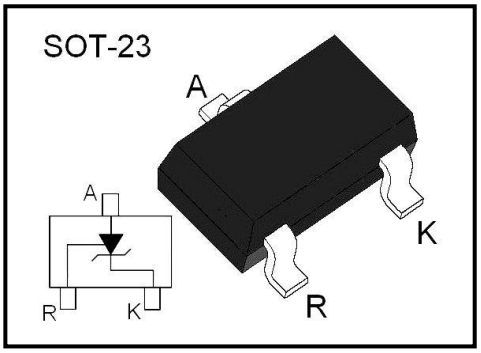
TL431 3-Terminal Adjustable shunt Regulators

- Adjustable Output Voltage: 2.5 to 36V
- Sink Current Capability: 1 to 100mA
- Typica Output Impedance: 0.22Ω
- 0.5% ,1% And 2% Voltage Precision



DESCRIPTION

The TL431 is a programmable shunt voltage reference with guaranteed temperature stability over the entire temperature range of operation.
The output voltage may be set to any value between 2.5V and 36V with two external resistors.
The TL431 operates with a wide current rangefrom 1 to 100mA with a typical dynamic impedance of 0.22Ω.

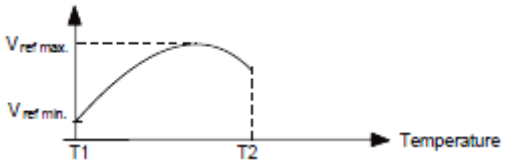
Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Cathode to Anode Voltage	V_{KA}	37	V
Continuous Cathode Current Range	I_K	-100 to +150	mV
Reference Input Current Range	I_{ref}	-0.05 to +10	mV
Power Dissipation	P_D	300	mW
Storage Temperature Range	T_{STG}	-55 ~ + 150	℃

Electrical Characteristics T_{amb} = 25°C (unless otherwise specified)

Parameter	Symbol	Conditions		Value Min	Value Typ	Value Max	Unit
Reference Input Voltage	Vref	$V_{KA} = V_{ref}$, I_K = 10mA	T_{amb} = 25°C	2.44	2.495	2.55	V
			$T_{min} \le T_{amb} \le T_{max}$	2.423		2.567	
Reference Input Voltage Deviation Over-Temperature Range - note 1	ΔVref	V_{KA} = Vref, I_K = 10mA, $T_{min} \le T_{amb} \le T_{max}$			3	17	mV
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage - (figure 2)	$\frac{\Delta V_{ref}}{\Delta V_{ka}}$	I_K= 10mA	ΔV_{KA} = 10V to V_{ref}		-1.4	-2.7	mV/V
			ΔV_{KA} = 36V to 10V		-1	-2	
Reference Input Current	I_{ref}	I_K = 10mA, R_1 = 10kΩ, R_2 = ∞	T_{amb} = 25°C		1.8	4	μA
			$T_{min} \le T_{amb} \le T_{max}$			5.2	
Reference Input Current Deviation Over Temperature Range	ΔI_{ref}	I_K= 10mA , R_1 = 10kΩ, R_2 = ∞, $T_{min} \le T_{amb} \le T_{max}$			0.4	1.2	μA
Minimum Cathode Current for Regulation	I_{min}	$V_{KA} = V_{ref}$			0.5	1	mA
Off-State Cathode Current	I_{off}				2.6	1000	nA
Dynamic Impedance - note 2	$\lvert Z_{KA} \rvert$	$V_{KA} = V_{ref}$, Δ I_k = 1 to100mA, f ≤1kHz			0.22	0.5	Ω

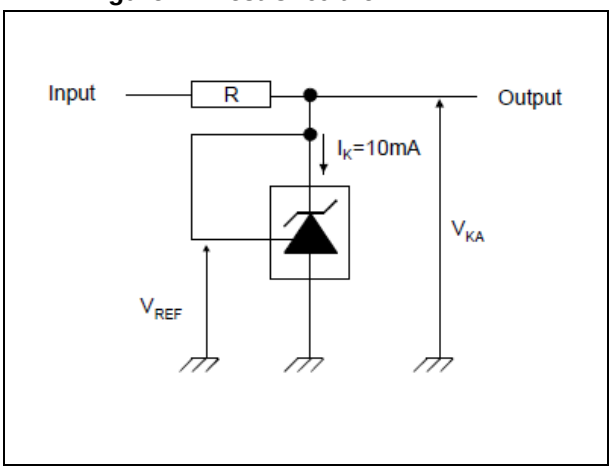
Notes:
1) ΔVref is defined as the difference between the maximum and minimum values obtained over the full temperature range.
ΔVref = Vref max. - Vref min.



2) The dynamic Impedance is definied as | ZKA | = ΔVKA / ΔIK

Test Circuits

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



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

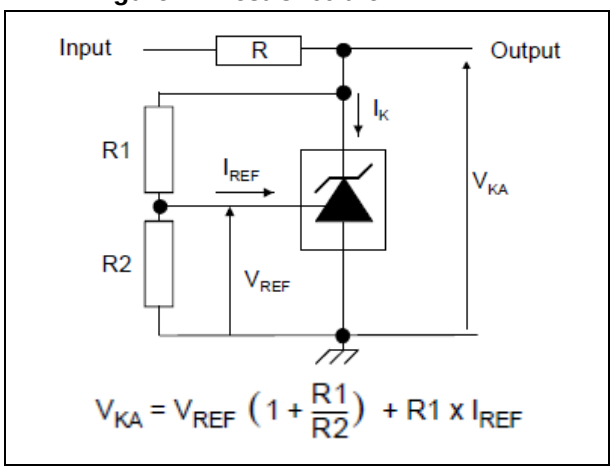


Figure 3 : Test Circuit for I_{OFF}

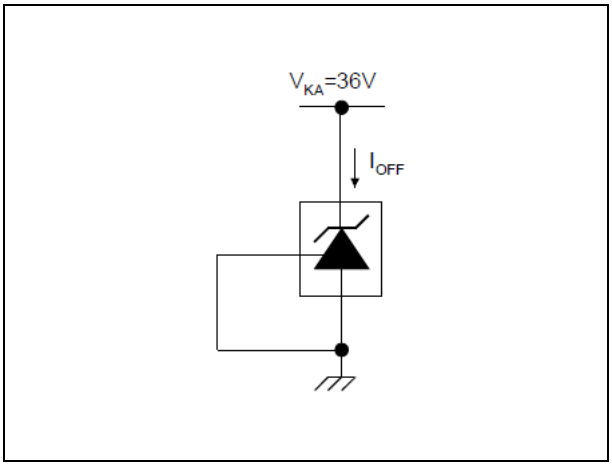


Figure 4 : Test Circuit for Phase Margin and Voltage Gain

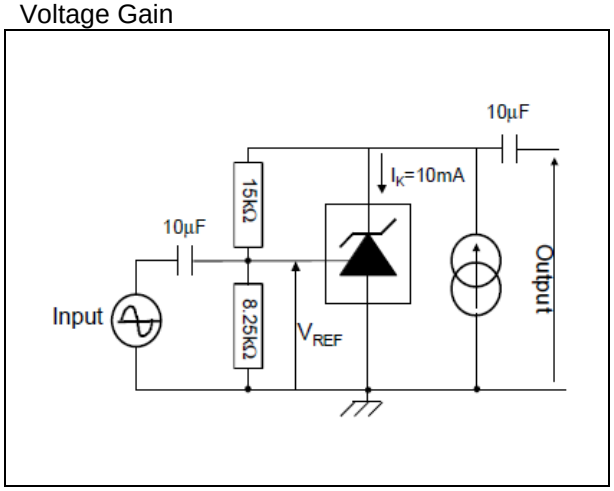


Figure 5 : Block diagram of TL1431

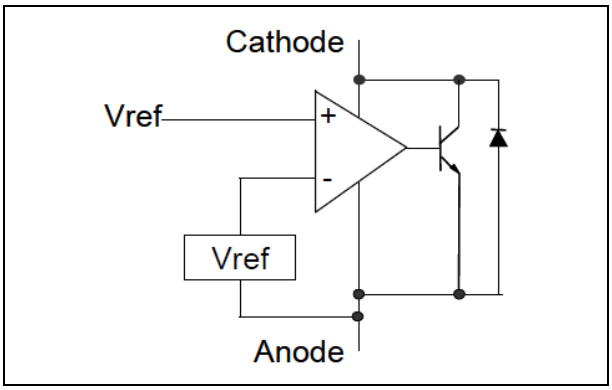


Figure 6 : Test Circuit for Response time