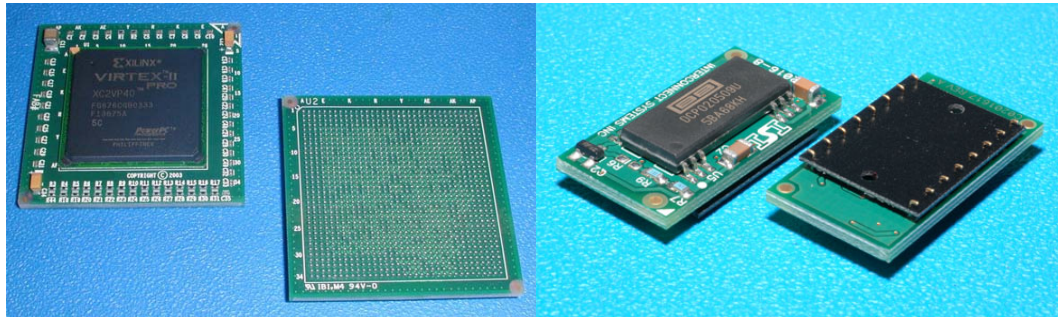


# Adapters - Overview



BGA to BGA Adapter

TSOP Adapter

BGA to PGA	BGA to QFP	BGA to BGA
QFP to BGA	SMT to DIP	SMT to SMT
PGA to PGA	Packaged Die to PGA or BGA	



BGA to QFP Adapter with VR using FlexFrame™ Interconnect



Various DIP Adapters

## Quick-Turn Solutions for IC Supply Issues

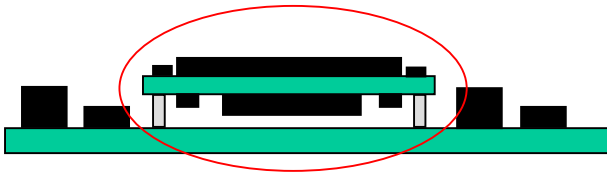
- ISI is the recognized industry leader and the world's largest volume manufacturer of adapter products that convert single or multiple components to almost any other footprint
- ISI designs approximately 150 new adapters each year to solve IC obsolescence and shortages. Our customers include leading electronics manufacturers such as: Agilent, BAE, Cisco, Fairchild, Harris, IBM, Lucent, Motorola, Nortel, Texas Instruments and Xerox
- In many cases, a newer package with an ISI adapter is more cost-effective than purchasing a component in an older package style
- ISI adapters allow the use of a newer or more available component package type without re-designing or re-qualifying the existing motherboard
- ISI can supply bare adapters ready for assembly, assemble your consigned components, or purchase all components to provide a complete turn-key assembly
- ISI has experience with fine pitch components. Adapters are available for QFPs with 0.4mm lead spacing, BGAs with 0.5mm lead spacing, and passive devices as small as 0201
- Power and ground supply planes and decoupling capacitors can be added as needed
- **Concept to prototype in 2 weeks, volume production in 4 weeks**

## Adapters - Examples

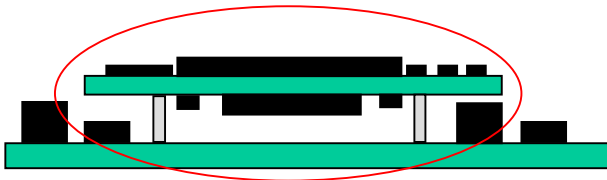
In many projects, more than one component is necessary to replace the original IC. For example, many adapters require bypass capacitors and/or voltage regulators. ISI has come up with many innovative solutions to allow multiple components to fit into the available space.



**Example A:** The new device(s) will fit into the same area as the original chip. Adapter has new device(s) on top side, and I/O to the motherboard on the bottom side



**Example B:** The new device and components will not fit into the same area as the original chip. I/O to the motherboard is lengthened to allow placement of devices on both sides of the adapter.



**Example C:** Adapter must extend above surrounding components to accommodate all components. I/O to the motherboard is lengthened and components can be placed on both sides

## Adapters - Examples

**Challenge:** A major network OEM discovered a field issue with a new IC after qualification was complete. Their product was ramping to full production, and the IC required a respin to solve the issue.



**Solution:** ISI adapter was designed to add Xilinx device and resolve issue.

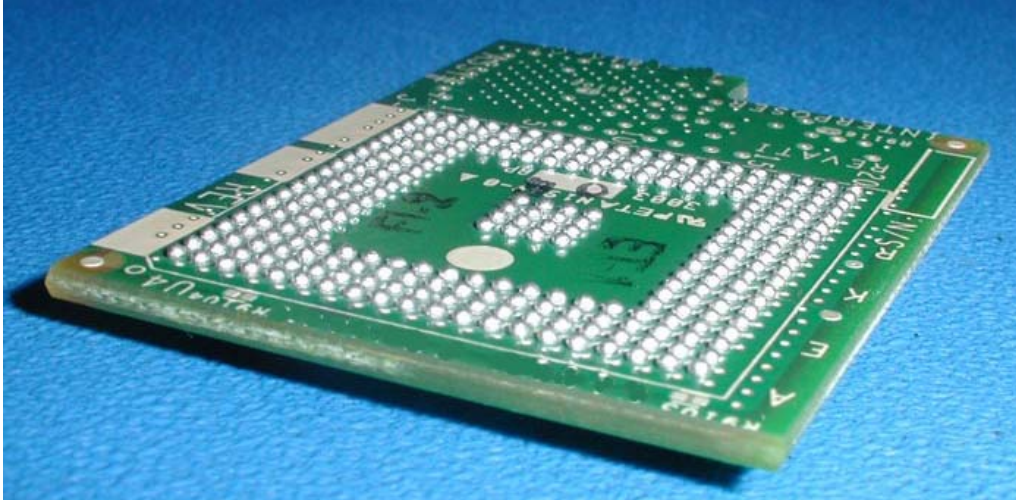
Adapter designed to fit around other components on motherboard.

Solder balls on bottom side of adapter solder to original BGA land pattern.

(4) Adapters assembled to each motherboard

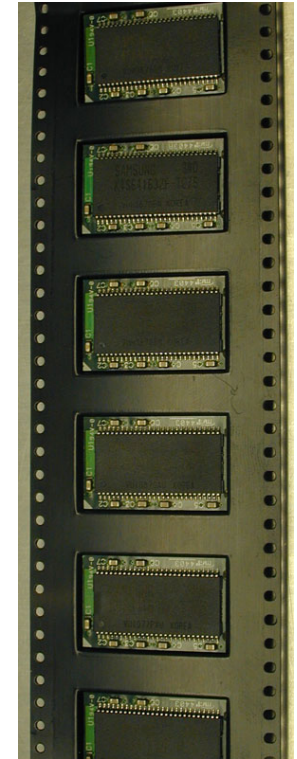
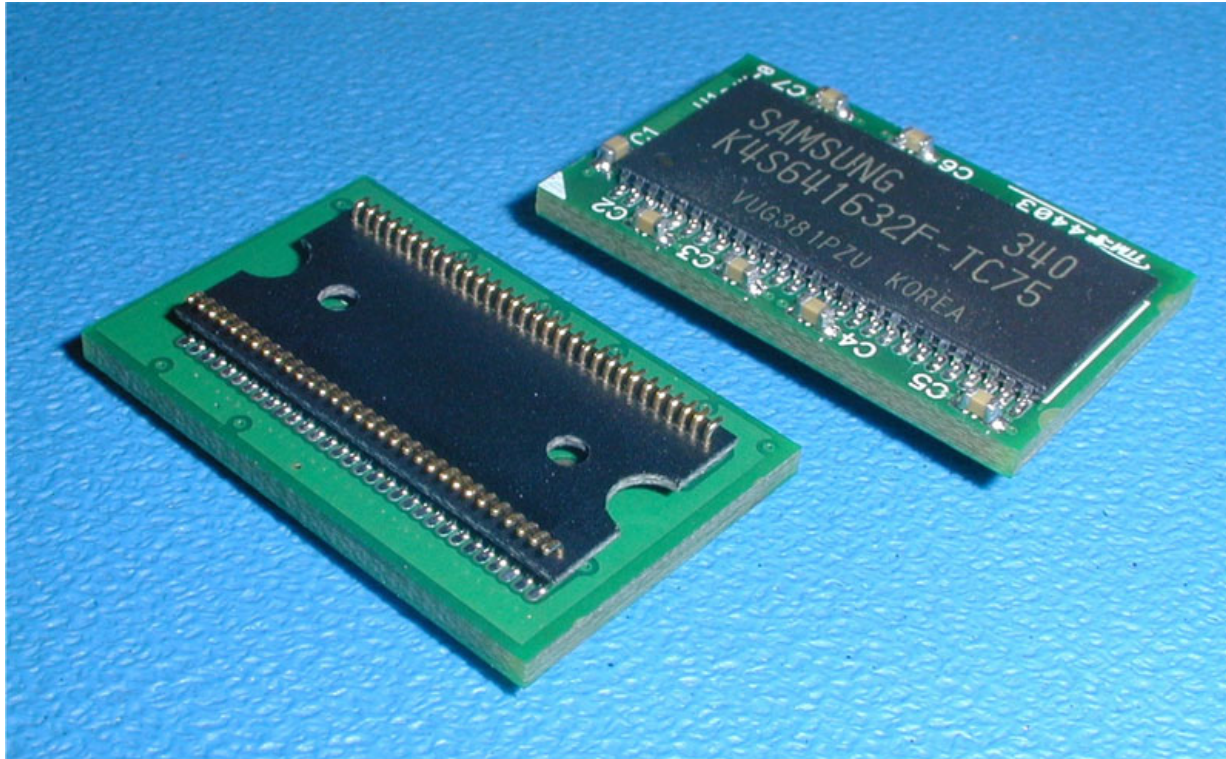
Adapter design completed and prototypes delivered in 6 working days

**Volume:** 400,000 pieces over an 8-month period. ISI ramped to volume in less than one month.



## Adapters - Examples

**Challenge:** A major telecom OEM won a large equipment order. A 62-pin SOJ memory chip used on several boards was obsolete, jeopardizing system delivery requirements for the program.



**Solution:** ISI adapter converts a standard 54-pin TSOP memory chip to a 62 position SOJ.

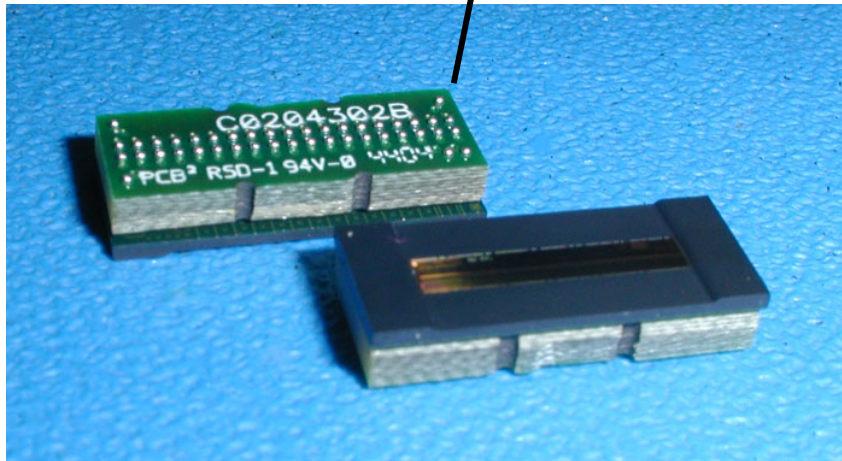
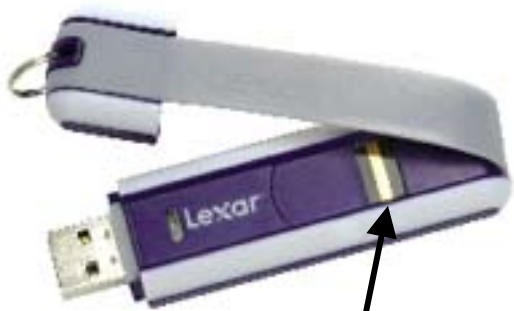
PCB and custom FlexFrame were designed 1 week after receipt of order, and prototypes delivered 8 days after design approval were built within 3 weeks. Volume production started immediately.

FlexFrame on bottom provides robust, cost-effective interconnect and high assembly yield at the CM. Turnkey adapters shipped in tape and reel to CM in Asia.

**Volume:** 350,000 pieces over a 9-month period.

## Adapters - Examples

**Challenge:** Lexar designed a fingerprint sensor into a next-generation USB Flash Memory Drive. The thin sensor package needed to be raised up to be flush with the surface of the plastic housing



**Solution:** ISI adapter was designed to raise fingerprint sensor 2mm.

'Z-height' tolerance critical for aesthetics and proper function

Aggressive cost target had to be met for highly competitive, low cost consumer application.

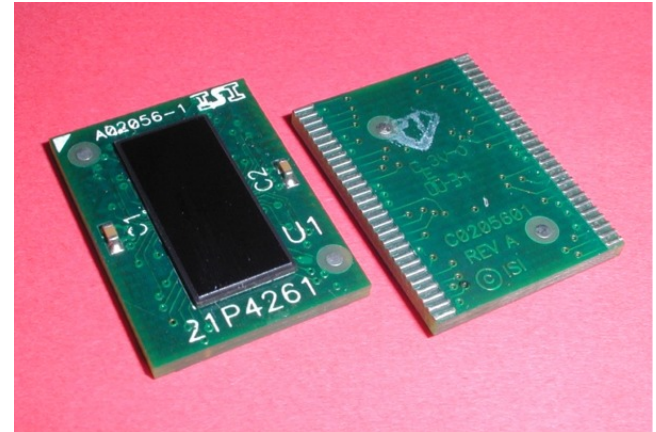
**Volume:** 10,000 pieces per week, ongoing production



## Adapters for Leadframe Packages



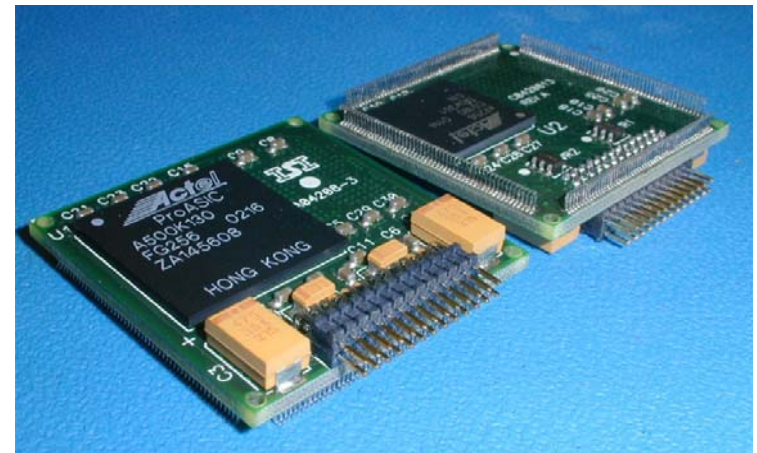
BGA to QFP  
with VR



MicroBGA to TSOP  
Pad to pad interconnect



SOIC to SOJ  
Memory Chip Adapter



Multi-Component to PLCC  
double-sided assembly

# Adapters - Examples

## Adapters for BGA Packages



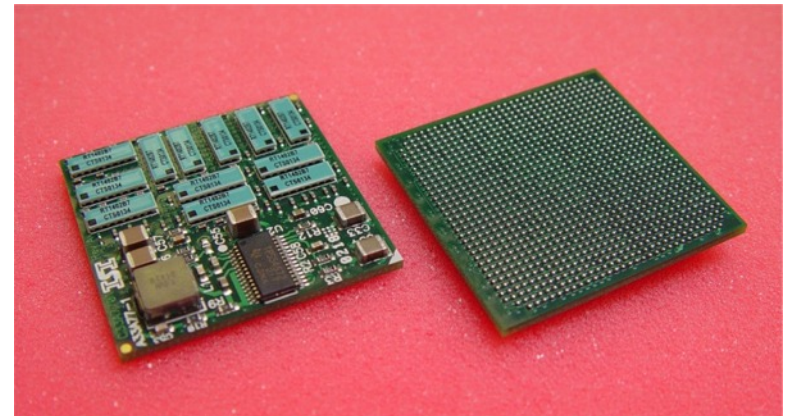
Dual BGA to BGA Adapter



BGA to BGA Adapter



BGA to BGA Adapter



BGA Termination Adapter  
(Terminates unused BGA site on motherboard)

## Why use a Footprint Conversion Adapter?

- **Obsolescence or shortage solution:** Permanent replacement of obsolete devices or devices in shortage without redesigning a motherboard.
- **Cost reduction:** New device with adapter may be less expensive than existing device
- **Avoid re-qualification expense:** Adapter is typically viewed as a component change, which may require less product re-qualification testing than redesigning the entire motherboard
- **Reduce engineering effort:** ISI can design the adapter PCB and build a turn-key replacement of your existing device. This avoids tying up Engineering to redesign and retest the existing motherboard
- **Fan-out:** Adapters can 'fan-out' fine pitch components to a larger pitch to avoid increasing motherboard layer count and eliminating microvias and blind/buried vias
- **Pin a SMT device:** In some cases customers prefer a pinned device because they want to use a socket, or they do not have SMT placement/inspection equipment

## Can a Footprint Conversion Adapter withstand multiple reflow cycles?

- Yes, and in most cases, standard eutectic solder can be used for adapter assembly because the surface tension of the solder holds components in place during additional reflow cycles. Standard double-sided SMT processes rely on this same principal. High mass component can be held in place with epoxy if necessary.
- ISI can assemble adapters with high temperature solder as required.
- Adapters with through-hole pinouts (DIP or PGA) can be designed for wave-solder attachment to the motherboard. Pins are typically tinned to prevent gold migration into the solder bath.

## Is a Footprint Conversion Adapter compatible with automated SMT placement equipment?

- Production volume adapters can be packaged in trays or tape and reel.
- The largest component is generally centered on the top of the adapter to provide a good surface for pick and place equipment.

## Adapter Design Process Flow

1. Concept & feasibility discussion between ISI & Customer
2. Customer provides project information

Mechanical drawings of ICs and target footprint

- Net list or schematic
  - Routing requirements; matched/maximum signal lengths, differential pair, controlled impedance, ground planes, etc.
  - X, Y, Z dimensional requirements
  - Any specific reliability requirements
  - Schedule requirements
  - Quantities required for prototypes and production
3. ISI provides quotation for NRE, prototypes and production
  4. Customer orders NRE & prototypes
  5. ISI designs module/adaptor and submits design to customer for approval
  6. Customer approves design
  7. ISI builds prototypes
  8. Customer verifies function and in some cases reliability of module/adaptor solution, places order for production requirements
  9. ISI builds turn-key solution to production schedule