

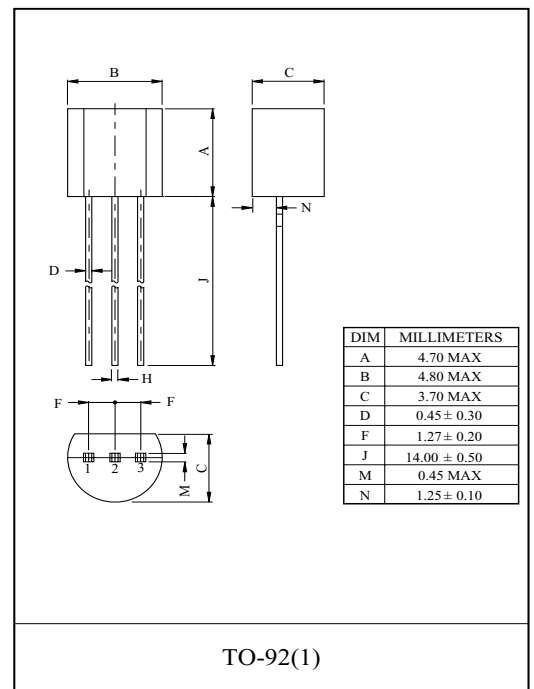
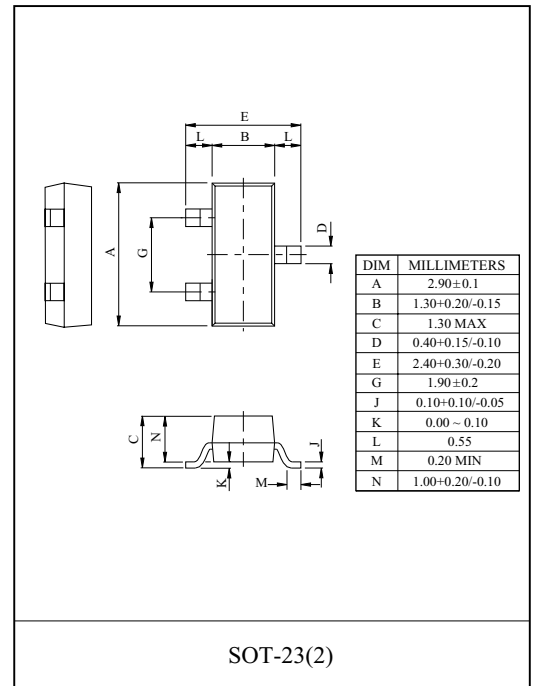
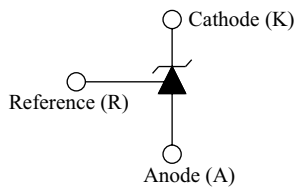
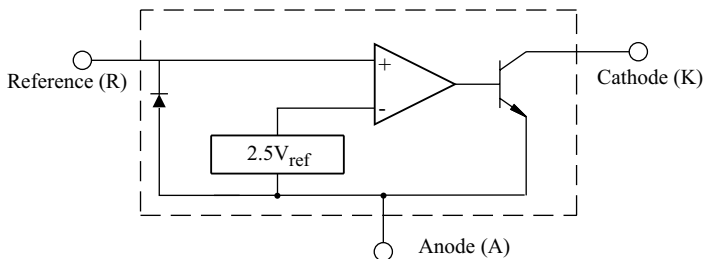
## PROGRAMMABLE PRECISION REFERENCES

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 minimum cathode current for regulation. The typical value of 50 $\mu$ A 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 0.22 . 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.

## FEATURES

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

## BLOCK DIAGRAM

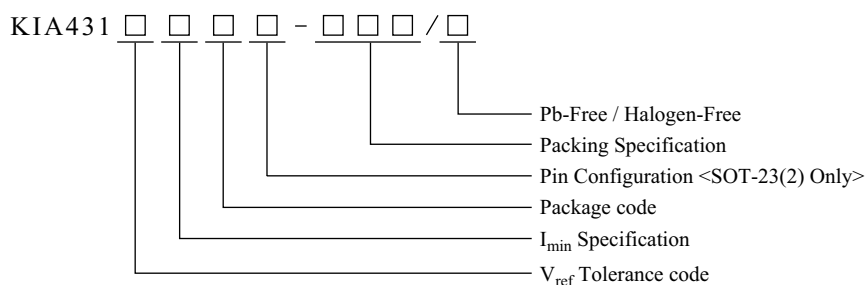


# KIA431AA/BA/CA Series

## LINE UP

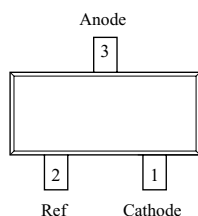
| Type No.   | Operating Voltage(V) | Package   | Marking |
|------------|----------------------|-----------|---------|
| KIA431AA   | 2.5 ~ 36             | TO-92(1)  | -       |
| KIA431BA   |                      |           |         |
| KIA431CA   |                      |           |         |
|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

## ORDERING INFORMATION

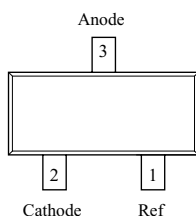


| V <sub>ref</sub> Tolerance code |        | I <sub>min</sub> Code |             | Package Code |           | Pin Configuration <SOT-23(2) only> |        | Packing Specification |          | Pb-Free / Halogen-Free |              |
|---------------------------------|--------|-----------------------|-------------|--------------|-----------|------------------------------------|--------|-----------------------|----------|------------------------|--------------|
| 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% |                       |             |              |           |                                    |        |                       |          |                        |              |

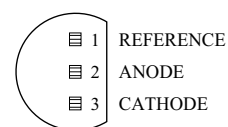
## PIN ASSIGNMENTS



SOT-23(2)  
(A-Type)



SOT-23(2)  
(B-Type)



TO-92(1)

# KIA431AA/BA/CA Series

## 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                         |                 | $V_{ref}$                | Figure 1 (Note 1) | $V_{KA}=V_{ref}, I_K=10mA,$<br>$T_a=0$ to 70   | -            | 5     | 17    | mV      |      |
| Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage |                 | $\frac{V_{ref}}{V_{KA}}$ | Figure 2          | $I_K=10mA$                                     | $V_{KA}=10V$ | -     | -1.4  | -2.7    | mV/V |
|  |                 |                          |                   |  | $V_{KA}=36V$ | -     | -1.0  | -2.0    |      |
| Reference Input Current  |                 | $I_{ref}$                | Figure 2          | $I_K=10mA, R1=10k, R2=$                        | -            | 0.3   | 4     | $\mu A$ |      |
| Reference Input Current Deviation Over Temperature Range                         |                 | $I_{ref}$                | Figure 2          | $I_K=10mA, R1=10k, R2=$                        | -            | 0.15  | 1.2   | $\mu A$ |      |
| Minimum Cathode Current For Regulation   |                 | $I_{min}$                | Figure 1          | $V_{KA}=V_{ref}$                               | -            | 50    | 100   | $\mu A$ |      |
| Off-State Cathode Current  |                 | $I_{off}$                | Figure 3          | $V_{KA}=36V, V_{ref}=0V$                       | -            | 0.05  | 0.9   | $\mu A$ |      |
| Dynamic Impedance  |                 | $Z_{ka}$                 | Figure 1 (Note 2) | $V_{KA}=V_{ref}, I_K=1.0$ 100mA,<br>$f$ 1.0kHz | -            | 0.22  | 0.5   |         |      |

# KIA431AA/BA/CA Series

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

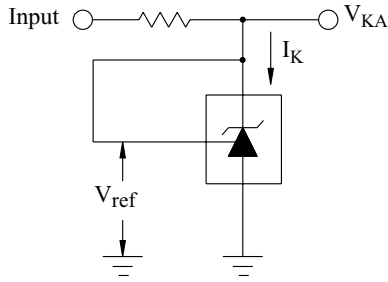
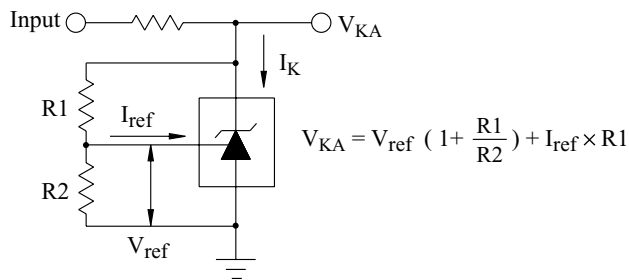
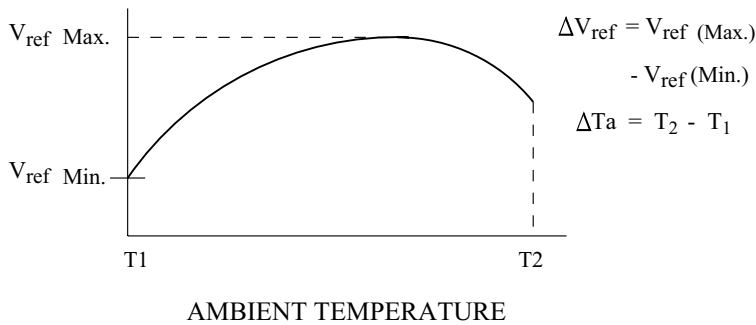


FIGURE 2-TEST CIRCUIT FOR  $V_{KA} > V_{ref}$



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.



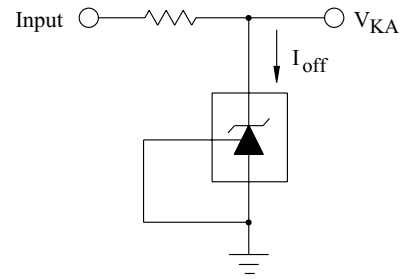
The average temperature coefficient of the Reference input voltage,  $V_{ref}$ , is defined as:

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

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

$V_{ref}$  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,  
 $V_{ref \text{ at } 25} = 2.495\text{V}$ ,  $T_a = 70$

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

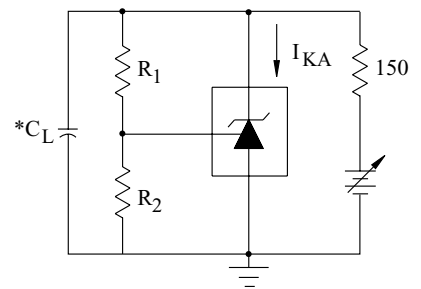
Note 2: The dynamic impedance  $Z_{ka}$  is defined as:

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

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:

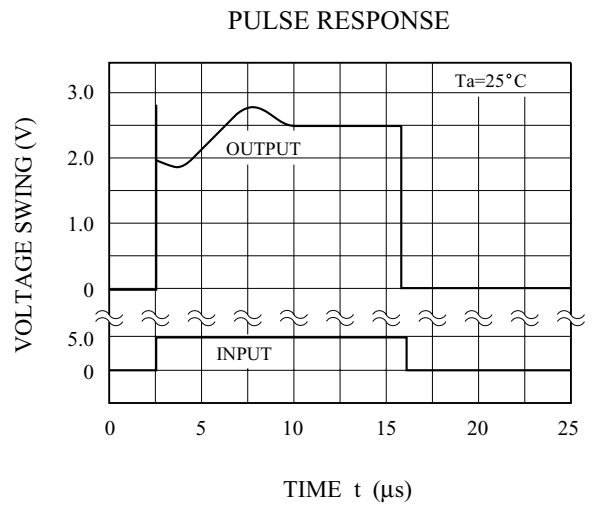
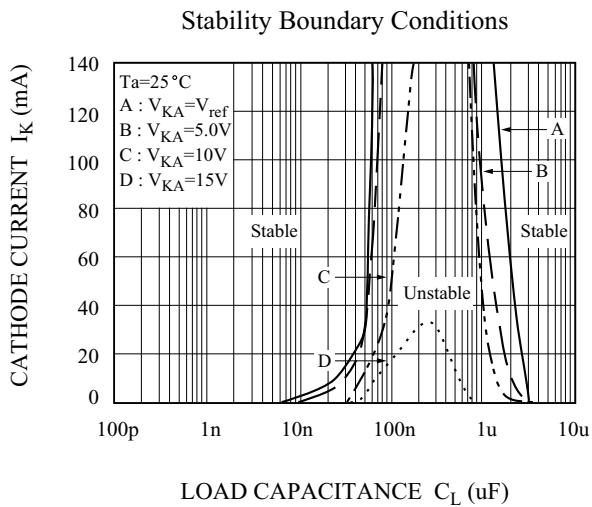
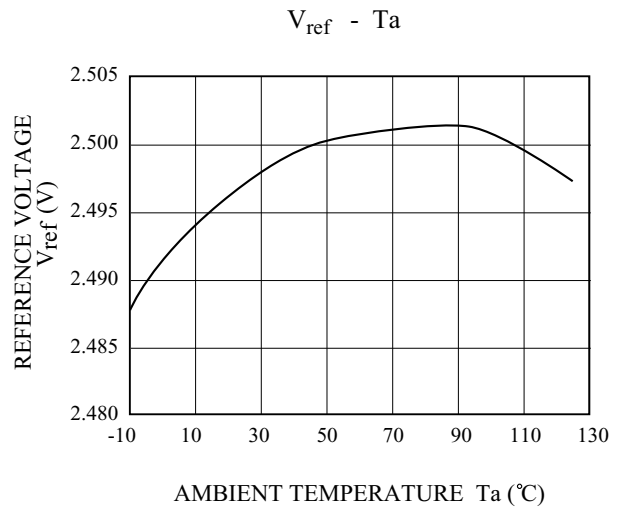
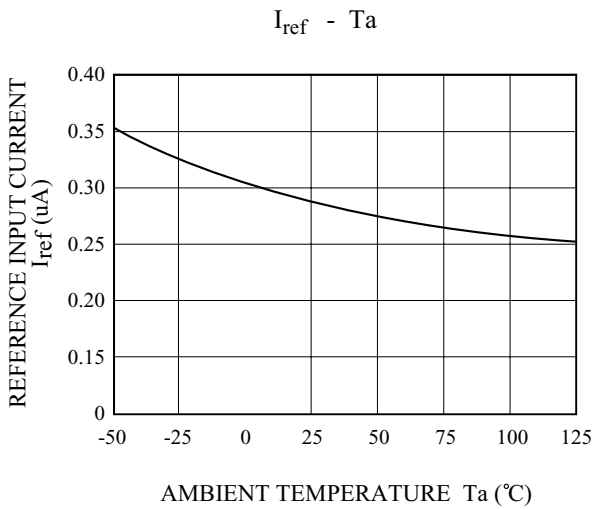
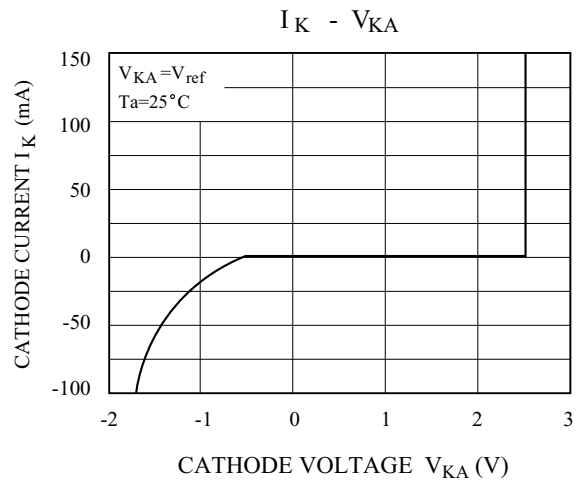
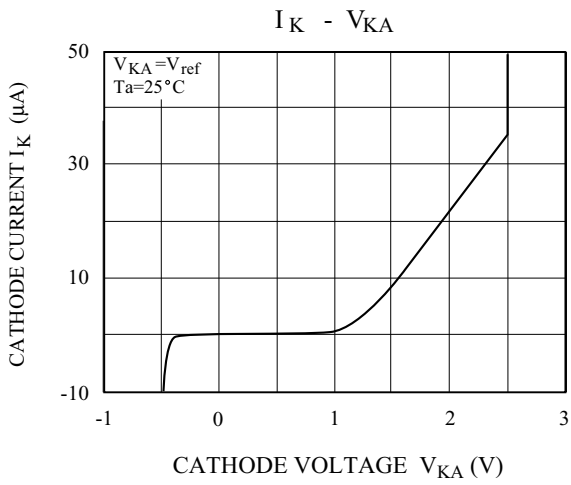
$$|Z_{ka'}| = |Z_{ka}| \left( 1 + \frac{R1}{R2} \right)$$

FIGURE 4-TEST CIRCUIT FOR stability boundary conditions



\* Note 1: Recommend using more than  $C_L = 10\mu\text{F}$  under  $I_{KA} = 1\text{mA}$

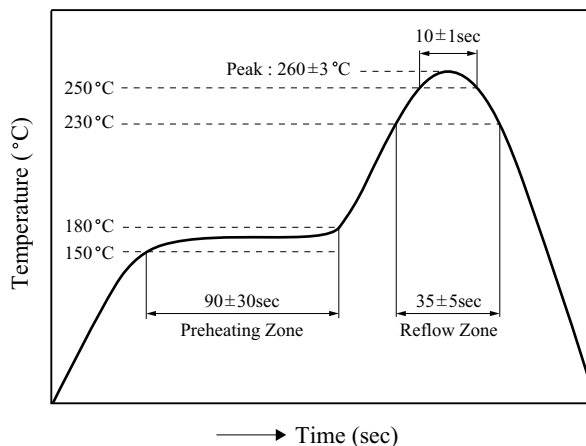
# KIA431AA/BA/CA Series



## 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.