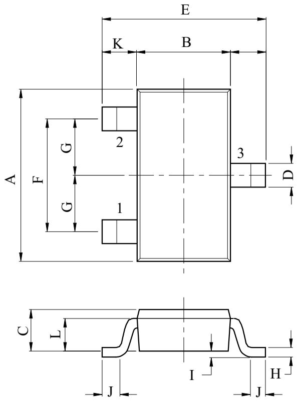
PROGRAMMABLE PRECISION REFERENCES

The KIA431S/AS/BS integrated circuits are three-terminal programmable shunt regulator diodes. These monolithic IC voltage reference operate as a low temperature coefficient zener which is programmable from V_{ref} to 20 volts with two external resistors. These devices exhibit a wide operating current range of 1.0 to 100mA with a typical dynamic impedance of 0.22 Ω. The characteristics of these references make them excellent replacements for zener diodes in many applications such as digital voltmeters, power supplies, and op amp circuitry. The 2.5 volt reference makes it convenient to obtain a stable reference from 5.0 volt logic supplies, and since the KIA431S/AS/BS operates as a shunt regulator, it can be used as either a positive or negative voltage reference.



DIM	MILLIMETERS
A	2.9±0.2
B	1.6+0.2/-0.1
C	0.70±0.05
D	0.4±0.1
E	2.8+0.2/-0.3
F	1.9±0.2
G	0.95
H	0.16±0.05
I	0.00-0.10
J	0.25+0.25/-0.15
K	0.60
L	0.55

1. CATHODE
2. REFERENCE
3.ANODE

TSM

FEATURES

· Programmable Output Voltage to 20 Volts.

ITEM	Vref Tolerance (%)
KIA431S	±2.2
KIA431AS	±1.0
* KIA431BS	±0.5

Note) * : Under development

· Low Dynamic Output Impedance : 0.22 Ω (Typ.).
· Sink Current Capability of 1.0 to 100mA.
· Equivalent Full-Range Temperature Coefficient of 50ppm/℃ (Typ.).
· Temperature Compensated for Operation Over Full Rated Operating Temperature Range.
· Low Output Noise Voltage.

Marking

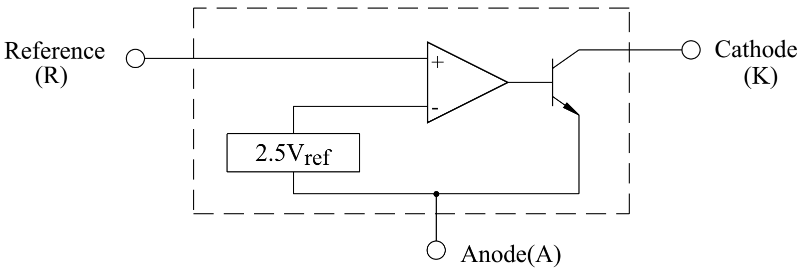
Type No.	Marking
KIA431S	3A
KIA431AS	3B
KIA431BS	3C

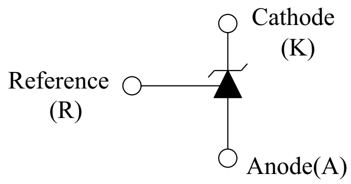
MAXIMUM RATINGS (Ta=25℃)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Cathode To Anode Voltage	V_{KA}	20	V
Cathode Current Range, Continuous	I_K	-100～150	mA
Reference Input Current Range, Continuous	I_{ref}	-0.05～10	mA
Operating Junction Temperature	T_j	150	℃
Operating Temperature	T_{opr}	-40～85	℃
Storage Temperature	T_{stg}	-65～150	℃
Total Power Dissipation (Note)	P_D	900	mW

Note) Package mounted on a ceramic board. (600m²×0.8m)

BLOCK DIAGRAM





ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	KIA431S	V_{ref}	Figure 1	$V_{KA}=V_{ref}$, I_K=10mA		2.440	2.495	2.550	V
	KIA431AS					2.470	2.495	2.520	V
	KIA431BS					2.4825	2.495	2.5075	V
Reference Input Voltage Deviation Over Temperature Range		ΔV_{ref}	Figure 1 (Note 1)	$V_{KA}=V_{ref}$, I_K=10mA		-	7.0	30	mV
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage		$\Delta V_{ref}/\Delta V_{KA}$	Figure 2	I_K=10mA	ΔV_{KA}= 10V～V_{ref}	-	-1.4	-2.7	mV/V
					ΔV_{KA}= 20V～10V	-	-1.0	-2.0	
Reference Input Current	Ta=25℃	I_{ref}	Figure 2	I_K=10mA, R1=10kΩ, R2=∞		-	1.8	4.0	μA
	Ta=T_{opr}					-	-	6.5	
Reference Input Current Deviation Over Temperature Range		ΔI_{ref}	Figure 2	I_K=10mA, R1=10kΩ, R2=∞		-	0.8	2.5	μA
Minimum Cathode Current For Regulation		I_{min}	Figure 1	$V_{KA}=V_{ref}$		-	0.5	1.0	mA
Off-State Cathode Current		I_{off}	Figure 3	V_{KA}=20V, V_{ref}=0V		-	2.6	1000	nA
Dynamic Impedance		Z_{ka}	Figure 1 (Note 2)	$V_{KA}=V_{ref}$, I_K=1.0～100mA, f≦1.0kHz		-	0.22	-	Ω

FIGURE 1-TEST CIRCUIT FOR $V_{KA} = V_{ref}$

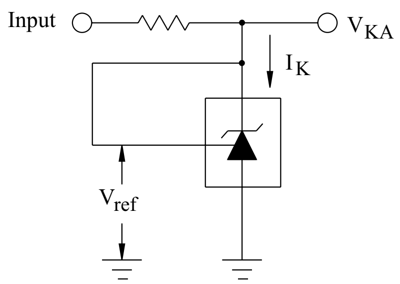
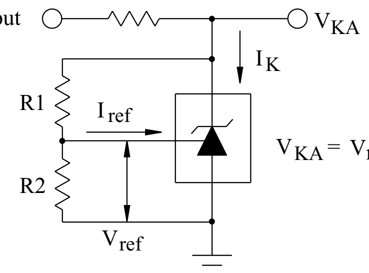


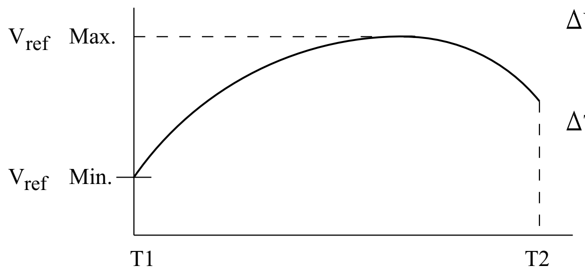
FIGURE 2-TEST CIRCUIT FOR $V_{KA} > V_{ref}$



$$V_{KA} = V_{ref} \left(1+\frac{R1}{R2}\right) + I_{ref} \times R1$$

Note 1:

The deviation parameter ΔV_{ref} is defined as the differences between the maximum and minimum values obtained over the full operating ambient temperature range that applies.



$\Delta V_{ref} = V_{ref}$ (Max.) - V_{ref} (Min.)

$\Delta Ta = T_2 - T_1$

AMBIENT TEMPERATURE

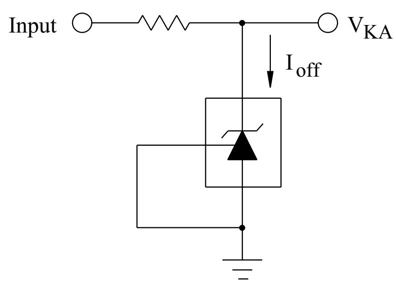
The average temperature coefficient of the Reference input voltage, ΔV_{ref} , is defined as:

$$\alpha V_{ref}\left(\frac{ppm}{℃}\right) = \frac{\left(\frac{\Delta V_{ref}}{V_{ref}\ at\ 25℃}\right) \times 10^6}{\Delta Ta}$$

$$= \frac{\Delta V_{ref} \times 10^6}{\Delta Ta(V_{ref}\ at\ 25℃)}$$

αV_{ref} can be positive or negative depending on whether V_{ref} Min. or V_{ref} Max. occurs at the lower ambient temperature.

FIGURE 3-TEST CIRCUIT FOR I_{off}



Example : ΔV_{ref} = 8.0mV and slope is positive,
V_{ref} at 25℃=2.495V, ΔTa=70℃

$$\alpha V_{ref} = \frac{0.008 \times 10^6}{70 \times (2.495)} = 45.8\ ppm/℃$$

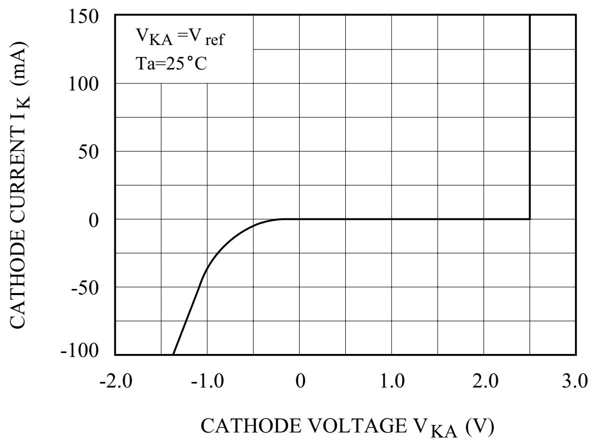
Note 2: The dynamic impedance Z_{ka} is defined as:

$$|Z_{ka}| = \frac{\Delta VKA}{\Delta Ik}$$

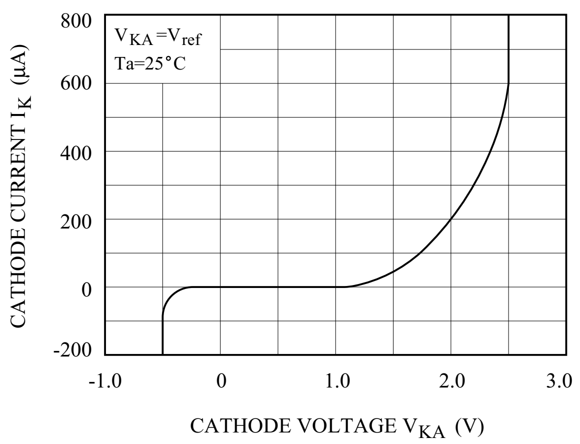
When the device is programmed with two external resistors, R1 and R2, (refer to Figure 2) the total dynamic impedance of the circuit is defined as:

$$|Z_{ka'}| = |Z_{ka}| \left(1+\frac{R1}{R2}\right)$$

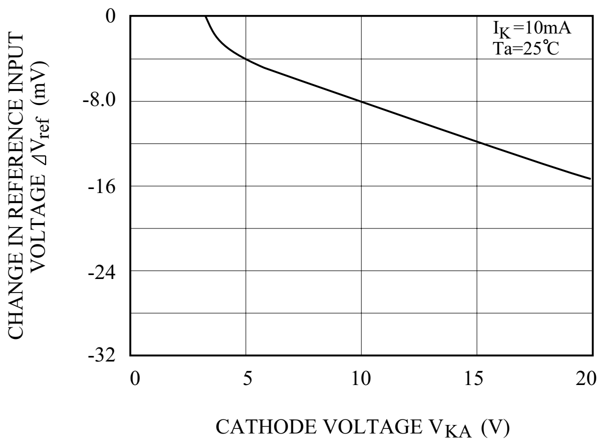
I_K - V_{KA}



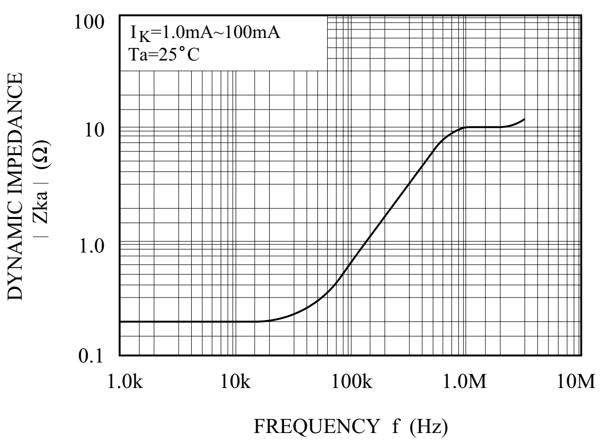
I_K - V_{KA}



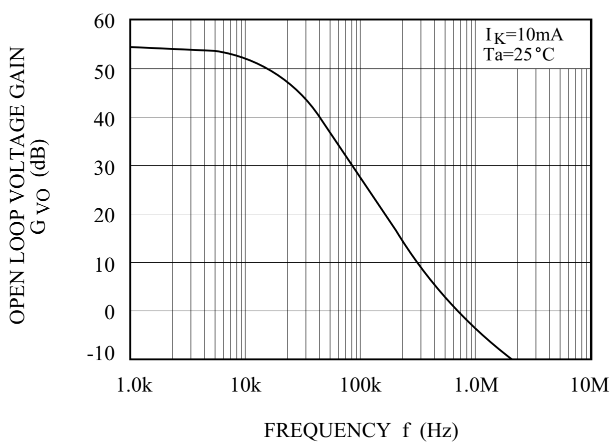
ΔV_{ref} - V_{KA}



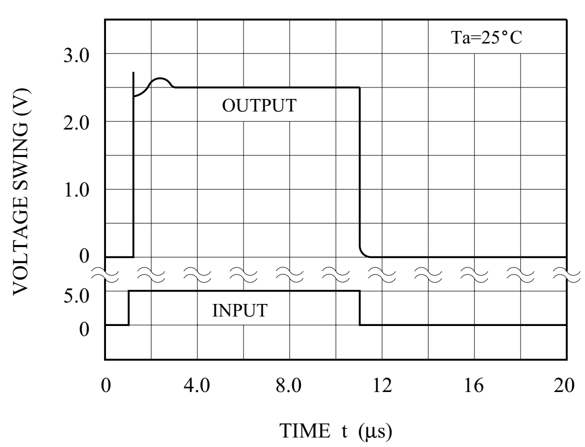
| Zka | - f

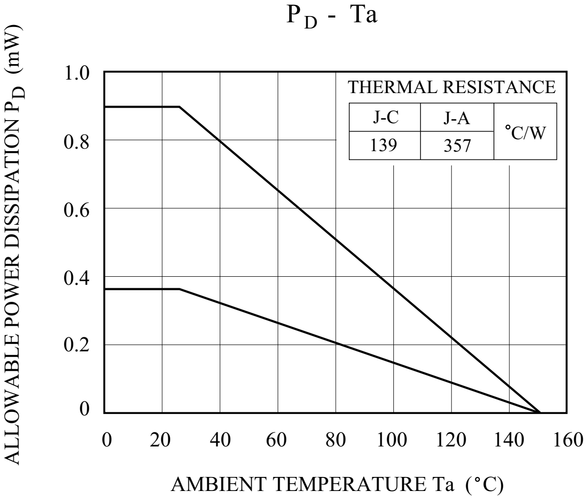


G_{VO} - f



PULSE RESPONSE




P_D - Ta
ALLOWABLE POWER DISSIPATION P_D (mW)
1.0
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
160
AMBIENT TEMPERATURE Ta (°C)
THERMAL RESISTANCE
J-C
J-A
139
357
°C/W