

### Features

- The Reference Input Voltage tolerance is 0.5%
- Sink Current Capability of 0.1mA to 100 mA
- Low Output Noise Voltage and Fast Turn On Response
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Epoxy Meets UL 94 V-0 Flammability Rating
- Moisture Sensitivity Level 1
- Halogen Free Available Upon Request By Adding Suffix "-HF"
- Lead Free Finish/RoHS Compliant ("P" Suffix designates RoHS Compliant. See ordering information)

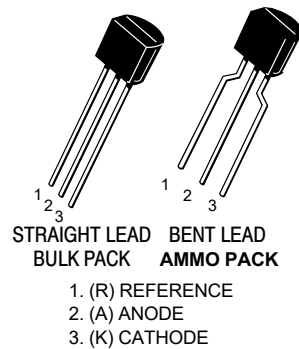
### Maximum Ratings

Parameter	Symbol	Value	Unit
Cathode Voltage	$V_{KA}$	37	V
Cathode Current Range	$I_K$	-100~150	mA
Reference Input Current Range	$I_{REF}$	0.05~10	mA
Power Dissipation at 25 °C	$P_D$	0.77	W
Thermal Resistance junction to ambient	$R_{\theta JA}$	162	°C/W
Junction Temperature	$T_J$	0~150	°C
Operating Temperature	$T_{opr}$	0~70	°C
Storage Temperature Range	$T_{STG}$	-65~150	°C

### Recommended Operating Conditions

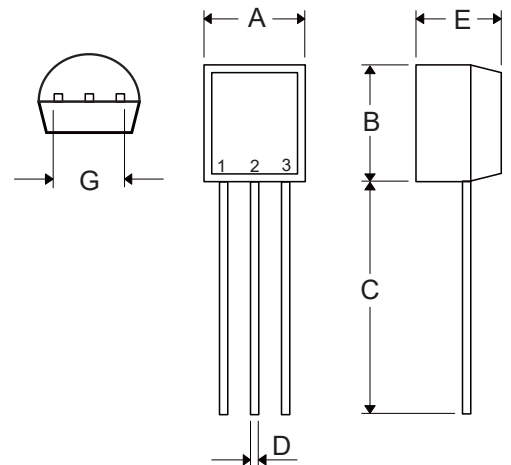
Parameter	Symbol	Min	Max	Unit
Cathode Voltage	$V_{KA}$	$V_{REF}$	36	V
Cathode Current Range	$I_K$	1	100	mA

### Marking Code: TL431



# Programmable Precision Regulator

## TO-92



DIM	DIMENSIONS				NOTE
	INCHES		MM		
	MIN	MAX	MIN	MAX	
A	0.169	0.185	4.30	4.70	
B	0.169	0.185	4.30	4.70	
C	0.500	-----	12.70	-----	
D	0.015	0.022	0.38	0.55	
E	0.130	0.146	3.30	3.70	
G	0.095	0.105	2.42	2.67	Straight Lead
	0.173	0.220	4.40	5.60	Bent

**Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage	$V_{ref}$		2.4875	2.5	2.5125	V
Deviation of reference Input Voltage	$V_{ref(dev)}$	$T_{min} \leq T_a \leq T_{max}$		4.5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	$\Delta V_{KA} = 10V \sim V_{ref}$		-1.0	-2.7	
		$\Delta V_{KA} = 36V \sim 10V$		-0.5	-2.0	
Reference Input Current	$I_{ref}$	$I_{KA} = 10mA,$ $R_1 = 10K\Omega, R_2 = \infty$		1.5	4.0	$\mu A$
Deviation of Reference Input Current Over Full Temperature Range	$\frac{\Delta I_{ref}}{\Delta T}$	$I_{KA} = 10mA,$ $R_1 = 10K\Omega, R_2 = \infty$ $T_A = \text{full Temperature}$		0.4	1.2	$\mu A$
Minimum Cathode Current for Regulation	$I_{KA(min)}$			0.45	1.0	mA
Off-State Cathode Current	$I_{KA(off)}$	$V_{KA} = 36V, V_{REF} = 0V$		0.05	1.0	$\mu A$
Dynamic Impedance	$Z_{KA}$	$I_{KA} = 10 \text{ to } 100mA,$ $f \leq 1.0KHz$		0.15	0.5	$\Omega$

Curve Characteristics

Figure 1. Test Circuit for  $V_{KA} = V_{ref}$

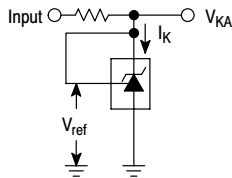


Figure 2. Test Circuit for  $V_{KA} > V_{ref}$

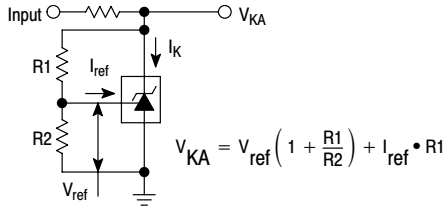


Figure 3. Test Circuit for  $I_{off}$

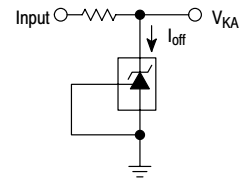


Figure 4. Cathode Current versus Cathode Voltage

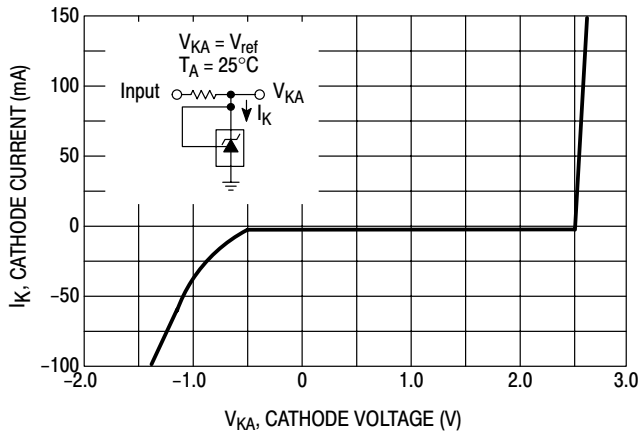


Figure 5. Cathode Current versus Cathode Voltage

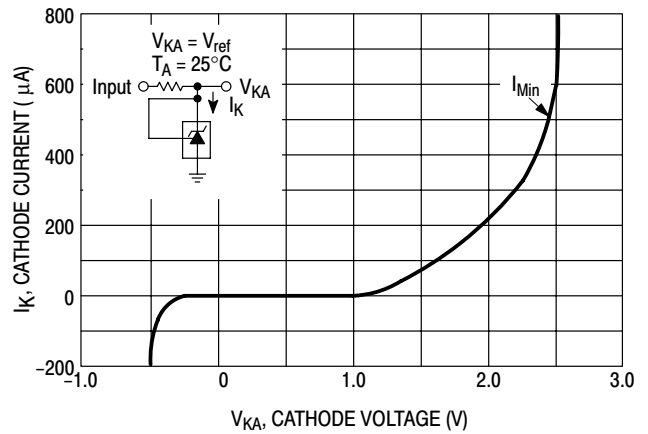


Figure 6. Reference Input Voltage versus Ambient Temperature

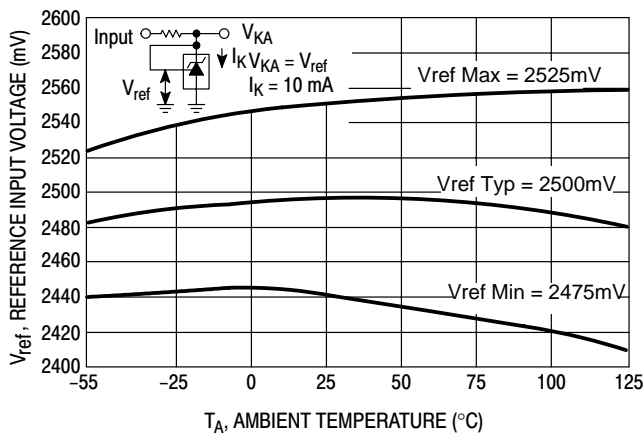
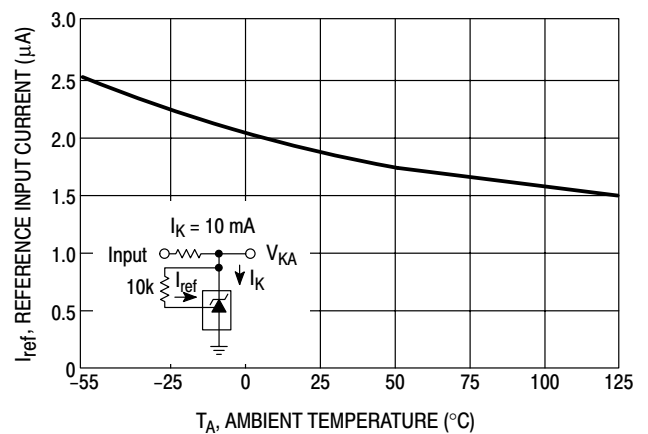


Figure 7. Reference Input Current versus Ambient Temperature



Curve Characteristics

Figure 8. Change in Reference Input Voltage versus Cathode Voltage

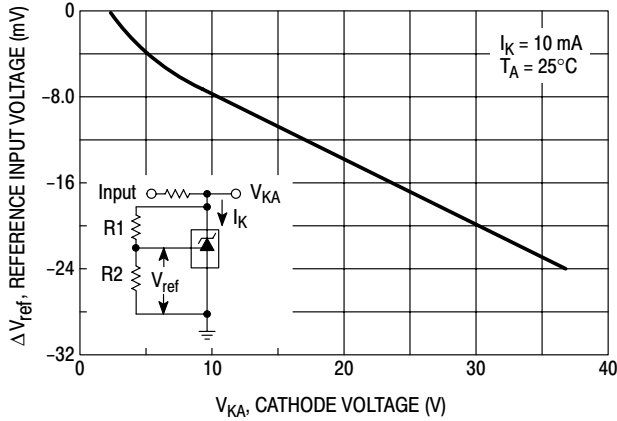


Figure 9. Off-State Cathode Current versus Ambient Temperature

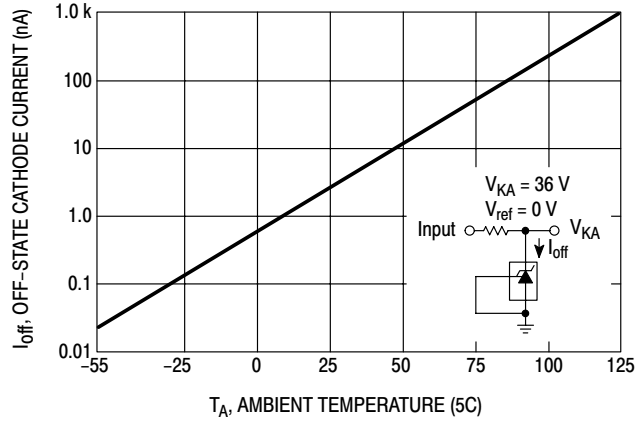


Figure 10. Dynamic Impedance versus Frequency

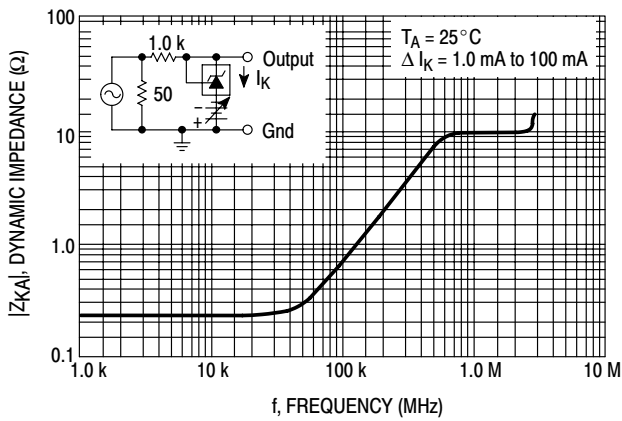


Figure 11. Dynamic Impedance versus Ambient Temperature

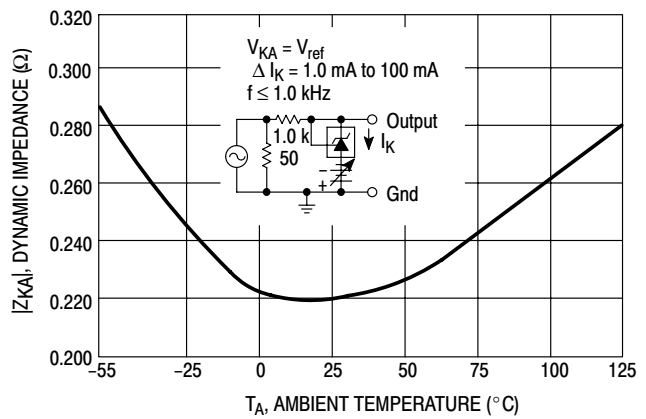


Figure 12. Open-Loop Voltage Gain versus Frequency

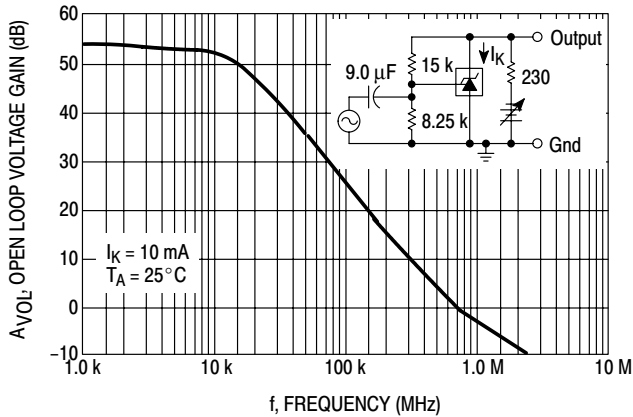
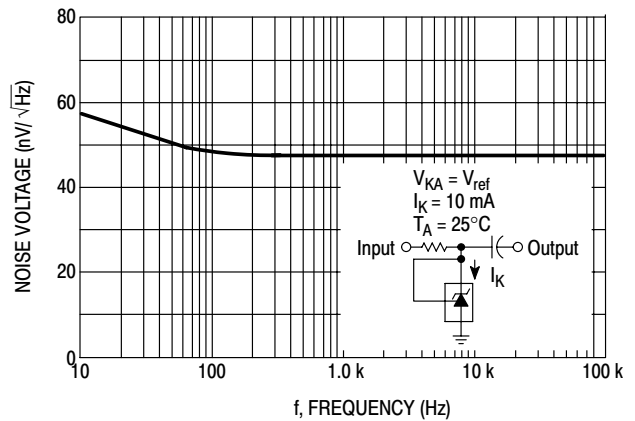


Figure 13. Spectral Noise Density



## Ordering Information

Device	Packing
Part Number-AP	Ammo Packing: 20Kpcs/Carton
Part Number-BP	Bulk: 100Kpcs/Carton

Note : Adding "-HF" Suffix for Halogen Free, eg. Part Number-BP-HF  
 Adding "-HF" Suffix for Halogen Free, eg. Part Number-AP-HF

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