

**TA76432AFT, TA76432AF, TA76432AFR, TA76432AS**

1.26-V Adjustable High-Precision Shunt Regulators

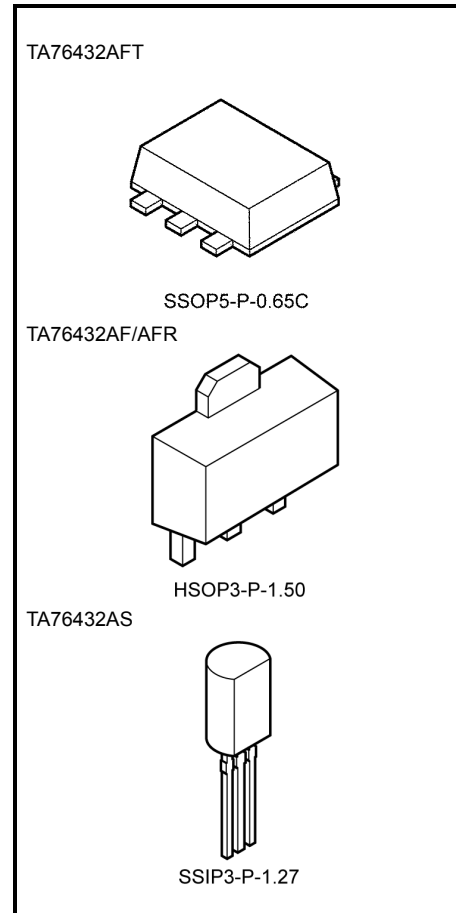
The TA76432 series consists of adjustable high-precision shunt regulators whose output voltage ( $V_{KA}$ ) can be set arbitrarily using two external resistors.

These devices have a precise internal reference voltage of 1.26 V, enabling them to operate at low voltage.

The devices are ideal for use as error amplifiers in 3-V switching-regulator systems. In addition, they can be used as zener diodes to perform temperature compensation.

**Features**

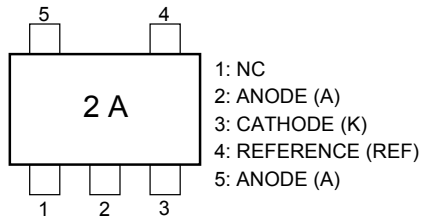
- Precision reference voltage:  $V_{REF} = 1.26 \text{ V} \pm 1\%$  ( $T_a = 25^\circ\text{C}$ )
- Small temperature coefficient:  $|\alpha V_{REF}| = 30 \text{ ppm}/^\circ\text{C}$  (typ.)
- Adjustable output voltage:  $V_{REF} \leq V_{OUT} \leq 19 \text{ V}$
- Minimum cathode current for regulation:  
 $I_{kmin} = 0.5 \text{ mA}$  (max.)
- Operating temperature:  $T_a = -40 \sim 85^\circ\text{C}$
- Packages: UFV (TA76432AFT),  
PW-MINI (TA76432AF/AFR) and  
TO-92MOD (TA76432AS)
- The TA76432AFT is housed in an ultra-thin UFV package.  
(thickness: 0.7 mm typ.)



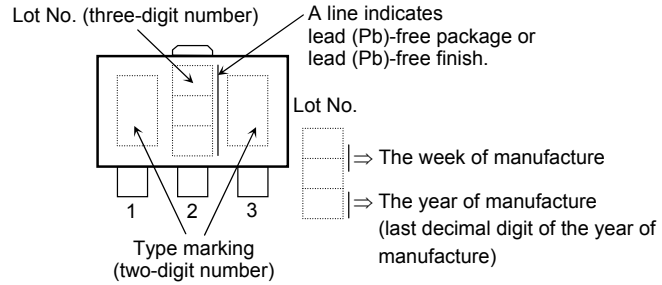
Weight  
 SSOP5-P-0.65C : 0.007 g (typ.)  
 HSOP3-P-1.50 : 0.05 g (typ.)  
 SSIP3-P-1.27 : 0.36 g (typ.)

## Pin Assignment/Marking

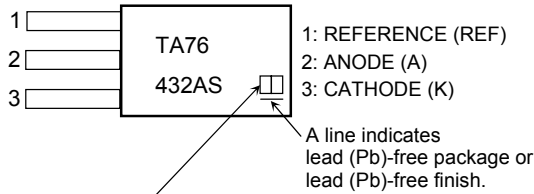
TA76432AFT



TA76432AF/AFR



TA76432AS



Lot No: The last decimal digit of the year of manufacture followed by the month as letters A to L of the alphabet.  
For example: Jan-2004 is coded as "4A"

- TA76432AF: AF
- TA76432AFR: BF

No.	TA76432AF	TA76432AFR
1	CATHODE (K)	REFERENCE (REF)
2	ANODE (A)	ANODE (A)
3	REFERENCE (REF)	CATHODE (K)

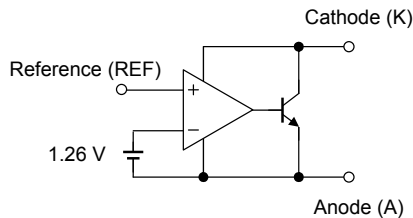
Note: TA76432AFvs.TA76432AFR:  
reverse pin connection.

## How to Order

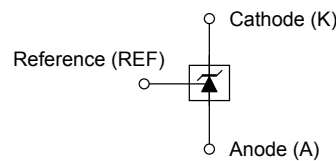
Product No.	Package Type	Packing Type and Capacity	Minimum Order
TA76432AFT (TE85L)	UFV (surface-mount type)	Embossed tape: 3000/tape	1 tape
TA76432AF/AFR	PW-MINI (SOT-89)	On cut tape (TE12L): 100/tape section	100
TA76432AF/AFR (TE12L)	(surface-mount type)	Embossed tape: 1000/tape	1 tape
TA76432AS	TO-92MOD	Loose in bag: 200/bag	1 bag
TA76432AS (TPE6)	(lead type)	Radial tape: 2000/tape	1 tape

Note: The lead pitch for the TA76432AS and TA76432AS (TPE6) may vary.

## Functional Block Diagram

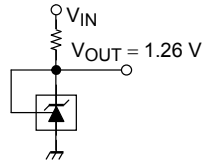


## Circuit Symbol

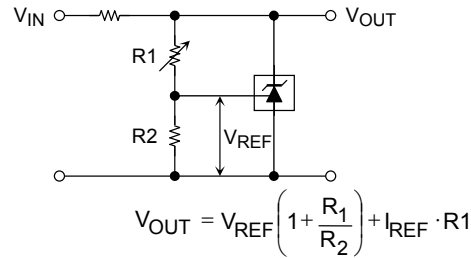


## Typical Application Circuits

1.26 V Reference ( $V_{KA} = V_{REF}$ )



Shunt regulator ( $V_{KA} > V_{REF}$ )



## Precautions during Use

- (1) TA76432AFT, TA76432AF/AFR, TA76432AS  
These products contain MOS elements. Please take care to avoid generating static electricity when handling these devices.
- (2) TA76432AFT, TA76432AF/AFR, TA76432AS  
The oscillation frequency of these devices is determined by the value of the capacitor connected between the anode and the cathode.  
When establishing maximum operating condition parameters, please derate the maximum rating values specified in these datasheets so as to allow an operational safety margin.  
Use of a laminated ceramic capacitor is recommended.
- (3) Precautions when handling anode pin of TA76432AFT  
Pin 2 and pin 5 should normally be shorted together. If only pin 5 is used, pin 2 should either be left open or always kept at a lower potential than pin 5. Do not leave pin 5 open and use pin 2 only.

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Cathode voltage	$V_{KA}$	20	V
Cathode current	$I_K$	20	mA
Cathode-anode reverse current	$-I_K$	10	mA
Reference voltage	$V_{REF}$	7	V
Reference current	$I_{REF}$	50	$\mu\text{A}$
Reference-anode reverse current	$-I_{REF}$	10	mA
Power dissipation	TA76432AFT	0.45 (Note 1)	W
	TA76432AF/AFR	0.5	
	TA76432AS	0.8	
Thermal resistance	TA76432AFT	277 (Note 1)	$^\circ\text{C/W}$
	TA76432AF/AFR	250	
	TA76432AS	156	
Operating temperature	$T_{opr}$	-40~85	$^\circ\text{C}$
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55~150	$^\circ\text{C}$

Note 1: Glass epoxy board mounting: 30 mm × 30 mm × 0.8 mm (Cu pad area 35 mm<sup>2</sup>)

Note 2: 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).

## Recommended Operating Conditions

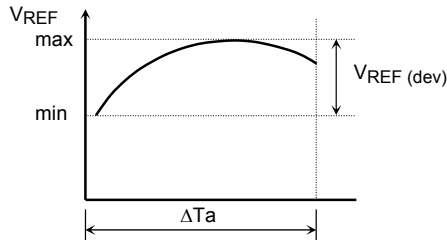
Characteristics	Symbol	Min	Typ.	Max	Unit
Cathode voltage	$V_{KA}$	$V_{REF}$	—	19	V
Cathode current	$I_K$	0.5	—	15	mA
Operating temperature	$T_{opr}$	-40	—	85	°C

## Electrical Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$ , $I_K = 5\text{ mA}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reference voltage	$V_{REF}$	$V_{KA} = V_{REF}$	1.247	1.26	1.273	V
Deviation of reference input voltage over temperature	$V_{REF}(\text{dev})$	$0^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ , $V_{KA} = V_{REF}$	—	3	15	mV
Ratio of change in reference input voltage to the change in cathode voltage	$\Delta V_{REF}/\Delta V$	$V_{REF} \leq V_{KA} \leq 5\text{ V}$	—	0.5	2.5	mV/V
		$5\text{ V} \leq V_{KA} \leq 19\text{ V}$	—	0.3	2.0	
Reference input current	$I_{REF}$	$V_{KA} = V_{REF}$	—	2	4	$\mu\text{A}$
Deviation of reference input current over temperature	$I_{REF}(\text{dev})$	$0^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ , $V_{KA} = V_{REF}$ , $R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$	—	0.3	1.2	$\mu\text{A}$
Minimum cathode current for regulation	$I_{Kmin}$	$V_{KA} = V_{REF}$	—	0.2	0.5	mA
Off-state cathode current	$I_{Koff}$	$V_{KA} = 19\text{ V}$ , $V_{REF} = 0\text{ V}$	—	—	1.0	$\mu\text{A}$
Dynamic impedance	$ Z_{KA} $	$V_{KA} = V_{REF}$ , $f \leq 1\text{ kHz}$ , $0.5\text{ mA} \leq I_K \leq 15\text{ mA}$	—	0.2	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.

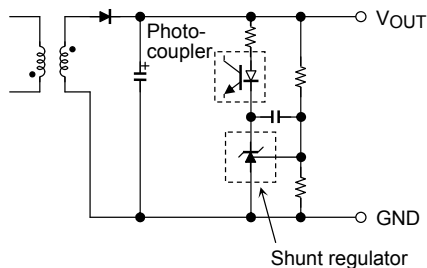
The average temperature coefficient of the  $V_{REF}$  is defined as:



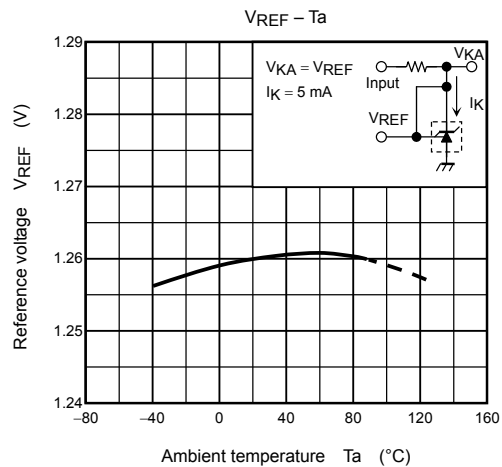
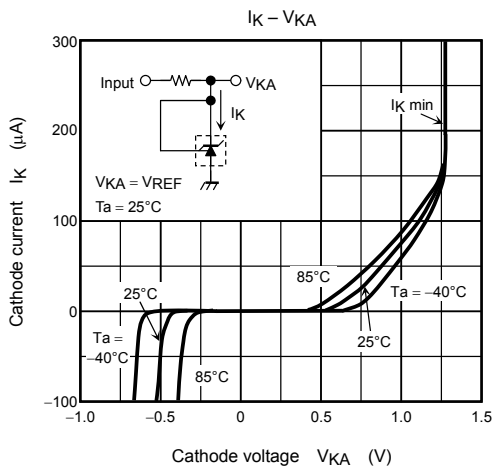
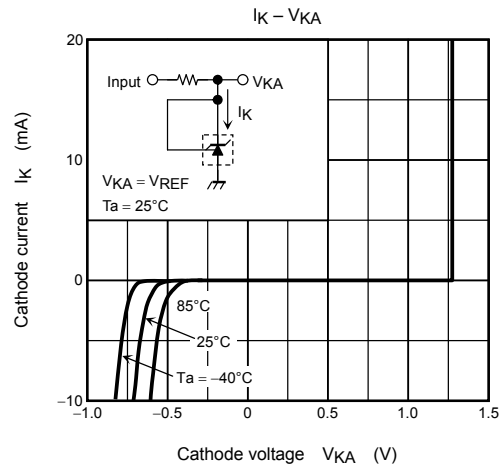
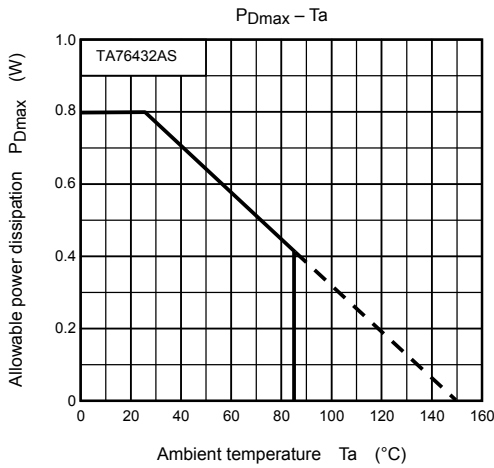
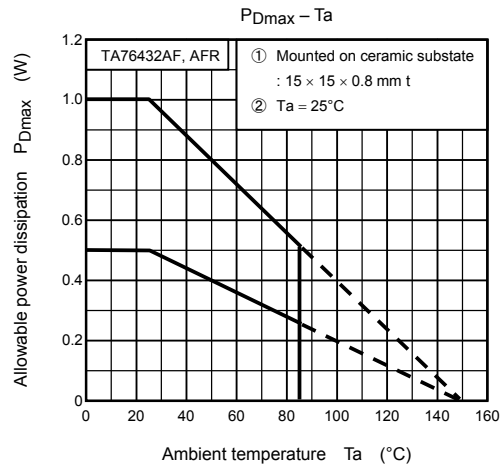
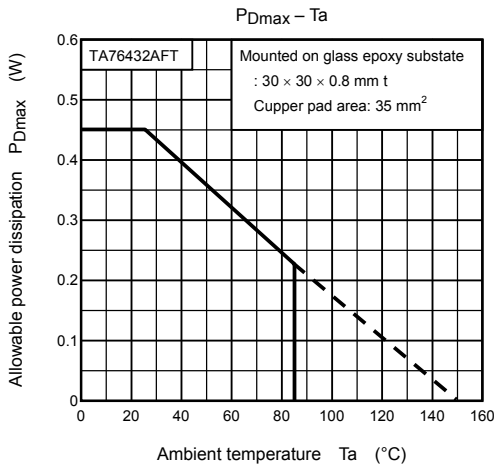
$$|\alpha V_{REF}| = \frac{\left( \frac{V_{REF}(\text{dev}) \times 10^6}{V_{REF} @ 25^\circ\text{C}} \right)}{\Delta T_a} \text{ (ppm/}^\circ\text{C)}$$

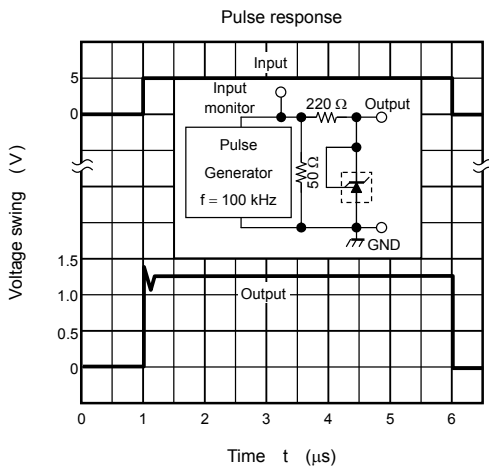
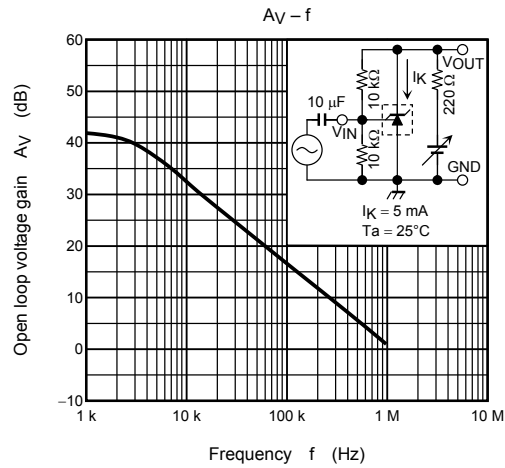
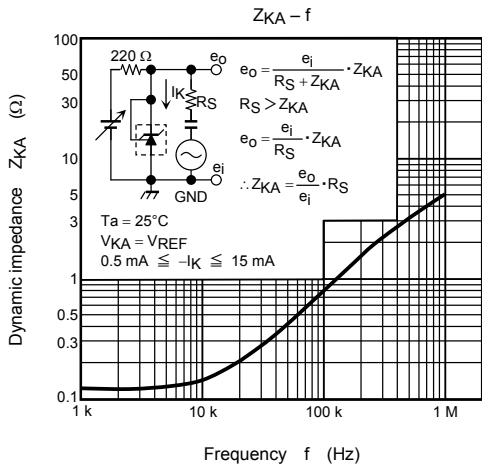
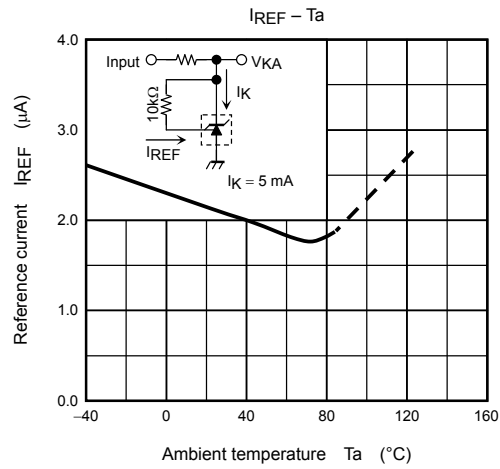
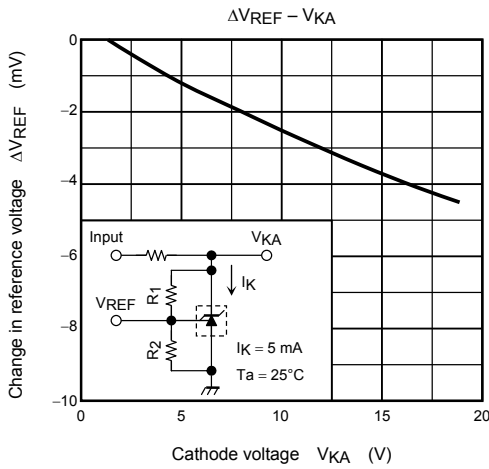
## Application Circuit Example

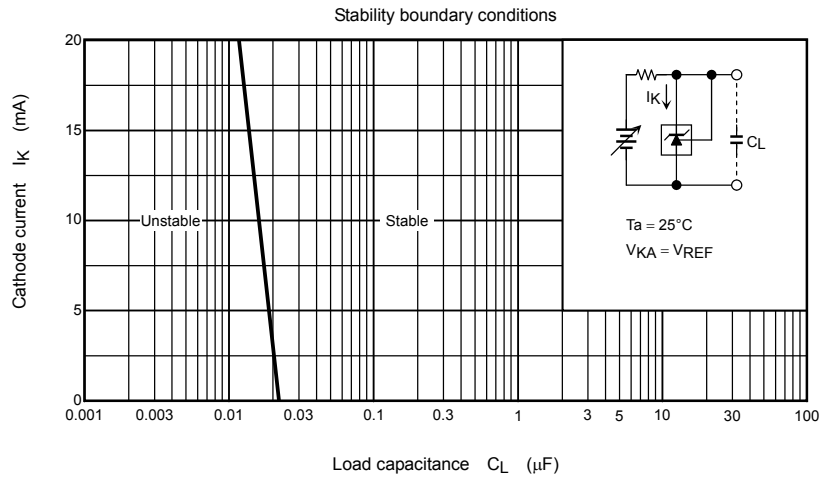
Error amplification circuit for switching power supply



This circuit amplifies the difference between the switching power supply's secondary output voltage and the shunt regulator's reference voltage. It then feeds the amplified voltage back to the primary input voltage via the photocoupler.



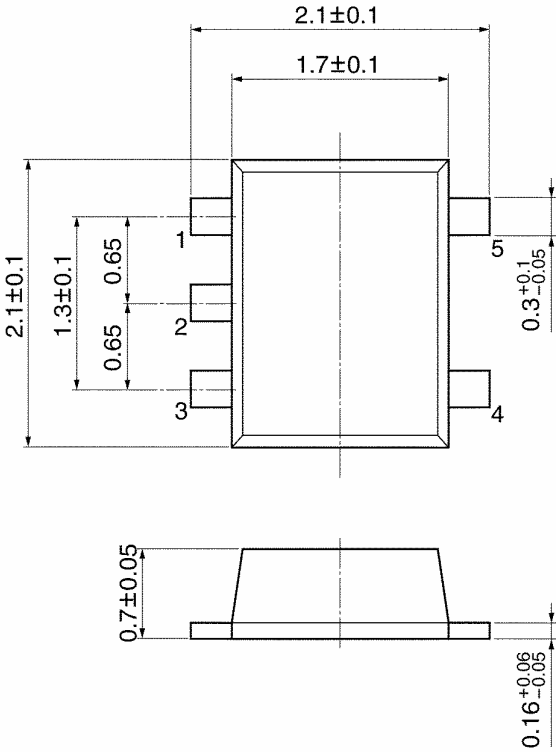




**Package Dimensions**

SSOP5-P-0.65C

Unit: mm



TA76432AFT (UFV)

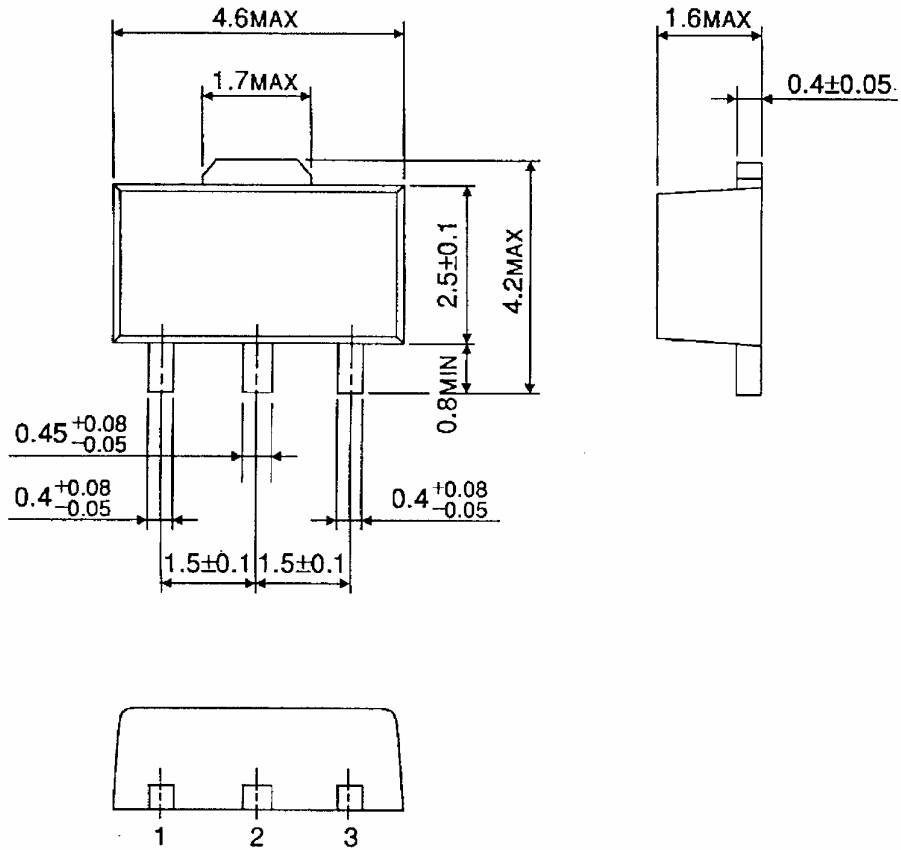
Weight: 0.007 g (typ.)



## Package Dimensions

HSOP3-P-1.50

Unit : mm

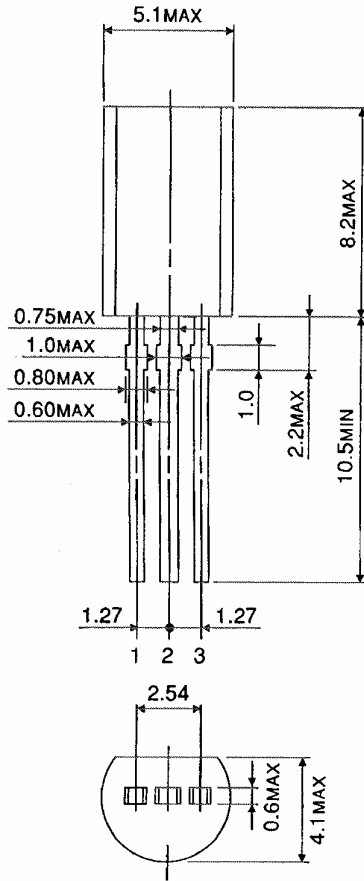


TA76432AF/AFR (PW-MINI)

Weight: 0.05 g (typ.)

**Package Dimensions**

SSIP3-P-1.27



TA76432AS (TO-92MOD)

Weight: 0.36 g (typ.)

**RESTRICTIONS ON PRODUCT USE**

20070701-EN

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