

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

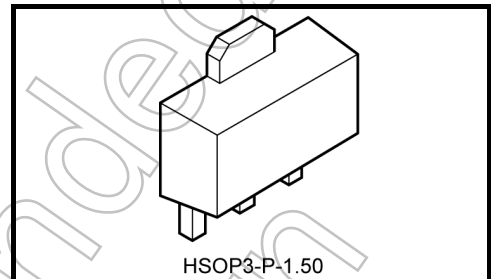
# TA76431F, TA76431FR

## Adjustable Precision Shunt Regulator

### Features

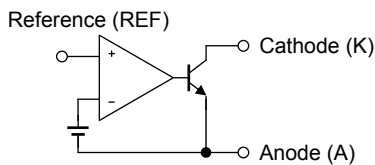
- Precision Reference Voltage:  $V_{REF} = 2.495\text{ V} \pm 2.2\%$
- Small Temperature Coefficient:  $|\alpha V_{REF}| = 46\text{ ppm}/^\circ\text{C}$
- Adjustable Output Voltage:  $V_{REF} \leq V_{OUT} \leq 36\text{ V}$
- Low Dynamic Output Impedance:  $|Z_{KA}| = 0.15\ \Omega$  (Typ.)
- Small Flat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

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

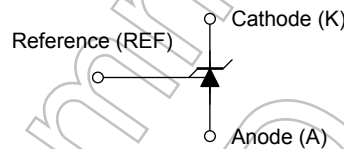


Weight: 0.05 g (typ.)

### Functional Block Diagram



### Circuit Symbol

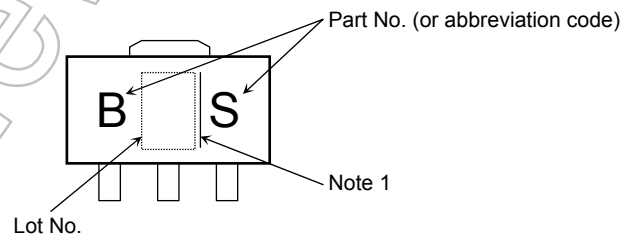
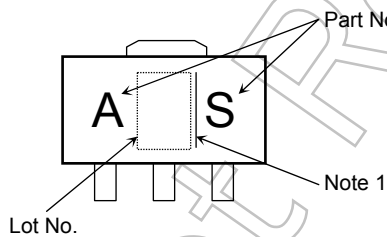


This IC contains electrostatic sensitive elements. Please take care to avoid generating static electricity when handling these devices.

### Marking

(1) TA76431F

(2) TA76431FR



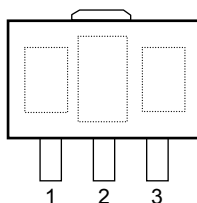
Note 1: A line beside a Lot No. identifies the indication of product Labels.

Without a line: `[[Pb]]/INCLUDES > MCV`

With a line: `[[G]]/RoHS COMPATIBLE` or `[[G]]/RoHS [[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

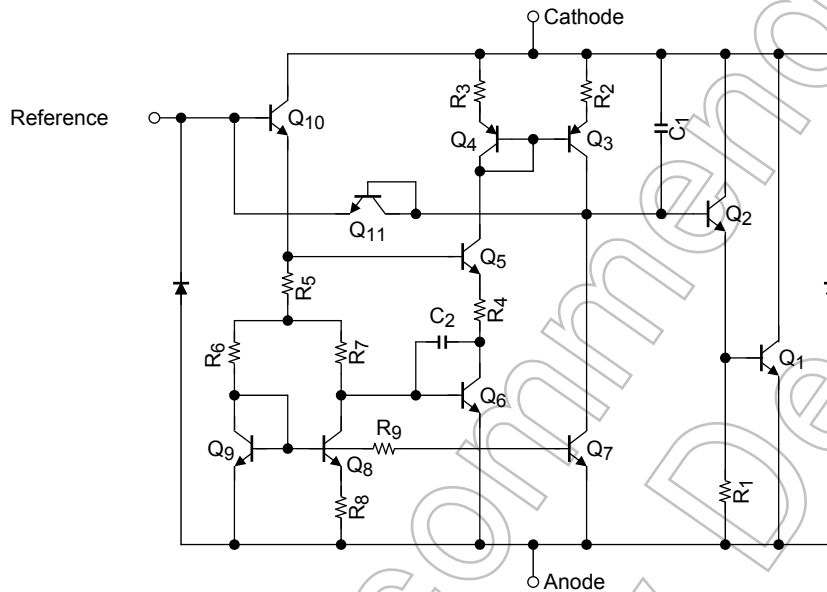


No.	(1) TA76431F	(2) TA76431FR
1	Cathode (K)	Reference (REF)
2	Anode (A)	Anode (A)
3	Reference (REF)	Cathode (K)

**How to Order**

No.	Product No.	Package Type	Packing Type and Capacity
(1)	TA76431F (F)	PW-Mini (SOT-89) (surface-mount type)	On cut tape (TE12L,F): 100 pcs/tape section
	TA76431F (TE12L,F)		Embossed tape: 1000 pcs/reel
(2)	TA76431FR (F)		On cut tape (TE12L,F): 100 pcs/tape section
	TA76431FR (TE12L,F)		Embossed tape: 1000 pcs/reel

**Equivalent Circuit**



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

Characteristics	Symbol	Rating	Unit
Cathode voltage	V <sub>KA</sub>	37	V
Cathode current	I <sub>K</sub>	-100 to 150	mA
Reference voltage	V <sub>REF</sub>	7	V
Reference current	I <sub>REF</sub>	50	μA
Reference-anode reverse current	-I <sub>REF</sub>	10	mA
Power dissipation (Ta = 25°C)	P <sub>D</sub>	500	mW
		1000 (Note 2)	
Operating temperature	T <sub>opr</sub>	-40 to 85	°C
Storage temperature	T <sub>stg</sub>	-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

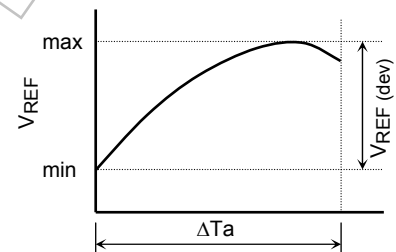
## Electrical Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$ , $I_K = 10\text{ mA}$ )

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.

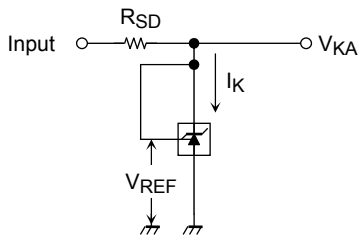
The average temperature coefficient of the  $V_{REF}$  is defined as:

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

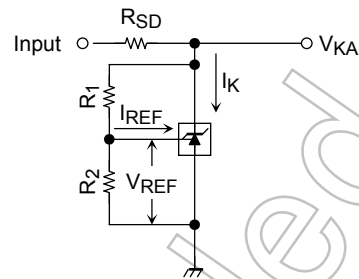


**Test Parameter**

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

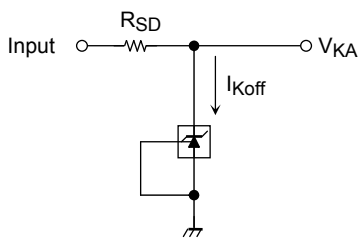


**(2)  $V_{KA} > V_{REF}$  Mode**



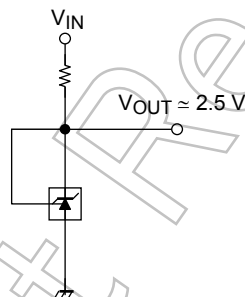
$$V_{KA} = V_{REF} \left( 1 + \frac{R_1}{R_2} \right) + I_{REF} \cdot R_1$$

**(3) OFF-State Mode**

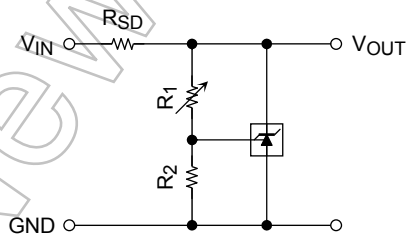


**Typical Application Circuits**

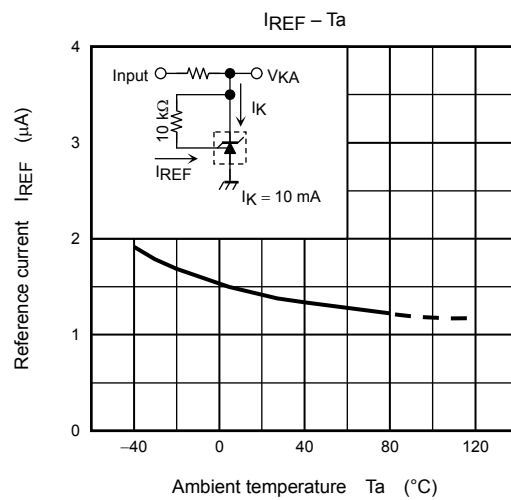
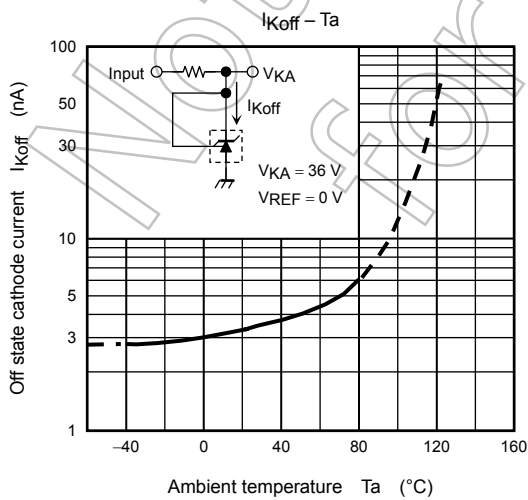
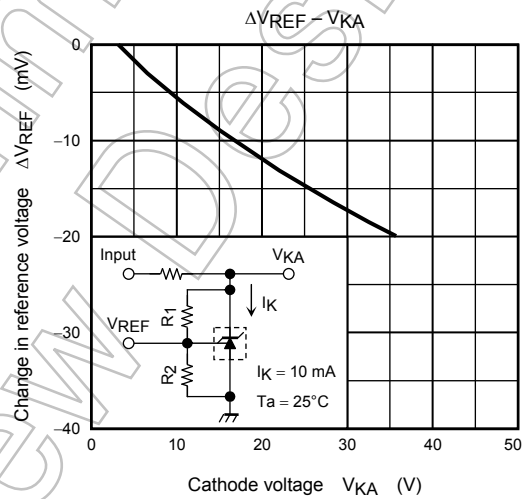
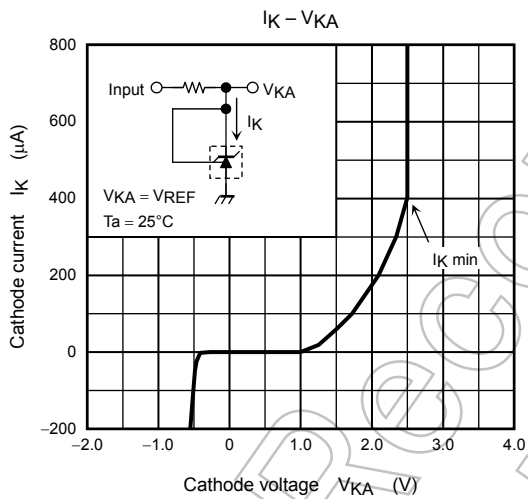
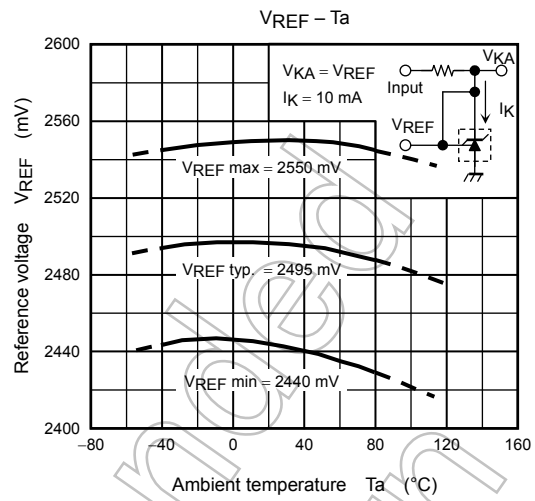
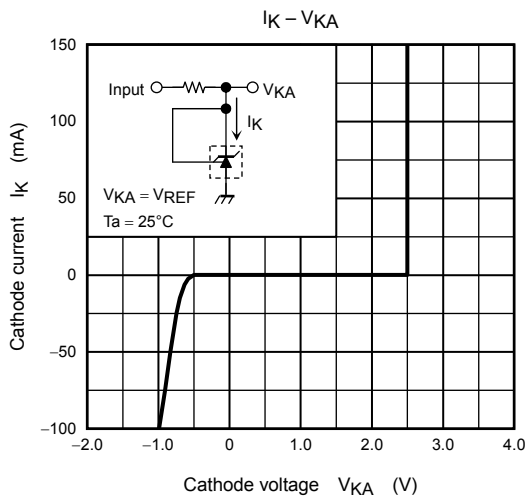
**(1) 2.5 V Reference**

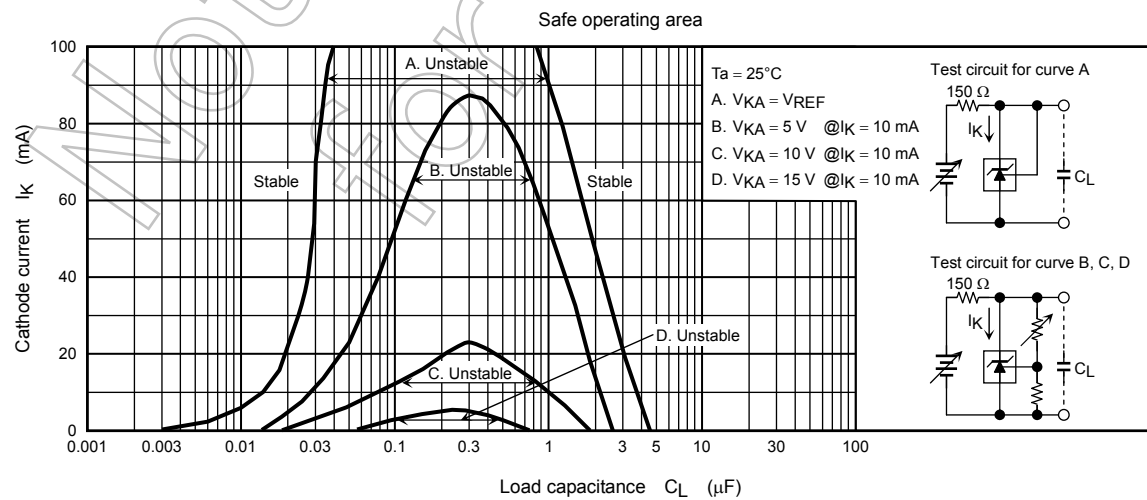
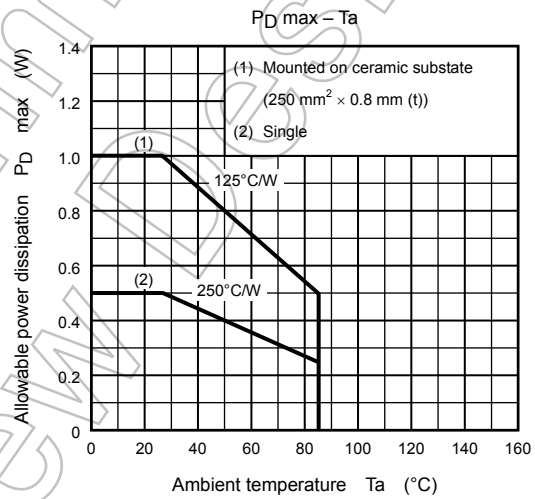
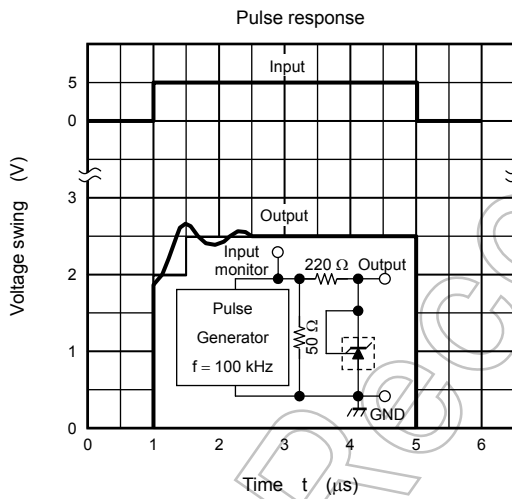
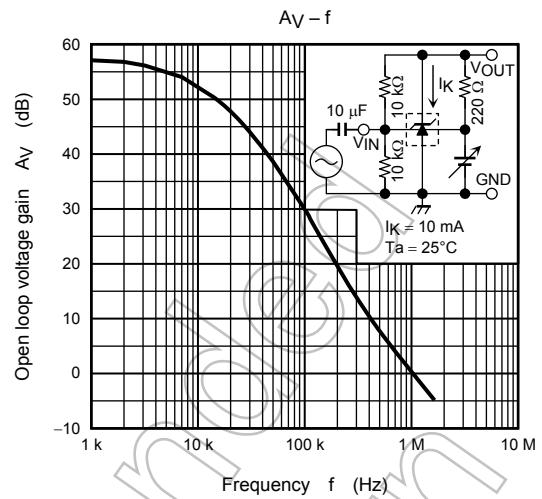
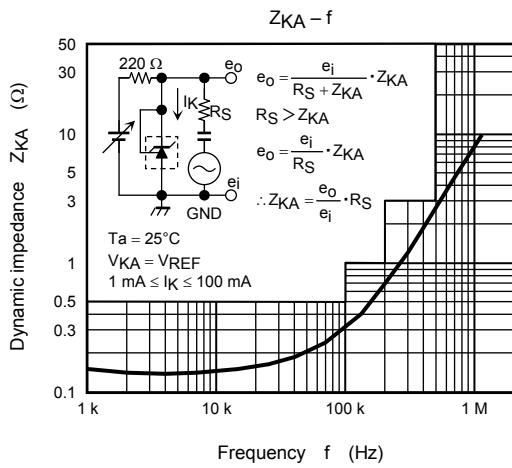


**(2) Shunt Regulator**



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

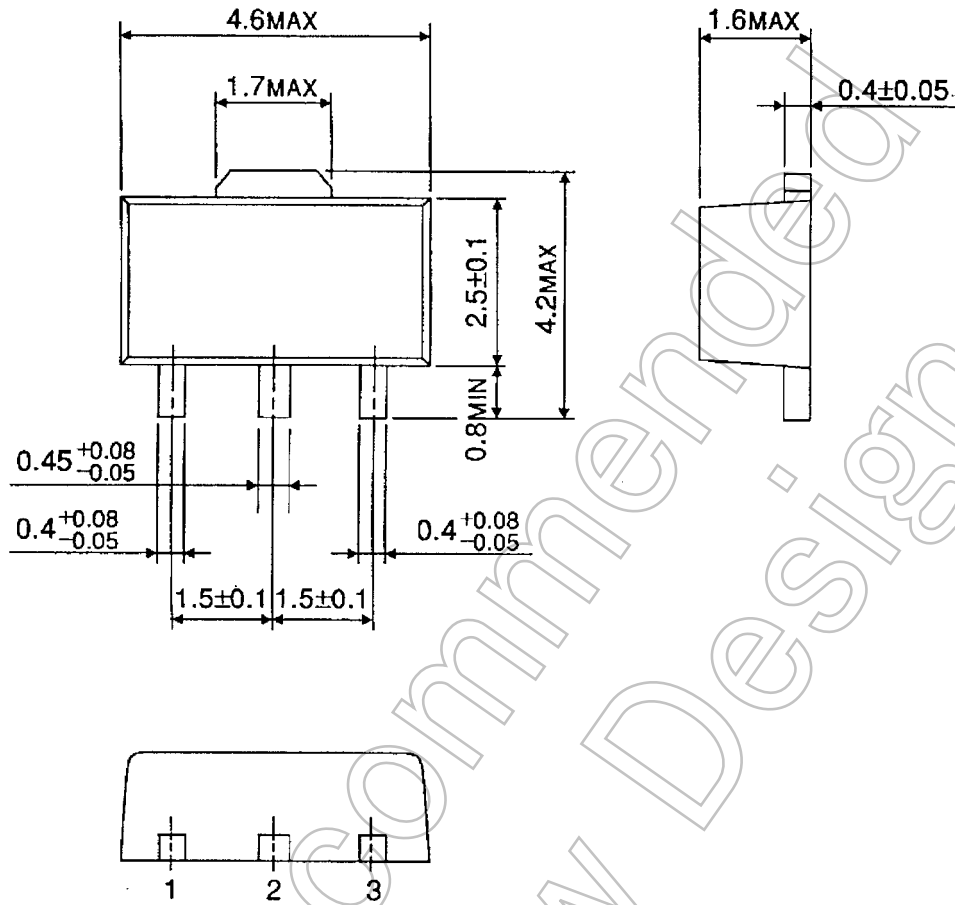




Package Dimensions

HSOP3-P-1.50

Unit : mm



Weight: 0.05 g (typ.)

Not Recommended for New Design

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