

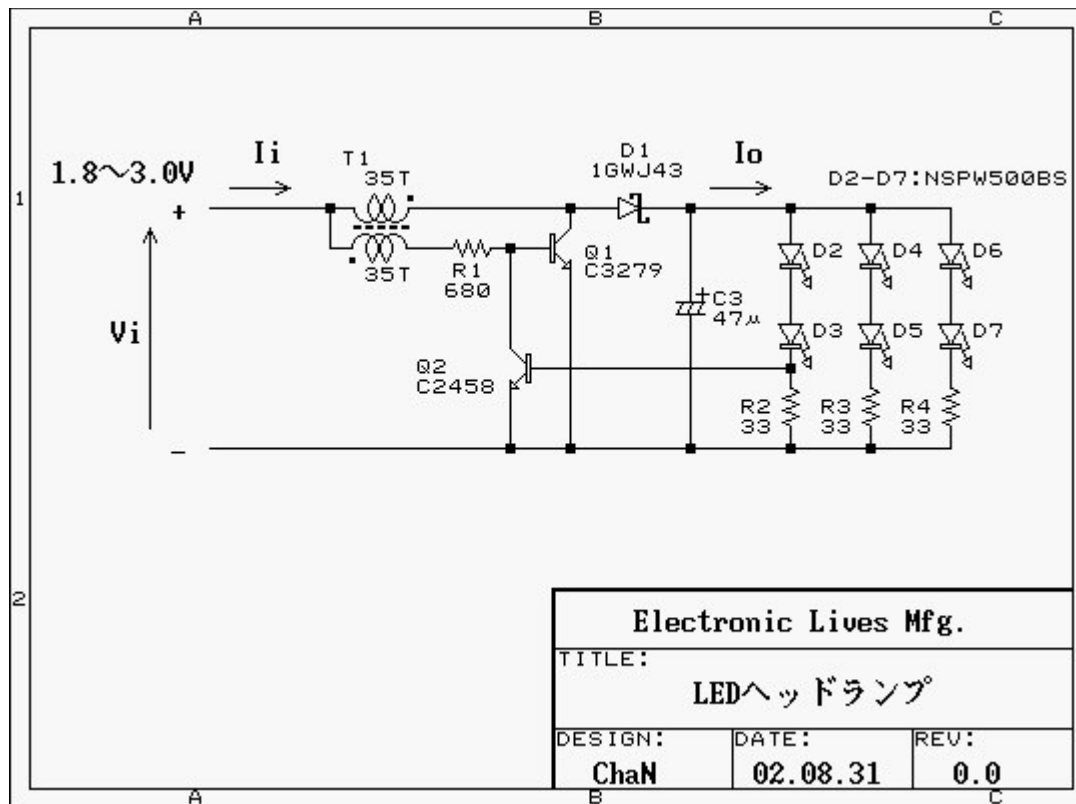
White LED Head Lamp

September 3, 2002



This is a practical white LED head mount lamp (flashlight). Recently many white LED flashlights appear on the market. However, most flashlights require three cells because they are regulating output current with only series resistor. The odd number of cells except one is not good, and a margin between V_{LED} and V_{BAT} is too small, intensity of light is affected by variation of input voltage within the battery life. Thus I built a white LED head lamp which operates with two cells and controls output current.

Circuit Diagram



According to VF-IF characteristics of white LED, to let flow sufficient current to the white LED, 3.4 volts of forward voltage is required, so that at least three cells are required to drive white LED directly. Two cells cannot drive the white LED, any voltage booster is required.

Right image shows the circuit diagram for this white LED head lamp. It boosts input voltage with self-oscillating DC-DC converter and supply high voltage to the white LEDs. Output current is fed-back and regulated to constant current. The feed-back of output current is from only one LED block, however using same devices for each LED can flow same current to other blocks. Adding blocks can also expand number of LEDs easy.

Output voltage is approx. 7 volts (depends on dropout voltage at LEDs). Setting higher voltage is to improve efficiency, because voltage ratio of dropout at current sensing resistor (approx. 0.7 volts) in output voltage becomes power loss. In this circuit, total efficiency is approx. 65 percent.

Recently many LED drivers for mobile applications are available, using them is one of the solutions, however there is few device works at down to below 2.0 volts.

Building the LED Head Lamp

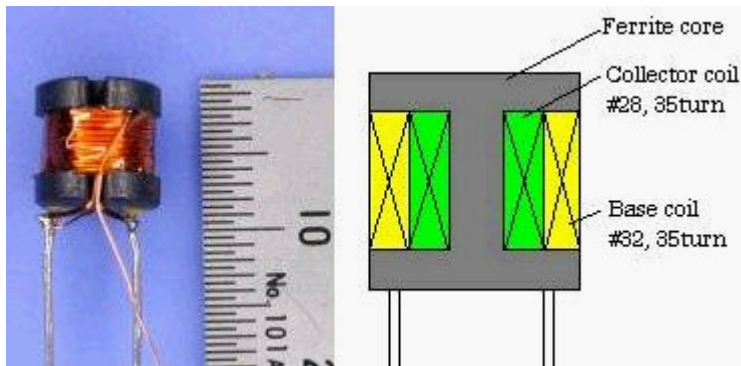


To make good appearance and to build quickly, I modified an ordinary head lamp. Why is it a head lamp ? because I had used it to wire LAN cable into ceiling :-)

This head lamp uses four AA cells in series-parallel connection, thus I removed two series cells and put circuit board at there. Right image shows inside of the battery box.



The LED array is built to proto-board, cut reflector and mounted LED board there. The reflector is not used however each LED have small radiation angle itself, its brightness is same as original miniture valve and power consumption is less than it.



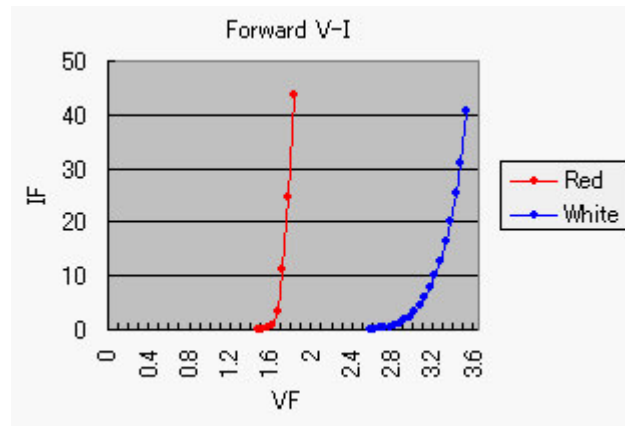
As for the transformer at DC-DC converter, it is not sold. You have to build it yourself. Right image shows how to build the transformer. When you could not obtain the ferrite core, rewinding any inductor is

recommended. Condition of the transformer affects total efficiency, some trial might be needed.

Transister Q1 is also impotant for efficiency, this can be find in strobe DC-DC converter. Replacing it with ordinaly small transistor will decrease efficiency, High HFE, high IC and low saturation voltage device should be chosen.

Technical Data

VF-IF characteristics of LED



Input - Output characteristics of the LED Head Lamp

