ALTIUMLIVE 2018:
IMSE: CREATING SMART SURFACES WITH ELECTRONIC FUNCTIONALITY

Vesa Männistö
Director, Product Management

Tuomas Heikkilä
Senior Specialist, Hardware

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IMSE = Injection Molded Structural Electronics

IMSE integrates printed circuitry and discrete electronic components inside plastics creating a single-part assembly with a revolutionary design freedom.

• Electronic functions in 3D contours
• Part thickness only 2 mm+
• One electromechanical interface
• Single-part construction, no assembly in production
IMSE technology turns plastics into smart surfaces by integrating flexible printed circuitry and electronic components like LEDs into 3D injection molded structures using standard high-speed manufacturing methods and equipment. IMSE products can be 1- or multi-film structures.

**IMSE Process**

1. Printing decoration, wiring, touch controls, and antennas

2. Mounting components on *flat* film

3. Forming 3D shape *with* components

4. Injection molding final single-part assembly
IMSE Part Structure

**Decorative A Surface**
- IML Film or Natural Materials
- Decorative inks

**A surface electronics**
- Conductive inks
- Dielectric inks
- SMT electronics

**Plastic Resin**
- PC, TPU

**B surface electronics**
- Conductive inks
- Dielectric inks
- SMT electronics

**Functional B Surface**
- IML film

**Electronics may be on one or both films**

**Everything is injection molded to one-piece assembly**

**Designs may be 1- or 2-film**
Smart Surfaces

• Integrate electronic functionality with existing surfaces and in space-limited locations where conventional electronics fail to be integrated

• Unlimited form factors
• Improved performance
• Make dumb smart
Evolution to the Shape and Build of Products

• Reduce the level of individual parts in assembly, reduce assembly phases and reduce maintenance of individual items in your inventory and systems

• Up to 90% less part thickness
• Up to 80% less weight
• No assembly
Durability and Reliability

• Wash & Go
• Safe from moisture and debris
• -40 to +80 temperatures
How it was done before

Overhead Control Panel
Traditional electronics assembly
45mm part thickness
64 parts + PCBA
650 gram weight

Doing it with IMSE

Overhead Control Panel
IMSE solution
3mm part thickness ~93% reduced thickness
1 molded part + small PCBA
200 gram weight ~70% reduced weight
Building Blocks
### IMSE BUILDING BLOCKS

<table>
<thead>
<tr>
<th>CONNECT</th>
<th>TOUCH</th>
<th>SENSE</th>
<th>ILLUMINATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wi-Fi</td>
<td>Button</td>
<td>Proximity</td>
<td>Indicator</td>
</tr>
<tr>
<td>BT</td>
<td>Slider</td>
<td>Gesture</td>
<td>Icon</td>
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<tr>
<td>NFC</td>
<td></td>
<td></td>
<td>Ambient</td>
</tr>
</tbody>
</table>

**MATERIALS & COMPONENTS**
- Surface materials
- Surface finishing
IMSE System Elements

IMSE Part

Connector interface from IMSE to Control Electronics

Flat Cable
In-Mold Connector

Control Software

Wireless Messaging
Drivers for Building Blocks

Control Electronics

LIN Messaging

Connector interface from Control Electronics to End System

Customer Specific Connector

System Integration from Control Software to End System

Not part of TT standard delivery
Making Products

How building blocks are used to create products.
Suunto Smart Connector

10K+ twist and bends
50+ washing cycles

www.movesense.com
Smart Ashtray Cover

3mm thickness
Seat heater control
Air ventilation control

www.quin-automotive.com
Wooden Door Trim

3mm thickness
Illuminated seat controls

www.novem.com
Learn the rules like a pro so you can breake them like an artist.

*Pablo Picasso*

How to Digitalize Adoption of New Technologies?
Disrupting Technology, Supporting Markets

**TactoTek Design & Manufacturing**
- TactoTek designs and validates product according to customer requirements
- Manufacturing @ TactoTek

**Licensed Manufacturing**
- TactoTek designs product according to customer requirements
- Manufacturing @ Customer factory with TactoTek IMSE Builder™

**Licensed Design & Manufacturing**
- Customer designs the product with TactoTek IMSE Designer™
- Manufacturing @ Customer factory with TactoTek IMSE Builder™
Why Specific Tools for IMSE Design

- IMSE Designer enables independent designers to create TactoTek IMSE products using familiar design and simulation tools

- Traditionally electronics and mechanics design are separate processes, where flat or flexible PCB is assembled inside mechanics and assembled together

- In IMSE the entire design process is working in parallel on the same part, the film, which contains the UI graphics, part geometry and electronics - hence the traditional design guidelines do not apply in many instances

- The full film assembly, including electronics, is thermoformed and injection-molded which in turn challenges the simulations for electromagnetic performance, thermoforming and injection mold-flow

There are currently no tools for IMSE Design
IMSE SPECIFICS IN ELECTRONICS DESIGN

- Identify cross-overs automatically
- Apply dielectrics automatically
- Prevent errors in component placing
IMSE vs. Traditional PCB’s
Comparing IMSE with Traditional PCB

Thin, Plastic Substrate
- FR4 vs. Plastic film
- Component footprint

Trace Resistance
- 99.9% copper vs. Silver flakes & polymers
- Trace dimensions vs. current capacity

Dielectric Design
- Dielectrics for bridges

IMSE Design for Manufacturing
- Trace & component distance from gate point

3D Surface
- 2D vs. 3D
- Location of components at stretching areas
IMSE Electronics Design Flow

IMSE Specific Details

IMSE Certified Components

Schematics

IMSE Layout Design Guidelines

Input Files
- Mechanics 2D
- Tooling 2D
- Antenna
- LED Map
- UI Graphics

Layout Design

Simulations

Fabrication Files

Engineers and CAD tools collaborating

OK

NOK
IMSE Design Example

3D Shape

Interface

Mechanical Feature

Capacitive Button

Traces & Wiring

Dielectrics
How have we done it?

PCB layer stack in IMSE

Via between 1st and 2nd conductive ink layers

Manual DRC

Mechanical layers for dielectric design
Reshape.

Restyle.

Reinvent.
Yesterday:

2D

Today:

3D
This is not the future.

This is today.

Catch the wave with us!

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