TS4431

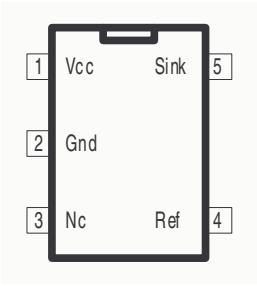
1.224V Open Collector Shunt Voltage Reference

- Internal 1.224V ±0.5% precision
- Low output saturation voltage
  75 mV max between SINK and GND
- Low current consumption: 250µA
- Industrial temperature range: -40 to +85°C
- 100ppm/°C temperature coefficient



SOT23-5L
(Plastic Micropackage)

Pin connections (top view)



Description

The TS4431 is a four-terminal device dedicated to low voltage Switch Mode Power Supplies (SMPS).

It integrates a 1.224V voltage reference, an amplifier, and an open collector output transistor in a single package. The TS4431'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.

TS4431 features an open collector transistor with an ultra-low saturation voltage, allowing it to be used in series with the optocoupler in an SMPS architecture to regulate low voltage SMPS.

Applications

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

Order Codes

Part Number	Accuracy	Temperature Range	Package	Packing	Marking
TS4431AILT	0.5%	-40, +85°C	SOT23-5	Tape & Reel	L288
TS4431ILT	1%				L275

1 Absolute Maximum Ratings

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_D	Power Dissipation (1)SOT23-5	500	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

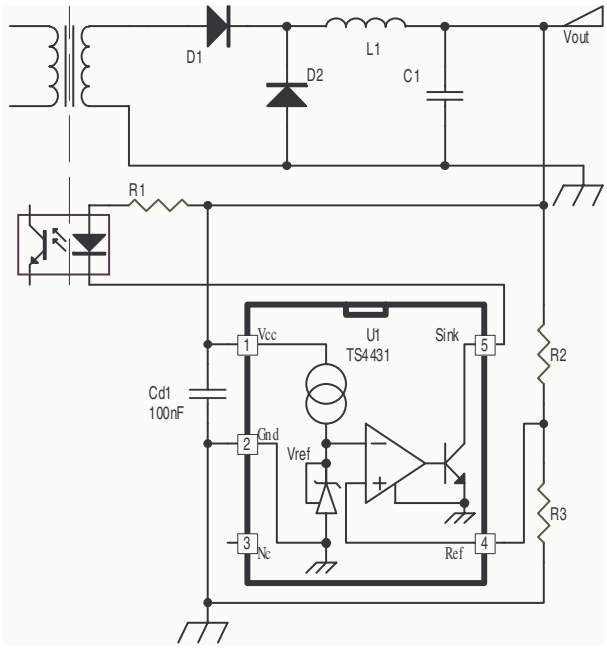
1. P_D has been calculated with T_{AMB} = 25°C, $T_{Junction}$=150°C and
Rth_{JA} = 250°C/W for the SOT23-5 package
Rth_{JC} = 81°C/W for the SOT23-5 package

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
T_{OPER}	Operating temperature range	-40 to +85	°C
V_{CC}	Supply voltage	1.5 to 10	V
I_{SINK}	Output sink current	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 Condition	Min.	Typ.	Max.	Unit
V_{REF}	Reference voltage TS4431A 0.5%		1.218	1.224	1.230	V
		-40°C < T < +85°C	1.209		1.239	
V_{REF}	Reference voltage TS4431 1%		1.212	1.224	1.236	V
		-40°C < T < +85°C	1.203		1.245	
T_C	Temperature coefficient				100	ppm/°C
$\frac{\Delta V_{REF}}{\Delta V_{CC}}$	Change in V_{REF} due to change in V_{CC}	V_{CC}=1.5 to 10V		1	2	mV
		-40°C < T < +85°C		2	3	
$\frac{\Delta V_{REF}}{\Delta I_{SINK}}$	Change in V_{REF} due to change in I_{SINK}	I_{SINK}=0.5 to 20mA		7	10	mV
		-40°C < T < +85°C			15	
I_{CC}	Supply current	I_{SINK}=2mA		250	300	µA
		-40°C < T < +85°C			350	
I_{OFF}	OFF-State supply current	Ref < 0.6V		15	20	µA
		-40°C < T < +85°C			30	
I_{REF}	Reference input current	0.1< I_{SINK} < 10mA		0.4	1	µA
		-40°C < T < +85°C			2	
V_{SAT}	Output transistor saturation voltage	I_{SINK}=5mA		30	50	mV
		-40°C < T < +85°C			60	
		I_{SINK}=20mA		90	100	
		-40°C < T < +85°C			120	
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. Vref vs. temp. Isink=2mA

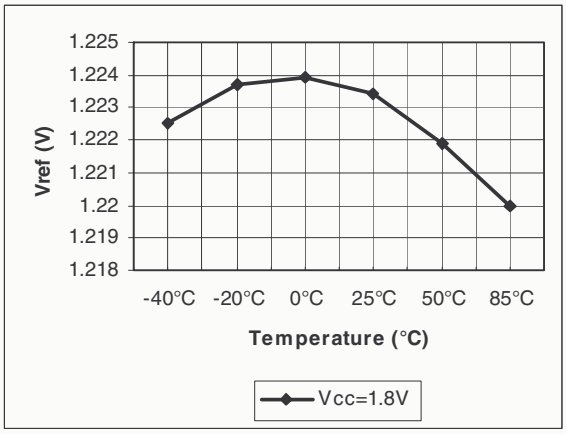


Figure 3. Vref vs. temp. Isink=2mA

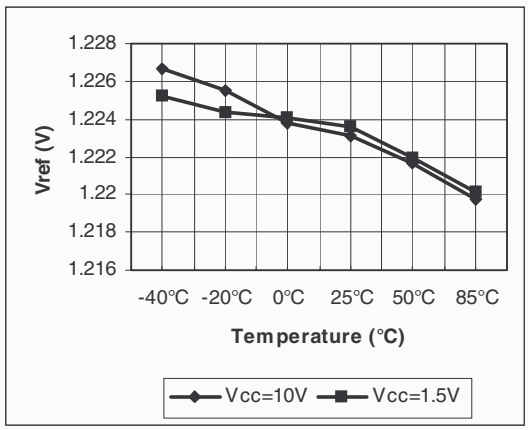


Figure 4. dVref/dVcc vs. temp. Isink=2mA

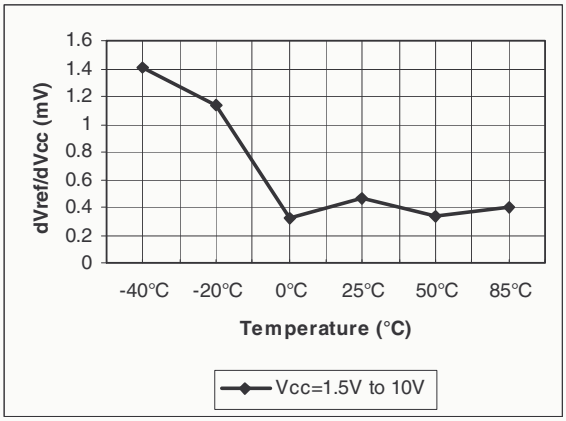


Figure 5. Icc vs. temp. Isink=2mA

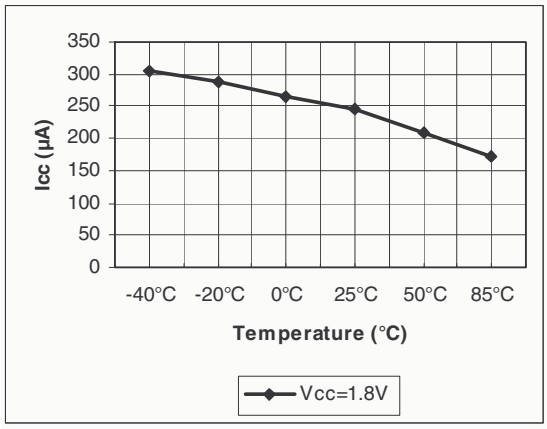


Figure 6. Icc vs. temp. Isink=2mA

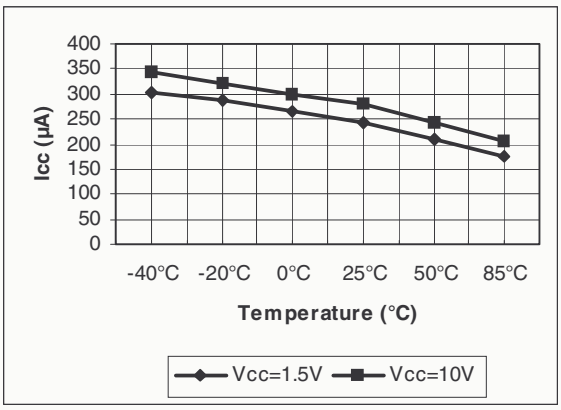


Figure 7. Vref vs. temp. Vcc=1.8V

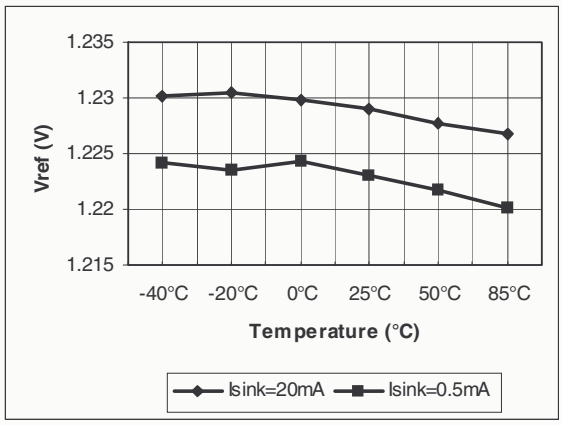


Figure 8. dVref/dIsink vs. temp. Vcc=1.8V

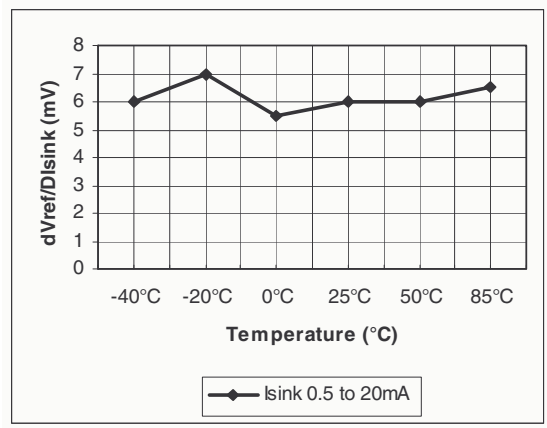


Figure 9. Iref vs. temp. Vcc=1.8V

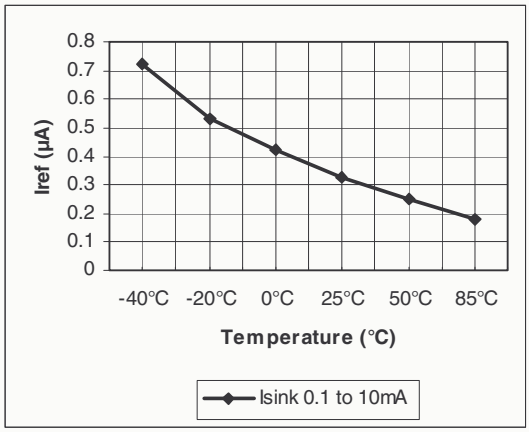
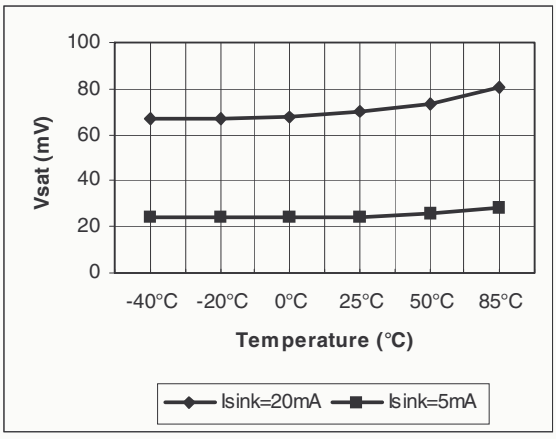


Figure 10. Vsat vs. temp. Vcc=1.8V



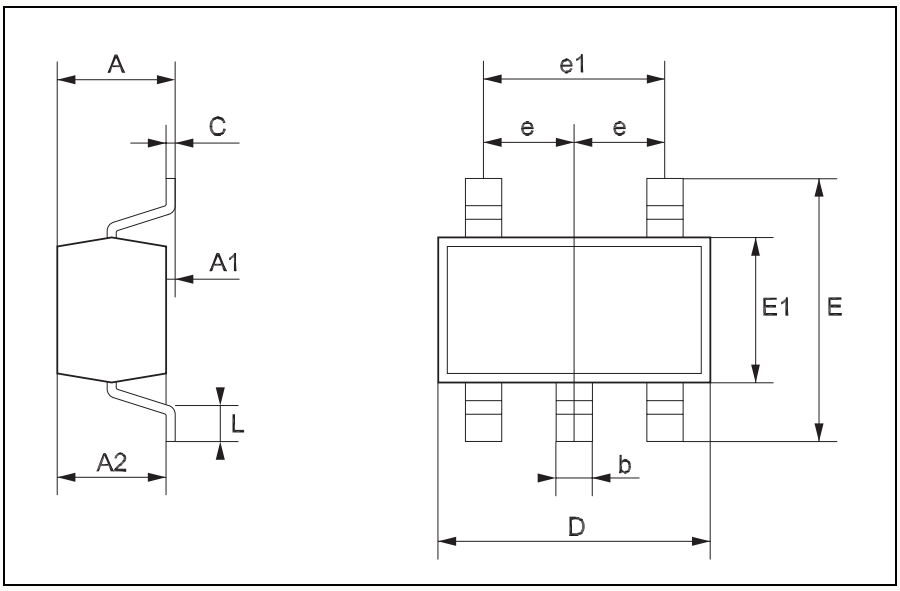
4 Package Mechanical Data

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.

SOT23-5L Package

SOT23-5L MECHANICAL DATA

DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	0.90		1.45	35.4		57.1
A1	0.00		0.15	0.0		5.9
A2	0.90		1.30	35.4		51.2
b	0.35		0.50	13.7		19.7
C	0.09		0.20	3.5		7.8
D	2.80		3.00	110.2		118.1
E	2.60		3.00	102.3		118.1
E1	1.50		1.75	59.0		68.8
e		0.95			37.4	
e1		1.9			74.8	
L	0.35		0.55	13.7		21.6



5 Revision History

Date	Revision	Changes
March 2005	1	First release corresponding to Preliminary Data version of datasheet.
Nov. 2005	2	First release of fully mature product data sheet.

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