

An easy way to provide 12V Standby from 5V source by using AIC1638

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Introduction

Have you ever noticed the personal computers are more sensible than ever while you enjoy switching the ON/OFF and power saving functions? Yes! The answer is the ACPI (Advanced Configurations Power Interface) which was co-specified by Intel, Microsoft and Toshiba in 1998.

As the ACPI has widely spreaded over the personal computer system, in other words, the power distribution is getting more and more complicated. For example, the ACPI defines 4 to 5 states of the working status for devices, processors and global systems. Even though the system manufactures would never fully support all of the above states, system designers still have to put some additional N type MOSFETs as a switch to achieve the ACPI function and provide the 12V to drive N type MOSFETs. Meanwhile, the degree of the complexity is increasing.

ATX power providing

Let's take a look at ATX power supply, and see the differences between the ON/OFF state, which is referred to the table 1 below, and ACPI sleeping

status.

Sleeping State	5V	3.3V	+12V	-12V	5V_{SBY}	ON/OFF
S0	V	V	V	V	V	ON
S1	V	V	V	V	V	ON
S2	V	V	V	V	V	ON
S3					V	OFF
S4					V	OFF
S5					V	OFF

Table 1. ATX voltage table versus ACPI sleeping state

In normal working state (S0, S1, and S2), the ATX power is at an ON state, that is, all the voltage output lines are activated including 5V_{SBY}. But in deeper sleeping state (S3, S4 and S5), the ATX power has already entered the suspended mode (shutdown for S5), all of the power output lines would no longer exist except 5V_{SBY}. That is to say, in order to drive the power switch during deeper sleeping state, the designers need to generate a 12V standby voltage from 5V_{SBY}.

Recommended solution

Here we provide an effective, easy way to generate a $12V_{\text{SBY}}$ from $5V_{\text{SBY}}$ during the sleeping time by utilizing AIC1638, which is a PFM (Pulse Frequency Modulation) DC/DC step-up converter originally used for supplying portable devices such as PDA, pager,

MP3 player...etc.

The circuit below is the complete diagram for the $12V_{\text{SBY}}$ application.

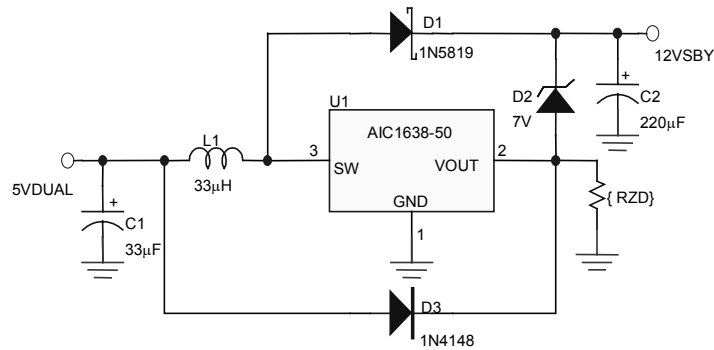


Figure 1. $12V_{\text{SBY}}$ application (1)

The voltage output is given by:

$$V_{\text{OUT}} = 5 + VD2 \quad (1)$$

Let's take an example here. The voltage output equals to 12V, and R_{DZ} should be attached if the output current is small or the output voltage is unstable. A resistor from 10K Ω to 100K Ω is recommended.

The following graphics are the output transient voltage when the variation occurs in voltage source line, which is to simulate the voltage change during the switch of sleeping state.

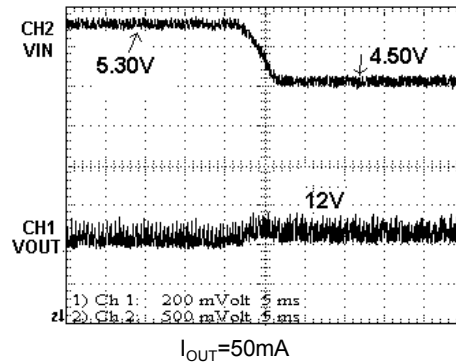


Figure 3. Load regulation (1)

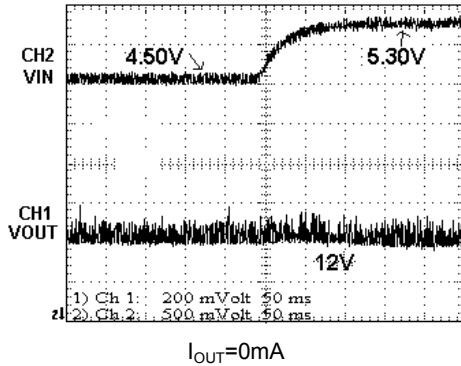


Figure 4. Load regulation (2)

But in order to reduce the load at $5V_{DUAL}$, we are able to change the power source to $5V_{SBY}$, instead of $5V_{DUAL}$. And adding one resistor to do a shutdown job when 12V from ATX power is present. This alternative solution provides the designer with the flexibility for designing the system. The circuit is shown below.

Set 5V SOURCES under the $\pm 5\%$ regulation as specified in ATX SMPS power design guide. That will assure stability of $12V_{SBY}$ output line.

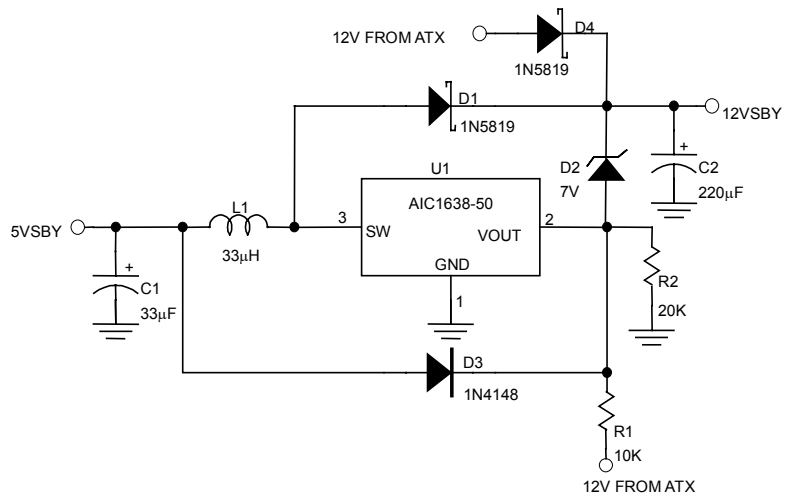


Figure 4. $12V_{SBY}$ application (2)

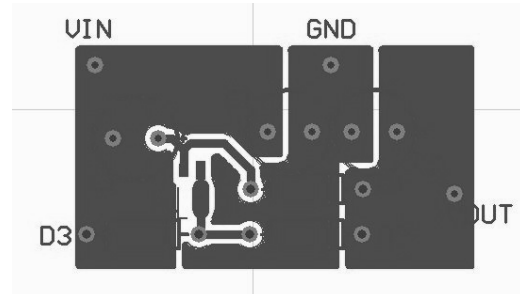
Components selection

- ✓ **D1-** A Schottky type diode with high switching speed as well as the rated current.
- ✓ **D2-** A Zener diode
- ✓ **D3-** A normal diode such as 1N4148.
- ✓ **L1-** Care must be taken to choose an inductor with smaller dc resistance and larger allowable current. Note that the choke coils are not allowed to store energy.
- ✓ **C2-** Use a capacitor with the good characteristics of high frequency and lower ESR (e.g. tantalum capacitor or higher quality electrolytic capacitors referring to reference II) and keep it larger than 100 μ F.

Layout tips and example PCB design

- ✓ Set the peripheral components as close as possible to IC body and minimize the conduction wire between the IC and the components.
- ✓ Make sure the grounding sufficiently present. The improper grounding may result in unstable operation of the IC.

The following design would provide the 12V_{SBY} application (1), of course, this is a part of a large PCB not bounded by the edges.



12V_{SBY} application (1) board layout

Summary

Here we provide an easy, effective way to generate 12V_{SBY} for driving switch MOSFETs during PC system's power saving duration.

Care must be taken to consider the components selection and tips on the layout mentioned above. That makes the performance of product even better.

Also, in recent years, the power demand and distribution for PC system are more and more sophisticated. We are well prepared with rich experience in achieving standby power. Contact us for more information.



References

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- II. "General information for electrolytic capacitors"
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