ASI

Switched-Capacitor Boost Converter 3.3V-5.0V 100mA

Technical Data Sheet **ASI3201**

FEATURES

Switched-Capacitor Step-Up Operation
Input Range: 2.7V to 5.0V
Output Voltage: 3.3V-5.0V (programmable)
Output Current: 100mA
Shutdown Mode
Low Quiescent Current: 30uA
1MHz Internal Oscillator
Thermal Protection Shutdown
Output Short-circuit Current Limit Protection
Automatic Soft-Start Reduces In-Rush Current
SOT23 Package

APPLICATIONS

Mobile Phones
White LED Drivers
USB portable devices
PDA, Palm and Notebook Computers
DSC, Handset Camera Module
PCMCIA cards
Personal Portable device

GENERAL DESCRIPTION

This is a switched capacitor DC/DC boost converter that produces a regulated 3.3V-5V (programmable) output. The input voltage range is from 2.7V to 5.0V that makes it ideally for a single cell Li-Ion battery source.

The part works well for step-up applications without the need for an inductor. The 1MHz switching frequency allows the use of small SMD capacitors. The part provides thermal protection, short-circuit current limit protection. In order to prevent in-rush current effectively, it provides automatic soft-start. The quiescent current is 30uA without load and its shutdown current is less than 0.1uA. The part is available in a SOT package.

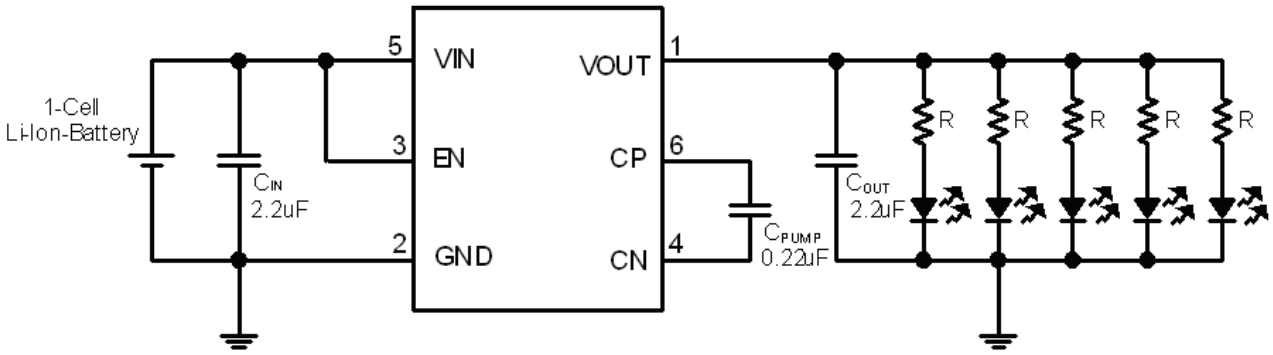

Figure 1. Typical application circuit

Pin Configuration

SOT23-6

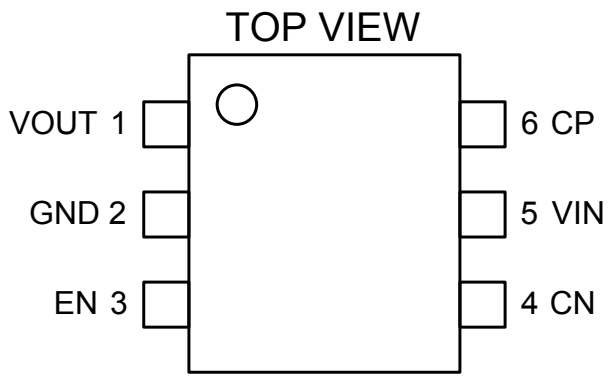

Figure 2. Pin configuration

Pin Description

Table 1

Pin	Name	Description
1	V_{OUT}	Regulated output voltage. VOUT should be bypassed with a low ESR capacitor for the best performance.
2	GND	Ground pin.
3	EN	1.5V or above will turn on the IC. Below 0.4V will put the chip in the shutdown mode.
4	CN	Pumping capacitor negative terminal.
5	V_{IN}	Input supply voltage. V_{IN} should be bypassed with a 2.2uF low ESR capacitor.
6	CP	Pumping capacitor positive terminal.

ELECTRICAL SPECIFICATIONS

At T_A=25℃, V_{IN}=V_{OUT}/2+0.75V, I_{OUT}=10mA, C_{IN}=C_{OUT}=2.2uF, C_{PUMP}=0.22uF, V_{ENABLE}=V_{IN}, unless otherwise noted.

Table 1

Symbol	Function Parameter	Test Conditions	Min	Typ	Max	Units
V_{IN}	Input Voltage		2.7		5.0	V
V_{OUT}	Output Voltage	I_{OUT}<100mA, 3.3V<V_{IN}<5.0V	4.7	5.0	5.3	V
I_{OUT}	Output Current			100		mA
I_{SC}	Output Current (short-circuit)			200		mA
F_{OSC}	Oscillator Frequency			1		MHz
η	Efficiency	I_{OUT} =25mA, V_{IN}=2.7V		92		%
V_R	Ripple Voltage	I_{OUT} =30mA		50		mVpp
V_{IH}	Enable Control (High)	Vin=3.3V to 5.0V	3		V_{IN}	V
V_{IL}	Enable Control (Low)	Vin=3.3V to 5.0V	-0.2		0.4	V
T_{ST}	Thermal Shutdown	Shutdown Temperature		~160		℃
T_{RT}	Thermal Recovery	Recovery Temperature		~140		℃
I_{QC}	Supply Current (Quiescent)	I_{OUT} =0mA		~30		uA
I_{SD}	Supply Current (Shutdown)	V_{IN} =2.7-5.0V, Enable=0V		~0.01		uA

Absolute Maximum Ratings

Supply Voltage .....-0.3V to 5.5V
Output Voltage..... -0.3V to (V_{IN}+0.3V)
Output Short-Circuit Duration ..... Infinite
Junction Temperature Range .....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature.....+250℃

FUNCTIONAL BLOCK DIAGRAM

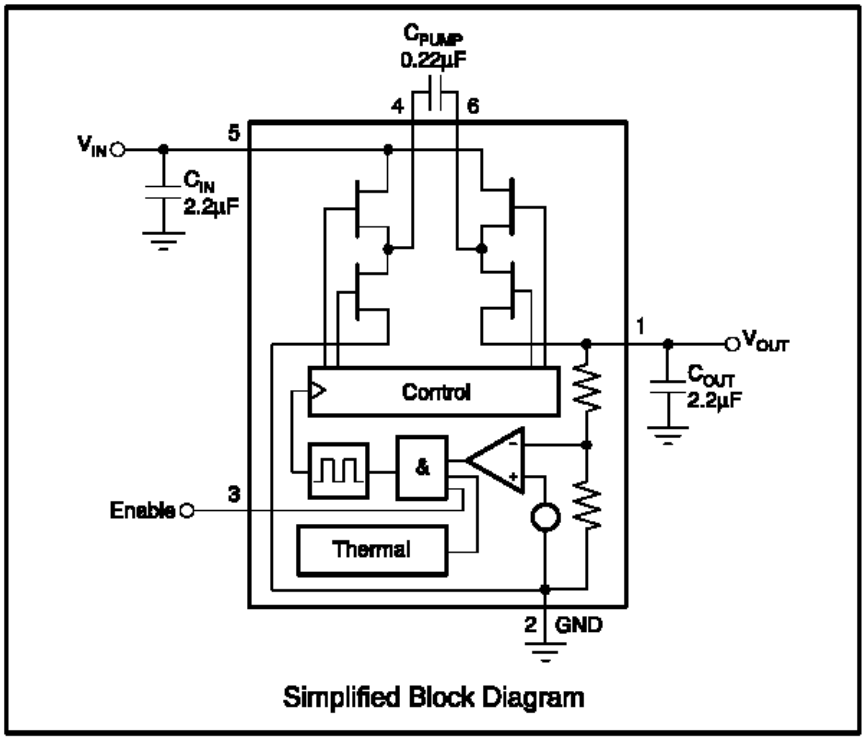

Figure 3. Simplified Block Diagram

FUNCTIONAL DESCRIPTIONS

The ASI3201 switched-capacitor charge pump provides a regulated 5V output voltage for input voltages between 2.7V and 5V. This is accomplished by a step-up or boost mode of operation. A conversion clock of 50% duty cycle is generated. During the first half cycle, the pumping capacitor C_{PUMP} charges to V_{IN}. During the second half cycle, the voltage on C_{PUMP} is added to V_{IN}, then deliver to V_{OUT}. The output voltage is regulated by skipping clock cycles as necessary.

Soft-Start and Short-Circuit Protection Circuitry

The ASI3201 includes soft-start circuitry to limit inrush current at turn-on. When starting up, the output capacitor is charged through the charge-pump capacitor with a limited current source. When the output voltage approached to its design value, the soft-start is terminated and normal operation begins. If an overload condition occurs, e.g. the output is shorted to ground, the output current is limited by the ASI3201 protection switching technique.

Thermal Protection

The regulator has thermal shutdown circuitry that protects it from damage caused by high temperature conditions. The thermal protection circuitry shut down the device when the junction temperature reached approximately 160^0C, allowing the device to cool. When the junction temperature cools to approximately 140^0C, the device is automatically re-enabled. Continuously running the regulator into thermal shutdown can degrade reliability.

Shutdown Mode

A control pin on the regulator can be used to place the device into an energy-saving shutdown mode. In this mode, the output is disconnected from the input.