



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

IPC-CI-408

Solderless Surface Mount Connector Design Characteristics and Application Guidelines

IPC-CI-408

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A standard developed by IPC

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Developed by the Solderless Surface Mount Connector Task Group
(B-22C) of the Electro-Mechanical Components Committee (B-20) of IPC

Users of this standard are encouraged to participate in the
development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the IPC Solderless Surface Mount Connector Task Group of the IPC Electro-Mechanical Components Committee are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Solderless Surface Mount Connector Design Characteristics and Application Guidelines

1.0 INTRODUCTION

1.1 Scope With the present packaging trend in systems moving towards high speed, compact configurations, the use of Surface Mount Technology offers a viable approach toward achieving the desired packaging goals. The degree of advancement in packaging of electronic components is predicated on the type of product being produced; the need for miniaturization and weight savings; plus the off-the-shelf availability of different component types.

The growing popularity of surface mount technology for packaging electronics has raised a need for surface mount connectors to produce a common packaging approach.

As higher density (0.51 mm [0.020 in] centerline and below), higher electrical performance systems become more common, traditional connector manufacturing technologies such as stamped and formed contacts and associated moldings are approaching density limits that are going to have to be overcome. Solderless surface mount interconnects appear capable of overcoming many of these limitations. Additional environmental benefits include reduction of lead content in assemblies and elimination of postsolder cleaning.

This document provides guidelines for the design, selection and application of solderless surface mount connectors and interconnections for all types of printed boards, rigid, flexible-rigid and backplanes.

1.2 Purpose The purpose of this document is to provide information on design characteristics and application of solderless surface mount connectors including conductive adhesives in order to aid the designer in effectively interconnecting his package. The interconnection material, design and mounting characteristics are discussed. Land pattern, metallization, assembly techniques, rework and repair procedures are covered.

Adherence to the guidelines set forth in this document will generally assure adequate reliability for the majority of applications; however, each end use application should be evaluated on a case by case basis.

The guidelines listed herein shall not be construed as standards since the state-of-the-art is constantly changing and applications and requirements may vary beyond the scope of this publication.

1.3 Terms, Definitions and Acronyms The definition of terms and acronyms used here shall be in accordance with IPC-T-50 and the following:

ACPF	Anisotropically Conducting Polymer Film
CP	Course Pitch
ECL	Emitter—Coupled Logic
ECPI	Elastomeric Conductive Polymer Interconnection
FEC	Flexible Etched Circuitry
FP	Fine Pitch
GaAs	Gallium Arsenide
LEE	Layered Elastomeric Elements
LGA	Land Grid Arrays
PSA	Pressure Sensitive Adhesives
PWB	Printed Wiring Board
TAB	Tape Automated Bonding
TCPI	Thermally Conductive Polymer Interconnection
ZAF	Z-Axis Film
ZIF/LIF	Zero Insertion Force/Low Insertion Force

1.4 Applicable Documents

- EIA-364-B** Electrical Connector Test Procedures Including Environmental Classifications
- IPC-CM-770C** Component Mounting Guidelines for Printed Boards
- IPC-SM-782A** Surface Mount Land Patterns (Configurations and Design Rules)

2.0 TECHNOLOGIES SUMMARIZED

2.1 Conductive Adhesives Adhesives in film or liquid form may be utilized for simultaneous physical attachment and electrical connections. Liquid adhesives with metal fillers are utilized for die attach and other applications. Anisotropically-conductive adhesives have proven useful as a medium for providing interconnections between flexible printed circuitry, which includes lead-frames for Tape Automated Bonding (TAB), and flat panel electronic displays. Typically these materials are tack-free films that are sparsely populated with conductive particles and are bondable with a brief application of heat and pressure.

Rework ranges from easy to difficult depending on the adhesive system. Adhesive interconnection is the method of choice for flat panel display interconnection in the manufacture of consumer products ranging in complexity from the pocket calculator to the laptop computer terminal. Section 3.1 provides the details of this technology.

2.2 Elastomerics—Metal on Elastomer Type This connector incorporates a thin flexible dielectric film on which individual parallel lines of etched copper circuitry are plated, usually gold over nickel. A typical circuitry pattern consists of 0.08 mm [0.003 in] wide lines on 0.18 mm [0.007 in] center lines. The silicone rubber core material is formulated to resist permanent set under long term compression. When this connector is compressed between two flat planes, the plated circuit lines interconnect the circuit pads on each plane. The contact area is pliable and conforms to irregular surfaces providing good electrical contact over a large surface area. This is especially advantageous when connecting thin, deposited pads on displays, ceramics, glass, etc. The resiliency of the connector core also helps create a sealed area around the contacts which provides environmental protection at the contact interface. Section 3.2 provides the details for this technology.

2.3 Layered Elastomeric Elements Layered elastomeric elements (LEE) consist of alternating layers of conductive and non-conductive silicone rubber. The conductive layers are filled with carbon or a conductive metal, usually silver or nickel particles. The carbon containing LEEs are largely limited to contacting liquid crystal displays because of their high resistance. The low resistance of silver filled LEEs—1/10,000 that of the carbon LEE—allows them to be used in a large variety of applications. Section 3.3 provides the details of this technology.

2.4 Elastomeric Conductive Polymer Interconnection (ECPI) Connectors are, in general, based on two primary mechanisms: a pin inserted into a socket or a pad to pad interconnection. As the demand for high density connectors with pitches below 0.64 mm [0.025 in] develops, it becomes difficult to construct inexpensive and robust connectors of the pin and socket type. The pad to pad connector system will meet the demand of low pitch interconnection; however, it is necessary to have some compliant conducting medium between mated pads in order to compensate for nonplanarities and geometrical irregularities in the connector mating surfaces. In the past this interconnection medium for larger than 1.27 mm [.050 in] pitch connectors was accomplished using springs or flexible clips. An alternative was later provided by anisotropically conducting films.

Anisotropically Conducting Polymer Film (ACPF)s have been in use for over twenty years as electrical connectors in various consumer goods. These connectors, such as the

often seen “zebra stripe” materials, are primarily used for connection of displays to driver electronics. In the past five years, a number of new ACPF materials have appeared that are designed for interconnection of high density pad-grid arrays. These materials offer unique advantages for high density connectors, socketing, device testing, and bare board testing.

Elastomeric Conductive Polymeric Interconnection (ECPI) is an example of one ACPF type. ECPI materials are metal-polymer composites with conduction isolated to the thin or “Z” direction.

Conduction and isolation in ECPIs are provided by a regular distribution of conductive columns within a sheet of silicone rubber. Pressure applied to the ECPI/pad contact completes the interconnection and is a requirement for any ECPI based connection. The ECPI materials are suitable for interconnecting high-density, fine-pitch, pad-grid arrays and are able to accommodate tolerance variations arising from non-uniform plating thickness, substrate warp, and other nonplanarities between opposing contacts.

ECPI materials are capable of interconnecting 3.81 mm² [0.15 in²] contact areas while providing electrical isolation across a 0.20 mm [.008 in] space. Through-resistances between mated 150 square mil pads, that are approximately 0.05 mm [0.002 in] high, average 40 to 100 m, depending on the specific ECPI material, for a 20 psi actuation pressure. Isolation resistance between 0.20 mm [0.008 in] separated conductors is in excess of 10¹¹ ohms. Frequencies greater than 2 GHz have been transmitted using ECPI with negligible attenuation. Section 3.4 provides the details of this technology.

2.5 Pressure Clip Interconnections This technology is primarily intended for the attachment of a flat cable to the edge of a printed board via a solderless pressure connection. Pads on the edge of a printed board are aligned with the exposed conductors of a flat cable, and mated with a “U”-shaped pressure clip. Section 3.5 provides the details of this technology.

2.6 Button Board Button or button board technology was pioneered in the 1970s for the purpose of implementing board to board interconnects without use of a conventional pin and socket type connector. Since then this technique has been extended to connecting “stacks” of printed wiring boards (PWB) and as a way to eliminate solder in component attachment, through either socketing or direct mounting, with the prime benefits of repairability and assembly process simplification.

The “button” itself is formed from a short length of fine wire, randomly woven into a cylindrical shape. This miniature spring is then loaded into a thin carrier so that the button protrudes from both sides. In use the carrier is positioned so that it may be sandwiched between the two surfaces to be connected and so that each button is in

with the electrical contact pads on those surfaces. Once fully compressed, the button forms a compliant spring loaded connection. Constant pressure must be maintained to insure a continued reliable connection. Section 3.6 provides the details of this technology.

3.0 TECHNOLOGIES EXPANDED

3.1 Conductive Adhesives

3.1.1 Physical Connector Design

3.1.1.1 Description Anisotropic electrically conductive materials permit current to flow in a single direction. An important characteristic of anisotropic materials is that they do not have to be applied selectively. A portion of an entire printed board can be covered without producing shorts between conductors. Flexible circuits and components, for example, can be contacted with a patch of film (Z-Axis Films or ZAF) covering the pad area. See Figures 3.1-1 and 3.1-2.

All commercial products achieve directional conductivity by metal, carbon, or chemical compounds dispersed in a dielectric medium. Since conductive particles are separated from one another, current can not flow in X or Y directions. By placing such material between a device and a printed board (Figure 3.1-3) and then applying heat or UV and pressure, electrical paths are formed in the Z direction.

3.1.1.1.1 Dry Z-Axis Film Adhesives

- A. Hot melt adhesive films incorporating anisotropic properties are available, and are used in commercial products to connect liquid-crystal displays and other difficult-to-bond devices to circuitry. The small particle size of the conductor makes possible bonding geometries below 0.05 mm [0.002 in]. The typical bonding process is to place the film between two parts to be connected with the application of heat and pressure for 10 to 20 seconds. Typical conditions are 150° C [302°F] to 200°C [392°F] at pressures of 7 to 21 kg/cm² [100 to 300 psi]. Thermoplastics are usually reworkable by reheating them to separate the parts followed by solvent cleaning and reapplication of the film.
- B. Dry film thermosets are typically metal filled epoxy resins that are hardened by a thermally activated latent catalyst. ZAFs using thermoset adhesive as the dielectric provide reliable connections between devices and printed boards. The dielectric materials are similar to laminating adhesives used in printed board manufacturing. Typical bonding conditions are 150°C to 250°C (302°F to 482°F) at 7 to 21 kg/cm² (100 to 300 psi) for 20 to 180 seconds. Most thermosets are not reworkable; however, new repairable thermosets have recently been reported which provide better dead load strength at elevated temperatures than solder with comparable electrical performance while allowing rework methods similar to thermoplastics.

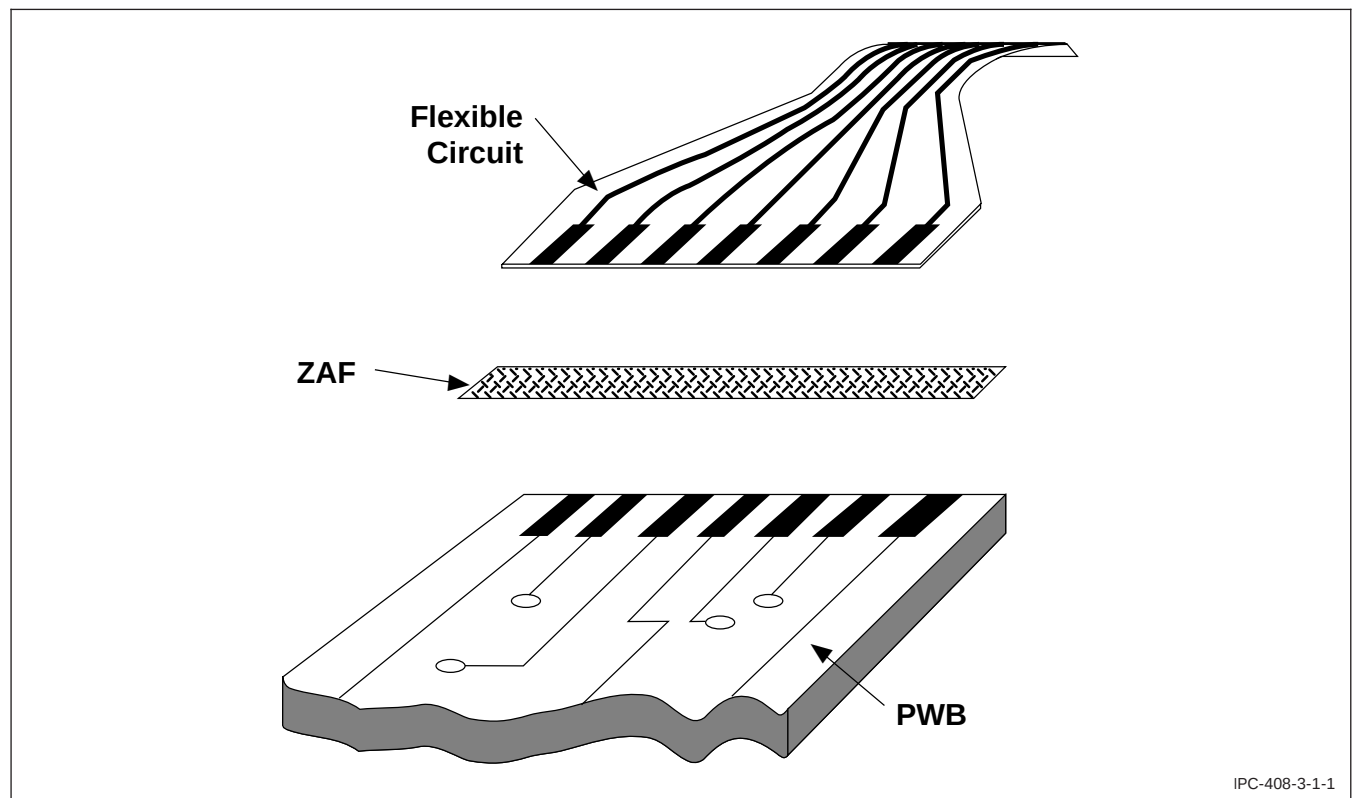


Figure 3.1-1 Flexible circuit to board

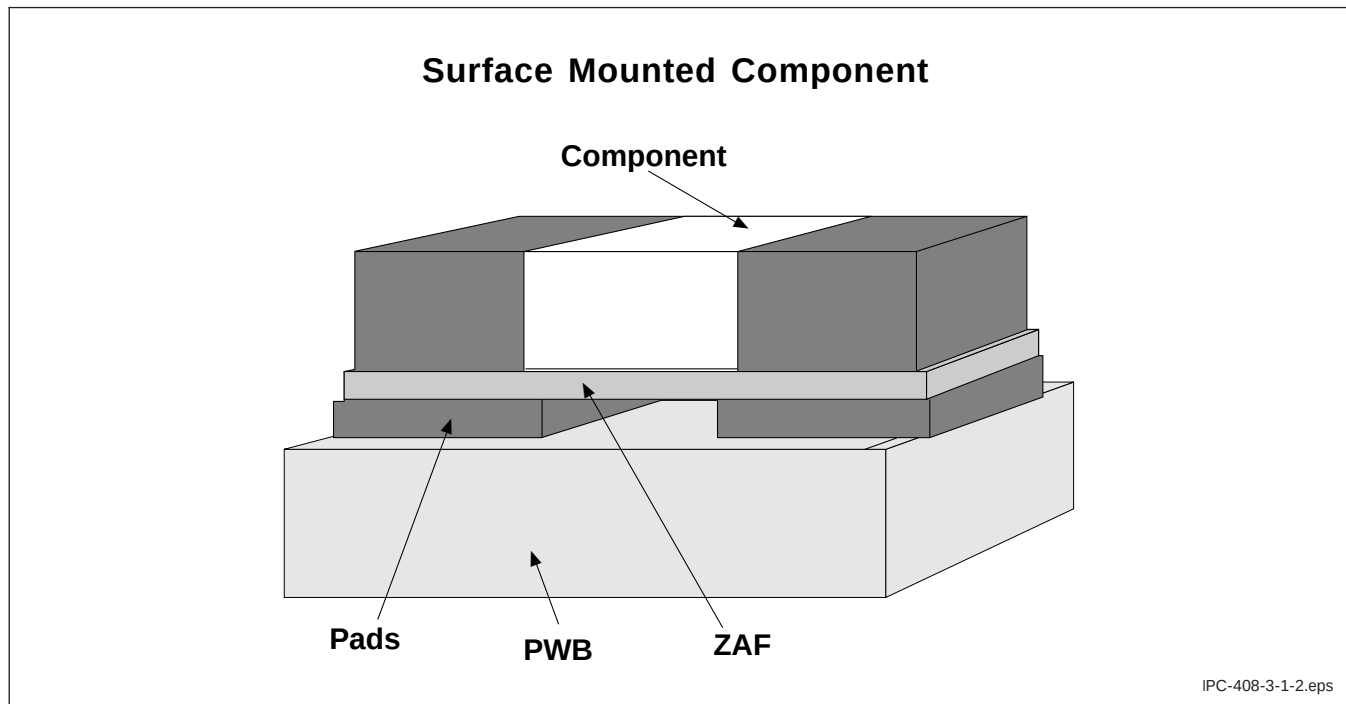


Figure 3.1-2 Component on printed board

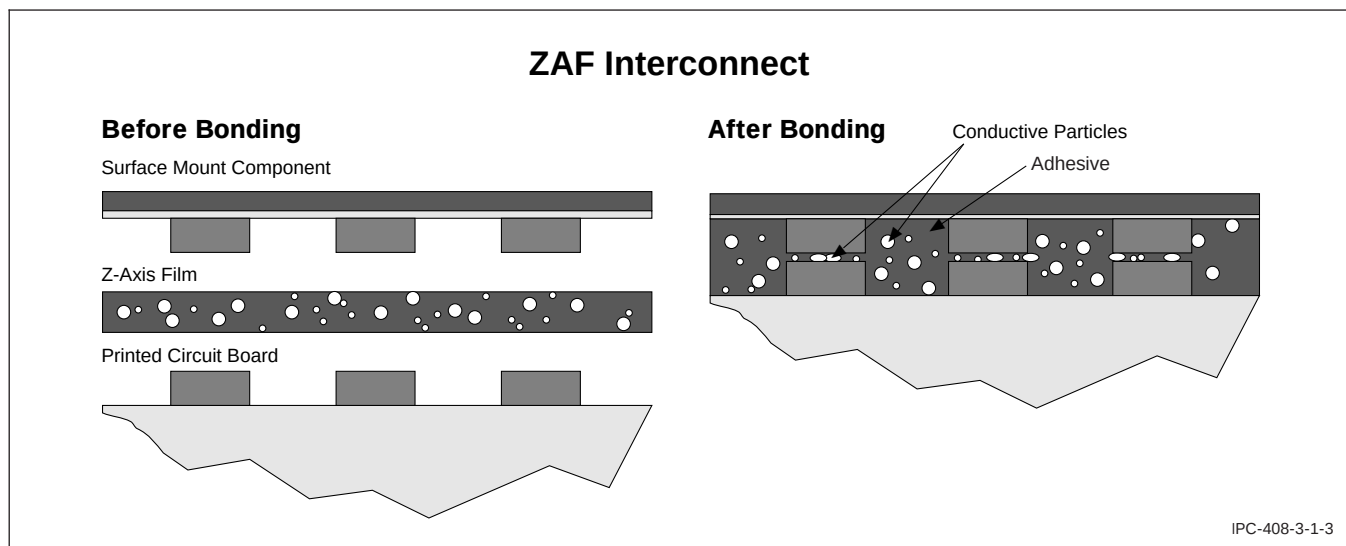


Figure 3.1-3 ZAF Interconnect

C. Pressure Sensitive Adhesives (PSA) are acrylic, silicone, or rubber-based materials filled with conductive metal particles. Because of their relatively low glass transition temperatures there is a tendency for PSAs to creep, resulting in increased contact resistance over a period of time. PSAs can provide adequate connections where service temperatures are moderate, mechanical loading is at a minimum, and the contact areas are large such as in printed board grounding or shielding.

3.1.1.1.2 Isotropic Liquid Conductive Thermoset Adhesives Isotropic liquid thermosets have been utilized for years in die attach applications. Silver is the most common conductor because of good conduction properties. How-

ever, silver has a tendency to migrate, causing short circuits in humid and electrically stressed conditions. Epoxy resins are popular because of a good balance of properties and a long history of use in electronics. Since these adhesives conduct electrically in all directions, they must be applied selectively by, for example, screen printing. Typical application conditions are 150°C to 200°C [302°F to 392°F] for 5 to 60 minutes to fully cure.

3.1.1.1.2 Holddowns Normally no holddown is required because of the bond strength of the adhesive. If a hold down device is utilized it should only be necessary to provide enough retention to prevent separation of the components.

vibration or mechanical shock. The electrical contact is maintained by the adhesive itself.

3.1.1.3 Electrical Connection Process Bonding to establish the electrical connection is typically done with the application of heat and pressure in the sequence shown in Figure 3.1-3. The ZAF is generally supplied on a carrier film to facilitate handling. The film is prebonded to one of the components or circuits to be contacted, the carrier film is removed, and final bond is made between the mating pad arrays. By placing such material between a device and a printed board (Figure 3.1-4) and then applying heat or UV and pressure electrical paths are formed in the Z direction.

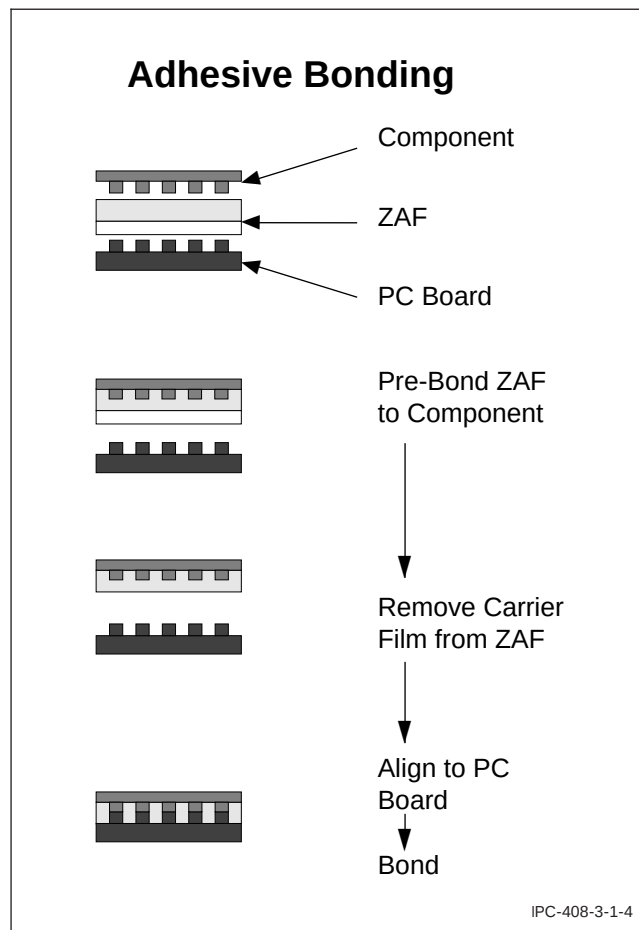


Figure 3.1-4 Adhesive bonding

3.1.1.3.1 Wipe Considerations Interconnection is made by trapping single conductive particles between the conductive surfaces. Although somewhat different from a traditional wipe action, a high, local normal force can be sufficient to break through oxides and contaminants. Pressures can exceed the yield point of the metals used. Systems filled with large numbers of fine particles will not provide a wiping action.

3.1.1.3.2 Zero Insertion Force/Low Insertion Force (ZIF/LIF) Considerations Although somewhat different than the traditional ZIF considerations, the application

pressures or bonding forces in the case of adhesives can range from near zero for liquid adhesive to 14.1 kg/cm² [200 psi] for film type systems. This is normally part of the bonding process with the application of heat and pressure in the Z-axis.

3.1.1.4 Interconnection Density Capabilities Isotropic adhesives offer pitch capabilities comparable to solder pastes. Anisotropic adhesives can provide finer pitch connections than solder or conventional connectors. Systems containing randomly distributed particles with pitches down to 0.15 mm [0.006 in] with selectively patterned particles, finer pitches are possible. The fine pitch capability of adhesives offers the opportunity to make direct connections to surface mount packaged and unpackaged chips with either random or patterned particle ZAFs.

3.1.1.5 Contact Interface Requirements The surfaces should be free of oils or other contaminants before applying adhesives. A typical cleaning procedure is to wipe the area to be bonded with a lint-free material soaked in a suitable solvent. If oxides are present, a light abrasive may be utilized for cleanup.

3.1.2 Electrical Characteristics

3.1.2.1 Signal/Power Considerations The capability of an adhesive to carry current will depend on the contact resistance achieved and the conductivity and loading of the conductive particles. Solid silver or gold plated nickel particles are individually very conductive. For example, if the contact pads are made of gold plated copper at least as thick as one ounce copper [0.0014 in], the resistance should be less than 10⁻¹ ohms and may be able to carry current typical of the cross section of the conductor. On the other hand, if the contacts are made of carbon or indium tin oxide the resistance will be hundreds or even thousands of ohms.

Low conductivity particles exhibit lower current capacity. Carbon, metallized glass or polymers may be used where only signal levels are needed.

3.1.2.2 Speed / Crosstalk / Capacitance / Impedances Issues The adhesives can provide a very short signal path in direct device-to-board contacts, and therefore may reduce potential impedance mismatching and transit time delay problems as compared to conventional connectors. High frequency performance can be limited by the dielectric constant of the adhesive, leakage current, and the geometry of the assembly.

3.1.3 Substrate Requirements

3.1.3.1 Materials Adhesives can usually be used on a wider range of contact metallizations than other methods because the contact is made with high pressure.

each conductive particle to break through oxides and contaminants. Also, a metallurgical bond is not needed, as with solder, so that a wider range of conductors including non-noble metals and indium tin oxide can be utilized.

3.1.3.2 Tolerance Considerations Just as with solder, adhesives are expected to provide a “fill” between the two surfaces to be contacted. Differences in pad height, board flatness, etc., can be accommodated to the extent that the adhesive can remain conductive and fill the voids. Liquid adhesives generally can accommodate larger gaps than film type (ZAF) systems. The ZAFs are limited by the original thickness of the film so that thicker films are needed for situations where there are greater tolerance differences.

3.1.3.3 Land Finish The finish of the contact surface may affect wetting of the adhesive or the contact area. The finishes usually associated with tinned or plated contacts are suitable for adhesives.

3.1.3.4 Land Footprints Adhesives provide maximum flexibility of land footprints since ZAFs can be utilized with arbitrary layouts. Screen printed liquid adhesives may be limited by those layouts which can be readily printed. Pad sizes may have a lower limit of 0.18 mm to 0.25 mm [0.007 to 0.010 in].

3.1.3.5 Hole Requirements Adhesives are inherently surface mount systems. Holes are not generally required, but may be needed to accommodate an external holddown feature in an extreme environment.

3.1.4 Assembly

3.1.4.1 Fixturing and Tooling Required The bonding apparatus must provide uniform pressure to ensure a good contact on all pads and to avoid damage to the substrates by high local pressure. ZAFs usually require 0.7 to 21.0 kg/cm² (10 to 300 psi). ZAFs, excluding PSAs, require bonding temperatures from 25°C to 250°C [77°F to 482°F]. The design of the thermode will depend on the land layout. The film may be dispensed as sheets or continuous roll material. Manual or automated placement of the film is needed to ensure complete coverage of the land area.

Liquid adhesive will require a dispenser and pick and place apparatus. A metered dispenser for the adhesive and a conventional pick and place machine of the type generally used for solder paste systems should be adequate.

It may be necessary to utilize optical alignment. If one of the components is transparent, alignment may be done by looking for proper contact registration through the component. If the parts are opaque a mirror or prism system that allows pre-alignment from the inside faces of the components may be utilized.

3.1.4.2 Automation Compatibility The application equipment will depend on the adhesive type and assembly method used. Liquid adhesives may be applied using pick and place machines with a follow up cure. ZAFs are applied with heat and pressure usually beyond the capability of pick and place machines. The cure, if required, is part of the bonding cycle.

3.1.4.3 Special Handling The shelf life of adhesives depends on the chemistry of the system and the environments involved. Generally a pot life of several days is expected with a refrigerated life of six months or more. The fast cure systems tend to display the shortest life and the pressure sensitive none-curing systems the longest. Systems that involve a UV cure may have better shelf life since they are not thermally activated.

3.1.4.4 Post Assembly Issues No clean up is normally required following adhesive assembly.

3.1.4.5 Process Procedure Refer to Paragraph 3.1.1.3

3.1.4.6 Rework and Repair If rework is appropriate for the particular adhesive, it is typically done in the sequence shown in Figure 3.1-5. The parts are separated by applying heat to soften the adhesive. Following this, if necessary, a solvent or light abrasive is used to clean the contact surfaces followed by application of new adhesive and rebonding following the original sequence.

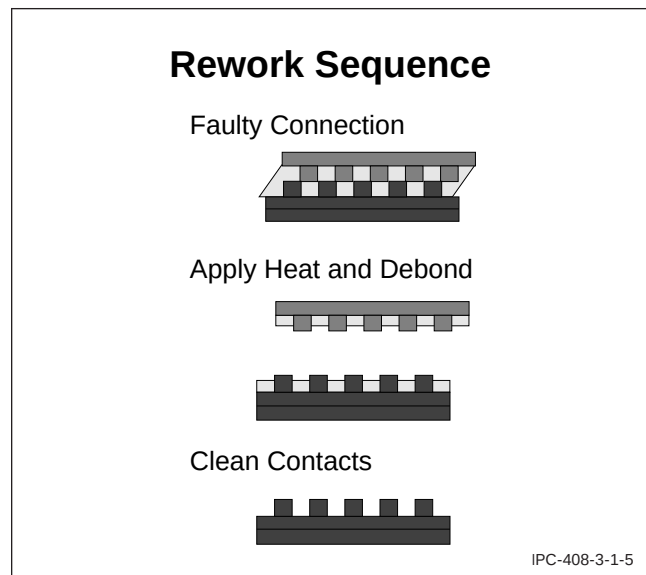


Figure 3.1-5 Rework sequence

3.1.5 Verification The integrity of the connection can be verified by visual inspection and electrical tests. Also, a shear or peel test may be done to measure the strength of the bond, which would indicate that the bonding process and adhesive characteristics are within specification.

3.1.6 Applications, Packaging Levels, and Limitations

3.1.6.1 Applications Adhesives can be utilized in place of solder or other connection means to mount and connect devices to printed boards. A variety of devices can be connected to printed boards with adhesives such as; packaged chips, passive devices, connectors, flexible circuits, displays, etc. The most common application to date has been to displays. The potential advantages of adhesives are: lower bonding temperatures, no flux cleanup, finer pitch capability, wider range of contact materials possible, no solder mask, no screen printing, etc. One of the obstacles to complete replacement of solder by adhesives has been the lack of surface mount devices with lead and body design which take full advantage of adhesive strengths.

Applications for conductive adhesives include:

- Liquid Crystal Displays
 - television
 - telephones
 - camcorders
 - auto instrumentation
- TAB
 - calculators
 - television
 - camcorders
- Flex
 - calculators
 - telephones

Table 3.1-1 lists characteristics of a variety of available conductive adhesives.

Table 3.1-1 Example of Adhesive Material Properties

AC Impedance	1x10 ¹² ohms
AC Dielectric Strength	>5kv/mm
DC Dielectric Strength	>8kv/mm
Dielectric Constant	3.3 @1 kHz
Dissipation Factor	0.6 @ 1 kHz
Ionic Extractables* (All Cations +Cl)	<5 ppm Each
Moisture Absorption**	1.2%

* 4 hrs. Boiling Water @ 2 atm.

** Equil. @ 85 C/85% RH

3.1.6.2 Levels of Packaging Interconnected Adhesives described here may be used on all levels of packaging from levels I through III. (Refer to Appendix A)

3.1.6.2.1 Environmental Characteristics Typical environmental requirements are as shown in Table 3.1-2.

3.1.6.3 Limitations Adhesives may be used in a variety of applications. Flexible circuit, TAB and device to board are common applications. In addition, bare chip to board is being developed. One of the limitations is that exposure of the adhesives to soldering temperatures may degrade per-

formance. It is recommended that adhesive be applied after all of the board soldering is completed. Also if rework is important only a limited number of adhesives allow rework.

Since adhesive connections are microscopic pressure engaged contacts, the most common mode of failure is relaxation of the adhesive. This can be caused by over heating, exposure to a softening solvent or a long term application of stress. It is important to choose an adhesive with appropriate temperature capability for the application, generally with a glass transition temperature well above the use temperature. Differential thermal expansion between the materials in the contact area can also be a source of stress which may be minimized by careful choice of an adhesive to match the substrate coefficient of expansion and to provide some degree of stress relaxation.

Chemical contamination of the contact areas can result in resistance increases. An adhesive should not contain significant levels of ionic impurities, such as ionic extractables (all cations plus chlorine) with four hours exposure to boiling water at two atmospheres pressure, which could cause local corrosion or insulating layer formation. The required levels of contamination are a few parts per million for direct microcircuit contacts, such as on IC interfaces, or tens of parts per million for coarser pitched board to board contacts.

Ultra high frequency (GHz) performance has been reported to 2 GHz. The presence of conductive particles in the spaces between contacts potentially could affect contact to contact isolation. Presently under development are anisotropic films with patterned clusters of particles located only in the contact areas to circumvent this issue.

Since PWBs can exhibit some warpage the adhesives must provide sufficient compliance and holding strength to maintain the electrical contact. The conductors are arranged in the adhesive layer such that they will bridge through the gaps formed by the boards. The layer must be at least as thick as the gap. For example, if there is a 0.1 mm [0.004 in] gap the adhesive must be at least that thick. Alternatively, if the boards can be forced together and held by the bonding pressure the gap will be reduced resulting in a thinner adhesive layer.

3.1.7 Testing Adhesives are tested in much the same way as solder connections for surface mount. Peel strength, shear, stability of electrical contact during environmental tests, etc., are important. The performance and reliability of the electrical contact depend on the electrical and physical properties of the adhesive. Typical accelerated test conditions are: temperature cycling from -55 to 105°C [-67 to 221°F], humidity at 85% RH and 85°C [185 °F], constant temperature 105°C [221°F], all for 1000 hours. The resistance and adhesion should not fall outside of the specified range during these tests.

Table 3.1-2 Conductive Adhesives

Supplier	Finest Pitch (microns)	Interconnection	Bonding Req.	Operating Environments
A	200	flex to glass flex-to-board	140-180°C 10-40 kg/cm ² 10-20 sec	(Information not available)
B	100	flex to glass flex-to-board	130-170°C 10-20 kg/cm ² 10-20 sec	-40 to +100°C
C	10	chip-to-glass (Au-to-Au)	UV	(Information not available)
D	100	flex-to-glass flex-to-board	min 130°C 30-40 kh/cm ²	-40 to +85°C 60°C/90%RH
E	500	SMD-to-board	max 140°C	0 to +60°C 60°C/90%RH
F	130	chip-to-glass	150-200°C 2-5 kg/cm ²	85°C/85%RH 60°C/90%RH
G	50	chip-to-glass	UV @ room temp.	40 to +100°C
H	200	flex-to-glass flex-to-flex	120-165°C 30-70 kg/cm ² 8-30 sec	-30 to +100°C 65°C/95%RH
I	60	SMD-to-board	cure under press 100-170°C 5-50 min	-55 to +185°C
J	60	flex-to-board flex-to-glass flex-to-flex	180°C at 20 kg/cm ² for 15-20 seconds	-55 to + 105°C 85°C/85%RH

Since the adhesive is present between the contact pads the dielectric properties and chemical purity are important. The ionic purity of the adhesives, particularly for adhesives which come into contact with corrodible metals or semiconductor chips, is very important for long life. Generally levels of Na, Cl, K, etc., should be below 10 ppm as measured by a water extraction method.

Table 3.1-3 shows dead load 90 degree peel test results comparing an adhesive to solder. This test is done by hanging a weight on a flex circuit which is soldered or bonded to a printed board. The assembly is exposed to 100°C [212°F] until the bond breaks. A properly designed adhesive will exhibit longer life than solder. A clamp or additional layer of support tape can be used to increase peel strength, but in most cases this is not necessary with adhesives.

Table 3.1-3 Dead Load Aging Results—Minimum Hours Survived at 100°C [212°F]

Bond	Load (g/cm)		
	50	100	150
Adhesive/PWB	>500	>500	70
Adhesive/Glass	>500	>500	70
Solder/PWB	>500	10	2

3.2 Elastomerics—Metal on Elastomer Type

3.2.1 Physical Connector Design

3.2.1.1 Description This connector incorporates a thin flexible dielectric film on which individual parallel lines of etched copper circuitry are plated, usually gold over nickel. A typical circuit pattern consists of 0.08 mm [0.003 in]

wide lines on 0.18 mm [0.007 in] center lines. The silicone rubber core material is formulated to resist permanent set under long term compression. When this connector is compressed between two flat planes, the plated circuit lines interconnect the circuit pads on each plane. See Figure 3.2-1.

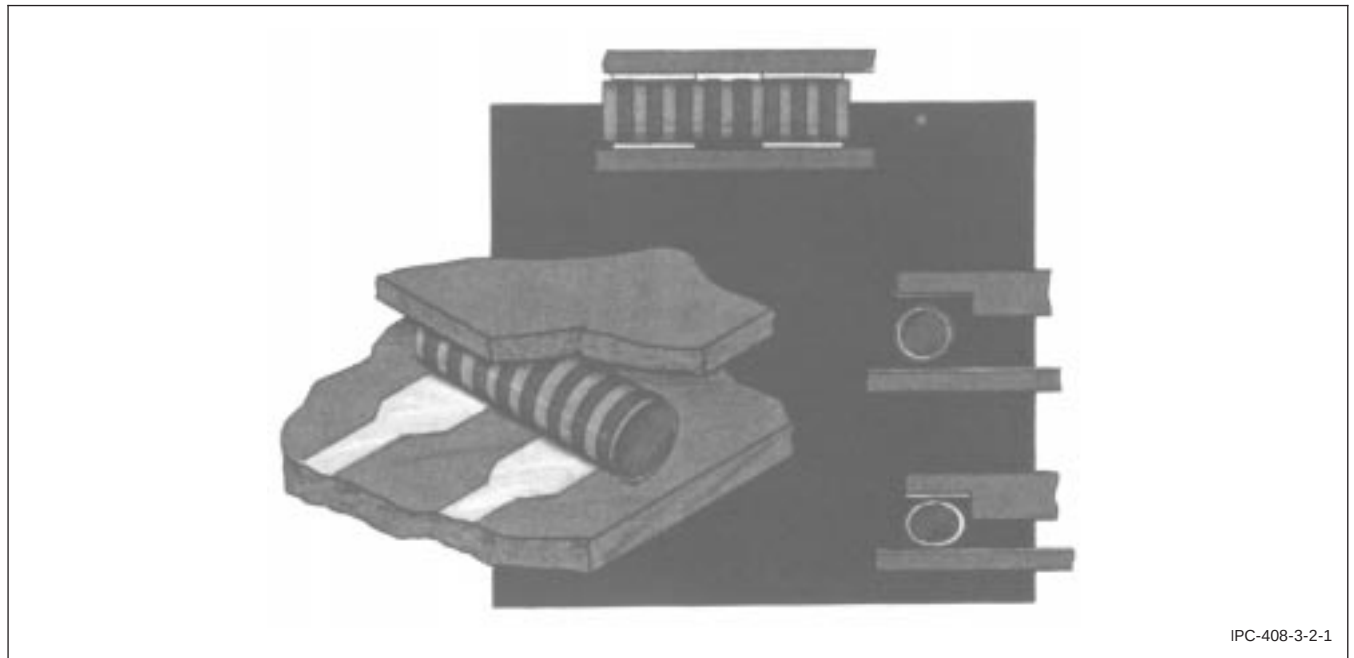
3.2.1.2 Holddowns Usually this connector is captured in some type of housing which is mounted to the surfaces being interconnected. In some applications, for example flex-to-board, a lid is incorporated as a means of insuring that even pressure is applied across the flexible etched circuitry (FEC). Other specific holddowns include screws, clamps, camming mechanisms and various other different mechanical devices. See Figure 3.2-2.

3.2.1.3 Electrical Connection Process The engagement or contact mechanism involves a gold-to-gold contact interface. This is generally an engagement that lacks wiping action, however the soft gold interface has proven acceptable in both laboratory test and field use.

3.2.1.3.1 Wipe Considerations A traditional wiping action associated with, for example, a pin and socket is not a characteristic of this style of surface mount connector.

3.2.1.3.2 ZIF/LIF Considerations As there is no insertion force and all the force is applied to deflect the element, metal-on-elastomer connectors are inherently ZIF.

3.2.1.4 Interconnection Density Capabilities The connector density as defined by the etched circuit traces becomes simply a function of the artwork used in etching



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Figure 3.2-1 Sketch of Metal as Elastomer Interconnector Parallel Planes

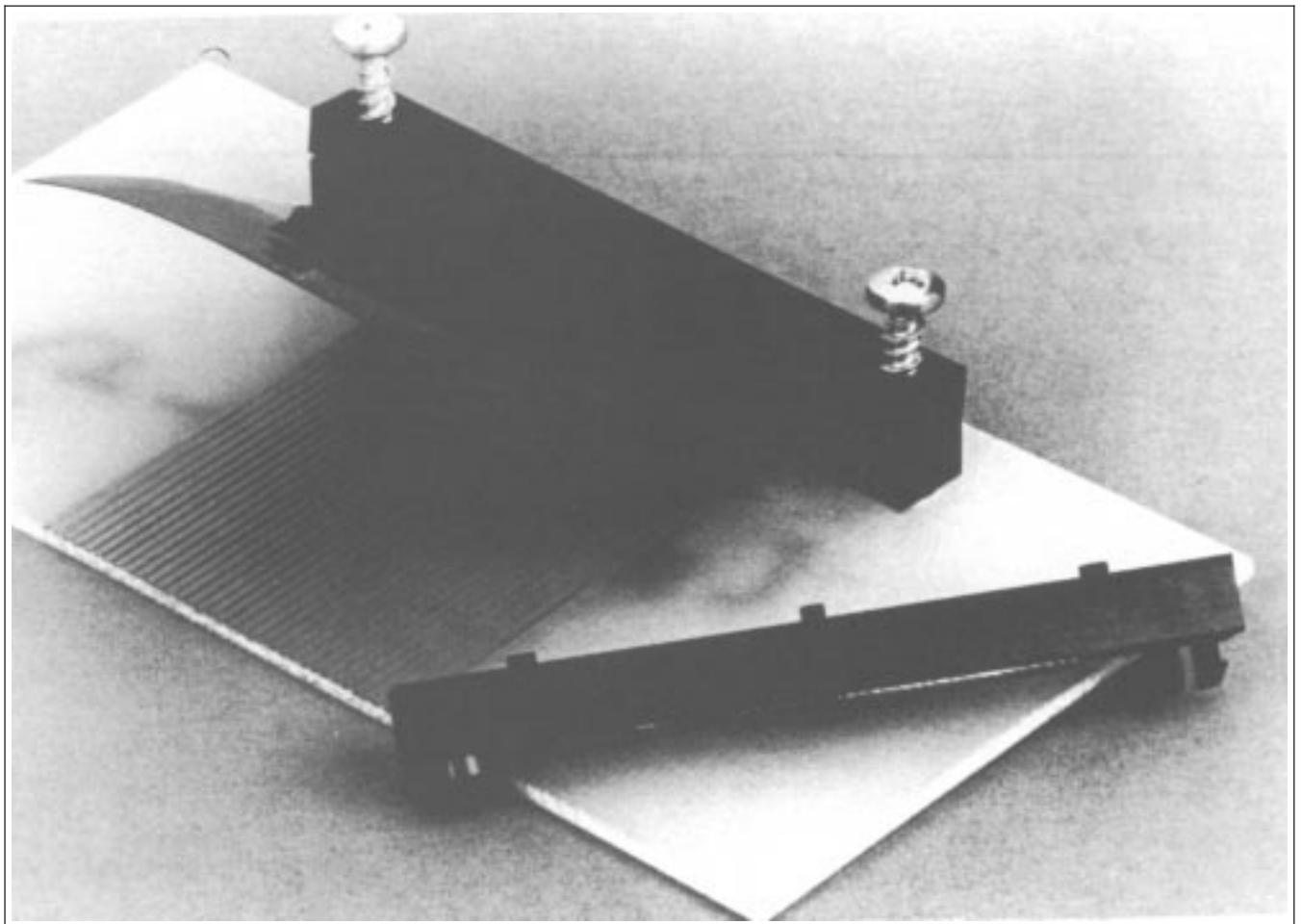


Figure 3.2-2 Flex-to-board metal on elastomer connector assembly