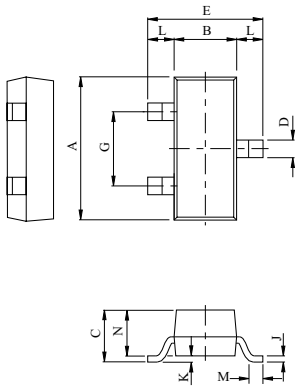
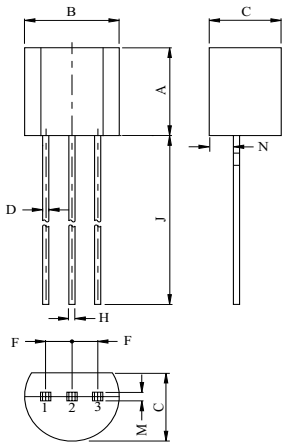
PROGRAMMABLE PRECISION REFERENCES

The KIA431AA/BA/CA Series 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 36 volts with two external resistors. It features a low mnimum cathode current for regulation. The typical value of 50uA make the parts ideal for low power application. These devices exhibit a wide operating current range of 0.1mA to 100mA with a typical dynamic impedance of 0.22Ω .
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 KIA431AA/BA/CA Series operates as a shunt regulator, it can be used as either a positive or negative voltage reference.



DIM	MILLIMETERS
A	2.90±0.1
B	1.30+0.20/-0.15
C	1.30 MAX
D	0.40+0.15/-0.10
E	2.40+0.30/-0.20
G	1.90±0.2
J	0.10+0.10/-0.05
K	0.00 ~ 0.10
L	0.55
M	0.20 MIN
N	1.00+0.20/-0.10

SOT-23(2)



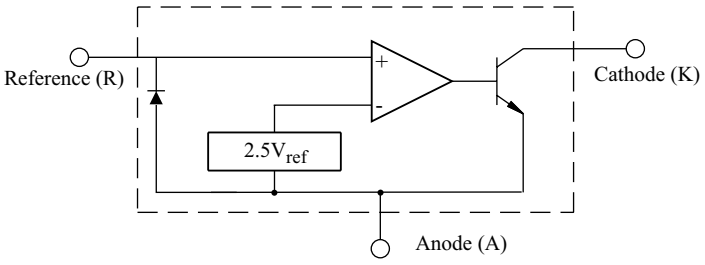
DIM	MILLIMETERS
A	4.70 MAX
B	4.80 MAX
C	3.70 MAX
D	0.45± 0.30
F	1.27± 0.20
J	14.00 ± 0.50
M	0.45 MAX
N	1.25± 0.10

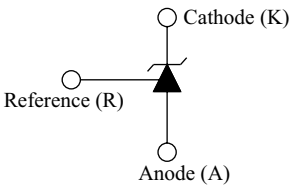
TO-92(1)

FEATURES

☐Programmable output voltage to 36V
☐Low Minimum Operation Current : 50μ A(Typ.@25℃)
☐Low Dynamic Output Impedance : 0.22Ω (Typ.).
☐Sink Current Capability of 0.1mA to 100mA.
☐Typical Temperature Drift : 5mV (0℃ to 70℃)

BLOCK DIAGRAM





LINE UP

Type No.	Operating Voltage(V)	Package	Marking
KIA431AA	2.5 ~ 36	TO-92(1)	-
KIA431BA			
KIA431CA			
KIA431AAM		SOT-23(2)	4AA
KIA431BAM			4BA
KIA431CAM			4CA
KIA431AAM2			41A
KIA431BAM2			41B
KIA431CAM2			41C

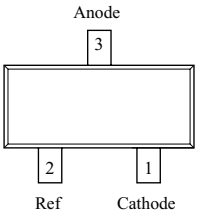
ORDERING INFORMATION

KIA431 □ □ □ □ - □ □ □ / □

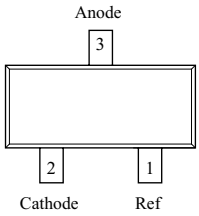
- Pb-Free / Halogen-Free
- Packing Specification
- Pin Configuration <SOT-23(2) Only>
- Package code
- I_{min} Specification
- V_{ref} Tolerance code

V_{ref} Tolerance code		I_{min} Code		Package Code		Pin Configuration <SOT-23(2) only>		Packing Specification		Pb-Free / Halogen-Free	
A	± 1.0%	Code	Spec.	Blank	TO-92(1)	Blank	A-Type	RTK	RTK type	P	Pb-Free
B	± 0.5%	A	100uA (Max)	M	SOT-23(2)	2	B-Type			H	Halogen-Free
C	± 0.3%										

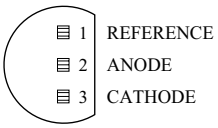
PIN ASSIGNMENTS



SOT-23(2)
(A-Type)



SOT-23(2)
(B-Type)



TO-92(1)

MAXIMUM RATINGS (Ta=25℃)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Cathode to Anode Voltage		V_{KA}	40	V
Cathode Current Range, Continuous		I_K	-100 ~ 150	mA
Reference Input Current Range, Continuous		I_{ref}	-0.05 ~ 10	mA
Maximum Junction Temperature		$T_{j,\,MAX}$	150	℃
Operating Temperature		T_{opr}	-40 ~ 125	℃
Storage Temperature		T_{stg}	-65 ~ 150	℃
Total Power Dissipation	KIA431	P_D	700	mW
	KIA431M (Note1)		350	
Thermal Resistance	KIA431	$R_{th(j-a)}$	179	℃/W
	KIA431M (Note1)		357	

Note1) Package mounted on 99.5% Alumina 10× 8× 0.6mm

RECOMMENDED OPERATION CONDITION

SYMBOL	CONDITION	Min	Max	Unit
V_{KA}	Cathode to Anode Voltage	V_{ref}	36	V
I_K	Cathode Current	0.1	100	mA

ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	KIA431AA (1.0%)	V_{ref}	Figure 1	$V_{KA}=V_{ref}$, I_K=10mA		2.470	2.495	2.520	V
	KIA431BA (0.5%)					2.483	2.495	2.507	
	KIA431CA (0.3%)					2.487	2.495	2.503	
Reference Input Voltage Deviation Over Temperature Range		ΔV_{ref}	Figure 1 (Note 1)	$V_{KA}=V_{ref}$, I_K=10mA, Ta= 0℃ to 70℃		-	5	17	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}= 36V ~ 10V	-	-1.0	-2.0	
Reference Input Current		I_{ref}	Figure 2	I_K=10mA, R1=10kΩ, R2=∞		-	0.3	4	μA
Reference Input Current Deviation Over Temperature Range		ΔI_{ref}	Figure 2	I_K=10mA, R1=10kΩ, R2=∞		-	0.15	1.2	μA
Minimum Cathode Current For Regulation		I_{min}	Figure 1	$V_{KA}=V_{ref}$		-	50	100	μA
Off-State Cathode Current		I_{off}	Figure 3	V_{KA}=36V, V_{ref}=0V		-	0.05	0.9	μA
Dynamic Impedance		Z_{ka}	Figure 1 (Note 2)	$V_{KA}=V_{ref}$, I_K=1.0 ~ 100mA, f□1.0kHz		-	0.22	0.5	Ω

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

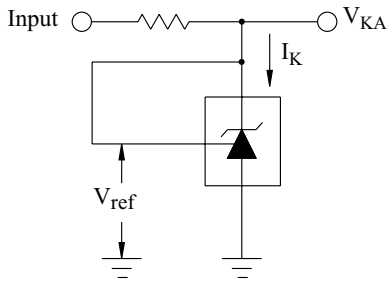
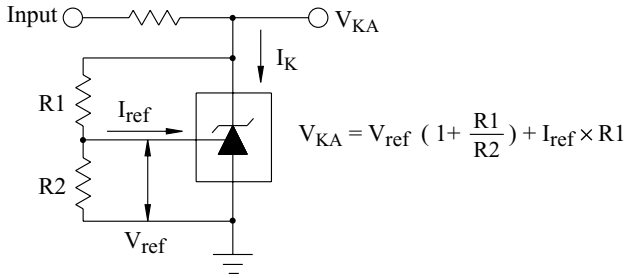
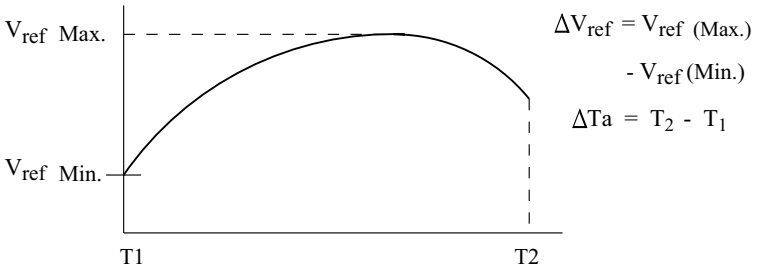


FIGURE 2-TEST CIRCUIT FOR $V_{KA} > V_{ref}$



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.



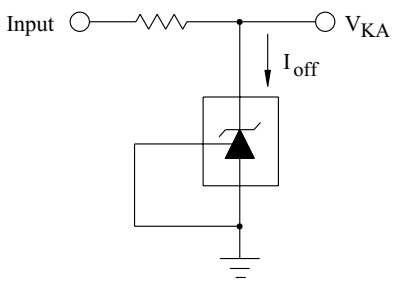
The average temperature coefficient of the Reference input voltage, ΔV_{ref}, is defined as:

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

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

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, Δ Ta=70℃

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

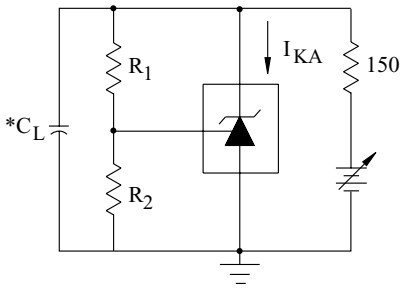
Note 2: The dynamic impedance Z_{ka} is defined as:

$$|Z_{ka}| = \frac{\Delta V_{KA}}{\Delta I_K}$$

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:

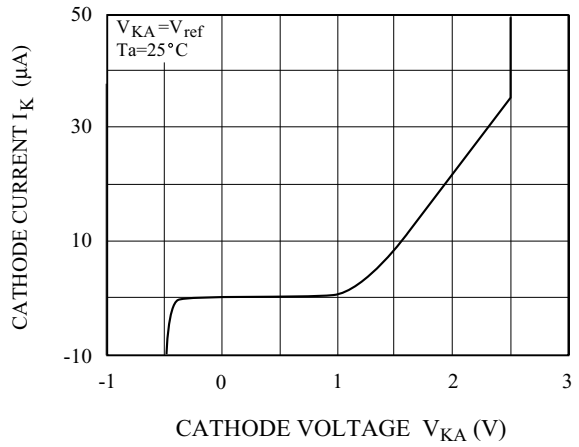
$$|Z_{ka'}| = |Z_{ka}| \left(1 + \frac{R1}{R2}\right)$$

FIGURE 4-TEST CIRCUIT FOR satbility boundary conditions

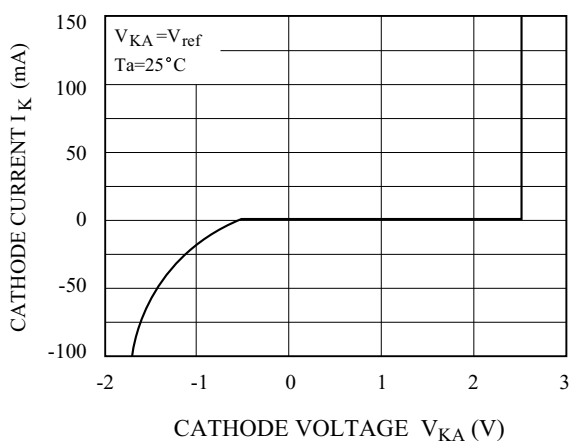


* Note 1: Recommend using more than C_L = 10uF under I_{KA} = 1mA

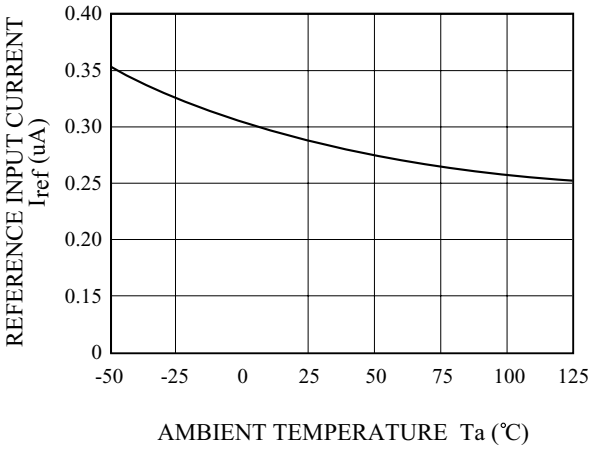
I_K - V_{KA}



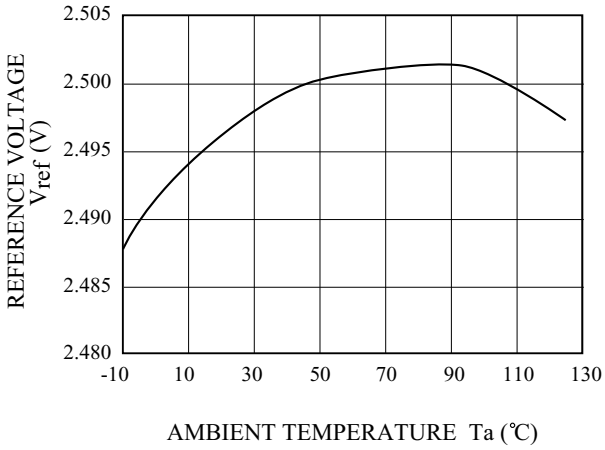
I_K - V_{KA}



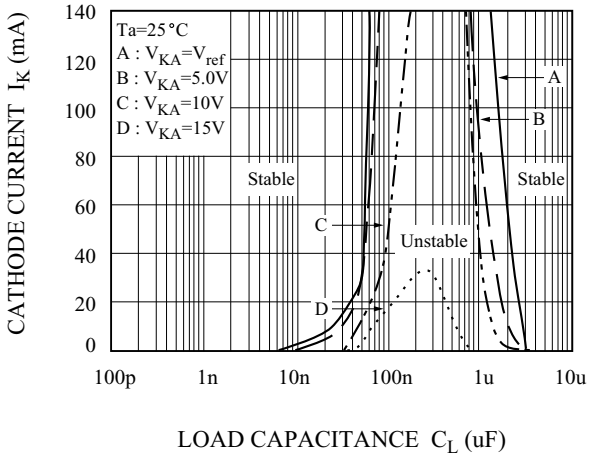
I_{ref} - Ta



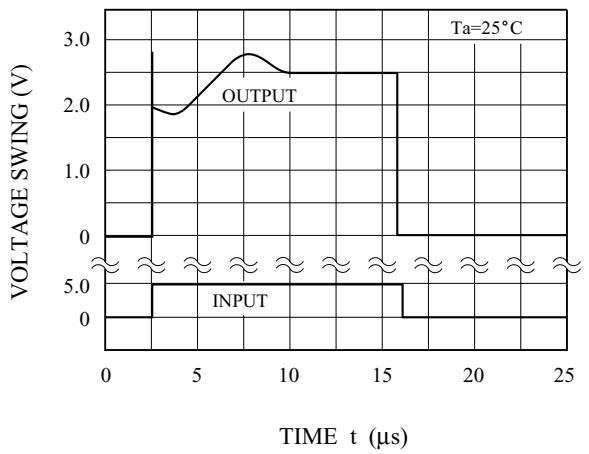
V_{ref} - Ta



Stability Boundary Conditions



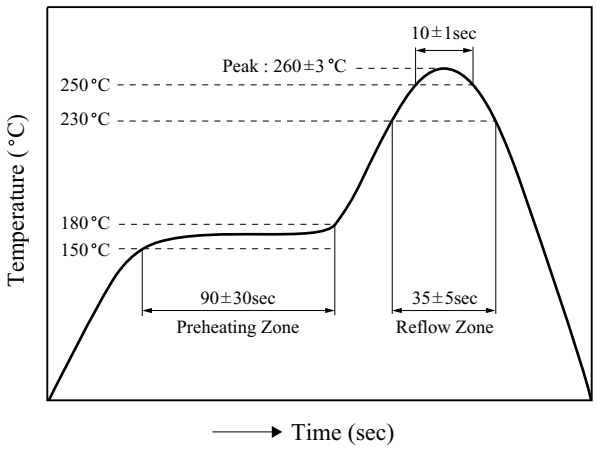
PULSE RESPONSE



PRECAUTION FOR USE

Lead-Free Soldering Condition.

Elements mounting styles of electronic devices are gaining in further diversification over recent years, and needs for components are all the more expanding in varieties. Especially, surface mounting is steadily penetrating into industrial segments as a world-wide popular technical trend. Although exposure to high temperature is inevitable during soldering we recommend limiting the soldering temperature to low levels as shown in figure for the sake of retaining inherent excellent reliability.



[Lead-Free Soldering Temperature Profile]

1. When employing solder reflow method

1) Soldering Condition

ⓐ Standard Condition : 250℃ (Temperature), 10± 1sec. (Time)

ⓑ Peak Condition : 260± 3℃

2) Recommend temperature profile

3) Precautions on heating method

When resin in kept exposed to high temperature for a long time, device reliability may be marred.

Therefore, it is essential to complete soldering in the shortest time possible to prevent temperature of resin from rising.

2. When employing halogen lamps or infrared-ray heaters

When halogen lamps or infrared-ray heaters are used, avoid direct irradiation onto resin surfaces; such devices cause extensive localized temperature rise.

※ Please keep a reflow solder operating when Surface Mount Package s Soldering.