

General Description:

The TL431 series ICs are three-terminal adjustable shunt regulators with guaranteed thermal stability over a full operation range. These ICs feature very 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 TL431 is especially suitable for industry applications types.

The TL431 precision reference is offered in one band- gap tolerance: A: 0.5%.

The TL431 are characterized for operation from -40°C to 125°C .

Features:

- Reference Voltage Tolerance at 25°C -0.5% (A Grade)
- Adjustable Output Voltage: V_{REF} to 36 V
- Operation From -40°C to 125°C
- Typical Temperature Drift
 - -10mV (-40 to 85°C)
 - -20mV (-40 to 125°C)
- Low Output Noise
- Sink-Current Capability: 0.12 mA to 100 mA

Applications:

- Precision Voltage Reference
- Switching Power Supply
- Charger
- Voltage Adapter
- Adjusted Power Supply

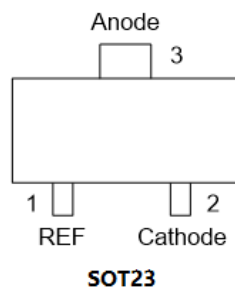


Figure 1. Package types of TL431

Ordering Information

Device Name	Package Types	Accuracy	Mark ID	Operating Free-Air Temperature (TA)
TL431AN	SOT23	0.5%	431	-40°C to 125°C

Functional Block Diagram:

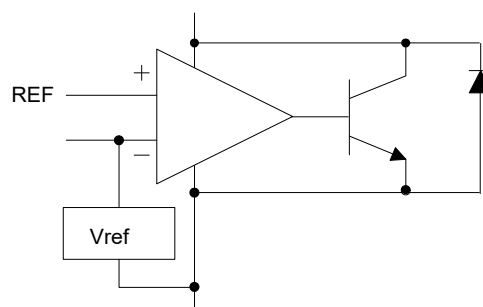


Figure 2. Functional Block Diagram of TL431

Adjustable shunt voltage reference IC

Absolute Maximum Ratings:

(Operation temperature range applies unless otherwise specified.)

Parameter	Symbol	Range	Unit
Cathode voltage	V_{KA}	40	V
Continuous cathode current	I_{KA}	-100 to 100	mA
Reference input current range	I_{REF}	-0.05 to 10	mA
Maximum junction temperature	T_{JMAX}	150	°C
Maximum lead temperature	T_{LEAD}	260	°C
Storage temperature	T_{STG}	-65 to 150	°C
Thermal resistance SOT23	θ_{JC}	76	°C/W
ESD rating	CDM	+/-1000	V

Note: 1. Absolute maximum ratings indicate stresses beyond which may cause permanent damage to the device.

Recommended Operation Ratings:

Parameter	Symbol	Min.	Max.	Unit
Cathode Voltage	V_{KA}	V_{REF}	40	V
Cathode Current	I_{KA}	0.4	80	mA
Operating Ambient Temperature Range		-40	125	°C

Electrical Characteristics:(Typical and limits appearing in normal tape apply for $T_J=25^{\circ}\text{C}$ unless otherwise noted.)

Parameter		Test Circuit	Symbol	Conditions	TL431			Unit
					Min.	Typ.	Max.	
Reference Voltage	A: 0.5%	Fig.3	V_{REF}	$V_{\text{KA}}=V_{\text{REF}}, I_{\text{KA}}=10\text{mA}$	2.484	2.497	2.509	V
Deviation of Reference Voltage Over-Temperature		Fig.3	ΔV_{REF}	$V_{\text{KA}}=V_{\text{REF}}, I_{\text{KA}}=10\text{mA}$ -40 to 85°C	-	10	15	mV
				-40 to 125°C	-	10	25	
Ratio of Change in Reference Voltage to the Change in Cathode Voltage		Fig.4	$\frac{\Delta V_{\text{REF}}}{\Delta V_{\text{KA}}}$	$I_{\text{KA}}=10\text{mA}$ $\Delta V_{\text{KA}}=10\text{V to } V_{\text{REF}}$	-	-1.0	-2.7	mV/V
				$\Delta V_{\text{KA}}=36\text{V o } 10\text{V}$	-	-0.5	-2.0	
Reference Current		Fig.4	I_{REF}	$I_{\text{KA}}=10\text{mA}, R1=10\text{k}\Omega, R2=\infty$	-	0.7	4	μA
Deviation of Reference Current Over Full Temperature Range		Fig.4	ΔI_{REF}	$I_{\text{KA}}=10\text{mA}, R1=0\text{k}\Omega, R2=\infty, T_A=-40 \text{ to } 105^{\circ}\text{C}$	-	0.4	1.2	μA
Minimum Cathode Current for Regulation		Fig.4	$I_{\text{KA}}(\text{MIN})$	$V_{\text{KA}}=V_{\text{REF}}$	-	0.12	0.5	mA
Off-State Cathode Current		Fig.5	$I_{\text{KA}}(\text{OFF})$	$V_{\text{KA}}=36\text{V}, V_{\text{REF}}=0$		0.1	0.5	μA
Dynamic Impedance		Fig.3	$ Z_{\text{KA}} $	$V_{\text{KA}}=V_{\text{REF}}, I_{\text{KA}}=1 \text{ to } 80\text{mA}, f \leq 1.0\text{kHz}$	-	0.2	0.5	Ω

Parameter Measurement Information

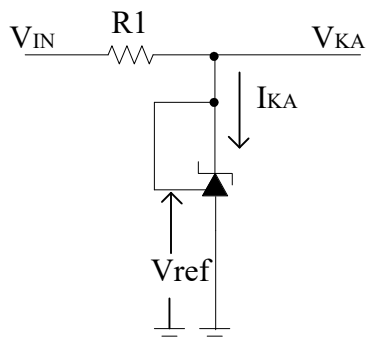


Figure 3. Test Circuit for $V_{KA}=V_{ref}$

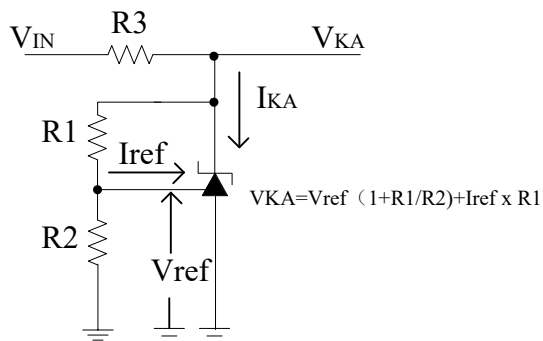


Figure 4. Test Circuit for $V_{KA}>V_{ref}$

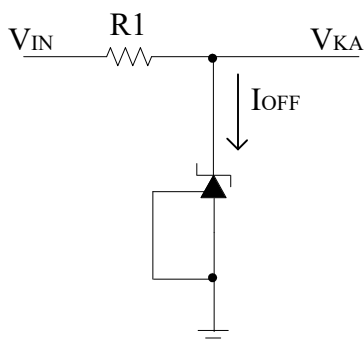
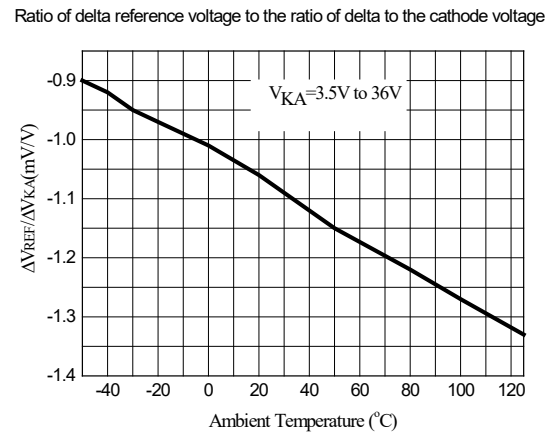
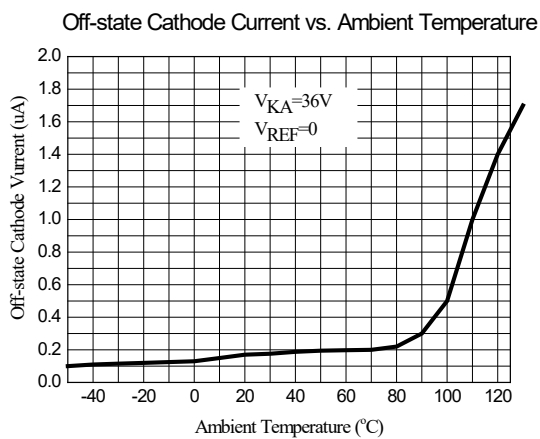
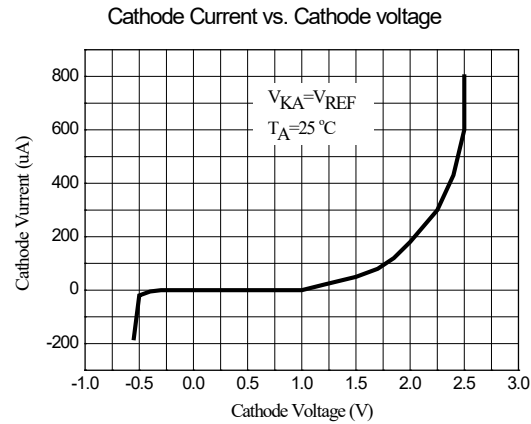
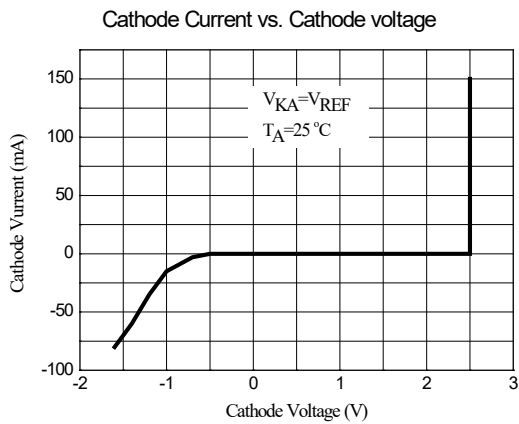
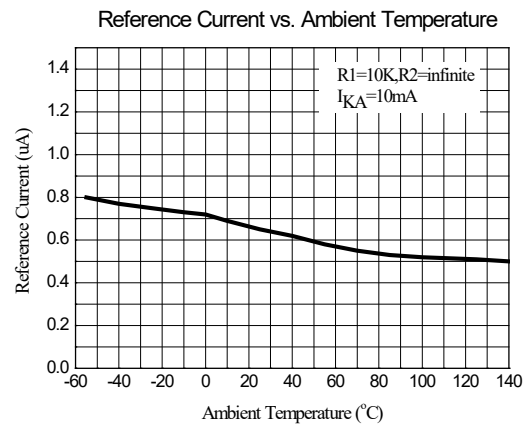
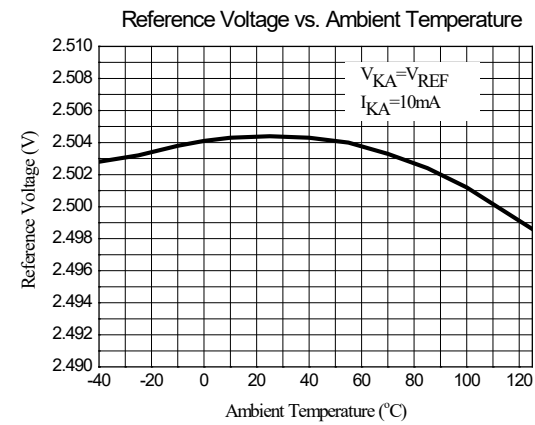


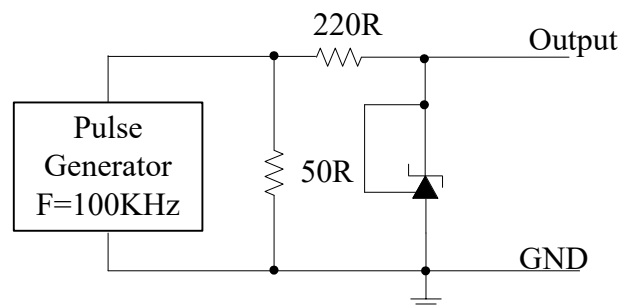
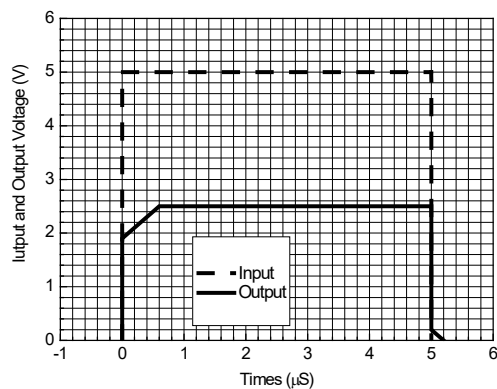
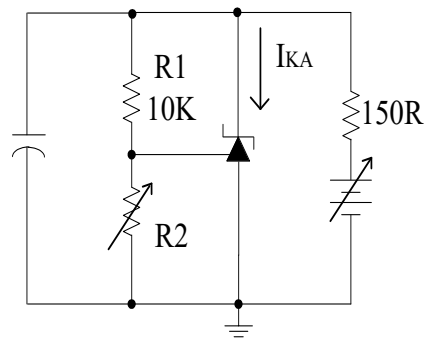
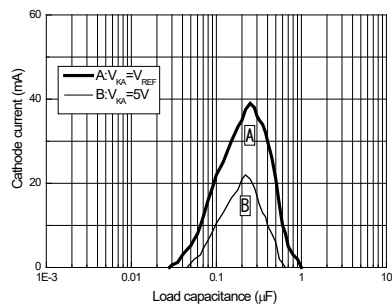
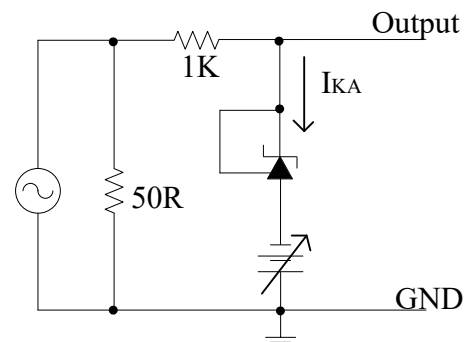
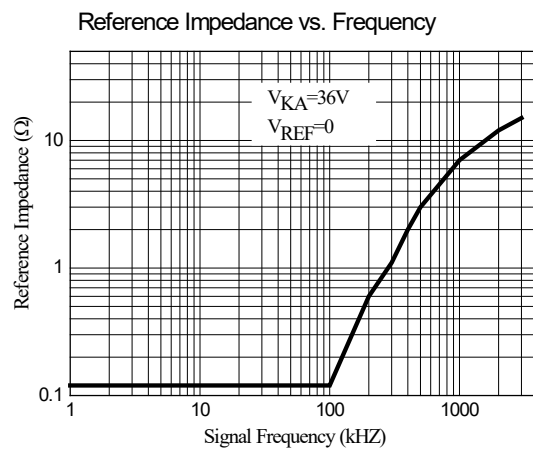
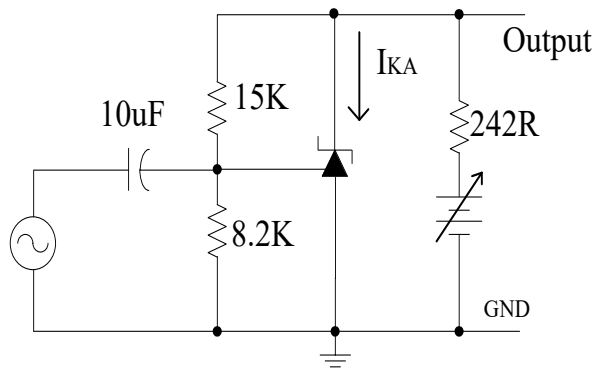
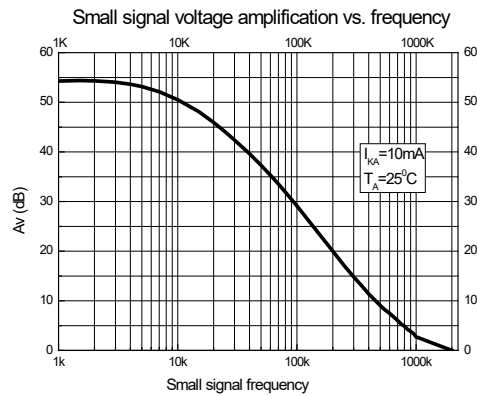
Figure 5. Test Circuit for I_{OFF}

Performance Characteristics



TL431

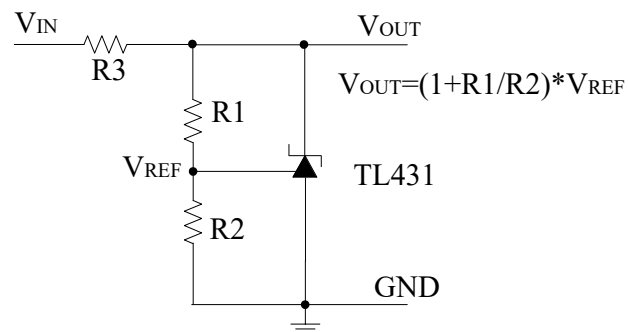
Adjustable shunt voltage reference IC



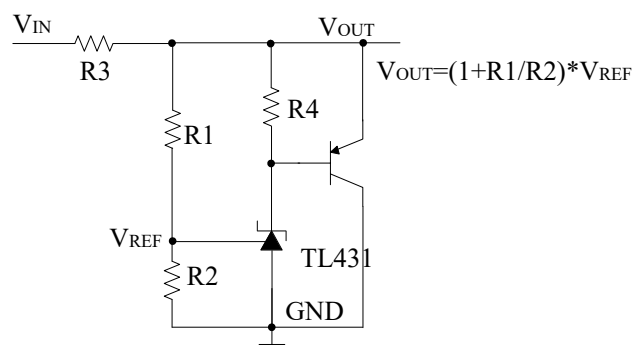
TL431

Adjustable shunt voltage reference IC

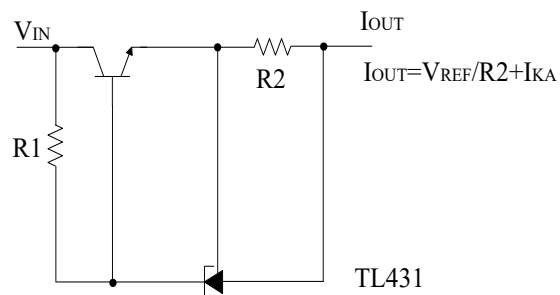
Typical Applications Circuit



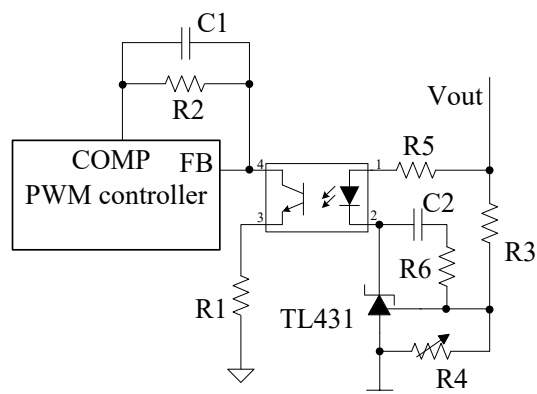
Shunt Regulator



High Current Shunt Regulator



Current Source or Current Limit



PWM Converter with Reference

TL431

Adjustable shunt voltage reference IC

Package Outline Dimensions:

SOT-23

