HA17L431/HA17L431A Series

Shunt Regulator

REJ03D0691-0600
(Previous: ADE-204-029E)
Rev.6.00
Jun 15, 2005

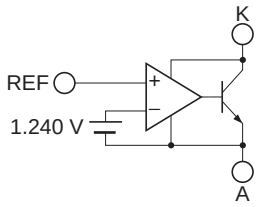
Description

The HA17L431 series and the HA17L431A series are temperature-compensated variable shunt regulators. These ICs can operate at about half voltage in comparison with HA17431 series. They can be replaced for simple Zener diode and they can also be used for switching power supply secondary-side error amplification circuit.

Features

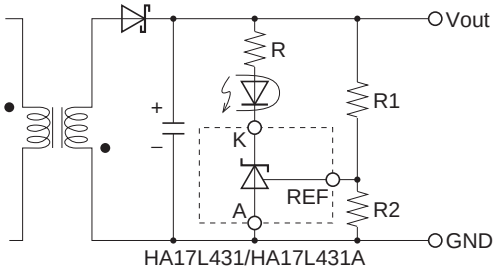
- On-chip high-precision reference voltage source : 1.240 V ± 1.0% at Ta = 25°C (HA17L431A)
  : 1.240 V ± 1.5% at Ta = 25°C (HA17L431)
- Small reference voltage temperature coefficient: 30 ppm/°C Typ
- Maximum cathode voltage: 16 V
- Maximum cathode current: 50 mA
- Minimum cathode current: 200 µA Typ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

Block Diagram



Application Circuit Example

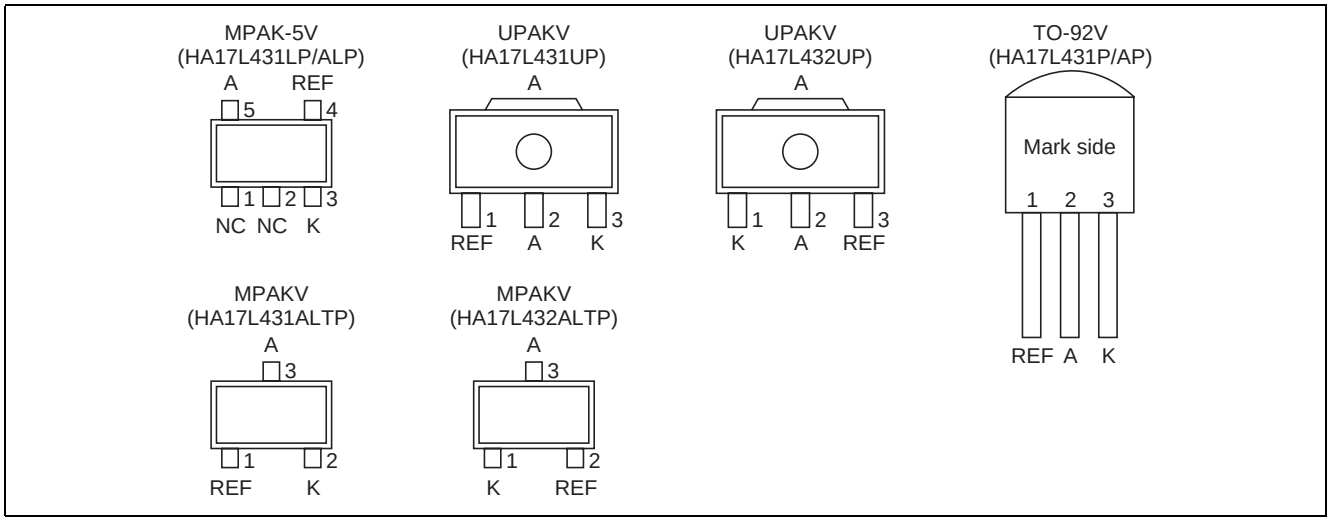
Switching Power Supply Secondary-Side
Error Amplification Circuit



Product Lineup

Item		Reference voltage (at 25°C)		Package Code (Previous Code)	Operating Temperature Range
		Normal Version ±1.5% 1.222V to 1.258V to 1.240V	A Version ±1.0% 1.227V to 1.253V to 1.240V		
Industrial use	HA17L431LP	O		PLSP0005ZB-A (MPAK-5V)	–20 to +85°C
	HA17L431ALP		O		
	HA17L431P	O		PRSS0003DA-A (TO-92V)	
	HA17L431AP		O		
	HA17L431UP	O		PLZZ0004CA-A (UPAKV)	
	HA17L432UP	O			
	HA17L431ALTP		O	PLSP0003ZB-A (MPAKV)	
	HA17L432ALTP		O		

Pin Arrangement

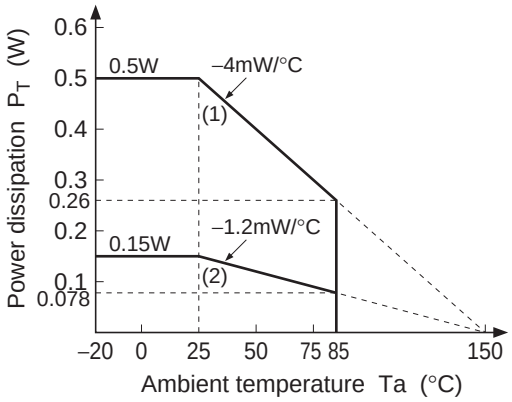


Absolute Maximum Ratings

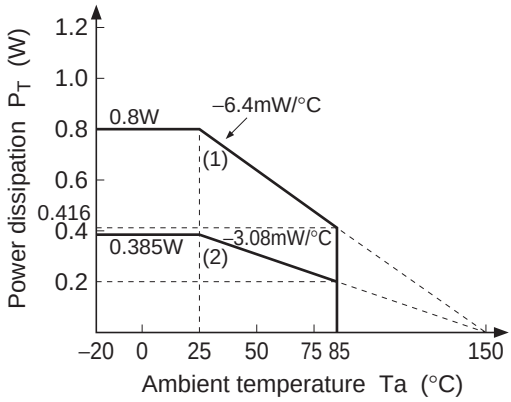
(Ta = 25°C)

Item	Symbol	Rated Value				Unit	Note
		HA17L431LP/ HA17L431ALP	HA17L431P/ HA17L431AP	HA17L431UP/ HA17L432UP	HA17L431ALTP/ HA17L432ALTP		
Cathode voltage	V_{KA}	16	16	16	16	V	1
Continuous cathode current	I_K	–30 to +50	–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	–0.05 to +5	mA	
Power dissipation	P_T	150	500	800	150	mW	2
Operating temperature	Topr	–20 to +85	–20 to +85	–20 to +85	–20 to +85	°C	
Storage temperature	Tstg	–55 to +150	–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/ALTP/432ALTP



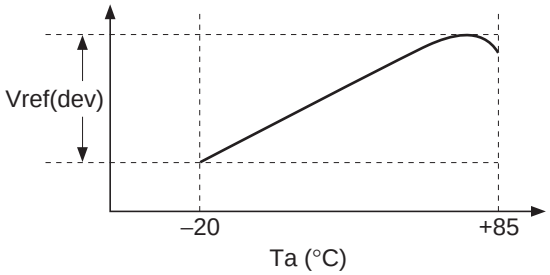
HA17L431UP/432UP
(1): With 15mm × 25mm × 0.7mm alumina ceramic board
(2): Without printed circuit board

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	

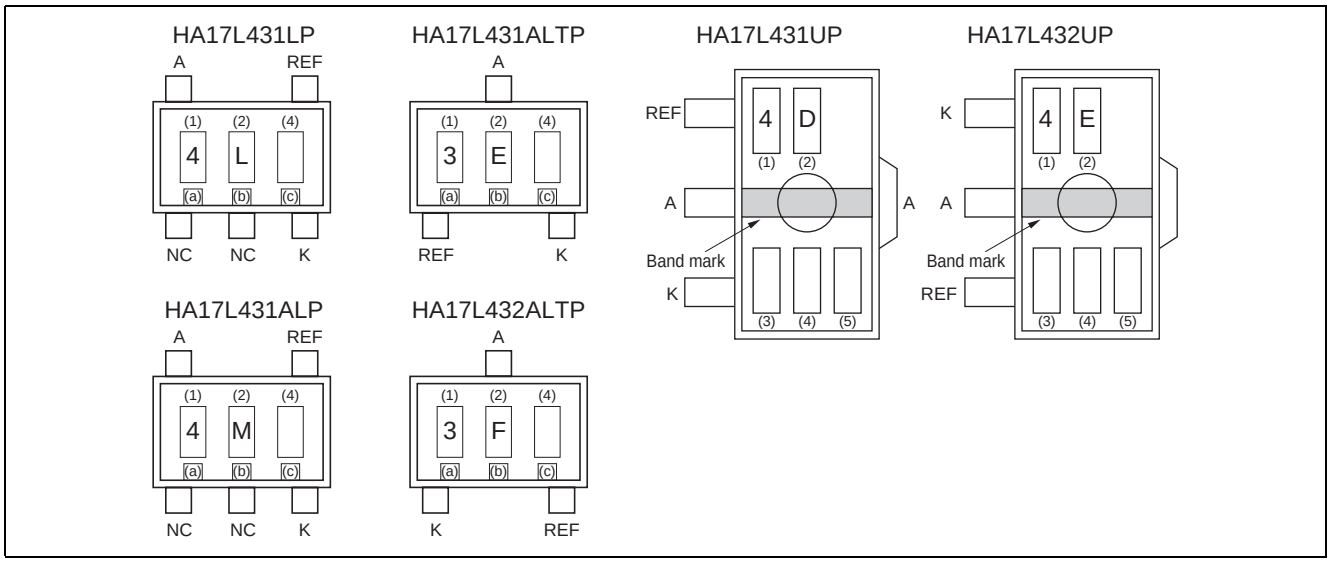
Notes: 1. Vref(dev) = (Vref maximum value at Ta = –20°C to +85°C) – (Vref minimum value at Ta = –20°C to +85°C)



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

MPAK-5V(5-pin), MPAKV(3-pin) and UPAKV Marking Patterns

The marking patterns shown below are used on MPAK-5V, MPAKV and UPAKV products. Note that the product code and mark pattern are different. The pattern is laser-printed.



Notes: 1. Boxes (1) to (5) in the figures show the position of the letters or numerals, and are not actually marked on the package.

2. The letters (1) and (2) show the product specific mark pattern.

Product	(1)	(2)
HA17L431LP	4	L
HA17L431ALP	4	M
HA17L431ALTP	3	E
HA17L432ALTP	3	F
HA17L431UP	4	D
HA17L432UP	4	E

3. The letter (3) shows the production year code (the last digit of the year) for UPAKV products.

4. The bars (a), (b) and (c) show a production year code for MPAK-5V and MPAKV products as shown below. After 2010 the code is repeated every 8 years.

Year	2002	2003	2004	2005	2006	2007	2008	2009
(a)	None	None	None	Bar	Bar	Bar	Bar	None
(b)	None	Bar	Bar	None	None	Bar	Bar	None
(c)	Bar	None	Bar	None	Bar	None	Bar	None

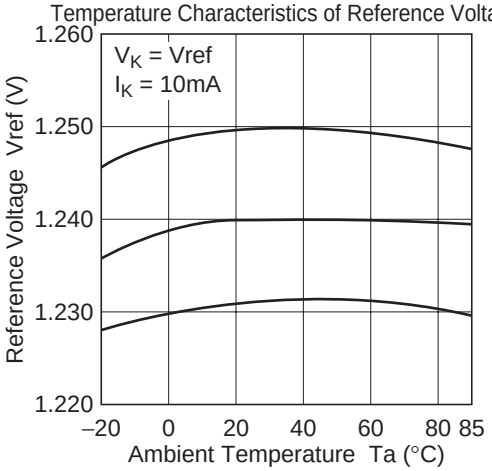
5. The letter (4) shows the production month code (see table below).

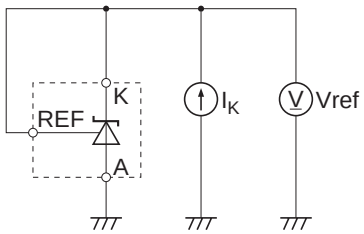
Production month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Marked code	A	B	C	D	E	F	G	H	J	K	L	M

6. The letter (5) shows manufacturing code. For UPAKV products.

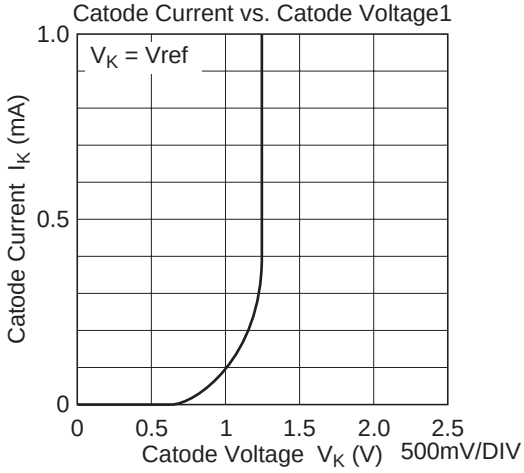
Characteristic Curves

Temperature Characteristics of Reference Voltage

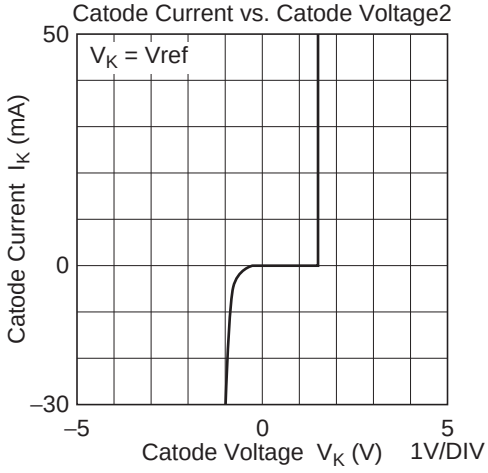




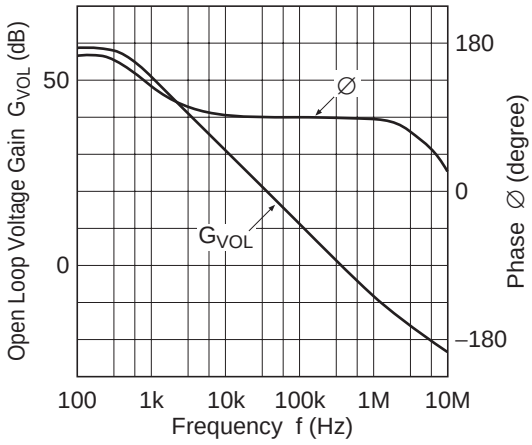
Catode Current vs. Catode Voltage1

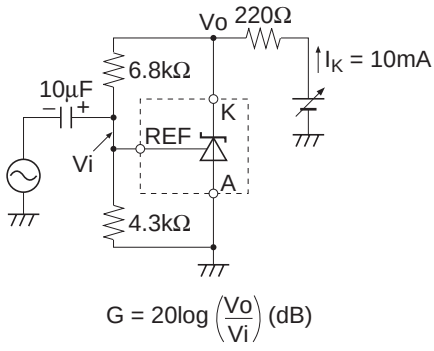


Catode Current vs. Catode Voltage2



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.

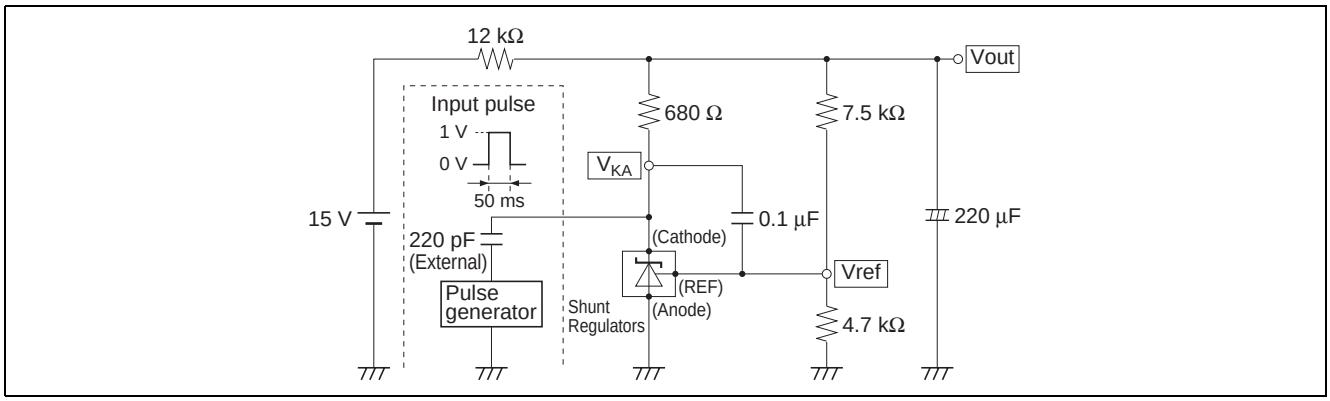


Figure 1 Noise Response Characteristics Measurement Circuit

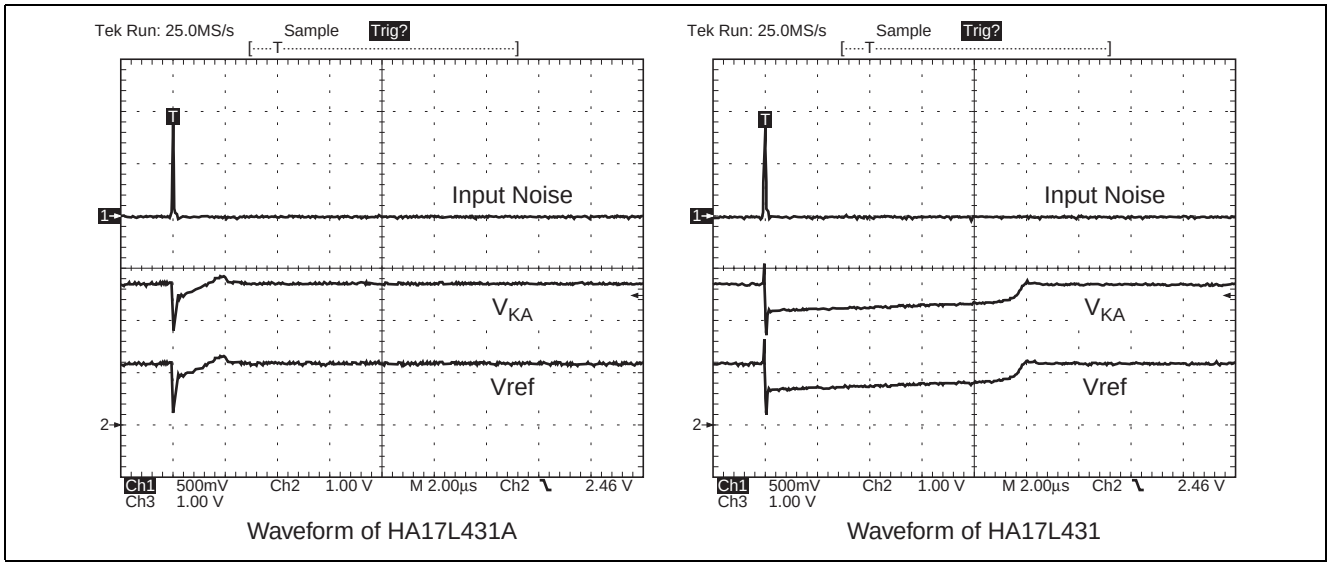
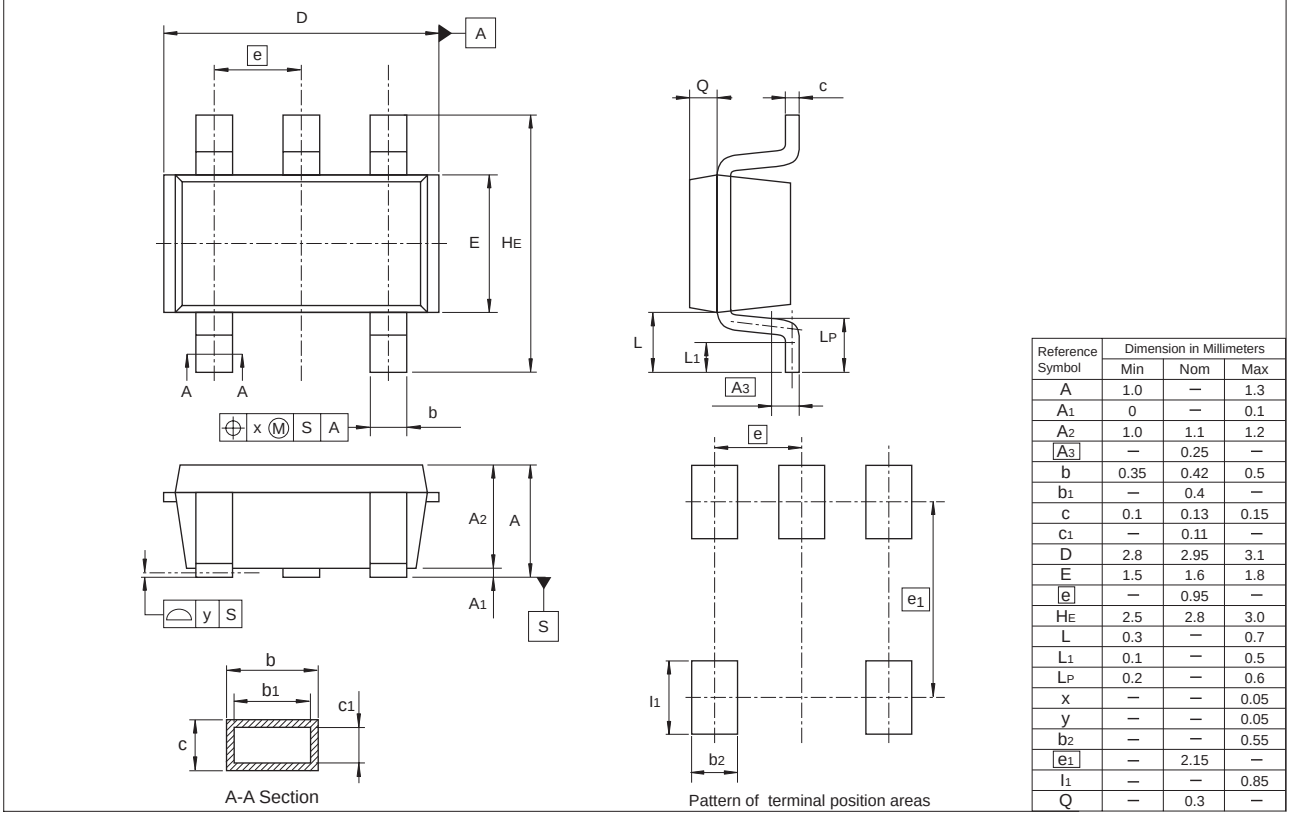


Figure 2 Noise Recovery Characteristics

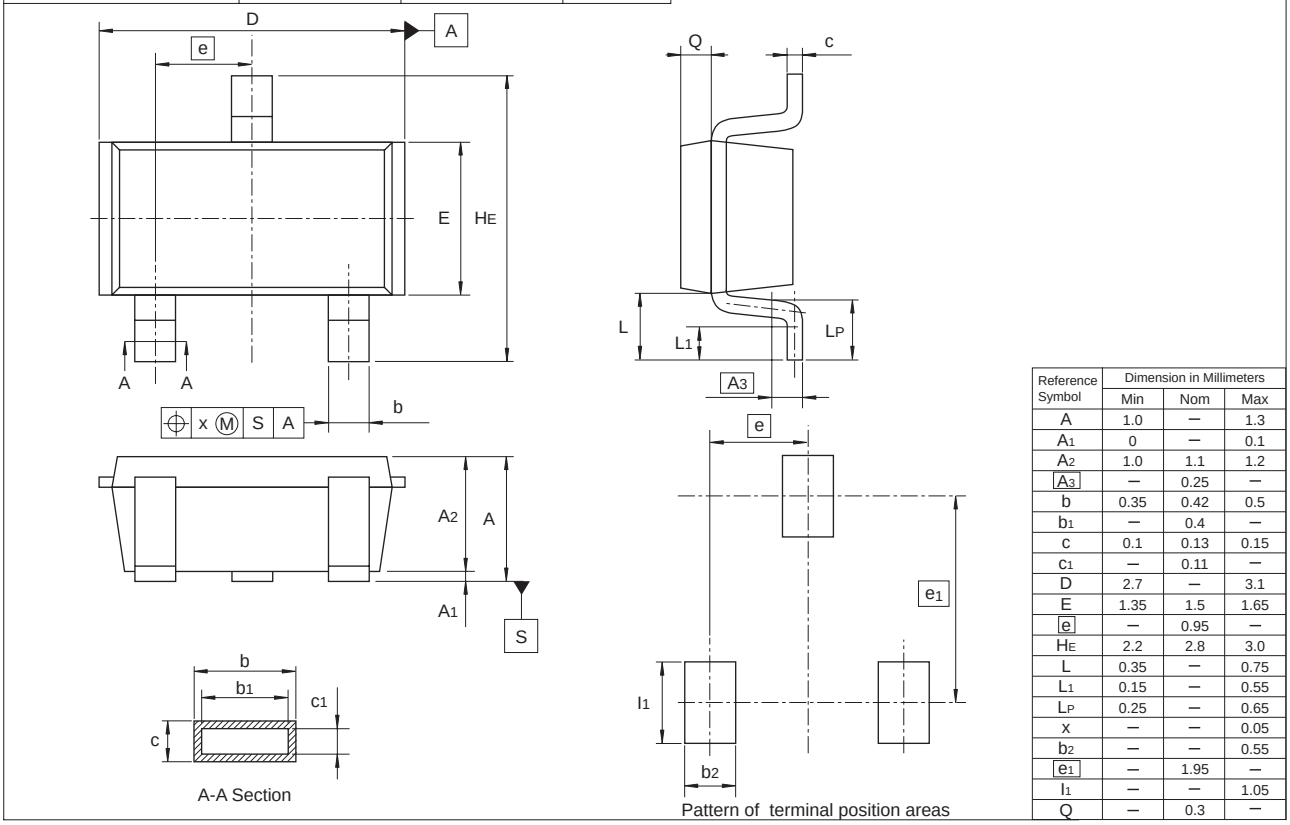
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
SC-74A	PLSP0005ZB-A	MPAK-5 / MPAK-5V	0.015g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	1.0	–	1.3
A_1	0	–	0.1
A_2	1.0	1.1	1.2
A_3	–	0.25	–
b	0.35	0.42	0.5
b_1	–	0.4	–
c	0.1	0.13	0.15
c_1	–	0.11	–
D	2.8	2.95	3.1
E	1.5	1.6	1.8
e	–	0.95	–
H_E	2.5	2.8	3.0
L	0.3	–	0.7
L_1	0.1	–	0.5
L_P	0.2	–	0.6
x	–	–	0.05
y	–	–	0.05
b_2	–	–	0.55
e_1	–	2.15	–
l_1	–	–	0.85
Q	–	0.3	–

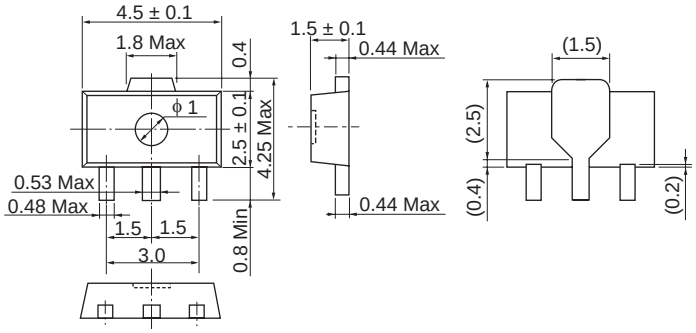
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
SC-59A	PLSP0003ZB-A	MPAK(T) / MPAK(T)V, MPAK / MPAKV	0.011g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	1.0	–	1.3
A_1	0	–	0.1
A_2	1.0	1.1	1.2
A_3	–	0.25	–
b	0.35	0.42	0.5
b_1	–	0.4	–
c	0.1	0.13	0.15
c_1	–	0.11	–
D	2.7	–	3.1
E	1.35	1.5	1.65
e	–	0.95	–
H_E	2.2	2.8	3.0
L	0.35	–	0.75
L_1	0.15	–	0.55
L_P	0.25	–	0.65
x	–	–	0.05
b_2	–	–	0.55
e_1	–	1.95	–
l_1	–	–	1.05
Q	–	0.3	–

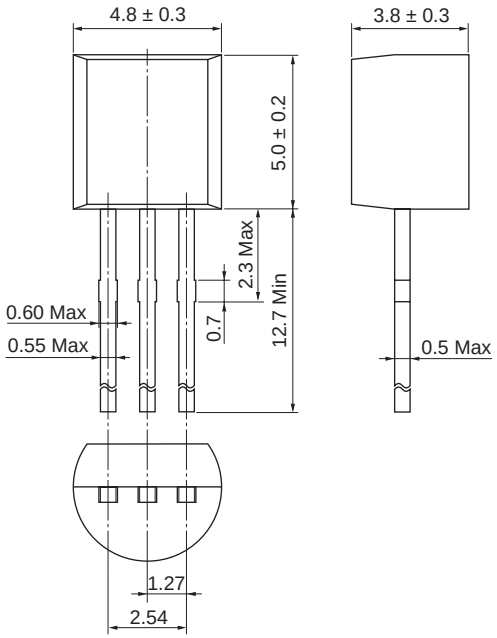
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
SC-62	PLZZ0004CA-A	UPAK / UPAKV	0.050g

Unit: mm



JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
SC-43A	PRSS0003DA-A	TO-92(1) / TO-92(1)V	0.25g

Unit: mm



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