

## 5V/1.5A Output Synchronous Boost with Current Limit Setting in SOT23-6

### DESCRIPTION

The HM6350A is a high efficiency synchronous step-up converter that can provide up to 1.5A to a fixed output up to 5V from a low voltage source. Unlike most step-up converter, it incorporates circuits that disconnect the input from output, during shutdown, short-circuit, output current overloading, or other events when output is higher than the input. This eliminates the need for an external MOSFET and its control circuitry to disconnect the input from output, and provides robust output overload protection. And HM6350A also provides the flexibility of setting input peak current limit and thus, output current is limited.

A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny and low profile inductors and ceramic capacitors. An internal synchronous MOSFET provides highest efficiency and with a current mode control that is internally compensated, external parts count is reduced to minimal.

HM6350A is housed in a tiny SOT23-6 package.

### FEATURES

- ◆ Output Disconnect
- ◆ Short-circuit Protection
- ◆ 5V/1.5A Output Power
- ◆ Output to Input Reversed Current Protection
- ◆ Up to 96% Efficiency
- ◆ 40 $\mu$ A No load  $I_Q$  and light load PFM Mode
- ◆ Internal Synchronous Rectifier
- ◆ Current Limit Programmable
- ◆ Current Mode control
- ◆ Logic Control Shutdown and Thermal shutdown
- ◆ SOT23-6 Package

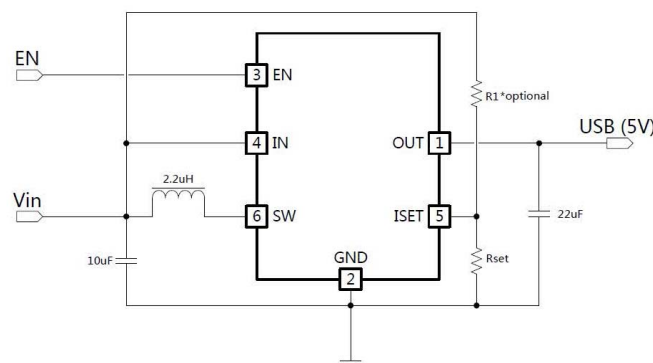
### APPLICATIONS

- ◆ USB OTG for MIDs, Smartphones
- ◆ Mobile back-up Battery Chargers
- ◆ Alkaline, NiCd, and NiMh batteries applications
- ◆ USB powered devices

### ORDERING INFORMATION

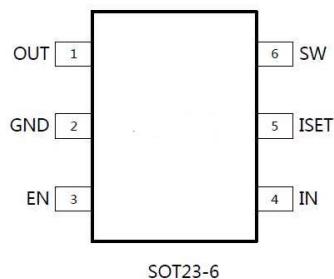
PART	PACKAGE PIN	TOP MARK
HM6350A	SOT23-6	ASYW <i>YW=Date Code</i>

### TYPICAL APPLICATION



Typical Application Circuit

## PIN CONFIGURATION



## ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

SW Voltage.....-0.3V to 5.5V

All Other PIN Voltages.....-0.3V to 5V

SW to ground current .....Internally limited

Operating Temperature Range .....-40°C to 85°C

Storage Temperature Range .....-55°C to 150°C

Thermal Resistance  $\theta_{JA}$   $\theta_{JC}$

SOT23-6.....180.....90..... °C/W

Lead Temperature (Soldering, 10sec) .....260°C

ESD HBM (Human Body Mode) .....2KV

ESD MM (Machine Mode) .....200V

## ELECTRICAL CHACRACTERISTICS

( $V_{IN}$  =3.6V,  $V_{OUT}$  = 5V, unless otherwise specified. Typical values are at  $T_A$  = 25°C.)

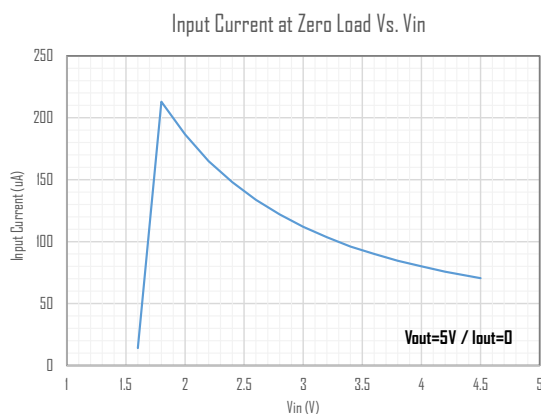
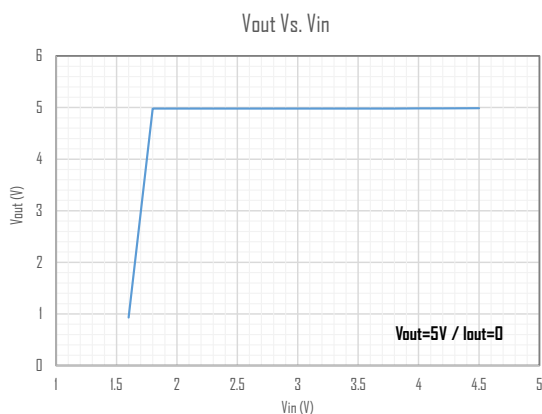
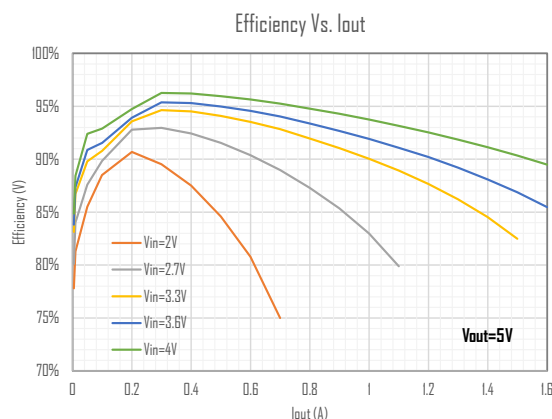
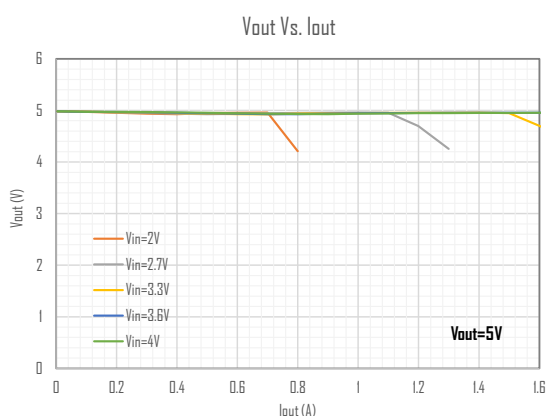
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Quiescent Current	EN=IN, No load, Not switching		40	80	μA
Shutdown Supply Current at $V_{IN}$	$V_{EN}$ =GND		0.5	5	μA
$V_{IN}$ UVLO at Rising			1.8		V
$V_{IN}$ UVLO at Falling			1.5		V
$V_{OUT}$	Output Voltage	4.97	5.07	5.17	V
Switching Frequency		0.7	1	1.3	MHz
NMOS Switch On Resistance	$I_{SW}$ =100mA		150		mΩ
PMOS Switch On Resistance	$I_{SW}$ =100mA		120		mΩ
SW Leakage Current	$V_{OUT}$ =5V, $V_{SW}$ =0 or 5V, $V_{EN}$ =GND			10	μA
NMOS Switch Current Limit		2.2	2.8		A
Start-up Current Limit			1.5		A
Short Circuit Hiccup time	ON		3.5		ms
	OFF		75		ms
EN Input Current		-1	0	1	μA
EN Input Low Voltage				0.6	V
EN Input High Voltage		1.5			V
Thermal Shutdown	Rising, Hysteresis=25°C		160		°C

## PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	OUT	Output pin. Bypass with a 22 $\mu$ F or larger ceramic capacitor closely between this pin and GND
2	GND	Ground Pin
3	EN	Enable pin for the IC. Drive this pin high to enable the part, low to disable.
4	IN	Input Supply Voltage. Bypass with a 4.7 $\mu$ F ceramic capacitor to GND
5	ISET	Current limit setting, connecting a resistor (Rset) to GND will set the input peak current, and with an additional resistor (RI) from Vin to ISET pin could achieve a constant output current limit.
6	SW	Inductor Connection. Connect an inductor Between SW and the input.

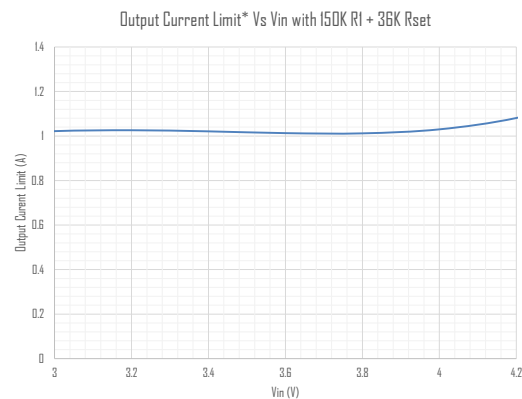
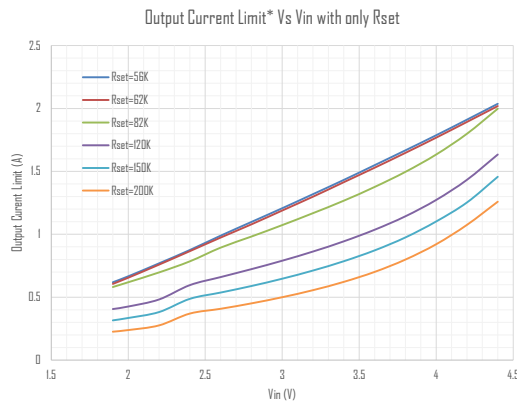
## TYPICAL CHARACTERISTICS

(Typical values are at  $T_A = 25^\circ\text{C}$  unless otherwise specified.)



## TYPICAL CHARACTERISTICS cont'

(Typical values are at  $T_A = 25^\circ\text{C}$  unless otherwise specified.)



\*Output current limit is the output current measured at  $V_{out}=4.75\text{V}$

## APPLICATION INFORMATION

### Loop Operation

The HM6350A is a wide input range, high-efficiency, DC/DC step up switching regulator, integrated with a  $120\text{m}\Omega$  Low Side Main MOSFET and  $150\text{m}\Omega$  synchronous MOSFET. It uses a PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

The peak current of the NMOS switch is also sensed to limit the maximum current flowing through the switch and the inductor. The typical peak current limit is set to  $2.8\text{A}$ . An internal temperature sensor prevents the device from getting overheated in case of excessive power dissipation.

### Light Load Operation

Traditionally, a fixed constant frequency PWM DC/DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFETs, power is lost due to the finite  $R_{DS(on)}$ s of the MOSFETs and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. HM6350A employs a proprietary control scheme that improves efficiency in this situation by enabling the device into a power saving mode during light load, thereby extending the range of high efficiency operation.

### Short-Circuit Protection

Unlike most step-up converters, the HM6350A allows for short circuits on the output. In the event of a short circuit, the device first turns off the NMOS when the sensed current reaches the current limit. After  $V_{OUT}$  drops below  $V_{IN}$  the device then enters a linear charge period with the current limited same as with the start-up period. In addition, the thermal shutdown circuits

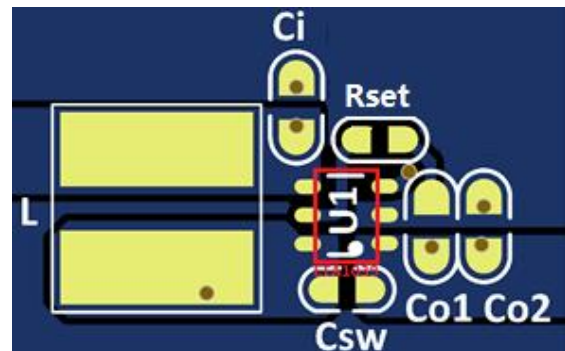
disable switching if the die temperature rises above 150°C.

### Down Mode ( $V_{IN} > V_{OUT}$ ) Operation

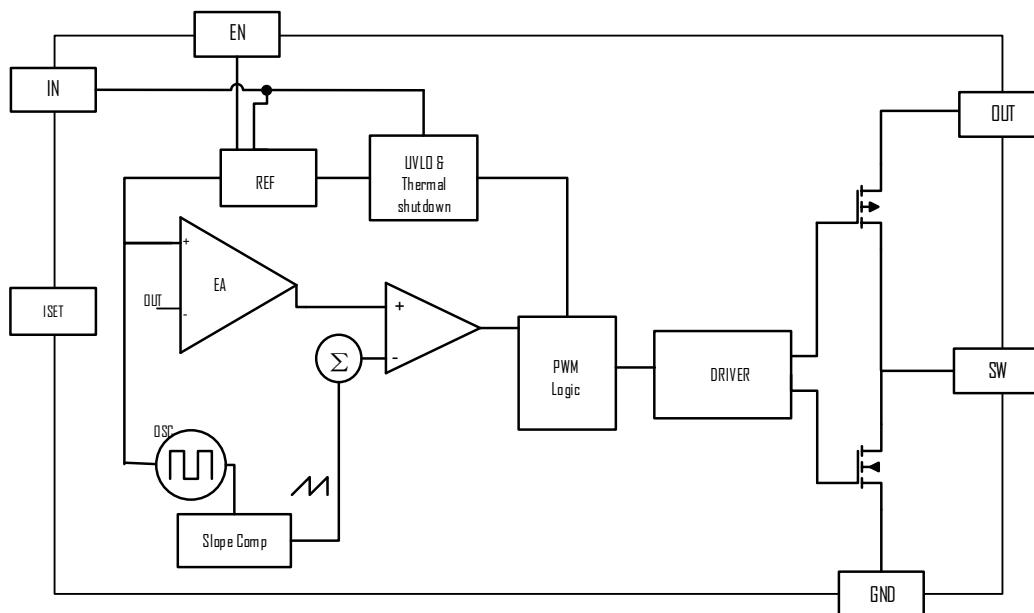
The HM6350A will continue to supply the output voltage even when the input voltage exceeds the output voltage. Since the PMOS no longer acts as a low-impedance switch in this mode, power dissipation increases within the IC to cause a sharp drop in efficiency. Limit the maximum output current to maintain an acceptable junction temperature.

## PCB GUIDELINES

A recommended PCB layout is shown on the right hand. Please place the output capacitors (Co1 and Co2) just besides the chip. And wire GND out underneath the IC body. And thus, the performance of HM6350A is guaranteed, and a very compact PCB design is also achieved.

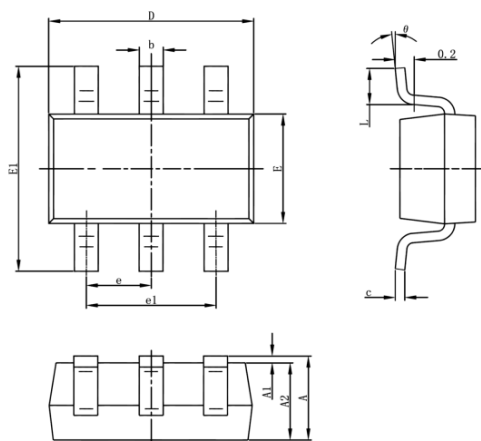


## BLOCK DIAGRAM



## PACKAGE OUTLINE

Package: SOT23-G



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	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°