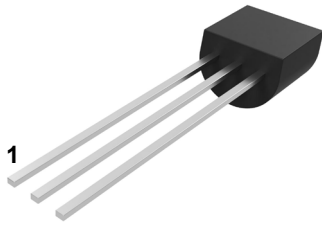


# Shunt Regulator Voltage Reference **multicomp**PRO

RoHS  
Compliant



"H431LKA" PN= Marking Code

Pin Assignment	
1	R
2	A
3	K

## Features

- Programmable Output Voltage to 40V
- Guaranteed 0.5% Reference Voltage Tolerance
- Low Dynamic Output Impedance 0.2Ω(Typ)
- Cathode Current Range (Continuous) -100 ~ 150mA
- Equivalent Full-Range Temperature Coefficient of 50 ppm/°C
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn on Response
- TO-92 package
- ESD Tolerance (human body model) 2000V
- Operating Temperature Range -60°C to +125°C

## Applications

- Switching Mode Power Supply
- Voltage Monitoring
- Adjustable Voltage and Current Referencing

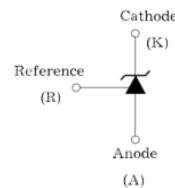
## Absolute Maximum Ratings (T<sub>J</sub>=25°C Unless Otherwise Noted)

Symbol	Parameter	Rating	Unit
V <sub>KA</sub>	Cathode Voltage	42	V
I <sub>K</sub>	Cathode Current Range (Continuous)	-100 ~ 150	mA
I <sub>REF</sub>	Reference Input Current Range	-0.05 ~ +10	
P <sub>D</sub>	Power Dissipation at 25°C: SOT-23 Package TO-92 Package	0.2 0.6	W
T <sub>J</sub>	Junction Temperature Range	0 ~ 150	°C
T <sub>OPER</sub>	Operating Temperature Range	-60 ~ +125	
T <sub>STG</sub>	Storage Temperature Range	-65 ~ +150	

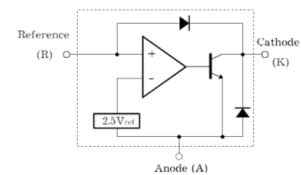
## Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V <sub>KA</sub>	Cathode Voltage	V <sub>REF</sub>	-	40	V
I <sub>K</sub>	Cathode Current Range (Continuous)	0.5	-	100	mA

### Symbol



### Functional block diagram



# Shunt Regulator Voltage Reference **multicomp** PRO

**Electrical Characteristics (Ta = 25°C, VKA = VREF, IK = 10mA unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
VREF	Reference Input Voltage	VKA = VREF, IK = 10mA	2.483	2.495	2.507	V
VREF(dev)	Deviation of Reference Input Voltage Over Full Temperature Range	Tmin ≤ Ta ≤ Tmax		3	17	mA
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{KA} = 10V - V_{REF}$ $\Delta V_{KA} = 40V - 10V$		-1.4 -1.0	-2.7 -2.0	mV/V
IREF	Reference Input Current	R1 = 10KΩ, R2 = ∞		1.8	4	uA
IREF(dev)	Deviation of Reference Input Current Over Full Temperature Range	R1 = 10KΩ, R2 = ∞	--	0.4	1.2	
IK(min)	Minimum Cathode Current for Regulation			--	0.5	mA
IK(off)	Off-State Cathode Current	VKA = 40V, IREF = 0		0.17	0.9	uA
ZKA	Dynamic Impedance	IK = 1mA to 100 mA , f ≤ 1.0KHz		0.27	0.5	Ω

## Test Circuits

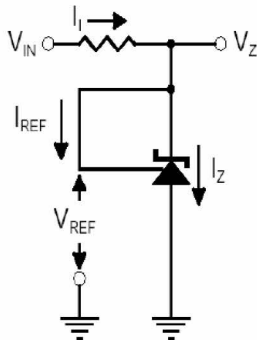


Fig1. Test Circuit for  $V_z = V_{REF}$

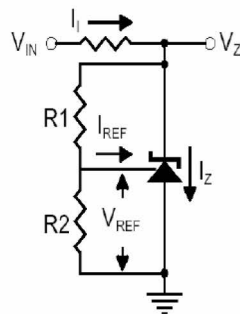


Fig2. Test Circuit for  $V_z > V_{REF}$   
Note:  $V_z = V_{REF}(1 + R1/R2) + I_{REF} \times R1$

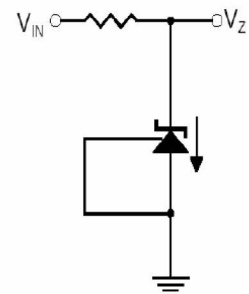
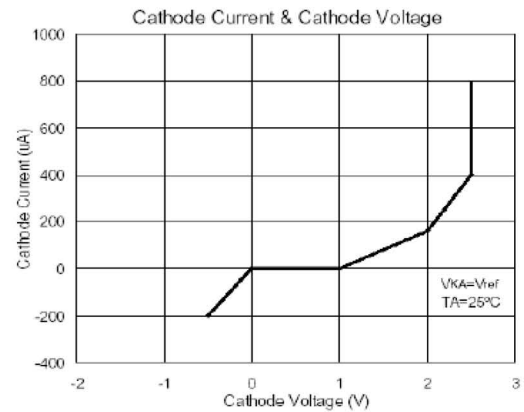
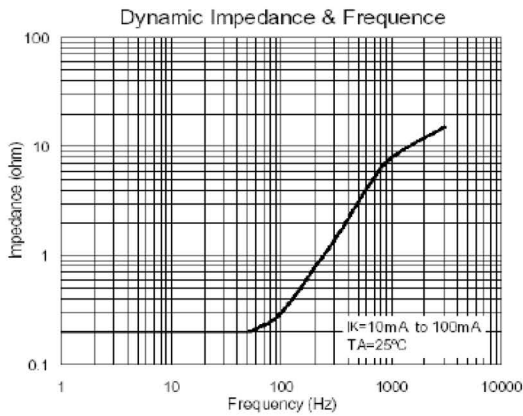
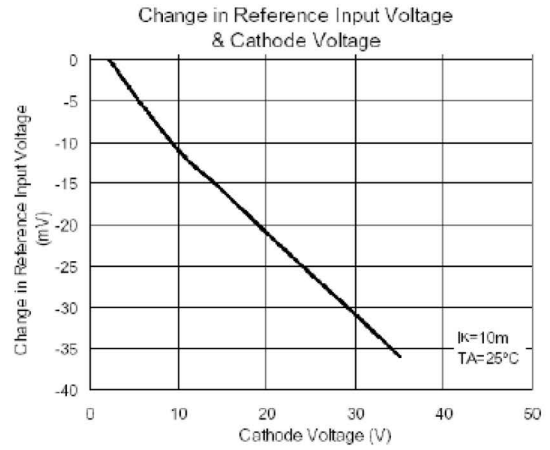
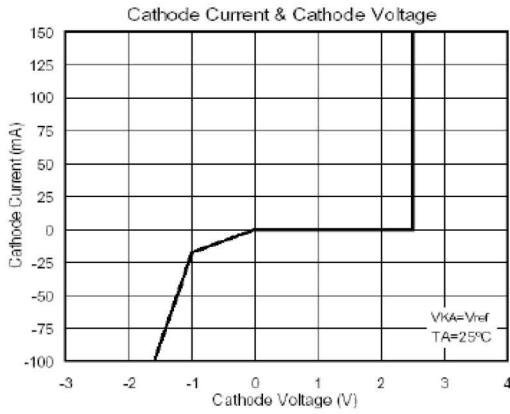


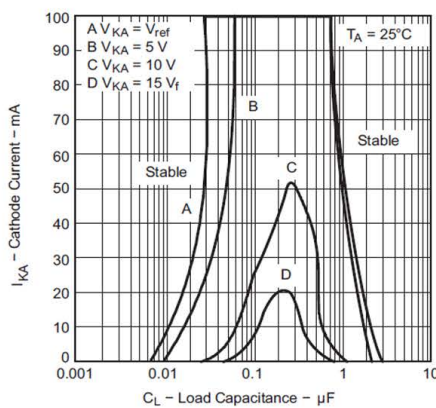
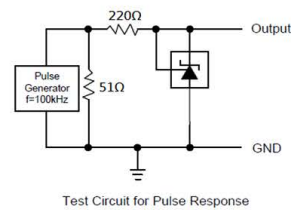
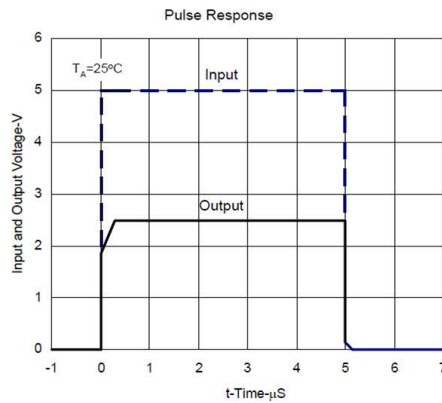
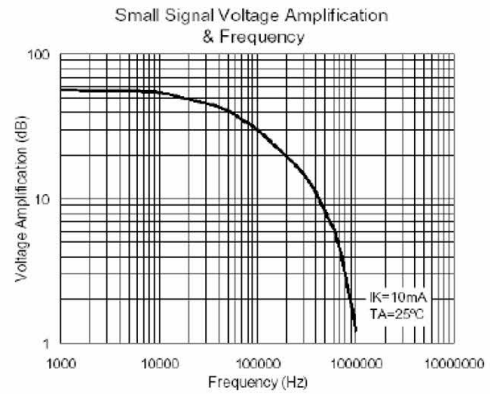
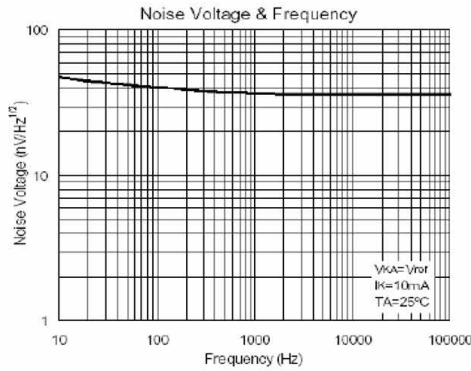
Fig3. Test Circuit for Off-State Current

## Electrical characteristic curves

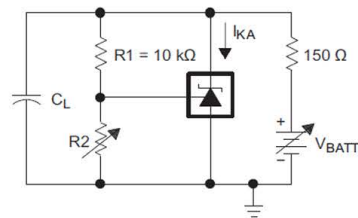
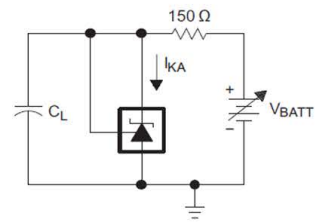


# Shunt Regulator Voltage Reference **multicomp** PRO

## Electrical characteristic curves



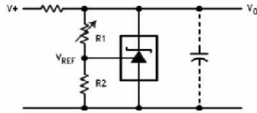
The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D,  $R_2$  and  $V_+$  are adjusted to establish the initial  $V_{KA}$  and  $I_{KA}$  conditions, with  $C_L = 0$ .  $V_{BATT}$  and  $C_L$  then are adjusted to determine the ranges of stability.



# Shunt Regulator Voltage Reference **multicomp** PRO

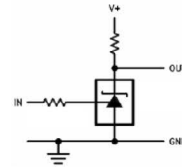
## Typical Application

Shunt Regulator



$$V_o \approx \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

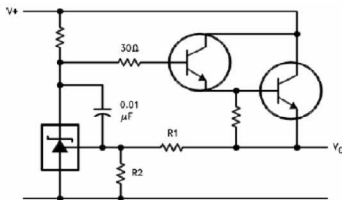
Single Supply Comparator with Temperature Compensated Threshold



$$V_{TH} \approx 2.5V$$

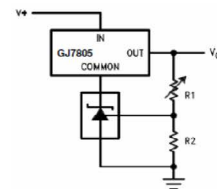
$$V_{ON} \approx 2V, V_{OFF} = V^*$$

Series Regulator



$$V_o \approx \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

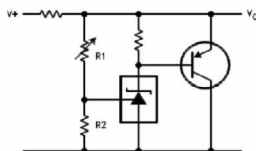
Output Control of a Three Terminal Fixed Regulator



$$V_o \approx \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

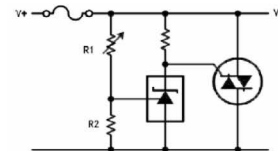
$$V_o \text{ MIN} \approx V_{REF} + 5V$$

Higher Current Shunt Regulator



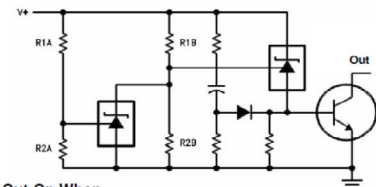
$$V_o \approx \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

Crow Bar



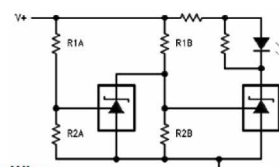
$$V_{Limit} \approx \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

Over Voltage/under Voltage Protection Circuit



Out On When  
 Low Limit < V\* < High Limit  
 Low Limit  $\approx V_{REF} \left(1 + \frac{R_{1B}}{R_{2B}}\right) + V_{BE}$   
 High Limit  $\approx V_{REF} \left(1 + \frac{R_{1A}}{R_{2A}}\right)$

Voltage Monitor

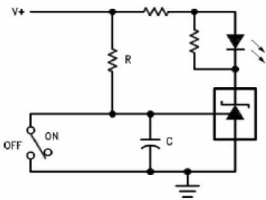


LED On When  
 Low Limit < V\* < High Limit  
 Low Limit  $\approx V_{REF} \left(1 + \frac{R_{1B}}{R_{2B}}\right)$   
 High Limit  $\approx V_{REF} \left(1 + \frac{R_{1A}}{R_{2A}}\right)$

# Shunt Regulator Voltage Reference **multicomp** PRO

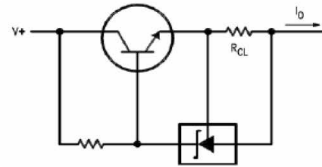
## Typical Application

Delay Timer



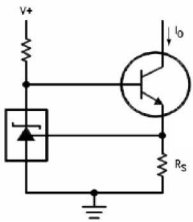
$$\text{Delay} = R \cdot C \cdot \ln \frac{V^+}{(V^+) - V_{REF}}$$

Current Limiter or Current Source



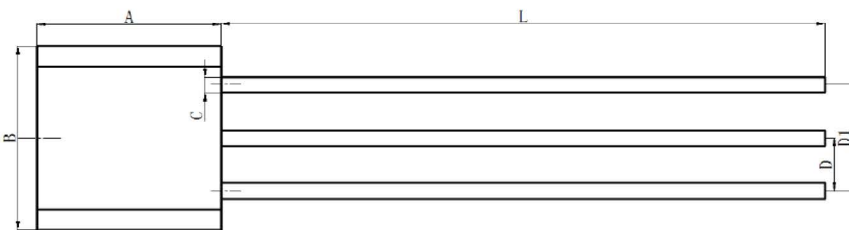
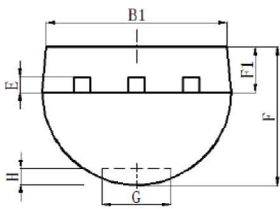
$$I_o = \frac{V_{REF}}{R_{CL}}$$

Constant Current Sink



$$I_o = \frac{V_{REF}}{R_s}$$

## Packaging Dimensions



TO-92 Package		
Dim	Min	Max
A	4.55	4.85
B	4.40	4.70
B1	4.30	4.40
C	0.41	0.51
D	1.27 REF.	
D1	2.44	2.64
E	0.30	0.40
F	3.30	3.70
F1	1.18	1.28
G	1.00	2.00
H	0.38 REF.	
L	13.80	14.80

Dimensions : Millimetres

## Part Number Table

Description	Part Number
Voltage Reference, Adjustable, 2.495V, 40V, $\pm 0.5\%$ , 150mA, TO-92	H431LKA

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