



In-Mold Electronics





Electronic components have evolved beyond the point where they must conform to a specific shape or flatness to guarantee optimal performance. In-mold electronics (IMEs) can maintain functionality while holding multiple different shapes and configurations, making them ideal for a broad range of unique product applications.

IME solutions have recently become more widely available. While IME technology had a rough introduction to the market several years ago, the technology has now progressed out of the research and development phase.

The manufacturing process is now robust enough for commercial and industrial applications. The supply chain that supports IME manufacturing is also growing, with raw materials manufacturers creating specialized films and conductive inks for use in In-Mold Electronics applications. It is highly likely that the IME market will experience rapid growth as the technology continues to advance.

What are In-Mold Electronics?

Traditionally, electronics incorporate a variety of rigid printed circuit boards and other circuitry solutions that require a portion of the physical space available in the design. IME manufacturing creates electronic circuits and systems with customizable shapes by incorporating screen printed circuits and graphic decorations onto flat, two-dimensional (2D) bases—such as films or plastics.

By using a combination of thermoforming, injection molding, and conductive inks, the 2D circuits created by this process can be integrated directly into complex three-dimensional (3D) designs that optimize available space. The result ultimately creates 3D objects with fully embedded circuitry. With less required space for electronic components, IME brings superior versatility to the design process for electronics and facilitate the design and construction of even smaller electronic devices.

How the Process Works

In-mold electronics use specially designed polyester films and polycarbonate film screen printed to create conductive circuitry. These materials can be used as a base for electronic components without inhibiting their functionality and may be thermoformed during later stages to hold unique 3D shapes. Manufacturers print layers of conductive and dielectric inks onto these films and sheets to form circuits. They may also incorporate decorative inks to hide or highlight the electronics or to provide labels for industrial parts.

Once the inks cure and dry, the sheets or films are heated and formed into the final desired shape by any of a variety of thermoforming or molding techniques. Once cooled, the sheets will be die-cut to remove excess sheet material.



At this point, 3D forms will be set in injection molds so a clear or colored resin can be injected behind the form. Manufacturers may also surface-mount additional components as needed, such as LED's and connectors. The final result will then be a fully formed, rigid plastic component with complete electronic functionality.

Initial IME manufacturing was a time-consuming process as materials available required slow print speeds and long cure times. More recently, however, material manufacturers have developed new inks and substrates to incorporate in-mold electronics fabrication into broader high-volume production processes. As such, design engineers can use the technology to create space-saving designs without risking high costs or slow production rates. This makes IME technology much more viable for broader use across a range of industries.





Industries and Applications

Commercial and industrial markets are rapidly progressing toward the use of in-mold electronics as the default process for incorporating static electronics systems into parts and products. Consumer-facing products—such as automotive interiors and white goods with embedded touchscreens—are setting this trend to meet high-volume production needs.

Industries

IME is becoming the preferred method over switch technologies for producing user interfaces in the following sectors:

- Aerospace
- Automotive
- Consumer electronics
- Home appliances
- Medical devices
- Military and defense
- Retail

According to IDTechEx's market forecasts, the in-mold electronics market will exceed \$1.1 billion before 2030.



Applications

In-mold electronics processes are primarily used to create user interface platforms. Human-machine interfaces (HMIs) are becoming increasingly popular across commercial, industrial, and consumer markets. They provide sophisticated tactile feedback on a wide range of devices, such as display and control screens for home appliances or onboard vehicle console applications like control buttons and navigation platforms.

Primarily, IMEs offer improved functionality in three areas when compared to alternative electronics manufacturing processes:

- **Illumination**, such as lit keys and visual feedback.
- **Touch technology**, which uses human touch to complete circuits and trigger responses.
- **Gesture responsiveness**, wherein technology responds to gestures such as hand waving or finger pinching



Benefits

In-mold electronics processes provide a broad range of benefits, such as:

- **Increased design possibility.** Simply put, IME creates more design possibilities. Designers have fewer restrictions due to the shape or space requirements of the circuitry. They also don't need to consider dead space for wire assemblies. Multiple design factors once considered challenging are ultimately eliminated, facilitating quick and easy design adjustments. Design engineers may also implement 3D plans without concerns about how complex geometries will impact functionality.
- **Lighter weight.** IMEs don't need buttons, wires, wire assemblies, circuit board substrates, or other traditional components, so the final electronics within a device will be up to 70% lighter. Additional weight reduction may occur due to the embedding of sensors, LEDs, and printed circuits directly in plastic without additional supports.
- **Reduced assembly time.** Assembly just requires a single snap-on operation rather than more complex (and often manual) wire assembling processes. This can cut total production time by up to 40%.
- **Cost-effectiveness.** Savings in time, weight, and materials decrease the total cost of production and transportation.
- **Reduced waste.** IME processes require less material for production, which means much of waste associated with traditional electronics manufacturing can be eliminated entirely.

Eastprint Solutions

Eastprint, Inc. has been an industry leader in printed electronics since 1978. Our experience in the electronics sector has led to proprietary innovations in the production of in-mold electronics.

We offer a full range of custom in-mold electronics solutions supported by our expansive in-house manufacturing and engineering capabilities. We partner with leading ink manufacturing, injection molding, thermoforming, and embossing companies to ensure the highest level of quality across each step of the manufacturing process.

When you work with Eastprint for your in-mold electronics needs, you benefit from the following:

- Our comprehensive database of compatible materials—including specific films, inks, and conductive epoxies—for easy project design and fulfillment.
- Our experience attaching SMT components to PET or PC film with conductive epoxies.
- Our state-of-the-art equipment, such as our high-speed and automated screen printing presses.
- Our preexisting supplier and partnership relationships with thermoforming and injection molding companies.



In-Mold Electronics Solutions from Eastprint, Inc.

IMEs are becoming very popular in an expansive range of industrial, commercial, and consumer markets. In-mold electronics may help you improve on your design or develop the next version of your product.

Our design experts can help you find the materials, designs, and manufacturing processes to get started. Please [contact us](#) for more information on in-mold electronics and our capabilities in this area.

About Us

Eastprint Incorporated is a global leader in the Printed Electronics industry with Manufacturing facilities in North Andover Massachusetts USA, Ciudad Juarez CHIH, Mexico and Guang Dong Shenzhen China.

We have been manufacturing and designing membrane switches since 1978 which makes us one of the very first Printed Electronic companies. Our solutions-oriented approach, engineering experience and expertise and breadth of design and manufacturing capabilities allow us to confidently take on your project challenges. From providing US based design assistance to low labor cost manufacturing locations we deliver your finished product on time, with exceptional quality at the right price.

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