

Why Component Carriers Are Now Replacing Flexible PCBs



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Flexible circuit boards offer numerous advantages. However, the mechanical fixation of these circuit boards is highly complex. HARTING has developed a new solution based on 3D-MID (molded interconnect device) technology that replaces flexible circuit boards. Thanks to component carriers, some customers are seeing significant cost savings.

Flexible printed circuit boards are made of thin polyimide films and have been used for many years in a wide array of applications. Populating and assembling them, however, is complex, which has led device manufacturers to demand a better solution. This is where a newly developed component carrier from HARTING enters the picture.

A standardized component carrier for electronic components

By harnessing this new HARTING development, electronic components can be placed directly onto the component carrier, replacing flexible circuit boards. The component carrier serves as a connecting element between the printed circuit board (PCB) and electronic components such as LEDs, ICs, photodiodes and sensors.

The populated component carriers are delivered in tape and reel. In their standard design, the carriers can be processed in automatic assembly systems, just like other SMD electronic components. Two different sizes are currently available and can accommodate electronic components of standard size SOIC-8 and smaller. Moreover, HARTING can produce the carriers in customer-specific sizes.

HARTING has identified three example applications where the component carrier can replace flexible circuit boards:

- **Components at a 90° angle to the circuit board:** The component carrier is suitable for scenarios in which electrical components, such as sensors, need to be positioned at a 90° angle to the circuit board. The automatic assembly process enables the placement of temperature sensors or hall sensors on the carrier to a high degree of accuracy, which

results in precise, reproducible measurements. Another salient example is optical components, such as LEDs or photodiodes used to generate precise light barriers.

- **Clearance from the circuit board:** The component carrier also makes it possible to maintain a clearance between the circuit board and an electronic component. Consequently, a temperature sensor can be used to measure the temperature in the housing without being influenced by the excess heat from other components on the PCB. It also means that an LED can be placed clear of the circuit board, thereby avoiding the risk of surrounding components casting shadows.
- **Antenna function:** The component carrier can be manufactured using different base polymers. In this way, different antenna material properties can be factored in, such as dielectric constant and loss factor. The specific antenna layout can be used for various applications in the MHz and GHz frequency range, such as Bluetooth, WiFi, Zigbee and 5G.

3D-MID technology as an alternative to flexible PCBs

Thanks to the 3D-MID technology, electronic components can be placed directly onto a three-dimensional body without the need for circuit boards or connecting cables. The base body is produced through injection molding, whereby the thermoplastic is provided with a non-conductive, inorganic additive. In order for this material to accommodate electrical circuits, the additives in the plastic are "activated" through laser direct structuring (LDS). In this process, the laser beam writes the areas intended for the conductive tracks and creates a micro-rough structure. The metal particles released in the process form the nucleus for the subsequent chemical metallization.

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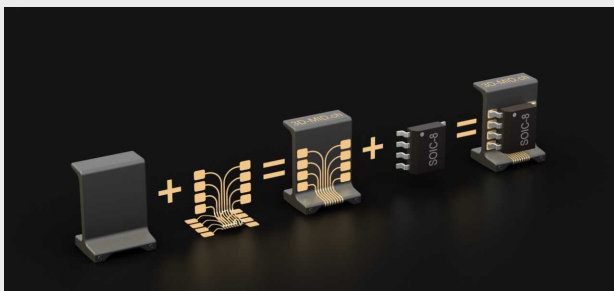
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This process creates electrical traces across the three-dimensional base body. The plastic employed offers high thermal stability and can, therefore, be soldered in the reflow oven.

HARTING has been implementing the entire 3D-MID process chain in house for over 10 years, from the project idea all the way to the populated series product. The technology is finding use in application scenarios in areas such as medical technology, industrial electronics and consumer electronics as well as safety-related components in the automotive industry. The HARTING 3D-MID business unit is the largest provider of 3D-MID components outside of Asia.

The component carrier developed by this process is suitable for various applications. It can be equipped with several sensors that, if desired, could be aligned in three directions to take measurements on three axes (X, Y, Z). Components can be placed simultaneously on two parallel surfaces on the front and back sides, as well as on the end face. HARTING has submitted a patent application for the component carrier.



The component carrier cuts costs by two-thirds and reduces turnaround times

In an automated process, HARTING fits electronic components such as LEDs, ICs, photodiodes and sensors directly on the component carrier. The total cost of the component carrier is two-thirds lower than those of flexible printed circuit board solutions. This is due to the fact that it eliminates the frequently complex handling involved with flexible printed circuit boards (e.g.,

populating, gluing and assembling). The process even delivers benefits in small volumes, as the component carrier can be used for different applications without adaptation, thereby eliminating the costs of a new injection mold. Compared to flexible printed circuit boards, this process achieves more precise component positioning, greater repeatability and better quality.

HARTING has identified another advantage of the component carrier, namely the short timeframe required to deliver finished components. Since the plastic carrier remains unchanged, specifications for the placement of the electronic components are all that is needed. Experts in 3D-MID can use this to create a production-optimized layout proposal. Adjustments of the laser program are all that is needed to tailor the electrical traces to the respective application. Once the customer has approved the product and the components have been received, initial production samples can be delivered within two to three weeks - and even faster, if necessary.

About HARTING 3D-MID

To discuss a 3D-MID application, please contact us via phone at +1 (866) 278-0306 or via email at TechSupportUS@HARTING.com.

HARTING 3D-MID offers the complete value chain for 3D-MID technologies from a single source. This includes the development/prototyping of customer-specific products, injection molding, laser direct structuring, metallization, assembly and connection technology, and final inspection. Its core business is the production of mechatronic components for automobile manufacturing, industry, medical technology and sensor systems. HARTING is the largest supplier of 3D-MID components outside of Asia. HARTING 3D-MID is a business unit of the HARTING Technology Group, headquartered in Espelkamp, Germany.

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