



High precision 3D printing (HP3DP) – freeform optics for VCSEL applications

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3D printing from the sub-100 nm to the cm scale with highest precision Nano – Micro - Macro

Multiphoton Optics GmbH





Fraunhofer Spin-Off in 2013.

16 (207) staff plus 2 associates (JPN, USA).

Worldwide B2B Bluechip Customers.

Products High Precision 3D Printer LithoProf3D[®] Prototyping & Engineering

High Precision 3D Printer: LithoProf3D®

Litho Prof 3D



Prototyping & Engineering: LithoP&E 3D



High Precision 3D Printing (HP3DP): Principles





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HP3DP: Optics Manufacturing



Scalability							
Nano	Micro	Meso	Mac	cro			
			© Multiphoton Optics GmbH	3.0 mm			
Филирание Салона Spherical	250 μm Shape	Freeform Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ	Arrays				

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MM WG in PCB





Freeform Optics on Chip Level Packaging (PIC – fiber)





Freeform Optics for LED application



NA

Miniaturization of LED illumination systems & influencing the light output distribution

Point source LED Chip w/o printed optic



Radiation pattern of point source LED Chip EOLC-625-19-10 on TO-18 header



Radiation pattern w/o printed optic



Radiation pattern w/ printed optic

	l _v (mcd)	Φ _v (mlm)	Φ _e (μW)	l _e (μW/sr)
w/o printed optic	8.6	14.3	94.0	35.0
w/ printed optic	28.2	24.7	212.0	108.4

Polymer Optics

enhanced light outcoupling of chip → shaping & focussing

Freeform Optics for Edge Emitters

Nanosystems and Technologies GmbH Nanoplus





Freeform Optics for Edge Emitters







Threshold (mA)		Efficiency (W/A)		
pre	post	pre	post	
20	21	0.18	0.22	

- All laser dies work after printing process.
- Lens influences threshold & efficiency.
- Lens influences far field positively.
- Far field depends on positioning of lens.



Reference Customers, Partners, Networks





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