

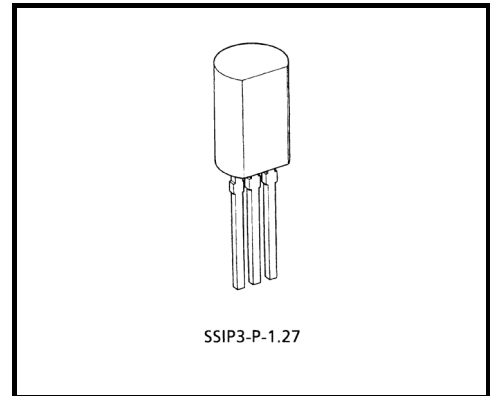
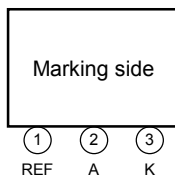
# TA76431S

## Adjustable Precision Shunt Regulator

### Features

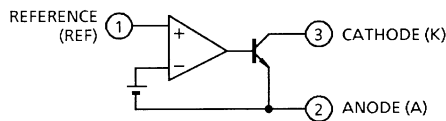
- Precision reference voltage:  $V_{REF} = 2.495\text{ V} \pm 2\%$
- Small temperature coefficient:  $|\alpha V_{REF}| = 46\text{ ppm}/^\circ\text{C}$
- Adjustable output voltage:  $V_{REF} \leq V_{OUT} \leq 36\text{ V}$
- Low dynamic output impedance:  $|Z_{KA}| = 0.15\ \Omega$  (Typ.)

### Pin Assignment

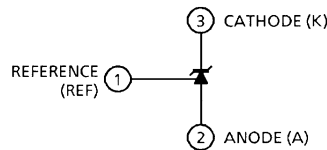


Weight: 0.36 g (Typ.)

### Functional Block Diagram

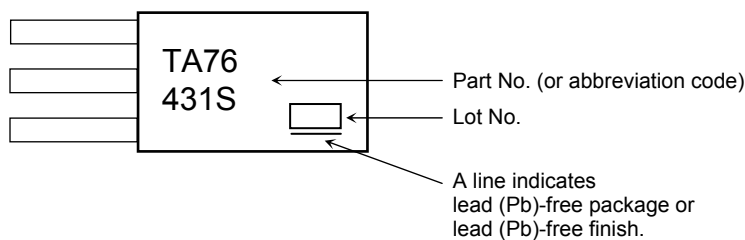


### Circuit Symbol

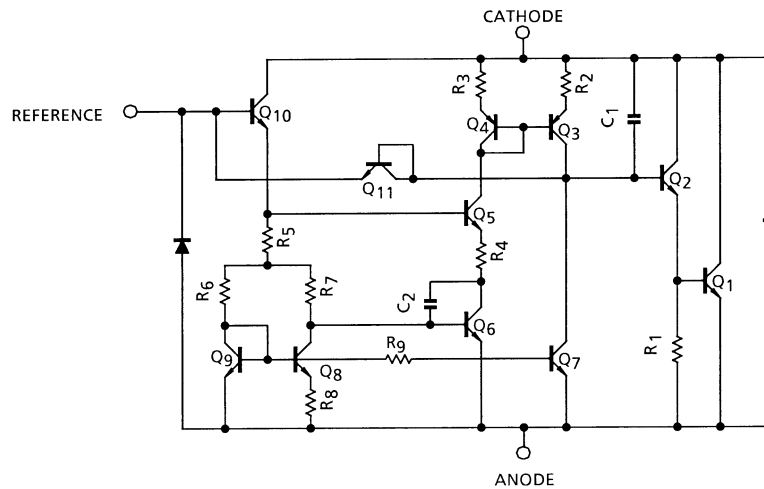


This IC contains electrostatic sensitive elements.  
Please handle with caution.

### Marking



**Equivalent Circuit**



**Absolute Maximum Ratings (Ta = 25°C)**

| Characteristics                 | Symbol     | Rating   | Unit    |
|---------------------------------|------------|----------|---------|
| Cathode voltage                 | $V_{KA}$   | 37       | V       |
| Cathode current                 | $I_K$      | -100~150 | mA      |
| Reference voltage               | $V_{REF}$  | 7        | V       |
| Reference current               | $I_{REF}$  | 50       | $\mu A$ |
| Reference-anode reverse current | $-I_{REF}$ | 10       | mA      |
| Power dissipation               | $P_D$      | 800      | mW      |
| Operating temperature           | $T_{opr}$  | -40~85   | °C      |
| Storage temperature             | $T_{stg}$  | -55~150  | °C      |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

**Operating Range**

| Characteristics       | Symbol    | Min       | Typ. | Max | Unit |
|-----------------------|-----------|-----------|------|-----|------|
| Cathode voltage       | $V_{KA}$  | $V_{REF}$ | —    | 36  | V    |
| Cathode current       | $I_K$     | 1         | —    | 100 | mA   |
| Operating temperature | $T_{opr}$ | -40       | —    | 85  | °C   |

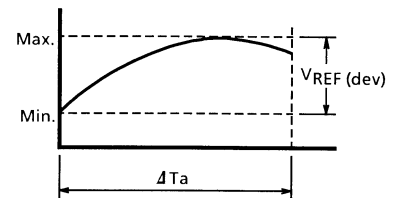
## Electrical Characteristics (Unless otherwise specified, Ta = 25°C, I<sub>K</sub> = 10 mA)

| Characteristics   | Symbol                             | Test Circuit | Test Condition  | Min   | Typ.  | Max   | Unit |
|---|------------------------------------|--------------|---|-------|-------|-------|------|
| Reference voltage   | V <sub>REF</sub>                   | —            | V <sub>KA</sub> = V <sub>REF</sub>  | 2.440 | 2.495 | 2.550 | V    |
| Deviation of reference input voltage over temperature                       | V <sub>REF (dev)</sub><br>(Note 1) | —            | 0°C ≤ Ta ≤ 70°C, V <sub>KA</sub> = V <sub>REF</sub>   | —     | 8     | 17    | mV   |
| Ratio of change in reference input voltage to the change in cathode voltage | ΔV <sub>REF</sub> /ΔV              | —            | V <sub>REF</sub> ≤ V <sub>KA</sub> ≤ 10 V   | —     | 0.8   | 2.7   | mV/V |
|   |                                    | —            | 10 V ≤ V <sub>KA</sub> ≤ 36 V   | —     | 0.5   | 2.0   |      |
| Reference input current   | I <sub>REF</sub>                   | —            | V <sub>KA</sub> = V <sub>REF</sub>  | —     | 1.4   | 4     | μA   |
| Deviation of reference input current over temperature                       | I <sub>REF (dev)</sub><br>(Note 1) | —            | 0°C ≤ Ta ≤ 70°C, V <sub>KA</sub> = V <sub>REF</sub><br>R <sub>1</sub> = 10 kΩ, R <sub>2</sub> = ∞ | —     | 0.3   | 1.2   | μA   |
| Minimum cathode current for regulation                                      | I <sub>Kmin</sub>                  | —            | V <sub>KA</sub> = V <sub>REF</sub>  | —     | 0.4   | 1.0   | mA   |
| Off-state cathode current   | I <sub>Koff</sub>                  | —            | V <sub>KA</sub> = 36 V, V <sub>REF</sub> = 0 V  | —     | —     | 1.0   | μA   |
| Dynamic impedance   | Z <sub>KA</sub>                    | —            | V <sub>KA</sub> = V <sub>REF</sub> , f ≤ 1 kHz<br>1 mA ≤ I <sub>K</sub> ≤ 100 mA                  | —     | 0.15  | 0.5   | Ω    |

Note 1: The deviation parameters V<sub>REF (dev)</sub> and I<sub>REF (dev)</sub> are defined as the maximum variation of the V<sub>REF</sub> and I<sub>REF</sub> over the rated temperature range.

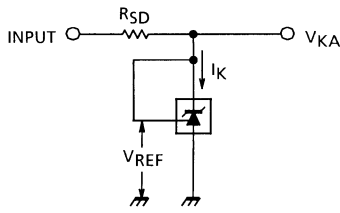
The average temperature coefficient of the V<sub>REF</sub> is defined as:

$$|\alpha V_{REF}| = \frac{\frac{V_{REF (dev)}}{V_{REF@25^\circ C}} \times 10^6}{\Delta T_a} \quad (\text{ppm} / ^\circ\text{C})$$

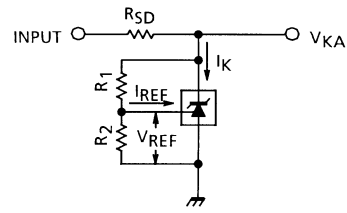


**Test Parameter**

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

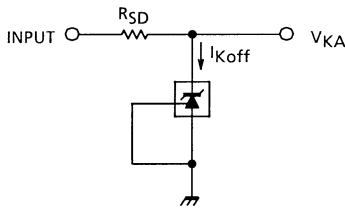


**(2)  $V_{KA} > V_{REF}$  mode**



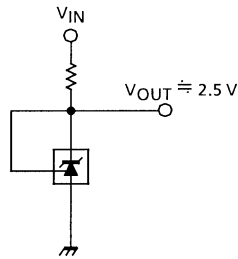
$$V_{KA} = V_{REF} \left( 1 + \frac{R_1}{R_2} \right) + I_{REF} \cdot R_1$$

**(3) Off-state mode**

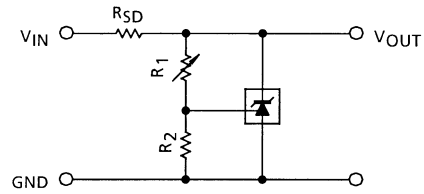


**Typical Applications**

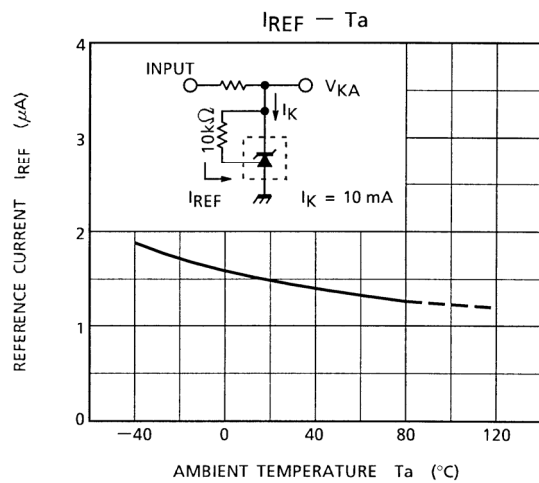
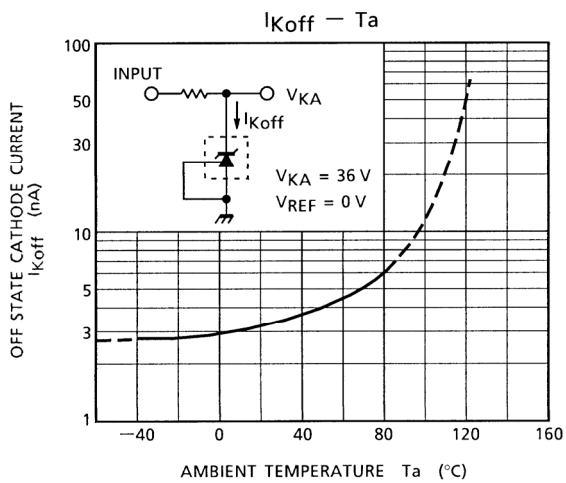
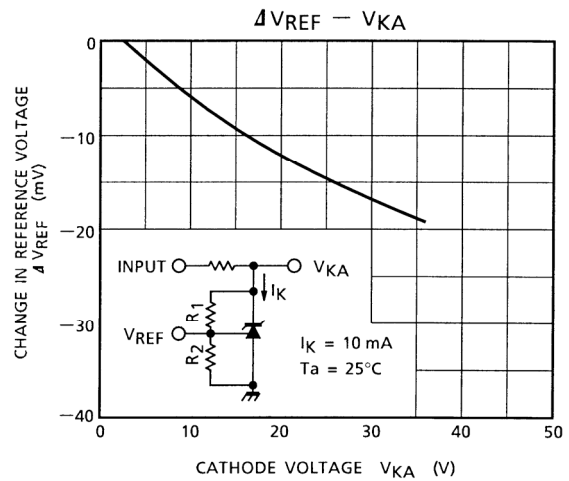
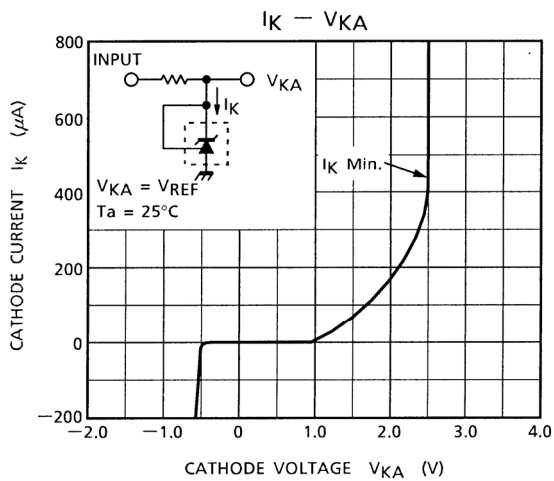
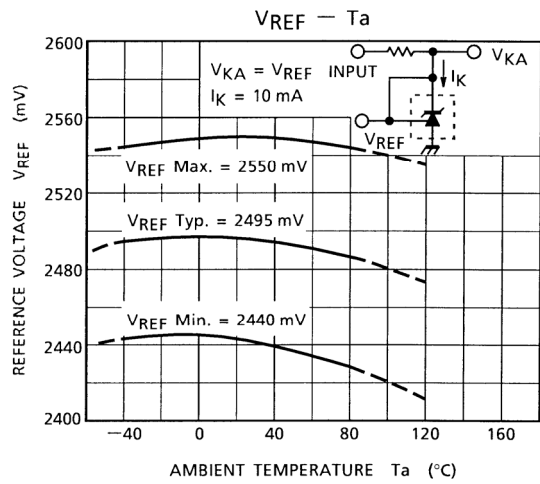
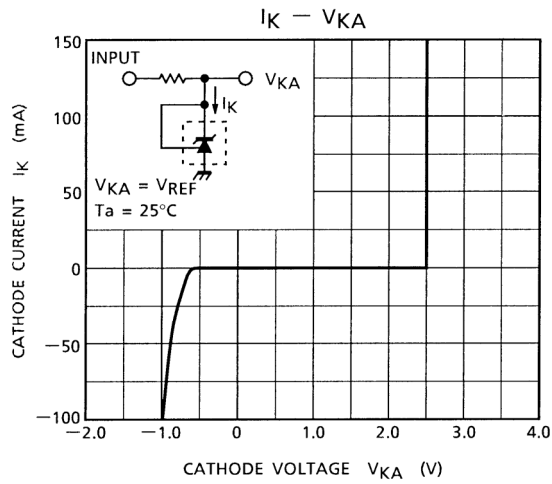
**(1) 2.5 V reference**

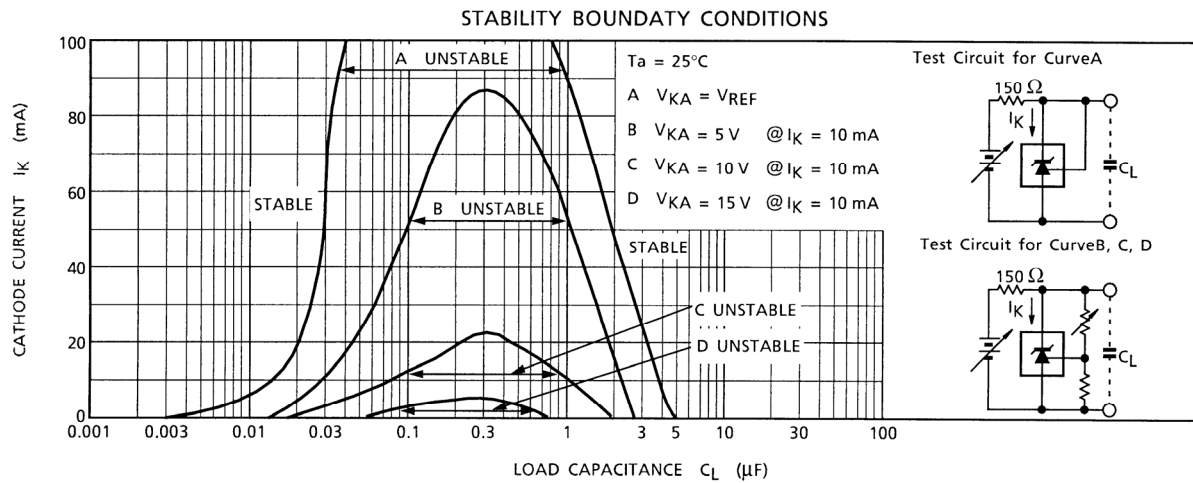
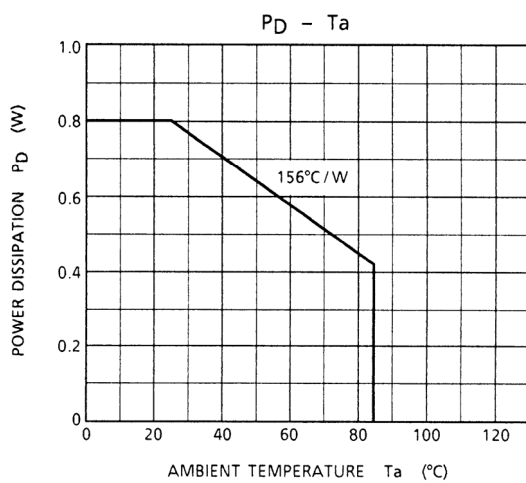
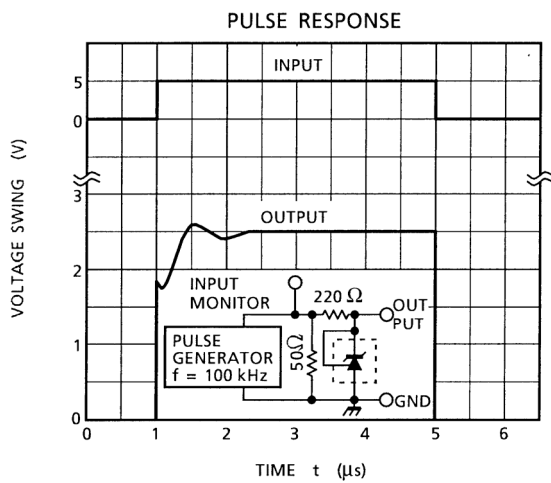
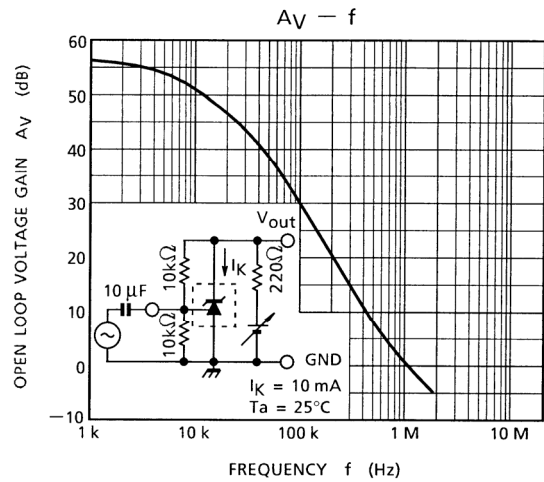
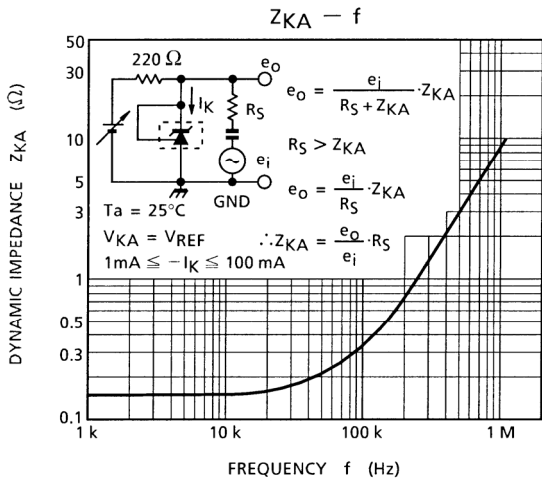


**(2) Shunt regulator**



$$V_{OUT} = V_{REF} \left( 1 + \frac{R_1}{R_2} \right) + I_{REF} \cdot R_1$$

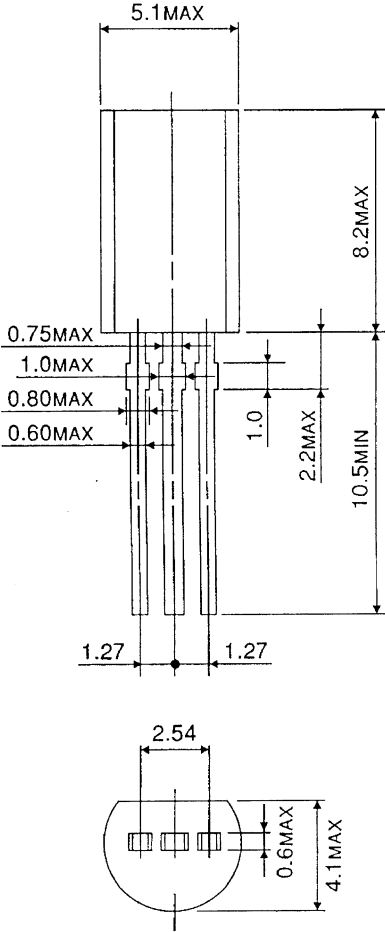




**Package Dimensions**

SSIP3-P-1.27

Unit : mm



Weight : 0.36 g (Typ.)

**RESTRICTIONS ON PRODUCT USE**

20070701-EN

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