AN1431T, AN1431M

Variable output shunt regulator

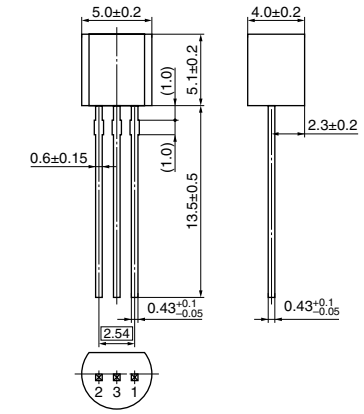
■ Overview

The AN1431T and AN1431M are highly accurate stabilized power supplies in which the output voltage can be adjusted in the range from approximately 2.5 to 36V under the operating temperature by using the external resistor. Because of its fast rising characteristic, it can be used as a Zener diode and has the wide application.

■ Features

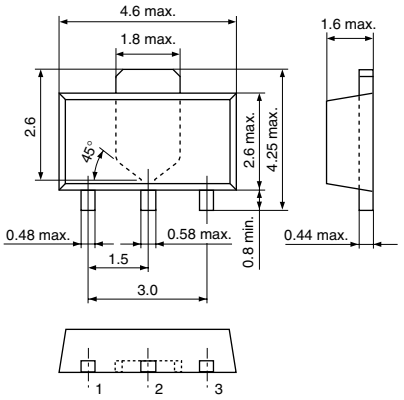
- High precision reference voltage: 2.5V (allowance: ±2%)
- High temperature stability: 17ppm/°C typ.
- Output voltage externally adjustable: 2.5 to 36V
- Fast rising output
- Low input impedance: 0.2Ω typ.
- Low output noise voltage

AN1431T Unit: mm



SSIP003-P-0000

AN1431M Unit: mm



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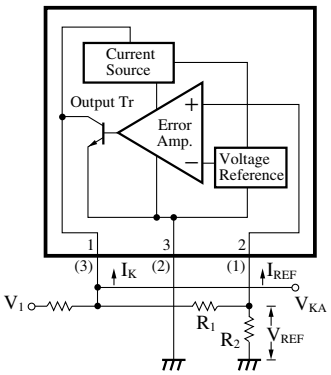
■ Block Diagram (AN1431T)



$$V_{KA} = V_{REF}\left(1 + \frac{R_1}{R_2}\right) + I_{REF} \cdot R_1$$

$R_2 = 2.5k\Omega$

Note) The number in ( ) shows the pin number for the AN1431M.

■ Pin Descriptions

- AN1431T

Pin No.	Description
1	Cathode
2	Reference pin
3	Anode

- AN1431M

Pin No.	Description
1	Reference pin
2	Anode
3	Cathode

■ Absolute Maximum Ratings at T_a = 25°C

Parameter		Symbol	Rating	Unit
Supply voltage		V_{CC}	37	V
Supply current		I_{CC}	−100 to +150	mA
Power dissipation		P_D	650 *	mW
Reference input current		I_{REF}	− 0.05 to +10	mA
Operating ambient temperature	AN1431T	V_{opr}	−20 to +85	°C
	AN1431M		−25 to +80	
Storage temperature	AN1431T	T_{stg}	−55 to +150	°C
	AN1431M		−55 to +125	

* AN1431M is mounted on a standard board (glass epoxy: 20mm × 20mm × t1.7mm with Cu foil of 1cm² or more).

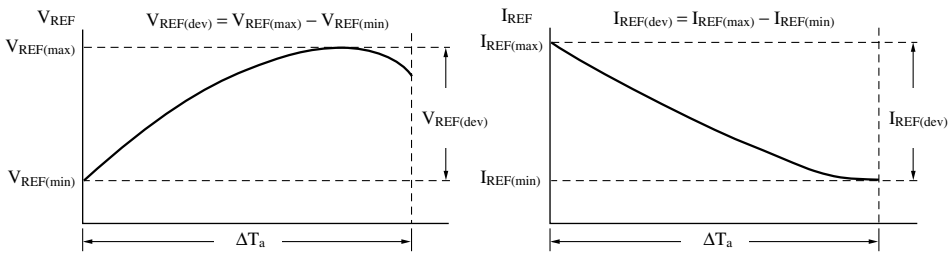
■ Recommended Operating Range at T_a = 25°C

Parameter	Symbol	Range
Supply voltage	V_{KA}	V_{REF} (2.5 to 36V)

■ Electrical Characteristics at T_a = 25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reference voltage	V_{REF}	$V_{KA} = V_{REF}$, I_K = 10mA	2.45	2.50	2.55	V
Reference voltage change to temperature	$V_{REF(Jev)}$ *1, 2	$V_{KA} = V_{REF}$, I_K = 10mA, T_a = 0 to +70°C	—	3	17	mV
Reference voltage power supply characteristic	ΔV_{REF}	I_K = 10mA, ΔV_{KA} = 10V to V_{REF}	—	−1.2	−2.7	mV/V
	ΔV_{KA}	I_K = 10mA, ΔV_{KA} = 36V to 10V	—	−1	−2	mV/V
Reference input current	I_{REF}	I_K = 10mA, R_1 = 10kΩ, R_2 = ∞	—	2	4	μA
Reference input current change to temperature	$I_{REF(dev)}$ *2	I_K = 10mA, R_1 = 10kΩ, R_2 = ∞, T_a = 0 to +70°C	—	0.4	1.2	μA
Minimum cathode current	I_{min}	$V_{KA} = V_{REF}$	—	0.4	1.0	mA
Off-state cathode current	I_{OFF}	V_{KA} = 36V, V_{REF} = 0V	—	0.1	1.0	μA
Dynamic impedance	$\lvert Z_{KA} \rvert$ *3	$V_{KA} = V_{REF}$, I_K = 1 to 100mA, f ≤ 1kHz	—	0.2	0.5	Ω

*1



The temperature coefficient aV_{REF} for the reference input voltage is equivalently given by the following expression.

$$\lvert aV_{REF} \rvert = \frac{\frac{V_{REF(dev)}}{V_{REF}\,^{\dagger}}}{\Delta T_a} \times 10^6 \ \text{(ppm/°C)} \qquad \dagger\ V_{REF} \text{ at } T_a = 25°C$$

For example, assuming $V_{REF(max)}$ = 2500mV (T_a = 30°C), $V_{REF(min)}$ = 2497mV (T_a = 0°C), ($V_{REF(dev)}$ = 3mV) and

V_{REF} = 2499mV (T_a = 25°C) ΔT_a = 70°C

then, $\lvert aV_{REF} \rvert = \dfrac{\frac{3mV}{2499mV}}{70°C} \times 10^6 = 17.1$ (ppm/°C)

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

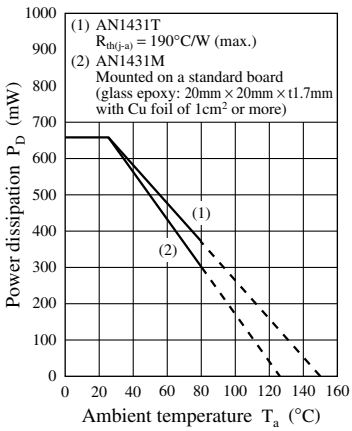
*3 The dynamic impedance is defined by the following expression. $\lvert Z_{KA} \rvert = \dfrac{\Delta V_{KA}}{\Delta I_K}$

The total dynamic impedance at ΔV_{REF} , ΔV_{KA} , I_{REF} and $I_{REF(dev)}$ is as follows.

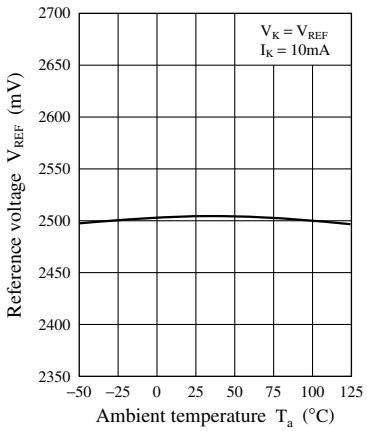
$$\lvert Z \rvert = \frac{\Delta V}{\Delta I} = \lvert Z_{KA} \rvert \left(1 + \frac{R_1}{R_2}\right)$$

■ Main Characteristics

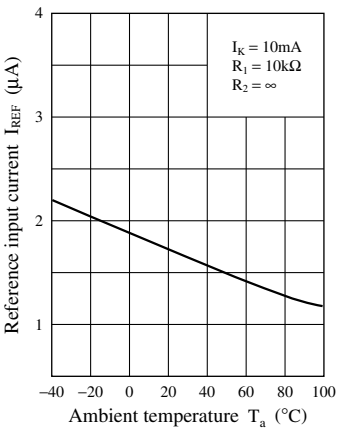
P_D — T_a



V_{REF} — T_a

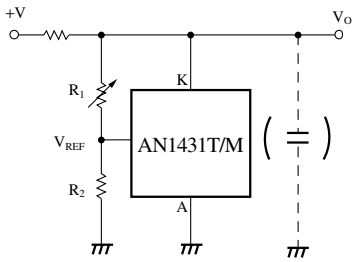


I_{REF} — T_a



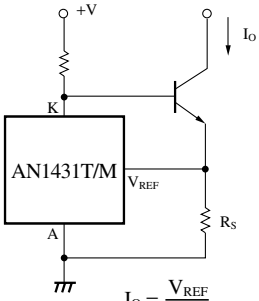
■ Application Circuit Examples

1. Shunt regulator



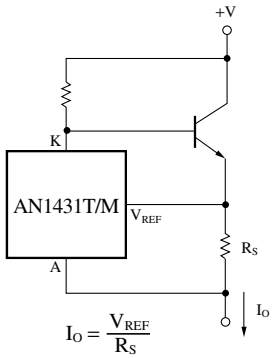
$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

2. Constant current power supply



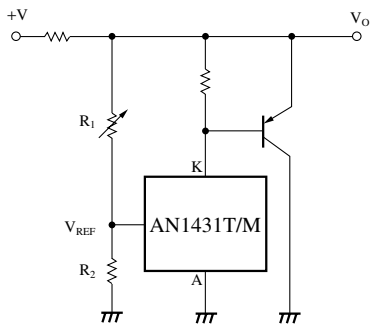
$$I_O = \frac{V_{REF}}{R_S}$$

3. Constant current source



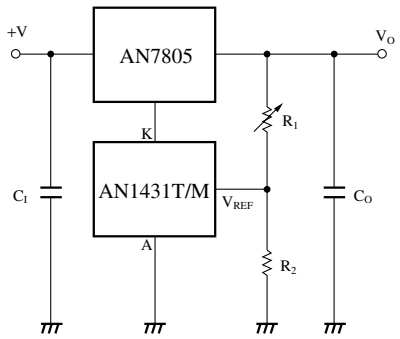
$$I_O = \frac{V_{REF}}{R_S}$$

4. Current bootstrap



$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

5. Adjustable output regulator combined with 3-pin regulator



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