# UTC TL431A LINEAR INTEGRATED CIRCUIT

## PROGRAMMABLE PRECISION REFERENCE

### DESCRIPTION

The UTC TL431A is a three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between Vref(approximately 2.5V) and 36V with two external resistors. It provides very wide applications, including shunt regulator, series regulator, switching regulator, voltage reference and others.

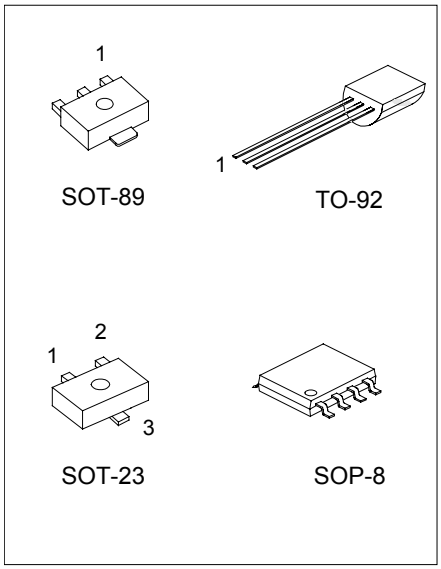
### FEATURES

*Programmable output Voltage to 36V.

*Low dynamic output impedance 0.2Ω.

*Sink current capability of 1 to 100mA.

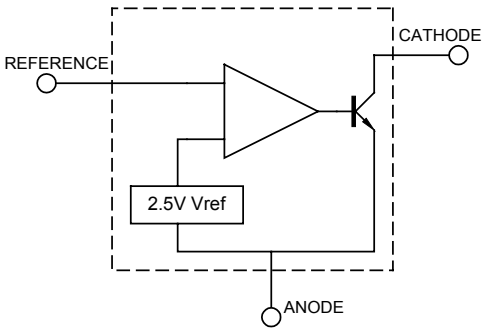
*Equivalent full-range temperature coefficient of 50ppm/ °C typical for operation over full rated operating temperature range.

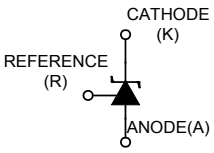



SOP-8 1: Cathode 2,3,6,7: Anode 8: Ref. 4,5: N.C.
TO-92 1: Ref ; 2: Anode; 3: Cathode
SOT-89 1: Ref ; 2: Anode; 3: Cathode
SOT-23 1: Cathode; 2: Ref; 3: Anode

*Pb-free plating product number: TL431AK

### BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified))

| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | 37 | V |
| Cathode Current Range(Continuous) | $I_{KA}$ | -100 ~ +150 | mA |
| Reference Input Current Range | Iref | -0.05 ~ +10 | mA |
| Operating Junction Temperature | Tj | 150 | °C |
| Operating Ambient Temperature | Topr | -40 ~ +85 | °C |
| Storage Temperature Temperature | Tstg | -65 ~ +150 | °C |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | $V_{REF}$ | | 36 | V |
| Cathode Current | $I_{KA}$ | 1 | | 100 | mA |

## ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Reference Input Voltage | Vref | $V_{KA}=V_{REF}, I_{KA}=10mA$ | | 2.483 | 2.495 | 2.507 | V |
| Deviation of reference Input Voltage Over temperature(note 1) | $\Delta Vref/\Delta T$ | $V_{KA}=V_{REF}, I_{KA}=10mA$<br>$T_{MIN}<=T_A<=T_{MAX}$ | | | 4.5 | 17 | mV |
| Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage | $\Delta Vref/\Delta V_{KA}$ | $I_{KA}=10mA$ | $\Delta V_{KA}=10V\sim V_{REF}$<br>$\Delta V_{KA}=36V\sim 10V$ | | -1.0<br>-0.5 | -2.7<br>-2.0 | mV/V |
| Reference Input Current | Iref | $I_{KA}=10mA, R1=10k\Omega, R2=\infty$ | | | 1.5 | 4 | μA |
| Deviation of Reference Input Current Over Full Temperature Range | $\Delta Iref/\Delta T$ | $I_{KA}=10mA, R1=10k\Omega, R2=\infty$<br>$T_A$=full Temperature | | | 0.4 | 1.2 | μA |
| Minimum Cathode Current for Regulation | $I_{KA}(min)$ | $V_{KA}=V_{REF}$ | | | 0.45 | 1.0 | mA |
| Off-State Cathode Current | $I_{KA}(OFF)$ | $V_{KA}=36V, V_{REF}=0$ | | | 0.05 | 1.0 | μA |
| Dynamic Impedance | $Z_{KA}$ | $V_{KA}=V_{REF}$, $I_{KA}$=1 to 100mA<br>f≤1.0kHz | | | 0.15 | 0.5 | Ω |

Note: $T_{MIN}$=0°C, $T_{MAX}$=+70°C

## TYPICAL PERFORMANCE CHARACTERISTICS

Fig 1 Cathode Current Vs Cathode Voltage

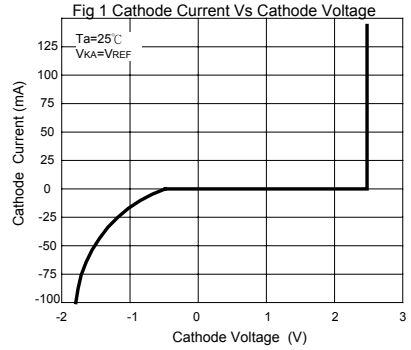



Fig 2 Cathode Current Vs Cathode Voltage

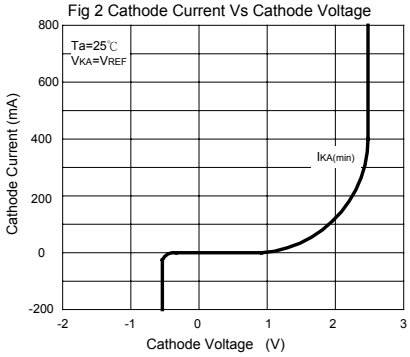



Fig 3 Change in Reference Input Voltage Vs Cathode voltage

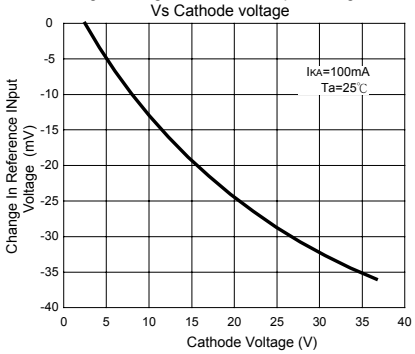



Fig 4 Pulse Response

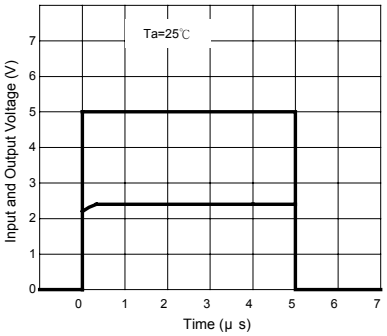



Fig 5 Dynamic Impedance Vs Frequency

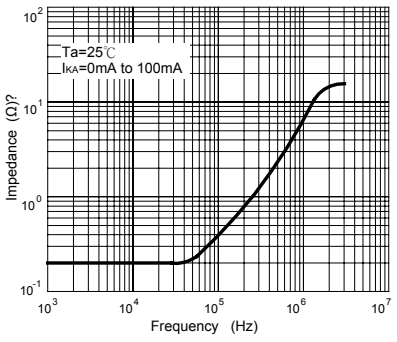
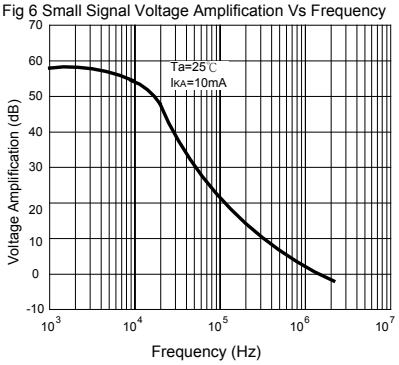



Fig 6 Small Signal Voltage Amplification Vs Frequency



## TEST CIRCUIT

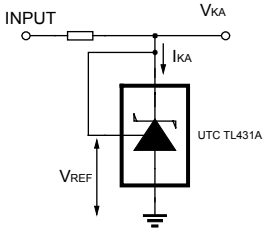



Fig 7 Test Circuit For $V_{KA}=V_{REF}$

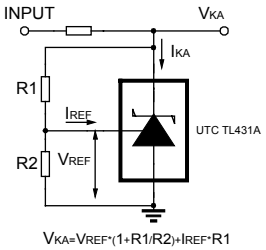



Fig 8 Test Circuit for $V_{KA} >= V_{REF}$

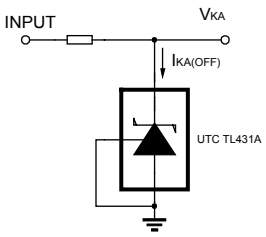



Fig 9 Test Circuit For $I_{KA(OFF)}$

## APPLICATION CIRCUIT

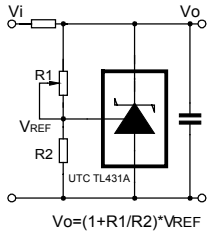



Fig 10 Shutdown Regulator

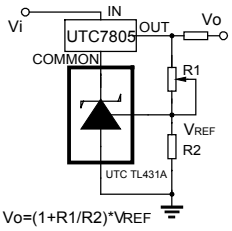



Fig 11 Output Control of a Three -Terminal Fixed Regulator

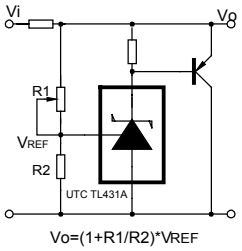



Fig 12 Higher-current Shunt Regulator

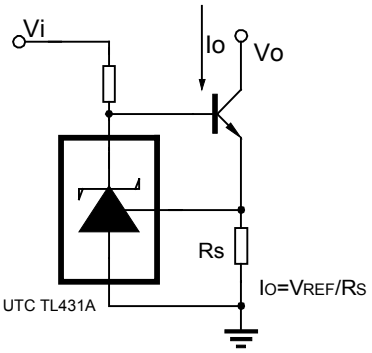



Fig 13 Constant-current Sink

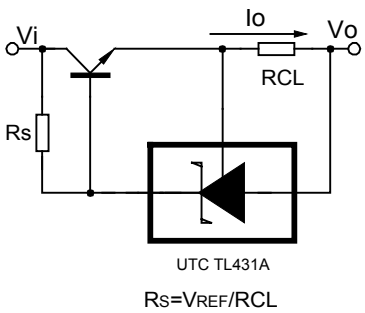



Fig 14 Current Limiting or Current Source