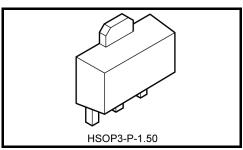
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

# TA76431F,TA76431FR

### Adjustable Precision Shunt Regulator

#### **Features**

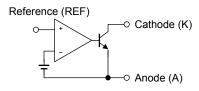
- Precision Reference Voltage:  $V_{REF} = 2.495 \text{ V} \pm 2.2\%$
- Small Temperature Coefficient:  $|\alpha V_{REF}| = 46 \text{ ppm/}^{\circ}\text{C}$
- Adjustable Output Voltage:  $V_{REF} \le V_{OUT} \le 36 \text{ V}$
- Low Dynamic Output Impedance:  $|Z_{KA}| = 0.15 \Omega$  (Typ.)
- Small Flat Package
- TA76431FR is a new Toshiba shunt regulator. This device's pin assignment is the reverse of that of the TA76431F.

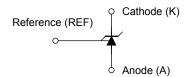


Weight: 0.05 g (typ.)

### **Functional Block Diagram**

### **Circuit Symbol**





(2) TA76431FR

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

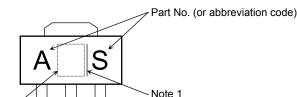
### Marking

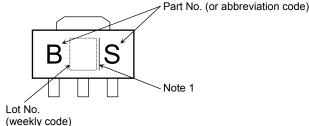
Lot No.

(weekly code)

(1) TA76431F







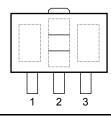
Note 1: A line beside a Lot No. identifies the indication of product Labels.

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

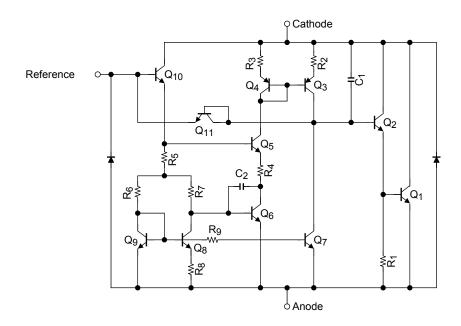


No.	(1) TA76431F	(2) TA76431FR
1	Cathode (K)	Reference (REF)
2	Anode (A)	Anode (A)
3	Reference (REF)	Cathode (K)

### **How to Order**

No.	Product No.	Package Type	Packing Type	Minimum Order
(1)	TA76431F	On cut tape (TE12L): 100 pcs/tape section		100
	TA76431F (TE12L)	PW-Mini (SOT-89) (surface-mount type)	Embossed tape: 1000 pcs/tape	1 tape
	TA76431FR	(Surface-mount type)	On cut tape (TE12L): 100 pcs/tape section	100
	TA76431FR (TE12L)		Embossed tape: 1000 pcs/tape	1 tape

### **Equivalent Circuit**



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

Characteristics	Symbol	Rating	Unit	
Cathode voltage	$V_{KA}$	37	V	
Cathode current	ΙK	-100 to 150	mA	
Reference voltage	$V_{REF}$	7	V	
Reference current	I <sub>REF</sub>	50	μΑ	
Reference-anode reverse current	-I <sub>REF</sub>	10	mA	
Power dissipation	PD	500	mW	
Fower dissipation	PD	1000 (Note 2)	IIIVV	
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	Тур.	Max	Unit
Cathode voltage	$V_{KA}$	$V_{REF}$	_	36	V
Cathode current	lκ	1	_	100	mA
Operating temperature	T <sub>opr</sub>	-40	_	85	°C

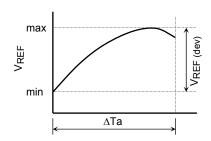
# Electrical Characteristics (Unless otherwise specified, Ta = 25°C, $I_K = 10$ mA)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Reference voltage	$V_{REF}$	V <sub>KA</sub> = V <sub>REF</sub>	2.440	2.495	2.550	V
Deviation of reference input voltage over temperature	V <sub>REF</sub> (dev)	$0^{\circ}C \le Ta \le 70^{\circ}C$ , $V_{KA} = V_{REF}$	_	8	17	mV
Ratio of change in reference input	ΔV <sub>REF</sub> /ΔV	V <sub>REF</sub> ≤ V <sub>KA</sub> ≤ 10 V	_	0.8	2.7	mV/V
voltage to the change in cathode voltage		10 V ≤ V <sub>KA</sub> ≤ 36 V	_	0.5	2.0	
Reference Input current	I <sub>REF</sub>	V <sub>KA</sub> = V <sub>REF</sub>	_	1.4	4	μА
Deviation of reference input current over temperature	I <sub>REF (dev)</sub>	$ \begin{array}{l} 0^{\circ}C \leq Ta \leq 70^{\circ}C, \ V_{KA} = V_{REF}, \\ R_{1} = 10 \ k\Omega, \ R_{2} = \infty \end{array} $	_	0.3	1.2	μА
Minimum cathode current for regulation	I <sub>Kmin</sub>	V <sub>KA</sub> = V <sub>REF</sub>	_	0.4	1.0	mA
Off-State cathode current	I <sub>Koff</sub>	$V_{KA} = 36 \text{ V}, V_{REF} = 0 \text{ V}$	_	_	1.0	μА
Dynamic impedance	Z <sub>KA</sub>	$V_{KA} = V_{REF}, f \le 1 \text{ kHz}, \\ 1 \text{ mA} \le I_K \le 100 \text{ mA}$	_	0.15	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.

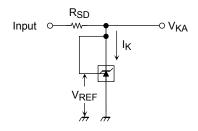
The average temperature coefficient of the  $\ensuremath{V_{REF}}$  is defined as:

$$\left|\alpha V_{REF}\right| = \frac{\left(\frac{V_{REF (dev)}}{V_{REF @25^{\circ}C}}\right) \times 10^{6}}{\Delta Ta} \left(\frac{\rho pm}{^{\circ}C}\right)$$

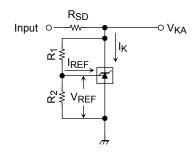


### **Test Parameter**

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

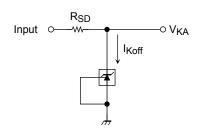


### (2) V<sub>KA</sub> > V<sub>REF</sub> Mode



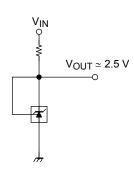
$$V_{KA} = V_{REF} \left( 1 + \frac{R_1}{R_2} \right) + I_{REF} \cdot R_1$$

## (3) OFF-State Mode

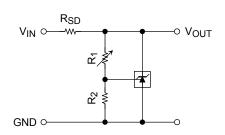


# **Typical Application Circuits**

### (1) 2.5 V Reference

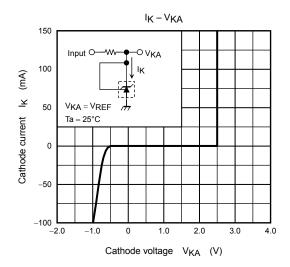


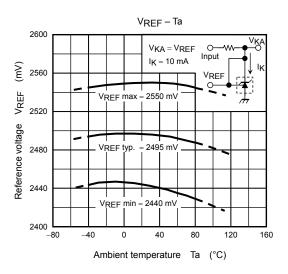
### (2) Shunt Regulator

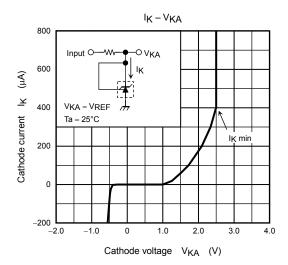


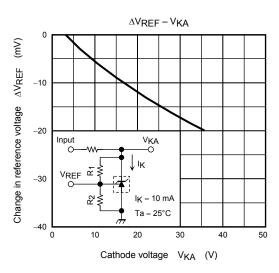
$$V_{OUT} = V_{REF} \left( 1 + \frac{R_1}{R_2} \right) + I_{REF} \cdot R_1$$

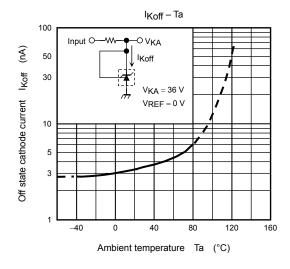
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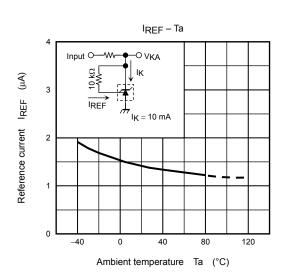


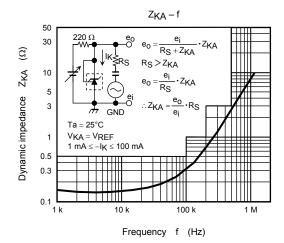


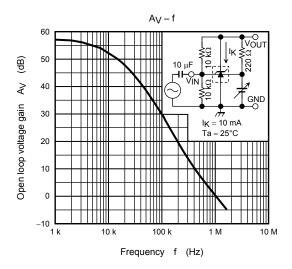


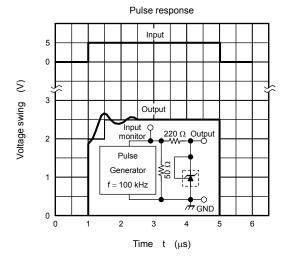


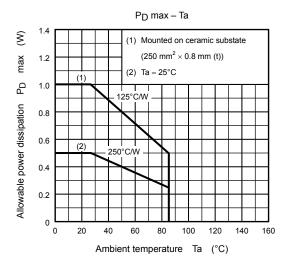


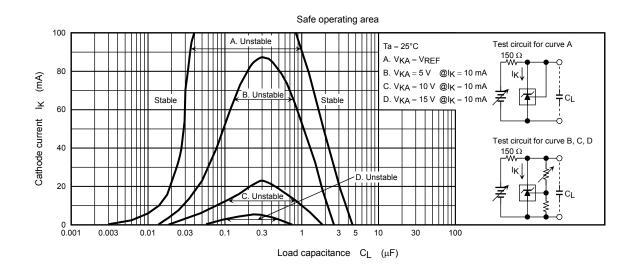








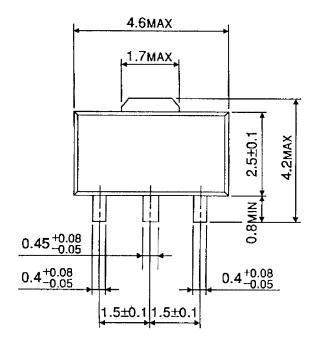




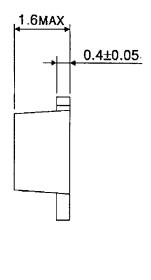
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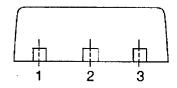
# **Package Dimensions**

HSOP3-P-1.50



Unit: mm





Weight: 0.05 g (typ.)

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