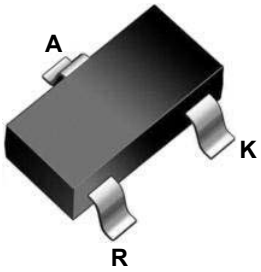
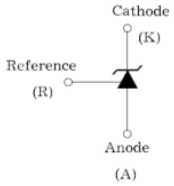
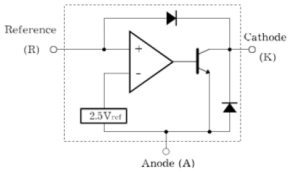
Shunt Regulator Voltage Reference



Symbol



Functional block diagram



RoHS Compliant

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
- SOT-23 packages
- 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 (θ_{JA} = 625°C/W)	0.2	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	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	2.506	V
$V_{REF(dev)}$	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 Voltageto the Change in Cathode Voltage	ΔV_{KA}=10V-V_{REF} ΔV_{KA} = 40V - 10V		0.6 0.4	2.7 2.0	mV/V
I_{REF}	Reference Input Current	R1 = 10KΩ, R2 = ∞		0.2	4	uA
$I_{REF(dev)}$	Deviation of Reference Input Current Over Full Temperature Range	R1 = 10KΩ, R2 = ∞	--	0.4	1.2	
$I_{K(min)}$	Minimum Cathode Current for Regulation			--	0.5	mA
$I_{K(off)}$	Off-State Cathode Current	V_{KA} = 37V, I_{REF} = 0		0.01	0.9	uA
Z_{KA}	Dynamic Impedance	I_K = 1mA to 100 mA , f≤1.0KHz		0.27	0.5	Ω

Test Circuits

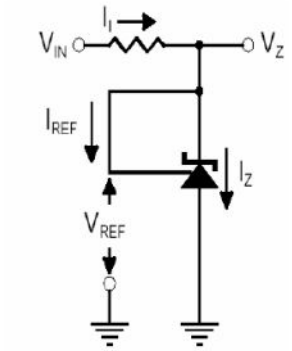


Fig1. Test Circuit for V_Z=V_{REF}

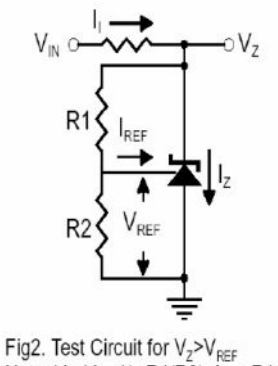


Fig2. Test Circuit for V_Z>V_{REF}
Note: V_Z=V_{REF}(1+R1/R2)+I_{REF}xR1

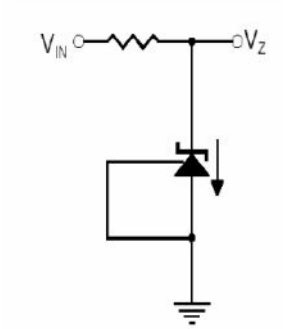
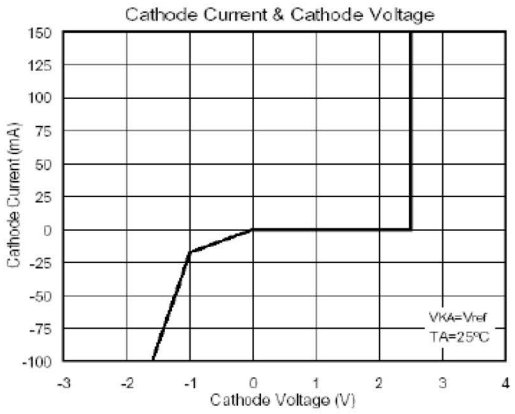
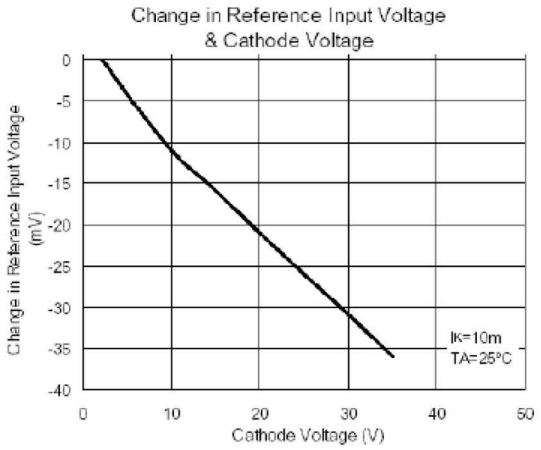
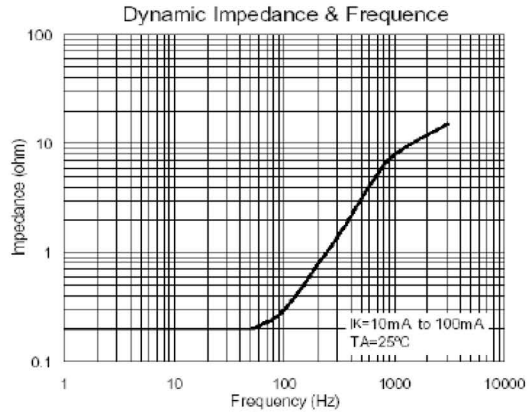


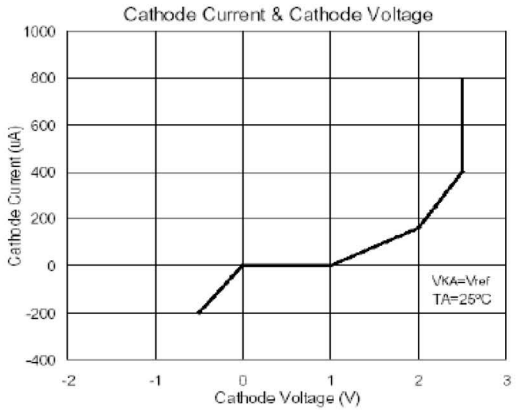
Fig3. Test Circuit for Off-State Current

Electrical characteristic curves

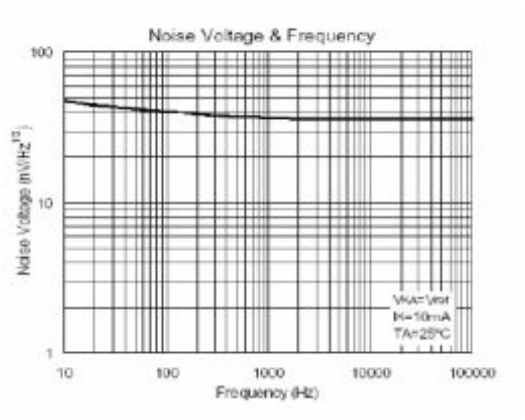


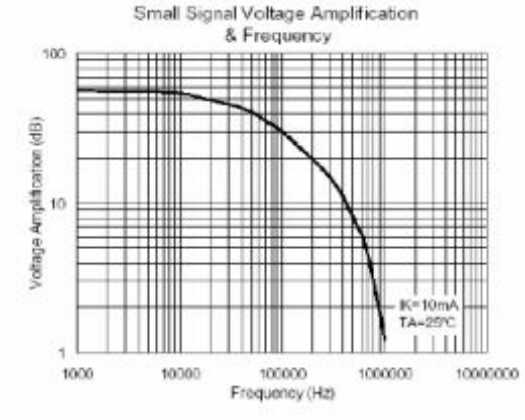


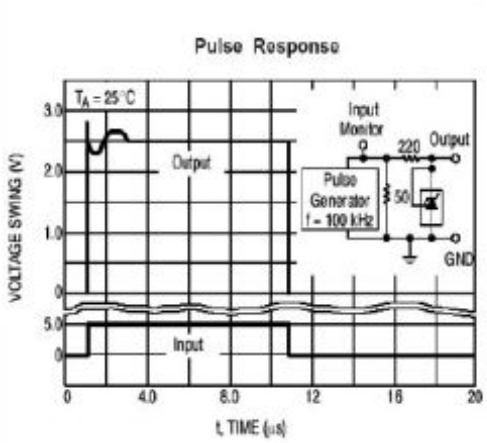




Electrical characteristic curves

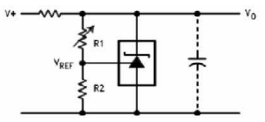






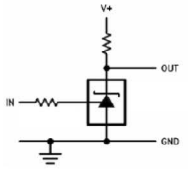
Typical Application

Shunt Regulator



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

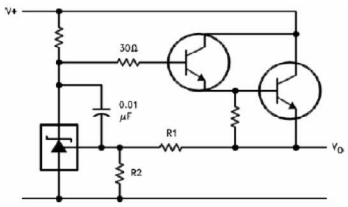
Single Supply Comparator with Temperature Compensated Threshold



$V_{TH} \approx 2.5V$

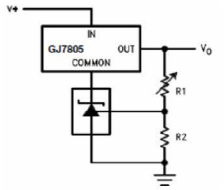
$V_{ON} \approx 2V, V_{OFF} = V^+$

Series Regulator



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

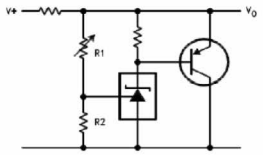
Output Control of a Three Terminal Fixed Regulator



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

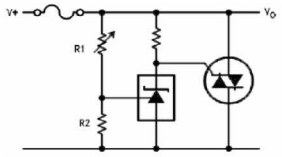
$V_{O\ MIN} \approx V_{REF} + 5V$

Higher Current Shunt Regulator



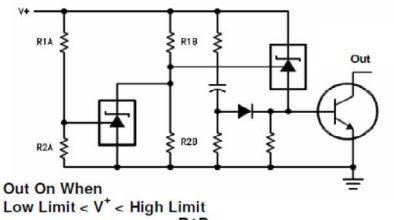
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{REF}$$

Crow Bar



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

Over Voltage/under Voltage Protection Circuit

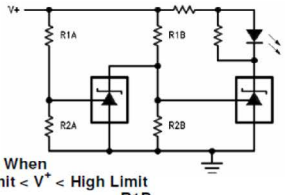


Out On When
Low Limit < V^+ < High Limit

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

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

Voltage Monitor



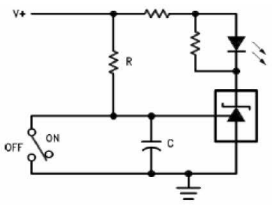
LED On When
Low Limit < V^+ < High Limit

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

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

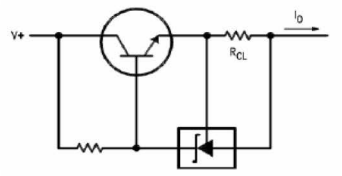
Typical Application

Delay Timer



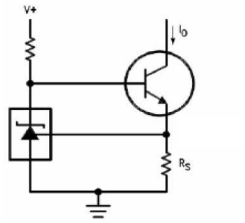
$$\text{Delay} = R \cdot C \cdot \ell n \frac{V^+}{(V^+)-V_{REF}}$$

Current Limiter or Current Source



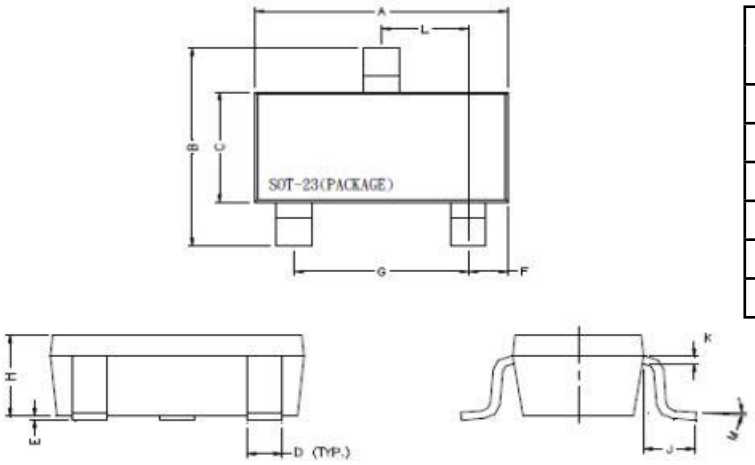
$$Io = \frac{V_{REF}}{R_{CL}}$$

Constant Current Sink



$$Io = \frac{V_{REF}}{R_S}$$

Packaging Dimensions



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	2.7	3.1	G	1.9 REF.	
B	2.4	2.8	H	1	1.3
C	1.4	1.6	K	0.1	0.2
D	0.35	0.5	J	0.4	-
E	0	0.1	L	0.85	1.15
F	0.45	0.55	M	0	10

Dimensions : Millimetres

Part Number Table

Description	Part Number
Voltage Reference, Adjustable, 2.495V, 37V, ±0.5%, 150mA, SOT-23	H431LT