PROGRAMMABLE PRECISION REFERENCES

The FA431Z/ZS/ZF 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 40 volts with two external resistors.
These devices exhibit a wide operating current range of 1.0 to 100mA with a typical dynamic impedance of 0.2Ω .
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
FA431 Series operates as a shunt regulator, it can be used as either a positive or negative voltage reference.
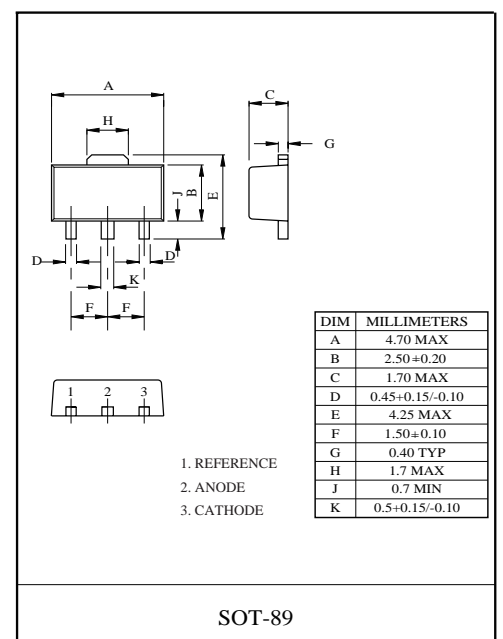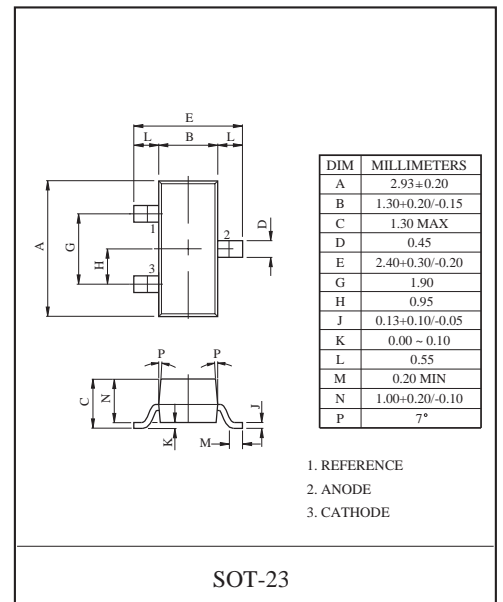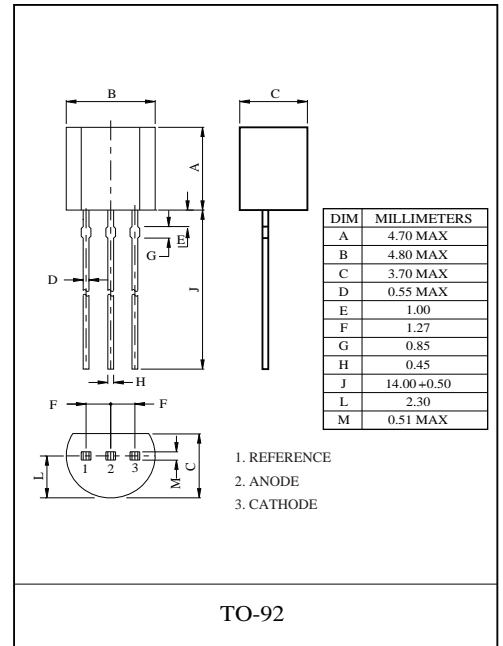
FEATURES

· Divice Code Name :FA431 + V_{ref} Code + Package Code

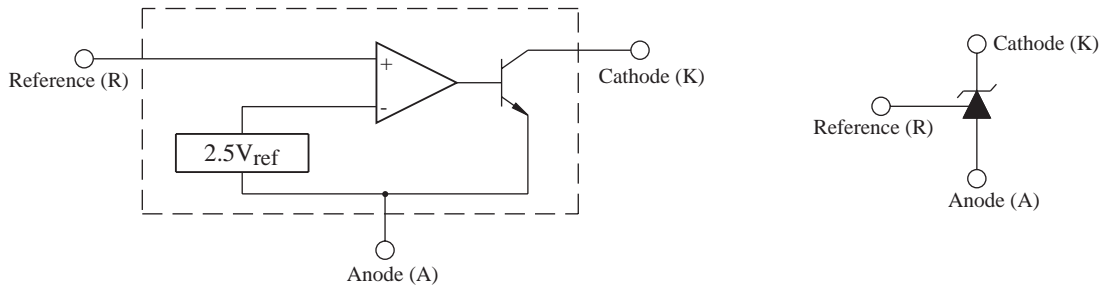| ITEM	V_{ref} Code		Package Code	
	Code	Tolerance (%)	Code	Package
		±2.0		TO-92
FA431	A	±1.0	F	SOT-89
	C	±0.5	S	SOT-23

· Low Dynamic Output Impedance : 0.2Ω (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.

· We declare that the material of product compliance with RoHS requirements.

LINE UP

Type No.	Mark	Operating Voltage(V)	Package
FA431Z			
FA431ZA			TO-92
FA431ZC		2.5~36	
FA431ZF			
FA431ZAF			SOT-89
FA431ZCF			
FA431ZS			
FA431ZAS		2.5~36	SOT-23
FA431ZCS	RA3		
FA431ACS	RA2		

DIM	MILLIMETERS
A	4.70 MAX
B	4.80 MAX
C	3.70 MAX
D	0.55 MAX
E	1.00
F	1.27
G	0.85
H	0.45
J	14.00+0.50
L	2.30
M	0.51 MAX

1. REFERENCE
2. ANODE
3. CATHODE

TO-92

DIM	MILLIMETERS
A	2.93±0.20
B	1.30+0.20/-0.15
C	1.30 MAX
D	0.45
E	2.40+0.30/-0.20
G	1.90
H	0.95
J	0.13+0.10/-0.05
K	0.00 ~ 0.10
L	0.55
M	0.20 MIN
N	1.00+0.20/-0.10
P	7°

1. REFERENCE
2. ANODE
3. CATHODE

SOT-23

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	1.7 MAX
J	0.7 MIN
K	0.5+0.15/-0.10

1. REFERENCE
2. ANODE
3. CATHODE

SOT-89

BLOCK DIAGRAM

MAXIMUM RATINGS (Ta=25℃)
(Full operating ambient temperature range applies unless otherwise noted.)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Cathode To Anode Voltage		V_{KA}	44	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	FA431Z	P_D	700	mW
	FA431ZF (Note)		800	
	FA431ZS		200	

Note) Package mounted on a ceramic board. (600㎟ ✕ 0.8㎜)

ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	FA431Z (2%)	V_{ref}	Figure 1	$V_{KA}=V_{ref}$, I_K=10mA		2.440	2.495	2.550	V
	FA431ZA (1%)					2.470	2.495	2.520	V
	FA431ZC (0.5%)					2.4825	2.495	2.5075	V
	FA431ACS (0.5%)					2.487	2.500	2.512	V
Reference Input Voltage Deviation Over Temperature Range		ΔV_{ref}	Figure 1 (Note 1)	$V_{KA}=V_{ref}$, I_K=10mA		-	3	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	$\Delta V_{KA}=$ 10V ~ V_{ref}	-	-1.4	-2.7	mV/V
					$\Delta V_{KA}=$ 36V ~ 10V	-	-1.0	-2.0	
Reference Input Current		I_{ref}	Figure 2	I_K=10mA, R1=10kΩ , R2=∞		-	0.5	2.0	μA
Reference Input Current Deviation Over Temperature Range		ΔI_{ref}	Figure 2	I_K=10mA, R1=10kΩ , R2=∞		-	0.4	1.2	μA
Minimum Cathode Current For Regulation		I_{min}	Figure 1	$V_{KA}=V_{ref}$		-	0.25	0.5	mA
Off-State Cathode Current		I_{off}	Figure 3	V_{KA}=40V, V_{ref}=0V		-	170	900	nA
Dynamic Impedance		Z_{ka}	Figure 1 (Note 2)	$V_{KA}=V_{ref}$, I_K=1.0 ~ 100mA, f ≤1.0kHz		-	0.27	0.5	Ω

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

Input ○—〜〜—•—○ V_{KA}

I_K
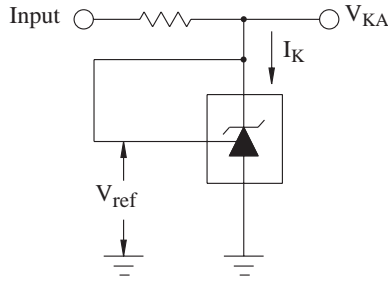
V_{ref}

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

Input ○—〜〜—•—○ V_{KA}

I_K

R1

I_{ref}

R2

V_{ref}

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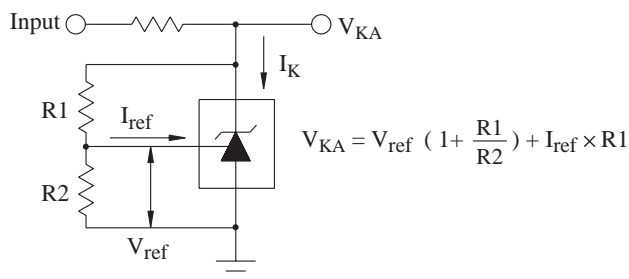
Note 1:

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

V_{ref} Max.

V_{ref} Min.

T1   T2

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

$$\varDelta Ta = T_2 - T_1$$

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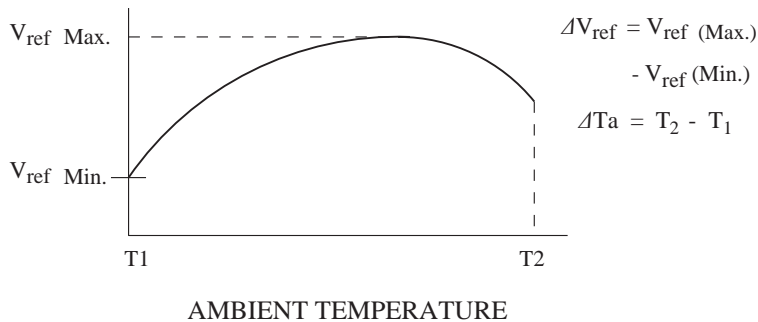
The average temperature coefficient of the Reference input voltage, $\varDelta V_{ref}$, is defined as:

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

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

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}

Input ○—〜〜—•—○ V_{KA}

I_{off}
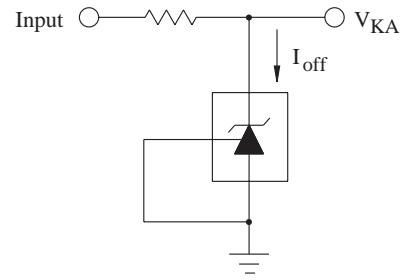
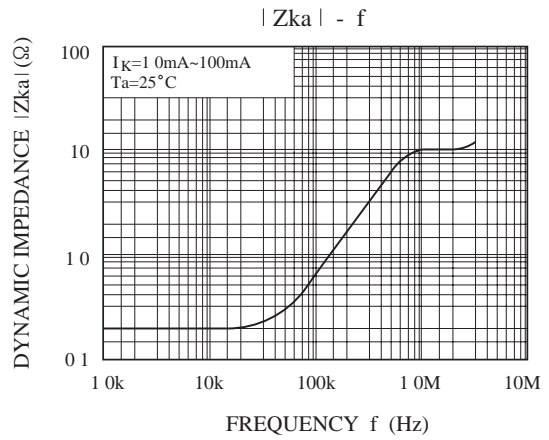Example : $\varDelta V_{ref} = 8.0mV$ and slope is positive, V_{ref} at 25℃=2.495V, $\varDelta Ta=70℃$
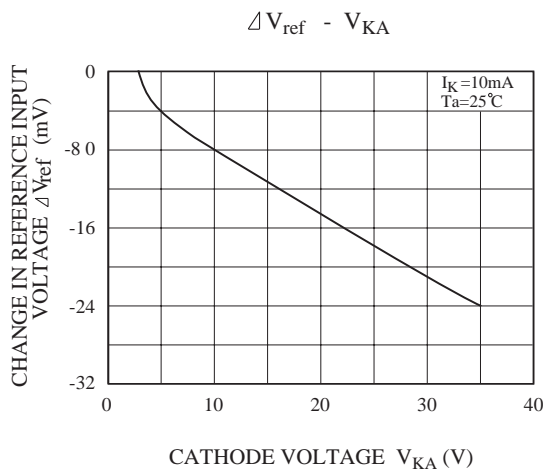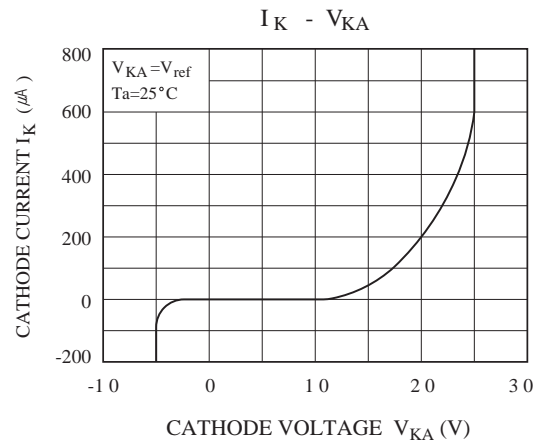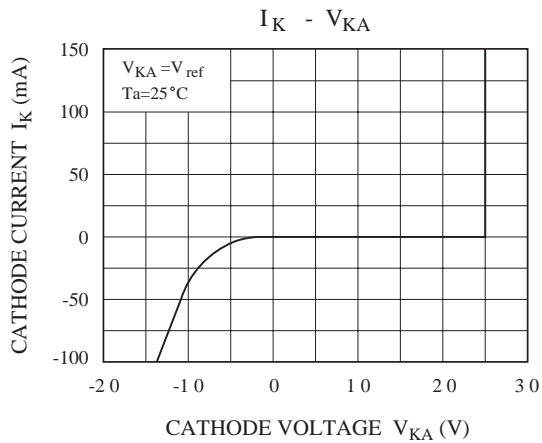
$$\alpha V_{ref} = \frac{0.008 \times 10^6}{70 \times (2.495)} = 45.8\ ppm/℃$$

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

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

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}

CATHODE CURRENT I_K (mA)

V_{KA} =V_{ref}
Ta=25°C

CATHODE VOLTAGE V_{KA} (V)

I_K - V_{KA}

CATHODE CURRENT I_K (μA)

V_{KA} =V_{ref}
Ta=25°C

CATHODE VOLTAGE V_{KA} (V)

$\triangle V_{ref}$ - V_{KA}

CHANGE IN REFERENCE INPUT VOLTAGE $\triangle V_{ref}$ (mV)

I_K =10mA
Ta=25°C

CATHODE VOLTAGE V_{KA} (V)

｜Zka｜ - f

DYNAMIC IMPEDANCE ｜Zka｜ (Ω)

I_K=1 0mA~100mA
Ta=25°C

FREQUENCY f (Hz)

G_{VO} - f

OPEN LOOP VOLTAGE GAIN G_{VO} (dB)

I_K =10mA
Ta=25°C

FREQUENCY f (Hz)

PULSE RESPONSE

VOLTAGE SWING (V)

Ta=25°C

OUTPUT

INPUT

TIME t (μs)

P_D - Ta

ALLOWABLE POWER DISSIPATION P_D (mW)

FA431ZF

FA431ZS

FA431Z

AMBIENT TEMPERATURE Ta (°C)

PRECAUTION FOR USE

SOLDERING

Flat Package (SMD 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.
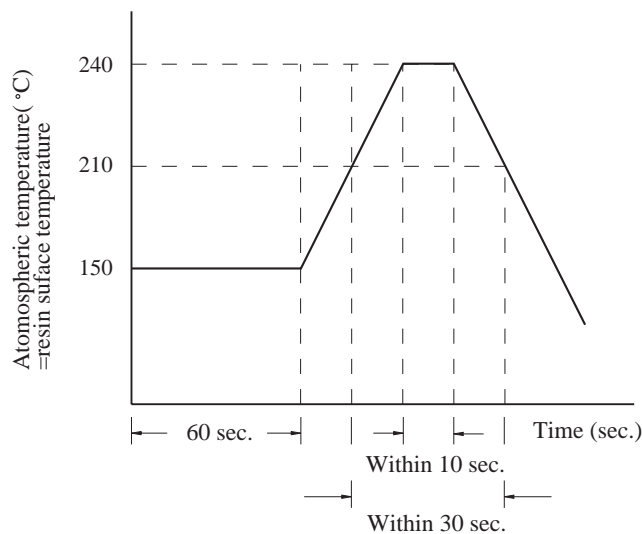

Fig. 6

(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 SMD package's soldering.