Design of Power Electronic Converters
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Module: Hardware Design
Lecture 64
Familiarity with Components - 2

Welcome back to the course on Design of Power Electronic Converters, we were discussing hardware design, and we saw some of the components that are used in electronic converters. Now, let us go further and get familiar with more components that are used for power converters. So, one of the main components that are required in any converter is your connector, now connectors may be of various types depending on what is the current rating and the voltage rating and the frequency for which the connector is required.

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Now, here what we see is what is called banana connectors or banana pins. So, these are usually used where the current is high and the voltage is also reasonably high enough at those places, for example, here this picture is shown for a power supply where these banana jacks are provided into which these banana pins can go and you can take out the voltage and the current that this power supply provides.

So, these are those banana connectors and these are the male connectors and the female connectors in various colors usually. They come for power purposes only. When for high power purposes banana jacks cannot be used, we use screws and what are called lugs.

So, here you can see that in this picture, this is the screw which is actually a power terminal coming out and then this lug is put on it and then this lug may be screwed in. Sometimes solder may also be put on it. So, that is how your high voltage and high current connections are formed. Screws and lugs come in various sizes.

And these are the places where actually through this your wire the copper wire goes in and then it may be crimped or solder, usually, it is crimped that means it is tightly held inside this lug and so to do this wire goes inside. This is where you can see that this is crimped, this connector, this wire which is coming from here, this wire which is coming here which is crimped over here inside it through this red cover that you see here. Then apart from that, for other purposes for different places where you have to give power supplies or you have to connect to some whatever the voltage or current that might be being sensed and you have to send signals.

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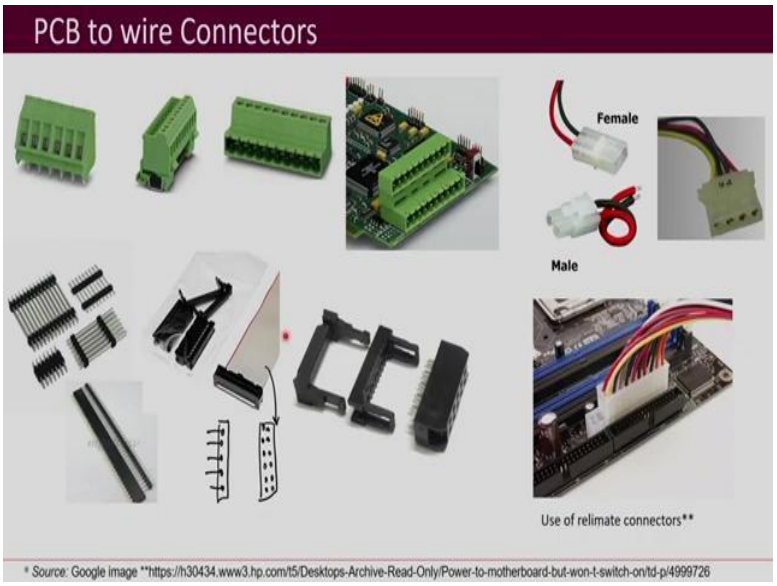

So, they board to wire connectors are used so, these are those pictures of this board to wire connectors terminal blocks. So, usually, these come in your green colour, of course, there are other colour terminal blocks that are also available. So, here you can see that these are those terminal blocks and here the wire goes inside in it and then they are usually screws which means you have got a screw through which the wire is pressed and the connection is formed. So, they come at the right angle or just normal connectors.

So, various different shapes and angles in which these kinds of connectors are available in the market. Then another type for that purpose only these kind of for white colour connectors are

also called as relimate connectors you can see here this is the picture of this 2 wire connector this white colour relimate connector which is used and these the number of contacts you get that varies from 2 to 3, 5 or more than that they are available in a different number of pins or number of connection points in which they are manufactured. And if they have to carry various digital signals, then in that case these kinds of strips are used. Many times they just form a single line or they can be in a double line.

So, what I mean by that is like this kind of single line may be there in which your different connections may be brought out or they may be in these shapes as well where you have 2 rows. So, for this kind of cables are used which are called as your FRC cables fat ribbon cables and then these kinds of connections these kinds of strips are then used for these connections and both male and female they come in pairs then these are also the number of connection points that you get in different numbers they are manufactured.

Sometimes you may be getting 5 or 10 or 40 which means to cross 20 so, different of those number of connection points may be there in which these kinds of connectors are manufactured and but when you have to clip this FRC also these different accessories are there which you have to connect and then you form the connector. Now, this is something when you practically do it and this is very simple you will get to see it actually here and just the pictures are being shown.

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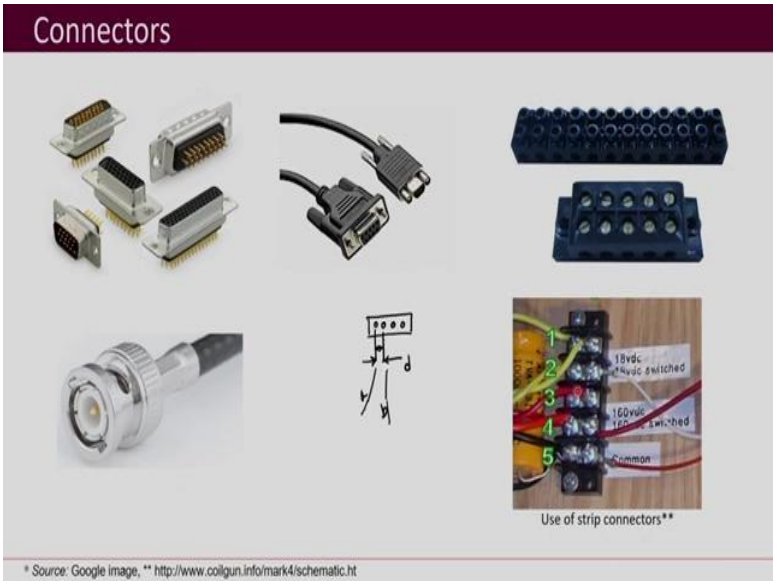

The next type of connector is your these D sub connectors and these are also for your transmitting signals they are used both analog and digital both types of signals may be taken over when you have more sensitive signals which means you want to protect more from noise, then these type of D sub connectors can be used. And then further if you have radio frequency signals to be carried then this type of connectors are used which are your BNC connectors.

So, the important thing to remember is that when you choose a connector, then the first thing is you look for the voltage whether it can withstand the voltage that is required, that is what is going to be applied in that connection, it can pass the current it can carry the current which that connection point is going to carry and when you have the distance between 2 connection points, the clearance the distance it should be such that it should be able to withstand the voltage that you are going to apply across 2 pins. So, what I want to say here is that let us say if you have this kind of a connector, where there is a 4 connection point are there.

So, the distance between these 2, you have to note down that whatever is the voltage that is applied at this point and say this is point a and this point b whatever is the difference, maximum voltage that is going to appear, the distance d between these 2 should be such that should be good enough for that voltage to withstand. And next thing is the frequency what is the signal that is being carried by a and b that frequency is such that the signal is not going to be distorted by the nature of the connector that is there. So, if you have a very high frequency signals which are very sensitive to noise, then you should be careful in choosing your

connector because the connector itself has got its own parasitic and it can distort the nature of your signal.

And the next type of connector is these kinds of strip connectors, which are usually mostly used in creating hardness when you have several different connections coming from different boards and different components and you have to connect to them in different ways. So, then this kind of strip connector is used.

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For the cables so, cables various different types of cables are used, cables mean the moment you think of cables or wires, it means these types of regular wires you are already familiar with of course used in power converters and then these FRC cables I just showed you now this may be shielded or not shielded if it is shielded it is better for your noise protection in EMI, electromagnetic interference. And this is a picture of shielded cable here you can see that these 4 wires, these are shielded and here also these other cables are shown which are these wires are of different cross-sectional areas and so different current carrying capabilities and they are all shielded.

And these FRC cables, they also can be coming in your shielded form if you want to shield the FRC there is been so, all the signals that these FRC capable may be carrying if it is susceptible to noise and then one important type of thing that if you have several wires coming in so then it is good to twist them together to cancel the electromagnetic fields. So, that is called as the lids connection in this is the picture of that lids wiring that is shown what is called as the lids wiring which is all twisted together.

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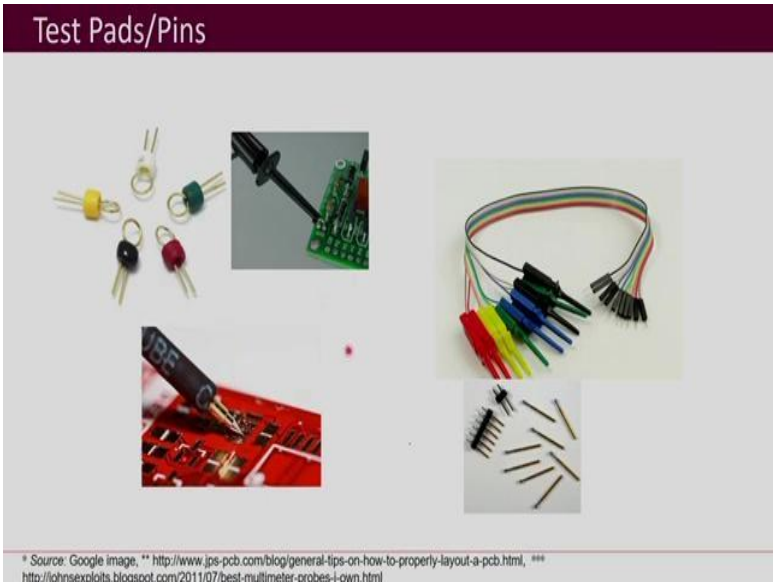

Then other types of components which are used are the miscellaneous components like the test pins here you can see that this is a test pin to which this probe is attached to if you want to see the voltage over here. So, these kinds of through-hole test pins maybe there are SMD test pins that may also be a place for some time.

So, you can see that is an example of a test pin just put that they do not need a component there is just a pad that you have to place and then further this, you might have already used this kind of crocodile pins and then this kind of single-point connection jumper wires, they are also used in the single pins also maybe put for your seeing the signals at various points.

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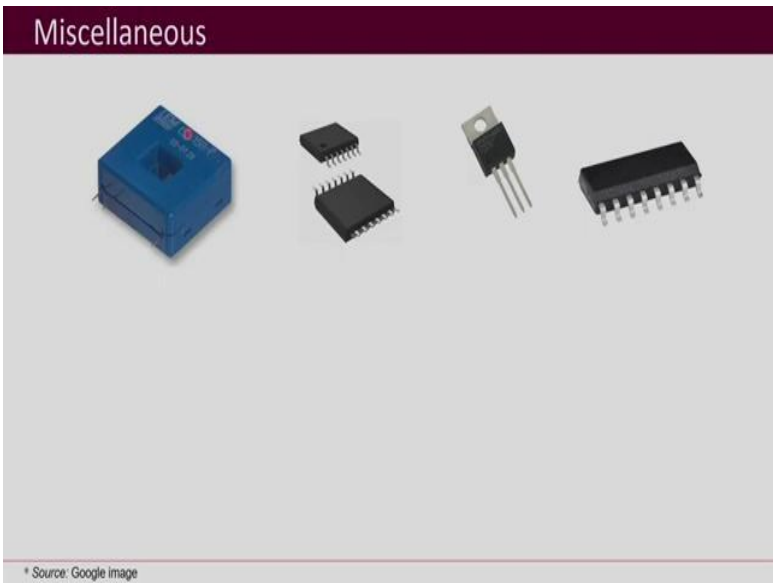

Further your sensors are like this. So, this is a picture of a current sensor Hall-Effect current sensor. These are also used for various different types of ICS voltage regulators, miscellaneous components, and logic gates, those are used in your power converters.

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And then your different tools that you require are these things your soldering station you have to solder it, you solder your PCB. If you do a mistake, then you have to de-solder so that is the de-soldering pump and this cutter and pliers and then crimping tools and your magnifying glasses if you are using SMD are very small to see within, you can use magnifying glasses to see more clearly and soldiering wire and paste. So, these are some of the various tools that you required for your hardware design.

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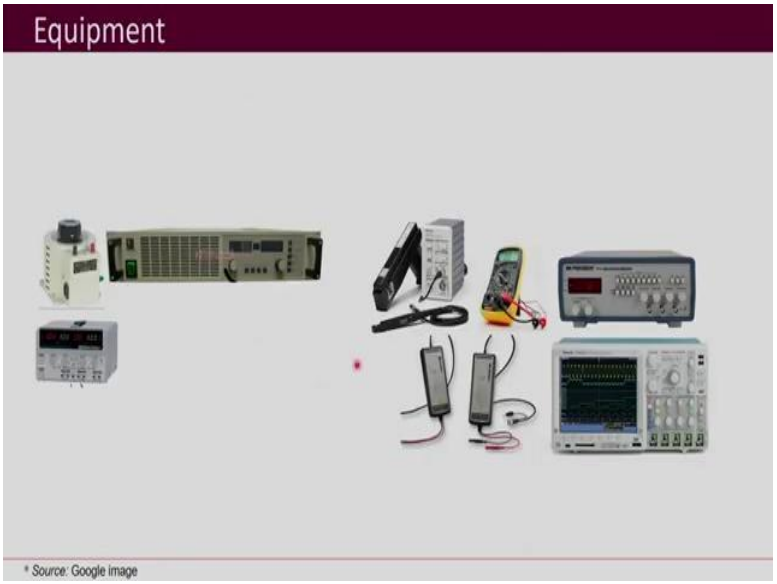

And some of the common equipment that is required is an oscilloscope. You might have already used one in your lab and the differential probes to see the voltages and current probes to see currents in multimeters are very common and function generator this also is very helpful in testing different things and your power supplies, DC power supplies or large power supplies and autotransformer and various other equipment may also be used as some of the very common equipment that you need to test by electronic converters.

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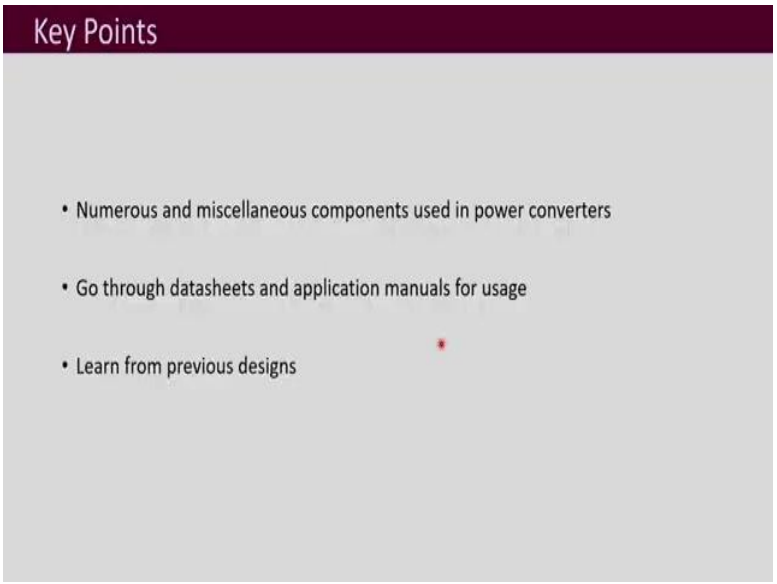

So, the key points are that there are numerous and miscellaneous components that are required to make or build a power electronic converter and you have to go through the datasheets of different components for which they that sheets are available. For very simple components do not have a datasheet.

Now, you may be having a question about which is the component you should be choosing out of the so many components that are available and generally the answer is that you learn from the previous design that is the practice that is followed for your power converter design. Usually, you do not start from scratch you look for a previous design and are different components that are used and from taking ideas from there then you decide what components you can use and then you can further do modifications in different components as and where it is required. Thank you.