

Precision Adjustable Shunt Regulator MM1431 Series

Outline

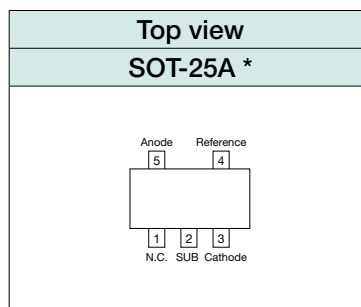
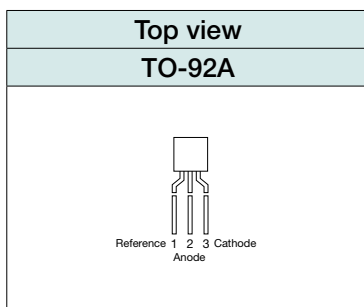
This IC is 3-terminal adjustable shunt regulator, which provides a highly accurate 0.8% bandgap reference voltage. The output voltage can be adjusted to any value between reference voltage V_{REF} and 35V with two external resistors. Moreover, there are a lot of ranges of the application as a zener diode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

Features

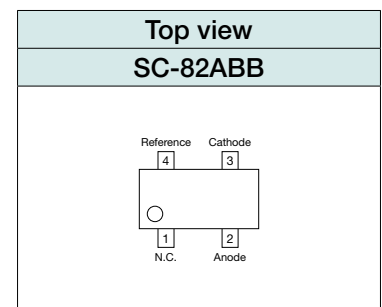
(Unless otherwise specified, $T_{opr}=+25^{\circ}C$)

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

Pin Assignment



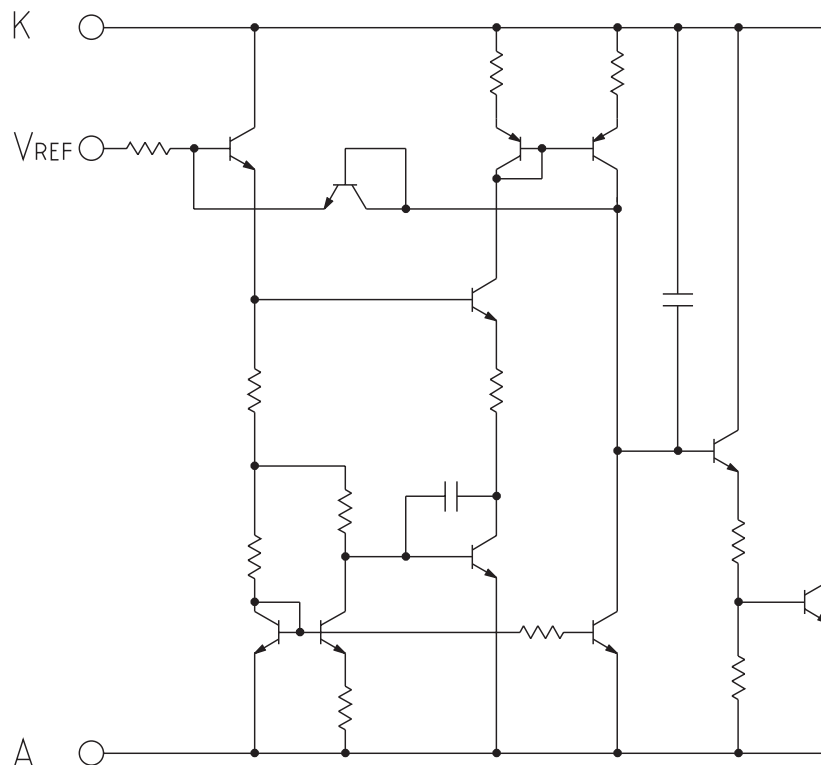
* note : The second terminal is SUB, so connect the terminal to GND.



Product list

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

Equivalent Circuit Diagram



Absolute Maximum Ratings (Ambient Temperature, Ta=25°C)

| Item | Symbol | Ratings | Unit |
|--------------------------|------------------|------------------------------|------|
| Operating Temperature | T _{OPR} | -30~+85 | °C |
| Storage Temperature | T _{STG} | -40~+125 | °C |
| Cathode to Anode voltage | V _{KA} | 35 | V |
| Cathode current | I _K | -100~100 | mA |
| Reference input current | I _{REF} | -0.05~10 | mA |
| Allowable loss | P _d | 550 (TO-92) 150 (SOT-25A) | mW |

Recommended Operating Conditions (Ambient Temperature, Ta=25°C)

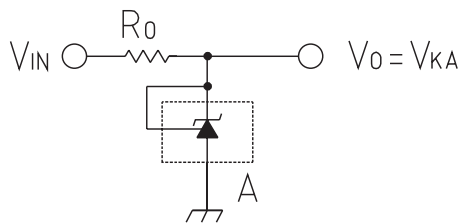
| | | | |
|--------------------------|-----------------|----------------------|----|
| Cathode to Anode voltage | V _{KA} | V _{REF} ~35 | V |
| Cathode current | I _K | 0.6~50 | mA |

Electrical Characteristics (Ambient Temperature, $T_a=25^\circ\text{C}$)

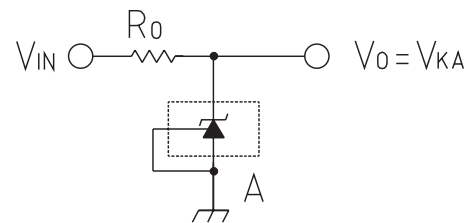
| Item | Symbol | Measurement conditions | Min. | Typ. | Max. | Unit |
|--|--------------------------------|--|-------|-----------|-------|---------------|
| Reference voltage | V_{REF} | $V_{KA}=V_{REF}, I_K=10\text{mA}$ | 2.475 | 2.495 | 2.515 | V |
| Reference voltage deviation over temperature range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

Measuring Circuit

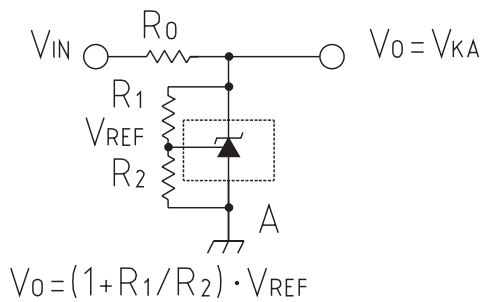
(1) $V_{KA}=V_{REF}$



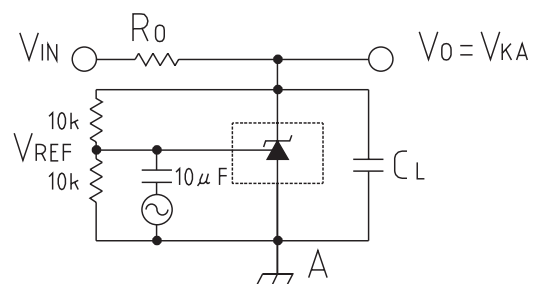
(3) I_{OFF}



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

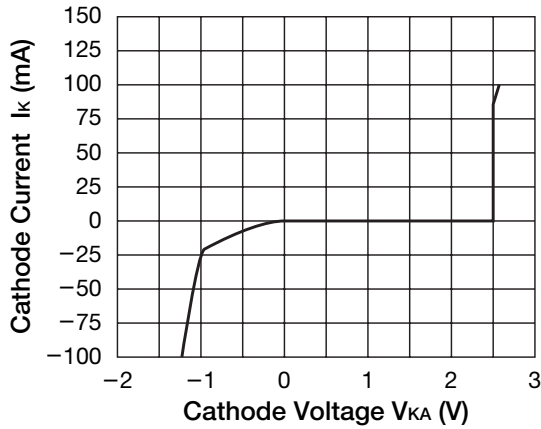


(4) Open Loop Voltage Gain

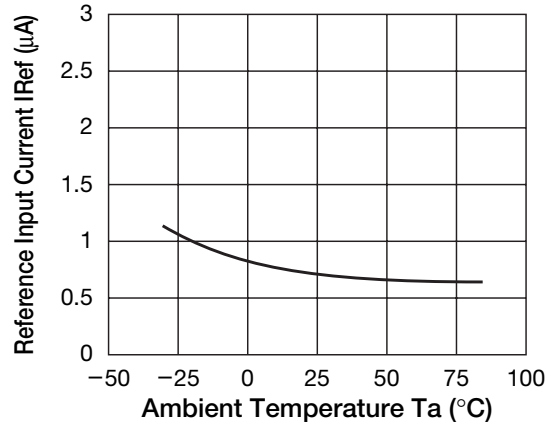


Characteristics

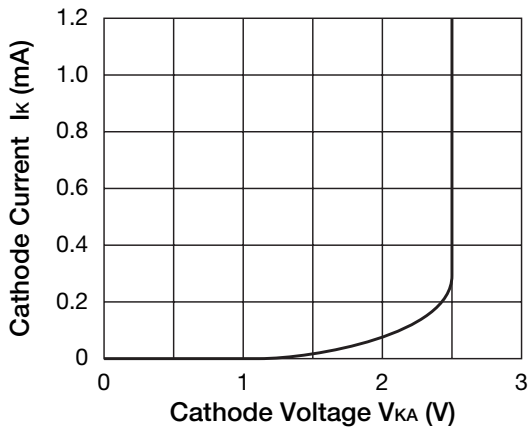
High Voltage Operating Characteristics



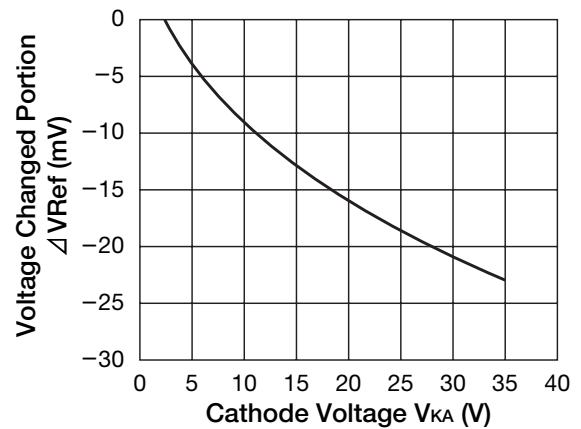
Reference Input Current



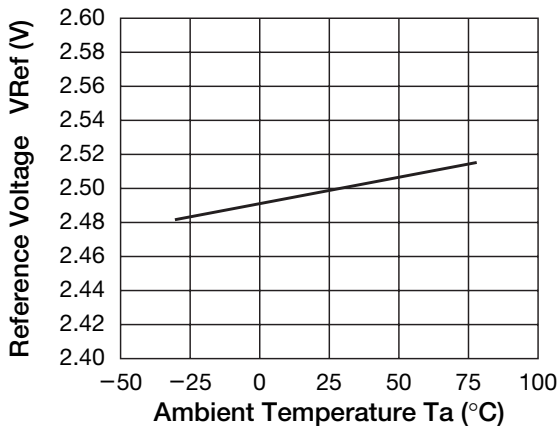
Low Current Operating Characteristics



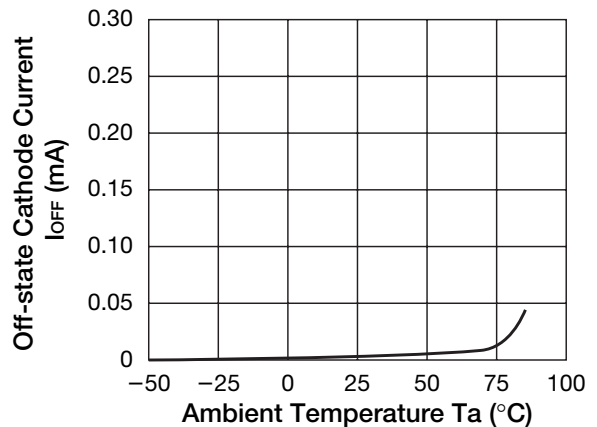
Reference Voltage



Reference Voltage

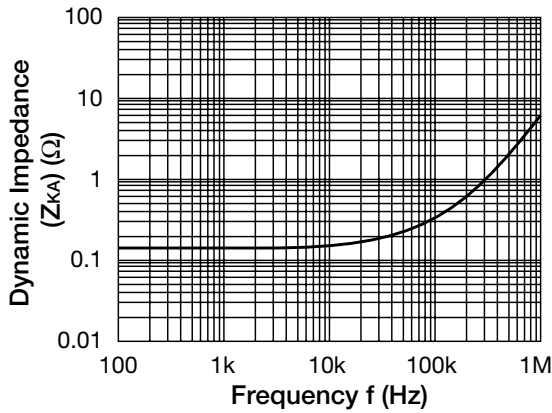


Off State Leakage

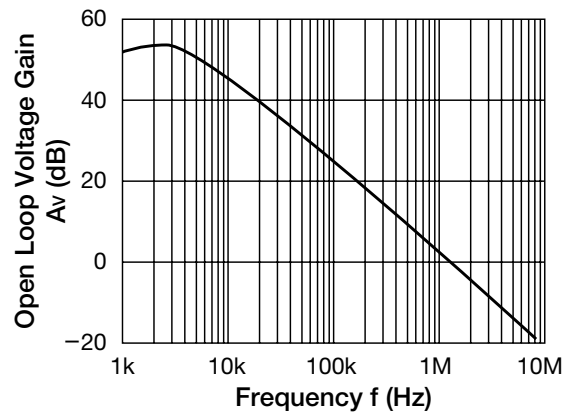


• Any products mentioned in this catalog are subject to any modification in their appearance and others for improvements without prior notification.
 • The details listed here are not a guarantee of the individual products at the time of ordering. When using the products, you will be asked to check their specifications.

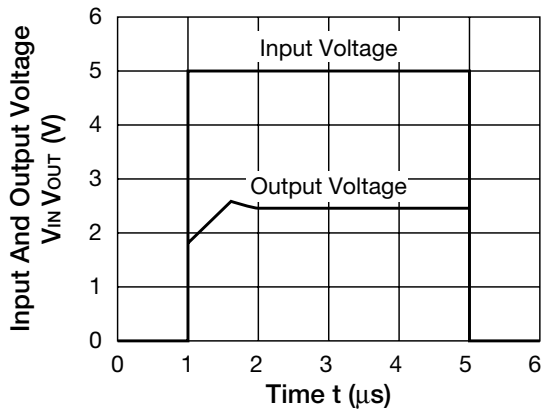
■ Dynamic Output Impedance



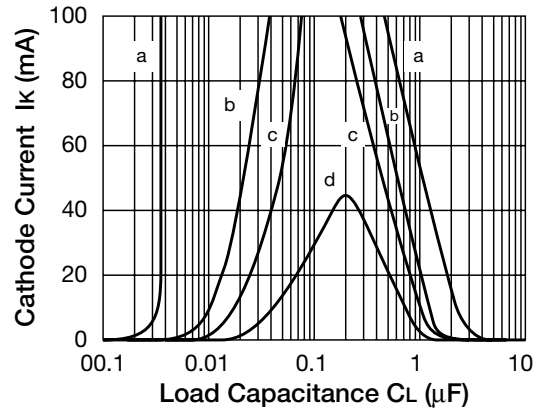
■ Open loop Voltage Gain $V_{KA}=5V$



■ 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.