

TOSHIBA Bipolar Linear Integrated Circuit    Silicon Monolithic

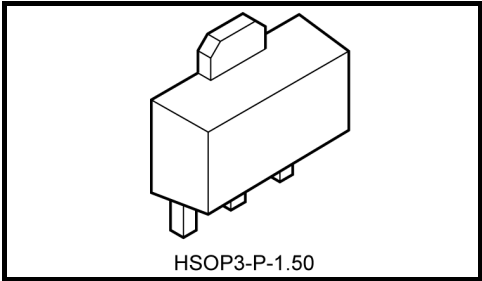
# TA76431F,TA76431FR

## Adjustable Precision Shunt Regulator

### Features

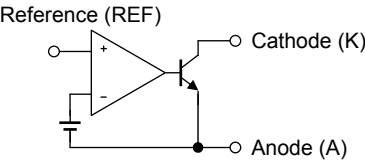
- Precision Reference Voltage:  $V_{REF} = 2.495\text{ V} \pm 2.2\%$
- Small Temperature Coefficient:  $|\alpha V_{REF}| = 46\text{ ppm}/^{\circ}\text{C}$
- Adjustable Output Voltage:  $V_{REF} \leq V_{OUT} \leq 36\text{ V}$
- Low Dynamic Output Impedance:  $|Z_{KA}| = 0.15\text{ }\Omega$  (Typ.)
- Small Flat Package
- TA76431FR is a new Toshiba shunt regulator.

This device's pin assignment is the reverse of that of the TA76431F.

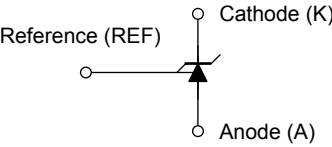


Weight: 0.05 g (typ.)

### Functional Block Diagram



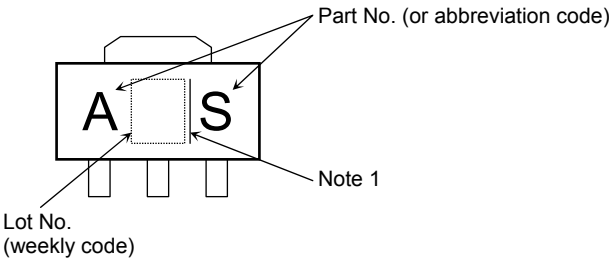
### Circuit Symbol



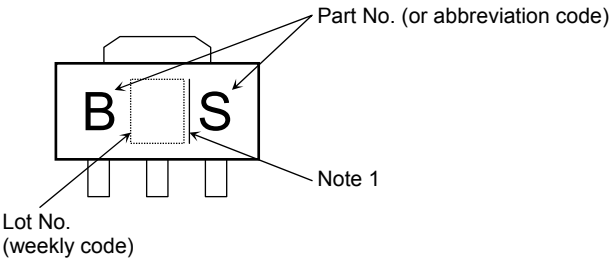
This IC contains electrostatic sensitive elements. Please take care to avoid generating static electricity when handling these devices.

### Marking

(1) TA76431F



(2) TA76431FR



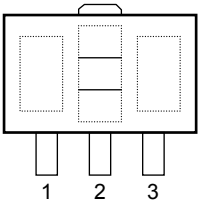
Note 1: A line beside a Lot No. identifies the indication of product Labels.

Without a line:  $[[\text{Pb}]]/\text{INCLUDES} > \text{MCV}$

With a line:  $[[\text{G}]]/\text{RoHS COMPATIBLE}$  or  $[[\text{G}]]/\text{RoHS } [[\text{Pb}]]$

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

### Pin Assignment

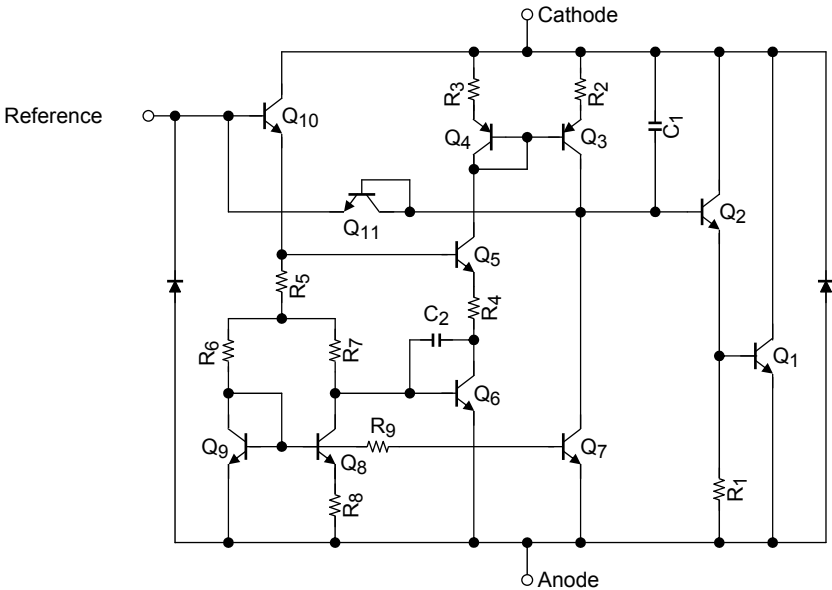


| No. | (1) TA76431F    | (2) TA76431FR   |
|-----|-----------------|-----------------|
| 1   | Cathode (K)     | Reference (REF) |
| 2   | Anode (A)       | Anode (A)       |
| 3   | Reference (REF) | Cathode (K)     |

How to Order

| No. | Product No.       | Package Type                          | Packing Type                              | Minimum Order |
|-----|-------------------|---------------------------------------|-------------------------------------------|---------------|
| (1) | TA76431F          | PW-Mini (SOT-89) (surface-mount type) | On cut tape (TE12L): 100 pcs/tape section | 100           |
|     | TA76431F (TE12L)  |                                       | Embossed tape: 1000 pcs/tape              | 1 tape        |
| (2) | TA76431FR         |                                       | On cut tape (TE12L): 100 pcs/tape section | 100           |
|     | TA76431FR (TE12L) |                                       | Embossed tape: 1000 pcs/tape              | 1 tape        |

Equivalent Circuit



Absolute Maximum Ratings (Ta = 25°C)

| Characteristics                 | Symbol     | Rating        | Unit    |
|---------------------------------|------------|---------------|---------|
| Cathode voltage                 | $V_{KA}$   | 37            | V       |
| Cathode current                 | $I_K$      | -100 to 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               | $P_D$      | 500           | mW      |
|                                 |            | 1000 (Note 2) |         |
| Operating temperature           | $T_{opr}$  | -40 to 85     | °C      |
| Storage temperature             | $T_{stg}$  | -55 to 150    | °C      |

Note 2: Mounted on ceramic substrate (250 mm<sup>2</sup> × 0.8 mm (t))

Note 3: 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 Ranges

| 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

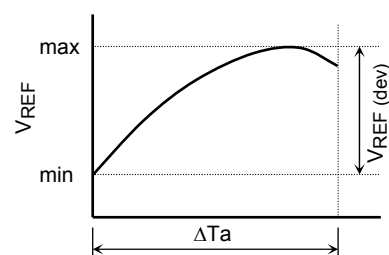
(Unless otherwise specified,  $T_a = 25^\circ\text{C}$ ,  $I_K = 10\text{ mA}$ )

| Characteristics                                                             | Symbol                    | Test Condition                                                                                                     | Min   | Typ.  | Max   | Unit          |
|-----------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------|-------|-------|-------|---------------|
| Reference voltage                                                           | $V_{REF}$                 | $V_{KA} = V_{REF}$                                                                                                 | 2.440 | 2.495 | 2.550 | V             |
| Deviation of reference input voltage over temperature                       | $V_{REF}(\text{dev})$     | $0^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$ , $V_{KA} = V_{REF}$                                              | —     | 8     | 17    | mV            |
| Ratio of change in reference input voltage to the change in cathode voltage | $\Delta V_{REF}/\Delta V$ | $V_{REF} \leq V_{KA} \leq 10\text{ V}$                                                                             | —     | 0.8   | 2.7   | mV/V          |
|                                                                             |                           | $10\text{ V} \leq V_{KA} \leq 36\text{ V}$                                                                         | —     | 0.5   | 2.0   |               |
| Reference Input current                                                     | $I_{REF}$                 | $V_{KA} = V_{REF}$                                                                                                 | —     | 1.4   | 4     | $\mu\text{A}$ |
| Deviation of reference input current over temperature                       | $I_{REF}(\text{dev})$     | $0^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$ , $V_{KA} = V_{REF}$ , $R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$ | —     | 0.3   | 1.2   | $\mu\text{A}$ |
| Minimum cathode current for regulation                                      | $I_{Kmin}$                | $V_{KA} = V_{REF}$                                                                                                 | —     | 0.4   | 1.0   | mA            |
| Off-State cathode current                                                   | $I_{Koff}$                | $V_{KA} = 36\text{ V}$ , $V_{REF} = 0\text{ V}$                                                                    | —     | —     | 1.0   | $\mu\text{A}$ |
| Dynamic impedance                                                           | $ Z_{KA} $                | $V_{KA} = V_{REF}$ , $f \leq 1\text{ kHz}$ , $1\text{ mA} \leq I_K \leq 100\text{ mA}$                             | —     | 0.15  | 0.5   | $\Omega$      |

The deviation parameters  $V_{REF}(\text{dev})$  and  $I_{REF}(\text{dev})$  are defined as the maximum variation of the  $V_{REF}$  and  $I_{REF}$  over the rated temperature range.

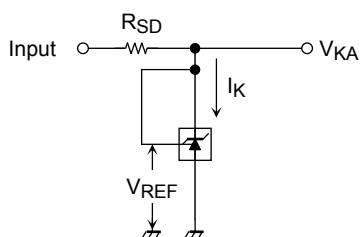
The average temperature coefficient of the  $V_{REF}$  is defined as:

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

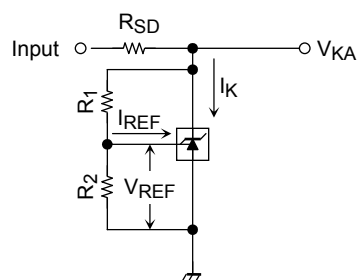


## Test Parameter

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

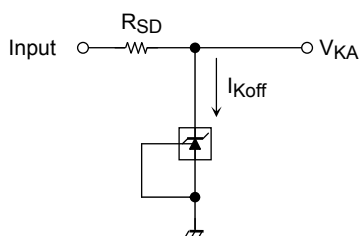


### (2) $V_{KA} > V_{REF}$ Mode



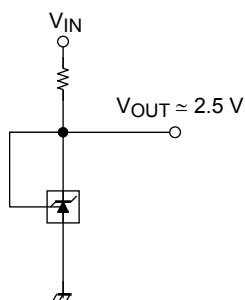
$$V_{KA} = V_{REF} \left( 1 + \frac{R_1}{R_2} \right) + I_{REF} \cdot R_1$$

### (3) OFF-State Mode

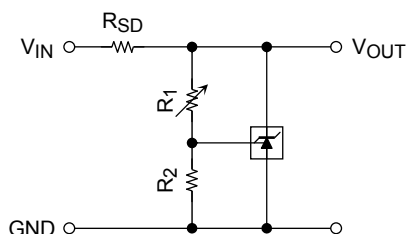


## Typical Application Circuits

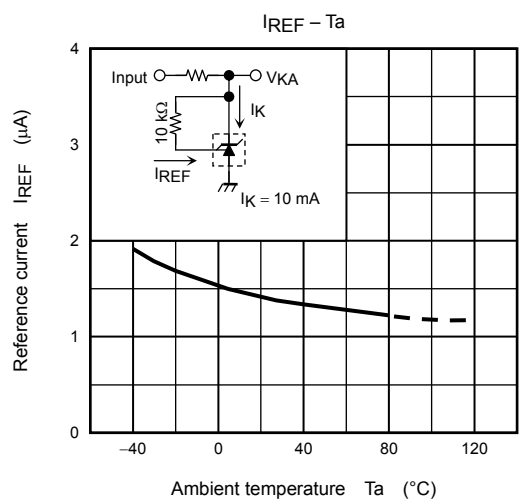
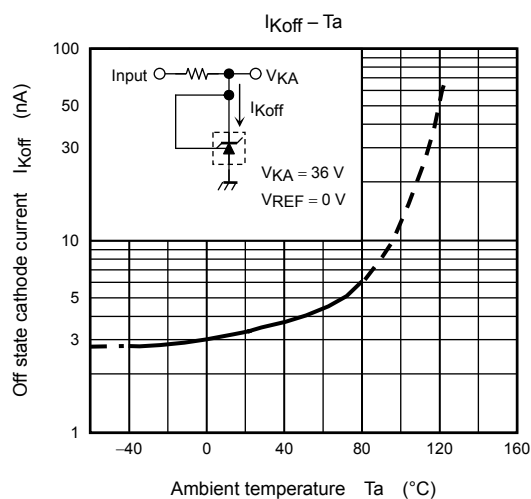
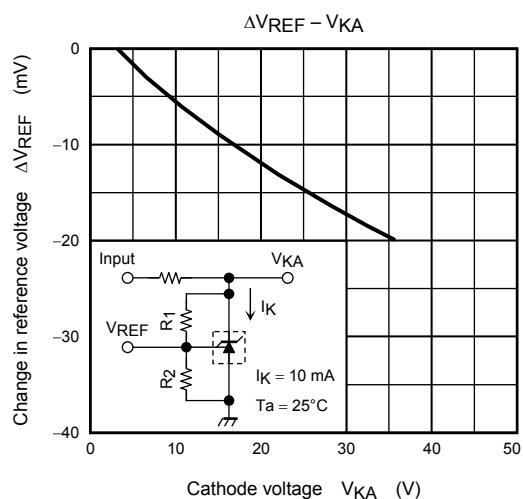
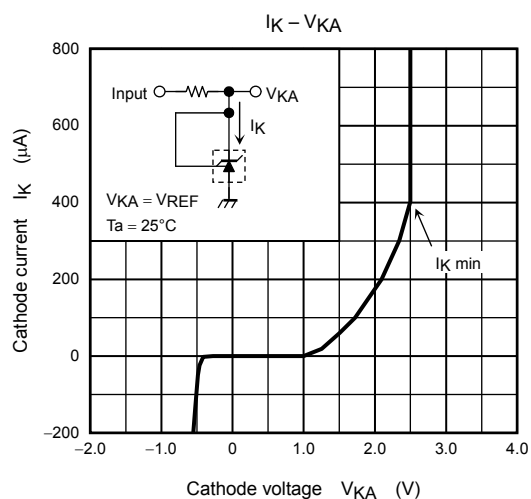
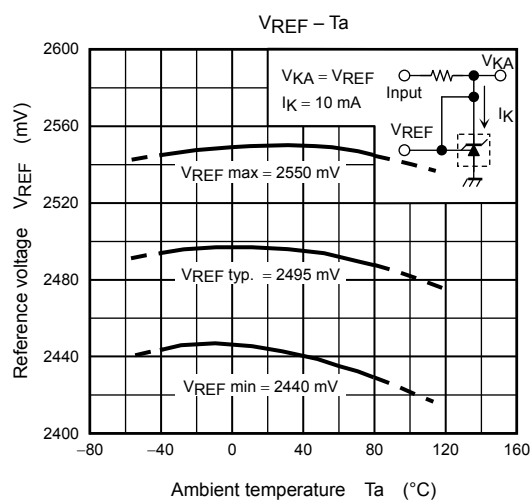
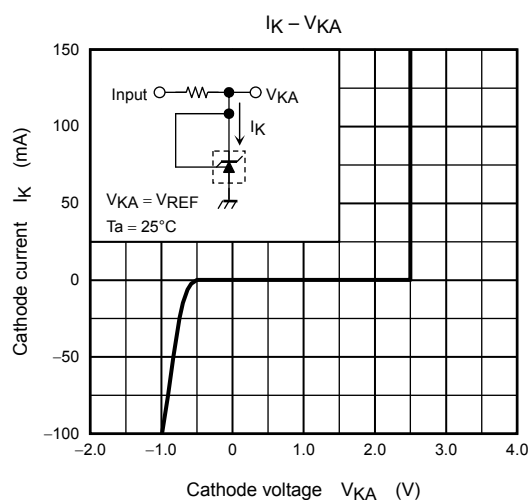
### (1) 2.5 V Reference

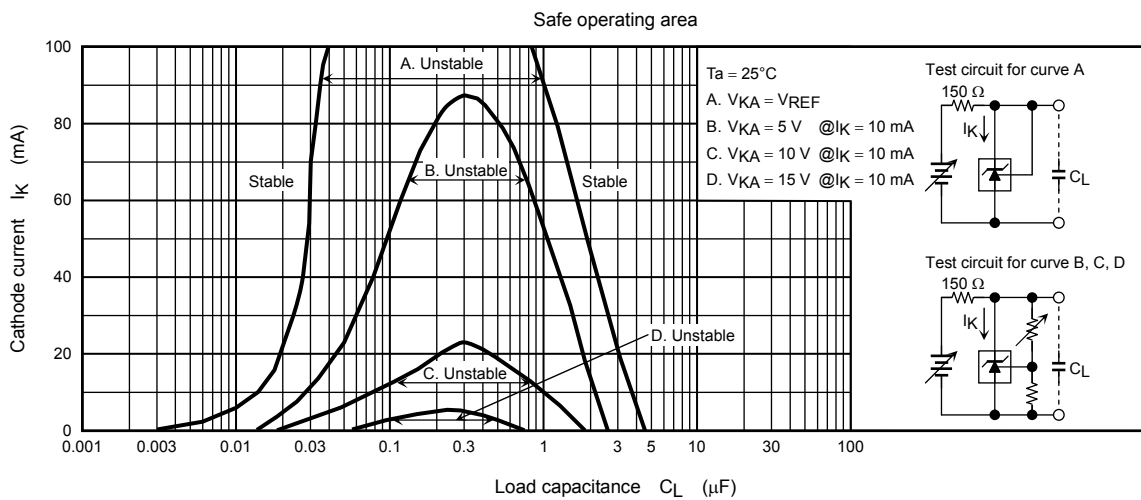
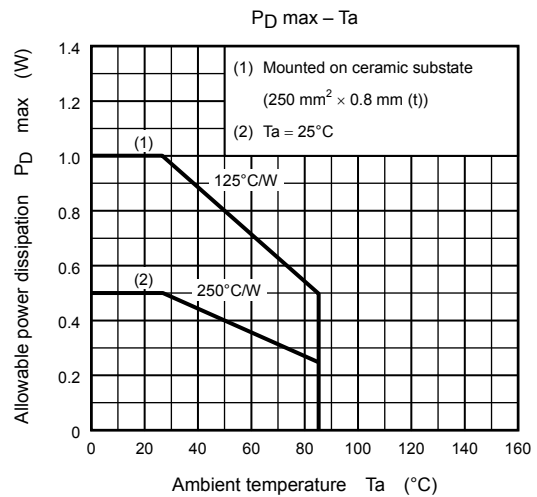
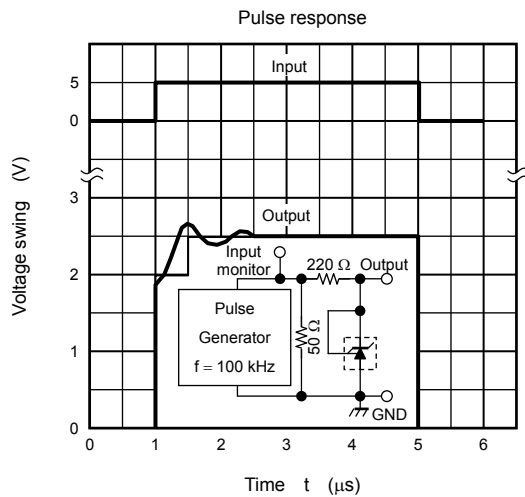
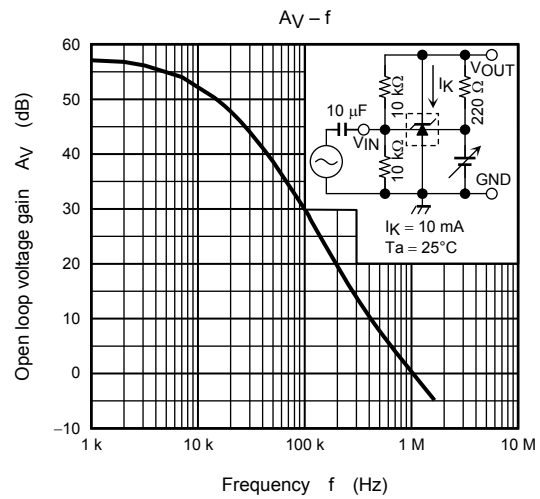
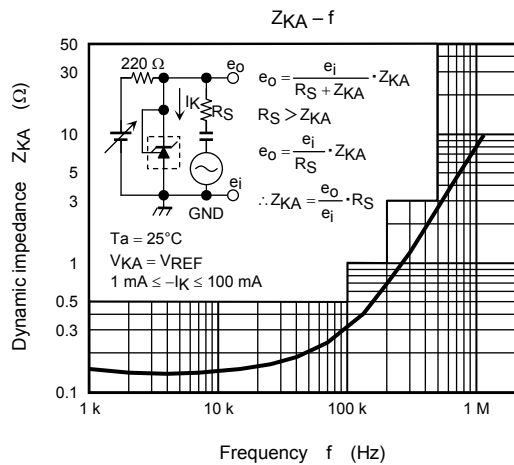


### (2) Shunt Regulator



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

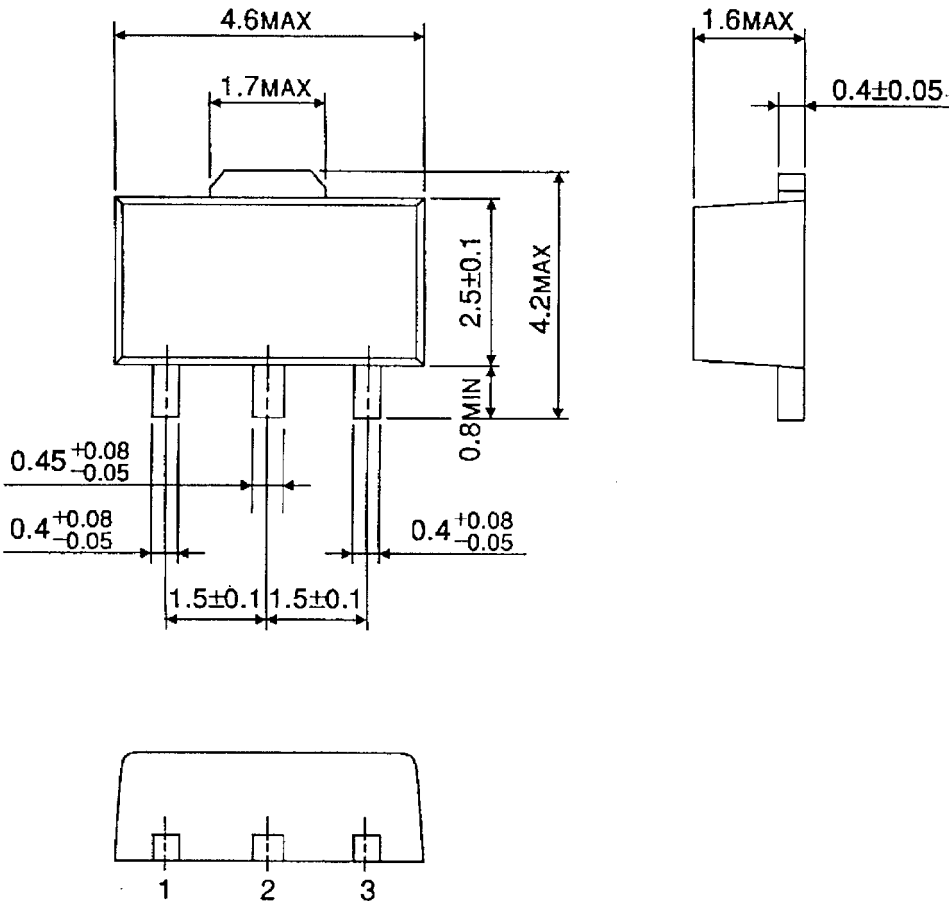




Package Dimensions

HSOP3-P-1.50

Unit : mm



Weight: 0.05 g (typ.)

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