HA17L431/HA17L431A Series

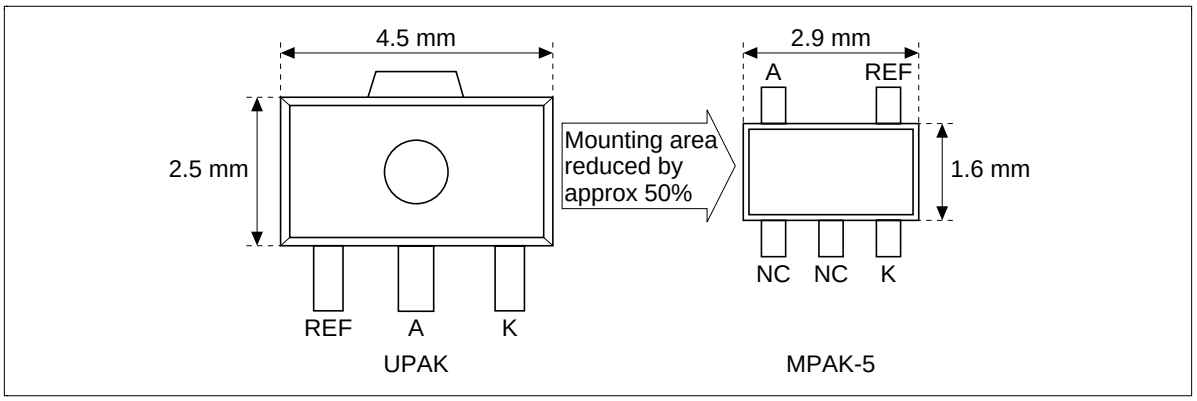
High-Precision Variable Shunt Regulators

HITACHI

ADE-204-029D (Z)
Rev.4
Dec. 2000

Description

The HA17L431LP(MPAK-5) / P(TO-92) / UP(UPAK) and the HA17L431ALP(MPAK-5) / AP(TO-92) are temperature-compensated variable shunt regulators. These ICs can operate at about half voltage in comparison with HA17431V series. They can be replaced for simple Zener diode and they can also be used for switching power supply secondary-side error amplification circuit. MPAK-5, TO-92 and UPAK packages are available. The MPAK-5 package, in particular, is suitable for high-density mounting, with a mounting area approximately half that of Hitachi's UPAK products.



Features

- On-chip high-precision reference voltage source : 1.240 V ± 1.0% (Ta = 25°C) [HA17L431A]
  : 1.240 V ± 1.5% (Ta = 25°C) [HA17L431]
- Small reference voltage temperature coefficient: 30 ppm/°C Typ
- Maximum cathode voltage: 16 V
- Maximum cathode current: 50 mA
- Minimum cathode current: 200 µA Typ
- Operating temperature range: –20 to +85°C

Application Example

- Reference voltage generation circuits, etc.

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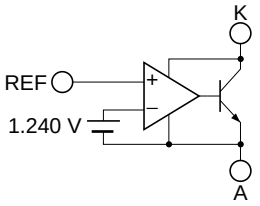
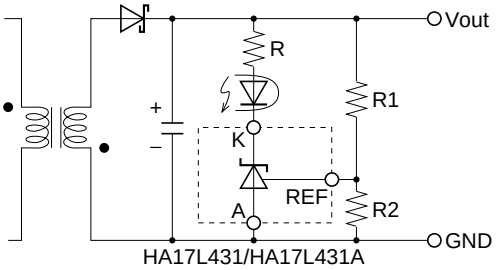
Block Diagram



Application Circuit Example

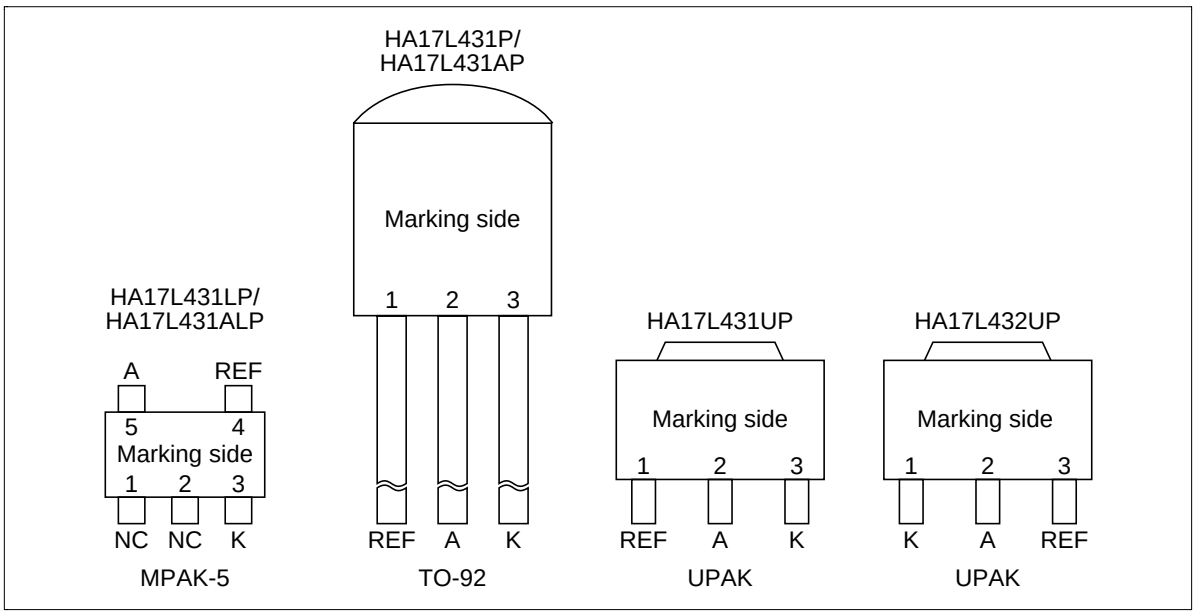
Switching Power Supply Secondary-Side
Error Amplification Circuit



Product Lineup

Item		Reference Voltage: Normal Version ±1.5% 1.222 to 1.258 V 1.240V	Reference Voltage: A Version ±1.0% 1.227 to 1.253 V 1.240V	Package	Operating Temperature Range
Industrial use	HA17L431LP	O		MPAK-5	–20 to +85°C
	HA17L431ALP		O		
	HA17L431P	O		TO-92	
	HA17L431AP		O		
	HA17L431UP	O		UPAK	
	HA17L432UP	O			

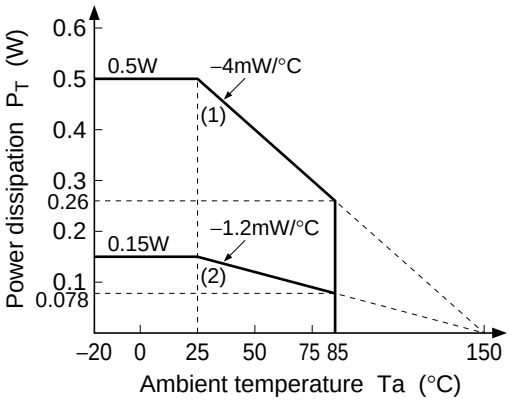
Pin Arrangement



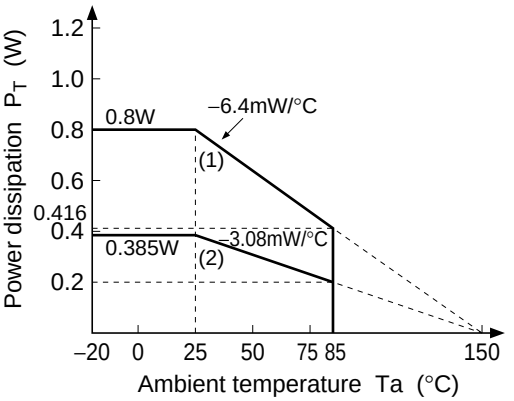
Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rated Value			Unit	Note
		HA17L431LP/ HA17L431ALP	HA17L431P/ HA17L431AP	HA17L431UP/ HA17L432UP		
Cathode voltage	V_{KA}	16	16	16	V	1
Continuous cathode current	I_K	–30 to +50	–30 to +50	–30 to +50	mA	
Reference input current	Iref	–0.05 to +5	–0.05 to +5	–0.05 to +5	mA	
Power dissipation	P_T	150	500	800	mW	2
Operating temperature	Topr	–20 to +85	–20 to +85	–20 to +85	°C	
Storage temperature	Tstg	–55 to +150	–55 to +150	–55 to +150	°C	

Notes: 1. The anode pin is used as the reference for voltage values.
2. These values apply when Ta ≤ 25°C. If Ta ≥ 25°C, derate by below figure.



(1): HA17L431P/AP
(2): HA17L431LP/ALP

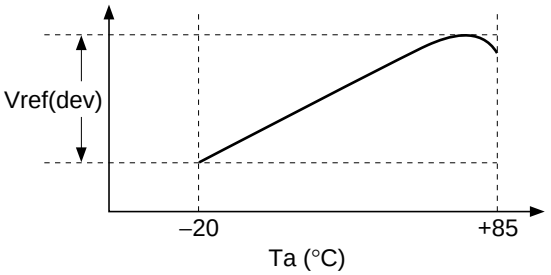


HA17L431UP/432UP
(1): With 15mm × 25mm × 0.7mm alumina ceramic board
(2): Without printed circuit board

Electrical Characteristics (Ta = 25°C, I_K = 10 mA)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Remark
Reference voltage	Vref	1.222	1.240	1.258	V	V_{KA} = Vref	HA17L431
		1.227	1.240	1.253			HA17L431A
Reference voltage deviation	Vref(dev)	—	5	—	mV	V_{KA} = Vref, Ta = –20°C to +85°C	*1
Reference voltage temperature coefficient	ΔVref/ΔTa	—	±30	—	ppm/°C	V_{KA} = Vref, 0°C to 50°C gradient	
Reference voltage regulation	$\Delta Vref/\Delta V_{KA}$	—	1.0	2.0	mV/V	V_{KA} = Vref to 16V	
Reference input current	Iref	—	2	6	μA	R1 = 10 kΩ, R2 = ∞	
Reference current temperature deviation	Iref(dev)	—	0.5	—	μA	R1 = 10 kΩ, R2 = ∞, Ta = –20°C to +85°C	
Minimum cathode current	Imin	—	0.2	1.0	mA	V_{KA} = Vref	*2
Off cathode current	Ioff	—	0.001	1.0	μA	V_{KA} = 16 V, Vref = 0 V	
Dynamic impedance	Z_{KA}	—	0.2	0.5	Ω	V_{KA} = Vref, I_K = 1 mA to 50 mA	

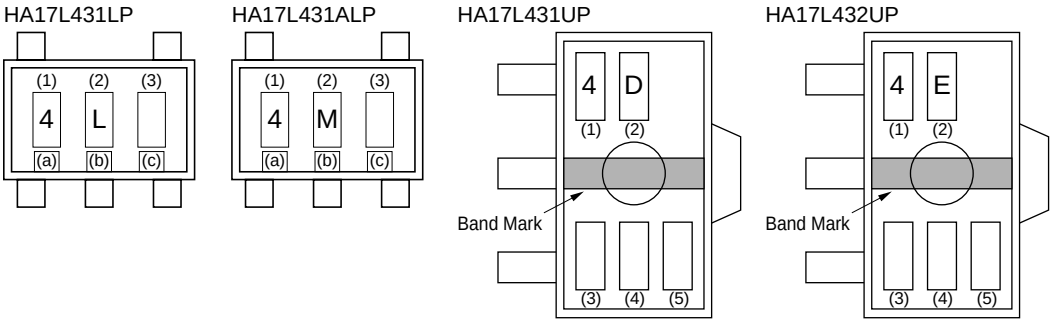
Notes: 1. Vref(dev) = (Vref maximum value at Ta = –20°C to +85°C) – (Vref minimum value at Ta = –20°C to +85°C)



2. Definition of minimum cathode current.
   Imin is the cathode current value at which Vref = $Vref_{(I_K = 10\ mA)}$ – 15 mV.

Marking Pattern on MPAK-5 Models (HA17L431LP/HA17L431ALP) and UPAK Models (HA17L431UP/HA17L432UP)

Because of the small package size, the following marking patterns are used on MPAK-5 and UPAK models. Note that the product code and marking pattern are different. The patterns are laser-marked.



Note: The boxes shown for (1) to (5) and (a) to (c) in the figure are only to indicate the position of the characters, and are not actually marked on the package.

Markings

• HA17L431LP, HA17L431ALP

	Type of Marking	Meaning
(1), (2)	Characters	Model code: 4L (HA17L431LP), 4M (HA17L431ALP)
(3)		Production month code:

Production month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Code	A	B	C	D	E	F	G	H	J	K	L	M

(a), (b), (c)	Bar mark	Production year code:

Production year	'98	'99	2000	2001	2002	2003	2004	2005
(a)	1	1	1	0	0	0	0	1
(b)	0	1	1	0	0	1	1	0
(c)	1	0	1	0	1	0	1	0

Notes: 1. 1 indicates a bar, and 0 indicates no bar.
2. Repeated every 8 years from 2006 on.

• HA17L431UP, HA17L432UP

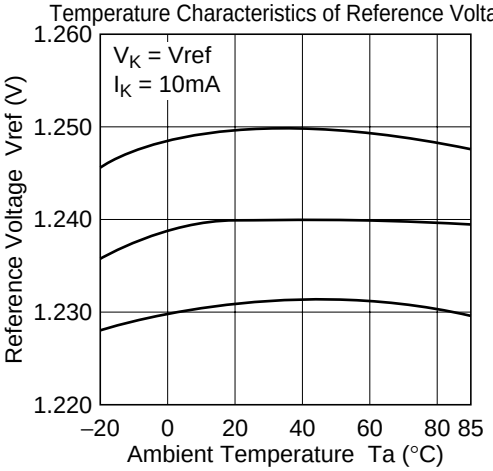
	Type of Marking	Meaning
(1), (2)	Characters	Model code: 4D (HA17L431UP), 4E (HA17L432UP)
(3)		Production year code: The last digit of the year.
(4)		Production month code:

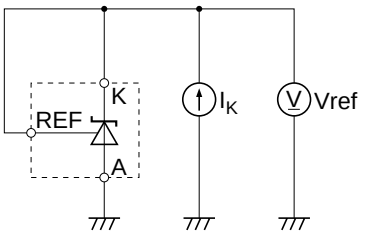
Production month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Code	A	B	C	D	E	F	G	H	J	K	L	M

(5)		HITACHI management code

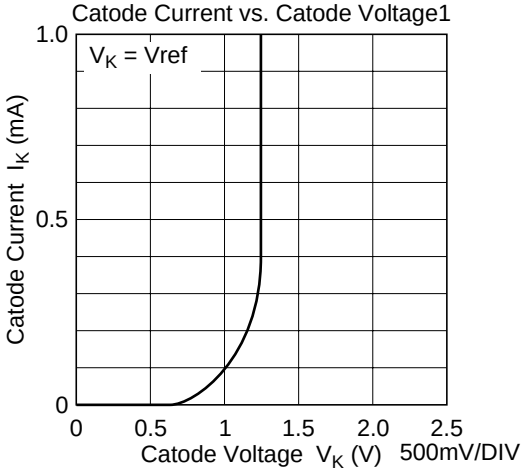
Characteristic Curves

Temperature Characteristics of Reference Voltage

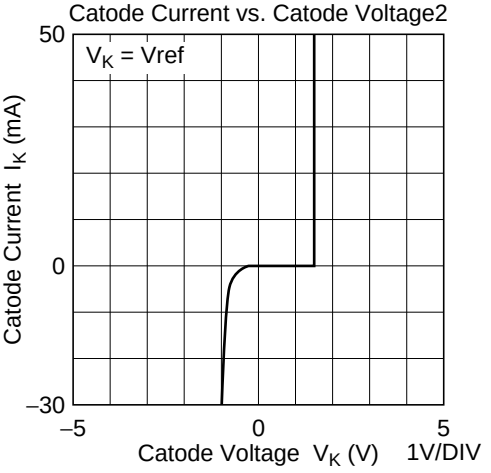




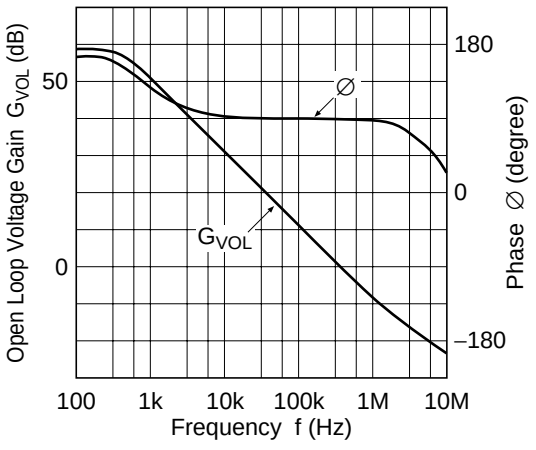
Catode Current vs. Catode Voltage1

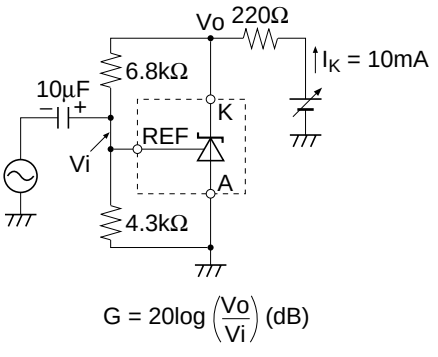


Catode Current vs. Catode Voltage2



Open Loop Voltage Gain, Phase vs. Frequency Characteristics





$$G = 20\log\left(\frac{Vo}{Vi}\right) (dB)$$

Noise Recovery Characteristics of HA17L431A and HA17L431

The HA17L431A bettered V_{KA} and Vref recovery time against the HA17L431 when it was inputted noise.

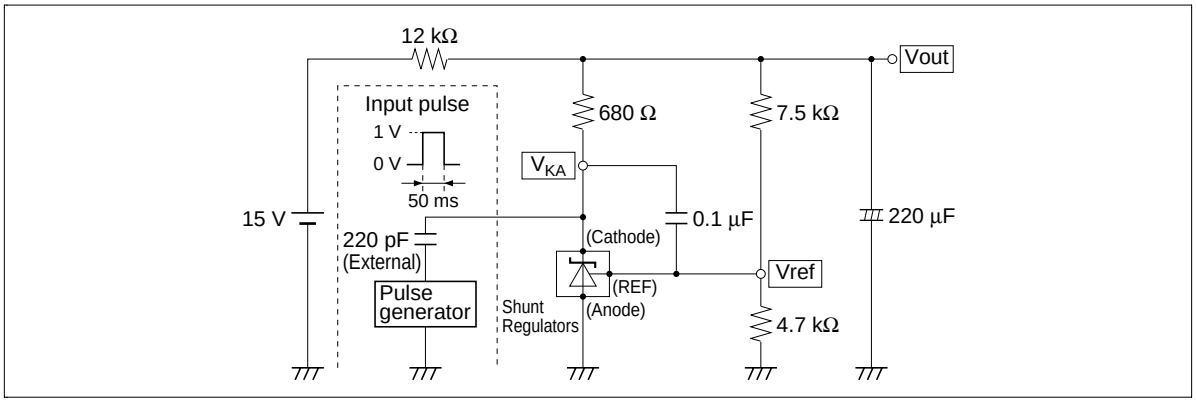


Figure 1 Noise Response Characteristics Measurement Circuit

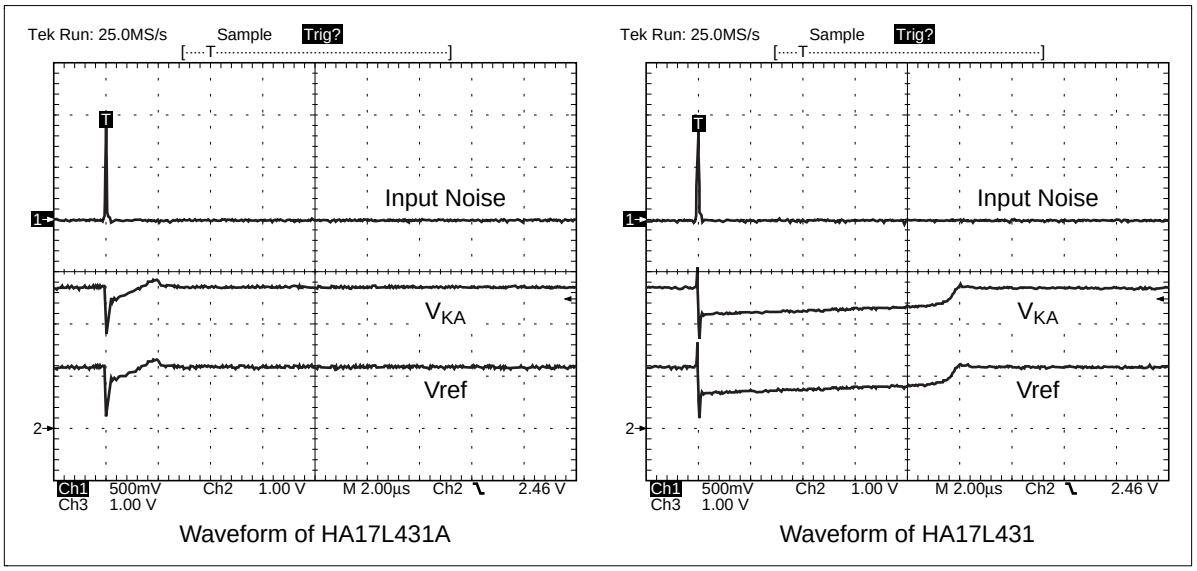
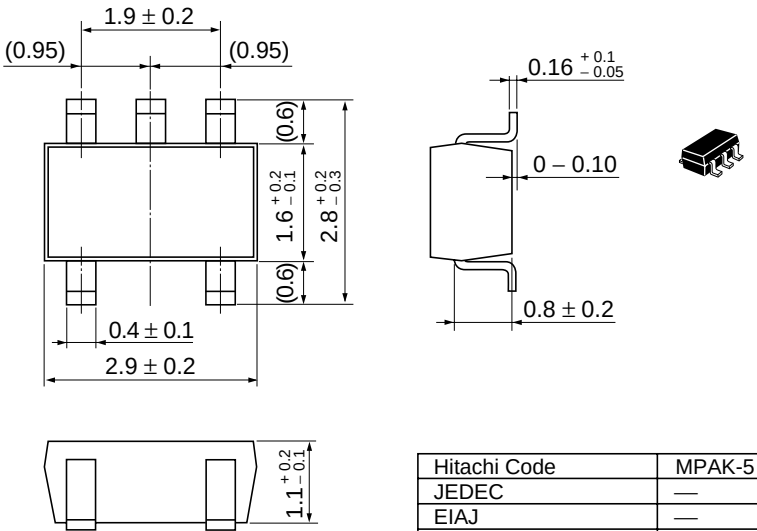


Figure 2 Noise Recovery Characteristics

Package Dimension

- HA17L431LP
- HA17L431ALP

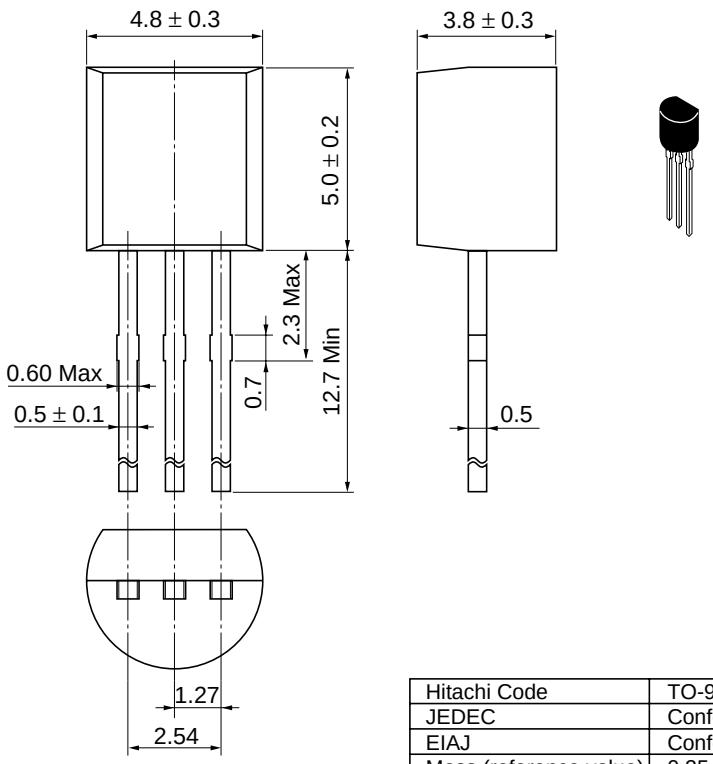
Unit: mm



Hitachi Code	MPAK-5
JEDEC	—
EIAJ	—
Mass (reference value)	0.013 g

- HA17L431P
- HA17L431AP

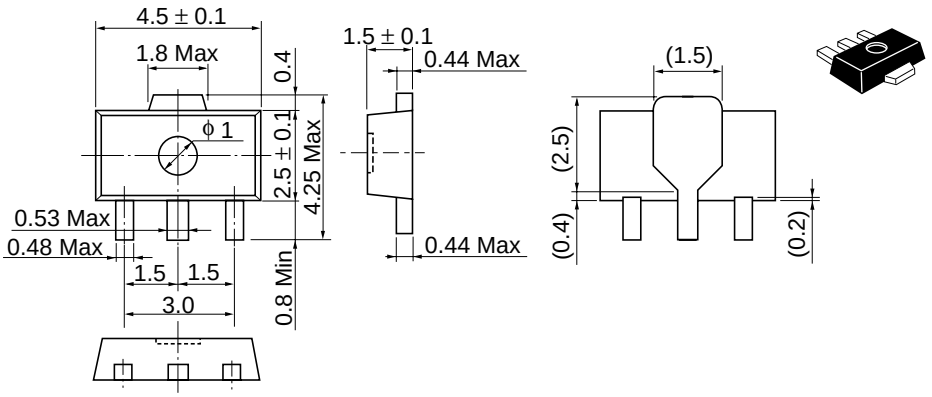
Unit: mm



Hitachi Code	TO-92 (1)
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.25 g

- HA17L431UP
- HA17L432UP

Unit: mm

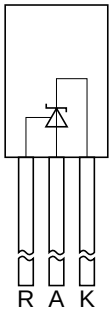
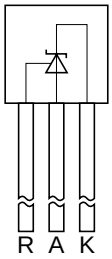
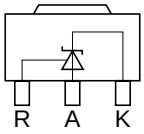
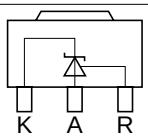
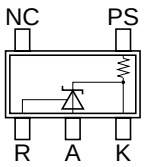
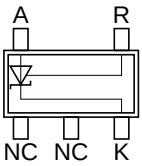
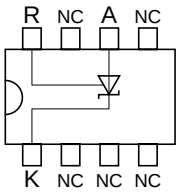


Hitachi Code	UPAK
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.050 g

Shunt Regulator Selection Guide

Package	Vref/Tolerance	I_K max (mA)	V_K max (V)	Topr (°C)	Product Name
TO-92	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17431PNA
	2.5 V ± 1.0%	–50 to +50	16	–20 to +85	HA17431VP
	1.24 V ± 1.5%	–30 to +50	16	–20 to +85	HA17L431P
	1.24 V ± 1.0%	–30 to +50	16	–20 to +85	HA17L431AP
TO-92MOD	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17431PA
UPAK	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17431UA
	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17431UPA
	1.24 V ± 1.5%	–30 to +50	16	–20 to +85	HA17L431UP
	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17432UA
	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17432UPA
	1.24 V ± 1.5%	–30 to +50	16	–20 to +85	HA17L432UP
MPAK-5	2.5 V ± 1.0%	–50 to +50	16	–20 to +85	HA17431VLP
	1.24 V ± 1.5%	–30 to +50	16	–20 to +85	HA17L431LP
	1.24 V ± 1.0%	–30 to +50	16	–20 to +85	HA17L431ALP
SOP-8	2.5 V ± 2.2%	–100 to +150	40	–20 to +85	HA17431FPA

Pin Arrangement by Product

Product Name (Vref / Tolerance)	Package	Pin Arrangement
HA17431PA (2.5 V ± 2.2%)	TO-92MOD	
HA17431VP (2.5 V ± 1%) HA17431PNA (2.5 V ± 2.2%) HA17L431P (1.24 V ± 1.5%) HA17L431AP (1.24 V ± 1%)	TO-92	
HA17431UA (2.5 V ± 2.2%) HA17431UPA (2.5 V ± 2.2%) HA17L431UP (1.24 V ± 1.5%)	UPAK	
HA17432UA (2.5 V ± 2.2%) HA17432UPA (2.5 V ± 2.2%) HA17L432UP (1.24 V ± 1.5%)	UPAK	
HA17431VLP (2.5 V ± 1%)	MPAK-5	
HA17L431LP (1.24 V ± 1.5%) HA17L431ALP (1.24 V ± 1%)	MPAK-5	
HA17431FPA (2.5 V ± 2.2%)	SOP-8	

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