

A large, light gray, stylized graphic element consisting of three vertical bars of varying heights that converge at the bottom into a downward-pointing arrow shape, positioned in the upper left corner of the page.

#42015

INFOCUS:

UL Approval

– How to guarantee PCBs

A topic from NCAB Group about integrated PCB production



Wendy Liu, Quality Manager, NCAB Group China during a factory visit. All the factories NCAB use have to be UL-certified and we inform and update them continuously about the importance of UL.

Security is key in the electronics industry. It is vital that users can rely on the finished products when considering factors such as fire and electrical safety, which means that both the PCB and the materials they contain must measure up to the highest standards. To ensure that the boards do conform, it has become common practice to UL certify the constituent materials or the PCB itself.

But what does UL certification actually involve, why do you need it, what does the approval process involve and what are the pitfalls? We put these questions to Emma Hudson, Lead PCB Engineer for Europe and Latin America at UL.



“UL recognition is an acknowledgment that the PCB is safe with regard to materials and construction”

EMMA HUDSON, LEAD PCB ENGINEER, UL

To start with, what is UL?

“The letters UL stand for Underwriters Laboratories, and we are a global, independent company within the field of safety science. We have more than 100 years of experience as safety solutions experts and are recognized leaders for standards development, testing and certification. UL are a big company with over 10,000 employees and more than 150 laboratories.”

“If we turn more specifically to PCBs, we have worked with safety standards in this area since the 1960s. We can test and approve the materials used to make a board, and the board itself. The standards that have to be met cover electrical safety, fire safety and mechanical durability.”

Why do PCBs need UL recognition?

“The drivers are primarily the need for OEMs and end-product owners to supply safe products. UL recognition is an acknowledgment that the PCB is safe with regard to materials and construction. This saves them spending time and resources to conduct their own tests. There is also an additional value to it, in some cases, companies opt for UL-marked boards and components, although it actually might not be necessary.”

“The risk involved in choosing a PCB that lacks UL recognition is simply that the buyer will then not be sure how safe the PCB and thus end product will be. The PCB could for example cause fires. With UL marking, you know that the board at least is safe. We conduct independent tests and follow up with unannounced audits and repeated tests to ensure that the board continues to meet the requirements.”

How does UL go about certifying printed circuit boards?

“We feel it is important that we are brought in early to work with the PCB manufacturer. Not least, we want to establish what kind of approval is needed. As an example, you might need a comprehensive ‘full’ recognition, or perhaps just a flame rating. We also need to understand what materials the boards are comprised of and the construction, the manufacturing process and application of the boards.”

“UL always strive to make an approval as general as possible, in order to give the manufacturer as broad a choice as possible in terms of designs, processes and materials. If the approval concerns a specific design or a specific manufacturing process, we can approve the PCB itself. It can help the manufacturer to secure deals since all parameters will be guaranteed to be correct.”

“We then run a test program where we again try to make it as easy as possible for the manufacturers. We would need them to provide us with samples to perform the tests on. We test the limits of the desired parameters, for example, flammability, bond strength and delamination, and so on. Other tests we carry out are typically construction dependant and include things such as silver migration and conductive paste adhesion.”

“When the tests have been completed, UL specify what the producer in question may manufacture with the approval, including the construction, the materials, the manufacturing process and parameters of the board. We then follow up continuously with unannounced audits and new tests. All the boards we have recognized are posted publicly in our database, with detailed information about what the authorization covers. The database is available to anyone on the Internet.”

Why should a product owner care about whether PCBs are UL approved or not?

“As I said, recognition guarantees a PCB's expected safety. With UL-marked boards that they can trust, they will not then have to spend time and resources on their own tests. Moreover, the UL mark sends a strong message and shows that you care about safety - many companies would lose business if their products did not carry the UL mark. It is also important to understand what the different markings stand for.”

“When the tests have been completed, UL specifies what the producer may manufacture with our approval. We then follow up continuously with unannounced audits and new tests”

EMMA HUDSON, LEAD PCB ENGINEER, UL

What is the difference between a printed circuit board that uses UL approved materials and PCBs that are UL approved?

“There are other key parameters than just the materials themselves, so you do not get the whole picture only with UL-approved materials. The materials can be influenced by the design and manufacturing process. Things can change, for example if a board is laminated several times, or if different materials are combined with one another then you can go from a V-0 rated material to a V-2 rated PCB. The choice of solder mask can have a bearing. That's why it is often a good idea not to try to take shortcuts, but go the extra mile and use UL-approved boards. Then, you know that the board has been investigated and tested by UL in its entirety.”



A screen print station in the clean room at Suntak, Shajing. UL has an open database on the internet where visitors can search amongst approved PCBs, laminates and surface treatment materials.

How can EMS companies or product owners be sure that the materials and PCBs they've purchased really are UL approved?

“The quick answer is to buy from a reputable source, and to inspect the UL marking on the PCB. All boards must be labeled in a specific way, to enable you to track where they were manufactured.”

“Both our online directory of certifications and our database of printed boards, laminate and surface materials are freely available on the internet. There you will find everything that we have approved and the data is searchable in various ways. There is also information on what the marking on each board should look like. If the marking is incorrect, you should not rely on the board. Even those companies that repackage other companies' materials must have their own UL recognition and marking.”

“If you find yourself hesitating about the authenticity of a marking, contact us at UL. We have the fingerprints of all the materials that we have recognized so we can investigate and offer advice. You can also contact us for help to understand the documentation online.”

UL IN BRIEF

- > UL stands for Underwriters Laboratories.
- > A global independent consulting and certification company in the field of science for safety.
- > Founded in 1894.
- > Head office in Northbrook, Illinois, USA.
- > Has over 10,000 employees and 150 laboratories.
- > Develops standards, certifies, approves, tests, inspects, audits, advises and trains.

From your experience, where in the supply chain do problems tend to arise?

“We find shortcomings mainly in people's understanding of the difference between approved materials and recognized boards. This has led to the appearance of incorrectly approved products being used delaying the OEM in getting the certification they need to put their product on the market or even counterfeit products entering the market. UL have a team that works exclusively to stop the illegitimate use of the UL mark. It is of course essential for us to work against counterfeiting. Often, it actually has to do with a lack of awareness of how the UL marking works, so it is also a matter of transferring knowledge.”

“Many companies would lose business if their products did not carry the UL mark”

EMMA HUDSON, LEAD PCB ENGINEER, UL

How knowledgeable and aware are Chinese PCB manufacturers in this area?

“I do not want to make any generalizations about conditions in specific countries. In China, as is the case for other countries, we see that there are highly knowledgeable manufacturers as well as less knowledgeable manufacturers. Training is an important issue, there as elsewhere, not least because of the position China has attained as a leading manufacturing nation. You need to learn what UL actually is, what the limits are regarding certification and what rights it confers.”

“If a factory, in China or elsewhere, consistently breaks the rules, we intensify our inspection of these factories and may even withdraw our approval. This may comprise things like a UL-approved company outsourcing production to another company that has not been authorized and is not being inspected yet still continuing to use the UL mark. We are constantly working on these issues and keep a tight control over it. If you have evidence that someone is breaking the rules, please report it to us so we can stop it.”

How would you describe the work NCAB Group does in this area?

“At UL, we are mindful of our independence, but I can still say that NCAB has always shown a willingness to cooperate with us and have put a great deal of effort into learning about UL certifications. Anyone who has gained appropriate knowledge can source the required PCBs. I think that the people at NCAB know what questions to ask both of the manufacturers and their customers, to make sure that customers get the right board.”

Can UL do anything more to help the PCB industry and users?

“We are well known from a safety aspect. We have long experience of working with the PCB industry, but would like to become an even better partner to it. In 2016, we will therefore launch new tests that can help the industry to deliver better and more reliable products, so stay tuned!”



Wendy Liu, Quality Manager, NCAB Group China, is looking through some documents during a factory audit.

“We influence and develop the factories”

NCAB works closely with its factories in China on UL recognition. Wendy Liu, quality manager at NCAB Group’s department for Factory Management in Shenzhen, describes the work.

Why is UL recognition important?

“UL is a major authority and enjoys a good reputation in the PCB industry. The company is irreplaceable for testing fire and electrical safety. Customers from around the world – including well-known Chinese companies – demand factories that can achieve UL recognition. Having UL recognition is therefore very important for PCB factories to produce secure boards and be able to access the international market.”

What is the general situation in China like regarding UL?

“Based on the statistics, there are more than 1,200 PCB factories with UL recognition, especially in the Yangtze River Delta and Pearl River Delta, and in Shenzhen, Dongguan and Kunshan. Because UL marking is both a safety assurance and gives access to the global market, it is extremely popular in China.”

How knowledgeable are NCAB’s factories about UL?

“All our factories must have UL recognition. From NCAB’s side, we also share our expertise. We influence and train the factories so they are aware of the importance of UL.”

What else is NCAB doing?

“To start with, we integrate all our factories’ UL information so that everyone within the NCAB Group can access it directly and easily and check the status of UL certifications.”

“We also regularly review the factories’ UL certification status. We

propose measures based on their situation and what the market demand is like, with the aim of making their UL recognition more comprehensive and efficient. In this way we ensure that our factories can match NCAB’s own development.”

“Thirdly, NCAB checks the application of UL in the factories during our annual audits so that we can be sure they are performing satisfactorily.”



“All NCAB’s factories must have UL recognition.”

WENDY LIU, QUALITY MANAGER,
NCAB GROUP CHINA

What is NCAB’s strategy regarding UL?

“The PCB industry is developing rapidly and NCAB will be encouraging the factories to expand their UL certifications to more new materials and new technologies so that we can satisfy our customers’ and the market’s demands.”

Does UL marking automatically mean quality of delivery?

“No, UL recognition is exclusively a certification of product safety, which is only one of several factors that determine quality of delivery.”

“NCAB will encourage the factories to expand their UL certifications to more new materials and new technologies so that we can satisfy our customers’ and the market’s demands”

WENDY LIU, QUALITY MANAGER, NCAB GROUP CHINA

“Quality assurance is also closely linked to factors like product performance, appearance and reliability testing.”

How would one get a special build approved by UL? How long does it take and what does it cost?

“The application process consists of five stages (see the adjacent sidebar). UL recognition of a special build normally takes between three and six months and the fee is about USD 10,000. However, the length of time and cost can of course vary depending on the actual application.”

Is there anything else to consider?

“In order for a PCB to be UL certified, it is important that the input materials (laminates and solder mask) are also certified by UL. It is therefore a good idea to check the materials’ UL certification before you make a UL application for a new PCB.”

FIVE STAGES TO RECEIVE UL RECOGNITION FOR A PCB

- 1 The applicant submits a written application, which includes detailed information about the company that is applying and the relevant product. More importantly, the manufacturing process must match the special build in the product information.
- 2 Based on the product information submitted, UL provide an engineering quotation, which includes the UL standard, the engineering costs, the time required, how many test samples are required, etc.
- 3 The applicant returns the application form and provides UL with test samples.
- 4 After UL have received the application form, payment and test samples, the tests are done and UL notifies the applicant when they will be completed. If the test samples do not pass the tests, UL will inform the applicant, who can make improvements and submit new test samples.
- 5 After UL have concluded their tests, a specification is issued telling what the applicant is permitted to manufacture with UL’s approval. UL then follow up continually with unannounced audits and renewed tests.

Questions around the world: How knowledgeable are your customers with regard to UL? And what are the advantages of possessing a better knowledge about UL?



FINLAND

TEEMU SUURONEN

Key Account Manager, NCAB Group Finland

“Considerable differences exist among our customers in terms of their knowledge levels regarding UL. Even those who know that they should require UL recognition from PCB suppliers, can find it difficult to get everything right by themselves. To ensure that UL recognition really applies, it is best to use reliable suppliers who are strongly aware of the requirements. Otherwise there could be expensive recalls of finished products if it turns out that the UL recognition did not meet the specifications.”



USA

WAYNE ANTAL

Program Manager, NCAB Group USA

“There is great variation in the degree of understanding of what UL really is and why UL recognition is required (or not). If we can help our customers to better understand the role that UL plays in the PCB supply chain, then it will be easier to link the customer’s actual needs with the best possible solutions we can offer. In this way we can make our customers more satisfied.”



SVERIGE

MICHAEL LARSSON

Key Account Manager, NCAB Group Sverige

“Many people specify a demand for UL without really knowing what it involves. Often it is okay, the customer’s demand is relevant and in most cases easy to meet. The main test is with special designs or materials.”

“What is hard is to check what a factory’s UL recognition actually covers, because it can vary for materials, technologies etc., and knowledge about this and how to check it is not very common. But such knowledge is crucial when seeking to identify potential infringements of UL regulations. Here NCAB can help customers by providing protection and advice.”

Shortcuts to certification can have catastrophic results

HANS STÄHL
CEO NCAB GROUP



Testing a product's safety is of course important. UL recognition is also required by law when exporting to countries such as the USA, a large market where many products end up. For this reason, basically all PCBs must be UL certified. But are you as a user of PCBs really 100 percent sure that your products have a correct UL recognition?

The big challenge with UL is that for a PCB factory it is both costly and time consuming to obtain UL recognition for all the base laminates, prepregs, soldermasks and so on in various combinations of

builds. There is a great temptation for PCB factories – even those in the USA and Europe – to take shortcuts with their recognition.

The consequences can be catastrophic for someone who supplies products without UL recognition or with incorrect marking. In the worst case they would be forced to do a general product recall from the market – leading to huge costs and maybe even bankruptcy.

As a purchaser and user of PCBs you risk falling into many traps regarding UL recognition. It is vital to thoroughly check that the factories' certifications really apply to the products you are buying.



NCAB Group in Social Media

For a few months now, customers and other interested parties have been able to follow us on Twitter and LinkedIn. We have also started a blog where we immerse ourselves in the versatile world of circuit-boards! » [Twitter](#) » [LinkedIn](#) » [Blog](#) » [YouTube](#)

Information about UL online:

- » [Online directory of certifications](#)
- » [UL iQ database of PCBs](#)
- » [European website UL Consumer Technology](#)

Subjects we have covered earlier

Do read our earlier newsletters. You will find them all on our website, www.ncabgroup.com/newsroom/

» Transition to outsource

2015 09 29 | NEWSLETTER 3 2015

» Purchasing PCBs

2015 06 01 | NEWSLETTER 2 2015

» Sustainable business

2014 12 22 | NEWSLETTER 4 2014

» High-tech PCBs

2014 10 07 | NEWSLETTER 3 2014

» Looking ahead with NCAB's Market Watch

2014 05 30 | NEWSLETTER 2 2014

» NCAB Group Production Insight Trips

2014 02 14 | NEWSLETTER 1 2014

Are we taking up the wrong subjects?

We are always looking for interesting subjects that we could take a more in depth look at.

If there is something you would like to learn more about, or perhaps you would like to comment on anything we have written, do get in touch with us and tell us more.

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