Electronics Enclosures Thermal Issues
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Lecture - 28
Prior art

Hello, me to little more what you call mix, how to make a thermally useful enclosure which uses standard what you call commercial extrusions and so on. The issue being in the just in the previous lecture I have shown you several enclosures and all which are taken directly from the industry.

Now, not every time they start with absolutely new fin designs and so on because, this have been routinely being used for such a long time.

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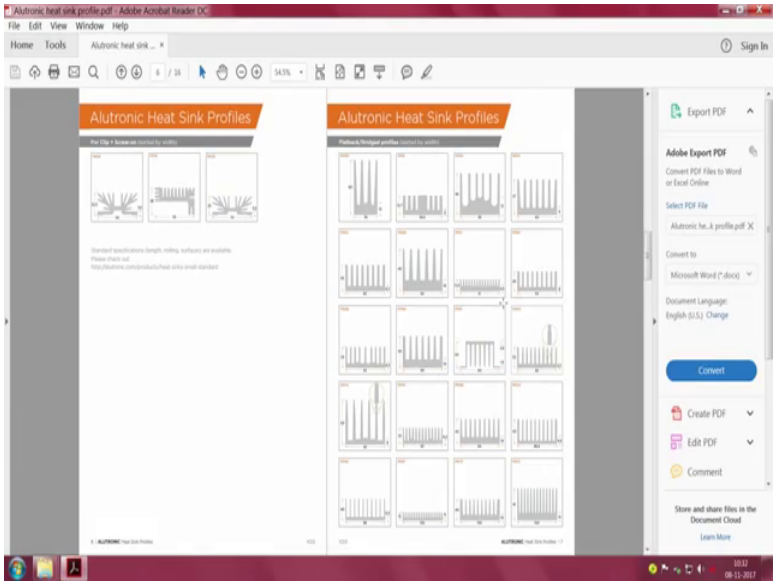

Now, if you have a look at a typical heat sink from the manufacturer you will notice here, that several of these profiles are already been in use for quite some time you have seen this here.

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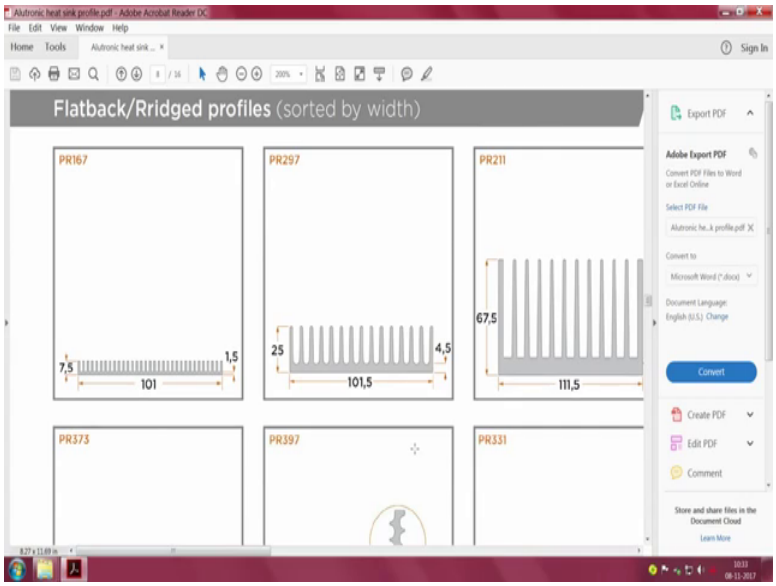

So, you have something which is typically around 100 mm wide. So, this is the hundred mm wide heat sink and then there is a 4.5 mm what you call base part is a aluminum and then there is a see now I will try to move it here. Now have a look at this heat sink which is about 115 mm wide there is a 10 mm thing.

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Now, if you see the example which I have here such show them the sample, that heat sink which is there probably belongs to 1 of these things here, can you see here this big monster here and in fact, at the base you know it is a little bigger it is 18 mm thick. So, I

will just take this things of seen the trend, this is going to man manufacturing defect it is not a manufacturing defect. It is just that the extrusion you know has come like this and maybe getting or handling it has bent and all that.

Now, coming back to our this what you call sample here, such I will call them standard or generally you know replaceable heat sinks are available like this. Why people use 1 of these profiles is that something nearby will already be available.

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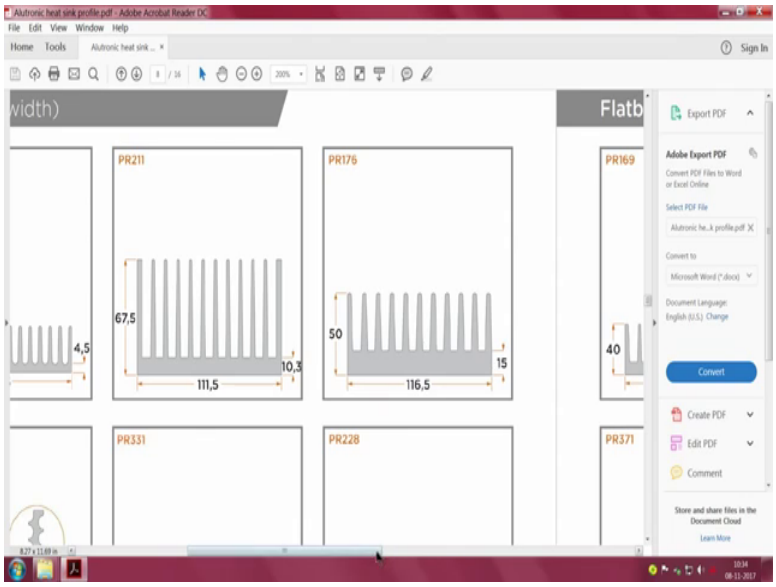

And if you are in the what you call you are designing for something, we know very well somebody else also know probably has a same type of what you call requirement and somebody in the world has made something is a little closer to the trend, the advantage of using this is they are not very expensive and once if you buy a profile like this and keep, you will be able to use it without any issue at all.

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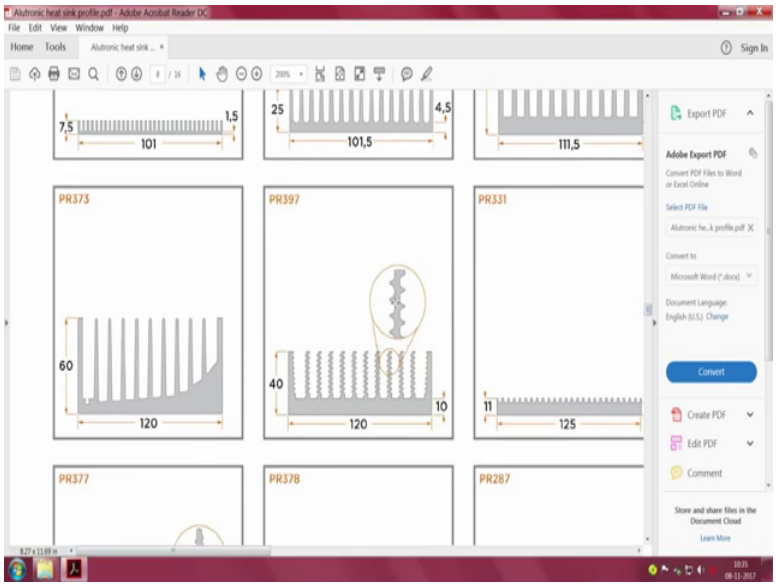

So, I will just try to go down and you see here 1 more important thing is, if you are to make your own we may not be able to achieve this detail when they have given here, you see the detail there at the left; detail there at the left is somewhat you call attempt has been made to increase the surface area by providing additional ridges.

Now, the next question you may ask is that, does it really help or how do you do that is for you to probably make a module and then try to compare what they have with, what you have and there is no IP involved in checking these proportions and you are adopting something similar to that.

Now, if you again look back at this small thing here can you see here, these ridges are little offset is that good or bad it is for you to decide whether it is good or bad; from my point of view I feel they have tried to make it, somehow they have optimized the load involved in creating the extrusion.

So, if you just put a tapered extrusion and give a few what you call cuts on this side and that side you know it may or may not be useful. If but however, if you see this corner here you see here it is a little about what exactly it is on the other side, but the way they have offset it and probably while the detail drawing does not clearly give you the details, probably the base is a little wider compared to when it goes on top and we need the this specific type of design because, these are all extrude extruded in long lengths. I am not very clear what is the current standard in the shops, we will get them about a meter long.

But then in the extrusion industry they are all made for building, standards building code requires that at least know you start with something typically 3 to 4 meters long, so you have 4 meter machines and 3 meter machines. Now if you can see the samples which I have put there these are all samples which have been taken from the building industry, I do not know what exactly that this component is there was some construction going on I just picked that.

So, it probably looks like extrusion for a window or something maybe you see the my trader 45 degree joint there. So, 2 of them can be joined together and you can make something which is a little like this, unfortunately that element of detailing is no way useful for us; they have made some you know arrangements or something to slide inside this is a something you know which has a there is a some extrusion, you know I mean 1 angle something which will go here something which will go here and they meet perfectly and then you can assemble think this are not useful for us in any way when we talk about our own electronic extrusion.

So, something called the electronic extrusions what you seen this catalog, have been specifically I am sorry developed with our concerns in the mind.

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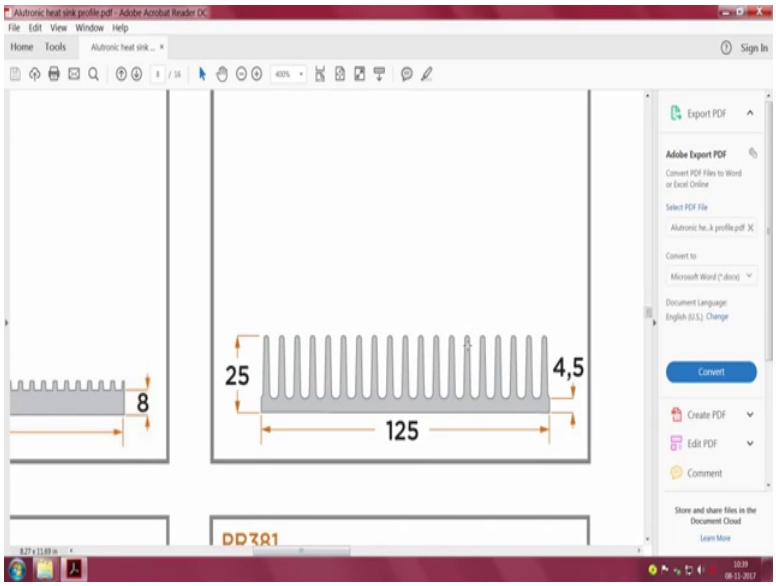

So, if you go down you have very simple straightforward things like this, see this 1 has only a u shaped base. So, that you will give a general what you call advantage or it then ridged profiles which I have shown you already you see here they are directly and

opposite directions there are these what you call ridges here you have notice something which very different from it here it is tapered.

So, somebody has the you know probably expect the actual electronic user like you and me have insisted, that they want something which is a heat sink should be much more effective then. Now you will notice this is slightly different from what we have seen there that same, what you call ridging is available there which is a radius ridge; which has probably some advantages and to make the fin effective it is much wider at the base and much narrower at the top.

Now, whether it is calculated or not depending on the manufacturer I will call them the vendor, with the actually user which is a designer. I expect that since the 2 this tooling is very expensive somebody has done the homework and these days homework is directly by carrying out a simulation probably in a computer and then the basic part of the simulation is that they should physically analyze which is good for them you understand know.

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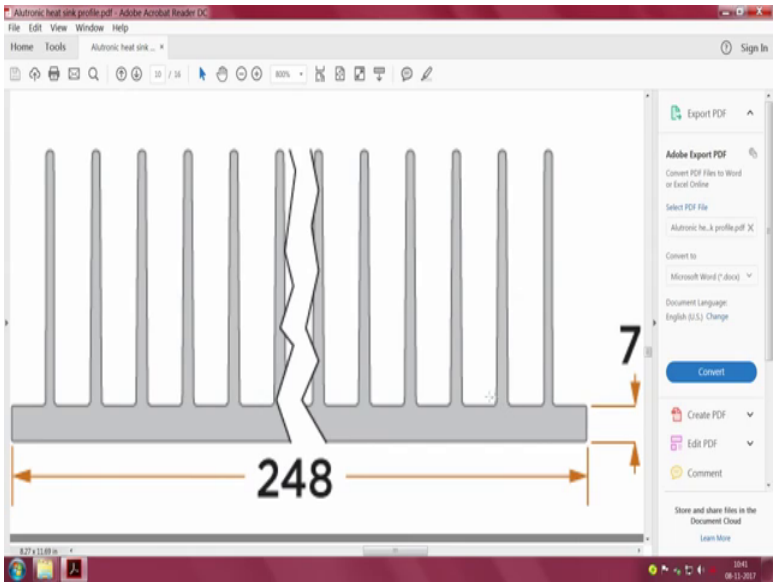

Some of these things if you see are very thin, so not very effective and then it gives you a general indication that these are probably meant for simple natural convection not meant for forced convection.

When you come to forced convection you will notice that there are wider like this and there is a little more space here. So, I will try to go back to the old thing and so not by just looking.

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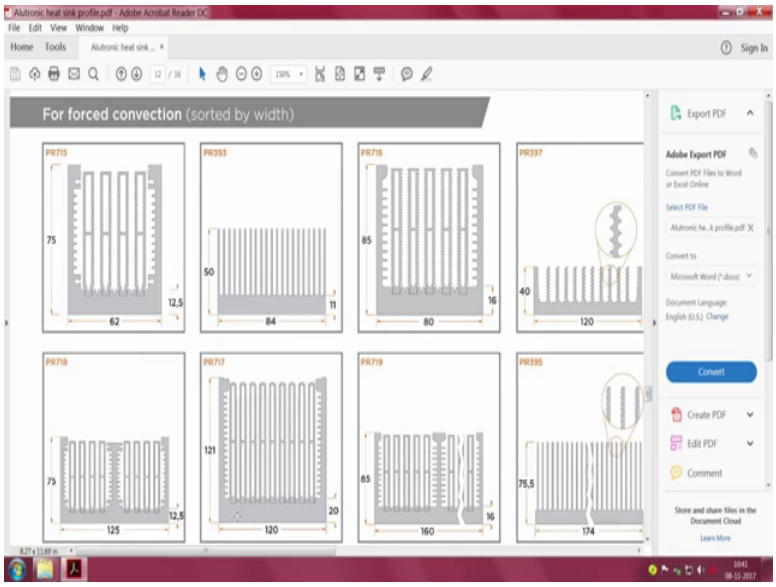

But also if you now go back to this catalog you see here very very complicated things are, have a look at this thing have a look at this. I am not very clear what it is for but expected yes it does have a purpose, you have extrusions in which I do not know whether it is a support or whatever it is you can go back to the catalog, is catalyze is taken from electronic. Electronic has probably develop these things for military and other professional people.

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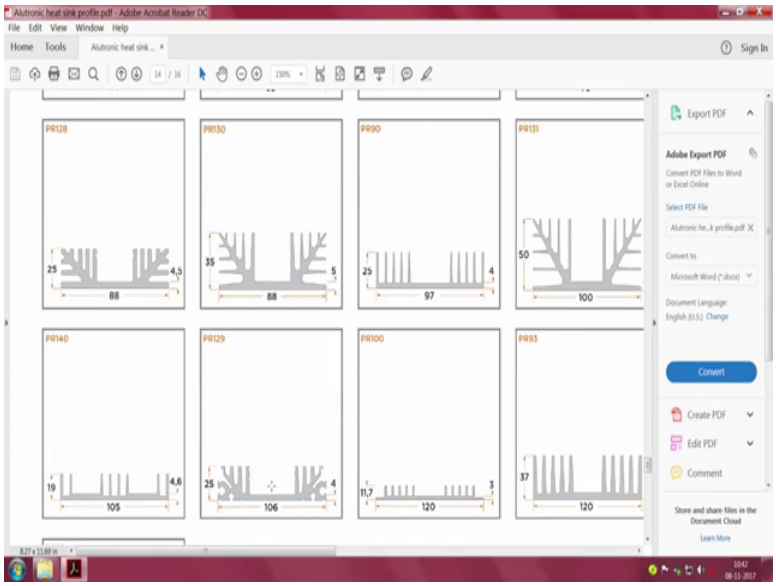

So, they will give you a lot of you know data if you directly interact with them, these are little few of them which I have been showing you here seen this know.

So, I will just talk about 1 small thing sometimes occasionally I find well I am not a nitpicker, if you have a look at this I hope I will be able to go to, ha they are partly here; you will see 1 or 2 what I feeler obvious what you call a few things which the over liked 1 of them is while the small notch here does seem to make some difference you see here. See that notch there it is likely to seriously interfered with the heat conduction pattern.

So, anything which is here see suddenly you know this whole thing this is the small bridge that is available for us, you have seen this is the restrictive bridge. So, any heat which comes here has to cross over this what you call narrow path here, moment you attempt to cross over all these things now we will not be that effective anymore.

So, if that removed this and then optimize the location of all these things, then these other things also can be used. But then from the purely from the product design point of view, probably this was required for some alignment or I do not know whatever it is. So, all this heavy mass here you know it is really not as effective as we want to have a look at it.

So, it is for you now if we can include this in your, what you call thermal modulator is good otherwise best in simple ways. Take a section of a approximate length which are

like to use mount if you per devices keep them in the linear region and you excide them and see what will be the in your conditions what will be the thermal resistance of a thing like this.

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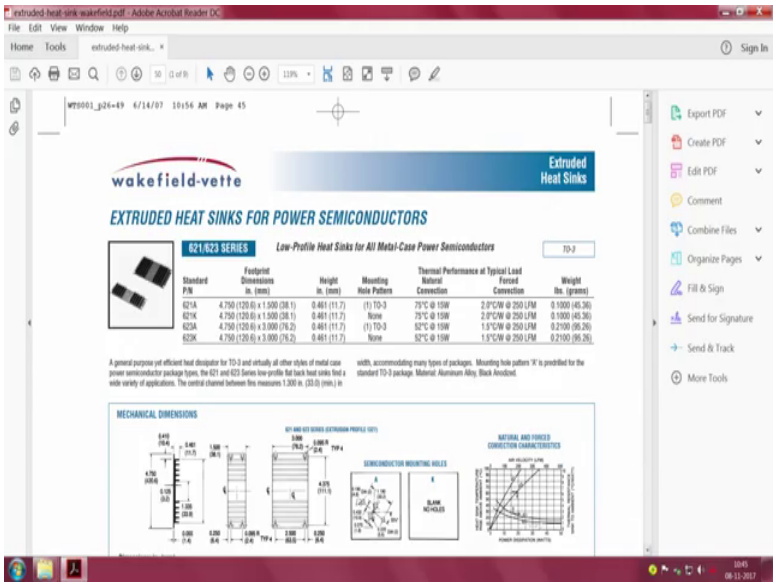

Now, I will try to close this and see 1 more, you see here this I thought know I should be able to which I was just talking about it, see what they have done is this particular small heat sink here and enlarge it later you will be able to see, they have given details of this is from an earlier era where we used to have TO3 packages and then you see this is the probably you know the most important thing I would like to point out to you; allow me to is play around a little got it.

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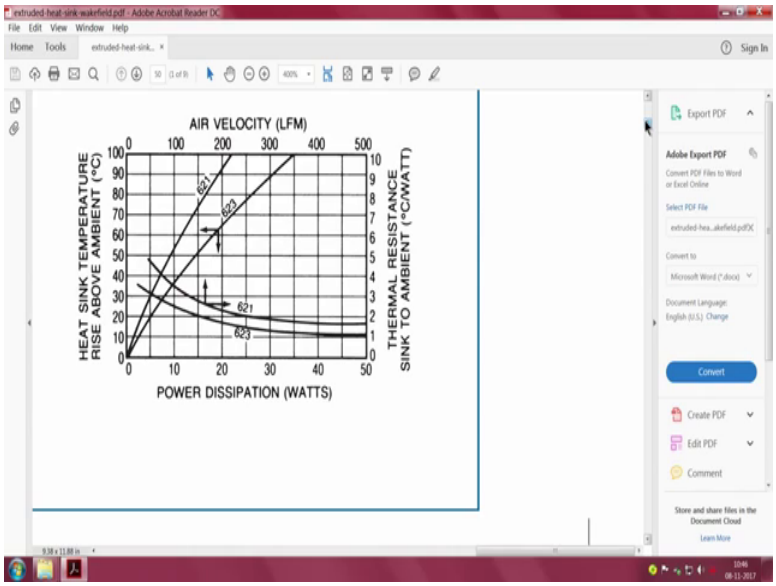

Seen something here air velocity then you have power dissipation and then heat sink rise above ambient and then thermal resistance all of them have been conveniently plotted here.

So, you will notice that if the heat sink temperature you know it keeps rising. So, they have given for 621 and all that how to read it they were given on the other side. Since to have my talking about it you know I suggest you try to read it about yourself, as you increase higher velocity the thermal resistance comes down for both 621 and 623, write a initial stage you know typically around 50 degrees centigrade per watt will be there and then as it goes down you know I am sorry the thermal resistance will keep coming down.

You will notice is that after it crosses typically about this 300 figure, increasing their velocity does not make much of difference. So, in my other shown (Refer Time: 15:22) other lecture know there they have typically given 6 meters per second, anything which goes above then it is just adds noise and turbulence and does not serve any purpose. For a given heat sink it looks like these figures you know are quite valid here, they have just given it generally you know how to mount it and then generally they have given about what is the length and then also a little bit about.

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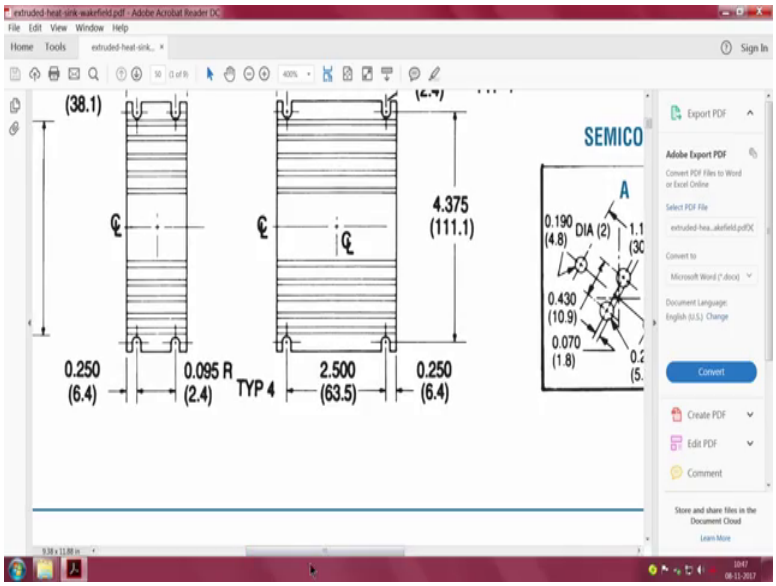

That 621 and 623 talks about these 2 modules 621 and extrusion profile 1 3 2 7 they have cut it here, so then they have given details at all low profile you will see the issue the issue is that basically it is a very extremely low profile device. So, we need to now check.

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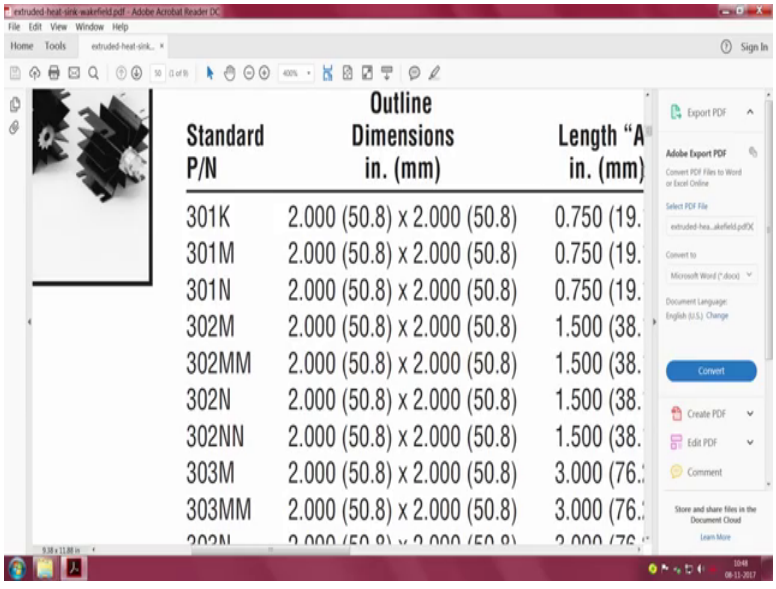

Now, if you go back here you see here at the left here and the left top, you have the heat sinks meant for stud mounted devices. So, we have a stud mounted device and I am not sure what it is and then 1 more thing have a noticed here, the anode declare has been

removed here and it has been machine clean. 2 variants are there 1 is you mask it such that it does not get the color while coloring it or you know what you call adding the dye to the thing, other thing is you get it in the proper condition because manufacturing is easy masking is always tough,

After you get it anywhere since the other operations are required including a tapping and things inside, you slightly lightly machine it and in the same way you can also probably lap it. The moment you do there you have a beautifully fantastic mounting surface and then you can do whatever you want with it. So, this is a part number 300 and k they have given here.

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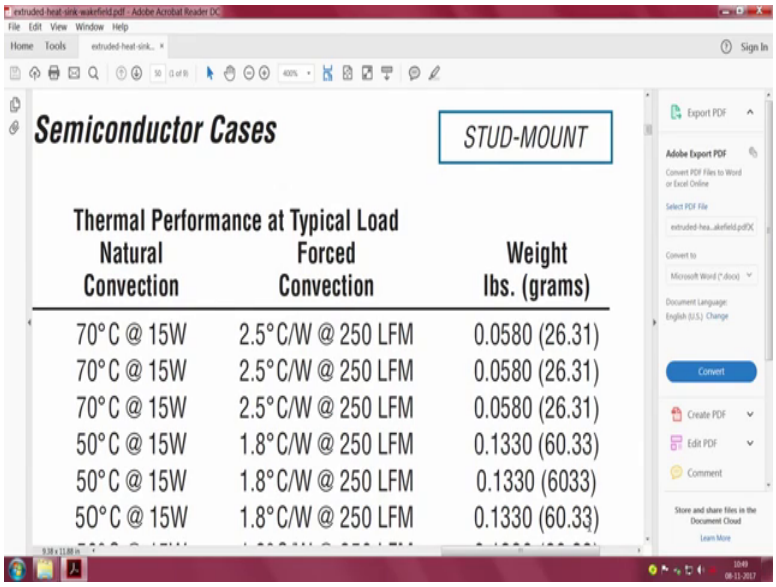

Now, extreme right side for each length mounting holes thermal performance they have given you have seen that, natural convection versus forced convection. If you give this much of what you call I am not very familiar with the units down it is explained, for a stud mount if you do not use anything for a given length you typically get about 70 degree centigrade at 15 watts dissipation and here know you will see here in forced convection 2.5 degree centigrade per watt

So, you can keep multiplying and then you see here as the length increases these numbers you know keep coming down, you have come you can come all the way up to almost 1 degree centigrade per watt and they are not very heavy then you see here.

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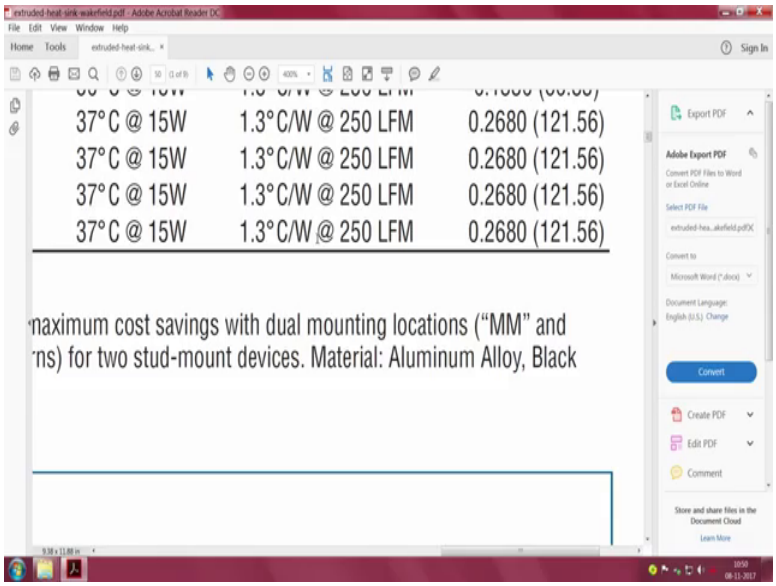

The length you know is not very what you call is not very very long.

So, we have more what you call design data about these things which are circular. So, if you go down you can so any of these manufacturers catalog gives details about more and more details about how do you mount these devices here and then you see here there is something very very what you call interesting or whatever it is you know.

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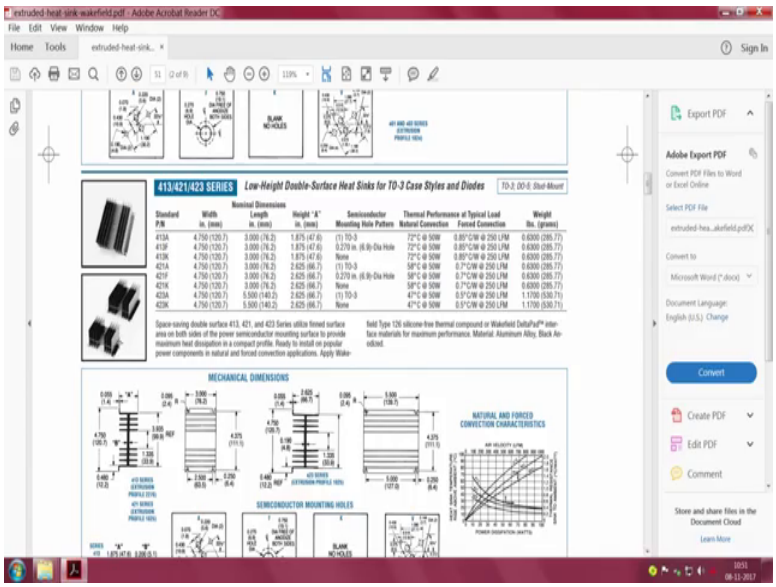

So, if you now look at these this type of heat sinks, this 1 I will see if I can enlarge it properly; unlike the earlier other things which I have shown this has fins on both sides

and width is 60 mm usable length is about 65 mm and then this length of it. You know comes from 120 mm of length ok, I will take this as height of the heat sink and the width of the heat sink 120 by 66 and then you have lengths of 76 mm and a little nearly double the length of it.

So, you see here this heat sink performance you know, I suggest you separately look at it a by in your hand and you will see that the air velocity as it increases how the thermal resistance come down and then how the heat sink you know, what you call dissipation and all know increases these details are given here for most of the commercially available power semiconductors. You have seen this then we have something for the various rectifiers and so on. So, this is a huge catalog deliberately I have taken an old catalog. So, that the samples we have approximately coincide with that.

Now this again looks a little like there is other heat sink we have here, you will see this we have other heat sink here and you see here now you will probably appreciate now if you come back we again have a fan which matches this.

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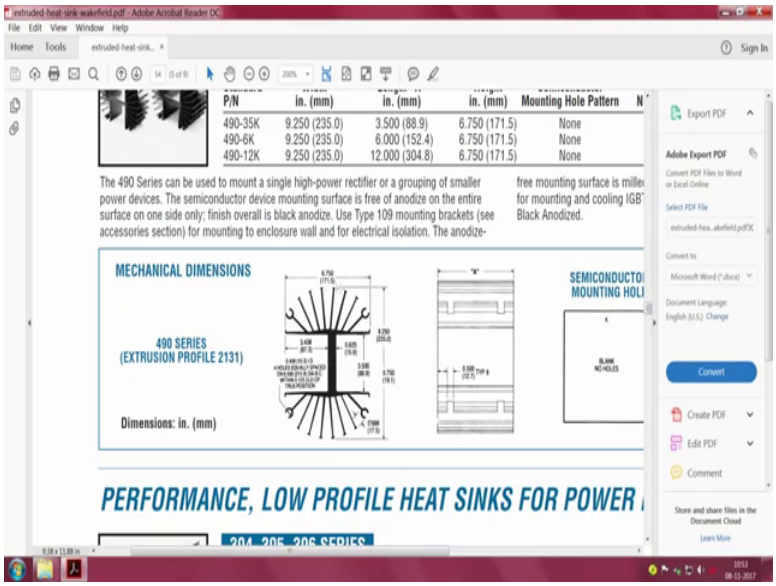

Now, you see here they are nicely made such that nicely they fit here.

So, we have a fan which is probably what you call 235 mm square, you can mount all this thing there are mounting holes here and huge amount of you know; what you call space they have given such that we can mount things for various semiconductors,

generally supplied with blank holes and you can attach fans directly and then if you are a both in the push pull mode this is also 1 of the interesting things I hope the catalog you know shows.

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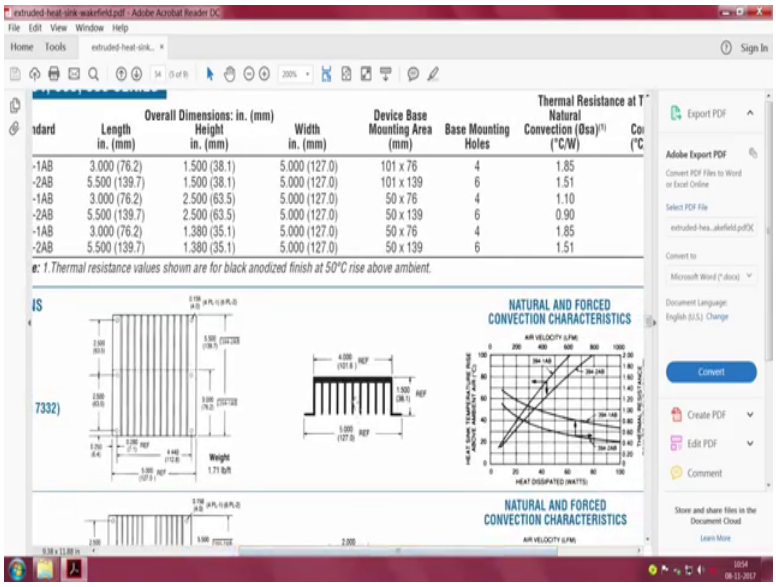

You see this I will draw your attention to this particular picture, unlike some of the other heat sinks which I have shown there, you will notice the mounting flanges are near the tip of the profile. So, these are probably you know the ones that are used in power semiconductors, I am sorry power electronics equipment while this part this part faces the wall.

I seen this you know this part faces the wall this part can be used, this flange can be used for mounting and all your semiconductors can be mounted on these face and if you put a cover here on the other side here equipment is ready and very miraculously this dimensions you know in the case is about 5 inch. Probably it follows the panel mounting standards, say the patients through go through all the catalogs or 1 more which intellectual property is to be protected.

But just like in the case of our academic this thing, we know published literature we are expected to already verify and then acknowledge in case somebody has already done the work, you cannot publish somebody else has publish. However, you can acknowledge and build on it the delta thing.

Same thing it is with our design thing also in the beginning somehow you have to find out your needs, once the needs are over comes the important thing instead of talking it as a patent, such you need to look for their prior art saying how is it others are doing and in the prior art well I am not advocating you know violating of IP, we can show how others I have already been doing it only thing is you cannot claim the, you cannot get a IP on that.

So, typically this is one of them, so if you take a standard drive there are any number of ways you can mount this what you call heat dissipation things.