

# HA17431G Series

## Adjustable Precision Shunt Regulators

REJ03D0805-0100  
Rev.1.00  
Mar 10, 2006

### Description

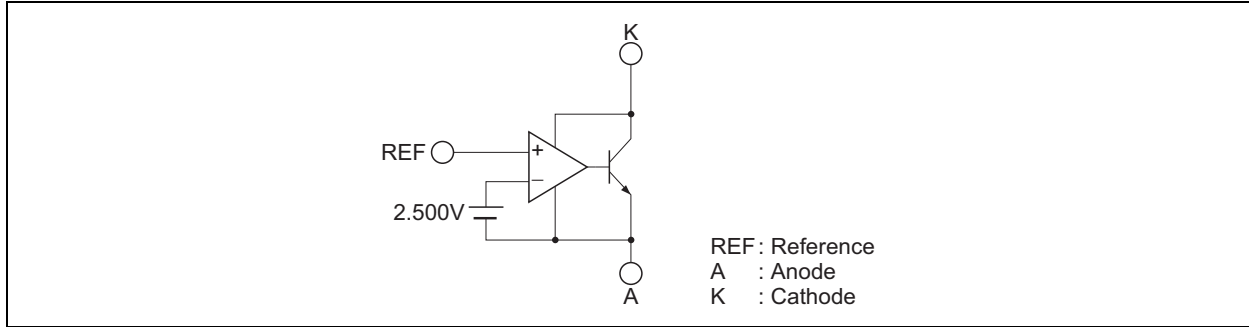
The HA17431G series is temperature-compensated adjustable precision shunt regulators. The products have improved features such as wide operating cathode voltage range and precision than the previous products.

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  $\pm 1.0\%$  standard version and  $\pm 0.5\%$  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.

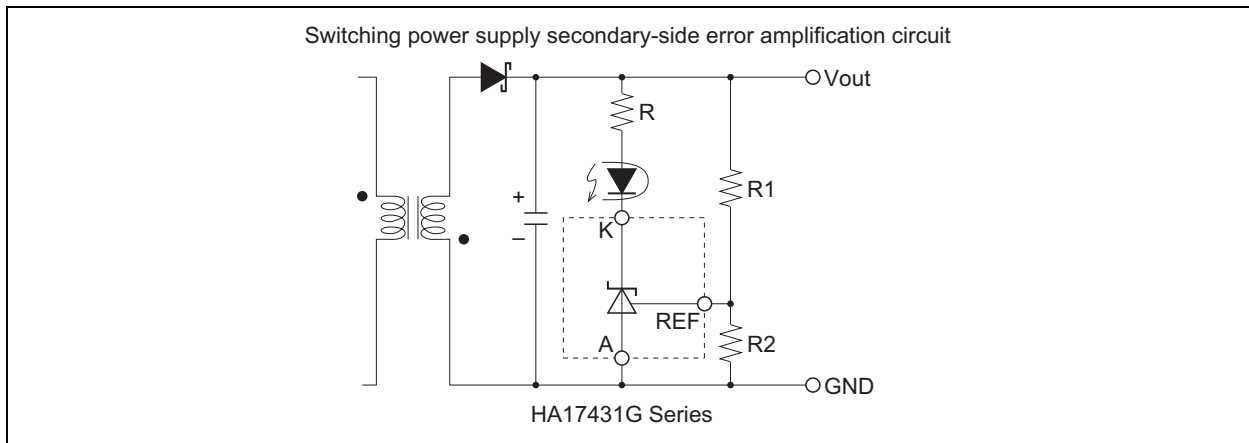
### Features

- High-precision reference voltage : 2.500 V  $\pm$  1.0% (Ta = 25°C, Standard version)  
: 2.500 V  $\pm$  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



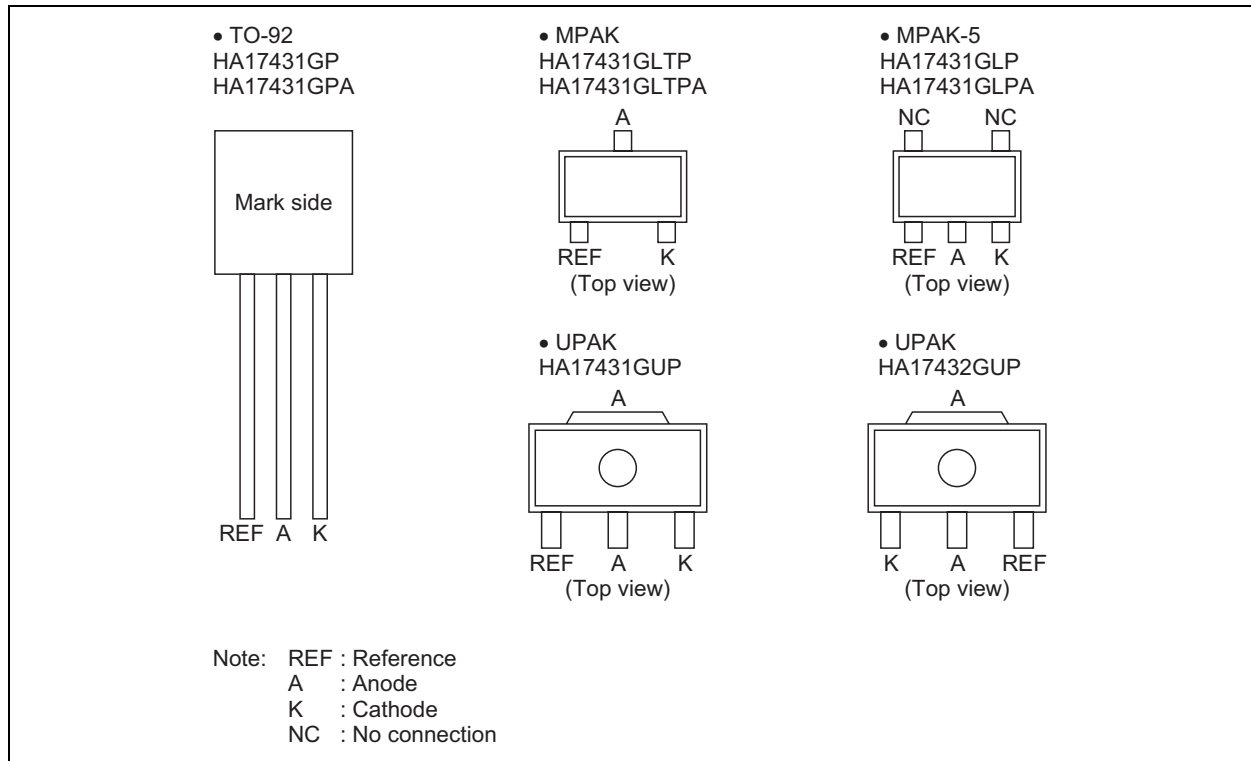
## Application Circuit Example



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



## 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	$I_{ref}$	-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	$T_{opr}$	-40 to +85	°C		
Storage temperature	$T_{stg}$	-55 to +150	°C		

Notes: 1. Voltage values are with reference to the Anode pin.

2.  $T_a \leq 25^\circ\text{C}$ . If  $T_a > 25^\circ\text{C}$ , derate by  $-4 \text{ mW}/^\circ\text{C}$ .

3.  $T_a \leq 25^\circ\text{C}$ . If  $T_a > 25^\circ\text{C}$ , derate by  $-1.2 \text{ mW}/^\circ\text{C}$ .

4. 15 mm × 25 mm × 0.7mm alumina ceramic board,  $T_a \leq 25^\circ\text{C}$ . If  $T_a > 25^\circ\text{C}$ , derate by  $-6.4 \text{ mW}/^\circ\text{C}$ .

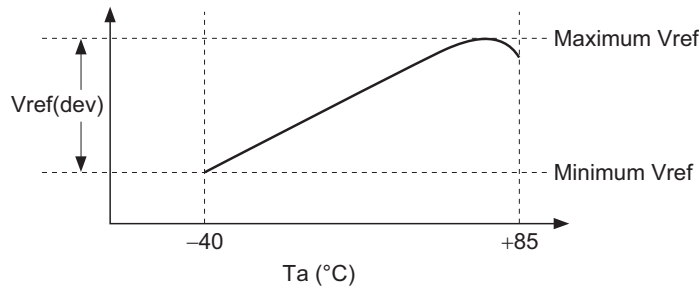
Electrical Characteristics

( $T_a = 25^\circ\text{C}$ ,  $I_K = 10\text{ mA}$ , unless otherwise noted)

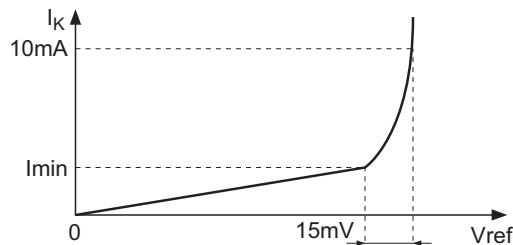
Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Notes
Reference voltage	$V_{\text{ref}}$	2.487	2.500	2.513	V	$V_{\text{KA}} = V_{\text{ref}}$	A
		2.475	2.500	2.525			Standard
Reference voltage temperature deviation	$V_{\text{ref}}(\text{dev})$	—	(14)	—	mV	$V_{\text{KA}} = V_{\text{ref}}$ , $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$	1, 2
Reference voltage temperature coefficient	$\Delta V_{\text{ref}}/\Delta T_a$	—	( $\pm 30$ )	—	ppm/ $^\circ\text{C}$	$V_{\text{KA}} = V_{\text{ref}}$ , $0^\circ\text{C}$ to $50^\circ\text{C}$ gradient	1
Reference voltage regulation	$\Delta V_{\text{ref}}/\Delta V_{\text{KA}}$	—	2.0	3.7	mV/V	$V_{\text{KA}} = V_{\text{ref}}$ to 10 V	
		—	2.0	3.7		$V_{\text{KA}} = 10\text{ V}$ to 40 V	
Reference input current	$I_{\text{ref}}$	—	2	6	$\mu\text{A}$	$R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$	
Reference current temperature deviation	$I_{\text{ref}}(\text{dev})$	—	(0.9)	—	$\mu\text{A}$	$R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$ , $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$	1
Minimum cathode current	$I_{\text{min}}$	—	0.4	1.0	mA	$V_{\text{KA}} = V_{\text{ref}}$	3
Off state cathode current	$I_{\text{off}}$	—	0.001	1.0	$\mu\text{A}$	$V_{\text{KA}} = 40\text{ V}$ , $V_{\text{ref}} = 0\text{ V}$	
Dynamic impedance	$Z_{\text{KA}}$	—	0.2	0.5	$\Omega$	$V_{\text{KA}} = V_{\text{ref}}$ , $I_K = 1\text{ mA}$ to 100 mA	

Notes: 1. Reference values for design.

2.  $V_{\text{ref}}(\text{dev}) = (V_{\text{ref}} \text{ maximum value at } T_a = -40^\circ\text{C} \text{ to } +85^\circ\text{C}) - (V_{\text{ref}} \text{ minimum value at } T_a = -40^\circ\text{C} \text{ to } +85^\circ\text{C})$

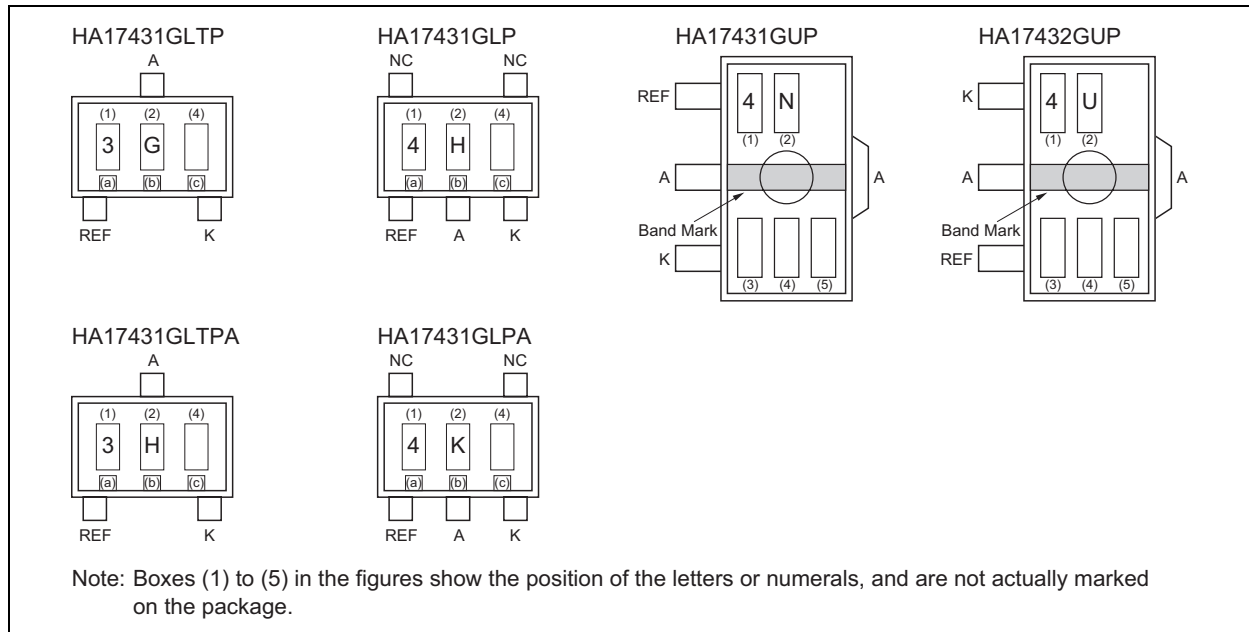


3. Definition of minimum cathode current.  $I_{\text{min}}$  is the cathode current value at which  $V_{\text{ref}} = V_{\text{ref}}(I_K=10\text{mA}) - 15\text{ mV}$ .



## Marking Patterns

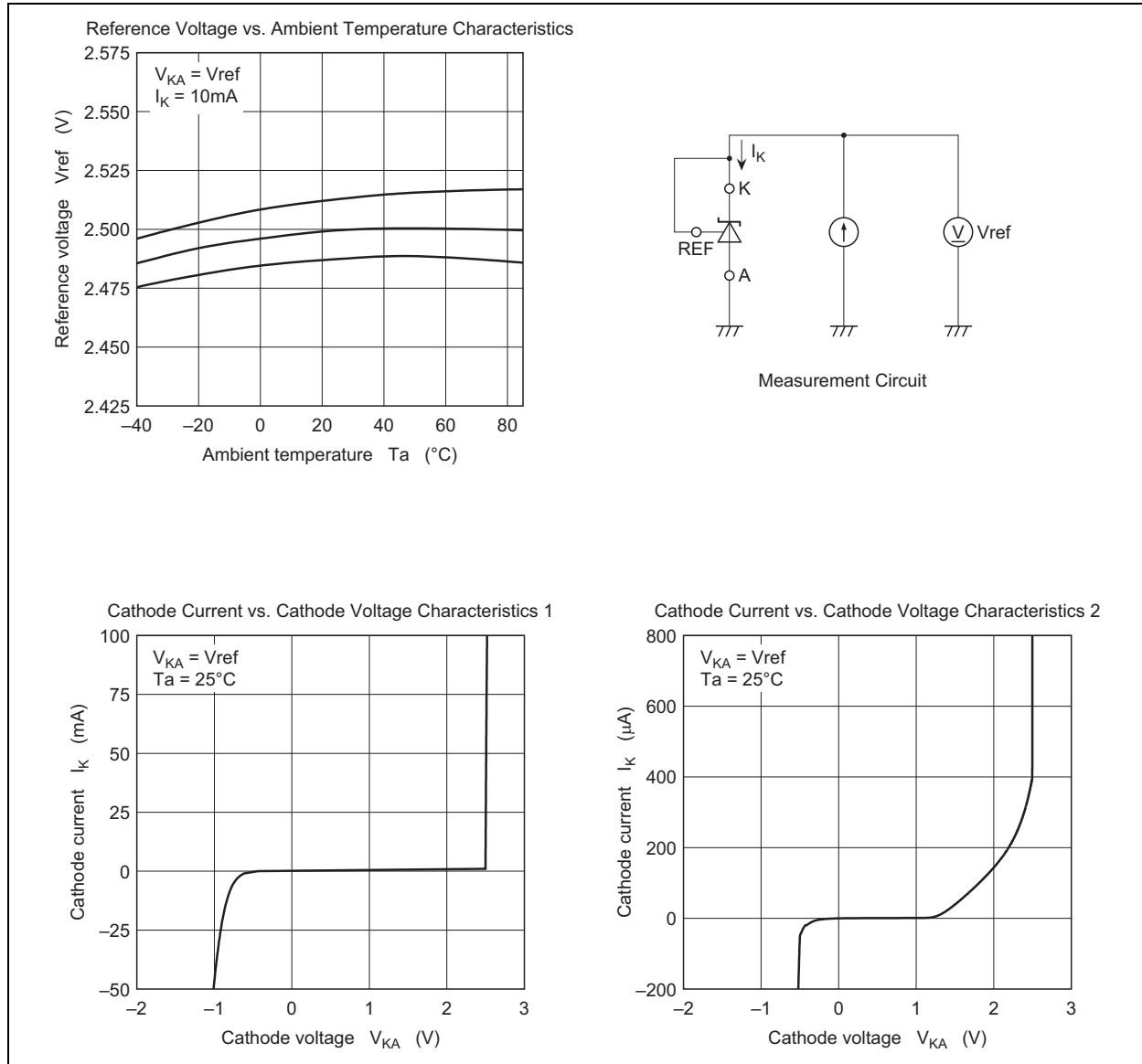
The marking patterns shown below are used on MPAK, MPAK-5 and UPAK products.



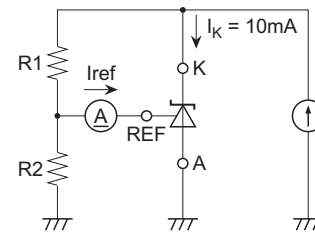
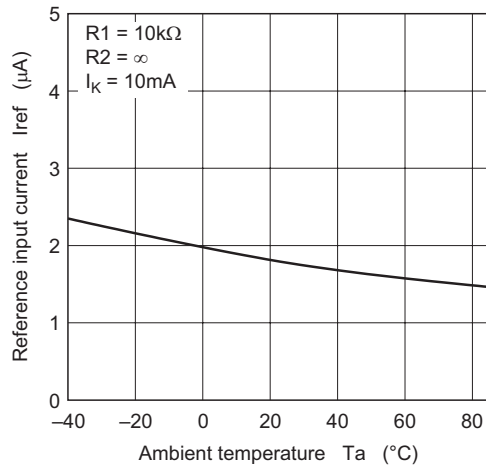
## Markings

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 <table border="1"> <thead> <tr> <th>Production Year</th> <th>2006</th> <th>2007</th> <th>2008</th> <th>2009</th> <th>2010</th> <th>2011</th> <th>2012</th> <th>2013</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Bar</td> <td>Bar</td> <td>Bar</td> <td>None</td> <td>None</td> <td>None</td> <td>None</td> <td>Bar</td> </tr> <tr> <td>(b)</td> <td>None</td> <td>Bar</td> <td>Bar</td> <td>None</td> <td>None</td> <td>Bar</td> <td>Bar</td> <td>None</td> </tr> <tr> <td>(c)</td> <td>Bar</td> <td>None</td> <td>Bar</td> <td>None</td> <td>Bar</td> <td>None</td> <td>Bar</td> <td>None</td> </tr> </tbody> </table> Notes: 2. Repeated every 8 years from 2014 on. 3. For MPAK products (HA17431GLTP, HA17431GLTPA) For MPAK-5 products (HA17431GLP, HA17431GLPA)	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
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																														
(4)	Characters	Production month code <table border="1"> <thead> <tr> <th>Production Month</th> <th>Jan.</th> <th>Feb.</th> <th>Mar.</th> <th>Apr.</th> <th>May</th> <th>Jun.</th> <th>Jul.</th> <th>Aug.</th> <th>Sep.</th> <th>Oct.</th> <th>Nov.</th> <th>Dec.</th> </tr> </thead> <tbody> <tr> <td>Code</td> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td>E</td> <td>F</td> <td>G</td> <td>H</td> <td>J</td> <td>K</td> <td>L</td> <td>M</td> </tr> </tbody> </table>	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										
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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

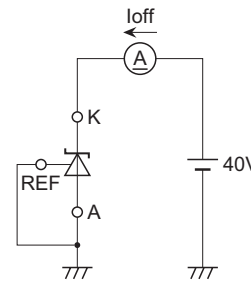
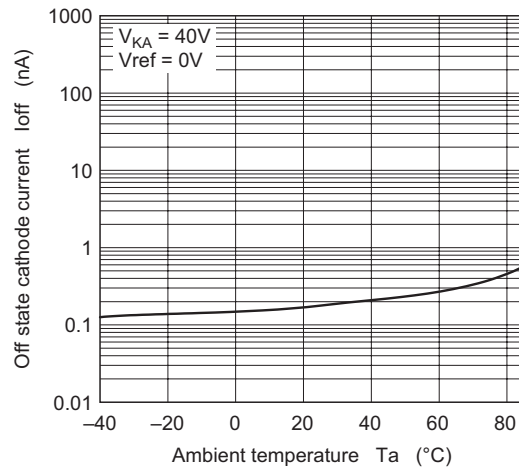


Reference Input Current vs. Ambient Temperature Characteristics



Measurement Circuit

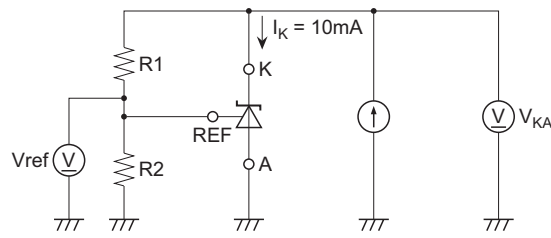
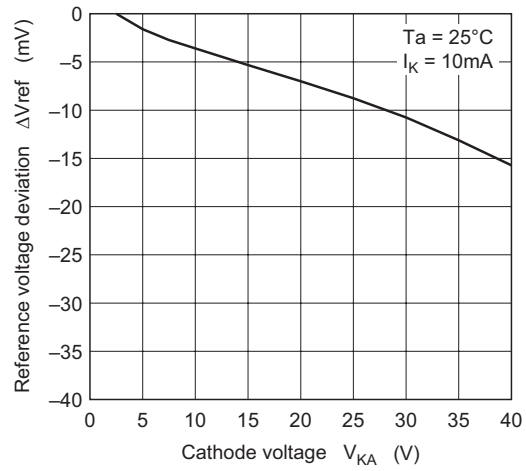
Off State Cathode Current vs. Ambient Temperature Characteristics



Measurement Circuit



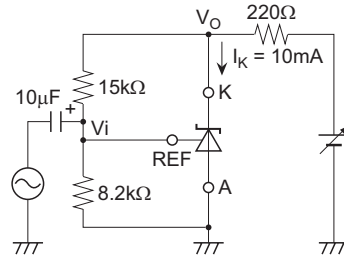
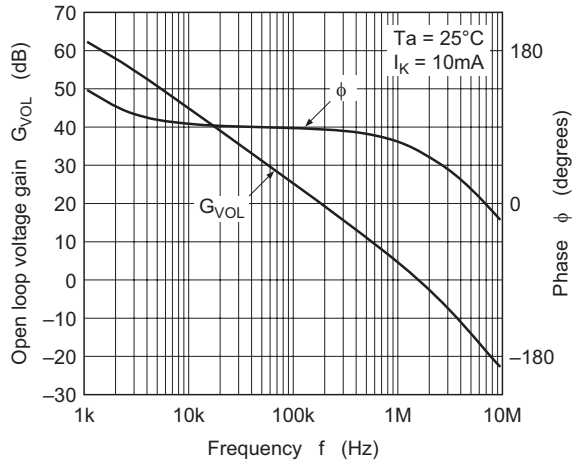
Reference Voltage Deviation vs. Cathode Voltage Characteristics



$$V_{KA} \cong V_{ref} \times \frac{R_1 + R_2}{R_2}$$

Measurement Circuit

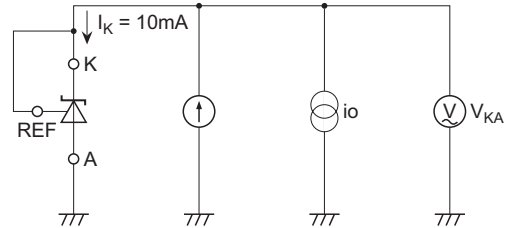
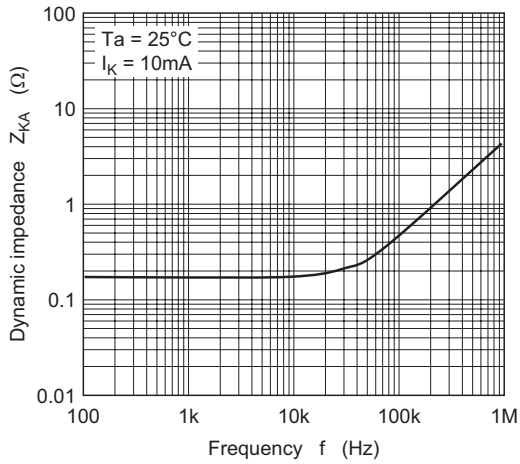
Open Loop Voltage Gain, Phase vs. Frequency Characteristics



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

Measurement Circuit

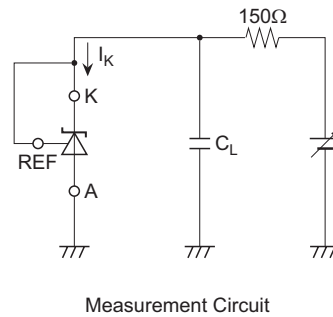
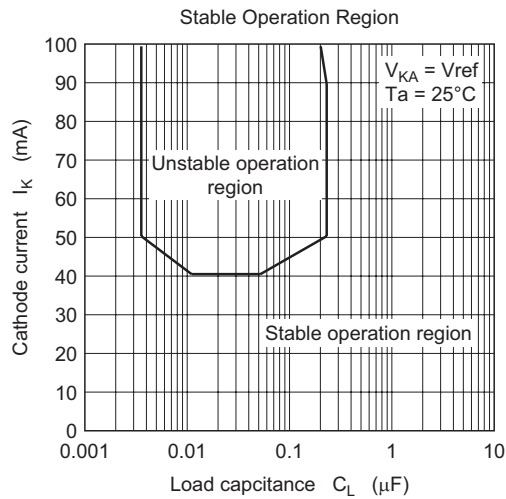
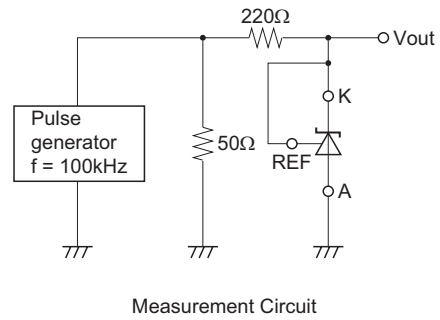
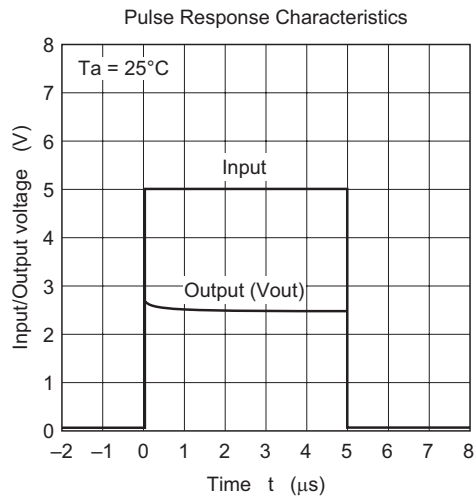
Dynamic Impedance vs. Frequency Characteristics



$$i_o = 707\text{mA rms} (= 2\text{mA p-p})$$

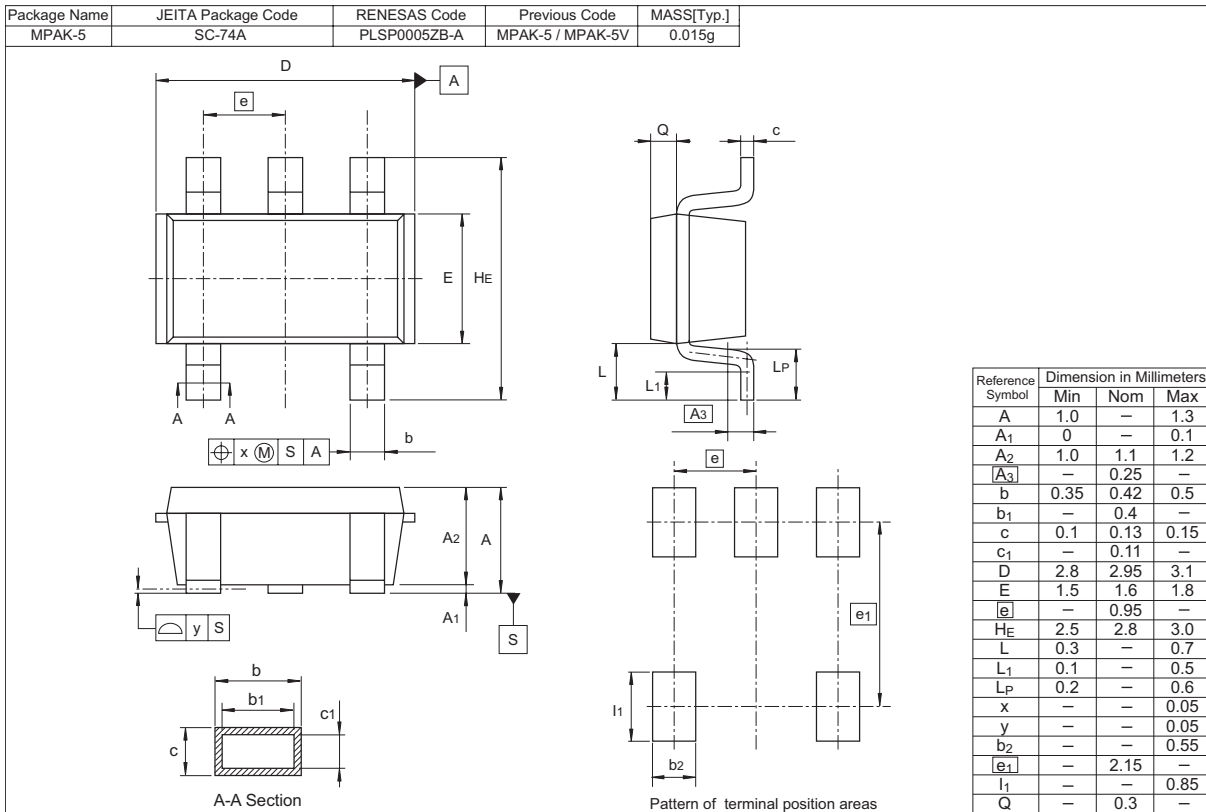
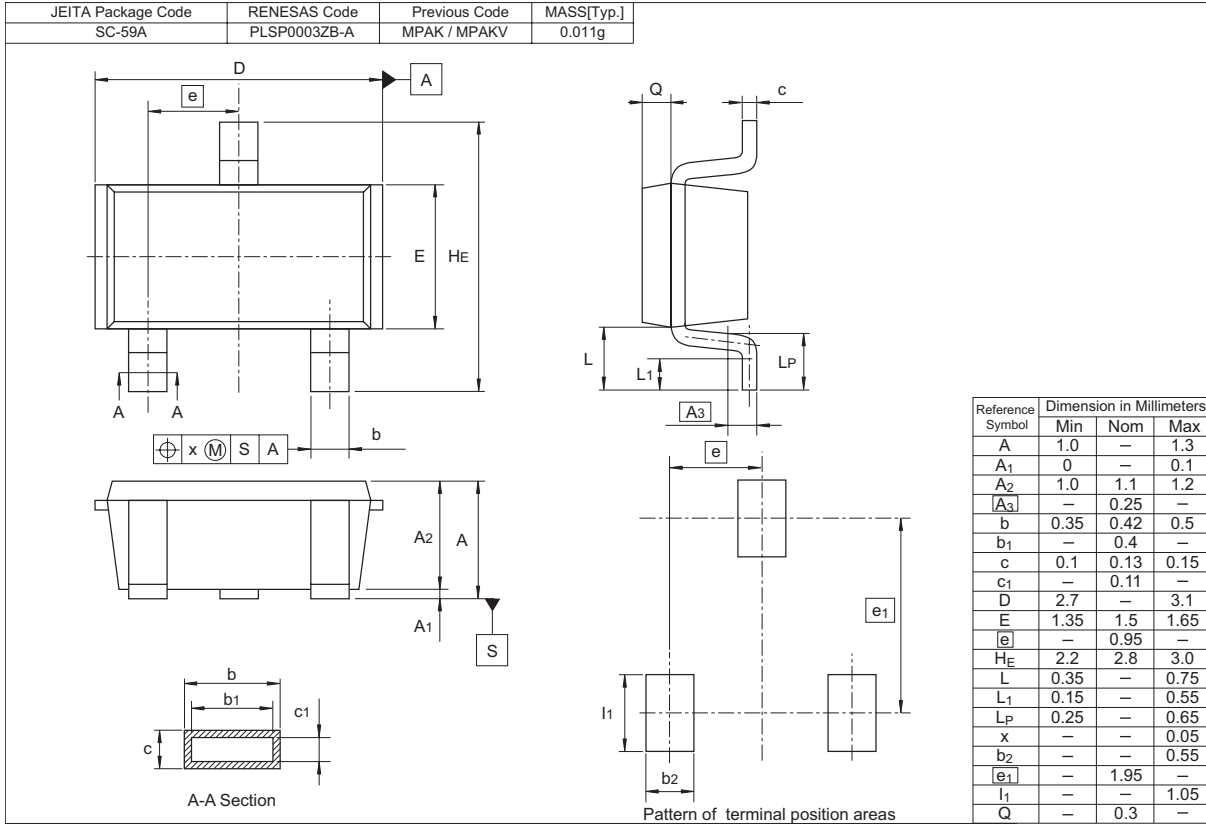
$$Z_{KA} = \frac{V_{KA}}{i_o} \text{ ( $\Omega$ )}$$

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.

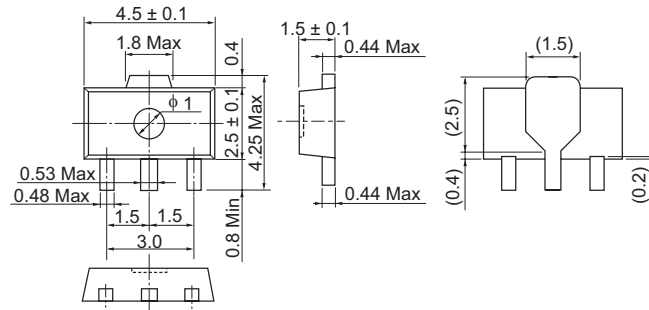
Package Dimensions



# HA17431G Series

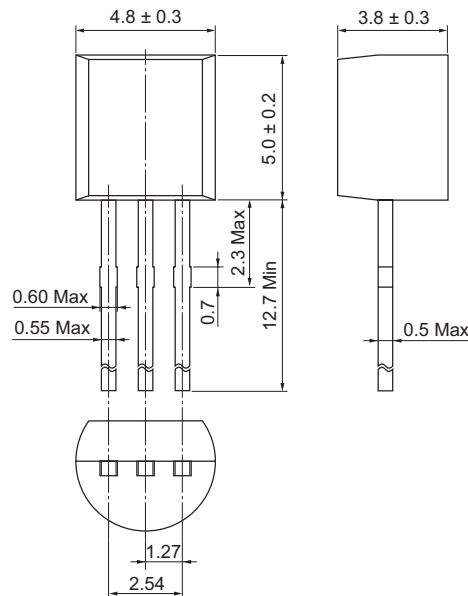
Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
UPAK	SC-62	PLZZ0004CA-A	UPAK / UPAKV	0.050g

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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