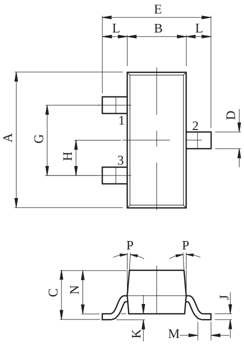
PROGRAMMABLE PRECISION REFERENCES

The FA431HCS 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 37 volts with two external resistors.
These devices exhibit a wide operating current range of 0.1 to 100mA with a typical dynamic impedance of 0.1Ω .
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 2.495 volt reference makes it convenient to obtain a stable reference from 5.0 volt logic supplies, and since the FA431HCS operates as a shunt regulator, it can be used as either a positive or negative voltage reference.



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

FEATURES

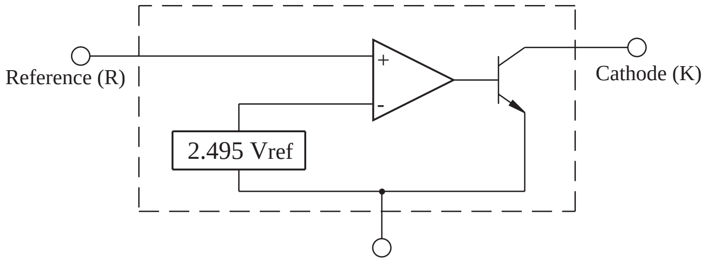
· Divice Code Name :FA431 + V_{ref} Code + Package Code

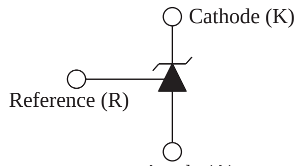
ITEM	V_{ref} Code		Package Code	
FA431HCS	Code	Tolerance (%)	Code	Package
	C	±0.5	S	SOT-23

- Low Dynamic output impedance 0.1Ω (Typ)
- Adjustable output voltage
- Fast turn-on response
- Sink current capability of 0.1mA to 100mA
- Low output noise
- Industrial temperature range
- Improved temperature compensation
- Excellent temperature coefficient 25ppm/°C
- Electrostatic discharge voltage 2.5kV

MARK: F31

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}	36	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 ~125	℃
Storage Temperature		T_{stg}	-65 ~ 150	℃
Total Power Dissipation	FA431HCS	P_D	200	mW

ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	FA431HCS (0.5%)	V_{ref}	Figure 1	$V_{KA}=V_{ref}$, I_K=10mA		2.4825	2.495	2.5075	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	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=∞		-	0.5	1.2	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	$V_{KA}=V_{ref}$		-	0.08	0.3	mA
Off-State Cathode Current		I_{off}	Figure 3	V_{KA}=40V, V_{ref}=0V		-	100	800	nA
Dynamic Impedance		Z_{ka}	Figure 1 (Note 2)	$V_{KA}=V_{ref}$, I_K=1.0 ~ 100mA, f ≤1.0kHz		-	0.1	0.37	Ω

FIGURE 1-TEST CIRCUIT FOR VKA=Vref

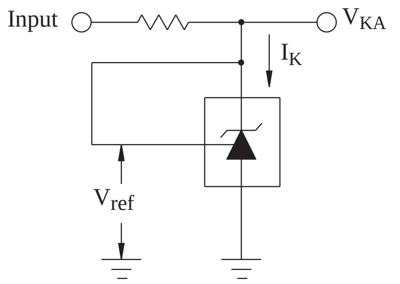
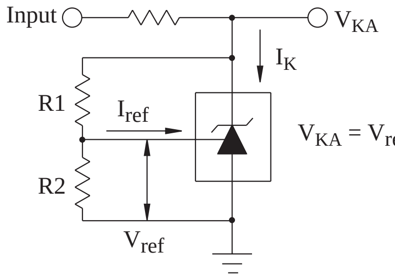
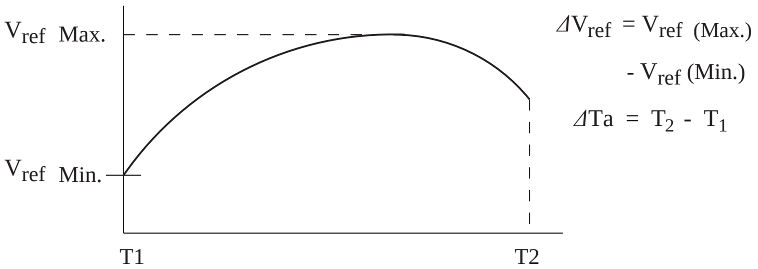


FIGURE 2-TEST CIRCUIT FOR $V_{KA} > V_{ref}$



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

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.



AMBIENT TEMPERATURE

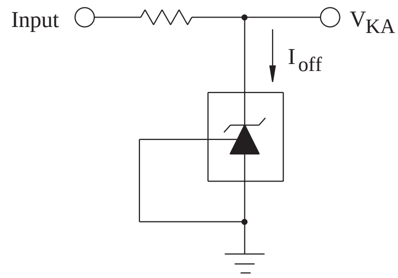
The average temperature coefficient of the Reference input voltage, ΔV_{ref} , is defined as:

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

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

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 Ioff



Example : ΔV_{ref} = 8.0mV and slope is positive,
V_{ref} at 25℃=2.500V, ΔTa=70℃

$$\alpha V_{ref} = \frac{0.008 \times 10^6}{70 \times (2.500)} = 45.8\ \text{ppm/℃}$$

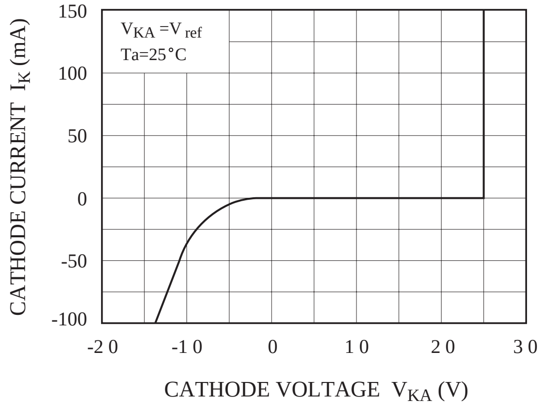
Note 2: The dynamic impedance Z_{ka} is defined as:

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

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:

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

I_K - V_{KA}



CATHODE CURRENT vs CATHODE VOLTAGE

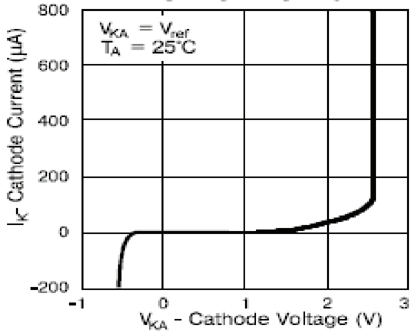
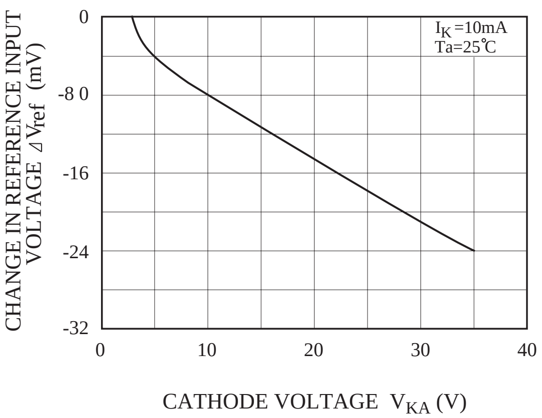
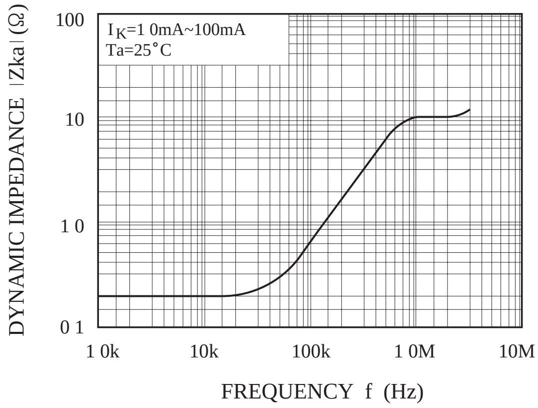


FIGURE 2

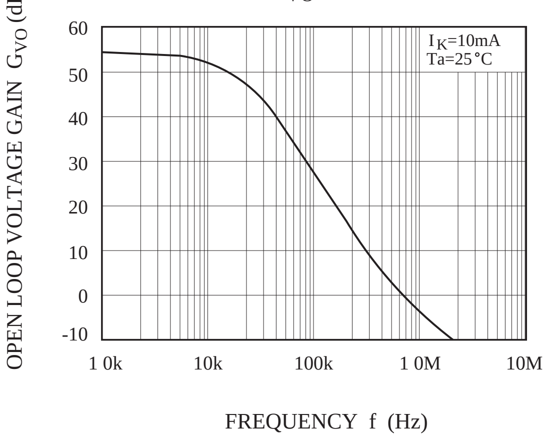
ΔVref - VKA



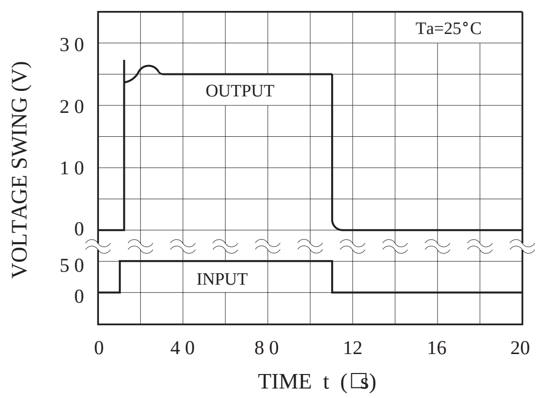
| Zka | - f



G_{VO} - f



PULSE RESPONSE



P_D - Ta