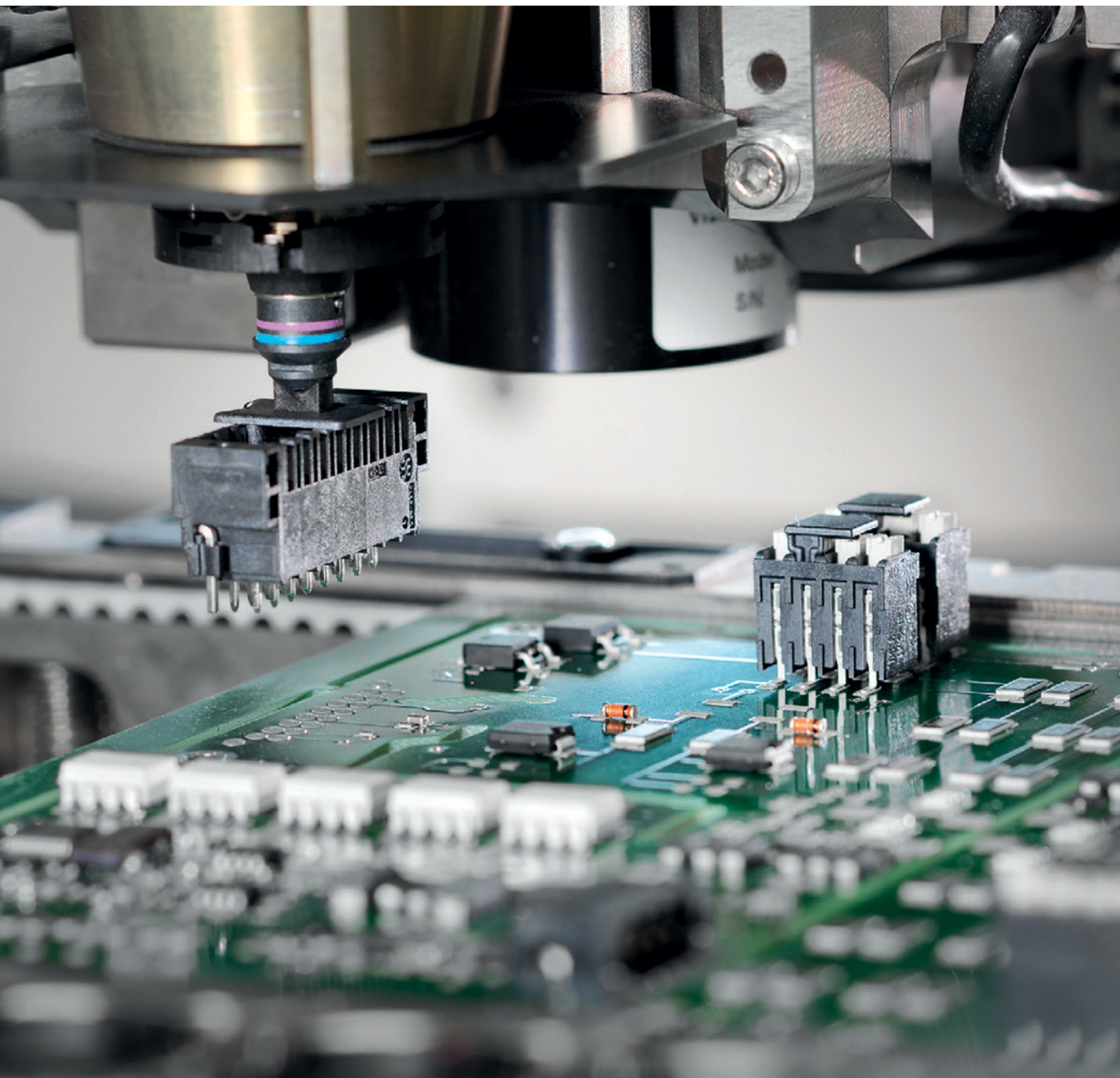


**SMT**

**A Single, Smarter Process for Building Today's PCBs**

How through-hole reflow technology combines with surface mount technology to maximize quality and cost savings

Whitepaper



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# 1. Executive Summary

For manufacturers designing and building printed circuit boards (PCBs), two goals consistently top the priority list: quality and cost-efficiency.

Over the past two decades, surface mount technology (SMT) has transformed the electronics assembly process by delivering faster, automated production and lowering the total cost of ownership (TCO).

Weidmueller is taking these benefits further with its through-hole reflow (THR) connectors to offer:

- **Greater automation:** Traditional through-hole technology (THT) connections require additional, often manual soldering steps for every connection point on a PCB.

With THR, one can pass a board through, as the name suggests, reflow ovens that can handle all soldering simultaneously. THR takes the proven fundamentals of SMT to the next level.

- **Streamlined processing:** THR connectors are built to sustain high temperatures, allowing all components to be connected in the same soldering process, which eliminates manual risks and speeds up production time.
- **Proven reliability:** THR components deliver the same trusted performance as conventional connectors, ensuring reliability and peace of mind. By improving the quality of the assembly process and eliminating manual work steps.

In this white paper, Weidmueller presents how, by eliminating manual soldering steps, THR connectors seamlessly integrate modern SMT workflows to unlock real savings in time, labor and development costs. Whether you're an engineer designing a new device or modernizing an existing assembly process, this is a shift worth exploring.

## 2. How SMT Jumpstarted the Move to Automation Production

Before addressing the new opportunities presented by through-hole reflow (THR) connectors, reviewing the current status of surface mount technology can provide a foundational understanding of this product's impact.

First developed in 1960, SMT had revolutionized electronics manufacturing by the late 1990s by allowing components to be mounted directly onto the surface of printed circuit boards. Traditionally, tiny chips and resistors were the main beneficiaries of SMT's automated placement and reflow soldering.

Some components — including connectors and relays — lagged behind, still requiring manual or semi-automated processes, such as hand, wave or selective soldering. These steps not only slowed production but introduced the potential for inconsistency and increased labor costs.

### Current state of SMT

Today's printed circuit board (PCB) is a platform for electronic components, Creating circuits whose complexity may vary from simple to highly sophisticated. Increasing requirements — including the miniaturization of components, greater functional densities and lower production costs — led to SMT.

SMT-designed components are set atop the board, which then undergoes reflow soldering — specifically infrared, convection or vapor phase soldering — to finalize their connections. Essentially, these boards pass through an industrialstyle oven that heats the soldering material, leading to hands-off connections.

However, many components — including those that might require stronger connections — still must be attached by through-hole technology (THT). Those components are inserted into pre-drilled holes on the board, then manually secured by soldering on the opposite side.

Weidmueller sought to develop a technology to close that gap and combine PCB production into a single process, leveraging the capabilities of SMT. The resulting THR process allows for components to be mounted through those pre-drilled holes — but secured during the same soldering process as the SMTdesigned components.

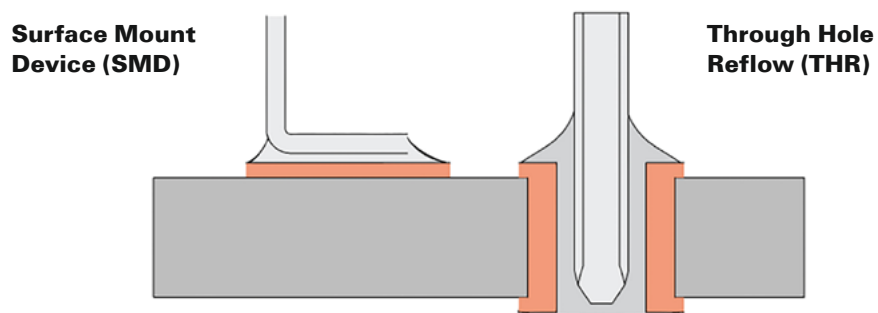
By eliminating the need for a separate soldering process, THR technology brings production a massive step forward, delivering exponential time and cost savings.

### 3. Innovative THR Technology Transforms Production

Through-hole reflow (THR) allows larger components to be processed in the same automated SMT reflow oven as surface mounted devices. This means one streamlined production line, one reflow cycle and significantly less manual handling – not to mention easier inspection and quality control.

Weidmueller's THR connectors are designed with high-temperature-resistant materials and optimized pin lengths and widths to ensure consistent and trusted soldering performance. The components are delivered in packaging formats compatible with pick-and-place, making them ready for high-volume production from day one.

**This important point bears repeating: THR allows all components to be connected simultaneously through the same soldering machine now.**



## 3.1 How THR delivers operational, cost gains

THR refers to processing components, which are inserted through a hole in the PCB and then soldered with other SMT components. This represents a milestone in PCB assembly with the following characteristics:

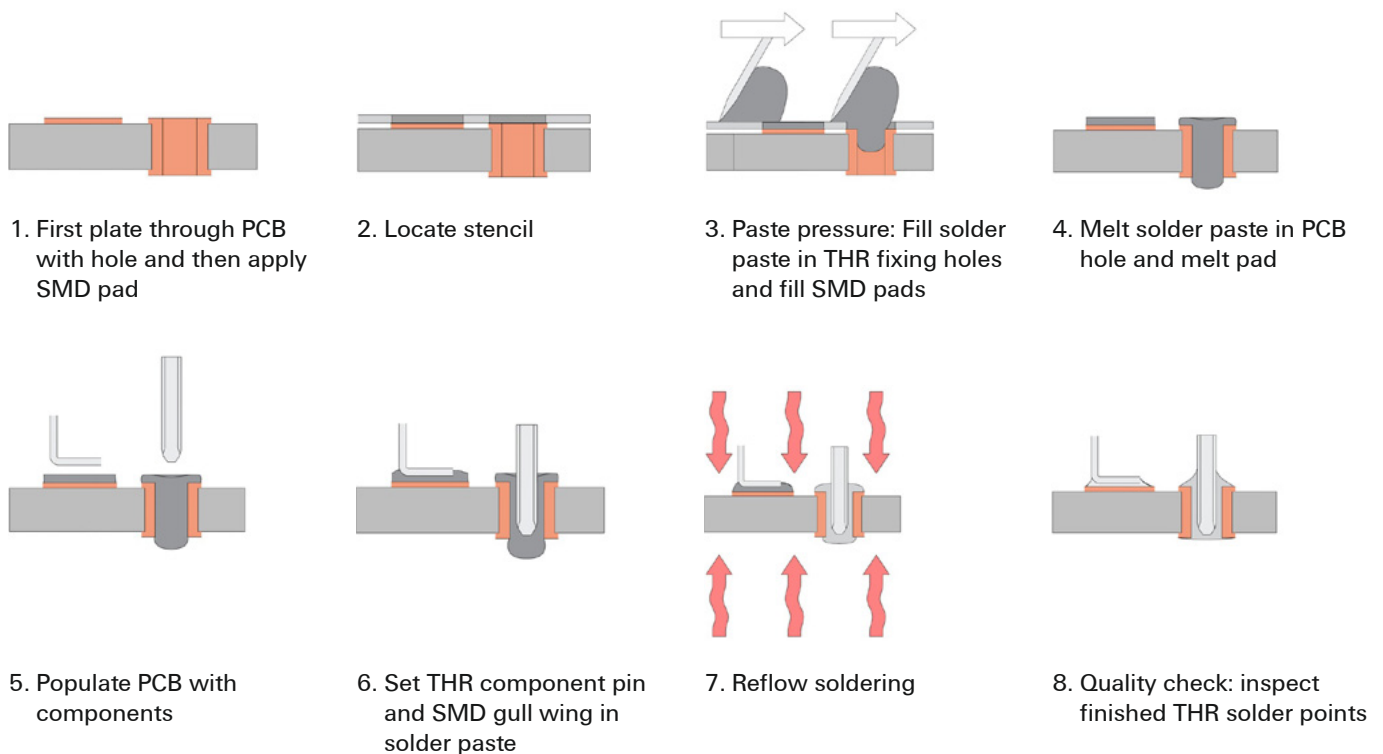
- A mechanically stable solder connection is established to the PCB
- All that is required is one soldering process
- Manual and wave soldering can be eliminated
- PCBs are automatically populated, at low production costs

For automatic assembly, components must have a smooth suction surface, which could be a component surface or a separate pick-and-place pad. Components also must have low intrinsic weights. With automatic sequential assembly or feed of the components, pick-and-place systems are used, and components must be packed for product-specific handling by robots, including tape-on-reel, tray and tube.

The soldering process requires high-temperature-resistant materials, an optimized heat supply and enough space in the soldering area. As the insulating body of the wired component may not come into contact with the solder paste, a sufficiently large stand-off should exist, depending on part size.

### SMT process steps

Surface mount technology includes the following process steps:



## 3.2 Benefits of THR technology

As noted previously, THR technology represents a milestone in PCB assembly with several distinct characteristics designed to improve efficiency and reduce costs associated with time and labor requirements.

The approach also reduces and eliminates related risks, such as varying pin lengths, pin widths and holes that are drilled either too big or too small. The uncertainty of perfect fits leads to risks of inadequate soldering results, which, in turn, limits or prevents component performance.

Weidmueller has developed a product range for the THR process that also makes wired connection technique applicable in the SMT process, which supports complete continuity in SMT production. As with all Weidmueller products, THR underwent rigorous internal testing to confirm the technology met or exceeded expectations before being launched in the market.

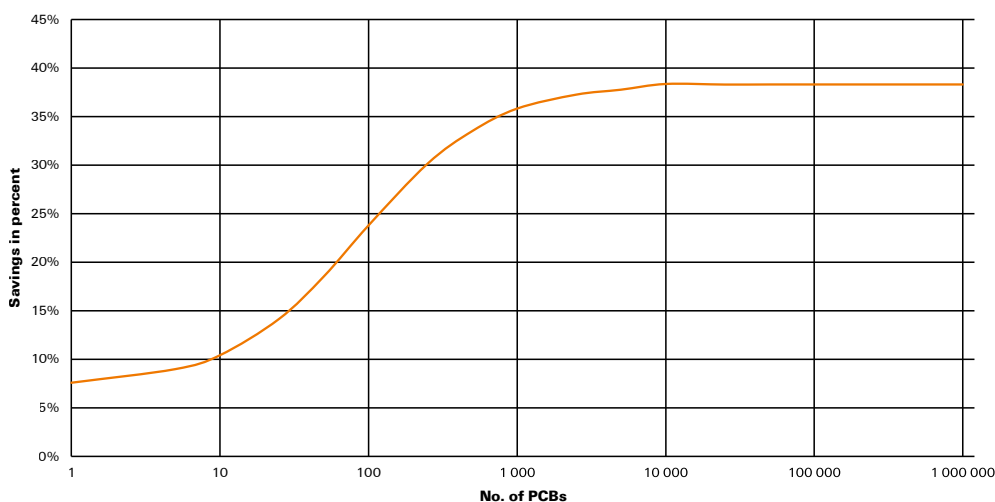
## 4. THR Saves Time and Money, with Same Trusted Performance

For companies seeking to maximize automation, minimize manual labor and build scalability into their operations, through-hole reflow (THR) adoption is a logical next step.

In a typical scenario, a control board includes both SMT chips and larger throughhole connectors. Historically, that meant two separate processes: SMT reflow for the chips and manual or selective soldering for the connectors. With Weidmueller's THR components, both component types can now be processed simultaneously — reducing labor hours, simplifying logistics and increasing throughput.

### 4.1 Real-world savings

A cost analysis done in collaboration with a major device manufacturer showed a 38% reduction in total cost per board when moving to a full SMT-plus- THR setup. Even small- to mid-sized manufacturers that outsource production to contract manufacturers benefit, as THR lowers the processing costs quoted by those vendors.



## 4.2 Design to cost

By specifying THR components at the start of a new project, engineers can design PCBs optimized for a single, automated reflow process. This “design to cost” approach ensures savings are integrated into the product from the ground up. And when updating legacy boards, THR parts offer a clear upgrade path that avoids costly production redesigns.

### Reliable PCB assembly with THR technology with our dimensionally stable pin headers made of fibreglass-reinforced LCP

#### Optimum solder pin length

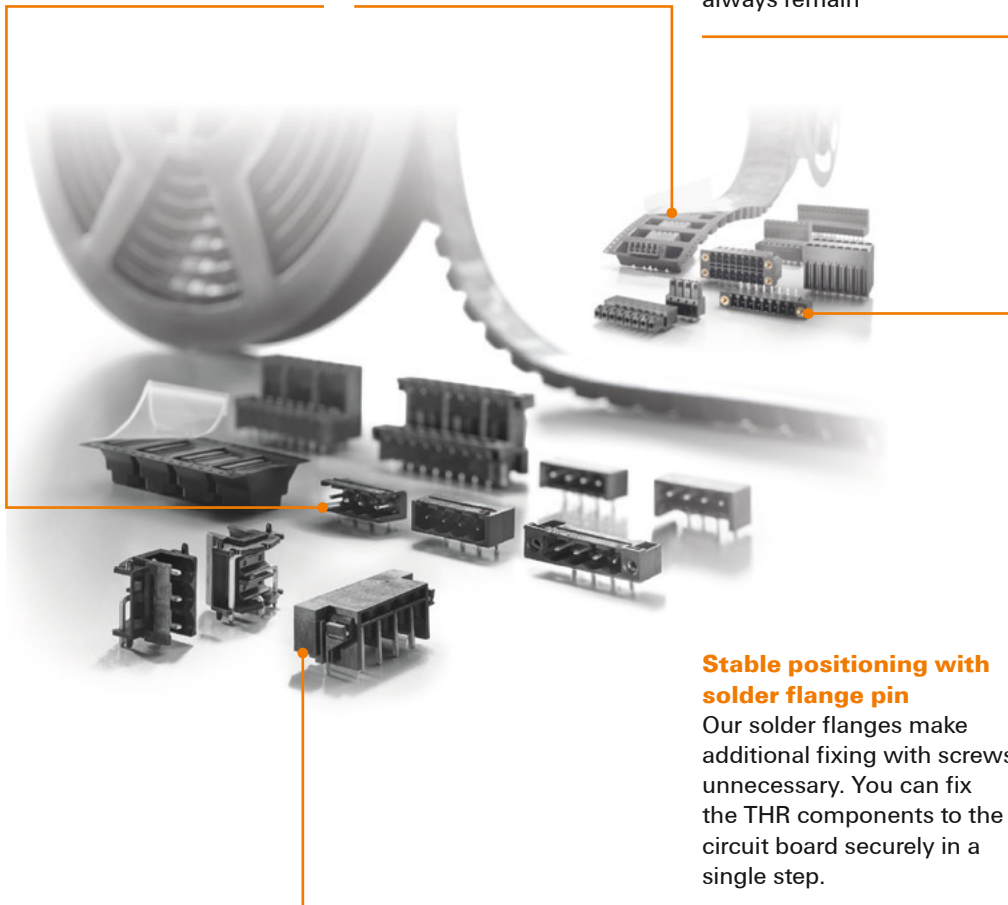
The pin length of 1.50 mm enables space saving, doublesided assembly of PCBs. At the same time, Weidmuller components meet all the requirements of IPC-A-610 E.

#### Robust insulating body

Thanks to MSL 1 (moisture sensitivity level 1), you can mount our THR components directly on the PCB without pre-drying. The durable material ensures dimensional stability

#### High-precision pin headers

With a position tolerance of less than  $\pm 0.1$  mm around the zero position, our solder pins comply with the IEC 61760-3 standard, and thanks to the latest production techniques they always remain



#### Stable positioning with solder flange pin

Our solder flanges make additional fixing with screws unnecessary. You can fix the THR components to the circuit board securely in a single step.

## 5. An Easy Transition Plan to THR Technology

Weidmueller's technology deserves attention from many organizations, but the through-hole reflow (THR) product line can generate significant gains for those who:

- Still rely on manual or wave soldering for connectors
- Seek to reduce lead times and labor costs
- Are designing new products or revising existing PCBs

### Next steps

Adopting a new technology can be daunting, but introducing THR can be game changing with large PCB volumes. To consider whether this is the right move for your organization, Weidmueller advises four key steps that inform smart transitions.

1. **Audit the current manufacturing process.** Do you use selective soldering? How about manual connector placement? That's your opportunity area. Consider how using a design-to-cost approach would generate a streamlined, tailored process at lower time and operational investments.
2. **Evaluate PCB volume.** Even at modest scale, THR offers measurable cost and time savings. The small difference in component costs can be overcome by looking at volume operations where you can generate operational gains — critical when every dollar matters in today's competitive economic climate.
3. **Engage Weidmueller early in the design phase.** Our engineers can help optimize layouts and pin lengths and widths for specific PCB needs. We will assist you with products, in-depth knowledge of applications and proven solutions expertise.
4. **Talk to contract manufacturers.** Ensure they're prepared to support SMT and THR production — and ask for cost comparisons. Drive the change you want to implement in your organization.

## 6. Conclusion: A Smarter Way to Build

Continuing Weidmueller's pioneering leadership in connection technology, through-hole technology (THR) delivers design to cost — a smarter way to build today's PCB boards. By eliminating additional soldering steps and embracing fully automated board and wire assembly, Weidmueller's THR and SNAP IN products come together as a clear path to faster, more cost-effective production.

### The key benefits include:

- **Up to 40% reduction in assembly costs** per board when switching from traditional through-hole connections to THR, which provides for streamlined processing and reduced manual steps
- **No additional soldering processes** (manual or wave) needed; components pass through the reflow oven with the rest of the board
- **Fewer steps, fewer errors and shorter lead times**
- **Same proven reliability** as conventional through-hole soldered components

Adopting THR as the new standard isn't just an incremental upgrade: It's a strategic shift that aligns with the future of smart manufacturing.

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