

Precision Adjustable Shunt Regulator

MM1431 Series

Outline

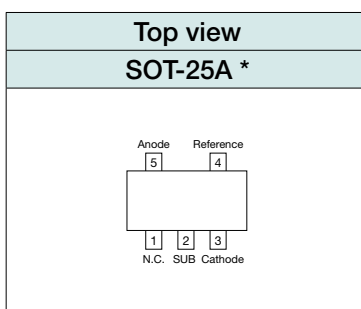
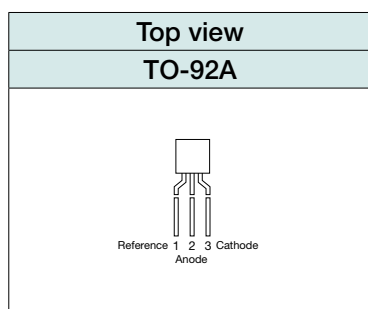
This IC is 3-terminal adjustable shunt regulator, which provides a highly accurate 0.8% bandgap reference voltage. The output voltage can be adjusted to any value between reference voltage V_{REF} and 35V with two external resistors. Moreover, there are a lot of ranges of the application as a zener diode besides the replacement is possible because it has steep turn-on characteristics.

Features

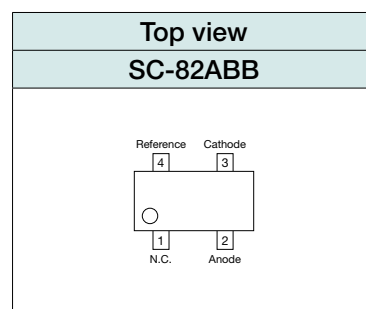
(Unless otherwise specified, $T_{opr}=+25^{\circ}\text{C}$)

- | | |
|--|--|
| (1) Reference voltage tolerance | $V_{REF}=2.495\text{V}\pm 0.8\%$ |
| (2) Output voltage can be adjusted | $V_{REF}\leq V_o\leq 35\text{V}$ |
| (3) Low Dynamic Output Impedance | $ Z_{KA} \leq 0.2\Omega$ typ. |
| (4) Specifications | |
| ● Operating Temperature | $-30\sim +85^{\circ}\text{C}$ |
| ● Cathode to Anode voltage | V_{KA} $V_{REF}\sim 35\text{V}$ |
| ● Cathode current | I_K $0.6\sim 50\text{mA}$ |
| ● Reference voltage | V_{REF} $2.495\text{V}\pm 0.8\%$ |
| ● Reference voltage deviation over temperature range | $\pm 10\text{mV}$ ($V_{KA}=V_{REF}$, $I_K=10\text{mA}$ $T_a=-30\sim +85^{\circ}\text{C}$) |
| ● Minimum Cathode Current | $I_{Kmin.}$ 0.6mA max. |
| ● Off-state Cathode Current | $I_{OFF.}$ $0.1\mu\text{A typ.}$ |

Pin Assignment



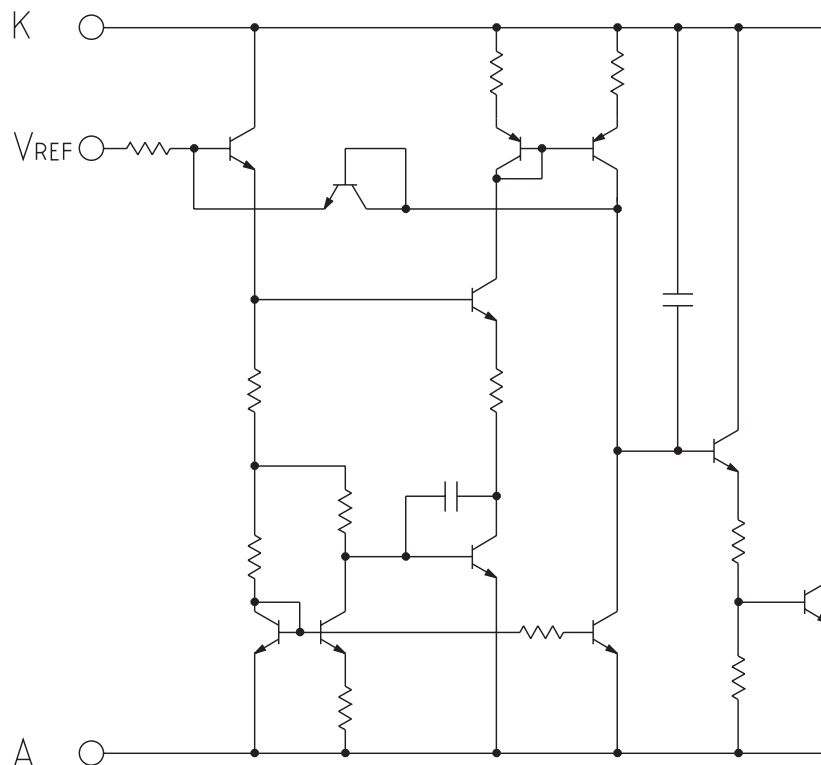
* note : The second terminal is SUB, so connect the terminal to GND.



Product list

Packages	Parts no.	Reference voltage	Cathode current	Dynamic impedance
TO-92A (BULK)	MM1431AT	$2.495\text{V}\pm 0.8\%$	$0.6\sim 50\text{mA}$	0.2Ω typ. / 0.5Ω Max
TO-92A (TAPING)	MM1431ATT	$2.495\text{V}\pm 0.8\%$	$0.6\sim 50\text{mA}$	0.2Ω typ. / 0.5Ω Max
SOT-25A	MM1431ANRE	$2.495\text{V}\pm 0.8\%$	$0.6\sim 50\text{mA}$	0.2Ω typ. / 0.5Ω Max
SC-82ABB	MM1431CURE	$2.495\text{V}\pm 0.8\%$	$0.6\sim 50\text{mA}$	0.2Ω typ. / 0.8Ω Max
SC-82ABB	MM1431DURE	$2.495\text{V}\pm 0.4\%$	$0.6\sim 50\text{mA}$	0.2Ω typ. / 0.8Ω Max

Equivalent Circuit Diagram



Absolute Maximum Ratings (Ambient Temperature, $T_a=25^\circ\text{C}$)

Item	Symbol	Ratings	Unit
Operating Temperature	T_{OPR}	$-30\sim+85$	$^\circ\text{C}$
Storage Temperature	T_{STG}	$-40\sim+125$	$^\circ\text{C}$
Cathode to Anode voltage	V_{KA}	35	V
Cathode current	I_K	$-100\sim100$	mA
Reference input current	I_{REF}	$-0.05\sim10$	mA
Allowable loss	P_d	550 (TO-92) 150 (SOT-25A)	mW

Recommended Operating Conditions (Ambient Temperature, $T_a=25^\circ\text{C}$)

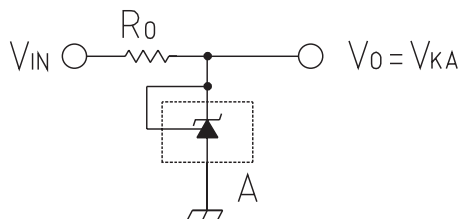
Cathode to Anode voltage	V_{KA}	$V_{REF}\sim35$	V
Cathode current	I_K	0.6~50	mA

Electrical Characteristics (Ambient Temperature, Ta=25°C)

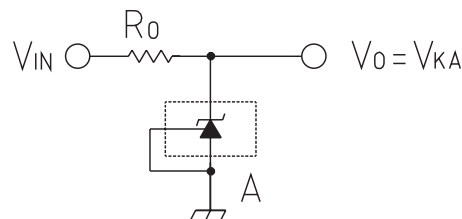
Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Reference voltage	V_{REF}	$V_{KA}=V_{REF}, I_K=10mA$	2.475	2.495	2.515	V
Reference voltage deviation over temperature range	$\Delta V_{REF}/\Delta T_a$	$V_{KA}=V_{REF}, I_K=10mA, T_a=-30\sim+85^\circ C$		± 10		mV
Load regulation	ΔV_{REF}	$\Delta V_{KA}=V_{REF}\sim 10V, I_K=10mA$		-1.4	-2.7	mV/V
	ΔV_{KA}	$\Delta V_{KA}=10V\sim 35V, I_K=10mA$		-1	-2	mV/V
Reference input current	I_{REF}	$I_K=10mA, R_1=10K, R_2=\infty$		1	4	μA
Reference input current deviation over temperature range	$\Delta I_{REF}/\Delta T_a$	$I_K=10mA, R_1=10K, R_2=\infty, T_a=-30\sim+85^\circ C$		± 0.5		μA
Minimum Cathode Current	$I_{Kmin.}$	$V_{KA}=V_{REF}$		0.3	0.6	mA
Off-state Cathode Current	I_{OFF}	$V_{KA}=35V, V_{REF}=0V$		0.1	1.0	μA
Dynamic Impedance	$ Z_{KA} $	$V_{KA}=V_{REF}, f \leq 1kHz, I_K=1\sim 50mA$		0.2	0.5	Ω

Measuring Circuit

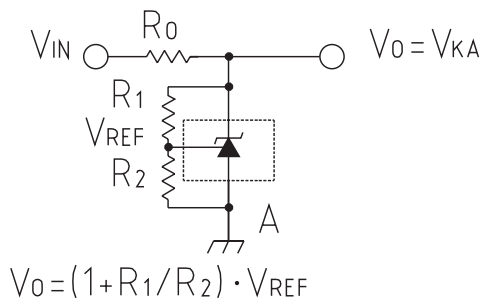
(1) $V_{KA}=V_{REF}$



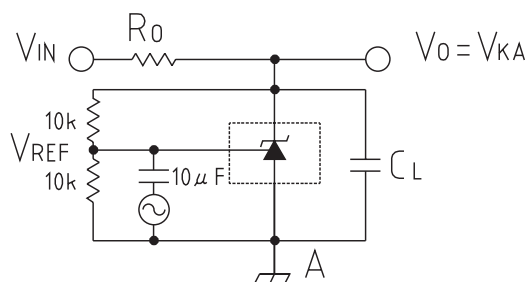
(3) I_{OFF}



(2) $V_{KA} \geq V_{REF}$ $V_0=V_{KA}=V_{REF}$

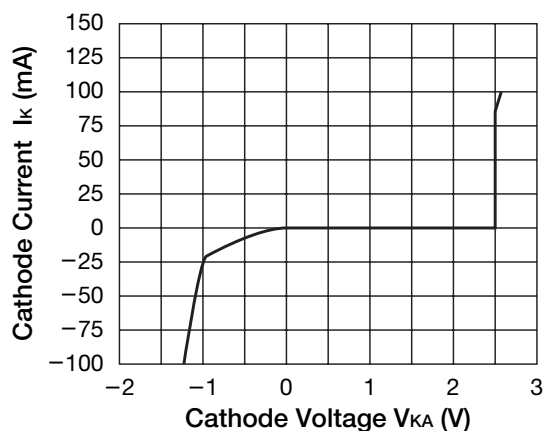


(4) Open Loop Voltage Gain

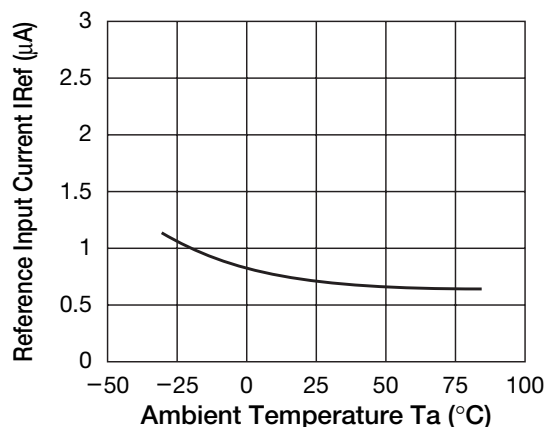


Characteristics

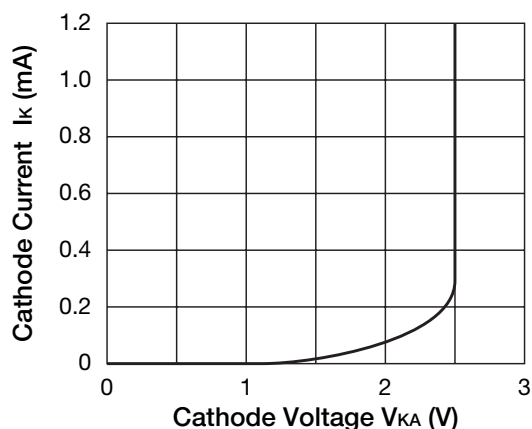
High Voltage Operating Characteristics



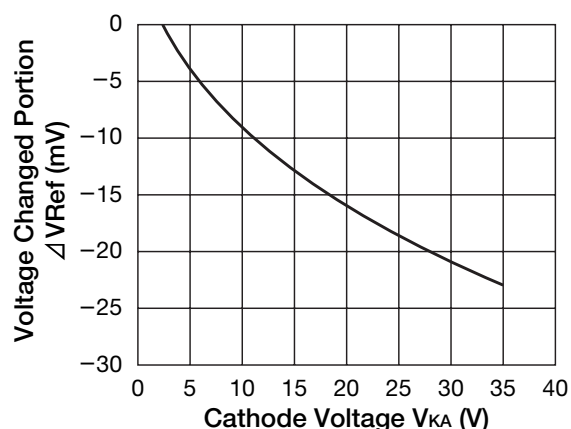
Reference Input Current



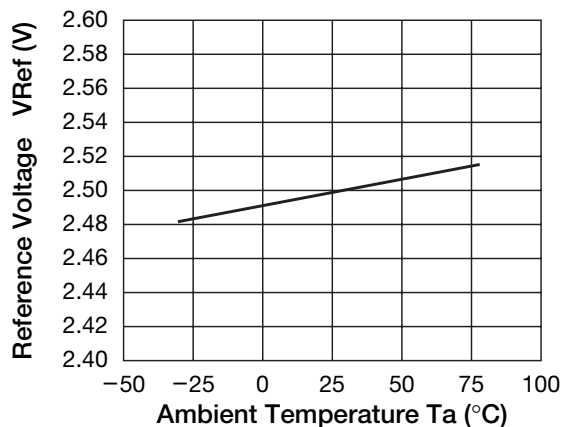
Low Current Operating Characteristics



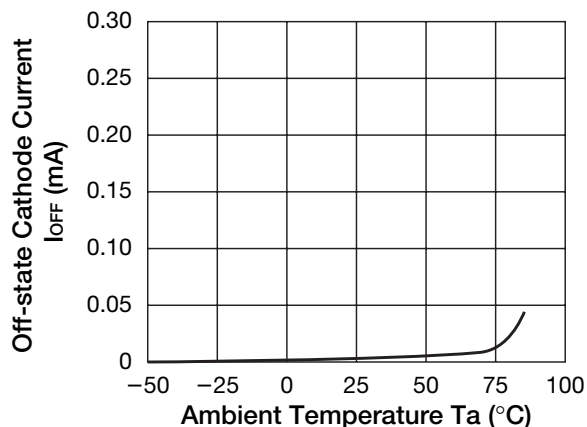
Reference Voltage



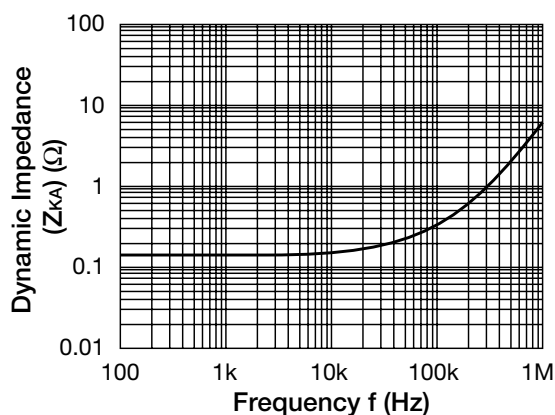
Reference Voltage



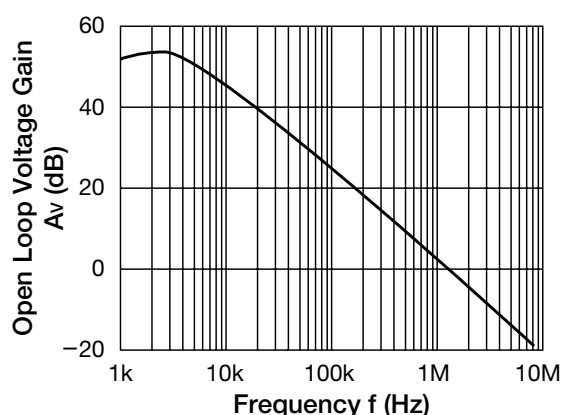
Off State Leakage



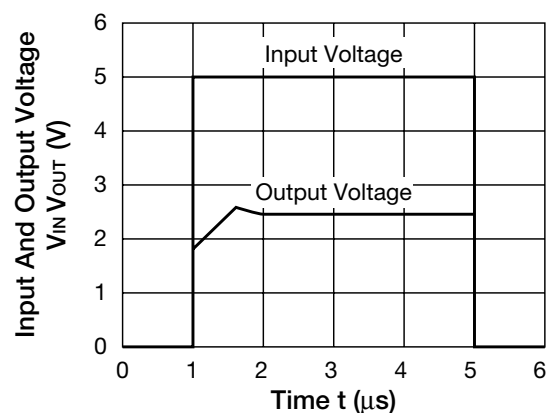
■ Dynamic Output Impedance



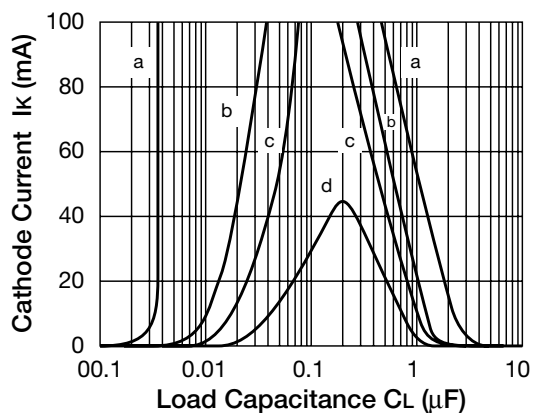
■ Open loop Voltage Gain $V_{KA}=5V$



■ Pulse Response



■ Stability Boundary Conditions



a: $V_{KA}=V_{REF}$ b: $V_{KA}=5V$ c: $V_{KA}=10V$

d: $V_{KA}=15V$

Cathode voltage temperature $T_a=25^\circ C$

$I_{KA}=10mA$ C_L : Ceramic capacitor

Notes concerning stability operation region

The MM1431AT/AN requires external capacitors for regulator stability. These capacitors must be correctly selected for good performance.