Constant Voltage and Constant Current Controller for Adaptors and Battery Chargers

IK3051

Description

IK3051 is a highly integrated solution for SMPS applications requiring constant voltage and constant current mode.

IK3051 integrates one voltage reference, two operational amplifiers (with ORed outputs – common collectors), and a current sensing circuit.

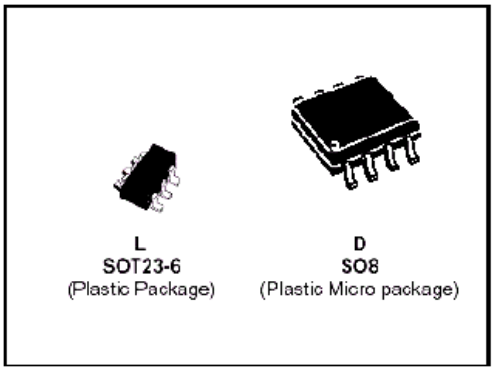
The voltage reference combined with one operational amplifier makes it an ideal voltage controller, and the other low voltage reference combined with the other operational amplifier makes it an ideal current limiter for output low side current sensing.

The current threshold is fixed and precise.

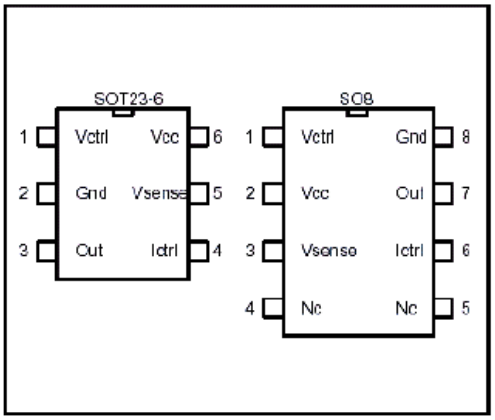
The only external components are:

- A resistor bridge to be connected to the output of the power supply (adapter, battery charger) to set the voltage regulation by dividing the desired output voltage to match the internal voltage reference value.
- A sense resistor having a value and allowable dissipation power which need to be chosen according to the internal voltage threshold.
- Optional compensation components (R and C).

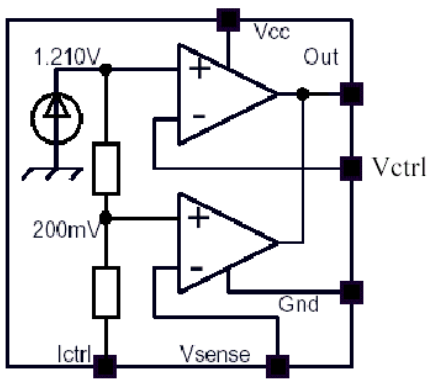
IK3051, is ideal for smallest package available, is ideal for space shrinked applications such as adapters and battery chargers.



PIN CONNECTIONS (top view)



INTERNAL SCHEMATIC



Features

- CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROL
- LOW VOLTAGE OPERATION
- PRECISION INTERNAL COMPONENT COUNT
- CURRENT SINK OUTPUT STAGE
- EASY COMPENSATION
- LOW AC MAINS VOLTAGE REJECTION

Pin Definitions and Functions

SOT23-6 Pinout

Name	Pin#	Type	Function
Vcc	6	Power Supply	Positive Power Supply Line
GND	2	Power Supply	Ground Line. 0V Reference For All Voltages
Vctrl	1	Analog Input	Input Pin of the Voltage Control Loop
Ictrl	4	Analog Input	Input Pin of the Current Control Loop
Out	3	Current Sink Output	Output Pin. Sinking Current Only
Vsense	5	Analog Input	Input Pin of the Current Control Loop

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
Vcc	DC Supply Voltage	14	V
Vi	Input Voltage	-0.3 to Vcc	V
Top	Operating Free Air Temperature Range	0 to 85	°C
Tj	Maximum Junction Temperature	150	°C

Operation Conditions

Symbol	Parameter	Value	Unit
Vcc	DC Supply Conditions	2.5 to 12	V

Electrical Characteristics

Tamb = 25°C and Vcc = +5V (unless otherwise specified)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
Total Current Consumption						
Icc	Total Supply Current – not taking the output sinking current into account	Tamb 0 < Tamb < 85°C		1.1 1.2	2	mA
Voltage Control Loop						
Gmv	Transconduction Gain (Vctrl). Sink Current Only [1)]	Tamb 0 < Tamb < 85°C	1	3.5 2.5		mA/mV
Vref	Voltage Control Loop Reference [2)]	Tamb 0 < Tamb < 85°C	1.198 1.186	1.21	1.222 1.234	V
Iibv	Input Bias Current (Vctrl)	Tamb 0 < Tamb < 85°C		50 100		nA
Current Control Loop						
Gmi	Transconduction Gain (Ictrl). Sink Current Only [3)]	Tamb 0 < Tamb < 85°C	1.5	7		mA/mV
Vsense	Current Control Loop Reference [4)]	Iout = 2.5 mA Tamb 0 < Tamb < 85°C	196 192	200	204 208	mV
Iibi	Current out of pin Ictrl at -200mV	Tamb 0 < Tamb < 85°C		25 50		µA
Output Stage						
Vol	Low output voltage at 10 mA sinking current	Tamb 0 < Tamb < 85°C		200		mV
Ios	Output Short Circuit Current. Output to Vcc. Sink Current Only	Tamb 0 < Tamb < 85°C		27 35	50	mA

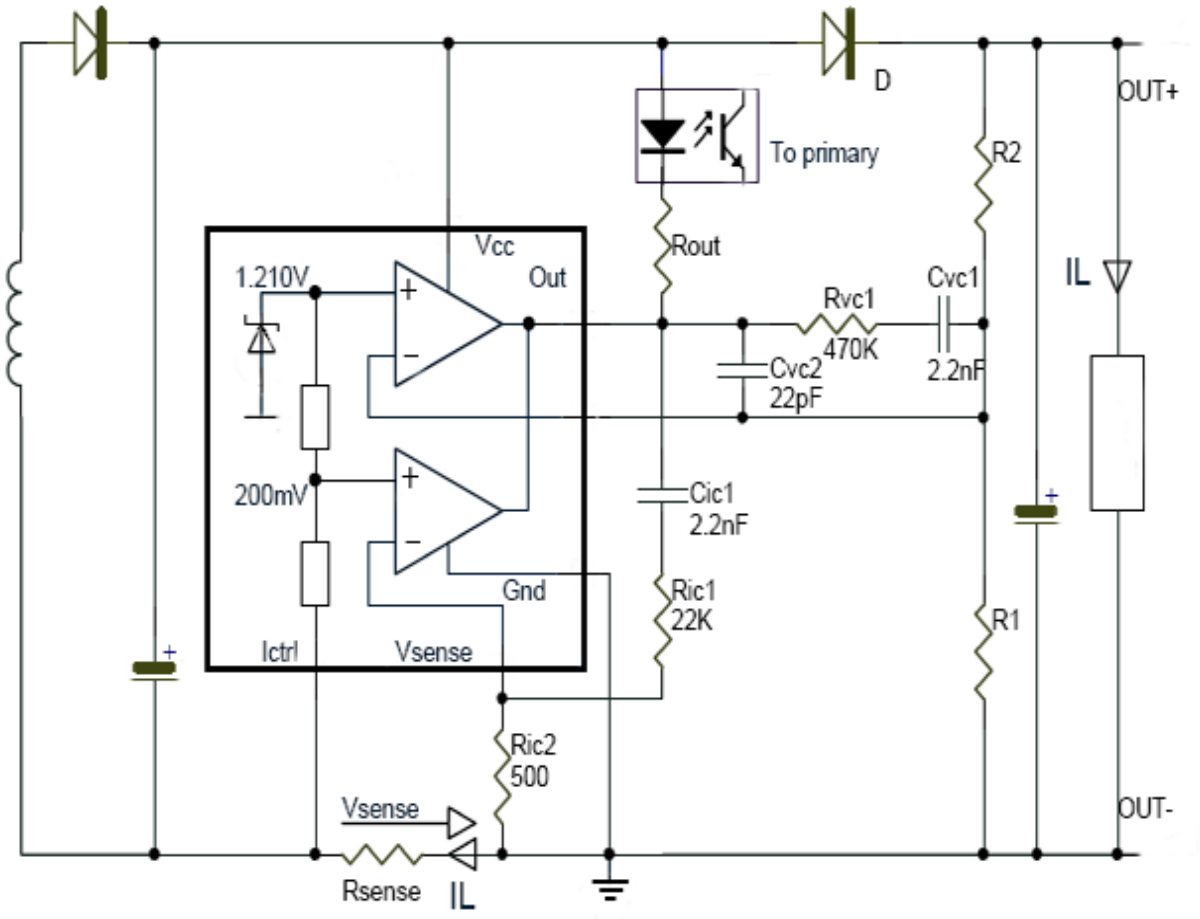
1. If the voltage on Vctrl (the negative input of the amplifier) is higher than the positive amplifier input (Vref=1.210V), and it is increased by 1mV, the sinking current at the output OUT will be increased by 3.5mA.

2. The internal Voltage Reference is set at 1.210V (bandgap reference). The voltage control loop precision takes into account the cumulative effects of the internal voltage reference deviation as well as the input offset voltage of the trans-conductance operational amplifier. The internal Voltage Reference is fixed by bandgap, and trimmed to 0.5% accuracy at room temperature.

3. When the positive input at Ictrl is lower than -200mV, and the voltage is decreased by 1mV, the sinking current at the output OUT will be increased by 7mA.

4. The internal current sense threshold is set to -200mV. The current control loop precision takes into account the cumulative effects of the internal voltage reference deviation as well as the input offset voltage of the trans-conduction operational amplifier.

Figure 1 : Typical Adapter or Battery Charger Application Using IK3051



In the above application schematic, the IK3051 is used on the secondary side of a flyback adapter (or battery charger) to provide an accurate control of voltage and current. The above feedback loop is made with an optocoupler.

Figure 3: Vref vs Ambient Temperature

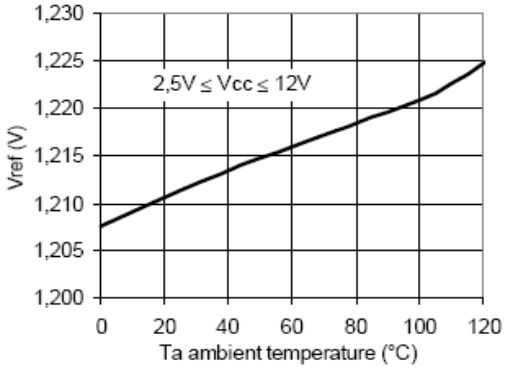


Figure 4: Vsense pin input bias current vs Ambient Temperature

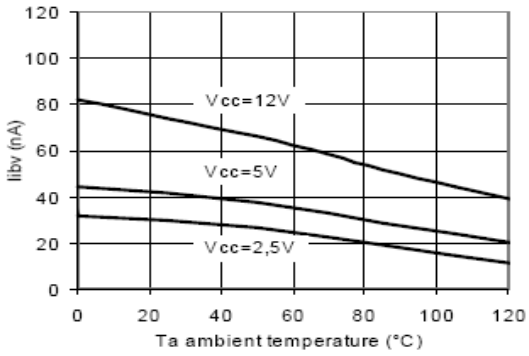


Figure 5: Output short circuit current vs Ambient Temperature

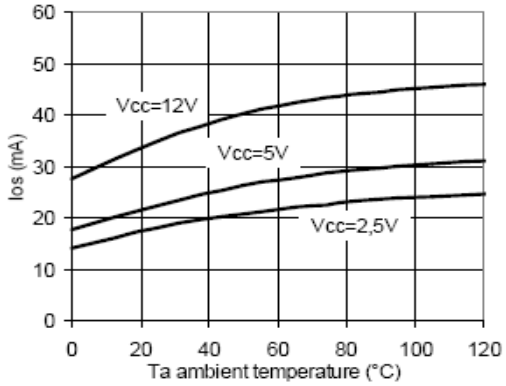


Figure 6: Vsense vs Ambient Temperature

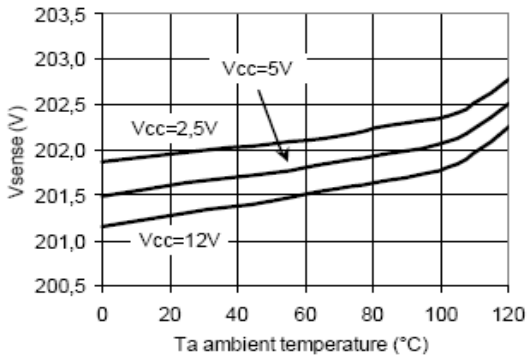


Figure 7: Ictrl pin input bias current vs Ambient Temperature

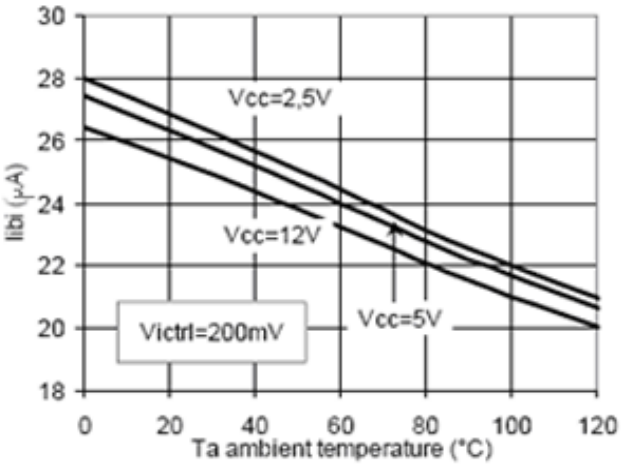
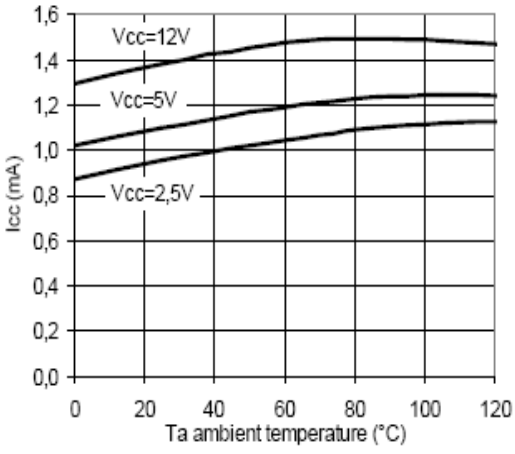
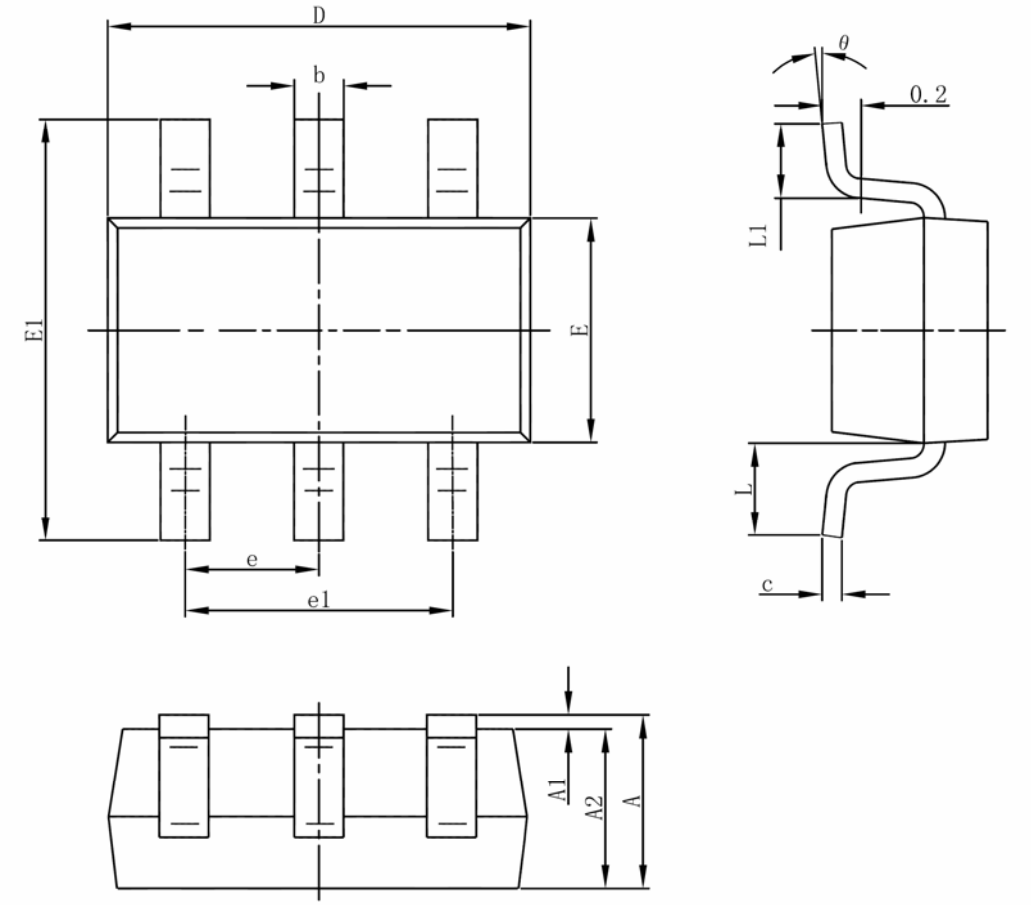


Figure 8: Supply current vs Ambient Temperature



PACKAGE DIMENSION

SOT-23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.600REF		0.024REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°