

## TA76432FT, TA76432FC, TA76432F, TA76432FR, TA76432S

### 1.26V Adjustable High-Precision Shunt Regulators

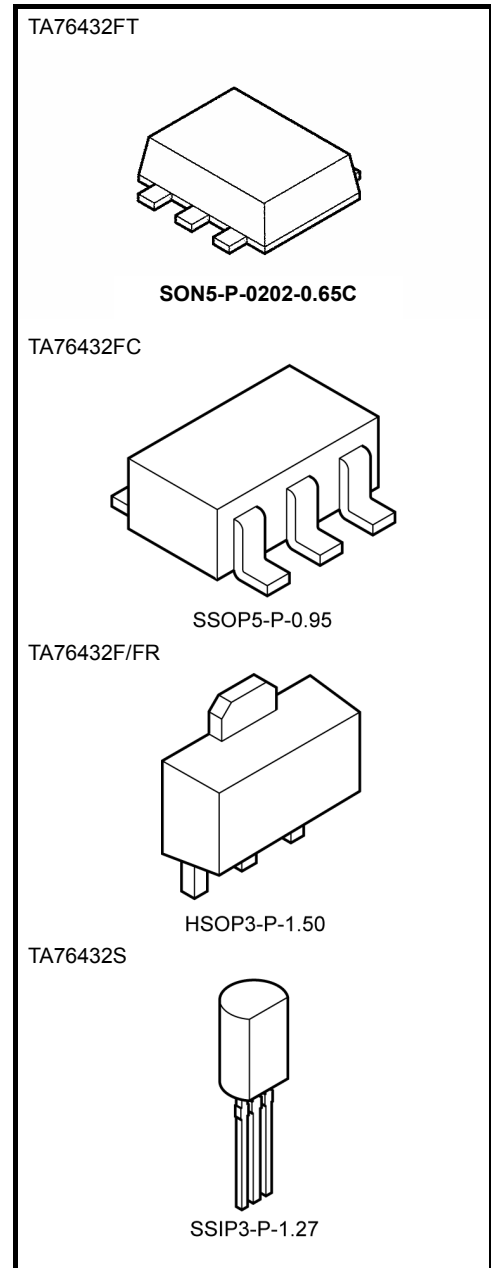
The TA76432 series consists of adjustable high-precision shunt regulators whose output voltage ( $V_{KA}$ ) can be set arbitrarily using two external resistors.

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 3V switching-regulator systems. In addition, they can be used as zener diodes to perform temperature compensation.

### Features

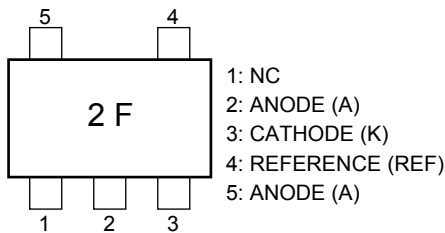
- Precision reference voltage:  $V_{REF} = 1.26 \text{ V} \pm 1.4\%$  ( $T_a = 25^\circ\text{C}$ )
- Small temperature coefficient:  $|\alpha V_{REF}| = 30 \text{ ppm}/^\circ\text{C}$  (typ.)
- Adjustable output voltage:  $V_{REF} \leq V_{OUT} \leq 19 \text{ V}$
- Minimum cathode current for regulation:  
 $I_{kmin} = 0.5 \text{ mA}$  (max.)
- Operating temperature:  $T_a = -40$  to  $85^\circ\text{C}$
- The TA76432FT is housed in an ultra-thin UFV package. (thickness: 0.7 mm typ.)
- Packages: UFV (TA76432FT), SMV (TA76432FC), PW-Mini (TA76432F/FR) and LSTM (TA76432S)



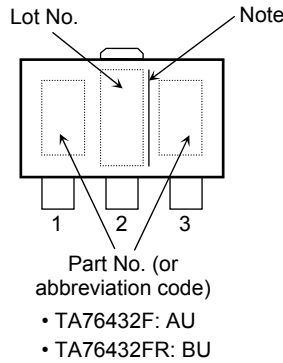
|                   |                  |
|-------------------|------------------|
| Weight            |                  |
| SON5-P-0202-0.65C | : 0.007 g (typ.) |
| SSOP5-P-0.95      | : 0.014 g (typ.) |
| HSOP3-P-1.50      | : 0.05 g (typ.)  |
| SSIP3-P-1.27      | : 0.36 g (typ.)  |

## Pin Assignment/Marking

TA76432FT/TA76432FC



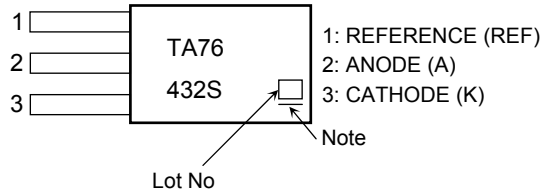
TA76432F/FR



| No. | TA76432F        | TA76432FR       |
|-----|-----------------|-----------------|
| 1   | CATHODE (K)     | REFERENCE (REF) |
| 2   | ANODE (A)       | ANODE (A)       |
| 3   | REFERENCE (REF) | CATHODE (K)     |

\*: TA76432F vs. TA76432FR  
Reverse pin connection.

TA76432S



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

Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

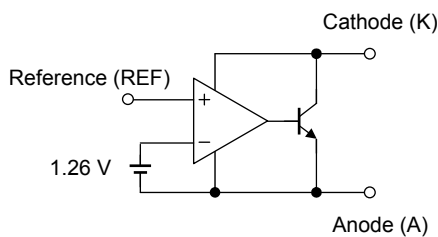
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical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

## How to Order

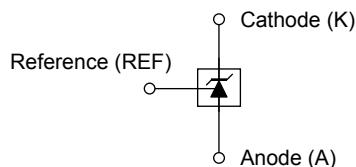
| Product No.           | Package Type                | Packing Type and Capacity                   |
|-----------------------|-----------------------------|---|
| TA76432FT (TE85L,F)   | UFV<br>(surface-mount type) | Embossed tape: 3000 pcs/tape                |
| TA76432FC (TE85L,F)   | SMV<br>(surface-mount type) | Embossed tape: 3000 pcs/reel                |
| TA76432F/FR(F)        | PW-Mini (SOT-89)            | On cut tape (TE12L,F): 100 pcs/tape section |
| TA76432F/FR (TE12L,F) | (surface-mount type)        | Embossed tape: 1000 pcs/reel                |
| TA76432S(F)           | LSTM                        | Loose in bag: 200 pcs/bag                   |
| TA76432S (TPE6,F)     | (lead type)                 | Radial tape: 2000 pcs/reel                  |

Note: The lead pitch for the TA76432S(F) and TA76432S (TPE6,F) may vary.

## Functional Block Diagram

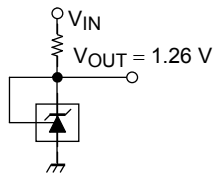


## Circuit Symbol

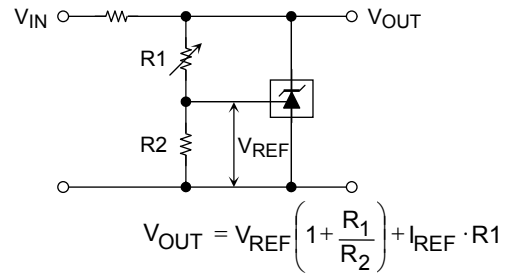


**Typical Application Circuits**

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



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



**Usage Precautions**

- (1) TA76432FT, TA76432FC, TA76432F/FR, TA76432S  
 These products contain MOS elements. Please take care to avoid generating static electricity when handling these devices.
- (2) TA76432FT, TA76432FC, TA76432F/FR, TA76432S  
 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 absolute 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 pins of TA76432FT/TA76432FC  
 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 (Ta = 25°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            | $\mu$ A        |
| Reference-anode reverse current |             | $-I_{REF}$ | 10            | mA             |
| Power dissipation               | TA76432FT   | $P_D$      | 0.45 (Note 1) | W              |
|                                 | TA76432FC   |            | 0.2           |                |
|                                 | TA76432F/FR |            | 0.38 (Note 2) |                |
|                                 | TA76432S    |            | 0.5           |                |
| Thermal resistance              | TA76432FT   | $R_{th}$   | 277 (Note 1)  | $^{\circ}$ C/W |
|                                 | TA76432FC   |            | 625           |                |
|                                 | TA76432F/FR |            | 328 (Note 2)  |                |
|                                 | TA76432S    |            | 250           |                |
| Operating temperature           |             | $T_{opr}$  | -40 to 85     | $^{\circ}$ C   |
| Junction temperature            |             | $T_j$      | 150           | $^{\circ}$ C   |
| Storage temperature             |             | $T_{stg}$  | -55 to 150    | $^{\circ}$ C   |

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

Note 2: Glass epoxy board mounting: 30 mm × 30 mm × 0.8 mm (Cu pad area 50 mm<sup>2</sup>)

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       | $V_{KA}$  | $V_{REF}$ | —    | 19  | V            |
| Cathode current       | $I_K$     | 0.5       | —    | 15  | mA           |
| Operating temperature | $T_{opr}$ | -40       | —    | 85  | $^{\circ}$ C |

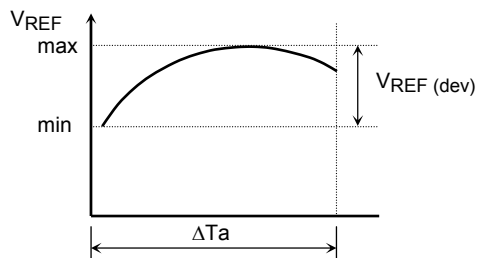
## Electrical Characteristics

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

| Characteristics   | Symbol                    | Test Condition   | Min   | Typ. | Max   | Unit          |
|---|---------------------------|--|-------|------|-------|---------------|
| Reference voltage   | $V_{REF}$                 | $V_{KA} = V_{REF}$   | 1.242 | 1.26 | 1.278 | 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.

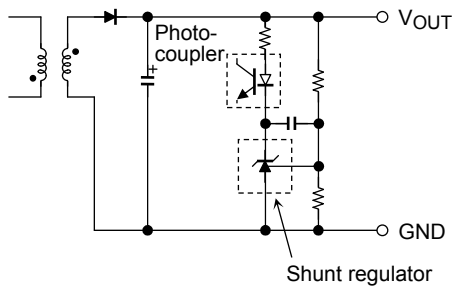
The average temperature coefficient of the  $V_{REF}$  is defined as:



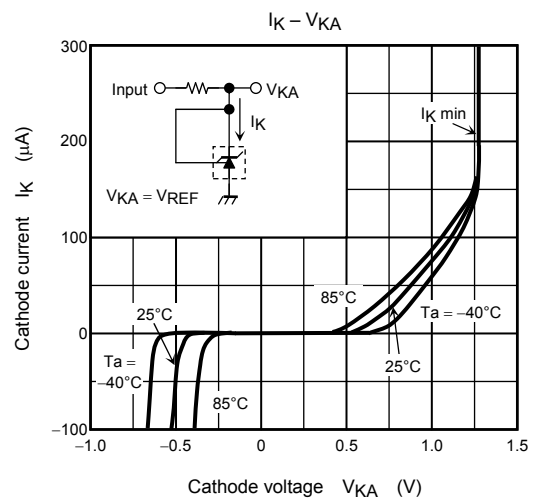
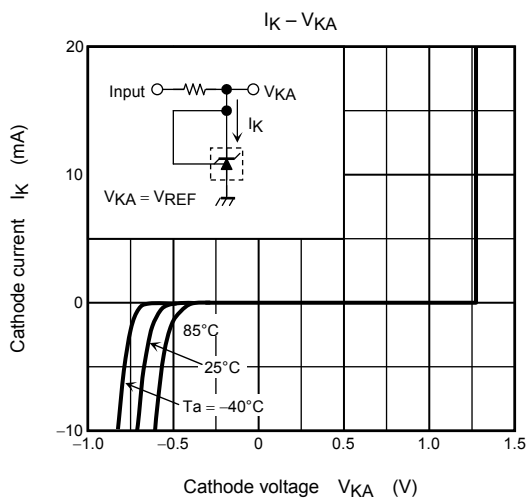
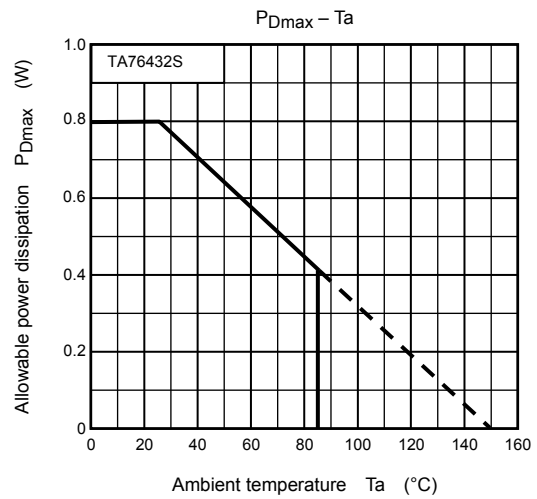
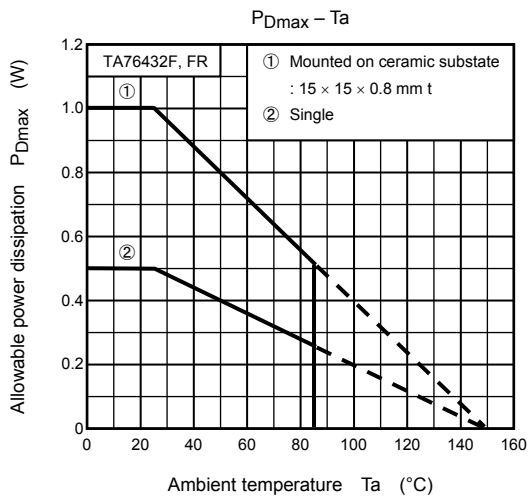
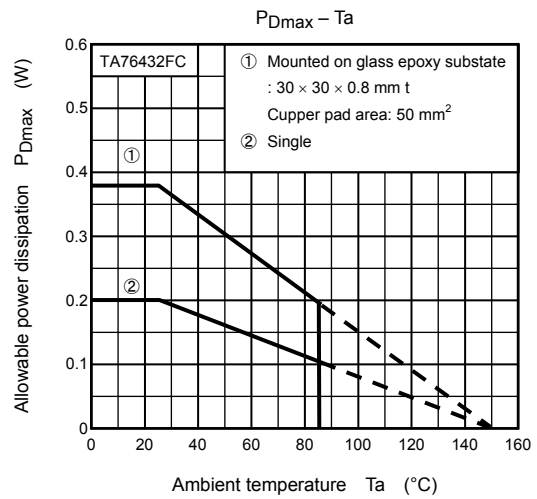
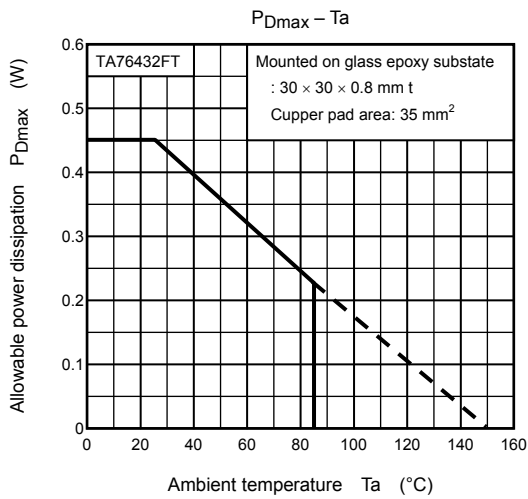
$$|\alpha V_{REF}| = \frac{\left( \frac{V_{REF}(\text{dev}) \times 10^6}{V_{REF} @ 25^\circ\text{C}} \right)}{\Delta T_a} \text{ (ppm/}^\circ\text{C)}$$

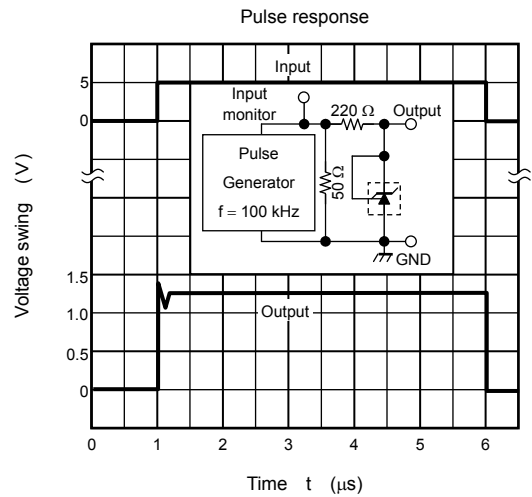
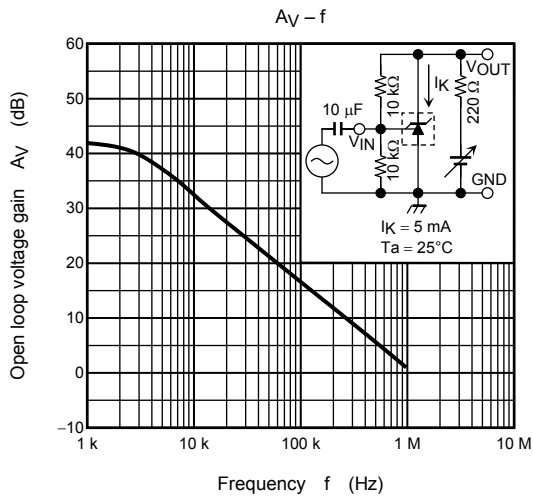
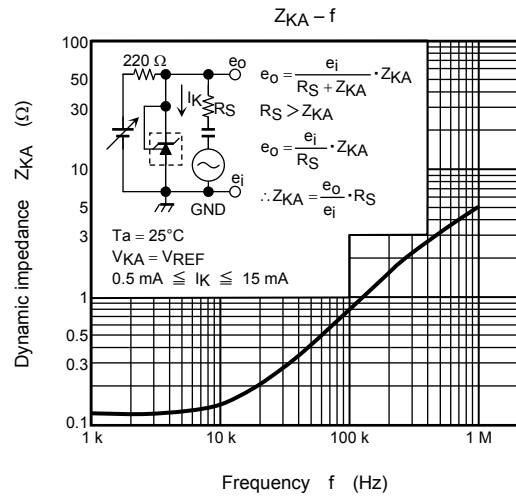
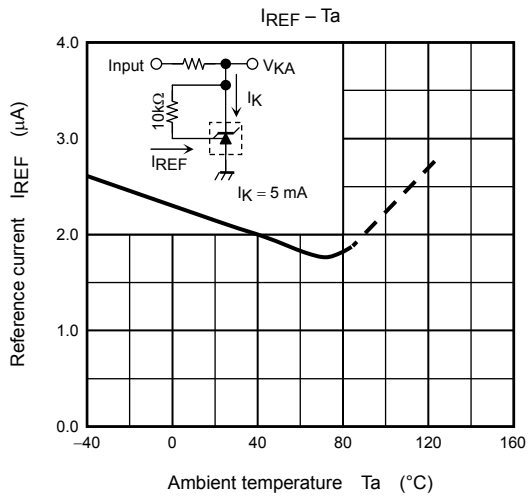
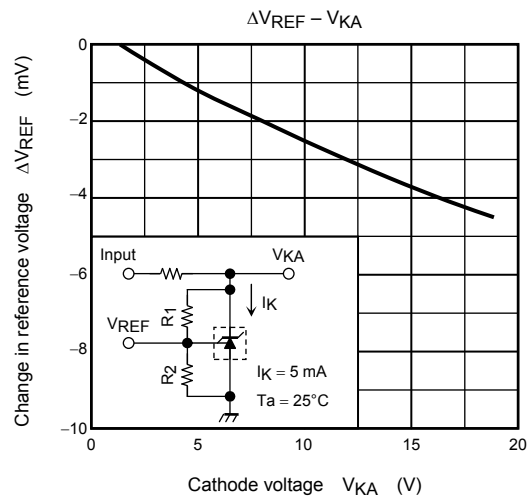
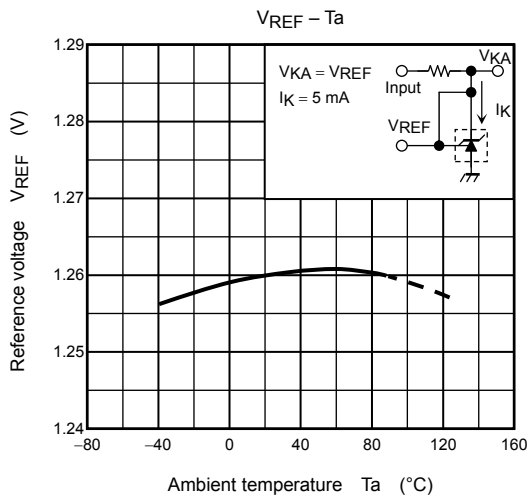
## Application Circuit Example

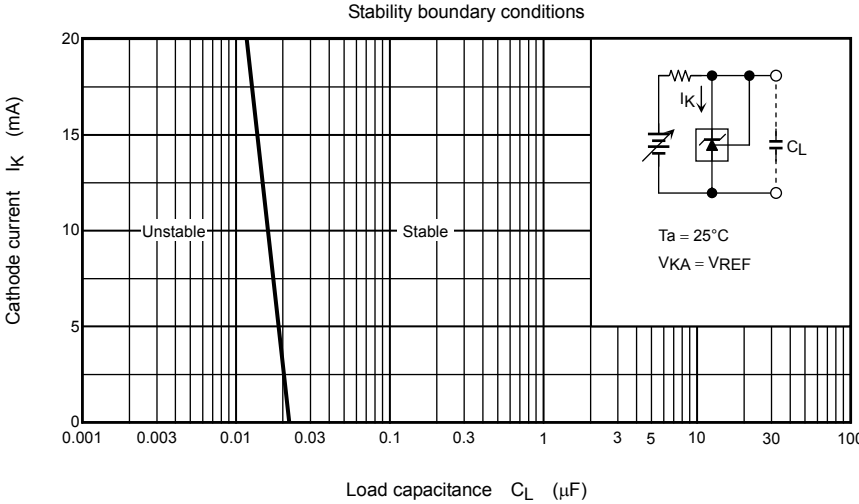
Error amplification circuit for the switching power supply



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.





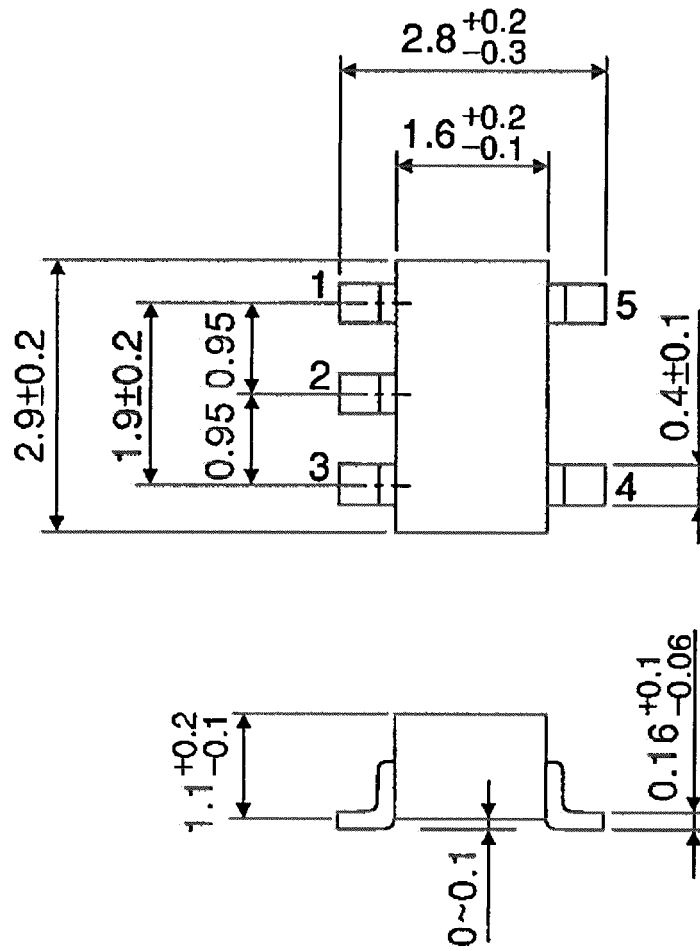




## Package Dimensions

SSOP5-P-0.95

Unit : mm



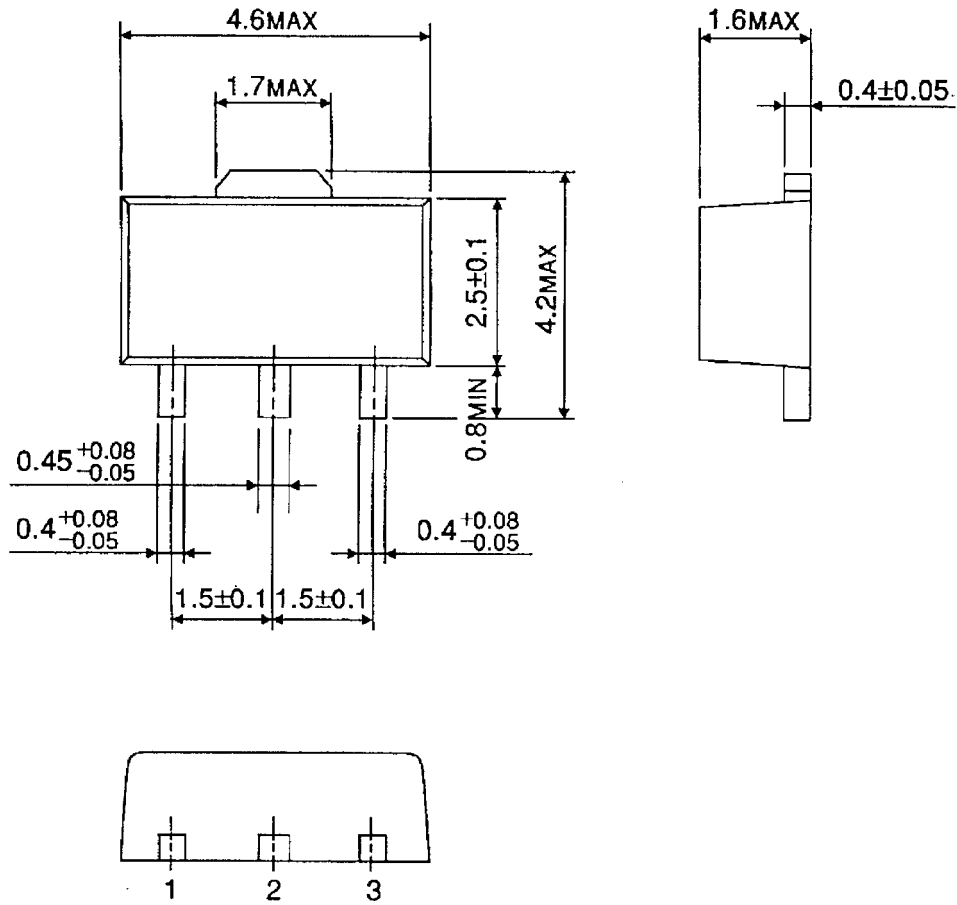
TA76432FC (SMV)

Weight: 0.014 g (typ.)

## Package Dimensions

HSOP3-P-1.50

Unit : mm



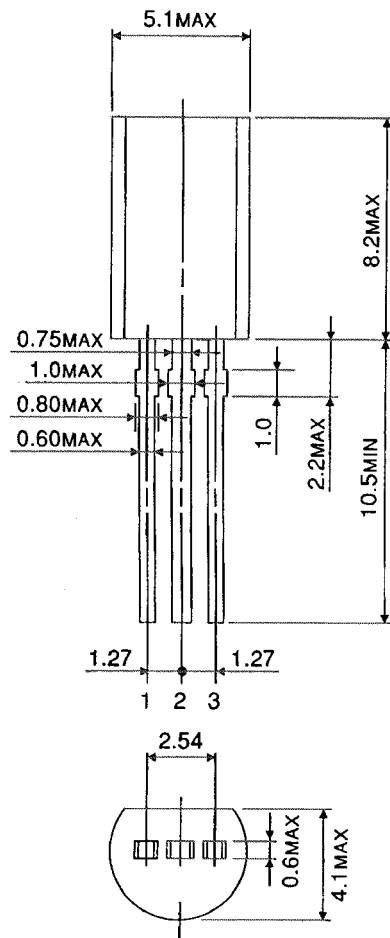
TA76432F/FR (PW-Mini)

Weight: 0.05 g (typ.)

## Package Dimensions

Unit : mm

SSIP3-P-1.27



TA76432S (LSTM)

Weight: 0.36 g (typ.)

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