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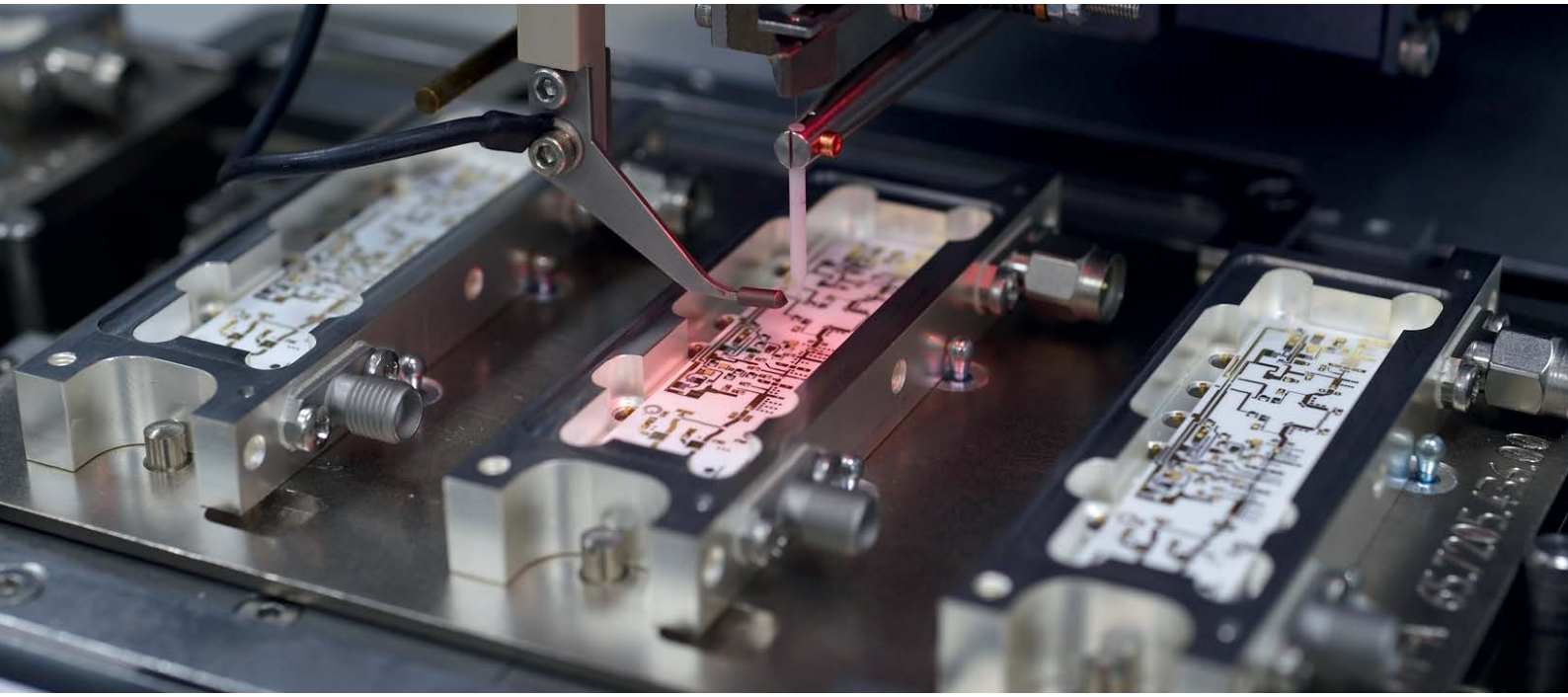
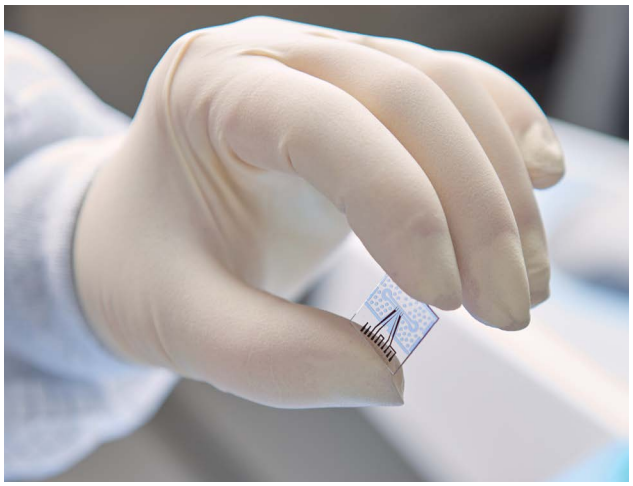


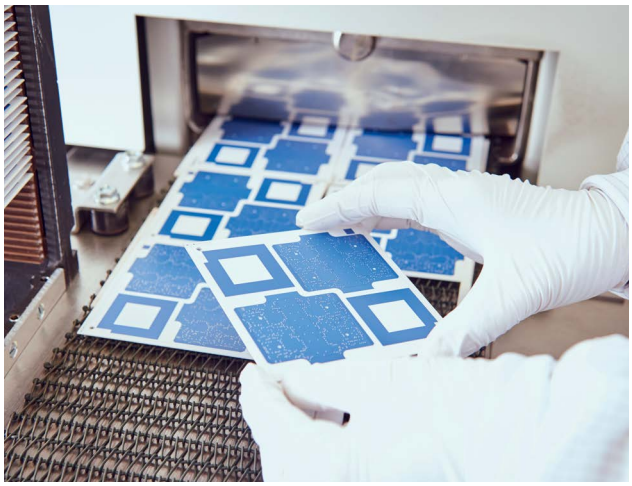
Hybrid circuits

Thin-film and thick-film substrates

Thin-film substrates are used where conventional PCB technologies cannot provide an adequate technical solution. Rigid and flexible multilayer circuits with highest resolution (10 µm) are possible. Thin-film technology uses semiconductor and microsystem technologies to produce circuit carriers on ceramic or organic materials.

The conductor tracks in the thick-film technology are applied by screen printing and then burned in. The use of ceramic as substrate enables highest reliability under the harshest environmental conditions. A thick-film circuit is clearly superior to the standard PCB in terms of temperature resistance and service life.





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Portfolio

Thin-film substrates

- **Rigid thin-film substrates:** For decades, thin-film substrates based on rigid substrate materials have been produced and used for applications such as space travel, radar technology and sensor systems. In addition to the standard material Al_2O_3, which is available in various grades, aluminum nitride is also becoming increasingly more common, particularly in applications requiring increased thermal conductivity. Circuits are also produced on ferrite material or even glass, for example, which can be adapted to a wide variety of applications.

- **Flexible thin-film substrates:** In the field of flexible thin-film substrates, the technologies and processes used for manufacturing circuits are the same as those used for rigid substrates. However, the emphasis here is on the use of organic materials, which are either processed from the liquid phase as insulators (or substrates) or which may already be present as film material. In this area, various forms of polyimide or LCP (liquid crystalline polymer) are primarily used as substrate material. When it comes to flexible substrates, the range of material thickness extends from a few micrometers up to several 100 µm, for example in LCP-based multilayer circuits.

Thick-film substrates

Thick-film technology is a highly sophisticated technology for the production of substrates that has been in use for decades. The conductor tracks are applied by screen printing and then burned in. The use of ceramic as substrate enables highest reliability under the harshest environmental conditions. Thick-film circuitry is clearly superior to PCBs in terms of temperature resistance and service life. The main advantages of this technology lie in the use of ceramics as wiring carriers with excellent thermal conductivity properties, the realization of printed resistors over a wide spectrum (mOhm to GOhm) with the possibility of producing any value with the aid of laser alignment. The possibility of active adjustment of thick-film resistors after component assembly is also advantageous.

Main advances include:

- Development of new printing pastes to improve the resolution of lines and vias, better adaptation of the coefficients of expansion of dielectric pastes to the substrate material.
- Improvement of the printing screens or stencils (finest fabric up to 500 mesh, calendered fabric).
- Improvement of the printers (fully automatic with camera adjustment) and curing ovens (improved temperature accuracy, better profile constancy).
- Photolithographic structuring of printed guide surfaces or laser structuring of conductor paths in order to minimize line and space widths extremely (up to approx. 30 µm).

Markets

- Industrial
- Medical
- Aerospace and defence
- Watches and consumer
- Automotive and transport
- Communication

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