

秦驰 TL431 的几种基本用法 TL431 中文资料简介

介绍：TL431 是一个有良好的热稳定性能的三端可调分流基准电压源。它的输出电压用两个电阻就可以任意地设置到从 V_{ref} (2.5V) 到 36V 范围内的任何值。该器件的典型动态阻抗为 $0.2\ \Omega$ ，在很多应用中可以用它代替齐纳二极管，例如，数字电压表，运放电路、可调压电源，开关电源等等。

特点：

- 可编程输出电压为 36V
- 电压参考误差： $\pm 0.4\%$ ，典型值@25°C (TL431B)
- 低动态输出阻抗，典型 $0.22\ \Omega$
- 负载电流能力 1.0mA to 100mA
- 等效全范围温度系数 50 ppm/°C 典型
- 温度补偿操作全额定工作温度范围
- 低输出噪声电压

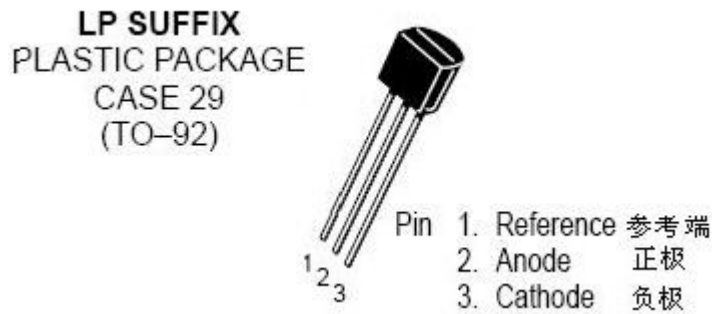
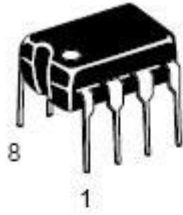


图 1 T092 封装引脚图



P SUFFIX
 PLASTIC PACKAGE
 CASE 626



DM SUFFIX
 PLASTIC PACKAGE
 CASE 846A
 (Micro-8)

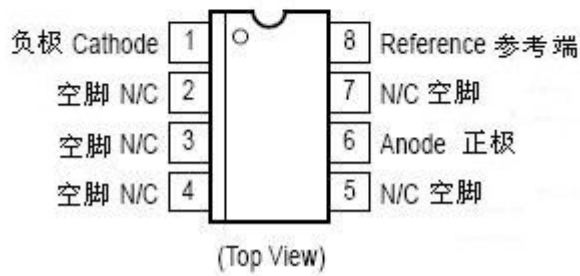


图 2 8 脚封装引脚功能

D SUFFIX
 PLASTIC PACKAGE
 CASE 751
 (SOP-8)

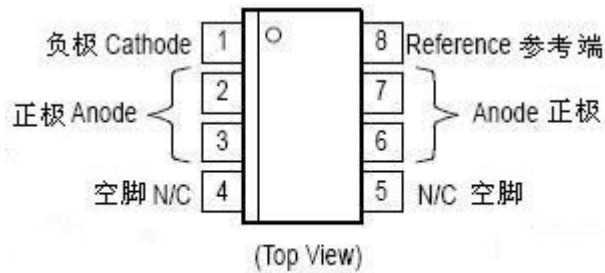
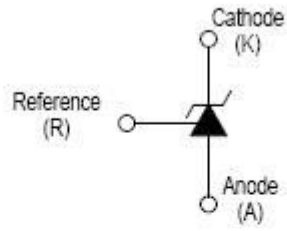


图 3 SOP-8 贴片封装引脚图

Symbol



Representative Block Diagram

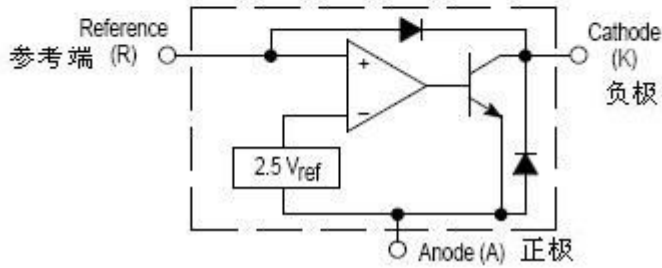


图 4 TL431 符号及内部方框图

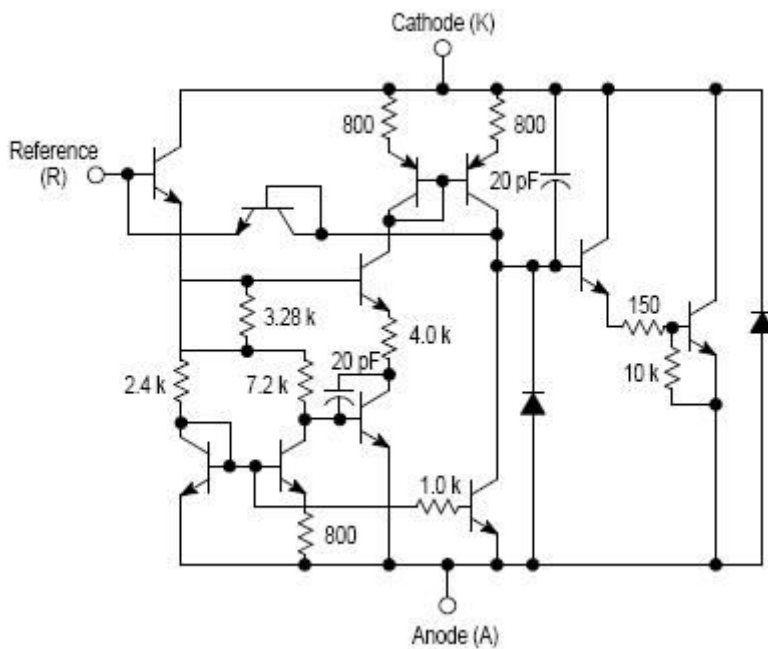


图 5 TL431 内部电路图

MAXIMUM RATINGS (Full operating ambient temperature range applies, unless otherwise noted.) 最大额定值 (环境温度范围适用, 除非另有说明。)

Rating 参数	Symbol	数值	Unit
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		符号		单位
Cathode to Anode Voltage 阴极阳极电压		VKA	37	V
Cathode Current Range, Continuous 阴极电流范围, 连续		IK	- 100 to +150	mA
Reference Input Current Range, Continuous 参考输入电流范围, 连续		Iref	- 0.05 to +10	mA
Operating Junction Temperature 工作结温		TJ	150	°C
Operating Ambient Temperature Range 操作环境温度范围	TL431I, TL431AI, TL431BI	TA	- 40 to +85	°C
	TL431C, TL431AC, TL431BC		0 to +70	
Storage Temperature Range 储存温度范围		Tstg	- 65 to +150	°C
Total Power Dissipation 总耗散功率 常温@ TA = 25°C Derate above 25°C Ambient Temperature	D, LP 后缀塑封	PD	0.70	W
	P 后缀塑封		1.10	
	DM 后缀塑封		0.52	
Total Power Dissipation @ TC = 25°C Derate above 25°C Case Temperature 总耗散功率 外壳温度	D, LP 后缀塑封	PD	1.5	W
	P 后缀塑封		3.0	

RECOMMENDED OPERATING CONDITIONS 建议操作条件

Condition 条件	Symbol 符号	Min 最大值	Max 最小值	Unit 单位
Cathode to Anode Voltage 阴极阳极电压	VKA	Vref	36	V
Cathode Current 阴极电流	IK	1.0	100	mA

THERMAL CHARACTERISTICS 热特性

Characteristic 特性	Symbol 符号	D, LP 后缀封装	P 后缀封装	DM 后缀封装	Unit 单位
Thermal Resistance, Junction - to - Ambient 热阻, 结点到环境	RqJA	178	114	240	°C/W
Thermal Resistance, Junction - to - Case 热阻, 结到外壳	RqJC	83	41	-	°C/W

ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise noted.) 电气特性 (25°C, 除非另有说明。)

Characteristic 特性		Symbol 符号	TL431I			TL431C			Unit 单位
			最小值	典型值	最大值	最小值	典型值	最大值	
Reference Input Voltage (Figure 1) 参考输入电压 VKA = Vref, IK = 10 mA	TA = 25°C	Vref	2.44	2.495	2.55	2.44	2.495	2.55	V
	TA = Tlow to Thigh (Note 1)		2.41	-	2.58	2.423	-	2.567	
Reference Input Voltage Deviation Over Temperature Range 参考输入电压偏差温度范围 (Figure 1, Notes 1, 2) VKA = Vref, IK = 10 mA		DVref	-	7.0	30	-	3.0	17	mV
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage IK = 10 mA (Figure 2),	Δ VKA = 10 V to Vref	$\frac{\Delta Vref}{\Delta VKA}$	-	-1.4	-2.7	-	-1.4	-2.7	mV/V
	Δ VKA = 36V to 10 V		-	-1.0	-2.0	-	-1.0	-2.0	
Reference Input Current (Figure 2) 参考输入电流 IK = 10 mA, R1 = 10k, R2 = ∞	TA = 25°C	Iref	-	1.8	4.0	-	1.8	4.0	μ A
	TA = Tlow to Thigh (Note 1)		-	-	6.5	-	-	5.2	
Reference Input Current Deviation Over Temperature Range 参考输入电流偏差温度范围 (Figure 2, Note 1, 4) IK = 10 mA, R1 = 10 k, R2 = ∞		DIref	-	0.8	2.5	-	0.4	1.2	μ A
Minimum Cathode Current For Regulation VKA = Vref (Figure 1) 最小阴极电流调节		Imin	-	0.5	1.0	-	0.5	1.0	mA
Off - State Cathode Current (Figure 3) VKA = 36 V, Vref = 0 V 断态阴极电流		Ioff	-	260	1000	-	260	1000	nA
Dynamic Impedance (Figure 1, Note 3) 动态阻抗 VKA = Vref, DIK = 1.0mA to 100mA f 3 1.0kHz		ZKA	-	0.22	0.5	-	0.22	0.5	Ω

ELECTRICAL CHARACTERISTICS (TA = 25°C, unless otherwise noted.) 电气特性 (25°C, 除非另有说明。)

Characteristic 特性		Symbol 符号	TL431AI			TL431AC			TL431BI			Unit 单
			最小值	典型值	最大值	最小值	典型值	最大值	最小值	典型值	最大值	
Reference Input Voltage (Figure 1) 参考输入电压 VKA = Vref, IK = 10 mA	TA = 25°C	Vref	2.47	2.495	2.52	2.47	2.495	2.52	2.483	2.495	2.507	V
	TA = Tlow to Thigh		2.44	-	2.55	2.453	-	2.537	2.475	2.495	2.515	
Reference Input Voltage Deviation Over Temperature Range (Figure 1, Notes 1, 2) 参考输入电压偏差温度范围 VKA = Vref, IK = 10 mA		DVref	-	7.0	30	-	3.0	17	-	3.0	17	mV
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage IK = 10 mA (Figure 2),	$\Delta VKA = 10 \text{ V to } Vref$	$\frac{\Delta Vref}{\Delta VKA}$	-	-1.4	-2.7	-	-1.4	-2.7	-	-1.4	-2.7	mV
	$\Delta VKA = 36 \text{ V to } 10 \text{ V}$		-	-1.0	-2.0	-	-1.0	-2.0	-	-1.0	-2.0	
Reference Input Current (Figure 2) 参考输入电流 IK = 10 mA, R1 = 10 k, R2 = ∞	TA = 25°C	Iref	-	1.8	4.0	-	1.8	4.0	-	1.1	2.0	μA
	TA = Tlow to Thigh (Note 1)			-	6.5	-	-	5.2	-	-	4.0	
Reference Input Current Deviation Over Temperature Range (Figure 2, Note 1) IK = 10 mA, R1 = 10k, R2 = ∞ 参考输入电流偏差温度范围		DIref	-	0.8	2.5	-	0.4	1.2	-	0.8	2.5	μA
Minimum Cathode Current For Regulation 最小阴极电流调节 VKA = Vref (Figure 1)		Imin	-	0.5	1.0	-	0.5	1.0	-	0.5	1.0	mA
Off - State Cathode Current (Figure 3) 断态阴极电流 VKA = 36V, Vref = 0V		Ioff	-	260	1000	-	260	1000	-	230	500	nA
Dynamic Impedance (Figure 1, Note 3) VKA = Vref, DIK = 1.0 mA to 100 mA f 3 1.0 kHz 动态阻抗		ZKA	-	0.22	0.5	-	0.22	0.5	-	0.14	0.3	Ω

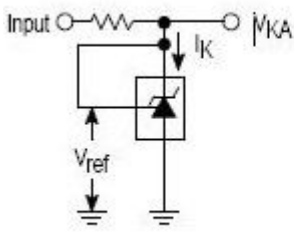


图6 测试电路 $V_{KA} = V_{ref}$

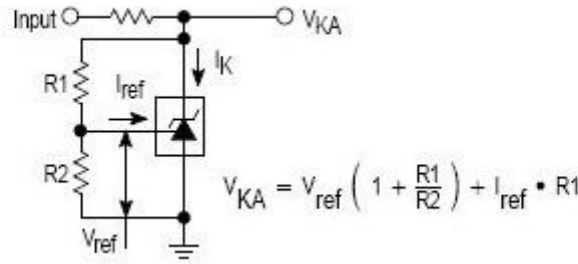


图7 测试电路 $V_{KA} > V_{ref}$

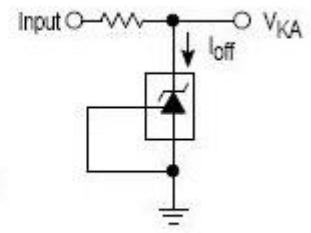


图8 测试电路 for I_{off}

曲线图:

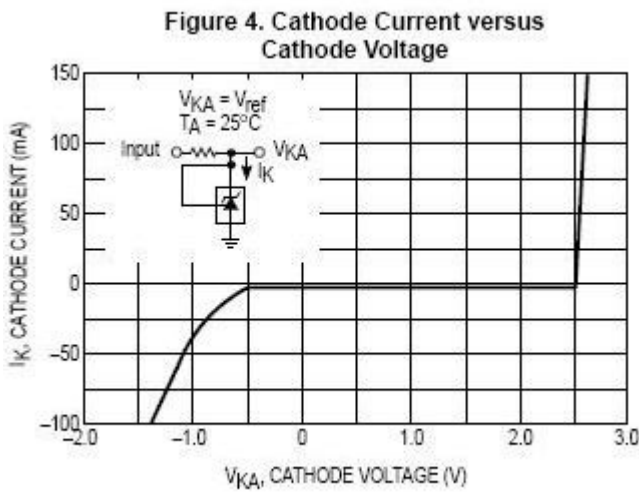


图9 阴极电流与阴极电压

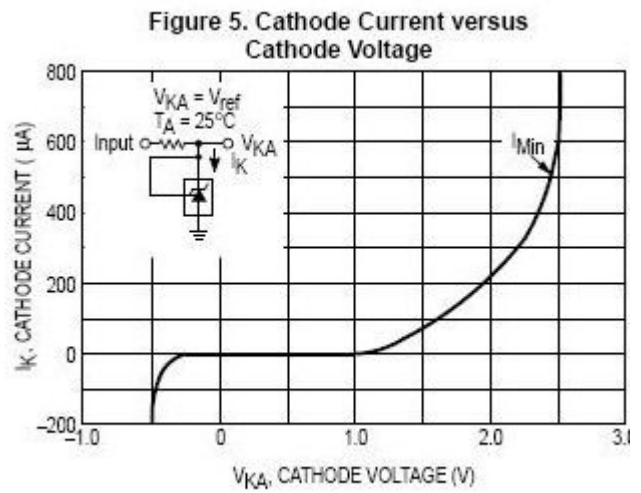


图10 阴极电流与阴极电压

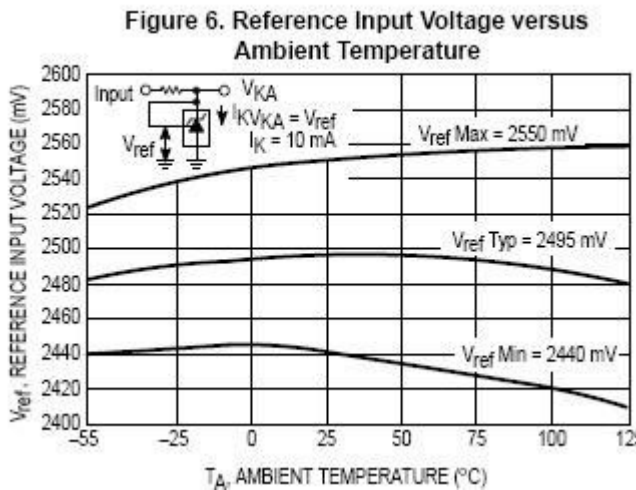


图9 阴极电流与阴极电压

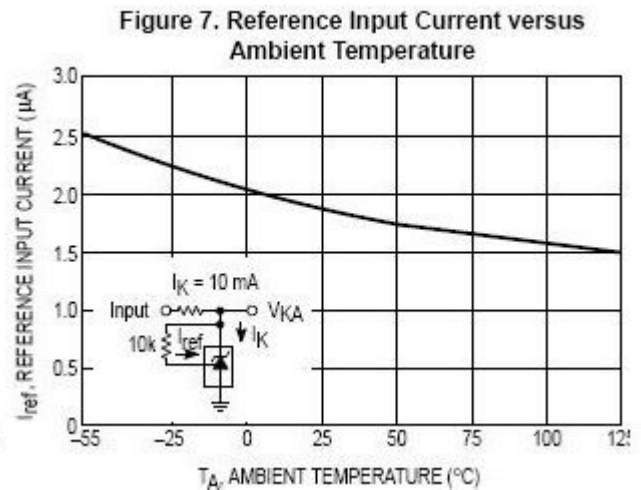


图10 阴极电流与阴极电压

图 11 参考输入电压与常温

图 12 参考输入电流与常温

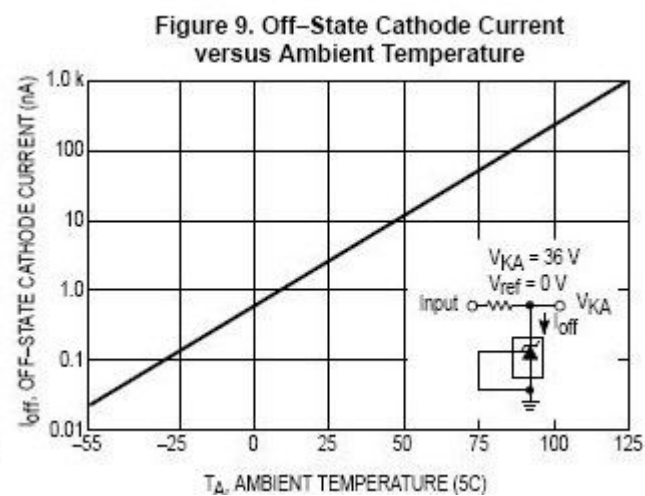
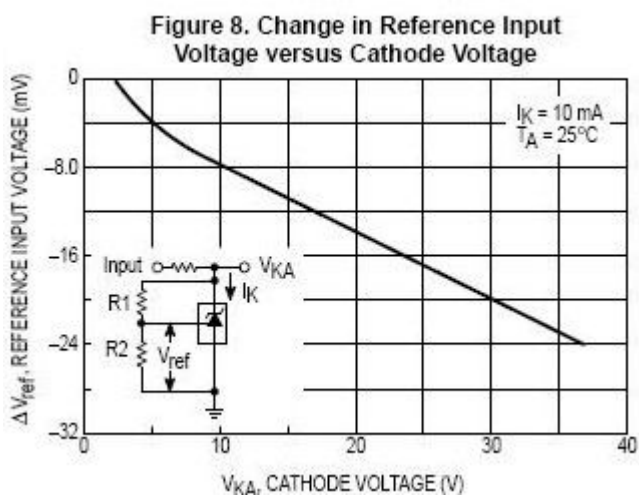


图 13 变化的参考输入电压与阴极电压

图 14 断态阴极电流随环境温度

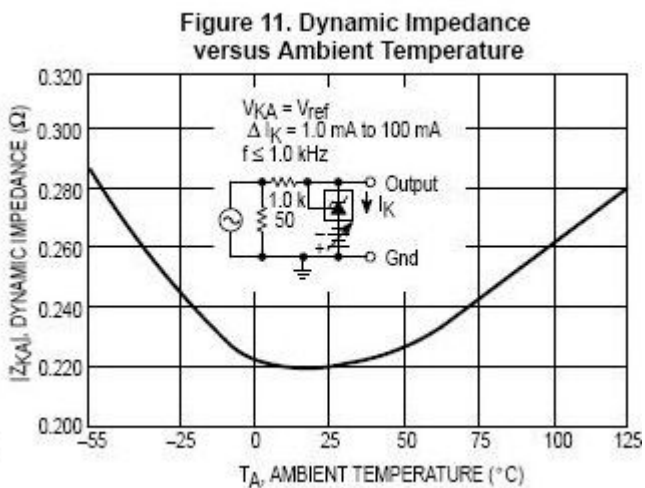
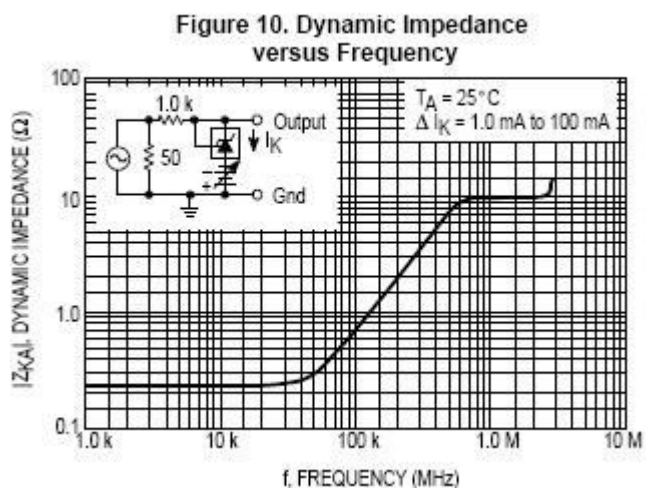


图 15 动态阻抗与频率

图 16 动态阻抗随环境

温度

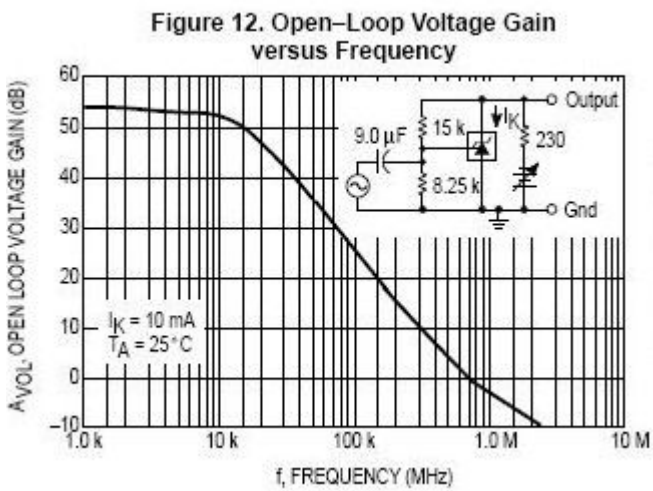


图 17 开环电压增益与频率

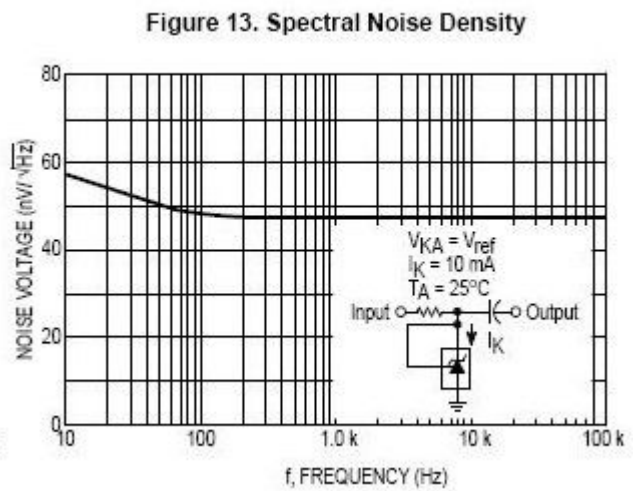


图 18 谱噪声密度

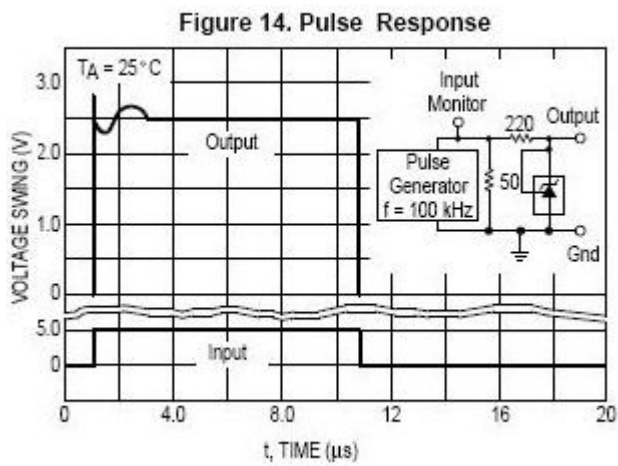


图 19 脉冲响应

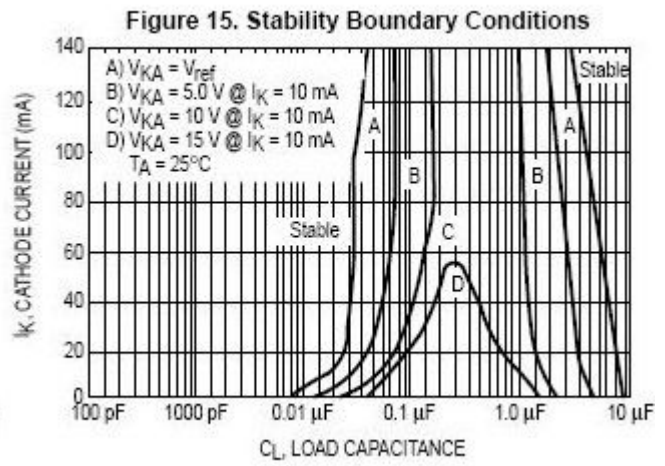


图 20 稳定的边界条件

边界条件

应用法:

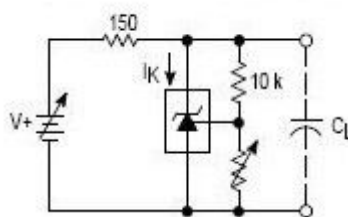
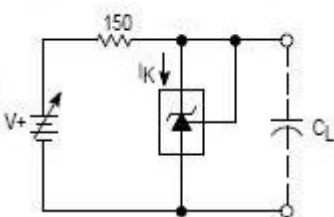


图 21 测试电路曲线 a 边界条件的稳定性 图 22 曲线测试电路的 B, C 和 D 边界条件的稳定性

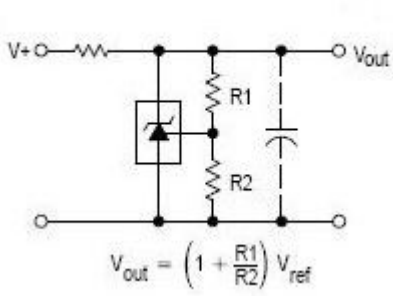


图 23 并联稳压器电路图

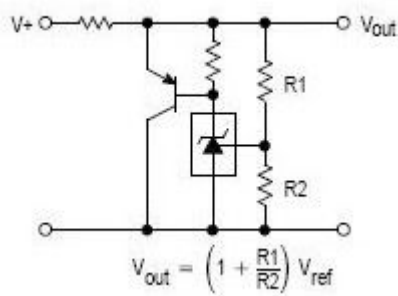


图 24 大电流并联稳压器电路

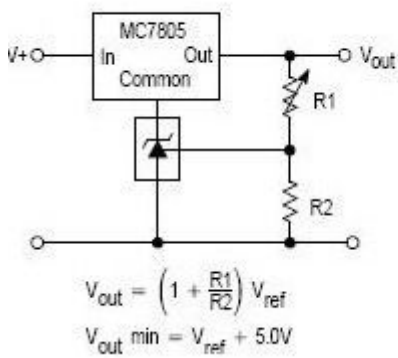


图 25 控制三端固定稳压输出电路

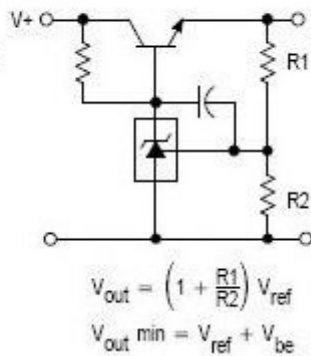


图 26 串联稳压调节电路

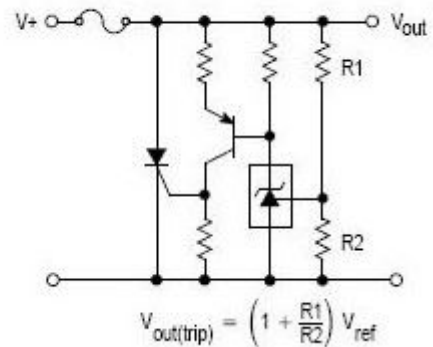


图 27 过压保护电路

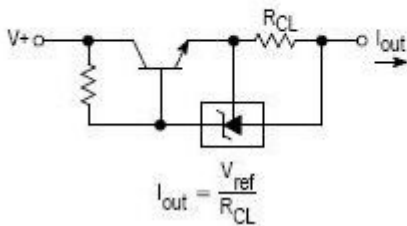


图 28 恒流源电路

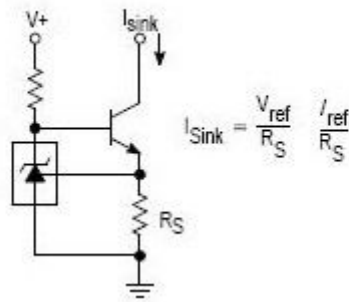


图 29 恒定流入电流源电路

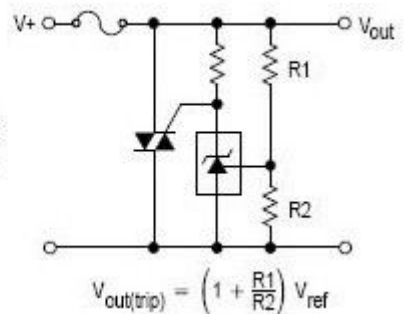


图 30 双向可控硅过压

保护电路

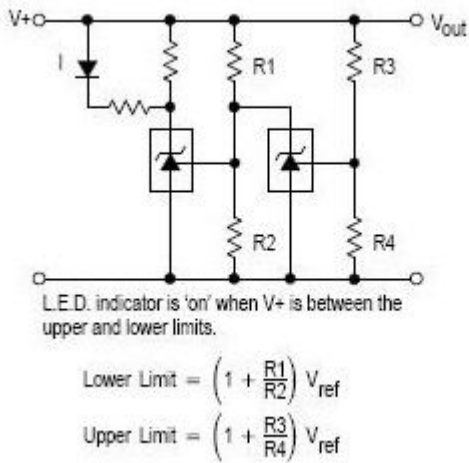


图 31 电压监视器电路

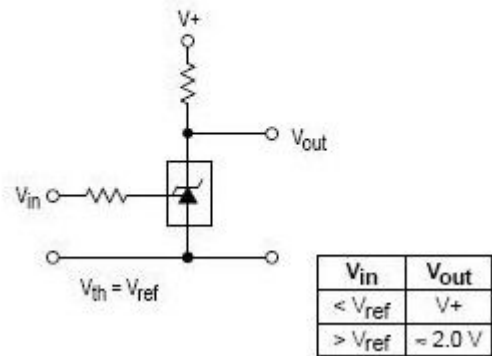


图 32 单电源比较温度补偿

电路

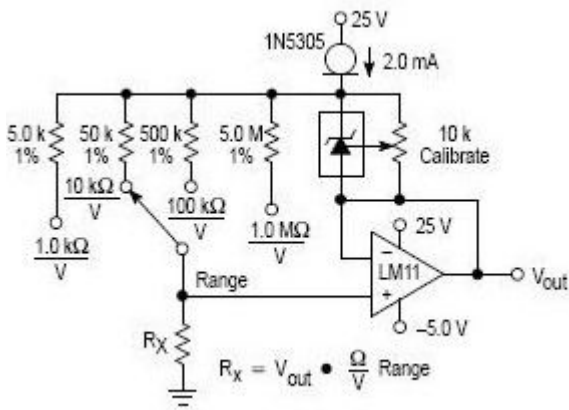


图 33 线性欧姆表电路图

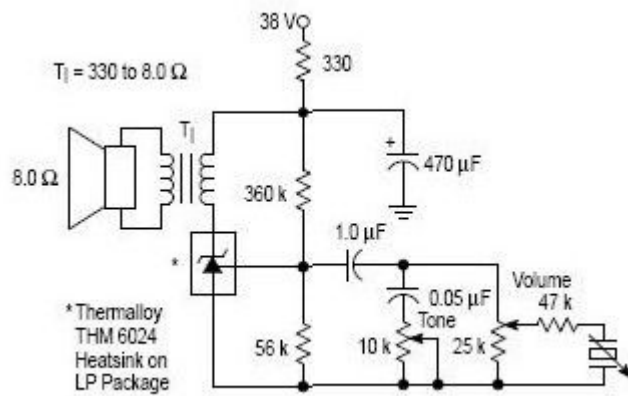


图 34 简单的 400 毫瓦唱机放大器

电路

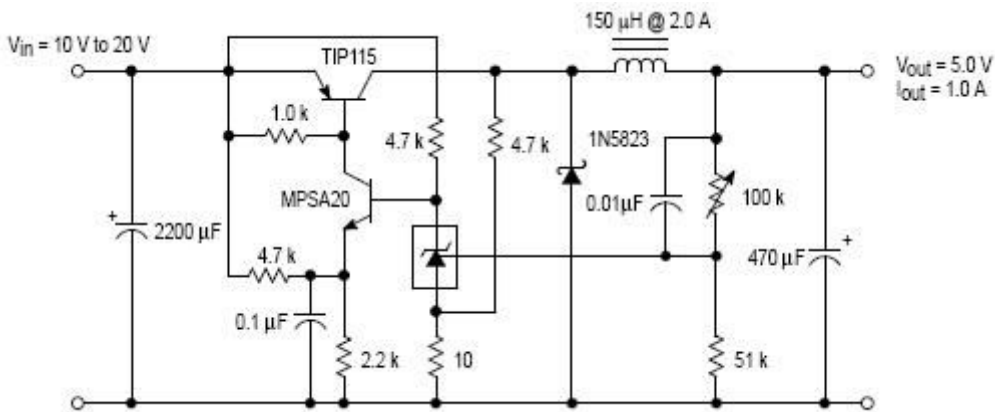


图 35 高效率降压型开关转换器电路图

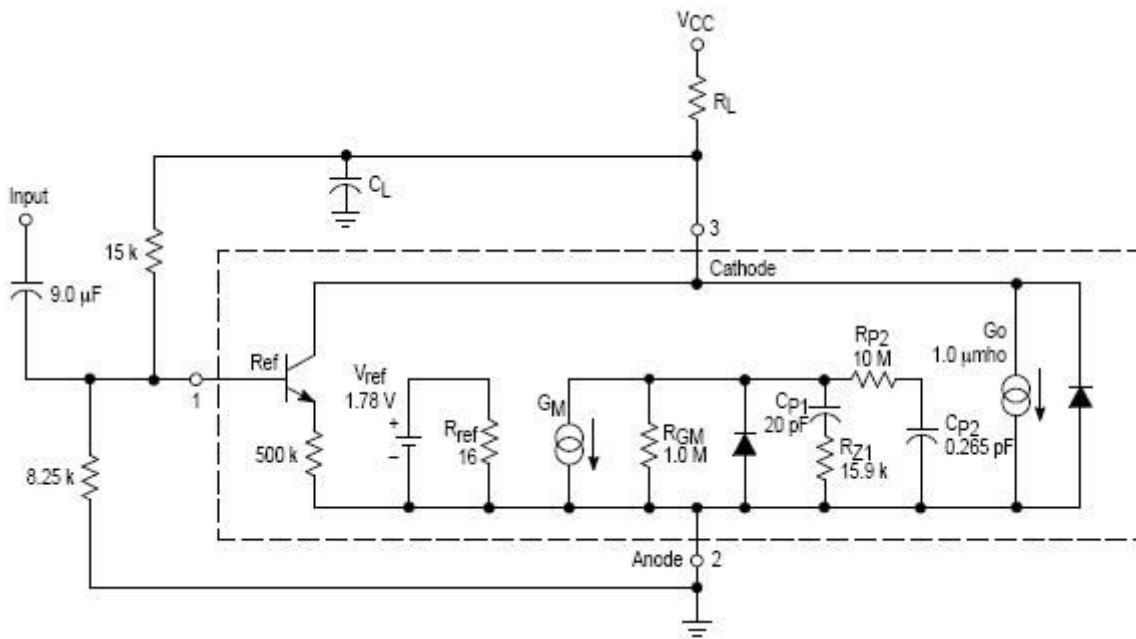


图 36 筒体 TL431 器件模型

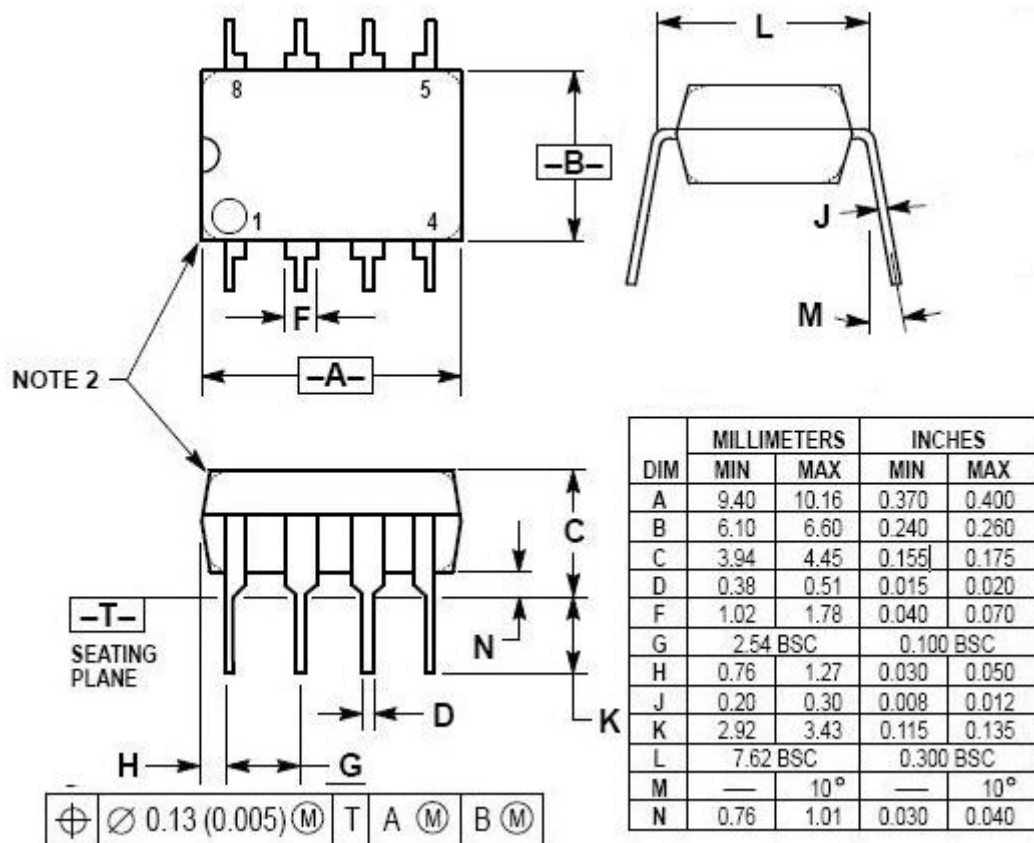
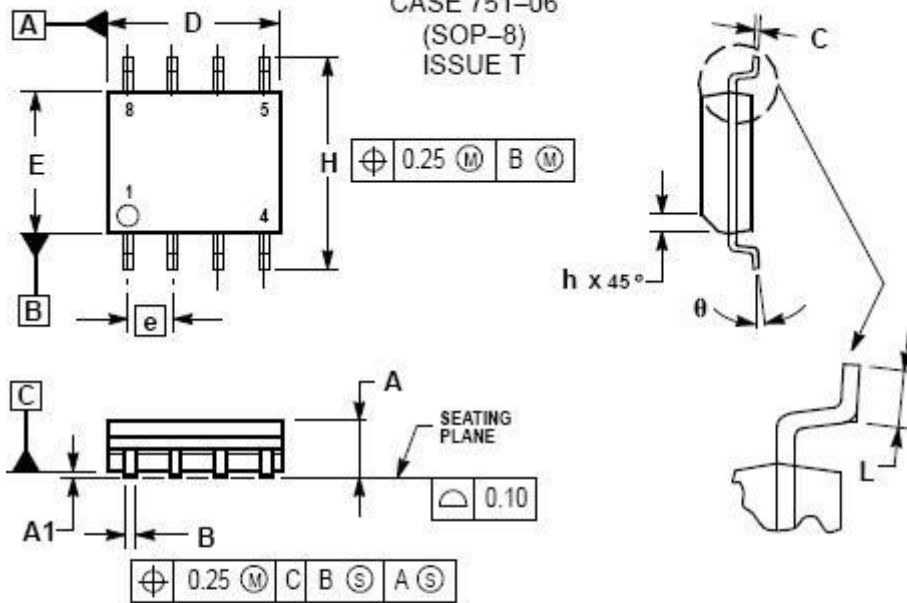


图 37 封装图

D SUFFIX
PLASTIC PACKAGE
CASE 751-06
(SOP-8)
ISSUE T

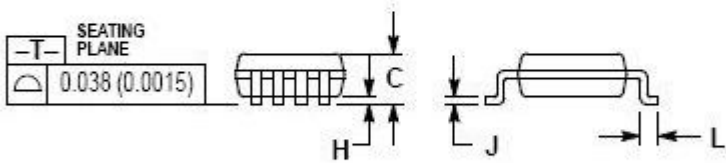
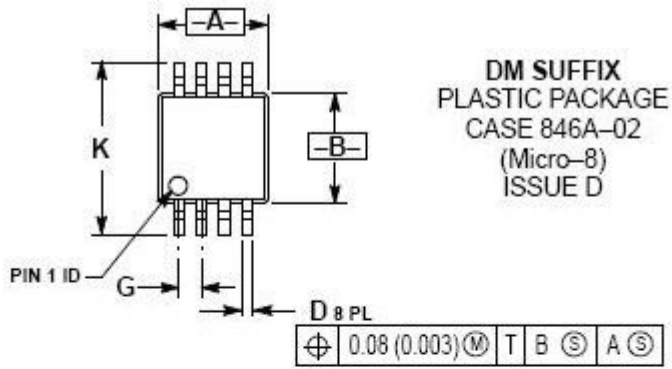


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

图 38 SOP-8 贴片封装图



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	—	1.10	—	0.043
D	0.25	0.40	0.010	0.016
G	0.65 BSC		0.028 BSC	
H	0.05	0.15	0.002	0.006
J	0.13	0.23	0.005	0.009
K	4.75	5.05	0.187	0.199
L	0.40	0.70	0.016	0.028

- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: MILLIMETER.
 - DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
 - DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.

图 39 封装图