## Application Note: 15-11-2013

# AS1390B

## High Power Management IC

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### Revision History

| Revision | Date | Owner | Description |
|---|---|---|---|
| 1.0 | 15.11.2013 | | |

# 1 High Power Boost Controller

Rapid evolution in TV technology has had a significant effect on the requirements of the power supply in these electronic devices. LEDs, which offer high efficiency and enable the design of ultra-thin form factors, have become the preferred light source for the LCD backlight. As a result big screens, the power supplies for today's TV backlighting systems are required to drive very high numbers of LEDs in multiple parallel strings, supplying a high voltage output and a high load current. The DC supply on a TV's board is usually 12V or 24V, and the voltage needed to drive strings of LEDs is often 60V or higher. Often, needed load is very high (1 to 3 A), and this load constantly varies as the strings of LEDs vary the intensity of their light output in dynamic response to the picture content being displayed. The boost converter circuit must not only meet the basic requirement of providing a high voltage output while supporting high peak current throughput; it must also operate at high efficiency, and maintain highly accurate voltage regulation across widely and rapidly varying load conditions. AS1390B makes such solution in the optimal way (Fig.1).

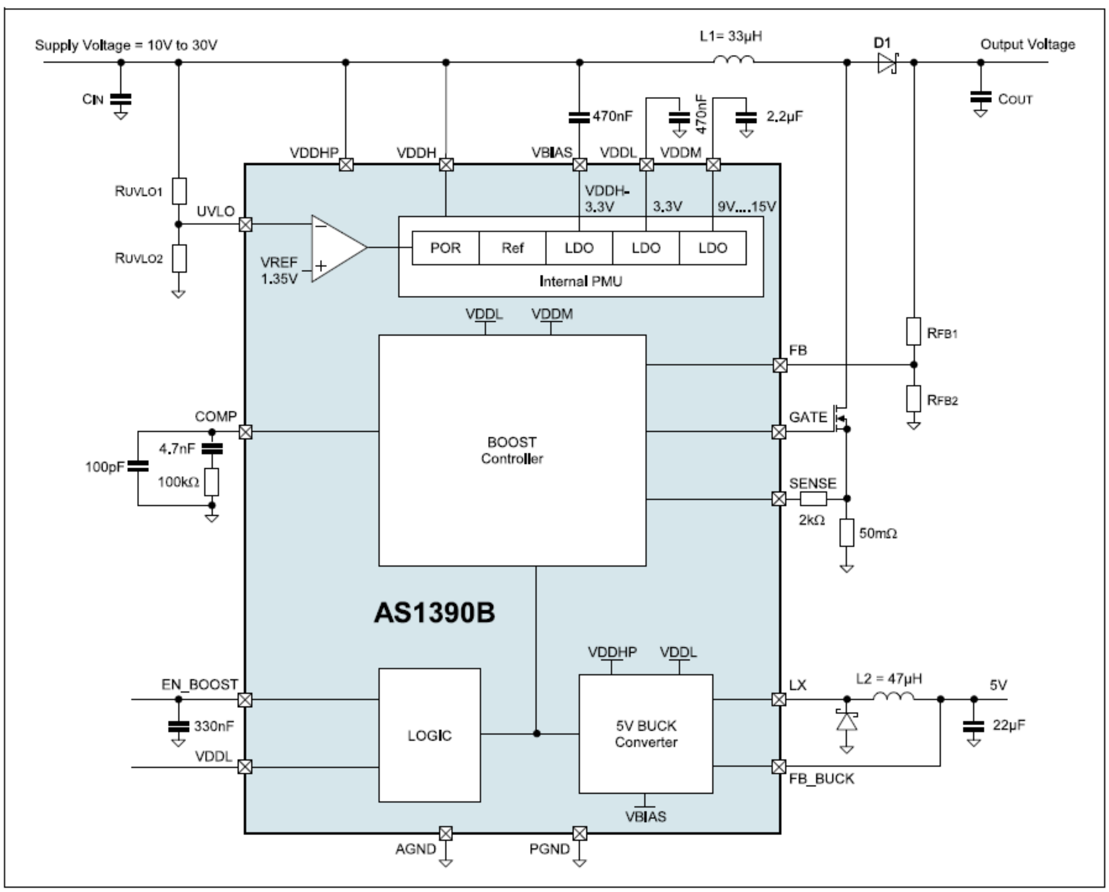


Fig.1: Typical Aplication AS1390B

The efficiency, which is the most important parameter of the voltage converter, presents the relation between output and input power, Eff=100%*Pout/Pin. In the ideal case, there is no power loss, and all energy would be transported from input to output, and efficiency would be 100%. However, in actual implementations there are different losses and output power is always smaller than the input power and efficiency is less than 100%. Consequently, input power must be higher than output power, or Iin*Vin>Iout*Vout. Vin, Vout and Iout are defined with application, and Iin>Iout*Vout/Vin.

For back lighting applications we often have Vin=12V and need Vout=60V. And for 3D mode, required Iout is up to 3A or even more. This means in case of 3A that Iin > 3A*60V/12V = 15A. To carry such a high current, external components, NMOSFET and diode are used. As a result, the design of the controller for such an application poses many challenges like handling the high peak current required for driving the gate of external MOSFET and handling the high peak currents on the PC board so that they do not influence the functionality of the chip and overall AC stability of the power supply.

In order to maximize efficiency, all losses during operation must be minimized. Many losses are dependent on the external components. The layout of the PCB should be drawn carefully so that the parasitic inductance and resistances are much less. The inductance in the power-path should especially be minimized to keep the voltage peaks low during switching. With high quality components and good PC board layout the efficiency can be optimized. One more major contributor for losses is the power dissipated in driving the gate of the NMOSFT. This loss can be minimized by reducing the voltage swing of the drive voltage. However, reducing the drive voltage will increase the on resistance of the NMOSFET and thereby increase the conduction loss in the NMOSFET.

Another important parameter for the in-TV back lighting is the load regulation, particularly during transient loading conditions like no load to full load since the full load current is quite large. Here, even though the peak current is supplied by the bulk output capacitor, the controller should respond as soon as possible to reduce the output voltage drop and the power supply should be stable across the whole load current range. Better stability is achieved by using the current mode control. For the presented cases where the load is very high, like 3A, this is challenging to reach.

## 2 Integrated buck converter

Most of the application solutions also need a buck converter for powering the micro processor (µP). The buck converter inside AS1390B is optimized for suppling a µP with 5V. It functions for the whole input voltage region 10 to 30V. Maximal output current of the integrated buck is 100 mA.Working of the buck converter will be always presented, while working of the boost controller can be turned off be EN_BOOST Pin. If both buck and boost are working, there is no influence between the two, which enables both of them to be used in a highly efficient system.

If the buck converter is not needed, it can be turned off. If only the boost controller is needed, the buck converter can be internally shut down by request, which would decrease quiescient current and increase efficiency.

AS1390B is offered in 16 Pins SOIC Package (Fig. 2).

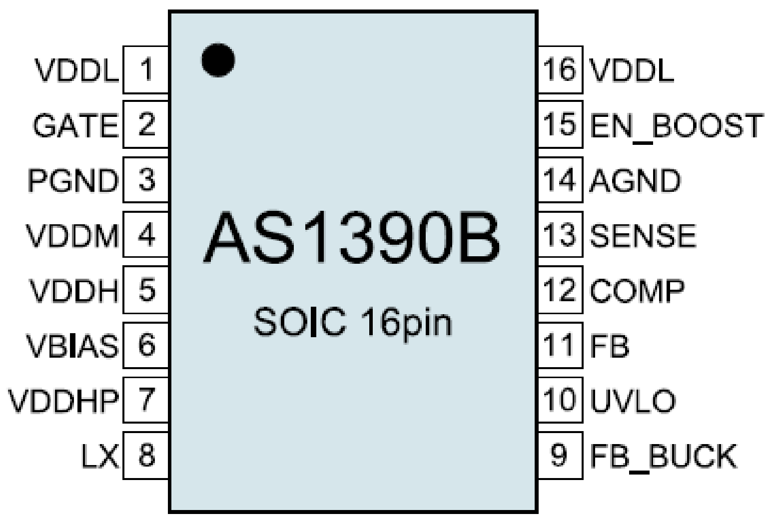


Fig. 2: Pin Assesments for AS1390B

# 3 Results

The AS1390B features high efficiency over all load range input and output voltages, as presented in Figures 3 and 4.

The high power boost controller with the supply voltage(VIN) range from 10V to 30V has an output voltage(VOUT) range from 30V to 90V. This chip also has a buck converter implemented that provides 5V. Maximum load current possible with VIN=12V and VOUT=60V is 3A.

It is critical that high load conditions are highly efficient. Otherwise, the energy lost would produce significant heat, which could prove problematic in the application system. In Fig. 3 we see that the efficiency for high load (> 500mA) is approximately 90% (85% to 95%).

To decrease the switching losses of the driver, it is supplied by a linear regulator (VDDM) whose output voltage can be internally programmed on request to 9V, 11V, 13V and 15V. The efficiency can be increased by selecting the optimum on resistance and gate drive voltage for the NMOSFET. Selecting the lower values for the VDDM also reduces the voltage peaks caused by the parasitic inductance on the PCB during the switching.

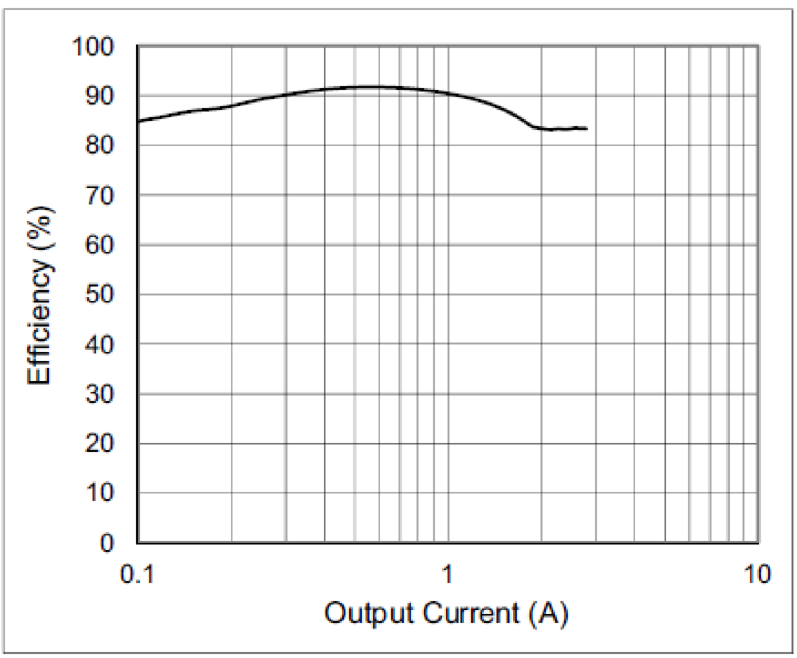


Fig. 3: Efficiency of the boost controller vs. load current, for VIN =12V and VOUT=60V

Since the load is much lower for the buck converter (< 100mA) efficiency is not critical. However, the efficiency of load conditions >40mA is good (>90%).

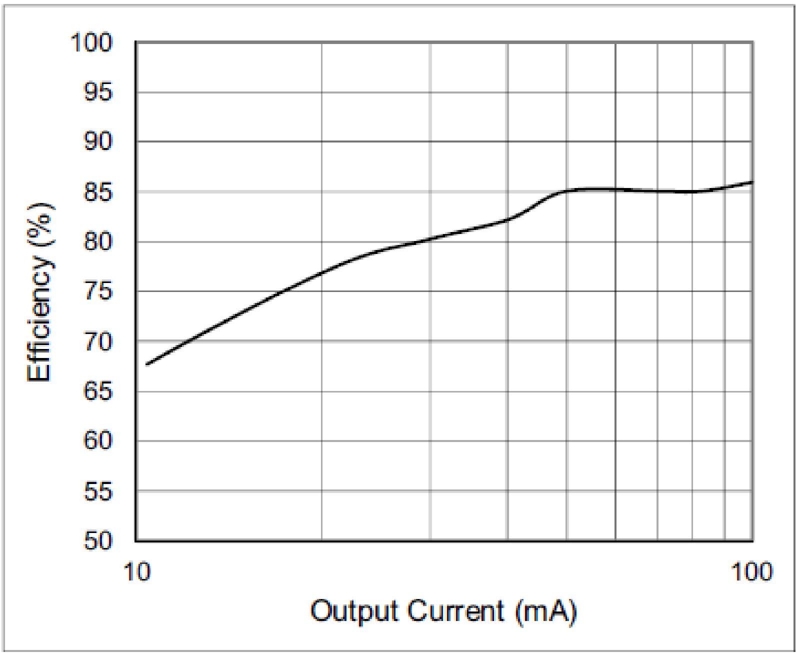


Fig. 4: Efficiency of the buck converter vs. load current, for VIN =12V and VOUT=5V

# 4 Ordering Information

Ordering Code: AS1390B-BSOT

Marking: AS1390B

Delivery Form: Tape and Reel

Package: 16-pin SOIC