Low Voltage Adjustable Precision Shunt Regulator

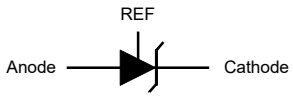
Features

- Precise Reference Voltage to 1.24V
- Guaranteed 0.5% or 1% Reference Voltage Tolerance
- Sink Current Capability, 80uA to 100mA
- Quick Turn-on
- Adjustable Output Voltage, $V_O = V_{REF}$ to 20V
- Low Operational Cathode Current, 80μA Typical
- 0.1Ω Typical Output Impedance
- SOT-23-3, SOT-23-5, TO-92 and SOT-89 Packages
- Lead Free Available (RoHS Compliant)

Applications

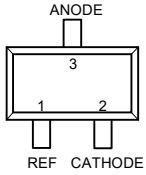
- Linear Regulators
- Adjustable Power Supply
- Switching Power Supply

Symbol

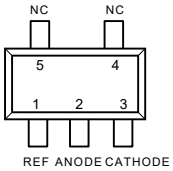


General Description

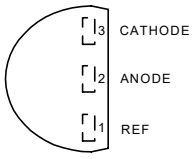
The APL431L is a 3-terminal low voltage adjustable precision reference with specified thermal stability over applicable commercial temperature ranges. Output voltage may be set to any value between V_{ref} (1.24 V) and 20 V with two external resistors (see Figure 2). When used with an photocoupler, the APL431L is an ideal voltage reference in isolated feedback circuits for 3V to 12V switching-mode power supplies. This device has a typical output impedance of 0.1Ω. Active output circuitry provides a very sharp turn-on characteristic, making the APL431L excellent replacements for zener diodes in many applications, including on-board regulation and adjustable power supplies.



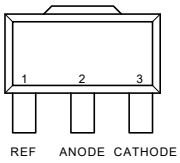
SOT-23-3 (Top View)



SOT-23-5 (Top View)

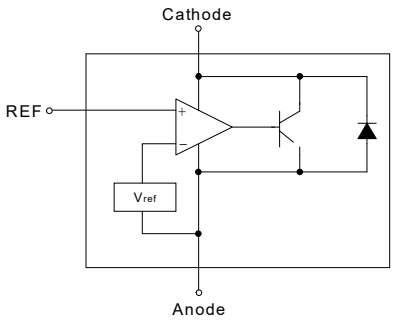


TO-92 (Top View)



SOT-89 (Top View)

Functional Diagram



Ordering and Marking Information

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<td>APL431L □□□-□□□
Lead Free Code
Handling Code
Temp. Range
Package Code
Elec. Grade</td>
<td>Elec. Grade
A : 0.5% Reference Voltage Tolerance
B : 1% Reference Voltage Tolerance
Package Code
A : SOT-23-3 B : SOT-23-5
D : SOT-89 E : TO-92
Y:Chip Form
Temp. Range
C : 0 to 70 ° C I : -40 to 85 ° C
Handling Code
PB : Plastic Bag TB : Tape & Box
TR : Tape & Reel
Lead Free Code
L : Lead Free Device Blank : Original Device</td>
</tr>
<tr>
<td>APL431L A/B : 431L</td>
<td>APL431L E : APL 431L XXXXX XXXXX - Date Code</td>
</tr>
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<td>APL431L D : APL431L XXXXX XXXXX - Date Code</td>
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Notes： ANPEC lead-free products contain molding compounds/die attach materials and 100% matte in plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldiering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{KA}	Cathode voltage	20	V
I_K	Continuous cathode current range	100	mA
I_{REF}	Reference current range	3	mA
θ_{JA}	Thermal Resistance from Junction to Ambient in Free Air		°C/W
	SOT-23-3	416	
	SOT-23-5	357	
	SOT-89	250	
	TO-92	250	
T_J	Operating Junction Temperature Range	-40 to 150	°C
T_{STG}	Storage Temperature Range	-65 to 150	°C
T_{SOL}	Lead temperature range, T_s (Soldering, 10sec)	260	°C

Electrical Characteristics T_A= 25°C (unless otherwise noted)

Symbol	Parameter	Test Conditions		APL431L Min.	APL431L Typ.	APL431L Max.	Unit
V_{REF}	Reference voltage	$V_{KA}=V_{REF}$, I_K=10mA T_A =25°C, (Fig. 1)	APL431LA	1.234	1.240	1.246	V
			APL431LB	1.228	1.240	1.252	
		T_A =full range(see Note1), (Fig.1)	APL431LA	1.222	1.240	1.258	
			APL431LB	1.215	1.240	1.265	
V_{DEF}	V_{DEF} Temp Deviation	T_A =full range (see Note1) $V_{KA}=V_{REF}$, I_K=10mA (Fig. 1)			5	15	mV
ΔV_{REF} / ΔV_{KA}	Ratio of Change in V_{REF} to Change in Cathods Votage	I_K=10mA, V_{KA}=16V to V_{REF} (Fig. 2)			-0.2	-1.0	mV/V
I_{REF}	Reference Input Current	I_K=10mA,R_1 =10kΩ,R_2 =∞ (Fig. 2)			0.15	0.5	µA
$I_{REF(DEV)}$	I_{REF} Temp Deviation	T_K=full range (see Note 1), R_1=10kΩ, R_2=∞, I_K=10mA, (Fig. 2)			0.05	0.3	µA
$I_{K(off)}$	off-state cathode current	V_{REF}=0V, (Fig. 3)	V_K=6V		0.01	0.1	µA
			V_K=16V		0.01	0.5	
Z_{KA}	Dynamic Output Impedance	$V_{KA}=V_{REF}$, I_K=1mA to 100mA, f ≤1kHz (Fig. 1)			0.1	0.4	Ω
$I_{K(MIN)}$	Minimum Operating Current	$V_{KA}=V_{REF}$ (Fig. 1)			80	100	µA

Notes : 1.Full temperature range is 0°C to 70°C for APL431LXXC,and -40°C to 85°C for APL431LXXI.

Test Figures

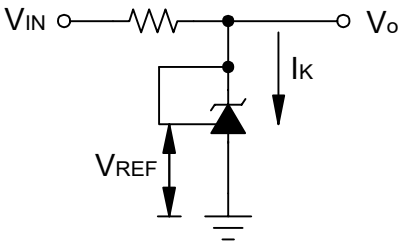


Figure 1. Test Circuit for $V_{KA}=V_{REF}$, $V_O=V_{KA}=V_{REF}$

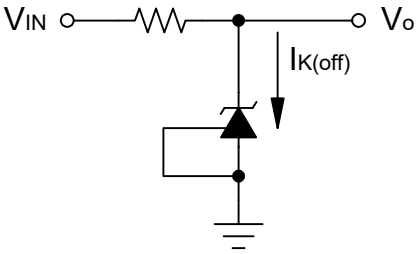


Figure 3. Test Circuit for $I_{K(off)}$

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

Test Figures (Cont.)

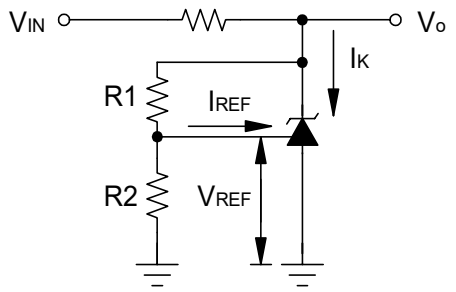
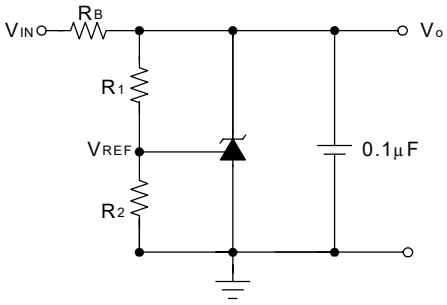


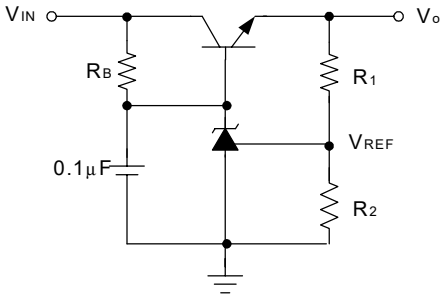
Figure 2. Test Circuit for $V_{KA}>V_{REF}$,
$V_O = V_{KA} = V_{REF} \times (1+R_1/R_2) + I_{REF} \times R_1$

Application Schematic

Precision Voltage Reference



Precision High-Current Series Regulator



Notes for Application Circuits:

1) To improve the stability of output voltage, a 0.1μF capacitor between cathode and anode of APL431L is strongly recommended.

2)Set V_{OUT} according to the following equation:
$V_{OUT} = V_{REF}(1+R1/R2)+I_{REF} R1$

3)Choose the value for R_B as follows:
A)The maximum limit for R_B should be such that the cathode current(I_K) is greater than the minimum operating current (80μA) at $V_{IN(MIN)}$.

B)The minimum limit for RB should be such that the cathode current (I_K) does not exceed 100mA under all load conditions, and the instantaneous turnon value for Ik does not exceed 150mA. Both of the following conditions must. be met:

$$R_{B,Min} \geq \frac{V_{IN(MAX)}}{150mA}$$ (to limit instantaneous turn-on I_K)

$$R_{B,Min} \geq \frac{V_{IN(MAX)}-V_{OUT}}{I_{OUT(MIN)}+100mA}$$

(to limit I_K under normal operating conditions)