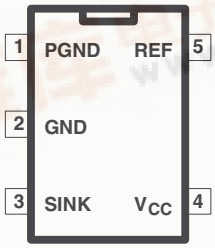
TS4436

Adjustable 0.6V Open Collector Shunt Voltage Reference

- Internal 0.6V ±0.5% precision
- Low output saturation voltage
  75mV max. between SINK and GND
- Low current consumption: 150µA
- Low supply voltage 1.7V
- Industrial temperature range: -40 to +85°C
- 150ppm/°C temperature coefficient
- Lead free available

SC70
(Plastic Micropackage)

Pin connections (top view)



Description

The TS4436 is a four-terminal device dedicated to low voltage Switch Mode Power Supplies (SMPS).

It integrates a 0.6V voltage reference, an amplifier, and an open collector output transistor in a single package. The TS4436's operating mode is similar to the well-known standard voltage reference, the TL431. It maintains the desired feedback voltage at the REF pin in a closed loop configuration by sinking a current proportional to the error voltage at the REF pin.

TS4436 features an open collector transistor with an ultra-low saturation voltage. This feature allows it to be used in series with the optocoupler in an SMPS for regulation up to a 1.8V output voltage.

Applications

- Low voltage switch mode power supplies
- Isolated DC/DC converter
- Computers
- Low voltage discrete regulators

Order Codes

Part Number	Accuracy	Temperature Range	Package	Packing	Marking
TS4436AICT	0.5%	-40, +85°C	SC70	Tape & Reel	L22
TS4436ICT	1%				L21

1 Absolute Maximum Ratings and Operating Conditions

Table 1. Key parameters and their absolute maximum ratings

Symbol	Parameter	Value	Unit
I_{SINK}	Output sink current	30	mA
V_{CC}	Supply voltage	12	V
V_{SINK}	Output voltage	12	V
P_{diss}	Power Dissipation (1)SOT23-5		mW
P_{diss}	Power Dissipation (2)SC70	310	mW
T_{STD}	Storage Temperature	-65 to +150	°C
ESD	Human Body Model (HBM)	2	kV
	Machine Model (MM)	200	V
T_{LEAD}	Lead Temperature (soldering, 10 seconds)	250	°C

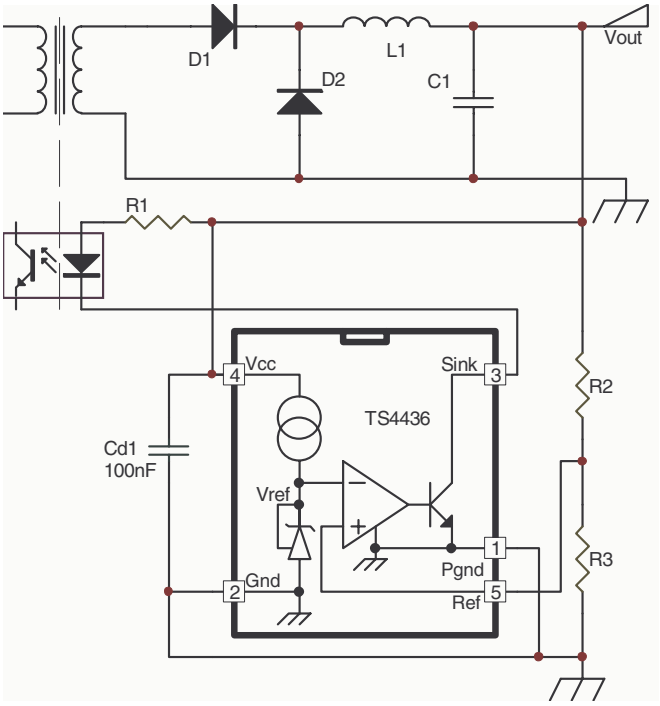
1. P_{diss} has been calculated with T_{AMB} = 25°C, $T_{Junction}$=150°C and R_{thJA} = 250°C/W for the SOT23-5 package R_{thJC} = 81°C/W for the SOT23-5 package
2. P_{diss} has been calculated with T_{AMB} = 25°C, $T_{Junction}$=150°C and R_{thJA} = 250°C/W for the SOT23-5 package R_{thJC} = 81°C/W for the SOT23-5 package

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
T_{OPER}	Operating temperature range	-40 to +85	°C
V_{CC}	Supply voltage	1.7 to 10	V
I_{SINK}	Output sink current	up to 20	mA

2 Typical Application Schematic

Figure 1. SMPS power supply: secondary side



3 Electrical Characteristics

Table 3. Electrical characteristics for T_{amb} = 25°C, V_{CC} = 1.8V, I_{SINK} = 2mA unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage TS4436A 0.5%		0.597	0.6	0.603	V
		-40°C < T < +85°C	0.589		0.611	
V_{ref}	Reference voltage TS4436 1%		0.594	0.6	0.606	V
		-40°C < T < +85°C	0.589	0.6	0.611	
T_C	Temperature coefficient				150	ppm/°C
RegLine	Change in V_{ref} due to change in V_{CC}	V_{CC}=1.7 to 10V		1	2.5	mV
		-40°C < T < +85°C		2	3	
RegLoad	Change in V_{ref} due to change in I_{SINK}	I_{SINK}=0.1 to 20mA		3.5	7	mV
		-40°C < T < +85°C			10	
I_{CC}	Supply current	I_{SINK}=2mA		150	200	µA
		-40°C < T < +85°C			250	
I_{REF}	Change in I_{ref} Reference input current due to change in I_{SINK}	0.1< I_{SINK} < 10mA		20	50	nA
		-40°C < T < +85°C			65	
V_{SAT}	Output transistor saturation voltage	I_{SINK}=5mA		30	50	mV
		-40°C < T < +85°C			60	
		I_{SINK}=20mA		90	120	
		-40°C < T < +85°C			140	
I_{OH}	Output leakage current	V_{SINK}=V_{CC}			0.05	µA
		-40°C < T < +85°C			0.1	

Note: Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation and by design.

Figure 2. V_{ref} vs. temperature

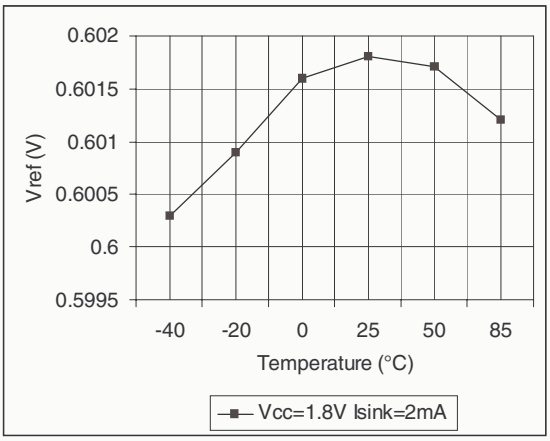


Figure 3. V_{ref} vs. temperature

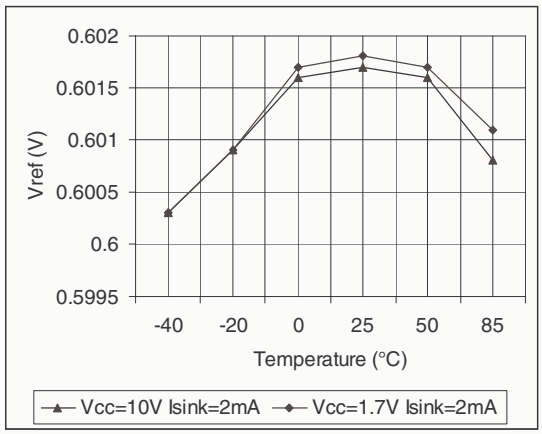


Figure 4. I_{CC} vs. temperature

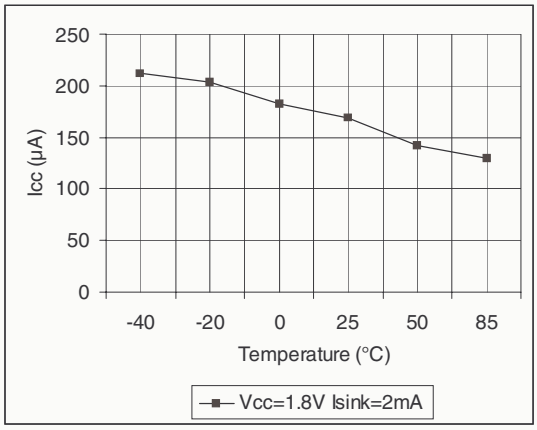


Figure 5. I_{CC} at 25°C

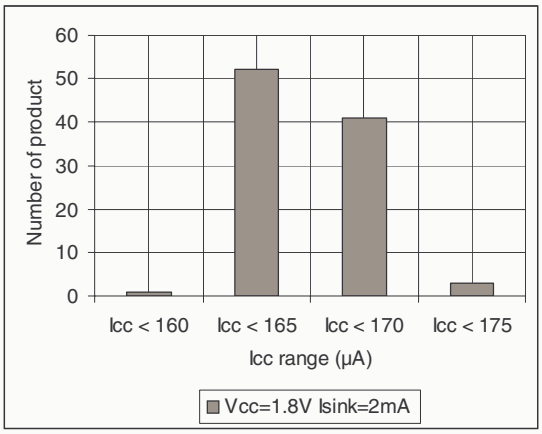


Figure 6. V_{SAT} vs. temperature

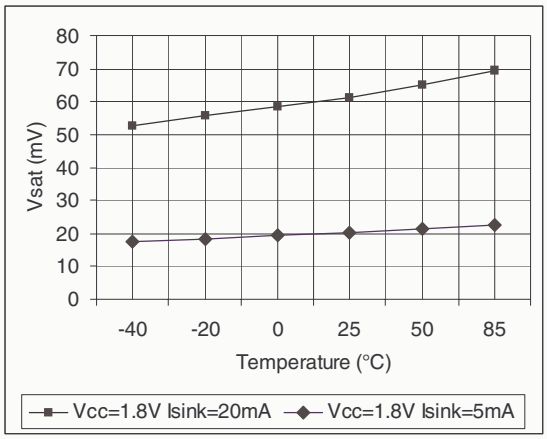
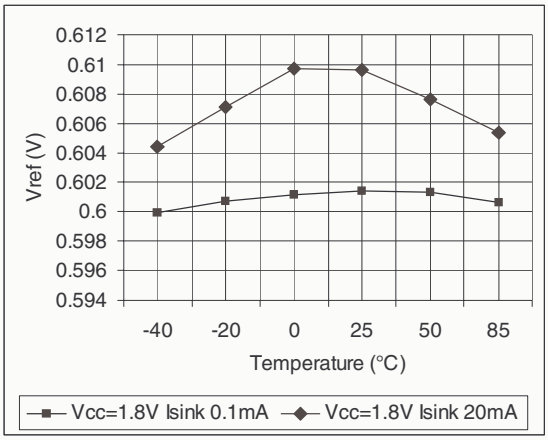


Figure 7. V_{ref} vs. temperature



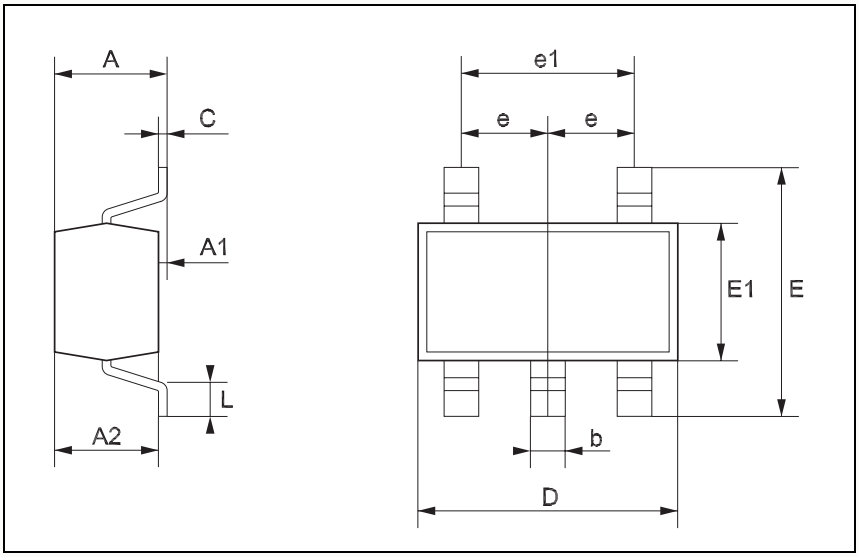
4 Package Mechanical Data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

SC70 Package

SOT323-5L MECHANICAL DATA

DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	0.80		1.10	31.5		43.3
A1	0.00		0.10	0.0		3.9
A2	0.80		1.00	31.5		39.4
b	0.15		0.30	5.9		11.8
C	0.10		0.18	3.9		7.1
D	1.80		2.20	70.9		86.6
E	1.80		2.40	70.9		94.5
E1	1.15		1.35	45.3		53.1
e		0.65			25.6	
e1		1.3			51.2	
L	0.10		0.30	3.9		11.8



5 Revision History

Table 4. Document revision history

Date	Revision	Changes
Feb. 2006	1	First release of datasheet.