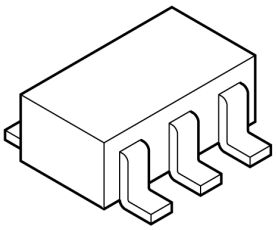
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA76433FC

High-Precision Shunt Regulators with Adjustable Output Voltage

Due to the increasing requirement for low power dissipation levels, 3-V power supply systems in electronic equipment are now in greater demand than conventional 5-V power supply systems. Toshiba has developed the TA76433FC, a high-precision shunt regulator with adjustable output voltage is aimed for use in even lower voltage applications.
It differs from the conventional shunt regulator (TA76431/432 series) of our company, the power supply input terminal which became separate of the cathode terminal is set up.
Since the cathode terminal of the detection side and the input terminal of the power supply side is separate, a cathode terminal can operate from 0.2 V.
It is suitable for the secondary side difference amplifier of the switching regulator of 1.8 V to 2 V class.



Weight: 0.014 g (typ.)

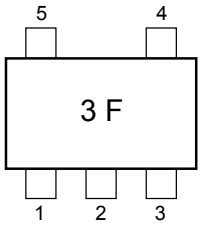
Features

- Separate power supply input pin (V_{CC}) and cathode pin (K)
- Precision reference voltage: V_{REF} = 1.26 V ± 1.4% (Ta = 25°C)
- Maximum cathode voltage: 15 V
- Maximum cathode current: 20 mA
- Cathode voltage: 0.2 to 14 V
- Cathode current: 0.4 to 20 mA
- Operating temperature: Ta = −40 to 85°C
- Packages: SMV can be mounted on a 3.1 × 3.0 mm space.

How to Order

Product No.	Package Type	Package Type and Capacity
TA76433FC	SMV (surface-mount type)	On cut tape (TE85L): 100/tape section
TA76433FC (TE85L)		Embossed tape (TE85L): 3000/tape section

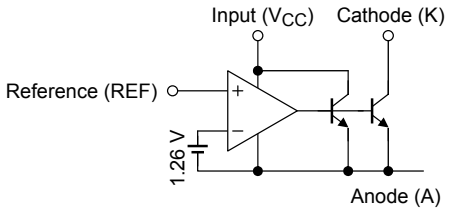
Pin Assignment/Marking



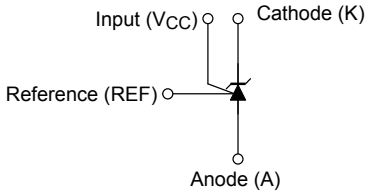
1: Reference (REF)
2: Anode (A)
3: Cathode (K)
4: Anode (A)
5: Input (V_{CC})

Pin No.	Symbol	Description
1	REF	Reference voltage terminal of 1.26 V
2	A	Ground terminal
3	K	Constant output voltage terminal
4	A	Ground terminal
5	V_{CC}	Power supply input terminal

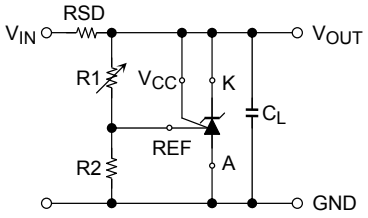
Functional Block Diagram



Circuit Symbol



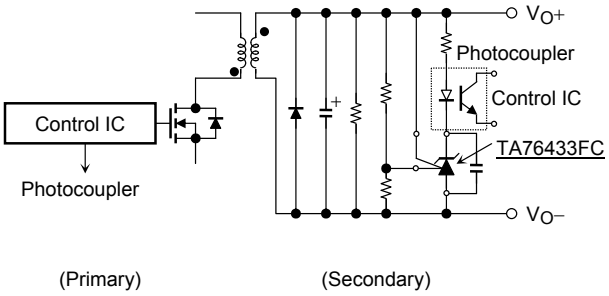
Typical Application Circuits



$$V_{OUT} = V_{REF}\left(1+\frac{R1}{R2}\right) + I_{REF}\cdot R1$$

Application Circuit Example

Error amplification circuit for switching power supply



The circuit amplifies the difference (a changed value) of the reference voltage of a shunt regulator and the output voltage of a switching regulator, and is fed back to a primary side through a photocoupler.

Precautions during Use

(1) TA76433FC
These products contain MOS elements. Please take care to avoid generating static electricity when handling these devices.

(2) TA76433FC
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.

(3) Precautions when handling anode pin of TA76433FC
Pin 2 and pin 4 should normally be shorted together. Do not leave pin 4 open and use pin 2 only.

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	15	V
Cathode voltage	V_{KA}	V_{CC}	V
Reference voltage	V_{REF}	7	V
Cathode current	I_K	20	mA
Cathode-anode reverse current	$-I_K$	10	mA
Reference current	I_{REF}	50	μA
Reference-anode reverse current	$-I_{REF}$	10	mA
Power supply current	I_{CC}	3	mA
Power dissipation	P_D	0.2	W
		0.38 (Note)	
Thermal resistance	R_{th}	625	°C/W
		328 (Note)	
Operating temperature	T_{opr}	−40~85	°C
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	−55~150	°C

Note 1: Mounted on a glass-epoxy substrate: 30 mm × 30 mm × 0.8 mmt (Cu pad area 50 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).

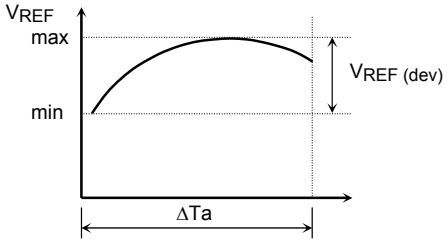
Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Power supply voltage	V_{CC}	V_{REF}	—	14	V
Cathode voltage	V_{KA}	0.2	—	V_{CC}	V
Cathode current	I_K	0.4	—	15	mA
Operating temperature	T_{opr}	−40	—	85	°C

Electrical Characteristics (Unless otherwise specified, V_{CC} = 2 V, I_K = 5 mA, Ta = 25°C)

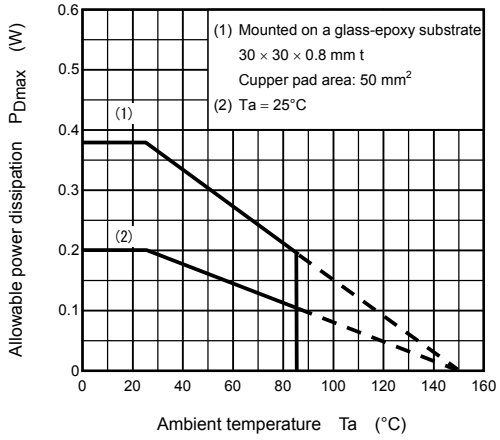
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reference voltage	V_{REF}	$V_{KA} = V_{REF}$	1.242	1.26	1.278	V
Deviation of reference input voltage overtemperature	$V_{REF\ (dev)}$	0°C ≦ Ta ≦ 85°C, $V_{KA} = V_{REF}$	—	5	15	mV
Ratio of change in reference input voltage to the change in power supply voltage	$\Delta V_{REF}/\Delta V_{CC}$	1.8 V ≦ V_{CC} ≦ 15 V	—	−0.3	−1.5	mV/V
Reference Input current	I_{REF}	$V_{KA} = V_{REF}$, R_1 = 10 kΩ, $R_2 = \infty$	—	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 kΩ, $R_2 = \infty$	—	0.3	1.2	μA
Minimum cathode current for regulation	I_{Kmin}	$V_{KA} = V_{REF}$	—	200	400	μA
Cathode saturation voltage	V_{Ksat}	V_{REF} = 1.3 V, I_K = 5 mA	—	0.05	0.2	V
Off-State cathode current	I_{Koff}	$V_{KA} = V_{CC}$ = 15 V, V_{REF} = 0 V	—	—	1.0	μA
Dynamic impedance	$\lvert Z_{KA} \rvert$	0.4 mA ≦ I_K ≦ 15 mA, f ≦ 1 kHz	—	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:

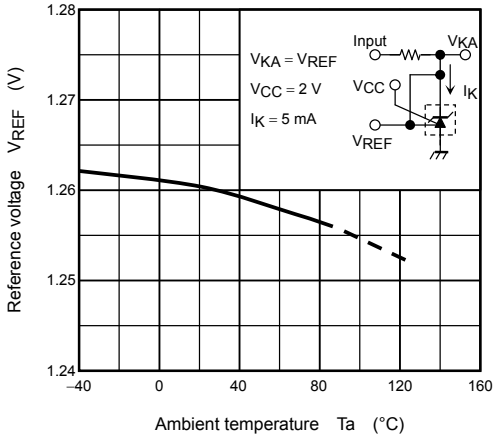


$$\left|\alpha V_{REF}\right| = \frac{\left(\frac{V_{REF\ (dev)} \times 10^6}{V_{REF}\ @25\,^{\circ}C}\right)}{\Delta Ta} \left(ppm/^{\circ}C\right)$$

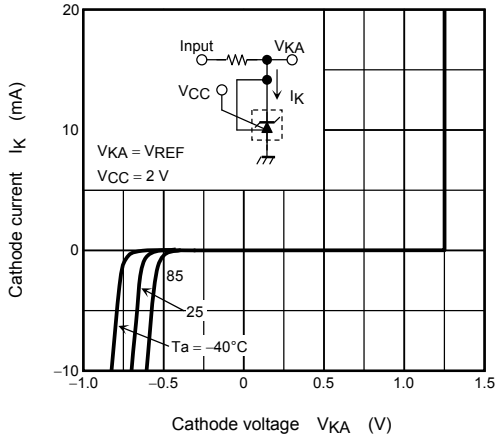
P_{Dmax} – Ta



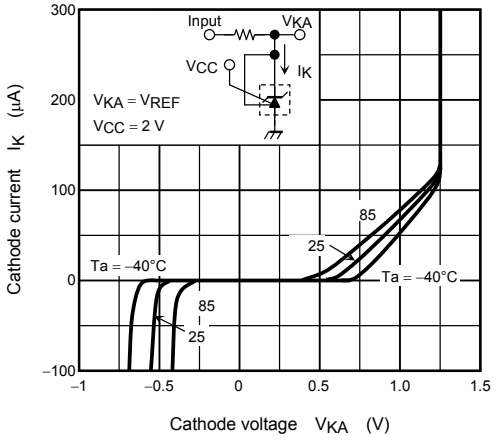
V_{REF} – Ta



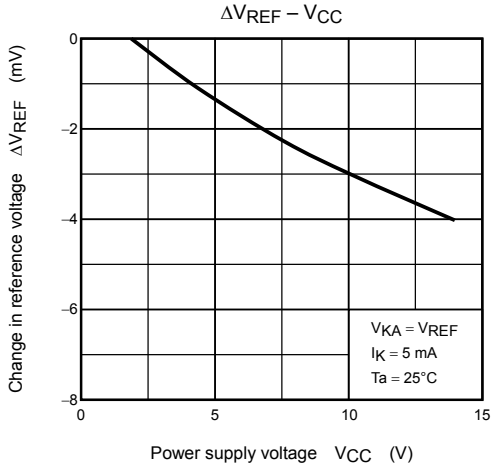
I_K – V_{KA}



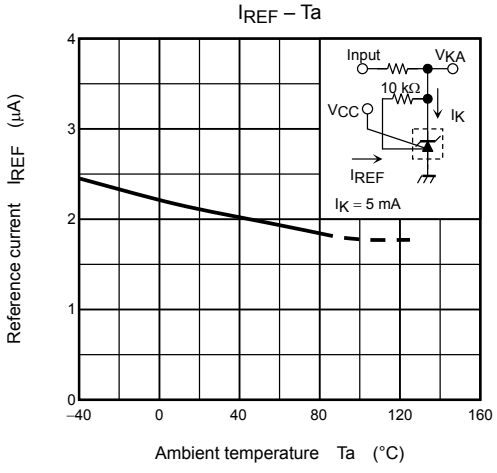
I_K – V_{KA}



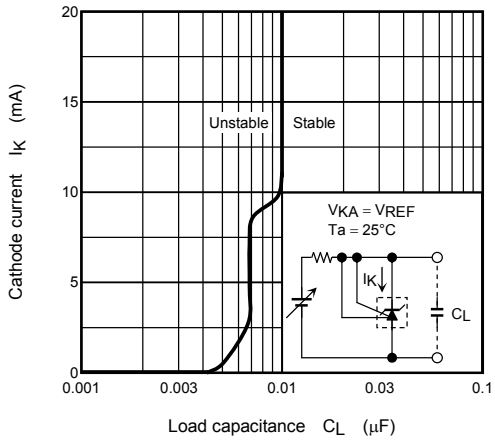
ΔV_{REF} – V_{CC}



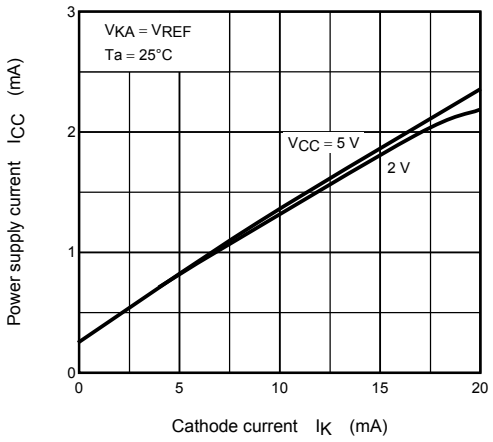
I_{REF} – Ta



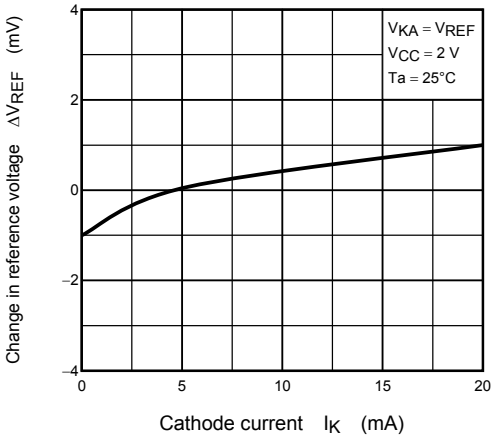
Safe operating area



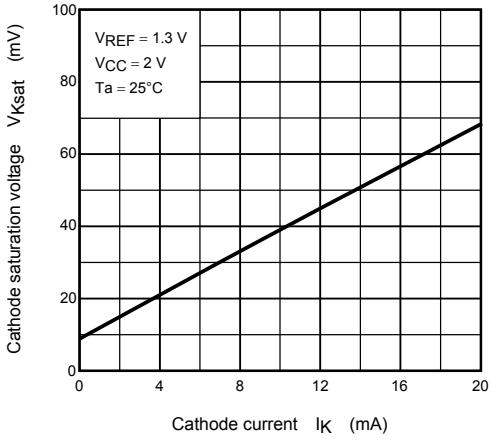
$I_{CC} - I_K$



$\Delta V_{REF} - I_K$

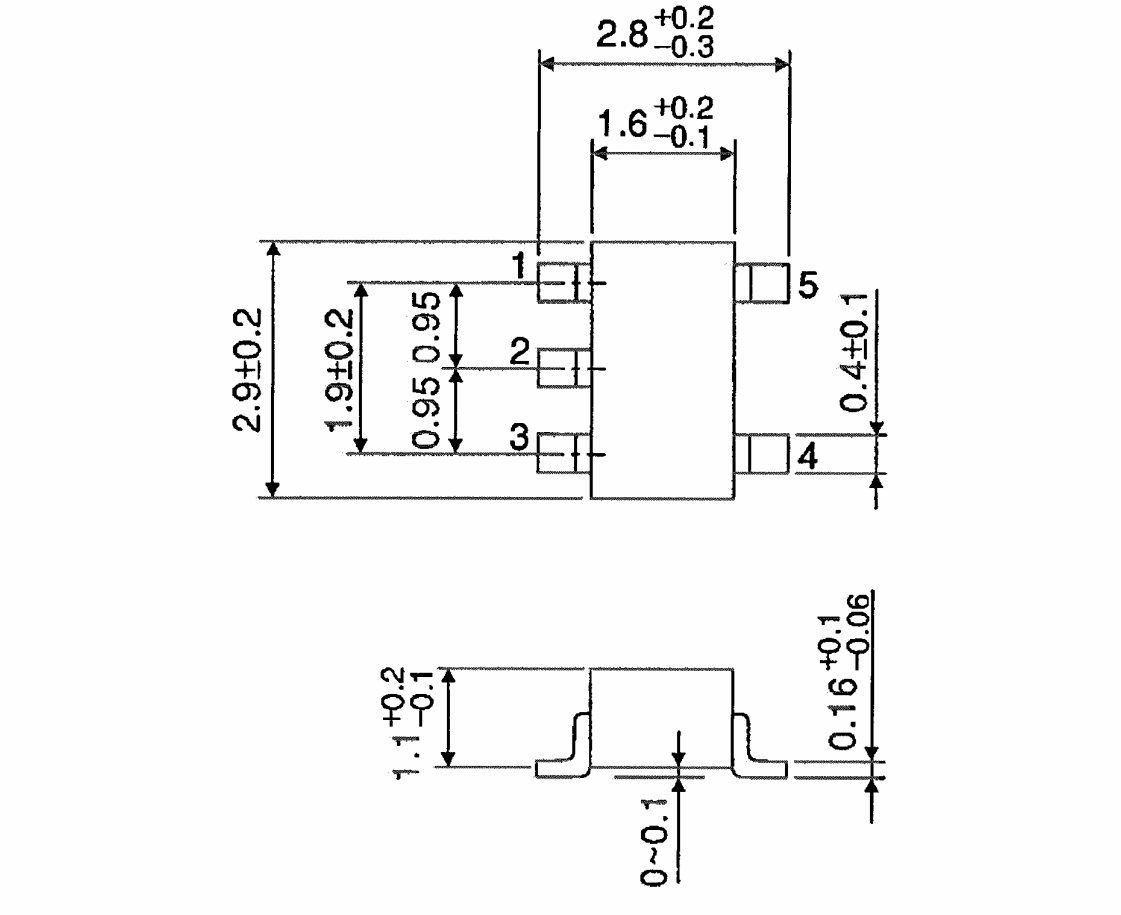


$V_{Ksat} - I_K$



Package Dimensions

SSOP5-P-0.95 Unit : mm



Weight: 0.014 g (typ.)

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