

PROGRAMMABLE PRECISION REFERENCES

The FA432/S/F 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 16 volts with two external resistors. These devices exhibit a wide operating current range of 0.1 to 20mA 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.

FEATURES

· Device Code Name :FA432 + V_{ref} Code + Package Code

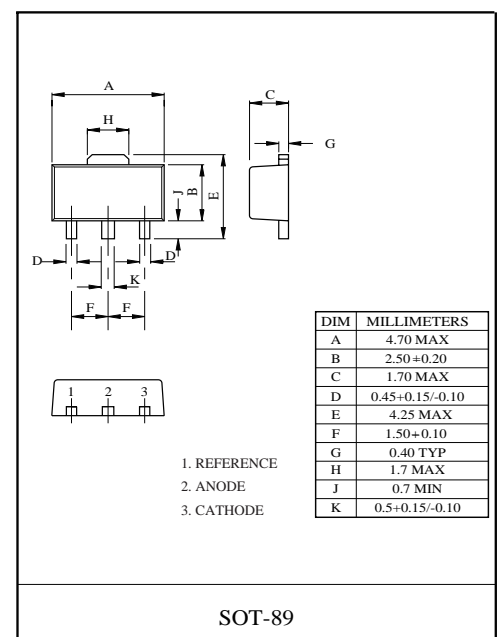
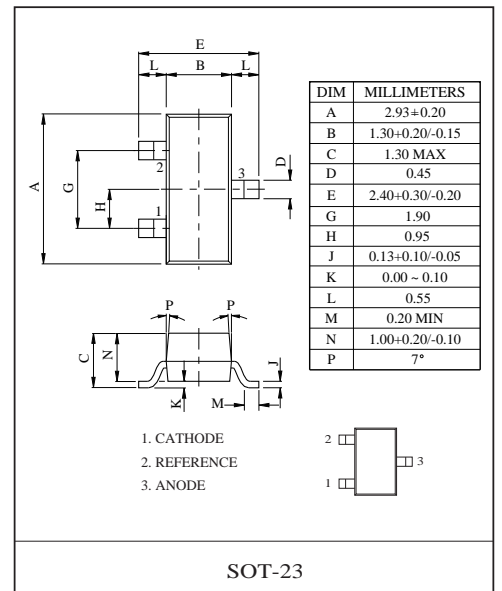
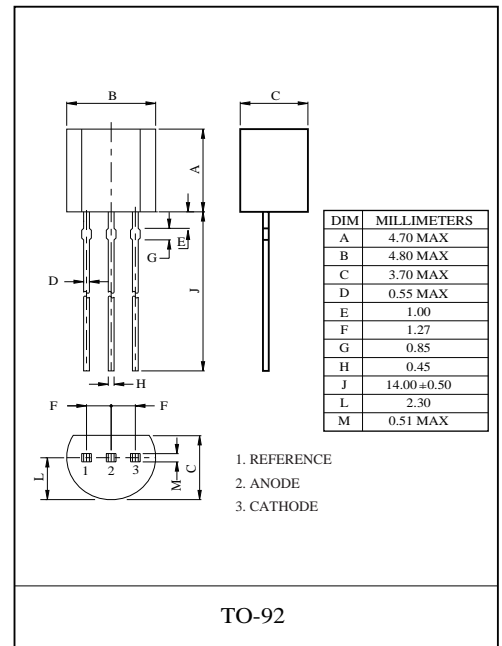
ITEM	V_{ref} Code		Package Code	
	Code	Tolerance (%)	Code	Package
FA432		± 2.0		TO-92
	A	± 1.0	F	SOT-89
	C	± 0.5	S	SOT-23

- Programmable Output Voltage
- Fast turn on response.
- Equivalent Full-Range Temperature Coefficient of 50ppm/°C (Typ.).
- Temperature Compensated for Operation Over Full Temperature Range.
- Low Output Noise Voltage.
- We declare that the material of product compliance with RoHS requirements.

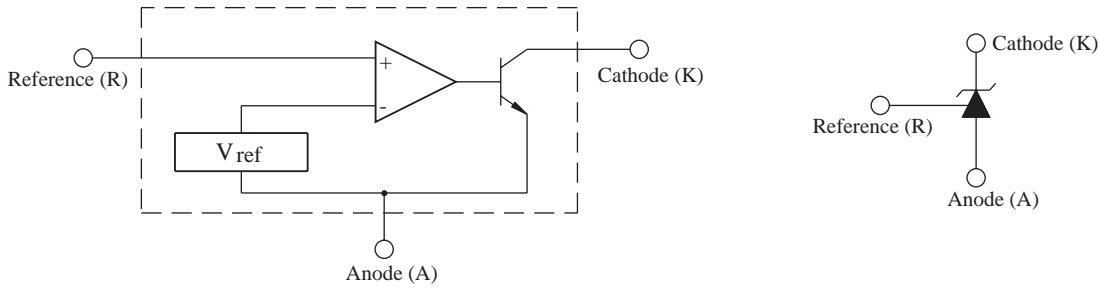
LINE UP

Type No.	Operating Voltage(V)	Package
FA432	1.24~16	TO-92
FA432A		
FA432C		
FA432F		SOT-89
FA432AF		
FA432CF		
FA432S		
FA432AS		SOT-23
FA432CS		

Marking : F32



BLOCK DIAGRAM



MAXIMUM RATINGS (Ta=25°C)

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

CHARACTERISTIC		SYMBOL	RATING	UNIT
Cathode To Anode Voltage		V_{KA}	18	V
Cathode Current Range, Continuous		I_K	-20 ~ 20	mA
Reference Input Current Range, Continuous		I_{ref}	10	mA
Operating Junction Temperature		T_j	150	°C
Operating Temperature		T_{opr}	-40 ~ 120	°C
Storage Temperature		T_{stg}	-65 ~ 150	°C
Total Power Dissipation	FA432	P_D	700	mW
	FA432F (Note)		800	
	FA432S		200	

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

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	FA432 (2%)	V_{ref}	Figure 1	$V_{KA}=V_{ref}, I_K=10mA$	1.215	1.24	1.265	V
	FA432A (1%)				1.228	1.24	1.252	V
	FA432C (0.5%)				1.234	1.24	1.246	V
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage		$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	Figure 2	$I_K=10mA$ $\Delta V_{KA}=16V \sim V_{ref}$		-1.0	-2.7	mV/V
Reference Input Current		I_{ref}	Figure 2	$I_K=10mA, R1=10k\Omega, R2=\infty$	-	0.15	0.5	μA
Minimum Cathode Current For Regulation		I_{min}	Figure 1	$V_{KA}=V_{ref}$	-	20	80	μA
Off-State Cathode Current		I_{off}	Figure 3	$V_{KA}=6V, V_{ref}=0V$ $V_{KA}=16V, V_{ref}=0V$	-	10 40	50 150	nA
Dynamic Impedance		Z_{ka}	Figure 1 (Note 2)	$V_{KA}=V_{ref}, I_K=0.1 \sim 20mA,$ $f \leq 1.0kHz$	-	0.2	0.4	Ω

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

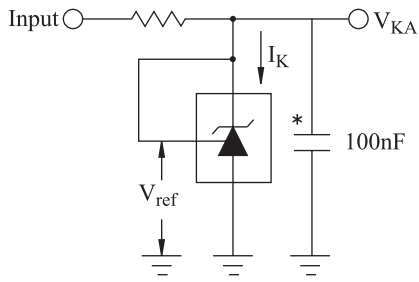


FIGURE 2-TEST CIRCUIT FOR $V_{KA} > V_{ref}$

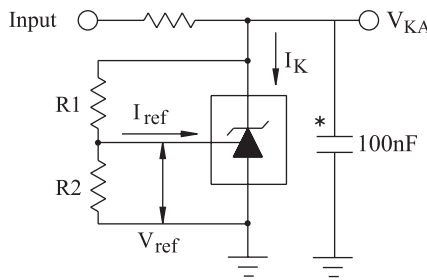
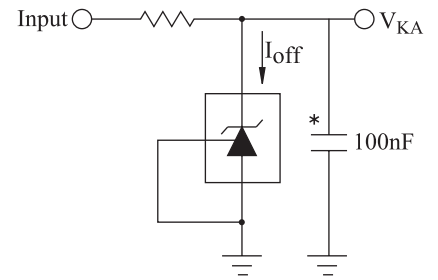


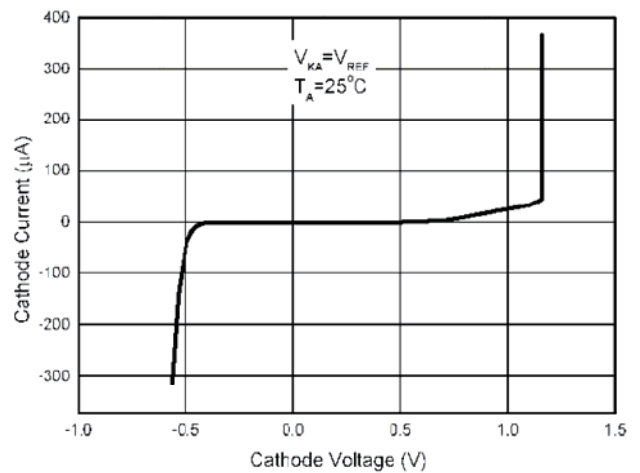
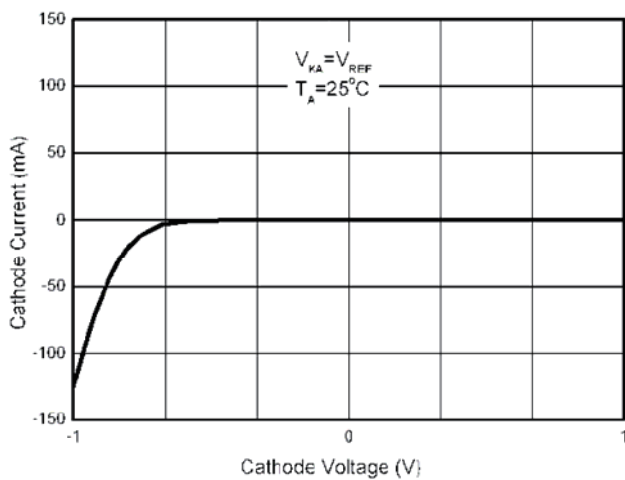
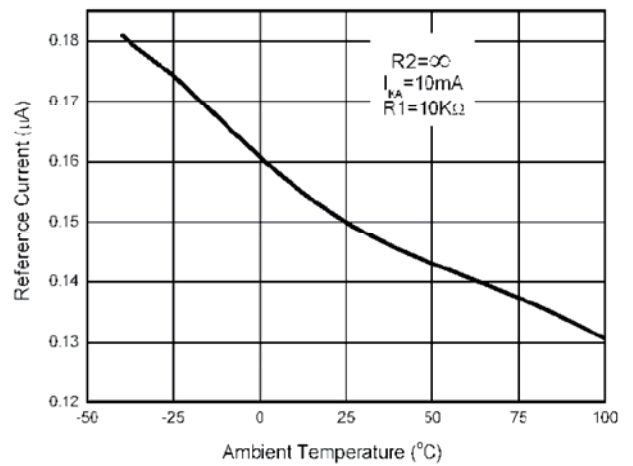
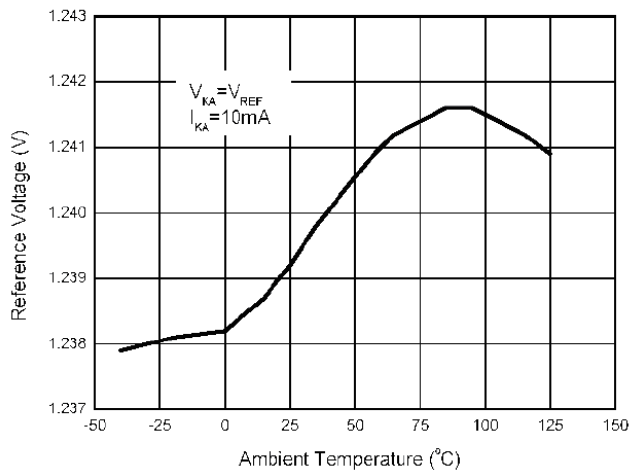
FIGURE 3-TEST CIRCUIT FOR I_{off}



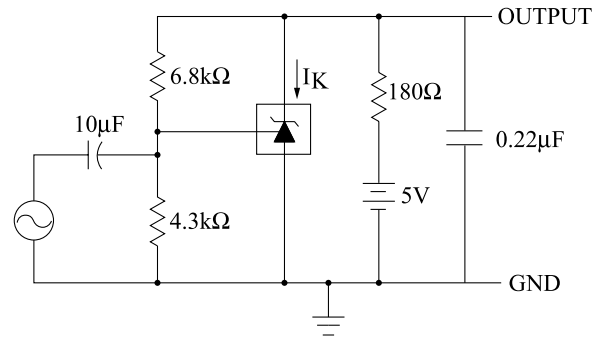
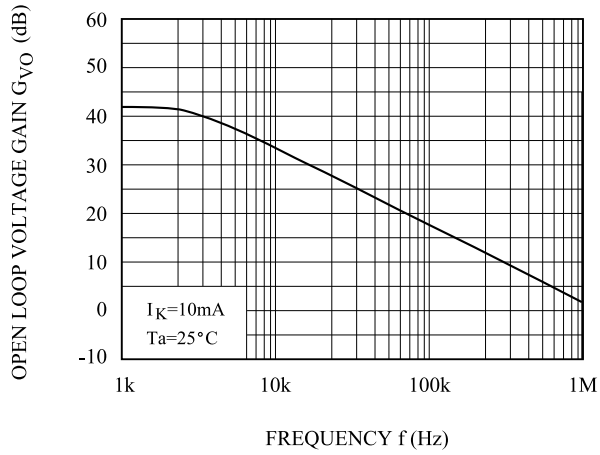
* C_{KA} greater than 100nF is needed for stability.

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

Characteristics Curve

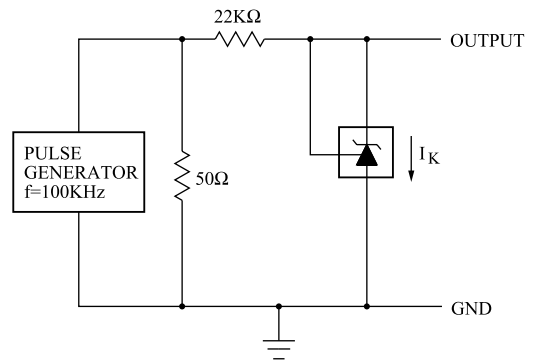
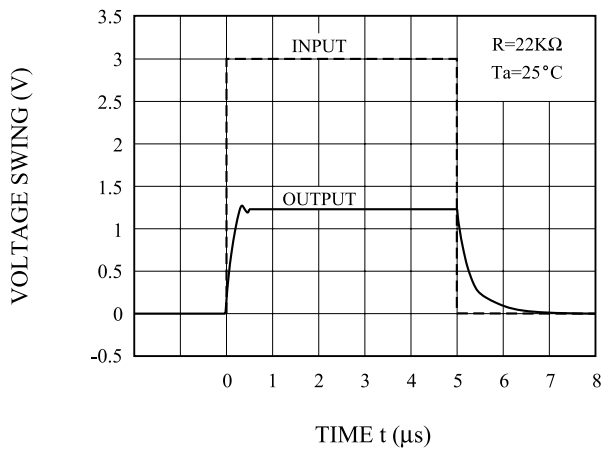


$G_V - f$



TEST CIRCUIT FOR VOLTAGE GAIN AND PHASE MARGIN

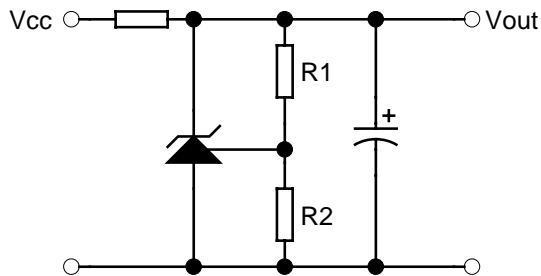
PULSE RESPONSE



TEST CIRCUIT FOR PULSE RESPONSE

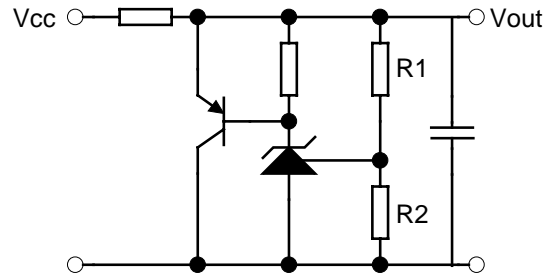
Typical Application

Fig 4. Shunt Regulator



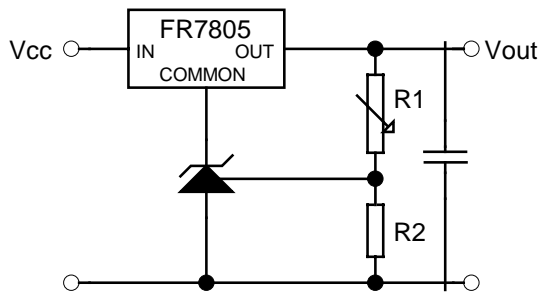
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 5. High Current Shunt Regulator



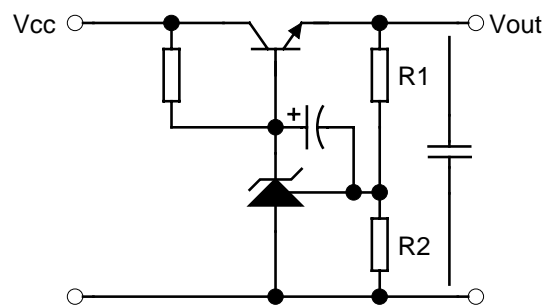
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 6. Output Control of a Three-Terminal Fixed Regulator



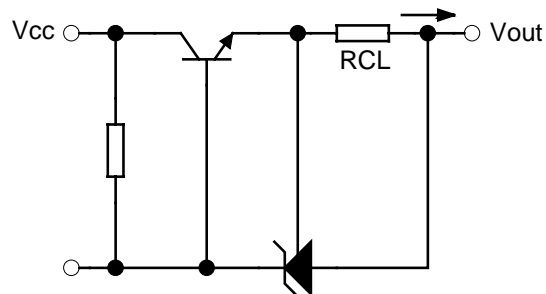
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + 5V$$

Fig 7. Series Pass Regulator



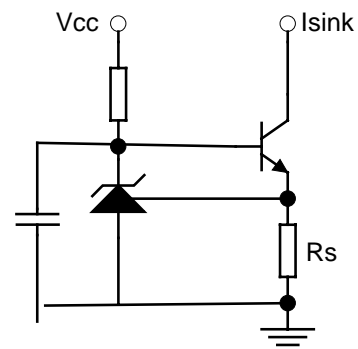
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + V_{BE}$$

Fig 8. Current Limiter or Current Source



$$I_{out} = V_{REF}/R_{CL}$$

Fig 9. Constant Current Sink

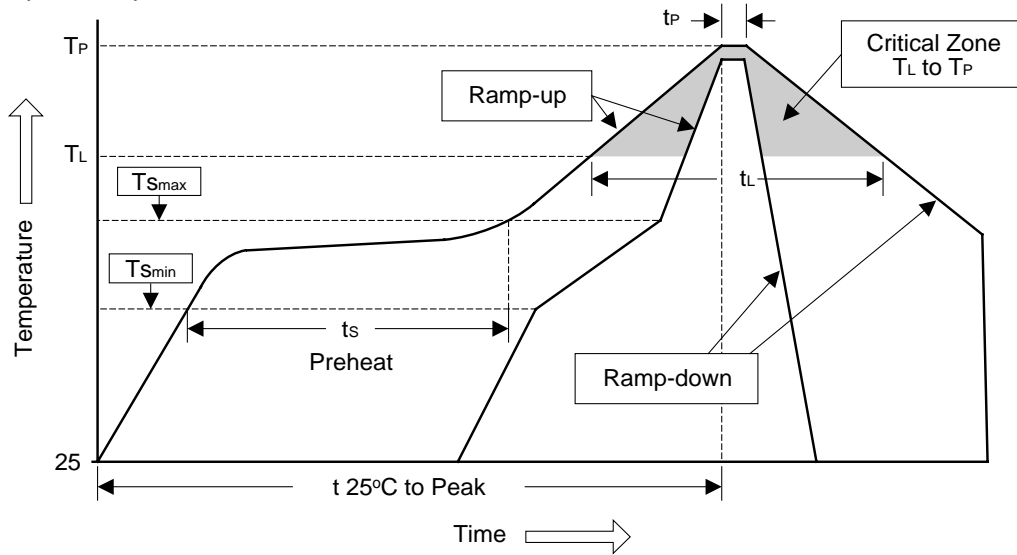


$$I_{sink} = V_{REF}/R_S$$

Soldering Methods

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (T_{Smin})	100°C	150°C
- Temperature Max (T_{Smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{Smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60~150 sec	60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec