



NANODIMENSION
3D PRINTED ELECTRONICS

A New Dimension in the Production of Professional Multilayer Printed Circuit Boards and 3D Circuitry



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CBO and Co-Founder of Nano Dimension



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3D PRINTED ELECTRONICS

NASDAQ / TASE: NNDM

Why 3D Print in General?

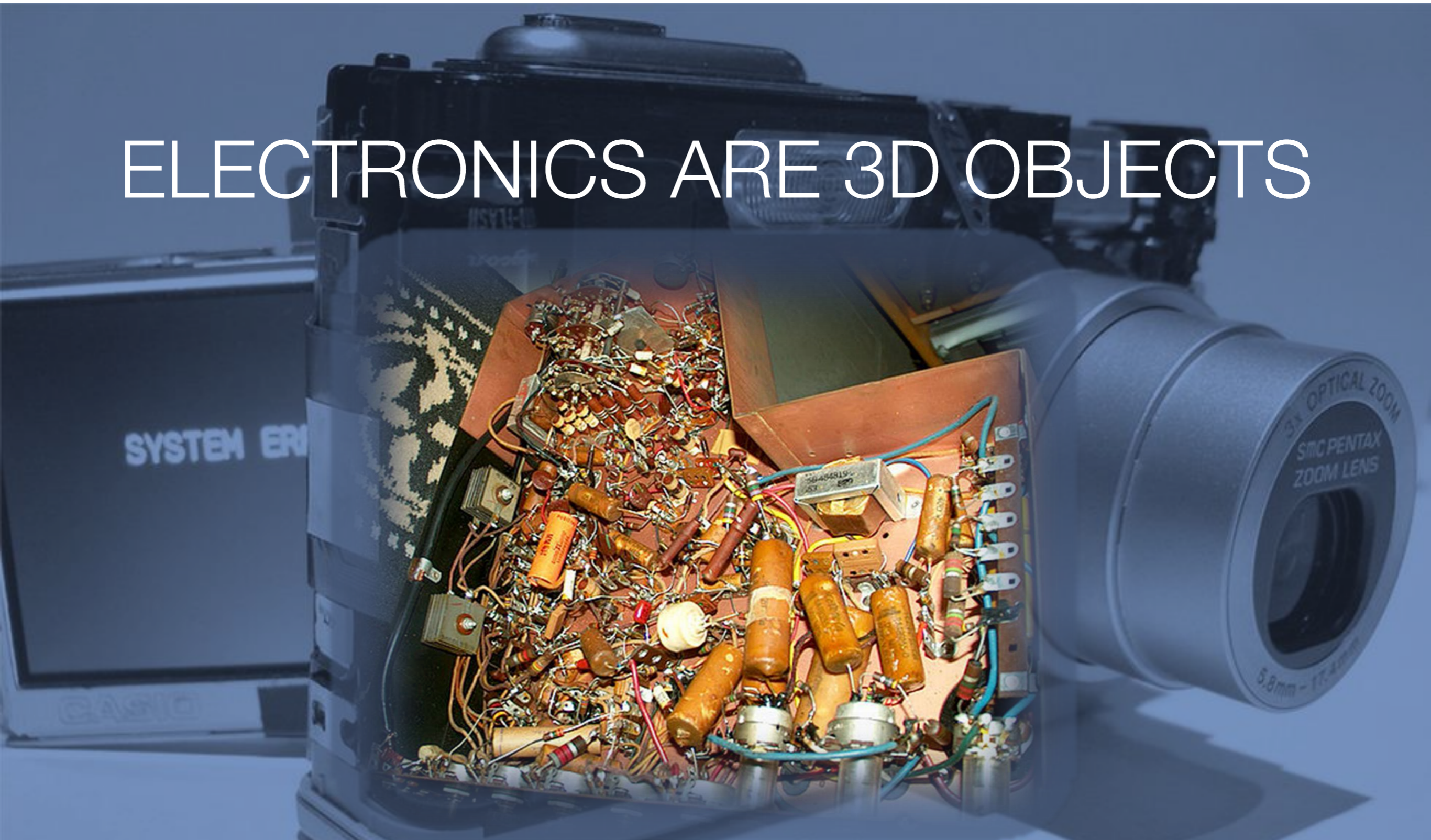
- Rapid Innovation - freedom to experiment
- New complex geometries
- Shift towards flexibility and customization
- Faster time-to-market
- Environmental sustainability



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ELECTRONICS ARE 3D OBJECTS





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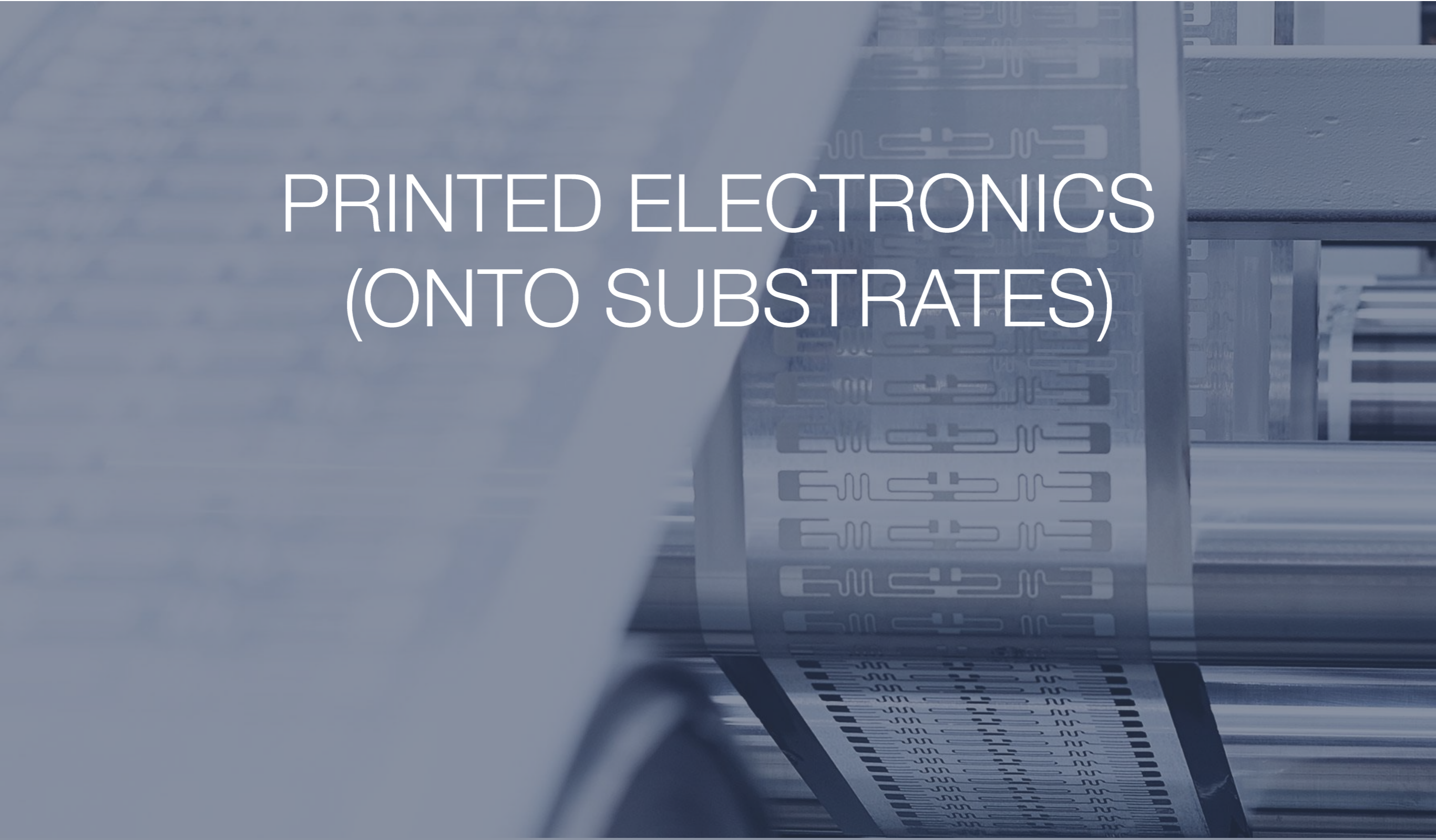
PRINTED ELECTRONICS



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PRINTED ELECTRONICS (ONTO SUBSTRATES)





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FROM TRACKING TO TOUCH





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CHEAPER

FASTER

FLEXIBLE



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3D PRINTED CIRCUITS (3D PCB)



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3D INKJET PRINTER FOR MULTILAYER AND 3D ELECTRONICS

ADVANCED NANOTECHNOLOGY-BASED INKS

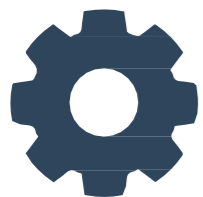


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TECHNOLOGY

Integrating high resolution inkjet and advanced nano inks



Desktop 3D Printer
with Inkjet technology



Sophisticated
proprietary software



Nano
Chemistry

- Advanced inkjet printheads with hundreds of small nozzles
- Tiny droplets of conductive and dielectric materials deposited

- Gerber file loaded into the printer's interface
- System automatically calculates the ink drop placement

- Advanced silver nanoparticle conductive ink
- Dielectric nanoparticle ink



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Quick Facts



- Founded - 2012, NASDAQ / TASE listed (NNDM)
- 80+ employees
- Beta testing with customers

The PCB Prototyping Challenge



Design file sent
to 3rd party
manufacturer



- Several weeks
- Slow time-to-market

Nano Dimension's 3D PCB Solution



3D printer:
In-house rapid
prototyping



Hours!



- Faster time-to-market
- Freedom to innovate
- Protect IP

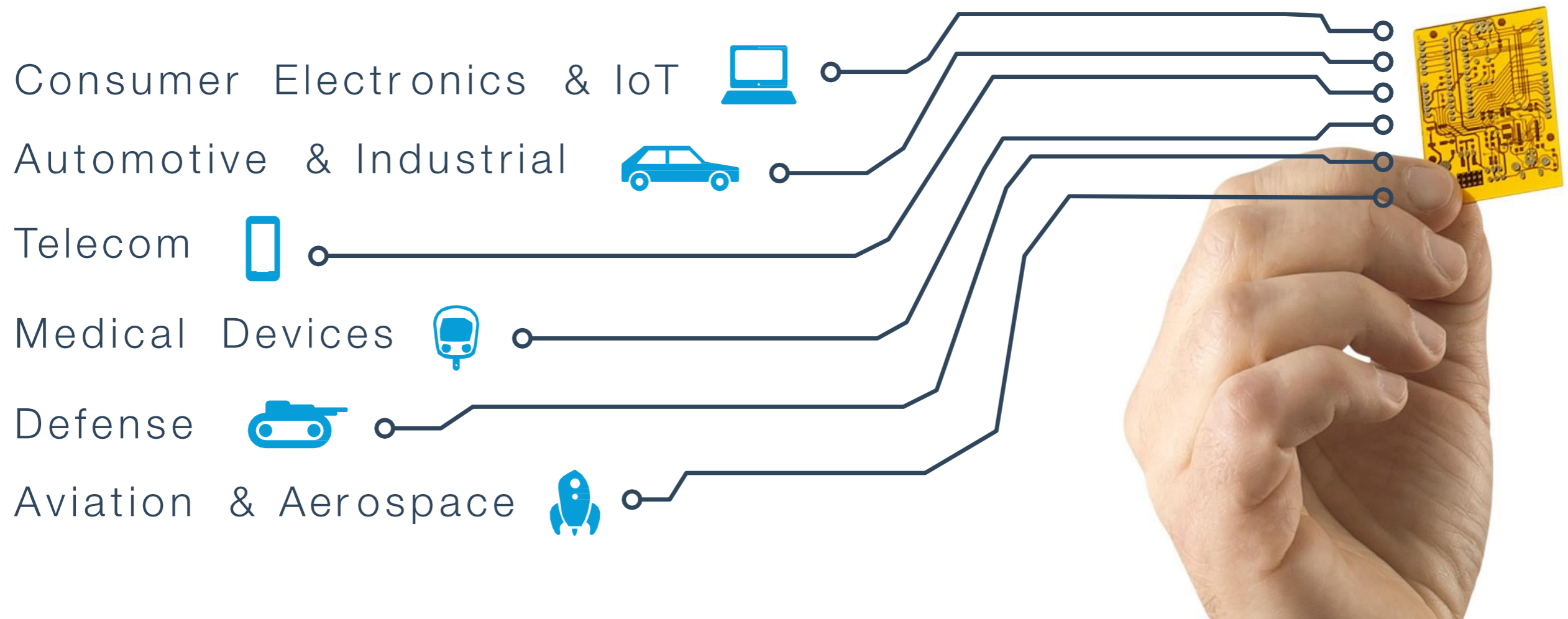


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Electric Circuits (PCBs) Everywhere

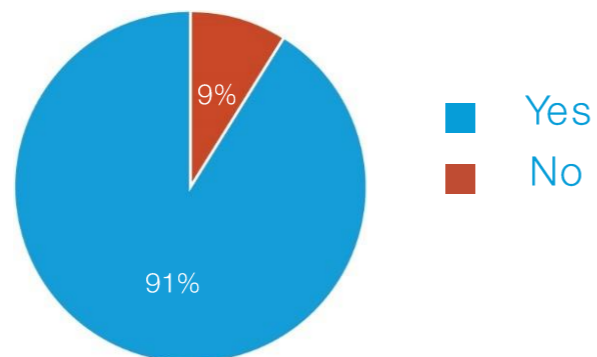
Growing Opportunities in a Diverse Set of Industries



PCB Prototyping Survey

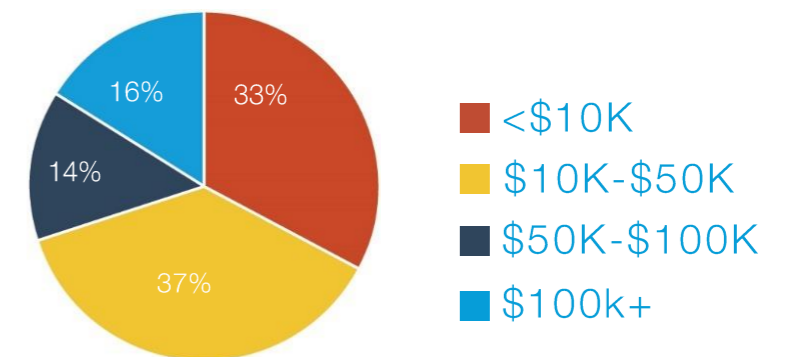
Do you use short-run, low-volume external PCB prototyping services?

N=978



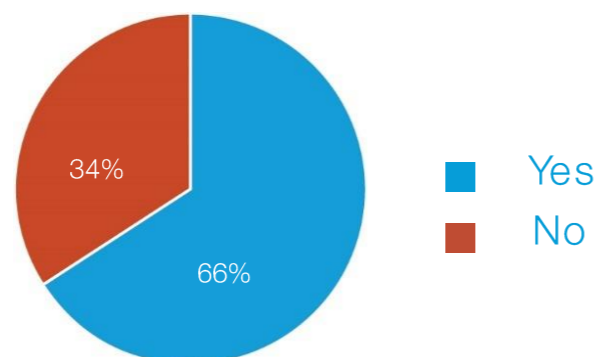
How much do you typically spend on PCB prototypes each year?

N=915



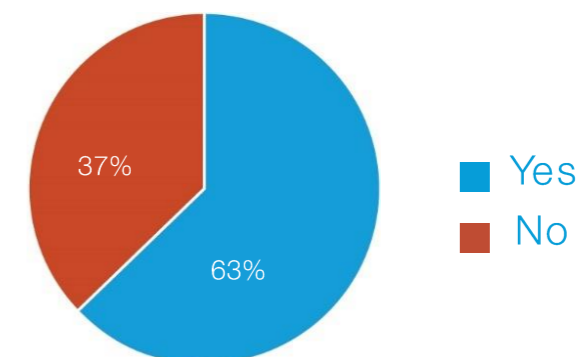
Do the PCBs you use have high layer counts?

N=978



Do you worry about IP security when sending designs to a 3rd party?

N=978



Source: * Nano Dimension Printer Readiness Survey 2016, as at 18 October 2016



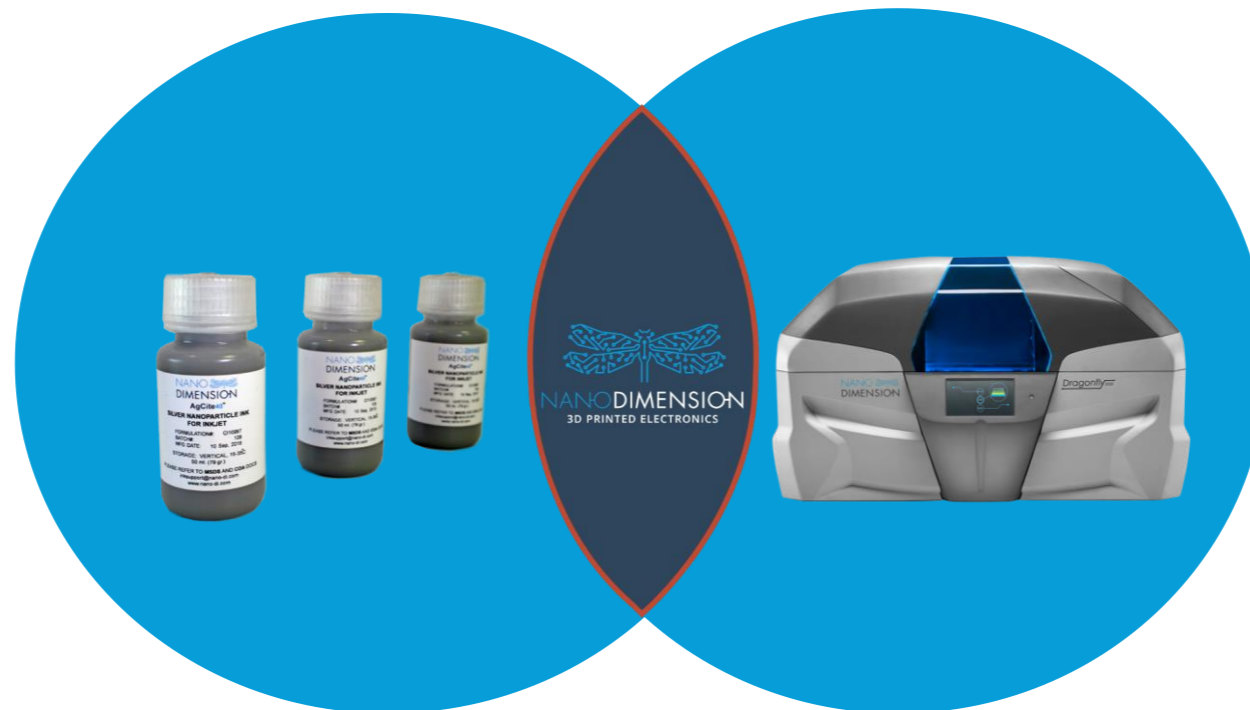
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Nano Dimension
Connecting Two

Worlds

High
Performance
Nano Inks



Advanced
3D Printing

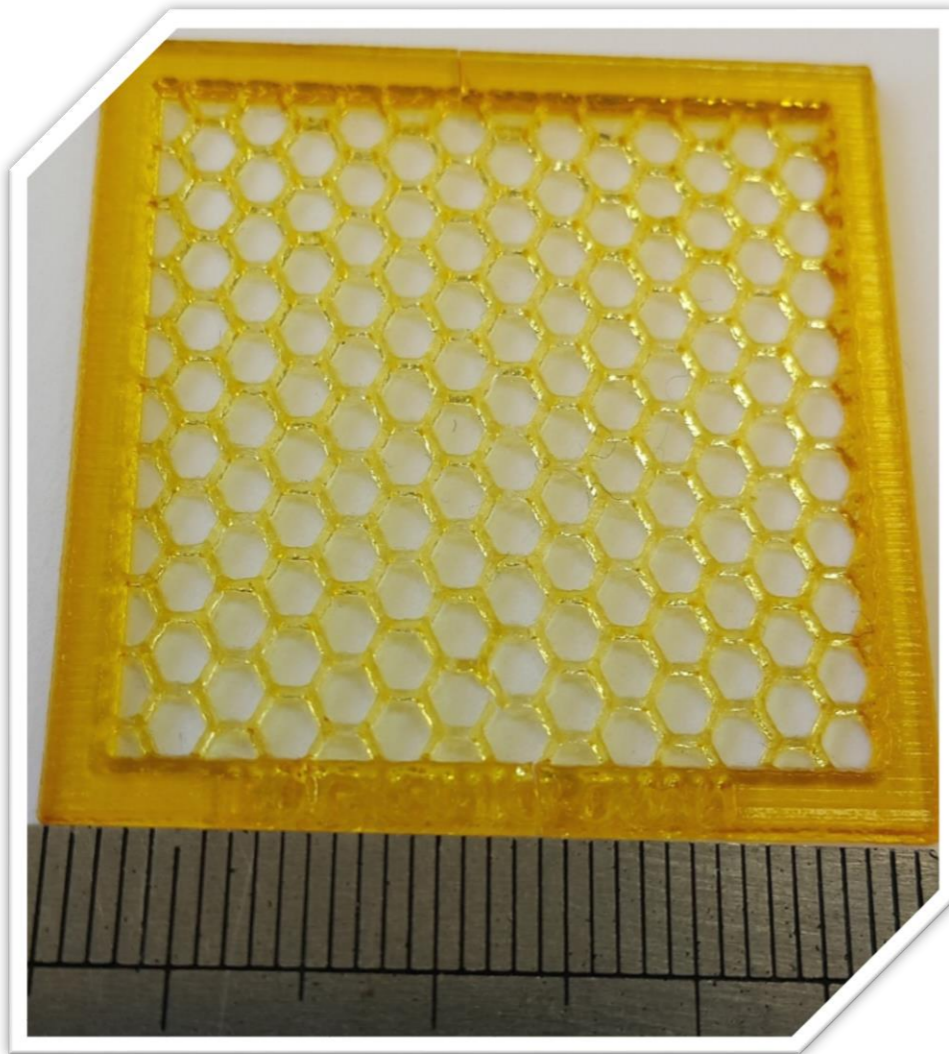


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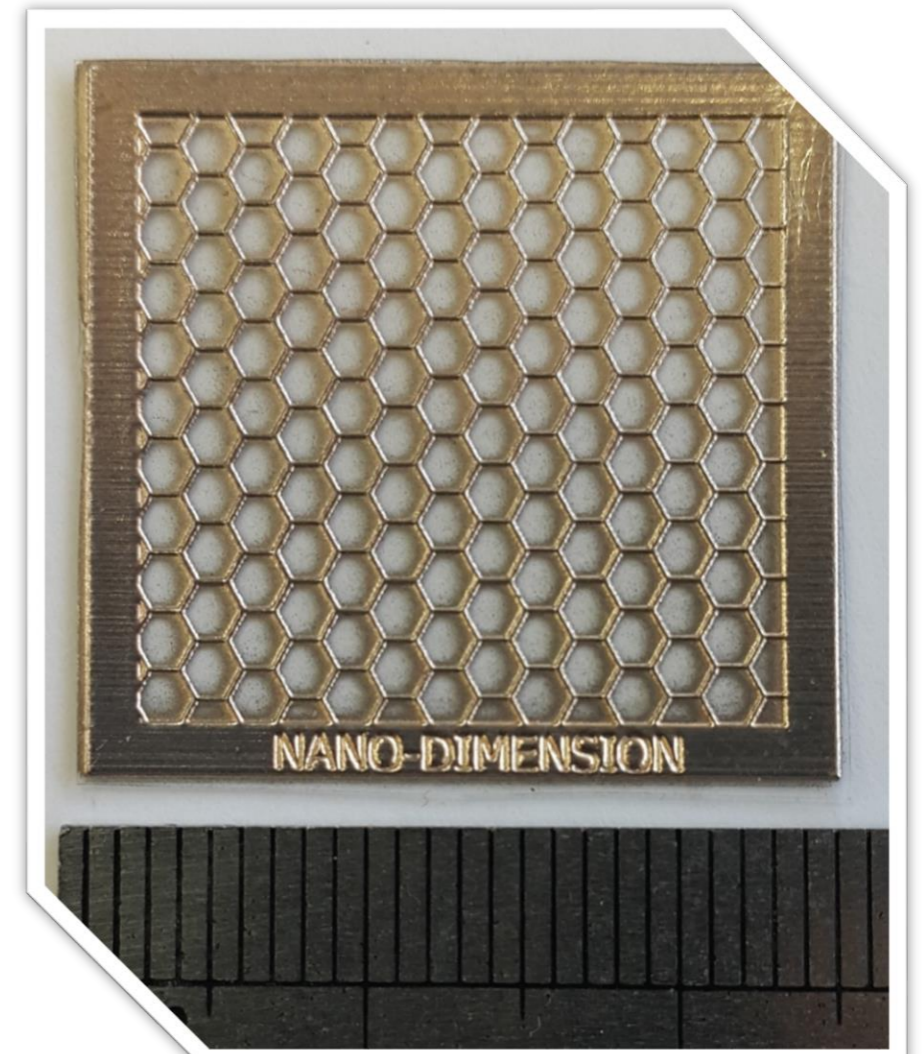
POLYMER:

DIELECTRIC & STRUCTURAL



METAL:

HIGHLY CONDUCTIVE SILVER





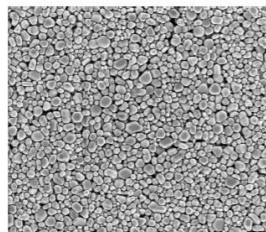
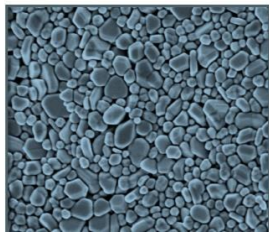
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AgCite™ Conductive Inks

Up to 75% of the conductivity of bulk copper

- Sizes and distribution of the silver particles optimized for 3D printing of highly conductive PCB traces
- Developed using a patent protected nanoparticle synthesis process licensed from Yissum & Prof. Magdassi of the Hebrew University



Silver Nanoparticles

10-100 nm size range produced by Nano Dimension in a range of shapes and distributions in accordance with ink requirements



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4Dimension Dielectric Ink

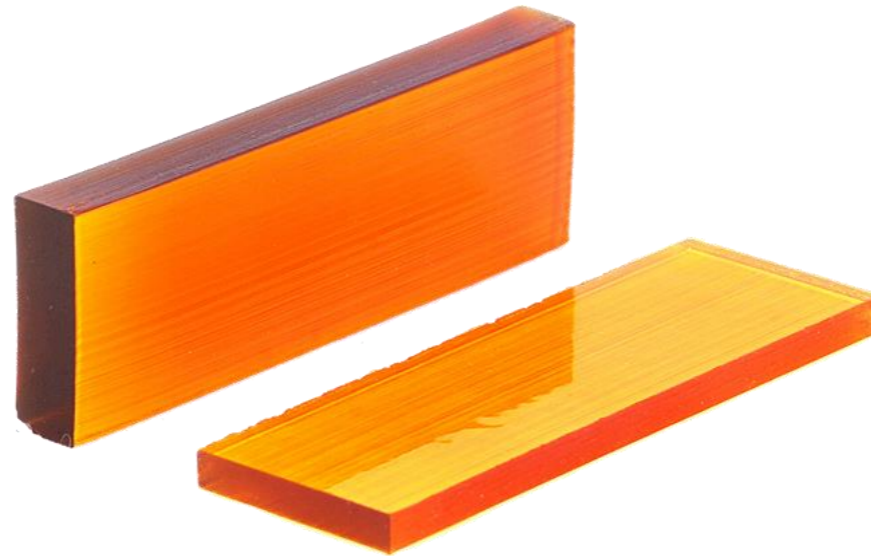
- Designed for compatibility with Nano Dimension AgCite ink
- Mimics industry FR4 and other dielectrics (range of formulations)
 1. Dielectric
 2. Structural: 3D Printing
 3. Mechanical: Rigid & Flexible



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1. Dielectric (matched to AgCite conductive ink)



Dielectric Constant @1MHz: 2.2-3.7

Loss Tangent @1MHz : 0.02-0.03

Dielectric Constant @1GHz: 1.9-4.5

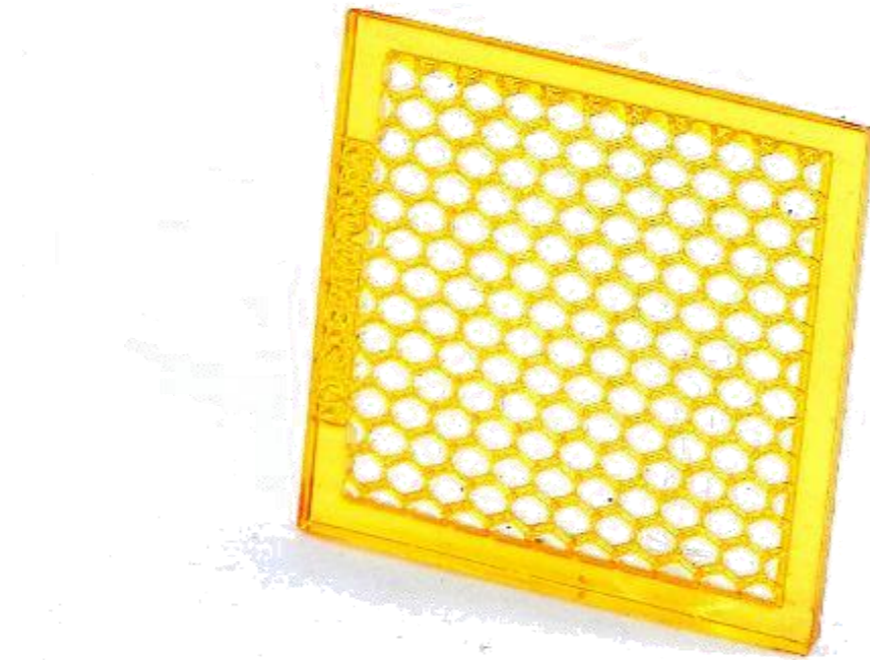
Loss Tangent @1GHz: 0.02-0.4



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2. Structural



High flexural strength: 200 Mpa

High temperature resistance: $>360^{\circ}\text{C}$



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3. Rigid & Flexible

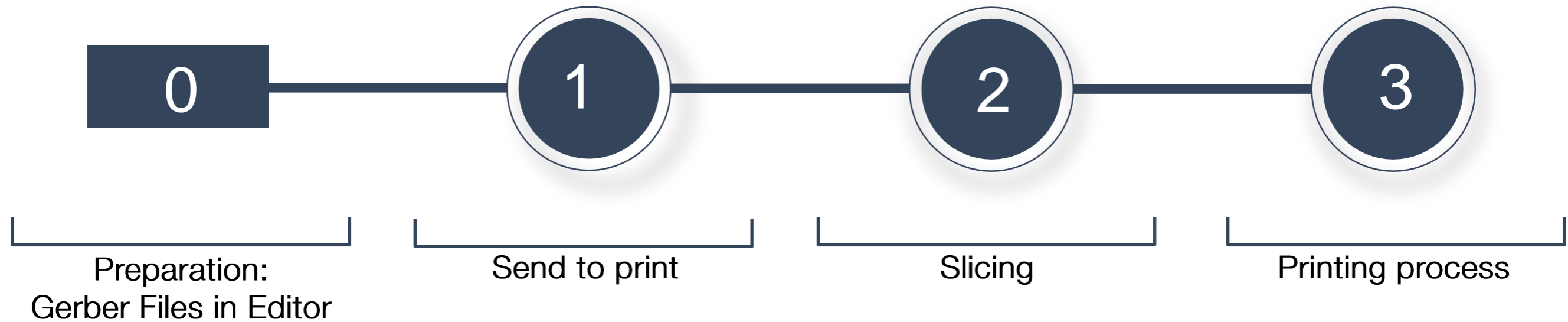


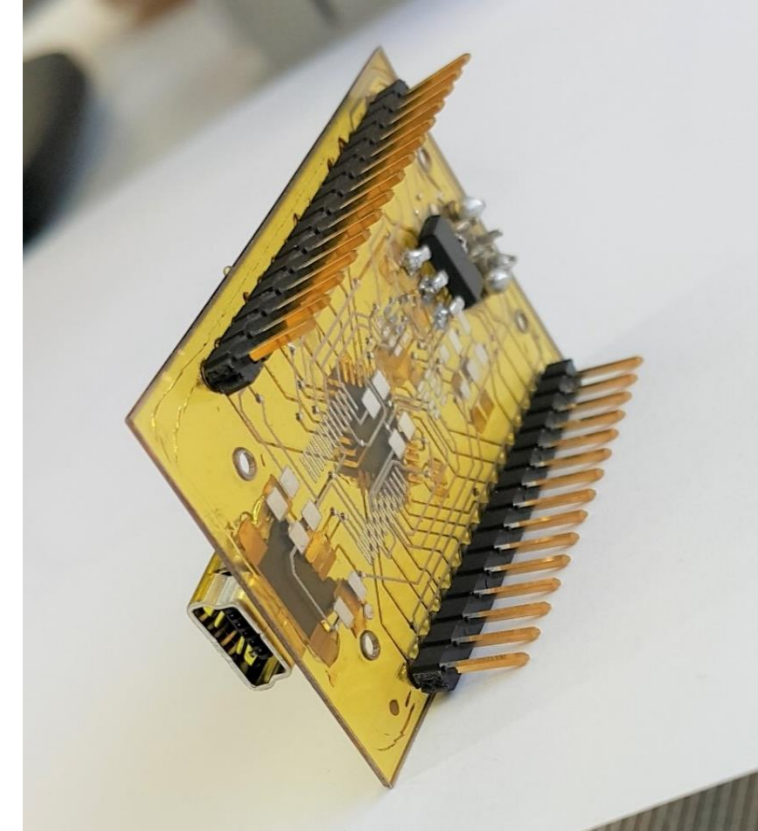
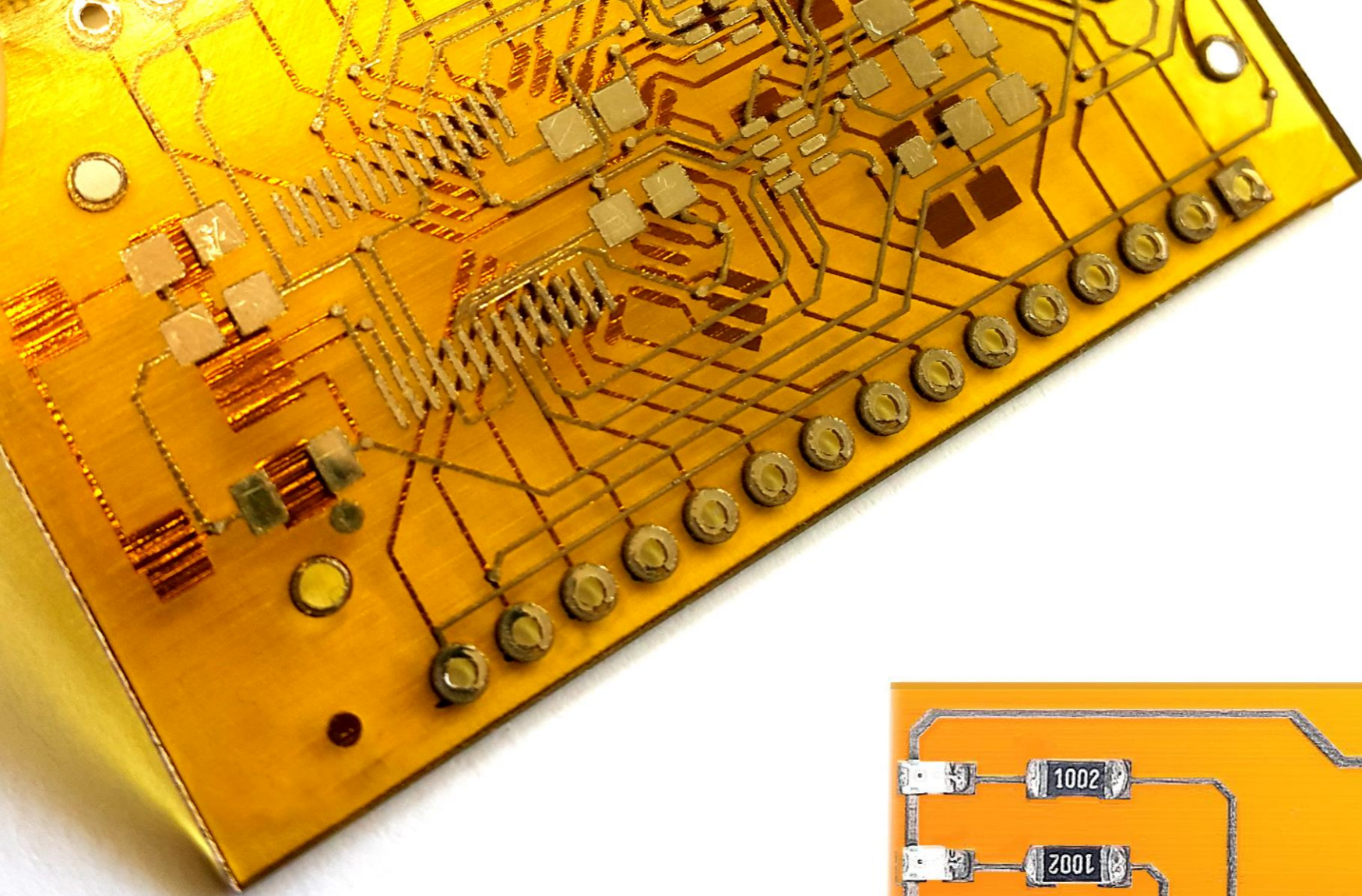
Define # of print layers to achieve flexibility or strength

Benefits:

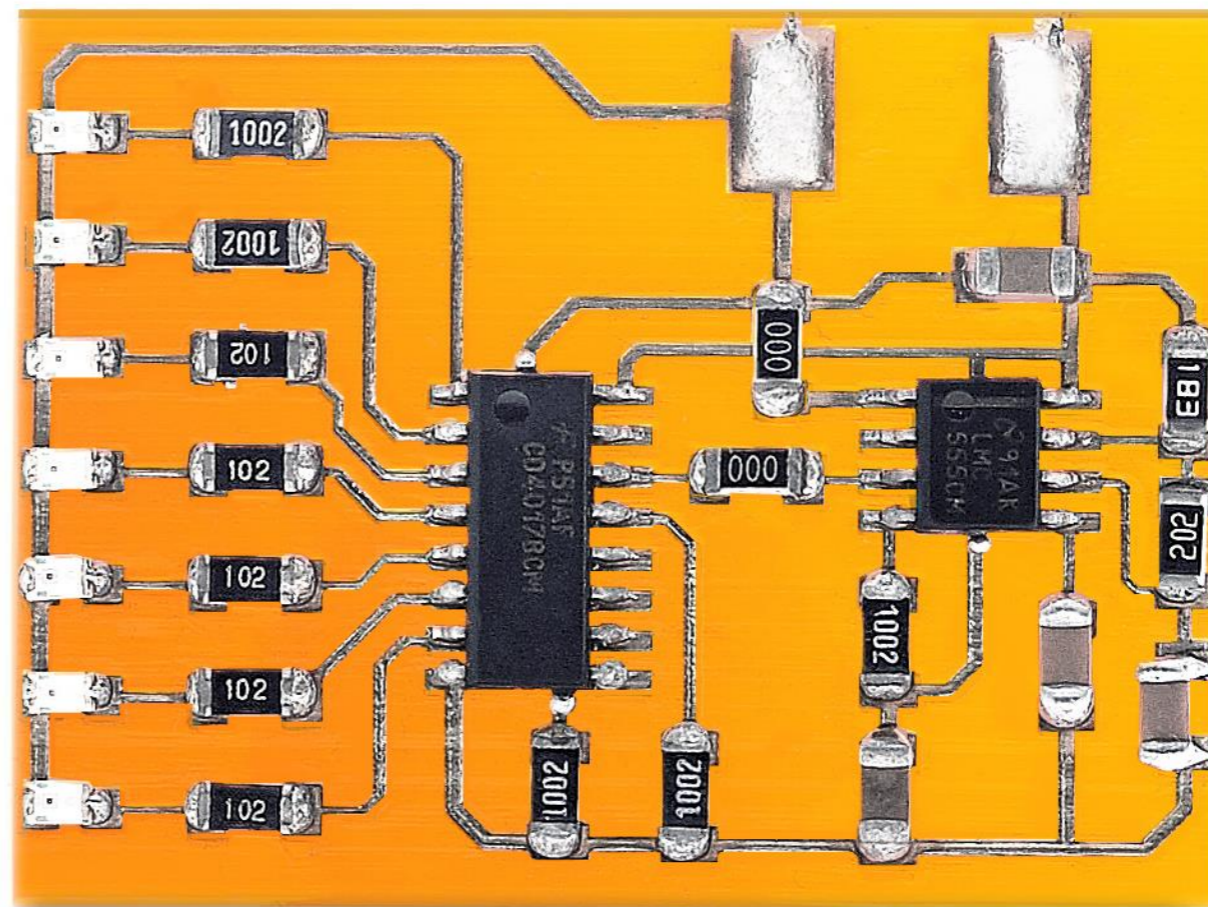
Customize flexibility for your design

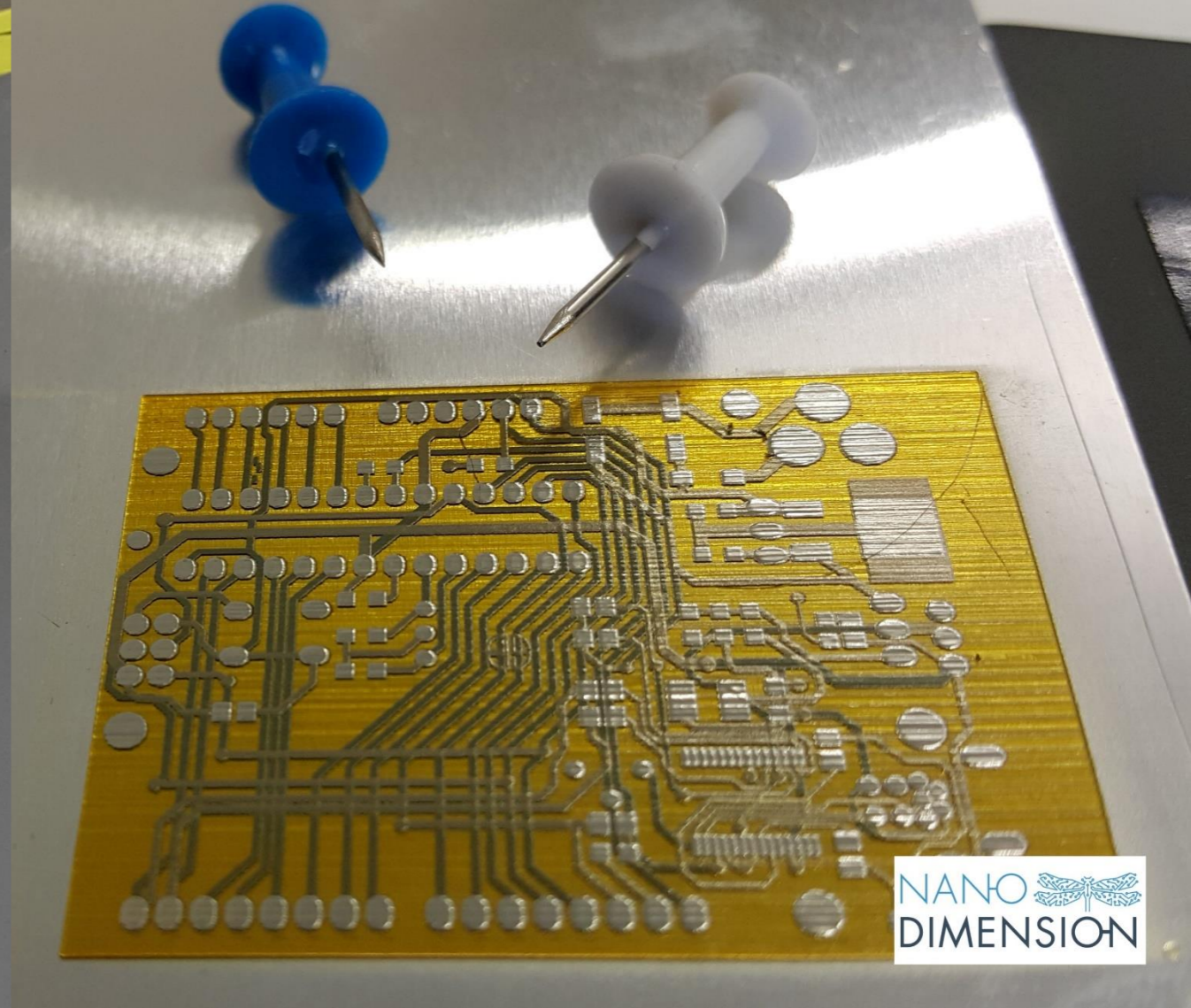
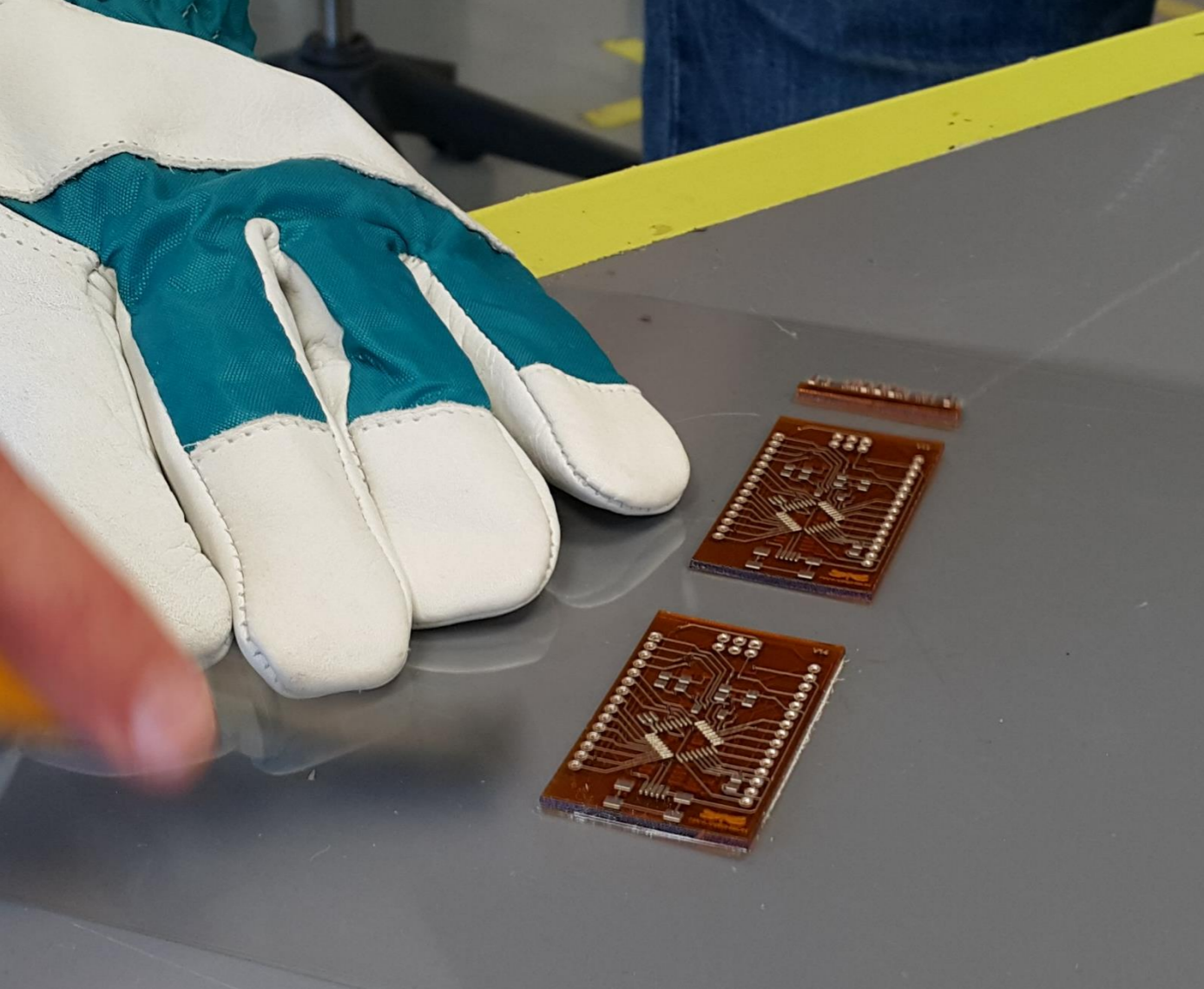
PCB Easy as 123





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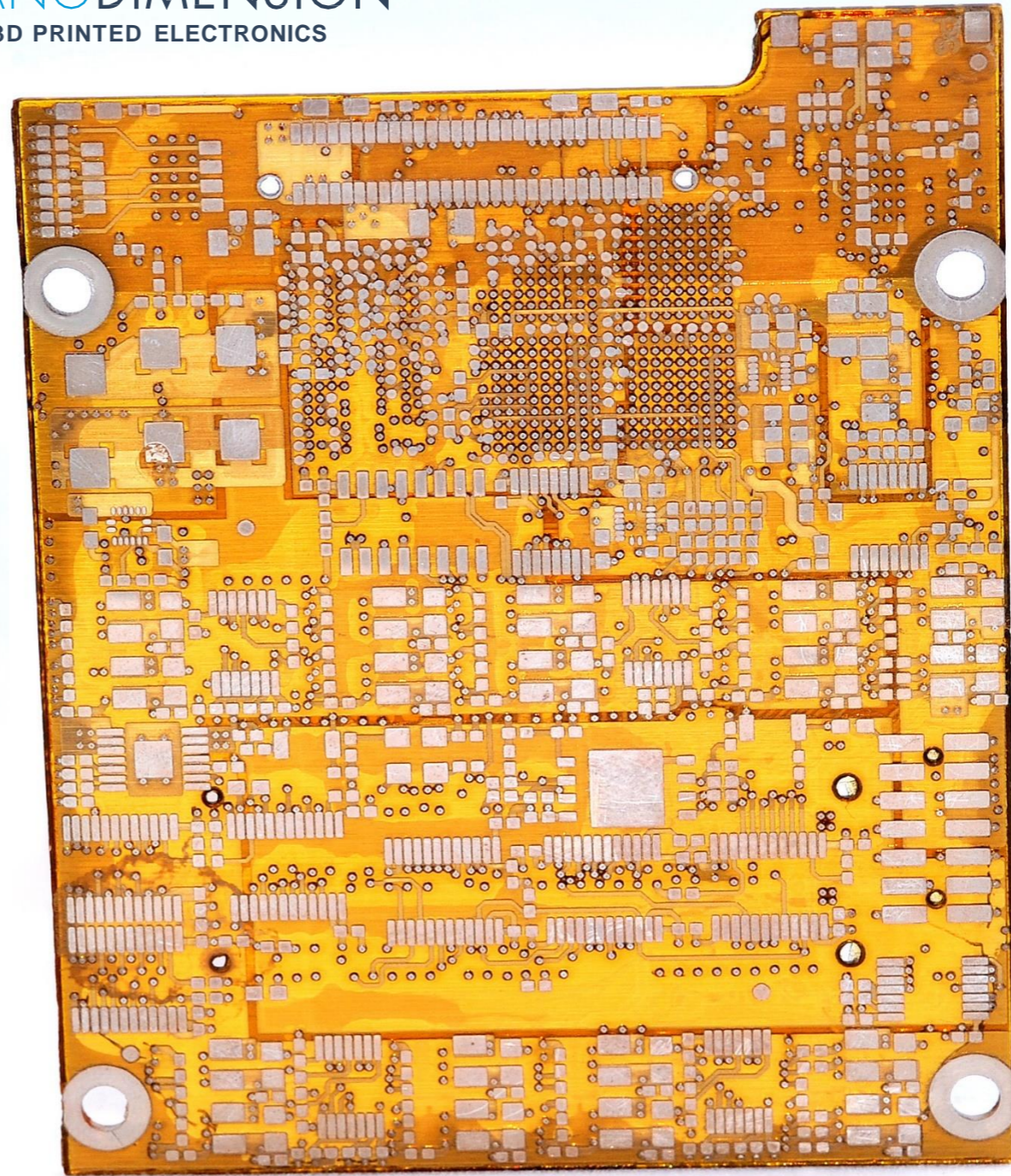
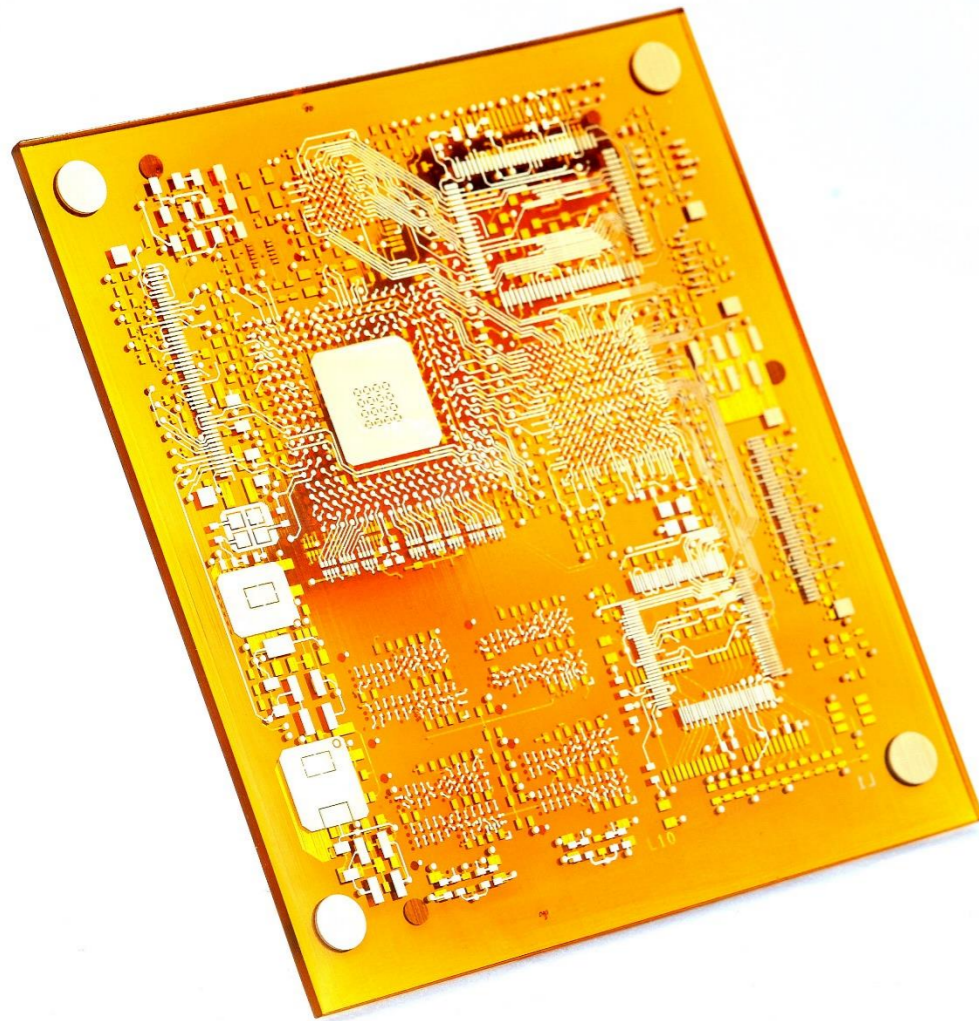


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10 Layer PCB: Fully 3D Printed

A person's hands are holding a white, 3D printed circuit board (PCB) against a blue background. The PCB is rectangular and features a complex network of printed circuit traces, pads, and a central component. The text is overlaid on the image in a white, sans-serif font.

Which Opportunities
Does 3D Printed
Electronics Offer?



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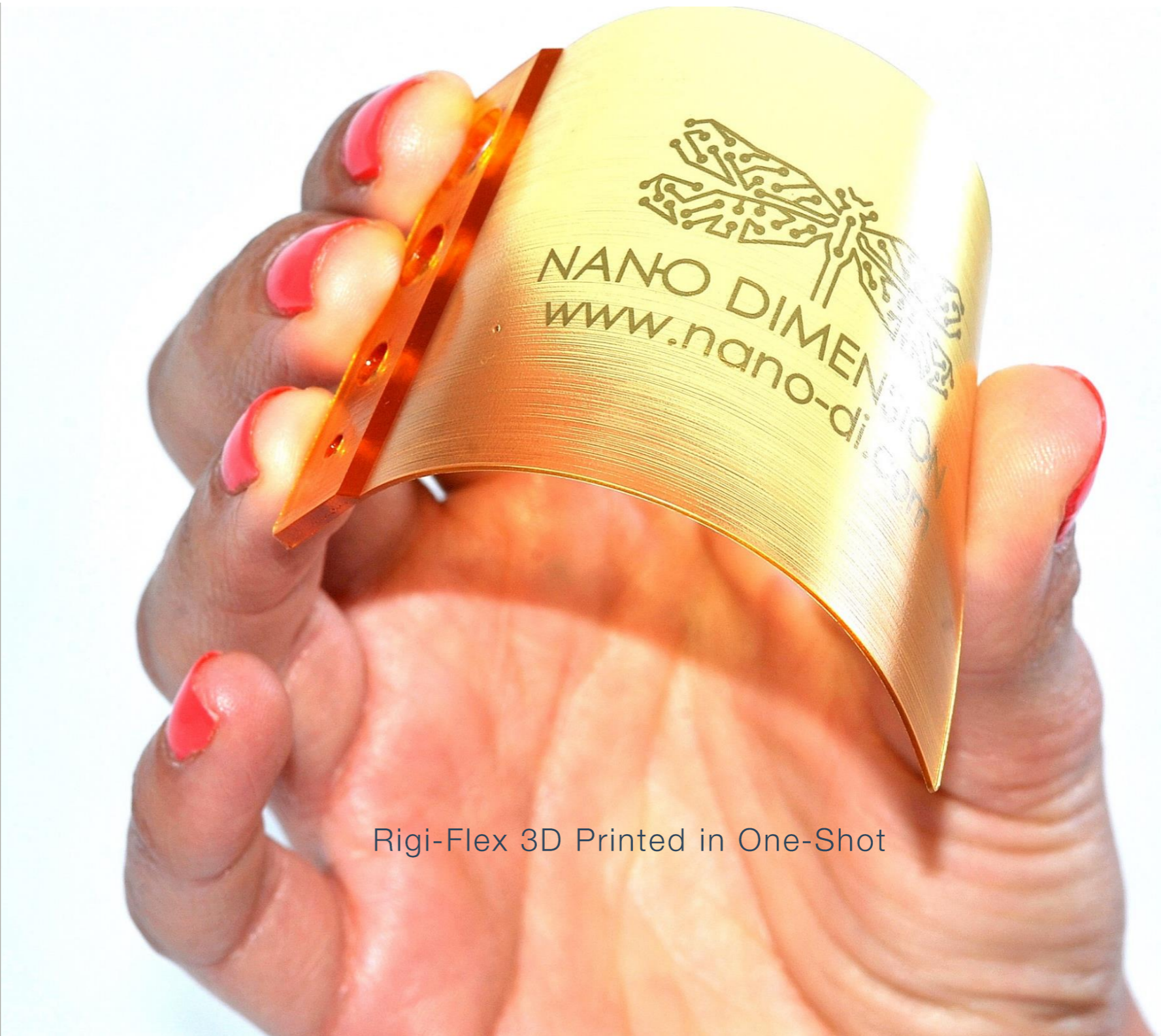
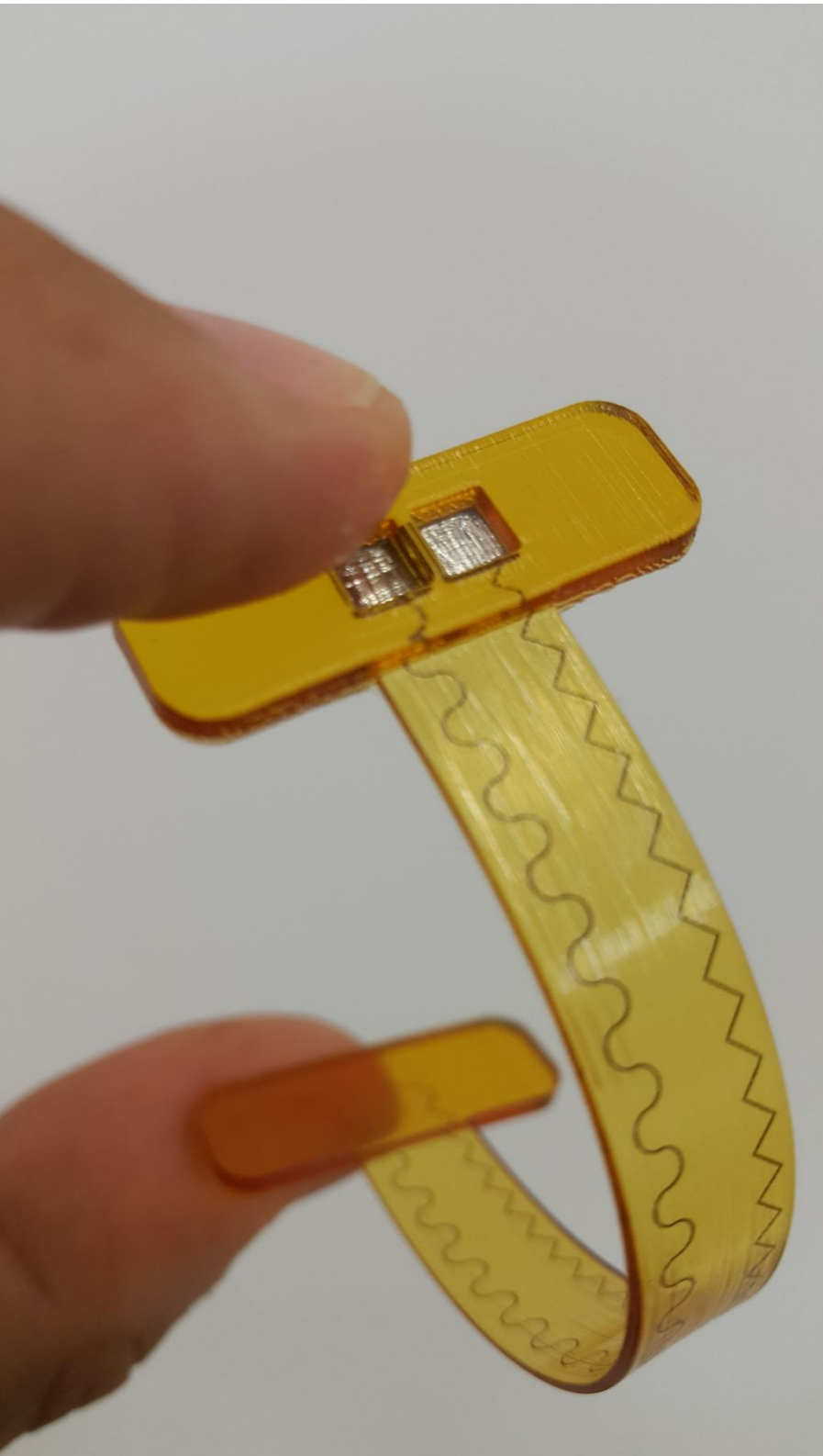


3D Printed MID: Conformal & Multi-layer Circuitry



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Rigi-Flex 3D Printed in One-Shot



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Structural & Functional





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www.nano-di.com

Nano Dimension's IP

18 Patents / Patent Applications:

- 3 patent families - Conductive inks, Prof. Magdassi, Hebrew University
- 14 patents - System, printing process, software, materials, design
- 1 patent - 3D printing of stem cells

Additional IP:

- Nickel nanoparticles, collaboration with Prof. Markovich, Tel Aviv University
- Developing nano copper ink



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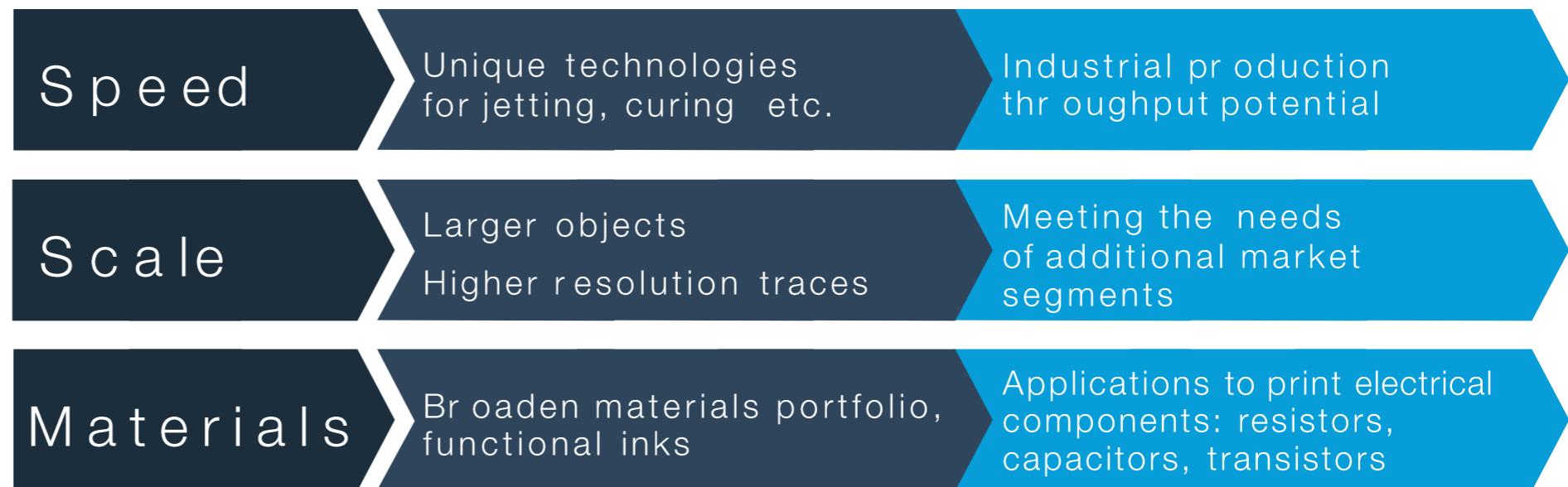
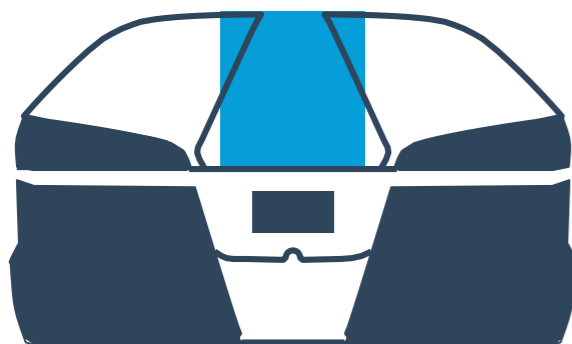
March 2016

Future Roadmap

Progress Towards More Advanced Solutions and Additional Markets

Prototyping

3D PCB Printer for
fast prototyping





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THANK YOU



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