# Non-Destructive Die Extraction and Reassembly

Greatly improved reliability – die can be removed from plastic packages and reassembled into rugged ceramic packages providing far greater reliability

Meet customer requirements – provide a customer with an obsolete IC in the package they NEED, not just the package in inventory

Fast Turn Times – same day turns available

Save Money – by not requiring large die lots for *Prototype* development

Cost Effective – ~$30 per extracted die *

GCI can extract die from ANY package and reassemble those die into ANY *other available package*

- Move die from plastic packages to rugged ceramic packages
- Reassemble previously removed die into any available package – plastic or ceramic
- Create Multi Chip Modules (MCM) from packaged ICs
- Die Removal Process does NOT induce damage to the die
- Locate Counterfeit circuitry in Die for Intellectual Property (IP) Verification and Litigation

Additional Services:

- De-capping
- Die Thinning
- Full Service Packaging
- Wire Bonding

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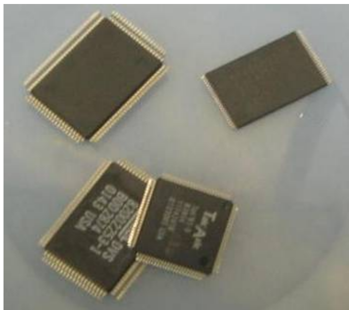
**Giga Connections, Inc.** (**GCI**) performs a wide variety of highly specialized engineering services for diverse semiconductor applications. Services include using GCI proprietary processes for "die removal" or "die harvesting" to remove die from plastic and ceramic packages without damaging the die. These die can then be reassembled into ANY available ceramic or plastic packages.

This is a proven approach to greatly increase product survivability in rugged and/or high temperature applications that require ceramic packages where those ICs are available in plastic packages but are NOT commercially available in ceramic packages. Although some packages are more difficult than others, GCI has yet to encounter a plastic or ceramic package where it was not able to successfully remove the die without damage to the die.

## Die Extraction Process



GCI will de-cap the package and safely extract the dice for repackaging or MCMs

Performing the etch and die removal process

Appraising etch process to assure product quality

Extracted dice from original packaging ready to ship or ready for reassembly

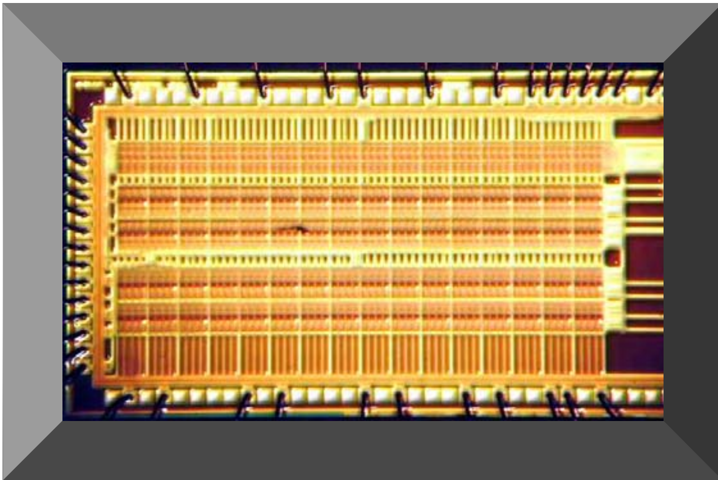
**Examples How GCI Die Removal and Reassembly Services Save Time and Money:**

***Example #1*** *- A customer's high-temperature, rugged application requires ICs packaged in ceramic packages but the needed ICs are only commercially available in plastic packages. GCI will extract the die from the plastic packages and re-assemble those die into rugged ceramic packages. This typically increases survivability by more than 10X in rugged, high- temperature environments.*

***Example #2*** *- A customer wants to build a few hundred engineering samples in a specific package, a flip-chip assembly or a multi-chip module (MCM) but cannot purchase die in quantities smaller than 10,000 units. However, small quantities of packaged units in an unwanted plastic package are immediately available. GCI will extract the die from these packages and reassemble them into the desired packages or supply "bare die" for an MCM application as desired.*

***Example #3*** *- A customer urgently requires a die in a package that is not readily available. Die removal and reassembly provides a viable option to waiting several weeks or indefinitely for additional silicon from a fab or foundry. If the die are available in ANY package, GCI can expedite a die removal order and either overnight the bare dice to the desired location, sometimes on the same day, or re-assemble into the desired package avoiding weeks of delay or longer.*

# Wire Bonding Repair Service



GCI can remove and re-attach bond wires and return prototype samples within days to save time and money

**Examples How GCI Wire Bonding Service Saves Time and Money:**

*A bond wire was inadvertently missed or mis-bonded due to an incorrect wire bond diagram that was discovered after a limited quantity of custom die had been encapsulated in plastic packages. It is often quicker and less costly to have GCI repair this problem than to procure die for a new build.*

## PRICING

* Non-destructive die removal is a highly labor-intensive process. Pricing for lots within the 200 to 400 unit range is generally about $30 per die for small die but could be more depending on the die size and the complexity of the job. Smaller lot sizes may have a higher price per unit and larger lot sizes may have a lower price per unit due to economies of scale. The minimum lot charge is $1000 per lot.

## CYCLE TIME

The standard production cycle time is three days from receipt to overnight return shipment. This can be expedited to a two-day, one-day or in some cases a same-day turn, if required. In a same-day turn, packages are received with an early AM delivery, and the bare dice will then ship via overnight to whatever address you specify later that same day.

## FLEXIBILITY

Distributors and Assembly houses have the option to refer Die Extraction, Reassembly, or Wire Bonding Repair customers to GCI or subcontract this work to GCI.

## RUGGED PERFORMANCE

GCI has taken side-by-side accelerated life test empirical data at 250C using the same silicon dice packaged in plastic ICs vs. packaged in ceramic ICs. The ceramic ICs contained dice that were removed from the same lot as the plastic ICs that were selected using a random sample. With every pin periodically tested for continuity at periodic readpoints after baking in an oven at 250C, the results showed the plastic packaged die began to fail showing "opens" after only 81 hours at 250C (which is equivalent to 350 hours at 185C) while the same die reassembled into ceramic packages began to show "opens" only after more than 1000 hours at 250C (which is equivalent to 16,000 hours at 185C). This data clearly demonstrates that the lifetime of the repackaged ceramic ICs was increased by more than 10X over the lifetimes of the plastic ICs at high temperatures.

**SHIPPING ADDRESS**

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