

Features

- Fixed 3.3V or 5V Outputs
- VIN Range: 1.8V to 4.5V(HX4002-3.3)
2.7V to 5.5V(HX4002-5)
- Output Current: Up to 200mA (HX4002-5)
Up to 50mA (HX4002-3.3)
- Constant Frequency Operation at All Loads
- Low Noise Constant Frequency (1.2MHz) Operation
- Shutdown Disconnects Load from Input
- Shutdown Current <1μA
- Short-Circuit/Thermal Protection
- Available in Low Profile 6-Lead sot23 Package

Application

- 2 AA Cell to 3.3V
- Li-Ion to 5V
- USB On-The-Go Devices
- White LED Drivers
- Handheld Devices

Description

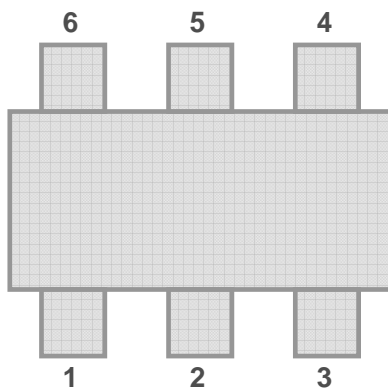
The HX4002 is a low noise, constant frequency (1.2MHz) switched capacitor voltage doublers. The HX3200-3.3 can produce a regulated output voltage of 3.3V from a minimum input voltage of 1.8V (2 alkaline cells) whereas the HX3200-5 can produce 5V from a minimum of 2.7V (Li-Ion battery) input.

HX4002 feature constant frequency operation at any load. Built-in soft-start circuitry prevents excessive inrush current during start-up. Thermal shutdown and current-limit circuitry allow the parts to survive a continuous short-circuit from VOUT to GND.

High switching frequency minimizes overall solution footprint by allowing the use of tiny ceramic capacitors. In shutdown, the load is disconnected from the input and the quiescent current is reduced to <1μA.

The HX4002 is available in the 6-pin SOT23

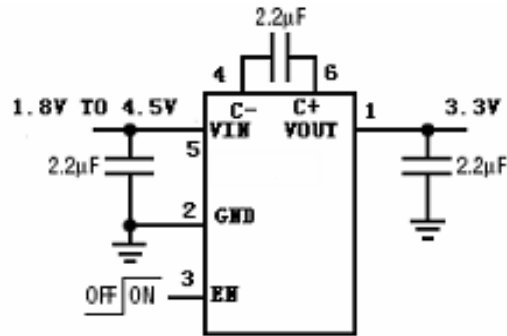
Pin Assignment



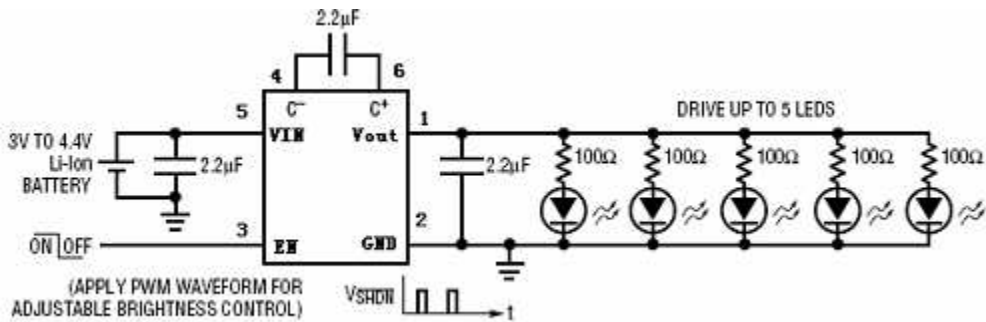
PIN NUMBER SOT-23-6	PIN NAME
1	V _{OUT}
2	GND
3	EN
4	C-
5	V _{IN}
6	C+

Typical Application

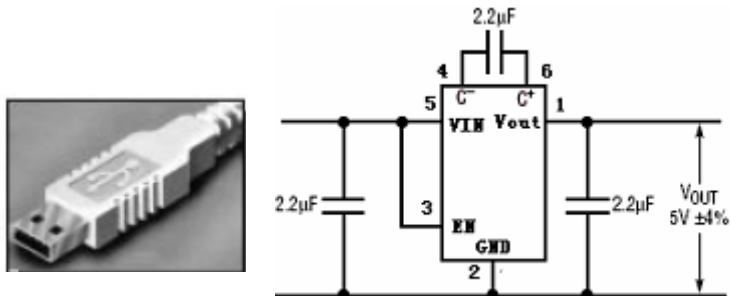
Regulated 3.3V Output



Lithium-Ion Battery to 5V White or Blue LED Driver



USB Port to Regulated 5V Power Supply



Electrical Characteristics

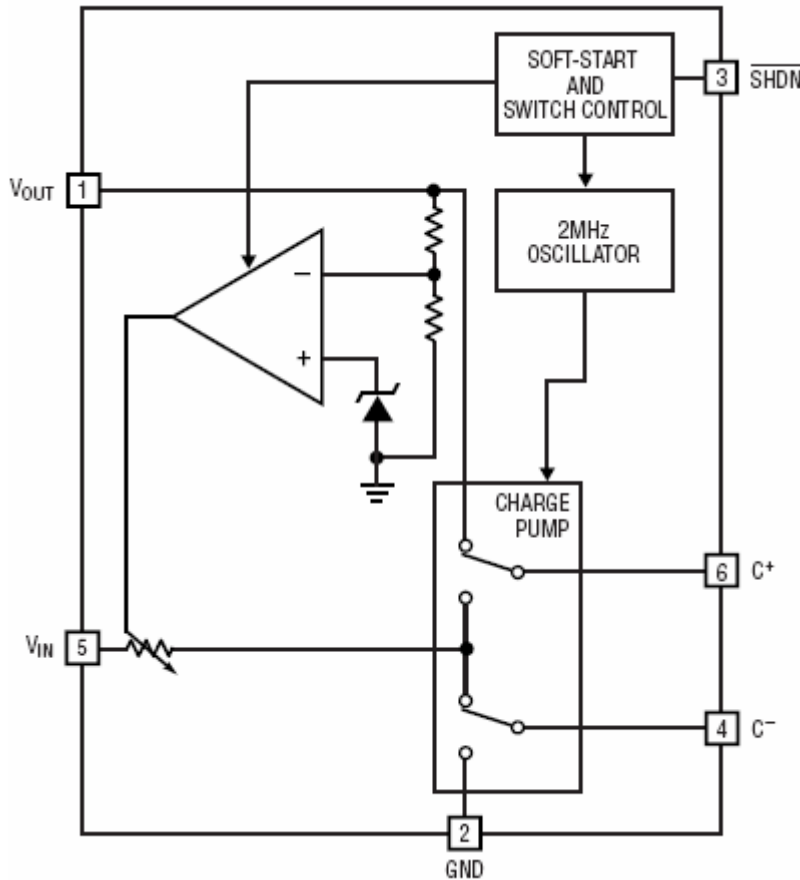
The • denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_{IN} = 3.6\text{V}$ $EN = V_{IN}$, $C_{IN} = C_{OUT} = 2.2\mu\text{F}$ or $1\mu\text{F}$ unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range(V_{IN})	HX4002-3.3 HX4002-5	• 1.8 • 2.7		4.5 5.5	V
Output Voltage Range(V_{OUT})	$2.7\text{V} < V_{IN} < 5.5\text{V}$, $I_{OUT} < 65\text{mA}$ $3.1\text{V} < V_{IN} < 5.5\text{V}$, $I_{OUT} < 150\text{mA}$	• 4.7	5	5.2	V
I_{SHDN} Shutdown Current	$EN = 0\text{V}$, $V_{OUT} = 0\text{V}$	• 0.3	0.5	1	μA
No load input current	$I_{OUT} = 0\text{mA}$, $V_{IN} = 2.7\text{V}$	•	0.11		mA
Output current limit	$V_{OUT} = 0\text{V}$	•	300		mA
Output Ripple (V_R)	$I_{OUT} = 100\text{mA}$		20		mV _{P-P}
Efficiency	$V_{IN} = 2.7\text{V}$, $I_{OUT} = 80\text{mA}$		83		%
Open-Loop Output Resistance $R_{OL} = (2V_{IN} - V_{OUT})/I_{OUT}$	$V_{IN} = 2.7\text{V}$, $V_{OUT} = 4.5\text{V}$	•	6		Ω
Switching Frequency(f_{osc})		• 0.6	1.2	1.8	MHz
High Level Input Voltage (V_{IH})		• 1.3			V
Low Level Input Voltage (V_{IL})		•		0.4	V
Input Current (I_{IH})		• -1		1	μA
Input Current (I_{IL})	$EN = 0\text{V}$	• -1		1	μA

Absolute Maximum Ratings

- V_{IN} - 0.3 V ~ + 6 V
- V_{OUT} - 0.3 V ~ + 5.5 V
- V_{OUT} Short-circuit Duration indefinite
- V_{EN} - 0.3 V ~ + 6 V
- Operating Temperature Range - 30°C ~ + 85°C
- Lead Temperature (Soldering 10 sec.) + 300°C
- Storage Temperature Range - 65°C ~ + 125°C

Functional Diagram



Application Information

V_{OUT} (Pin 1): Regulated Output Voltage. V_{OUT} should be bypassed with a low ESR ceramic capacitor providing at least 2μF of capacitance as close to the pin as possible for best performance.

GND(Pin 2): Ground. These pins should be tied to a ground plane for best performance. The exposed pad must be soldered to PCB ground to provide electrical contact and optimum thermal performance.

EN (Pin3): Active Low Shutdown Input. This pin must not be allowed to float.

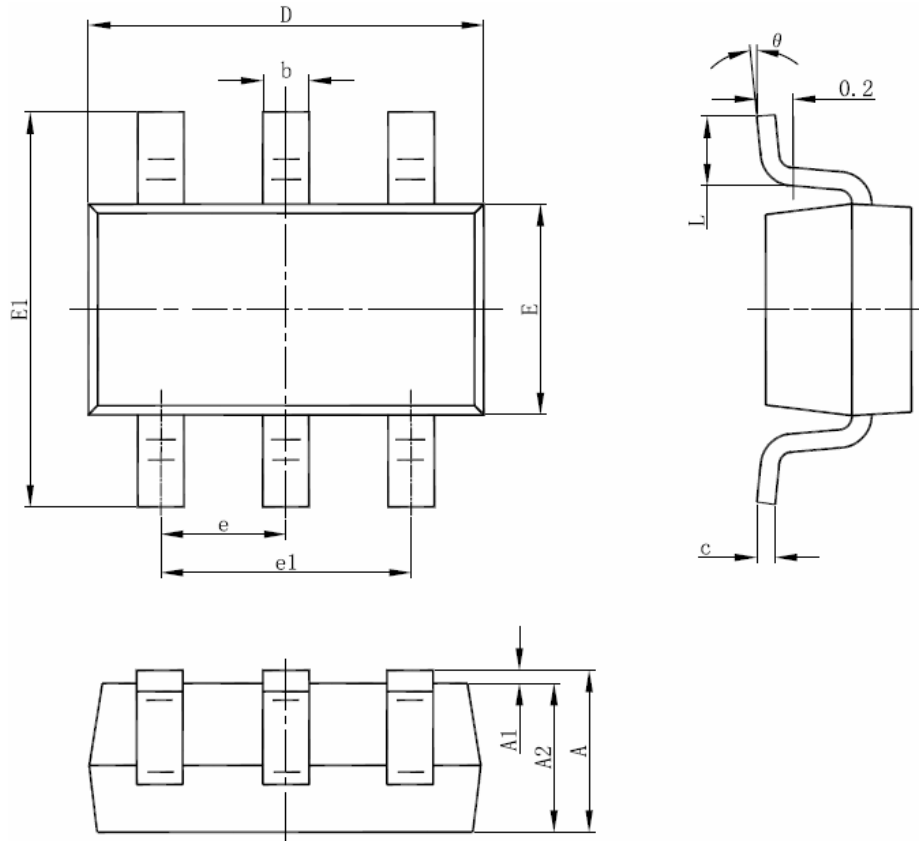
C-(Pin 4): Flying Capacitor Positive Terminal.

V_{IN} (Pin 5): Input Supply Voltage. V_{IN} should be bypassed with a 1μF to 4.7μF low impedance ceramic capacitor.

C+ (Pin6): Flying Capacitor Positive Terminal.

Packaging Information

SOT-23-6 Package Outline Dimension



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°