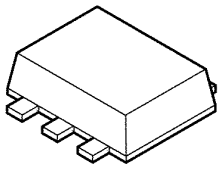
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA76L431FT

2.49-V Adjustable High-Precision Shunt Regulators

This device are adjustable high-precision shunt regulators whose output voltage (V_{KA}) can be set arbitrarily using two external resistors.
This device has a precise internal reference voltage of 2.49 V, enabling them to operate at the voltage. In addition, they can be used as zener diodes to perform temperature compensation.

TA76L431FT



SSOP5-P-0.65C

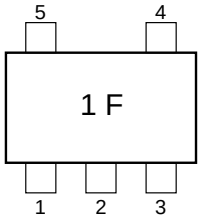
Weight
SSOP5-P-0.65C : 0.007 g (typ.)

Features

- Precision reference voltage
  : V_{REF} = 2.49V ± 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.)
- Operating temperature: Ta = −40~85°C
- Packages: UFV
- The TA76L431FT is housed in an ultra-thin UFV package. (thickness: 0.7 mm typ.)

Pin Assignment/Marking

TA76L431FT

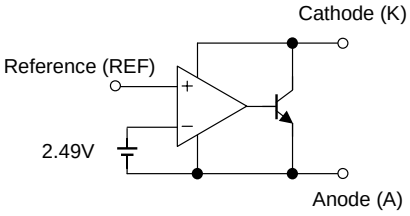


1: NC
2: ANODE (A)
3: CATHODE (K)
4: REFERENCE (REF)
5: ANODE (A)

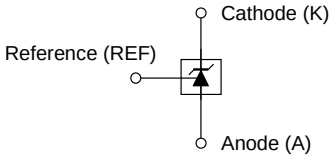
How to Order

Product No.	Package Type	Packing Type and Capacity	Minimum Order
TA76L431FT (TE85L,F)	UFV (surface-mount type)	Embossed tape: 3000/tape	1 tape

Functional Block Diagram

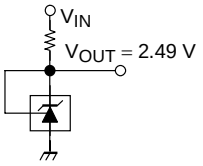


Circuit Symbol

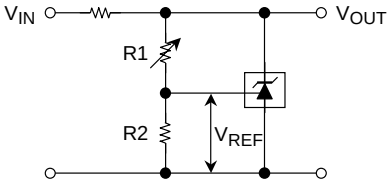


Typical Application Circuits

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



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



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

Precautions during Use

1. TA76L431FT

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

2. TA76L431FT

   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.

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	0.45 (Note 1)	W
Thermal resistance	R_{th}	277 (Note 1)	°C/W
Operating temperature	T_{opr}	−40~85	°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)

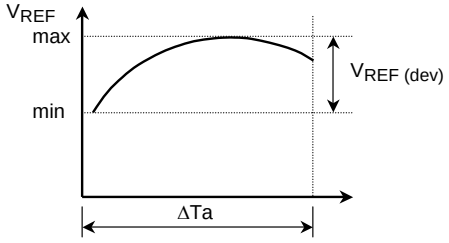
Recommended Operating Conditions

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, Ta = 25°C, I_K = 10 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°C ≦ Ta ≦ 70°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} ≦ V_{KA} ≦ 10 V	—	0.8	2.4	mV/V
		10V ≦ 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

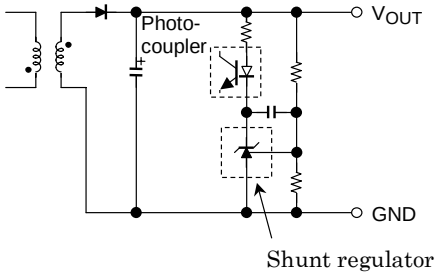
The deviation parameters $V_{REF\ (dev)}$ and $I_{REF\ (dev)}$ are defined as the maximum variation of the V_{REF} and I_{REF} over the rated temperature range.
The average temperature coefficient of the V_{REF} is defined as:



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

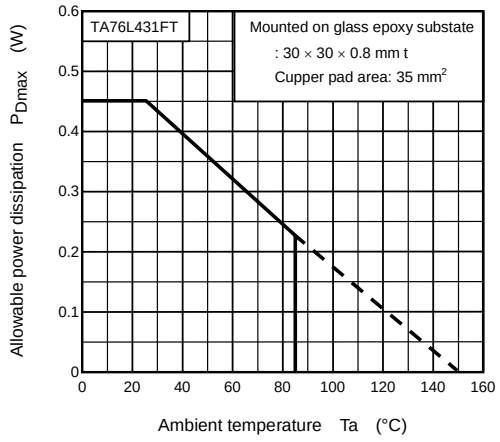
Application Circuit Example

Error amplification circuit for switching power supply

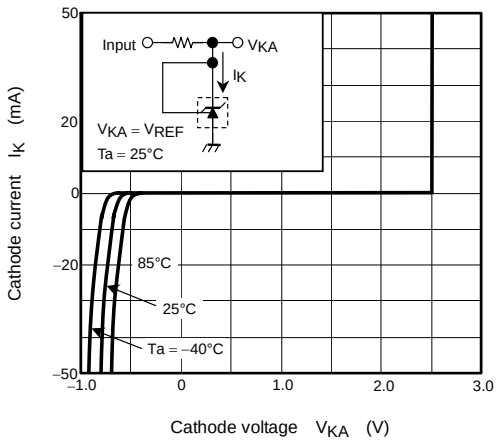


This circuit amplifies the difference between the switching power supply's secondary output voltage and the shunt regulator's reference voltage. It then feeds the amplified voltage back to the primary input voltage via the photocoupler.

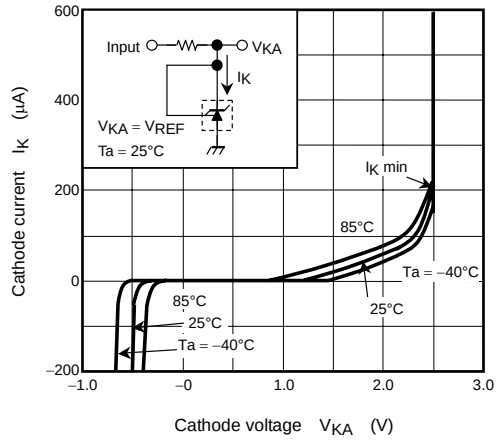
P_{Dmax} – Ta



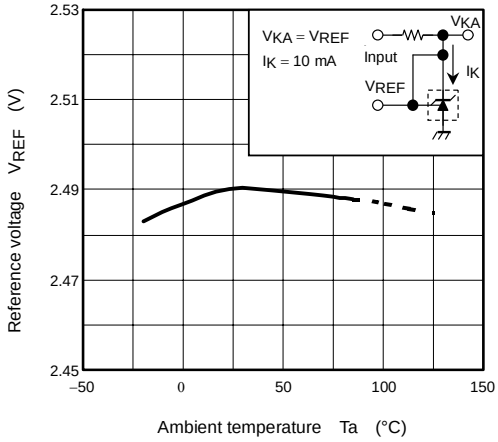
I_K – V_{KA}



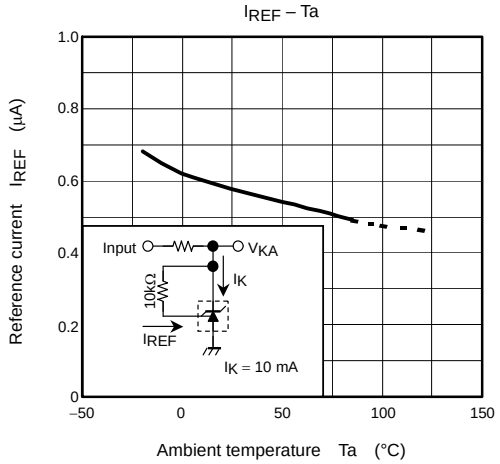
I_K – V_{KA}



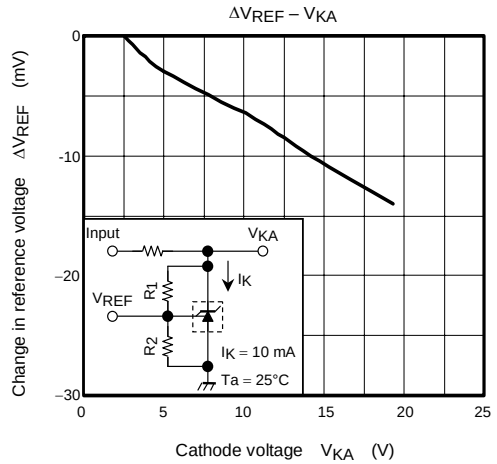
V_{REF} – Ta



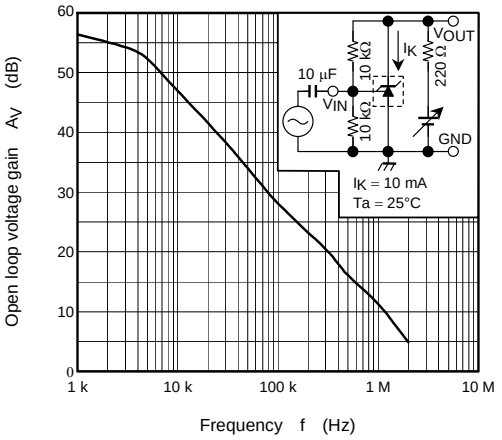
I_{REF} – Ta



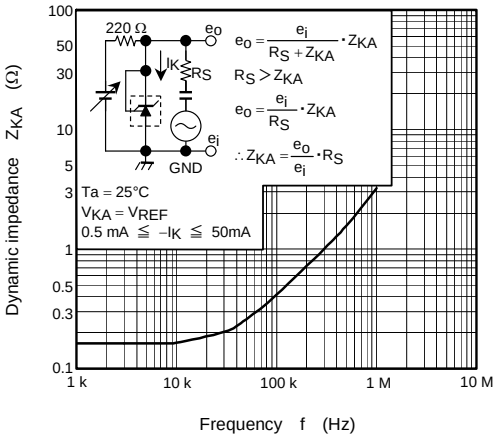
ΔV_{REF} – V_{KA}



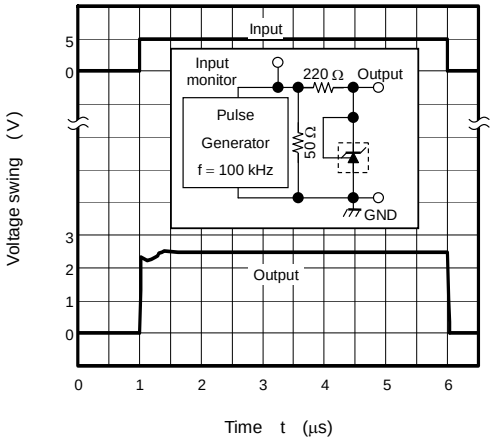
A_V – f



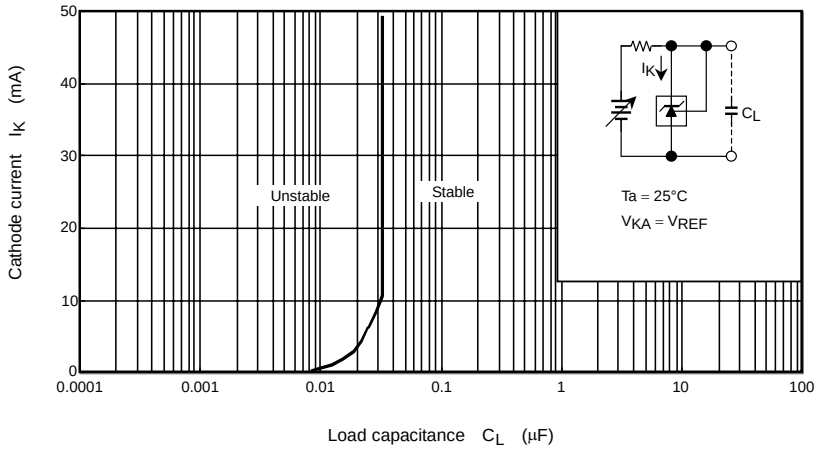
Z_{KA} – f



Pulse response

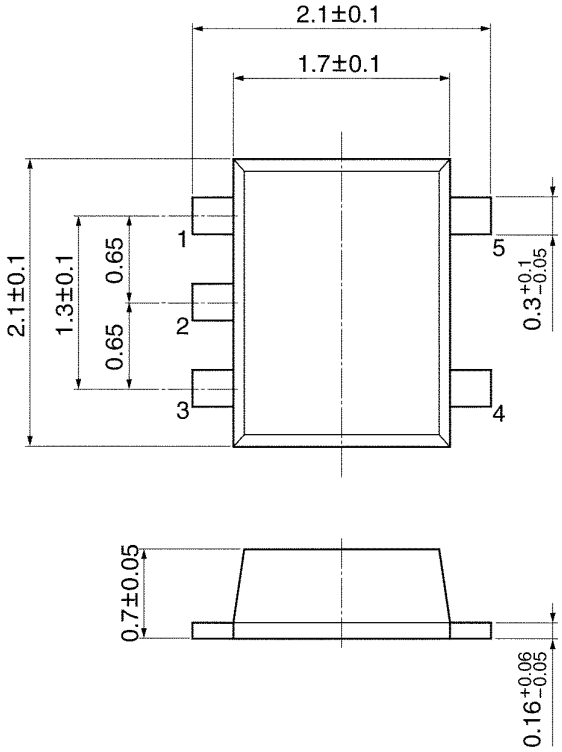


Stability boundary conditions



Package Dimensions

SSOP5-P-0.65C Unit: mm



Weight: 0.007 g (typ.)

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