

Choosing an Adhesive for Small Electronics and PCBs

Trending Toward Smaller Devices and Faster Production



e ELLSWORTH
ADHESIVES

Jay Richardson - Vice President, Sales

As the electronics industry evolves with smaller, more powerful devices, manufacturers seeking to expand their market position must recognize that new adhesive technologies are not merely joining components; they are enabling new business strategies in a time-sensitive global marketplace.

With fierce global competition, manufacturing speed and efficiency has become nearly as crucial as product innovation. This accelerated market environment puts extreme pressure on assembly lines to improve efficiency at every step.

For the world of adhesives, these pressures also mean designers and leaders must prioritize high-performance materials. Those materials must work within tighter tolerances for bonding, sealing, and protecting devices — and they must enhance production speed.

Agile companies that can respond faster to consumer demands and production opportunities may be better positioned for the miniature electronics era — especially in regions with higher labor costs.

In this special Ellsworth Adhesives report, we'll discuss:

- The current landscape of options for bonding and sealing
- Key bottlenecks in current electronics production lines
- Opportunities for cost savings and higher-quality products



Pushing Performance with Bonds and Seals

As devices continue to shrink, traditional fastening methods such as screws have long become impractical in devices. Large volumes of adhesives have also become impractical as cell phones and smart watches become slimmer. Still, maintaining strong bonds and seals remains essential. To achieve that, engineers must consider innovative products for every step of their design for:

- Creating smaller screen bezels
- Bonding low surface energy plastics
- Preventing moisture and contaminant ingress

To tackle the challenge, several common options are on the market today including two-part epoxies, UV curing adhesives, and newer one-part epoxy formulations. Each formulation can offer significant advantages in both performance and process, but each also brings drawbacks.

Two-Part Epoxies: A Time-Tested Solution

Two-part epoxies have long been a staple for various electronics applications with their strong bond strength and versatile formulations that can tackle nearly any substrate and specialty.

Most two-part formulations are customizable at-scale by the right manufacturer, making them a popular choice for sealing screens, attaching housings, bonding small components, and more.

Two-part epoxies also offer some of the greatest affordability with their time-tested formulas. Behind their strong properties and customizability, however, can hide disadvantages.

A key drawback is the inherent mixing requirement, which can require additional labor or specialized equipment, create waste, and affect repeatability. Typical two-parts may also have a short working time.



Common two-part epoxy advantages:

- High bond strength across substrates
- Chemical and environmental resistance
- Adjustable cure profiles
- Good electrical insulation properties
- May be more affordable

Common two-part epoxy limitations:

- Requires precise mixing at specific ratios
- Limited working time after mixing
- May require specialized tools
- Quality concerns if mixing is inconsistent
- May complicate processes with post-mixing degassing

UV Curing Adhesives: An On-Demand Curing



UV curing adhesives have become increasingly popular since their inception over 50 years ago. They often come as a single-component system, aiding in their simplicity.

UV curing set-ups are especially common with electronic and medical device manufacturers for their strong conformal coating and structural bonding capabilities. Their “on-demand cure” allows for great workability — components can easily be placed and moved many times over before curing.

For large-scale manufacturing operations, UV cure systems can greatly improve cycle times with their rapid cure nature. A key drawback, however, is that they require specialty curing machines which offer limited repurposing and steep costs for scaling.

Many UV curing adhesives offer great improvements for cycle times, but many have low elongation, making them less effective against impacts from drops and falls.

Common UV curing adhesive advantages:

- Extremely fast curing when exposed to UV light
- Precise alignment and long working time
- Can eliminate mixing errors
- Wide variety of formulations

Common UV curing adhesive limitations:

- Limited depth of cure
- Formulas may have lower customizability
- Potential for “shadow areas” remaining uncured
- Require specialized UV equipment and safety protocols

One-Part Epoxies: A Mix-Free Method

Traditional one-part epoxies are essentially a pre-mixed version of a two-part epoxy. This format offers a simpler application process with their mix-free design.

Because one parts are pre-mixed, storage entails a constant battle to prevent premature curing. A solution is to maintain freezers to suspend the epoxy from curing; however, freezers are energy-intensive, bulky, and require products to thaw before use.

Many one-parts also require high heat for speedy curing, which can damage sensitive components and warp PCBs. Two-part epoxies may have a similar downside when rapid curing is necessary.

Often, one-parts and two-parts alike also require large spaces dedicated for curing racks — a final, but significant delay in the production process.

Common one-part epoxy advantages:

- Can improve consistency and reduce labor
- Extended shelf life when stored properly
- Lower risk of air entrapment
- Generally good adhesion to many substrates

Common one-part epoxy limitations:

- High cure temperatures
- Relatively long cure times
- Requires refrigeration or freezing

3M™ Scotch-Weld™ One-Part Epoxy Adhesives 6101 and 6102: A Breakthrough for One-Part Adhesives

3M's new one-part epoxies address several crucial and longstanding challenges that have constrained other one-parts in both manufacturing efficiency and design innovation. At the forefront of their new capabilities, designers will find:

- Rapid curing without high heat
- Highly flexible bond lines
- Improved impact resistance
- Reliable sealing with thin applications
- Longer room-temperature stability
- And other improvements

Production floors that have switched to these new one-part epoxies have already found opportunities to relieve bottlenecks, speed up their process, and save millions of dollars while creating a more reliable device.

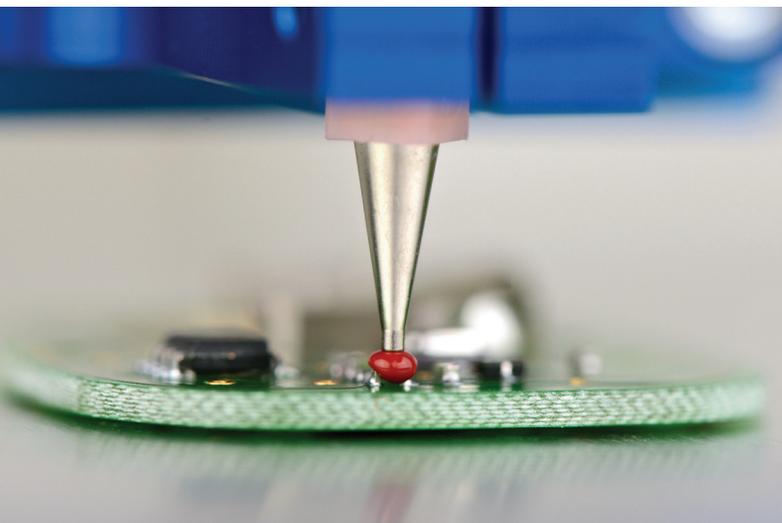
From Traditional Constraints to New Possibilities

Currently, many one-part epoxies require curing in energy-intensive, high-footprint ovens that can damage components and boards.

Alternatively, both 3M™ Scotch-Weld™ One-Part Epoxy Adhesive 6101 and 6102 can cure quickly with temps around 65°C. They also offer a “snap” cure option that allows materials to be completed and ready for shipping nearly instantaneously.

These one-part epoxies offer around four weeks of stability at room temperature, eliminating the need for intensive on-site refrigeration except for long-term storage. This increased stability also eliminates thaw and freeze cycles.

These improvements can immensely cut down on work-in-progress, allowing for faster product completion.



Improved Adhesive Performance and Process Capabilities

These one-part epoxy adhesives feature a thixotropic non-sag viscosity, enabling extremely thin bond lines that stay put with precision placement — perfect for working on extremely small devices and constructing extremely thin screen bezels. Both one-part epoxies, which mainly differ in color, are compatible with screen printing, jetting, and more traditional methods to fit into any process.

Their precise nature is well-suited for bonding and sealing a wide variety of dissimilar substrates including electronics grade plastics, composites, and metals.

Another key performance metric of these epoxy adhesives are their extreme flexibility after curing. With a high elongation point, designers can expect great impact resistance against bumps and drops — a critical metric for consumers with their devices.

These one-parts also exert minimal cure stress, ensuring small components are not damaged or warped after application.

With their extremely thin bond lines, these epoxy adhesives also offer reliable protection against water and contaminant ingress, enabling engineers to design highly reliable devices that may frequently encounter rain and sweat.

This combination of processing benefits and performance properties enables manufacturers to create thinner, lighter, more durable electronic devices — free from the constraints imposed by many contemporary bonding methods. These achievements can streamline production and reduce costs in today's competitive global marketplace.



3M™ Scotch-Weld™ One-Part Epoxy Adhesives 6101 and 6102: Real World Examples

Companies that have already switched to these one-part epoxy adhesives have experienced large improvements for both process speed and product quality.

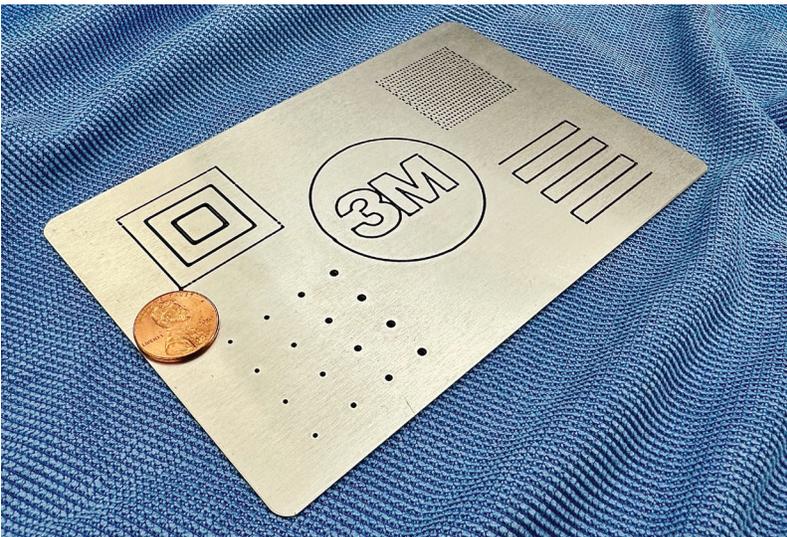
Reducing WIP While Resisting Impacts and Water

An electronics manufacturer needed to bond composites, seal out water, and rigidize components for a device that undergo intense day-to-day usage.

To handle the expected impacts, potential water exposure, and low surface-energy construction, they turned to 3M™ Scotch-Weld™ One-Part Epoxy Adhesive 6101. Their choice improved both product quality and production efficiency.

With only a 1/32" bond line, designers achieved IP67 rated protection. They also greatly improved durability with the high elongation of 3M™ Scotch-Weld™ One-Part Epoxy Adhesive 6101.

The rapid heat cure feature of 3M™ Scotch-Weld™ One-Part Epoxy Adhesive 6101 also improved throughput and reduced work-in-progress, allowing increased revenue and millions of dollars in savings.



Thinner Bezels while Resisting Thermal Shock

A manufacturer was bonding the edge of a glass screen to a PVB body. They needed to ensure ideal aesthetics with thin bezels while resisting potential thermal shock.

Designers turned to 3M™ Scotch-Weld™ One-Part Epoxy Adhesive 6102 to achieve a smooth, matte finish and thin edges. As an added benefit, their design was able to better resist thermal cycling and shock within constantly changing environments. .

Start Specifying and Testing Today

As a global distributor specializing in the supply and logistics of specialty chemicals and equipment, Ellsworth Adhesives is backed by decades of experience and a team of experts who offer complete solutions for nearly any application.

Our specialty chemical distribution facilities have made investments into freezer storage space while our engineering sales representatives (ESRs) possess diverse expertise to assist designers as they specify and validate these new products.

Ask an Ellsworth ESR today for samples and additional information to find out how these one-part epoxies can improve your process and product.

Global Network, Local Support

Our experts reach across the globe for materials and hardware and deliver them with a localized approach.

Import/export compliance • Tracking available for certain shipments • Creative international packaging
Digital lot & shelf-life controls • Dedicated R&D space • Ship to one location or many
DDTC registered with ITAR compliance programs in place

1200+
Employees

20+
Countries

25+
Distribution Centers

3M and Scotch-Weld are trademarks of 3M Company.