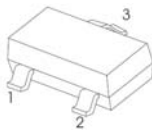
TL431

Adjustable Accurate Reference Source

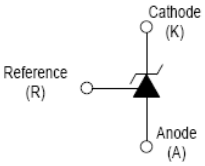
DEVICE DESCRIPSION

The TL431 is a three-terminal adjustable shunt regulator offering excellent temperature stability . This device has a typical dynamic output impedance of 0.2Ω. The device can be used as a replacement for zener diodes in many applications.

SOT-23



1. REFERENCE
2. CATHODE
3. ANODE



FEATURES

- The output voltage can be adjusted to 36V
- Low dynamic output impedance, its typical value is 0.2Ω
- Trapping current capability is 1 to 100mA
- Low output noise voltage
- Fast on -state response
- The effective temperature compensation in the working range of full temperature
- The typical value of the equivalent temperature factor in the whole temperature scope is 50 ppm/℃

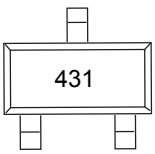
APPLICATION

- Shunt Regulator
- High-Current Shunt Regulator
- Precision Current Limiter

ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified)

Parameter	Symbol	Value	Units
Cathode Voltage	V_{KA}	37	V
Cathode Current Range (Continuous)	I_{KA}	-100~+150	mA
Reference Input Current Range	Iref	0.05~+10	mA
Power Dissipation	P_D	3 5 0	mW
Operating temperature	Topr	-40~+85	℃
Storage temperature Range	Tstg	-65~+150	℃

MARKING



ELECTRICAL CHARACTERISTICS (T_a=25℃ unless otherwise specified)

Parameter	Symbol	Test conditions		Min	Typ	Max	Unit
Reference Input Voltage (Fig.1)	V_{ref}	$V_{KA}=V_{REF}$, I_{KA}=10mA		2.487	2.5	2.513	V
Deviation of reference input Voltage Over temperature (note) (Fig.1)	$\triangle V_{ref}/\triangle T$	$V_{KA}=V_{REF}$, I_{KA}=10mA $T_{min}\leq T_a\leq T_{max}$			3.0	17	mV
Ratio Of Change in Reference Input Voltage to the change in Cathode Voltage (Fig.2)	$\triangle V_{ref}/\triangle V_{KA}$	I_{KA}=10mA	$\triangle V_{KA}$ =10V~V_{REF}		-1.0	-2.7	mV/V
			$\triangle V_{KA}$ =36V~ 10V		-0.5	-2.0	mV/V
Reference Input Current (Fig.2)	I_{ref}	I_{KA}= 10mA,R_1=10 KΩ R_2=∞			1.5	4	μA
Deviation Of Reference Input Current Over Full Temperature Range (Fig.2)	$\triangle I_{ref}/\triangle T$	I_{KA}=10mA, R_1=10 KΩ R_2=∞ T_a=full Temperature			0.4	1.2	μA
Minimum cathode current for Regulation (Fig.1)	$I_{KA(min)}$	$V_{KA}=V_{REF}$			0.45	1.0	mA
Off-state cathode Current (Fig.3)	$I_{KA(OFF)}$	V_{KA}=36V,V_{REF}=0			0.05	1.0	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA f≤1.0KHz			0.15	0.5	Ω

note: T_{MIN}=0℃ ,T_{MAX}=+70℃

CLASSIFICATION OF V_{ref}

Rank	**0.5%**
Range	2.487-2.513

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

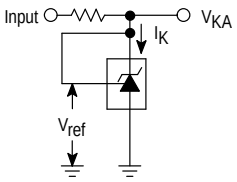


Figure 2. Test Circuit for V_{KA} > V_{ref}

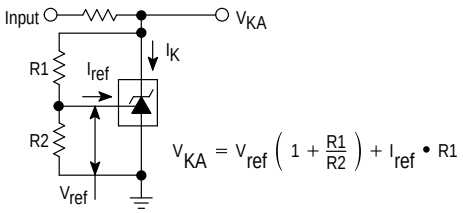
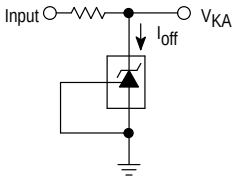
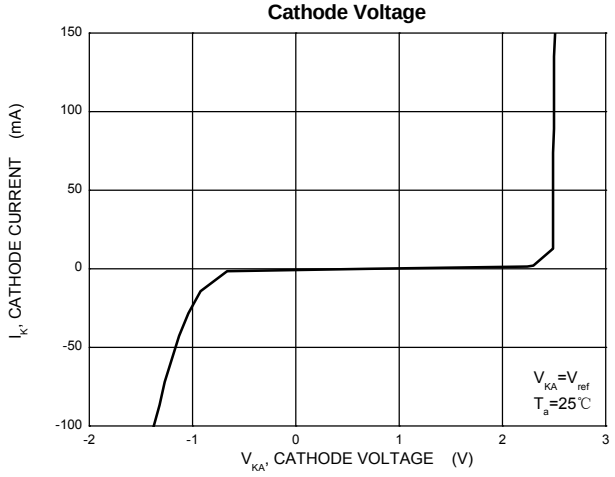


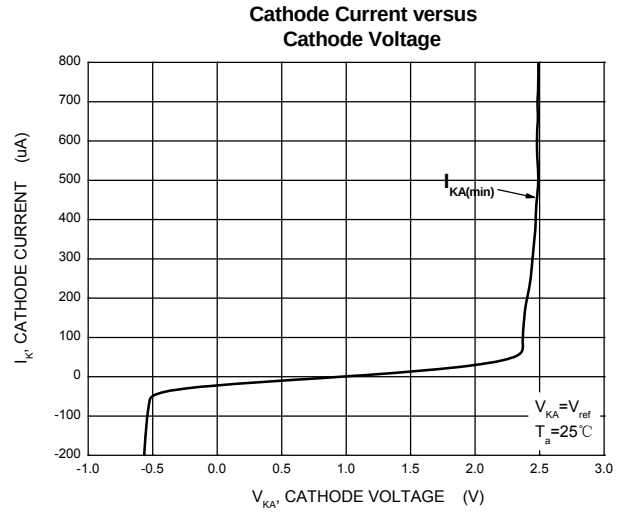
Figure 3. Test Circuit for I_{off}



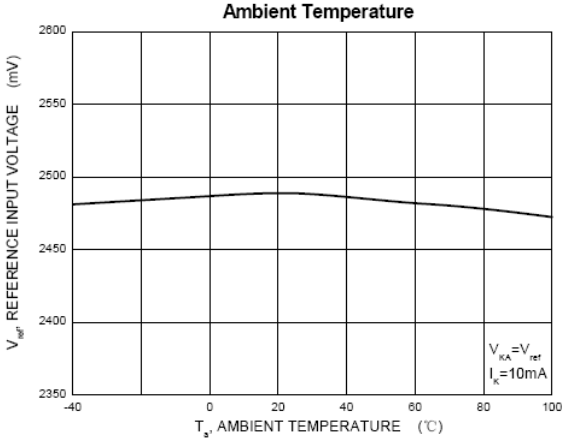
Cathode Current versus Cathode Voltage

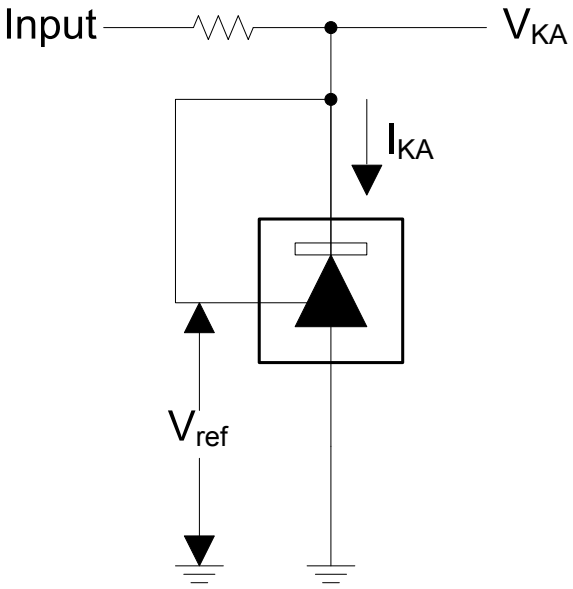


Cathode Current versus Cathode Voltage

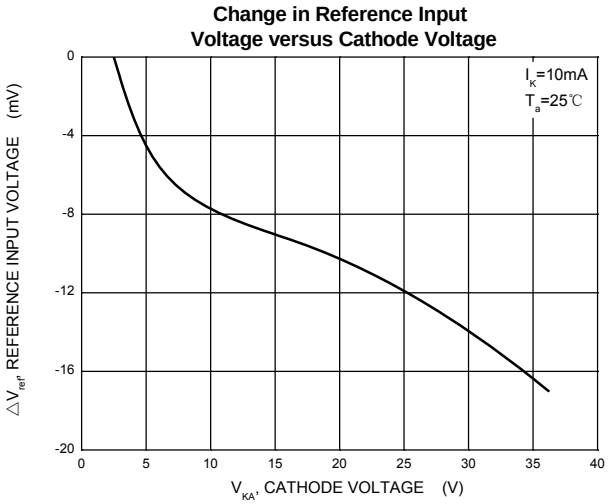


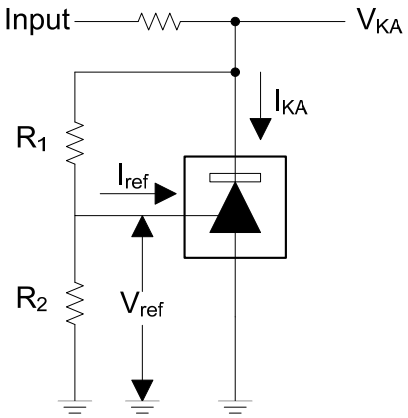
Reference Input Voltage versus Ambient Temperature



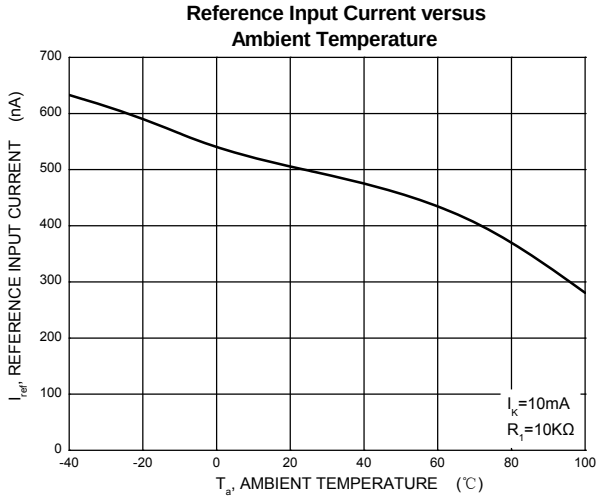


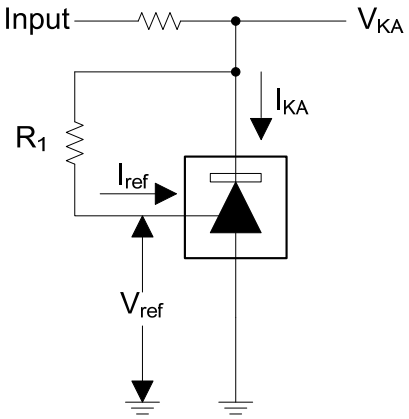
Test Circuit for $V_{KA}=V_{ref}$



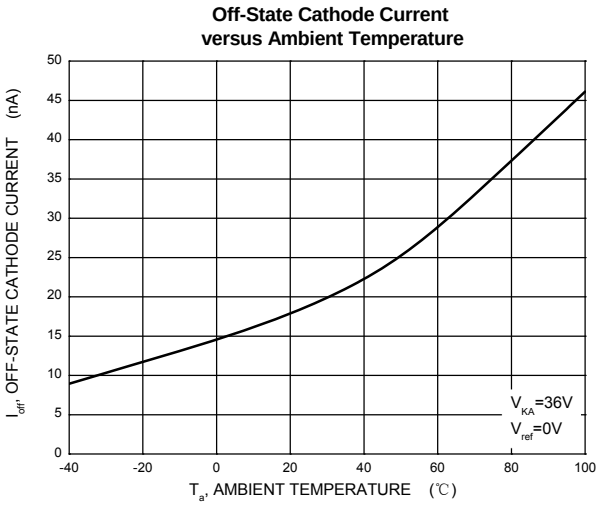


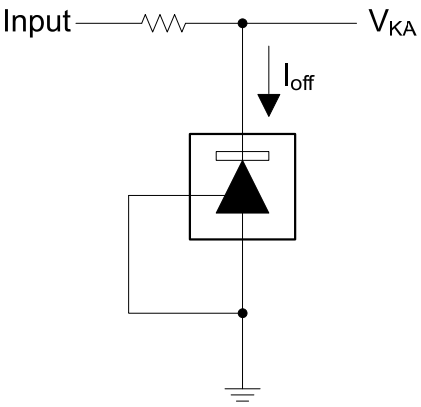
Test Circuit for $V_{KA}=V_{ref}(1+R1/R2)+R1*I_{ref}$





Test Circuit for I_{ref}





Test Circuit for I_{off}

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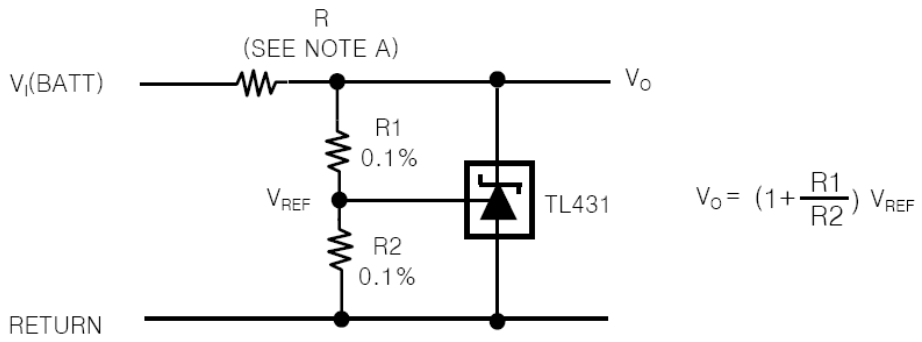
AS-222645	2008/02/10	2013/05/13	C	6

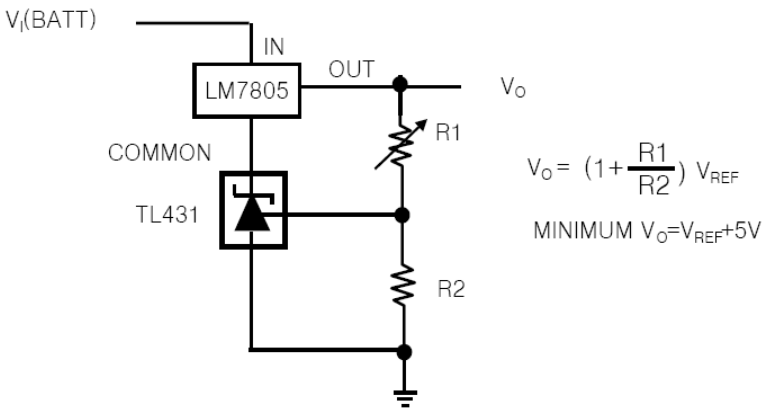
APPICATION INFORMATION

1. Shunt Regulator

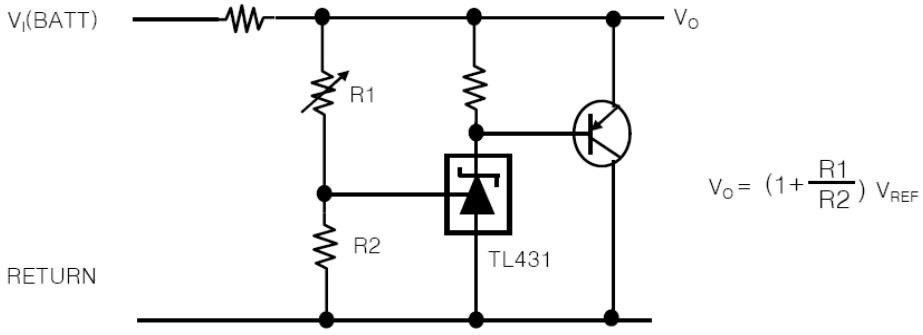


Note A : R Should provide cathode current 1mA to the TL431 at minimum $V_{I(BATT)}$

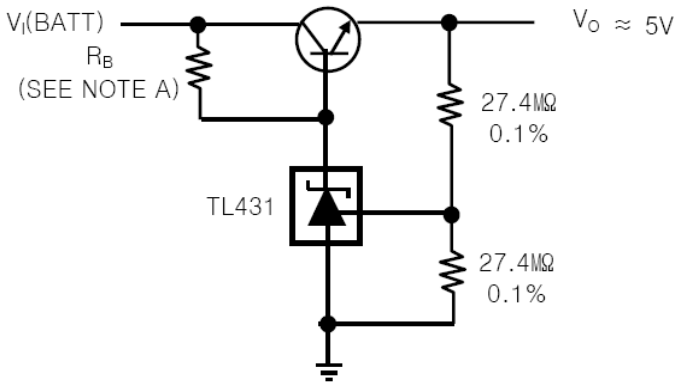
2. Output Control of a Three-Terminal Fixed Regulator



3. High-Current Shunt Regulator

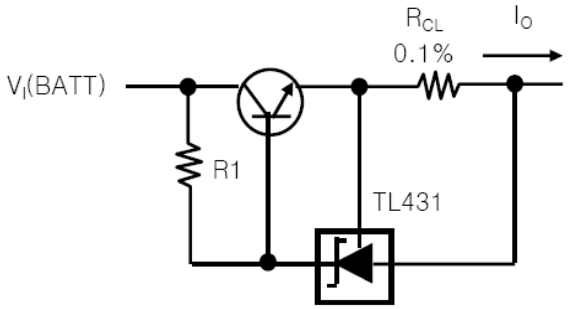


4. Efficient 5-V Precision Regulator



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

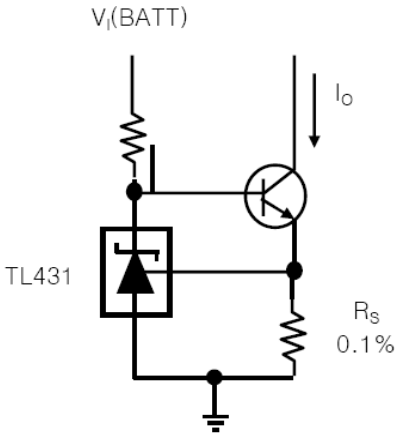
5. Precision Current Limiter



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

$$R1 = \frac{V_{I(BATT)}}{\frac{I_O}{H_{FE}}} + I_{KA}$$

6. Precision Constant-Current Sink



$$I_O = \frac{V_{REF}}{R_S}$$