KA431/KA431A/KA431L

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

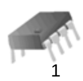
Description

The KA431/KA431A/KA431L are three-terminal adjustable regulator series with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between VREF (approximately 2.5 volts) and 36 volts with two external resistors These devices have a typical dynamic output impedance of 0.2Ω. Active output circuitry provides a very sharp turn on characteristic, making these devices excellent replacement for zener diodes in many applications.

TO-92

1. Ref 2. Anode 3. Cathode

8-DIP

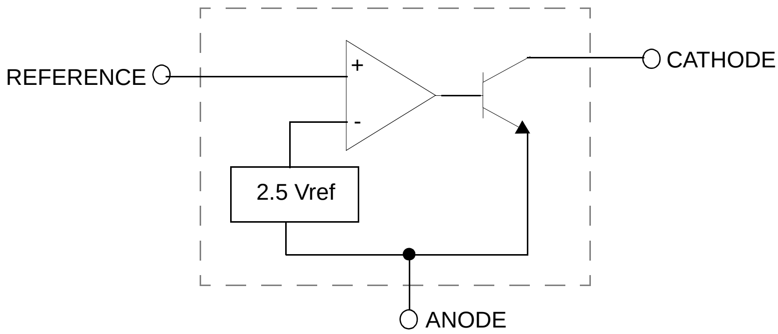


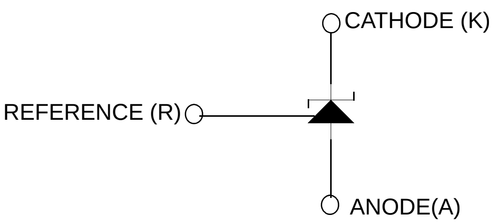
1.Cathode 2.3.4.5.7.NC
6.Anode 8.Ref

8-SOP

1.Cathode 2.3.6.7.Anode
4.5.NC 8.Ref

Internal Block Diagram





Rev. 1.0.9

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
Power Dissipation D, Z Suffix Package DIP Package	P_D	 770 1000	 mW mW
Operating Temperature Range	T_{OPR}	-25 ~ +85	°C
Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

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

Electrical Characteristics

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

Parameter	Symbol	Conditions	KA431			KA431A			KA431L			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	mV/V
Reference Input Current	I_{REF}	I_{KA}=10mA, R1=10kΩ,R2=∞	-	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, R1=10kΩ,R2=∞ 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

- T_{MIN} = -25°C, T_{MAX} = +85°C

Test Circuits

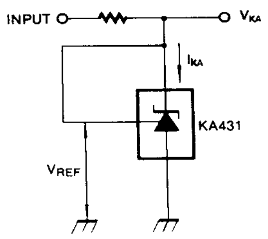


Figure 1. Test Circuit for $V_{KA}=V_{REF}$

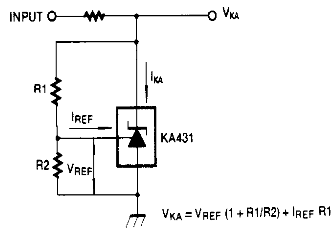


Figure 2. Test Circuit for $V_{KA} \geq V_{REF}$

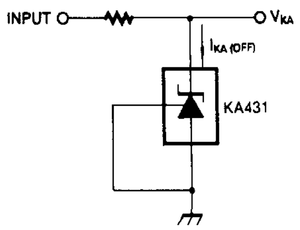


Figure 3. Test Circuit for $I_{KA(OFF)}$

Typical Performance Characteristics

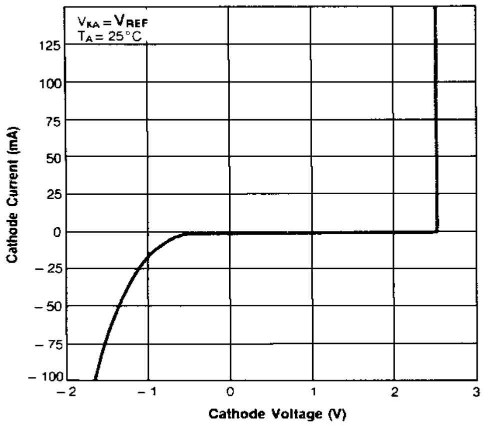


Figure 4. Cathode Current vs. Cathode Voltage

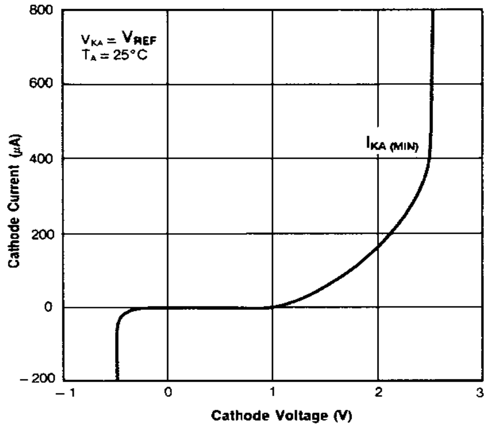


Figure 5. Cathode Current vs. Cathode Voltage

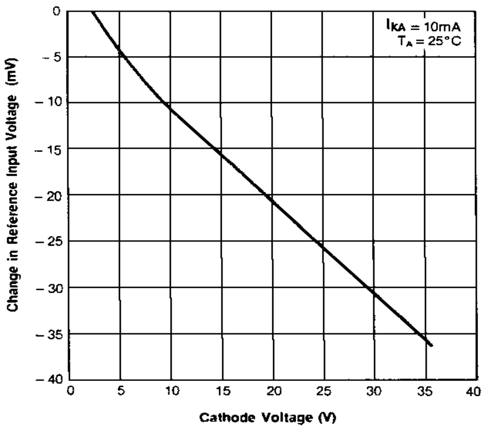


Figure 6. Change In Reference Input Voltage vs. Cathode Voltage

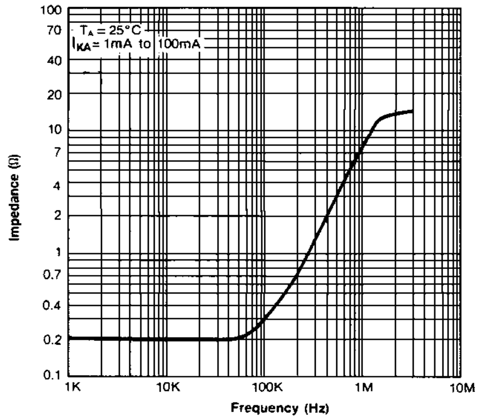


Figure7. Dynamic Impedance Frequency

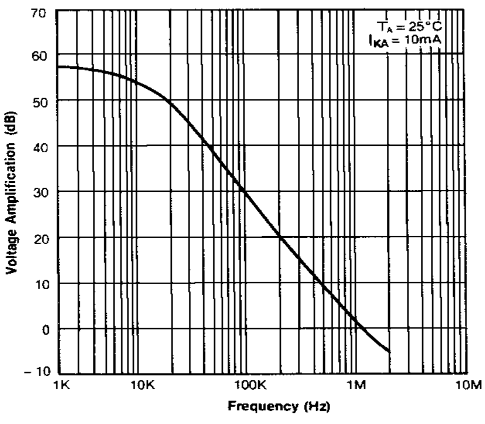


Figure 8. Small Signal Voltage Amplification vs. Frequency

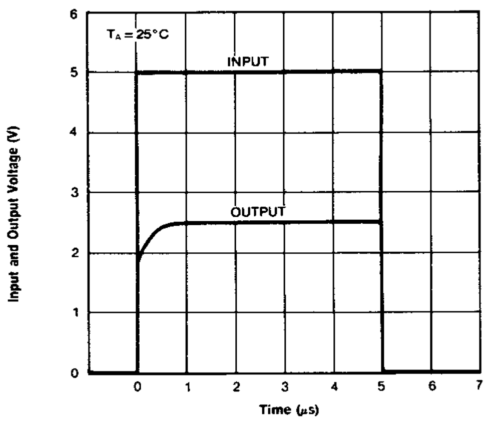


Figure 9. Pulse Response

Typical Performance Characteristics (Continued)

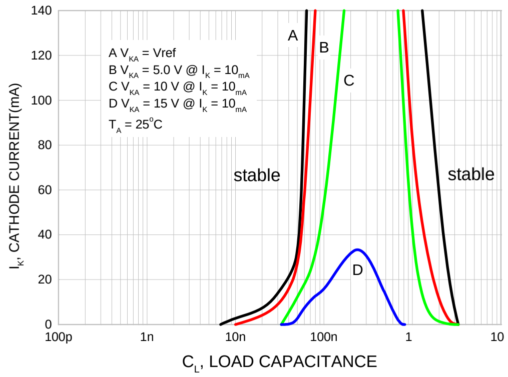


Figure 10. Stability Boundary Conditions

Typical Application

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

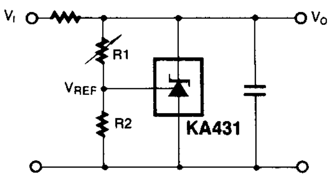


Figure 11. Shunt Regulator

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

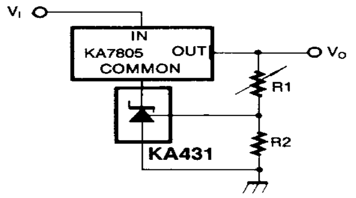


Figure 12. Output Control for Three–Ter minal Fixed Regulator

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

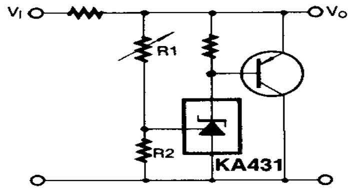


Figure 13. High Current Shunt Regulator

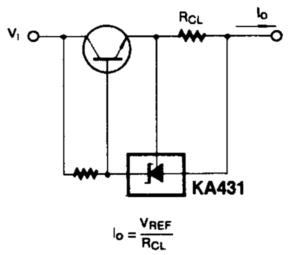


Figure 14. Current Limit or Current Source

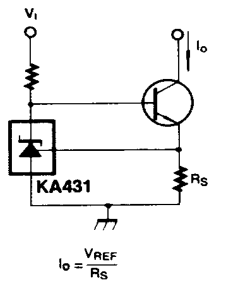


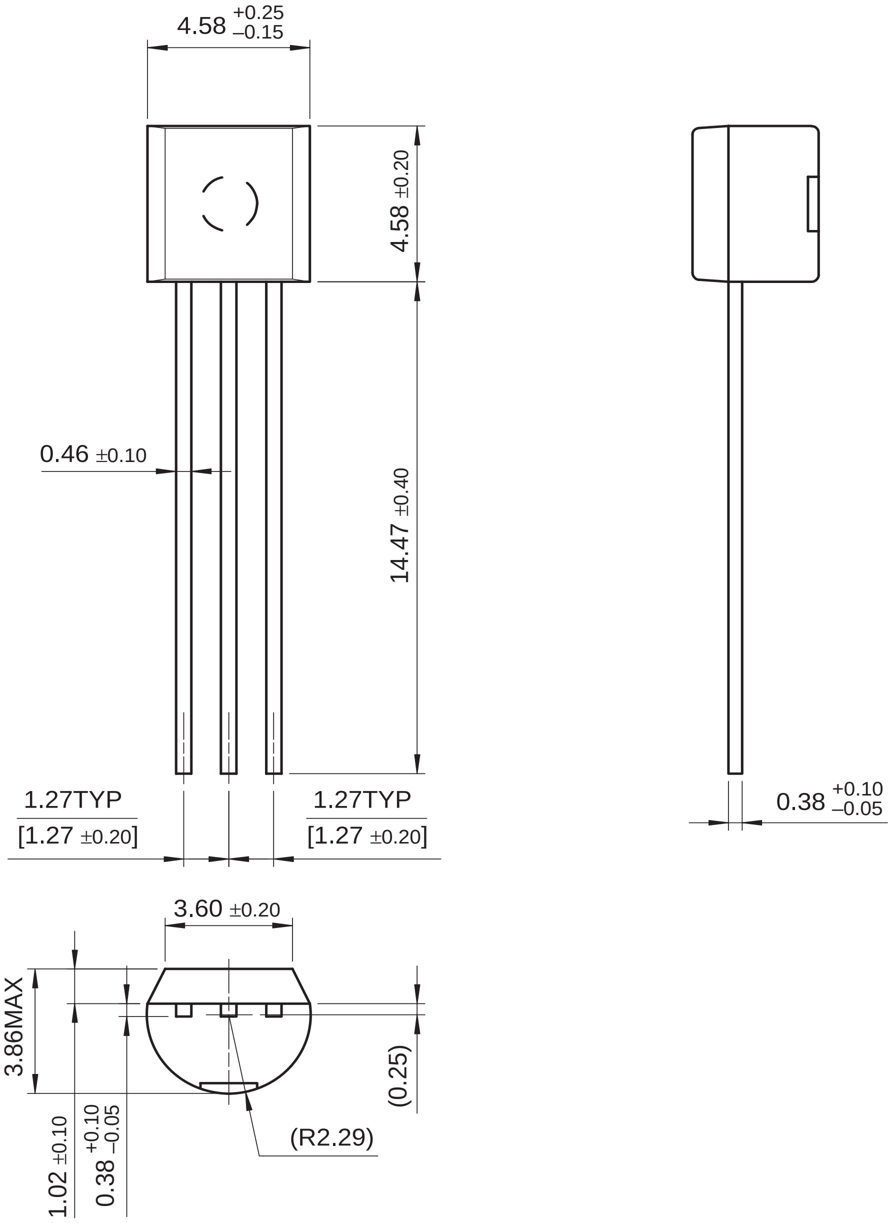
Figure 15. Constant-Current Sink

Mechanical Dimensions

Package

Dimensions in millimeters

TO-92 Bulk Type

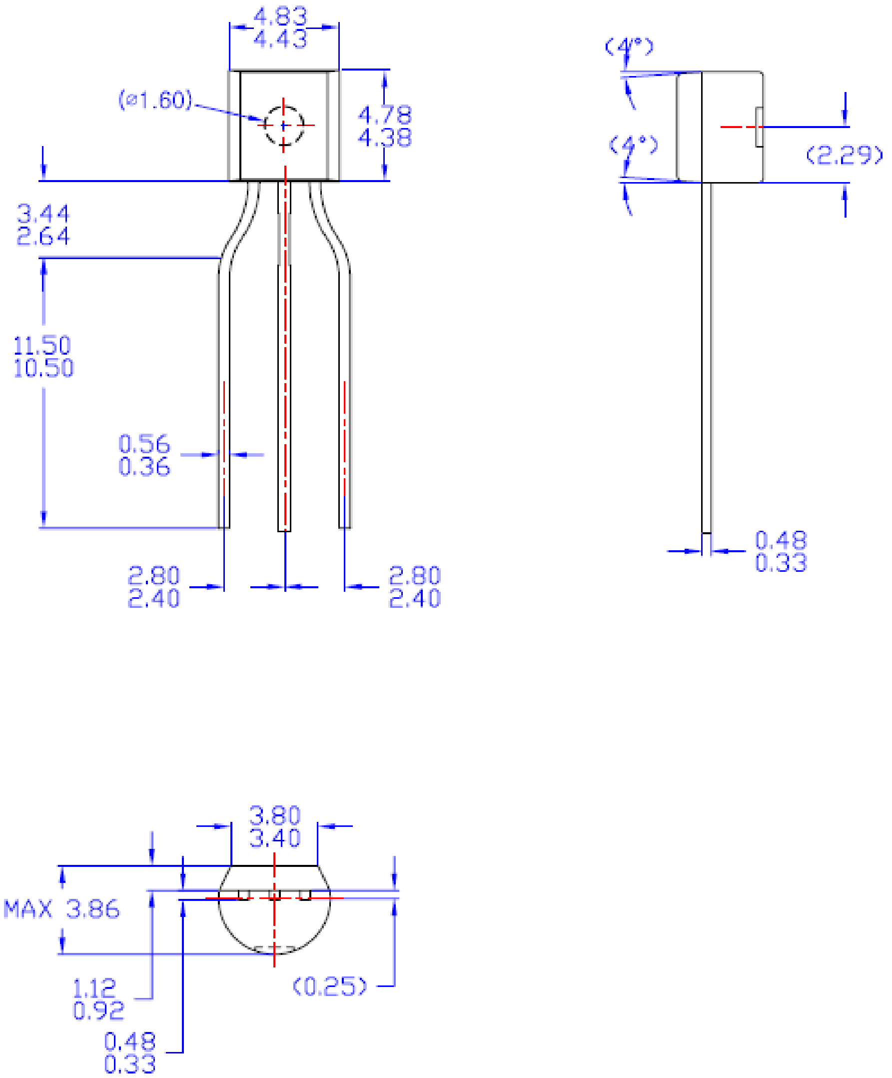


Mechanical Dimensions (Continued)

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.

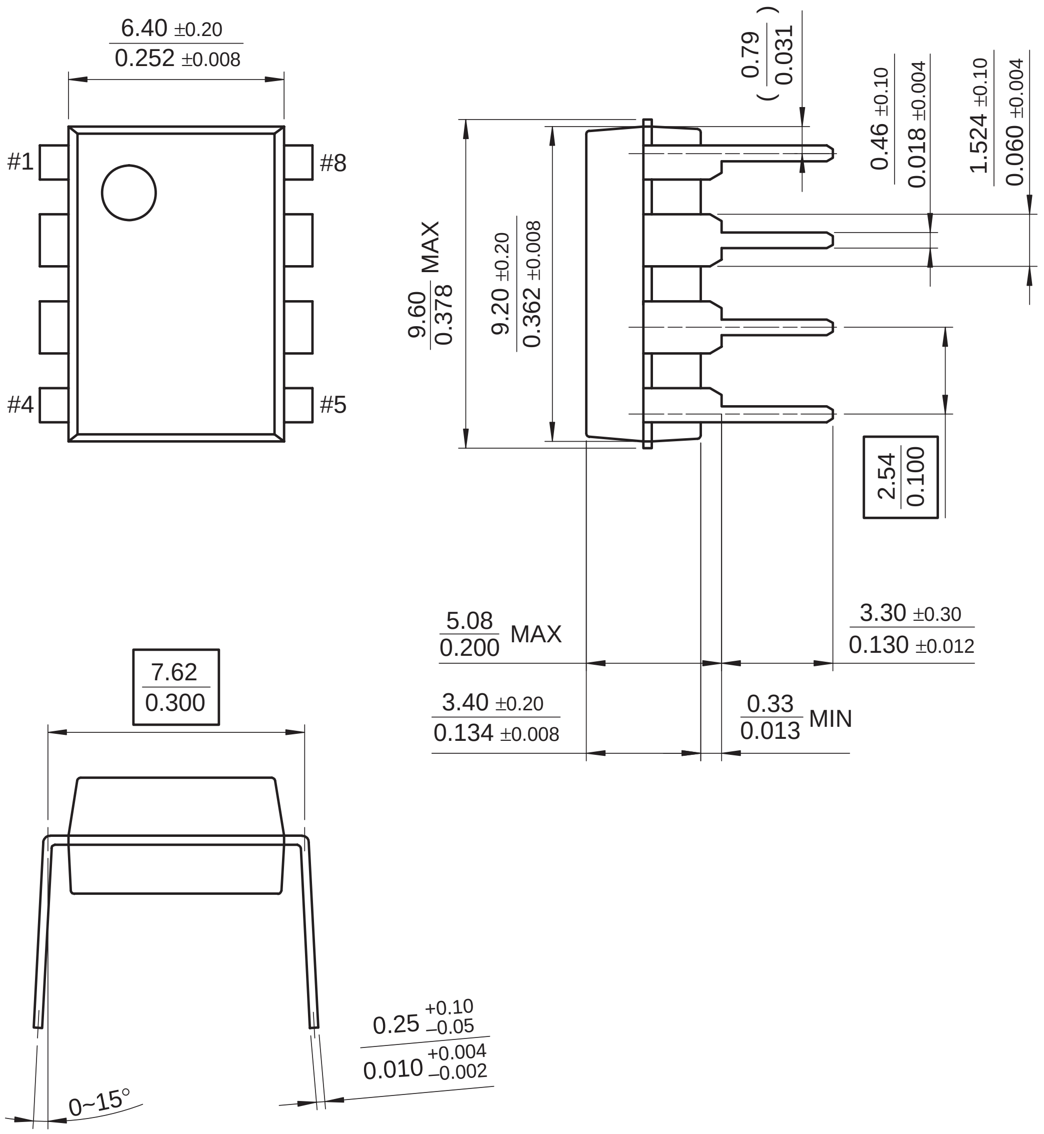
FILE NAME:MKT-TO-92J61Z

Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

8-DIP

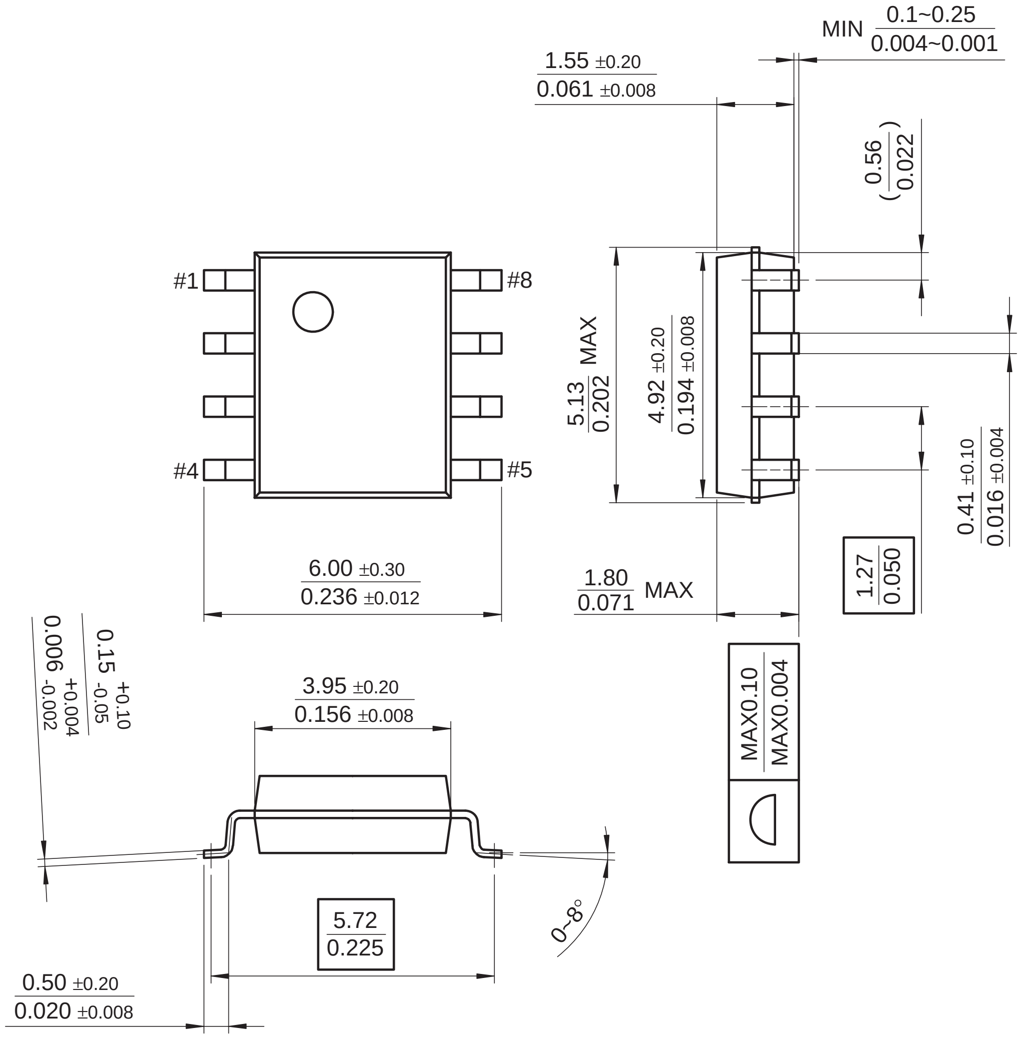


Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

8-SOP



Ordering Information

<table>
<tr><th>Product Number</th><th>Output Voltage Tolerance</th><th>Package</th><th>Operating Temperature</th><th>Shipping</th></tr>
<tr><td>KA431LZ</td><td rowspan="2">0.5%</td><td>TO-92</td><td rowspan="15">-25 ~ +85°C</td><td></td></tr>
<tr><td>KA431LD</td><td>8-SOP</td><td></td></tr>
<tr><td>KA431AZ</td><td rowspan="2">1%</td><td>TO-92</td><td></td></tr>
<tr><td>KA431AD</td><td>8-SOP</td><td></td></tr>
<tr><td>KA431</td><td rowspan="3">2%</td><td>8-DIP</td><td></td></tr>
<tr><td>KA431Z</td><td>TO-92</td><td></td></tr>
<tr><td>KA431D</td><td>8-SOP</td><td></td></tr>
<tr><td>KA431AZMTA</td><td rowspan="3">1%</td><td rowspan="9">TO-92</td><td rowspan="2">Ammo Pack</td></tr>
<tr><td>KA431AZTA</td></tr>
<tr><td>KA431AZTF</td><td>Tape & Reel</td></tr>
<tr><td>KA431LZMTA</td><td rowspan="3">0.5%</td><td rowspan="2">Ammo Pack</td></tr>
<tr><td>KA431LZTA</td></tr>
<tr><td>KA431LZTF</td><td>Tape & Reel</td></tr>
<tr><td>KA431ZMTA</td><td rowspan="3">2%</td><td rowspan="2">Ammo Pack</td></tr>
<tr><td>KA431ZTA</td></tr>
<tr><td>KA431ZTF</td><td>Tape & Reel</td></tr>
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- For information on tape & reel and ammo pack specifications, including part orientation and tape sizes, please refer to our tape and reel data, http://www.fairchildsemi.com/products/analog/packaging/to92r.html

2/22/11 0.0m 001
Stock#DS400029