



# IMSE

In-Mold Structural Electronics



IMSE is the combination of a printed graphic, printed electronic traces and injection molding.

The result is a cost effective plastic part with integrated circuitry. In-Mold Electronics makes “dumb” surfaces “smart”.

[Watch](#) our IMSE Technical Webinar





## Design Freedom



Inks and substrates can conform into complex, thin shapes allowing for more 3D design latitude.

## Smaller PCB



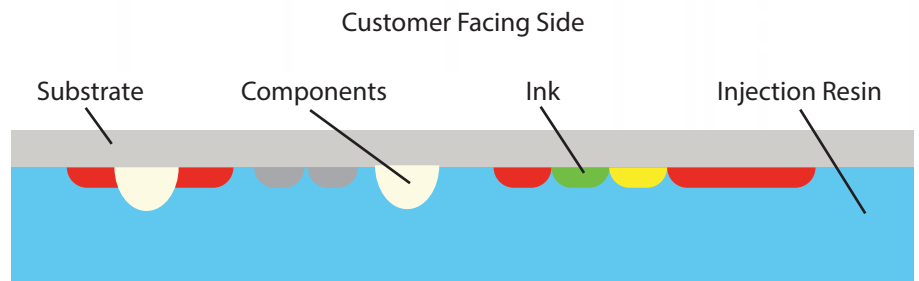
The PCB can be significantly smaller since it doesn't have to be behind all the switches and lights. PCB standardization even with switch quantity and location variation.

Printed electronics and components are encapsulated in resin to protect them from the environment.

Reduced electronics weight by 70% and assembly depth by up to 90% creates tremendous opportunities for designers and engineers.

Reduced BOM and increased ease of manufacturing. No switches to connect, no misalignment of LEDs to graphics.

## Durability



## Reduced Weight



## Reduced Bill of Materials



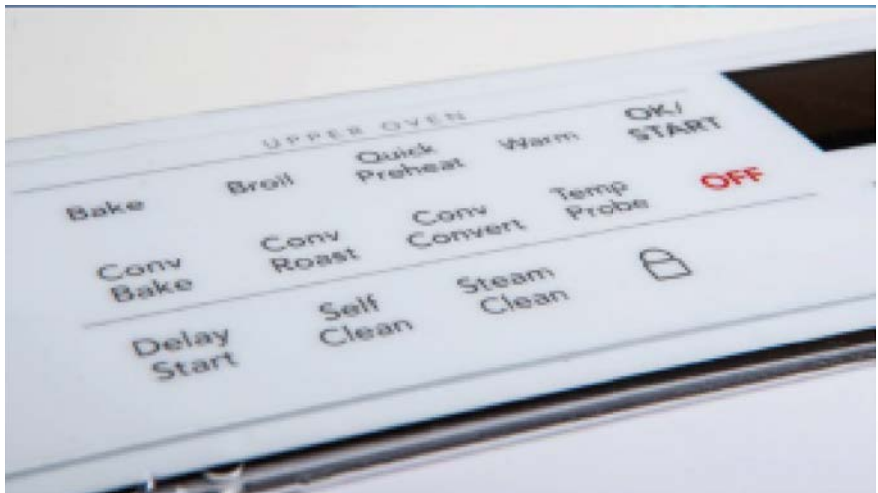
## Haptics

Haptics can be added as needed to enhance the user interface.



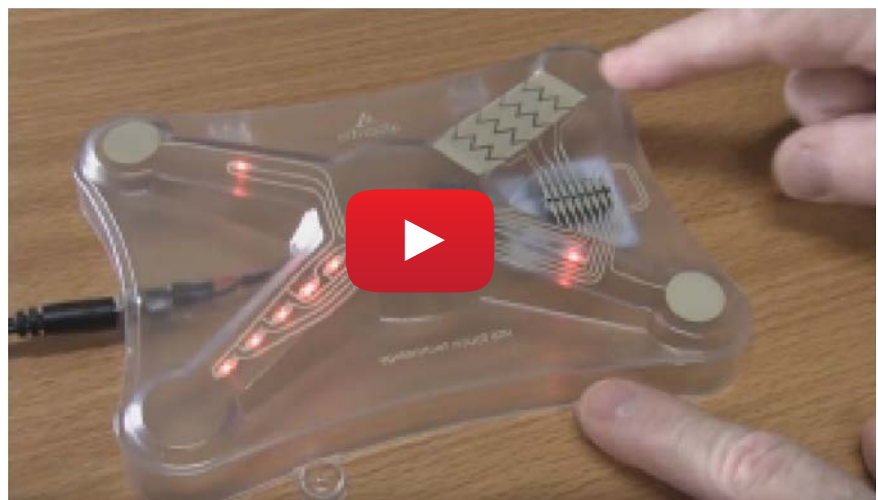
## Sealed Surfaces

Products that need thorough cleaning, no cracks and crevices around switches or buttons for dirt and bacterial to hide.



## Hydrophobic

Liquid rejection through tuning. No false actuations when cleaning or in outdoor environments.

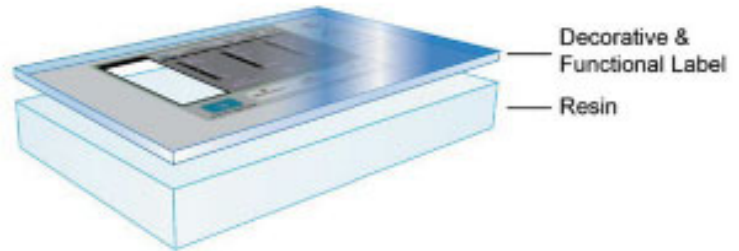




## Types of IMSE Construction

### Back Molded

- Resin molded behind label containing graphics and electronics
- Embedded connection (header)



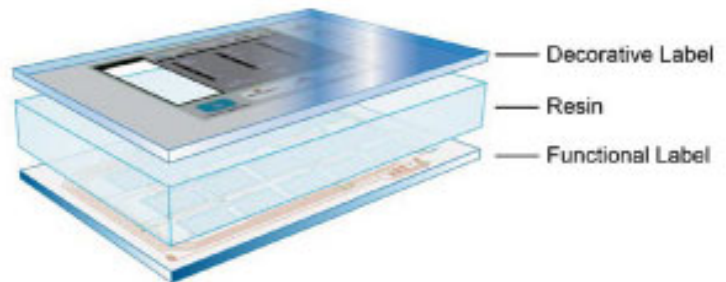
### Over Molded

- Resin molded in front of label containing graphics and electronics
- Connection to the circuit can be made post molding as a secondary operation. Chip on tail is also an option.



### Dual Label

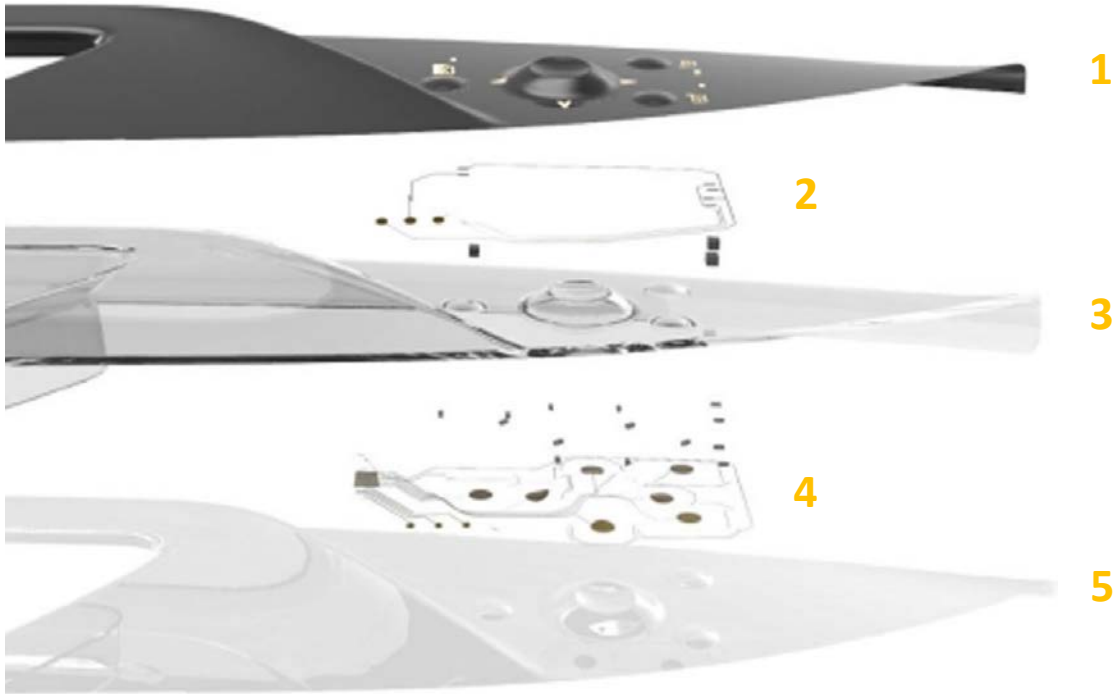
- Traditional in-mold decoration label on front and IMSE circuit label on back with resin molded between.
- Allows for more substrate options on the first surface (e.g.: gloss material).
- Elimination of header or ink telegraphing through to the first surface.





## IMSE Part Construction

Everything is injection molded to one-piece assembly



Designs may be 1 or 2 films  
Electronics may be on one or both films

**1. Decorative A Surface**  
IML Film or Natural Materials  
Decorative

**2. A surface electronics**  
Conductive inks  
Dielectric inks  
SMT electronics

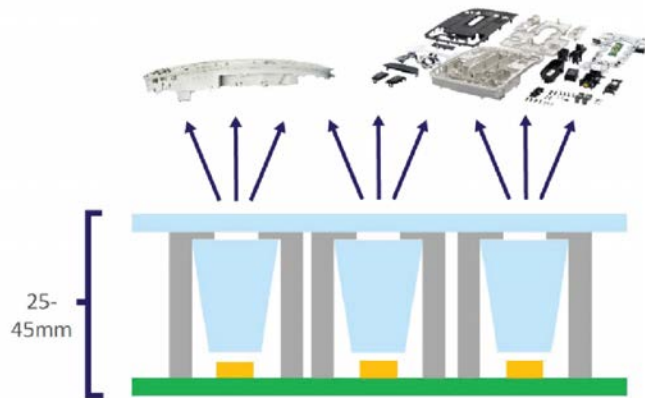
**3. Plastic Resin**  
PC, TPU

**4. B surface electronics**  
Conductive inks  
Dielectric inks  
SMT electronics

**5. Functional B Surface**  
IML film

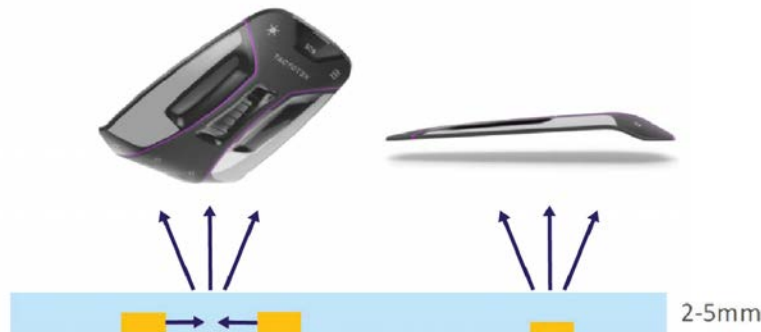


## IMSE Illumination Basics



**Conventional**

Conventional electro-mechanical structure carries LEDs on a PCB, and uses mechanical light guide assemblies to control light.



**IMSE**

IMSE part structure eliminates the need for separate light guides, and uses printing layers and injection molding resin as method(s) for controlling light.



## Validation Testing

### Environmental

Damp heat  
+85C/85RH, 1000 hours  
Thermal shock  
-40/+85C, 1000 cycles  
High heat aging  
+110C, 1000 hours

### Electrical

(in process)

Conducted RF Emissions  
CISPR-25  
(Current on all lines in harness)  
Radiated emissions  
CISPR-25  
Radiated immunity  
BCI - ISO11452-1 and ISO11452-4  
  
Radiated immunity  
ALSE - ISO11452-2

### Wearables

10K+ twist and bends  
  
50+ washing cycles



## DESIGN CONSIDERATIONS

In order for IMSE to be successful, projects need to be designed for manufacture. There are design guidelines and manufacturing limitations that need to be considered.

### Interconnect

How do we connect the circuits we print to the control board?

- Tail vs No tail
- Shutoffs and witness marks
- 2 label approach
- Overmolding

### Forming around SMD components

- LEDs
- Resistors
- ICs

### Substrates

- Hardness/Impact resistance
- UV resistance
- Chemical resistance
- Formability
- Dissimilar CTEs between the substrate

and

molding resin

### Ink systems

- Graphics inks – prefer UV inks that can be run on high speed equipment
- Functional inks – What are the resistances requirements or forming requirements.
- Adhesion promoters – Can we marry our ink systems with the selected resin system.

## IMSE CAPABILITIES

Capacitive touch buttons

Linear and radial sliders

Scroll wheels

LED indicators and icon backlighting

Resistive heating elements in plastic

Eliminate wiring harnesses by routing traces through existing plastic parts

## DESIGN ADVANTAGES

PCB's are rigid and cannot be formed. This limits the design freedom for the industrial designer. IMSE with molded 3D shapes and the use of formable inks offer design freedom for customers to differentiate their products in the market place. 3D User Interfaces open up a whole new toolbox for industrial designers and engineers

## DESIGN EFFICIENCIES

IMSE uses the internal volume of a plastic part to route electronics and reducing the overall space needed. By encasing the electronics in the plastic, overall weight and space can be saved. The IMSE process removes some volume of plastic resin and replaces it with electronic components which reduces the weight of the PCB.

## HOW DOES IMSE DIFFER FROM IMD/IML?

IMD/IML are graphics only

IMSE can be the addition of electronic circuit inks to an IMD label or a stand alone circuit and includes an electrically functional component.

- HMI
- Sensors
- Heaters
- Placing circuitry in real estate that is normally unavailable
- Smart Surfaces





DuraTech has been printing engineered graphics for 44 years.

Two manufacturing locations.

Approximatly 400 employees worldwide.

DuraTech developed their first IMSE device 9 years ago.

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**Watch our IMSE Technical Webinar**

