New technology platform for increased functionality in the smallest of spaces

With the new DenciTec platform, Cicor follows the trend towards ever more intelligent printed circuit board technology and thus offers users the highest functionality at reasonable production costs

It is not only in old age that hearing reduces. Hearing instruments can provide assistance. They should be as discreet as possible and so are fixed behind the ear or
disappear completely into the ear canal and must therefore be small. Nevertheless, they must be reliable, interference-resistant and affordable.

Natural hearing requires directional hearing, understanding words in spite of background noises and in echoing surroundings. To achieve this, a hearing instrument requires several microphones, a processor that recognizes from where the noise signal is coming and dampens unwanted environmental noise in a targeted manner whilst at the same time strengthening the voice signal. In order to provide all of these functions, hearing instruments have up to two megabyte on-chip flash memories as well as several hearing programs with the relevant processing algorithms.

For higher quality digital hearing instruments, there is also wireless technology that is used, e.g. when worn on both ears, the two devices communicate with each other and align themselves synchronously. A set amplification threshold should also protect the inner ear from overload. Digital hearing instruments recognize interference and wind noises and then lower the amplification in the relevant frequency ranges.

Bluetooth transmission is also possible for hearing instruments to transmit signals from cellphones and audio devices to the hearing instrument without ambient interference. And the developers did not stop there. The hearing instrument should only be a little more expensive and certainly no larger.

Sensors in industrial environments are also becoming ever more functional. Instead of only measuring and transmitting one value, an initial data processing stage takes place in the sensors in order, for example, to reduce the data volumes to be transmitted from the sensor, e.g. to the control system. In order to save the complicated cabling that demands so much space and money, sensors increasingly also have a wireless module and all within a very tight space.

What all of these applications have in common is that ever more functions must be integrated into a component. So the printed circuit board manufacturers have to further increase the functionality of their products. Therefore the printed circuit boards have to be packed ever more tightly. The compression here not only concerns the area but also spatially because for some considerable time now printed circuit boards have been stacked or folded to achieve greater functionality. Conventional technology has already reached its limits here - or will soon do so. Completely new manufacturing processes have to be scaled up from the laboratory and made suitable for mass production, which often takes years and uses up lots of cash. A solution here is the intelligent marrying of common processes that are already able to reliably serve mass production.

Two of these technologies that have already been used for many decades are the panel plating and pattern plating processes. Conventionally, this technology has only allowed switching circuits with conductor widths and distances of less than 50 µm to a limited extent. In addition, these processes do not support all of the options for modern printed circuit board technology.

In pattern plating, a conducting copper layer is attached to the printed circuit board in a so called strike plating step. Then, using photolithography, selective plating takes place on the strip conductors, which are then covered with a metallic etch-resist - usually galvanic tin. After producing the circuit by alkaline etching, the metallic etching resist must be removed by stripping away the remaining tin. Although this aggressive stripping has little impact on the copper, it does have negative effect on the etched pattern. The smaller and more sensitive the structures, the more disturbing and noticeable this effect gets.

For panel plating or tenting, the printed circuit board is coated with all of the necessary copper and then the circuit diagram is created using photolithography. The process is simpler than pattern plating because it requires fewer process steps, is very reliable and does not require metal resist. But it has limitations when it comes to the smallest circuit and distance widths.

So a resolution of 25 µm and relevant distances can only be achieved with a very thin copper layer of around 8 µm with a photo resist of 10 µm in thickness.
Due to the maximum total copper thickness of 8 µm, no connections between layers using stacked via technology and small via in pad structures are possible - which are actually state-of-the-art. Even when using base materials with ultra-thin copper claddings, the thickness of the deposited galvanic copper layer is not sufficient to adequately fill blind holes with copper or to comply with the specifications.

Using thin-film technology, in recent years circuits have increasingly been implemented on organic substrates, such as polyimide or LCP films, as a classic semi-additive process using vacuum deposition, photolithography, electroplating as well as chemical and dry etching procedures.

With this technology, you do achieve circuit widths and distances under 15 µm but since the size is limited to 36 square inches the price is simply too high. With new processes, it may be possible to scale up this technology, but at what cost? This would require new systems engineering. Process steps, and the handling of flexible films without copper lamination would have to be improved.

In addition, the polyimide materials currently used are not available without copper lamination which must be removed before processing can start and lack appropriate photoresist. Even if larger circuits were possible by this means, the high production costs would make manufacturing unprofitable.

The disadvantages can be avoided using an intelligent combination of classical technologies. With DenciTec, Cicor has created the option of producing switching circuits with extremely high density without the disadvantages of the methods stated above. The new technology provides highly reliable circuits without restrictions on the design freedom. In addition, new base materials are available.

So the new technology enables the functional structures of the printed circuit board to be miniaturized further. For line widths and spacings, the process allows down to 25 µm, for copper thicknesses of 20 +/- 5 µm on all layers, laser via diameters of 35 µm, annular rings of 30 µm on the inner layers and 20 µm on the outer layers, copper-filled blind vias with the option of via-stacking and vias in pads, ultrathin circuits by using a 12.5 µm polyimide core material (4-layer flex circuits at a thickness below 120 µm) and all of this at the highest reliability.

With the miniaturization of the circuit diagram that this permits, new functions can be integrated without expanding the size of the printed circuit board or in the best case scenario it is possible to save up to 70% of the area on average on all layers.

High reliability is required in medicine and industry. DenciTec achieves this, is very flexible, and the product output and yield are of a size common for printed circuit board production.

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About us

CICOR – YOUR TECHNOLOGY PARTNER
Cicor is a global engineering and manufacturing service provider with innovative technology solutions for the electronics industry. With 1 841 employees at ten production sites, Cicor manufactures highly complex printed circuit boards, hybrid circuits and 3D-MID solutions and offers complete electronic assembly and plastic injection molding. The Group supplies customized solutions from design to finished product for international customers. The shares of Cicor Technologies Ltd. are listed on the SIX Swiss Exchange (CICN).

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