

AN1431, AN1431T

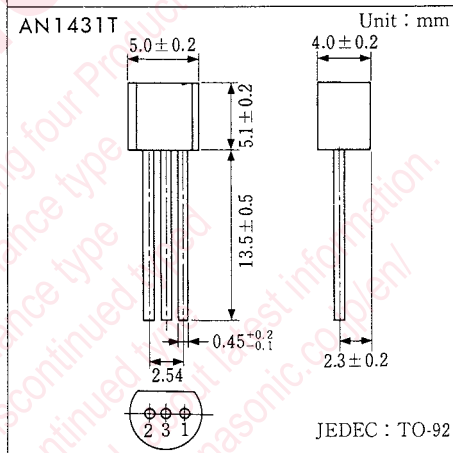
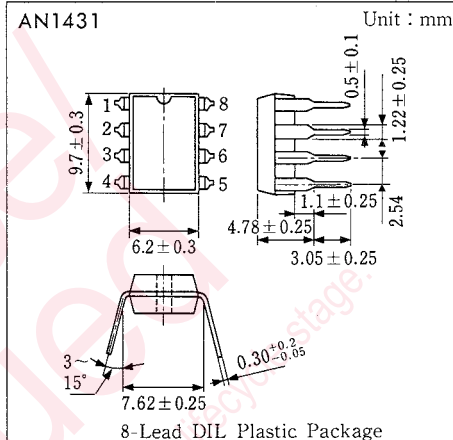
Adjustable Precision Shunt Regulators

■ Outline

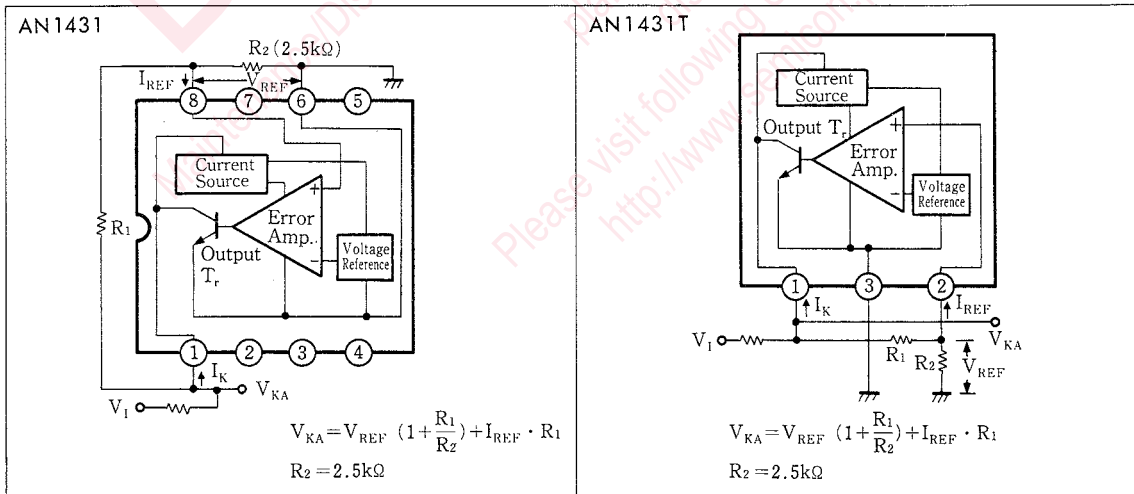
The AN1431 and the AN1431T are high precision voltage regulators which allow adjustment of output voltage between 2.5V and 36V with external resistance within the operating temperature range. Moreover, they have the fast turn-on response characteristics, allowing replacement as zener diode and application of wide range.

■ Features

- High precision output voltage : $2.5 \pm 2\%$
- Equivalent full-range temperature : 17ppm/°C typ.
- Adjustable output voltage : 2.5~36V
- Fast turn-on response
- Low dynamic output impedance : 0.2Ω typ.
- Low output noise voltage



■ Block Diagrams



■ Pin

● AN1431

Pin No.	Pin Name
1	Cathode
2	NC
3	NC
4	NC
5	NC
6	Anode
7	NC
8	Reference

● AN1431T

Pin No.	Pin Name
1	Cathode
2	Reference
3	Anode

■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply Voltage	V _{CC}	37	V
Supply Current	I _{CC}	-100 ~ +150	mA
Power Dissipation	P _D	750	mW
		650	mW
Reference Input Current	I _{REF}	-0.05 ~ +10	mA
Operating Ambient Temperature	T _{opr}	-20 ~ +85	°C
Storage Temperature	T _{stg}	-55 ~ +150	°C

■ Electrical Characteristics (Ta=25°C ± 2°C)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Reference Voltage	V _{REF}	1	V _{KA} = V _{REF} , I _K = 10mA	2.45	2.50	2.55	V
Reference Voltage Temperature Deviation	V _{REF(dev)} ^{*1,2}	1	V _{KA} = V _{REF} , I _K = 10mA, T _a = 0 ~ +70°C		3	17	mV
Reference Voltage Fluctuation	ΔV _{REF}	2	I _K = 10mA, ΔV _{KA} = 10V ~ V _{REF}		-1.2	-2.7	mV/V
	ΔV _{KA}		I _K = 10mA, ΔV _{KA} = 36V ~ 10V		-1	-2	mV/V
Reference Input Current	I _{REF}	2	I _K = 10mA, R ₁ = 10kΩ, R ₂ = ∞		2	4	μA
Reference Input Current Temperature Deviation	I _{REF(dev)} ^{*2}	2	I _K = 10mA, R ₁ = 10kΩ, R ₂ = ∞, T _a = 0 ~ +70°C		0.4	1.2	μA
Minimum Cathode Current	I _{min}	1	V _{KA} = V _{REF}		0.4	1.0	mA
Off State Cathode Current	I _{OFF}	3	V _{KA} = 36V, V _{REF} = 0V		0.1	1.0	μA
Dynamic Impedance	Z _{KA} ^{*3}	1	V _{KA} = V _{REF} , I _K = 1 ~ 100mA, f ≤ 1kHz		0.2	0.5	Ω

Note) The operating supply voltage range is V_{KA} = V_{REF} (2.5V ~ 36V)

$$*1 \quad |\alpha V_{REF}| = \left(\frac{V_{REF(dev)}}{V_{REF}} \right) \times 10^6 / \Delta T_a \left(\frac{ppm}{C} \right)$$

$$V_{REF}^* = V_{REF} \text{ (at } T_a = 25^\circ\text{C)}$$

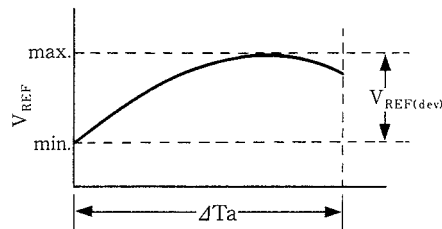
● Example : V_{REF(dev)} = 3mV, the temperature coefficient of V_{REF} is

$$|\alpha V_{REF}| = (3\text{mV}/2500\text{mV}) \times 10^6 / 70^\circ\text{C} = 17.1 \left(\frac{ppm}{C} \right)$$

*2 These values are design reference values, not guaranteed values.

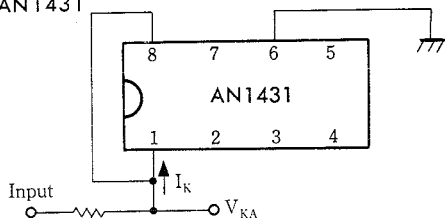
*3 The dynamic impedance can be defined by the following expression.

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_K} \quad \left(\text{The total } Z_{KA} \text{ at the test circuit 2 is } |Z'| = \frac{\Delta V}{\Delta I} \approx |Z_{KA}| \left(1 + \frac{R_1}{R_2} \right) \right)$$

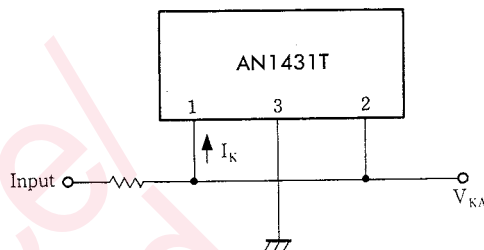


Test Circuit 1 (V_{REF} , $V_{REF(dev)}$, I_{min} , Z_{KA}) Note)

●AN1431

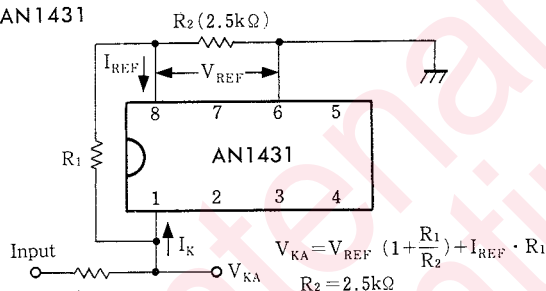


●AN1431T

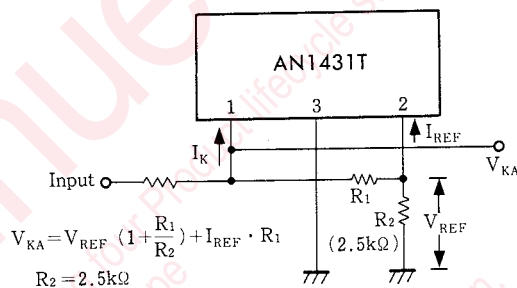


Test Circuit 2 ($\Delta V_{REF}/\Delta V_{KA}$, I_{REF} , $I_{REF(dev)}$) Note)

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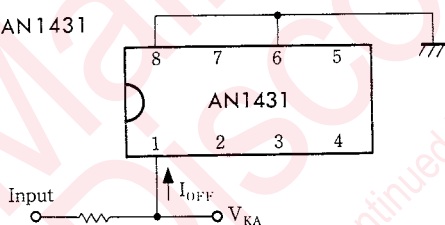


●AN1431T

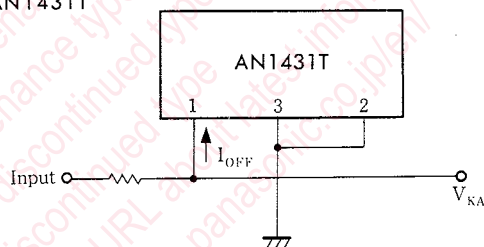


Test Circuit 3 (I_{OFF})

●AN1431

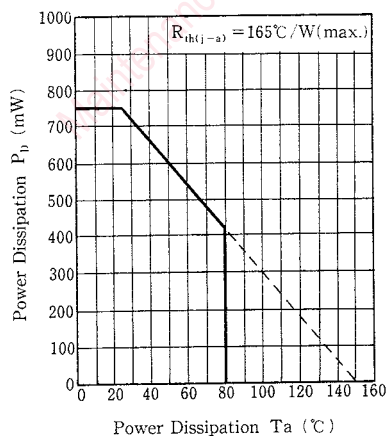


●AN1431T

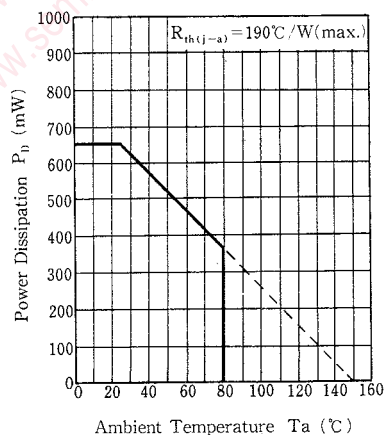


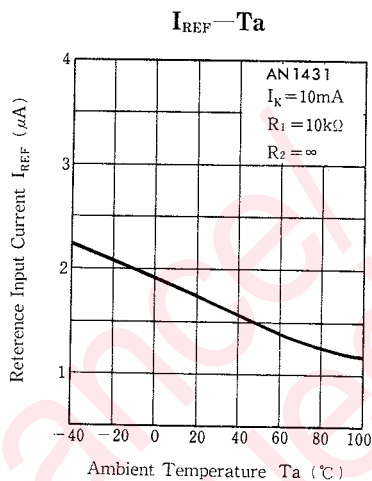
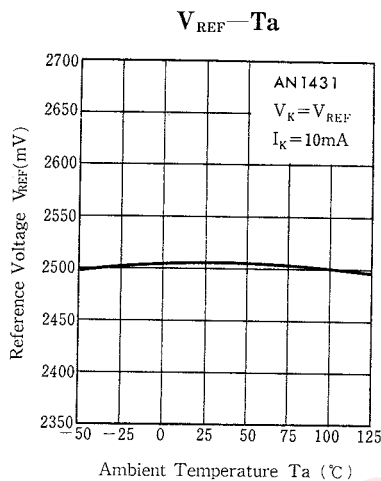
Note) The test time should be so short that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

$P_D - T_a$ (AN1431)



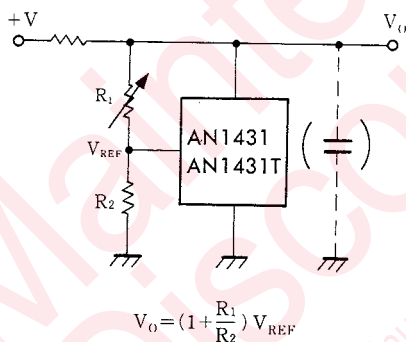
$P_D - T_a$ (AN1431T)



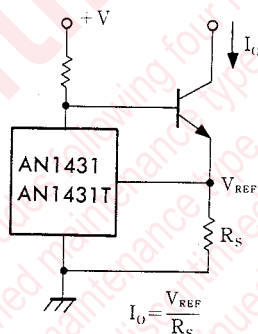


■ Application Circuits

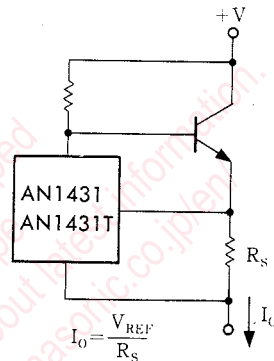
① Shunt Regulator



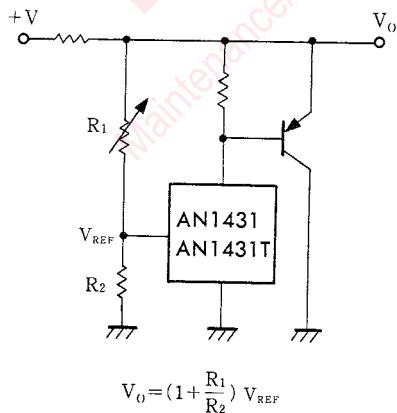
② Constant Current SINK



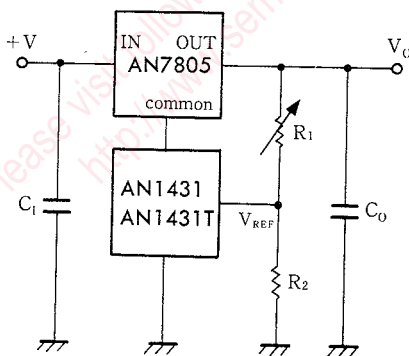
③ Constant Current Source



④ High Current Shunt Regulator



⑤ Adjustable Output Regulator Combined with 3-Terminal Regulator



$$V_O = V_{REF} (1 + \frac{R_1}{R_2}), \quad V_{O(\min.)} = V_{REF} + 5V$$

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