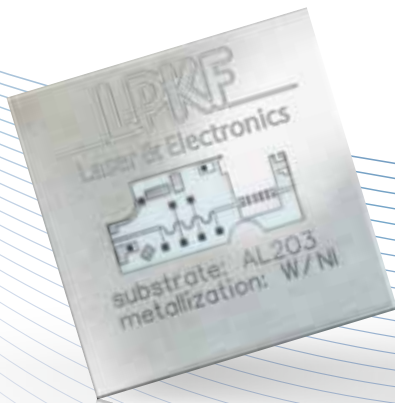


The Swiss Army Knife of the Laboratory  
Micro-Material Processing with the  
LPKF ProtoLaser U3





Size of printed board: 25 x 25 mm (0.98" x 0.98")  
Substrate: AL203  
Metallization: W/Ni/Cu/Ni/Au or W/Ni  
Structuring time: < 20 min

# The Multipurpose Tool for Micro-Material Processing

One system, many applications. The LPKF ProtoLaser U3 creates applications for product development that were previously only possible with the help of large, industrial systems. The machine's UV laser processes nearly all materials, including laminated substrates. The system is easy to install and even easier to operate, which makes it a popular research and development tool at an attractive price.

## Faster Production

The ProtoLaser U3 shows how quickly applications can be processed. For example, a UV laser beam easily and precisely separates individual circuit boards from large printed boards, cuts LTCC and prepregs, drills holes and microvias or structures FR4 substrates. The high pulse energy of the UV laser eliminates residue from the ablation process, resulting in geometrically exact contours. Switching between products is hassle free; the system simply requires the new project file to be loaded, offering maximum flexibility.

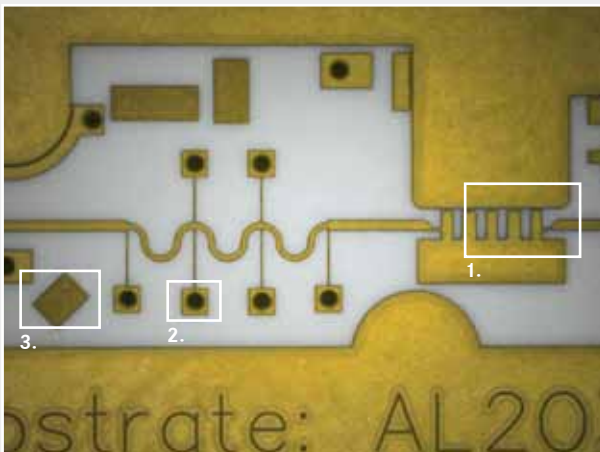
## Minimal Requirements, High Performance

The LPKF ProtoLaser U3 requires only an electrical connection, dust extraction and compressed air – and then things can take off. It will go through any laboratory door and can be easily moved on its rollers.

## Broad Range of Materials

Ceramic, LTCC (green tape), FR4, Rogers, protective sheets and metal foils or flexible and flex-rigid materials: the LPKF ProtoLaser U3 can process the most varied materials quickly, cleanly and precisely.

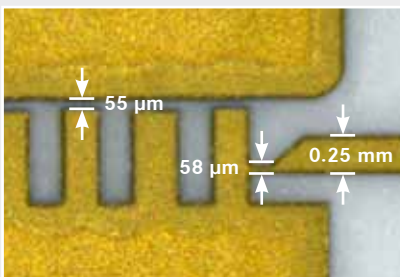
- Structure laminated substrates
- Cut rigid, flex-rigid and flexible materials
- Drill and separate ceramics
- Structure TCO/ITO
- Cut LTCC



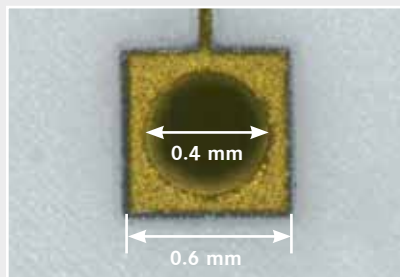
### Impressive Results with the LPKF ProtoLaser U3

Laser-structured printed boards trump etched printed boards on important criteria such as repeat accuracy, exact geometry and conformity with simulation results, especially in the RF range.

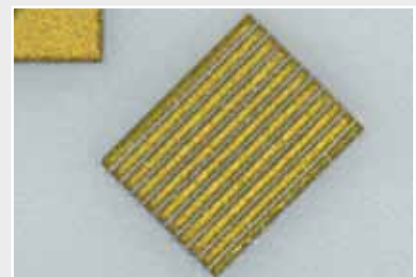
The pictured printed board with dimensions of 25 x 25 mm (0.98" x 0.98") shows a test pattern with demanding RF structures on ceramics. The structuring was done in just a few minutes!



1. The ProtoLaser U3 achieves high detail accuracy even when mapping complex geometries.



2. Drill hole with a diameter of 0.4 mm and a quadratic pad.



3. Ultra-fine structures and clearances: line/space 50/25 µm at an angle of 135°.

### Advantages of Laser Processing

The LPKF ProtoLaser U3 opens up a host of new options for product development. If you are doing your own prototyping, it can process unusual materials, deal with a complex substrate structure and is ideal for multi-layer production.

The laser process itself stands out from competing processes due to its high flexibility and fast processing. The laser uses no environmentally hazardous chemicals, requires no masks and keeps outlay for tool production to a minimum. The laser works contact-free and therefore can also be used with sensitive materials.

The ProtoLaser U3 can make prototypes of a quality that meets or even exceeds that of industrial processing. It is also suitable for small series production and for production of individual components with high variance.

- Simple job preparation
- Quiet and compact
- Multifunctional use
- With high-performance CAM software





# The Compact Laser Laboratory

Genuine innovation with proven results: The ProtoLaser U3 combines the processing options of its predecessor, the ProtoLaser U, with those of the ProtoLaser S, which is still available. The functionality of the previous UV laser system was utilized in its entirety and further developed. A special low-maintenance laser source serves as the foundation for this universal tool for micro-material processing. In addition, LPKF has implemented routines for structuring laminated substrates. Until now, these functions were reserved for the ProtoLaser S.

## Easy Operation

All LPKF laser systems are designed for ease of use. The LPKF software included in delivery easily converts all current layout data formats into production data. Usually a mouse click suffices; field-proven process parameters have already been stored for many applications. The administrator mode allows full control of all system settings.

## Compact and Safe

The LPKF ProtoLaser U3 processing area prevents accidental intervention in the working process. The laser switches off as soon as the processing area is opened. During ongoing operation, the system corresponds to laser class 1 - no protective measures required. The LPKF ProtoLaser U3 fits through any laboratory door on its rollers and requires only dust extraction, an electrical connection and compressed air.

## Small Series and Prototypes

In addition to its flexibility, the ProtoLaser U3 offers impressive repeat accuracy. The optimal focal position of the laser is set automatically, with a camera locating the position of the workpiece on the basis of fiducials. The integrated vacuum table also reliably fixes flexible and thin substrates, making the LPKF ProtoLaser U3 an ideal solution for prototyping and for small series production on demand.



For structuring of laminated substrates, the hood on the right replaces the standard hood (left). The standard hood comes with a vector lighting for better recognition of circuitry edges or fiducials. Changing the hood is an easy plug & play procedure.

# High Level Material Processing

## Cutting

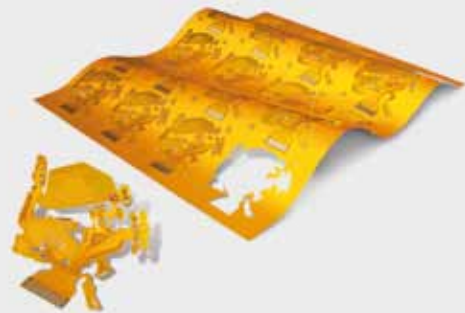
The ProtoLaser U3 cuts a multitude of materials: stress-free, with flexible contours, populated or unpopulated. The precisely focused laser beam produces clean edges – the material that is struck vaporizes in a fraction of a second virtually without residue. The laser beam also scores or cuts through individual layers or thin material compounds without mechanical influence.



Precise cuts in sensitive materials (aluminum nitride).



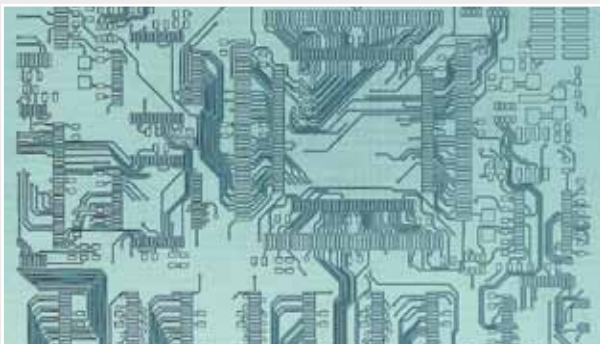
Separation of flexible printed board materials without specific holding devices using the integrated vacuum table.



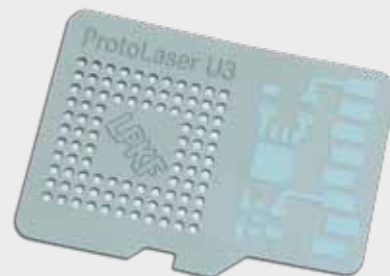
Separation of individual interconnect devices and populated circuit boards from larger panels.

## Structuring

The LPMK ProtoLaser U3 is ideally suited for structuring metallic and organic resists. The precisely calibrated laser beam produces ultra-fine structures with the highest accuracy. In addition, it also opens up solder resists and protective sheets.



Tin-resist exposure forms the basis for ultra-fine circuit boards in the etching process.



Sensitive low-temperature co-fired ceramics (LTCC) are reliably structured by the UV laser beam. The ProtoLaser U3 can cut and structure these materials in a single step.

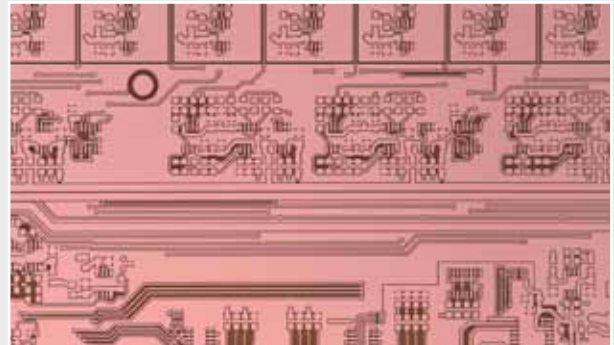
## Laminated Substrates

The LPKF ProtoLaser U3 is the only UV laser system worldwide that can also structure laminated substrates. The UV laser system has become even more precise and fine. It produces ultra-fine conductors with a line width/distance of  $70\ \mu\text{m}$  /  $30\ \mu\text{m}$  and gently remove large metal surfaces at the same time. This system is therefore recommended for all applications that require highly precise geometry, high repeat accuracy and layout data protection.

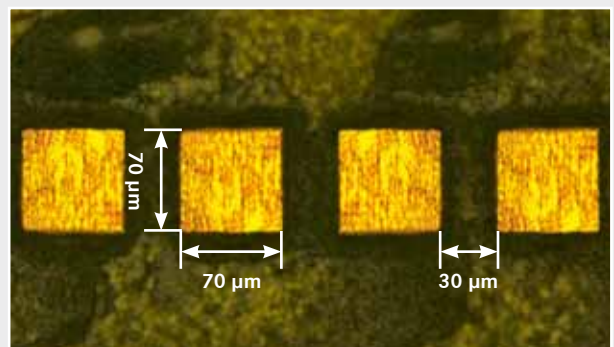
The LPKF ProtoLaser U3 structures laminated substrates such as FR4 or Rogers 4350 in two steps: First, it produces the contours of the conductor path structure; then it removes the remaining copper surfaces using reduced power. For this process, a specialized hood is required which, along with the dust extraction, also has a compressed air feature. Both hoods and the LPKF CAM software are included in delivery.

The UV laser offers several processing options. For example, it can cut the holes for throughplating two- or multi-layer printed boards. For through holes, the substrate layer, as well as the upper and lower metallization layer, are cut through. In the case of blind vias for contacting internal multi-layers, the lower metal layer is preserved. The laser stops upon reaching this level and only roughens the metal layer.

The LPKF ProtoLaser U3 is also useful for separating individual printed boards from large panels. Conventional processes such as milling, sawing or manually separating breakout tabs mechanically stress the printed board. The ProtoLaser U3 separates rigid, flex-rigid and flexible printed boards in close proximity to conductive structures or equipped components, without mechanical forces affecting the cutting channel or its surroundings.



As a rule, laser structuring is a negative process: The laser removes metal layers on both sides of the desired strip conductor. The remaining portion of the metallization forms the conductive structures.



Even with  $18\text{-}\mu\text{m}$  copper coating, a pitch of  $100\ \mu\text{m}$  is possible (line  $70\ \mu\text{m}$  / gap  $30\ \mu\text{m}$ ).



Holes and blind vias: drilling in HDI circuit boards with a minimum diameter of only  $50\ \mu\text{m}$ . The laser beam vaporizes the copper layer and then the substrate. With blind vias, the inner layer is only lightly roughened.

## PCB Prototyping with Worldwide Support

Users of LPKF prototyping laser systems can rely on global application centers in Germany, the USA, Japan and China for assistance. Application centers provide access to LPKF's many years of experience in laser material processing and offers expert counsel on technical questions, new processes and applications. Along with structuring lasers, LPKF offers a wide range of systems and processes that make functional, close-to-production printed boards out of structured boards.

### Technical Data: LPKF ProtoLaser U3

<b>Max. material size and layout area (X/Y/Z)</b>	229 x 305 x 10 mm (9" x 12" x 0.4")
<b>Laser wavelength</b>	355 nm
<b>Diameter of focussed laser beam</b>	15 µm (0.6 mil)
<b>Accuracy*</b>	2 µm (0.08 mil)
<b>Repeatability</b>	± 2 µm (± 0.08 mil) <sup>a</sup>
<b>Dimensions (W x H x D)</b>	875 mm x 1,430 mm x 750 mm (34.5" x 56.3" x 29.5") <sup>b</sup>
<b>Weight</b>	260 kg (573 pounds)
<b>Operating conditions</b>	
<b>Power supply</b>	110/230 V, 50–60 Hz, 1.4 kW
<b>Compressed air supply**</b>	8 bar (116 psi), 160 l/min (5.66 cfm)
<b>Cooling</b>	Air cooled (internal cooling cycle)
<b>Ambient temperature</b>	22 ± 2 °C (68 °F ± 4 °F)
<b>Required accessories</b>	Exhaust unit, PC, compressor**
<b>Hardware and software requirements</b>	Microsoft® Windows® 2000/XP/7, 700 MHz processor or higher, min. 512 MB RAM (1 GB recommended), screen resolution min. 1024 x 768 pixels, USB 2.0

a This value reflects direct repeated movements of the laser beam

\* Resolution scanfield

b Height with open working door 1,730 mm (68.1")

\*\* Required only when working with laminated materials



In normal operation, the system is classified as a Class 1 laser product.

In maintenance mode, it is classified as a Class 4 laser product.

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