FAN431/FAN431A/FAN431L

Programmable Shunt Regulator

Features

- Programmable Output Voltage to 36 Volts
- Low Dynamic Output Impedance 0.2Ω Typical
- Sink Current Capability of 1.0 to 100mA
- Equivalent Full-Range Temperature Coefficient of 50ppm/°C Typical
- Temperature Compensated for Operation Over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn-on Response

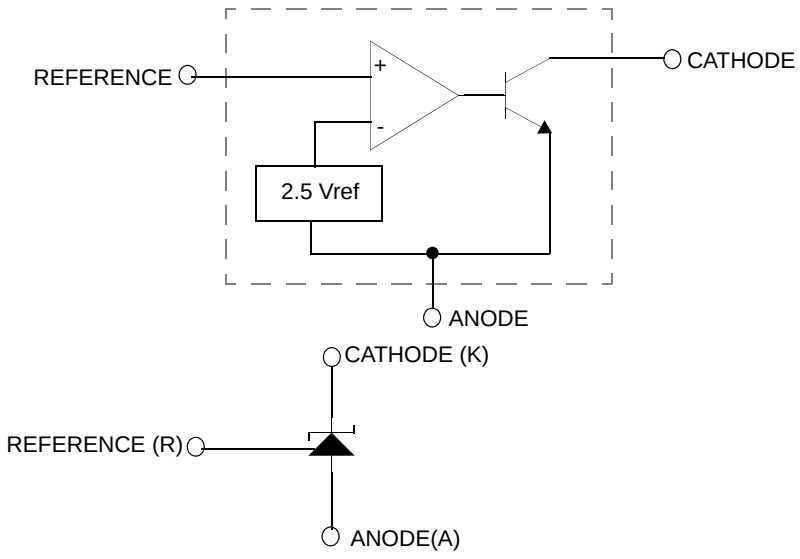
Description

The FAN431/FAN431A/FAN431L are three terminal output adjustable regulators with thermal stability over operating temperature range. The output voltage can be set any value between V_{REF} (approximately 2.5 volts) and 36 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω. Active output circuit provides a sharp turn-on characteristic, making these devices excellent replacement for Zener Diodes in many applications.

TO-92

1. Ref 2. Anode 3. Cathode

Internal Block Diagram



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Absolute Maximum Ratings

(Operating temperature range applies unless otherwise specified.)

Parameter	Symbol	Value	Unit
Cathode Voltage	V_{KA}	37	V
Cathode current Range (Continuous)	I_{KA}	-100 ~ +150	mA
Reference Input Current Range	I_{REF}	-0.05 ~ +10	mA
Thermal Resistance Junction-Air (Note1,2) Z Suffix Package	$R_{\theta JA}$	132	°C/W
Power Dissipation (Note3,4) Z Suffix Package	P_D	940	mW
Junction Temperature	T_J	150	°C
Operating Temperature Range	T_{OPR}	-25 ~ +85	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Note:

1. Thermal resistance test board
   Size: 76.2mm * 114.3mm * 1.6mm (1S0P)
   JEDEC Standard: JESD51-3, JESD51-7
2. Assume no ambient airflow.
3. T_{JMAX} = 150°C, Ratings apply to ambient temperature at 25°C
4. Power dissipation calculation: $P_D = (T_J - T_A)/R_{\theta JA}$

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Cathode Voltage	V_{KA}	V_{REF}	-	36	V
Cathode Current	I_{KA}	1.0	-	100	mA

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Electrical Characteristics

(T_A = +25°C, unless otherwise specified)

Parameter	Symbol	Conditions	FAN431			FAN431A			FAN431L			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA	2.450	2.500	2.550	2.470	2.495	2.520	2.482	2.495	2.508	V
Deviation of Reference Input Voltage Over-Temperature	$\Delta V_{REF}/\Delta T$	$V_{KA}=V_{REF}$, I_{KA}=10mA $T_{MIN} \le T_A \le T_{MAX}$	-	4.5	17	-	4.5	17	-	4.5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	I_{KA} =10mA, ΔV_{KA}=10V-V_{REF}	-	-1.0	-2.7	-	-1.0	-2.7	-	-1.0	-2.7	mV/V
		I_{KA} =10mA, ΔV_{KA}=36V-10V	-	-0.5	-2.0	-	-0.5	-2.0	-	-0.5	-2.0	
Reference Input Current	I_{REF}	I_{KA}=10mA, R_1=10kΩ,R_2=∞	-	1.5	4	-	1.5	4	-	1.5	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	I_{KA}=10mA, R_1=10kΩ,R_2=∞ T_A =Full Range	-	0.4	1.2	-	0.4	1.2	-	0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA(MIN)}$	$V_{KA}=V_{REF}$	-	0.45	1.0	-	0.45	1.0	-	0.45	1.0	mA
Off -Stage Cathode Current	$I_{KA(OFF)}$	V_{KA}=36V, V_{REF}=0	-	0.05	1.0	-	0.05	1.0	-	0.05	1.0	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA ,f ≥1.0kHz	-	0.15	0.5	-	0.15	0.5	-	0.15	0.5	Ω

Note1

T_{MIN} = -25°C, T_{MAX} = +85°C

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Test Circuits

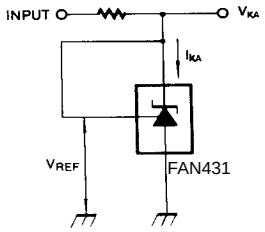

Figure 1. Test Circuit for $V_{KA}=V_{REF}$

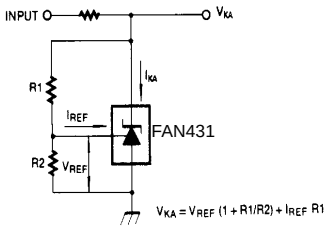

Figure 2. Test Circuit for $V_{KA} \geq V_{REF}$

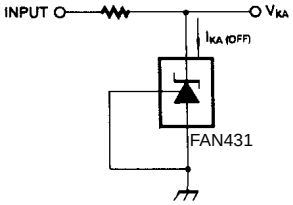

Figure 3. Test Circuit for $I_{KA(OFF)}$

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Typical Performance Characteristics

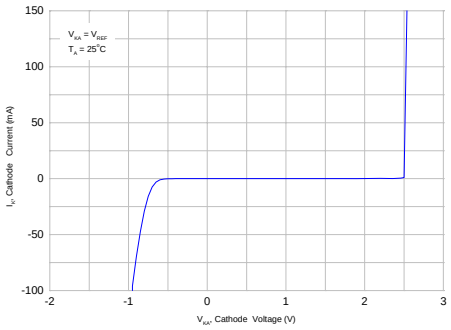

Figure 4. Cathode Current vs. Cathode Voltage

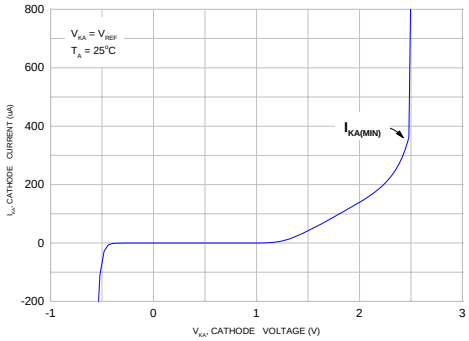

Figure 5. Cathode Current vs. Cathode Voltage

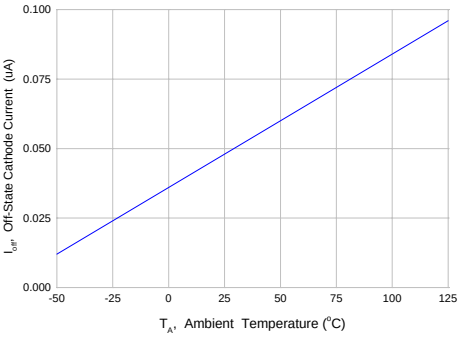

Figure 6. OFF-State Cathode Current vs. Ambient Temperature

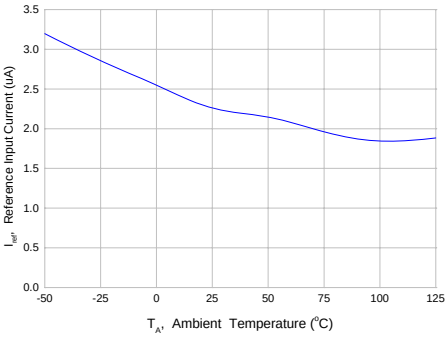

Figure7. Reference Input Current vs. Ambient Temperature

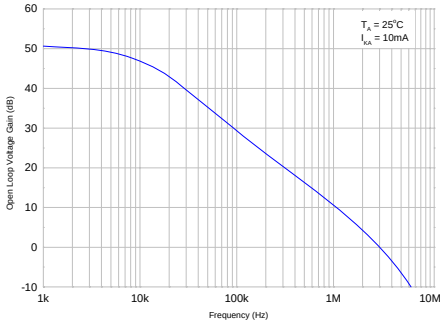

Figure 8. Small Signal Voltage Amplification vs. Frequency

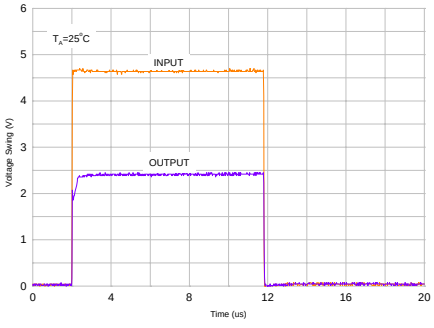

Figure 9. Pulse Response

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Typical Performance Characteristics (Continued)

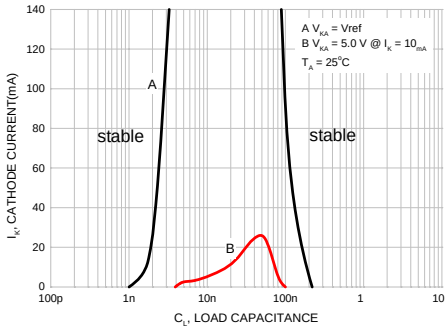

Figure 10. Stability Boundary Conditions

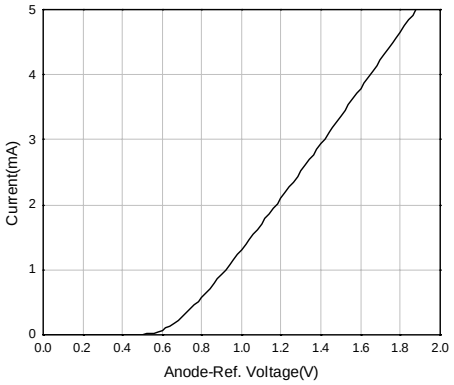

Figure 11. Anode-Reference Diode Curve

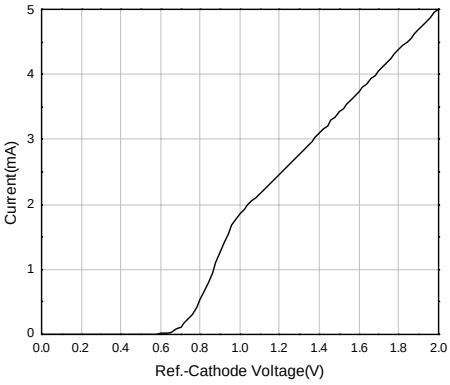

Figure 12. Reference-Cathode Diode Curve

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Typical Application

$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{ref}$$

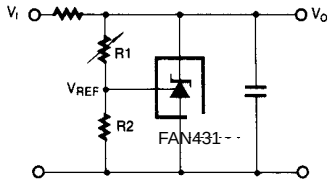

Figure 13. Shunt Regulator

$$V_O = V_{ref}\left(1 + \frac{R_1}{R_2}\right)$$

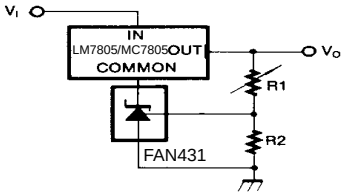

Figure 14. Output Control for Three-Termianl Fixed Regulator

$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{ref}$$

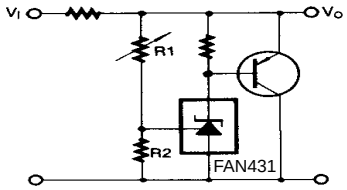

Figure 15. High Current Shunt Regulator

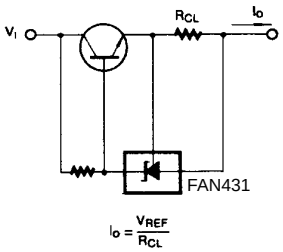

Figure 16. Current Limit or Current Source

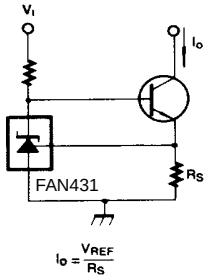

Figure 17. Constant-Current Sink

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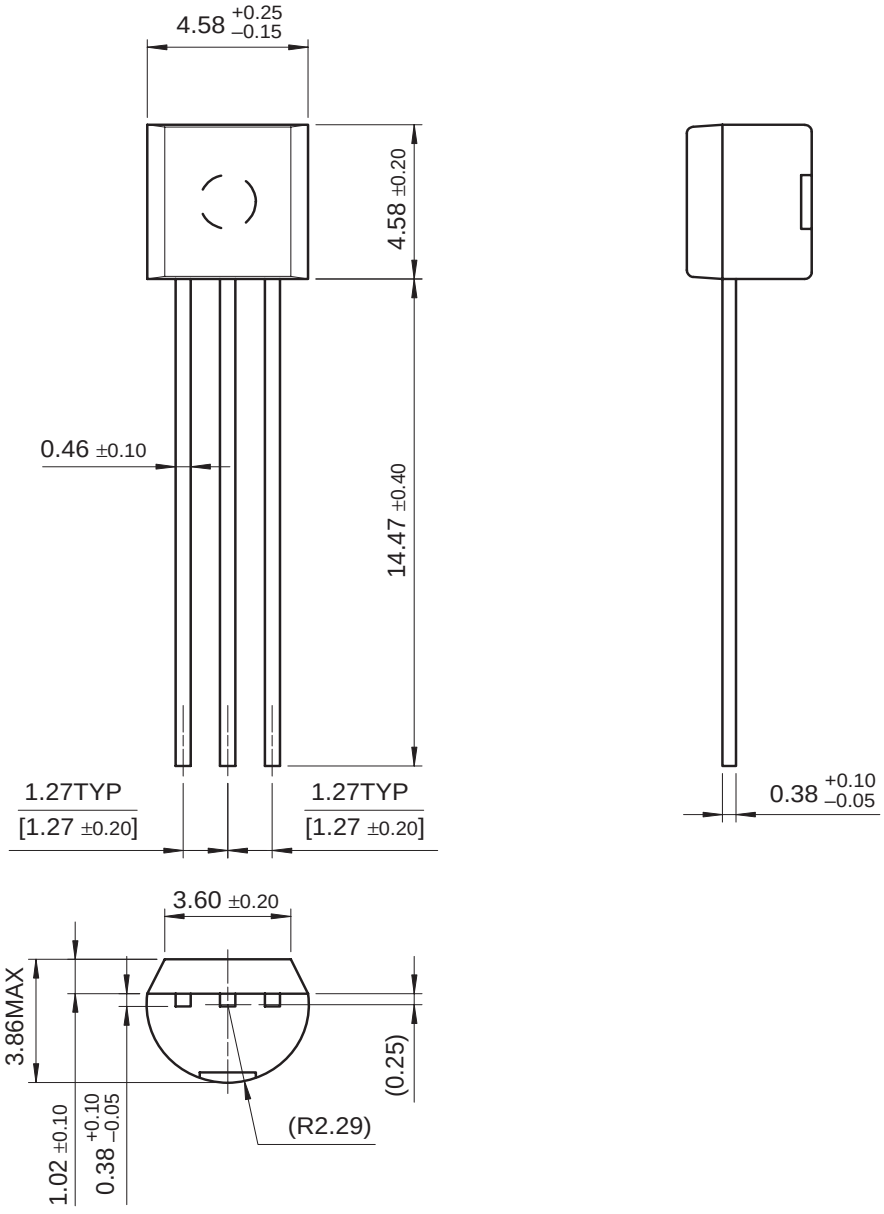
Mechanical Dimensions

Package

Dimensions in millimeters

TO-92 Bulk Type



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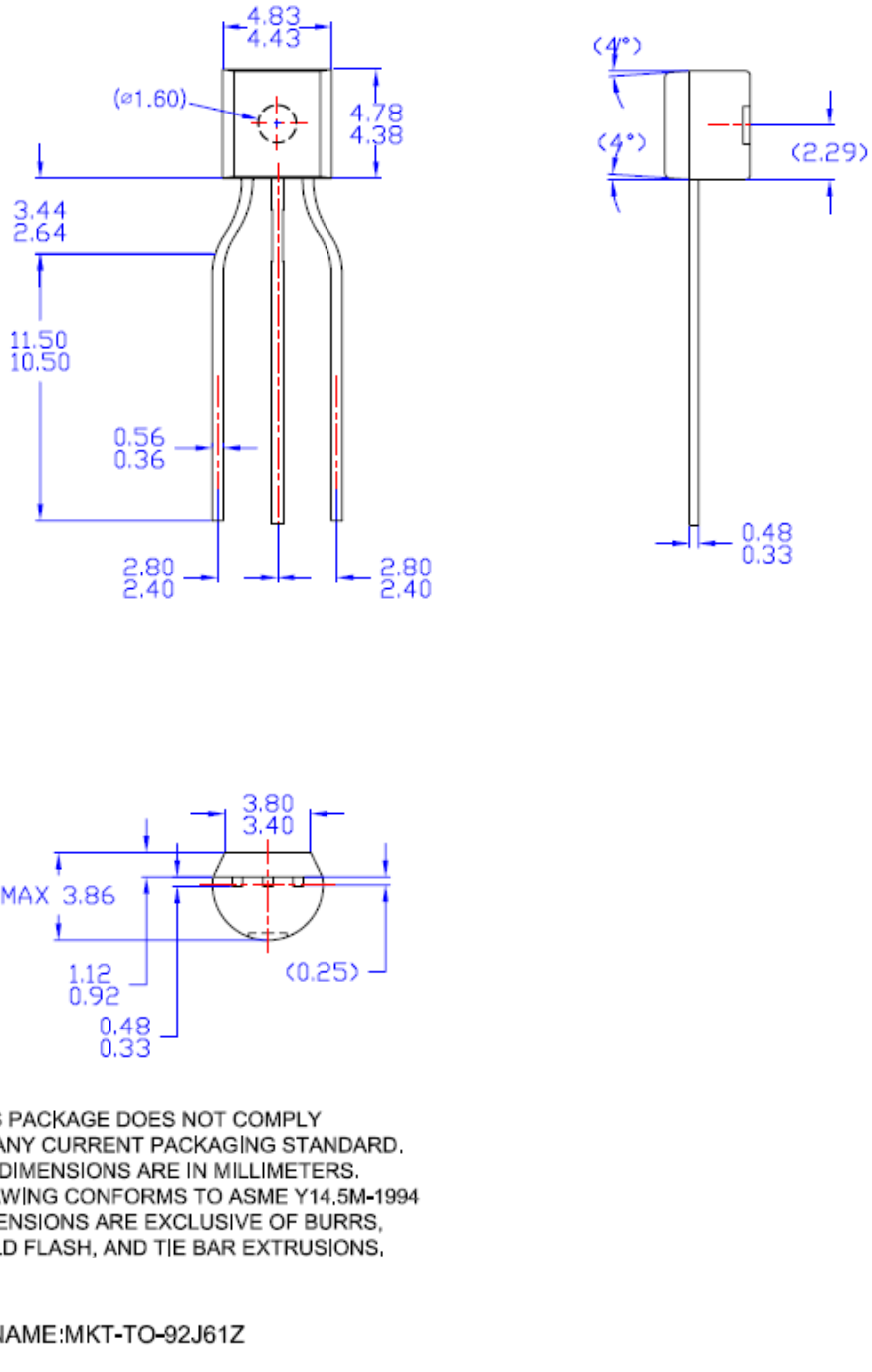
Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

TO-92 Ammo Type & Tape And Reel Type



NOTES:
A) THIS PACKAGE DOES NOT COMPLY TO ANY CURRENT PACKAGING STANDARD.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DRAWING CONFORMS TO ASME Y14.5M-1994
D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

FILE NAME:MKT-TO-92J61Z

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Ordering Information

Product Number	Output Voltage Tolerance	Package	Operating Temperature	Shipping
FAN431ZXA	2%	TO-92	-25 ~ +85°C	Ammo Pack
FAN431AZXA	1%			
FAN431LZXA	0.5%			

- For information on tape & reel and ammo pack specifications, including part orientation and tape sizes, please refer to our tape and reel data, www.fairchildsemi.com/products/discrete/pdf/to92_tr.pdf.

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