

Introduction

The knowledge and skills needed for PCB repair are practiced and taught daily by BEST Inc. The procedures in this instruction manual comply with the IPC-the governing body dealing with the standards for printed circuit board manufacturing. These standards include the following

J-STD-001	Requirements for Soldered Electrical Connections
IPC-7711	Rework of Electronic Assemblies
IPC-7721	Repair and Modification of Printed Boards and Assemblies
IPC-610	Acceptability of Electronic Assemblies
IPC-600	Acceptability of Printed Boards

General handling guidelines for printed circuit boards are applicable to any rework or repair done to PCBs. These guidelines are referred to in the following:

1. Electronic components and assemblies need to be handled and cared for per the J-STD-033 MSD guidelines
2. IPC-A-610
3. IPC 7721 Section 2.1 Handling Electronic Assemblies
4. Proper Care for Electrostatic Discharge (ESD)
5. Proper Care for EOS Electrical Overstress (EOS)

Why BEST Inc Repair Kits?

- BEST repair kits feature the right “tools of the trade” selected by BEST Inc repair technicians who have repaired thousands of PCBs over the years. For instance, “tools of the trade” such as dental pics are great for digging out burnt PCB laminate materials and are included in our standard PCB repair kit.
- Compare the number of patterns available on BEST frames with those of other manufacturers and you will agree that you get more for your money with BEST circuit frames. You will get MORE repairs out of BEST circuit frames.
- Easy to follow instructions including “how to” photos allows you to more accurately repeat the procedures followed by professional PCB repair instructors and technicians.
- Instruction, either through a video medium or in person, is available from an IPC master instructor in 7721 procedures

Repair procedures are highly labor intensive and as such rely on the individual skills of the operator. Repair of printed circuit boards is based on the experience of the operators and should not be performed by personnel who are only performing the repairs a few hours per week or on a rotational basis with other job functions. PCB repairs are highly specialized requiring the skill, caring and creativity normally found and practiced by artisans.

IPC Compliance

Most of the products herein are designed to comply with procedures referenced in IPC 7721 Modification and Repair of Printed Boards and Assemblies

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Trace Repair -see “Pad Trace Instructions” instructional slides

Procedure: This procedure is designed to repair damaged SMT land/trace combinations. The traces you cut from the BEST circuit frame library are joined to existing printed circuit board traces.

IPC Referring Procedures: IPC 7721 4.2.1

Tools Required

- | | |
|---------------------------|-----------------|
| Small c-clamps | Flux* |
| Cleaning solvent* | Microscope* |
| BEST Circuit Frame #3 | Dental pics |
| BEST epoxy | Solder* |
| Kapton tape* | Soldering Iron* |
| Knife | Wipes* |
| ESD-safe cutting surface* | Popsicle sticks |
| Orange sticks | |
- (* not included with standard repair kit)

Procedure

- a. Clean the area with an approved solvent.
- b. Remove the damaged circuitry from the board utilizing the cutting knife supplied in the repair kit. The damaged conductor should be trimmed on the PCB to a point where it is still well-bonded to the PCB.



Heat can be applied to the damaged conductor using a soldering iron to allow the trace to be removed more easily

- c. Clean any excess solder off the existing trace for a distance of 2-3 trace widths.. Apply flux and tin this area.
- d. Clean the board with an approved solvent.
- e. Match up the trace from the BEST Frame. Be sure to remember the identifying letter or number on the circuit frame for any further procedures which may be required



For custom sizes use a knife to trim the proper trace from the circuit frame or call BEST (847) 797-9250 for custom trace requirements.



DO NOT CUT THE SELECTED REPLACEMENT CIRCUIT AT THIS TIME

- f. Scrape the excess oxides from the copper surface where you will be lapping to the existing circuit trace
- g. Cut the replacement circuitry from the frame using the knife provided.



Do not stretch or damage the trace prior to placement.

- h. Position the replacement trace section at the proper location. If necessary bend the trace using the orange sticks as needed to match the shape of the existing conductor.



Wooden sticks can be used to help bend the new traces. Use one orange stick to hold the new trace at the location of the bend while using the other to bend the other wood stick to form the shape as needed.



For wider traces you may need to fold over the trace to produce sharp bends.

- k. Form the final trace shape holding it into place with ESD-safe tape.
- l. Apply flux and form a lap solder joint at the overlap. Remove the tape.
- m. Mix the epoxy. Coat the bottom of the trace with epoxy using the ends of the wooden orange sticks.



In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.

- n. Cure the epoxy per the manufacturer's directions
- o. Clean the repair area with an approved solvent.
- p. Apply any coating to the board that was previously existent.
- q. Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A) test method 2.4.1.
- r. Visually examine the proper alignment of the trace and the overlap of the trace.
- s. Visually examine the area of the epoxy coating for texture matches.
- t. Test the site for electrical continuity as applicable.

Via Repair-see “PlatedHole Instructions” instructional slides

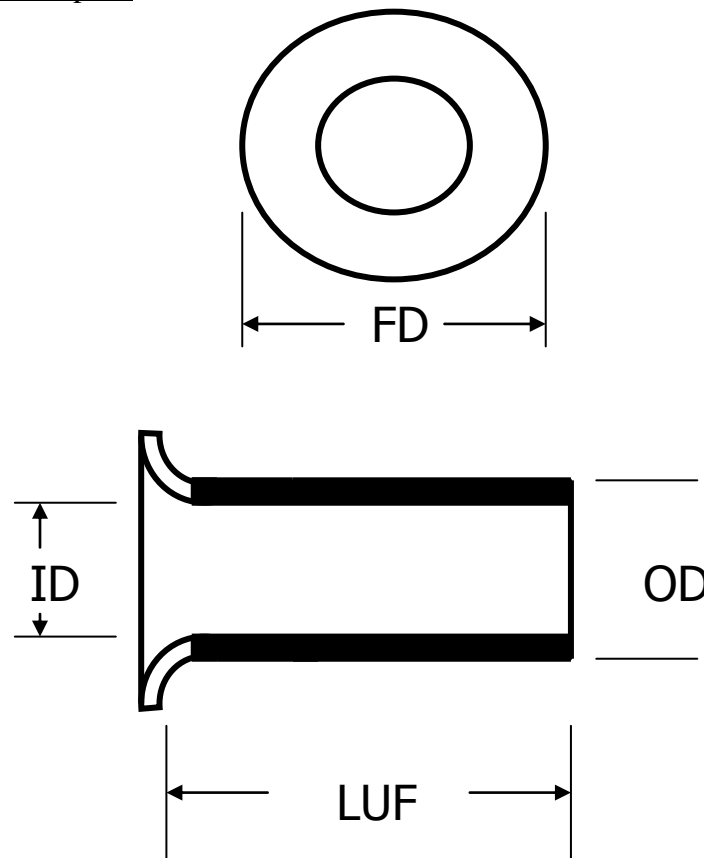
Procedure: This procedure is designed to repair damaged vias/holes with no interlayer connections. Damage to the hole is repaired with an eyelet with the eyelet flanges replacing the pads on the PCB.

IPC Referring Procedures: IPC 7721 5.1

Tools Required

- | | |
|----------------------|----------------------------|
| Caliper* | Flux* |
| Cleaning solvent* | Microscope* |
| Knife | Drill Press or hand drill* |
| Eyelet kit | Wipes* |
| Eyelet forming tools | Solder* |
| Soldering Iron* | Drill bits or ball mills* |
| Hammer | |
- (* not included with std repair kit)

Choosing the right eyelet for the repair:



Chose the proper eyelet keeping the following in mind:

- **LUF** The length of the eyelet barrel under the flange should be 0.630-0.890mm greater than the thickness of PCB(this allows the for the right length after the flange is formed)
- **ID** Eyelet inside diameter should be 0.075-0.500mm greater than the component lead diameter for proper fit of the through-hole component lead.
- **FD** The flange diameter should be sized so that it does not protrude out onto other pads or conductors in the vicinity
- **OD** The clearance in the PCB hole should allow the eyelet to be inserted without undue force but, but should not exceed 0.125mm greater than the eyelet outside diameter.

Or use the eyelet chart found in the appendix of this user manual.

NOTE: While there are many different eyelet sizes available your BEST kit has been outfitted with the most common sizes. A minimum order quantity for new sizes applies to eyelet purchase outside of those in this kit. Call BEST Inc @ (847) 797-9250 for further details.

Procedure

- a. Clean the area with an approved solvent.
- b. Select the proper eyelet as per the criteria mentioned above. Calipers will aid you in confirming all of the dimensions
- c. Using a ball mill or conventional drill bit, drill out the hole needing repair. Make sure the plating is removed on the interior of the hole. The drilled hole should be 0.025 – 0.125mm larger than the eyelet O.D.

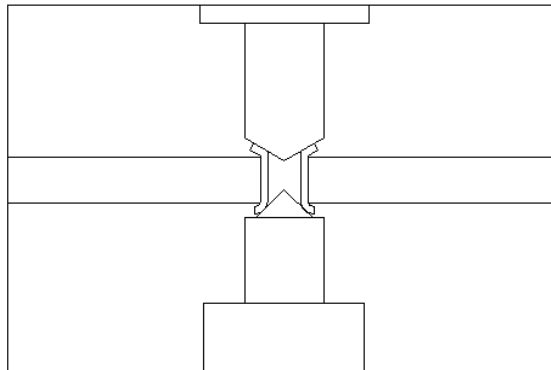


Drill should enter from the undamaged side of the PCB to exit on the damaged side. This prevents further PCB damage.



Any internal connections to the plated throughhole will be isolated on multilayer boards

- d. Clean the area with an approved solvent.
- e. Apply a small amount of liquid flux to the conductor or pad area on the PCB surface (if there is one connected to the hole to be repaired). Tin with solder using a soldering iron. Clean the area after tinning.
- f. Insert the replacement eyelet into the hole. If a replacement conductor is required it may extend into the drilled hole. The flange of the new eyelet will hold the new conductor in place.
- g. Flip the PCB board over and rest the eyelet flange on the lower setting tool/tool base. Stabilize the board using a board holder or your hands. Using the upper flaring tool flare the extension of the eyelet to form a cone. Using the setting tool and a small hammer, strike the tool to flat set the eyelet.



Make sure the board is supported and flat prior to striking the upper eyelet forming tool. This will insure a uniform flange.



Inspect eyelet per IPC 610 Acceptability Criteria

- h. Apply a small amount of liquid flux and solder the eyelet flanges to the pads of the PCB if necessary. The solder should go up 75% of the height of the flared flange. Clean the area. Inspect for a good solder connection. It should be properly wetted and should have flowed to the proper areas.
- i. Inspect the pad diameter both inside and outside.
- j. Make any electrical continuity measurements

Lifted Pad Repair- see “*Pad Trace Instructions*” instructional slides

Procedure: This procedure describes how to rebond a lifted conductor. Liquid epoxy is inserted under and around the conductor in order to bond it back down to the PCB surface.

IPC Referring Procedures: IPC 4.1.1.

Tools Required

Cleaning Solvent*	Kapton 2” wide tape*
Wipes*	c-clamp
Epoxy	Popsicle sticks
Knife	
Dental Pick	

(* not included with std repair kit)

Procedure

- a. Clean the area with an approved solvent.
- b. Remove any items preventing the lifted conductor from making contact with the base PCB material
- c. Clean the area with an approved solvent
- d. Mix the epoxy per the specified instructions
 1. Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
 2. Mix both resin and hardener on a discardable, clean, dry, flat surface.
 3. Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
 4. Mix thoroughly until both the Resin and Hardener blend into one uniform color
 5. Apply adhesive within 50 minutes after mixing.
- e. Carefully apply a small amount of epoxy under the entire lifted area of the conductor. Use either a knife tip or a small orange stick to get the epoxy underneath the conductor area.
- f. Press the lifted pad or conductor down into the epoxy and into contact with the base PCB material
- g. Apply additional epoxy to the surface of the lifted pad/conductor and to all sides as needed



In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.

- h. Cure the epoxy per the instructions
- i. If there was previously a surface coating, re-apply the same coating
- u. Visually examine the repair. Tape test as per per IPC-TM-650 (ANSI/IPC-FC-250A) test method 2.4.1.
- j. Make appropriate electrical tests.

Edge Connector Repair *see "Edge Connector Instructions" instructional slides*

Procedure: .This procedure describes the replacement of damaged and missing edge contacts.

IPC Referring Procedures: 4.6.2

Tools Required

Cleaner*	c-clamps
Wipes*	Popsicle sticks
Epoxy	BEST Circuit Frame #2
Knife	Dental Pick
Solvent*	Solder*
Soldering Iron*	Flux*
ESD cutting surface*	Kapton tape
Small flat file*	

(* not included with std repair kit)

Procedure

1. Clean the area with an approved solvent.
2. Overlay the edge connector frame so that the damaged or missing connector is aligned. Make sure to mark down the identifying letter on the frame as a reference. (If coating is present on the circuit trace , remove the coating before performing step #3)



DO NOT CUT THE EDGE CONNECTOR FROM THE FRAME AT THIS TIME'



THE CIRCUIT TRACE WIDTH MUST BE EQUAL TO THE ORIGINAL FOR CURRENT HANDLING CAPABILTIIES

3. Remove the damaged edge connector from the board using the appropriate cutting tool handle (with the appropriate blade). Trim the trace from the circuit frame to a point where the trace is still well bonded to the PCB. Heat from the soldering iron will allow the old contact to be removed more easily
4. Using a knife or dental pick, scrape off the area of any coating, epoxy or burnt board material from the PCB surface
5. Scrape off oxides on the existing trace on the PCB for a length of at least 3 trace widths using the knife to remove any oxides and mask. Tin the trace end by first fluxing the area and then applying solder.
6. Clean the board using an approved solvent.
7. Cut the replacement edge connector (with trace) from the circuit frame BEST #2. Use the cutting tool handle and an ESD safe cutting surface.

8Position the replacement edge connector at the proper location. The area where the new connector will be placed should be flat and smooth. If NOT then refer to other laminate repair procedures. Kapton tape

can be used at the replacement edge connector in order to properly hold it into position. The trace overlap should be at least 2 times the circuit trace width.



In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.

9. Mixing and Preparing the epoxy

1. Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
2. Mix both resin and hardener on a discardable, clean, dry, flat surface.
3. Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
4. Mix thoroughly until both the Resin and Hardener blend into one uniform color
5. Apply adhesive within 50 minutes after mixing.

10. Apply a small amount of epoxy to the surface where the new contact will be placed. Place the trace onto the PCB.

11. After the epoxy has cured, remove any tape that was used. Inspect for placement. Chamfer the edge of the replacement edge connector with a file. This will help provide a smooth surface while lessening edge damage not causing the edge connector.



ADDITIONAL EPOXY CAN BE APPLIED TO THE PERIMETER OF THE NEW EDGE CONTACT TO PROVIDE BOND STRENGTH.

12. Flux the area where the trace is attached to the PCB. Create a lap joint by soldering the circuit traces together overlapping one with the other.

13. Clean the area with an approved solvent.

14. If sealing of the lap joint is required, coat the lap solder joint solder connections with solder mask.

15. If plating is required refer to the appropriate procedures.

16. Examine visually. Confirm pad and trace dimensions.

k. Check electrical continuity

Base Board Repair-

Procedure: This procedure describes how to “fill” holes, gouges or large scratches in the PCB laminate. Liquid epoxy is selectively filled in to areas of the PCB where scratches, holes, gouges are located.

IPC Referring Procedures: IPC 7711 4.1.1.

Tools Required

Cleaning Solvent*	Kapton 2” wide tape*
Wipes*	c-clamp
Epoxy	Popsicle sticks
Knife	Scraper*
Dental Pick	Hand drill*
Ball mill, large and small*	
(* not included with std repair kit)	

Procedure

1. Clean the area with an approved solvent.
2. Remove any components or materials preventing access to the area requiring repair.
3. Clean the area with an approved solvent
4. Remove the laminate or any sharp edges or exposed fibers on the corner of that laminate
5. Use oversized ball mill to remove any signs of the damaged or charred laminate. Follow this with a smaller ball mill to “smoothen out” the edges of the repair
6. Use a scraper to “flatten out” the bottom of the hollowed out area of the removed area such that it is parallel to the surface of the laminate
7. Clean the area with an approved solvent
8. Prepare the two-part epoxy resin supplied as per the instructions.
 - a. Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
 - b. Mix both resin and hardener on a discardable, clean, dry, flat surface.
 - c. Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
 - d. Mix thoroughly until both the Resin and Hardener blend into one uniform color
 - e. Prepare the color of the epoxy using the color agents provided (if required)
 - f. Apply adhesive within 50 minutes after mixing.
9. Cure the epoxy as per the manufacturers' guidelines. It will dry somewhat concave (protruding from the surface of the circuit board)



NOTE: Protect heat sensitive components or remove them prior to heat curing the epoxy

10. Wet sand with a fine grit emory paper
11. Apply buttercoat finish. Use some of the epoxy /resin previously mixed and add a small amount of isoprpryl alcohol to the mixture. Mix this in with the epoxy/resin compound. Apply a “skim coat” or very thin layer to the top of the PCB in order to smooth out the surface finish.
12. If there was previously a surface coating, re-apply the same coating
13. Visually examine the repair.
14. Make appropriate electrical tests.

Solder Mask Repair

Procedure: The procedure described below is used to replace solder mask on printed circuit boards. The repair uses the brushing technique to apply the repair material.

IPC Referring Document: IPC 7721 2.4.1

Cleaning Solvent*	Utility knife
Drill bits or ball mills *	Microscope*
Color agent, variety of colors*	Oven*
Epoxy	Wipes*
Kapton tape*	

(* not included with std repair kit)

Procedure

1. Clean the damaged area with an approved solvent



NOTE: This repair method can only be used for surface damages or those into the base board material. However, this method should not be used when the damage is completely through the board.

2. Remove the laminate or any sharp edges or exposed fibers on the corner of the laminate



NOTE: In order to make sure all of the damaged laminate and PCB solder mask are “seen”, flood the area being repaired with alcohol. If any of the PCB internal fibers are damaged, then they will likely show up at this time.

3. Clean the area with an approved solvent
4. Apply Kapton tape to protect the parts of the PCB that need protection and as a “mask” to the area being repaired.
5. Prepare the two-part epoxy resin supplied as per the instructions.
6. Mix the epoxy per the specified instructions
 - a. Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
 - b. Mix both resin and hardener on a discardable, clean, dry, flat surface.
 - c. Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
 - d. Prepare the color of the epoxy using the color agents provided (if required)
 - e. Mix thoroughly until both the Resin and Hardener blend into one uniform color
7. Apply adhesive within 50 minutes after mixing.
8. Cure the epoxy as per the manufacturers' guidelines. It will dry somewhat concave (protruding from the surface of the circuit board)



NOTE: Protect heat sensitive components or remove them

9. Remove the Kapton tape
10. If there was previously a surface coating, re-apply the same coating
11. Visually examine the repair. Tape test as per per IPC-TM-650 (ANSI/IPC-FC-250A) test method
12. Make appropriate electrical tests.

Damaged Corner or Laminate Edge Repair

Procedure: This procedure describes how to repair a damaged PCB laminate edge or corners. These damages are usually the result of handling or packaging damage.

IPC Referring Document: IPC 7721 3.5.3

Tools Required:

Cleaning solvent*	Utility knife
Drill bits or ball mills*	Microscope*
Color agent, variety of colors*	Oven*
Epoxy	Scraper*
Hand-held drill*	Wipes*
Kapton tape*	Plastic box*

(* not included with std repair kit)

Procedure

1. Clean the area with an approved solvent



Remove any items preventing you from having complete access to area requiring repair.

2. Remove the laminate or any sharp edges or exposed fibers on the corner of that laminate
3. Find a small plastic box such as used in holding electronic components. All you will need is a single corner of the box matching the peripheral lengths of the corner area of the PCB.
4. Align the PCB with the damaged corner “nestled into” the corner of the plastic box. Make sure to align these edges. Fixture or tape the PCB into place.
5. Mix the epoxy per the specified instructions
 - a. Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
 - b. Mix both resin and hardener on a discardable, clean, dry, flat surface.
 - c. Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
 - d. Mix thoroughly until both the Resin and Hardener blend into one uniform color
 - e. Add colorant if required
 - f. Apply adhesive within 50 minutes after mixing.
6. Backfill the mixed epoxy into the corner of the box until the level of the epoxy is even with the level of the PCB laminate surface.
7. Cure the epoxy as per the manufacturers' guidelines. It will dry somewhat concave (protruding from the surface of the circuit board)



NOTE: Protect heat sensitive components or remove them

8. Wet sand with a fine grit Emory paper
9. Apply butter coat finish. This is done by taking some of the epoxy /resin previously mixed and adding a small amount of isopropyl alcohol to the mixture. Mix this in with the epoxy/resin compound. Apply a “skim coat” or very thin layer to the top of the PCB in order to smooth out the surface finish.
10. Clean the repair area using isopropyl alcohol
11. Dry with antistatic wipes
12. Visually inspect
16. Make the appropriate electrical test

Gold Finger Replating

Procedure: This procedure describes the replating of gold edge contacts by selective brush plating via a handheld swab system. When edge contacts are scratched or become “splashed” with excess solder or they do not meet the minimum thickness specifications they need to be replated. This procedure allows you to do this with the BEST replating kit.

This brush plating process uses an easy-to-use cleaning and replating system. It includes a miniature variable DC power supply. One lead (- BLACK) is connected to the connector edge contacts that need plating. A second lead is connected to the plating wand (+ RED). This wand has swab tips where solution is absorbed. When the tip of this plating wand is swabbed across the edge connector contacts the material contained in the swab tip is plated wherever electrical contact has been made.

IPC Referring Procedures: IPC 7721 4.6.3

Tools Required

Microscope*	Polyimide Tape*
Soldering Iron*	Lint Free Wipes*
Solder*	Power Supply with Integrated Cables
Solder Wick*	Nickel Tip/Swab
Liquid Flux*	Gold Tip/Swab
DI Water*	Cerium Oxide
Isopropyl Alcohol*	Nickel Solution
Safety Gloves*	Gold Solution
Safety Glasses*	Pull Testing Tape

(* not included with standard repair kit)

- a. Clean the area with an approved solvent.
- b. Apply polyimide tape around the site to be replated to protect the surrounding area and components.
- c. Add solder to the entire area to be replated to ensure an even surface when complete.
- d. Wick off solder using a soldering iron and braid such that the surfaces to be plated are flat.
- e. Clean with isopropyl alcohol prior to plating. Use a lint free wipe and dab off excess isopropyl alcohol.

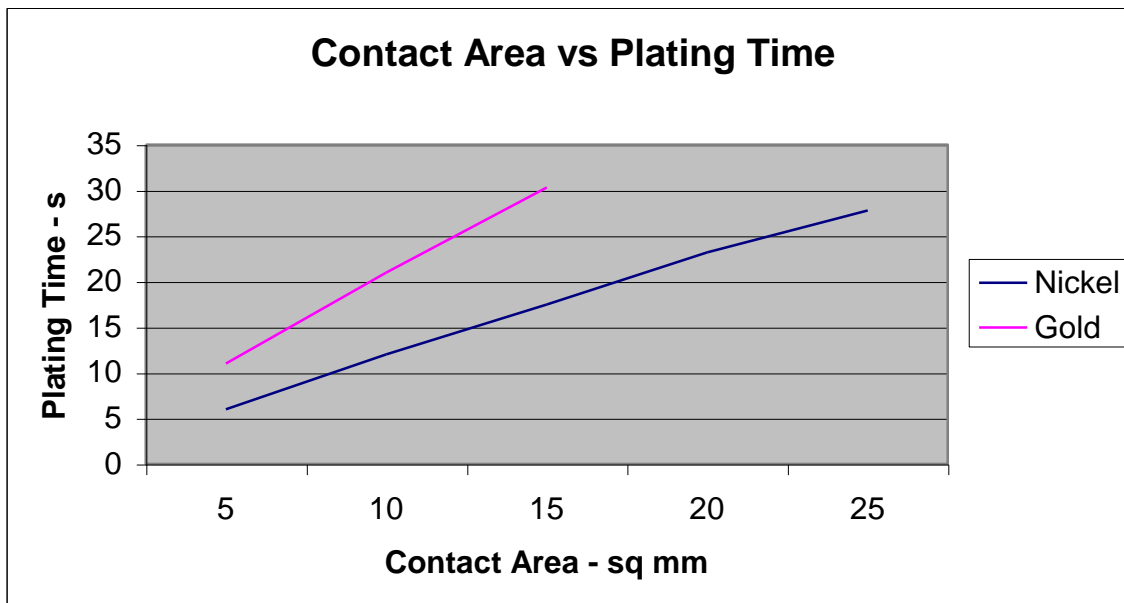


A conductive bus can be attached to all contacts that need plating. While there are other connection options the bus method produces the highest quality replating. For other connection methods call BEST (847) 797-9250.

The Plating Process

- f. Plug the power supply into the proper outlet. Make sure the output voltage setting is correct as given in the chart in this manual. Set the power supply to 6 V for nickel.
- g. Attach the probe system to the power supply using the black connector. Attach the plating pen to the (+RED) connector.
- h. Install the nickel tip/swab into the plating pen. Dip the tip into the nickel solution and saturate the tip.
- i. Touch the contact probe (-BLACK) to the inboard edge of each contact being replated or to the conductive bus if used. Using the saturated plating pen, swab the entire surface to be plated by brushing the surface with the swab. The plating swab should be moved back and forth briskly to prevent burning and to provide even coverage. Refer to the plating thickness vs. time chart in this manual for approximate coating thickness.
- j. Recap container when step is completed. Remove the nickel plating tip/swab. (NOTE: Do not cross contaminate nickel and gold tips)
- k. Buff with the powder slurry made of cerium oxide and water. Rinse the contact pads thoroughly with water.
- l. Set the output voltage of the power supply to 8V for gold.
- m. Install the gold tip/swab into the plating pen. Dip the tip into the gold solution and saturate the tip.
- n. Touch the contact probe (-BLACK) to the inboard edge of each contact being replated or to the conductive bus if used. Using the saturated plating pen, swab the entire surface to be plated by brushing the surface with the plating probe. The plating probe should be moved back and forth briskly to prevent burning and to provide even coverage. Refer to the plating thickness vs. time chart in this manual for approximate coating thickness.
- o. Recap the container when this step is completed. Remove the gold plating tip/swab. (NOTE: Do not cross contaminate nickel and gold tips)
- p. Buff rework area with the powder slurry made of cerium oxide and water. Rinse thoroughly with water.
- q. Evaluate/inspect the replated area. Make sure the coverage is complete and the finish is uniform on the surface to be plated. No extraneous plating or nickel foot or edge pull back nor skip plating shall be on the plated surfaces (See IPC A610 Acceptability Requirements)
- r. Measure the nickel and gold thicknesses via the proper measuring equipment. The nickel thickness shall be between 3 and 6 μm (118.1 to 236.2 μin). Gold thickness shall be a minimum of 0.05 μm (1.97 μin). The typical range is 0.075 to 0.125 μm (2.955 to 4.925 μin of gold)

- s. Using IPC TM-650 check the peel strength of the plating material using the peel tape test
 - a. Use 3M brand 600 tape ½” in width.
 - b. Apply 50 mm length of tape to plated area. Make sure all entrapped air is out from underneath the tape. The time from application until the peel test shall be less than 1 minute. The strip must be unused to perform this test.
 - c. Remove the tape by rapid perpendicular pull force relative to the board.
 - d. Visually examine tape and test area for any remnant plating material. Remnants on either shall be a fail.
- t. Examine the rework area for color and luster at 1.75x magnification.
- u. Remove polyimide tape from surrounding area and remove any remaining residues. Inspect the surrounding area for any defects.
- v. Test the site for electrical continuity as applicable.



Recommended Output Voltage for Each of Plating Pens

Description	Voltage	Usage
Gold-24K	6-8V	Plating over gold and nickel
Nickel	5-6V	Plating over copper

Epoxy Curing Instructions

Procedure: The BEST 2-part epoxy is used to adhere replacement pads, traces and lads to the PCB as well as being used as a media for the repair of the PCB base. The epoxy system has been used for 20 plus years and features: a clear color, room temp or heat cure and is easy to mix.

Tools Required:

Premixed epoxy/resin package

Flat plate for mixing epoxy

Orangewood stick for mixing epoxy

Dental pick or other device for applying mixed epoxy to small areas

Procedure

1. Clean the area with an approved solvent. Make sure it is dry.



Remove any items preventing you from having complete access to the area requiring repair.

2. Combine the Resin and the hardner in the correct ratio and mix thoroughly until the color and consistency are uniform. **EQUAL BEAD LENGTHS OF BOTH THE RESIN AND HARDNER WILL GIVE YOU THE RIGHT RATIO!**



Mixing the adhesive just prior to use is recommended

Heat build up during or after mixing is normal.

Mixing smaller quantities will minimize the heat buildup.

3. The bonded parts should be held in contact until the part has developed holding strength.

4. This adhesive system can be completely cured with heat such as 2 hours at 60°C (140°F), 1 hour at 60°C (180° F) or 30 minutes at 121°C (250° F). Heat cures can be used to achieved a desired degree of cure from handling strength to the full cure. After 24 hours at room temperature 90% of the full cure properties are obtained. The parts will be completely cured after 3 days at room temperature.



Store the epoxy elements in an unopened container in a cool dry location. Ideal storage conditions are between 8 and 21° C (46 to 70° F). Exposure to temperatures over 28°C (82° F) for prolonged periods should be avoided as this can adversely impact product properties.

PCB REPAIR KITS AVAILABLE

BEST PCB Repair Kit

BEST PCB repair kits give you the tools you need for fast repair and modification of lands, traces, contact fingers, SMT pads, plated hole connections and PCB base board material. These materials, packaged together and designed by one of the premier PCB repair companies, BEST Inc., allow you to meet original PCB quality standards.

BEST Circuit Trace Repair Kit

BEST PCB circuit trace repair kit give you the tools you need for fast repair and modification of circuit traces. These materials, packaged together and designed by one of premier PCB repair companies, BEST Inc, allows you to meet original PCB quality standards

BEST Epoxy Repair Kit

This kit contains 10 packages of clear, low viscosity, superior strength epoxy, precisely measured out into two-compartment plastic packages so it's easy to use and there's no measuring. Once cured, this epoxy makes an effective electrical insulator with good high temperature mechanical and impact resistance properties. The epoxy can be used to fill in holes, gaps, burns or to inject into delaminated locations. The kit also contains mixing sticks, mixing cups and foam swabs.

BEST Baseboard Repair Kit

The BEST baseboard repair kit gives you the tools to repair nearly all types of base board defects including impact damage, burns, delamination, blistering, measling, warp, routing errors and more. We can also repair defects in coatings, solder mask and legend

BEST Solder Mask Repair Kit

The BEST solder mask repair kit gives you all of the supplies you need to repair damaged solder mask.

BEST Plated hole Repair Kit

Here are all the tools and materials you'll need to repair damaged plated holes in circuit boards. Kit includes 8 different sizes of eyelets.

BEST Pad Repair Kit

This kit includes everything you need to reliably replace damaged surface mount and BGA pads. The replacement pads use the epoxy technique.

BEST Land Repair Kit

You'll find the solution in this kit specifically designed to make the process of land repair as simple and effective as possible.

BEST Gold Replating Kit

In this kit you will find all of the necessary materials for the replating of gold plated contact fingers and gold plated areas.

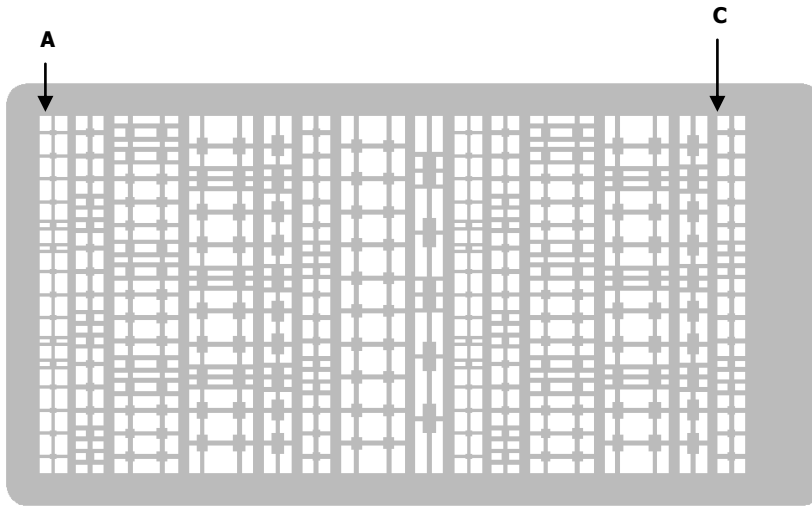
ACCESSORY PARTS/SPARES

Part Number	Description
ResinHarnerforPCBRepKit2gm	Resin/Hardner, 2gms with divider
PopSickleStickWood-10	Popsicle sticks for clamping down for PCB repairs, 10 count
OrangeStickWood-10	Orange sticks for mixing, 10 count
SwageToolBase	Swaging tool for through hole repairs-base
SwageToolFixture	Swaging tool for through hole repairs-fixture
Eylt021030078-100	Eyelet .021" ID, .030" OD, .078" LUF 100 pcs
Eylt034046093-100	Eyelet .034" ID, .046" OD, .093" LUF 100 pcs
Eylt058068102-100	Eyelet .058" ID, .068" OD, .102" LUF 100 pcs
Eylt076040093-100	Eyelet .076" ID, .040" OD, .093" LUF 100 pcs
Eylt064076091-100	Eyelet .064" ID, .076" OD, .091" LUF 100 pcs
Eylt048059093-100	Eyelet .048" ID, .059" OD, .093" LUF 100 pcs
BEST1CktTrack	Surface Mount Pad Circuit Frame, tin plated, for epoxy use
BEST2CktTrack	Edge Connector Circuit Frame, tin plated, for epoxy use
BEST3CktTrack	Trace Circuit Frame, tin plated, for epoxy use
BEST4CktTrack	Through Hole Circuit Frame, tin plated, for epoxy use
BEST5CktTrack	BGA Pad Circuit Frame, tin plated, for epoxy use
BEST6CktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST7CktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST8CktTrack	Land Repair Circuit Frame, tin plated, for epoxy use
BEST9CktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST10CktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST11CktTrack	Trace Repair Circuit Frame, tin plated, for epoxy use
BEST12CktTrack	Through-Hole repair Circuit Frame, tin plated, for epoxy use
BEST13CktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST14CktTrack	SMT + TH Variety Circuit Frame, tin plated, for epoxy use
BEST15CktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST16CktTrack	Surface mount pad Circuit Frame, tin plated, for epoxy use
CircuitTrk.002x.005	Circuit Tracks, copper .002" (.051mm) x .005" (.127mm), 72" (1,829mm) total length
CircuitTrk.002x.006	Circuit Tracks, copper .002" (.051mm) x .006" (.152mm), 72" (1,829mm) total length
CircuitTrk.002x.008	Circuit Tracks, copper .002" (.051mm) x .008" (.203mm), 72" (1,829mm) total length
CircuitTrk.002x.010	Circuit Tracks, copper .002" (.051mm) x .010" (.254mm), 72" (1,829mm) total length
CircuitTrk.003x.015	Circuit Tracks, copper .003" (.076mm) x .015" (.381mm), 72" (1,829mm) total length
CircuitTrk.005x.020	Circuit Tracks, copper .005" (.127mm) x .020" (.508mm), 72" (1,829mm) total length
CircuitTrk.005x.030	Circuit Tracks, copper .005" (.127mm) x .030" (.762mm), 72" (1,829mm) total length
PP1	Absorbent pen used prior to plating
PP2	24K Gold pen used for plating
PP3	Nickel pen used as undercoating to gold
Plating Power Supply	Plating power supply for re-plating gold contacts

A. Frames

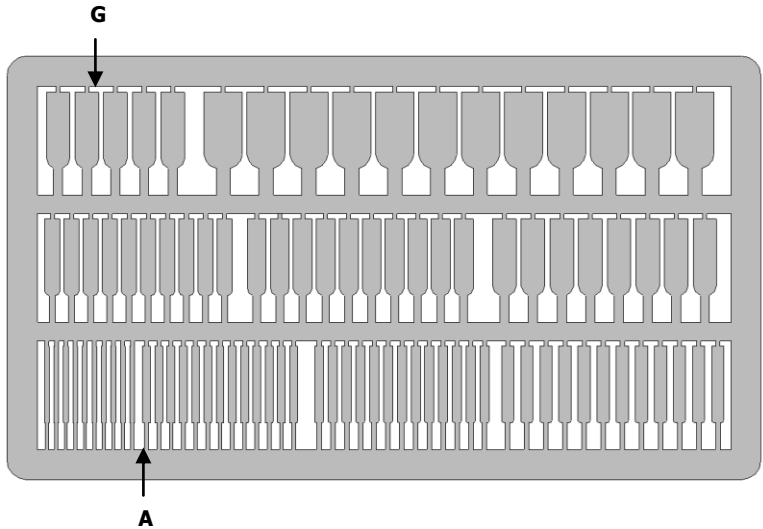
Frame Material:	1oz copper foil
Plating	Tin coating standard on all except edge connector frames
Plating Thickness	Tin – 0.0036mm (0.002 inches)-lead-free compatible Gold- 0.0013 mm (0.001 inches) over
Pull/Peel Strength	Results meet all pull/peel test specifications for original PCB manufacturing per MIL-P-55110 and IPC-TM-650

**SMT Replacement Pads
BEST1 Circuit Frame**



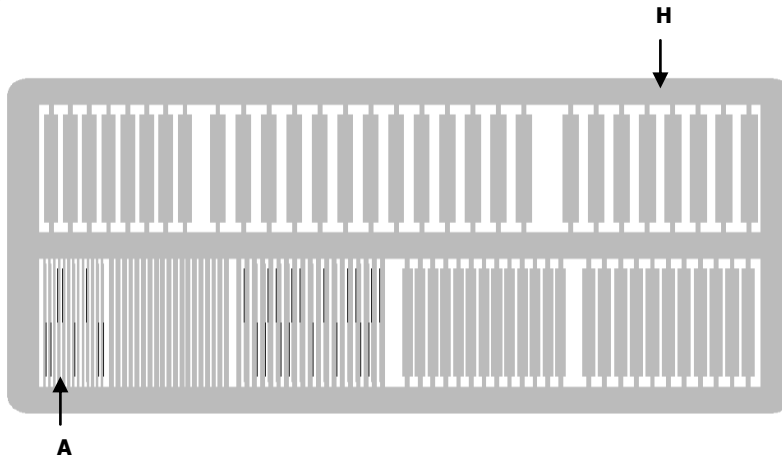
Designator	Length (mm)	Width (mm)	Length (inches)	Width (inches)
A	0.7	0.9	0.028	0.035
B	1.1	1.1	0.043	0.043
D	1.4	1.3	0.055	0.051
E	1.5	1.6	0.059	0.063
H	2.5	1.6	0.098	0.063
I	2.5	1.8	0.098	0.071
J	3.1	1.8	0.122	0.071
C	1.1	1	0.043	0.039
G	1.9	1.6	0.075	0.063
F	1.7	1.6	0.067	0.063
K	4.3	1.9	0.169	0.075
A	0.7	0.9	0.028	0.035
B	1.1	1.1	0.043	0.043
D	1.4	1.3	0.055	0.051
E	1.5	1.6	0.059	0.063
H	2.5	1.6	0.098	0.063
I	2.5	1.8	0.098	0.071
J	3.1	1.8	0.122	0.071
C	1.1	1	0.043	0.039

**Edge Connector Replacements
BEST2**



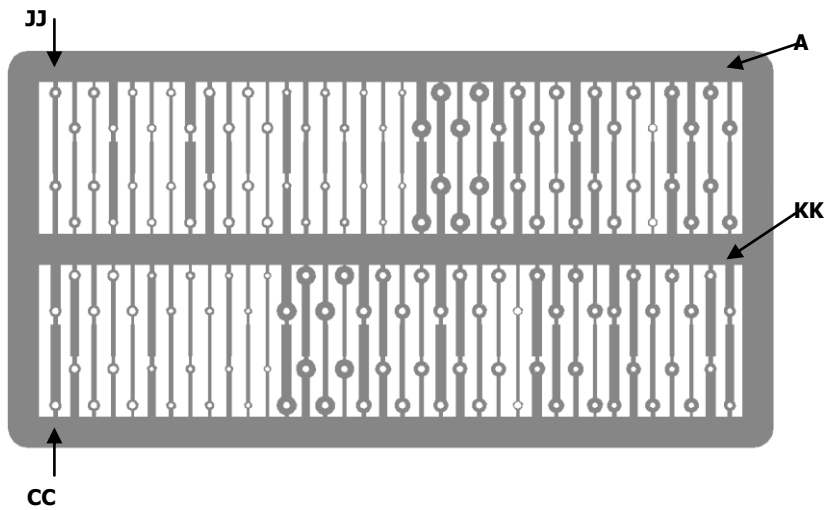
Designator	# of Pads	Pad Size (mm)	Pad Size (inches)	Pad Length (mm)	Pad Length (inches)	Trace Width (mm)	Trace Width (inches)	Trace Length (mm)	Trace Length (inches)	Ckt Frame Conn Width (mm)	Ckt Frame Conn Width (inches)
A	10	0.79	0.031	12.8	0.504	0.51	0.020	4.5	0.177	0.71	0.028
B	13	1.3	0.051	12.8	0.504	0.64	0.025	4.5	0.177	0.71	0.028
C	13	1.57	0.062	12.8	0.504	0.79	0.031	4.5	0.177	0.71	0.028
D	12	2.03	0.080	12.8	0.504	0.79	0.031	4.5	0.177	0.71	0.028
E	10	2.54	0.100	12.8	0.504	1.04	0.041	4.5	0.177	0.71	0.028
F	10	3.18	0.125	12.8	0.504	1.3	0.051	4.5	0.177	0.71	0.028
G	13	3.96	0.156	12.8	0.504	1.57	0.062	4.5	0.177	0.71	0.028
H	12	6.35	0.250	12.8	0.504	2.36	0.093	4.5	0.177	0.71	0.028

SMT Replacement Traces
BEST3



Designator	# OF Traces	Trace Width(mm)	Trace Width(inches)
A	13	0.38	0.015
B	19	0.64	0.025
C	20	0.76	0.030
D	13	1.60	0.063
E	11	2.00	0.079
F	8	2.20	0.087
G	13	2.40	0.094
H	8	2.60	0.102

SMT Replacement Throughhole Pads
BEST4

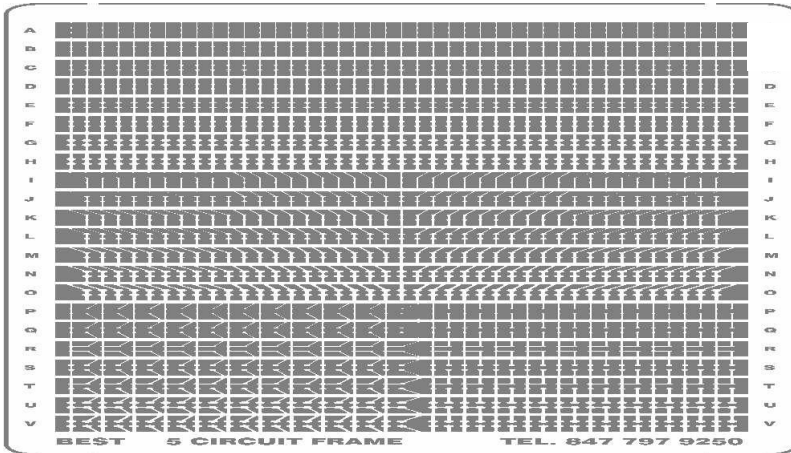


	PAD OD	PAD OD	PAD ID	PAD ID	Track	Track
		(mm)	(inches)	(mm)	Width	Width
					(inches)	(mm)
A	0.100	2.54	0.040	1.02	0.025	0.64
B	0.100	2.54	0.040	1.02	0.03	0.79
C	0.100	2.54	0.040	1.02	0.05	1.27
D	0.100	2.54	0.040	1.02	0.06	1.57
E	0.062	1.57	0.050	1.24	0.02	0.51
F	0.093	2.36	0.050	1.24	0.025	0.64
G	0.093	2.36	0.050	1.24	0.03	0.79
H	0.093	2.36	0.050	1.24	0.05	1.27
I	0.093	2.36	0.050	1.24	0.06	1.57
J	0.100	2.54	0.050	1.24	0.025	0.64
K	0.100	2.54	0.050	1.24	0.03	0.79
L	0.100	2.54	0.050	1.24	0.05	1.27
M	0.100	2.54	0.050	1.24	0.06	1.57
N	0.125	3.18	0.050	1.24	0.025	0.51
O	0.125	3.18	0.050	1.24	0.03	0.64
P	0.125	3.18	0.050	1.24	0.05	0.79
Q	0.125	3.18	0.050	1.24	0.06	0.51
R	0.050	1.27	0.033	0.84	0.02	0.64
S	0.050	1.27	0.033	0.84	0.025	0.79
T	0.050	1.27	0.033	0.84	0.03	1.27
U	0.062	1.57	0.033	0.84	0.02	0.51
V	0.062	1.57	0.033	0.84	0.025	0.64
W	0.062	1.57	0.033	0.84	0.03	0.79
X	0.062	1.57	0.033	0.84	0.05	1.27

SMT Replacement Throughhole Pads
BEST4 Page - 2

	PAD OD	PAD OD	PAD ID	PAD ID	Track Width	Track Width
		(mm)	(inches)	(mm)	(inches)	(mm)
Y	0.075	1.91	0.050	1.24	0.025	0.51
Z	0.075	1.91	0.050	1.24	0.03	0.64
AA	0.075	1.91	0.050	1.24	0.05	0.79
BB	0.075	1.91	0.050	1.24	0.06	1.27
CC	0.075	1.91	0.050	1.24	0.02	0.51
DD	0.062	1.57	0.040	1.02	0.025	0.64
EE	0.062	1.57	0.040	1.02	0.03	0.79
FF	0.062	1.57	0.040	1.02	0.05	1.27
GG	0.062	1.57	0.040	1.02	0.02	0.51
HH	0.075	1.91	0.040	1.02	0.025	0.64
II	0.075	1.91	0.040	1.02	0.03	0.79
JJ	0.075	1.91	0.040	1.02	0.05	1.27
KK	0.075	1.91	0.040	1.02	0.06	1.57
LL	0.075	1.91	0.040	1.02	0.02	0.51
MM	0.093	2.36	0.040	1.02	0.025	0.64
NN	0.093	2.36	0.040	1.02	0.03	0.79
OO	0.093	2.36	0.040	1.02	0.05	1.27
PP	0.093	2.36	0.040	1.02	0.06	1.57
QQ	0.093	2.36	0.040	1.02	0.02	1.57

**BGA Pad Repair
BEST5 Circuit Frame**



	PAD OD	PAD OD	Track Width	Track Width
	(inches)	(mm)	(inches)	(mm)
A	0.015	0.381	0.005	0.127
B	0.015	0.381	0.075	0.19
C	0.02	0.508	0.075	0.19
D	0.02	0.508	0.01	0.254
E	0.025	0.635	0.0875	0.222
F	0.025	0.635	0.0125	0.3175
G	0.035	0.888	0.0125	0.3175
H	0.035	0.888	0.015	0.381
I	0.015	0.381	0.005	0.127
J	0.015	0.381	0.075	0.19
K	0.02	0.508	0.075	0.19
L	0.02	0.508	0.01	0.254
M	0.025	0.635	0.0875	0.222
N	0.025	0.635	0.0125	0.3175
O	0.035	0.888	0.0125	0.3175
P	0.015	0.381	0.005	0.127
Q	0.015	0.381	0.075	0.19
R	0.02	0.508	0.075	0.19
S	0.02	0.508	0.01	0.254
T	0.025	0.635	0.0875	0.222
U	0.025	0.635	0.0125	0.3175
V	0.035	0.888	0.0125	0.3175

B> Eyelets

BEST Eyelet Part Number	PCB Thickness (inches)	PCB Thickness (mm)	Max'm Lead Diameter (inches)	Max'm Lead Diameter (mm)	Flange Diameter (inches)	Flange Diameter (mm)	Length Under Flange (inches)	Length Under Flange (mm)
Eylt021030078	0.01	0.38	0.02	0.5	0.046	1.17	0.088	2.24
Eylt034046093	0.06	1.6	0.02	0.64	0.06	1.52	0.093	2.36
Eylt048059093	0.06	1.6	0.03	0.89	0.078	1.98	0.0925	2.35
Eylt058068102	0.06	1.6	0.04	1.14	0.09	2.29	0.093	2.36
Eylt064076091	0.06	1.6	0.06	1.63	0.11	2.79	0.084	2.13
Eylt035040093	0.06	1.6	0.05	1.47	0.114	2.9	0.102	2.59

C> Reference Material

Basics of IPC-TM-650 Tape Test Method (for adherence of new patterns to PCB)

- Press a strip of pressure-sensitive tape (3M Brand 600 ½ “ wide) , 50mm in length, firmly across the test area making sure to remove any entrapped air
- Within 1 minute of application test by rapidly pulling the tape perpendicular to the board from the test area
- Visually examine tape and look for evidence of any portion of the material tested having been removed from the specimen

Where to go for assistance on PCB repair techniques.

BEST can provide PCB repair technician training through IPC 7721 PCB repair technician training.

Product Sale Terms

All products sold by BEST are warranted to be free of manufacturing and design defects. Any warranty claim must be presented to BEST by Purchaser within six months of Purchaser's receipt of the goods purchased from BEST. Upon receipt of a warranty claim, and due inquiry by BEST, the product will be replaced, or a refund issued for the purchase price as deemed appropriate by BEST. All other warranties of merchantability and/or fitness are specifically disclaimed by BEST. The express warranty made by BEST is specifically limited to product replacement and/or the return of the purchase price. No other remedies are available to a Purchaser under the terms of this limited warranty. Any and all claims for direct or consequential damages against BEST for any breach of the limited product warranty contained herein are specifically disclaimed and released by Purchaser in conjunction with the purchase of goods from BEST. This limited warranty and its exclusions are material parts of each product transaction by and between Purchaser and BEST.

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