
TL431

可调精密电压基准

1, 概述

TL431是一个三端可调精密并联稳压电路，具有良好的稳压特性，在许多应用场合可替代稳压二极管，在工作温度范围内具体良好的稳定性，低温度系数，快速开关响应，低输出阻抗，广泛应用于开关电源、充电器、适配器及其它可调输出场合。输出电压可以在2.495V到 V_{in} 内调节，精度分0.5%和1%。

封装形式 有SOT-23 、 TO-92和SOT89 。

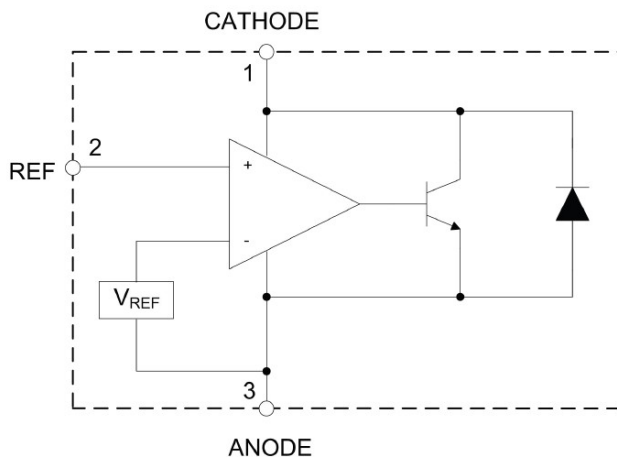
2, 主要特性:

- 输出电压可调 (2.495V - 36V)
- 容性负载下稳定度高
- 全温度范围内低温漂 :4.5mV (典型值)
- 全温度范围内低温度系数 50ppm/°C (典型值)
- 低动态输出阻抗: 0.27 Ω (典型值)
- 灌电流能力 1mA - 100mA (推荐)
- 低噪声
- 工作温度 -20 ~ +125°C
- 封装: SOT-23 、 TO-92、 SOT89

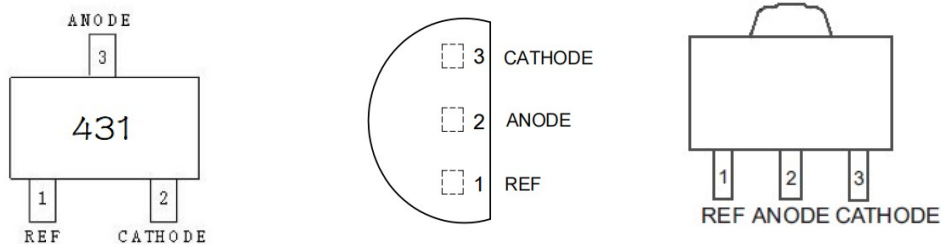
3, 典型应用:

- ◆ 充电器
- ◆ 适配器
- ◆ 开关电源
- ◆ 精密电压基准

4, 功能框图



5. 引脚定义（SOT23, TO92, SOT89俯视图）



6. 极限参数

符号	参数	额定值	单位
V_{KA}	阴极电压	40	V
I_{KA}	阴极电流(连续)	-100 ~ 150	mA
I_{REF}	基准端电流	0.05~10	mA
P_D	功耗	700	mW
T_J	结温	+150	°C
ESD	ESD (HumanBody Model)	2000	V
T_{STG}	储存温度范围	-65 ~ +150	°C

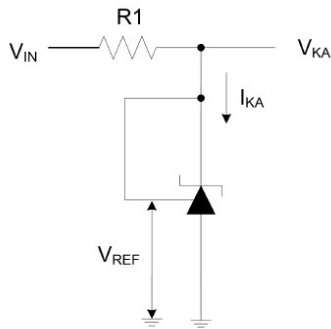
7. 推荐工作条件

符号	参数	最小值	最大值	单位
V_{KA}	阴极电压	V_{REF}	36	V
I_{KA}	阴极电流	1.0	100	mA
T_A	工作环境温度	-20	+125	°C

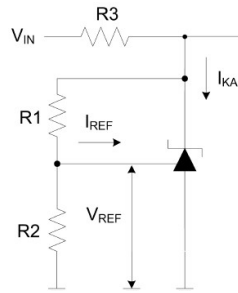
8. 电特性（除非另有说明， $V_{KA}=V_{REF}$ ， $I_K=10mA$ ， $T_A=25^{\circ}C$ ）

符号	参数		测试 线路	测试条件		规范值			单位
						最小	典型	最大	
V_{REF}	基准电压	0.5%	1	$V_{KA}=V_{REF}$, $I_{KA}=10mA$		2.483	2.495	2.507	V
		1.0%				2.470	2.495	2.520	
ΔV_{REF}	全温度范围内基准电压的变化		1	$V_{KA}=V_{REF}$ $I_{KA}=10mA$	-20°C to +125°C		4.5	8	mV
$\Delta V_{REF}/\Delta V_{KA}$	基准电压变化与阴极电压变化比例		2	$I_{KA}=10mA$	$\Delta V_{KA}=10V$ to V_{REF}	-04	0	2.7	mV/V
					$\Delta V_{KA}=36V$ to 10V	-0.4	0	2.0	
I_{REF}	基准端电流		2	$I_{KA}=10mA$, $R1=10K\Omega$, $R2=\infty$			1.80	4.0	μA
ΔI_{REF}	全温度范围基准电流变化		2	$I_{KA}=10mA$, $R1=10K\Omega$, $R2=\infty$, $T_A=-20 \sim +125^{\circ}C$			0.4	1.2	
$I_{KA(min)}$	电压调整最小阴极电流		1	$V_{KA}=V_{REF}$			0.25	0.5	mA
$I_{KA(off)}$	关断状态阴极电流		3	$V_{KA}=40V$, $V_{REF}=0$			0.17	0.9	μA

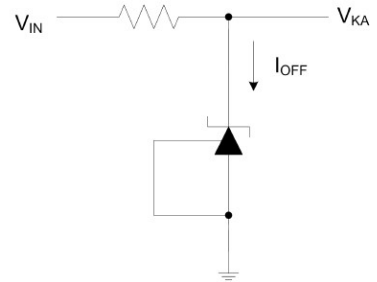
Z_{KA}	动态阻抗	1	$V_{KA}=V_{REF}, I_{KA}=1 \text{ to } 100\text{mA};$ $f \leq 1.0\text{KHz}$		0.27	0.5	Ω
θ_{JC}	热阻	-	SOT-23		380		$^{\circ}\text{C}/\text{W}$
			TO92		165		
			SOT89		165		



测试线路 1 for $V_{KA}=V_{REF}$



测试线路 2 for $V_{KA} > V_{REF}$

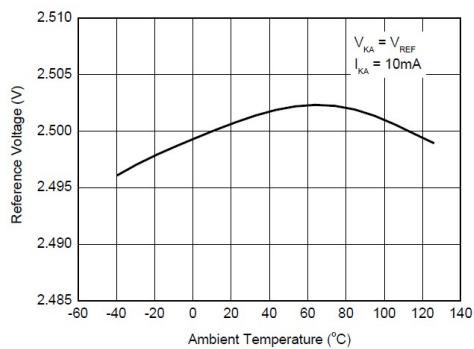


测试线路 3 for $I_{KA}(\text{off})$

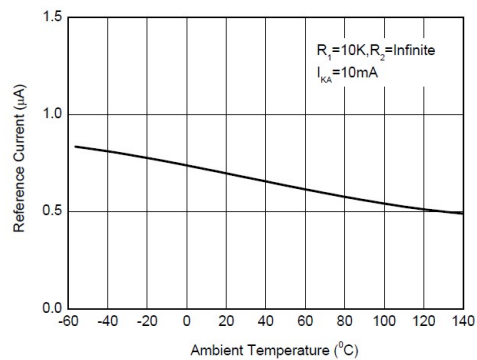
$$V_{KA}=V_{REF}*(1+R1/R2)+ I_{REF}*R1$$

9, 特性曲线图

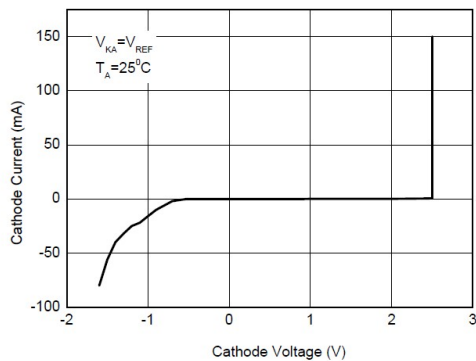
Reference Voltage vs. Ambient Temperature



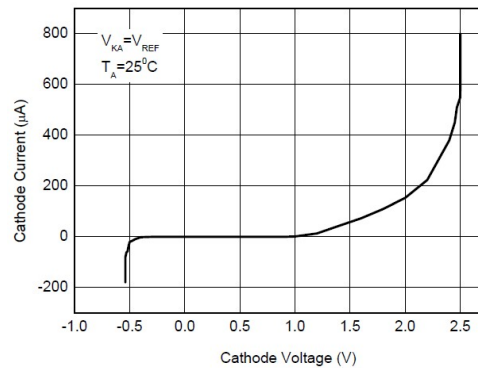
Reference Current vs. Ambient Temperature



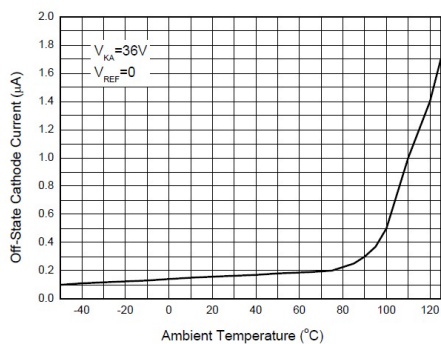
Cathode Current vs. Cathode Voltage



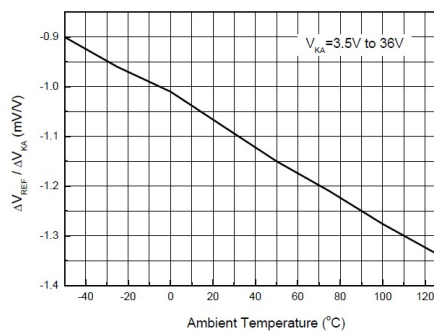
Cathode Current vs. Cathode Voltage



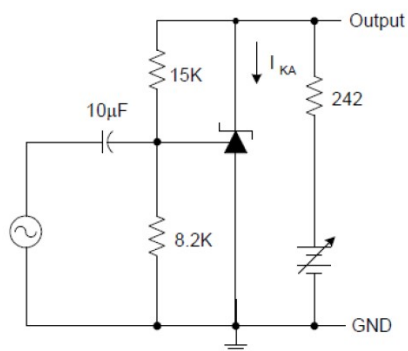
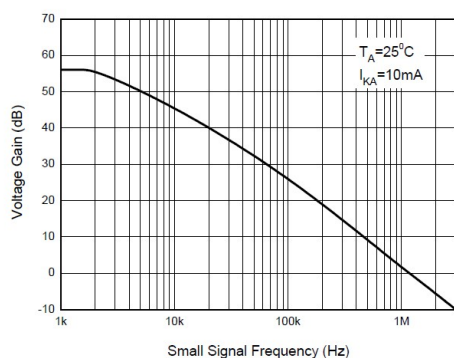
Off-State Cathode Current vs. Ambient Temperature



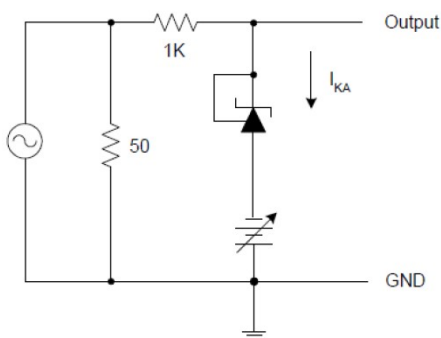
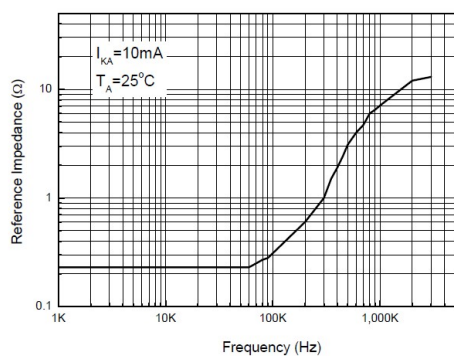
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



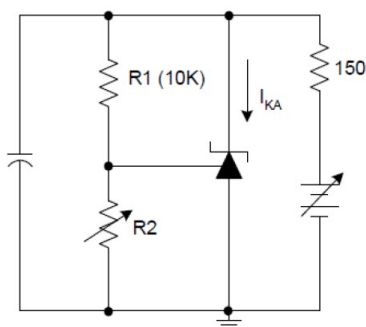
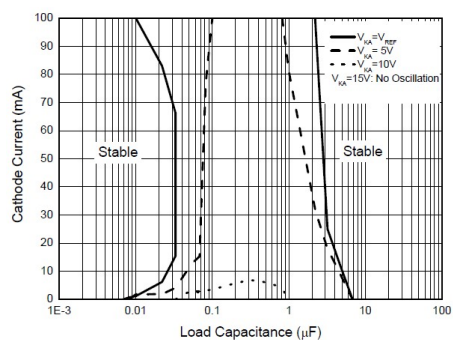
Small Signal Voltage Gain vs. Frequency



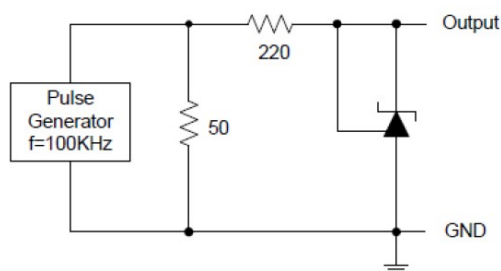
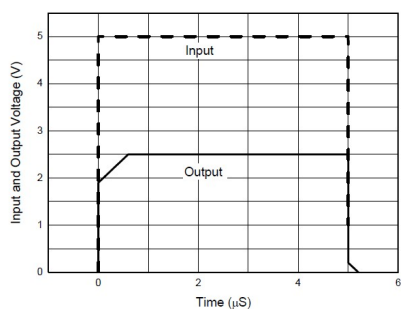
Reference Impedance vs. Frequency



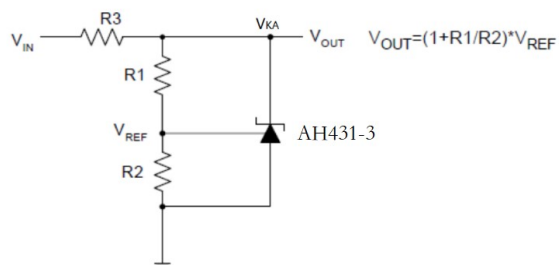
Stability Boundary Conditions vs. Load Capacitance



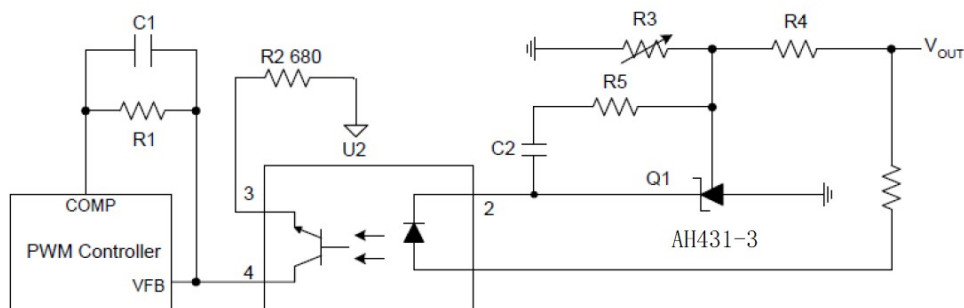
Pulse Response of Input and Output Voltage



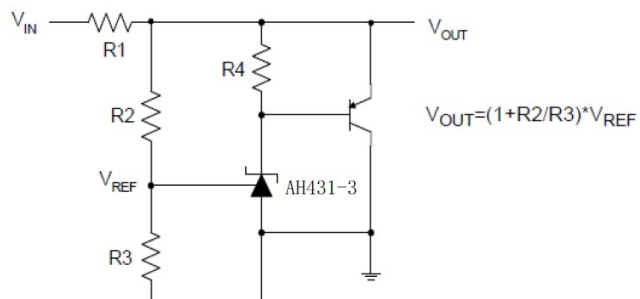
10, 典型应用图



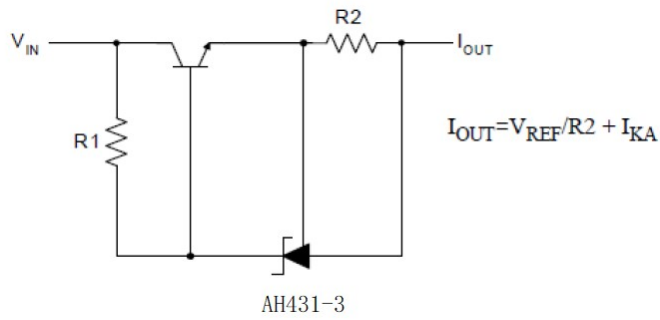
应用图1: Shunt Regulator



应用图2: PWM Converter With Reference



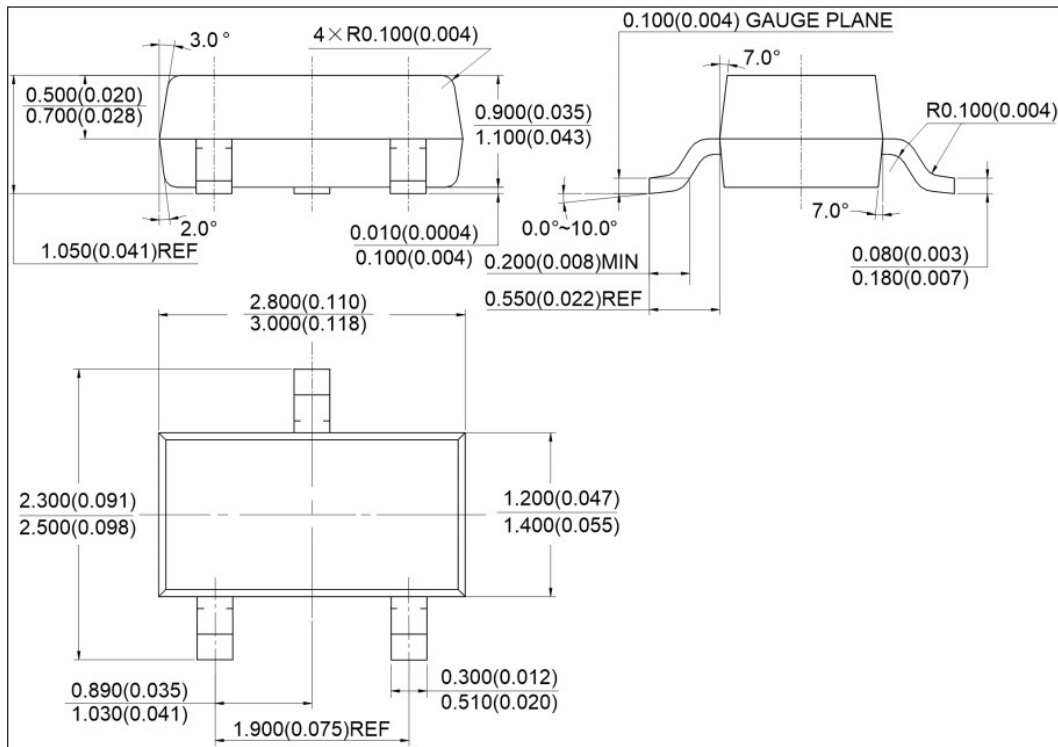
应用图3: High Current Shunt Regulator



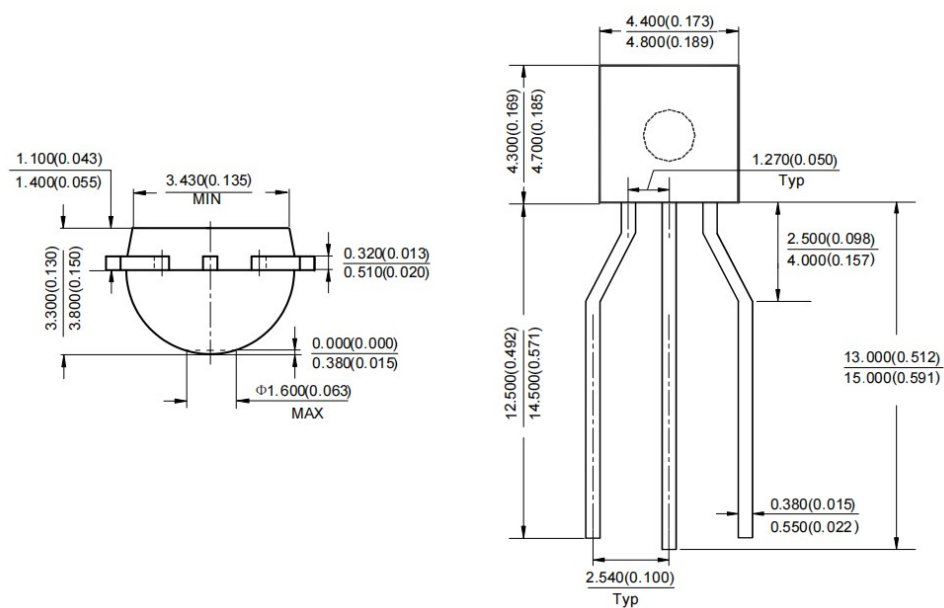
应用图4: Current Source or Current Limit

11, 封装尺寸 (单位: mm)

11.1 SOT23



11.2 TO92



11.3 SOT89

