HA17431G Series

Adjustable Precision Shunt Regulators

R03DS0087EJ0200
Rev.2.00
Jan 10, 2014

Description

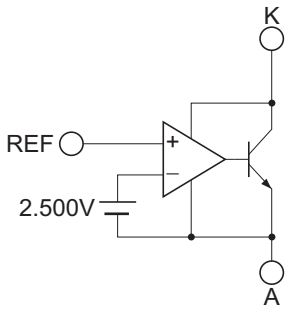
The HA17431G series is temperature-compensated adjustable precision shunt regulators. The products have improved features such as wide operating cathode voltage range and precision than the previous products.

Output voltage can be set to any value in the range from the reference voltage (Vref) to 40 V by two external resistors. There are two types of reference voltage accuracy sources such as ±1.0% standard version and ±0.5% A version with higher precision. As for the packages, small surface-mounted types such as MPAK, MPAK-5, and UPAK are available. Therefore, the HA17431G series is suitable for various applications that require high precision and miniaturization.

Features

- High-precision reference voltage : 2.500 V ± 1.0% (Ta = 25°C, Standard version)
  : 2.500 V ± 0.5% (Ta = 25°C, A version)
- Maximum cathode voltage : 40 V
- Continuous cathode current : 100 mA
- K-REF pin reversing type : HA17432G (UPAK)
- Operating temperature range : –40°C to +85°C

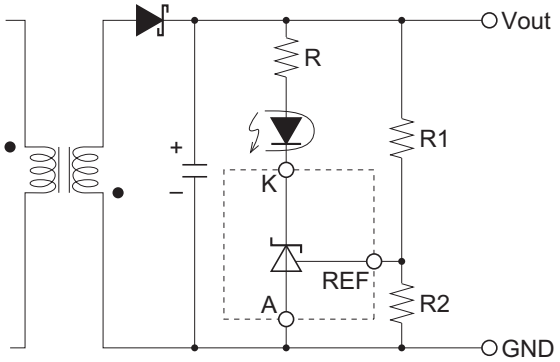
Block Diagram



REF : Reference
A : Anode
K : Cathode

Application Circuit Example

Switching power supply secondary-side error amplification circuit



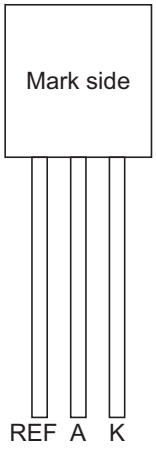
HA17431G Series

Ordering Information

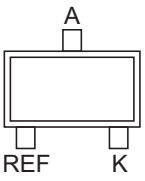
Application	Type No.	Reference Voltage (Ta = 25°C)		Package Name (Package Code)	Operating Temperature Range
		Standard Version 2.500V ± 1.0%	A Version 2.500V ± 0.5%		
Industrial use	HA17431GP	○		TO-92 (PRSS0003DA-A)	–40°C to +85°C
	HA17431GPA		○		
	HA17431GLTP	○		MPAK (PLSP0003ZB-A)	
	HA17431GLTPA		○		
	HA17431GLP	○		MPAK-5 (PLSP0005ZB-A)	
	HA17431GLPA		○		
	HA17431GUP	○		UPAK (PLZZ0004CA-A)	
	HA17432GUP (K-REF pin reversing type)	○			

Pin Arrangement

• TO-92
HA17431GP
HA17431GPA

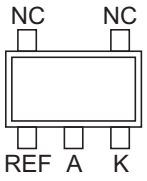


• MPAK
HA17431GLTP
HA17431GLTPA



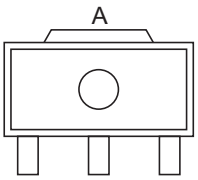
(Top view)

• MPAK-5
HA17431GLP
HA17431GLPA



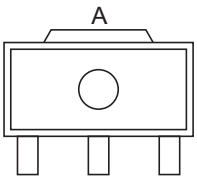
(Top view)

• UPAK
HA17431GUP



(Top view)

• UPAK
HA17432GUP



(Top view)

Note: REF : Reference
A : Anode
K : Cathode
NC : No connection

Absolute Maximum Ratings

(Ta = 25°C)

Item		Symbol	Ratings	Unit	Notes
Cathode voltage		V_{KA}	40	V	1
Continuous cathode current		I_K	–50 to +100	mA	
Reference input current		Iref	–0.05 to +10	mA	
Power dissipation	TO-92	P_T	500	mW	2
	MPAK		150		3
	MPAK-5		150		3
	UPAK		800		4
Operating temperature range		Topr	–40 to +85	°C	
Storage temperature		Tstg	–55 to +150	°C	

Notes: 1. Voltage values are with reference to the Anode pin.
2. Ta ≤ 25°C. If Ta > 25°C, derate by –4 mW/°C.
3. Ta ≤ 25°C. If Ta > 25°C, derate by –1.2 mW/°C.
4. 15 mm × 25 mm × 0.7mmt alumina ceramic board, Ta ≤ 25°C. If Ta > 25°C, derate by –6.4 mW/°C.

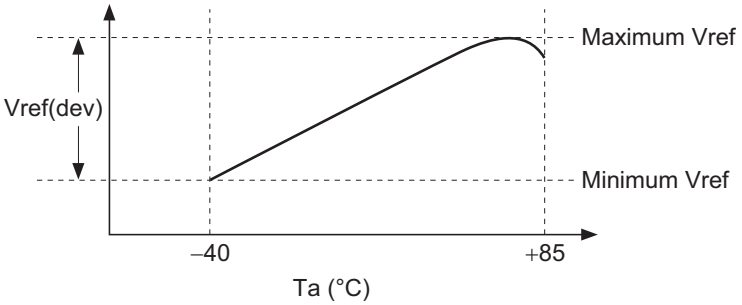
Electrical Characteristics

($Ta = 25°C$, $I_K = 10$ mA, unless otherwise noted)

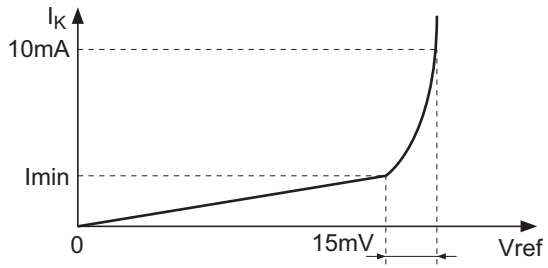
Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Notes
Reference voltage	Vref	2.487	2.500	2.513	V	V_{KA} = Vref	A
		2.475	2.500	2.525			Standard
Reference voltage temperature deviation	Vref(dev)	—	(14)	—	mV	V_{KA} = Vref, Ta = –40°C to +85°C	1, 2
Reference voltage temperature coefficient	ΔVref/ΔTa	—	(±30)	—	ppm/°C	V_{KA} = Vref, 0°C to 50°C gradient	1
Reference voltage regulation	$\Delta Vref/\Delta V_{KA}$	—	2.0	3.7	mV/V	V_{KA} = Vref to 10 V	
		—	2.0	3.7		V_{KA} = 10 V to 40 V	
Reference input current	Iref	—	2	6	μA	R1 = 10 kΩ, R_2 = ∞	
Reference current temperature deviation	Iref(dev)	—	(0.9)	—	μA	R1 = 10 kΩ, R_2 = ∞, Ta = –40°C to +85°C	1
Minimum cathode current	Imin	—	0.4	1.0	mA	V_{KA} = Vref	3
Off state cathode current	Ioff	—	0.001	1.0	μA	V_{KA} = 40 V, Vref = 0 V	
Dynamic impedance	Z_{KA}	—	0.2	0.5	Ω	V_{KA} = Vref, I_K = 1 mA to 100 mA	

Notes: 1. Reference values for design.

2. Vref(dev) = (Vref maximum value at Ta = –40°C to +85°C) – (Vref minimum value at Ta = –40°C to +85°C)



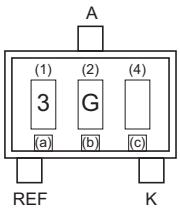
3. Definition of minimum cathode current. Imin is the cathode current value at which Vref = $Vref_{(IK=10mA)}$ – 15 mV.



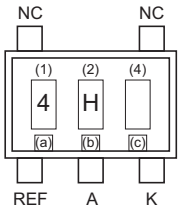
Marking Patterns

The marking patterns shown below are used on MPAK, MPAK-5 and UPAK products.

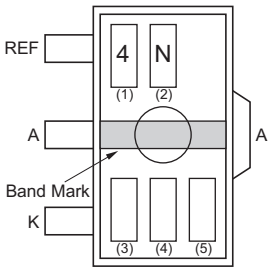
HA17431GLTP



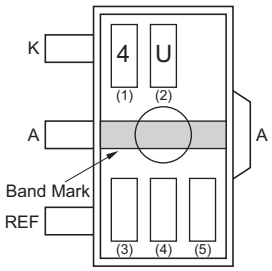
HA17431GLP



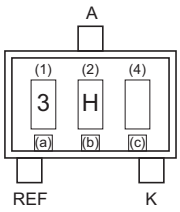
HA17431GUP



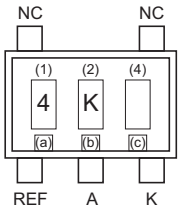
HA17432GUP



HA17431GLTPA



HA17431GLPA



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

Markings

Position	Type of Marking	Meaning
(1), (2)	Characters	Type No. code HA17431GLTP: 3G HA17431GLTPA: 3H HA17431GLP: 4H HA17431GLPA: 4K HA17431GUP: 4N HA17432GUP: 4U
(3)		Production year code (The last digit of the year) Notes: 1. For UPAK products (HA17431GUP, HA17432GUP)
(a), (b), (c)	Bar mark	Production year code

Production Year	2006	2007	2008	2009	2010	2011	2012	2013
(a)	Bar	Bar	Bar	None	None	None	None	Bar
(b)	None	Bar	Bar	None	None	Bar	Bar	None
(c)	Bar	None	Bar	None	Bar	None	Bar	None

Notes: 2. Repeated every 8 years from 2014 on.
3. For MPAK products (HA17431GLTP, HA17431GLTPA)
For MPAK-5 products (HA17431GLP, HA17431GLPA)

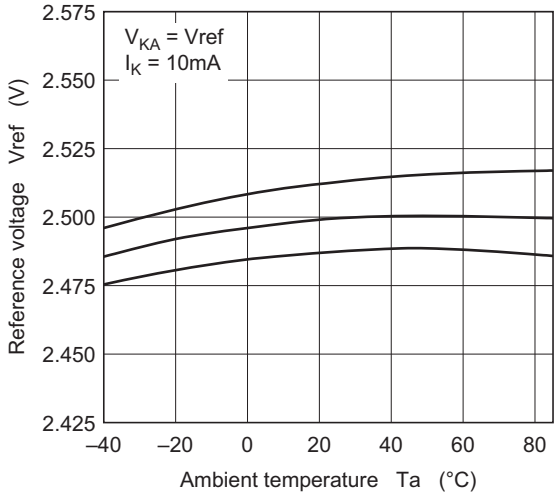
(4)	Characters	Production month code

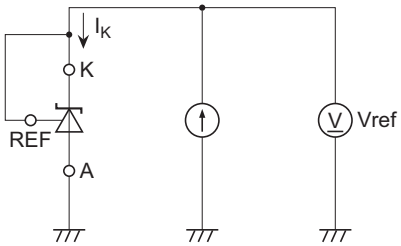
Production Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Code	A	B	C	D	E	F	G	H	J	K	L	M

(5)		Management code Notes: 4. For UPAK products (HA17431GUP, HA17432GUP)

Characteristics Curves

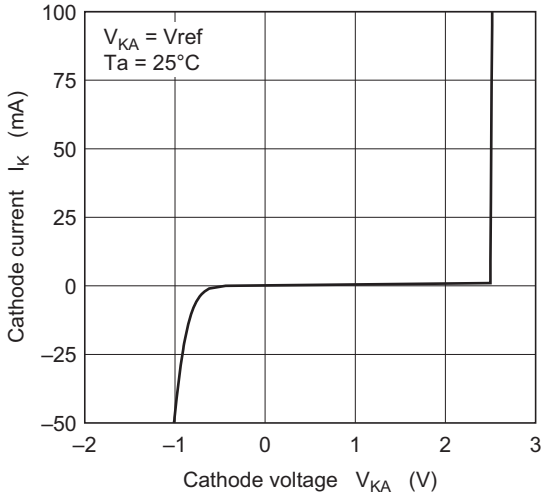
Reference Voltage vs. Ambient Temperature Characteristics



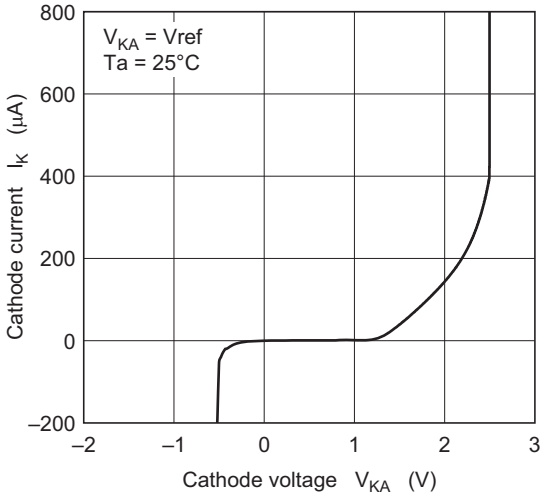


Measurement Circuit

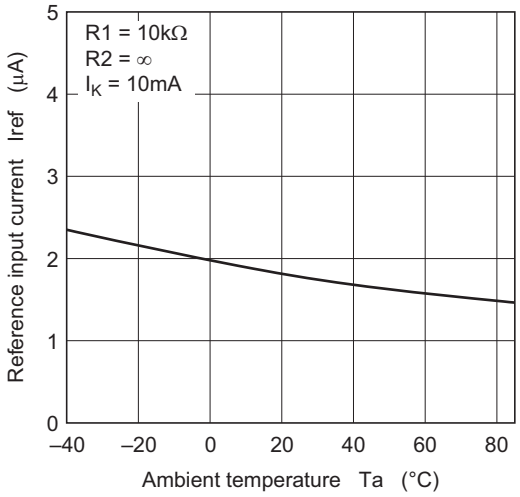
Cathode Current vs. Cathode Voltage Characteristics 1

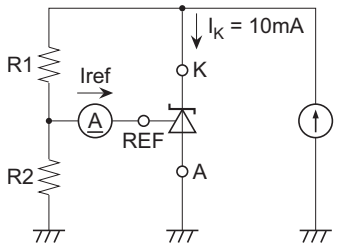


Cathode Current vs. Cathode Voltage Characteristics 2



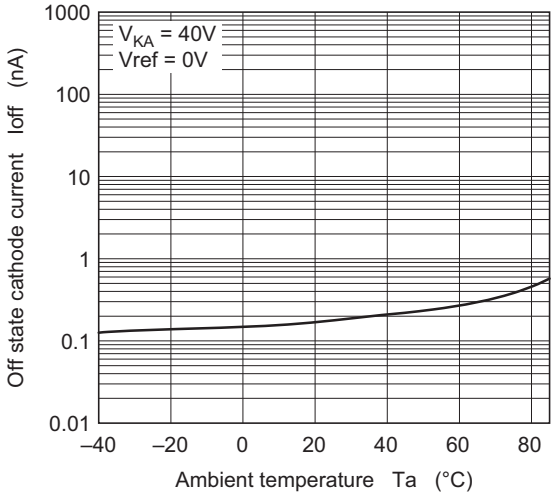
Reference Input Current vs. Ambient Temperature Characteristics

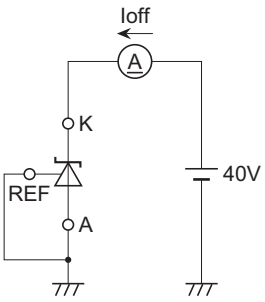




Measurement Circuit

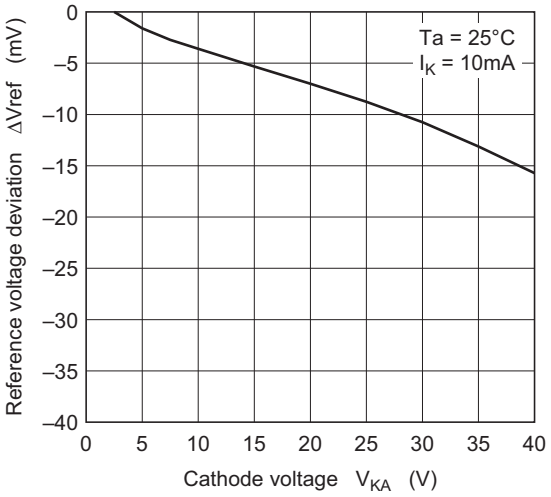
Off State Cathode Current vs. Ambient Temperature Characteristics

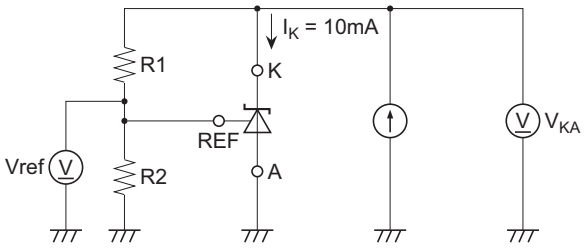




Measurement Circuit

Reference Voltage Deviation vs. Cathode Voltage Characteristics

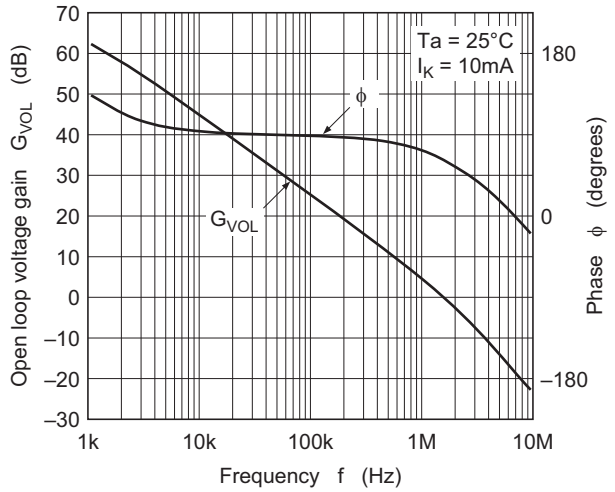


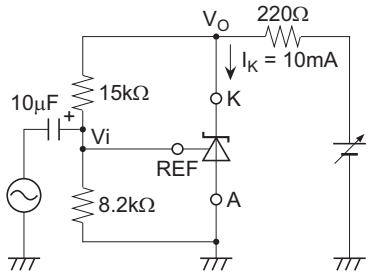


$$V_{KA} \cong Vref \times \frac{R1 + R2}{R2}$$

Measurement Circuit

Open Loop Voltage Gain, Phase vs. Frequency Characteristics

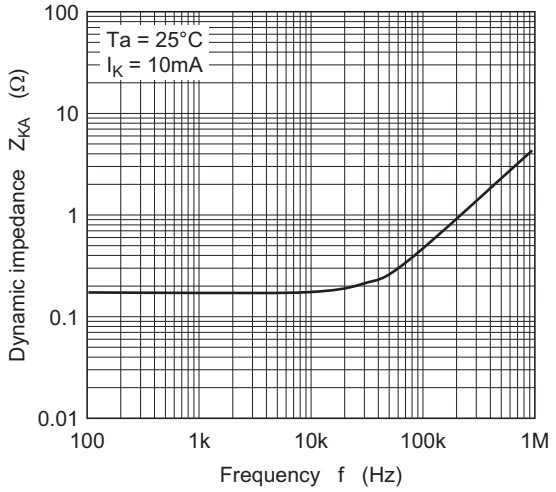


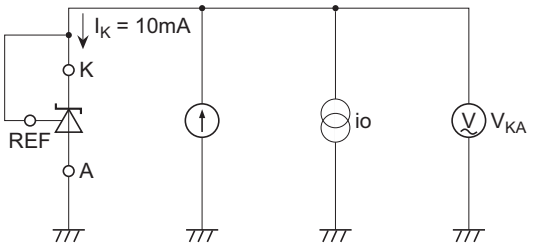


$$G_{VOL} = 20\log\left(\frac{V_O}{Vi}\right) \text{ (dB)}$$

Measurement Circuit

Dynamic Impedance vs. Frequency Characteristics



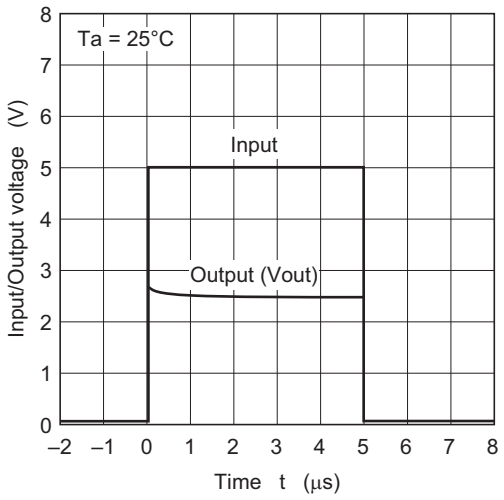


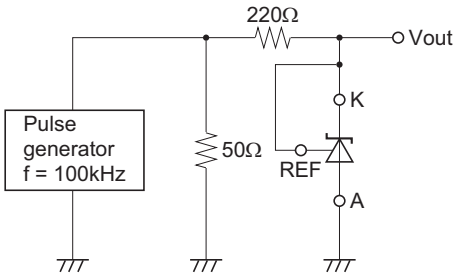
io = 707mArms (= 2mAp-p)

$$Z_{KA} = \frac{V_{KA}}{io} \text{ (Ω)}$$

Measurement Circuit

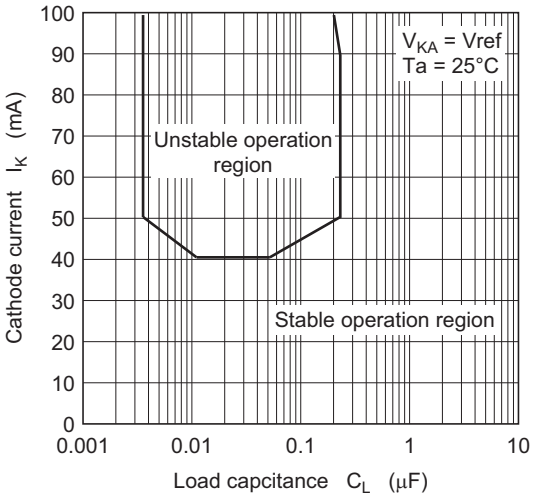
Pulse Response Characteristics

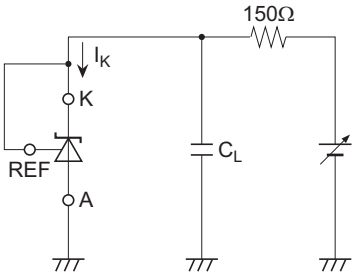




Measurement Circuit

Stable Operation Region



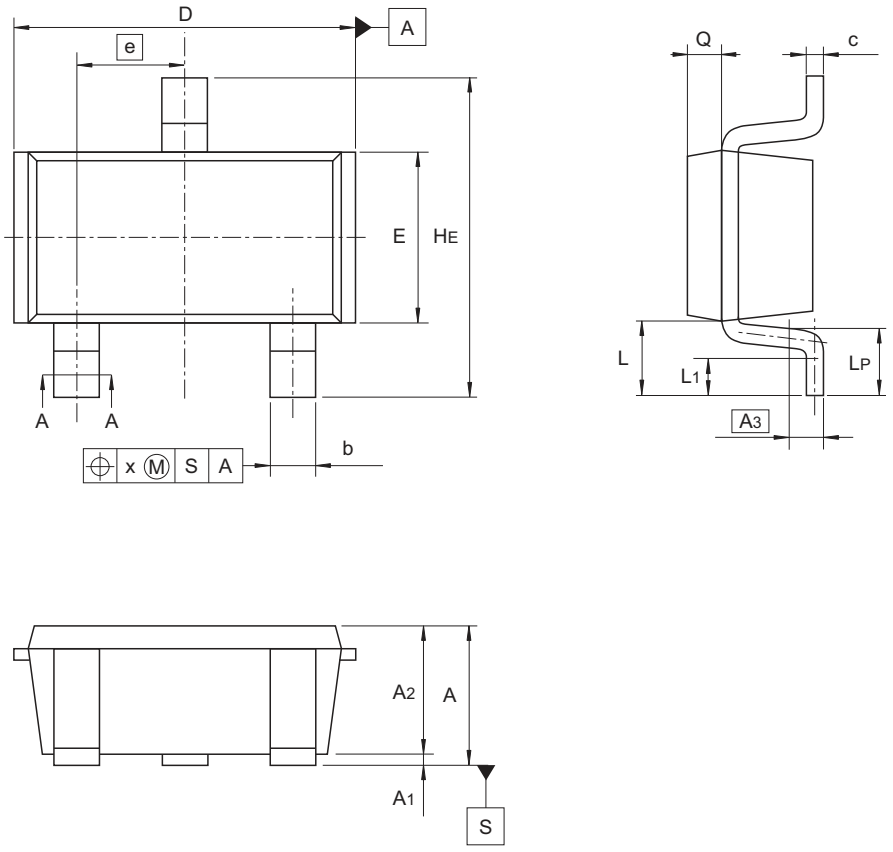


Measurement Circuit

Note: In the unstable operation region, there is a possibility that the device oscillates. Please change to the setting with an enough margin in consideration of the difference when you use it.

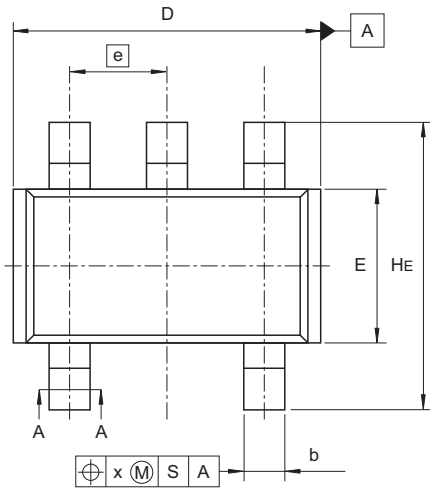
Package Dimensions

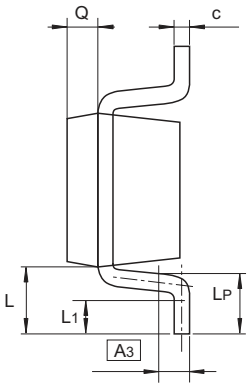
JEITA Package Code	RENESAS Code	Previous Code	MASS (Typ) [g]
SC-59A	PLSP0003ZB-A	MPAK(T) / MPAK(T)V	0.011

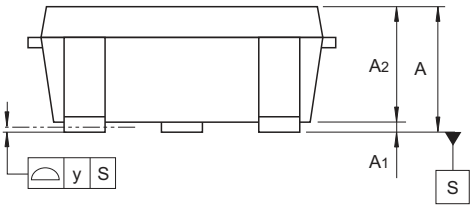


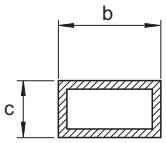
Reference Symbol	Dimensions in millimeters		
	Min	Nom	Max
A	1.0	—	1.3
A_1	0	—	0.1
A_2	1.0	1.1	1.2
$\boxed{A_3}$	—	0.25	—
b	0.35	0.4	0.5
c	0.1	0.16	0.26
D	2.7	—	3.1
E	1.35	1.5	1.65
$\boxed{e}$	—	0.95	—
H_E	2.2	2.8	3.0
L	0.35	—	0.75
L_1	0.15	—	0.55
L_P	0.25	—	0.65
x	—	—	0.05
Q	—	0.3	—

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







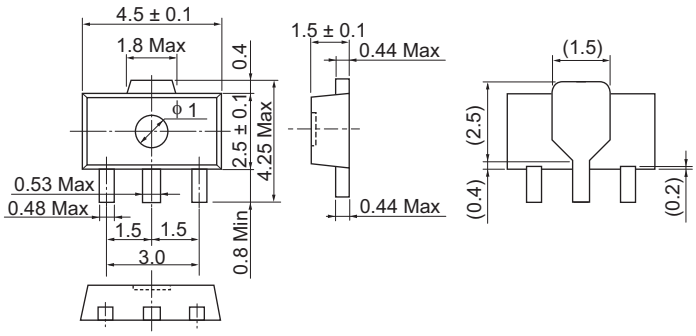


A-A Section

Reference Symbol	Dimensions in millimeters		
	Min	Nom	Max
A	1.0	—	1.4
A_1	0	—	0.1
A_2	1.0	1.1	1.3
A_3	—	0.25	—
b	0.35	0.4	0.5
c	0.11	0.16	0.26
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
Q	—	0.3	—

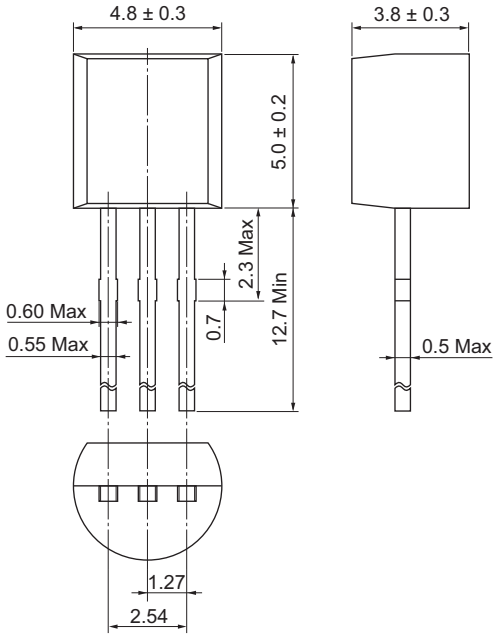
Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
UPAK	SC-62	PLZZ0004CA-A	UPAK / UPAKV	0.050g

Unit: mm



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

Unit: mm



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