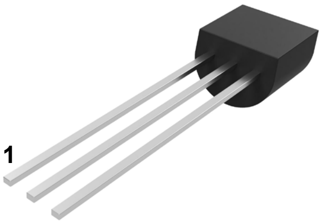
Shunt Regulator Voltage Reference

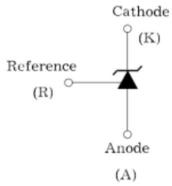


"H431LKA" PN= Marking Code

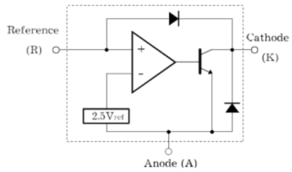
Pin Assigment	
1	R
2	A
3	K

RoHS Compliant

Symbol



Functional block diagram



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_J=25°C Unless Otherwise Noted)

Symbol	Parameter	Rating	Unit
V_{KA}	Cathode Voltage	42	V
I_K	Cathode Current Range (Continuous)	-100 ~ 150	mA
I_{REF}	Reference Input Current Range	-0.05 ~ +10	
P_D	Power Dissipation at 25°C: SOT-23 Package TO-92 Package	0.2 0.6	W
T_J	Junction Temperature Range	0 ~ 150	°C
T_{OPER}	Operating Temperature Range	-60 ~ +125	
T_{STG}	Storage Temperature Range	-65 ~ +150	

Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{KA}	Cathode Voltage	V_{REF}	-	40	V
I_K	Cathode Current Range (Continuous)	0.5	-	100	mA

Electrical Characteristics (Ta = 25°C, V_{KA} = V_{REF}, I_K = 10mA unless otherwise specified)

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

Test Circuits

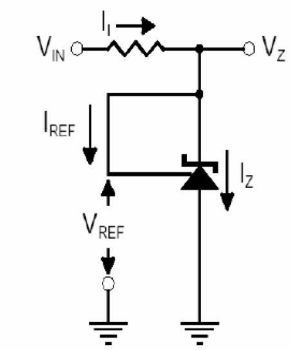


Fig1. Test Circuit for V_Z=V_{REF}

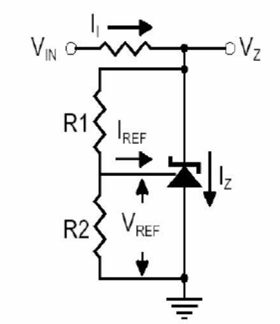


Fig2. Test Circuit for V_Z>V_{REF}
Note: V_Z=V_{REF}(1+R1/R2)+I_{REF}xR1

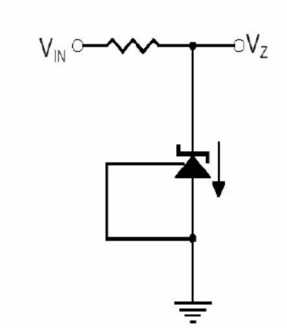
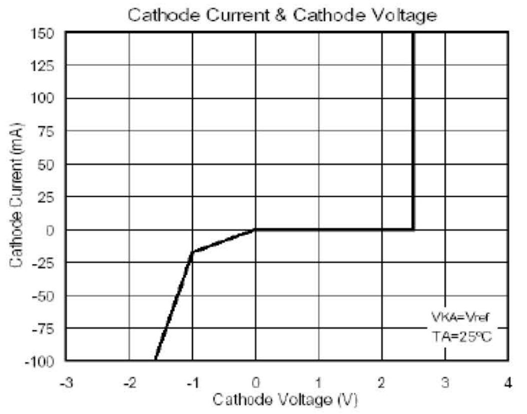
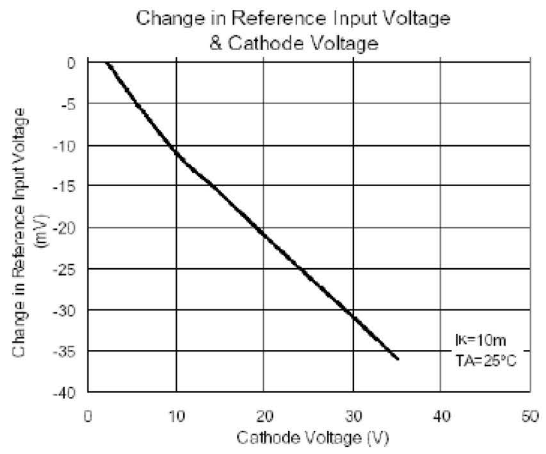
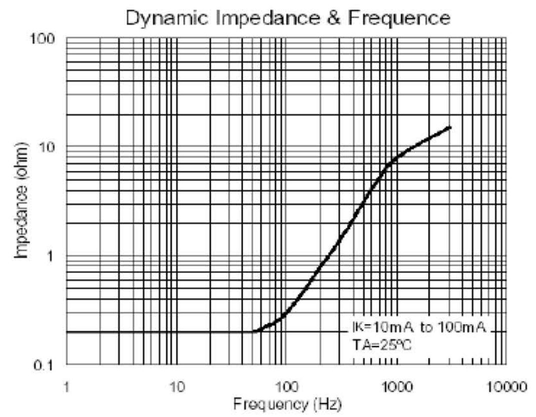


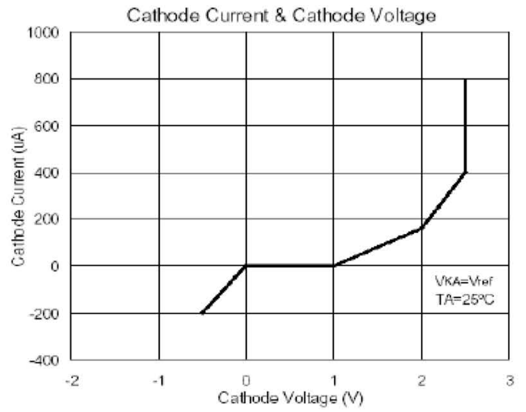
Fig3. Test Circuit for Off-State Current

Electrical characteristic curves

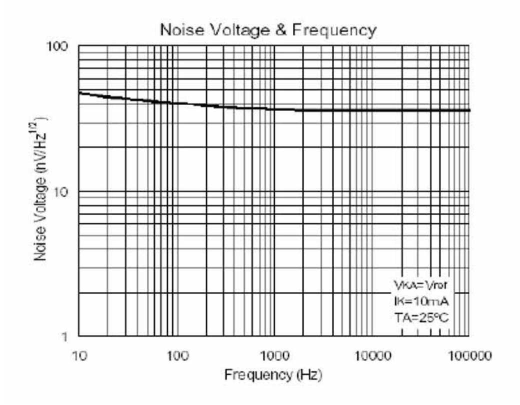


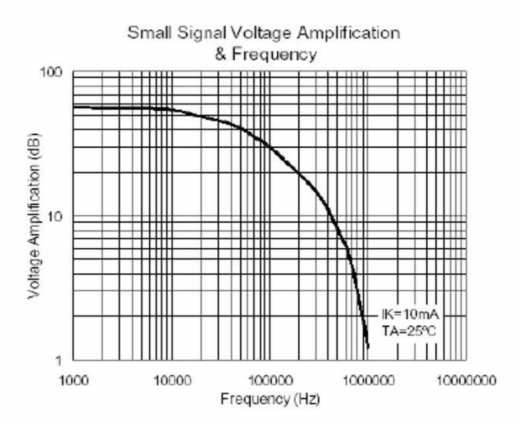


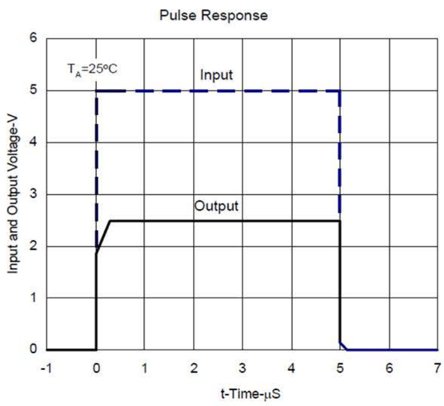


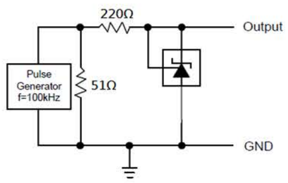


Electrical characteristic curves

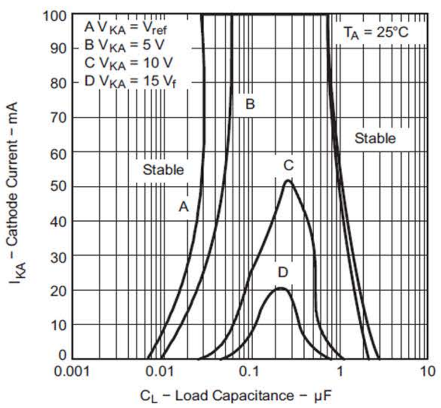




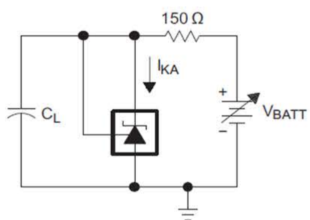




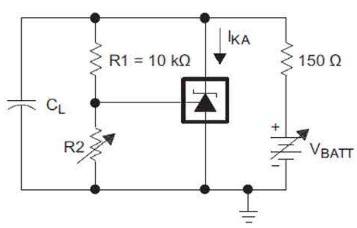
Test Circuit for Pulse Response



The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 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.



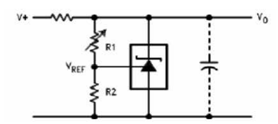
TEST CIRCUIT FOR CURVE A



TEST CIRCUIT FOR CURVES B, C, AND D

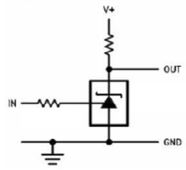
Typical Application

Shunt Regulator



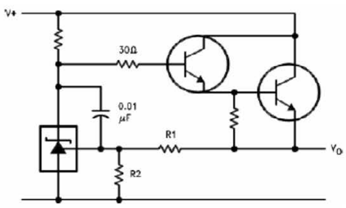
$V_O \approx (1 + \frac{R1}{R2})\, V_{REF}$

Single Supply Comparator with Temperature Compensated Threshold



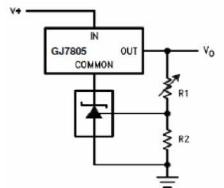
$V_{TH} \approx 2.5V$ $V_{ON} \approx 2V,\ V_{OFF} = V^+$

Series Regulator



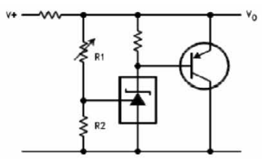
$V_O \approx (1 + \frac{R1}{R2})\, V_{REF}$

Output Control of a Three Terminal Fixed Regulator



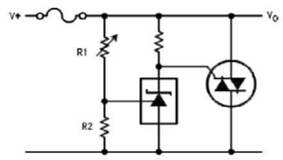
$V_O \approx (1 + \frac{R1}{R2})\, V_{REF}$ $V_{O\ MIN} \approx V_{REF} + 5V$

Higher Current Shunt Regulator



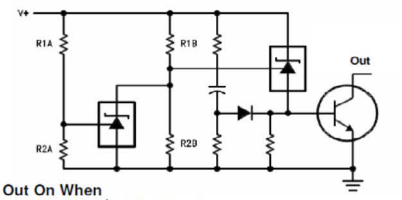
$V_O \approx (1 + \frac{R1}{R2})\, V_{REF}$

Crow Bar



$V_{Limit} \approx (1 + \frac{R1}{R2})\, V_{REF}$

Over Voltage/under Voltage Protection Circuit



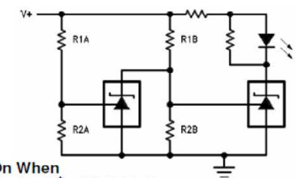
Out On When

Low Limit $< V^+ <$ High Limit

Low Limit $\approx V_{REF}(1 + \frac{R1B}{R2B}) + V_{BE}$

High Limit $\approx V_{REF}(1 + \frac{R1A}{R2A})$

Voltage Monitor



LED On When

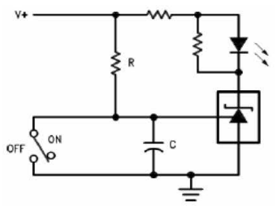
Low Limit $< V^+ <$ High Limit

Low Limit $\approx V_{REF}(1 + \frac{R1B}{R2B})$

High Limit $\approx V_{REF}(1 + \frac{R1A}{R2A})$

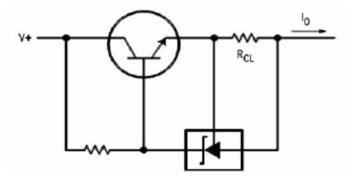
Typical Application

Delay Timer



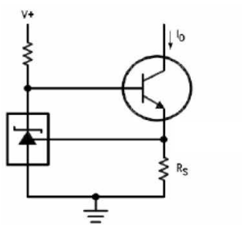
$$\text{Delay} = R \cdot C \cdot \ell n \frac{V^{+}}{(V^{+})\text{-}V_{REF}}$$

Current Limiter or Current Source



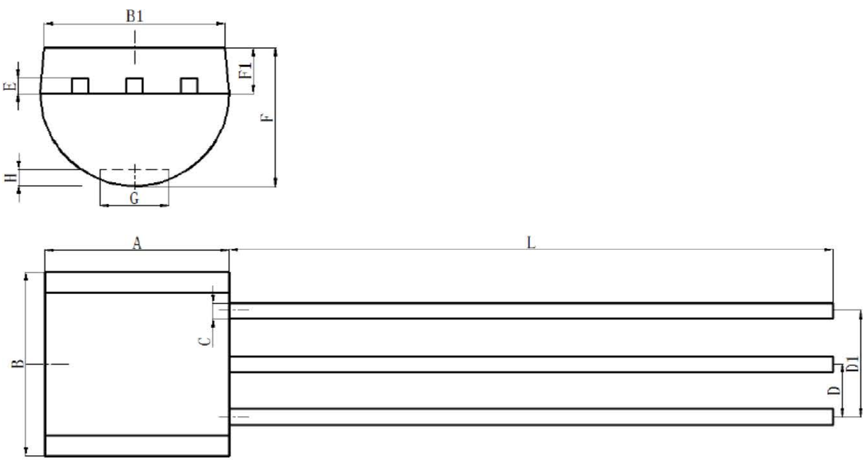
$$I_O = \frac{V_{REF}}{R_{CL}}$$

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, ±0.5%, 150mA, TO-92	H431LKA