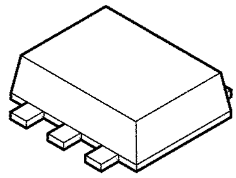
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA76432FT,TA76432FC,TA76432F,TA76432FR,TA76432S

1.26-V Adjustable High-Precision Shunt Regulators

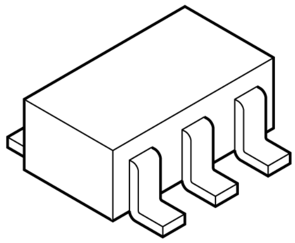
The TA76432 series consists of adjustable high-precision shunt regulators whose output voltage (V_{KA}) can be set arbitrarily using two external resistors.
These devices have a precise internal reference voltage of 1.26 V, enabling them to operate at low voltage.
The devices are ideal for use as error amplifiers in 3-V switching-regulator systems. In addition, they can be used as zener diodes to perform temperature compensation.

TA76432FT



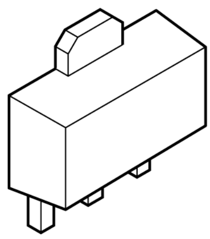
SSOP5-P-0.65C

TA76432FC



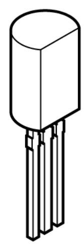
SSOP5-P-0.95

TA76432F/FR



HSOP3-P-1.50

TA76432S



SSIP3-P-1.27

Weight

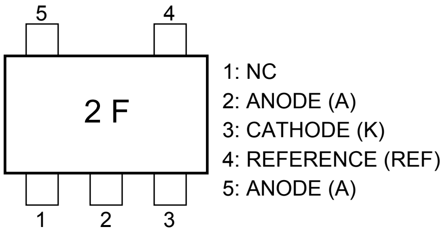
SSOP5-P-0.65C	: 0.007 g (typ.)
SSOP5-P-0.95	: 0.014 g (typ.)
HSOP3-P-1.50	: 0.05 g (typ.)
SSIP3-P-1.27	: 0.36 g (typ.)

Features

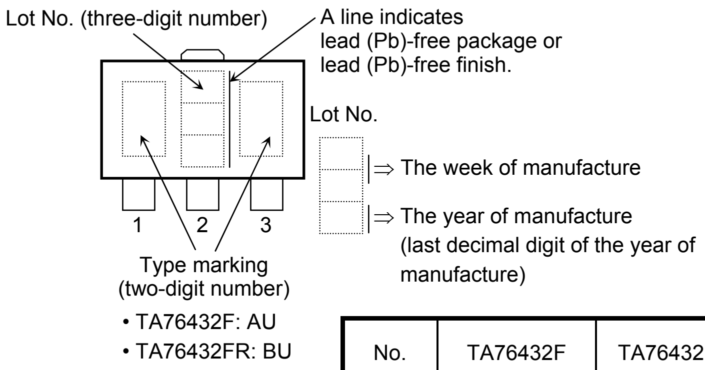
- Precision reference voltage: V_{REF} = 1.26 V ± 1.4% (Ta = 25°C)
- Small temperature coefficient: $|\alpha V_{REF}|$ = 30 ppm/°C (typ.)
- Adjustable output voltage: $V_{REF} \le V_{OUT} \le 19$ V
- Minimum cathode current for regulation:
  I_{kmin} = 0.5 mA (max.)
- Operating temperature: Ta = −40~85°C
- Packages: UFV (TA76432FT), SMV (TA76432FC),
  PW-MINI (TA76432F/FR) and
  TO-92MOD (TA76432S)
- The TA76432FT is housed in an ultra-thin UFV package.
  (thickness: 0.7 mm typ.)

Pin Assignment/Marking

TA76432FT/TA76432FC



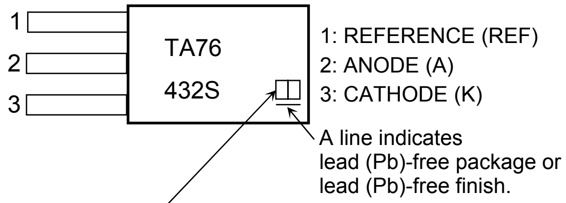
TA76432F/FR



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

Note: TA76432F vs. TA76432FR: reverse pin connection.

TA76432S



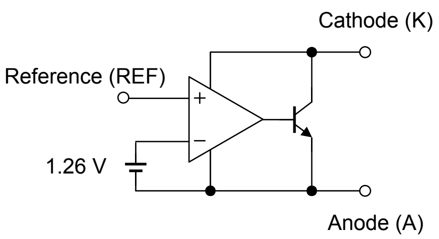
Lot No: The last decimal digit of the year of manufacture followed by the month as letters A to L of the alphabet.
For example: Jan-2001 is coded as “1A”

How to Order

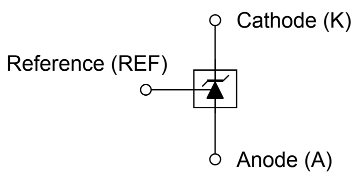
Product No.	Package Type	Packing Type and Capacity	Minimum Order
TA76432FT (TE85L)	UFV (surface-mount type)	Embossed tape: 3000/tape	1 tape
TA76432FC (TE85L)	SMV (surface-mount type)	Embossed tape: 3000/tape	1 tape
TA76432F/R	PW-MINI (SOT-89) (surface-mount type)	On cut tape (TE12L): 100/tape section	100
TA76432F/R (TE12L)		Embossed tape: 1000/tape	1 tape
TA76432S	TO-92MOD (lead type)	Loose in bag: 200/bag	1 bag
TA76432S (TPE6)		Radial tape: 2000/tape	1 tape

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

Functional Block Diagram

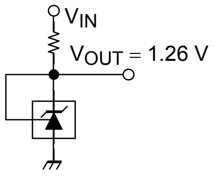


Circuit Symbol

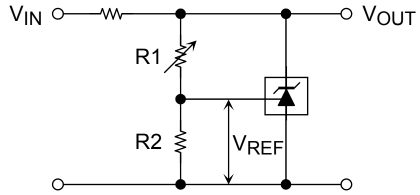


Typical Application Circuits

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



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



$$V_{OUT} = V_{REF}\left(1 + \frac{R_1}{R_2}\right) + I_{REF} \cdot R1$$

Precautions during Use

(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 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	μA
Reference-anode reverse current		$-I_{REF}$	10	mA
Power dissipation	TA76432FT	P_D	0.45 (Note 1)	W
	TA76432FC		0.2	
			0.38 (Note 2)	
	TA76432F/FR		0.5	
	TA76432S		0.8	
Thermal resistance	TA76432FT	R_{th}	277 (Note 1)	°C/W
	TA76432FC		625	
			328 (Note 2)	
	TA76432F/FR		250	
	TA76432S		156	
Operating temperature		T_{opr}	−40~85	°C
Junction temperature		T_j	150	°C
Storage temperature		T_{stg}	−55~150	°C

Note 1: Glass epoxy board mounting: 30 mm × 30 mm × 0.8 mmt (Cu pad area 35 mm^2)

Note 2: Glass epoxy board mounting: 30 mm × 30 mm × 0.8 mmt (Cu pad area 50 mm^2)

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).

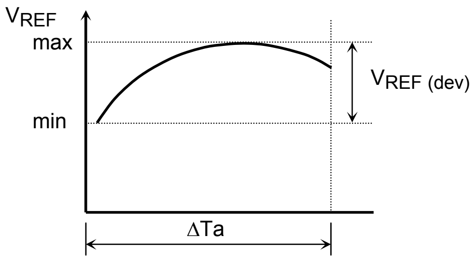
Recommended Operating Conditions

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, Ta = 25°C, I_K = 5 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	$V_{REF\ (dev)}$	0°C ≦ Ta ≦ 85°C, $V_{KA} = V_{REF}$	—	3	15	mV
Ratio of change in reference input voltage to the change in cathode voltage	$\Delta V_{REF}/\Delta V$	$V_{REF} \leqq V_{KA} \leqq 5$ V	—	0.5	2.5	mV/V
		5 V ≦ V_{KA} ≦ 19 V	—	0.3	2.0	
Reference input current	I_{REF}	$V_{KA} = V_{REF}$	—	2	4	μA
Deviation of reference input current over temperature	$I_{REF\ (dev)}$	0°C ≦ Ta ≦ 85°C, $V_{KA} = V_{REF}$, $R_1 = 10\ k\Omega$, $R_2 = \infty$	—	0.3	1.2	μA
Minimum cathode current for regulation	I_{Kmin}	$V_{KA} = V_{REF}$	—	0.2	0.5	mA
Off-State cathode current	I_{Koff}	$V_{KA} = 19$ V, $V_{REF} = 0$ V	—	—	1.0	μA
Dynamic impedance	$\lvert Z_{KA} \rvert$	$V_{KA} = V_{REF}$, f ≦ 1 kHz, 0.5 mA ≦ I_K ≦ 15 mA	—	0.2	0.5	Ω

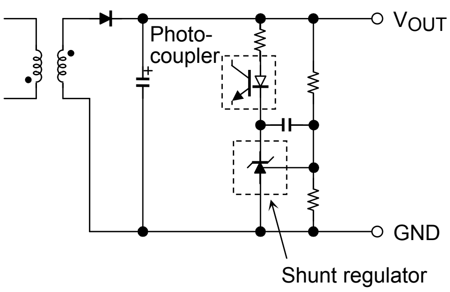
The deviation parameters $V_{REF\ (dev)}$ and $I_{REF\ (dev)}$ are defined as the maximum variation of the V_{REF} and I_{REF} over the rated temperature range.
The average temperature coefficient of the V_{REF} is defined as:



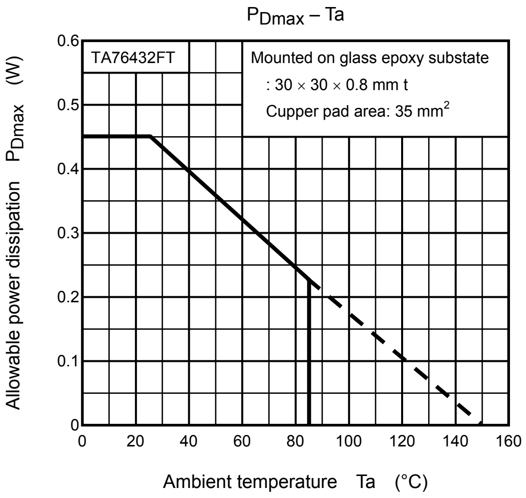
$$\left|\alpha V_{REF}\right| = \frac{\left(\dfrac{V_{REF\ (dev)} \times 10^6}{V_{REF}\ @25°C}\right)}{\Delta Ta}\ (\mathrm{ppm}/°C)$$

Application Circuit Example

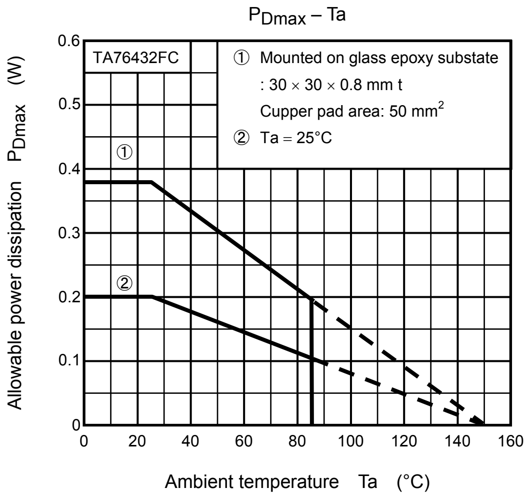
Error amplification circuit for the switching power supply



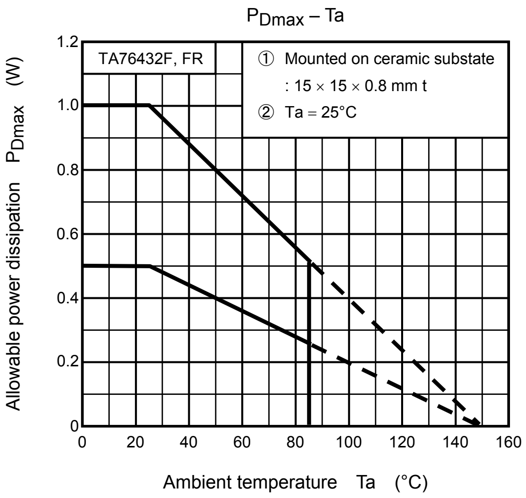
This circuit amplifies the difference between the switching power supply's secondary output voltage and the shunt regulator's reference voltage. It then feeds the amplified voltage back to the primary input voltage via the photocoupler.



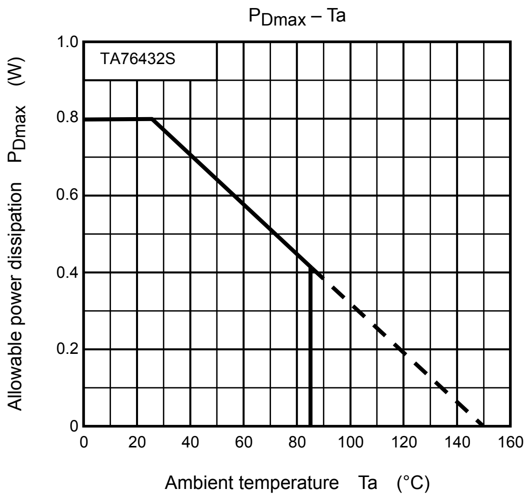
PDmax – Ta
TA76432FT
Mounted on glass epoxy substate
: 30 × 30 × 0.8 mm t
Cupper pad area: 35 mm2
Allowable power dissipation PDmax (W)
Ambient temperature Ta (°C)



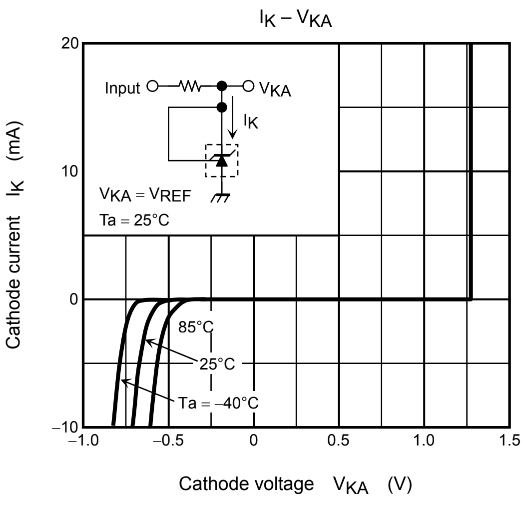
PDmax – Ta
TA76432FC
① Mounted on glass epoxy substate
: 30 × 30 × 0.8 mm t
Cupper pad area: 50 mm2
② Ta = 25°C
Allowable power dissipation PDmax (W)
Ambient temperature Ta (°C)



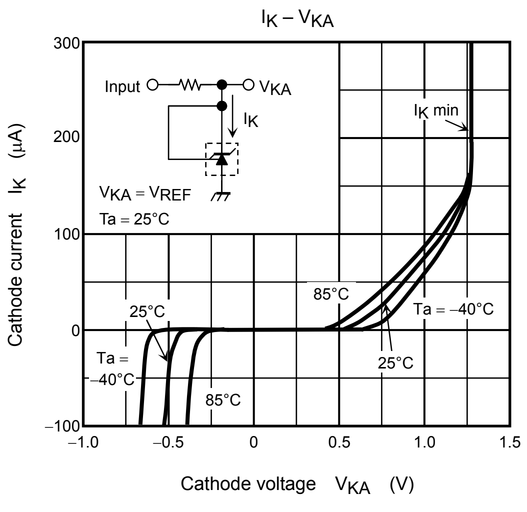
PDmax – Ta
TA76432F, FR
① Mounted on ceramic substate
: 15 × 15 × 0.8 mm t
② Ta = 25°C
Allowable power dissipation PDmax (W)
Ambient temperature Ta (°C)



PDmax – Ta
TA76432S
Allowable power dissipation PDmax (W)
Ambient temperature Ta (°C)

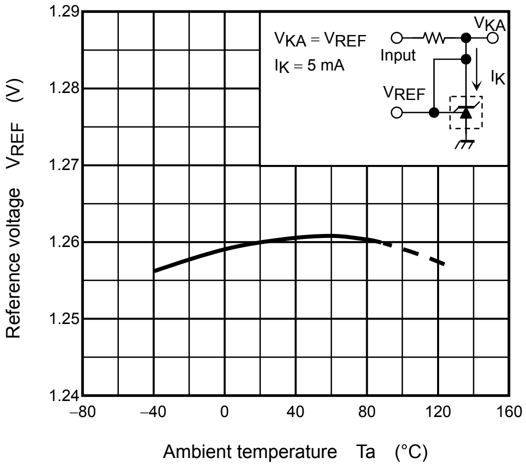


IK – VKA
Input
VKA
IK
VKA = VREF
Ta = 25°C
85°C
25°C
Ta = –40°C
Cathode current IK (mA)
Cathode voltage VKA (V)

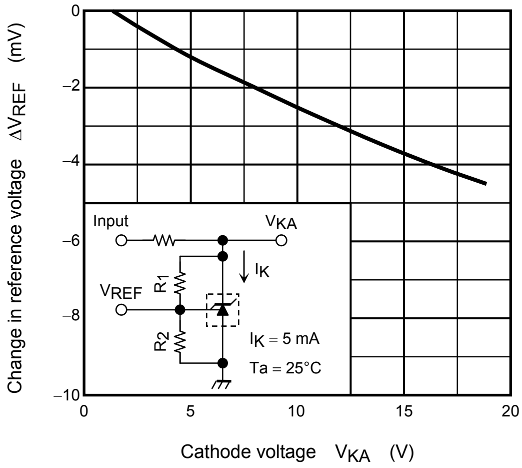


IK – VKA
Input
VKA
IK
IK min
VKA = VREF
Ta = 25°C
85°C
Ta = –40°C
25°C
25°C
Ta = –40°C
85°C
Cathode current IK (μA)
Cathode voltage VKA (V)

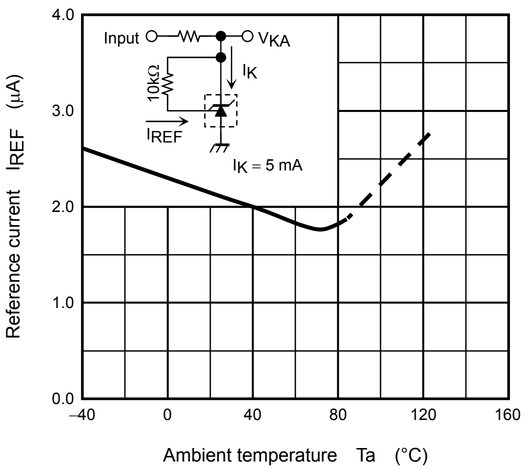
V_{REF} – Ta



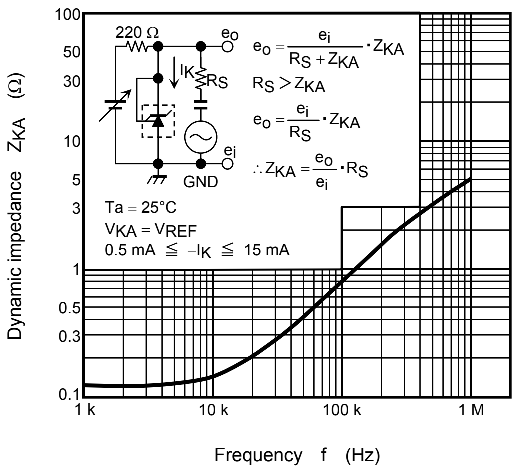
ΔV_{REF} – V_{KA}



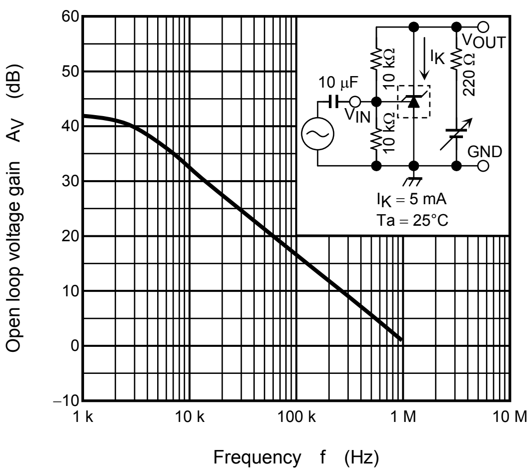
I_{REF} – Ta



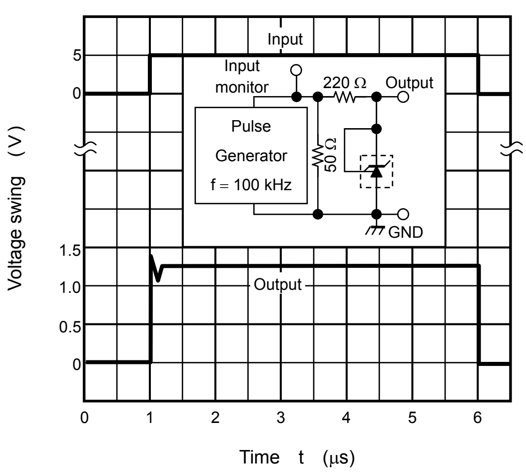
Z_{KA} – f

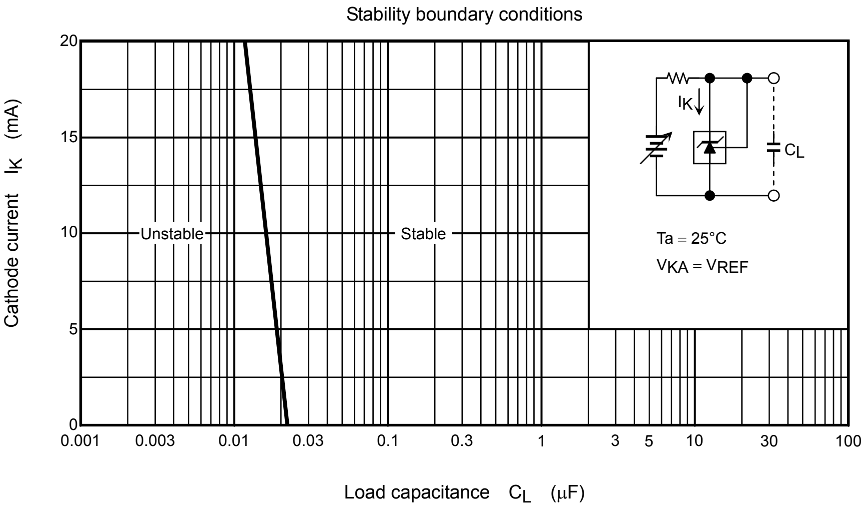


A_V – f



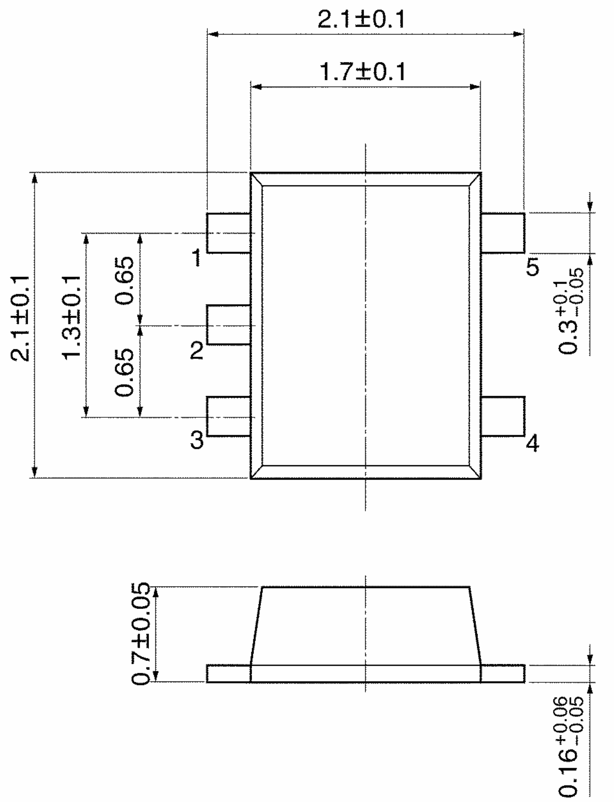
Pulse response




Stability boundary conditions
Cathode current IK (mA)
20
15
10
5
0
Unstable
Stable
IK
CL
Ta = 25°C
VKA = VREF
0.001
0.003
0.01
0.03
0.1
0.3
1
3
5
10
30
100
Load capacitance CL (μF)

Package Dimensions

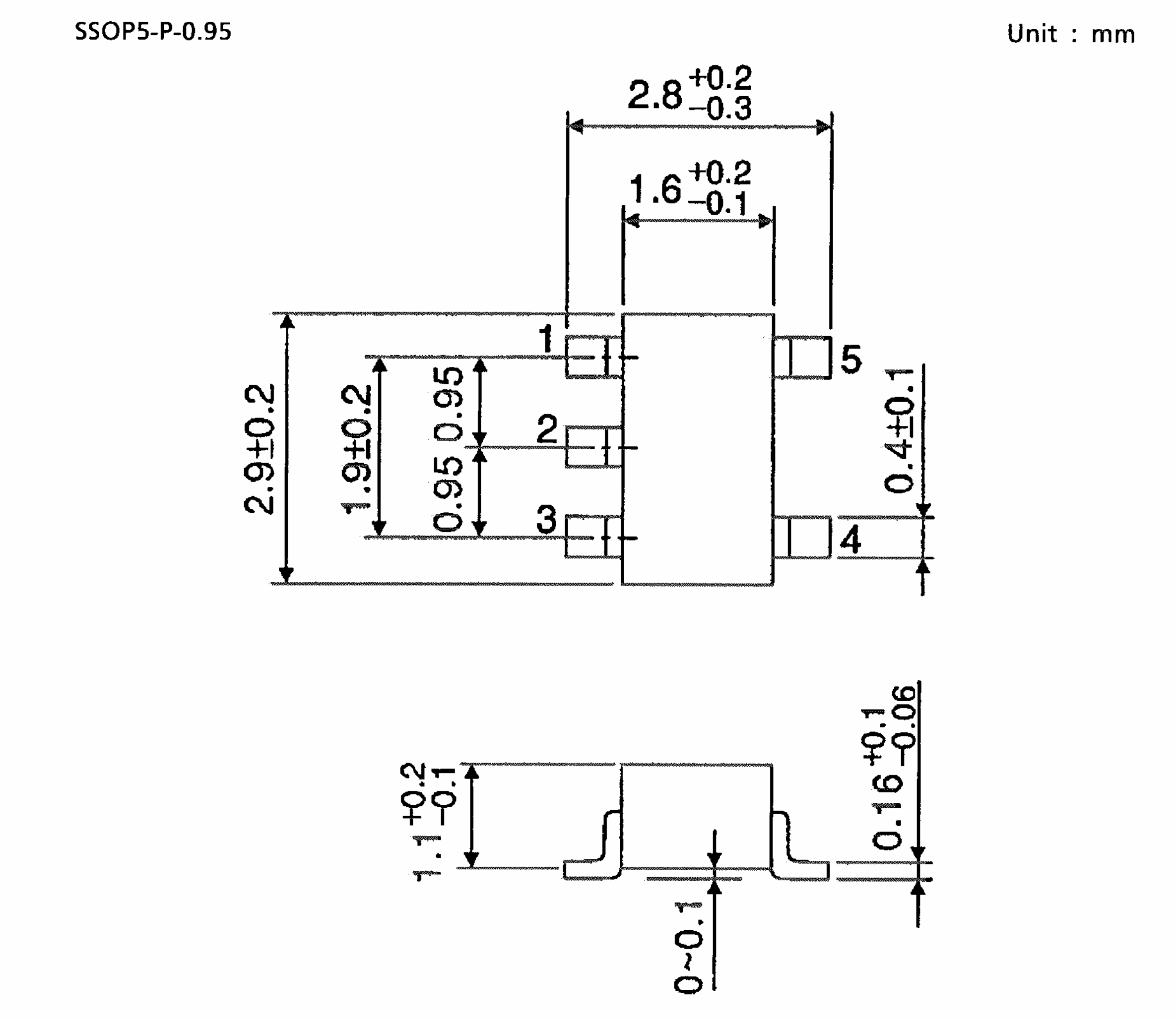
SSOP5-P-0.65C Unit: mm



TA76432FT (UFV)

Weight: 0.007 g (typ.)

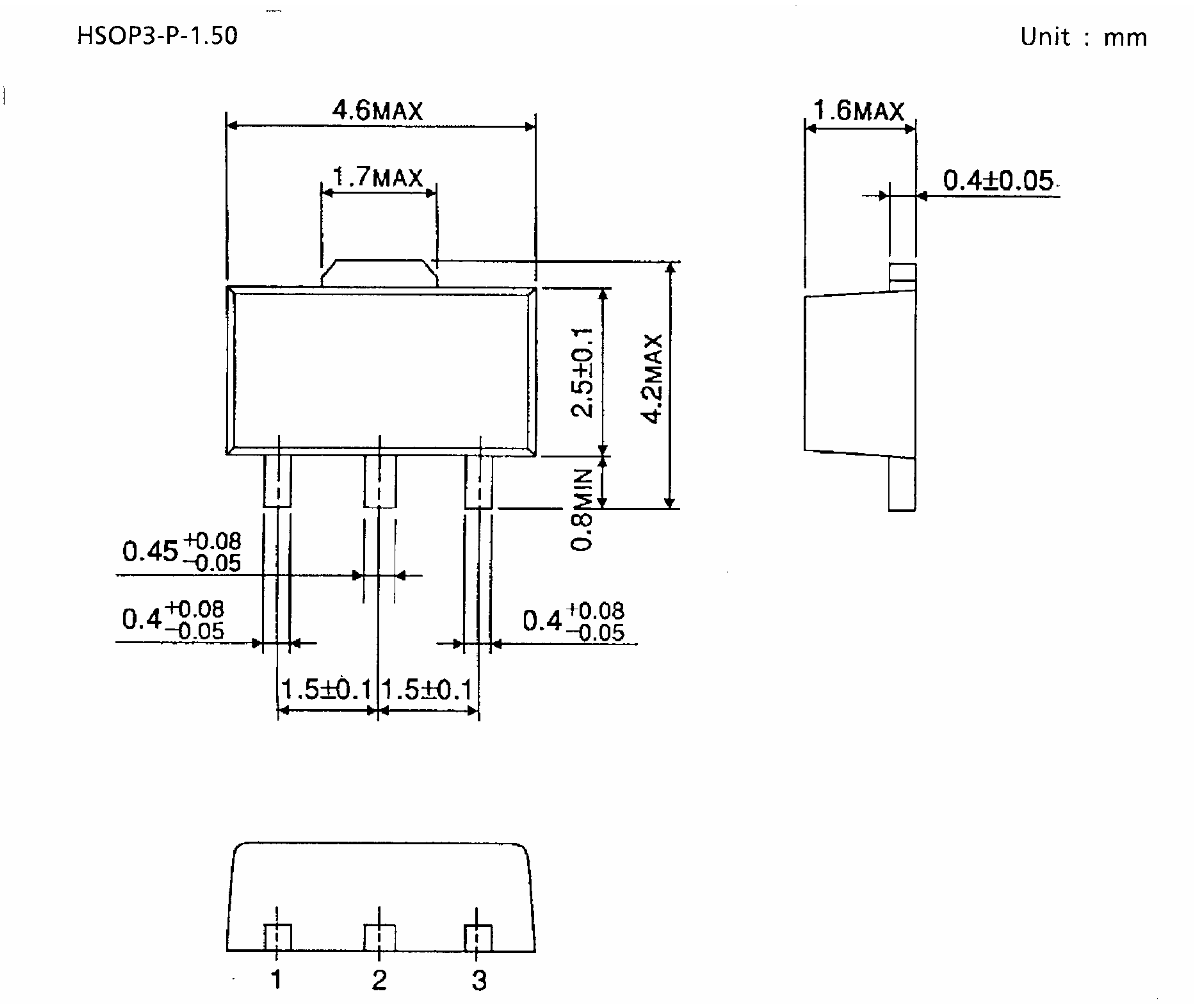
Package Dimensions



TA76432FC (SMV)

Weight: 0.014 g (typ.)

Package Dimensions

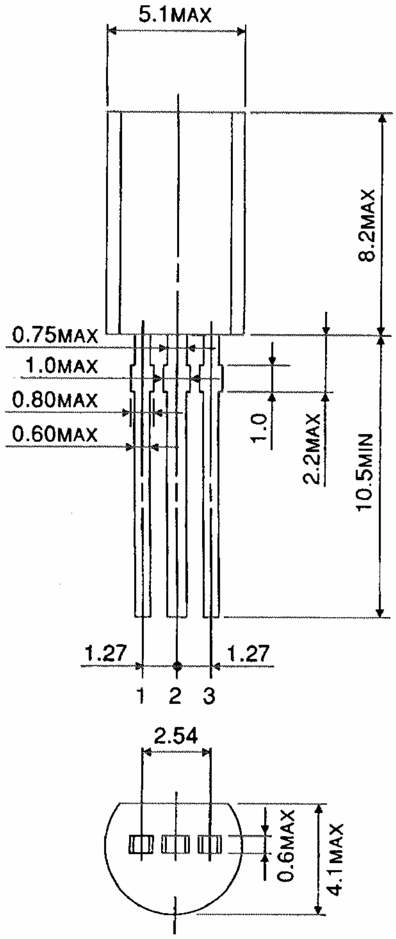


TA76432F/FR (PW-MINI)

Weight: 0.05 g (typ.)

Package Dimensions

SSIP3-P-1.27



TA76432S (TO-92MOD)

Weight: 0.36 g (typ.)

RESTRICTIONS ON PRODUCT USE