

## PROGRAMMABLE PRECISION REFERENCES

The KIA431 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. These devices exhibit a wide operating current range of 1.0 to 100mA with a typical dynamic impedance of 0.22  $\Omega$ . 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 KIA431 Series operates as a shunt regulator, it can be used as either a positive or negative voltage reference.

### FEATURES

- Device Code Name : KIA431 +  $V_{ref}$  Code + Package Code + Pin Configuration Code

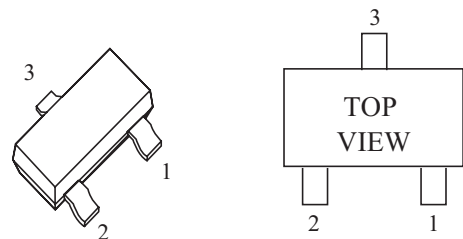
ITEM	$V_{ref}$ Code		Package Code	
	Code	Tolerance (%)	Code	Package
KIA431	Blank	$\pm 2.2$	Blank	TO-92
	Z	$\pm 1.5$	F	SOT-89
	A	$\pm 1.0$	M	SOT-23
	B	$\pm 0.5$		

- Low Dynamic Output Impedance : 0.22  $\Omega$  (Typ.).
- Sink Current Capability of 1.0 to 100mA.
- Equivalent Full-Range Temperature Coefficient of 50ppm/  $^{\circ}C$  (Typ.).
- Temperature Compensated for Operation Over Full Rated Operating Temperature Range.
- Low Output Noise Voltage.
- Suffix U : Qualified to AEC-Q100(Grade 3)
  - : Automotive and standard product are electrically and thermally the same, except where specified. ex) KIA431\*M-RTK/HU.

### LINE UP

Type No.	Operating Voltage(V)	Package	Marking	
KIA431	2.5 ~ 36	TO-92		
KIA431Z				
KIA431A				
KIA431B				
KIA431F		SOT-89		3A
KIA431ZF				3Z
KIA431AF				3B
KIA431BF				3C
KIA431M		SOT-23		43C
KIA431ZM				43Z
KIA431AM				43A
KIA431BM				43B

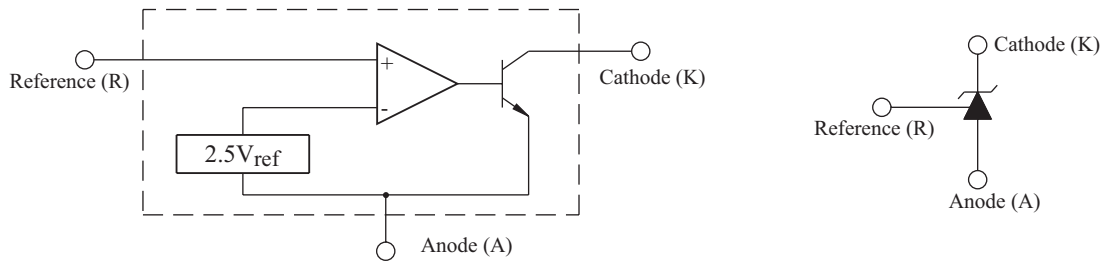
### PIN CONFIGURATION (SOT-23)



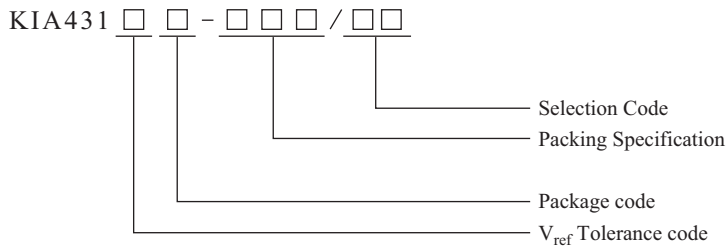
1. Cathode 2. Ref 3. Anode

# KIA431 Series

## BLOCK DIAGRAM



## ORDERING INFORMATION



$V_{ref}$ Tolerance Code		Package Code		Selection Code	
Blank	$\pm 2.2\%$	Blank	TO-92	P/PS	Pb-Free
Z	$\pm 1.5\%$	F	SOT-89	H	Halogen-Free
A	$\pm 1.0\%$	M	SOT-23		
B	$\pm 0.5\%$				

Packing Specification	TO-92	AT : Taping of AMMO PACK type
	SOT-89	RTF : RTF type
	SOT-23	RTK : RTK type

# KIA431 Series

## MAXIMUM RATINGS (Ta=25 )

(Full operating ambient temperature range applies unless otherwise noted.)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Cathode To Anode Voltage		$V_{KA}$	37	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	KIA431	$P_D$	700	mW
	KIA431F		800	
	KIA431M (Note1)		350	
Thermal Resistance	KIA431	$R_{th(j-a)}$	179	/W
	KIA431F		156	
	KIA431M (Note1)		357	

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

## ELECTRICAL CHARACTERISTICS (Ta=25 )

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Reference Input Voltage	KIA431	$V_{ref}$	Figure 1	$V_{KA}=V_{ref}, I_K=10mA$	2.440	2.495	2.550	V	
	KIA431Z				2.458	2.495	2.532	V	
	KIA431A				2.470	2.495	2.520	V	
	KIA431B				2.4825	2.495	2.5075	V	
Reference Input Voltage Deviation Over Temperature Range		$V_{ref}$	Figure 1 (Note 1)	$V_{KA}=V_{ref}, I_K=10mA$	-	7.0	30*	mV	
					-	7.0	40		
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage		$V_{ref}/V_{KA}$	Figure 2	$I_K=10mA$	$V_{KA}=10V, V_{ref}$	-	-1.4	-2.7	mV/V
					$V_{KA}=36V, 10V$	-	-1.0	-2.0	
Reference Input Current	Ta=25	$I_{ref}$	Figure 2	$I_K=10mA, R1=10k, R2=$	-	1.8	4.0	$\mu A$	
	Ta=T <sub>opr</sub>				-	-	6.5		
Reference Input Current Deviation Over Temperature Range		$I_{ref}$	Figure 2	$I_K=10mA, R1=10k, R2=$	-	0.8	2.5	$\mu A$	
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	$V_{KA}=36V, V_{ref}=0V$	-	2.6	1000	nA	
Dynamic Impedance		$Z_{ka}$	Figure 1 (Note 2)	$V_{KA}=V_{ref}, I_K=1.0 \sim 100mA,$ $f = 1.0kHz$	-	0.22	-		

\* : Selection Code (PS)

# KIA431 Series

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

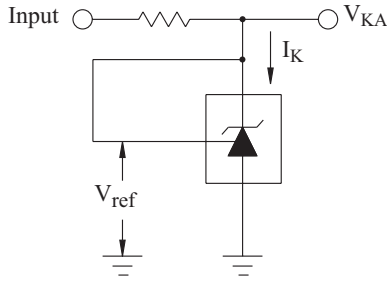
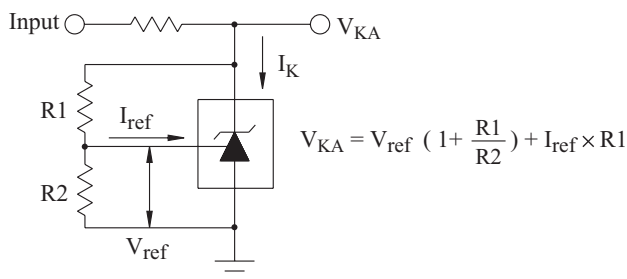
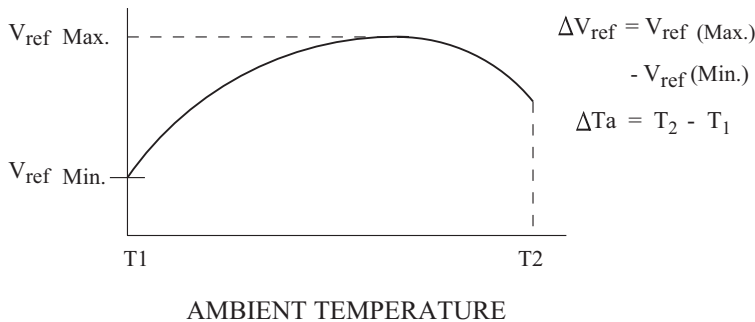


FIGURE 2-TEST CIRCUIT FOR  $V_{KA} > V_{ref}$



Note 1:

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



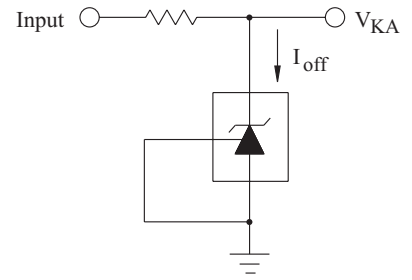
The average temperature coefficient of the Reference input voltage,  $V_{ref}$ , is defined as:

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

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

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

FIGURE 3-TEST CIRCUIT FOR  $I_{off}$



Example :  $V_{ref} = 8.0\text{mV}$  and slope is positive,  
 $V_{ref \text{ at } 25} = 2.495\text{V}$ ,  $T_a = 70$

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

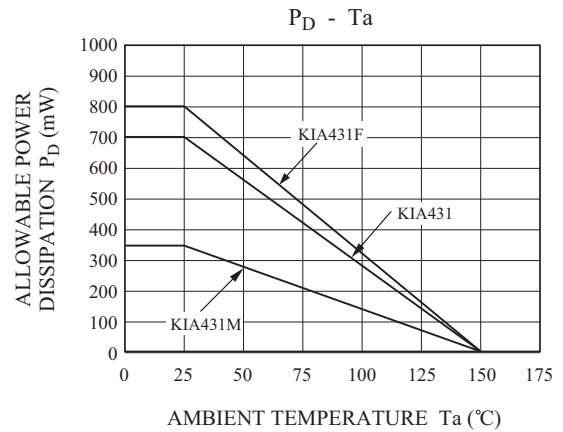
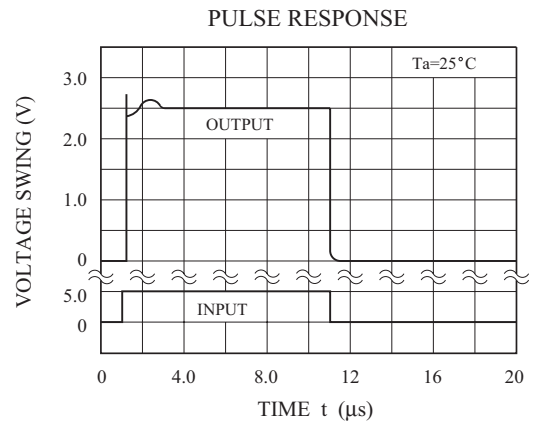
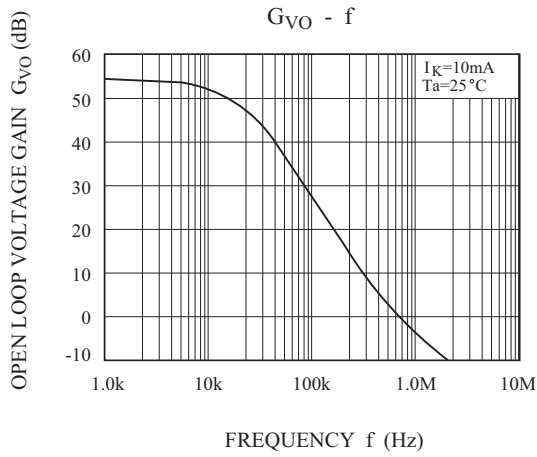
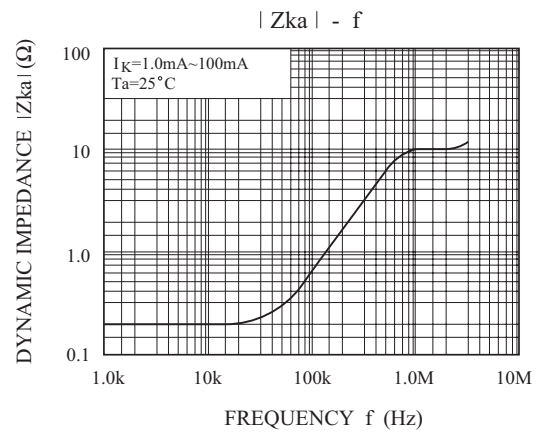
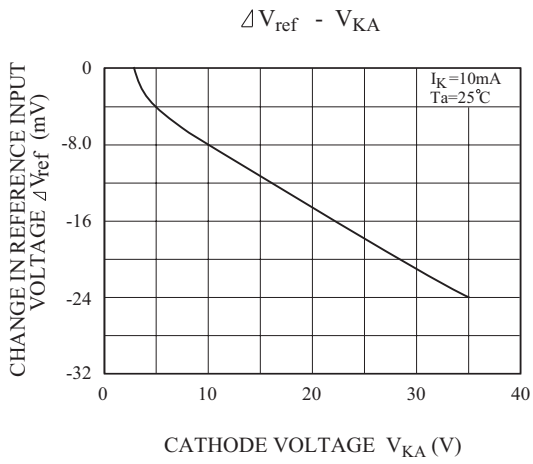
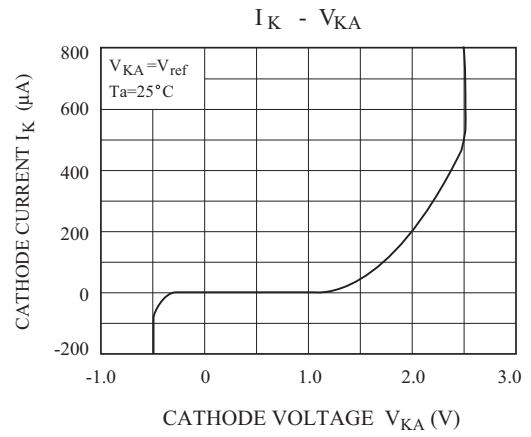
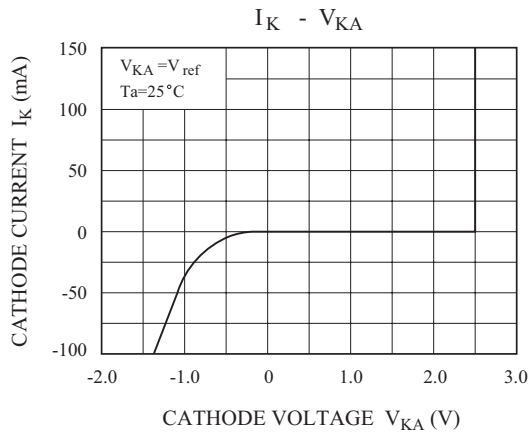
Note 2: The dynamic impedance  $Z_{ka}$  is defined as:

$$|Z_{ka}| = \frac{V_{KA}}{I_k}$$

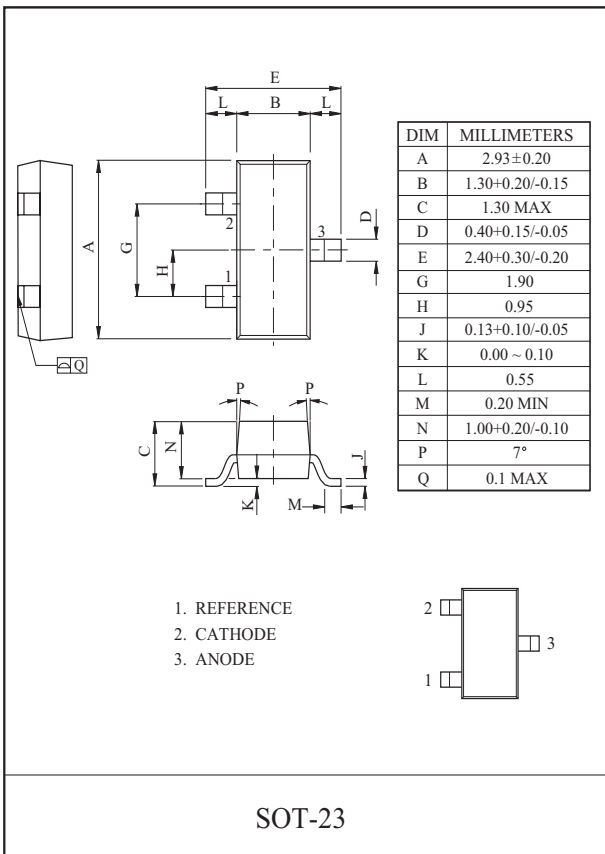
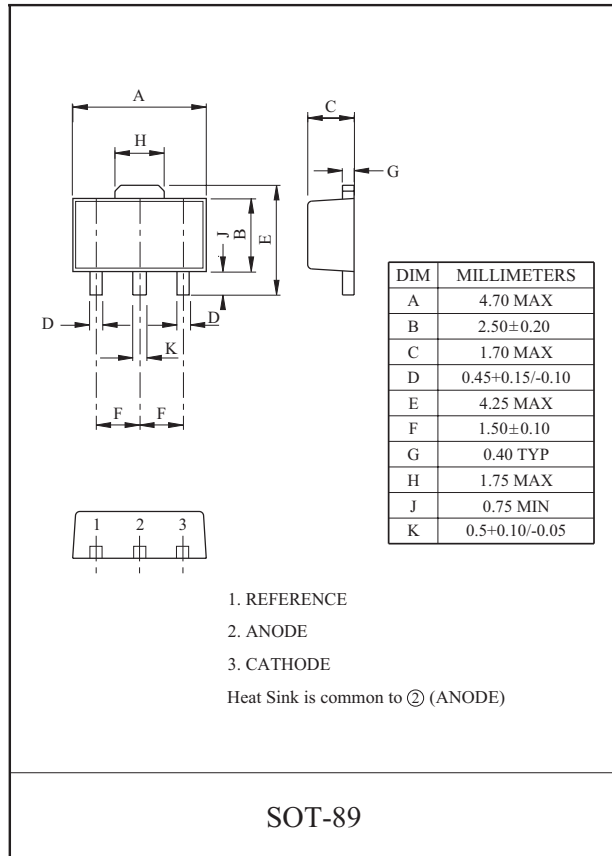
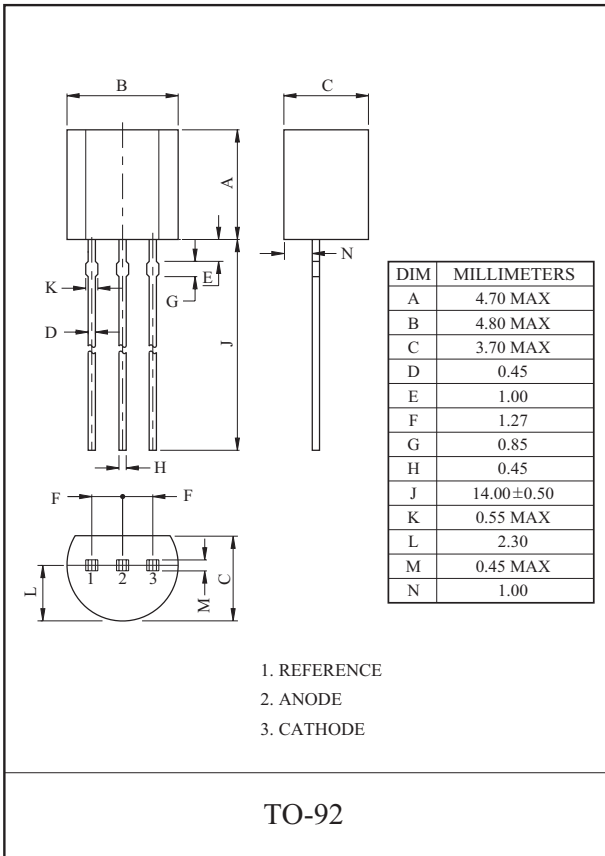
When the device is programmed with two external resistors, R1 and R2, (refer to Figure 2) the total dynamic impedance of the circuit is defined as:

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

# KIA431 Series



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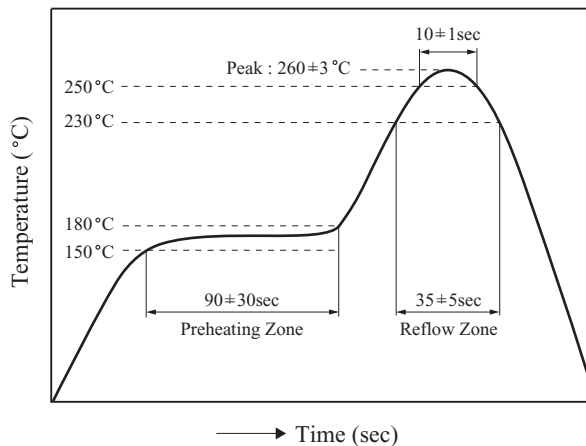


# KIA431 Series

## 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 is 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.