



# H432 Series

Adjustable Shunt Regulator

## Description

The H432 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between  $V_{REF}$  (approximately 1.24 or 1.25 volts) and 30 volts with two external resistors. These devices have a typical dynamic output impedance of  $0.2\Omega$ . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

## Features

- Programmable output voltage
- Temperature coefficient is 50ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response

## Ordering Information

Package	$V_{REF}$ 1.24V±2%	$V_{REF}$ 1.24V±1%	$V_{REF}$ 1.24V±0.5%	$V_{REF}$ 1.25V±2%	$V_{REF}$ 1.25V±1%	$V_{REF}$ 1.25V±0.5%
SOT-23	H432AN	H432BN	H432CN	H432DN	H432EN	H432FN
SOT-89	H432AM	H432BM	H432CM	H432DM	H432EM	H432FM
TO-92	H432AA	H432BA	H432CA	H432DA	H432EA	H432FA

## Absolute Maximum Ratings

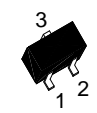
(Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	$V_{KA}$	30	V
Cathode Current Range (Continuous)	$I_K$	50	mA
Reference Input Current Range	$I_{REF}$	0.05~+10	mA
Power Dissipation	$P_D$	SOT-23	280
		SOT-89	770
		TO-92	770
Operating Temperature Range	$T_{opr}$	-25~+85	°C
Junction Temperature	$T_J$	150	°C
Storage Temperature Range	$T_{stg}$	-65~+150	°C

## Operating Conditions

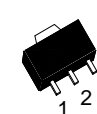
Characteristics	Symbol	Min.	Typ.	Max.	Unit
Cathode Voltage	$V_{KA}$	$V_{REF}$	-	30	V
Cathode Current Range (Continuous)	$I_K$	1	10	-	mA

**H432 Series Pin Assignment**



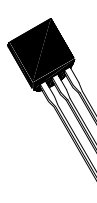
3  
1 2

3-Lead Plastic **SOT-23**  
 Package Code: N  
 Pin 1: Reference  
 Pin 2: Cathode  
 Pin 3: Anode



1 2 3

3-Lead Plastic **SOT-89**  
 Package Code: M  
 Pin 1: Reference  
 Pin 2: Anode  
 Pin 3: Cathode

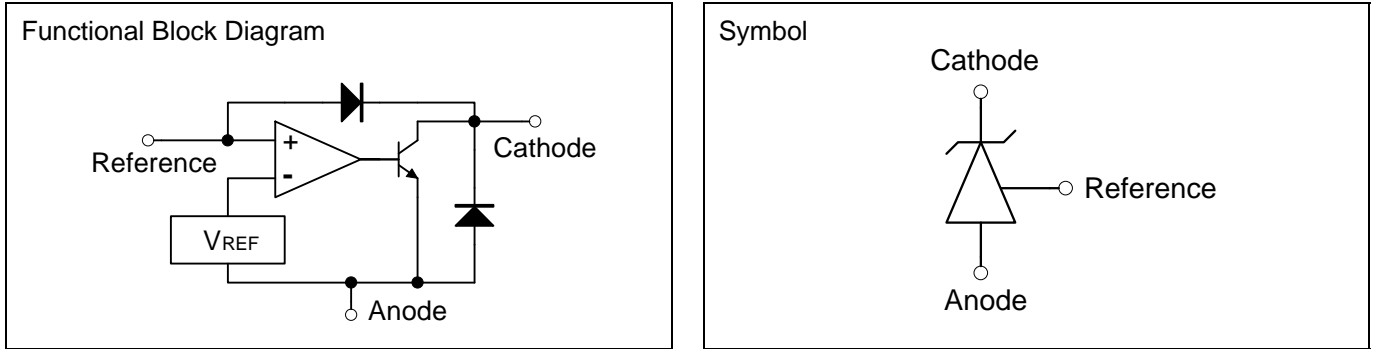


1 2 3

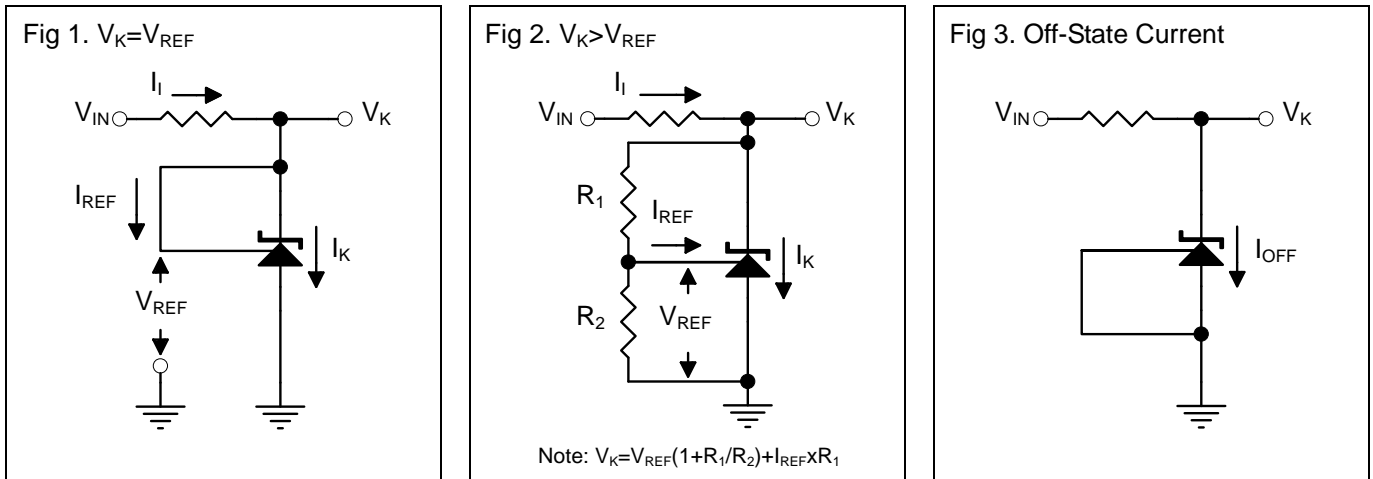
3-Lead Plastic **TO-92**  
 Package Code: A  
 Pin 1: Reference  
 Pin 2: Anode  
 Pin 3: Cathode



### Functional Block Diagram & Symbol



### Test Circuits

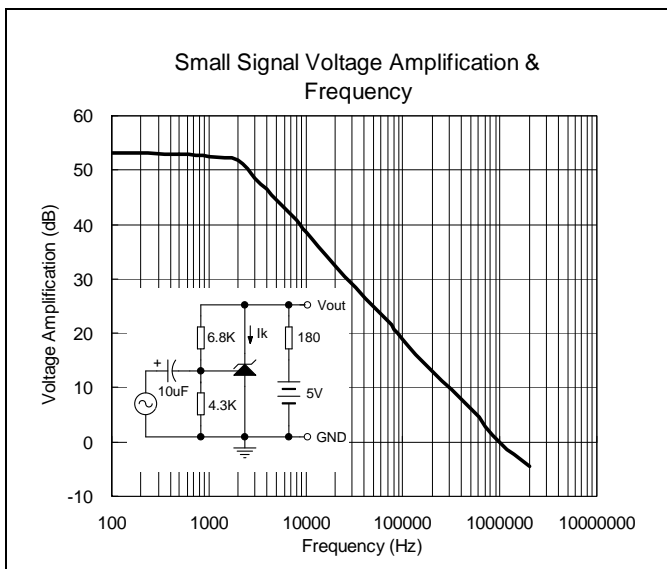
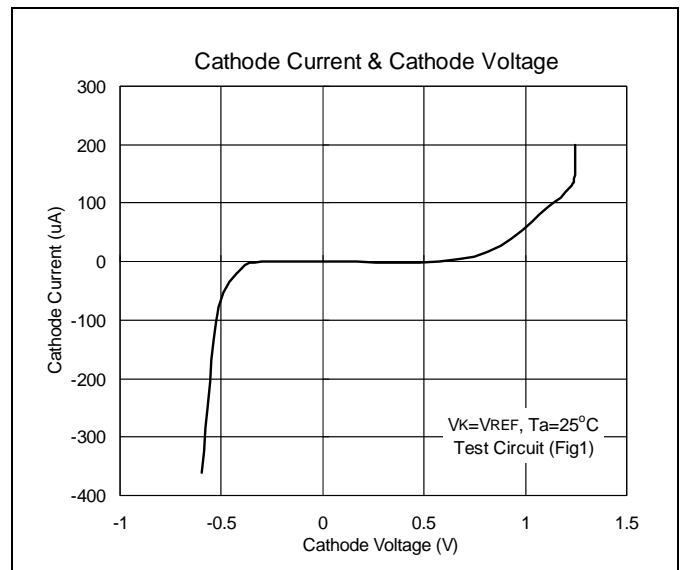
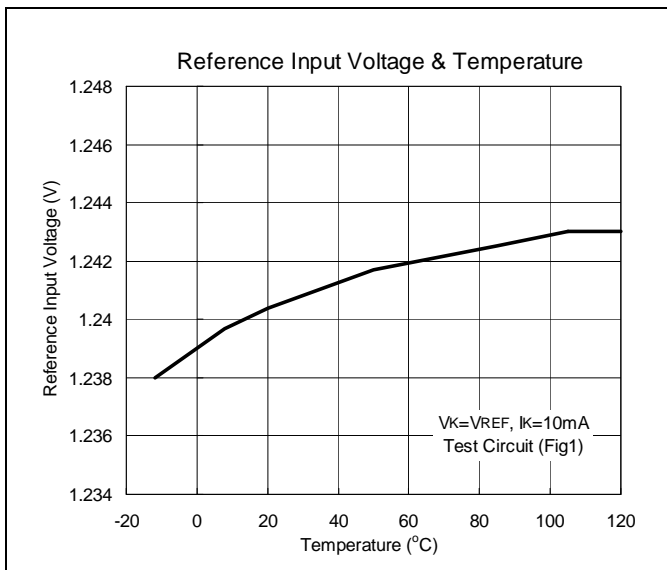
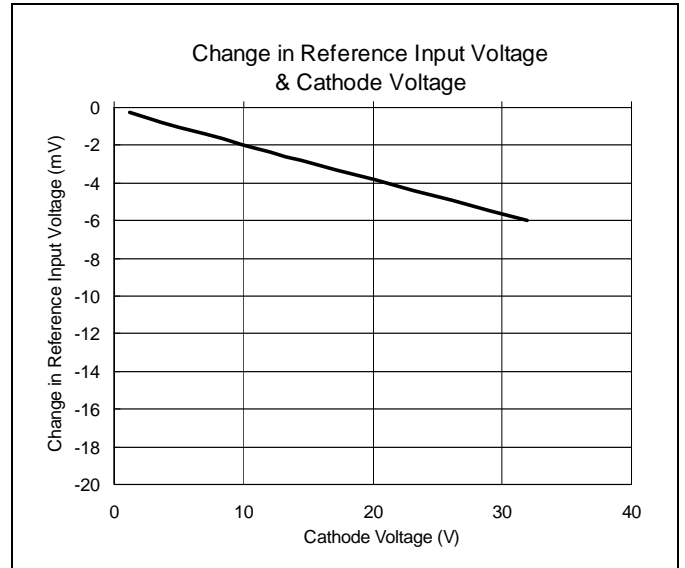
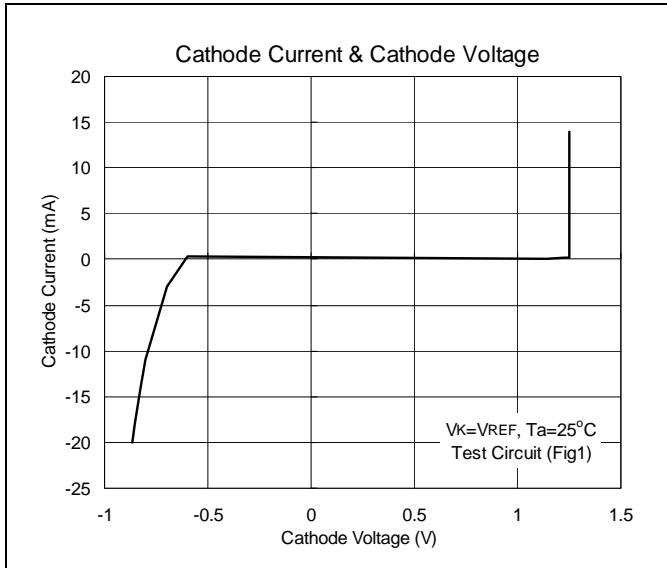


### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

Characteristics		Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage (Fig1)	H432AN/AM/AA	$V_{REF}$	$V_K = V_{REF}, I_K = 10\text{mA}$	1.215	1.24	1.265	V
	H432BN/BM/BA			1.228	1.24	1.252	
	H432CA/CM/CA			1.234	1.24	1.246	
	H432DN/DM/DA			1.225	1.25	1.275	
	H432EN/EM/EA			1.238	1.25	1.262	
	H432FN/FM/FA			1.244	1.25	1.256	
Deviation of Reference Input Voltage Over-Temperature (Fig1)		$V_{REF(\text{dev})}$	$V_K = V_{REF}, I_K = 10\text{mA}$ $T_{\text{min}} \leq T_a \leq T_{\text{max}}$	-	4	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage (Fig2)		$\Delta V_{REF} / \Delta V_K$	$I_K = 10\text{mA}, \Delta V_K = 10\text{V to } V_{REF}$	-	-1.4	-2.7	mV/V
			$I_K = 10\text{mA}, \Delta V_K = 30\text{V to } 10\text{V}$	-	-1	-2	mV/V
Reference Input Current (Fig2)		$I_{REF}$	$I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$	-	1	4	$\mu\text{A}$
Deviation of Reference Input Current Over Full Temperature Range (Fig2)		$I_{REF(\text{dev})}$	$I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty, T_a = \text{Full Range}$	-	0.4	1.2	$\mu\text{A}$
Minimum Cathode Current for Regulation (Fig1)		$I_{K(\text{min})}$	$V_K = V_{REF}$	-	0.4	1	mA
Off-State Cathode Current (Fig3)		$I_{K(\text{off})}$	$V_K = 30\text{V}, V_{REF} = 0$	-	0.1	1	$\mu\text{A}$



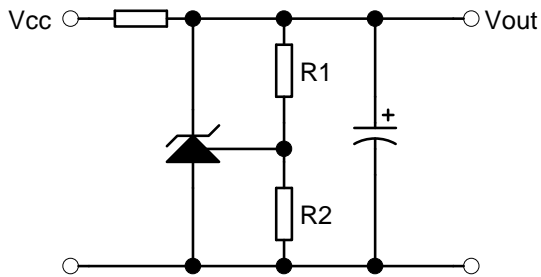
### Characteristics Curve





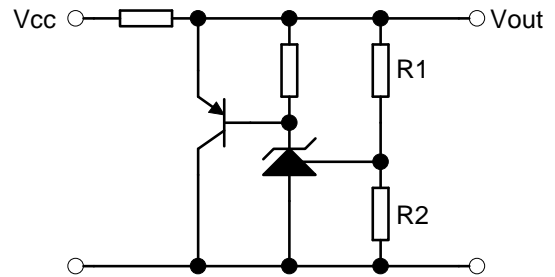
**Typical Application**

Fig 4. Shunt Regulator



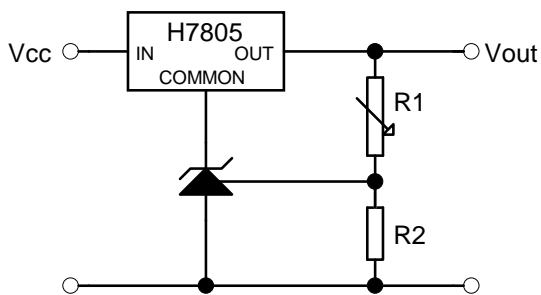
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 5. High Current Shunt Regulator



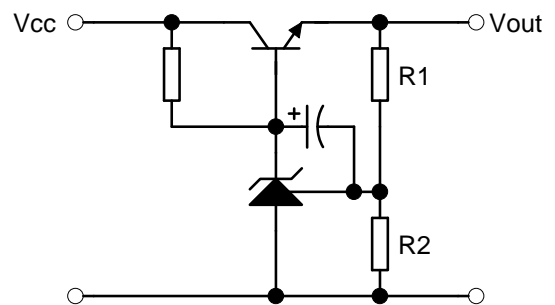
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 6. Output Control of a Three-Terminal Fixed Regulator



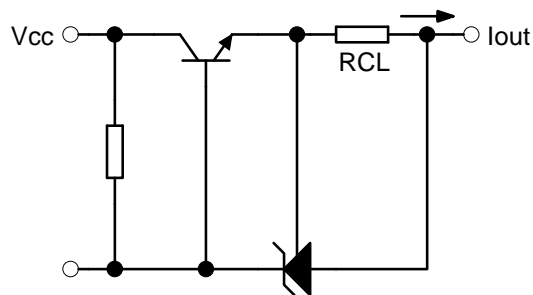
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + 5V$$

Fig 7. Series Pass Regulator



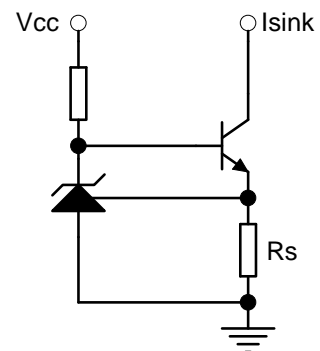
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + V_{BE}$$

Fig 8. Current Limiter or Current Source



$$I_{out} = V_{REF}/R_{CL}$$

Fig 9. Constant Current Sink



$$I_{sink} = V_{REF}/R_s$$



### SOT-89 Dimension

**Marking:**

Date Code      Control Code

HSMC Logo → H 4 3 2      Pb Free Mark  
 Pb-Free: "●" (Note)  
 Normal: None

Note: Green label is used for pb-free packing

Pin Style: 1.Reference 2.Anode 3.Cathode

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	4.40	4.60
B	4.05	4.25
C	1.50	1.70
D	2.40	2.60
E	0.36	0.51
F	*1.50	-
G	*3.00	-
H	1.40	1.60
I	0.35	0.41

\*: Typical, Unit: mm

3-Lead SOT-89 Plastic Surface Mounted Package  
HSMC Package Code: M

### TO-92 Dimension

**Marking:**

Pb Free Mark  
 Pb-Free: "●" (Note)  
 Normal: None

Date Code      Control Code

Note: Green label is used for pb-free packing

Pin Style: 1.Reference 2.Anode 3.Cathode

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	4.33	4.83
B	4.33	4.83
C	12.70	-
D	0.36	0.56
E	-	*1.27
F	3.36	3.76
G	0.36	0.56
H	-	*2.54
I	-	*1.27
$\alpha 1$	-	*5°
$\alpha 2$	-	*2°
$\alpha 3$	-	*2°

\*: Typical, Unit: mm

3-Lead TO-92 Plastic Package  
HSMC Package Code: A



### SOT-23 Dimension

Marking:

Pb Free Mark  
 Pb-Free: \* (Note)  
 Normal: None

Note: Pb-free product can distinguish by the green label or the extra description on the right side of the label.

Pin Style: 1.Reference 2.Cathode 3.Anode

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	2.80	3.04
B	1.20	1.60
C	0.89	1.30
D	0.30	0.50
G	1.70	2.30
H	0.013	0.10
J	0.085	0.177
K	0.32	0.67
L	0.85	1.15
S	2.10	2.75
V	0.25	0.65

\*: Typical, Unit: mm

3-Lead SOT-23 Plastic  
 Surface Mounted Package  
 HSMC Package Code: N

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