## General Description

The SE3608 is a high efficiency current-mode boost converter with a fixed operation frequency. The SE3608 integrates a very low Rds-on NMOSFET to reduce power loss and achieve higher efficiency. The maximum efficiency is up to 93%. SE3608 can output 2A current when Vin is higher than 3.3V and output is 5V. The high 1.2MHz operation frequency minimizes L and C value. The internal compensation network reduces external component counts. Small foot print SOT23-6 package provides the best solution for PCB layout area.

SE3608 is designed with 12V process. This allows SE3608 to be used in applications where higher voltage is needed, such as charging two Lithium batteries in series. The other possible application where the higher voltage is needed is Qualcomm Quick Charge 2.0 compatible portable chargers. SE3608 can support 9V Vout for this application.

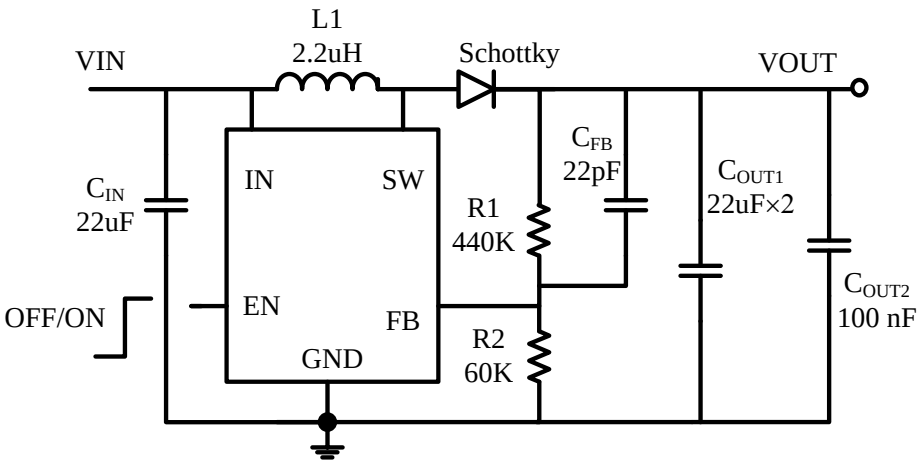
## Features

- Wide Input Range: 2.5-6V Input
- Up to 1.5A Output Current
- Maximum 8V Output Voltage
- 1.2MHz Switching Frequency
- Low RDS(ON): 70mΩ
- Up to 90% Efficiency
- Under-Voltage Lockout Protection
- Over-Temperature Protection
- Internal Soft Start
- 1uA Shutdown Current
- Accurate Reference: 0.6V $V_{REF}$
- Compact package: SOT23-6

## Applications

- Chargers
- LCD Displays
- Digital Cameras
- Handheld Devices
- Portable Products

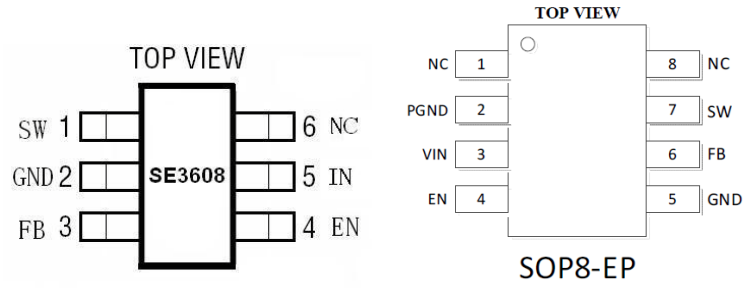
## Typical Application





**Preliminary and all contents are subject to change without prior notice.**
© Seaward Electronics, Inc., • www.seawardinc.com.cn • Page 1

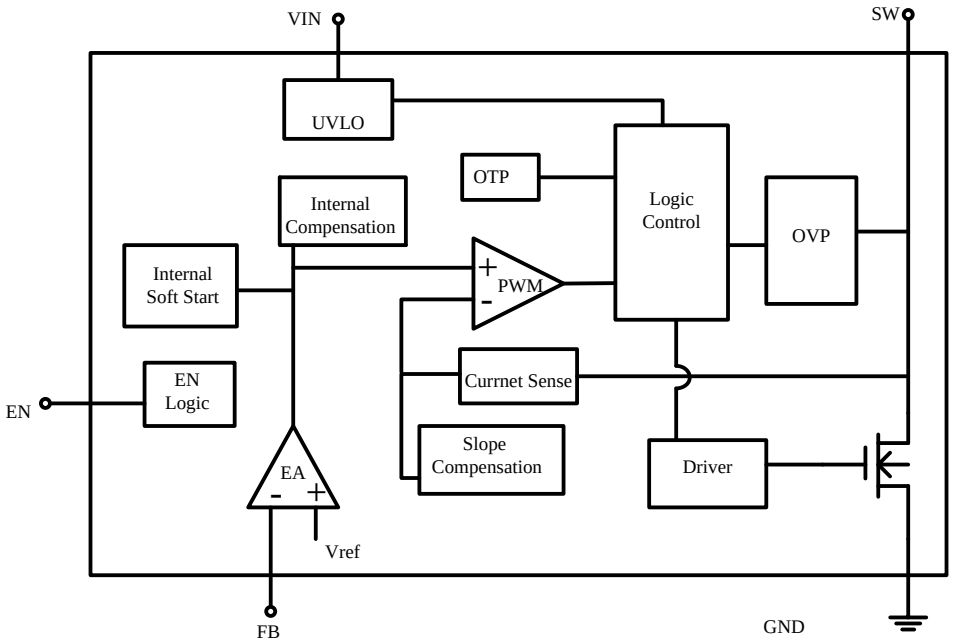
## Pin Configuration




## Pin Description

| NO. | Pin Name | Pin Function Description |
|---|---|---|
| 1 | **SW** | Power Switch Output. Connect the inductor and the blocking Schottky diode to SW. |
| 2 | **GND** | GND |
| 3 | **FB** | Feedback |
| 4 | **EN** | Enable pin. A high input at EN enables the device and a low input disables the devices. When not used, connect EN to the input source for automatic startup. |
| 5 | **IN** | Input Supply Pin. Must be locally bypassed. |
| 6 | **NC** | No Internal Connection |

## Functional Block Diagram



## Absolute Maximum Ratings

| Symbol | Parameter | Maximum | Units |
|---|---|---|---|
| VIN | $V_{IN}$ Supply Voltage | -0.3～6.5 | V |
| $V_{SW}$ | Voltage at SW Pin | -0.5～12 | V |
| $V_{IO}$ | All Other I/O Pins | GND-0.3 to VDD+0.3 | V |
| $P_{TR1}$ | Thermal Resistance(SOT23-6)<br>$\Theta_{JA}$ | 220 | ℃/W |
| $T_{stg}$ | Storage Temperature | -55 to 150 | ℃ |
| $T_{solder}$ | Package Lead Soldering Temperature（10s） | 260 | ℃ |
| ESD Susceptibility | HBM(Human Body Mode) | 2 | kV |

Note: Exceeding these ratings may damage the device.

## Recommended Operating Conditions

| Symbol | Parameter | Maximum | Units |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | 2.5 to 6 | V |
| $V_{SW}$ | Output Voltage | VIN to 10 | V |
| $T_A$ | Ambient Temperature | -40 to +85 | ℃ |
| $T_J$ | Junction Temperature | -40 to +125 | ℃ |

Note: The device is not guaranteed to function outside of its operating rating.

## Electrical Characteristics

（$V_{IN}$ = 3.3V, $V_{OUT}$=5V, $I_{OUT}$=100mA, $T_A$ = 25°C unless otherwise specified）

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | | 2.5 | | 6 | V |
| **Feedback** | | | | | | |
| $V_{FB}$ | Feedback Voltage | | 588 | 600 | 612 | mV |
| $I_{bias}$ | FB Pin Input Bias Current | | | 0.05 | 1 | μA |
| **UVLO** | | | | | | |
| UVLO | Under Voltage Lock Out | | | 2.1 | | V |
| **Operating Current** | | | | | | |
| $I_{off}$ | Operating Current（Shutdown） | | | 0.1 | 1 | μA |
| $I_{sby}$ | No Switching | Vin=3V $V_{FB}$=0.7V | | 100 | | μA |
| $F_{sw}$ | Switching Frequency | | | 1.2 | | MHz |
| $D_{max}$ | Maximum Duty Cycle | $V_{FB}$=0V | | 90 | | % |
| **Chip Enable** | | | | | | |
| $V_{EN_H}$ | EN Minimum High Level | | 1.5 | | | V |
| $V_{EN_L}$ | EN Maximum Low Level | | | | 0.4 | V |
| $V_{HYS}$ | EN Hysteresis | | | 90 | | mV |
| $I_{EN}$ | EN Input Bias Current | | | | 1 | μA |
| **OTP** | | | | | | |
| OTP | | | | 120 | | ℃ |
| OTP Hysteresis | | | | 20 | | ℃ |
| **Output Switch** | | | | | | |
| $R_{ON}$ | SW On Resistance (Note 3) | | | 70 | | mΩ |
| $I_{LIMIT}$ | SW Current Limit | | | 5 | | A |
| $I_{LEAK}$ | SW Leakage Current | $V_{sw}$＝5V | | 0.01 | 1 | μA |
| **Open Circuit Protection** | | | | | | |
| $V_{OV}$ | SE3608 | | | $V_{OUT}$×112% | | V |
| **Soft Start** | | | | | | |
| $t_{ss}$ | Soft Start Time (Note 3) | $V_{IN}$ Power On | | 400 | | μS |

Note3: Guaranteed by design.


**Preliminary and all contents are subject to change without prior notice.**
© Seaward Electronics, Inc., • www.seawardinc.com.cn • Page 4

## Typical Performance Characteristics

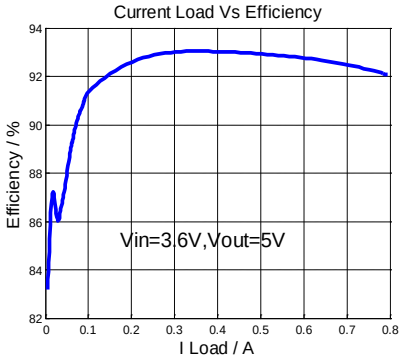



Fig 1 Efficiency Vs Light Load

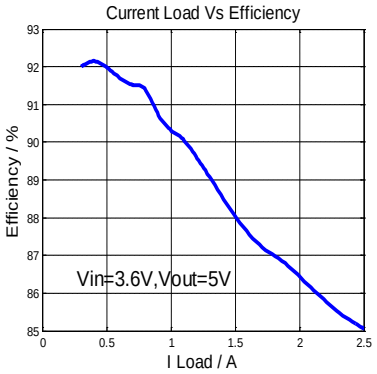



Fig 2 Efficiency Vs Heavy Load

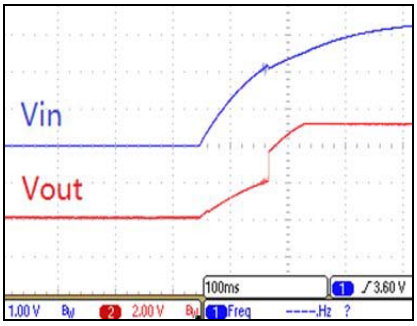



Fig 3 Startup with $V_{in}$

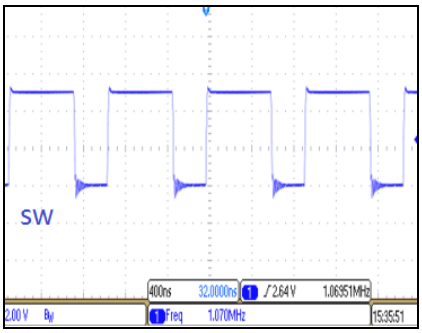



Fig 4 SW Waveform

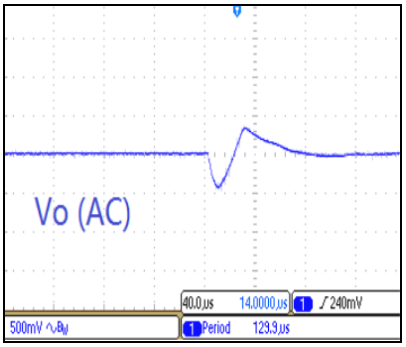



Fig 5 Transient Response

($V_{IN}$=3.6V, Vout=5V, $I_{load}$=0.9A to 0.15A)

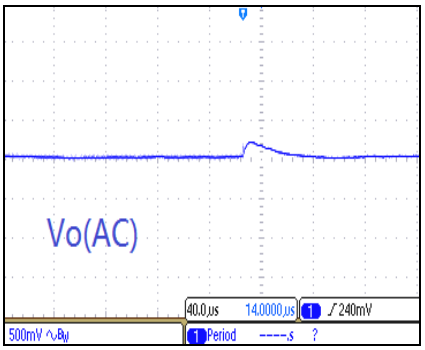



Fig 6 Transient Response

($V_{IN}$=3.6V, Vout=5V, $I_{load}$=0.15A to 0.9A)

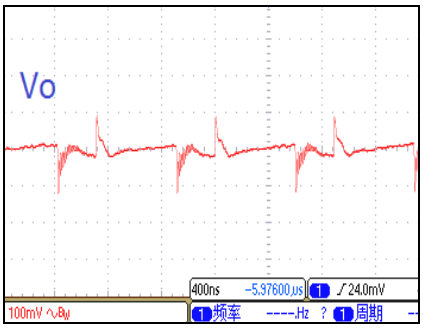



Fig 7 Vout Ripple

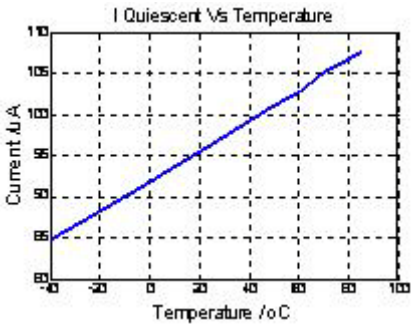



Fig 8 Quiescent Current Vs Temperature

## Operation Description

The SE3608 adopts a fixed frequency, peak current mode boost regulator architecture to regulate output voltage. The operating principle of the SE3608 can be easily understood by referring to the functional block diagram. At the beginning of each oscillator cycle the MOSFET is turned on by the control circuit. To prevent sub-harmonic oscillations at duty cycle larger than 50 percent, a stabilizing ramp is added to the output of the current sense amplifier and the result is fed into the negative input of the PWM comparator. When this voltage equals the output voltage of the error amplifier, the power MOSFET is turned off. The voltage at the output of the error amplifier is an amplified result of the difference between the 0.6V reference voltage and the feedback voltage. In this way the peak current level keeps the output voltage in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases, resulting in more current to flow through the power MOSFET, thus increasing the power delivered to the output. The SE3608 has internal soft start to avoid rush input current during the startup and also to avoid overshoot on the output.

## Applications Information

Because of the high integration in the SE3608, the application circuit based on this regulator IC is rather simple. Only input capacitor $C_{IN}$, output capacitor $C_{OUT1}$ and $C_{OUT2}$, inductor L, Schottky diode and feedback resistors (R1 and R2) need to be selected for the targeted applications.

## Feedback Resistor Divider R1 and R2:

R1 and R2 should be chosen to program the proper output voltage. To minimize the power consumption under light loads, it is desirable to choose large resistance values for both R1 and R2. A value of between 330KΩ and 5MΩ is recommended for both resistors. If R1=440KΩ is chosen, then R2 can be calculated to be 60 KΩ based on the following equation:

R2 = (R1×0.6V)/(VOUT - 0.6V)

## Feedback Capacitor $C_{FB}$:

In order to enhance response speed of the convertor, feedback capacitor $C_{FB}$ should be added to the loop. Its value should not be less than 22pF.

## Input Capacitor $C_{IN}$:

To minimize the potential noise problem, place a typical X5R or better grade ceramic capacitor really close to the IN and GND pins. Care should be taken to minimize the loop area formed by CIN, and IN/GND pins. In this case a 10uF low ESR ceramic is recommended.

### Output Capacitor $C_{OUT1}$ and $C_{OUT2}$:

The output capacitor is selected to meet the output ripple noise requirements. Both steady state ripple and transient requirements must be taken into consideration when selecting these capacitors. For the best performance, it is recommended $C_{OUT1}$ should be X5R or better grade ceramic capacitor with 10V rating and more than two pieces of 22uF Capacitors. Only when $C_{OUT1}$ is big enough, it can absorb the energy of inductor and prevent the Vout to shoot up too high when there is a sudden reduction in the current load. It is recommended $C_{OUT2}$ is 100nF. It can also reduce the ripple of output voltage.

### Boost Inductor L:

The recommended value of inductor is 1u H. Small size and better efficiency are the major concerns for portable devices. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation the current rating should be considered.

### Diode Selection:

Schottky diode is a good choice for SE3608 because of its low forward voltage drop and fast reverses recovery in order to get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. The diode reverse breakdown voltage should be larger than the output voltage, and its forward voltage should be less than 0.6V.

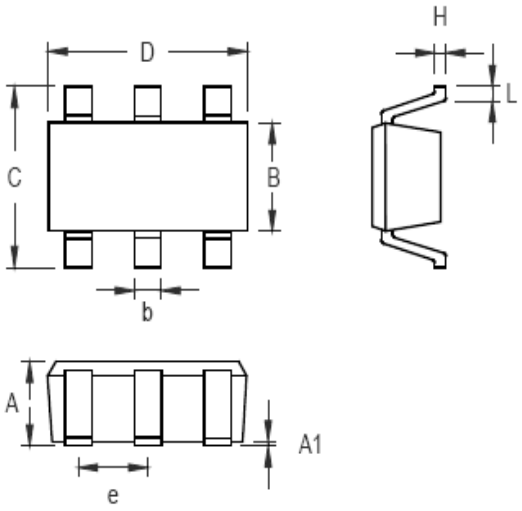
### Start-up and Inrush Current:

The SE3608 has internal soft start to limit the value of current through $V_{IN}$ during the startup and also to avoid overshoot on the output. The soft start is realized by gradually increasing the output of error amplify during start-up.

### Over Voltage Protection:

The SE3608 has integrated over voltage protection function. If the output voltage exceeds the predetermined value of 12%, the internal circuit will shut power MOS, until $V_{OUT}$ voltage falls down.

## Outline Drawing For SOT23-6




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.889 | 1.295 | 0.031 | 0.051 |
| A1 | 0.000 | 0.152 | 0.000 | 0.006 |
| B | 1.397 | 1.803 | 0.055 | 0.071 |
| b | 0.250 | 0.560 | 0.010 | 0.022 |
| C | 2.591 | 2.997 | 0.102 | 0.118 |
| D | 2.692 | 3.099 | 0.106 | 0.122 |
| e | 0.838 | 1.041 | 0.033 | 0.041 |
| H | 0.080 | 0.254 | 0.003 | 0.010 |
| L | 0.300 | 0.610 | 0.012 | 0.024 |

**联系方式：**

北京思旺电子技术有限公司–中国总部

地址：中国北京市海淀区信息路 22 号上地科技综合楼 B 座二层

邮编：100085

电话:010-82895700/1/5

传真:010-82895706

Seaward Electronics Corporation – 台湾办事处

2F, #181, Sec. 3, Minquan East Rd,

Taipei, Taiwan R.O.C

电话: 886-2-2712-0307

传真: 886-2-2712-0191

Seaward Electronics Incorporated – 北美办事处

1512 Centre Pointe Dr.

Milpitas, CA95035, USA

电话: 1-408-821-6600