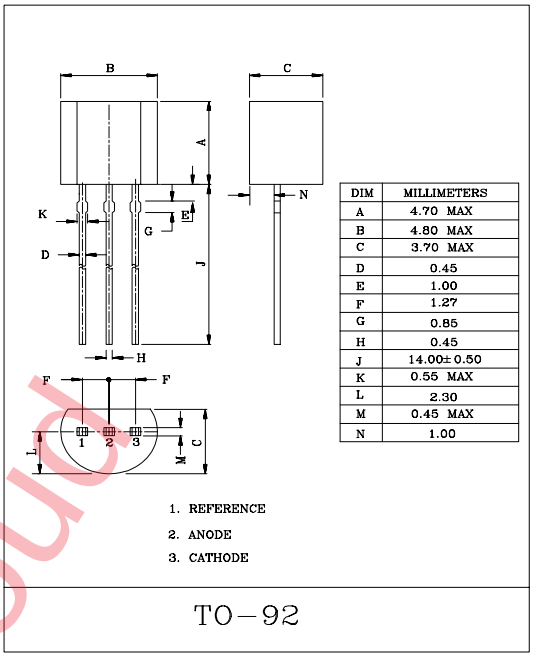
PROGRAMMABLE PRECISION REFERENCES

The KIA431/F/A/AF/B/BF 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 0.22Ω. 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 KIA431/F/A/AF/B/BF operates as a shunt regulator, it can be used as either a positive or negative voltage reference.



DIM	MILLIMETERS
A	4.70 MAX
B	4.80 MAX
C	3.70 MAX
D	0.45
E	1.00
F	1.27
G	0.85
H	0.45
J	14.00±0.50
K	0.55 MAX
L	2.30
M	0.45 MAX
N	1.00

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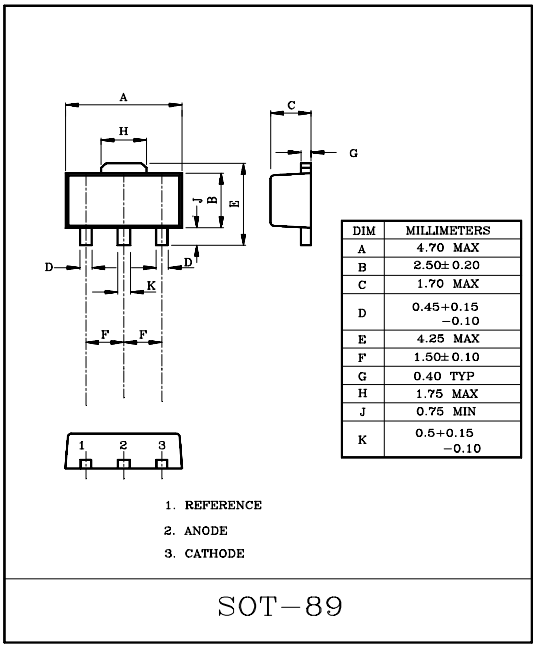


DIM	MILLIMETERS
A	4.70 MAX
B	2.50±0.20
C	1.70 MAX
D	0.45+0.15 −0.10
E	4.25 MAX
F	1.50±0.10
G	0.40 TYP
H	1.75 MAX
J	0.75 MIN
K	0.5+0.15 −0.10

SOT-89

FEATURES

- Programmable Output Voltage to 36 Volts.

ITEM	Vref Tolerance (%)
KIA431/F	2.2
KIA431A/AF	1.0
* KIA431B/BF	0.5

Note) * : Under development

- Low Dynamic Output Impedance : 0.22Ω(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

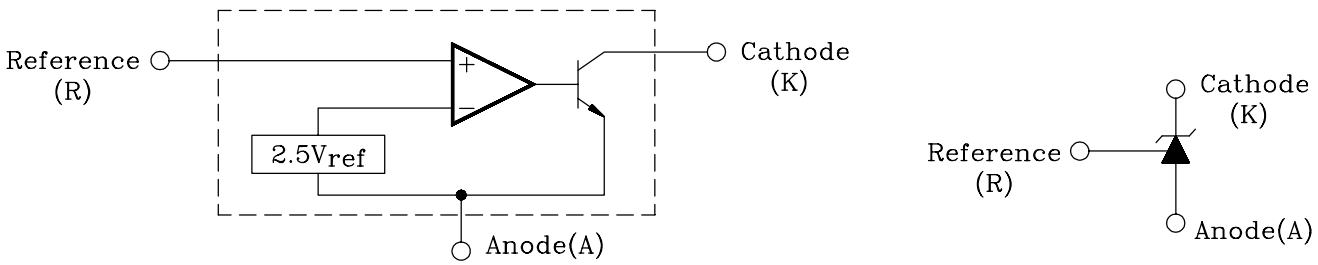
Type No.	Marking
KIA431F	3A
KIA431AF	3B
KIA431BF	3C

MAXIMUM RATINGS

(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, Continuos		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/A/B	P_D	700	mW
	KIA431F/AF/BF		800	

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	KIA431/F	V_{ref}	Figure 1	$V_{KA}=V_{ref}$, I_K=10mA		2.440	2.495	2.550	V
	KIA431A/AF					2.470	2.495	2.520	V
	KIA431B/BF					2.4825	2.495	2.5075	V
Reference Input Voltage Deviation Over Temperature Range		$\triangle V_{ref}$	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		$\triangle V_{ref}/\triangle V_{KA}$	Figure 2	I_K=10mA	$\triangle V_{KA}$= 10V～V_{ref}	-	-1.4	-2.7	mV/V
					$\triangle V_{KA}$= 36V～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		$\triangle I_{ref}$	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}=36V, 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 $V_{KA} = V_{ref}$

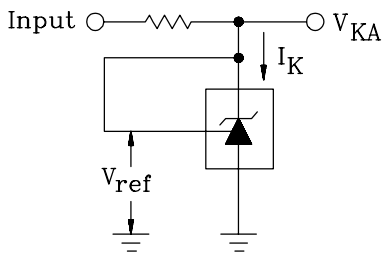
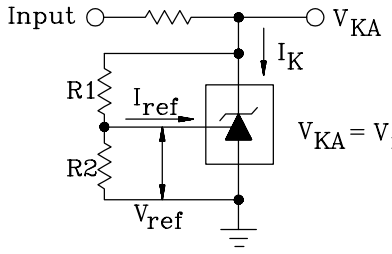
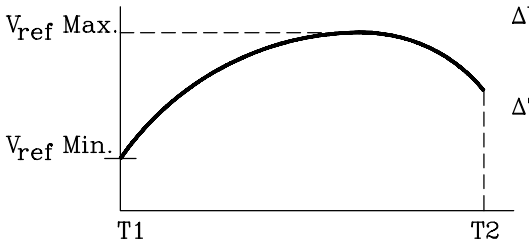


FIGURE 2-TEST CIRCUIT FOR $V_{KA} > V_{ref}$



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

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

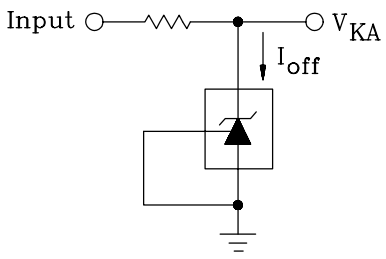
The average temperature coefficient of the Reference input voltage, αV_{ref}, is defined as:

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

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

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, ΔTa=70℃

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

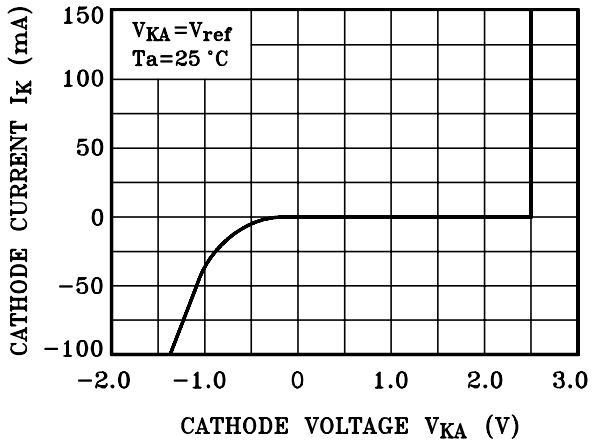
Note 2:
The dynamic impedance Z_{ka} is defined as:

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

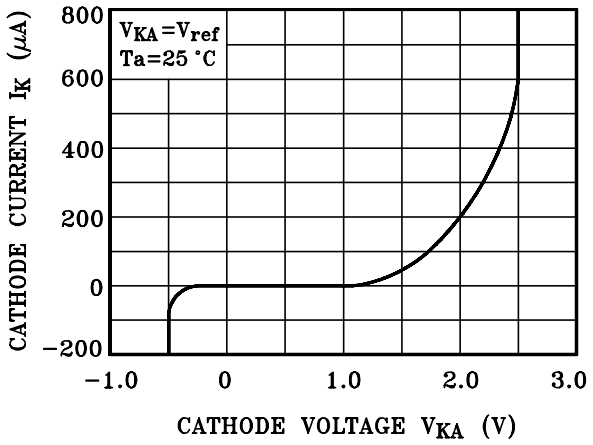
When the device is programmed with two external resistors, R1 and R2, (refer to Figure 2) the total dynamic impedance of the circuit is defined as:

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

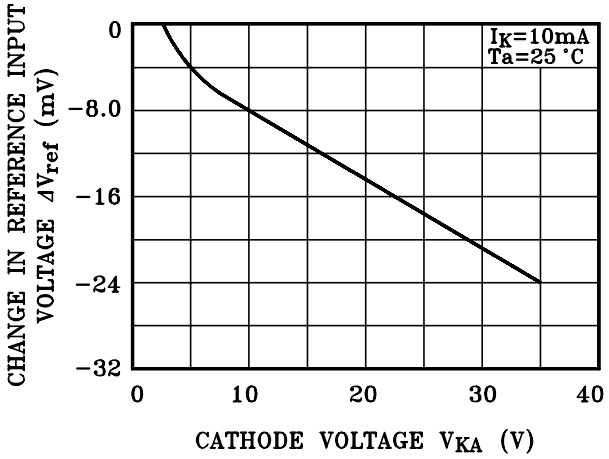
I_K – V_{KA}



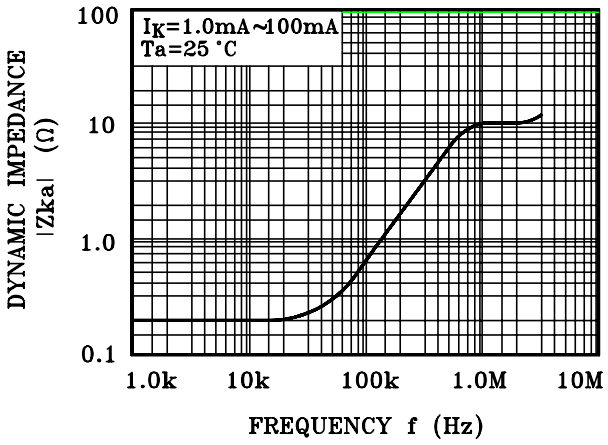
I_K – V_{KA}



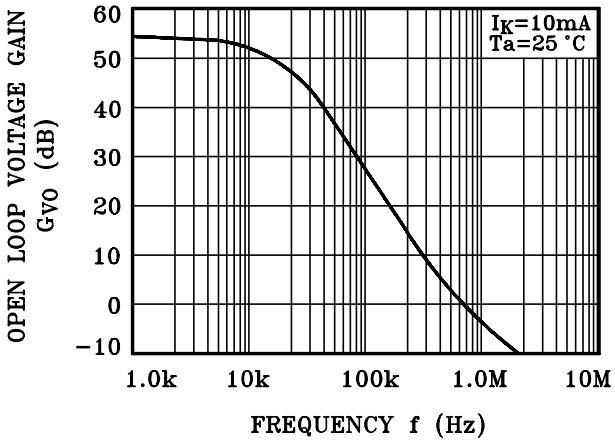
ΔV_{ref} – V_{KA}



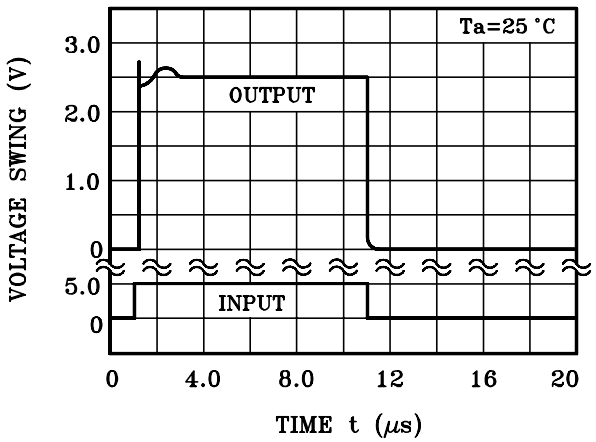
|Zka| – f

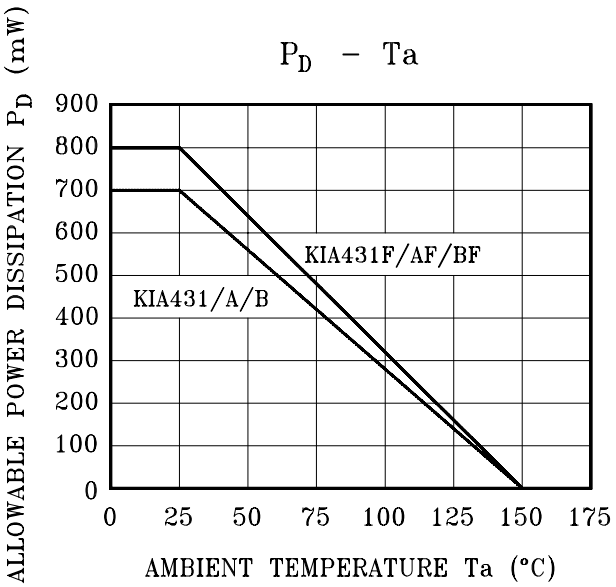


G_{VO} – f



PULSE RESPONSE




P_D - Ta
ALLOWABLE POWER DISSIPATION P_D (mW)
900
800
700
600
500
400
300
200
100
0
0
25
50
75
100
125
150
175
KIA431F/AF/BF
KIA431/A/B
AMBIENT TEMPERATURE Ta (°C)

PRECAUTION FOR USE

SOLDERING

Flat Package (SOT-89 Package)

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.

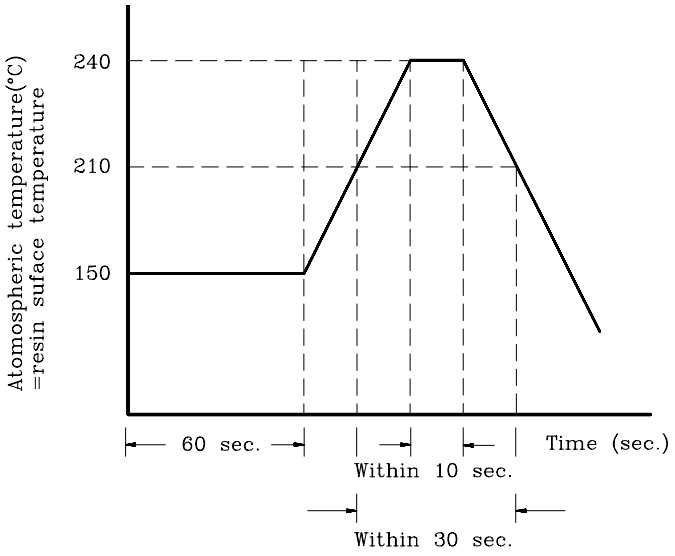


Fig 6

(a) When employing solder reflow method
① Atmospheric temperature around resin surfaces must be less than 240℃, not exceeding the time length of 10 sec.
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.

(b) 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 SOT-89 package's soldering.