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Boost converter tutorial pdf

We went through all the pesky situations where we needed a voltage a little higher than our power supply could provide. We need 12 volts, but only a 9 volt battery. Or maybe we have a 3.3V supply when our chips need 5V. That, in most cases, the current draw results are pretty good. Finally, we ask ourselves the question, is it possible to convert one DC voltage to another? Luckily for us, the answer is yes. It is possible to convert one DC voltage to another, however the methods are slightly on the smart side. And no, it doesn't involve converting DC to AC and vice versa. Because it involves too many steps. Anything with too many steps is ineffective; this is also a good life lesson. Enter the world of DC-DC conversion mode! They are called switch modes because there are often quick on and off switches. What is an enhanced converter? The enhanced converter is one of the simplest types of conversion modes. As the name suggests, it takes an input voltage and increases or increases it. All it consists of is a indus coil, a switch of the two (these days it is a MOSFET, as you can get really nice ones these days), a diode and capacitors. Also necessary is a source of a periodically square wave. This can be something as simple as a 555 timer or even a dedicated IC SMPS like the famous MC34063A IC. As you can see, there are only a few parts needed to create the enhanced converter. It is less cumbersome than AC or indi coil. They are very simple because they were originally developed in the 1960s to power in-flight electronics systems. It is a requirement that these converter converter be as compact and efficient as possible. The biggest advantage driving conversion offers is their high efficiency – some of them can even go up to 99%! In other words, 99% of input energy is converted into useful output energy, only 1% is wasted. How does the in-rise converter work? It's time to take a really deep breath, we're about to plunge into the depths of electronics. I will say from the beginning that it is a very rewarding field. To understand the work of an enhanced converter, it is imperative that you know how indus coil, MOSFETs, iodine and capacitors work. With that knowledge, we can go through the working process of the converter accelerating step by step. STEP - 1 Here, nothing happens. The input capacitors are calculated into the input voltage minus one drop of diode. STEP - 2 Now, it's time to turn on the switch. Our signal source goes high, turn on THE MOSFET. All current is redirected via MOSFET via indus coil. Note that the power supply is still charged because it cannot discharge through diode now back to bias. The power supply is not immediately short-circuited, all since the indestion makes the current seam up relatively slowly. In addition, a field accumulates around the indi candies. Note the polarity of the voltage is applied on the ind]. STEP - 3 MOSFET is turned off and the current to the indus roll is Sudden. The essence of an indi candies is to maintain the current smooth flow; it doesn't like sudden changes in the present. Therefore, it does not like the sudden shutdown of the current. It responds to this by creating a large voltage with the opposite polarity of the voltage originally supplied to it using the energy stored in the field to maintain that current flow. If we forget the rest of the circuit elements and notice only the polarity symbols, we notice that the indestor now acts like a voltage source in the chain with the supply voltage. This means that the anode of the iodine is currently at a higher voltage than the negative (remember, the lid has been charged to provide voltage in the first place) and is forwarded biased. Capacitors are now taking into into re into higher voltages than before, which means we have successfully stepped up a low DC voltage to a higher voltage! I recommend going through the steps again very slowly and understanding them visually. These steps occur thousands of times (depending on the frequency of the oscillating set) to maintain the input voltage under the load. Boost Converter Operation – The Fine Points By now many of you have had questions about this oversimplified explanation. There was a lot left out, but it was worth it to make the work of the increased converter absolutely clear. So now that we have that understanding, we can move on to better details. 1. Oscillating set. You can't turn on the MOSFET input switch forever, no indus roll is ideal - they have saturated current. If we were to keep the MOSFET switch on for any longer than a few hundred microseconds maximum, the supply would be short circuitry and inslable inslable indant fire out and MOSFET go bankrupt and other unpleasant things happen. We use our knowledge of indian rolls to calculate the time it takes to achieve a reasonable current (e.g. an Amp) and then configure the time of the oscillating set accordingly. This resulted in the current wavelength coil looking like a saw edge, hereby the name sawtooth. 2. Mosfet itself. If you look closely, in step 3, MOSFET finds that the voltage is the supply voltage plus the indus coil voltage, which means that MOSFET must be evaluated for high voltage, again implying quite high voltage. The boost converter design is always a compromise between the MOSFET analytical voltage and the voltage. The MOSFET conversion of the increase converter is always a weakness, as I learned from the cold, difficult experience. The maximum input voltage of the increased converter is not limited by the design but by the decomposition voltage of the MOSFET. 3. Indi cans. Obviously, just any old insy reels won't work. The indus roll used in the converter increases so it can withstand high current and has a high permeability core, so the indus for a certain size is high. Conversion enhancement activity There is another way of thinking about the operation of the enhanced converter. We know that energy is saved in a indi can by: 1/2 x L x I2 Where L is the indesti sense of coil and I am the maximum peak current. So we store some energy in the indestion from the input and transfer the same energy to the output although at higher voltage (the capacity is preserved, obviously). This happens thousands of times a second (depending on the frequency of fluctuations) and therefore the energy increases during each cycle so that you get a nice energy output measured and useful, for example 10 Joules per second, 10 watts. As the equation tell us, the energy stored in the indimeter is proportional to the indimeter and also to the square of the peak current. To increase the power of our first thought input may be to increase the size of the indus roll. Of course, this will help, but not as much as we think! If we make the voltage larger, the maximum peak current that can be achieved in a given time decreases, or the duration taken to achieve that current increase (remember the basic equation V / L = dI / dt), so the overall output energy does not increase a significant amount! However, since the energy is proportional to the normality of the maximum current, increasing the current will lead to an increase in greater output energy! Therefore, we understand that the choice of indi coil is a good balance between touch and peak current. With this knowledge, we can understand the official method of designing enhanced converter. Boost Converter Design STEP - 1 To get started, we need to understand clearly what our load requires. It is highly recommended (from experience) that if you try to build an increased converter at first, it is very important to know the output voltage and independent current, the product of which is our output capacity. STEP - 2 Once we have the power of the input, we can divide it by the input voltage (should also be decided) to get the necessary average input current. We increase the input current by 40% to account for ripples. This new value is the top input line. In addition, the input current is at least 0.8 times the average input current, thus maning the average input current by 0.8. Now that we have peak and minimum current, we can calculate the total number of changes in current by subtract peak and minimum current. STEP - 3 Now we calculate the task cycle of the converter, i.e. the rate of time on and off of the oscillating set. The task cycle is given by this textbook formula: DC = (Vout - Vin)/(Vout) This will give us a reasonable tithing value, above 0 but below 0.999. STEP - 4 Now is the time to decide the frequency of the oscillating. This has to be included as a separate step because the signal source can be anything from a 555 timer (where the frequency and mission cycle is completely under your control) or a fixed frequency PWM controller. Once the frequency is determined, we can figure out the total interval by taking an inverse. Hours of time intervals are added by the task cycle value to get time. STEP – 5 Because we have determined the time, input voltage and and in the present, we can plug those values into the indus roll formula that has been rearramed a little: L = (V * dt) / dI In which V is the input voltage, dt is about time and dI is the change in the present. Don't worry if the indestion value isn't usually available, use the nearest standard value available. With a little tweaking, the system will work fine. Option Part 1. SwitchIng Sellers I have not mentioned the type since it is entirely based on the application. Of course, MOSFETs are used in all applications these days, as they are very effective, but there may be situations where a normal bipolar ordibly can be enough because of the simplicity. I'll repeat what I've said before - choose a grid with a trouble voltage higher than the maximum input voltage of the converter. It can also be a good option to view the MOSFET datasheet and determine the input capacity/port capacity. The lower this value, the easier it is to drive. Anything below 3500pF is acceptable and moderately easy to drive. My personal choice would be IRF3205, which has a voltage above 8 milliOhms and a trouble voltage of 55V, with a managed input capacitance of 3247pF, besides being an easily available part. Also not mentioned in the diagram is a dedicated MOSFET port driver. Again, I*highly* recommend using one. It will save you a lot of losses and time. My recommendation - the TC4427. It has two drivers in a DIP8 package, which can be parallel easily for many existing drives. 2. Diode outing Although this may seem trivial, at the currents we are dealing with (or sometimes voltage) the choice of diode plays a big role in efficiency. Unfortunately popular 1N4007 will not work, as it is too slow. Nor is beefy 1N5408. I've both tried designs that I've worked on, both done miserably since they're very slow. It's not worth even trying. I use UF4007, with the same voltage ion as 1N4007 (reverse 1000V). If you are building a low voltage converter (say 3.3V to 5V) then the diode of choice would be a Schottky, like 1N5822. Conclusion Read this article, I feel, the equivalent of sitting through an electrical system lecture, hoping to leave you with more knowledge. As always, the best way to learn is to really build something. Now you have the necessary knowledge to build and use the enhanced converter! Converter!

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