Fundamentals of Power Electronics
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Lecture - 80
Intro for drive circuits

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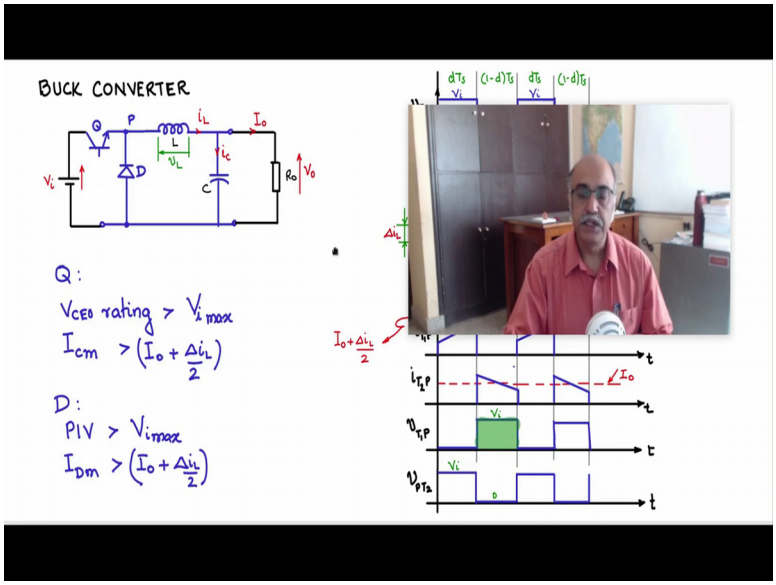

In this session we shall discuss on the very important topic of drive circuits. You see that we have used semiconductor switches at many places in DC DC converter. In the beginning while we were discussing and studying the buck converter we have used a BJT at this position. Now instead of this BJT it could as well be a mosfet or it could as well be an IGBT.

Observe here that there is this control signal we have just always left it floating in all the circuits saying that if we give the proper signal; signal as per the drive requirements, then this which will be on and during the dTs period. Q will be on during 1 minus dTs period, Q will be off these are just only information signals. How do you convert the information signals of this dTs period high pulse and 1 minus dTs period low pulse to ultimately drive this switch on and off now that is what we need to study.

Because all these semiconductor switches are have their own characteristics. For example, the BJT is a current driven switch you need to give the proper base current to switch this on and you have to remove a certain amount of base charges to turn this off.

How do we provide for all those things in the base or the drive electronic circuits. In the case the MOSFETs you need to provide a certain amount of charge gate charge for it to turn on and remove a certain amount of gate charge for it to turn off. So, like that each of the semiconductor switch will have their own characteristic and we will have to design the drive circuit appropriately. So, that you can turn on the switch and turn off the switch at will.

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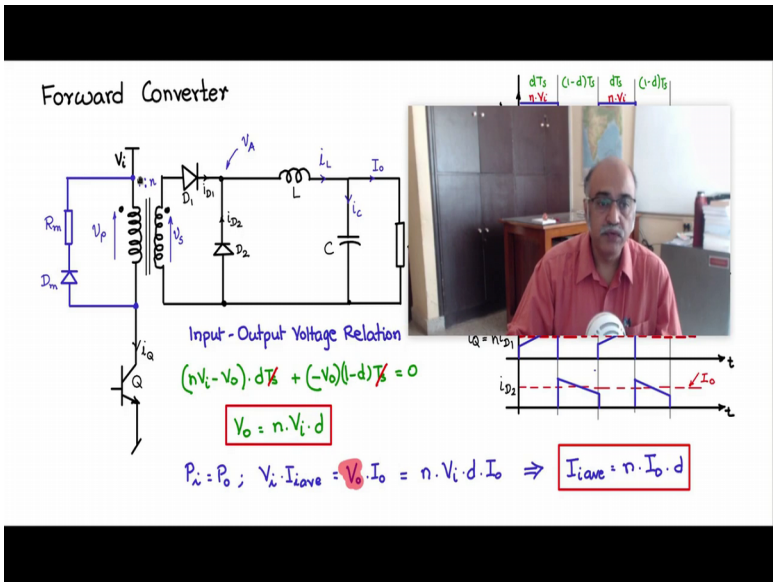

We have seen also in the forward converter there is this BJT, now we have shifted the BJT from the rail based to the ground based saying that the drive circuit is simpler if it is driving a ground based switch, we will see all those issues why it becomes simpler to drive a switch which is ground based.

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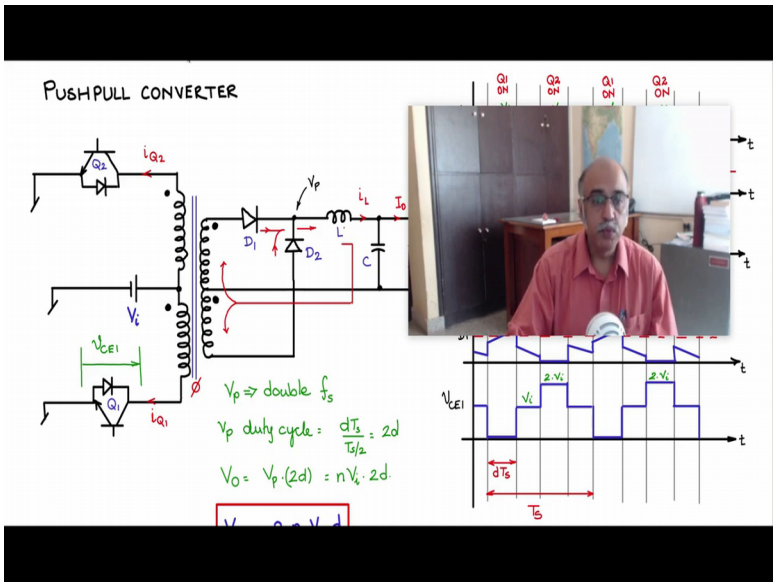

The push pull converter has two switches which are mutually exclusive and they need to be switched in a particular pattern, it is easy for us to get the on off signal information. But how do you convert this on off signal into a proper base current or a charge drive for BJT or a MOSFET is the matter that will be concerned, now that we will be discussing in this particular session.

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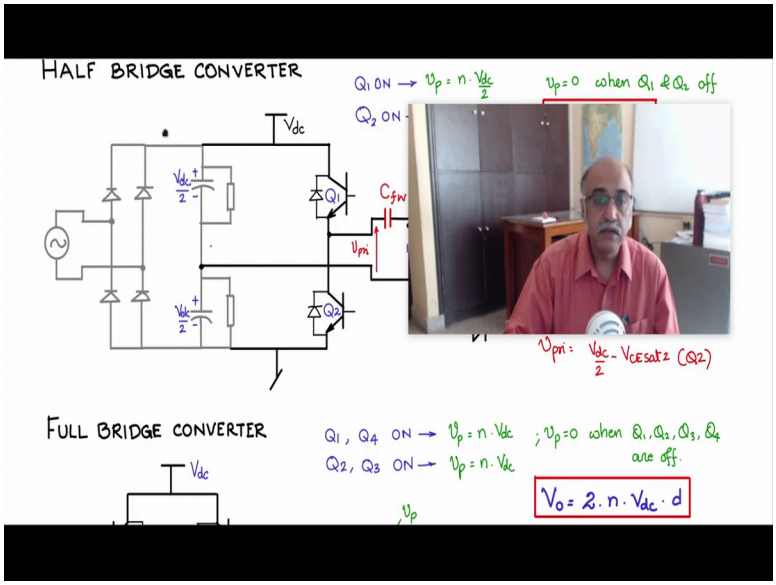

In the case of the half bridge converter and the full bridge converter you have top semiconductor switch and a bottom semiconductor switch. The bottom semiconductor

switch is ground base drive, the top semiconductor switch is a floating drive. So, how do you make such kind of drives? Complimentary, but is able to address the half bridge and the full bridge converter switch arms.

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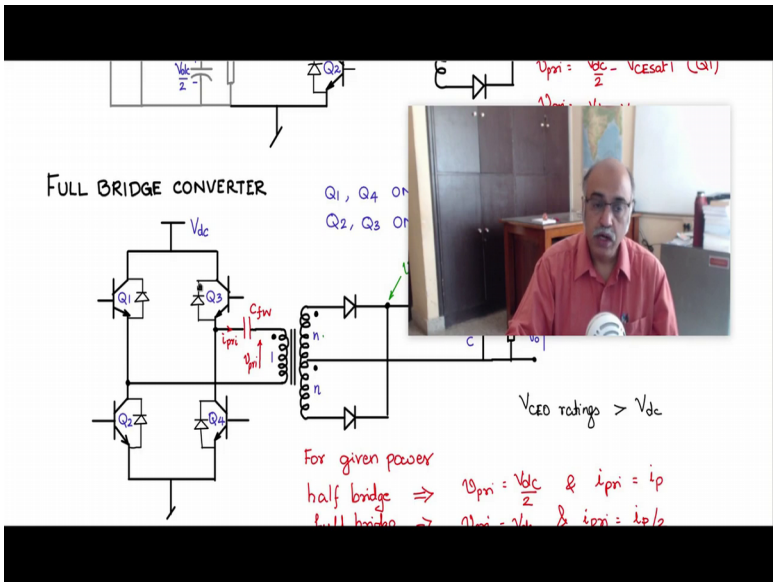

And the case of full bridge like the half bridge you have two switches semiconductor switches which are floating drive and two semiconductor switches which are ground based drive. So, these are the aspects that will come into the picture.

Apart from that we need to provide protection or stress relief for the switches because there will be d i by d t l d i by d t voltage surges across the switches when they are turning off and when they are turning on there will be currents surges through the switches.

And we need to definitely protect them or limit the stress on these switches by using some circuits which we will call as snubber circuits. And these snubber circuits are important component of the switch base drives.

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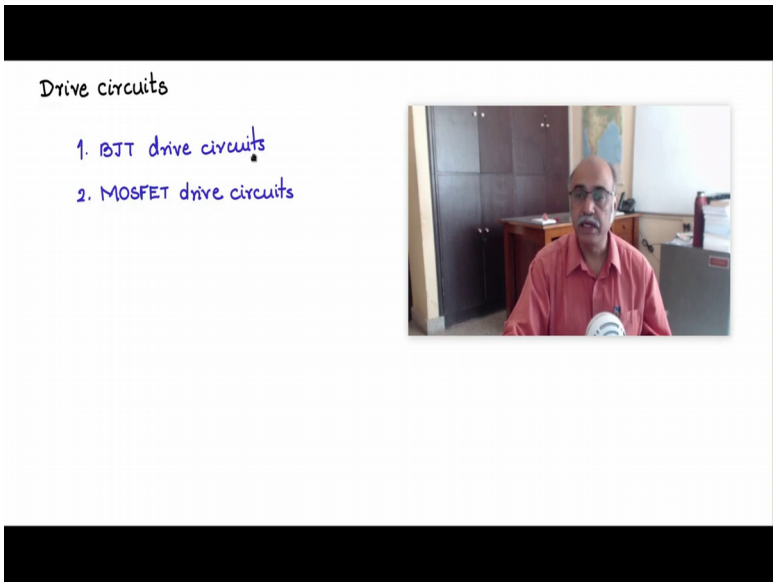

In this session we shall discuss the drive circuits of two very important most popular devices one is the BJT, the Bipolar Junction Transistor. The BJT drive circuit they are very important because they are ubiquitous there they come in the drive circuits of almost all the power semiconductor switches whether it be the BJT power switch semiconductor itself or whether it be a MOSFET power switch or whether it be IGBT power switch or the now more recent silicon carbide and GaN switches.

The BJT comes as one of the circuit elements in the drive circuits. So this is very very popular and very useful we need to study that if you have to understand the drive circuit. The second one that we will be studying is the MOSFETs the MOSFET switch are very very popular in all DC DC converter circuits and we need to study that.

Of course, in the high power and high voltage circuit's IGBTs are the most popular, but have drives similar to MOSFETs and if you know how to do the drive circuits for MOSFETs you could as well do it for IGBTs to. So, this is basically the focus of our discussion in this coming session and that is what we will be talking about circuits drive circuits for BJTs and MOSFETs.