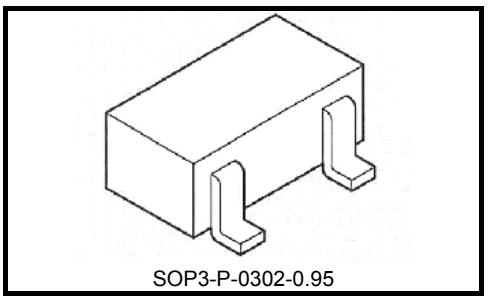
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA76L431FB

2.495 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 2.495 V, enabling them to operate at low voltage. In addition, they can be used as zener diodes to perform temperature compensation.

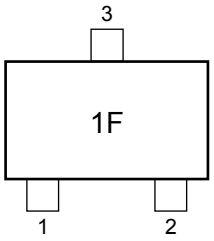


Weight: 0.012 g (typ.)

Features

- Precision reference voltage
  : V_{REF} = 2.495 V ± 1.0% (Ta = 25°C)
- Adjustable output voltage: $V_{REF} \leq V_{OUT} \leq 19$ V
- Minimum cathode current for regulation: I_{kmin} = 0.5 mA (max)
- Packages: Surface-mount S-Mini

Pin Assignment/Marking

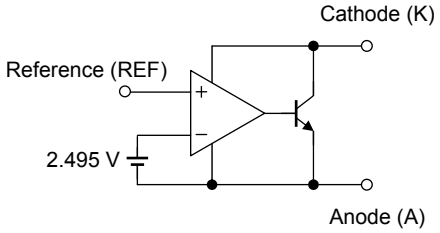


1: Cathode (K)
2: Reference (REF)
3: Anode (A)

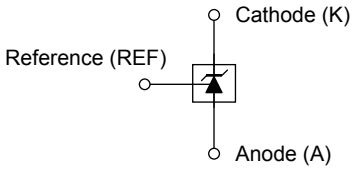
How to Order

Product No.	Package	Packing Type and Capacity
TA76L431FB(TE85L,F)	S-Mini	Embossed tape: 3000 pcs/real

Functional Block Diagram

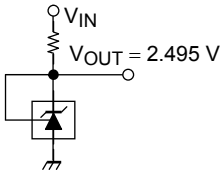


Circuit Symbol

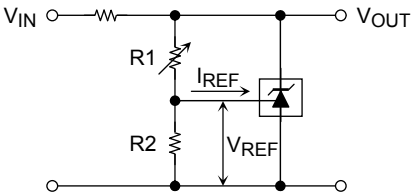


Typical Application Circuits

(1) 2.495 V Reference ($V_{KA} = V_{REF}$)



(2) Shunt Regulator ($V_{KA} > V_{REF}$)



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

Precautions During Use

1. TA76L431FB
   These products contain MOS elements. Please take care to avoid generating static electricity when handling these devices.
2. TA76L431FB
   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

Absolute Maximum Ratings (Ta = 25°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	μA
Reference-anode reverse current	$-I_{REF}$	10	mA
Power dissipation	P_D	200 (Note 1)	mW
Thermal resistance	R_{th}	625 (Note 1)	°C/W
Operating junction temperature	T_{jopr}	−40~150	°C
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	−55~150	°C

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

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).

Operating Ranges

Characteristics	Symbol	Min	Typ.	Max	Unit
Cathode voltage	V_{KA}	V_{REF}	—	19	V
Cathode current	I_K	0.5	—	40	mA

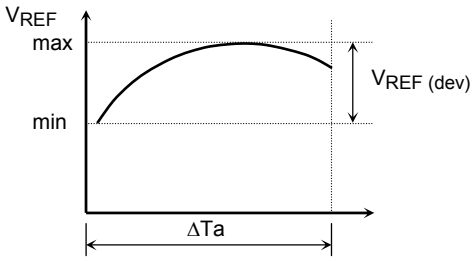
Electrical Characteristics (Unless otherwise specified, Ta = 25°C, I_K = 10 mA)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reference voltage	V_{REF}	$V_{KA} = V_{REF}$	2.470	2.495	2.520	V
Deviation of reference input voltage over temperature	$V_{REF\ (dev)}$	0°C ≦ Ta ≦ 70°C, $V_{KA} = V_{REF}$	—	8	18	mV
Ratio of change in reference input voltage to the change in cathode voltage	$\Delta V_{REF}/\Delta V$	$V_{REF} \leqq V_{KA} \leqq 10$ V	—	0.8	2.4	mV/V
		10 V ≦ V_{KA} ≦ 19 V	—	0.8	2.0	
Reference input current	I_{REF}	$V_{KA} = V_{REF}$	—	0.6	3	μA
Deviation of reference input current over temperature	$I_{REF\ (dev)}$	0°C ≦ Ta ≦ 70°C, $V_{KA} = V_{REF}$, R_1 = 10 kΩ, $R_2 = \infty$	—	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 ≦ 40 mA	—	0.2	0.5	Ω

Precaution on Application

T_j = 25°C in the measurement conditions of each item is a regulation for where a pulse test is carried out and any drift in the electrical characteristic due to a rise in the junction temperature of the chip may be disregarded.

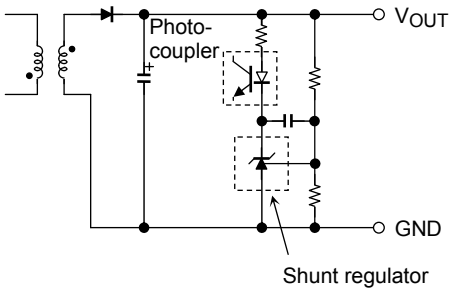
The deviation parameters $V_{REF\ (dev)}$ and $I_{REF\ (dev)}$ are defined as the maximum variation of the V_{REF} and I_{REF} over the rated temperature range (Ta = 0 to 70°C).
The average temperature coefficient of the V_{REF} is defined as:



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

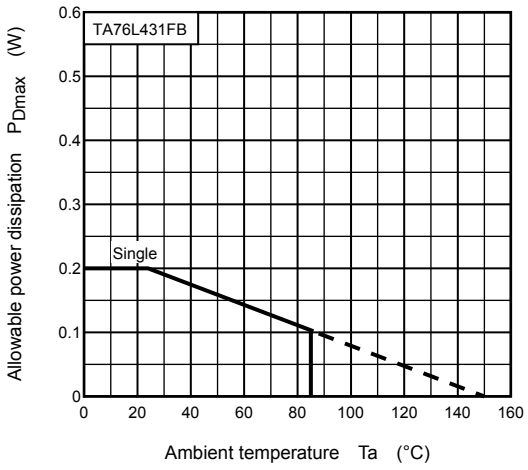
Application Circuit Example

Error amplification circuit for switching power supply

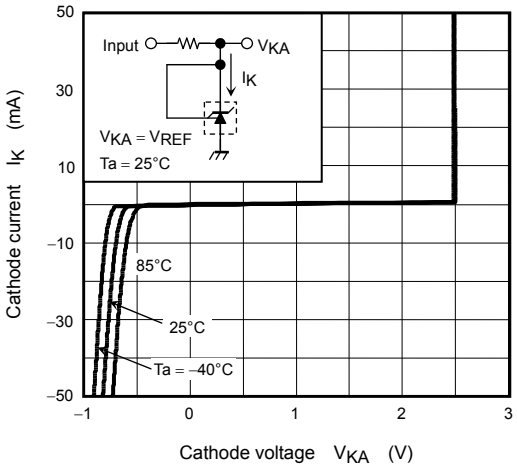


This circuit amplifies the difference between the switching power supply's secondary output voltage and the shunt regulator's reference voltage. It then feeds the amplified voltage back to the primary input voltage via the photocoupler.

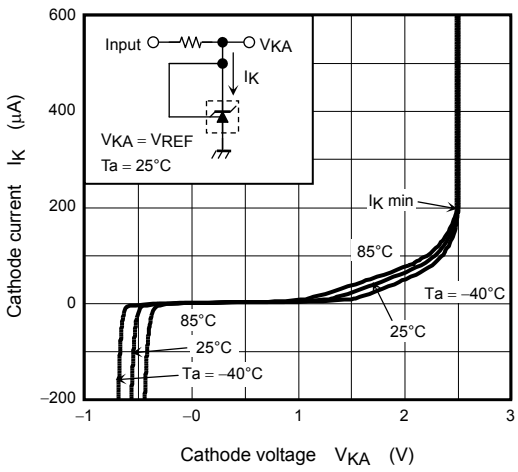
P_{Dmax} – Ta



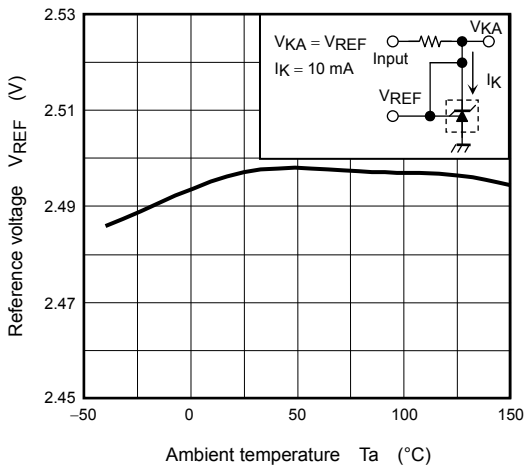
I_K – V_{KA}



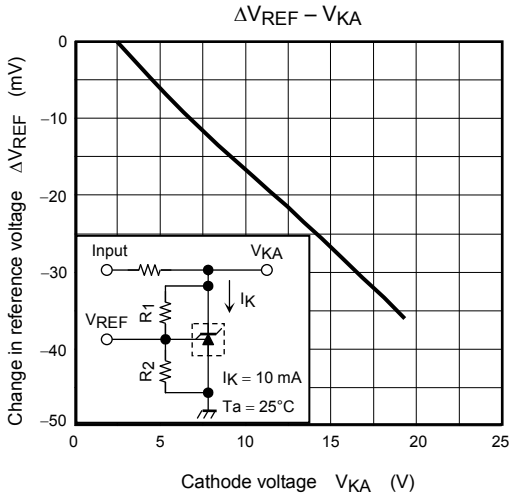
I_K – V_{KA}



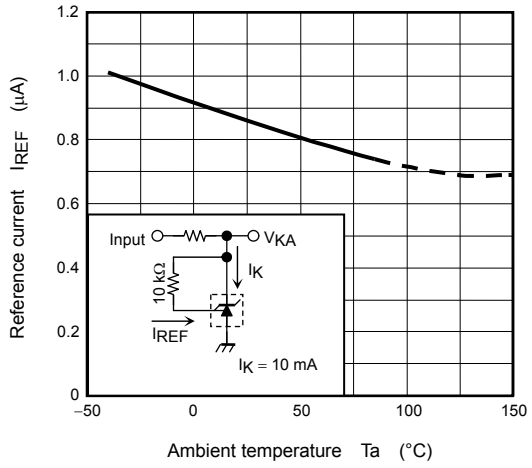
V_{REF} – Ta



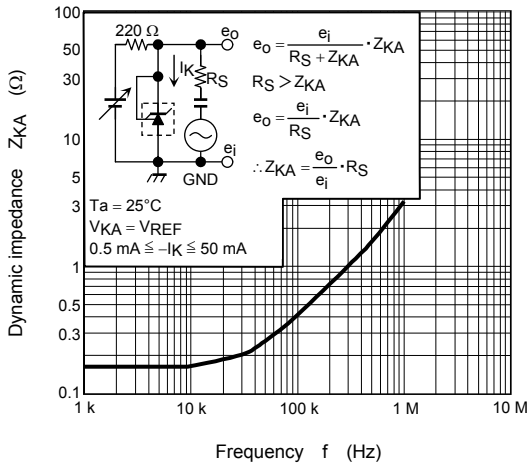
ΔV_{REF} – V_{KA}



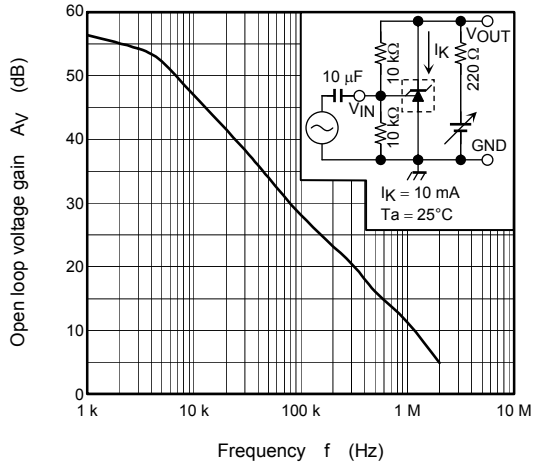
I_{REF} – Ta



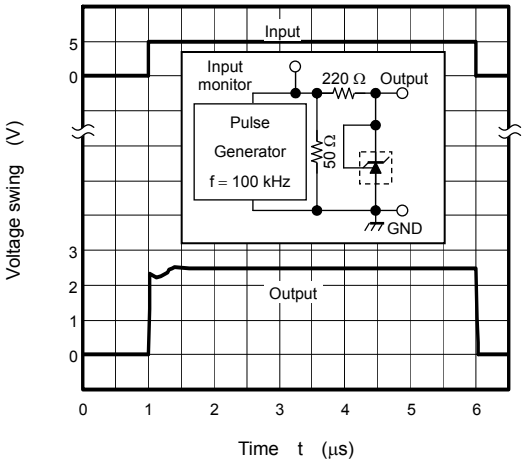
Z_{KA} – f



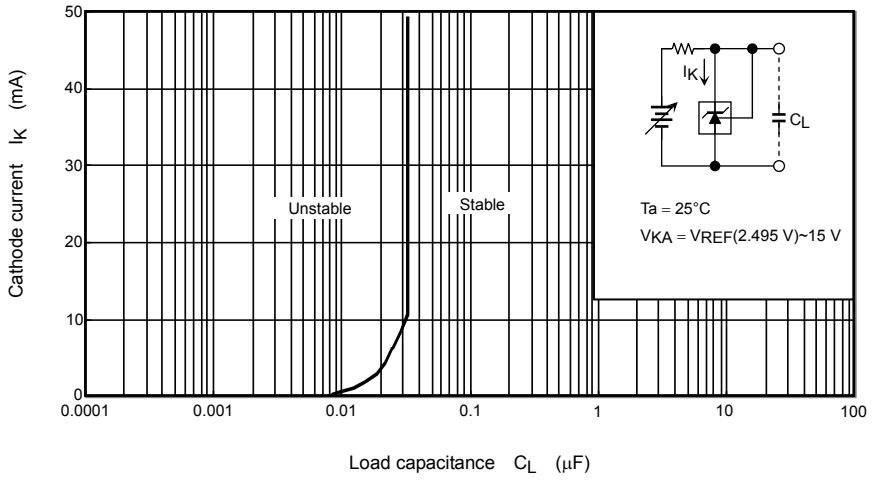
A_V – f



Pulse response

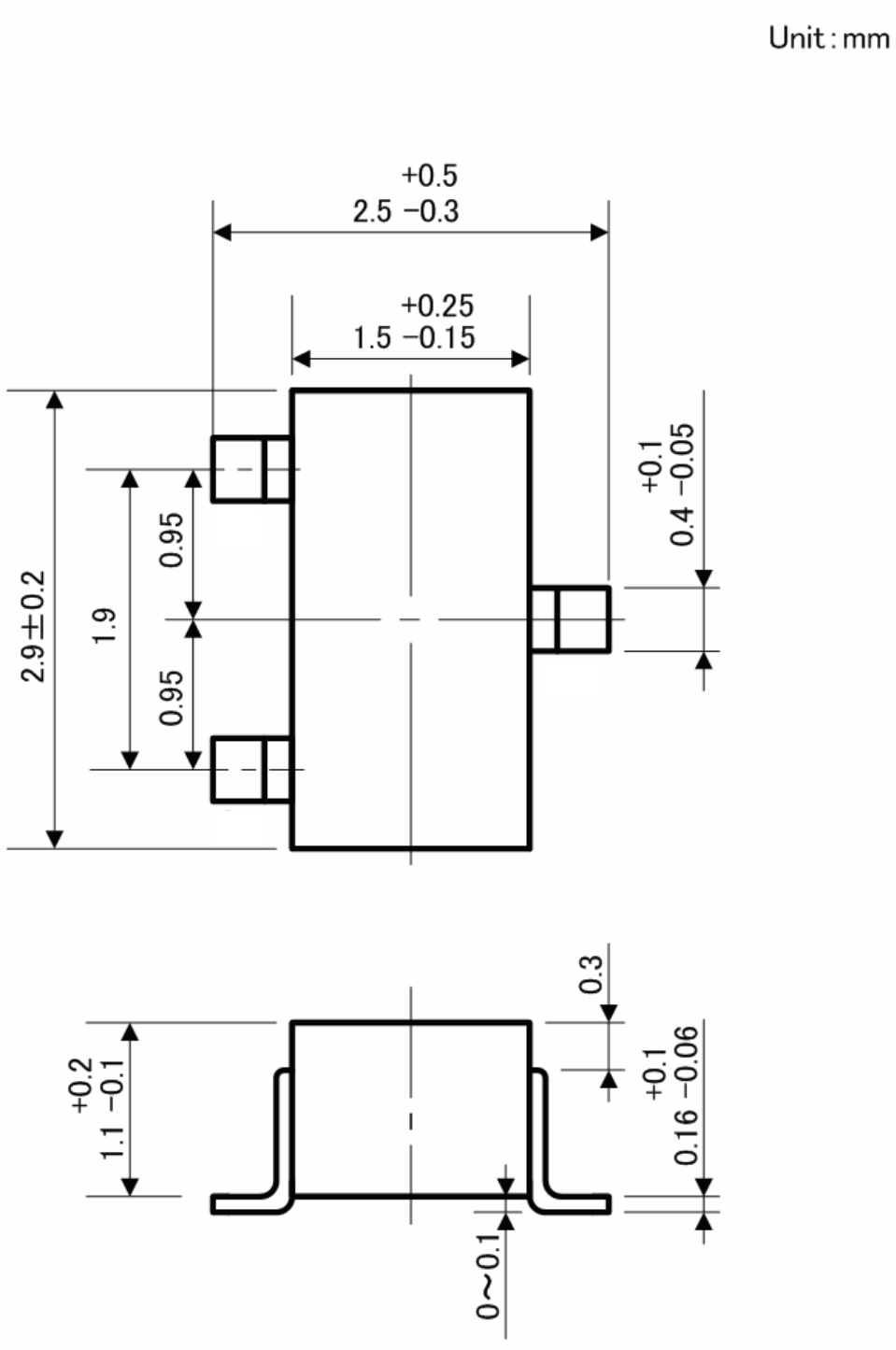


Stability Boundaty Conditions



Package Dimensions

SOP3-P-0302-0.95



Weight: 0.012 g (typ.)

RESTRICTIONS ON PRODUCT USE

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