Application Note

AS1331

How efficient is buck-boost DC/DC converter?

Content Guide

1 How efficient is buck-boost DC/DC converter?

AS1331 is a synchronous buck-boost DC/DC converter which can handle input voltages above, below and equal to the output voltage. This is exactly what is needed in many portable devices, because the range of the most batteries is very wide and goes from 5V for USB, 2.7V to 4.2V for lithium-ion batteries or 1.8V to 3.6V for dual-cell alkaline (NiCd or NiMH) batteries. Even solutions with three AA batteries are often used with a 2.7V to 5.4V voltage range. On the other hand, most integrated circuits in devices that are supplied with these batteries need a supply bus of 2.5V, 3V or 3.3V. To be able to produce such a supply bus from a whole range of the given batteries, an exact buck-boost converter such as the AS1331 is needed.

Due to the internal structure of the AS1331 which is working continuously through all operation modes this device is ideal for different kinds of battery applications, with its input voltage range from 1.8V to 5.5V, and output voltage from 2.5V to 3.3V (fixed or adjustable by feed back resistors). With such voltage conversions the battery is as rarely as possible discharged, which is highly desired in many applications. Not only is this given, but also the great efficiency for all input ranges, which makes the battery life even longer.

2 On what does efficiency depend?

Efficiency of the DC/DC converters is usually expressed in a percentage and is defined as the ratio between output and input power, where power is a multiplication of voltage and current:

Eff = Pout/Pin * 100%,

where Pout=Vout*Iout and Pin=Vin*Iin.

In a perfect case scenario there would be no losses, therefore Pout=Pin and efficiency would be at 100%. Unfortunately for every voltage conversion we must consider some losses, such as resistive or switching losses.

3 Efficiency of AS1331

In the following two figures, the efficiency of AS1331, dependent on input voltage and output current, is presented. It is evident that for most of the time efficiency lies between 80 and 90%, because the losses are kept to a minimum.

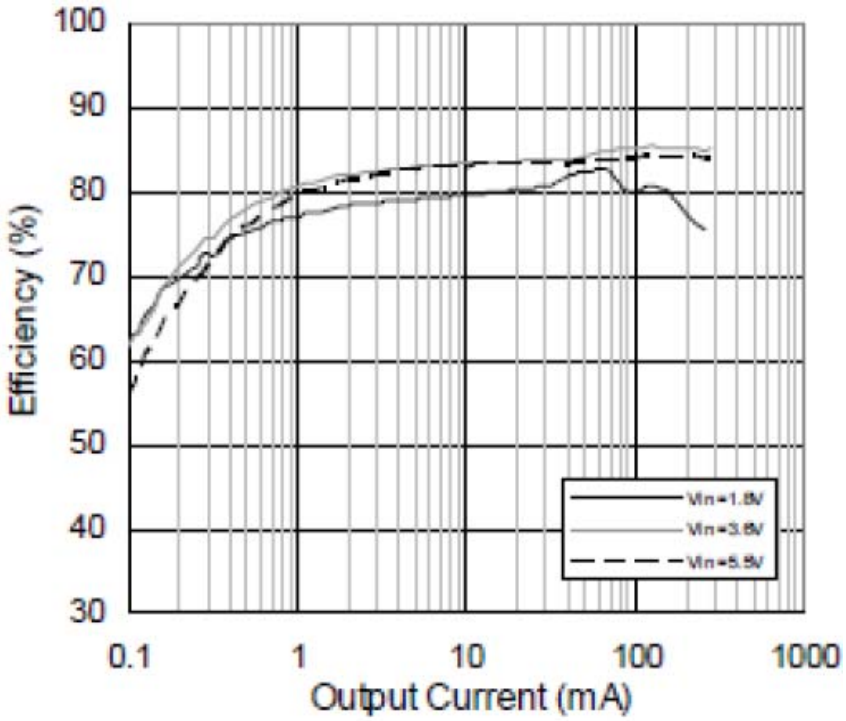

Fig 1: Eff. vs. output current for different input voltages (Vout=2.5V)

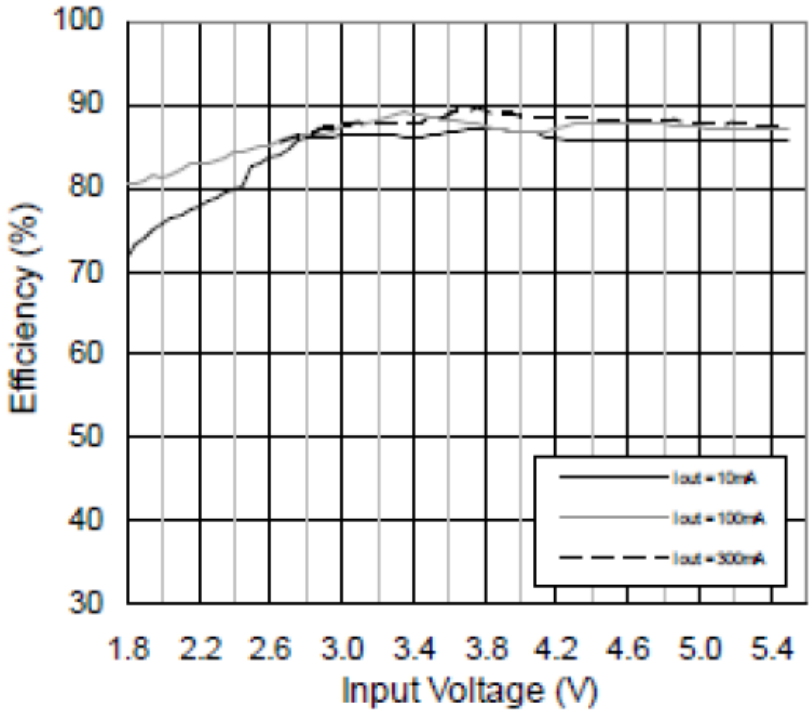

Fig 2: Eff. vs. input voltage for different output currents (Vout=3.3V)

4 Structure of AS1331

As most buck-boost converters the AS1331 has four internal switches A, B, C and D (Fig. 3). The current path always leads through two switches (resistive and switching losses must be considered for both switches). This makes efficiency slightly lower in comparison to buck or boost converters, where the current only flows through one switch. However, the AS1331 has minimal losses during all operation modes, and a great efficiency for buck-boost converters.

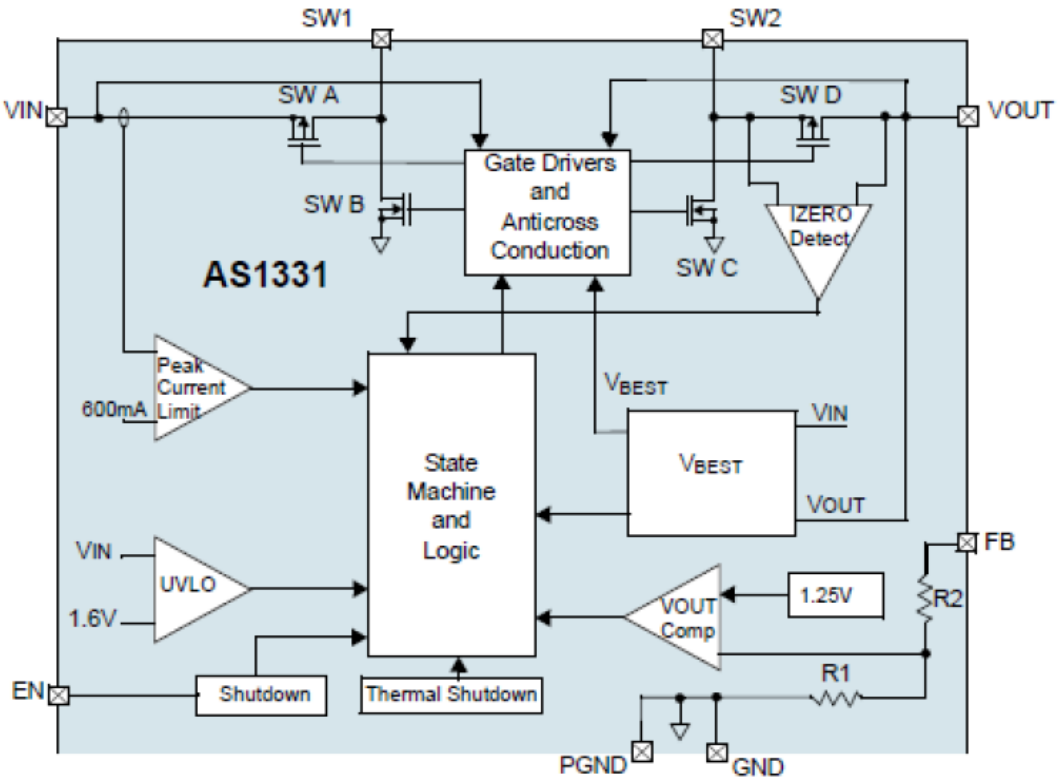

Figure 1: Block Diagram of AS1331

With this efficiency the AS1331 is an ideal solution for two and three cell Alkaline, NiCd or NiMH or single cell Li battery powered products (handheld computers, handheld instruments, portable music players and PDA's).

5 Contact Information

Buy our products or get free samples online at:
www.ams.com/ICdirect

Technical Support is available at:
www.ams.com/Technical-Support

Provide feedback about this document at:
www.ams.com/Document-Feedback

For further information and requests, e-mail us at:
ams_sales@ams.com

For sales offices, distributors and representatives, please visit:
www.ams.com/contact

Headquarters
ams AG
Tobelbaderstrasse 30
8141 Unterpremstaetten
Austria, Europe

Tel: +43 (0) 3136 500 0
Website: www.ams.com

6 Copyrights & Disclaimer

Information in this document is believed to be accurate and reliable. However, ams AG does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

Applications that are described herein are for illustrative purposes only. ams AG makes no representation or warranty that such applications will be appropriate for the specified use without further testing or modification. ams AG takes no responsibility for the design, operation and testing of the applications and end-products as well as assistance with the applications or end-product designs when using ams AG products. ams AG is not liable for the suitability and fit of ams AG products in applications and end-products planned.

ams AG shall not be liable to recipient or any third party for any damages, including but not limited to personal injury, property damage, loss of profits, loss of use, interruption of business or indirect, special, incidental or consequential damages, of any kind, in connection with or arising out of the furnishing, performance or use of the technical data or applications described herein. No obligation or liability to recipient or any third party shall arise or flow out of ams AG rendering of technical or other services.

ams AG reserves the right to change information in this document at any time and without notice.

7 Revision Information

Changes from 0.1 to current revision 0-10 (2014-Jul-18)	Page
Content updated to latest ams design	

Note: Page numbers for the previous version may differ from page numbers in the current revision.