit 1 for V_{KA} = V_{REF}



Test Circuit 2 for V_{KA} > V_{REF}



Test Circuit 3 for I_{OFF}

10. Typical Performance Characteristics

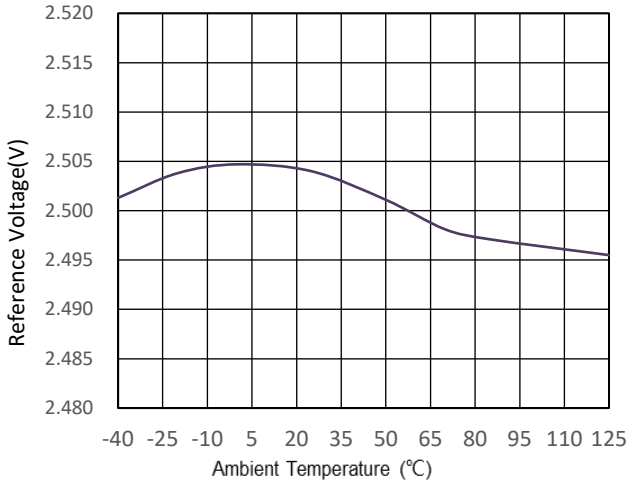


Figure 1. Reference Voltage vs. Ambient Temperature

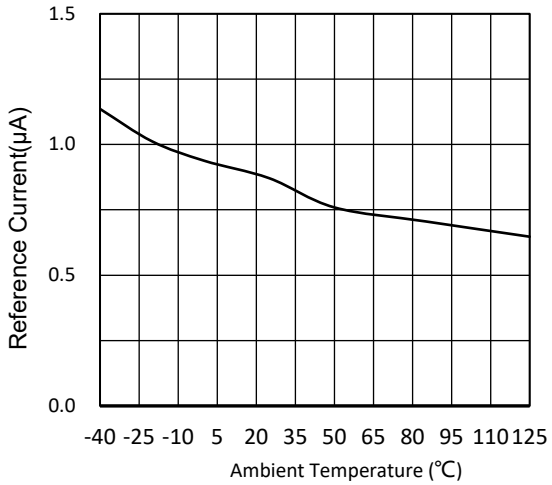


Figure 2. Reference Current vs. Ambient Temperature

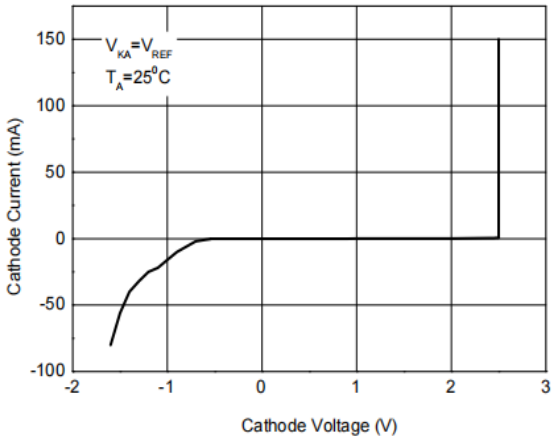


Figure 3. Cathode Current vs. Cathode Voltage

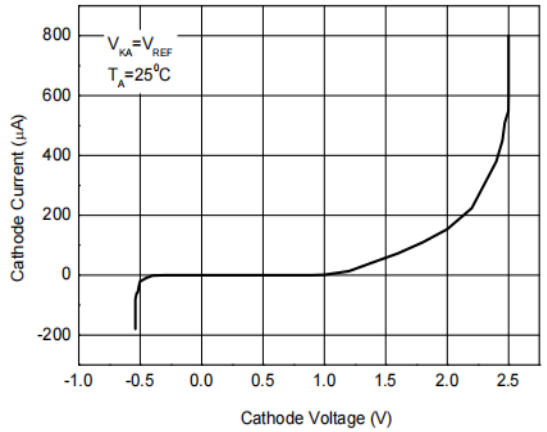


Figure4. Cathode Current vs. Cathode Voltage

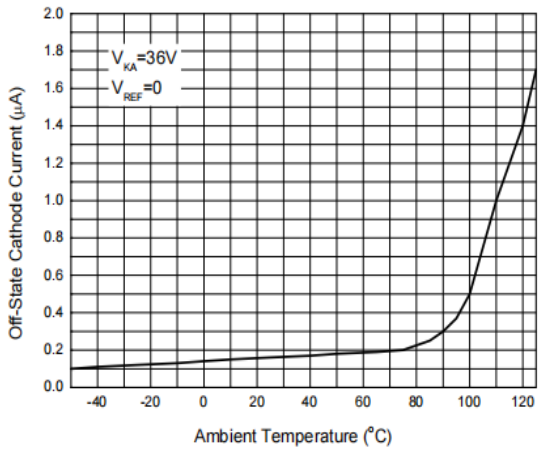


Figure 5. Off-State Cathode Current vs. Ambient Temperature

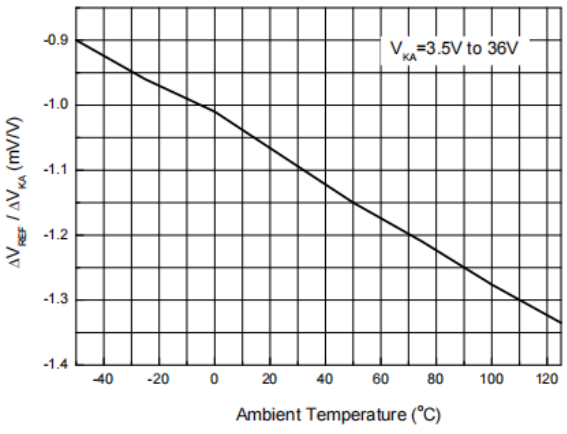


Figure 6. Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage

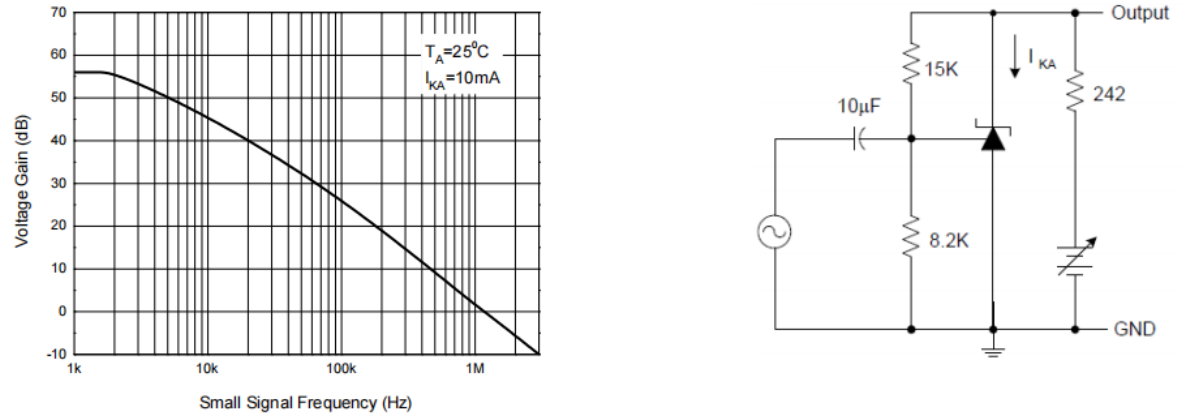


Figure 7. Small Signal Voltage Gain vs. Frequency

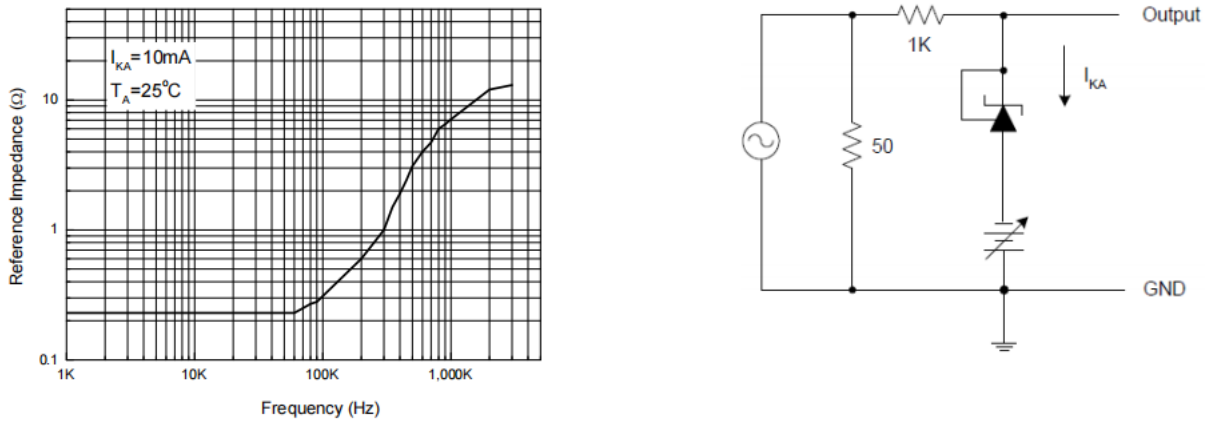


Figure 8. Reference Impedance vs. Frequency

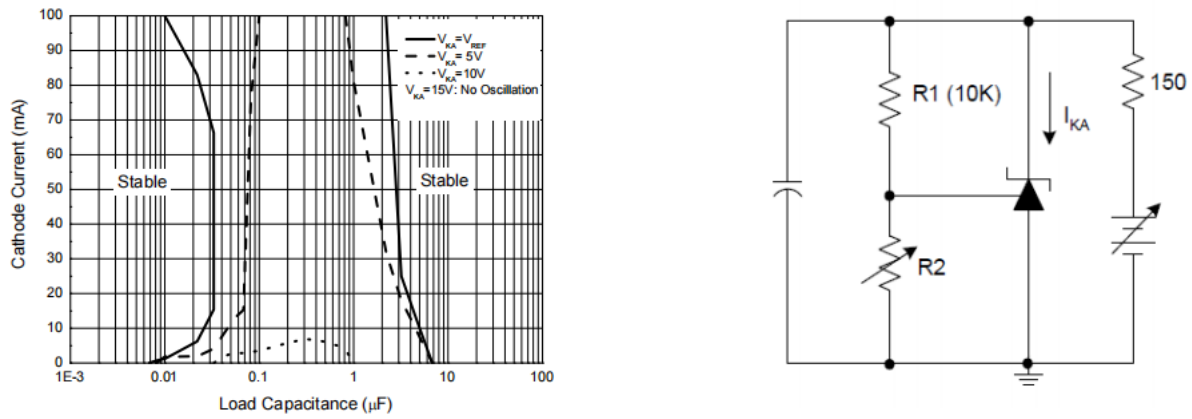


Figure 9. Stability Boundary Conditions vs. Load Capacitance

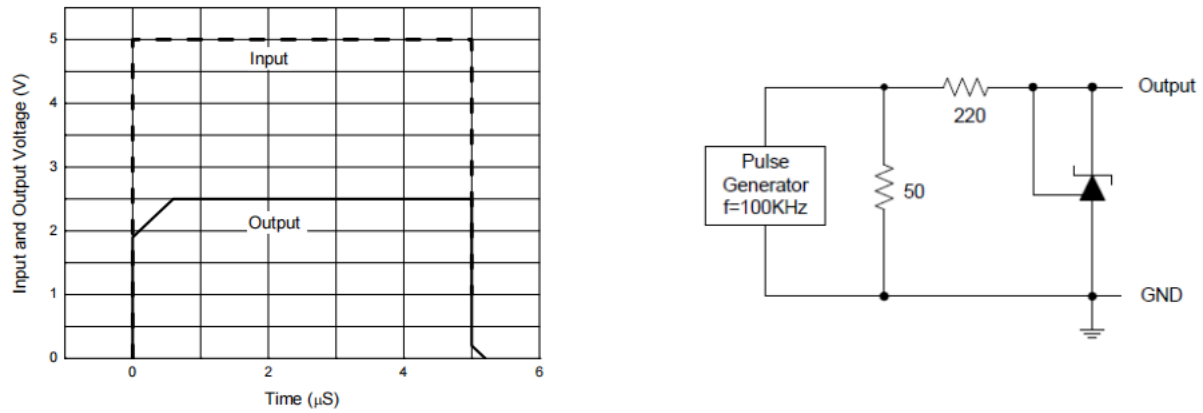
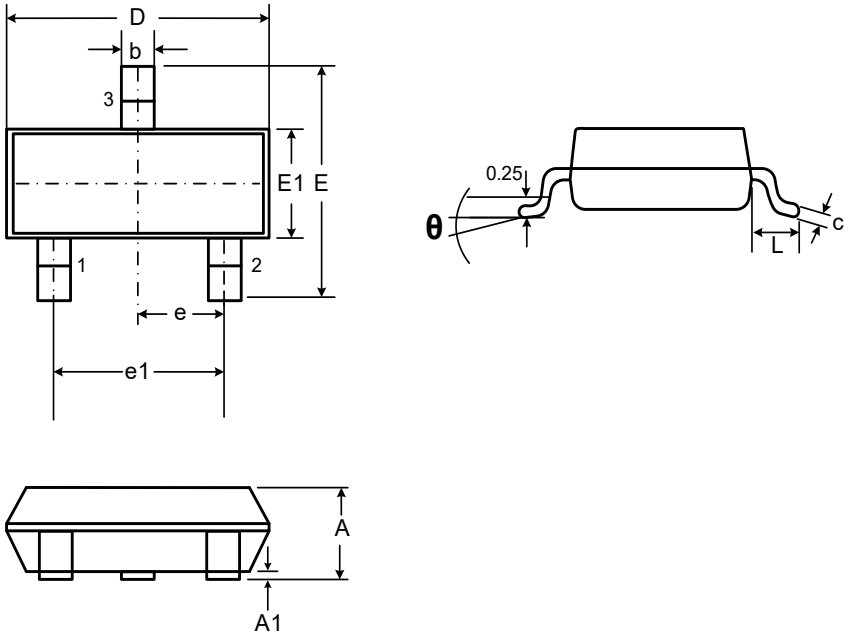


Figure 10. Pulse Response of Input and Output Voltage

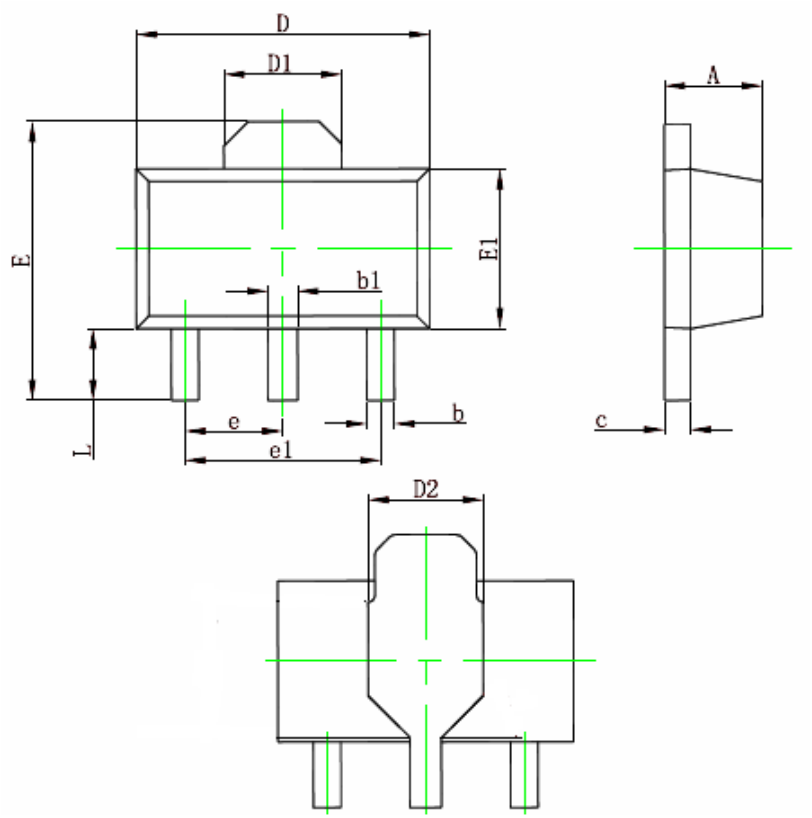
11. Package Information

SOT -23



SYMBOL	MILLIMETER	
	MIN	MAX
A	0.90	1.15
A1	0.00	0.10
b	0.30	0.50
c	0.07	0.15
D	2.80	3.04
E	2.25	2.64
E1	1.20	1.40
e	0.95 BSC	
E1	1.80	2.00
L	0.55REF	
θ	0°	8°

SOT89-3L



SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.4	1.5	1.6
b	0.320	0.420	0.520
b1	0.380	0.480	0.580
c	0.350	0.405	0.460
D	4.400	4.500	4.600
D1	1.65REF		
D2	1.700	1.950	2.200
E	3.940	4.120	4.300
E1	2.300	2.450	2.600
e	1.5BSC		
e1	3.00BSC		
L	0.800	1.000	1.200

12. Ordering Information

Part Number	Voltage Tolerance	Output Voltage	Package	Packing Quantity	Marking*
WR431-AS30R	0.4%	2.5V	SOT-23	3K/Reel	WR431 A XXXX
WR431-BS30R	0.8%	2.5V	SOT-23	3K/Reel	WR431 B XXXX
WR431-AS31R	0.4%	2.5V	SOT-23	3K/Reel	WR431 A XXXX
WR431-BS31R	0.8%	2.5V	SOT-23	3K/Reel	WR431 B XXXX
WR431-AA20R	0.4%	2.5V	SOT89-3	1K/Reel	WR431 A XXXX
WR431-BA20R	0.8%	2.5V	SOT89-3	1K/Reel	WR431 B XXXX

* XXXX is variable.

STATEMENTS

WAY-ON provides data sheets based on the actual performance of the device, and users should verify actual device performance in their specific applications. The device characteristics and parameters in this data sheet can and do vary from application to application, and actual device performance may change over time.This information is intended for developers designing with WAY-ON products. Users are responsible for selecting the appropriate WAY-ON product for their application and for designing and verifying the application to ensure that your application meets the appropriate standards or other requirements, and users are responsible for all consequences. Specifications are subject to change without notice.

Contact Information

No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201202
Tel: 86-21-68960674 Fax: 86-21-50757680 Email: market@way-on.com
WAYON website: http://www.way-on.com
For additional information, please contact your local Sales Representative.