Panasonic

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

■ Block Diagram (AN1431T)

$$V_{KA} = V_{REF}\left(1 + \frac{R_1}{R_2}\right) + I_{REF} \cdot R_1$$
$$R_2 = 2.5k\Omega$$
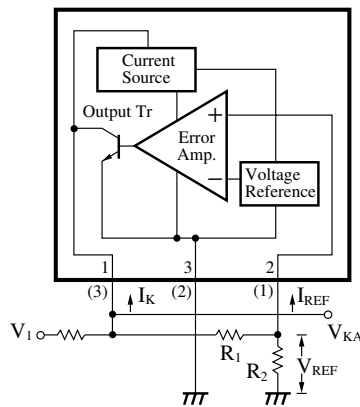
Note) The number in ( ) shows the pin number for the AN1431M.

AN1431T — Unit: mm — SSIP003-P-0000

AN1431M — Unit: mm — HSIP003-P-0000B

Note) The packages (SSIP003-P-0000 and HSIP003-P-0000B) of this product will be changed to lead-free type (SSIP003-P-0000S and HSIP003-P-0000Q). See the new package dimensions section later of this datasheet.
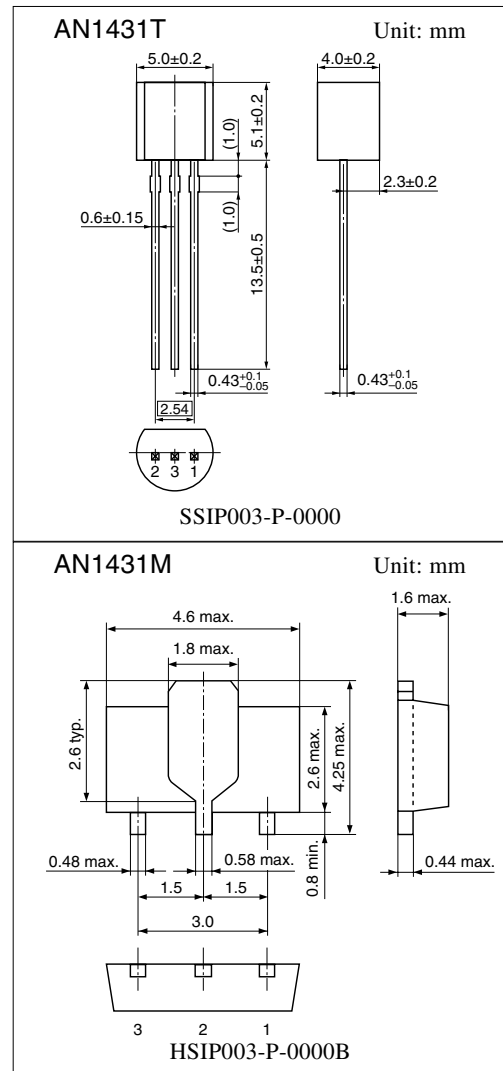
■ Pin Descriptions

- AN1431T

Pin No.	Description
1	Cathode
2	Reference pin
3	Anode

- AN1431M

Pin No.	Description
1	Reference pin
2	Anode
3	Cathode

1

■ 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	T_{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 $1cm^2$ 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}	$I_K = 10mA$, $\Delta V_{KA} = 10V$ to V_{REF}	——	−1.2	−2.7	mV/V
	ΔV_{KA}	$I_K = 10mA$, $\Delta V_{KA} = 36V$ to $10V$	——	−1	−2	mV/V
Reference input current	I_{REF}	$I_K = 10mA$, $R_1 = 10k\Omega$, $R_2 = \infty$	——	2	4	μA
Reference input current change to temperature	$I_{REF(dev)}$ *2	$I_K = 10mA$, $R_1 = 10k\Omega$, $R_2 = \infty$, $T_a = 0$ 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 $100mA$, $f \leq 1kHz$	——	0.2	0.5	Ω

*1
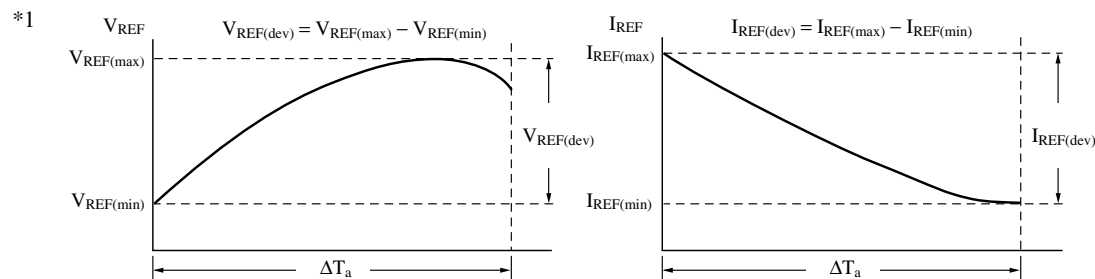
The temperature coefficient aV_{REF} for the reference input voltage is equivalently given by the following expression.

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

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

$$V_{REF} = 2499mV \ (T_a = 25°C) \ \Delta T_a = 70°C$$

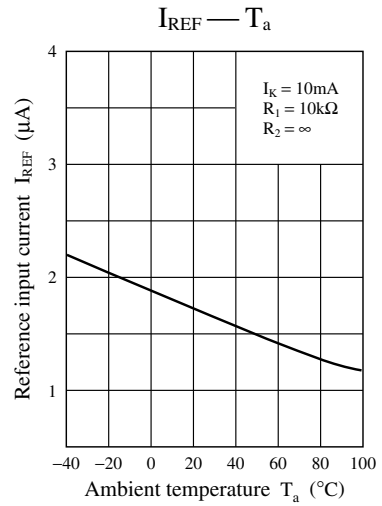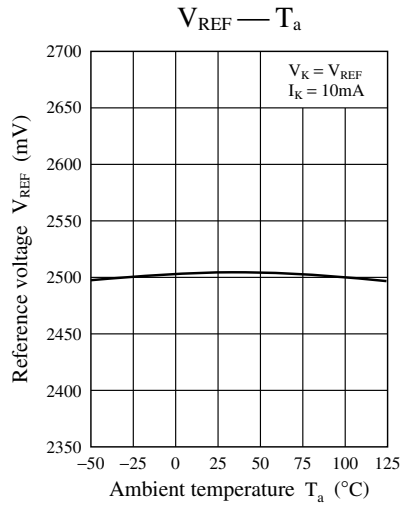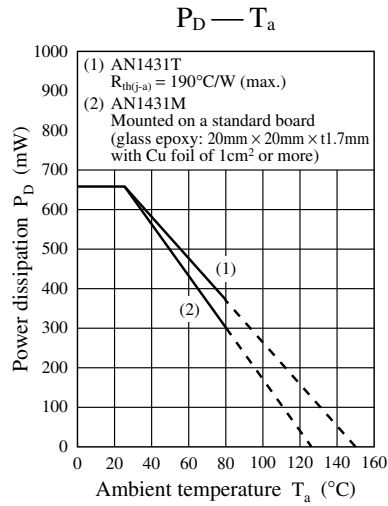then, $\lvert aV_{REF} \rvert = \dfrac{\frac{3mV}{2499mV}}{70°C} \times 10^6 = 17.1 \ (ppm/°C)$

*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.

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

■ Main Characteristics

P_D — T_a

V_{REF} — T_a

I_{REF} — T_a

(1) AN1431T
$R_{th(j-a)}$ = 190°C/W (max.)
(2) AN1431M
Mounted on a standard board
(glass epoxy: 20mm × 20mm × t1.7mm
with Cu foil of 1cm² or more)

$V_K = V_{REF}$
I_K = 10mA

I_K = 10mA
R_1 = 10kΩ
$R_2 = \infty$

■ Application Circuit Examples

1. Shunt regulator

$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$
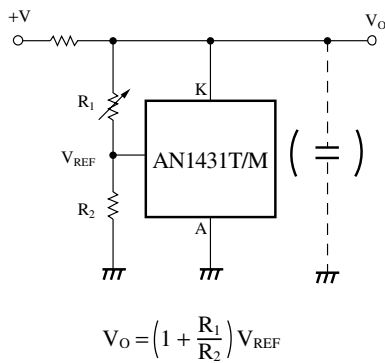
2. Constant current power supply

$$I_O = \frac{V_{REF}}{R_S}$$
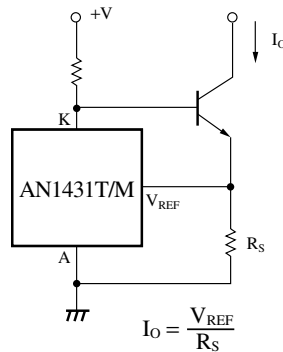
3. Constant current source

$$I_O = \frac{V_{REF}}{R_S}$$
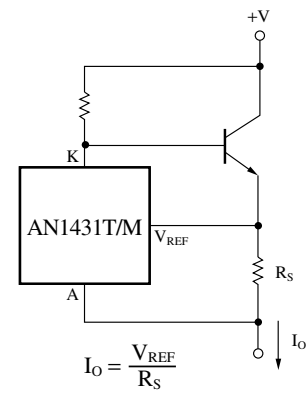
4. Current bootstrap

$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$
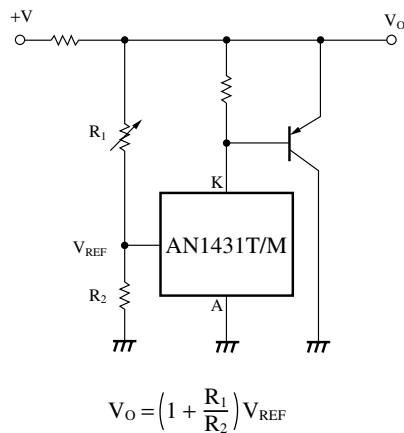
5. Adjustable output regulator combined with 3-pin regulator

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

SFF00001CEB

Panasonic
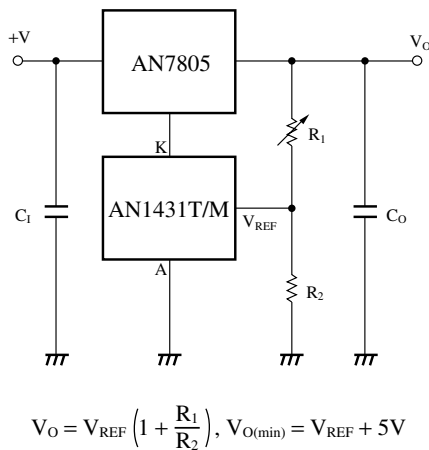
■ New Package Dimensions (Unit: mm)

• SSIP003-P-0000S (Lead-free package)
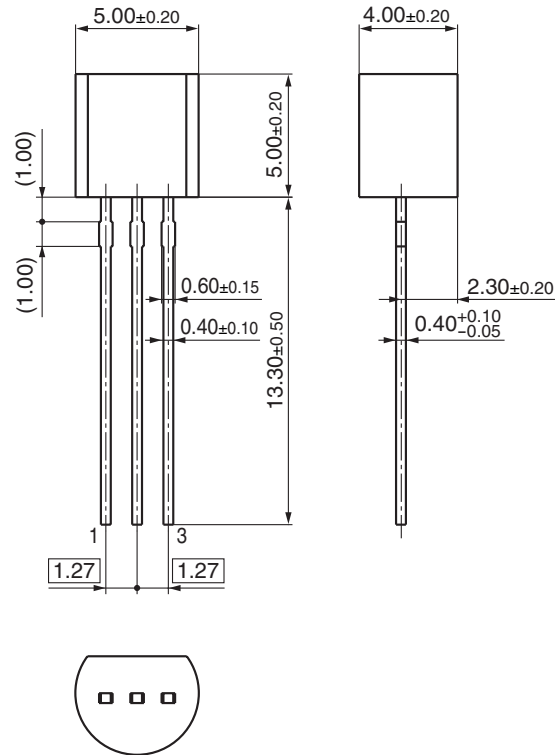
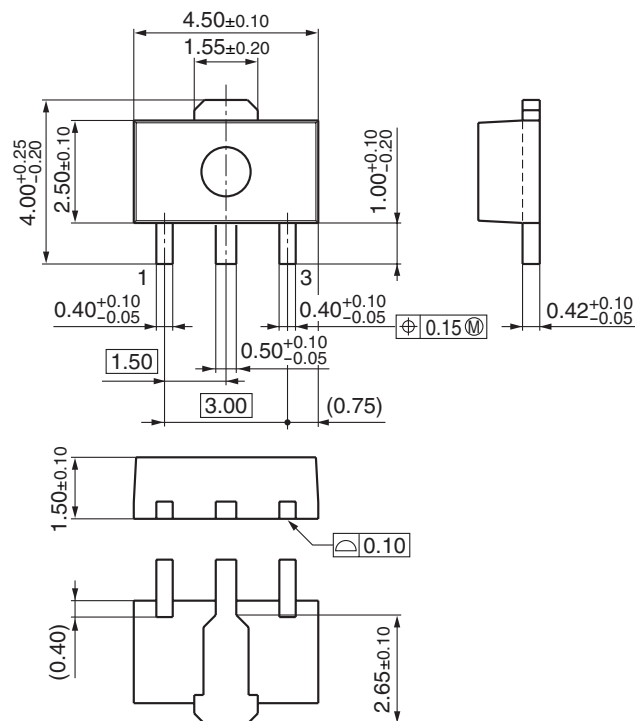• HSIP003-P-0000Q (Lead-free package)

SFF00001CEB

Request for your special attention and precautions in using the technical information and semiconductors described in this book

(1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.

(2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products, and no license is granted under any intellectual property right or other right owned by our company or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.

(3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).
Consult our sales staff in advance for information on the following applications:
・Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
・Any applications other than the standard applications intended.

(4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

(7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of Matsushita Electric Industrial Co., Ltd.