

Cost-Effective Entry into  
Laser Direct Structuring (LDS)  
LPKF Fusion3D 1100



A simple plastic clip integrates conductive paths and becomes a smartphone antenna: the LPKF LDS process leads to new product designs and introduces new and efficient forms of production - from a single component to mass production.



# Introducing New Manufacturing Methods for 3D Circuitry

Smaller, more complex, more compact. Modern electronics present manufacturers with great challenges. LDS components offer an effective way to overcome these challenges, turning simple plastic components into high-quality 3D interconnect devices. The LPKF Fusion3D 1100 provides cost-effective access to this technology, and is ideal for small batches or 3D prototyping.

In today's electronics labs, an increasing number of functions must be accomplished in a constantly dwindling space. As a result, components like plastic clips, panels and housing parts, which previously served a purely mechanical purpose, are now taking on electronic functions. Injection moldings are the basis for these three-dimensional interconnect devices, also known as molded interconnect devices (MIDs).

Laser direct structuring (LDS) has attained a market share of more than 50 percent among production methods, and the trend is rising. For example, at the beginning of 2010 a production capacity of 60 MM smartphone antennas was installed. This capacity rose at the beginning of 2011 to 180 MM. Other markets are experiencing rapid growth including the automotive industry, medical technology and the consumer field.

The LPKF Fusion3D 1100 provides a cost-effective and flexible entry into this rapidly growing technology.

## The LDS Process

Components are produced from plastic with additives in a single-component process for laser direct structuring. Every major manufacturer offers LDS plastics. A newly developed LDS-graded lacquer, LPKF ProtoPaint LDS, provides the same properties for laser structuring.


The laser structures the surface inside a machining cube and roughens it, activating the additive. Rotating the component and tracking the laser focus during the machining process adds true three-dimensionality.

First copper is deposited on the activated structures in a current-free metallization process. If necessary, nickel and gold are deposited in additional baths.



# Cost-Effective, Entry-Level LDS Technology

Laser direct structuring has been tried and tested in a broad range of products. LPKF is contributing to this innovative technology's continued growth with a new entry-level system, the LPKF Fusion3D 1100.

A close-up photograph of the LPKF Fusion3D 1100 laser structuring machine. A bright red laser beam is directed at a small, white, rectangular component mounted on a metal fixture. The machine's housing is dark grey with various adjustment knobs and a yellow safety light. The background is a light, neutral color.

The LPKF Fusion3D 1100 laser structurer lowers the price threshold for entering the 3D interconnect device market. It can be used for manufacturing small and medium volumes or for prototyping without removing high-volume systems from production.

- Flexible, compact, lab-fit
- Fusion3D machining laser
- For prototypes and small batches

### **Built-In Flexibility**

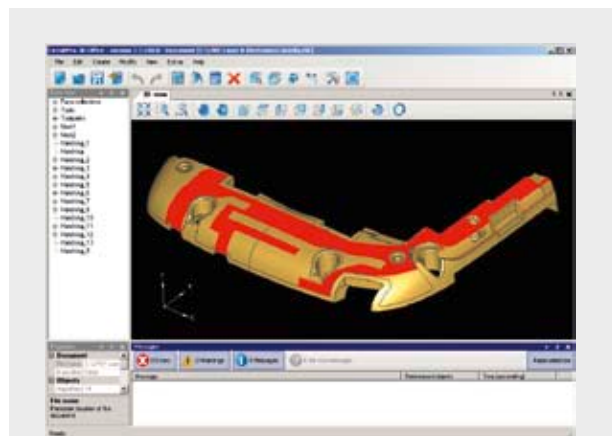
The LPKF Fusion3D 1100 features a solid granite base and casters that allow it to be easily moved around. This design combines efficient components with a compact design suitable for lab use. The basic version of the LPKF Fusion3D 1100 features a large, height-adjustable work surface to which the customer's fixtures can be attached. A pilot laser helps align the components.

### **Proven Technology**

The LPKF Fusion3D 1100 uses the same laser processing unit as the mass-production system, the LPKF Fusion3D 6000. The CAM software, production parameters and structuring area are identical and the parameters detected by the Fusion3D 1100 can be copied directly to the production system.

### **Fusion3D 1100 for 3D Prototyping**

The large working platform with z-axis travel is excellent for prototyping, and can also be used to produce small and medium batches. The Fusion3D 1100 can be equipped with customer jigs or actuators for aligning the pieces to be laser processed.



### **Converting Data with Ease**

CAD data are used as a basis for the laser structuring of 3D circuit boards. Volume models from 3D layout programs include the component information and surfaces to be structured.

The data acquisition and processing of structuring jobs is carried out by LPKF CircuitPro3D software, which interprets data and optimizes the structuring process. Complex layouts can be split into individual sub-projects to allow laser-structuring in different angular positions.

# Near-Series Prototyping

There are several prototype stages between designing an MID component and launching production, for decision making, assembly studies or to generally accelerate product development. It's important to create prototypes as close to series as possible, an often time-consuming and costly process. The LPKF Fusion3D 1100 and associated prototyping methods allow functional prototypes to be built in one day, without taking up production systems.



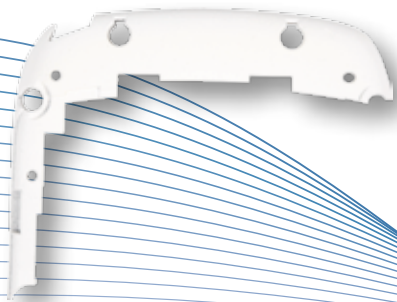
## Constructing the Base

Rapid advances in 3D printing methods allow components to be manufactured directly from CAD data – without molds. Stereolithography, laser sintering or FDM (Fused Deposition Molding) are used layer by layer to build the blank from the design data.



## Applying an LDS Lacquer

LPKF has developed a paint with LDS additives which can be laser activated. After applying and curing the paint, the component can be processed just like any conventional LDS component.



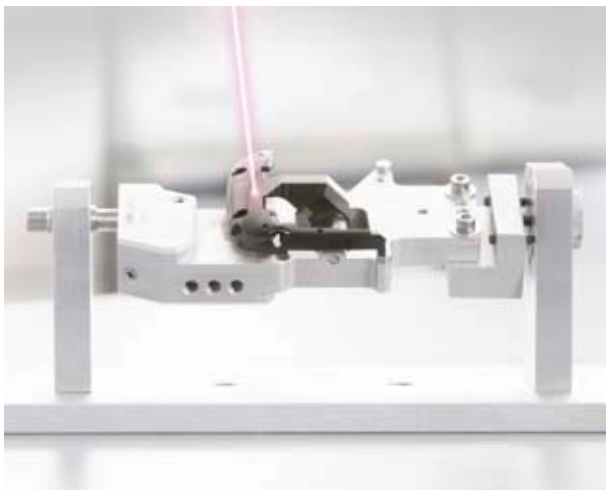
### LPKF ProtoPaint LDS Makes Plastic Parts LDS-Capable

The LPKF ProtoPaint LDS makes many plastic surfaces LDS-capable. The dual-component paint consists of a basecoat and a hardening agent. LPKF ProtoPaint LDS accelerates the prototyping of mechatronic components with generative 3D manufacturing processes. The material blank is provided at a layer thickness of ca. 30 – 40 µm. Two to three successive paintings are ideal for building up a sufficiently thick and homogeneous layer. Partial paintings are also possible – especially with larger objects.



### Metallization for Prototypes

Mix, throw it in, wait. The new trend-setting metallization technology allows just one bath in the beaker and does not require any large laboratory devices. The metallization bath is specifically designed for the LDS process. It produces a simple and reliable copper coating of activated plastic surfaces. The single-component bath can be purchased via LPKF and is especially suitable for making inexpensive close-to-production prototypes.



### Laser Structuring with the LPKF Fusion3D 1100

The laser structurer copies the proposed conducting paths to the coated component in a matter of seconds. A pilot laser helps align the component when various positions are required.



### Metallizing the Component

Current-free metallization is the last step in the process. LPKF provides a solution for prototyping which can also be used for manufacturing small volumes or determining the optimal laser parameters under standard metallization conditions. A copper layer only requires one metallization step in a beaker, but even the subsequent processes for nickel and gold are clearly defined.



## Laser Direct Structuring with Global Support

LPKF Fusion3D laser system users around the world benefit from application centers in Germany, the USA, Japan and China. These centers give customers access to LPKF's years of experience in laser material processing and the full range of LDS technology. User training for technical staff and special consulting services complete the global market leader's range of services for laser systems for structuring interconnect devices.

Please contact LPKF for application reports and more information.

Technical Data: LPKF Fusion3D 1100	
<b>Structuring area (X/Y/Z)</b>	120 mm x 120 mm x 50 mm (4.7" x 4.7" x 2.0")
<b>Number of processing units (PU)</b>	1
<b>Fixturing base plate</b>	413 mm x 730 mm (16" x 28")
<b>Accuracy*</b>	± 25 µm (±1 mil)
<b>Max. structuring speed</b>	4,000 mm/s (157" per second)
<b>Input data formats</b>	IGES, STEP
<b>Software</b>	LPKF CircuitPro3D
<b>Laser wavelength</b>	1,064 nm
<b>Laser pulse frequency</b>	10 kHz – 200 kHz
<b>Machine dimensions (W x H x D)</b>	921 mm x 1,880 mm x 1,441 mm (36" x 74" x 57")
<b>Machine weight</b>	approx. 550 kg (1,200 lbs), excluding exhaust unit
<b>Operating conditions</b>	
<b>Electric supply</b>	230 V single phase, 50/60 Hz, ~1.5 kVA. Not supporting exhaust supply
<b>Cooling</b>	air-cooled
<b>Ambient temperature</b>	22° C ± 2.5° C (71.6° F ± 4° F)
<b>Humidity</b>	max. 70 %
<b>Exhaust unit</b>	
<b>Volume flow</b>	max. 320 m <sup>3</sup> /h, max. suction 21,000 PA
<b>Filter</b>	Active charcoal filter and F8 fine filter

\* Calibrated scanfield

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