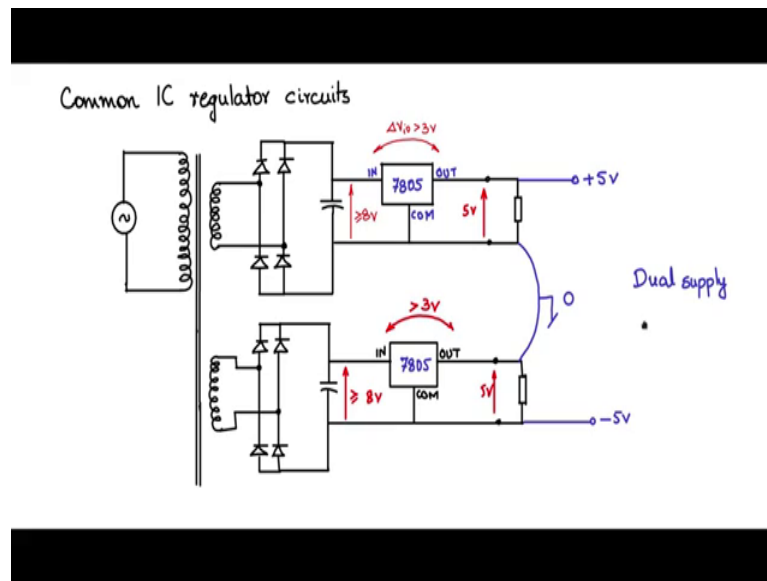


Fundamentals of Power Electronics
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Lecture – 43
Common IC regulator circuits

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Let us now discuss some common IC regulator circuits IC regulators that are available in the market popularly available in the market. One of them of course, we just now saw in the data sheet which is 7-8 excess series, let us see how we will incorporate them in the circuit. Consider that we have 230 volt means this is an AC voltage and we will use a transformer and the output of the transformer is a step down transformer. So, that we get output 5 volts.

Then the step down transformer is connected to a rectifier circuit like this and output of the rectifier is connected to a capacitor filter and output the capacitor filter is connected to a 3 terminal regulator like this and the output this is the load r naught.

So, let us have if I use seven 7805 which means a 5 volt regulator this has the in terminal out terminal and the common terminal and here you will have 5 volts coming at the output of 7805. You should have a minimum differential law of delta v_{io} of at least, 3 volt should be greater than 3 volts which means that here the voltage of the greater than 8 volts. So, when you are designing the turns ratio, you should see that at least under v_i

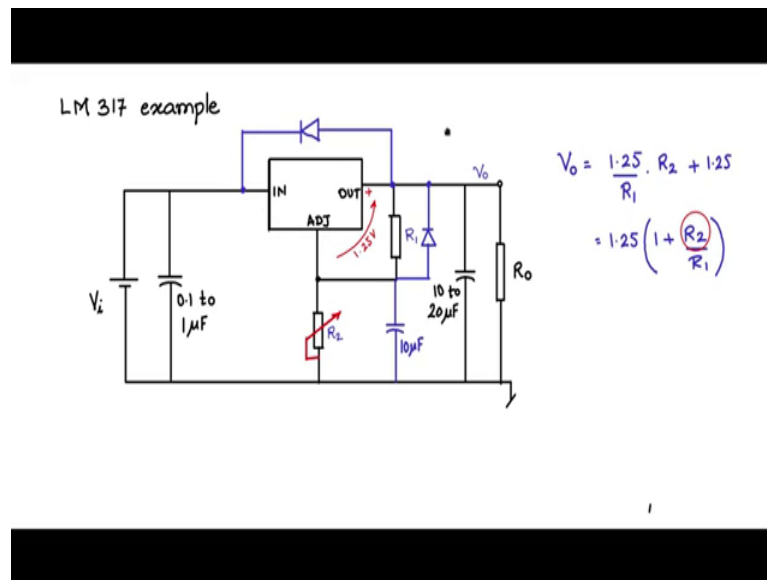
min condition you should get 8 volts at least. So, that then only this 3 terminal regulator will provide regulated output.

Let us say now that you have you need a multi output power supply; let us say you need a 5 volts and you have another you need another 15 volts which is isolated you do not need to put another transformer, you can wind one more secondary on the existing transformer. So, on the same transformer you have one more secondary have one more rectifier diode bridge on the secondary side, only this turns ratio and this turns ratio will be different and put a capacitance and output of the capacitance put a 3 terminal regulator let us say 7815 and connected to the load we have the IN OUT COMMON.

So, if you need 5 15 volts here you need a minimum differential of at least 3 volts and at least 18 volts is needed at this point. So, accordingly you can adjust the turns ratio between the primary and the secondary. Now this is a way you will get a multiple output power supply. Now let us say that we would like to have a dual power supply with a common ground plus 5 and minus 5 volts how would you go about doing that? The input side remains the same you will have a transformer with multiple secondary rectifier and the capacitors make some modifications here on the output side, let me remove this and then put a 7805 I will set this to 8 volts like this, this will be 5 volts which means I will replace this by 7805.

So, both these are giving 5 volt isolated outputs no common ground. So, what you do you short the minus of this to the plus of this and indicate that has the ground or the 0 potential. Now all your further circuits should consider this as the 0 potential or the circuit ground, then with respect to this 0 potential with respect to this node this point will be at plus 5 volts and with respect to this 0 ground, this point will be minus 5 volts. So, this way this power supply together shown like this acts like a dual positive negative power supply.

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Let us discuss another example this time an example of LM 317 where LM 317 is a high power variable output voltage regulator you can set to any output voltage just like LM 723 also both LM 723 and 317 or variable output voltage regulators I will take LM 137 as example.

Another (Refer Time: 05:08) of LM 317 is LM 350 which is a much higher power regulator. So, let us construct the regulator structure I have an important unregulated voltage and that is connected to the 3 pin regulator the IN pin the ADJUST pin OUT pin and output connected to the load or not like this.

Now, the ADJUST pin is brought down connect a resistor here like this and from here you connect another resistor in this fashion name this as R 1 name this as R 2 how do we choose R 1 and R 2? Observe that look into the data sheet there is a fixed voltage difference between the out and the ADJUST pin out paying more positive than the adjust and that is 1.25 volts for the 3 1 7 regulator and also 350.

Now if this is V_{naught} then we can say V_{naught} equal to if you look at this network 1.25 by R_1 is the current that flows through R_1 this is a high input impedance pin therefore, all the current flows in through R_2 . So, you will have 1.25 by R_1 current flowing through R_2 into R_2 will be the voltage drop across R_2 plus 1.25 will be V_{naught} . So, therefore, V_{naught} is equal to 1.25 into 1 plus R_2 by R_1 . So, this is the voltage relationship and then accordingly you can choose the value of R_1 and R_2 .

If you make R_2 adjustable like this, you will see that R_2 in this equation is a variable and you can get an output voltage setting as different values for different values of R_2 . Apart from this there are few other protection components that are needed to complete the circuit. First of all of course, we need to put a 0.1 to 1 microfarad capacitor here this is just in case to be to make sure that there is decoupling at the input side and there is sinking capability also.

Likewise in the output side also you put a capacitor 10 to 20 microfarads then important you have to put a protection diode like this. The protection diode does not come into operation normally, but this comes into operation during switch off condition let us for you switch on, when you switch on there is some voltage here and then there is a drop across this and then there is a voltage at the V_{naught} some set value.

Now when you switch off this let us say the input goes to 0 quickly and the output is not at discharged; which means the out terminal will have some finite positive voltage in terminal be 0 and then the input output differential voltage will be negative which will damage the IC. Therefore, if you put a diode like this whenever the output terminal is more positive than the input terminal the diode will conduct and sink it to the capacitance thereby protect the IC.

So, there is an important protection diode that you need to put. So, that the input output differential voltage does not go negative. Another important component we can have is add a capacitance here 10 microfarad. This will act like a filter and stabilize the potential here once the stabilize the potential here output regulation is much better.

However, you will see that when you switch off there is no discharge path for this 10 microfarad capacitance it has to be through R_2 or it has to be through R_1 and the output capacitor or the input capacitor. This can be a long time constant in order to speed up we can put a diode like this, which in this way this capacitor can directly go and sink into the output or sink into the input. So, these are some of these protection features you add and this will make it workable circuit.