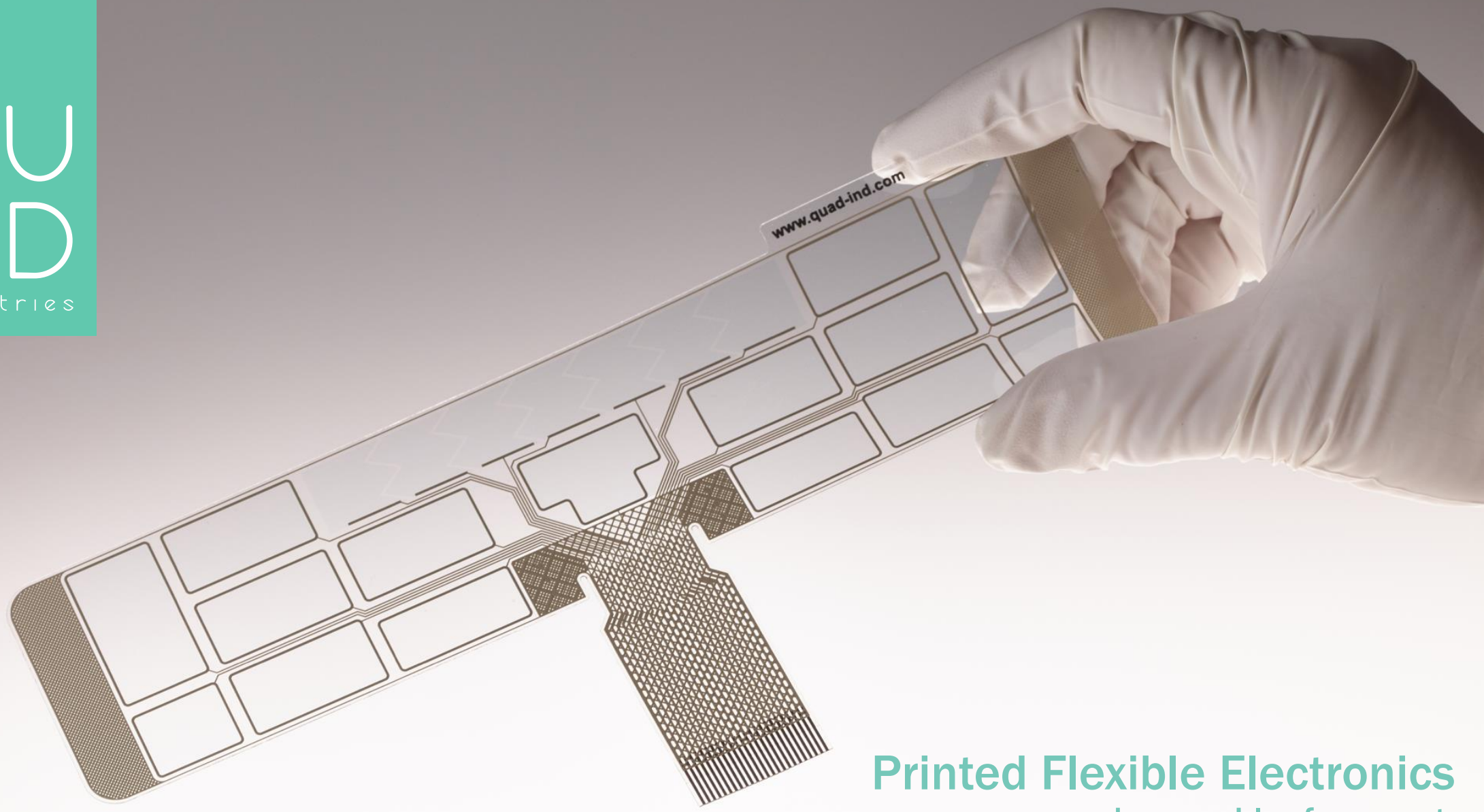
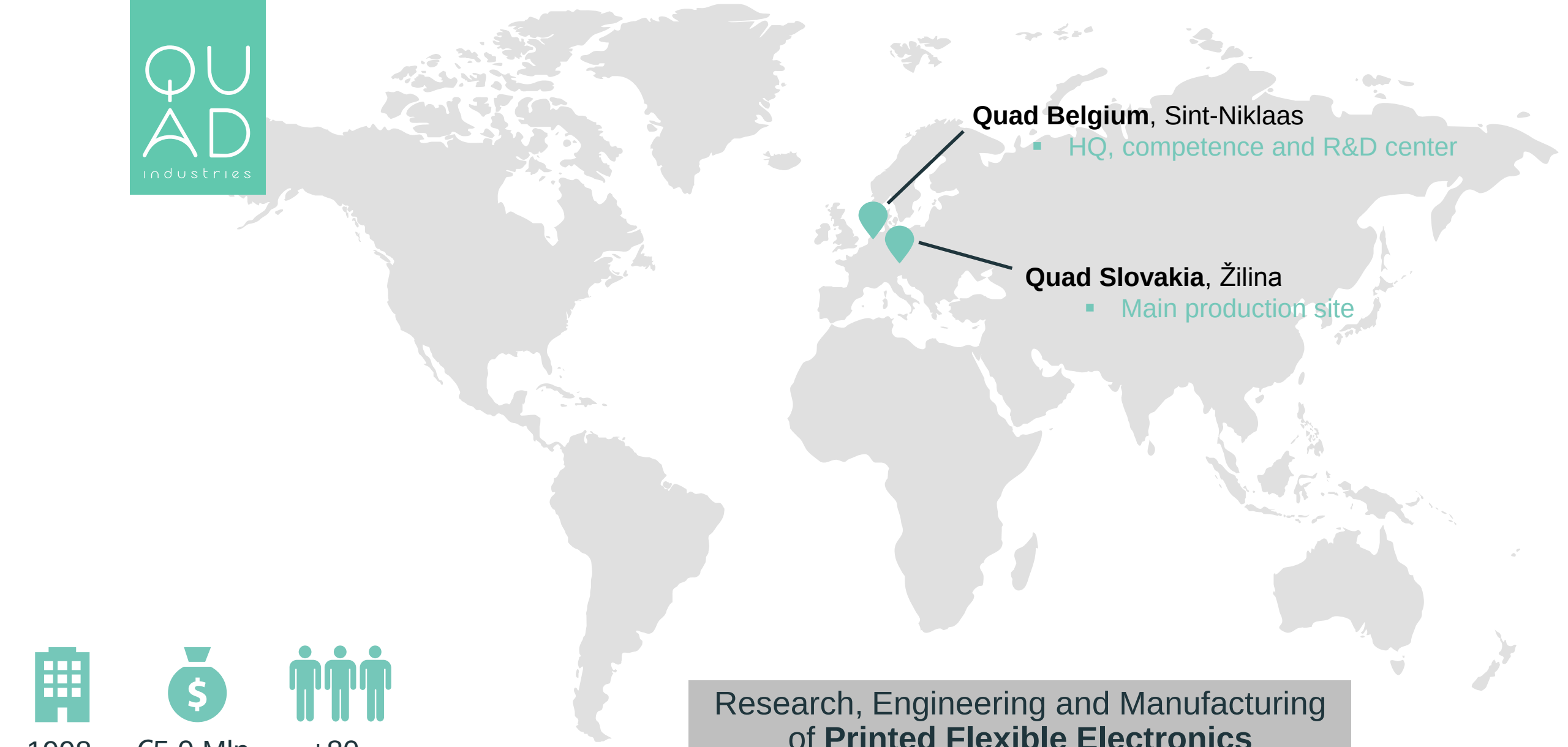
QUAD
industries




# Printed Flexible Electronics

## key enabler for smart, interactive 3D surfaces

QUAD industries




1998 €5.0 Mln. +80

Research, Engineering and Manufacturing
of **Printed Flexible Electronics**

# MANUFACTURING ACTIVITIES


QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001

IATF 16949 launch is pending

1. **Screen-printing**
   - Fully automated + semi automated lines
2. **SMD assembly**
   - On rigid and flexible substrates
3. **Adhesive bonding**
   - PSA & OCA tape bonding + optical (vacüum) bonding
   - Mechanical assembly
4. **Cutting**
   - Laser- & knife cutting, punching

# PRINTED ELECTRONICS

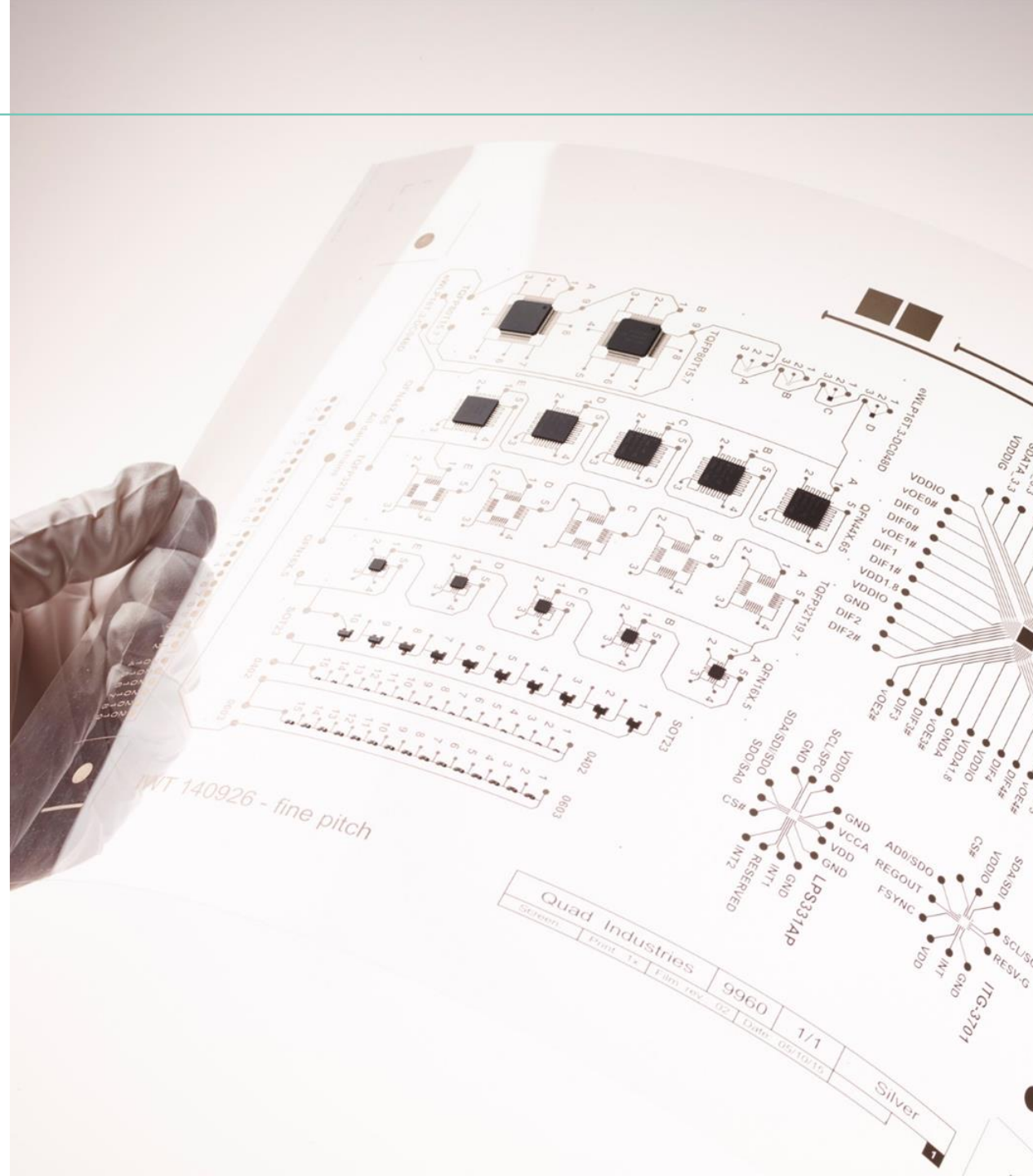
Manufacturing of electronics by standard screen-printing processes

Possibly combined with traditional electronics to exploit the competitive advantages of both technologies = **hybrid electronics**

**Key Benefits:**

- Direct Integration on thin, flexible materials
  - (Thermo) Plastics: PC, PET, TPU
  - Textiles
  - Paper
- Light weight
- Stretchable
- Low-cost + low ecological footprint
  - Additive manufacturing
  - No (etching) chemicals
  - Less process steps

**>>> Enabler for 3D shaped Electronics <<<**



# PRINTED ELECTRONICS

## Functionalities

- **Sensors**
  - Force, pressure, temperature, weight, liquid level, presence detection, biosignals, gas,…
- **Wireless communication**
  - Printed antennas: RFID, NFC, BLE, RADIO & TV…
  - Quad provides simulation, design & printed manufacturing
- **Energy storage**
  - Printed **batteries:** Quad Industries is Enfucell licensed battery manufacturer
- **Heating**
  - Rapid heating, uniform, self-regulating (PTC), screen-printed heaters
- **Lighting & displays**
  - Electroluminescence, electrochromic displays

# PRINTED ELECTRONICS

- **USER INTERFACES**
  - Membrane switches
  - Capacitive touch & gesture control
  - Haptic Piezo Touch
  - Pressure sensing

- Quad Industries competences & support:
  - R&D
  - Engineering (HW design & SW development)
  - Prototyping
  - Manufacturing


We focus on creating innovative **2D touch controls** that include the latest technologies in **backlighting** and **haptic feedback**.

# Now how do we go from 2D to 3D?

Laminated Electronics

3D shaped Electronics

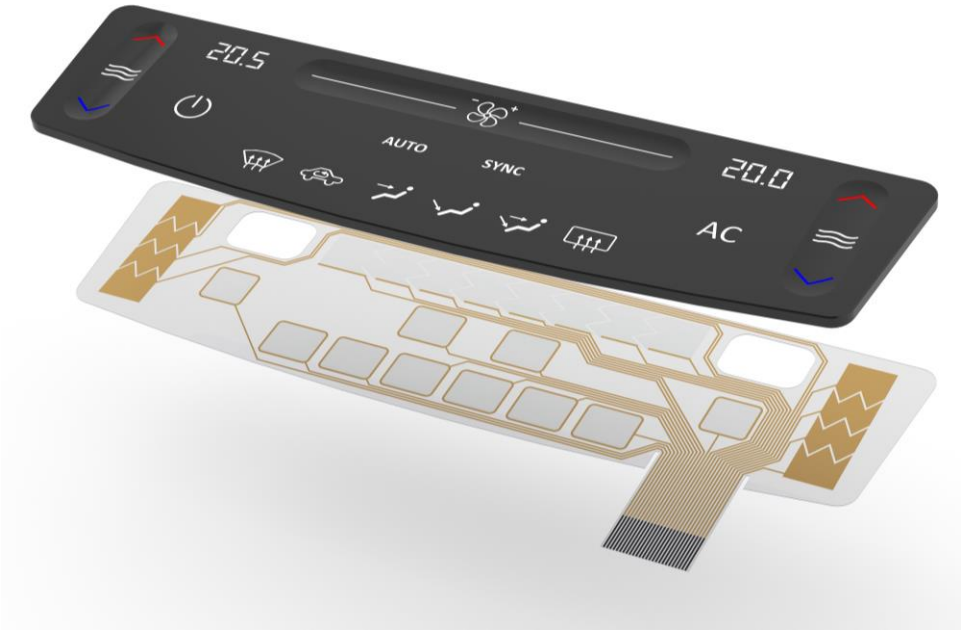
# LAMINATED ELECTRONICS

- Primary functionalities:
  - Touch & gesture
  - Wireless connectivity
  - Backlighting

- Process:
  1. Print decoration on cover lens
  2. Print wiring, touch controls, antennes on functional film
  3. Mount SMD components on flat film
  4. Laminate functional film on backside of plastic / glass parts

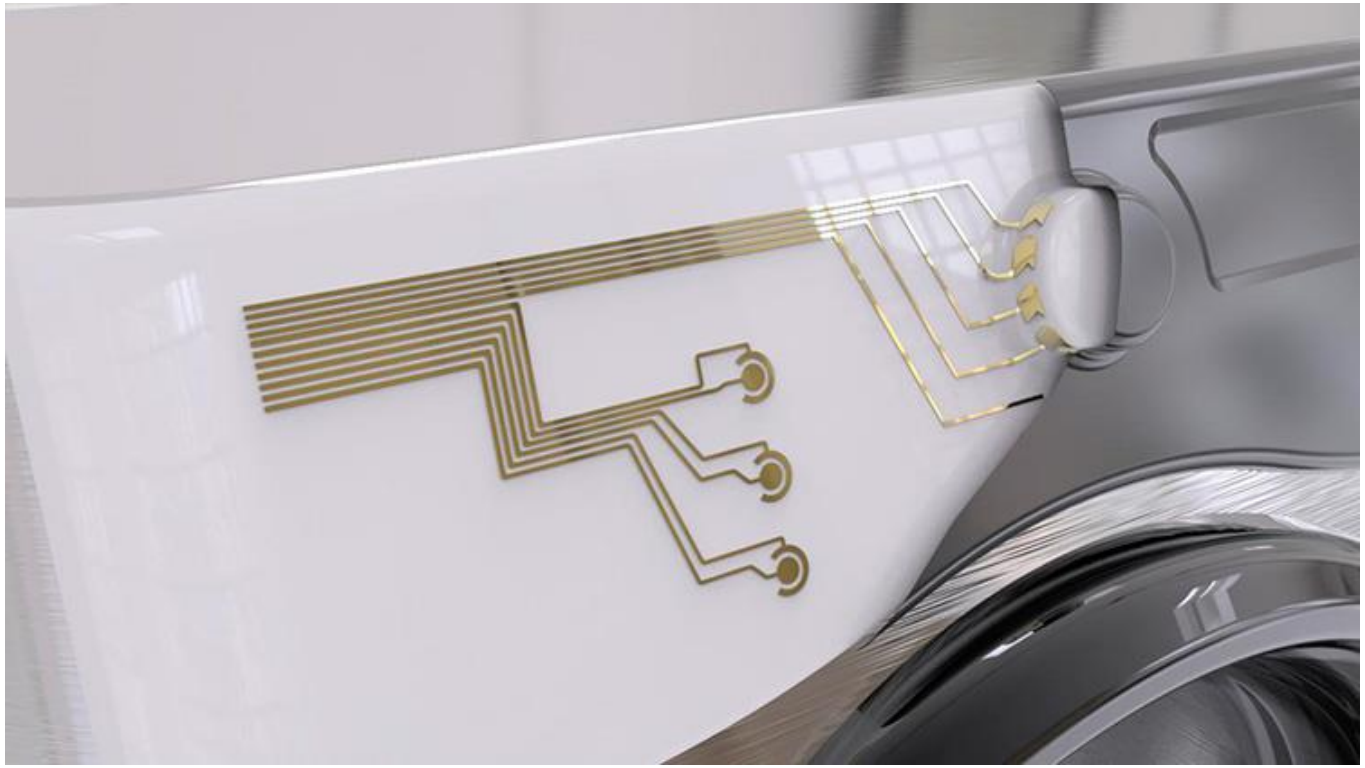
- Benefits
  - Advanced alternative solution for mechanical keys and switches
  - Seamless integration of touch keys and sliders

- Limitations
  - Backside touch film assembly only allows for flat or 2D curved surfaces
  - Need for integration (lamination) step on backside of plastic part



# 3D SHAPED ELECTRONICS

Quad Industries partners with **thermoforming** and **film-insert molding** experts to enable seamless and cost-effective integration of printed electronic features into plastics.



# 3D SHAPED ELECTRONICS

TERA SEL
Thermoplastically deformable circuits for Embedded Randomly Shaped Electronics

**Thermoplastically deformable circuits for embedded randomly shaped electronics**

- Funded under: 7th FWP (Seventh Framework Programme)
- Start date: 01/10/2013
- Duration: 3 years
- Partners:

imec
ACB ADVANCED CIRCUIT BOARDS ATLANTEC CIRCUIT BOARDS
CRF CENTRO RICERCHE FIAT
Fraunhofer IZM
Freudenberg
niebling Formtechnologie
SINTEX NP GROUP
page.be electronica
PHILIPS
PEP CENTRE TECHNIQUE DE LA PLASTURGIE ET DES COMPOSITES
plasticelectronic
QUAD industries
Holst Centre Open Innovation by imec and TNO
TPVISION
Fundi€o

# 3D SHAPED ELECTRONICS

- **TERASEL** demonstrator >> 3D touch wheel
  - Replacement of mechanical rotary button into a touch sensitive surface
- Based on trends in user interfacing:

Increasing demand for touch controls

Evolve from flat to 3D shaped interfaces

# 3D SHAPED ELECTRONICS

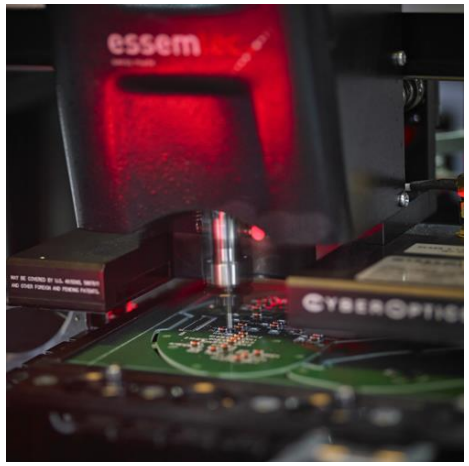
- Key advantages of **FORMED & IN-MOLD ELECTRONICS**:
  - Design freedom > 3D shaped user interfaces
  - Smooth and seamless
  - Space efficient
  - Thin and lightweight
  - Reduction of single parts – less mechanical steps during assembly
    - Reduced complexity
    - Increased reliability
  - High chemical and physical resistance – no more keys & buttons

# 3D SHAPED ELECTRONICS

**Process**:

1. Print decoration
2. Print wiring, touch controls, antennes

Screen printing on thermoplastic polymers

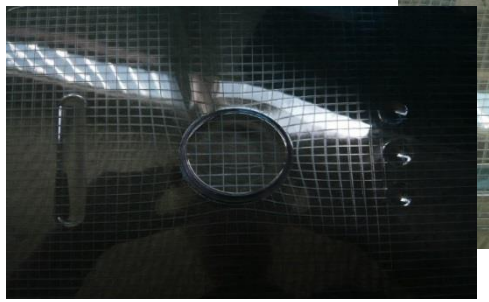



3. Mount components on flat film

SMD assembly

4. Pre-form
5. In-mold insert

Forming / Injection moulding



# 3D SHAPED ELECTRONICS

3D touch wheel demonstrator:

QUAD industries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