



Micro Commercial Components



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TL431K

Programmable Precision Regulator

Features

- Lead Free Finish/RoHS Compliant ("P" Suffix designates RoHS Compliant. See ordering information)
- Epoxy meets UL 94 V-0 flammability rating
- Moisture Sensitivity Level 1
- Programmable Output Voltage 36V
- Sink Current Capability of 0.1mA to 100 mA
- The typical value of the equivalent temperature factor in the whole temperature scope is 50 ppm/°C
- Low output noise voltage and Fast turn on response
- The Reference Input Voltage tolerance is 0.5%
- Marking Code: 431K
- Halogen free available upon request by adding suffix "-HF"

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	0.3	W
Operating Temperature	T_{opr}	-40---85	°C
Storage Temperature Range	T_{STG}	-65---+150	°C

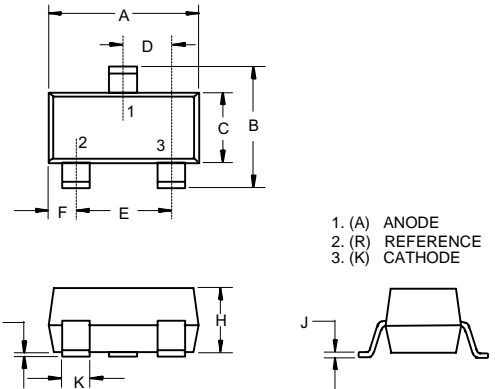
Recommended Operating Conditions

Parameter	Sym	Min	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current Range	I_K	1.0	100	mA

Electrical Characteristics @ 25°C Unless Otherwise Specified

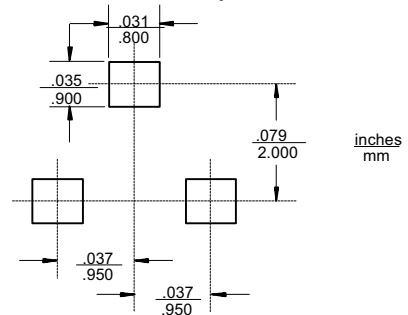
Parameter	Sym	Min	Typ	Max	Test conditions
Reference Input Voltage	V_{ref}	2.482V	2.500V	2.508V	$V_{KA}=V_{REF}$, $I_{KA}=10mA$
Deviation of reference input voltage	$\frac{\Delta V_{ref}}{\Delta T}$		4.5mV	17mV	$V_{KA}=V_{REF}$, $I_{KA}=10mA$ $T_{min} \leq T_a \leq T_{max}$
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{ref}}{\Delta V_{KA}}$		-1.0	-2.7	$\Delta V_{KA}=10V \sim V_{ref}$
Reference Input Current	I_{ref}		1.5µA	4.0µA	$I_{KA}=10mA$, $R_1=10K\Omega$, $R_2=\infty$
Deviation of Reference Input Current Over Full Temperature Range	$\frac{\Delta I_{ref}}{\Delta T}$		0.4µA	1.2µA	$I_{KA}=10mA$, $R_1=10K\Omega$, $R_2=\infty$ $T_A=full\ Temperature$
Minimum Cathode Current for Regulation	$I_{KA(min)}$		0.45mA	1.0mA	
Off-State Cathode Current	$I_{KA(off)}$		0.05µA	0.5µA	$V_{KA}=40V$, $V_{REF}=0V$
Dynamic Impedance	Z_{KA}		0.15Ω	0.5Ω	$I_{KA}=1\ to\ 100mA$, $f \leq 1.0KHz$

SOT-23



DIM	DIMENSIONS				NOTE
	INCHES		MM		
A	.110	.120	2.80	3.04	
B	.083	.104	2.10	2.64	
C	.047	.055	1.20	1.40	
D	.035	.041	.89	1.03	
E	.070	.081	1.78	2.05	
F	.018	.024	.45	.60	
G	.0005	.0039	.013	.100	
H	.035	.044	.89	1.12	
J	.003	.007	.085	.180	
K	.015	.020	.37	.51	

Suggested Solder Pad Layout



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

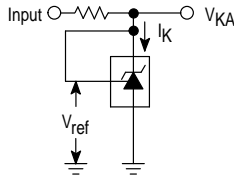


Figure 2. Test Circuit for $V_{KA} > V_{ref}$

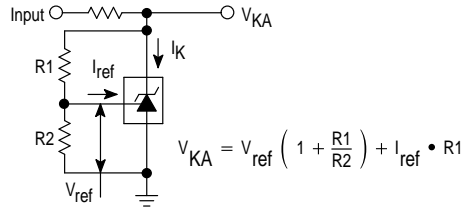
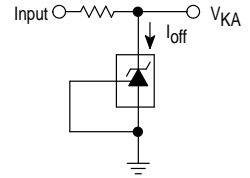
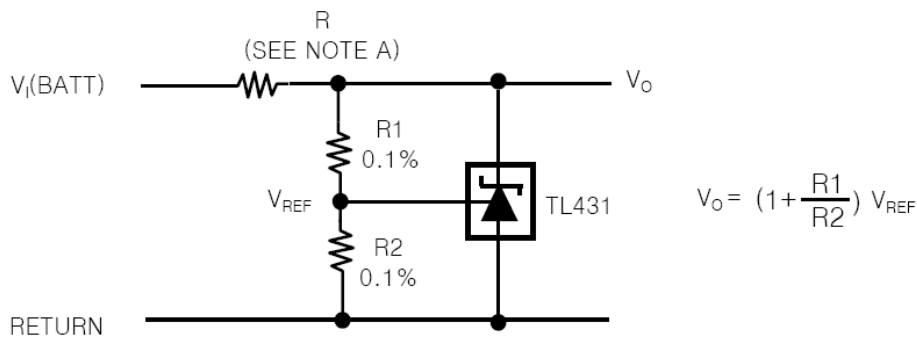


Figure 3. Test Circuit for I_{off}



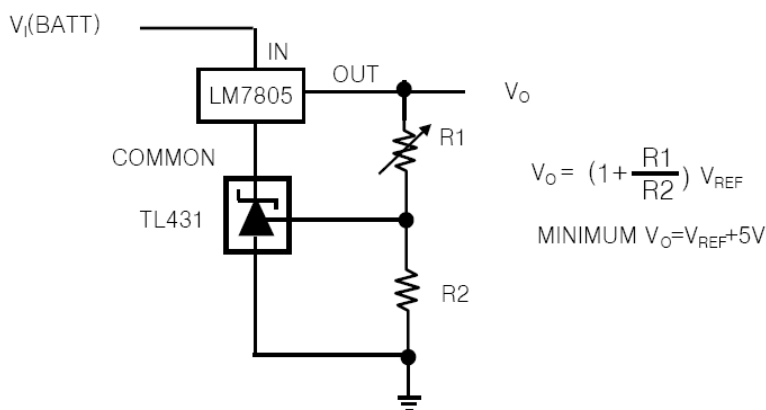
APPLICATION INFORMATION

1. Shunt Regulator



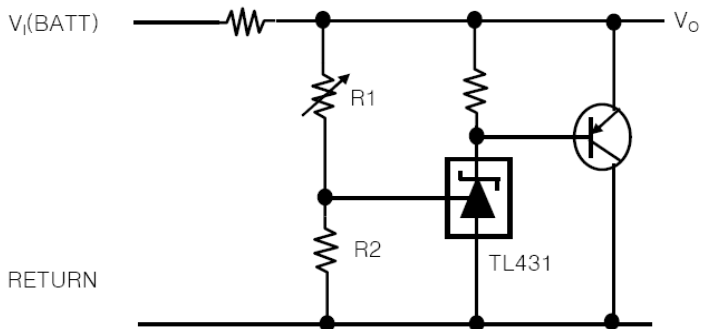
Note A : R Should provide cathode current 1mA to the TL431 at minimum $V_{i(BATT)}$

2. Output Control of a Three-Terminal Fixed Regulator



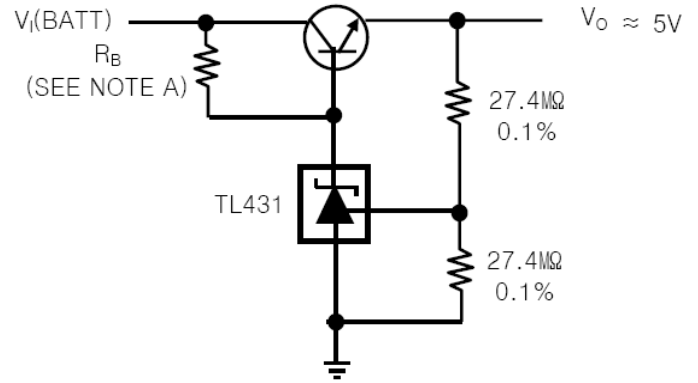
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3. High-Current Shunt Regulator



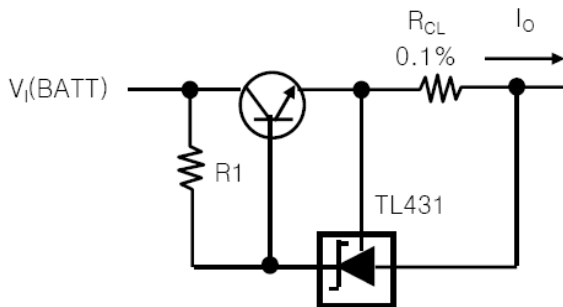
$$V_o = (1 + \dots)$$

4. Efficient 5-V Precision Regulator



NOTE A : R_B Should provide cathode current ≥ 1mA to the TL431.

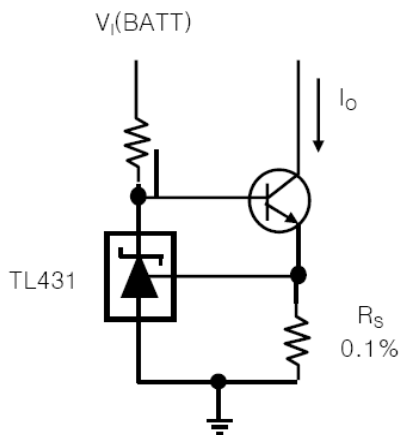
5. Precision Current Limiter



$$I_{OUT} = \frac{V_{REF}}{R_{CL}} + I_{KA}$$

$$R1 = \frac{V_{I(BATT)}}{I_o} + I_{KA}$$

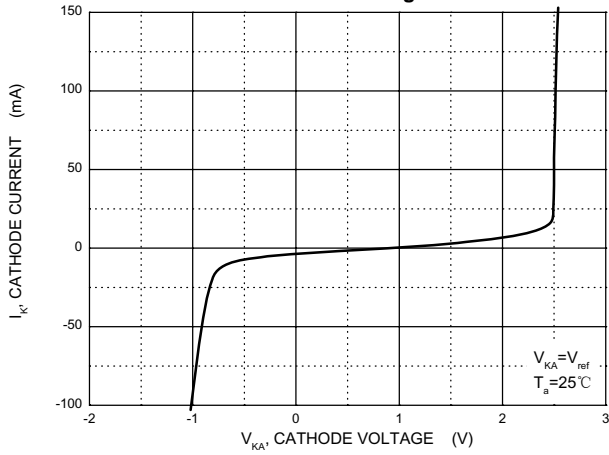
6. Precision Constant-Current Sink



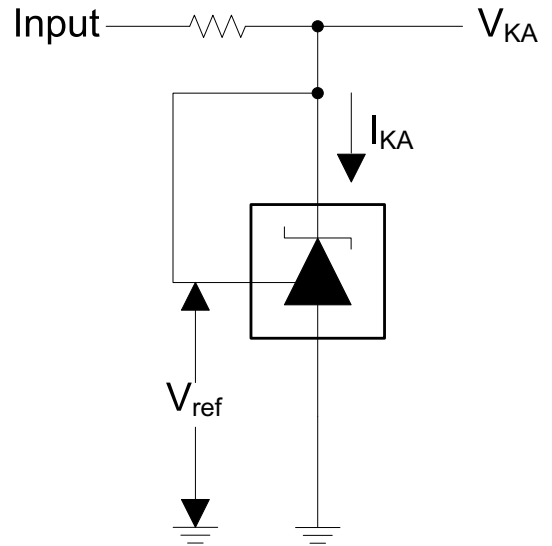
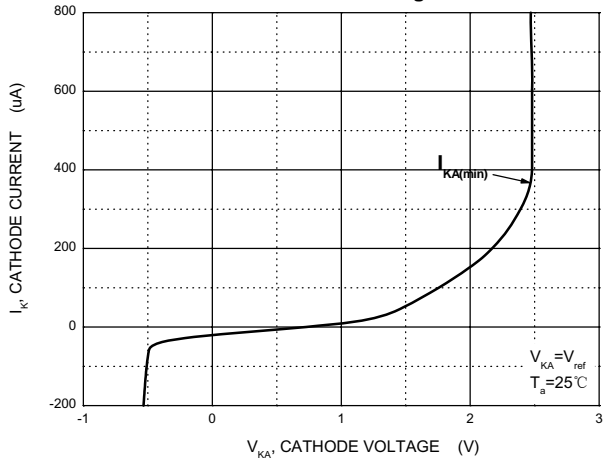
$$I_o = \frac{V_{REF}}{R_s}$$

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Cathode Current versus Cathode Voltage

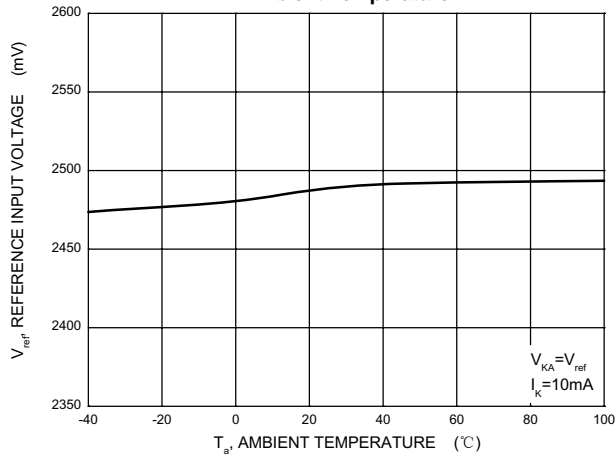


Cathode Current versus Cathode Voltage

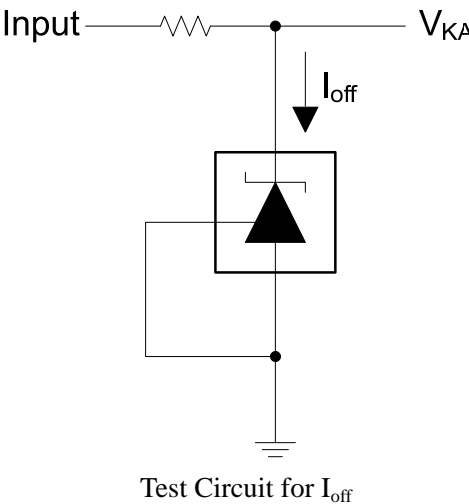
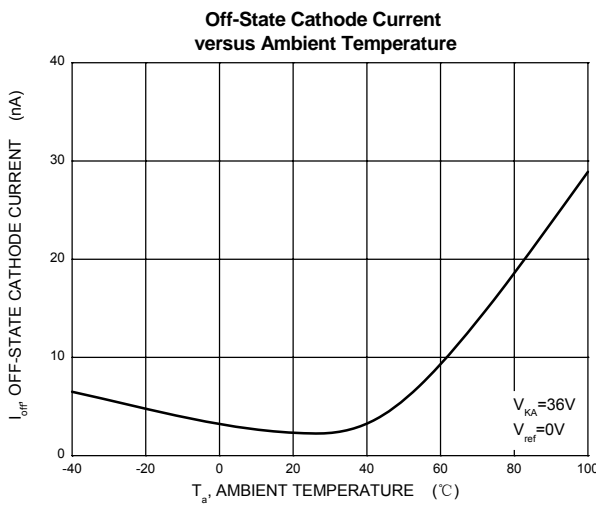
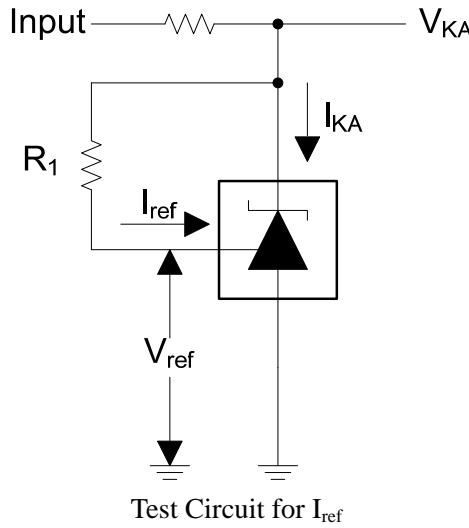
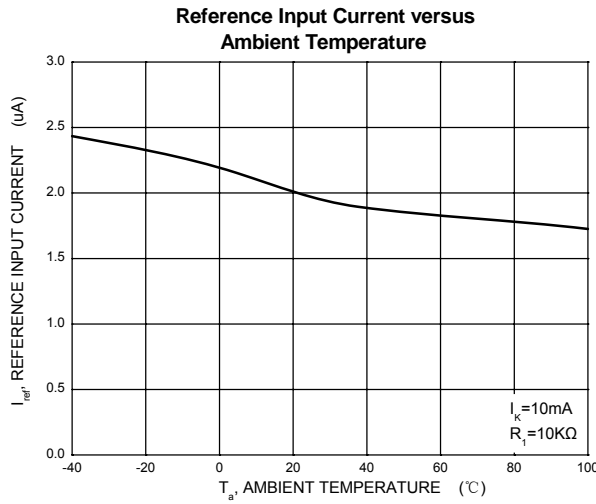
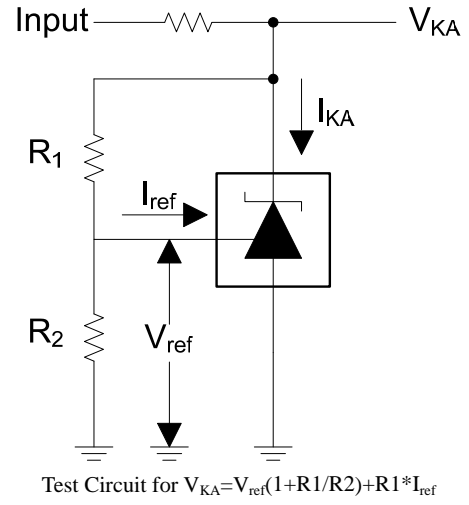
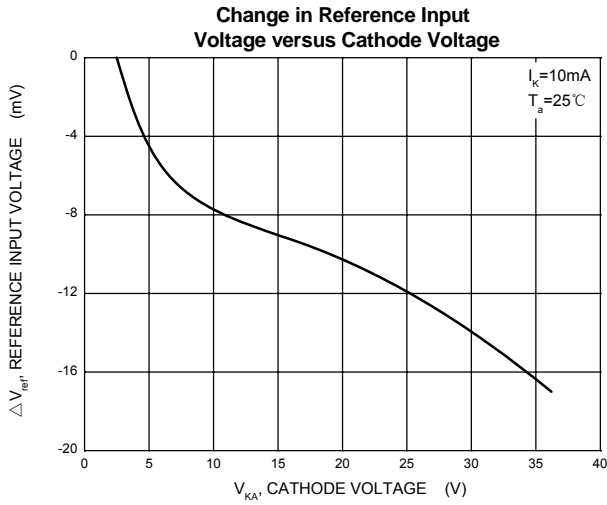


Test Circuit for $V_{KA} = V_{ref}$

Reference Input Voltage versus Ambient Temperature



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Ordering Information :

Device	Packing
Part Number-TP	Tape&Reel; 3Kpcs/Reel

Note : Adding "-HF" suffix for halogen free, eg. Part Number-TP-HF

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