

## TA76L431FT, TA76L431S

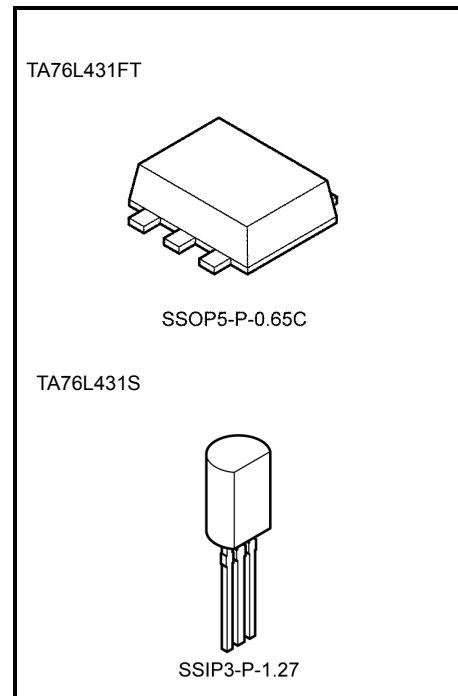
### 2.49-V Adjustable High-Precision Shunt Regulators

These devices are adjustable high-precision shunt regulators whose output voltage ( $V_{KA}$ ) can be set arbitrarily using two external resistors.

The devices have a precise internal reference voltage of 2.49 V, enabling them to operate at low voltage. In addition, they can be used as zener diodes to perform temperature compensation.

#### Features

- Precision reference voltage  
:  $V_{REF} = 2.49V \pm 1.0\%$  ( $T_a = 25^\circ C$ )
- Adjustable output voltage  
:  $V_{REF} \leq V_{OUT} \leq 19 V$
- Minimum cathode current for regulation  
:  $I_{kmin} = 0.5 \text{ mA (max.)}$
- Operating temperature:  $T_a = -40 \sim 85^\circ C$
- Packages: UFV (TA76L431FT),  
TO-92MOD (TA76L431S)
- The TA76L431FT is housed in an ultra-thin UFV package.  
(thickness: 0.7 mm typ.)

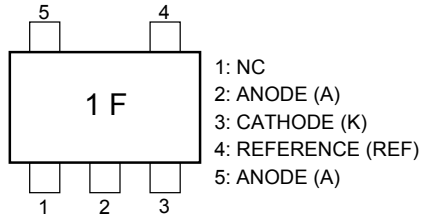


#### Weight

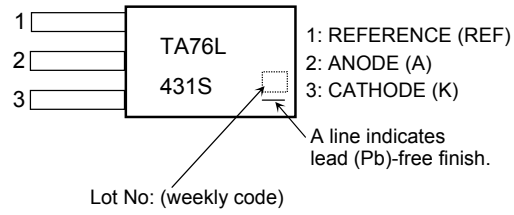
SSOP5-P-0.65C : 0.007 g (typ.)  
SSIP3-P-1.27 : 0.36 g (typ.)

## Pin Assignment/Marking

TA76L431FT



TA76L431S

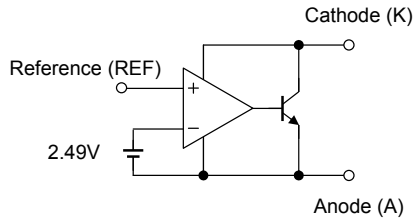


## How to Order

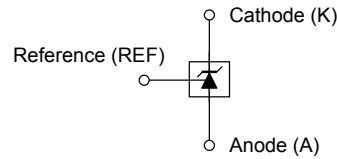
Product No.	Package Type	Packing Type and Capacity	Minimum Order
TA76L431FT (TE85L,F)	UFV (surface-mount type)	Embossed tape: 3000/tape	1 tape
TA76L431S(Q)	TO-92MOD (lead type)	Loose in bag: 200/bag	1 bag
TA76L431S (TPE6,Q)		Radial tape: 2000/tape	1 tape

Note: The lead pitch for the TA76L431S(Q) and TA76L431S(TPE6,Q) may vary.

## Functional Block Diagram

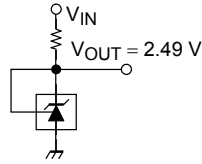


## Circuit Symbol

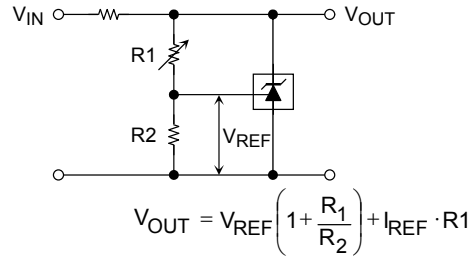


## Typical Application Circuits

### (1) 2.49 V Reference ( $V_{KA} = V_{REF}$ )



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



## Precautions during Use

#### 1. TA76L431FT, TA76L431S

These products contain MOS elements. Please take care to avoid generating static electricity when handling these devices.

#### 2. TA76L431FT, TA76L431S

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 TA76L431FT

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	$I_K$	50	mA
Cathode-anode reverse current	$-I_K$	50	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	TA76L431FT	0.45 (Note 1)	W
	TA76L431S	0.8	
Thermal resistance	TA76L431FT	277 (Note 1)	$^\circ\text{C/W}$
	TA76L431S	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 substrate 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

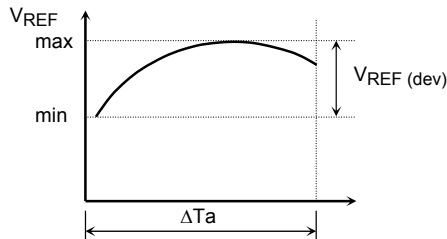
Characteristics	Symbol	Min	Typ.	Max	Unit
Cathode voltage	$V_{KA}$	$V_{REF}$	—	19	V
Cathode current	$I_K$	0.5	—	40	mA
Operating temperature	$T_{opr}$	-40	—	85	°C

## 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	$V_{REF}$	$V_{KA} = V_{REF}$	2.465	2.49	2.515	V
Deviation of reference input voltage over temperature	$V_{REF (dev)}$	$0^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$ , $V_{KA} = V_{REF}$	—	5	15	mV
Ratio of change in reference input voltage to the change in cathode voltage	$\Delta V_{REF}/\Delta V$	$V_{REF} \leq V_{KA} \leq 10\text{ V}$	—	0.8	2.4	mV/V
		$10\text{ V} \leq V_{KA} \leq 19\text{ V}$	—	0.8	2.0	
Reference Input current	$I_{REF}$	$V_{KA} = V_{REF}$	—	0.6	3	$\mu\text{A}$
Deviation of reference input current over temperature	$I_{REF (dev)}$	$0^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$ , $V_{KA} = V_{REF}$ , $R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$	—	0.3	1.2	$\mu\text{A}$
Minimum cathode current for regulation	$I_{Kmin}$	$V_{KA} = V_{REF}$	—	0.2	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} $	$V_{KA} = V_{REF}$ , $f \leq 1\text{ kHz}$ , $0.5\text{ mA} \leq I_K \leq 40\text{ mA}$	—	0.2	0.5	$\Omega$

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 ( $T_a = 0$  to  $70^\circ\text{C}$ ).

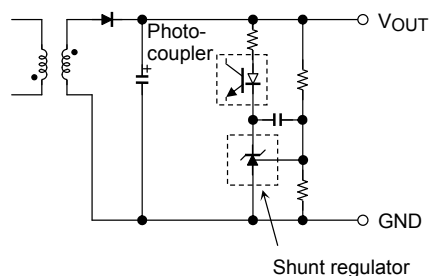
The average temperature coefficient of the  $V_{REF}$  is defined as:



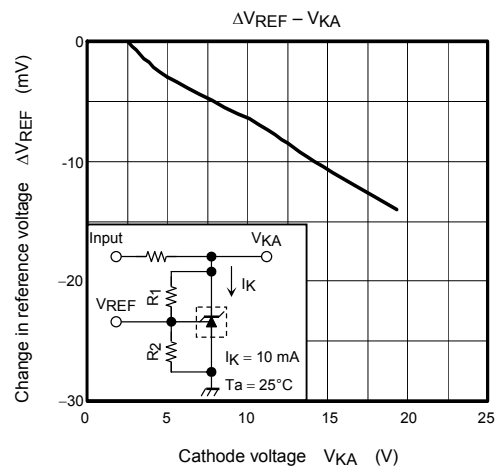
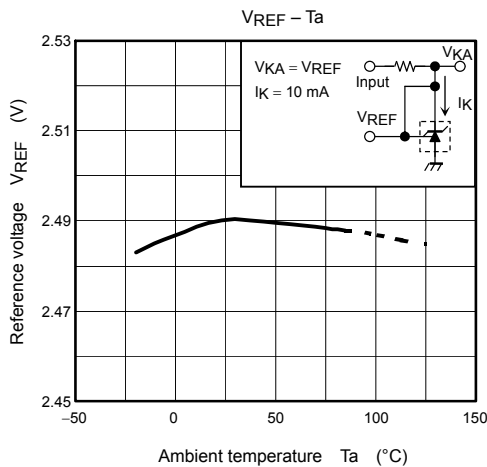
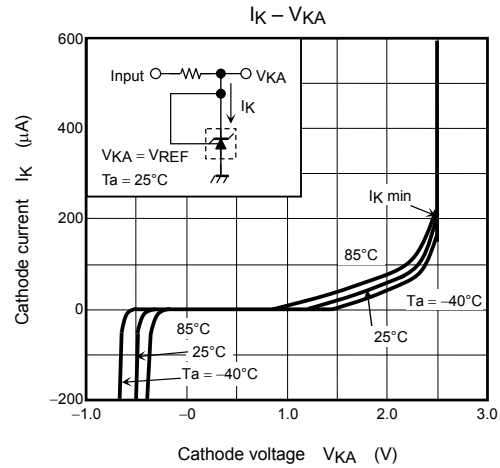
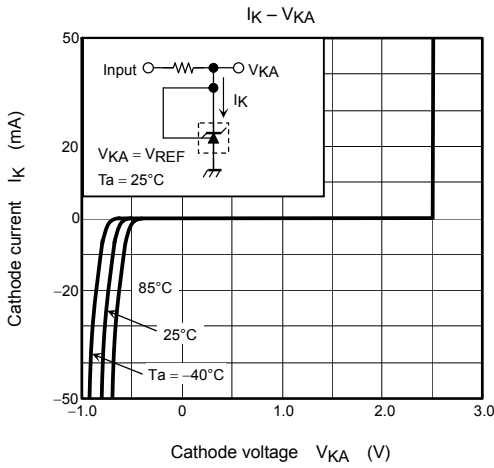
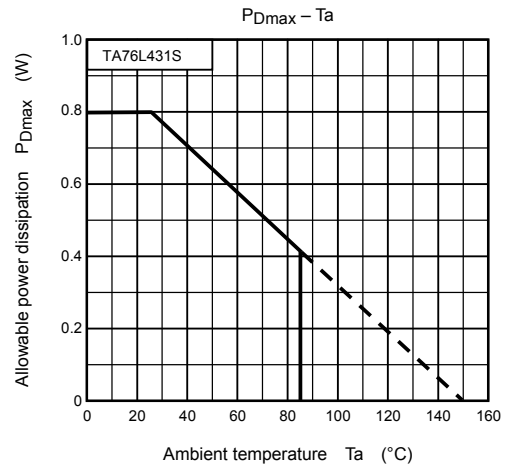
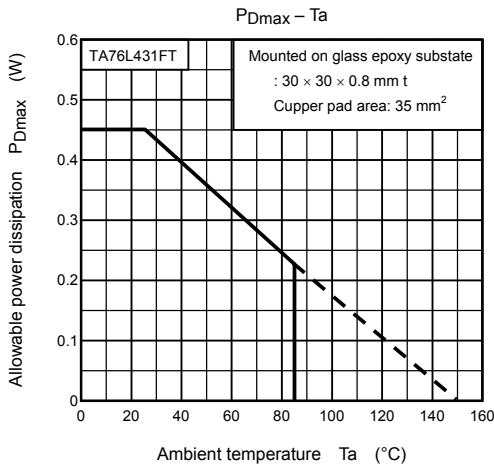
$$|\alpha V_{REF}| = \frac{\left( \frac{V_{REF (dev)} \times 10^6}{V_{REF @ 25^\circ\text{C}}} \right)}{\Delta T_a} \text{ (ppm/}^\circ\text{C)}$$

## 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.

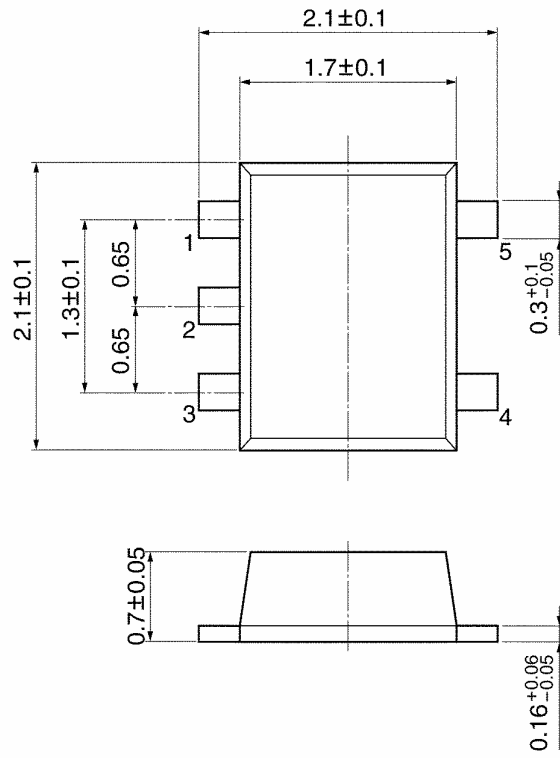




## Package Dimensions

SSOP5-P-0.65C

Unit: mm



TA76L431FT (UFV)

Weight: 0.007 g (typ.)





**RESTRICTIONS ON PRODUCT USE**

20070701-EN

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.