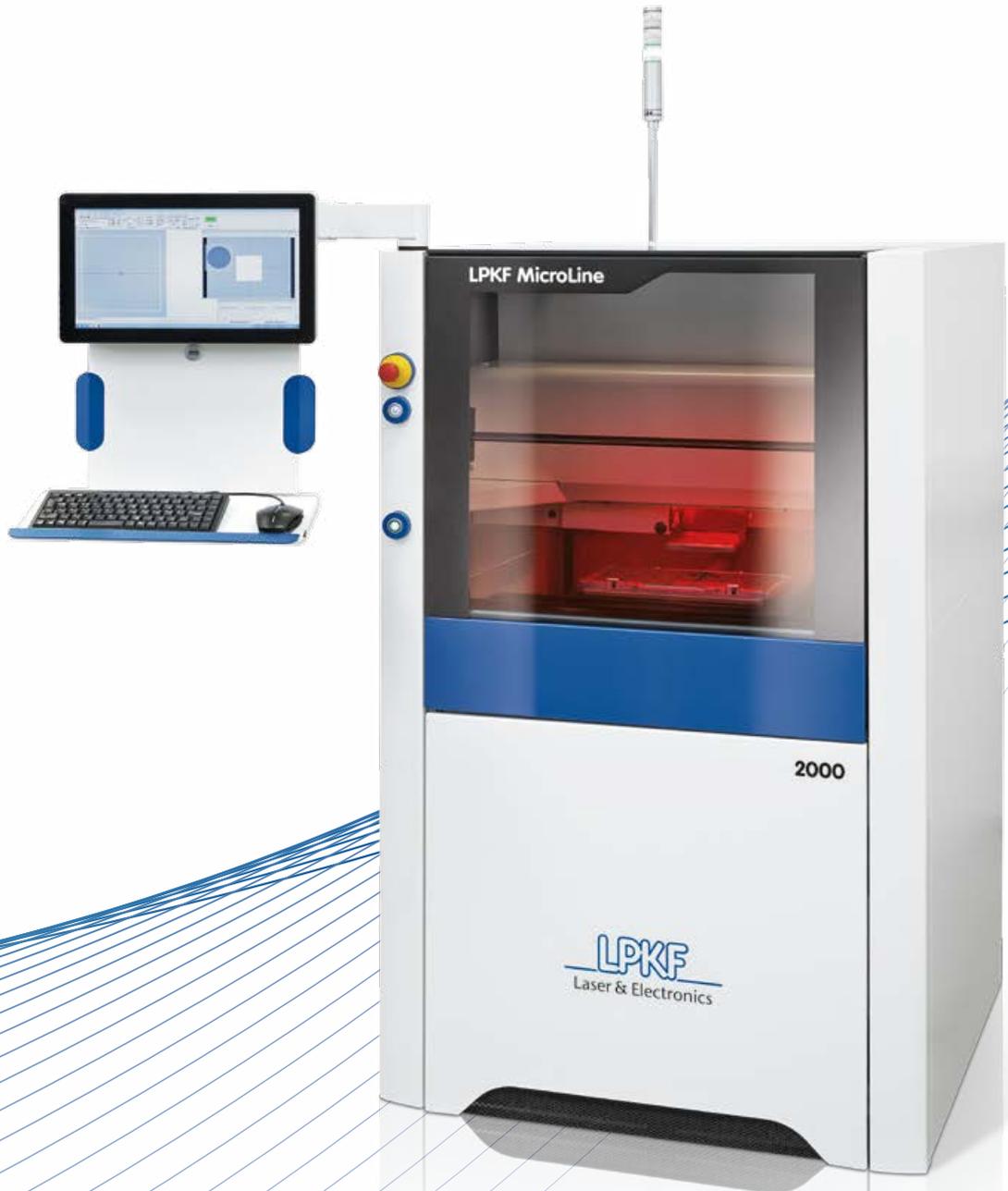


# Precision Cutting of Printed Circuit Boards and Cover Layers

## UV Laser Cutting with LPKF MicroLine 2000 Systems



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## Beaming Cutting-Edge Technology

LPKF UV laser cutting systems quickly, cleanly, and precisely process even highly complicated tasks on printed circuit boards (PCBs). The new MicroLine systems are built on the solid track record of their successful predecessors. They are available in different configurations, customized for the cutting of populated and unpopulated rigid PCBs, as well as flex circuits and cover layers.

### **No Stress, no Burrs, no Particles**

The LPKF MicroLine 2000 systems incorporate advances in laser technology and mechanical engineering for precision cutting and separating of rigid, rigid-flex and flexible PCBs and cover layers.

The MicroLine 2000's UV laser source cuts even complex contours with minimal tolerances. Cutting data can be imported directly from your PCB layout software.

Laser cutting leaves virtually no burrs or particles and does not mechanically stress the material or components.

The heat-affected zone is very small, affecting only the edge of the material.

Particles from the laser cut are cleanly removed by the machine's exhaust system.

- Precision cutting of complex contours
- Working area of up to 350 mm x 350 mm (13.8" x 13.8")
- Low energy and space requirements
- Easy to operate
- Different laser sources available

### **Low Investment and Operating Costs**

The MicroLine 2000 systems are designed for production depaneling and PCB processing. Laser cutting reduces the expense of the consumables typical with mechanical cutting solutions. Additionally, the systems have low energy consumption and take up minimal production floor space. Fixturing is also designed to be simple and economical – either with the MicroLine 2000 P, which is equipped with a vacuum table, or with the S or Ci models, which are intended for inexpensive application-specific fixtures. The MicroLine 2000 Ci is designed as an in-line system.

### **Vision System**

An integrated vision system quickly aligns to programmed fiducial and alignment points. A variety of fiducial options can be used as well as edge detection of routed areas. Calculations can be performed on fiducial data to mitigate rotation and distortion within the material and to even out tolerance differences, thus increasing production yields. The high-speed table, coupled with the new fiducial recognition system, results in superior processing times.

### **Flexible Production**

If the cutting data changes in the circuit board layout, the new contour can be produced quickly on the MicroLine 2000 systems. UV laser cutting creates new freedom in production planning, from prototypes to manufacturing – production on demand.

### **Easy Programming and Setup**

The core of a laser cutting system is its software. The MicroLine 2000 systems include field-tested CAM software. LPKF CircuitMaster software is optimized for processing speed and intuitive operation, allowing you to import files directly from your design software and storing projects for easy access on the production floor. CircuitMaster provides for various user levels, from one button operation to complete access to all process parameters.

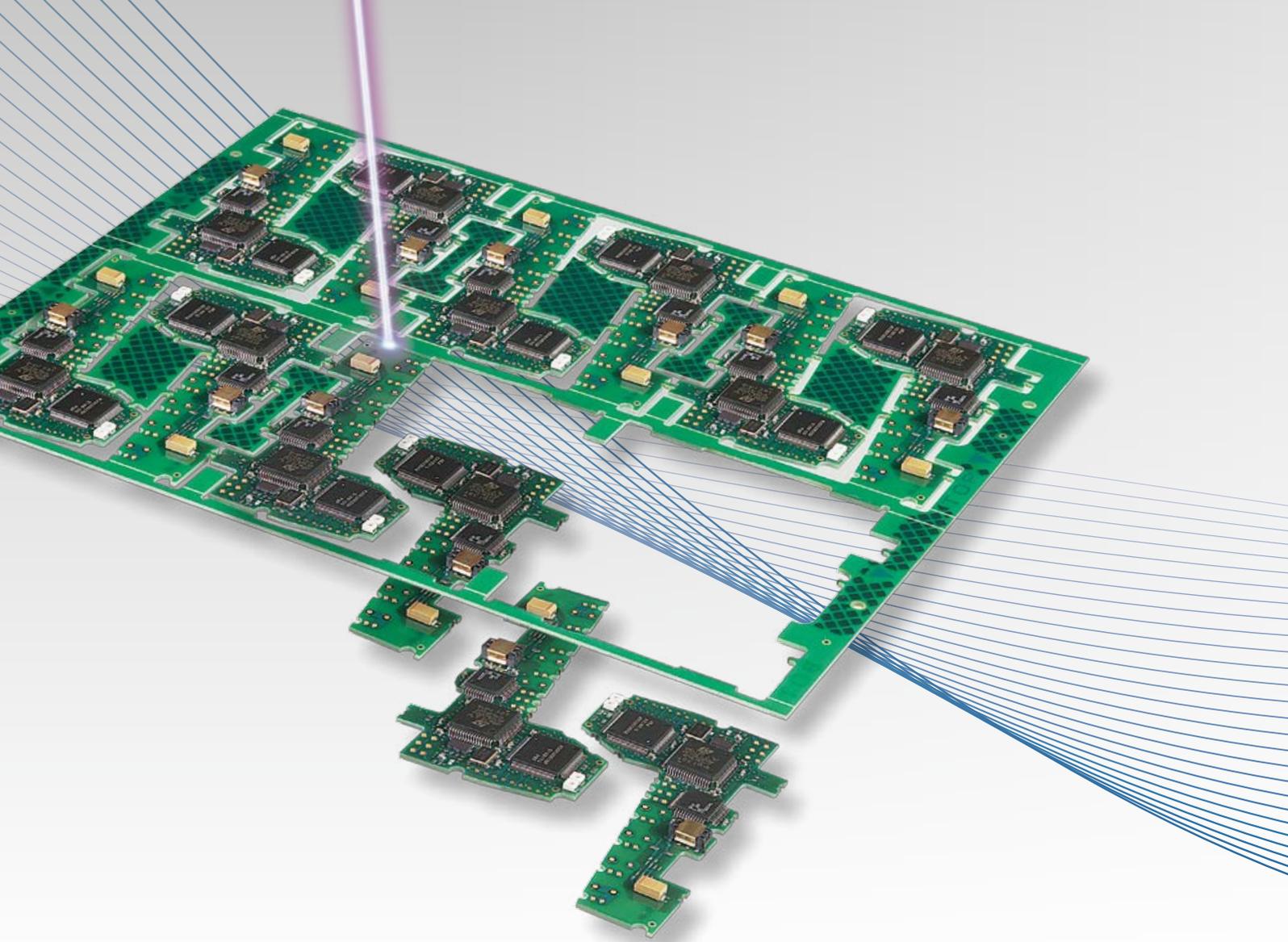
All MicroLine 2000 systems incorporate a fully automated hood and viewing window. This provides a safety interlock to ensure operator safety and a full laser class 1 enclosure while the laser is on.

### **Traceability Package**

The MicroLine 2000 systems are able to write and read marks such as 1D and 2D codes on the substrate. For small parts especially, the laser is the best tool to mark brands permanently and to identify your components, eliminating consumables to save money. The traceability package supports logging as well as good/bad board recognition and processing.

### **Laser Power Options**

LPKF builds and implements a proprietary line of UV lasers designed specifically for the needs of laser cutting and PCB processing in the electronics industry. The MicroLine 2000 family can be equipped with 10 watt or 15 watt UV lasers. The 10 watt source is most effective at cutting through flex, rigid flex, and rigid materials up to a thickness of around 0.8 mm. The 15 watt laser not only increases throughput on these materials, but can handle thicknesses of up to 1.6 mm or higher (depending on substrate).



# MicroLine 2000 S and Ci – Cutting Assembled Circuit Boards

## Stress Free Cutting

The UV laser cuts with minimal thermal stress and no mechanical stress. Higher density arrays increase throughput while the lack of stress on the board works to increase yield.

Populated boards are easily processed with custom fixtures on the MicroLine 2000 S and Ci systems. Simple and inexpensive production fixtures can be made to depanel boards that have components on both sides of the substrate.

The MicroLine 2000 S and Ci systems provide clean cuts in FR4, FR5, and CEM materials. Further materials include polyesters, ceramics and other RF-materials.



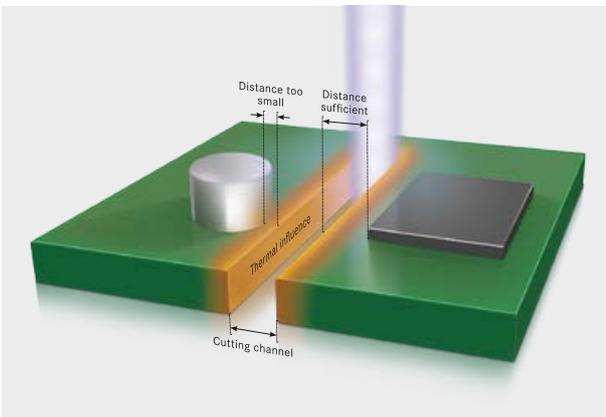
LPKF MicroLine 2000 S

- Stress-free cutting
- Close to tracks or components
- Optimal utilization of the substrate
- Highly dynamic XY-table for custom fixtures



### Perfect Integration in Production Lines

The MicroLine 2000 Ci features integrated feed conveyors and SMEMA-compatible interfaces. The system's architecture allows for transportation of the applications through the machine.



The laser beam creates minimal cutting channels with a very small heat-affected zone. The diameter of the focused laser beam is just 20  $\mu\text{m}$ .



High quality UV laser depaneling ensures clean cutting channel side walls. Compared to  $\text{CO}_2$  laser processing, carbonization is virtually eliminated, increasing the breakthrough voltage threshold.

# MicroLine 2000 P – For Flex PCBs, Cover Layers, and Unpopulated PCBs

## Growing with the Tasks

The LPKF MicroLine 2000 P is optimized for processing of unpopulated materials. The integrated homogenous exactly levelled vacuum table creates a simple and effective fixturing platform. The easy-to-use software and programmable tool path allows a quick setup and production for projects of all sizes. Such as:

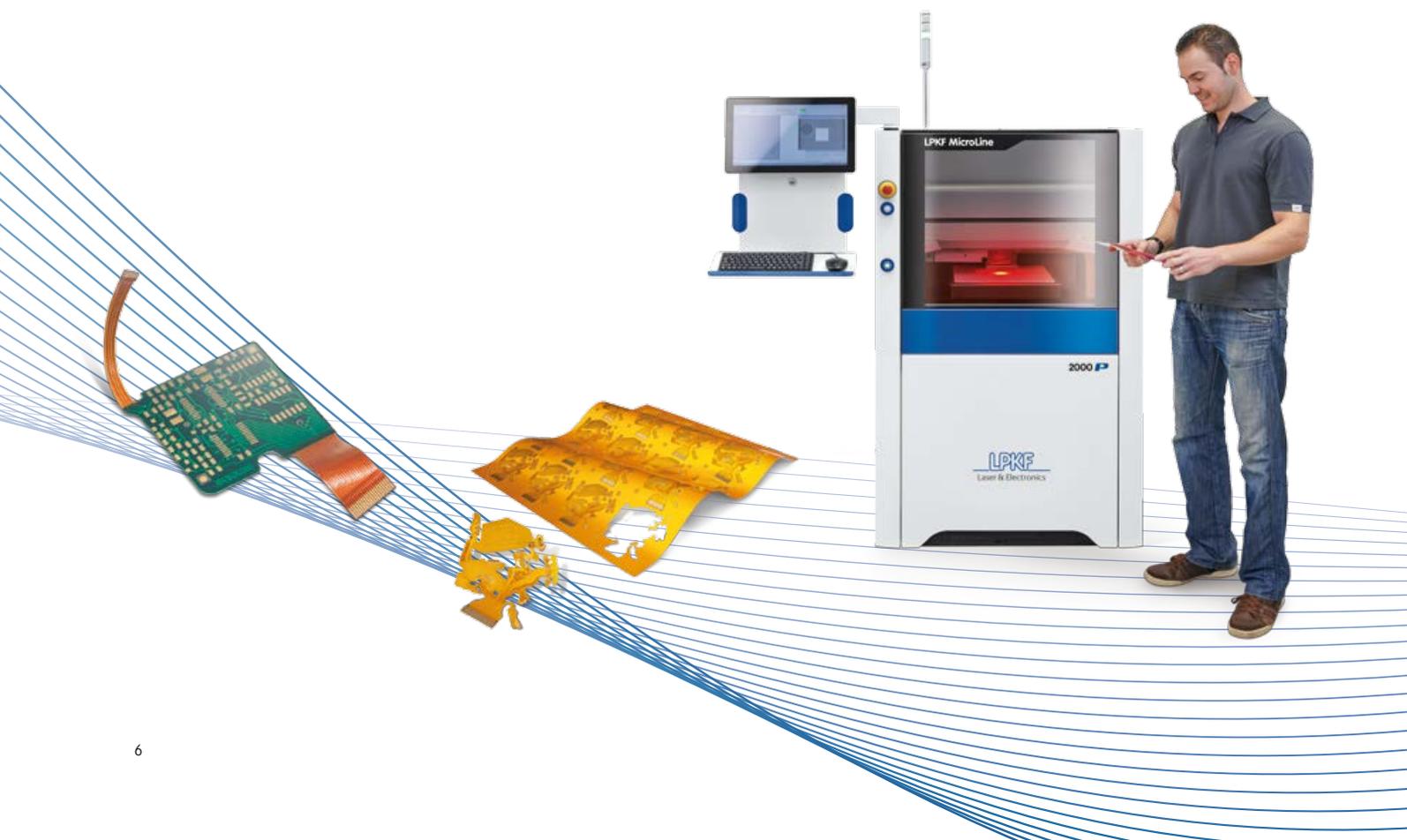
- Separating or cutting of thin flexible substrates, with or without conductor networks (e. g., cover layers and flex circuits)
- Hole cutting in rigid or flex materials
- Pocket creation in various substrates

Precision is the main focus: UV laser cutting allows for maximum use of the base material and production time. The narrow beam width requires minimal space for tool paths and eliminates buffer zones for mechanical stress – making it possible to add more boards per panel.

## Drilling, Cutting and Ablation

In addition to cutting /drilling the laser can be programmed to ablate a defined amount of material to reach a desired depth. Furthermore, delicate operations such as skiving and decapping are also possible with this versatile tool.

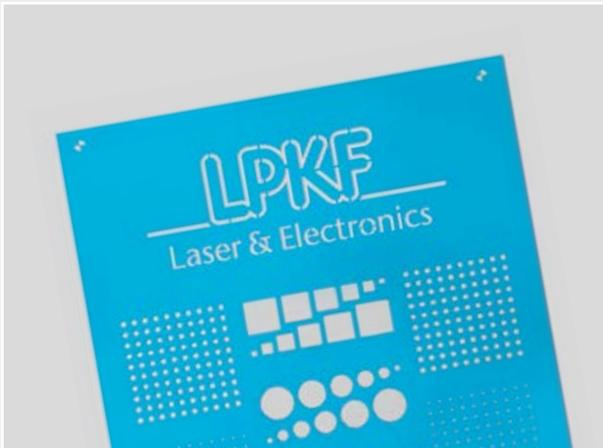
- Complex contours in organic and inorganic material
- Stress-free cutting, drilling and ablation
- No dust, no burr
- Precision vacuum table



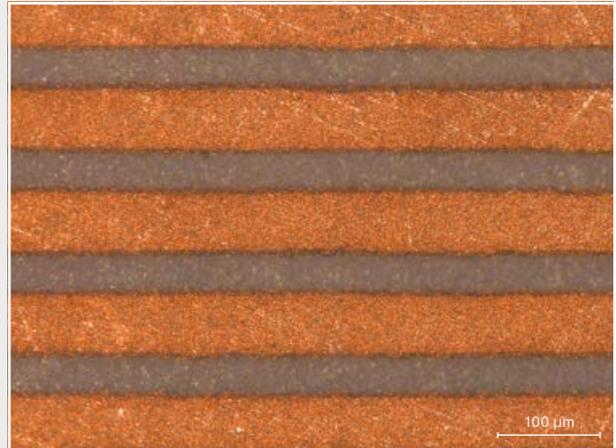
## Additional applications for UV Laser Systems

LPKF UV Laser cutting systems are used extensively in the cutting of PCB materials.

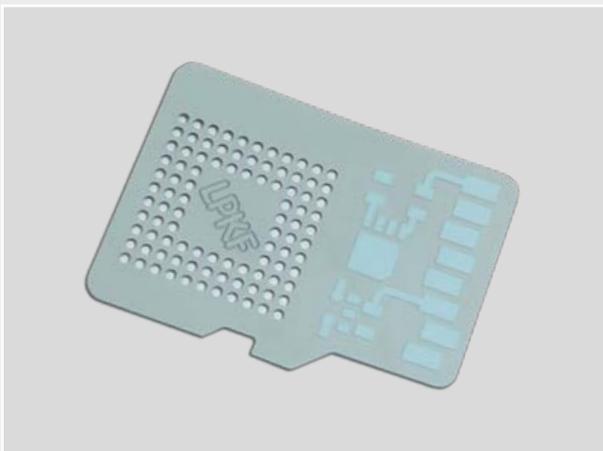
Other applications include:



Scoring, drilling and cutting of fired ceramics



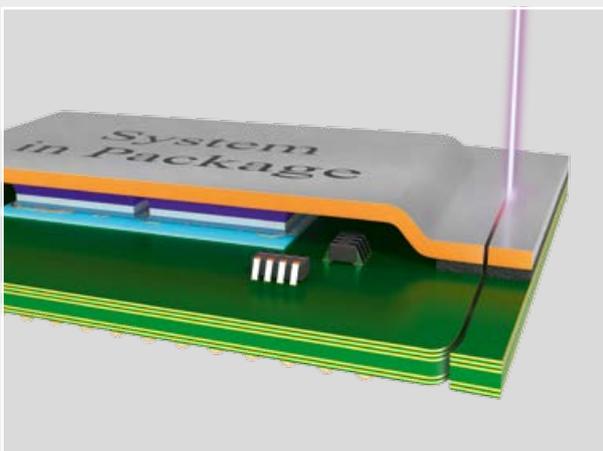
High-precision structuring of metal layers on ceramics



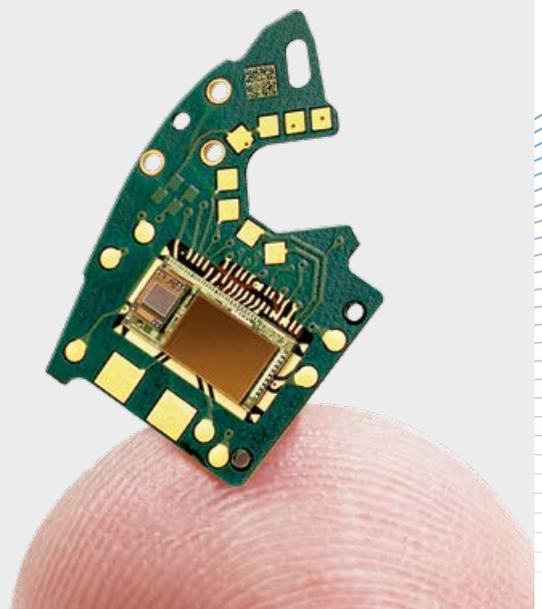
Cutting, drilling and engraving of unfired ceramic (green tape)



Processing of TCO/ITO layers without damaging the substrate



Singulating IC Packages such as Multi-Chip-Modules (MCM) and System-in-Package-Modules (SIP): Curved cuts through compound materials that include thermosetting plastics, FR4 and copper.



## Laser Cutting with Worldwide Support

LPKF supports global users of its MicroLine UV laser systems from its application centers in Germany, the USA, Japan, Korea and China. Users can benefit from LPKF's technical expertise and many years of experience in laser material processing, as well as having access to new processes and new applications. User training for technical employees and special consulting services complete the offer from the world market leader in PCB laser processing.

Technical Data: LPKF MicroLine	2000 P	2000 S	2000 Ci
<b>Laser class</b>	1		
<b>Max. working area (X x Y x Z)</b>	350 mm x 350 mm x 11 mm (13.8" x 13.8" x 0.4")		300 mm x 250 mm x 11 mm (11.8" x 9.8" x 0.4")
<b>Max. recognition area (X x Y)</b>	300 mm x 300 mm (11.8" x 11.8")		300 mm x 250 mm (11.8" x 9.8")
<b>Max. material size (X x Y)</b>	350 mm x 350 mm (13.8" x 13.8")		300 mm x 250 mm (11.8" x 9.8")
<b>Max. assembly height (Z)</b>	27 mm (1.1"), 4 mm (0.1")**	27 mm (1.1"), 7 mm (0.3")**	27 mm (1.1"), 7 mm (0.3")**
<b>Data input formats</b>	Gerber, X-Gerber, DXF, HPGL, Sieb & Meier, Excellon, ODB++		
<b>Max. structuring speed</b>	Depends on application		
<b>Max. moving speed (table)</b>	1 000 mm/s (39.4"/s)		
<b>Positioning accuracy</b>	± 25 µm (1 Mil)		
<b>Diameter of focused laser beam</b>	~ 20 µm (0.8 Mil)		
<b>Laser wavelength</b>	355 nm		
<b>System dimensions (W x H x D)</b>	875 mm x 1 530 mm x 1 300 mm (34.5" x 60.2" x 51.2")*		
<b>Weight</b>	~ 450 kg (990 lbs)		
<b>Operating conditions</b>			
<b>Power supply</b>	230 VAC, 50 – 60 Hz, 3 kVA		
<b>Cooling</b>	Air-cooled (internal water-air cooling)		
<b>Ambient temperature</b>	22 °C ± 2 °C @ ± 25 µm / 22 °C ± 6 °C @ ± 50 µm (71.6 °F ± 3.6 °F @ 1 Mil / 71.6 °F ± 10.8 °F @ 2 Mil)		
<b>Humidity</b>	60 % (non-condensing)		
<b>Compressed air</b>	-		6 bar
<b>Required accessories</b>	Exhaust unit, 320 m <sup>3</sup> /h	Exhaust unit, 320 m <sup>3</sup> /h, production fixture	

\* Height incl. StatusLight = 2 020 mm (79.5")

\*\* Excluding handling system

**MicroLine 2000 series systems feature multiple variations: MicroLine 2120 P (10 watt laser source) and MicroLine 2820 P (15 watt laser source), MicroLine 2120 S / Ci (10 watt laser source) and MicroLine 2820 S / Ci (15 watt laser source).**

### Worldwide (LPKF Headquarters)

LPKF Laser & Electronics AG Osteriede 7 30827 Garbsen Germany  
Phone +49 (5131) 7095-0 info@lpkf.com www.lpkf.com

### North / Central America

LPKF Laser & Electronics North America  
Phone +1 (503) 454-4200 sales@lpkfusa.com www.lpkfusa.com

### China

LPKF Tianjin Co., Ltd.  
Phone +86 (22) 2378-5318 sales.china@lpkf.com www.lpkf.cn

### Hong Kong

LPKF Laser & Electronics (Hong Kong) Ltd.  
Phone +852-2545-4005 hongkong@lpkf.com www.lpkf.com

### Japan

LPKF Laser & Electronics K.K. Japan  
Phone +81 (0) 3 5439 5906 info.japan@lpkf.com jp.lpkf.com

### South Korea

LPKF Laser & Electronics Korea Ltd.  
Phone +82 (31) 689 3660 info.korea@lpkf.com www.lpkf.com

LPKF Laser & Electronics AG sells and markets products and provides support in more than 50 countries. Find your local representative at [www.lpkf.com](http://www.lpkf.com).



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