

IPC-T-50M

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Terms and Definitions for Interconnecting and Packaging Electronic Circuits

Supersedes IPC-T-50K
June 2013

A standard developed by IPC

Association Connecting Electronics Industries



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- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
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Terms and Definitions for Interconnecting and Packaging Electronic Circuits

Developed by the IPC Terms and Definition Committee (2-30)

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

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Acknowledgment

Members of the IPC Terms and Definition Committee (2-30) have worked together to develop this document. We would like to thank them for their dedication to this effort. Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the IPC Terms and Definitions Committee (2-30) 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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Terms and Definitions for Interconnecting and Packaging Electronic Circuits

Scope This document is designed to provide definitions for terms commonly used in the electronics industry which have meanings specific to electronics. The definitions are intended to provide sufficient clarity of detail such that a reader utilizing English as a second language could understand the subtleties of the meaning. Terms which have a specialized meaning or usage within a single IPC document may be defined differently within that document. Commonly used English language terms which do not change meaning when applied to electronics are not defined here.

Acronyms commonly used in electronics are defined in Appendix A.

Note: Changes made to this revision of the IPC-T-50 are indicated throughout by gray-shading of the term and definition and/or Figure header.

A

AABUS (As Agreed Between User and Supplier)

Indicates additional or alternate requirements that **shall** be negotiated between the user and the supplier in the procurement documentation. Examples include contractual requirements, modifications to purchase documentation and information on the drawing. Agreements can be used to define test methods, conditions, frequencies, categories or acceptance criteria within a test, if not already established.

Abrasion Resistance

The ability of a material to withstand surface wear.

Absolute Maximum Ratings

The range of voltages, currents, temperatures, etc., beyond which a device may suffer degradation in performance or reliability, may cease functioning or may suffer irreversible damage.

Absorption Coefficient

A measure of the absorption of radiant energy as it passes through a specific substance.

Absorptivity, Infra-red

The ratio (or percentage) of the amount of energy absorbed by a substrate as compared with the total amount of incident energy.

Accelerated Aging

A test in which the parameters such as voltage and temperature are increased above normal operating values to obtain observable or measurable deterioration in a relatively short period of time.

Accelerated Equivalent Soak (Plastic Encapsulated SMDs)

An environmental soak of a component at a higher temperature for a shorter time (compared to the standard soak), to provide roughly the same amount of moisture absorption. See also "Soak."

Accelerated Life Test

See "Accelerated Aging."

Accelerated Test

A test of an electronic component or electronic assembly in a short period of time by applying physically severe condition(s).

Accelerator

See "Catalyst."

Acceleration Factor (AF)

The ratio of stress in reliability testing to the normal operating condition.

Acceptable Condition

This condition, while not necessarily perfect, will maintain the integrity and reliability of the assembly in its service environment.

Acceptance Quality Level (AQL)

A specified maximum number of defects, expressed as a percentage, that is considered to be acceptable quality and normally associated with statistically derived sampling plans.

Acceptance Tests

Those tests deemed necessary to determine the acceptability of a product and AABUS.

Acceptance Inspection (Criteria)

An inspection that determines conformance of a product to design specifications as the basis for acceptance.

Access Hole (Lamination)

A blind hole that is made in a multi-layer board through one or more layers to provide access to the surface of a land on the inner layer of the board. (See Figure A-1.)

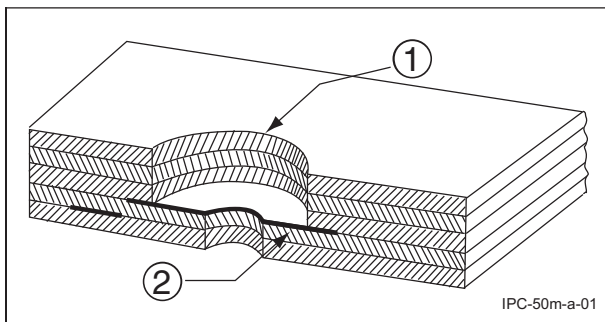


Figure A-1 Access Hole

1. Access Hole

2. Land

Access Protocol

An agreed principle for establishing how nodes in a network communicate electronically.

Accordion Contact

A type of connector contact that consists of a flat spring formed into a “Z” shape in order to permit high deflection without overstress.

Accuracy

The deviation of the measured or observed value from the actual value.

Acid Flux

A solution of an acid and an inorganic, organic, or water soluble organic flux. (See also “Inorganic Flux,” “Organic Flux,” and “Water-Soluble Flux.”)

Acid Number

The amount of potassium hydroxide in milligrams that is required to neutralize one gram of an acid medium.

Acid Value

See “Acid Number.”

Acid-Core Solder

Wire solder with a self-contained acid flux.

Acoustic Microscope

Equipment that creates an image using ultrasound to view a specimen’s surface or subsurface features, including defects and damage.

Actinic Radiation

Light energy that reacts with a photosensitive material in order to produce an image.

Activated Rosin Flux

A mixture of rosin and small amounts of organic-halide or organic-acid activators. (See also “Synthetic Activated Flux.”)

Activating

A treatment that renders nonconductive material receptive to electroless deposition.

Activating Layer

A layer of material that renders a nonconductive material receptive to electroless deposition.

Activator

A substance that improves the ability of a flux to remove surface oxides from the surfaces being joined.

Active Desiccant

Desiccant that is either fresh (new) or has been baked according to the manufacturer’s recommendations to renew desiccant to original specifications.

Active Device

An electronic component that can change a signal or respond to the signal in a way that is dependent upon the nature of the signal and/or other controlling factors. (This includes diodes, transistors, amplifiers, thyristors, gates, ASIC’s and other integrated circuits that are used for the rectification, amplification, switching, etc., of analog or digital circuits in either monolithic or hybrid form.)

Active Metal

A metal that has a very high electromotive force.

Active Trimming

Adjusting the value of a film circuit element in order to obtain a specified functional output from the circuit while it is electrically activated. (See also “Laser Trimming.”)

Actual Size

The measured size.

Additive Process

A process for obtaining conductive patterns by the selective deposition of conductive material on clad or unclad base material. (See also “Semi-Additive Process” and “Fully-Additive Process.”)

Add-On Component

Discrete or integrated packaged or chip components that are attached to a film circuit in order to complete the circuit’s function.

Adhesion (Pressure Sensitive Tape)

The bond produced by contact between pressure-sensitive adhesive and a surface.

Adhesive

A substance such as glue or cement used to fasten objects together. In surface mounting, an epoxy adhesive is used to adhere SMDs to the substrate.

Adhesion Failure

The separation of an adhesive bond at the interface between two materials.

Adhesion Layer

The metal layer that adheres a barrier metal to a metal land on the surface of an integrated circuit.

Adhesion Promotion

The process of preparing a surface to enhance its ability to be bonded to another material.

Adhesive Coated Substrate

A base material upon which an adhesive coating is applied, for the purpose of retaining the conductive material (either additively applied or attached as foil for subtractive processing), that becomes part of a metal-clad dielectric.

Adhesive-Coated Catalyzed Laminate

A base material with a thin polymer coating, that contains a plating catalyst, that is subsequently treated in order to obtain a microporous surface.

Adhesive-Coated Uncatalyzed Laminate

A base material with a thin polymer coating, that does not contain a plating catalyst, that is subsequently treated in order to obtain a microporous surface.

Adhesive Transfer (Pressure Sensitive Tape)

The transfer of adhesive from its normal position on the pressure sensitive tape to the surface to which the tape was attached, either during unwind or removal.

Adsorbed Contaminant

A contaminant attracted to the surface of a material that is held captive in the form of a gas, vapor or condensate.

Advanced Statistical Method

A statistical process analysis and control technique that is more sophisticated and less widely applicable than basic statistical methods.

Aging

The change of a property, e.g., solderability, with time. (See also "Accelerated Aging.")

Air Contamination

See "Air Pollution."

Air Pollution

Contamination of the atmosphere with substances that are toxic or otherwise harmful.

Algorithm

A set of procedures for the solution of a problem in a series of steps.

Alignment Mark

A stylized pattern that is selectively positioned on a substrate material to assist in alignment. (See Figure A-2).

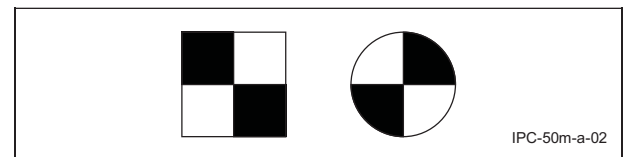


Figure A-2 Alignment Mark

Aliphatic Solvents

"Straight chain" solvents, derived from petroleum, of low solvent power.

Alkaline Cleaner

A material blended from alkali hydroxides and alkaline salts.

All Metal Package

A hybrid circuit package made solely of metal, without glass or ceramic.

Allowable Temperature

The temperature range that an electronic circuit or component can perform its intended functions.

Alloy, Tin Bismuth (Sn-Bi)

An alloy that is used as a lead free solder and consisting of tin and bismuth as the main constituents. Sn-Bi58 has a low melting point of 138 °C [280 °F], but is not widely used because of its brittle properties.

Alloy, Tin Copper (Sn-Cu)

An alloy that is used as a lead free solder consisting of tin and copper considered to be applicable for wave or reflow soldering.

Alloy, Tin Silver (Sn-Ag)

An alloy that is used as a lead free solder and consisting of tin and silver as the main constituents used as a high temperature solder.

Alloy, Tin Silver Bismuth (Sn-Ag-Bi)

An alloy that is used as a lead free solder and consisting of tin, silver and bismuth as the main constituents. The Bi in Sn-Ag-Bi alloy reduces the melting temperature. The higher the Bi content, the higher the mechanical strength, but with poorer elongation capability. There is a limit to Bi content.

Alloy, Tin Silver Copper (Sn-Ag-Cu)

An alloy that is used as a lead free solder consisting of tin, silver and copper as the main constituents.

Alloy, Tin Zinc (Sn-Zn)

An alloy that is used as a lead free solder and consisting of tin and zinc as the main constituents. Zn09 alloy has a melting point of 199 °C [390 °F], is closest to the melting point of Sn-Pb alloy among lead free solders, which allows soldering work at present soldering temperatures, but tends to form a stable oxide film, causing difficulty in securing a good solder wetting.

Alpha Error (α)

The probability of rejecting the null hypothesis that is true (sometimes known as the “Producer’s Risk” or a “Type I Error”).

Alphanumeric

Pertaining to data that contain the letters of an alphabet, the decimal digits, and may contain control characters, special characters and the space character.

Alpha Particle

A He^4 nucleus generated from a nuclear decay that is capable of generating hole-electron pairs in microelectronic devices and switching cells causing soft errors in some devices.

Alternating Current (ac)

A current that varies with time, commonly applied to a power source that switches polarity many times per second, in the shape of a sinusoidal, square, or triangular wave.

Alternative Hypothesis

The supposition that a significant difference exists between the desired results of two comparable populations. (See also “Null Hypothesis” and “Statistical Hypothesis.”)

Alumina Substrate

Aluminum oxide used as a ceramic substrate material.

Ambient

The surrounding environment coming into contact with the system or component in question.

American Wire Gauge (AWG)

One of several standard systems for designating solid or stranded wire diameter that is primarily used for electrical conductors in the United States.

Amorphous Polymer

A polymer with a random and unstructured molecular configuration.

Amplitude, Voltage

The magnitude of a voltage during a complete cycle, with respect to a reference, such as a ground plane.

Analog Circuit

An electrical circuit that provides a continuous relationship between its input and output.

Analysis of Variance (ANOVA)

The systematic method of statistically evaluating experimental results in order to separate the sources of variation.

Anchoring Spur

An extension of a land on a flexible printed board that extends beneath the coverlay to assist in holding the land to the base material. (See Figure A-3.)

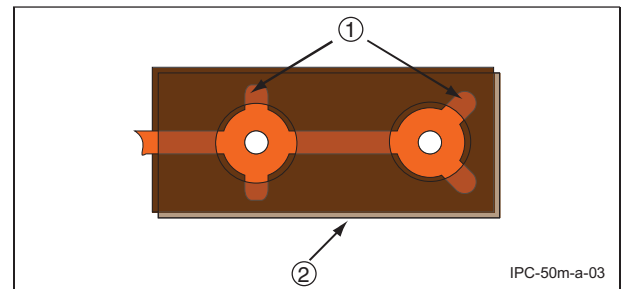


Figure A-3 Lands with Anchoring Spurs

1. Anchoring Spurs
2. Cover layer

Angled Bond

The impression of the first and second bonds that are not in a straight line.

Anisotropic/Anisotropy

The condition for a substance having differing values for properties, such as permittivity, depending on the direction within the material.

Anisotropic Conductive Contact

An electrical connection using an anisotropic conductive film or paste wherein conductive particles of gold, silver, nickel, solder, etc. are dispersed. When it is compressed, an electrical connection is attained only in the direction of compression.

Annealing

A heat treatment that alters the microstructure of a material causing changes in properties such as strength and hardness, to induce ductility and relieve internal stresses.

Annotation

Text, notes, or other identification, constructed by a computer-aided system, intended to be inserted on a drawing, map or diagram.

Annular Ring (Annular Width)

That portion of conductive material completely surrounding a hole. (See Figure A-4.)

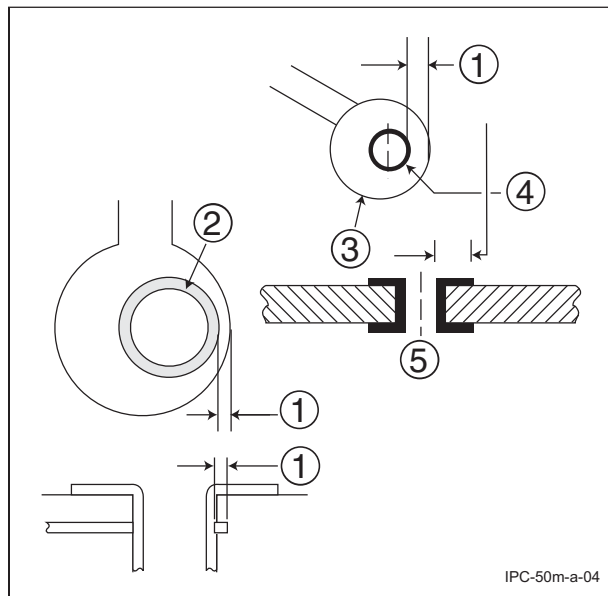


Figure A-4 Annular Ring (Annular Width)

- | | |
|-------------------------|--------------------------|
| 1. Minimum Annular Ring | 4. Plated Through-Hole |
| 2. Hole Plating | 5. External Annular Ring |
| 3. Land | |

Anode (BGA)

The electrode from which the forward current flows within the device.

Anodic Cleaning

The removal of foreign substances from a metallic surface by electrolysis with the metal as the anode.

Antipad

A clearance in a conductive plane surrounding a hole, intended to prevent connection to the plane (for plated holes) or to keep copper away from the edge (for non-plated holes).

Aperture

An opening that limits the amount of light used to expose film in a photoplotter.

Aperture (Stencil)

An opening in the stencil-foil.

Apparent Field-of-View Angle

The angular subtense of the field-of-view in the image space of an optical system.

Application Specific Integrated Circuit (ASIC)

A custom built integrated circuit component that is designed for a unique, specific application.

Aqueous Flux

See "Water-Soluble Flux."

Aramid

See "Para-aramid."

Arc Resistance

A measure of the durability of an insulating or dielectric material to the effects of a high voltage, low current arc (under prescribed conditions) passing across the surface of the material. (The resistance is stated as a measure of total elapsed time at that voltage required to form a conductive path on the surface - material carbonized by the arc).

Architecture (Computer)

The structure of a computer's functional elements that makes it possess specific maximum and minimum capabilities.

Area Array Package

A package that has terminations arranged in a grid on the bottom of the package and contained within the package outline. (See Figure A-5.)

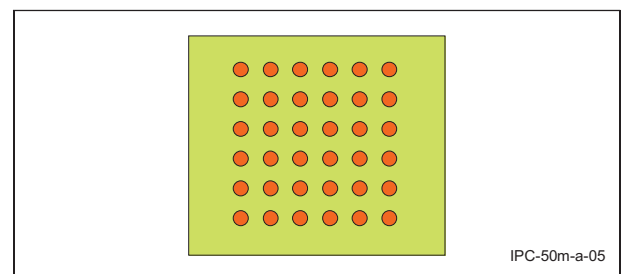


Figure A-5 Area Array

Area Array Tape Automated Bonding

Tape Automated Bonding where some carrier tape terminations are made to lands within the perimeter of the die.

Area Ratio

The ratio of the area of aperture opening to the area of aperture walls.

Array

A group of elements or circuits arranged in rows and columns on a base material.

Artificial Intelligence

The capacity of a machine to perform functions that are normally associated with human intelligence, such as reasoning and learning.

Artwork

An accurately-scaled configuration that is used to produce the “Artwork Master” or “Production Master.” (See Figure A-6.)

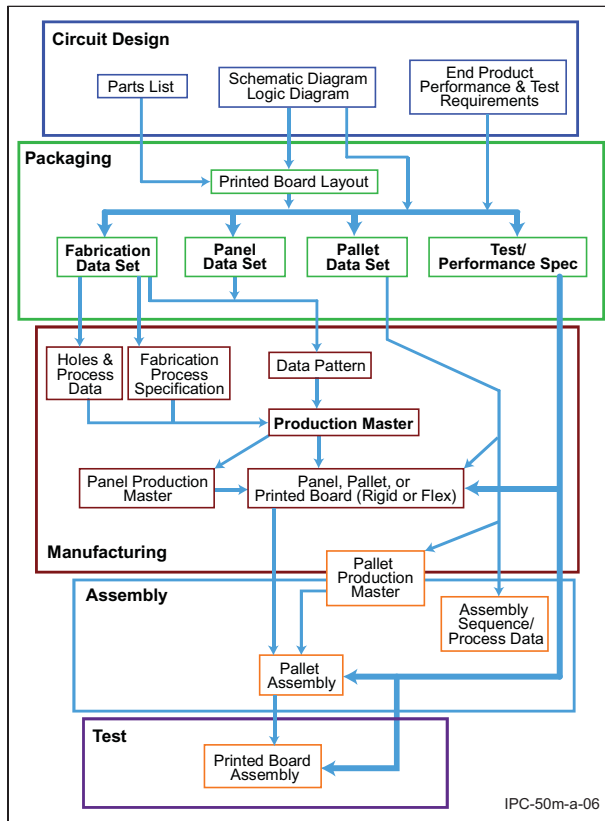


Figure A-6 Artwork (Simplified Flow Chart of Printed Board Design/Fabrication Sequence)

Artwork Master

An accurately-scaled, usually 1:1, pattern that is used to produce the “Production Master.” (See Figure A-6.)

As-Fired

The condition (values) of thick-film components or the surface condition of ceramic base materials, after they have been processed in a firing furnace and prior to trimming or polishing.

Aspect Ratio (Film)

The ratio of the length of a film component to its width.

Aspect Ratio (Hole)

The ratio of the length or depth of a hole to its preplated diameter. (See Figure A-7.)

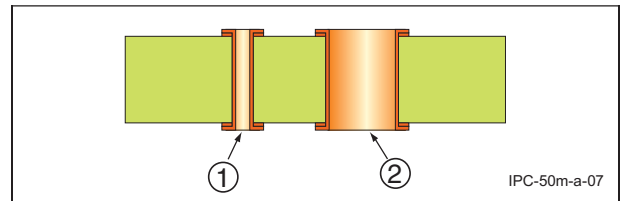


Figure A-7 Aspect Ratio (Hole)

1. Higher Aspect Ratio

2. Lower Aspect Ratio

Aspect Ratio (Stencil)

The ratio of the width of the aperture to the thickness of the stencil-foil.

Assembled Board

See “Assembly.”

Assembly

A number of parts, subassemblies or combinations thereof joined together. (Note: This term can be used in conjunction with other terms listed herein, e.g., “Printed Board Assembly.”)

Assembly Drawing

A document that depicts the physical relationship of two or more parts, a combination of parts and subordinate assemblies, or a group of assemblies required to form an assembly of a higher order.

Assembly Language

A computer language made up of brief expressions that an assembler program can translate into a machine language.

Assembly Manufacturer

The individual, organization, or company responsible for the assembly process and verification operations necessary to ensure full compliance of assemblies.

Assignable Cause

An identifiable, specific cause of variation in a given process or measurement that affects only some of the individual values of process output. Also known as “Special Cause.” (See also “Common Cause”).

Asymmetric Stripline

A stripline signal conductor that is embedded, but not centered, between two ground planes. (See Figure A-8.)

Attachment Density

The average number of surface mount or through-hole solder joints, based on pitch and land size, that may be accommodated in a prescribed unit area e.g., cm², considering land size within the unit area to accommodate solder joint attachment.

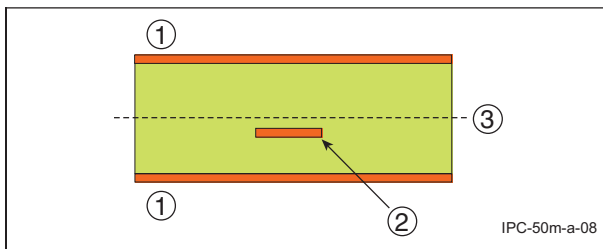


Figure A-8 Asymmetric Stripline

1. Ground
2. Signal
3. Center Line

Attenuation (Signal)

A general term that refers to any reduction in the strength of a signal. Attenuation occurs with any type of signal, whether digital or analog. Sometimes called loss, attenuation is a natural consequence of signal transmission over long distances. The extent of attenuation is usually expressed in units called decibels (dBs).

Attributes Data

Qualitative data that can be counted, but not measured, for recording and analysis purposes.

Audit

The periodic observance of procedures and performed activities to evaluate compliance with requirements.

Automated Component Insertion

The act or operation of assembling discrete components to printed boards by means of electronically-controlled equipment.

Automatic Component Placement

Software that automatically optimizes the layout of components on a printed board.

Automatic Conductor Routing

Software that automatically determines the placement of interconnections on a printed board.

Automatic Control

A system in which mechanized guidance or manipulation is used to achieve a prescribed value of a variable.

Automatic Dimensioning

A computer-aided drafting function that automatically generates dimensions, leaders, arrowheads, etc., that make up a complete set of documented dimensions.

Automated Optical Inspection (AOI) Equipment

A programmed device for visually inspecting a surface.

Automatic Test Equipment

Equipment that automatically analyzes functional or static parameters in order to evaluate performance.

Automatic Test Generation

Computer generation of a test program based solely on circuit topology with little or no manual programming effort.

AWG Equivalent

The American Wire Gauge (AWG) round-conductor number that is used to designate a flat conductor with an equal cross-sectional area.

Axial Lead

Lead wire extending from a component or module body along its longitudinal axis. (See Figure A-9.)

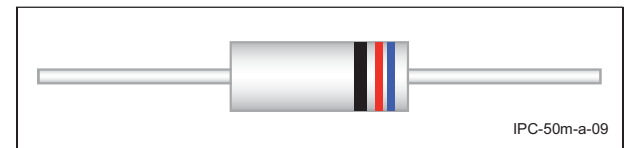


Figure A-9 Axial Lead

Azeotrope

See "Azeotropic Mixture."

Azeotropic Mixture (Azeotrope)

A liquid mixture of two or more substances that behaves like a single substance. The vapor produced by partial evaporation of the liquid has the same composition as the liquid.

B

B-Stage

An intermediate state in the curing process of a thermosetting resin, in which the material is only partially polymerized. (See also "C-Staged Resin.")

B-Staged Material

See "Prepreg."

B-Staged Resin

A thermosetting resin that is in an intermediate state of cure. (See also "C-Staged Resin.")

Back Annotation

The process of extracting appropriate information from a printed board design and inserting it on the board's schematic diagram.

Back Bonding

Attaching a die to a base material with its circuitry facing away from the base material. (See Figure B-1.)

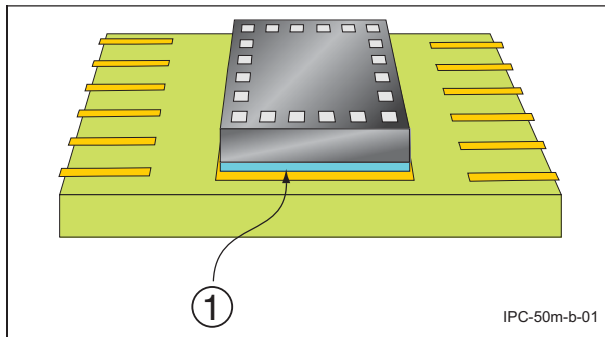


Figure B-1 Back Bonding
1. Back Bond

Back Drilling

A secondary, controlled depth drilling operation, performed after plating, whereby plating is removed from the unused conductive portion of a plated through-hole by means of a drill bit whose diameter is larger than that of the one used to create the original through-hole.

Back Mounting

See “Back Bonding.”

Back Taper(s)

The constant decrease in diameter along the length of the body of a drill, from the cutting tip to the end of the drill shank.

Back-Bared Land

A land in flexible printed wiring that has a portion of the side normally bonded to the base dielectric material exposed by a clearance hole. (See Figure B-2.)

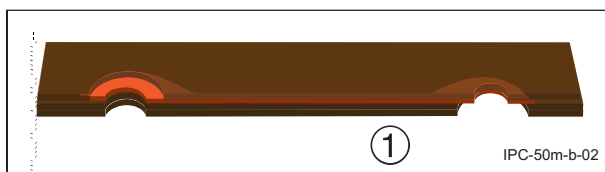


Figure B-2 Back-Bared Land
1. Back Side Access

Backdriving

An in-circuit testing technique that drives digital circuitry outputs to a given logic level, by supplying pulses of sufficient electrical current magnitude in parallel with the outputs, in order to overdrive the logic state conditions of the next digital device inputs.

Backfill (Gas)

Filling a hybrid circuit package with a dry inert gas prior to hermetic sealing.

Backfill (Liquid)

The act of sealing the edge of a component with an adhesive or encapsulant to prevent intrusion of liquids or other contaminants.

Background (Artwork)

The nonfunctional area of a phototool.

Background Variable

A parameter of no experimental interest that is not held at a constant value. Its effect is assumed to be insignificant or negligible (noise).

Backlighting

Placing an object between the light source and the eye or recording medium for illumination.

Backpanel

See “Backplane.”

Backplane

A printed board assembly that serves as a backbone to connect application specific printed board assemblies that share common I/O and power distribution. For additional information see also “Motherboard” and “Daughterboard.”

Backup Pin

A supporting pin that is located under a printed board to prevent deflection of the board during component mounting.

Backward Crosstalk

Noise induced into an adjacent line, as seen at that end of the adjacent line which is closest to the signal source, when this line has been placed near an active line. (See also “Forward Crosstalk.”)

Bake

Exposing a product to heat, normally in an oven, for a specific period of time to cure and/or drive moisture from a part. Can be IR, convection or conduction.

Bake Out

Subjecting a product to an elevated temperature in order to remove moisture and unwanted gasses prior to performing certain processes in printed board manufacturing, assembly, repair or final coating.

Balanced Transmission Line

A transmission line that has distributed inductance, capacitance, resistance, and conductance elements that are equally distributed between its conductors.

Ball

A conductive sphere attached to a package substrate used to facilitate bonding or soldering to the next level of interconnect.

Ball Array

A group of balls arranged in rows and columns.

Ball Bond

The welded connection of a bond wire to the bond pad of an integrated circuit die. The bond wire is melted to form a ball and the ball is bonded by use of thermocompression or thermosonic techniques.

Ball Grid Array (BGA)

A surface mount package wherein the balls for terminations are formed in a grid on the bottom of a package. (See Figure B-3.)

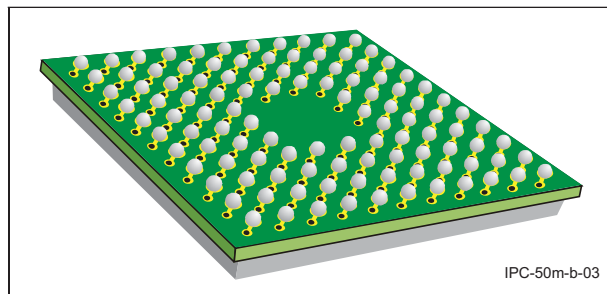


Figure B-3 Ball Grid Array (BGA)

Ball Lift

A category of ball bond failure in which the ball lifts from the surface of the integrated circuit die bond pad metallization or lifts the metallization from the surface of the underlying oxide or silicon.

Bar

The dark element of a bar code.

Bar Code

A linear arrangement of bars and spaces in a predetermined pattern.

Bar Code Label

The manufacturer's label that includes information in a code consisting of parallel bars and spaces on a 2D matrix format.

Bar Code Marking

An identification code consisting of a pattern of vertical bars whose width and spacing identifies the item marked on a 2D matrix format.

Bar Code Printer

A printer with the ability to print bar coded labels and forms.

Bar Code Scanner/Reader

A device used for machine reading of a bar code. Readers may be hand held-wands, fixed optical beams, or moving optical beams.

Bar Code Symbol

A printed or photographically reproduced bar code composed of parallel bars and spaces of various widths. A bar code symbol contains a leading quiet zone, a start character, data characters, a stop character, and a trailing quiet zone. In some cases, a check character is included.

Bare Board

An unassembled (unpopulated) printed board.

Bare Die

Completely processed discrete semiconductor or integrated circuit device to a stage where the die is suitable for interconnection to a substrate or component package configuration.

Bare Die (with Connection Structures)

Unpackaged die that have had bumps, lead frames or other terminations added for electrical attachment.

Bare Copper

Copper without any additional surface finish or treatment.

Barrel Crack

A crack of the plated metal on the internal wall of a through-hole. (See also "Circumferential Separation.") (See Figure B-4.)

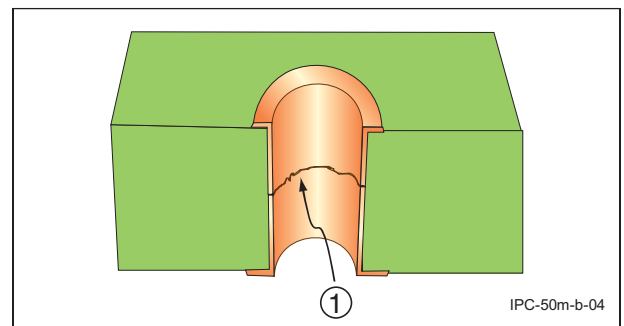


Figure B-4 Barrel Crack

1. Barrel Crack**Barrier Metal**

A metal used to seal the semiconductor-die lands.

Base Film (Flexible Circuits)

The film that is the base material for the flexible printed board and on the surface of which the conductive pattern can be formed. When the heat resistance is required, polyimide film is mostly used, and polyester film is usually used when the heat resistance is not required.

Base Material

The insulating material upon which a conductive pattern may be formed. (The base material may be rigid or flexible. It may be a dielectric or insulated metal sheet.)

Base Material Thickness

The thickness of the base material excluding conductive foil or material deposited on the surfaces.

Base Metal

See "Basis Metal."

Base Metal (Solder)

The underlying metal surface to be wetted by solder, also referred to as basis metal.

Base Plane

The plane that includes the lowest point of the mounting surface of the package, except for packages using stand-offs.

Base Solderability

The ease with which a metal or metal alloy surface can be wetted under typical soldering conditions.

Baseline Dimensioning

The dimensioning of feature positions from the origin of the coordinate system. (See Figure B-5.)

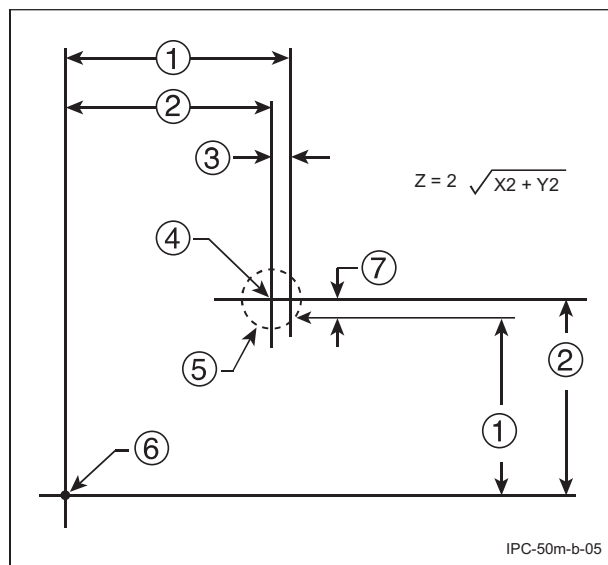


Figure B-5 Example of Feature Location using Baseline Dimensions

- | | |
|------------------------------|-------------------------------|
| 1. Actual Measurement (Part) | 5. Actual Positional Diameter |
| 2. Basic Dimension (Drawing) | 6. Datum |
| 3. X (Difference) | 7. Y (Difference) |
| 4. True Position | |

Basic Dimension

A theoretically exact dimension, given from a datum to a feature of interest. It represents an ideal case and as such, has no tolerance.

Basic Dimensioning and Tolerancing

A system of dimensioning, tolerancing and related requirements used on engineering drawings. It is the basis from which permissible variations are established given in notes or as feature control symbols.

Basic Specification (BS)

A document that describes the common elements for a set, family or group of products, materials, or services.

Basic Statistical Method

The application of a theory of variation through the use of basic problem-solving techniques and statistical process control. (This includes control and capability analysis for both variables and attributes data.)

Basis Material

Material upon which coatings are deposited.

Basis Metal

A metal upon which coatings are deposited.

Batch Oven

A temperature-controlled oven used for drying, baking, curing, etc. where the material being processed is stationary.

Batch Processing (Software)

The computer processing of several data packages, e.g. with a program for computer-aided manufacturing, in succession without human input.

Batch Size

See "Lot Size."

Bathtub Curve

The form of a graph where the functional relationship is initially high, then low for a period of time, and then high. This curve is frequently found in the life cycle analysis of components. This behavior is initially caused by infant mortality and finally by product deterioration. (See Figure B-6.)

Baumé Scale

An arbitrary gradation scale of specific gravities used in hydrometers.

Bead (Discrete Wiring)

The external (surface) annular ring of copper plating around a plated-through hole on a fully additive circuit board which functions to conduct heat and promote solder wicking during the soldering of components.

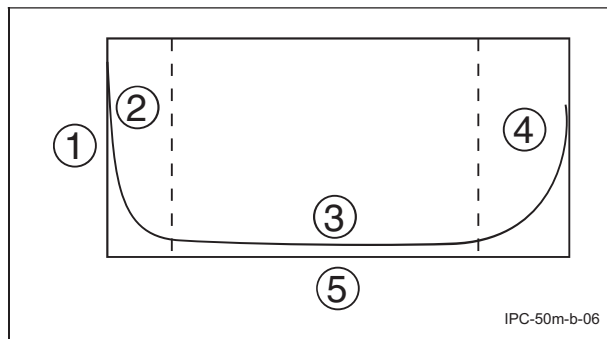


Figure B-6 Bathtub Curve

- | | |
|----------------------|---------------------|
| 1. Failure Rate | 4. Wear Out Failure |
| 2. Infant Failure | 5. Time |
| 3. Intrinsic Failure | |

Beam Lead

A component terminal in the form of a long metallic structural member that is not supported along its length.

Beaming

The operation in which yarn from several section beams is combined on the final warp beam.

Beam-Lead Device

An active or passive chip component with beam leads for interconnecting it to lands on a base material. (See Figure B-7.)

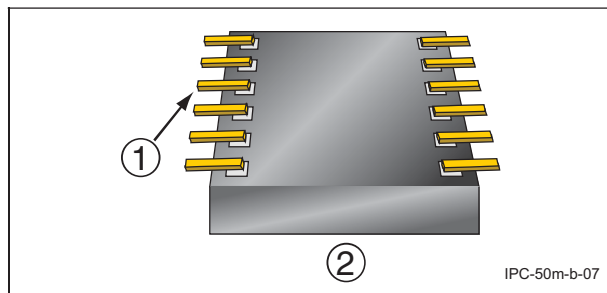


Figure B-7 Beam-Lead Device

- | |
|---------------------|
| 1. Beam Lead |
| 2. Beam Lead Device |

Bed-of-Nails Fixture

A test fixture consisting of a frame and a holder containing a field of spring-loaded pins that make electrical contact with a planar test object.

Bellmouth

A flared portion at the front and/or back of the wire barrel crimp that provides a gradual entrance and exit for the wire strands to avoid causing damage.

Bellows Contact

A type of contact that consists of a flat spring that has been folded to provide a very uniform spring rate over the full range of contact with the mating part.

Benchmark, Computer

A standard measure of the performance of computers relative to each other, including set-up time, program generation, and data processing capability.

Benchmark, Testing

A standard measure of the performance of testers relative to each other, including set-up time, test program generation, and fixturing.

Bending Resistance

The ability of a material to withstand repeated bending to specified parameters without producing cracks and breaks in excess of the specification allowance.

Beta Error (β)

The probability of accepting the null hypothesis when false (sometimes known as the "Consumer's Risk" or "Type II error").

Bias

Constant offset from the true value – In practice, bias is measured as the difference between a known value (traceable reference standard; e.g., NIST) and the average of a set measurement of the standard.

Bias (Fabric)

Filling yarn that is off-square with the warp ends of a fabric.

BiCMOS

Transistor fabrication technology, resulting in the creation of both bipolar and CMOS devices.

Bifurcated Contact

A type of connector contact that usually consists of a flat spring that has been slotted length-wise in order to provide independent contact points with the mating part.

Bifurcated Solder Terminal

A solder terminal with a slot or slit opening through which one or more wires are placed prior to soldering. (See Figure B-8.)

Bilateral Tolerance

A tolerance in which variation is permitted in both directions from the specified dimension.

Billboarding

A discrete component with both terminations soldered when mounted on its narrow edge. (See Figure B-9.)

Binder

Material added to thick-film compositions and unfired base materials to give them additional strength for pre-fire handling. (See also "Glass Binder.")

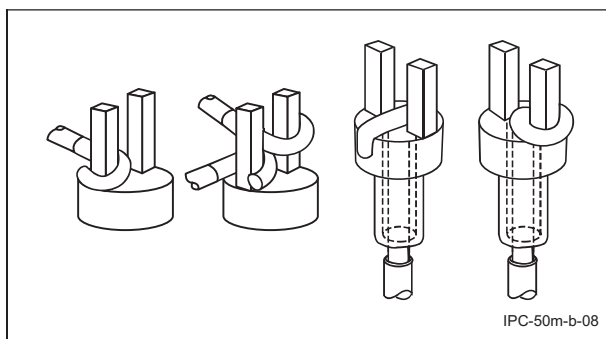


Figure B-8 Bifurcated Solder Terminal

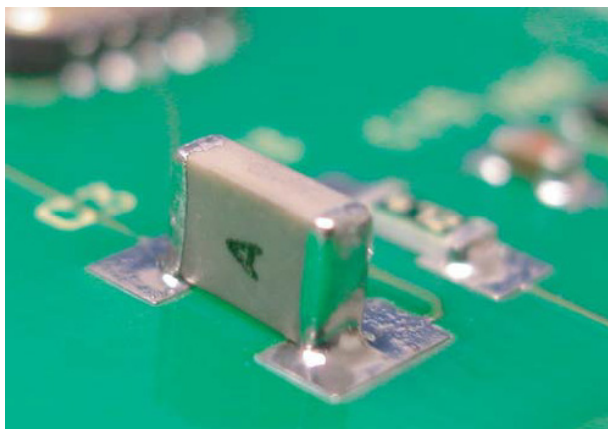


Figure B-9 Billboarding

Binomial Distribution

A discrete probability distribution that describes the possible number of times that a particular event will occur in a sequence of observations.

Biochemical Oxygen Demand

The quantity of oxygen consumed by decomposing organic material, used to measure contamination of water.

Biocide

A general name for any substance that kills or inhibits the growth of micro-organisms.

Bipolar Device

A device in which both majority and minority carriers are present. Bi-polar and Metal-Oxide Semi-conductor (MOS) are the two most common device types.

Birdcage

Stranded wire whereby the strands in the stripped portion between the covering of an insulated wire and a soldered connection, or an end-tinned lead, have separated from the normal lay of the strands.

Bismaleimide

A resin that has the generic chemical structure of an aromatic chemical group that is attached to two (or “Bis”) maleimide groups.

Bismaleimide Triazine

A resin that contains a mixture of bismaleimide and triazine resins.

Blank

An unprocessed or partially processed piece of base material or metal or metal clad base material that has been cut from a sheet.

Blanking

Cutting a sheet of material into pieces, usually using a die, to the specified blank dimensions.

Bleeding

A condition in which a product or part, e.g. a plated hole of a printed board, discharges water, process materials or solutions from crevices or voids, or a condition in which a resist or paint migrates beyond the image area.

Blends

A mixture of different substances or different types of the same substance, e.g. a mixture of resins in board manufacturing.

Blind Via

A via extending only to one surface of a printed board. (See Figure B-10.)

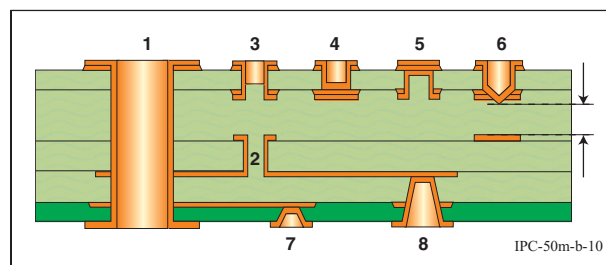


Figure B-10 Blind and Buried Vias

- | | |
|---------------------------------|---------------------------|
| 1. Standard Through Via | 5. Reverse Blind Via |
| 2. Standard Buried Via | 6. Controlled Depth Drill |
| 3. Semi-blind (Semi-buried) via | 7. Photo Defined Via |
| 4. Blind Via (Laser Drilled) | 8. Trepanned Via (Laser) |

Blister

Delamination in the form of a localized swelling and separation between any of the layers of a laminated base material, or between base material and conductive foil or protective coating, or solder mask. (See also “Delamination.”)

Blocking Variables

In a Design of Experiments, a variable added to isolate the significant variables in the experiment.

Blow Hole

A void caused by outgassing.

Blow Through (Molding)

Any condition where the mold material migrates through or around the connector insert/contact or is present on the electrical mating surface and/or prevents proper mating or function of the connector.

Board

See “Printed Board,” and “Multilayer Printed Board.”

Board Fabricator

The individual, organization, or company responsible for the fabrication of the bare printed board, including all process and verification operations necessary to ensure full compliance with customer requirements.

Board Thickness

The overall thickness of the metal-clad base material or printed board as defined by the user.

Body Land Clearance

That portion of a drill bit, where the diameter is decreased compared with the minor cutting edge in order to provide a clearance behind the margin. (See Figure B-11, Feature K.)

Bond

An interconnection that performs a permanent electrical and/or mechanical function.

Bond Deformation

The plastic-flow change in the form of a lead caused by a bonding tool during a termination process.

Bond Enhancement Treatment

A treatment or coating on a metal foil surface to enhance the bondability of the foil to a resin surface.

Bond Envelope

The range of termination parameters within which acceptable bonds may be formed.

Bond Interface

The common area between a lead and a land to which it has been terminated.

Bond Land

See “Bonding Area.”

Bond Lift-Off

The failure mode whereby a bonded lead separates from the surface to which it has been joined.

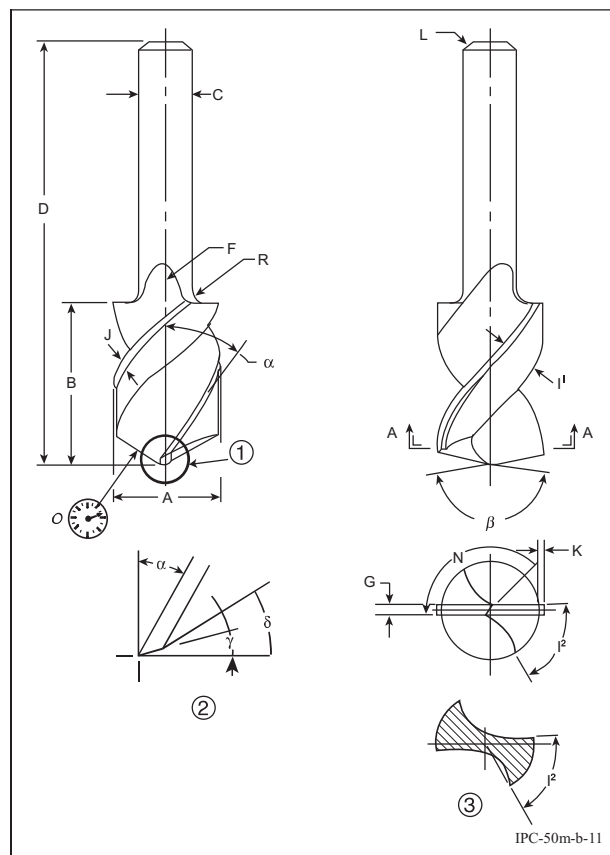


Figure B-11 Drill Features

1. See Detail I

2. Detail I

3. Section A-A.

A. Drill Diameter

B. Drill Body Length

C. Shank Diameter

D. Overall Length

F. Carry Out

G. Web Thickness

I¹. Land Width

I². Land Width Angle

J. Margin Width

K. Body Land Clearance

L. Chamfer Angle

N. Chisel-Edge Angle

O. Lip Height

R. Fillet Radius

α. Helix Angle

β. Point Angle

δ. Relief Secondary

γ. Relief Primary

Bond Pad

See “Bond Site.”

Bond Pull Test

Test involving the pulling of the die bond wires to failure to determine the strength of the bonds.

Bond Schedule

The values of termination machine parameters.

Bond Separation

The distance between the termination points of the first bond and the second bond.

Bond Site

The metallized area on a die or substrate that is used for temporary or permanent electrical connection (bonding).

Bond Strength

The force perpendicular to a board's surface required to separate two adjacent layers of the board, expressed as force per unit area.

Bond Surface

See "Bonding Area."

Bond-to-Bond Distance

The distance from the bonding site on a die to the corresponding bonding site on a lead frame, interconnecting base material, etc.

Bond-to-Die Distance

The distance from the heel of the bond of a beam lead to the die.

Bondability

The ability of a surface to be bonded, dependent upon degree of surface preparation, as in cleanliness and texture.

Bonding Area

The area defined by the extent of a land or portion of a terminal to which a lead is to be bonded.

Bonding, Die

See "Die Bonding."

Bonding Island

See "Bonding Area."

Bonding Layer

An adhesive layer used in bonding together other discrete layers of a multilayer printed board during lamination.

Bonding Pad (IC)

An area of metallization on an integrated circuit die that permit connection of fine wires or circuit element to the die.

Bonding Time

The time duration from the commencement of thermo heat-up until the reflow profile is completed.

Bonding Tool

The instrument used to position leads or discrete wires over a land and to impart sufficient energy to complete the termination.

Bonding Wire

Fine gold or aluminum wire used for making electrical connections between lands, lead frames, and terminals.

Boot

A protective housing usually made from a resilient material to prevent entry of moisture or other contaminants into the wire entry to a connector.

Border (Stencil)

Peripheral tensioned mesh, either polyester or stainless steel which keeps the stencil foil flat and taut. The border connects the foil to the frame.

Border Area

The region on a base material that is external to that of the end-product being fabricated within it.

Border Data

Patterns that appear in the border area, such as tooling features, test patterns, and registration marks.

Boss (Connector)

A raised section on a connector that fits into a specific slot in the positive polarization or keying feature of a mating connector.

Bottom Termination Components (BTC)

Surface mountable electronic components whose external connections consist of metallized terminations on the underside that are an integral part of the component body. BTC includes, for example, QFN, DFN, SON, LGA, MLP, and MLFP.

Bounce Pad (Discrete Wiring)

An isolated area in a copper plane which acts solely as a stop for the laser drilling operation.

Bow (Fabric)

Filling yarn that lies in an arc across the width of a fabric.

Bow (Sheet, Panel, or Printed Board)

The out of plane distance when all corners are in the same plane. (See Figure B-12.) (See also "Twist.")

Braid

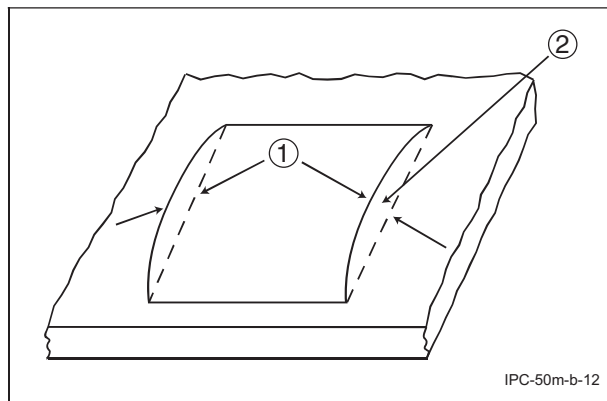
See "Braided Conductor" and "Braided Shield."

Braid Angle

The smaller of the two angles formed by the shielding strand and the axis of the cable being shielded.

Braid Carrier

A spool or bobbin on braiding equipment which holds one group of strands or filaments consisting of a specific number of wire ends. The carrier revolves during the braiding operation.

**Figure B-12 Bow****1. Deflection from Surface Plane****2. Bow****Braid Ends**

The strands used to make up one carrier. The strands are wound side by side on the carrier bobbin and lie parallel in the finished braid.

Braid Fold Back

That portion of the braid that is folded back to allow a solder connection between the braid and another conductor.

Braided Conductor

Woven bare metallic or tinned copper conductor used as a ground wire for batteries or heavy industrial equipment.

Braided Shield

A woven copper wire used as shielding for wires or woven fibrous protective outer covering over a conductor or cable.

Breakaway

The function of excising printed boards or printed board assemblies from their panel structure after all processing has been completed. (See Figure B-13.)

Breakdown Voltage

The voltage at which the dielectric material between two conductors fails.

Breakout

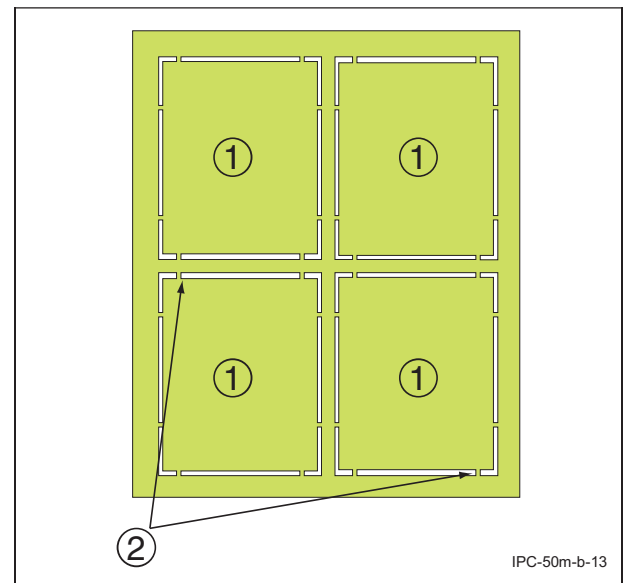
See "Hole Breakout."

Breakout (Harness)

The point at which a conductor or group of conductors is separated from a multi-conductor cable or wiring harness to complete circuits at other points.

Bridging (Conformal Coating)

Fillet or meniscus formation of coating joining the leads of a component.

**Figure B-13 Breakaway****1. Printed Board****2. Breakaway Tabs****Bridging (Electrical)**

The formation of a conductive path between conductors. (See also "Solder Bridging.")

Brightness

See "Luminance."

Broken Pick

A filling yarn that is missing from a portion of the width of a fabric.

Brominated Epoxy

An epoxy resin containing chemically-bound bromine which is added to act as a flame retardant.

Brown Streak (Base Materials)

A thin vein or stain seen in the reinforcement that can range from light amber to nearly chocolate brown. It usually runs within a fiber bundle for 3.0 to 13.0 mm [0.13 to 0.512 in]. It is most commonly found in the warp yarns and may appear singly or in multiples, or in a pattern. It is due to the remnants of the glass binder agent, which the weaver did not remove.

Brown Thread (Base Materials)

See "Brown Streak."

Bubble Effect

The entrapment of air, solvent or moisture bubbles in a protective coating.

Bubbles (Molding)

Spherical voids in a molding material.

Buffer Material

A resilient material that is used to protect a crack-sensitive component from the stresses generated by a conformal coating.

Build-up Process

See “Sequential Lamination.”

Bulge

A localized swelling of a printed board that is usually caused by internal delamination or separation of fibers from the resin.

Bulk Conductance

Conductance between two points of a homogeneous material.

Bulk Packaging

A method for packaging loose parts, into a bag or case.

Bulk Reflow

Reflow of multiple components, with simultaneous attachment, by an infrared (IR), convection/IR, convection, or vapor phase reflow (VPR) process.

Bulls-Eye

A stylized pattern that is located in the border area in order to aid in alignment.

Bump

A means of providing a (electrical) connection to the terminal area of a device. A small mound is formed on the device or substrate pads and is used as a contact for face-down loading.

Bump (Die)

A raised metal feature on a die land or tape carrier tape that facilitates inner-lead bonding.

Bump Array

A group of bumps arranged in rows and columns.

Bump Contact

A contacting pad that rises substantially above the surface level of the chip.

Bumped Die

A semiconductor die with raised metal features that facilitate inner-lead bonding. (See Figure B-14.)

Bumped Tape

Carrier tape with raised metal features that facilitate inner-lead bonding.

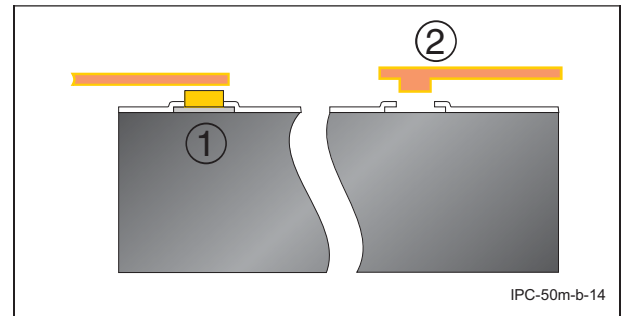


Figure B-14 Bumped Die

1. Bumped Die

2. Bumped Lead

Bumped Wafer

A semiconductor wafer with raised metal features on its die lands that facilitate inner-lead bonding.

Buried Via

A via that does not extend to the surface of a printed board. (See Figure B-10.)

Burn-In

The process of electrically stressing a device at an elevated temperature, for a sufficient amount of time to cause the failure of marginal devices (Infant Mortality).

Burn-In, Dynamic

Burn-in at high temperatures that simulates the effects of actual or simulated operating conditions.

Burn-In, Static

Burn-in at high temperatures with unvarying voltage, either forward or reverse bias.

Burn-Off

See “Flame-Off.”

Burnt Resin (Base Materials)

See “Treater Dirt.”

Burr

Small lumps or masses with an irregular shape, convex to a surface, which occur as a result of a machine process such as drilling or gouging.

Bus

One or more conductors used for transmitting power or data signals, such as, address signals, control information, etc.

Bus Bar

A conduit, such as a component or conductor on a printed board, that is used for distributing electrical energy. (See also “Plating Bar.”)

Butt Leads

A SMT lead form where leads extend horizontally from about the center of a component body, formed down at a 90 degree angle and end immediately below the component body without additional bends.

Butt Plating Joint

A joint between two or more conductors of a printed board, at the end of one or both, and either at right angles or oblique to the grain of the conductors, with no overlap of the conductors.

Butt Plating Joint (Wrap Plating)

The consequent via structure of a surface interconnect termination with the absence of wrap plating. (See Figure B-15.)

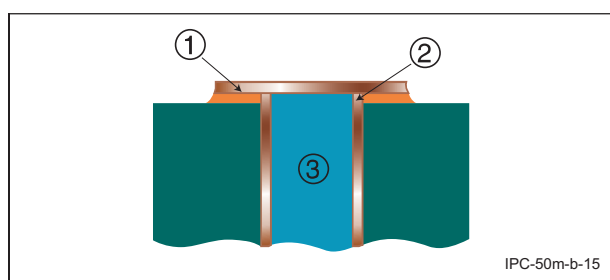


Figure B-15 Butt Plating Joint (Wrap Plating)

1. Panel Plating
2. Butt Plating Joint
3. Via Fill

Butt Splice

A technique for joining conductors end to end.

Butter Coat

An increased amount of resin on the outer surface of a base material.

Button Plating

A selective plating technique in which copper is plated only in the holes and/or on artwork defined pads. (See Figure B-16.)

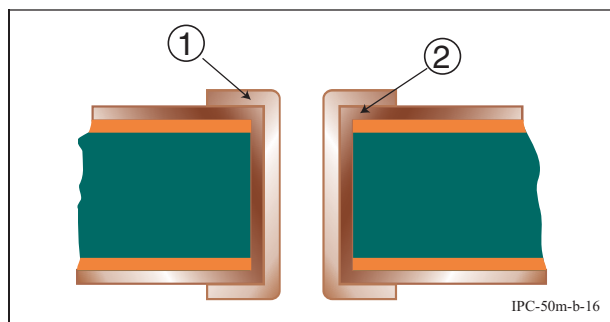


Figure B-16 Button Plating

1. Button Plating
2. Wrap Plating

C**C-Staged Resin**

A resin in its final state of cure. (See also “B-Staged Resin.”)

Cable

A group of individually insulated conductors in twisted or parallel configuration.

Cable Clamp

A device used to give mechanical support to a wire bundle or cable.

Camber

A deviation in the form of a flat cable or a flexible material from a plane.

Cant

The angle between the bottom mounting surface of a component and the top surface of the printed board.

Cap Lamination

A process for making multilayer printed boards using one-sided metal clad base material for the external layers. (See also “Foil Lamination.”)

Capability Detail Specification (CapDS)

A document that establishes the specific requirements, noted in a detailed specification, in order to establish the level of capability that a manufacturer possesses when he has demonstrated that he has met those requirements.

Capability Index (Cp)

See “Capability Performance Index.”

Capability Performance Index (Cp)

Relationship of the allowable process spread to the actual process spread (natural tolerance).

Cpk Index (Cpk)

A measure of the relationship between the scaled distance between the process mean value and the closest specification limit.

Capability Performance, Lower (Cpkl)

A measure of the relationship between the performance of a process and the lower specification limit. (See also “Capability Performance, Upper.”)

Capability Performance, Upper (Cpku)

A measure of the relationship between the performance of a process and the upper specification limit. (See also “Capability Performance, Lower.”)

Capability Test Board (CTB)

A printed board specifically designed to act as a capability qualifying component (CQC), or to be used by manufacturer to evaluate process variation, process control, or continuous improvement procedures.

Capability Test Segment (CTS)

A segment or portion of a capability test board (CTB), containing a set or group of individual test patterns (ITP), intended to be used to demonstrate a specific level of printed board complexity or manufacturing capability.

Capacitance

The measure of a material's ability to store a charge.

Capacitance Density (Embedded)

The amount of capacitance available per unit of the conductor area.

Capacitive Coupling

The electrical interaction between two conductors that is caused by the capacitance between them.

Capillary Tool

A tube with a very small inner diameter or a hollow, often used in assembly to guide wire to the bonding site and to be used to apply pressure during bonding cycle. (See also "Wedge Tool.")

Capture Land (Via Top Land)

The external land portion during formation of a blind or buried microvia. (See Figure C-1.)

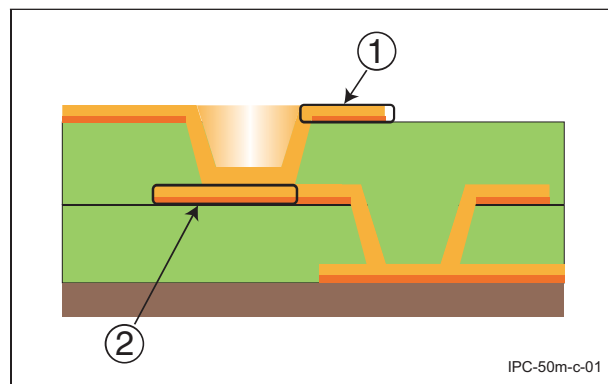


Figure C-1 Capture and Target Land (Microvia)

1. Capture Land
2. Target Land

Card

See "Printed Board."

Card-Edge Connector

See "Edge-Board Connector."

Card-Insertion Connector

See "Edge-Board Connector."

Carrier (Component)

Container that directly holds components, such as a tray, tube, or tape and reel.

Carrier (Foil)

A temporary support medium that facilitates the handling of thin and soft-metal foils.

Carrier Tape

The carrier for conductors used in tape-automated bonding. (See also "Multilayer Carrier Tape," "Single-Layer Carrier Tape," "Two-Layer Carrier Tape" and "Three-Layer Carrier Tape")

Carry-Out

The curved back portion of the flute of a drill.

Cartridge

A container for components that facilitates the loading and unloading of them.

Castellation

A recessed metallized feature on the edge of a leadless chip carrier that is used to interconnect conducting surfaces or planes within or on the chip carrier. (See Figure C-2.)

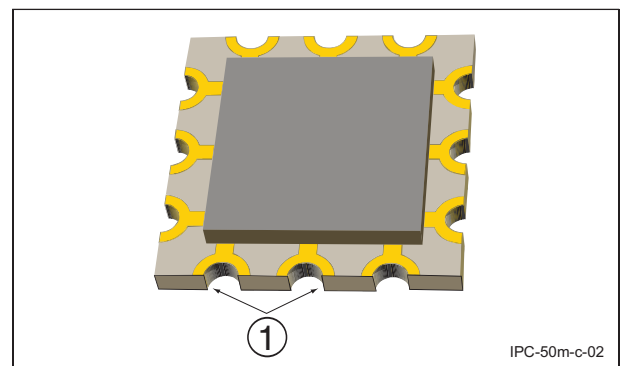


Figure C-2 Castellations

1. Castellations

Casting

The application of an organic compound, such as adhesive or resin, where the casting mold is removed.

Catalyst (Resin)

A chemical that is used to initiate the reaction or increase the speed of the reaction between a resin and a curing agent.

Catalyzing

See "Activating."

Cathodic Cleaning

Electrolytic cleaning in which the work is the cathode.

Cation Exchange

See “Ion Exchange.”

Cationic Reagent

Surface-active substances that have the active constituent in the positive ion.

Cause-and-Effect Diagram

A problem solving tool that uses a graphic description of various process elements in order to analyze potential sources of process variation. Also called fishbone diagram (after its appearance) or Ishikawa diagram (after its developer).

Center-to-Center Spacing

The nominal distance between the centers of adjacent features on any single layer of a printed board. (See Figure C-3.) (See also “Pitch.”)

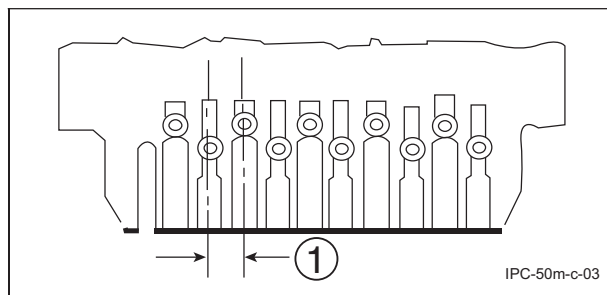


Figure C-3 Center-to-Center Spacing (pitch)
1. Pitch

Centering Force

The force required by the pick-up tooling to center a surface mounting device in its proper location on a substrate.

Centerwire Break

A fracture mode in a wire pull test whereby the wire fractures at approximately its midspan.

Centipoise

A metric unit of the measure of viscosity equal to 1/100 poise. See “Poise.”

Central Line

The line on a control chart that depicts the average or median value of the items being plotted.

Ceramic Dual-in-line Package (CERDIP)

A dual in-line-package that has a package body of ceramic material and hermetically sealed by a glass. (See also “Dual-in-line Package.”)

Ceramic Pin Grid Array

A pin grid array package (PGA) made of a ceramic material, hermetically sealed by metal, with leads formed on a grid extending from the bottom of the package.

Ceramic Quad Flat Pack (CQFP)

A quad flat package (QFP) made of a ceramic material, hermetically sealed by metal, with leads extending from all four sides.

Certification

The verification that specified training or testing has been performed and that required proficiency or parameter values have been attained.

Chain Dimensioning

A method of dimensioning features so that a subsequent measurement will start from the preceding measurement and so on. The tolerances are additive.

Chalking (Cured Solder Mask)

When the solder mask is degraded such that fine particulates can be removed from the surface.

Chamfer (Drill)

The bevelled edge at the end of a drill shank. (See Figure B-11.)

Char

Carbon ash residue.

Character (Bar Code)

A letter, digit, or other special form that is used to represent data in a bar code symbol. (see also “Bar Code Symbol.”)

Characteristic Curve

A plot of photographic product optical-density data versus the logarithm of the exposure used to characterize the response of the material to exposure and development. (See Figure C-4.)

Characteristic Impedance

The resistance of a transmission line structure to the flow of alternating current (AC) or signal, usually applied to high speed circuits, and normally consisting of a constant value over a wide range of frequencies.

Characterization

A description of the characteristics of a product or process by mathematical modeling, design of experiments, or statistical data evaluation.

Check Plot

An interim drawing used for graphical data verification.

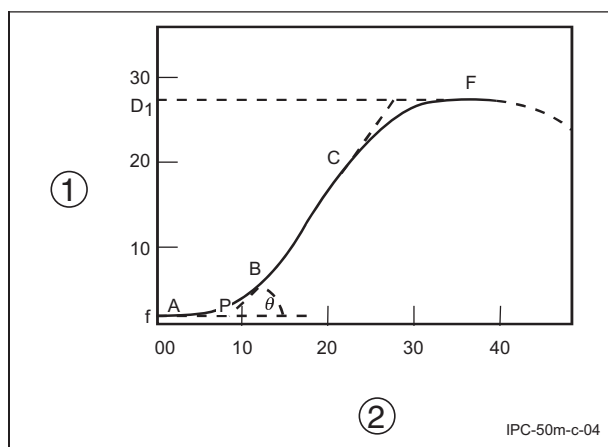


Figure C-4 Characteristic Curve

1. Density

2. log E

Chelate Compound

A compound in which metal is contained as an integral part of a ring structure.

Chelating Agent

A compound capable of forming a chelate compound with a metal ion.

Chemical Conversion Coating

A protective coating produced by the chemical reaction of a metal with a chemical solution.

Chemical Resistance

The resistance of an insulating material to the degradation of surface characteristics, such as surface roughness, swelling, tackiness, blistering or color change, beyond the specified allowance by exposure to chemicals such as acids, alkalis, salts, or solvents.

Chemical Vapor Deposition

The deposition of a film onto the surface of a substrate by the chemical reduction of a vapor on contact with the base material.

Chemical Wire Stripping

The process of removing insulation from wire using chemical compounds.

Chemically-Deposited Printed Circuit

See "Additive Process."

Chemically-Deposited Printed Wiring

See "Additive Process."

Chemisorption

The formation of bonds between the surface molecules of a metal, or other material of high surface energy, and another gas or liquid substance in contact with it.

Chessman

A disk, knob or lever used to manually control the position of a bonding tool with respect to land.

Chill Mark (Knit or Weld Line)

A location where two flow fronts meet during the injection mold process.

Chip

See "Die."

Chip Carrier

A low-profile, usually square, surface-mount component semiconductor package whose die cavity or die mounting area is a large fraction of the package size and whose external connections are usually on all four sides of the package. (It may be leaded or leadless.)

Chip-and-Wire

An assembly method that uses discrete wires to interconnect back-bonding die to lands, lead frames, etc.

Chip-in-Board (CIB)

An electronic component where a chip is inserted into an opening of a ceramic or glass-epoxy substrate and bonded by wire bonding or TAB techniques. The object of this technique is to reduce the thickness of the COB assembly. The chip may be covered by a resin after bonding.

Chip-on-Board (COB)

A printed board assembly technology that places unpackaged semiconductor dice and interconnects them by wire bonding or similar attachment techniques. Silicon area density is usually less than that of the printed board. (See Figure C-5.)

Chip-on-Board Assembly

A printed board assembly using a combination of uncased chips and other devices. The silicon area density is less than 30%.

Chip-on-Flex (COF)

Semiconductor chip mounted directly onto flexible printed board.

Chip-on-Glass (COG)

An assembly technology that uses an unpackaged semiconductor die mounted directly on a glass substrate such as a glass plate for liquid crystal display (LCD).

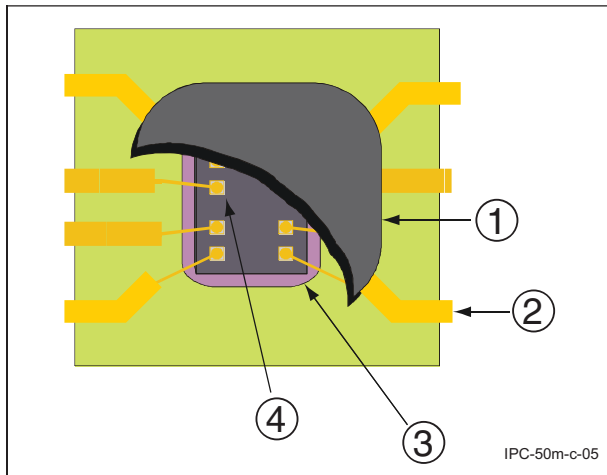


Figure C-5 Chip-on-Board (COB)

- | | |
|--------------------------------------|---------------|
| 1. Encapsulant (Glob Top) | 3. Die Attach |
| 2. I/o Pitch Translation (Substrate) | 4. Wire Bonds |

Chip Scale Package (CSP)

Packages that are no more than 1.2X the area of the internal die size.

Chipped Point

A condition whereby the amount of chips on the leading edge of a drill point exceeds an allowable value.

Chipping

A piece of a panel or board that has broken away.

Chisel

A tool used for wedge and ultrasonic bonding.

Chisel-Edge Angle

See "Point Angle" and Figure B-11.

Circuit

A number of electrical elements and devices that have been interconnected to perform a desired electrical function.

Circuit Board

See "Printed Board."

Circuit Card

See "Printed Board."

Circuit Density

The average quantity of electronic components (prefabricated or part of the interconnecting structure) on a unit area of a printed board considering one or both sides for component mounting.

Circuitry Layer

A layer of a printed board containing conductors, including ground and voltage planes.

Circular Mill

A unit of measurement for the area of a one mil [0.001 in] (0.0254 mm) diameter circle; 7.845×10^{-7} sq. in (5.066×10^{-6} sq. cm). Used to express wire cross sectional area.

Circumferential Crimp

Final configuration of a terminal barrel made when crimping dies completely surround the barrel and form symmetrical indentations.

Circumferential Separation

A crack or void in the plating extending around the entire circumference of a plated through hole, a solder fillet around lead wire or eyelet, or the interface between a solder fillet and a land.

Clad (adj.)

A condition of the base material to which a relatively-thin layer or sheet of metal foil has been bonded to one or both of its sides, e.g. "a metal-clad base material."

Classification Temperature (Tc) (Plastic Encapsulated SMDs)

The maximum body temperature at which the component manufacturer guarantees the component MSL as noted on the caution and/or bar code label.

Clearance Hole

A hole in a conductive pattern that is larger than, and coaxial with a hole in the base material of a printed board. (See Figure C-6.)

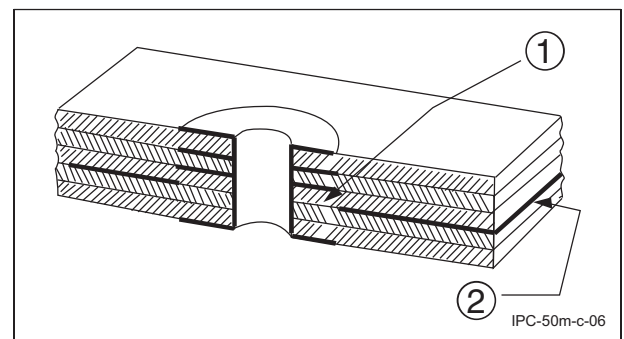


Figure C-6 Clearance Hole

1. Clearance Hole
2. Conductive Pattern

Clinched Lead

A component lead that is inserted through a hole in a printed board and is then formed in order to retain the component in place and in order to make metal-to-metal contact with a land prior to soldering. (See also "Partially-Clinched Lead.")

Clinched-Wire Interfacial Connection

See "Clinched-Wire Through Connection."

Clinched-Wire Through Connection

A connection made by a bare wire that has been passed through a hole in a printed board and subsequently formed (clinched) and soldered to the conductive pattern on each side of the board. (See Figure C-7.)

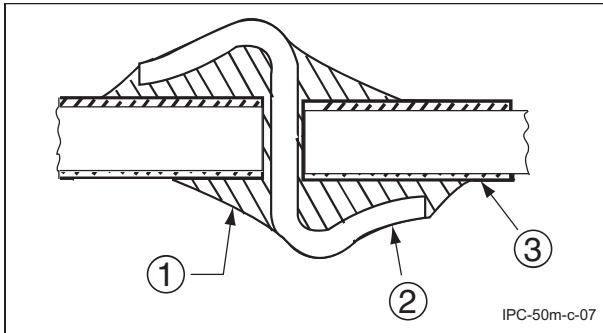


Figure C-7 Clinched-Wire Through Connection

1. Solder
2. Lead
3. Conductive Pattern

Closed-Entry Contact

A type of female connector contact that prevents the entry of an oversized mating part. (See also "Open-Entry Contact.")

Closing, Wire

An operation where all leads are to be covered and the jacket insulation is captured by a type of hood or cover.

Co-Firing

The simultaneous firing of thick-film circuit elements during one cycle.

Coaxial Cable

A cable in the form of a central wire surrounded by a conductor tubing or sheathing, separated by a dielectric, which serves as a shield and return.

Cocoon or Pouch

A removable protective cover over the flexible section of a rigid flex printed board to prevent processing chemicals from being entrapped between the flexible layers during fabrication.

Code 39

A type of bar code named because it contains nine elements, bars and spaces, with three wide elements and six narrow elements.

Code Density

The number of characters per unit length in a bar code symbol.

Coefficient of Thermal Expansion (CTE)

The linear dimensional change of a material per unit change in temperature. (See also "Thermal Expansion Mismatch.")

Cohesion (Pressure Sensitive Tape)

The ability of a pressure sensitive adhesive to resist splitting.

Cohesive Failure

The rupture of an adhesive bond such that the separation appears to be within the adhesive.

Coined Lead

The end of a round lead that has been formed to have parallel surfaces that approximate the shape of a ribbon lead.

Cold Flow

The deformation, distortion or dimensional change of a material as a result of applied mechanical force or pressure over a period of time at ambient temperature.

Cold Flow (Pressure Sensitive Tape)

The tendency of some pressure sensitive adhesives to act like a heavy viscous liquid and exhibit a limited amount of flow over a period of hours or days at room temperature.

Cold Hand Cleaning

Cleaning with a soft brush and rinsing in a small open tank of chlorinated, non-chlorinated or isopropanol (2-Propanol) solvent.

Cold Machine Cleaning

Cleaning with a chlorinated or non-chlorinated solvent and an inline brush or wave cleaner.

Cold Solder Connection

A solder connection that exhibits poor wetting, and that is characterized by a grayish, porous appearance. (This is due to excessive impurities in the solder, inadequate cleaning prior to soldering, and/or the insufficient application of heat during the soldering process.) (See also "Rosin Soldered Connection.")

Color Selectivity

The preferential absorption of thermal radiation caused by emitted energy with wavelength frequencies in the visible band of from 0.39-0.78 microns.

Color Temperature

A measure of the energy distribution over the visible spectral range of a light source with a continuous spectrum, expressed in degrees Kelvin (K).

Column Grid Array (CGA)

A surface mount package wherein the columns for termination are formed in a grid on the bottom of a package.

Comb Pattern

A set of interdigitated comblike arrays of uniformly-spaced conductors. (See Figure C-8.)

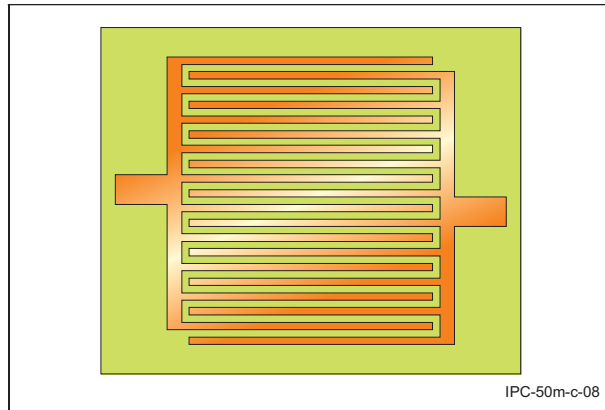


Figure C-8 Comb Pattern

Combination Mask

A type of screen mask that is composed of two areas wherein the one is located in the center of the screen mask and is made by a metal screen mesh with a printing image, and the other is located in the periphery of the screen mask and is made by a thin elastic material.

Comment Record

A record that provides, or refers to, additional descriptive material that further clarifies the control of a data set.

Common Cause

Variation caused by unknown factors resulting in a steady but random distribution of output around the average of the data, also referred to as noise. It is a measure of the process potential, or how well the process can perform when special cause variation is removed. (See also “Assignable Cause.”)

Compensated Artwork

Production master or artwork data that has been enlarged or reduced in order to meet the needs of subsequent processing requirements.

Compensation Circuit

An electrical circuit that alters the functioning of another circuit to which it is applied to achieve desired performance.

Compiler

A software module that analyzes and converts programs from a high-level language to binary machine codes.

Complementary Metal Oxide Semiconductor (CMOS)

A fabrication technology that results in the creation of both N and P type MOS FET devices.

Complex Ion

An ion composed of two or more ions or radicals that are capable of an independent existence.

Compliant Bond

A bond that uses an elastically- and/or plastically-deformable member to impart the required energy to the lead.

Component

An individual part or combination of parts that, when together, perform a design function(s). (See also “Discrete Component.”)

Component Density

The quantity of components on a unit area of printed board.

Component Hole

A hole that is used for the attachment and/or electrical connection of component terminations, including pins and wires, to a printed board.

Component Lead

The solid or stranded wire or formed conductor that extends from a component to serve as a mechanical or electrical connector, or both. (See also “Component Pin.”)

Component Mounting

The act of attaching components to a printed board, the manner in which they are attached, or both.

Component Mounting Orientation

The direction in which the components on a printed board or other assembly are lined up with respect to the polarity of polarized components, to one another, and/or to the board outline.

Component Mounting Site

A location on a printed board or mounting structure that consists of a land pattern and conductor fan-out to additional circuit features for testing or vias that are associated with the mounting of a single component.

Component Pin

A component lead, often not requiring forming. (See also “Component Lead.”)

Component Side

Traditionally, the side of a printed board that contained the most active components. (See also “Primary Side.”)

Component Thermal Masses

The quantity of heat energy that a component is able to absorb or retain; it is dependent on the mass of the component.

Composite (Phototool)

A photograph that consists of a combination of two separate (aligned) images.

Composite Record

A collection of records that make up an electrical pattern that is used repeatedly in a design. (The definition and relationship of such records are covered and referred to as “subroutine definition” and “subroutine definition call.”)

Composite Test Pattern (CTP)

A grouping of individual test patterns into specific arrangements, to reflect control and capability of a manufacturer or manufacturing process.

Compound Die Set

A set consisting of a punch and matching die used to punch holes, details or the outlines of panels and/or printed boards.

Compression Seal

A tight joint made between an component package and its leads that is formed as heated metal cools and shrinks around a glass insulator.

Computer Numerical Control (CNC)

A system that utilizes a computer and software as the primary numerical control technique. (See also “Numerical Control.”)

Computer-Aided Design (CAD)

The interactive use of computer systems, programs, and procedures in the design process wherein the decision-making activity rests with the human operator and a computer provides the data manipulation function.

Computer-Aided Engineering (CAE)

The interactive use of computer systems, programs, and procedures in an engineering process wherein the decision-making activity rests with the human operator and a computer provides the data manipulation function.

Computer-Aided Manufacturing (CAM)

The interactive use of computer systems, programs, and procedures in various phases of a manufacturing process wherein the decision-making activity rests with the human operator and a computer provides the data manipulation functions.

Concentration Polarization

Polarization of an electrolytic component near an electrode caused by ion concentration changes at the metal-electrolytic interface due to passing current through the electrode body.

Condensation Soldering

See “Vapor Phase Soldering.”

Conditional End-of-Test

A command in a test program to stop the execution of the program when a particular condition, or set of conditions, is reached.

Conditioning

The time-related exposure of a test specimen to a specified environment(s) prior to or after testing and before evaluation.

Conductance

A measure of conductivity of a material.

Conducting Salt

A salt added to a plating solution in order to increase its conductivity.

Conductive Anodic Filament (CAF)

Conductive material along the resin/glass interface, typically grown through an electrochemical process from the anode toward the cathode.

Conductive Foil

A sheet of metal that is used to form a conductive pattern on a base material.

Conductive Ink

A low viscosity liquid medium with a suspended powder of an electrically conductive material.

Conductive Medium

A material with a suspended powder of an electrically conductive material. (See also conductive paints, inks, pastes.)

Conductive Paint

A high viscosity liquid medium with a suspended powder of an electrically conductive material.

Conductive Paste

A conductive material used to make conductive patterns and through holes on a base material consisting of silver, copper, nickel, carbon, etc. in a cream-like form.

Conductive Pattern

The configuration or design of the conductors on a base material. (This includes traces, lands, vias, planes, and passive components when these are an integral part of the printed board manufacturing process.)

Conductivity (Electrical)

The ability of a substance or material to conduct electricity.

Conductivity (Thermal)

The ability of a substance or material to conduct heat.

Conductor

A substance that allows the flow of electric current or thermal energy. Conductors intended for electric current are typically wires, traces, lands, planes or plated holes.

Conductor Base Spacing

The spacing between conductor at the plane of the surface of a base material. (See also “Design Spacing of Conductors.”) (See Figure C-9.)

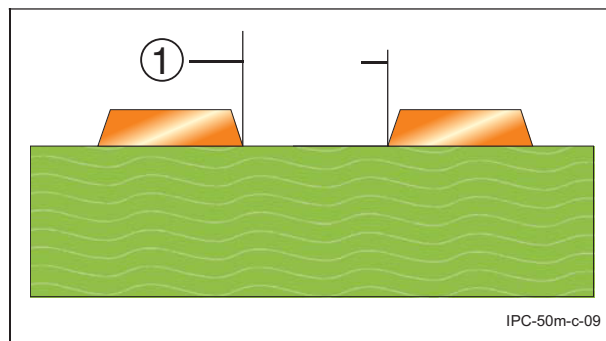


Figure C-9 Conductor Base Spacing
1. Conductor Spacing

Conductor Base Width

The width of a conductor at the plane of the surface of a base material. (See also “Conductor Width” and “Design Width of Conductors.”)

Conductor Layer No.1

The first layer of a printed board that has a conductive pattern on or adjacent to its primary side.

Conductor Layer

Any layer of a printed board with a conductive pattern, including ground or voltage planes.

Conductor Line

See “Conductor Trace.”

Conductor Nick

A reduction in a conductor trace cross-sectional area (internal or external) which may or may not expose the base material.

Conductor Path

See “Conductor Trace.”

Conductor Pattern

See “Conductive Pattern.”

Conductor Pitch

The distance between the centers of adjacent conductor traces.

Conductor Protrusion

A random extension of conductor pattern that reduces the conductor spacing below the minimum requirement.

Conductor Side

The side of a single-sided printed board that contains the conductive pattern.

Conductor Spacing

The observable distance between adjacent edges (not center-to-center spacing) of isolated conductive patterns in a conductor layer. (See Figure C-10.) (See also “Center-to-Center Spacing.”)

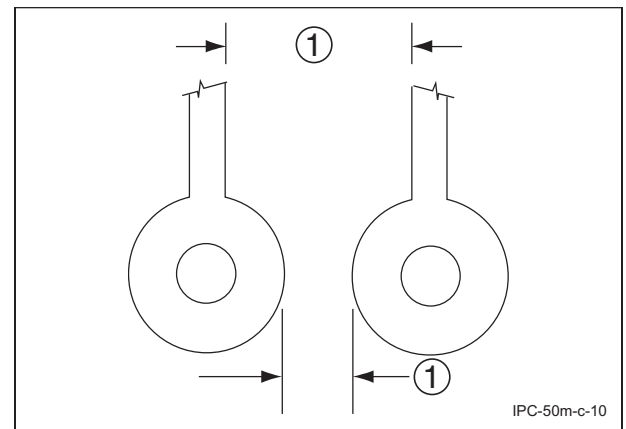


Figure C-10 Conductor Spacing
1. Spacing

Conductor Thickness

Thickness of a conductor including additional metallic coatings but excluding non-conductive coatings.

Conductor Trace

A single conductive linear entity (element) which has length, width and thickness.

Conductor Track

See “Conductor Trace.”

Conductor Width

The observable width of a conductor trace at any point chosen at random on a printed board as viewed from directly above unless otherwise specified. (See also “Design Width of Conductor Traces or Planes” and “Conductor Base Width.”)

Conduit

A tube in which insulated wires or cables are contained.

Confidence Interval

The range of values around a sample statistic where the true population parameters can be expected to be located with a specific probability.

Configuration Control

Revision control of the issuance or changes to supporting documents, for example, manufacturing or engineering specifications.

Confirmation Run

A test of an actual process to confirm the results that are obtained during a designed experiment, evaluating if the results are reliable and reproducible in an actual application.

Conformal Coating

An insulating protective covering that conforms to the configuration of the objects coated (e.g. Printed Boards, Printed Board Assembly) providing a protective barrier against deleterious effects from environmental conditions.

Conformance Test

A test to determine that relevant requirements for specific performance characteristics of a product specification (or representative samples thereof) are fulfilled.

Conformance Test Coupon Set

A complement of test coupons which are comprised of various coupon types, each of which is designed for a specific test or tests, but which were all made in the same manufacturing lot.

Conformal Via

A type of build-up via in which the conductor layer of a uniform thickness is formed conforming to the shape of a hole in the insulating layer.

Confounding

A relationship between two or more variables such that their effects cannot be separated.

Connector

A device used to physically and electrically connect/disconnect service for electrical terminations.

Connector Area

That portion of a printed board used for the purpose of providing external connections.

Connector Contact

The conducting member of a connecting device that provides a separable connection.

Connector Housing

A plastic shell that holds electrical contacts in a specific field pattern that may also have polarization/keying bosses or slots.

Connector/Mold Interface

The location where the connector is in contact with the mold.

Connector, One-Part

See “Edge-Board Connector.”

Connector Tang

The mating part of an edge printed board connector.

Connector, Two-Part

A connector containing two sets of discretely-formed mating metal contacts.

Connector, Two-Part, Printed Board

A two-part connector wherein at least one set of contacts is mechanically and electrically attached to a printed board.

Constraining Core

A supporting plane that is internal to a packaging and inter-connecting structure.

Consumer's Risk

See “Beta Error.”

Contact Angle (Bonding)

The angle between the bonding lead or wire and the bonding land.

Contact Angle (Soldering)

The angle of a solder fillet that is enclosed between the basis metal surface and a plane that is tangent to the solder surface at the point of intersection of solder and metal. (See Figure C-11.)

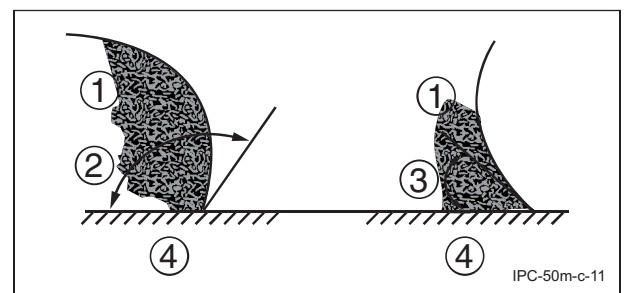


Figure C-11 Soldering Contact Angle

- | | |
|-----------------------|-----------------------|
| 1. Solder | 3. Small Contact Area |
| 2. Large Contact Area | 4. Base Metal Surface |

Contact Area

The common conductive area between a conductor and a connector.

Contact Area Distance

The distance of travel made by a contact in touch with another during the insertion and removal of a connector.

Contact Corrosion

See “Crevice Corrosion.”

Contact Length

The distance of travel made by a contacting surface that is in touch with the relevant mating part during the insertion or removal of a connector.

Contact Plating

The plating applied to the parts of a printed board that are used as the electrical contact to the circuit outside.

Contact Printing

A light-exposure process that transfers an image from a film to a photosensitive coating on a base material while both film and base material are in intimate physical contact.

Contact Resistance

The electrical resistance at the interface of two touching contact areas under specified conditions.

Contact Retention Force

The maximum axial load that can be applied to a contact inserted in its normal position in a connector, without separating the mated contacts.

Contact Size

Defines the diameter of the engagement end of the pin and controls the largest size wire that can be used with that contact.

Contact Spacing

See “Pitch.”

Contact Spring

The spring member of a socket-type contact that forces the engaging pin-type contact into a position of positive intimate contact.

Contact Window

An opening that has been etched in the semiconductor oxide, nitride or other insulating layer, grown or deposited directly onto the die, so as to allow electrical contact to the underlying semiconductor material.

Contained Paste Transfer Head (Stencil)

A stencil printer head that holds, in a single replaceable component, the squeegee blades and a pressurized chamber filled with solder paste.

Contamination Host Material

The material within which contamination is deposited or entrapped.

Continuity

An uninterrupted path for the flow of electrical current in a circuit.

Continuity Test

Resistance test to insure all the required points have electrical continuity.

Contract Services

Operations or processes that are performed by another provider.

Control Chart

A graphic representation of a characteristic of a process that shows plotted values of some statistic gathered from characteristic, a central line, and one or two statistically-derived control limits.

Control Console

A device terminal used to manipulate and maintain the operating system of a computer.

Control Drawing

See “Master Drawing.”

Control Limits

The maximum allowable variation of a process characteristic due solely to common causes.

Control Plan

Documented activities required to maintain expected levels of variation in process/product parameters.

Control System

A practice in which a desired output is achieved by operating on the various inputs to the system until the output falls within an acceptable range of values.

Controlled Collapse, Component Connection

See “Controlled Collapse Soldering.”

Controlled Collapse, Bonding

A bonding technique that makes termination by reflowing the solder bump on a chip and connecting it to the land on the printed board.

Controlled Collapse, Soldering

A technique for soldering a component (i.e., flip chip, chip scale package, BGA) to a substrate, where the component connection surface tension forces of the liquid solder supports the weight of the component and controls the height of the joint.

Convected Energy

Heat transferred through circulation of fluid or gas.

Convection

Heat transfer that occurs at the interface of a solid and a fluid or gas that is due to their differences in temperature.

Convection Controlled

Thermal transfer in which the characteristics, such as flow rate, velocity, and temperature are precisely controlled.

Convection Forced

Convection that occurs by forcing the fluid over the solid media.

Conveyor, Edge

A transporting mechanism that supports a product by the edges.

Conveyor, Mesh

A transporting mechanism that fully supports the product.

Conveyor, Secondary

A transporting mechanism used beneath the edge conveyor to catch a fallen product.

Cooldown

The period of time during which the solder joints go through a liquidus phase and become solid.

Coordinatograph

An X- and Y-coordinate plotting and measuring machine.

Coplanar Leads

The flat beam leads of a component package that have been formed so that they can simultaneously contact the plane of a base material.

Coplanarity

The distance in height between the lowest and highest leads when the component is in its seating plane.

Copolymerize

The creation of a polymer by the joining of two or more different monomers in repeating chain.

Copper Island

A piece of copper generated during plane formation that is not connected to power, ground or a signal (active). When the term is used regarding a single layer of data, it may be connected using a via to another layer (see Figure C-12). Several methods of plane generation exist that can generate copper islands.

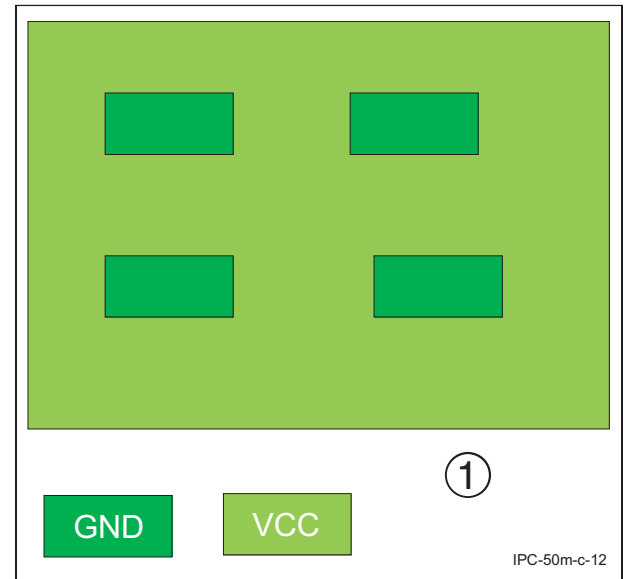


Figure C-12 Copper Island (Data)
1. Layer 4 (Split Plane)

Copper Thickness

The thickness dimension of the copper cladding on a base material.

Copper Weight

The mass of copper per unit area for a foil, typically expressed in ounces per square foot or grams per square centimeters (these units are not equivalent).

Copper-Mirror Test

A test of the corrosivity of a flux on a copper film that is vacuum-deposited on a glass plate.

Core (Cable)

A component or assembly of components over which additional components (shield, sheath, etc.) are applied.

Corner Crack (Knee Crack)

A crack in the plated metal at the knee (the intersection of the hole barrel and the pad or land) of a plated through-hole.

Corner Marks

The marks at the corners of artwork whose inside edges establish, or help to establish, the borders and contour of a printed board.

Corona Discharge

An electrical discharge brought on by the ionization of a fluid surrounding a conductor, which occurs when the potential gradient (the strength of the electric field) exceeds a certain value, but conditions are insufficient to cause complete electrical breakdown or arcing.

Coronizing

Continuous full or partial heat cleaning of glass fabric conducted in a continuous oven. The operation is often called "Caramelizing" because the fabric color during the operation becomes brown.

Corrosion (Chemical/Electrolytic) v.

The attack of chemicals, flux, and flux residues on metals.

Corrosive Flux

Flux that contains levels of halides, amines, or organic acids that cause corrosion of copper.

Cosine Law (Radiation Physics)

A law of illumination that states that the flux radiated or received in a given direction varies with the projected area of the receiver or emitter in a plane that is perpendicular to the direction of the flux.

Cost of Quality

The money spent in the creation, control, and evaluation of quality and dealing with the consequences of the failure to meet specified requirements, including disposition, rework and scrap.

Coupling Ring

A device used on cylindrical connectors to lock a plug and receptacle together.

Coupon

See "Test Coupon."

Coupon (Breakaway)

Coupons made as an integral part of the deliverable panel and connected as one piece, except one edge of the coupon has perforations or a thin section connected to the panel which can be easily broken off without damaging either the coupon or the board.

Covercoat

Material deposited as a liquid onto the circuitry that subsequently becomes a permanent dielectric coating. (See "Cover Material.")

Coverfilm

Film made from *i)* a homogeneous, single component; *ii)* separate layers of generically similar chemistries; or *iii)* as a composite blend (See "Cover Material.")

Coverlay

Film and adhesive made from separate layers of generically different chemistries. (See "Cover Material.")

Coverlay Access Hole

The clearance area around a terminal hole or land of a printed board. (See Figure C-13.)

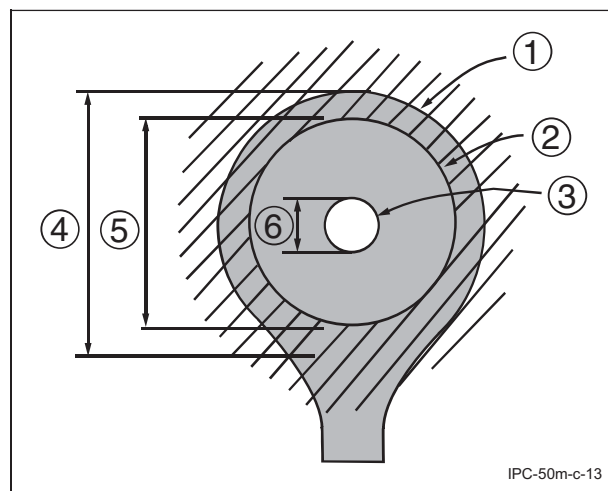


Figure C-13 Coverlay Access Hole

- | | |
|---------------------|---------------------|
| 1. Land | 4. Pad Size |
| 2. Coverlay | 5. Coverlay Opening |
| 3. Product Aperture | 6. Hole Opening |

Cover Layer (Discrete Wiring)

A polymeric material which is applied to a circuit board over surface wired levels.

Cover Material

A thin dielectric material used to encapsulate circuitry, most commonly for flexible circuit applications.

Crack, Foil

A break or separation that extends partially or completely through a layer of metallic foil.

Crack, Plating

A break or separation that extends partially or completely through a metallic coating(s), its overplate, or both.

Cracking

A condition that makes breaks or separations in coatings that extend through to an underlying surface.

Cratering (CHIP-OUT)

A category of ball bond failure in which the ball lifts from the surface of the integrated circuit die bond pad, taking with it a portion of the bond pad metallization and the underlying oxide or silicon.

Cratering (Wire Bonding)

A defect in which a portion of the IC material under the bond pad metallization is damaged by excessive heat, force or ultrasonic energy during ultrasonic bonding.

Crazing (Base Material)

An internal condition that occurs in reinforced laminate base material whereby glass fibers are separated from the resin at the weave intersections. (This condition manifests itself in the form of connected white spots or crosses that are below the surface of the base material.) It is usually related to mechanically-induced stress. (See "Measling.")

Crazing (Conformal or Solder Mask Coating)

A network of fine cracks on the surface of or within the coating.

Crazing (Ceramic)

Surface micro-cracks or minute cracks in the glassivation.

Crease

A ridge in a material that is caused by a fold or wrinkle being placed under pressure.

Creel

A device used as a yarn package rack to hold warp ends for a section beam.

Creep

The time-dependent plastic deformation of a material as a function of applied stress and temperature.

Creep Endurance

Resistance against a time dependent strain occurring under stress on a material.

Creep Resistant Holding Power (Pressure Sensitive Tape)

The ability of a pressure sensitive adhesive tape to resist static forces of shear applied to the same plane as the backing.

Creepage Distance

The shortest path between two conductors, which includes traces, terminals and structures, measured along the surface of the insulation.

Crevice Corrosion

Localized corrosion that is the result of the formation of a crevice between a metal and a nonmetal, or between two metal surfaces.

Crimp

Final configuration of a terminal or contact barrel formed by the compression of terminal barrel and wire.

Crimp Contact

A type of connector contact whose nonmating end is a hollow cylinder that can be crimped onto a wire inserted within it.

Crimp Height

A measurement taken of the overall wire barrel height after the terminal or contact has been crimped. (See Figure C-14.)

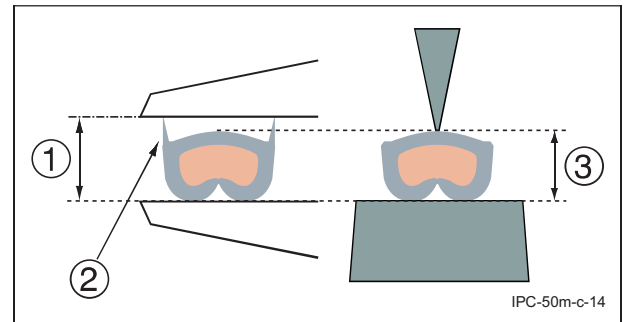


Figure C-14 Crimp Height

- 1. Incorrect Height Measurement (Using Calipers)**
- 2. Flash**
- 3. Correct (true) Height Measurement (Using Crimp Height Micrometer)**

Crimping Nest

Part of a crimping die set, that provides the location and support for the terminal barrel as it is being deformed into the desired crimp configuration by the indenter (anvil).

Critical Current Density

The current density above which a new and sometimes undesirable reaction occurs.

Critical Humidity

The relative humidity above which the atmospheric corrosion rate of a given metal increases sharply, or above which the surface resistance of an insulation material or a polymer coating decreases sharply.

Critical Solution Temperature

The temperature above or below which two liquids are miscible in all proportions.

Crop Marks

See "Corner Marks."

Cross-Over (Discrete Wiring)

A point where two or more discrete insulated wires intersect and cross each other.

Cross-Sectioning

See "Microsectioning"

Crosshatching

The breaking up of large conductive areas by the use of a pattern of voids in the conductive material. (See Figure C-15.)

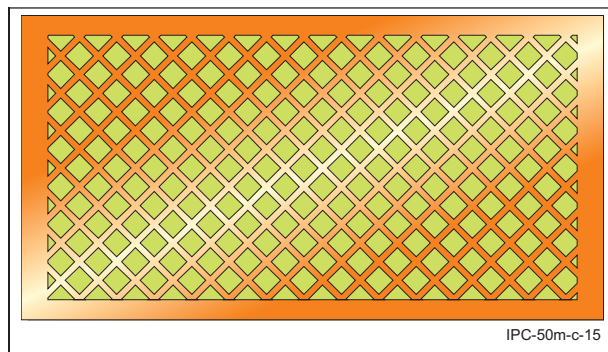


Figure C-15 Crosshatching

Crossing Count

The unit for measuring optimum component placement characteristics that is based on the number of times there are crossovers of the signal conductor that are used to provide electrical interconnection between devices.

Cross-link

The formation of chemical bonds in a thermosetting resin during polymerization.

Crosstalk

The undesirable transfer of electrical energy between neighboring conductors (coupling) by mutual inductance and capacitance. (See also “Backward Crosstalk” and “Forward Crosstalk.”)

Crystalline Polymer

A polymer with a regular, structured molecular configuration.

Cubic Components

A part with a three-dimensional shape having the form of a cube.

Cumulative Tolerance

The summation of the tolerances that are permitted between functionally-related features. (See also “Baseline Dimensioning,” “Basic Dimensioning,” “Chain Dimensioning” and “Direct Dimensioning.”)

Cup Solder Terminal

A cylindrical solder terminal with a hollow opening into which one or more wires are placed prior to soldering. (See Figure C-16.)

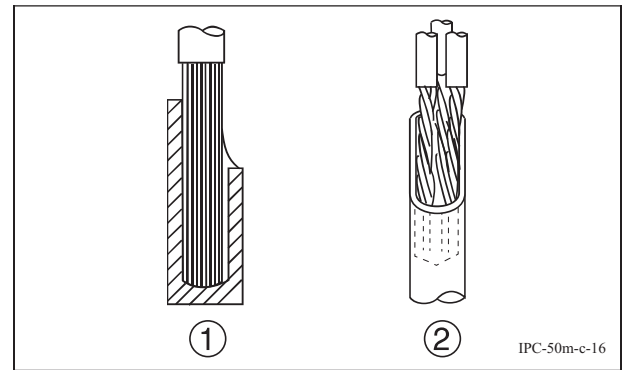


Figure C-16 Cup Solder Terminal

1. Single Wire Fill
2. Multiple Wire Fill

Cupping (BGA)

A condition of a ball grid array (BGA) package after reflow where the corners turn up and away from the printed board laminate surface. This condition in the worse case causes the balls on the outside row to be in tension and the balls in the center to be in compression. (Opposite of “Doming (BGA)”)

Cure

A physical change of state, by solvent removal or cross-linking, whereby a liquid or paste forms a solid.

Cure Time

The time at which ultimate physical properties of a curing thermosetting plastic composition are reached.

Curing Agent

A chemical substance that reacts with a resin and results in cross-linked connections. In this way, it becomes a component of the resin resulting in physical hardening.

Current

The flow or movement of electrons in a conductor as the result of a voltage difference between the ends of the conductive path.

Current-Carrying Capacity

The maximum electrical current that can be transported continuously by a conductor of a printed board, under specified conditions, without causing objectionable degradation of electrical and mechanical properties of the printed board as a result of excessive heating of the conductor.

Customer Detail Specification (CDS)

A document that establishes the specific requirements, noted in a detailed specification, in order to tailor these to meet the needs of a custom product, material, or service.

Customer Test Data

Normal performance data generated at incoming inspection by the customer.

Cusum Chart

A statistical control diagram on which the cumulative sum of deviations is plotted over a period of time.

Cut-and-Peel

See “Cut-and-Strip.”

Cut-and-Strip

The making of artwork by cutting a pattern in a resist and stripping away the unwanted areas or resist.

Cut-Off

The operation that follows the final bonding step that separates the bond from the source of the wire.

Cylindrical Components

A part having the shape of a cylinder.

D**D Curve**

See “Characteristic Curve.”

D+ (D-plus)

The difference in diameter between a drilled, or otherwise formed hole, and its associated circular land. In common usage, D+ is expressed in micrometers or thousandths of an inch. For example, a 330 μm [0.013 in] drill into a 635 μm [0.025 in] land would be described as a “D+ 305 μm [0.012 in].”

Daisy Chain

The connection of multiple points with one conductor or wire. (See Figure D-1.)

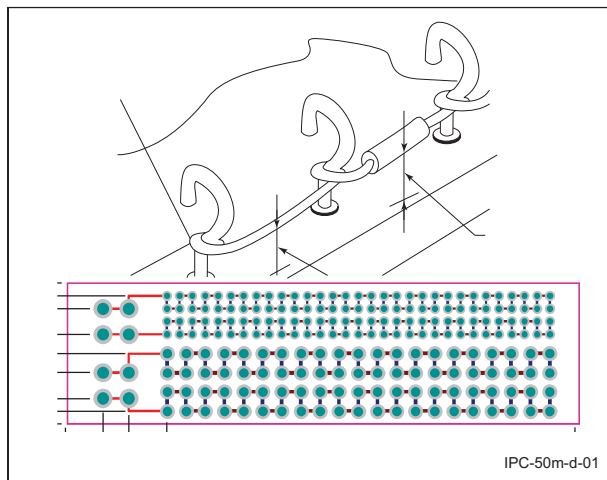


Figure D-1 Daisy Chain

Daisy Chain (Devices)

An interconnection of computer devices, peripherals, or network nodes in series, one after another.

Damage

The result of an event that degrades a product, e.g., component, printed board, module, etc., beyond the form, fit and function limits of the governing document.

Damage Response (Plastic Encapsulated SMDs)

All irreversible changes caused by exposure to a reflow soldering profile.

Dambar

A portion of the lead frame that prevents mold compound from flowing to the end of the lead frame.

Data (Computing)

Intelligent information that is used directly by machine or software program in order to accomplish a particular event.

Data Capture

The automatic collection of information from a given machine or other information source.

Data File

A compilation of related records organized in a specific manner for a specific application.

Data Layer

A specific group of related records that are within any individual data-information module.

Data Logging

The ability of a host computer or test analyzer to store analyzed data along with statistical data.

Data-Entry Device

A device terminal used to enter information into a computer system. (See also “Control Console.”)

Data-Information Module (DIM)

A group of records that contain related data that describe a specific function or task.

Database

A comprehensive collection of information that is so structured that some or all of its data may be used to create queries about related items contained within it.

Date Code

Marking of products to indicate their date of manufacture. An example is a four digit numeric code where the first two digits represent the year of manufacture, and the last two digits represent the week.

Datum

The theoretically-exact point, axis or plane that is the origin from which the location of geometric characteristics of features of a part are established.

Datum Axis

The theoretical axis derived from the true geometric counterpart of a specified feature (i.e., tooling hole, fiducial) as established by the extremities of contacting points of the actual datum feature.

Datum Feature

An actual feature of a part that is used to establish a datum.

Datum Reference

A defined point, line or plane that is used to locate a pattern or a layer for purposes of manufacturing, inspection, or both.

Datum Target

A specified point or area on a printed board used to establish a datum.

Daughterboard

A printed board assembly that is fastened and electrically connected to a motherboard or backplane.

Dead-Bug

The orientation of an electronic component package with the terminations facing up.

Decomposition

A chemical reaction in which a polymerized material partially or completely degenerates to a lower polymeric state or to the original monomer. (This is usually accompanied by significant changes in physical and mechanical properties.)

Decomposition Temperature (T_D)

The temperature at which a base laminate material experiences an established percentage of weight loss using Thermogravimetric Analysis (TGA).

Decoupling

The absorption of noise pulses generated by switching logic devices, to prevent other devices sharing the same power supply from being affected by such noise pulses.

Defect

A departure of a quality characteristic from its intended level or state that occurs with a severity sufficient to cause an associated product or service not to satisfy intended usage requirements.

Defect Identification

The provision for recording the location of a non-conforming anomaly for identification at subsequent manufacturing processing.

Defect Level

The number or percentage of defects (detected or undetected) in a lot.

Definition (Imaging)

Degree of conformity of the pattern edges with the production master.

Definition (Phototool)

The clarity of detail in an optically-produced image.

Degassing

The process of removing gasses from a substance or enclosure, often using vacuum.

Degradation

A decrease in quality or integrity with a loss of expected properties.

Degrees of Freedom (df)

The number of independent variables in a system.

Deionized Water

Water which has been treated to remove ionic contaminants such as mineral salts.

Delamination

A separation between plies within a base material, between a base material and a conductive foil, between a conformal coating and a surface, or any other planar separation. For mechanical separation see "Haloing." (See also "Blister.")

Delivered Panel (DP)

A production or prototype panel, or portion of either, supplied to the assembler, intended to contain one or more printed boards in a specific arrangement or cluster, in order to facilitate economic assembly and testing in the next level of manufacturing. (See also "Pallet (Printed Board).")

Delivery Inspection

"See Final Inspection."

Dendritic Growth

Metallic filaments that grow between conductors in the presence of condensed moisture and an electric bias.

Dendritic Migration

Migration that proceeds through an insulator in a "treeing" fashion.

Denier

The weight, in grams, of 9000 meters of fiber, filament or yarn.

Densitometer

An instrument that is used to measure the density of a photographic film emulsion which has been exposed to light.

Density (Material)

The mass of a substance per unit volume.

Density (Phototool)

The logarithm of the value of opacity.

Dent

A smooth depression in conductive foil that does not significantly reduce the foil's thickness.

Dentrices

See "Dendritic Migration."

Depth of Field (Optical)

The expansion length of the object field of an optical imaging system in the direction of the optical axis, which appears in the optical image without noticeable loss of sharpness.

Desiccant

An absorbent material used to maintain a low relative humidity.

Design Automation

The use of computer systems, programs, and procedures in the design process wherein, the computer is responsible for the decision-making activity and data manipulation function.

Design of Experiments (DOE)

Statistical techniques that analyze multiple factors simultaneously to understand their relationship to product or process outputs.

Design Spacing of Conductor Traces or Planes

The spacing between conductors as delineated or otherwise noted on the master drawing. (See also "Conductor Base Spacing.")

Design Width of Conductor Trace or Plane

The width of conductors as delineated or otherwise noted on the master drawing. (See also "Conductor Base Width" and "Conductor Width.")

Design Review

A formal and independent examination of an existing or proposed design for the purpose of detection and remedy of deficiencies in the requirements and design.

Design Rule

Parameters and constraints that can be incorporated into a design so that software can warn or prevent potential errors. Design rules can include connectivity checking, impedance and timing constraints, width rules (for current carrying capability), minimum clearances, placement and routing keepouts, height restrictions, etc.

Design-Rule Check (DRC)

A process to verify that the database does not violate mechanical or topological design rules.

Desmear

The removal of friction-melted resin and drilling debris from a hole wall.

Destructive Physical Analysis (DPA)

A process of determination of device construction or failure modes.

Detail Specification

A detailed written description of a part or a process.

Detailed Specification

A document that describes the exact requirements for a specific product, material, or service.

Developing (Phototool)

The chemical treatment of radiation-modified photosensitive material in order to produce an image.

Development (Resist)

The process of exposing a photoresist to a chemical solution which dissolves unwanted material and without affecting wanted material. The standard method of distinguishing between wanted and unwanted material is by polymerizing the resist so as to make it less soluble in the development solvent.

Device

An individual electrical circuit element that cannot be further reduced without destroying its stated function.

Device Under Test (DUT)

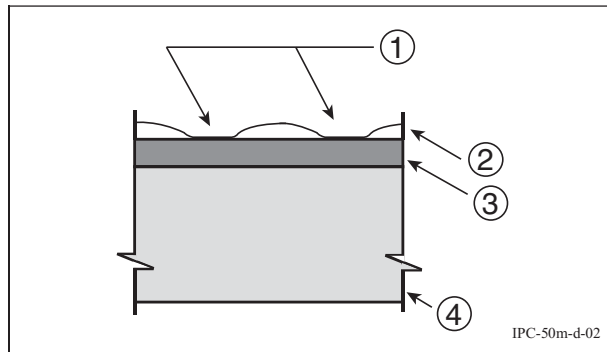
The device that is currently undergoing mechanical, electrical or environmental test.

Dewetting

Failure of a liquid (for example molten solder or conformal coat) to spread evenly and adhere to a surface, forming irregularly shaped drops or mounds.

Dewetting (Solder)

A condition that results when molten solder coats a surface and then recedes to leave irregularly-shaped mounds of solder that are separated by areas that are covered with a thin film of solder and with the basis metal not exposed. (See Figure D-2.)

**Figure D-2 Dewetting****1. Dewetting****2. Solder****3. Base Metal****4. Base Material****Dewetting (Printed Board Base Materials)**

A loss or reduction of resin coverage from localized or large areas of reinforcement.

Diazo Material

A non-silver, room-light handling, ultraviolet-sensitive material, used as a coating film for creating phototools.

Dibasic Acid

An acid containing two atoms of acidic hydrogen in a molecule.

Dice

Two or more die.

Dicing

The separating of semi-conductor wafers into individual die.

Dicyandiamide

A solid curing agent for epoxy resins.

Die (Singular or Plural)

Separated piece(s) of semiconductor wafer that constitute a discrete semiconductor or integrated circuit. They are normally uncased and leadless forms of an electronic component that may be either active or passive. (See also "Dice.")

Die Attached Pad

See "Die Pad."

Die Bonding

The attachment of a die to base material.

Die Device

A bare die, with or without connection structures, or a minimally-packaged die.

Die Mount Pad

See "Die Pad."

Die Pad

A land on which the integrated circuit die is mounted during the assembly process.

Die Paddle

The central portion of the lead frame on which the die and adhesive are placed during the attachment process.

Die Shrink

Method of reducing silicon area used for the same circuitry by reducing layout feature size by a common percentage for all levels.

Die Stamping (Conductor)

A process to make a conductive circuit in which the patterns are stamped out of a metal sheet.

Dielectric

A non-conductive material with a high resistance to the flow of electrical current.

Dielectric Breakdown

The complete failure of a dielectric material that is characterized by a disruptive electrical discharge through the material that is due to deterioration of material or due to an excessive sudden increase in applied voltage.

Dielectric Constant

The ratio of the capacitance of a configuration of electrodes with a specific material as the dielectric between them to the capacitance of the same electrode configuration with a vacuum or air as the dielectric. See "Permittivity."

Dielectric Fluid

A fluid that has excellent dielectric strength, excellent volume resistivity, a low dielectric constant, and a low dissipation factor.

Dielectric Strength

The maximum voltage that a dielectric can withstand under specified conditions without resulting in a voltage breakdown, usually expressed as volts per unit dimension.

Dielectric Withstanding Voltage

Maximum potential gradient (voltage) that a dielectric can withstand without a material property failure.

Dieter (Bergman)

A forty-five minute answer to a one-minute question.

Differential Etching

The process of removing copper from a conductive pattern that has been plated on a starting thin copper foil such that the portions of the thin starting foil are completely removed and the thicker plated portions are slightly reduced by the etchant.

Diffusion Bond

A bond of two metal surfaces formed without using any liquid or fused connecting medium; the bonding is caused by the mutual diffusion of atoms from one metal to the other forming a common interface layer.

Digital Circuit

An electrical circuit that provides two (binary) or three distinct relationships (states) between its input and output.

Digitizing (CAD)

The converting of feature locations on a flat plane to its digital representation in X-Y coordinates.

Dilution

A reduction in concentration that can be achieved by mixing a non-reacting, soluble agent into the material.

Dilution Ratio

The relationship of a unit volume of a solute to a volume of a solvent.

Dimensional Stability

A measure of the dimensional change of material that is caused by factors such as temperature changes, humidity changes, chemical treatment (aging), and stress exposure.

Dimensioned Hole

A hole in a printed board whose location is determined by physical dimensions or coordinate values that do not necessarily coincide with the stated grid.

Dimorphism

The existence of a substance in two different crystalline forms.

Dip Soldering

The making of soldered terminations simultaneously by bringing the solder side of a printed board with through-hole mounted components into contact with the surface of a static pool of molten solder. (See also "Drag Soldering (Static Pool).")

Diphase Cleaning

Cleaning by means of solutions that contain a solvent layer and an aqueous layer.

Dipole (Electronic)

A distribution of positively and negatively charged atoms or subatomic particles, whose total charge is zero, but whose centers are different.

Dipole Moment

Molecules in which the atoms, their electrons, and their nuclei, are so arranged that one part of the molecule has a positive electrical charge while the other part is negatively charged.

Direct Cleaning

See "Cathodic Cleaning."

Direct Current (DC)

A current produced by a voltage source that does not vary with time, and is normally provided by power supplies or batteries to power electronic circuits.

Direct Current Cleaning

See "Cathodic Cleaning."

Direct Dimensioning

The dimensioning of features from the origin of the coordinate system. The maximum variation of the distance between two features will be controlled by the tolerances of the direct dimensions of both features. (See also "Baseline dimensioning.")

Discontinuity

A lack of either electrical or mechanical continuity.

Discrepant Material

Material that does not conform to specification.

Discrete Data

Numerical data that arises from counting and that can only occur at definite points or at some specific values, such as pass/fail.

Discrete Semiconductor

A single semiconductor device with two, three or four terminals that is a separate part of a printed board assembly that performs a circuit function; e.g., a resistor or a capacitor.

Discrete Wiring

A conductive pattern established by techniques other than printing, plating, and/or etching, that provides point-to-point connections in a predetermined arrangement on a common base.

Discrete Wiring Board

A board upon which discrete wiring techniques are used to obtain electrical interconnections.

Discrete Wiring Board Assembly

An assembly that uses a discrete wiring board for component mounting and interconnecting purposes.

Dispersant (Organosol)

A liquid component that has a solvating or peptizing action on a resin so as to aid in dispersing and spreading it.

Disperse Phase (Suspension)

The particles of solid material dispersed in a liquid medium.

Dispersing Agent

A surface-active agent added to a suspending medium to promote uniform separation of extremely-fine solid particles.

Disposition (Defects)

The determination of how defects should be treated. Dispositions include, but are not limited to, rework, use as is, scrap or repair.

Dissipation Factor

The tendency of insulating or dielectric materials to absorb some of the energy in an alternating-current signal. Also known as "Loss Tangent."

Dissolution of Metallization

The process of dissolving metal, usually by the introduction of chemicals. (See also "Leaching, Metallization.")

Dissolution of Termination Metallization (Leaching)

See "Leaching, Metallization."

Distance to Neutral Point (DNP)

The linear separation of a joint from the neutral point on a chip. This dimension controls the strain on the joint imposed by expansion mismatch between chip and substrate.

Distributed Numerical Control (DNC)

A network that links computer programs or computer-aided systems to numerically-controlled machine tools.

Disturbed Solder Connection

A solder connection that is characterized by the appearance that there was motion between the metals being joined when the solder was solidifying.

Documentation Package

The communication mechanism between design functions and manufacturing facilities, consisting of information sets that encompass a variety of techniques or media, such as, data and drawing.

Doming (BGA)

A condition of a ball grid array (BGA) package after reflow where the corners turn down and toward the printed board laminate surface. This condition in the worse case causes the balls on the outside row to be in compression and the balls in the center to be in tension. (Opposite of "Cupping (BGA).")

Don't Care Area

See "Exclusion Area."

Doping

The addition of a specific impurity to a slice of silicon monocrystal to alter the conductivity of the crystal in a specified manner in order to produce semiconductor devices from this crystal.

Double-Sided Assembly

A packaging and interconnecting structure with components mounted on both the primary and secondary sides. (See also "Single-Sided Assembly.")

Double-Sided Printed Board

A printed board with a conductive pattern on both of its sides.

Double-Sided Flexible Printed Wiring Board

See "Flexible Double-Sided Printed Board."

Double-Sided Printed Wiring Board

See "Double-Sided Printed Board."

Doubled-Treated Foil (DTF)

Application of a chemical adhesion promoter treatment that is placed on both surfaces of the copper (matte and drum sides).

Download, Computer

The transfer of computer programs or data from a computer to a lower-level computer.

Download (Tester)

The transfer of the results of a test analysis and data logging information from the tester to a host computer.

Drafting Image

An image that is part of a master drawing or layout.

Drag Soldering (Static Pool)

The making of soldered terminations by moving the solder side of a supported printed board with through-hole mounted components through the surface of a static pool of molten solder (See also "Dip Soldering.").

Drag Soldering (Moving Iron)

Moving the soldering iron or selective soldering head across the surface of a board, instead of lifting point-to-point.

Drain Wire

The wire from the shield of a cable that connects directly to ground.

Drawbridged Component

See "Tombstoned Component."

Drawing

A type of documentation describing a product, in hard or soft copy, that requires human interpretation to facilitate manufacturing or assembly.

Drilling

A process for making holes using a drill bit or laser.

Drill Bit

A rod with spiral flutes (grooves) and an obtuse angled point with sharpened cutting edges used to make holes by rotary action.

Drill Body Length

The distance from the drill point to the intersection of the drill diameter and shoulder angle. See Figure B-11.

Drill Diameter

The diameter of the outer cutting edges of a drill bit.

Drill Point Concentricity

The total variation of the location of the drill point to a rotated drill shank. (See also "Shank-to-drill Body concentricity.")

Drip Loop

A loop or wire bend formed to direct condensation or accumulated moisture to a noncritical area; e.g. prevents accumulated moisture from following the span of a cable path into a moisture sensitive area.

Dross

Oxide and other contaminants that form on the surface of molten solder.

Drying (Solder Paste)

Ambient or heating process to evaporate volatile components from solder paste which may or may not result in melting of rosin/resin.

Dry Film Resist

A material composed of photosensitive emulsion that is sensitive to portions of the light spectrum and either carried by or sandwiched between polymer release films, and is used to expose imagery on printed boards.

Dry Glass (Clad Laminate)

A general reference to the appearance of a laminate where the reinforcement is highly visible, due to low/lost resin content or poor wetting/encapsulation of the resin to the reinforcement, although the resin coverage is acceptable.

Dual Fixture

A fixture for testing electrical continuity with two separate bed-of-nails units.

Dual-Inline Package (DIP)

An electronic device package with a rectangular housing and two parallel rows of electrical connecting pins, usually protruding from the longer sides of the package and bent downward.

Durometer

A measure of the degree of hardness or the resistance to deformation or fracture.

E**E Glass**

A low alkali lime alumina borosilicate glass with good electrical properties.

Edge Definition

The reproduction fidelity of a pattern's edge relative to the production master.

Edge Detection

The ability to recognize (differentiate) the location of an edge.

Edge Rate

The rate of change in voltage with time of a logic signal transition.

Edge Short

An electrical short caused by carrier tape leads making contact with the edge of a semiconductor die.

Edge Spacing

The distance of a pattern or component body from the edges of a printed board.

Edge-Board Connector

A connector that is used specifically for making nonpermanent interconnections with the edge-board contacts on a printed board.

Edge-Board Contact(s)

Printed contact(s) on or near any edge of a printed board, that are used specifically for mating with edge-board connectors.

Edge-to-Edge Spacing

See "Conductor Spacing."

Edge-Transition Attenuation

The loss of a logic signal's switching-edge sharpness that has been caused by the absorption of the highest-frequency components by the transmission line. (See also "Attenuation.")

Effective Focal Length

The distance from the principal point of an optical magnification system to the corresponding focal point.

Effective Permittivity

See "Effective Relative Dielectric Constant."

Effective Relative Dielectric Constant

The relative permittivity (See "Dielectric Constant") of a mixed media configuration, such as air and the solid dielectrics used in microstrip, that has the equivalent electromagnetic wave propagation characteristics of a single dielectric medium.

Elastomeric Connector

A pliant strip of flexible material with insulating and conductive elements intended for providing electrical interconnections.

Electrical Characteristics

The distinguishing electrical traits or properties of a component or assembly.

Electrical Clearance

The shortest distance between two conductors, which includes traces, terminals and structures, measured through air.

Electrical Resistance

See "Resistance."

Electrochemical Migration (ECM)

The growth of conductive metal filaments under the influence of a DC voltage bias where growth is by electro-deposition from a solution containing metal ions that are dissolved from the anode, transported by the electric field and re-deposited at the cathode.

Electrodeposited Foil

A metal foil that is produced by electrodeposition of the metal onto a material acting as a cathode.

Electrodeposition

The deposition of a conductive material from a plating solution by the application of electrical current.

Electroless Deposition

The deposition of conductive material from an autocatalytic plating solution without the application of electrical current.

Electroless Plating

See "Electroless Deposition."

Electrolytic Cleaning

Cleaning in which a current is passed through an alkaline solution with the part to be cleaned being one of the electrodes.

Electrolytic Corrosion

Corrosion caused by an electrochemical reaction.

Electrolytic Corrosion Factor (Pressure Sensitive Tape)

A measure of the pressure sensitive adhesive tape's corrosive effect on a copper conductor.

Electrolytic Deposition

See "Electrodeposition."

Electromagnetic Compatibility (EMC)

A device's ability to function properly in its operating environment without causing electromagnetic interference to other equipment, or itself being susceptible to external interference.

Electromagnetic Interference (EMI)

Electromagnetic energy that couples into electrical circuits and adversely affects their performance.

Electromigration

An undesirable phenomenon in which metal ions migrate through a suitable medium under the influence of an electrical field.

Electron-Beam Bonding

Terminations made by heating with a stream of electrons in a vacuum.

Electroplating

See “Electrodeposition.”

Electrostatic Discharge (ESD)

The rapid flow of electricity between objects with different potential.

Element (Bar Code)

In a bar code, a generic term referring to a bar or space.

Elongation

The increase in length of a material that is caused by a tensile load.

Embedded Active Component (Device)

An active device that is inserted or formed between the layers of the primary interconnect substrate. It should have terminals which can connect with the layers of the substrate.

Embedded Component

A discrete component that is fabricated as an integral part of a printed board. (See Figure E-1.)

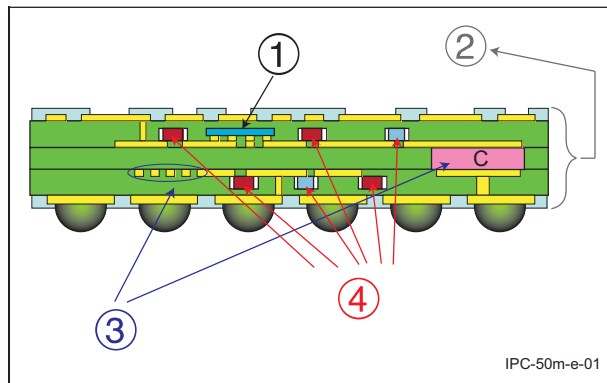


Figure E-1 Embedded Component (Inserted)

1. Embedded Active Component
2. Module with Embedded Components
3. Embedded Passive Component (Formed Type)
4. Embedded Passive Component (Inserted Type)

A functional component that is inserted between the layers of the primary interconnect substrate, as opposed to being on the surface.

Embedded Component (Formed)

A component that is created, from raw materials, inside the primary interconnect substrate, as opposed to being on the surface.

Embedded Copper (Base Materials)

An inclusion which is composed of copper and sourced from the cladding, and may be particles from treatment transfer, broken away copper tooth, or spurious copper.

Embedded Fiber (Base Materials)

An inclusion which has an insignificant width or diameter but has significant length, usually but not always in a curly or twisted configuration, generally from organic sources such as clothing or packaging materials.

Embedded Passive

A sheet of resistive, capacitive or inductive material which is laminated onto a dielectric, and either etched or lasered away to define individual resistors, capacitors or inductors.

Embedded Passive Component (Device)

A passive component that may be formed or placed inside the primary interconnect substrate, as opposed to being mounted on the surface. Formed embedded passive components may be singulated (embedded discrete) or embedded distributed (planar) structures. (See Figure E-2)

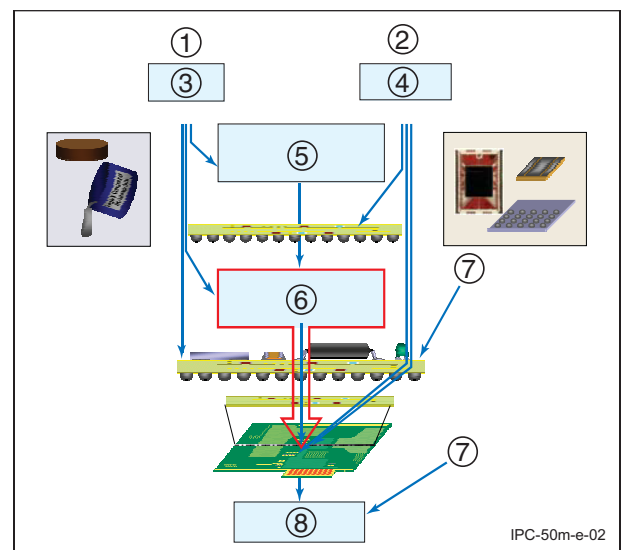


Figure E-2 Embedded Passive Component (Device)

1. Formed
2. Placed
3. Material
4. Discrete Component
5. Substrate (Interposer) with Embedded Component
6. Module (Package) with Embedded Component
7. Other Parts/Materials
8. Printed Board with Embedded Component

Embedded Passive Materials and Processes

Materials and processes which add capacitive, resistive and/or inductive functionality within the printed board. (See Figure E-1.)

Encapsulant

Materials used for potting, glob-topping or molding. See also "Potting Compound."

Encapsulation

The encasement of a component in a coating by dipping, spraying, or embedding with or without a mold, to provide mechanical support and environmental protection.

End Cap Slice

A wire union where all the wires enter the connection from the same side.

End Item

See "End Product."

End Missing

A very small portion of the warp in a fabric that may have been broken in the pick-out of waste material.

End Product

An individual part or assembly in its final completed state.

End Mill

A rod with straight or spiral flutes (grooves) sharpened as a cutting surface(s) and a flat or shaped end with cutting teeth, used for surface or side milling by rotary action.

Engineering Drawing

A document that discloses the dimensions, tolerances and materials to be used of a part by means of pictorial presentations and text.

Entry/Backup Material

A material which when placed on the top (entry) and/or bottom (backup) of a stack of printed boards being drilled or routed, supports the edges of drilled holes or routed profile such that the presence of burrs is minimized.

Epoxy Glass Substrate

An epoxy resin that polymerizes when components are mixed and combined with glass fiber to form a substrate.

Epoxy Novolac

A multifunctional resin having epoxy groups attached to a novolac group(s).

Epoxy Resin

A thermosetting resin containing at least two reactive oxirane rings that is made by the reaction of epichlorohydrine and bis-phenol A.

Epoxy Smear

See "Resin Smear."

Equilibrium Wetting

The degree of wetting in which the forces of wetting are in equilibrium with the forces of gravity. The visible indication of this is that the wetting balance curve describing the wetting action when the rate of change approaches zero.

Equivalent Series Resistance (ESR)

A loss parameter used to compare two capacitors of equal value in order to determine their relative effectiveness as filters.

ESD Protected Area

An area or workplace that provides protection against damage due to ESD.

Electrostatic Discharge Sensitivity (ESDS)

The propensity to be damaged by electrostatic discharge.

Escape Rate

The ratio of the number of defective items not detected to the total number inspected, expressed as a percentage.

Escape

A defect that is missed by an inspection system.

Etch Factor

The ratio of the depth of etch to the amount of lateral etch, i.e., the ratio of conductor thickness to the amount of undercut. (See Figure E-3.)

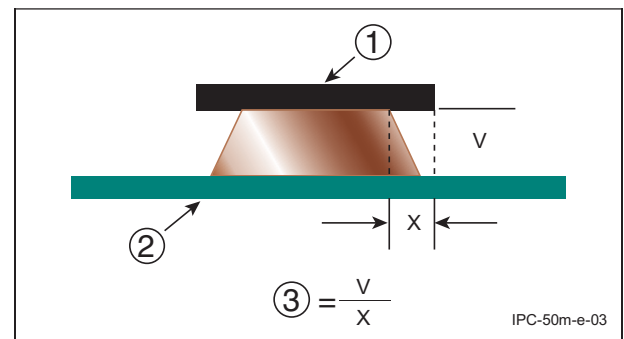


Figure E-3 Etch Factor

1. Resist
2. Laminate
3. Etch Factor

Etchant

A solution used to remove the unwanted portion of material from a printed board by a chemical reaction.

Etchback (Positive)

The controlled removal of non-metallic materials from the sidewalls of holes in order to remove resin smear and to expose additional internal conductor surfaces. (See Figure E-4.)

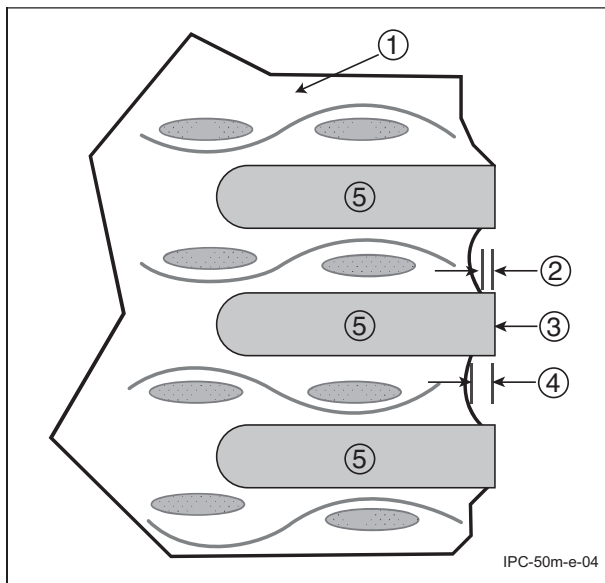


Figure E-4 Etchback

1. Dielectric
2. Etchback Measurement (Minimum)
3. Positive Etchback at Conductor
4. Etchback Measurement (Maximum)
5. Internal Conductor

Etched Printed Board

A printed board having a conductive pattern that was formed by the chemical removal of unwanted portions of a conductive foil.

Etching

The chemical, or chemical and electrolytic, removal of unwanted portions of conductive or resistive material.

Etching Indicator

A wedge-shaped or other specified pattern that is affixed to a conductive foil in order to indicate the quality of etching.

Etch Resist

An organic or metal plated material used to protect the conductive pattern image from the etching chemistry. The organic material may be photosensitive.

Ethanol

A solvent used in cleaning electrical assemblies (Ethyl Alcohol).

Eutectic (Solder)

The alloy composition at which a solder alloy melts/freezes completely without going through a pasty (partially solid) phase.

Eutectic

An isothermal reversible reaction in which on cooling a liquid solution is converted into two or more intimately-mixed solids, with the number of solids formed being the same as the number of components in the system.

Eutectic Die Attach

The mounting of a semiconductor die to circuitry using the formation of a eutectic alloy that is brought above its eutectic melting temperature.

Eutrophication

The enrichment of either fresh or salt water by a chemical element or compound.

Excess Solder Connection

A solder connection that is characterized by the complete obscuring of the surfaces of the connected metals and/or by the presence of solder beyond the connection area.

Exchange Reaction

A chemical reaction in which atoms of the same element in two different molecules, or in two different positions in the same molecule, transfer places.

Excising

The cutting of the unterminated (outer) leads of an inner-lead bonded die in order to separate it from the carrier tape subsequent to further assembly processing.

Excitation Current

The current in a field coil of a generator, motor, etc., or the magnetizing current in a transformer.

Exclusion Area

A predetermined region where inspection is excluded.

Exfoliation

Scaling from a surface in flakes or layers as a result of corrosion.

Experimental Error (e)

A variation that is due to a measurement error, a chance occurrence, or other factors.

Exposure

The process of generating a pattern within a photosensitive material through a chemical reaction using either laser direct imaging or conventional imaging with a working phototool.

Exposure Time (Component)

The compensation factor which accounts for the time after bake that the component manufacturer requires to process the components prior to bag seal.

External Layer

A conductive pattern on the surface of a printed board.

Extraction, Liquid-Liquid

See “Solvent Extraction.”

Extraction Tool

A device used for removing a contact from a connector body or insert, a component from a socket, or a printed board from its enclosure.

Extraneous Copper (Base Materials)

A portion of the copper cladding which could not be etched off. Usually due to a contaminate stuck to the clad laminate which acts as a barrier to etching.

Extraneous Metal

Unwanted metal, usually copper, that remains on a base material after chemical processing.

Eyelet

A short metallic tube, the ends of which can be formed outward in order to fasten it within a hole in material such as a printed board.

F**F (Fisher) Test**

A test that attempts to determine if two populations have the same variance.

F Ratio (F)

The ratio of two variances.

FCC System

A complete flat-conductor cabling system that is suitable for installation under carpet squares. (See “Flat Cable.”)

Fabrication Data Set

The combination of information provided to the board fabricator that describes the requirements of the final product including physical description, fabrication instructions, material references, specification requirements, etc., that facilitates communication between user and supplier.

Fabrication Allowance

A dimensional value added to a printed board feature or feature location intended to assure that manufacturing variations can maintain certain physical or performance characteristics of the end product.

Fabrication Panel

See “Panel.”

Face Bonding

Attaching a die to a base material with its circuitry facing the base material.

Face Down Bonding

A method of attaching a component or circuit chip to a substrate by inverting the chip and bonding chip contacts to the mirror-image contact points on the substrate.

Face Up Bonding

A type of integrated circuit bonding wherein the back of the die is attached to a base material.

Failure Analysis

The logical, systematic examination of an item to identify and analyze the failure mechanism.

False Alarm

An anomaly identified by an inspection system that is not a critical defect.

False Alarm Rate

The ratio of the number of items not accepted because of a false alarm to the total number of items inspected, expressed as a percentage.

Farad

A unit of electrical capacitance.

Far-End Crosstalk

See “Forward Crosstalk.”

Fatigue Life

The number of cycles of stress that can be sustained prior to failure for a stated test condition.

Fatigue Limit

The maximum stress below which a material can presumably endure an infinite number of stress cycles.

Fatigue Strength

The maximum strength that can be sustained for a specific number of cycles without failure, with the stress being completely reversed within each cycle unless otherwise stated.

Fatigue-Strength Reduction Factor (Kf)

The ratio of the fatigue strength of a member or specimen with no stress concentration to the fatigue strength with stress concentration.

Fatty Acid

A carboxylic acid derived from, or contained in, an animal or vegetable fat or oil.

Fatty Ester

A fatty acid with the active hydrogen replaced by the alkyl group of a monohydric alcohol.

Fault

Any condition that causes a device or circuit to fail to operate in a proper manner.

Fault Dictionary

A list of elements in which each element consists of a fault signature that can be used to detect a fault.

Fault Isolation

The identification process used to determine the location of a fault to within a small number of replaceable components.

Fault Localization

The identification process used to determine the location of a fault to within a general area of a circuit.

Fault Masking

A condition that occurs when one fault conceals the existence of another.

Fault Modes

The various ways faults may occur.

Fault Resolution

A measure of the capability of a test process to perform failure isolation.

Fault Signature

The characteristic, unique erroneous response produced by a specific fault.

Fault Simulation

A process that allows for the prediction or observation of a system's behavior in the presence of a specific fault without actually having that fault occur.

Feather Length

The distance from the last warp end of a fabric to the end of the pick.

Feature

The general term that is applied to a physical portion of a part, such as a surface, hole or slot.

Feature Window

An opening in the insulation material of a carrier tape that allows for the creation and bonding of separated leads.

Feature-Based Modeling

A computer-based modeling method that is based on the use of part features instead of geometric entities.

Ferrule

A short tube used to make solderless connections to shielded or coaxial cable.

Fiber Exposure

The exposure of reinforcing fibers that are within machined, abraded, or chemical-attacked areas of a base material. (See also "Weave Exposure.")

Fiber Optic Cables (Optical Fiber)

A cable containing one or more optical fibers (see Figure F-1). The optical fiber elements are typically individually coated with polymer layers and contained in a protective tube suitable for the environment where the cable will be deployed.

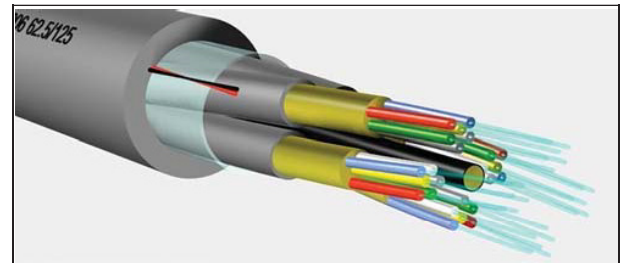


Figure F-1 Fiber Optic Cable

Fiducial

A printed board feature (or features) that is (are) created in the same process as the conductive pattern and that provides a common measurable point with respect to a land pattern or land patterns.

Field Trimming

The adjusting of the value of a resistor in order to modify a circuit output voltage or current.

Filiform Corrosion

Corrosion that develops under organic coatings on metals in the form of randomly distributed fine hairlines that are usually curved, wavy, or coiled.

Fill

Yarns that are woven in a crosswise direction of a fabric.

Filler

An inert, insoluble substance that is added to a material to improve its solidity, bulk, or other properties. Also a material used in multi-conductor cables to occupy voids formed by the assembled conductors.

Fillet, Adhesive

The portion of an adhesive that fills the corner, or the angle formed, where two adherends are joined. (See Figure F-2.)

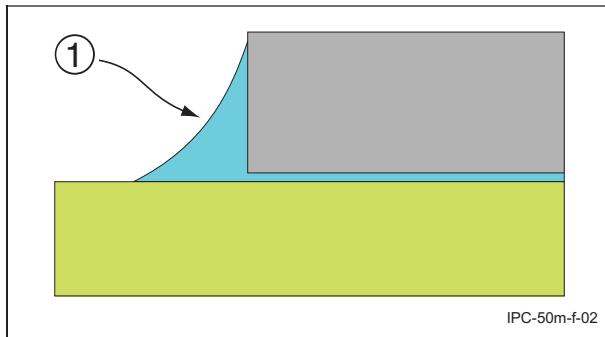


Figure F-2 Fillet, Adhesive
1. Fillet

Fillet, Keyhole

The expansion of a conductor to land junction area using a circular overlay to alleviate breakout conditions.

Fillet, Solder

See “Solder Fillet.”

Film

Single or multiple layers of material used to form hybrid circuit elements, interconnections, and crossovers. (See also “Thin Film” and “Thick Film.”)

Film Conductor

A conductor formed in place on a base material by depositing a conductive material using screening, plating or evaporating techniques.

Film Network

An electrical network composed of thin-film and/or thick-film components on a base material.

Final Inspection

An evaluation of quality characteristics relating to a standard, specification, or design drawing prior to shipping to the customer.

Final Seal

The manufacturing process that completes the enclosure of a microcircuit so that further internal processing cannot be performed without removing a lid or otherwise disassembling the package.

Fine Leak

A leak in a sealed package that is less than 0.00001 cubic centimeters per second at one atmosphere of differential air pressure.

Fine-Pitch QFP

A quad flat pack (QFP) package with the lead pitch at or less than 0.65 mm [0.025 in] centers.

Fine-Pitch BGA

Ball grid array with less than 1 mm [0.039 in] pitch.

Fine-Pitch Technology (FPT)

A surface-mount assembly technology with component terminations on less than 0.65 mm [0.025 in] centers.

Fingers

See “Edge-Board Contacts.”

Finished Fabric

A fabric that has been treated in order to aid its compatibility with resin.” The noun in question here is “fabric” and not “treatment.”

Finished Board

See “Printed Board.”

Finite-Element Analysis (FEA)

A computer-based analysis method that subdivides geometric entities into successively smaller elements and links a series of equations to each element so that they can then be analyzed simultaneously.

Finite-Element Modeling (FEM)

The use of a model to represent a problem that can be evaluated by finite-element analysis.

Fire (v.)

To heat a circuit so that its thick-film components are transformed into their final form.

Firing Sensitivity

Within semiconductor fabrication, the change of the numerical value of a film component characteristic caused by a change of the peak temperature, expressed as percentage change per degree centigrade.

First Article

A part or assembly that has been manufactured prior to the start of a production run for the purpose of ascertaining whether or not the manufacturing processes used to fabricate it are capable of making items that will meet all applicable end-product requirements.

First Bond

The initial termination in a sequence of bonds made to form a conductive path. (See also “Second Bond.”)

First Radius

The radius of the front edge of a bonding-tool foot.

First-Pass Yield

The number of finished units in a group that pass all tests without any rework, expressed in percent.

Fishbone Diagram

A “Cause-and-Effect Diagram” formatted in a fishbone pattern.

Fisheye

A defect area on or in a fabric, film or coating that resists wetting.

Fissuring

The cracking of a conductor or dielectric material caused by stresses occurring during firing.

Fixed Contact

A type of connector contact that is permanently retained within the connector body or insert.

Fixture, Test

An interface between test equipment and the unit under test.

Flag

The support area for a die or lead frame. (See Figure F-3.)

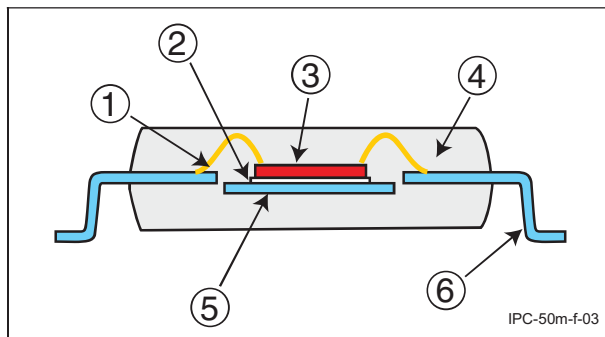


Figure F-3 Flag

- | | |
|---------------|-------------------------|
| 1. Bond Wire | 4. Epoxy Mold Compound |
| 2. Die Attach | 5. Leadframe pad (Flag) |
| 3. Die | 6. Lead |

Flame-Off

Severing of a bonding wire by a flame where a ball is formed at the wire end for the next ball-bonding termination.

Flame Resistance

The degree to which a given substance will resist being ignited when exposed to a flame.

Flame Retardance

The tendency of the material, when burning, to self-extinguish once the source of ignition is removed.

Flammability

The tendency of the material to ignite and burn when subjected to an ignition source.

Flare

The undesirable enlarged and tapered area around a punched hole that is on the side of the material through which the punch exited during hole formation. (See Figure F-4.)

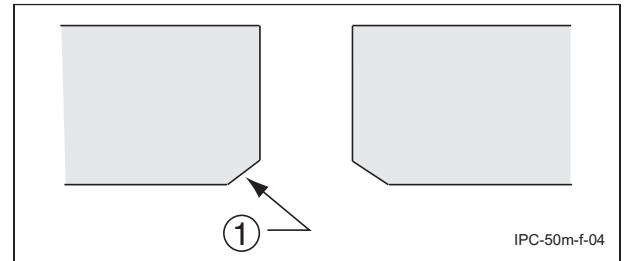


Figure F-4 Flare

1. Flare**Flash (Plastic)**

Seepage of plastic material along parting lines and/or mating surfaces (i.e., thin surplus of material that has been forced between mating mold surfaces during molding operation).

Flash Distillation

Distillation in which an appreciable proportion of liquid is quickly converted to a vapor in such a way that the final vapor is in equilibrium with the final liquid.

Flashover

An electric discharge that takes place around or on the surface of an insulator between conductors with different potentials when a path becomes sufficiently ionized to sustain an electric arc.

Flat Cable

Two or more parallel, round or flat, conductors that are contained in the same plane of a flat dielectric material.

Flat Conductor

A rectangular conductor that is wider than it is high.

Flat Pack

A rectangular component package that has a row of leads extending from each of the longer sides of its body that are parallel to the base of its body.

Flexible Material Interconnect Construction (FMIC)

The integration of passive and active components with mechanical components (including switches and connectors) on a flexible or thin base material, i.e., flexible printed board, in order to produce an electronic assembly.

Flexible Printed Board

A printed board using a flexible base material only. May be partially provided with electrically non-functional stiffeners and/or coverlay.

Flexural Failure

A failure that is caused by the repeated flexing of a material.

Flexural Strength

The tensile strength of the outermost fiber of a material that is being bent.

Flip Chip

A leadless monolithic, circuit element structure that electrically and mechanically interconnects to a printed board through the use of conductive bumps. (See Figure F-5.)

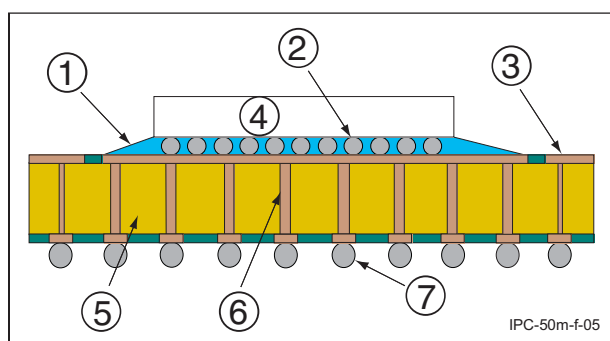


Figure F-5 Flip Chip

- | | |
|------------------------------|-------------------------|
| 1. Underfill Epoxy | 5. BT Substrate |
| 2. 97/3 or 95/5 Sn/Pb Solder | 6. Thermal Via |
| 3. Plated Copper Conductor | 7. Eutectic Solder Ball |
| 4. IC | |

Flip-Chip Mounting

The mounting and interconnecting of a flip chip component to a base material.

Float

A warp or fill yarn that does not interlace with the next designated yarn, but passes over or under two or more adjacent yarns.

Float (Mold)

Any internal component that is unintentionally visible at the surface of the mold material.

Floating Bushing

A connector mounting device that allows for connector body movement in order to facilitate its alignment with a mating part or mating assembly.

Floating-Annulus Tape-Automated Bonding

A carrier tape format that uses a free-floating annulus ring to separate suspended leads.

Flocculant

A substance that induces flocculation.

Flocculation

The combination or aggregation of suspended solid particles in such a way that they form small clumps or tufts that resemble wool.

Floor Life

The allowable time period of exposure to the environment for components and printed boards, after removal from a moisture barrier bag, dry storage or dry bake and before the start of the solder reflow process.

Flow Lines

Unintentional marks that are visible on the finished molding that indicate the direction of plastic material flow.

Flow Soldering

A wave, drag or dip soldering process where the product is brought into contact with molten solder in order to attach electronic components to the interconnecting surface.

Flow Soldering (Nitrogen Process)

A flow soldering process, carried out in a nitrogen atmosphere, intended to retard oxidation of solder and board conductive surfaces and improve solder wetting.

Flush Conductor

A conductor whose outer surface is in the same plane as is the surface of the insulating material adjacent to the conductor.

Flux

A chemically and physically active compound that, when heated, promotes the wetting of a base metal surface by molten solder by removing minor surface oxidation and other surface films and by protecting the surfaces from reoxidation during a soldering operation.

Flux Activation Temperature

The temperature at which flux becomes active enough to remove oxides from the metals being joined.

Flux Activity

The degree or efficiency with which a flux promotes wetting of a surface with molten solder. (See also "Solder-Spread Test," "Wetting Balance.")

Flux Characterization

A series of tests that determines the basic corrosive and conductive properties of fluxes and flux residues.

Flux Residue

A flux-related contaminant that is present on or near the surface of a solder connection.

Flux-Cored Solder

A wire or ribbon of solder that contains one or more continuous flux-filled cavities along its length.

Flux-Spatter Test

A semiquantitative test that characterizes the ability of flux and flux residues, upon rapid heating of the flux, to remain in one area rather than form a dispersion of fine droplets.

Fluxing

The application of a flux during a soldering process to promote wetting of a surface with molten solder.

Foil (Stencil)

The sheet used to create the stencil.

Foil Burr

A roughness or a small rough area, that remains at the cutting edge of a metal foil after it has been cut, pierced or drilled.

Foil Lamination

A process for making multilayer printed boards with surface layer(s) of metal foil bonded in a single operation. (See also "Cap Lamination.")

Foil Profile

The roughness of a foil surface that results from the manufacture of the foil and/or from a bond-enhancement treatment.

Foot Length

The longer dimension of the bonding surface of a wedge-type bonding tool.

Footprint

The area projected onto the printed board, described by the component body, including the lead terminations.

Forced Gas Convection Soldering

Reflow soldering using forced hot air or nitrogen gas as the primary source of heat.

Forced-Field Analysis

A technique that is used to help solve a problem by identifying those forces that are preventing improvement (restraints) and those forces that affect improvement (drives).

Foreign Material

See "Inclusion."

Foreign Material (Soldering)

A lumpy, irregular coating that has covered, or partially covered, particles of material that are located on, but are different than, the material or coating of the items to be soldered.

Fork Contact

A type of female connector contact that consists of flat spring metal that has been formed into a two tine "fork-like" shape so that it mates with a spade contact.

Form

The shape of a feature.

Forward Crosstalk

Noise induced into a quiet line, as seen at the end of the quiet line that is the farthest from the signal source, because the quiet line has been placed next to an active line. (See also "Backward Crosstalk.")

Fractional Factorial Experiment

An experiment whereby only a portion of the complete factorial is run. (See also "Full Factorial Experiment.")

Frame Pitch

The distance from the centerline of one tape-automated bonding frame to the centerline on the next frame site on a reel of carrier tape.

Frequency, Electrical Current

The number of cycles (hertz) or completed alterations per unit of time.

Frit (Semiconductor)

A glass composition with a relatively low softening point.

From-To List

Written instructions in the form of a list that indicates the locations of wiring terminations.

Full Factorial Experiment

An experimental design that evaluates every possible combination of events. (See also "Fractional Factorial Experiment.")

Fully Additive Process

An additive process wherein the entire thickness of electrically isolated conductors is obtained by the use of electroless deposition. (See also "Semi-Additive Process.")

Fully Electroless Process

See "Fully Additive Process."

Functional Testing

Testing conducted to evaluate the compliance of a system or component with specified function requirements.

Functionality, Resin or Curing Agent

The number of reactive groups per molecule.

Fused Coating

A metallic coating, usually a tin or solder alloy, that has been melted and solidified to form a metallurgical bond to a basis metal.

Fusing

Melting of a metallic coating (usually electrodeposited tin or tin-lead) on a conductive pattern, followed by solidification.

Fusing Fluid

The heat-transfer medium used to attain a fused coating.

Fusing Flux

An activated organic fluid that is used in the fusing of a tin-lead plating on a basis metal. (The application of these predominantly water-soluble fluids is usually followed by the use of a fusing oil.)

Fusing Oil

A thermally-stable, nonactivated, fluid that is used in the fusing of tin lead plating on a basis metal. (The application of these predominantly water-soluble fluids is usually preceded by the use of a fusing flux.)

G**Galvanic Corrosion**

Corrosion associated with the current of a galvanic cell consisting of two dissimilar conductors in an electrolyte or two similar conductors in dissimilar electrolytes.

Galvanic Deposition

See "Electrodeposition."

Galvanic Displacement

See "Immersion Plating."

Gas Blanket

A flowing inert gas atmosphere used to keep metallization from oxidizing.

Gas-Tight Area

The common area between mated metal surfaces from which gas vapors and impurities are excluded.

Gas-Tight Contact

A contact that is impervious to ingress by gases.

Gaussian Distribution

See "Normal Distribution."

Gel Time

The time (usually expressed in seconds) at a given temperature for a resin to go from a free flowing melt stage to a semisolid condition.

Gelation Particle

Microparticles of precured, usually translucent, resin in a laminate system.

Generative Process Planning

A computer-based method whereby new process plans are created that are based on part or product information and manufacturing capabilities.

Generic Specification (GS)

A document that describes as many general requirements as possible, pertaining to a set, family or group of products, materials, or service.

Geometric Tolerance

The allowable variation of a physical dimension.

Gerber Data

A type of data that consists of aperture selection and operation commands and dimensions in X- and Y-coordinates. (The data is generally used to direct a photoplotter in generating photoplotted artwork.)

Glassivation

The top layer(s) of transparent insulating material, which covers the active circuit area including metallization, except bond pads.

Glass Binder

Glass powder added to a thick-film resistive or conductive ink in order to bind together the metallic particles after firing.

Glass Cloth

A pliable material made by weaving glass fiber bundles into a fabric layer.

Glass Fabric

Fabric woven with glass yarns.

Glass Distortion (Base Materials)

A localized variance in the linearity of the yarns of the reinforcement.

Glass Transition Temperature (T_g)

The approximate temperature at which an amorphous polymer, or the amorphous regions in a partially-crystalline polymer, reversibly changes state. An example is when a material changes between a relatively brittle condition and a viscous or rubbery condition.

Glass Yarn

A generic term for a continuous strand (collection) of twisted glass filaments (fibers) in a form suitable for weaving.

Glob-Topped Encapsulation

A localized application of a viscous compound to a printed board assembly, other substrate or component/wire, which is then fully cured to provide mechanical support and environmental protection.

Globule Method

A test method that evaluates the solderability of a surface using a small ball of solder.

Go/No-Go Test

A testing process that yields only a pass or a fail condition.

Golden Assembly

See “Known Good Assembly.”

Golden Board

See “Known Good Board.”

Gouge

A form of wear that consists of a wide groove deformation, accompanied by material removal, that penetrates a considerable distance below a surface.

Graded Wedge

See “Etching Indicator.”

Grading Frame

Equipment used to continuously inspect fabric by the use of backlighting.

Green Strength

The strength of substance, joint, or assembly before it has been cured (set).

Greige

Fabric in a loom state that has no finish.

Grey-Scale (Step Wedge)

A tool used to optimize the photo-exposure and development processes, utilizing a step scale of varying degrees of opacity.

Grid

An orthogonal network of two sets of parallel equidistant lines that is used for locating points on a printed board.

Gross Leak

A leak in a sealed package that is greater than 0.00001 cubic centimeters per second at one atmosphere of differential air pressure.

Grommet

Metal, plastic, or rubber rings that are inserted into a hole made through another material. They may be used to reinforce the hole, to shield something from the sharp edges of the hole, or provide a seal.

Ground

A common reference point for electrical circuit returns, shielding, or heat sinking.

Ground Plane

A conductor layer, or portion thereof, that serves as a common reference for electrical circuit returns, shielding, or heat sinking. (See also “Signal Plane” and “Voltage Plane.”)

Guarding

The protecting activity or a protective shielding for ensuring that a shunt path in an electrical circuit does not interfere with the adjacent devices or conductors.

Guide Pin

A connector interfacing device that allows for connector body movement in order to facilitate contact alignment prior to contact engagement.

Gull Wing Leads

An SMT lead form. Leads extending horizontally from the component body centerline, bent downward immediately past the body and then bent outward just below the bottom of the body, thus forming the shape of a gull's wing.

H**Halide Content (Flux)**

The ratio of the mass of free halides to the mass of solids in a flux expressed in mass percent of free chloride ion.

Haloing

Mechanically-induced fracturing, on or below the surface of a base material, that is usually exhibited by a light area around holes or other machined features.

Hand Soldering

Soldering using a soldering iron or other hand-held, operator-controllable apparatus.

Hard Wiring

Electrical wiring that is inseparable from an assembly without the use of special tools and processes.

Hardener

See “Curing Agent.”

Hardness

A measure of the resistance of solid matter to indentation or other deformation when a force is applied. (See also “Durometer.”)

Harness

A group of wires or cables that are routed together and which provides interconnection of electric circuits.

Head in Pillow

See “Head On Pillow.”

Head On Pillow

A solder defect in which the solder sphere (ball) of an area array component and its associated solder have both melted and re-solidified, but have not combined to form an integral solder joint.

Header (Connector)

A pin field that is positioned in a 3- or 4-sided plastic housing that mounts directly onto a printed board.

Header (Module)

The base of an electronic component package that contains leads.

Heat Absorption Coefficient

The degree to which various materials absorb heat or radiant energy when compared to each other.

Heat Cleaning

A process in which organic yarn binder (size) is removed from a fabric. (See also “Sizing.”)

Heat Column

The heating element in a eutectic die bonder or wire bonder that is used to bring the substrate up to its bonding temperature.

Heat of Fusion

The quantity of heat required to convert a unit weight of solid material to its liquid state in an isotherm transition.

Heat Resistance

The degree to which a material resists changes in its physical properties when subjected to changes in temperature.

Heatsink

A mechanical device that is made of a high thermal-conductivity and low specific-heat material that dissipates heat generated by a component or assembly.

Heatsink Plane

A continuous sheet of metal on or in a printed board that functions to dissipate heat away from heat generating components.

Heatsink Tool

A heatsink that is temporarily attached to a heat-sensitive component in order to minimize the transfer of heat from the component lead to the component body during a soldering operation.

Heavy Mark (Fabric)

A filling defect that extends across the width of a fabric containing in excess of two picks per inch from nominal.

Heel, Bonding

The part of a lead adjacent to a termination that has been deformed by the edge of the bonding tool.

Heel Break

The rupture of a lead at the heel of a bond.

Heel Crack

A crack across the width of a lead at the heel of a bond.

Heel (Drill)

The trailing edge of a drill land.

Heel Fillet

The solder fillet formed in the land area behind the lead. (See Figure H-1.)

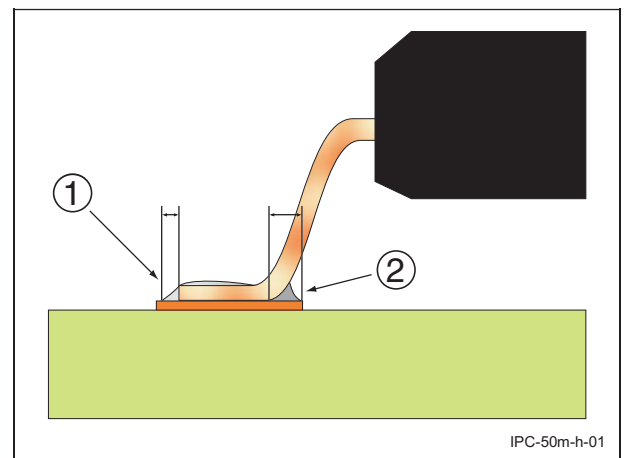


Figure H-1 Heel Fillet

1. Toe Fillet

2. Heel Fillet

Helix Angle

The angle of the spiral generated by the flute of a drill with respect to the axis of the drill. (See Figure B-11.)

Hermaphroditic Contact

A type of connector contact that mates with a contact that is identical to itself.

Hermetic (Sealed)

The condition of sealing a component from incoming gases to a specific of inward diffusion normally less than 1×10^{-6} cubic cm per second.

Hierarchical Database

A database that is arranged in a tree-like structure of logic.

High Density Interconnect (HDI)

A generic term for substrates or boards with a higher circuit density per unit area than conventional printed boards, often containing microvias.

High Density Plastic Quad Flat Pack

A QFP with greater than 196 leads at a pitch of 0.4 millimeters.

High-Impedance State

See “Tri-State.”

High-Voltage Wire

Insulated wire, with an insulation thickness that is determined by corona-related factors, that is used for voltages over 240 Vac RMS or over 340 Vdc.

Hipot Test

A test designed to verify the integrity of a conductor's isolation when subjected to a high voltage.

Histogram

An analytical tool in which a graph is obtained by dividing the range of a data set into equal intervals and plotting the number of data points in each interval. (See Figure H-2.)

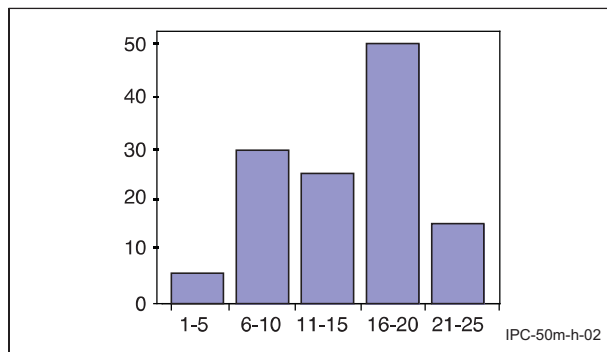


Figure H-2 Histogram

Hole, Knee

The intersection of the wall of a hole at the outermost surface of the printed board. (See Figure H-3.)

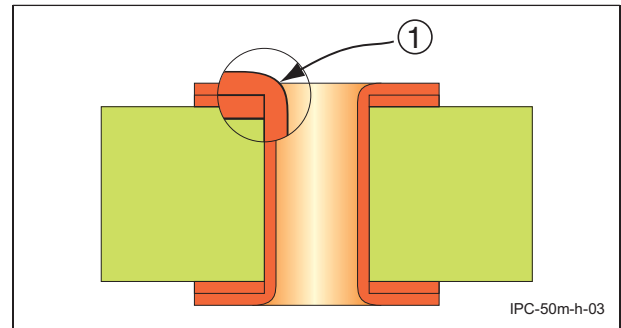


Figure H-3 Hole, Knee

1. Hole, Knee**Hole Base Positioning**

The positioning of a printed board/panel or board assembly/array using tooling holes on the board to facilitate further manufacturing.

Hole Breakout

A condition in which a hole is not completely surrounded by the land. (See Figure H-4.)

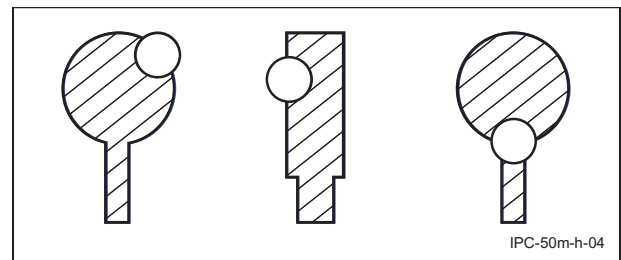


Figure H-4 Hole Breakout

Hole Density

The quantity of holes in a unit area of printed board.

Hole Edge Roughness

Unevenness of the edge of a hole formed by drilling or punching.

Hole Filling Process

A process of adding a conductive or non-conductive fill material to a plated through-hole, followed by adding an etch resist that covers the hole and its land. The process also includes etching away of the unwanted copper and subsequent stripping of the etch resist.

Hole Plugging Process

A process of plugging a plated through-hole with liquid solder mask material after the circuit configuration has been completed in order to prevent chemistry from entering the hole during the assembly process.

Hole Location

The dimensional position of the center of a hole.

Hole Pattern

The arrangement of all the holes in a printed board.

Hole Pull Strength

The load or pull force along the axis of a plated-through hole that will rupture the hole.

Hole Roughness

The coarseness of a hole (at the knee of the hole) or on the wall (barrel) of the hole caused by drilling or punching.

Hole Plating Void

A void in the metallic deposit of a plated-through hole that exposes the base material. (See Figure H-5.)

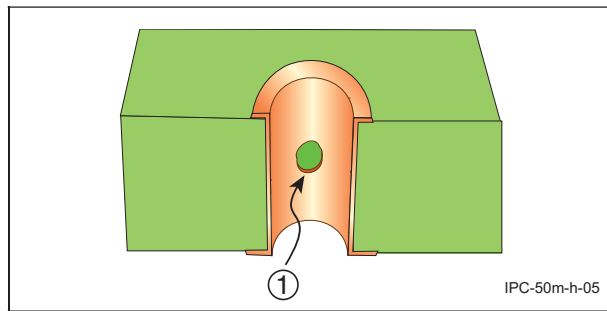


Figure H-5 Hole Plating Void

1. Hole Void**Hole Wall Pullaway**

A separation between the copper PTH/via barrel wall and the surrounding resin matrix, typically occurring after exposure to soldering process(es) and the result of some plastic deformation of the copper barrel walls at peak soldering temperatures.

Homologous Series

A series of organic compounds in which each successive member has one more CH_2 group in its molecule than the preceding member.

Homopolymer

A polymer derived from a single monomer with the aid of initiators that act in the manner of catalysts.

Hood

A cover used to enclose wires that are assembled into a connector.

Hook

The rake condition in the flute face of a drill. (See Figure H-6.)

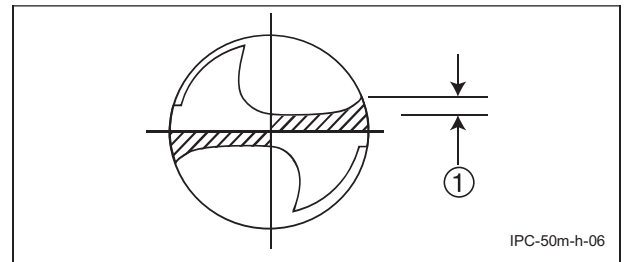


Figure H-6 Hook

1. Hook**Hook Solder Terminal**

A solder terminal with a curved feature around which one or more wires are wrapped prior to soldering. (See Figure H-7.)

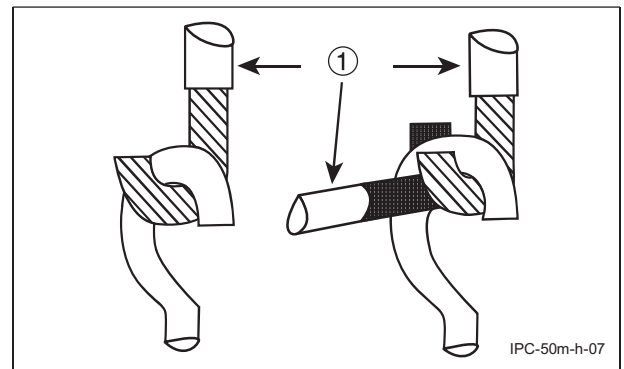


Figure H-7 Hook Solder Terminal

1. Wire Lead**Horn**

A cone-shaped object that transmits ultrasonic energy from a transducer to a bonding tool.

Hot Air (Solder) Leveling (HASL)

A physical deposition process using a solder bath into which the printed board is immersed into a molten solder bath and withdrawn across a set of hot air knives (forced hot air flow) used to remove excess solder.

Hot Air Reflow Soldering

A method of reflow soldering where heated air is circulated in a reflow chamber.

Hot Bar

A bonding tool for soldering leads of TAB of QFP to substrate using local heat and pressure.

Hot Plate Reflow Soldering

Reflow soldering using direct contact or close proximity to a hot plate as the primary source of heat.

Hot Stamping

Permanent markings of letters or numbers that are stamped by heat under pressure onto wire insulation or shrink tubing.

Humidity Aging

The exposure to a humid environment as a preconditioning step before a test for component reliability.

Humidity Indicator Card (HIC)

A card on which a moisture-sensitive chemical is applied such that it will make a significant, perceptible change in color (hue), typically from blue (dry) to pink (wet) when the indicated relative humidity is exceeded. The HIC is packed inside the moisture-barrier bag, along with a desiccant, to aid in determining the level of moisture to which the moisture-sensitive devices or printed boards have been subjected.

Hybrid Circuit

A circuit comprising insulating base material with various combinations of interconnected film conductors, film components, semiconductor dice, passive components and bonding wire. See also "Multichip Module."

Hybrid Integrated Circuit

A circuit comprising insulating base material with various combinations of interconnected film conductors, film components, semiconductor dice, passive components and bonding wire that perform the same function as a monolithic semiconductor integrated circuit.

Hybrid Microcircuit

See "Hybrid Circuit."

Hydrolytic Stability

The degree of resistance of a polymer to moisture that may cause permanent property changes.

Hydrophilic Matter

See "Polar Matter."

Hydrophilic Solvent

See "Polar Solvent."

Hydrophobic Matter

See "Nonpolar Matter."

Hydrophobic Solvent

See "Nonpolar Solvent."

Hydrotrope

A chemical that can increase the aqueous solubility of slightly-soluble organic chemicals.

Hydrotrophe

See "Hydrotrope."

Hypersorption

The process by which activated carbon selectively absorbs less-volatile components from a gaseous mixture while the more-volatile components are unaffected.

Hypothesis Test

An objective method to determine, within known levels of risk, whether a hypothesis is accepted or rejected.

I**Icicle**

See "Solder Projection."

Identical Processing

Fabrication that is conducted under conditions that have demonstrated the capability to produce measurable attributes within a narrow band of variability.

Illuminance

Luminous flux striking a surface.

Illumination

See "Illuminance."

Image Blur

The state that a part of an image of the original film is not reproduced on the resist or in the pattern transfer.

Immersion Attitude

The positioning of an object when immersed in a solder bath.

Immersion Conditions

Test conditions resulting when surface mount device package leads are immersed into a solder bath to check resistance to soldering temperatures.

Immersion Plating

The chemical deposition of a thin metallic coating over certain basis metals that is achieved by a partial displacement of the basis metal.

Impedance

The resistance to the flow of current, represented by an electrical network of combined resistance, capacitance and inductance, in a conductor as seen by an AC source of varying time voltage. The unit is Ohm, and is equal to the square root of the sum of the squares of Ohmic resistance, reactance and inductance.

Impulse Current Soldering

See "Parallel-Gap Soldering"

In-Circuit Testing

The application of test signals directly to a device's input terminals and sensing the results directly from the device's output terminals.

In-Process Inspection

An evaluation of quality characteristics relating to a standard, specification, or design drawing during the manufacturing cycle and prior to completion of all manufacturing processes.

Inclusion

A foreign particle, metallic or nonmetallic, that may be entrapped in an insulating material, conductive layer, plating, base material, or solder connection.

Indentation

See "Dent."

Independent Variable

A variable that is statistically related to another variable, based on causal theories outside statistics. For example, temperature and pressure are independent variables explaining variations in the degree of cure of laminated product.

Independent of Size

The concept that requires the tolerance of form or position to vary independent of, and without regard to, feature size.

Index Edge

See "Locating Edge."

Index Edge Marker

See "Locating Edge Marker."

Indexing Notch

See "Locating Notch."

Indexing Slot

See "Locating Slot."

Individual Test Pattern (ITP)

A single test pattern designed and intended to serve a specific evaluation technique for determining a particular aspect(s) of a manufacturer or manufacturing process capability.

Individual Test Specimen (ITS)

A single test specimen that contains an individual test pattern (ITP) and is used to determine a particular aspect(s) of a manufacturer or manufacturing process capability.

Inductance

The property of a conductor that allows it to store energy in a magnetic field induced by a current flowing through it. The unit of measure is henry (H).

Infrared Reflow (IR)

Remelting of solder using infrared heating as the primary source of energy.

Infrared Soldering

A reflow soldering using infrared energy as the source of heat. (See "Infrared Reflow.")

Initiating

See "Activating."

Inner Layer

See "Internal Layer."

Inner-Lead Bond (ILB)

The connection between a conductor on a carrier tape and a bare die. (See also "Outer-Lead Bond.")

Innerlayer Connection

A conductor that connects conductive patterns on internal layers of a multilayer printed board, e.g. a plated-through hole. (See also "Interfacial Connection.")

Inorganic Flux

An aqueous flux solution of inorganic acids and halides. (See also "Acid Flux.")

Insert (Connector)

The element that holds connector contacts in their proper arrangement and electrically insulates the contacts from one another and from the connector shell.

Insert Retention

Axial load in either direction that an insert must withstand without having a structural failure between the pin and the connector.

Insertion Force

The effort required to engage mating components.

Insertion Loss

The ratio of transmitted electromagnetic power to incident power, usually expressed in decibel (dB) units. This loss of power includes losses by conversion to heat in the dielectric and in the conductors.

Insertion Tool

A tool used to insert contacts into a connector.

Inspection Facility

The combination of equipment, personnel, and procedure resources that perform inspection measurements and evaluations for the purpose of ascertaining the conformance of a product to applicable specifications.

Inspection Lot

Consists of all product fabricated from the same materials, using the same processing procedures and construction, produced under essentially the same conditions during a defined time period and offered for inspection at one time.

Inspection Overlay

A transparency with a positive or negative pattern on the overlay of a printed board layer, that is made from a production master and that is used as an inspection aid.

Inspection Personnel

Those individuals that inspect products for the purpose of ascertaining the conformance of a product to applicable specifications.

Inspection Rate

The number of features per unit of time that can be evaluated at specified false-alarm and escape-rate settings.

Instrument Bus

Four common lines or channels to which any analog test instrument can be connected via a multiplexer and any unit under test circuit mode that can be connected via a scanner.

Insufficient Solder Connection

A solder connection that is characterized by the incomplete coverage of one or more of the surfaces of the connected metals and/or by the presence of incomplete solder fillets.

Insulation

A material with a high resistance to the flow of electrical current. (See also "Dielectric.")

Insulation Crimp

An area of a terminal, splice or connection that has been formed around the insulation of the wire. (See Figure I-1.)

Insulation Displacement Connector (IDC)

A cable connector with contacts that displaces the conductor insulation for each wire through a crimping process.

Insulation Resistance

The electrical resistance of an insulating material that is determined under specific conditions between any pair of contacts, conductors, or grounding devices in various combinations.

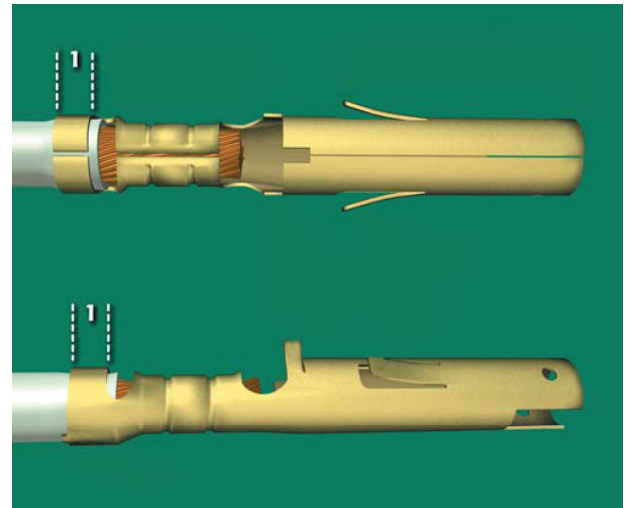


Figure I-1 Insulation Crimp
1. Crimp Around Insulation Wire

Insulation Support

An extension of the rear portion of the contact that gives the wire side support.

Integrated Circuit

A combination of inseparable associated circuit elements that are formed in place and interconnected on or within a single base material to perform a particular electrical function.

Integrated Passive Component

A passive electrical component (resistor, capacitor, etc.) that is embedded and integrated within the cross section, or layers of, a printed board.

Inter-Test Time (ITT)

The duration between two successive tests in a test series with the same apparatus.

Interconnection

The joining of electrical devices to complete a circuit.

Interconnection Density

The average number of conductors, based on conductor width and clearance, that may be routed in a prescribed unit area, e.g. cm^2 , considering that there is no restriction within the area to the routing condition and that the conductor length is equal to the unit length of the prescribed area.

Interface Resistance

See "Contact Resistance."

Interfacial Connection

A conductor that connects conductive patterns on both sides of a printed board, e.g. a plated-through hole. (See also "Interlayer Connection.")

Intergranular Corrosion

Corrosion that occurs preferentially at grain boundaries.

Interlaminar Metallization

See “Electrochemical Migration.”

Interlayer Connection

An electrical connection between two or more layers of conductive patterns on or in a printed board. (See also “Inner-layer Connection.”)

Intermetallic Compound, Solder

An intermediate layer in a wetted solder connection between the wetted surface and the solder, consisting of the solution of at least one constituent of the wetted surface and at least one constituent of the solder.

Intermittent Fault

A fault whose effect on a circuit appears and disappears at irregular intervals.

Internal Capability Assessment

Periodic supplier verification of data captured through process control and analyzed for variation that exceeds the performance limits desired by the manufacturing processes.

Internal Layer

A conductive pattern that is contained entirely within a multilayer printed board.

Interposer

A material placed between two surfaces giving electrical insulation, redistribution of electrical connections, mechanical strength and/or controlled mechanical and thermal separation between the two surfaces. (See Figure I-2.)

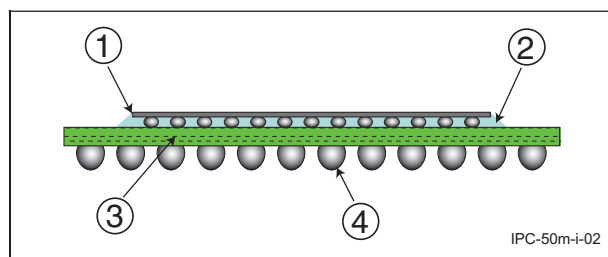


Figure I-2 Interposer

1. Flip Chip Die Element
2. Polymer Underfill
3. Substrate Interposer
4. Interposer-to-Printed Board Solder Ball Contacts

Interstitial Via

See “Blind Via” and “Buried Via.”

Intrusive Soldering

A process in which the solder paste for the through-hole components is applied using a stencil or syringe to accommodate through-hole components that are inserted and reflow-soldered together with the surface-mount components.

Intumescence

The foaming or swelling of a material when it is exposed to high surface temperatures or flames.

Ion Exchange

A reversible chemical reaction between a solid and a fluid by means of which ions are interchanged from one substance to another.

Ionic Cleanliness

The degree of surface cleanliness with respect to the number of ions or weight of ionic matter per unit square of surface.

Ionizable (Ionic) Contamination

A polar (ionic) compound, usually a processing residue, that dissolves in water as free ions. (This includes flux activators, finger prints, etching or plating salts, etc., that decrease the resistivity of water when they are dissolved in it.)

Isotropy

The condition for a substance having a value for a property that is the same in all directions.

J**Jacket**

An outer covering of a cable, wire, etc., usually nonmetallic, mainly used for protection from the environment.

Jacket Pullout (Pop-Out)

Where the sleeve, cable jacket or insulation is pulled out of the molded connector.

Jackscrew

A screw attached to one half of a two-piece, multiple-contact connector and used to draw both halves together or to separate them.

J-Leads

The preferred surface mount lead form used on PLCCs, so named because the lead departs the package body near its Z axis centerline, is formed down and then rolled under the package. Leads so formed are shaped like the letter “J.”

Jet Wave Soldering

A type of wave soldering that uses a pump to force solder up through a narrow slit to form a solder jet.

Job Set

A group of one or more data-information modules.

Jumper Wire

A discrete electrical connection that is part of the original design, or a discrete electrical connection that is used to bridge portions of the basic conductive pattern of a printed board.

Junction Temperature

The temperature of the region of a transition between the p-type and n-type semiconductor material in a transistor or diode element produced during operation.

Just-in-Time (JIT)

Production control techniques that minimize inventory by delivering parts and material to a manufacturing facility just before they are incorporated into a product.

K**Kerf**

A laser-beam or abrasive-jet cut (slit) in a film component as a part of the trimming operation.

Key

A device that assures that the coupling of two components can occur in only one position.

Keying (n.)

A device that is used in addition to, or in lieu of, a polarization feature to assure that the coupling of identical mating components can occur in only one position.

Keying

The use of a device in addition to, or in lieu of, a polarizing feature to assure that the coupling of identical mating components can occur in only one direction.

Keying Plug Contact

An object that is inserted into a cavity of a connector housing or insert, to assure alignment of matched components.

Keying Slot

A slot in a printed board that permits the printed board assembly to be plugged into its mating connector and prevents the board from being plugged into any other connector. (See also "Polarizing Slot.")

Keyway

A general term that encompasses both keying slots and polarizing slots.

Kink (Wire)

An abrupt twist or bend from which a wire strand is not easily restored to its original condition.

Knot (Base Materials)

A clump of reinforcement material formed either by the yarn within the web of the fabric or which was deposited onto the web during the treating process.

Known Good Board (KGB)

A correctly fabricated printed board that serves as a standard unit by which others can be compared.

Known Good Assembly (KGA)

A correctly operating printed board assembly that serves as a standard unit by which others can be compared.

Known Good Die (KGD)

A qualification of a semiconductor die which indicates that the die has been tested to a specified or determined level of quality and reliability. (KGD is considered comparable to equivalently packaged parts.)

Known Tested Die (KTD)

A die-form semiconductor product functionally verified by probing tests equal to the expected performance of the packaged product, without full quality assurance by supplier(s). The requirements for testing are AABUS.

Kovar

An alloy of 53% iron, 17% cobalt, 29% nickel and trace elements, with a thermal expansion approximately matching that of alumina ceramics and sealing glasses.

L**L Cut**

A trim notch in a film component that is created by a cut that starts perpendicular to the component's major axis and then turns ninety degrees to complete the trimming operation.

Laminate (n.)

A product made by bonding together two or more layers of material.

Laminate (v.)

The producing of a laminate. (See also "Lamination (Multi-layer)" and "Lamination (Dry Film).")

Laminate Thickness

The thickness of single- or double-sided metal-clad base material prior to any subsequent processing. (See also "Board Thickness.")

Laminate Void

The absence of resin or adhesive in an area that normally contains them.

Lamination (Dry Film)

The process of adhering a dry film photo resist or solder mask to a substrate utilizing heat and pressure.

Lamination (Multilayer)

The process of bonding one or more innerlayers together with an adhesive layer or layers (such as pre-preg) utilizing a combination of heat and pressure.

Land

A portion of a conductive pattern usually used for the connection and/or attachment of components.

Land (Drill)

The peripheral portion of the drill body that is between adjacent drill flutes.

Land Grid Array (LGA)

A generic rectangular component package with termination lands located in a grid pattern on the bottom of the package.

Land Pattern

A combination of lands that is used for the mounting, interconnection and testing of a particular component.

Land Tearing

The tearing of a land from a base material during a test of land adhesion robustness.

Land Width Angle (Drill)

The angle between the minor cutting edge and the heel of a drill land as measured at the drill axis. (See Figure B-11.)

Land Width (Drill)

The perpendicular distance from the minor cutting edge to the heel of a drill land. (See Figure B-11.)

Landless Hole

A plated-through hole without land(s).

Landless Via

A via in which the land diameter is designed to be less than or equal to the via diameter.

Lanyard

A device, attached to certain connectors, which permits uncoupling and separation of connector halves by pulling on a wire or cable.

Lap Joint

A technique for joining two pieces of material by overlapping them.

Lap Shear Strength

The shearing pressure at which an adhesive-bonded (and cured) lap joint fails. (See also "Shear Strength")

Large-Scale Integrated Circuit (LSI Circuit)

An integrated circuit with over 100 gates.

Laser Bonding

A process effecting a metal-to-metal bond of two conductors by welding them together with a laser beam as a heat source.

Laser Direct Imaging (LDI)

The selective exposure of patterns onto a photosensitive material (such as dry film or liquid) without using a working phototool (artwork master).

Laser Scanner (Bar Code)

A bar code scanner that uses laser technology to read bar codes; has the ability to read from distances and on curved surfaces.

Laser Soldering

Method to reflow solder by optically concentrating and applying a laser beam to the part to be soldered or its individual leads.

Laser Trimming

The modification of a film component's value by the partial removal of film by applying heat from a focused laser beam.

Laser Via

See "Microvia (Build-Up Via)."

Latch (Connector)

A device at both ends of a connector header that is used to hold in place and eject a mating receptacle connector.

Lay-up

The process of combining one or more innerlayers, and pre-preg or adhesive layer(s) into a lamination package. The package may consist of innerlayers, outerlayers and copper foil.

Layer

Stratum of a printed board or semiconductor. Layers are differentiated according to their function (conductor layer, insulating layer) and their location.

Layer-to-Layer-Registration

The process of aligning circuit features (lands) on individual layers of a printed board through the use of tooling image location features (fiducials) or tooling holes.

Layer-to-Layer Spacing

The thickness of dielectric material between adjacent layers of conductive patterns in a printed board. (See Figure L-1.)

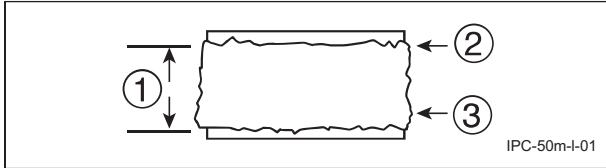


Figure L-1 Layer-to-Layer Spacing

1. Layer-to-Layer Spacing
2. Conductive Pattern
3. Dielectric

Leaching, Metallization

The loss or removal of a basis metal or coating during a soldering operation.

Lead

A length of insulated or uninsulated metallic conductor that is used for electrical interconnections.

Lead Extension

That part of a lead or wire that extends beyond a solder connection.

Lead Fingers

The interior ends of the lead frame leads to which the bond wires are connected to complete the circuit from the integrated circuit die bond lands.

Lead Frame

The metallic portion of the device package on which the integrated circuit die is mounted and connected from the die or dice bonding sites to the structure that becomes the outer leads of the package.

Lead Free Plating

A metallic plating with an alloy containing no more than 0.1% of lead.

Lead Free Solder

An alloy that does not contain more than 0.1% lead (Pb) by weight as its constituent and is used for joining components to substrates or for coating surfaces.

Lead Mounting Hole

See “Component Hole.”

Lead Pin

See “Component Pin.”

Lead Projection

The distance that a component lead protrudes through the side of a printed board that is opposite from the one upon which the component is mounted.

Lead Wire

See “Component Lead.”

Leaded Chip Carrier

A chip carrier whose external connections consist of leads that are around and down the side of the package. (See also “Leadless Chip Carrier.”)

Leaded Surface-Mount Component

A surface-mount component for which external connections consist of leads that are around and down the side of the package. (See Figure L-2.) (See also “Leadless Surface-Mount Component.”)

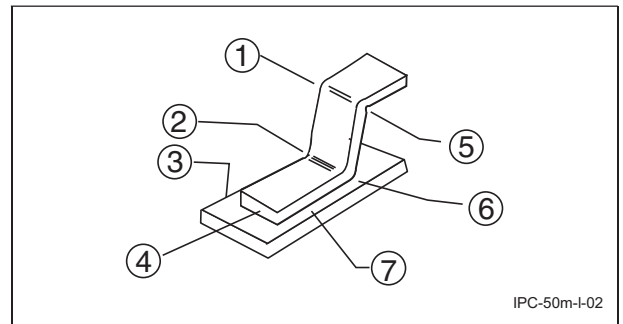


Figure L-2 Leaded-Surface Mount Component Gull-Wing Shaped Lead

- | | |
|----------------------|----------------------|
| 1. Knee | 5. Upper Bend Radius |
| 2. Lower Bend Radius | 6. Heel |
| 3. Land | 7. Foot |
| 4. Toe | |

Leadless Chip Carrier

A chip carrier whose external connections consist of metalized terminations that are an integral part of the component body. (See also “Leaded Chip Carrier.”)

Leadless Component

See “Leadless Surface Mount Components.”

Leadless Device

See “Die” and “Leadless Surface Mount Component.”

Leadless Inverted Device

A single or multiple device package, where integrated circuits and/or passive devices are mounted in a cavity on the bottom of a leadless ceramic or organic carrier, which is inverted for surface mount attachment to a printed board assembly.

Leadless Surface-Mount Component

A surface-mount component whose external connections consist of metallized terminations that are an integral part of the component body. (See also “Leaded Surface-Mount Component.”)

Leakage Current

The undesired flow of an electrical current at the surface or through an insulator.

Learn Time

The time it takes to do initial programming (teaching) to store feature coordinate locations and other data in an inspection/test machines memory.

Least Material Condition (LMC)

The condition in which a feature of size contains the least amount of material within the stated limits of size.

Legend

A format of letters, numbers, symbols and patterns that are used primarily to identify component locations and orientations for convenience of assembly and maintenance operations.

Leno End Out

Warp-end wrapper that is missing from the end of a fabric.

Leveling

See “Fusing and HASL/HAL.”

Leveling Flux

See “Fusing Flux.”

Leveling Oil

See “Fusing Oil.”

Library

A catalog of related items that contains all of the information about the items that is necessary for processing by a computer program.

Lifted Land

A land that has fully or partially separated (lifted) from the base material, regardless of whether or not any resin is lifted with the land.

Lift-off

See “Solder Fillet Lifting.”

Light Mark (Fabric)

A filling defect that extends across the width of a fabric containing less than one pick per 25 mm from nominal.

Limits of Size

The specified maximum and minimum sizes.

Line

See “Conductor Trace.”

Line Coupling

The interaction between two transmission lines that is caused by their mutual inductance and the capacitance between them.

Lip Height

The perpendicular distance between the two primary cutting edges of a drill, measured in a plane perpendicular to the drill axis and through the drill corner. (See Figure B-11.)

Liquidus, Solder

The temperature at which a solder alloy is completely melted.

Liquefaction (Cured Solder Mask)

When cured (solid) solder mask becomes partially to fully liquefied.

Load Capacitance

The capacitance seen by the output of a logic circuit or other signal source.

Load Time

The time it takes to load a unit in an inspection/test machine and to perform any necessary programming or machine alignment.

Loading Direction

The direction of board passing through an assembly line viewed from the operator side.

Local Fiducial

A fiducial mark (or marks) used to locate the position of a land pattern for an individual component on a printed board.

Local Intelligence

The capability of a work station to independently process data without the use of a host or central processing unit.

Local Reflow Soldering

The process of reflow soldering using the heat that is directly supplied to the local area to be reflowed by an energy beam (laser), soldering iron or hot air reflow tool.

Locating Accuracy (Component)

The accuracy in positioning of a component described by the amount of displacement from the desired position.

Locating Edge

A tooling feature in the form of the edge of a printed board.

Locating Edge Marker

A symbol that is used to identify which edge of a printed board is the index edge.

Locating Notch

A tooling feature in the form of a notch in a printed board.

Locating Slot

A tooling feature in the form of a slot in a printed board.

Location Hole

A hole or notch in the panel or printed board to enable either to be positioned accurately.

Locator (Crimping Die)

Device for positioning terminals, splices or contacts.

Logic

The functional digital circuits used to perform computational functions.

Logic Diagram

A drawing that depicts the multistate device implementation of logic functions with logic symbols and supplementary notations that show the details of signal flow and control, but not necessarily the point-to-point wiring.

Logic Family

A collection of logic functions using the same form of electronic circuit, e.g., emitter-coupled logic (ECL), transistor-transistor logic (TTL), complementary metal-oxide semiconductor logic (CMOS).

Loom Beam

A large flanged cylinder onto which all warp yarns are wound and from which the yarns enter the loom.

Loop Height

The magnitude of deviation of a wire from a straight path between its end attachment points.

Loop, Wire

The curve (arc) in a bonding wire between its end attachment points.

Loss Tangent

See "Dissipation Factor."

Lot Acceptance Number

For an acceptable quality level sample plan, the number of nonconforming units found in the sample equal to or less than the acceptance number, the lot shall be considered acceptable.

Lot Rejection Number

For an acceptable quality level sample plan, the number of nonconforming units found in the sample equal to or more than the rejection number, the lot shall be considered not acceptable.

Lot Size

A collection of units produced in one continuous, uninterrupted fabrication run.

Lot Tolerance Percent Defective (LTPD)

A single lot sampling concept that statistically ensures rejection of 90% of all lots having a greater percentage defective than the specified LTPD.

Low Profile Components

A height of 1.0 mm or less of total package thickness, excluding lead terminations.

Low Residue Solder Paste

A solder paste wherein the ionic, non-ionic, and carrier residues after soldering are controlled to low level.

Lug

A type of wire terminal secured by a screw.

Luminance

The light flux that is emitted or reflected in a given direction per unit of projected area. Its unit is cd/m^2 (Candela per m^2).

Luminous Energy

Energy transferred in the form of visible radiation measured in units of lumen-seconds.

Luminous Flux

A measure of flow of visible light energy past any given point in space, expressed in lumens (lm).

Lyophilic

A characterization of material that readily goes into colloidal suspension in a liquid.

Lyophobic

A characterization of material that exists in a colloidal state with a tendency to repel liquids.

M

Machine Language

The actual language, usually a binary code, that is used by a computer when it performs operations.

Machined Contact

A type of connector contact that consists of solid spring metal that has been formed by machining. (See also “Sheet-Metal Contact.”)

Major Defect

A defect that is likely to result in a failure of a unit or product or that materially reduces its usability for its intended purpose.

Manhattan Distance

The distance between two points in a grid, based on a strictly horizontal and/or vertical path (that is, along the grid lines), as opposed to the diagonal distance. (See Figure M-1.)

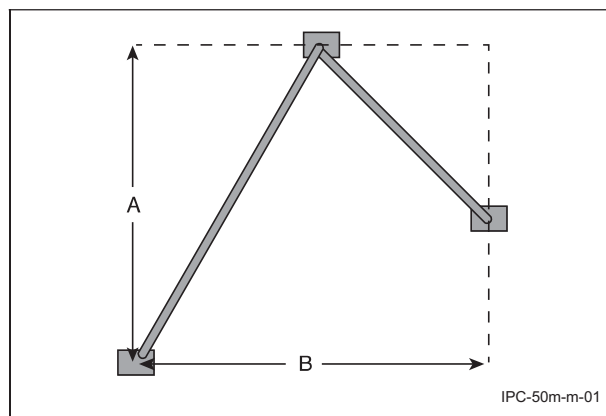


Figure M-1 Manhattan Distance
1. Manhattan Distance = A + B

Manual Data Input

Computer data that is manually inserted with the aid of a data-entry device, such as a keyboard, lightpen, mouse, etc.

Manual Soldering

See “Hand Soldering.”

Manufacturing Drawing

A working document that shows the dimensional limits or grid locations that are applicable to any and all parts of a product to be fabricated, including the arrangement of conductors and nonconductive patterns or elements; the size, type, and location of holes; and all other necessary information.

Manufacturing Hole

See “Tooling Hole.”

Margin (Flat Cable)

The distance between the reference edge of a flat cable and the nearest edge of the first conductor. (See also “Edge Spacing.”)

Margin Width (Drill)

The thickness of the cylindrical portion of a drill land that is perpendicular to the minor cutting edge. (See Figure B-11.)

Mark (Fabric)

A heavy or light area in a fabric that is due to excessive or insufficient filling yarns.

Marking

Recording of traceability and legend information on hardware.

Mask

A coating material, in a specific pattern, that is used to cover or protect selected areas of conductive circuitry during manufacturing or testing from the action of an etchant, plating, solder, etc.

Mass Lamination

The simultaneous lamination of a number of pre-etched, multiple-image, C-staged resin panels or sheets that are sandwiched between layers of B-staged resin and copper foil. (See also “Cap Lamination” and “Foil Lamination.”)

Mass Soldering

Methods of soldering in which many joints are made in the same operation.

Master Dot Pattern

See “Hole Pattern.”

Master Drawing

A control document that shows the dimensional limits or grid locations that are applicable to any and all parts of a product to be fabricated, including the arrangement of conductors and nonconductive patterns or elements; the size, type, and location of holes; and all other necessary information.

Master Line

See “Design Width of Conductor.”

Master Pattern

See “Production Master.”

Mating (Connector)

The joining of two connector halves in a normal engaging mode.

Maximum Material Condition (MMC)

The condition in which a feature of size contains the most amount of material within the stated limits of size.

Maximum Rated Voltage

Maximum voltage between two non-connected adjacent conductors with the greatest potential difference.

Mealing

A condition in the form of discrete spots or patches that reveals a separation at the interface between a conformal coating and a base material on the surface of a printed board, on the surface of an attached component, or both.

Measling

A condition that occurs in laminated base material in which internal glass fibers are separated from the resin at the weave intersection. (This condition manifests itself in the form of discrete white spots or “crosses” that are below the surface of the base material. It is usually related to thermally-induced stress.) (See also “Crazing, Base Material.”)

Mechanical Stress

To subject a mechanical component to a process of physical stress.

Mechanical Wrap

The physical securing of a wire lead or component lead around a solder terminal.

Meniscus

The contour (convex or concave) of a shape that is the result of the surface-tension forces that take place during wetting. (See Figure M-2.)

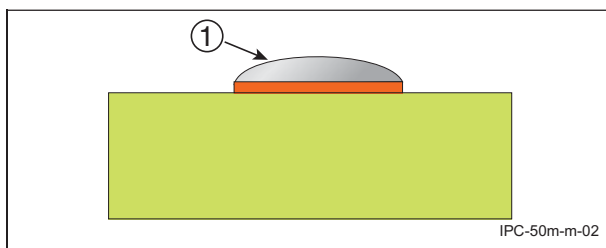


Figure M-2 Meniscus
1. Meniscus

Message (Bar Code)

A string of characters encoded into a bar code symbol of a specific length.

Metal-Clad Base Material

Base material covered with conductive foil on one or both sides.

Metal-Clad Laminate

See “Metal-Clad Base Material.”

Metal Core Printed Board

A printed board having a metal core as the support for the printed board structure, usually used as a heat sink or power supply grounding layer.

Metal Migration

The electrolytic transfer of metal ions along an electrically conductive path from one metal surface to another when an electrical potential is applied to the two metal surfaces.

Metal Migrativity

A measure of the velocity of metal migration under specified conditions.

Metal Surface Migration

The migration of metal on the surface of an electrical insulator.

Metal Through Migration

The migration of metal through an electrical insulator.

Metallized Land Areas

A pattern of conductive material used on a substrate to interconnect electronic components, or a widened conductor area that is used as an attachment point for wire bonding or other devices.

Metallization (n.)

A deposited or plated thin metallic film that is used for its protective and/or electrical properties.

Microbond

A termination made with a small diameter wire, i.e., 0.025 mm [0.001 in] or less.

Microcircuit

A relatively high density combination of equivalent circuit elements that are interconnected so as to perform as an indivisible electronic circuit component.

Microcircuit Module

A combination of microcircuits and discrete components that are interconnected so as to perform as an indivisible circuit assembly.

Microelectronics

The area of electronic technology with, or applied to, the realization of electronic systems from extremely-small electronic elements, devices or parts.

Micron

A linear dimension equal to 1×10^{-6} meters or 39.4×10^{-6} inches.

Microprobe

A small sharp-pointed object with a positional handle that is used to make temporary electrical contact to a land for testing purposes.

Microsectioning

The preparation of a specimen of a material, or materials, that is to be used in a metallographic examination. (This usually consists of cutting out a cross-section, followed by encapsulation, coarse-grinding, polishing, etching, staining, etc.)

Microsection (Mount)

The polymer encapsulation of a sample for support during destructive cross-sectional view preparation. Without this support, the sample would be unacceptably deformed by grinding and polishing, such that it could not be examined. It is commonly used for the microscopic examination of printed board features.

Microstrip

A transmission line (See “Transmission Line”) structure that consists of a signal conductor that runs parallel to and is separated from a much wider reference plane. (See Figure M-3.)

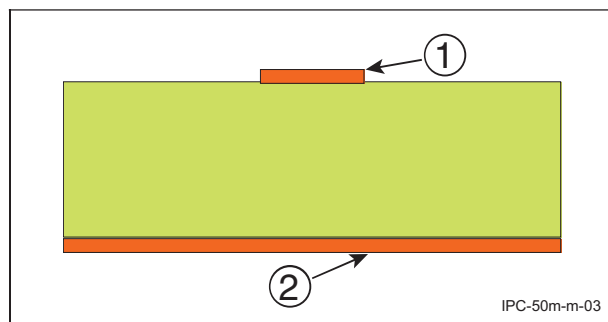


Figure M-3 Microstrip

1. Signal
2. Ground

Microvia

A blind structure (as plated) with a maximum aspect ratio of 1:1 when measured in accordance with Figure M-4, terminating on or penetrating a target land, with a total depth (X) of no more than 0.25 mm [0.00984 in] measured from the structure’s capture land foil to the target land.

Microwave Integrated Circuit

An integrated circuit that performs at microwave frequencies.

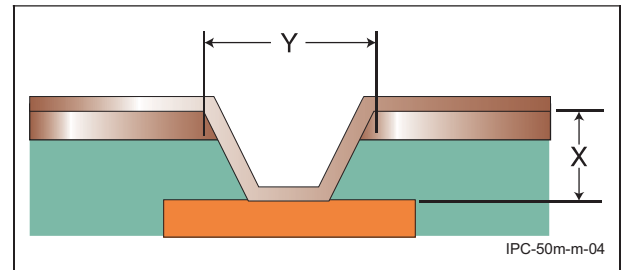


Figure M-4 Microvia Definition

Note: X/Y = Microvia Plating Aspect Ratio, with $X \leq 0.25$ mm [0.00984 in] and aspect ratio $\leq 1:1$.

Microwave Laminate

A laminate of metal cladding on dielectric substrate of composition selected to be suitable for circuit boards intended for operation at microwave frequencies.

Microwaves

A term generally applied to radio waves in the frequency range of 1GHz to 100 GHz. It generally refers to the frequency range where circuits and device interconnects are described as distributed elements instead of lumped elements.

Migration (Pressure Sensitive Tape)

The movement between tape components or between the tape and the surface to which it is applied, over a long period of time.

Migration Rate

The distance over which metal migration proceeds in a given unit of time.

Migration Resistance

That property of a printed board that resists insulation degradation by electromigration of metal atoms of a conductor under the influence of a difference in electrical potential.

Migration Velocity

See “Migration Rate.”

Minimally-Packaged Die (MPD)

Die that have had some exterior packaging medium and interconnection structure added for protection and ease of handling.

Minimum Annular Ring

See “Minimum Annular Width.”

Minimum Annular Width

The minimum width of metal(s) at the narrowest point between the edge of a hole and the outer edge of a circumscribing land. (This determination is made to the drilled hole on internal layers of multilayer printed boards and to the edge of the plating on external layers of multilayer and double-sided printed board.)

Minimum Bump Pitch

Minimum pitch between the center of any two perfectly aligned bumps.

Minimum Electrical Spacing

The minimum allowable distance between adjacent conductors, or between conductors and non-common conductors such as mounting hardware, ground, etc., at a given voltage and altitude, that is sufficient to prevent dielectric breakdown, corona, or both, from occurring between the conductors.

Minor Defect

A defect that is not likely to result in a failure of a unit or product or that does not materially reduce its usability for its intended purpose.

Mirrored Pattern

A pattern whose orientation denotes a transposition from right reading. (See Figure M-5.)

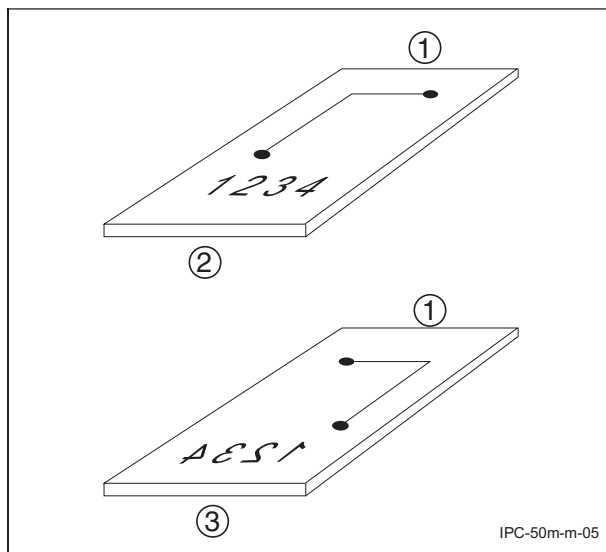


Figure M-5 Mirrored and Right-Reading Patterns
Note: Phototooling emulsion for the right reading Kansas City pattern is by definition the same as for the mirrored pattern. That is, both are either emulsion up or both emulsion down.

1. Primary Side Viewing
2. Right Reading Pattern
3. Mirrored Pattern

Mis-Pick

A break in the pattern of cloth from selvage to selvage that is caused by a missing filling yarn.

Mislocated Bond

See "Off Bond."

Misregistration

Imperfect registration.

Mixed Technology

A component mounting technology that uses through hole components and surface mounting components on a printed board.

Modification

The revision of the form, fit and/or functional capability of a product to satisfy new acceptance criteria.

Module

A separable unit in a packaging scheme.

Module Board

A substrate on which bare die and surface-mount components are attached and interconnected and intended to be further assembled to a product planar board.

Moisture Absorption

Under specified test conditions, the weight percentage of moisture absorbed by a material.

Moisture Barrier Bag (MBB)

A bag designed to restrict the transmission of water vapor and used to pack moisture sensitive devices.

Moisture/Reflow Sensitivity Classification

The characterization, by moisture sensitivity level, of a plastic electronic device's susceptibility to damage due to absorbed moisture when subjected to reflow soldering.

Moisture/Reflow Sensitivity Reclassification

The process of assigning a new moisture sensitivity level (MSL) to a previously classified device.

Moisture Resistance

The measure of how well the insulation characteristics of a material are maintained when exposed to temperature and humidity.

Moisture Sensitivity Level (MSL)

An alphanumeric rating indicating a plastic electronic device's susceptibility to damage due to absorbed moisture when subjected to reflow soldering.

Molded Interconnection Device

A combination of molded plastic substrate and conductive patterns that provide both the mechanical and electrical functions of an electronic interconnection package.

Molding Compound

Material used in conjunction with a mold for encapsulation. See also "Potting Compound."

Molecular Dye-Imaging Material

See "Diazo Material."

Monolithic Integrated Circuit

An integrated circuit in the form of a monolithic structure.

Monomer

A molecule that can chemically bond to other molecules to form a polymer.

Montreal Protocol

An agreement by industrialized nations, at a meeting held in Montreal, Canada, to eliminate chlorofluorocarbons from all processes by 1995.

Motherboard

A printed board assembly that is used for interconnecting arrays of plug-in electronic modules.

Mounting Hole

A hole that is used for the mechanical support of a printed board or for the mechanical attachment of components to a printed board.

Mounting Tack Time

The interval of time required for mounting one component or all components on one printed board.

Mouse Bite (Low Stress Breakaway)

The drill pattern that furnishes a break point. See Figure M-6 and "Breakaway."

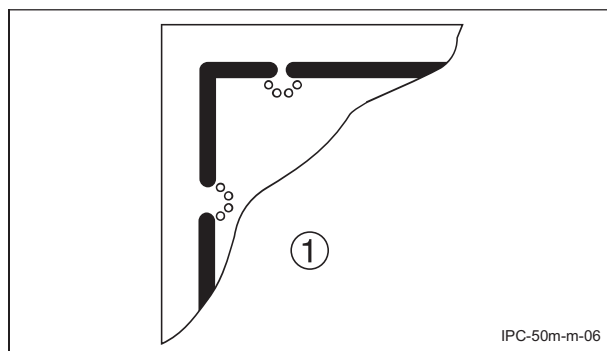


Figure M-6 Mouse Bite (Low Stress Breakaway)
1. Mouse Bite Below Flush

Mouse Bite (Missing Copper)

Missing copper on a feature of a printed board. See Figure M-7.

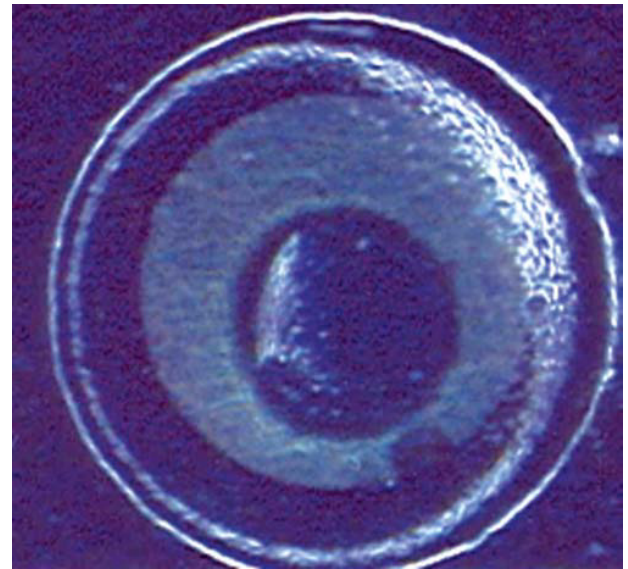


Figure M-7 Mouse Bite (Missing Copper)

Multi-Vari Analysis

A graphical representation of the relationship between variables.

Multichip Integrated Circuit

See "Multichip Module."

Multichip Microcircuit

See "Multichip Module."

Multichip Module (MCM)

A module that contains two or more dice and/or minimally-packaged dice. See Also "Hybrid Circuit" and "Multichip Package."

Multichip Module-Ceramic (MCM-C)

Multichip module primarily using hybrid processing technology where materials of the mounting structure are ceramic or glass-ceramic alternatives.

Multichip Module Deposited (MCM-D)

Multichip module where unreinforced dielectric and conductive materials are added sequentially to form an interconnecting structure on a substrate.

Multichip Module Laminate (MCM-L)

Multichip modules built primarily using printed board manufacturing processes and materials.

Multi-Chip Package (MCP)

A package that contains two or more dice and/or minimally-packaged dice. See also “Hybrid Microcircuit” and “Multi-Chip Module (MCM).”

Multilayer Carrier Tape

Carrier tape with two or more conductor layers.

Multilayer Printed Board

The general term for a printed board that consists of rigid or flexible insulation materials and three or more alternate printed wiring and/or printed circuit layers that have been bonded together and electrically interconnected.

Multilayer Printed Board (Metal Base)

Consists of alternate layers of conductors and base materials laminated to an external metal base including at least one internal conductive layer.

Multilayer Printed Board Assembly

An assembly that uses a multilayer printed board for component mounting and interconnecting purposes.

Multiple Image Production Master

A production master having at least two 1:1 scale patterns.

Multiple Indications

An anomaly that is detected from more than one reference point.

Multiple Pattern

The arrangement of two or more 1:1 scale patterns contained within the size of one panel.

Multiple Printed Board

A printed panel in which one or more patterns occur two or more times, processed as a single unit and subsequently divided.

N**Nail Heading**

The flared condition of copper on an inner conductive layer of a multilayer printed board that is caused by hole-drilling. (See Figure N-1.)

Nail

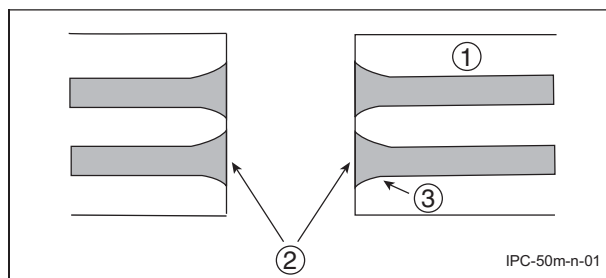
See “Probe, Test.”

Nailhead Bond

See “Ball Bond.”

Near-End Crosstalk

See “Backward Crosstalk.”

**Figure N-1 Nail Heading**

1. Base Material

2. Nail Heading

3. Copper Conductor Layer

Neckbreak

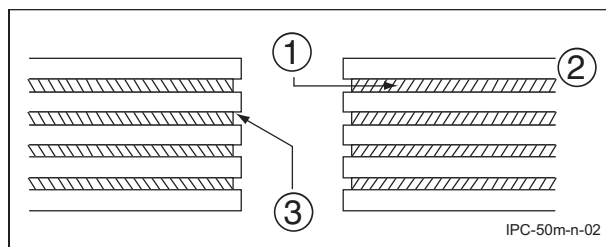
A break in a bond immediately above a ball bond.

Negative

An artwork, artwork master, or production master in which the pattern being fabricated is transparent to light and the other areas are opaque.

Negative Etchback

Etchback in which the inner conductor layer material is recessed relative to the surrounding base material. (See Figure N-2.)

**Figure N-2 Negative Etchback**

1. Copper Conductive Layer

2. Base Material

3. Negative Etchback

Negative Pattern

See “Negative.”

Negative-Acting Resist

A resist that is polymerized by light and which, after exposure and development, remains on a surface in those areas that were under the transparent areas of a production master.

Neighborhood Processing

The determination of information about a location or pixel by the use of information obtained about its neighbors.

Nesting

Embedding data in levels of other data so that certain routines may be executed or accessed continuously in loops.

Net

An entire string of electrical connections from the first source point to the last target point, including lands and vias.

Net List

A list of alphanumeric representations, each of which is used to describe a group of two or more points that are electrically common.

Neutral Point

The neutral point is usually the geometric center which defines the point at which there is no relative motion of the chip during thermal cycling.

Nick

A cut or notch in a wire on the surface or in the edge of a conductor.

Node

The endpoint of an electrical network branch or the junction of two or more branches.

Nodule

A mass or small lump with an irregular shape that is convex to a surface.

Noise (Process Control)

Factors in a manufacturing process that are uncontrollable or too costly to control.

Nominal

The design target dimension for a physical characteristic of a product or a feature to which a tolerance may be applied that establishes the limits of variation from the target that are acceptable.

Nominal Cured Thickness

The thickness of a multilayer printed board, or the distance between two adjacent layers of a multilayer printed board, after the prepreg has been cured at the temperature and pressure specified for that particular class of resin flow.

Nominal Value

The center value between a minimum and maximum allowance.

Nonactivated Flux

A natural or synthetic-resin flux without activators.

Nonconductive Pattern

A configuration that is formed by the functional nonconductive material of a printed circuit, e.g., dielectric, resist, etc.

Nonconforming

A departure of a quality characteristic from its intended level or state, causing an associated product or service not to meet a specification requirement.

Nonfunctional Interfacial Connection

A plated-through hole in a double-sided printed board that electrically connects a printed conductor on one side of the board to a nonfunctional land on the other side of the board. (See Figure N-3.)

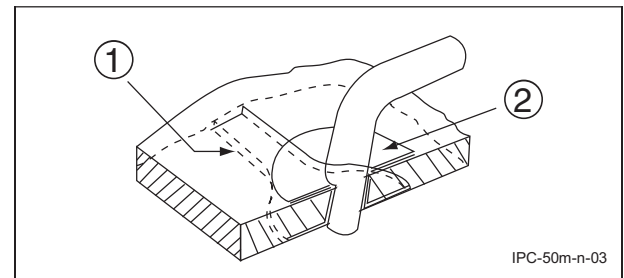


Figure N-3 Nonfunctional Interfacial Connection

1. Conductor

2. Nonfunctional Land

Nonfunctional Land

A land that is not connected electrically to the conductive pattern on its layer.

Nonfunctional Terminal Area

See "Nonfunctional Land."

Nonionic Contaminant

A residue that does not readily ionize in water.

Nonpolar Matter

A substance that cannot be dissolved in water that is soluble in hydrophobic solvents.

Nonpolar Solvent

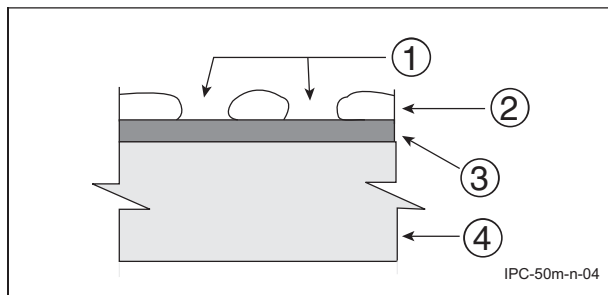
A liquid that is not ionized to the extent that it is electrically conductive, that can dissolve nonpolar compounds (such as hydrocarbons and resins), and cannot dissolve polar compounds (such as inorganic salts.)

Nonwetting (Solder)

The inability of molten solder to form a metallic bond with the basis metal. (See Figure N-4.)

Nonwoven Glass Mat

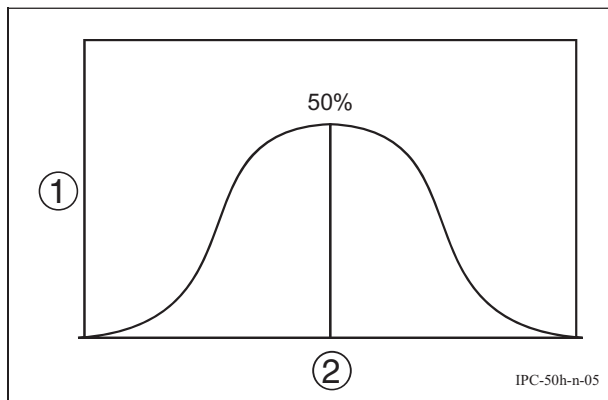
Glass fibers chopped into defined lengths (typically less than 50 mm) and uniformly distributed in random orientation into a horizontal plane and bound together with suitable chemical means.

**Figure N-4 Nonwetting (Solder)**

- | | |
|---------------|------------------|
| 1. Nonwetting | 3. Basis Metal |
| 2. Solder | 4. Base Material |

Normal Distribution

A mathematically-defined continuous distribution of values that has a bell shape that is perfectly symmetrical about a mean value. (See Figure N-5.)

**Figure N-5 Normal Distribution**

- | |
|-----------|
| 1. Number |
| 2. Value |

Null Hypothesis

The supposition that no statistically significant difference exists between two comparable populations. (See also "Alternative Hypothesis" and "Statistical Hypothesis.")

Numerical Control (NC) (Machining)

The automatic control of electromechanical devices by means of a digital input to an electronic controller.

Numerical Control (NC) (Computer Aided Design)

The use of mathematics to define, design or test geometric quantities that are used in a computer-aided technology.

O**Object Code**

The output from a computer compiler or assembler that is, or is suitable for, processing into executable machine codes.

Objective Evidence

Data-based and factual documentation in the form of hard copy, computer data, video, or other media.

Object-Oriented Database

A database that combines graphics and text to describe objects.

Odd-shape Chip Type Component

Parts with rectangular or cylindrical shapes, i.e., semi-fixed resistor or trimmer.

Off Bond

A termination that has some portion of the bonding area extending off the bonding land.

Off-contact Printing

A printing method wherein the image or mask is not in continuous contact with the material to be printed.

Offset Land

A secondary land connected to but separate from its associated hole.

Offset Terminal Area

See "Offset Land."

Omnibus Ring

See "Support Ring."

On-contact Printing

A printing method wherein the imaged mask is in continuous contact with the material to be printed.

One-Piece Connector

See "Edge-Board Connector."

One-Sided Board

See "Single-Sided Printed Board."

Oozing (Pressure Sensitive Tape)

In pressure sensitive tape technology, a squeezing out of the adhesive from under the backing.

Opacuer

A material that, when added to a resin system, renders laminate sufficiently opaque, so that the yarn or weave of the reinforcing material cannot be seen with the unaided eye using either reflected or transmitting light.

Open Circuit Potential

The potential of a cell from which no current flows in the external circuit.

Open, Electrical

A separation of two intended electrically-connected points on a printed board or an electrical circuit. See also “Discontinuity.”

Open-Entry Contact

A type of female connector contact that does not prevent the entry of an oversized mating part. (See also “Closed-Entry Contact.”)

Open Time

The duration of the interval from the application of an adhesive to the formation of a satisfactory bond. (See also “Working Time.”)

Operating Limits (Manufacturing Limits)

Tolerances or specification limits for a process parameter.

Optical Image

An image that is projected onto a viewing screen.

Organic Contamination

A type of contamination composed of one or more organic substances.

Organic Flux

Flux primarily composed of organic materials other than rosin or resin.

Organic Solderability Preservative (OSP)

An organic compound that reacts selectively with copper surfaces forming a thin, uniform film that prevents copper oxidation and helps maintain solderability after extended printed board storage.

Original Production Master

The original artwork or computer data file used to produce the production master that serves as the phototool in the manufacturing image transfer process.

Orthochromatic Emulsion

A photographic emulsion that is spectrally sensitive to the violet, blue, and green portions of the visible light spectrum.

Orthogonal Array Experiment

A balanced experiment whereby the average effect of a factor is determined while systematically changing the levels of all other factors in the design.

Outer-Lead Bond (OLB)

The connection between a conductor on a carrier tape and the base material. (See also “Inner-Lead Bond.”)

Outgassing

The gaseous emission from a material exposed to heat or reduced air pressure, or both.

Outgrowth

The increase in size of one side of a conductor that is caused by plating that is in excess of that delineated on the production master. (See Figure O-1 and Figure O-2.)

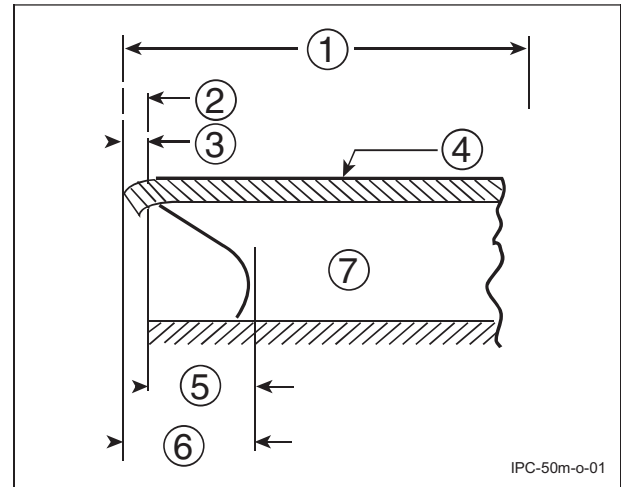


Figure O-1 Outgrowth, Overhang, and Undercut

- | | |
|--|---------------------|
| 1. Conductor Width (Actual) | 4. Tin/Lead Plating |
| 2. Conductor Width As on Production Master | 5. Undercut |
| 3. Outgrowth | 6. Overhang |
| | 7. Copper |

Outlier

An observation that differs significantly from comparable observations in a sample. It may or may not belong to the same population as the remaining observations in the sample.

Overall Length of A Drill

The distance from the end of a drill shank to the cutting end of the tool, including the point. (See Figure B-11.)

Overcoat

A thin film of insulating material that is applied over a semiconductor die for the purposes of mechanical and contamination protection.

Overhang

The sum of outgrowth and undercut. (See Figure O-2.) (If undercut does not occur, the overhang is the same as the outgrowth.)

Overheated Solder Connection

A solder connection that is characterized by solder surfaces that are dull, chalky, grainy, and porous or pitted.

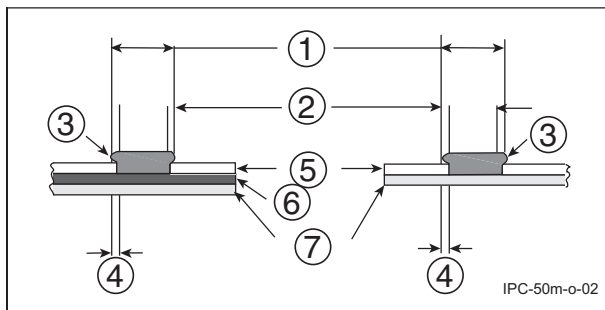


Figure O-2 Outgrowth, Overhang, and Undercut

- | | |
|--|------------------|
| 1. Conductor Width | 4. Outgrowth |
| 2. Conductor Width As on Production Master | 5. Resist |
| 3. Plating | 6. Metal Foil |
| | 7. Base Material |

Overlap (Film)

The contact area between a film component and a film conductor.

Overlap (Wire)

See "Wire Overlap."

Overplate

Conformal metallic deposition on a previously formed conductive pattern or part thereof.

Overprinting

The use of stencils with apertures larger than the pads or annular rings on the board.

Overwrap (Wire)

See "Wire Overlap."

Oxide Transfer

See "Treatment Transfer."

Oxygen Concentration Cell

A galvanic cell resulting primarily from differences in oxygen concentration.

P

Package

The total container which protects one or more electronic components from mechanical, environmental and electrical damage throughout its operational life and which provides means of interconnection.

Package Cap

A cuplike package cover.

Package Cover

The cover that encloses the contents in the cavity of a package in the final sealing operation.

Package Cracking

Cracks in a plastic integrated circuit package caused by stress that results from exposure to reflow solder temperature. These cracks may propagate from the die or die pad to the surface of the package, or only extend part way to the surface or lead fingers.

Package Lid

A flat package cover.

Package Thickness

The component thickness excluding external terminals (balls, bumps, lands, leads) and/or non-integral heat sinks.

Packaging and Interconnecting Assembly

The general term for an assembly that has components mounted on either or both sides of a packaging and interconnecting structure.

Packaging and Interconnection Structure

The general term for a completely processed combination of base materials, supporting planes or constraining cores, and interconnection wiring that are used for the purpose of mounting and interconnecting components.

Packaging Density

The quantity of functions (components, interconnection devices, mechanical devices, etc.) per unit volume. (This is usually expressed by qualitative terms such as high, medium, and low.)

Packing Material

A material that is used to protect electronic items from mechanical, environmental and electrical damage during transportation or storage and that is discarded prior to the incorporation of the item into its end application

Pad

See "Land."

Pad (Land) Cratering

The formation of a cohesive (or adhesive) dielectric crack or fracture underneath the pad of a surface mount component, most commonly BGA packages. (See Figure P-1.)

Paddle

See "Die Pad."

Pallet (Printed Board)

The printed board image or patterns plus the additional contiguous deliverable material from the panel. This may include tabs, fiducials, tooling holes, etc.

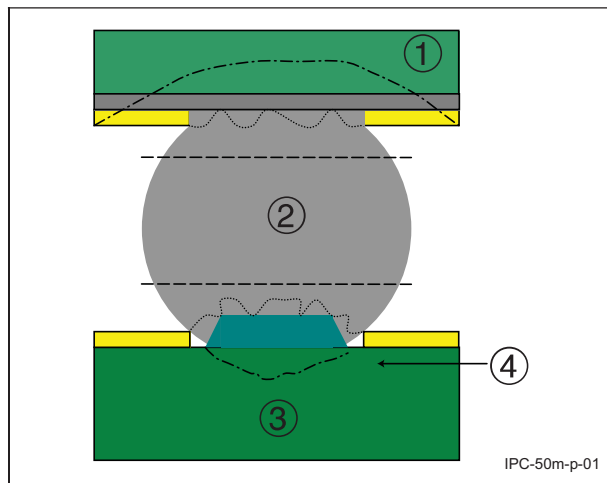


Figure P-1 Pad Cratering

1. Package Substrate 3. Printed Board
2. Solder Ball 4. Printed Board Pad Lift/Crater

Panchromatic Emulsion

A photographic emulsion that is spectrally sensitive to all portions of the visible light spectrum.

Panel

A sheet or set of sheets of base material and/or metal-clad material of predetermined size that is used for the construction and processing of one or more printed boards and, when required, one or more test coupons.

Panel Drawing

A document that shows the production master with related manufacturing patterns and artifacts that relate to the fabrication of printed boards.

Panel Plating

The plating of an entire surface of a panel including holes.

Para-aramid

The generic term that describes fibers that are made from wholly aromatic polyamide, amide polymers in which at least 85% of the amide linkages are directly attached to two benzene rings at the para position in the polymer chain.

Parallel Pair

Two conductors that are side-by-side at a controlled spacing.

Parallel-Gap Soldering

The passing of an electrical current through a high-resistance space between two parallel electrodes in order to provide the energy required to make a soldered termination.

Parallel-Gap Welding

The passing of an electrical current through a high-resistance space between two parallel electrodes in order to provide the energy required to make a welded termination.

Parameter

A variable affecting or describing the measurable or theoretical feature of an input or an output of a process.

Pareto Analysis

A problem-solving technique whereby all potential problem areas or sources of variation are ranked.

Part Line

The split line between the two halves of a matched mold.

Partial Lift

A bonded lead that has been partially removed from the bonding area.

Partially-Clinched Lead

A component lead that is inserted through a hole in a printed board and is then formed in order to retain the component in place and but not necessarily in order to make metal-to-metal contact with a land prior to soldering. (See also "Clinched Lead.")

Passivation

The formation of an insulating layer to protect a surface from contaminants, moisture and particulate matter.

Passivation (Semiconductor Processing)

Top or final processing and covering on a die, usually of semiconductor oxide or nitride, that protects and seals the active areas of the die from further external chemical or mechanical contamination. Note: Bond pads require an opening in this passivation to allow electrical contact.

Passive Array

Comprises multiple passive components of like function, which are formed on the surface of a separate substrate and packaged in a single SMT case. The case is then mounted on the primary interconnect substrate of the system. Examples include an array of capacitors or resistors. See Figure P-2.

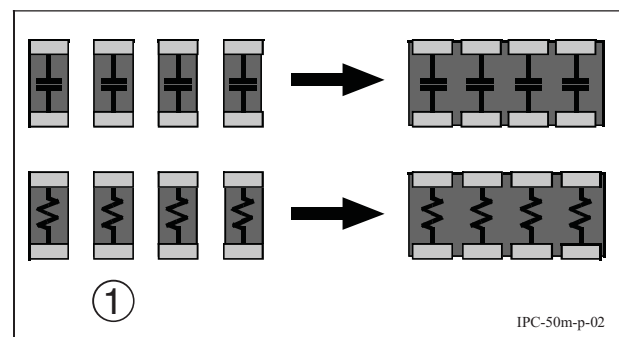


Figure P-2 Passive Array
1. Source: NEMI Roadmap

Passive Base Material

Base material, that does not exhibit transistance, that serves as the physical support and thermal sink for film circuits.

Passive Component (Element)

A discrete electronic device that behaves in a fixed way in response to a signal of a given characteristic. (This includes components such as resistors, capacitors, inductors and transformers.)

Passive Network

Passive networks comprise multiple passive components of more than one function, which are formed on the surface of a separate substrate and packaged in a single SMT case. The case is then mounted on the primary interconnect substrate of the system. Passive networks typically have some internal connections to form simple functions such as terminations or filters.

Passive-Active Cell

A cell whose electromotive force is due to the potential difference between a metal in an active state and the same metal in a passive state.

Paste Flux

A flux formulated in the form of a paste to facilitate its application. (See also “Solder Paste” and “Solder-Paste Flux.”)

Paste-in-Hole

See “Intrusive Soldering.”

Paste Soldering

A soldering method that uses a solder paste applied to the land, device termination, or both.

Path (Electrical)

See “Conductor.”

Pattern

The configuration of conductive and nonconductive materials on a base material, and the circuit configuration on related tools, drawings and masters.

Pattern Area

The section of a designated configuration that includes the pattern and background.

Pattern Plating

The selective plating of a conductive pattern and associated holes.

Peak Package Body Temperature (T_p)

The highest temperature that an individual package body reaches during moisture sensitivity level (MSL) classification.

Peel Adhesion (Pressure Sensitive Tape)

The force required to break the bond between pressure sensitive tape and the surface to which it is applied.

Peel Strength

The force per unit width that is required to peel a conductor foil from a laminate perpendicular to the surface of the substrate.

Peeling (Cured Solder Mask)

The loss of a portion of the solder mask from the printed board resulting from a lack of adhesion.

Percent Contribution

The amount that a single factor contributes to a totality, e.g. a total variation, expressed as a percentage.

Percent of the Field of View

The specific part of interest of the minimum required field of view of a magnification device.

Perforated (Pierced) Solder Terminal

A flat-metal solder terminal with an opening through which one or more wires are placed prior to soldering. (See Figure P-3.)

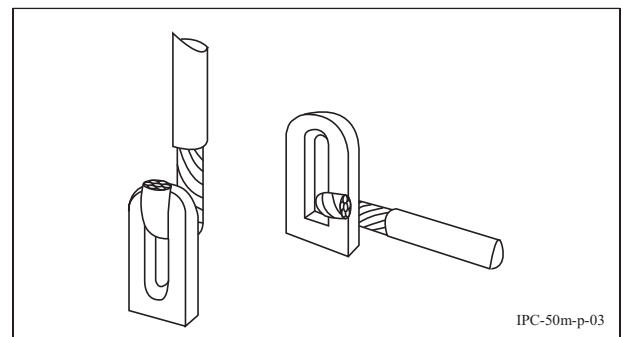


Figure P-3 Perforated (Pierced Solder Terminal)

Perforation

A mechanical method that removes a portion of the material outlining the board, in order to facilitate ease of breakout (removal) from the manufacturing/assembly panel. (See “Breakaway.”)

Performance Index

Mathematical expression that characterizes the quality of control under specified conditions.

Perimeter Sealing Area

The surface on the perimeter of the cavity of a package that is used for attachment to the package cover.

Permanent Resist

A resist that is not removed after processing, e.g., plating resist that is used in a fully-additive process.

Permeability

A general term used to express various relationships between magnetic induction and magnetizing force.

Permeability (Absolute)

The proportional factor between the magnetic induction and the magnetic field strength in vacuum.

Permeability (Relative)

The factor by which the magnetic induction of a material changes relative to the magnetic field strength in vacuum; it is a constant without a dimension.

Permeability (Chemical)

The ability of molecules of a gas or a liquid to flow through a solid.

Permittivity

The square root of the ratio of the electromagnetic wave propagation characteristics of free space to that of the dielectric medium. The permittivity, ϵ , of a material is, in general, a complex-valued (has real and imaginary parts) parameter. The real and imaginary parts of ϵ are given by ϵ' and ϵ'' , respectively. See "Dielectric Constant."

Phenolic Resin

A thermosetting phenol and aldehyde compound resin used in printed board applications that are environmentally benign in terms of moisture, temperature and cycling exposures.

Photographic Fog

Any unwanted increase in density on a negative-working photographic product or a loss of density on a positive-working product that appears on exposed and processed glass film or paper that is not the result of image exposure.

Photographic Image

An image in a photomask or in an emulsion that is on a film or plate.

Photographic Layer

A light-sensitive layer of material that is capable of being exposed and processed so that it yields a visible image.

Photographic Plate

A "soda-lime-silica" sheet of glass with a photographic layer.

Photographic-Reduction Dimension

The dimensions on an artwork master, such as the distance between lines or between two specified points, that determine the extent to which the artwork master is to be photographically reduced. (The value of the dimension refers to the 1:1 scale and must be specified.)

Photomaster

See "Artwork Master."

Photometry

Light measurement where the luminous intensity is compared by measurable attenuation with that of the light source to be measured. The three major types are visual, physical and photographic. For the visual photometry, the eye is the receiver.

Photoplotting

A photographic process whereby an image is generated by a controlled-light beam that directly exposes a light-sensitive material.

Photoprint

The process of forming a circuit pattern image by exposing photo-sensitive material to light energy.

Photoresist

A material that is sensitive to a portion of the light spectrum and that, when properly exposed and developed, can mask the required portions of a substrate to form a pattern or image.

Photoresist Image

An exposed and developed image in a coating on a base material.

Phototool

A phototool is a physical film, Mylar® (or similar), which contains the pattern that is used to produce a circuitry image on a photo-sensitive material by way of exposure to light-energy such as UV light. (see also "Artwork," "Artwork Master," "Production Master," "Working Master.")

Phototooling

The entire group of photographic products that are used to produce a pattern on a base material.

Phototooling Aid

A photographic product that is used to assist in the inspection of, but not the transfer of, imaged patterns.

Photo Via

A via formed by the photo process.

Physical Vapor Deposition

The deposition of a film onto the surface of a substrate by the physical transfer of vapor from the source to the substrate. (See also "Chemical Vapor Deposition.")

Pick (Braid)

Distance between two adjacent crossover points of braid filaments. The measurement in picks per inch indicates the degree of coverage.

Pick (Yarn)

Filling yarn that runs crosswise to the entire width of a fabric.

Pick-Up Force

The force required to pick up a surface mounting component from its packaging medium for placement on a substrate.

Pick-Up Tool

A tool used to pick up surface mount components from a packaging medium for placement on a substrate and which may be hand activated or a part of a pick-and-place machine.

Pilot Hole

See “Tooling Hole.”

Pin Grid Array (PGA)

A square or rectangular component package with pins protruding from the bottom surface with a pitch perpendicular to the plane of the package. (See Figure P-4.)

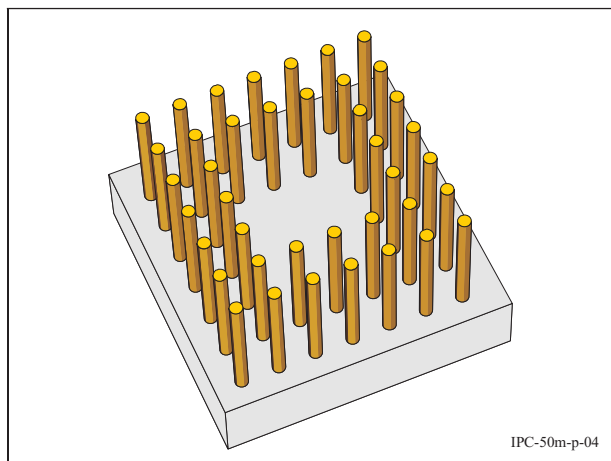


Figure P-4 Pin Grid Array

Pin Lamination

A manufacturing technique utilizing pins to align various innerlayers and prepreg (adhesive layers) during the multi-layer lay-up and lamination process.

Pin-hole (Base Materials)

An open point in the resin coverage of the reinforcement, usually within the window formed by adjacent yarns in x and y directions.

Pinhole (Material)

An imperfection in the form of a small hole that penetrates entirely through a layer of material. (See also “Pit” and “Solder Connection Pinhole.”)

Pinhole (Phototool)

A clear defect that is completely within a black pattern or in the black background of a clear pattern.

Pin-In-Hole

See “Intrusive Soldering.”

Pin-In-Paste

See “Intrusive Soldering.”

Pink Ring

A zone around a through-hole/innerlayer interface from which a copper oxide coating has been chemically removed.

Pit

An imperfection in the form of a small hole that does not penetrate entirely through a layer of foil. (See also “Pinhole, Material.”)

Pitch

The nominal center-to-center distance of adjacent features. (When the features are of equal size and their spacing is uniform, the pitch is usually measured from the reference edge of the adjacent feature.)

Pixel

The smallest definable picture element area capable of being displayed.

Placement Force

The force required to deposit a surface mount component.

Plain Hole

See “Unsupported Hole.”

Plain Weave

A fabric configuration whereby each warp end goes over one pick and under the next, and whereby each pick goes over one warp end and under the next.

Planar Resistor

An etched or deposited resistive element incorporated within or on the surface of the printed board.

Planar-Mount Device

See “Surface-Mount Component (SMC).”

Planar Board

A substrate on which bare chips and surface- and insertion-mount components are mounted. After being mounted with these components, the substrate is no longer heated for mounting on other planar boards. It generally includes motherboards, daughter cards, etc.

Plane Clearance

Removed portions of a plane around a circuit feature, hole or edge of a printed board resulting in isolation from that plane. (See Figure P-5.)

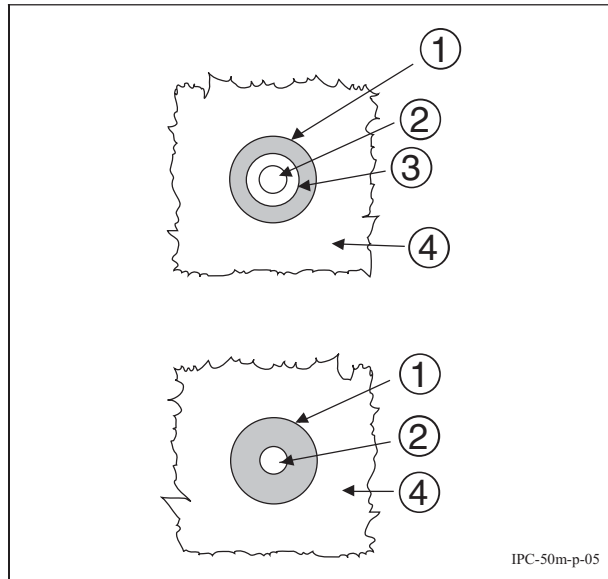


Figure P-5 Plane Clearance

- | | |
|---------------------------|-----------------------|
| 1. Ground-Plane Clearance | 3. Nonfunctional Land |
| 2. Through-Hole | 4. Conductive Pattern |

Plastic

Any of a group of synthetic or natural organic compounds produced by polymerization, optionally combined with additives (organic or inorganic fillers, modifiers, etc.) into a homogeneous material capable of being molded, extruded, coated or cast into various shapes and films.

Plastic QFP (PQFP)

See “Quad Flat Pack.”

Plastic Ball Grid Array (PBGA)

A polymer based package with interconnects formed of tin-lead or lead-free solder spheres. The solder interconnects are located in an array area in board side of package.

Plastic Deformation

Deformation that does, or will, remain permanent after removal of the load that caused it.

Plastic Device

A semiconductor component wherein the package or encapsulant is plastic.

Plastic Leaded Chip Carrier (PLCC)

A surface mount family of integrated circuit packages with leads exiting from all four sides of the package, generally with a 1.27 mm [0.050 in] lead-to-lead pitch.

Plastic QUAD Flat Pack (PQFP)

A surface mount family of integrated circuit packages, bounded on all four sides by bumpers, with leads exiting from all four sides of the package and formed into a “gull-wing” lead format.

Plate Finish, Laminating

The surface finish, without modification by subsequent processing, of the metal on metal-clad base material that results from direct contact with laminating press plates.

Plated-Through Hole (PTH)/Plated Hole

A hole with plating on its walls that makes an electrical connection between conductive patterns on internal layers, external layers, or both, of a printed board. (See Figure P-6.)

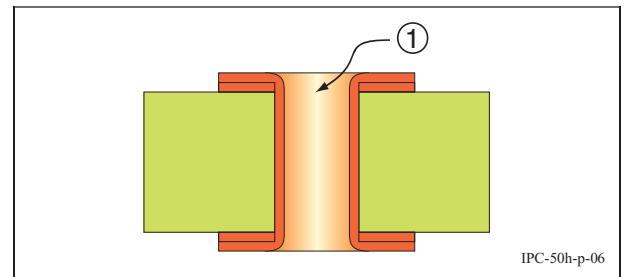


Figure P-6 Plated-Through Hole (PTH)

1. Plated Through-Hole

Plating

Chemical or electrochemical deposition of metal on an entire surface (See “Panel Plate”) or on a conductive pattern (See “Pattern Plate.”)

Plating Bar

The conductive path that temporarily interconnects areas of a conductive pattern that are to be electroplated. (See also “Bus Bar.”)

Plating, Burned

A rough, dull electrodeposit that was caused by excessive plating current density.

Plating Fold

A condition at an area of hole sidewall irregularity where the plating conditions cause the edges of a plating cavity to fuse together and form an enclosure. This cavity can entrap contaminants or process chemistry. (See Figure P-7)

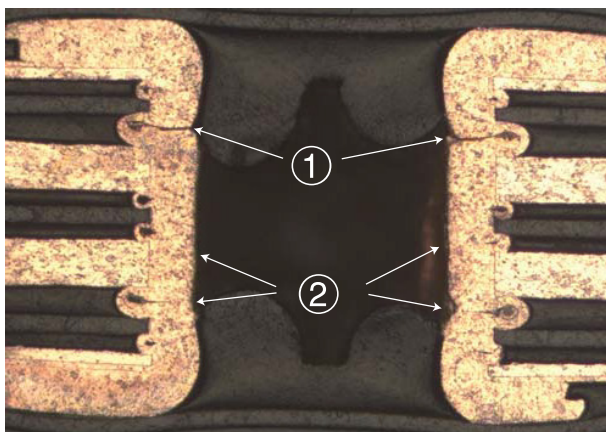


Figure P-7 Plating Fold

1. Not Enclosed
2. Enclosed

Plating Resist

An organic material intended to prevent the deposition of metallic plating on specific portions of copper planes that are on the surface of copper-clad laminate or printed board out-layers.

Plating Solution

A chemical solution containing metal ions used in plating a metal-film on a substrate. Also may be referred to as an electrolyte.

Plating Thief

A nonfunctional pattern on a panel or racking device, that is used to help achieve a more uniform current density on parts during an electroplating process.

Plating, Palladium

One of the lead-free platings using palladium. The basis metal should be Cu or Ni, but not Fe-Ni because of corrosion.

Plating, Tin (Sn)

One of the lead-free platings using tin only and employed mainly for passive chip components. When using Tin (Sn) plating, the occurrence of whiskers is a possibility and should be avoided.

Plating, Tin Bismuth (Sn-Bi)

One of the lead-free plating using tin with bismuth added to no more than about 3%.

Plating, Tin Copper (Sn-Cu)

One of the lead-free plating using tin with copper added no to more than about 2.5%.

Plating, Tin Silver (Sn-Ag)

One of the lead-free platings using tin with silver added to about 3%.

Plating Up

The electrochemical deposition of a conductive material on a base material that takes place after the base material has been made conductive.

Plating Void

An isolated location where the plating is absent or the plating thickness is less than the minimum specified copper thickness.

Plenum

A chamber that is used to uniformly distribute a fluid, e.g., air, nitrogen, or other gas, into a processing chamber.

Plied Yarn

Yarn with two or more twisted yarns.

Plotting

The mechanical converting of X-Y positional information into a visual pattern, such as artwork.

Plug Connector

The unmounted half of a two-piece connector pair that mates with a receptacle connector.

Point Angle

The included angle between two cutting edges of a drill. (See also Figure B-11.)

Poise

A metric unit of measure of viscosity expressed as dyne-seconds per square centimeter.

Poisson Distribution

A discrete probability distribution for attributes data that is particularly applicable when there are many opportunities for the occurrence of an event but a low probability on each trial.

Polar Matter

A substance that can dissolve in water and hydrophilic solvents.

Polar Solvent

A liquid that is ionized to the extent that it is electrically conductive, that can dissolve polar compounds (such as hydrocarbons and resins), but cannot dissolve non-polar compounds (such as inorganic salts).

Polarization

A mechanical arrangement of insert and shell configurations (also referred to as clocking) that prohibits the mating of mismatched plugs and receptacles. This is to allow connectors of the same size to be adjacent, with no danger of installing the wrong connector.

Polarized Component

A component wherein the terminations are assigned as positive or negative electrical polarity.

Polarizing Pin

A pin located on one half of a two-piece connector in such a position that, by mating with an appropriate hole on the other half during assembly of the connector, will assure that only related connector halves can be assembled.

Polarizing Slot

A slot in the edge of a printed board that is used to assure the proper insertion and location of the board in a mating connector. (See also “Keying Slot.”)

Polyester

The synthetic polymer that has more than two ester radicals in the main chain.

Polyimide

The synthetic polymer that has more than two imide radicals in the main chain.

Polymer

A compound of high molecular weight that is derived from either the joining together of many small similar or dissimilar molecules or by the condensation of many small molecules by the elimination of water, alcohol, or some other solvent.

Polymer Reversion

The irreversible softening or liquefaction of a polymer as the result of hydrolysis due to the bombardment of the polymer with vapor molecules that contain an active hydroxyl group.

Polymerize

To form a polymer or polymeric compound.

Polymerized Rosin

Rosin that has reacted with itself during the course of a soldering operation.

Porosity (Solder)

A concentration of small pinholes and pits causing an uneven surface and a spongy appearance of the solder surface.

Positional Tolerance

The amount that a feature is permitted to vary from its true-position location.

Positioner (Crimp)

A device attached to the crimping tool to position the conductor barrel between the indentors.

Positive Pattern

An artwork, artwork master, or production master in which the pattern being fabricated is opaque to light and the other areas are transparent.

Positive-Acting Resist

A resist that is decomposed (softened) by light and which, after exposure and development, is removed from those areas of surface that were under the transparent areas of a production master.

Post

See “Terminal.”

Post Curing

Heat aging in order to stabilize material through stress relief.

Postprocessing

Manipulating data after it has been generated or run through a batch process.

Postprocessor

A processor that interprets generally formulated data by using a software procedure or program and formats them into data that are readable by a numerically-controlled machine or by other computer programs.

Pot Life

The length of time a material, substance, or product is in use while it meets all applicable requirements and remains suitable for its intended use.

Potting

The generic term for the process of molding or encapsulating with a resin or other organic compound.

Potting Compound

A material, usually organic, that is used for the encapsulation of components and/or wires, to exclude moisture, prevent short circuits or provide strain relief.

Potting Mold

An item, solid or split, designed to be used as a hollow form into which potting compound is injected and allowed to cure or set to seal a component.

Power Dissipation

The energy used by an electronic device in the performance of its function.

Power Factor

The cosine of the angle of phase difference between current and the voltage applied.

Power of Experiment

The probability of rejecting a null hypothesis when it is false and accepting an alternative hypothesis when it is true.

Power of Source

See "Radiant Intensity."

Power Plane

See "Voltage Plane."

Power Plane Inductance

The inductance in response to AC noise, seen on a DC back-plane system.

Preconditioning

Preparation of a component, an assembly or a test specimen for processing or testing.

Preferred Solder Connection

A solder connection that is smooth, bright, and feathered-out to a thin edge in order to indicate proper solder flow and wetting action. Also no bare metal is exposed within the solder connection and there are no sharp protrusions of solder or the evidence of contamination, e.g., embedded foreign material.

Pre-finish (n.)

A coupling agent that is applied to a glass fabric in order to improve its compatibility with resins.

Pre-setting

The fixing of component(s) to prescribed position using adhesive to prevent the movement of components during soldering.

Preflow

See "Stabilization Period."

Pregelation Particle

See "Prepreg."

Preheat (n.)

A preliminary phase of a process during which the product is heated at a predetermined rate from ambient temperature to a desired elevated temperature.

Preheat Force

In hot-bar conductive soldering, that portion of the force profile where light contact pressure is made during preheat between a thermode and the component leads being terminated to allow for wetting of the metals being joined prior the application of the full bonding force.

Preheating (v.)

The raising of the temperature of a material(s) above the ambient temperature in order to reduce the thermal shock and to influence the dwell time during subsequent elevated-temperature processing.

Preimpregnated Bonding Sheet

See "Prepreg."

Prepreg

A sheet of material that has been impregnated with a resin partially cured to an intermediate stage, i.e., B-staged resin.

Pressfit Contact

An electrical contact that can be pressed into a hole in an insulator or printed board with or without plated-through holes.

Pretinning

See "Tinning."

Primary Flare

A condition whereby the drill's cutting edge is wider at its periphery than it is at its center. (See Figure P-8.)

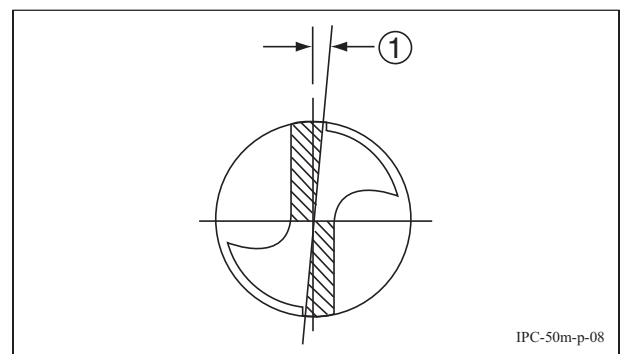


Figure P-8 Primary Flare

1. Primary Flare**Primary Relief**

The clearance angle at the outer corner of the cutting edge of a drill point. (See Figure B-11.)

Primary Side

The side of a packaging and interconnecting structure that is so defined on the master drawing. (It is usually the side that contains the most complex or the most number of components.)

Primary Taper

A condition whereby the cutting edge is wider at the center of a drill than it is at the periphery. (See Figure P-9.)

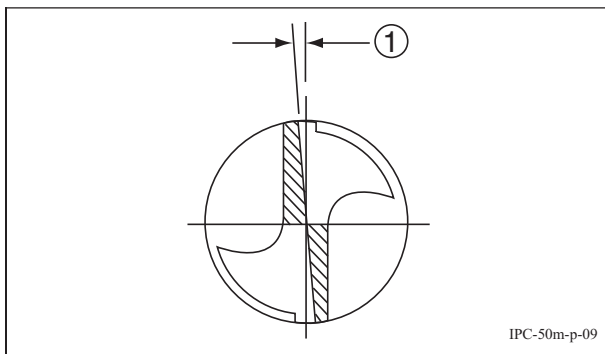


Figure P-9 Primary Taper
1. Primary Taper

Primer

A material used to improve the adhesion of a polymer to a substrate.

Print Contrast Signal

In bar code symbols, a comparison between the reflectance of the bars and spaces.

Printed Board

A composite structure incorporating point-to-point interconnections for electronic circuits. It may include embedded components. (This includes single-sided, double-sided, multi-layer, rigid, rigid-flex, and flex constructions.)

Printed Board Assembly

The assembly that uses a printed board for component mounting and interconnecting purposes.

Printed Board Assembly Drawing

The document that shows a printed board, separately manufactured components, and any information for joining them together in order to perform a specific function.

Printed Circuit

A conductive pattern that is composed of printed components, printed wiring, discrete wiring, or a combination thereof, that is formed in a predetermined arrangement on a common base.

Printed Circuit Board

See "Printed Board."

Printed Circuit Board Assembly

See "Printed Board Assembly."

Printed Component

A part (such as an inductor, resistor, capacitor, or transmission line) that is formed as part of the conductive pattern of a printed board.

Printed Contact

A portion of a conductive pattern that serves as one part of a contact system.

Printed Edge-Board Contact

See "Edge-Board Contact."

Printed Electronics

The manufacturing of electronics by printing (generally additive deposition) processes on or between a wider variety of surfaces than more traditional rigid or flexible printed circuit boards (paper, textiles, glass, etc.).

Printed Wiring

A conductive pattern that provides point-to-point connections but not printed components in a predetermined arrangement on a common base. (See also "Printed Circuit.")

Printed Wiring Board

See "Printed Board."

Printed Wiring Board Assembly

See "Printed Board Assembly."

Printing

Act of reproducing a pattern on a surface by any process.

Probe Point

The predetermined location on a printed board where electrical contact can be made to exposed circuitry for electrical diagnostic purposes.

Probe, Test

A spring-loaded metal device used to make electrical contact between test equipment and the unit under test.

Prober

A device which contacts an individual testing point.

Process Average

The sum of the measured process characteristics divided by the number of measurements.

Process Control

A system or method used to adjust and/or maintain an operation, reducing variation in the processes or products, to meet or exceed quality and performance requirements.

Process Indicator

A detectable anomaly other than a defect that is attributable to variation in material, equipment operation, workmanship or processes.

Process Sensitivity Level

A rating used to identify a component that is solder process sensitive because the component cannot be used in one or more of the base solder process conditions.

Process Spread

The extent to which the individual values of a process may vary.

Producer's Risk

See "Alpha Error."

Production Board

A printed board or discrete-wiring board that has been manufactured in accordance with the applicable detailed drawings, specifications, and procurement requirements.

Production Data

Normal performance data from manufacturing runs generated as a quality assurance function. This data can be compiled, analyzed, and reported as support for product compliance to a standard by the manufacturer.

Production Master

A 1:1 scale pattern that is used to produce rigid or flexible printed boards within the accuracy specified on the master drawing. (See also "Multiple Image Production Master" and "Single Image Production Master").

Production Panel (PP)

A panel consisting of an arrangement of printed boards fabricated from laminate or base materials as a group in a specific cluster to facilitate fabrication techniques.

Production Printed Board (PPB)

A printed board fabricated from laminate or base materials in an environment that consists of controlled and documented chemical, mechanical and electrical processes used in combination to produce the features and characteristics of the final printed board product.

Proficiency

The capability to perform processes in compliance with detailed requirements.

Profile Factor

The amount by which the overall average thickness of a metal exceeds the thickness that is calculated from the established density of the metal and the area of the sample.

Profile Tolerance

Tolerances used to define a tolerance zone to control form or combinations of size, form, orientation, and location of a feature(s) relative to a true profile.

Propagation Delay

The time required for a signal to travel along a transmission line from output to input, or the time required for a logic device to receive an input stimulus, perform its function, and present a signal at its output.

Protective Isolation Coating

Adhesive material having a known dielectric used to insulate conductors.

Protrusion of Conductor

See "Conductor Protrusion."

Pull Strength

See "Bond Strength."

Pull-off Strength (SMD)

The force required to remove a surface mount device (SMD) mounted on a printed board by the application of a force that is perpendicular and away from the surface upon which it is mounted.

Pull-Out Strength

The force, normal to the printed board, required to separate the metallic wall of a plated-through hole from the base material.

Pulse, Digital

A logic signal that switches from one digital state to the other and back again in a short period of time, and that remains in the original state for most of the time.

Pulse Soldering

Soldering by the heat generated by pulsing an electrical current through a high resistance point of the joint area and the solder.

Punching

Formation of a hole, a slot, or a finished board by use of a female die and a male punch.

Push Back

The process of returning the printed board or printed board assembly that has been removed from the panel, back into its original position.

Push-Off Strength

The force required to dislodge a component by the application of a force that is parallel to the surface upon which it is mounted.

Q**QFP with Bumper (BQFP)**

A QFP package with a guarding bumper.

Quad Flat J-Lead (QFJ)

A generic rectangular component package, containing an electronic device, with leads on all four sides that are formed in a “J” shape.

Quad Flat No-Lead (QFN)

A generic rectangular component package outline wherein the metal pad terminations are formed on four sides of the bottom of a package.

Quad Flat Pack (QFP)

A generic rectangular component package, containing an electronic device, with leads on all four sides that are formed in a “gullwing” shape.

Qualification Agency

The organization that is used to perform documentation reviews and audits of an inspection or testing facility.

Qualification Testing

The demonstration that a product meets all the requirements specified.

Qualitative Analysis

The subdivision of chemistry concerned with the identification of materials.

Quality Conformance Testing

Qualification testing that is performed on a regularly-scheduled basis in order to demonstrate the continued ability of a product to meet all of the quality requirements specified.

Quality-Conformance Test Circuitry

A portion of a printed board panel that contains a complete set of test coupons that are used to determine the acceptability of the board(s) on the panel.

Quality Function Deployment (QFD)

A tool used for relating customer requirements to product and process parameters.

Quality System

A set of interrelated or interacting quality elements within an organization's operations.

Quality Management System

A management system which directs an organization in regards to quality.

Quantitative Analysis

Chemical determination of the composition of mixtures or the constituents of a pure compound without regard to quantity.

Quartz Fiber (Electrical Grade)

Quartz yarn or fiber, which is to be used to develop the reinforcement for printed board applications.

Quiet Zone (Bar Code)

In a bar code symbol, the area that contains no markings, immediately preceding the start character and following the stop character.

Quill

A bobbin onto which filling yarns are wound.

R**RF Connector**

Connector used for connecting or terminating coaxial cable.

Radial Lead Component

A component where the leads are located on the bottom, radially and parallel to the central axis.

Radiant Flux

The power that is incident on a surface or emitted from a radiant source in form of radiation, expressed in watts.

Radiant Intensity

The amount of power from a point source that is generated into a solid angle per second, measured in watts per steradian.

Radiation, Infrared

Thermal radiation emitted in the infrared region of the electromagnetic spectrum.

Radiation, Long Wave, Infrared

Infrared energy that is radiated at a wavelength that is between 5 and 100 microns.

Radiation, Medium Wave Infrared

Infrared energy that is radiated at a wavelength that is between 2.5 and 5 microns.

Radiation, Near Infrared

See “Radiation, Short Wave Infrared.”

Radiation, Re-emitted Infrared

That portion of thermal energy absorbed by a media that is in turn emitted in the infrared portion of the electromagnetic spectrum.

Radiation, Short Wave Infrared

Infrared energy that is radiated at a wave length that is between 0.78 and 2.5 microns.

Radiometry

The measurement of radiation in the optical spectrum. (This includes infrared (IR), ultraviolet (UV), and visible.)

Random-Effects Model

An experimental procedure whereby a random sample is taken from a large population of results in such a manner that the conclusions reached can be extended to the entire population and the inferences are not restricted to the experiment in which they were evaluated.

Random Sample

A set of individuals that is taken from a population in such a way that each possible individual in the population has an equal chance of being selected.

Randomization

The random selection of populations of experimental runs, in order to minimize biases that are due to unknown or uncontrollable factors in an experimental design.

Randomness

A situation in which any individual event has the same mathematical probability of occurring as does all of the other events within the set of events.

Ratchet Control (Crimp)

A device used to ensure the completion of a full crimp cycle.

Rebond

A termination made at, on top of, or adjacent to, the location of a prior bond.

Receptacle Connector

The fixed or stationary half of a connector pair that mates with a plug connector.

Reciprocity Failure

The deviation from the Reciprocity Law.

Reciprocity Law

A general law that pertains to chemical reactions that states the mass of product from such a reaction is determined simply by the total energy involved.

Recovered Diameter

Diameter of shrinkable products after heating.

Rectangular Leads

A lead form or leg shape whose cross section is rectangular in shape.

Reduction Marks

A set of stylized patterns in the border area of an artwork between which the photographic-reduction dimension is defined.

Reed

A thin comb made of pressed steel wires between which warp ends are drawn after passing through the needle eyes, used in the production of glass fabric.

Reference Dimension

A dimension without a tolerance that is used only for informational purposes that does not govern inspection or manufacturing operations.

Reference Edge

A physical feature from which measurements are made.

Reference Edge (Cable)

A physical feature of a cable, conductor, etc., from which measurements are made.

Reference Hole

See "Tooling Hole."

Reference Master

Artwork that is free of defects.

Reflection, Signal Propagation

The fraction of a propagating signal that is reflected back toward its source after the signal has encountered a discontinuity in the electrical impedance of the transmission line on which it is traveling.

Reflection Coefficient

The percentage of power (or voltage) reflected from a load that is attached to a circuit or transmission line.

Reflectivity

The percentage of incident infrared energy that reflects from the surface. (See "Transmissivity.")

Reflow Oven

Heating equipment in which the atmosphere and temperature required for the reflow soldering process can be produced and maintained.

Reflow Soldering

The joining of surfaces that have been tinned and/or have solder between them, placing them together, heating them until the solder flows, and allowing the surface and the solder to cool in the joined position.

Reflow Soldering (Nitrogen Process)

A reflow soldering process, carried out in a nitrogen atmosphere, intended to retard oxidation of solder and board conductive surfaces and improve solder wetting.

Reflow Spike

The portion of the reflow soldering process during which the temperature of the solder is temporarily raised above liquidus, causing the solder to melt.

Reflow Temperature

The temperature range of a reflow soldering process during which the solder is in its liquidus phase.

Regardless of Feature Size (RFS)

Indicates a geometric tolerance applies at any increment of size of the actual mating envelope of the feature of size. (See ANSI Y14.5.)

Registered Production Master

A production master that incorporates physical registration features.

Registration

The degree of conformity of the position of a pattern (or portion thereof), a hole, or other feature to its intended position on a product.

Registration Mark

A stylized pattern (symbol) that is used as a reference point for registration.

Regression Analysis

A statistical technique for estimating the parameters of an equation relating one or more independent variables (regressors) to a dependent variable (regressand).

Release Agent

A material used to prevent adhesion and aid in removing a part from a mold.

Relative Permittivity (ϵ_r)

The ratio of the permittivity of a material to that of free space.

Release Liner (Pressure Sensitive Tape)

A web or sheet of material covering the adhesive side of a pressure sensitive tape.

Reliability

The probability that a component, device, or assembly will function properly for a definite period of time under the influence of specific environmental and operational conditions.

Re-melting Separation

The phenomenon in which solder on the previously soldered surface is re-melted by the heat being applied for soldering on the opposite side, causing separation of the solder and a component termination, or between the solder and a land (pad).

Removable Contact

A type of connector contact that is not permanently retained within the connector body or insert.

Render True Color

The correction of the color aberrations of an optical system to increase the resolving power.

Repair

Action on a nonconforming product to make it conform to form, fit and functional attributes, but will not meet all drawing requirements. It may involve materials and processes that are not specified by the controlling drawing. Unlike rework, repair can affect or change parts of the nonconforming product.

Repeat Set-Up Time

The set-up time for preparation of a unit or process that is identical to one previously performed.

Repeatability (Accept/Reject) Decisions

The statistical level of features that show the same acceptance or rejection status on a minimum of three consecutive tests using identical operating modes and conditions in a statistically-significant random sample

Reproducibility

The ability of the outcome of measurements to be replicated.

Residue

Any visual or measurable form of process-related contamination.

Resin

A natural or synthetic organic polymeric material. (See also "Rosin" and "Synthetic Resin.")

Resin Flux

A resin and small amounts of organic activators in an organic solvent.

Resin Particle (Base Material)

An inclusion that is normally amber to brown and slightly translucent, composed of a particle of non-indigenous and previously dried or cured resin that may appear similar to "treater dirt" which tends to be less translucent, darker and chunkier.

Resin Recession

The separation of the resin portion from the metallization of a plated-through hole of a printed board away from the metal wall, that occurred during the exposure of the board to high temperatures, and is visible in a microsection in the form of voids. (See Figure R-1.)

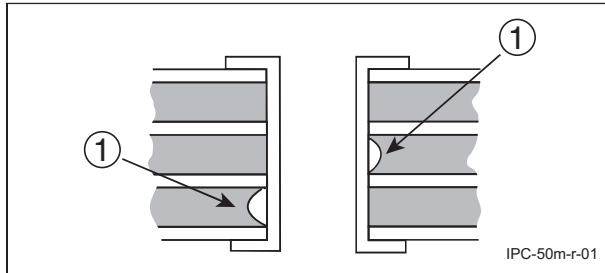


Figure R-1 Resin Recession
1. Resin Recession

Resin Smear

Base material resin that covers the exposed edge of conductive material in the wall of a drilled hole. (This resin transfer is usually caused by the drilling operation.)

Resin-Rich Area

The location in a printed board of a significant thickness of unreinforced resin that is of the same composition as the resin within the base material.

Resin-Starved Area

The location in a printed board that does not have a sufficient amount of resin to completely wet out the reinforcing material. (Evidence of this condition is often in the form of low-gloss dry spots or exposed fibers.)

Resist (Mask)

See "Mask."

Resistance

The restriction to the flow of electrons, determined by Ohms law; the quotient of DC voltage, applied to the extremes of a conductor or insulator, and the current flowing through it.

Resistance Soldering

Joining two conductors by passing a high current through them in the presence of solder.

Resistance to Solvents

The ability of the base laminate and other materials to resist damage to the material when exposed to solvents.

Resistance Welding

Welding by a combination of pressure and heat generated by passing a high current through two mechanically-joined conductors.

Resistive Clad Laminate

A clad laminate containing resistive material that is used in making planar resistors.

Resistor Drift

The irreversible change in resistance of a resistor caused by aging or other factors.

Resolving Power

The ability of a system to distinguish between parallel lines and spaces in an image when their relative displacement is small.

Response Variable

The dependent variable being studied.

Return Loss

Level of the reflected signal which is a result of a mismatch between a load and a source. It is usually expressed as the ratio of reflected power to incident power in dB units.

Reversal Development

The reversing of the tone of an image on a photographic emulsion from that which can be accomplished with conventional developing.

Reverse Current Cleaning

See "Anodic Cleaning."

Reverse Etchback

See "Negative Etchback."

Reverse-Treated Core

A core (innerlayer) whereby the copper foil is laminated to the base material with the drum side down.

Reverse-Treated Foil (RTF)

Metal foil on which the drum or smooth side has been chemically treated to make the surface rougher for increased adhesion to bonded surfaces

Reversion

See "Decomposition."

Rework

The act of reprocessing non-complying product, through the use of original or alternate equivalent processing, in a manner that assures compliance of the product with applicable drawings or specifications.

Rheology

The study of the change in form and flow of matter, generally characterized by elasticity, viscosity, and plasticity.

Ribbon Cable

A flat cable with round conductors.

Ribbon Interconnect

A flat narrow ribbon of metal used to make interconnections to lands, lead frames, etc.

Right Reading

The orientation of a phototool pattern if a legend integrated in the pattern is readable correctly when viewed from the primary side. (See Figure M-5 and Figure R-2.)

Right Reading Down

The orientation of a phototool in which the pattern is right reading and the emulsion is on the surface that is away from the viewing surface. (See Figure M-5 and Figure R-2.)

Right Reading Up

The orientation of a phototool in which the pattern is right reading and the emulsion is on the surface that is toward the viewing surface. (See Figure M-5 and Figure R-2.)

Rigid Double-Sided Printed Board

Double-sided printed board, either printed circuit or printed wiring, using rigid base materials only.

Rigid Multilayer Printed Board

Multilayer printed board, either printed circuit or printed wiring, using rigid base materials only.

Rigid Printed Board

A printed board using rigid base materials only.

Rigid Single-Sided Printed Board

Single-sided printed board, either printed circuit or printed wiring, using rigid base materials only.

Rigid-Flex Printed Board

A printed board with both rigid and flexible base materials.

Ring Tongue Terminal

Round-end tongue terminal with hole to accommodate screw or stud.

Rise Time (Transition Duration)

The time required for a logic-signal voltage to switch from 10 to 90 percent of the difference between logic states.

Risk Management Factor (RMF)

The maximum tolerable percentage of possible defects within a lot (group) of units, based on approximately 95% confidence level.

Robber

See “Plating Thief.”

Robustness

The insensitivity of a process to the effects of normal variation in inputs, causes, or normal conditions of operation or usage.

Roll-to-Roll Process

A method of manufacturing flexible printed circuits using a continuous roll process, rather than individual panels.

Rosin

A natural or synthetic resin, consisting of organic acids and their isomers, and terpene hydrocarbons.

Rosin Flux

Rosin in an organic solvent or rosin as a paste with activators.

Rosin Soldered Connection

A soldered connection that has practically the same appearance as does a cold soldered connection, and may also show evidence of entrapped rosin between the joined surfaces. (See also “Cold Solder Connection.”)

Rotational Error

The angular misalignment of a functional pattern with respect to the X and Y axes.

Router (CAD)

A computer program that automatically determines paths between points to be interconnected.

Router Bit

A straight or shaped rotary cutting tool used in a power router to cut, trim or shape materials by rotary action.

Routing

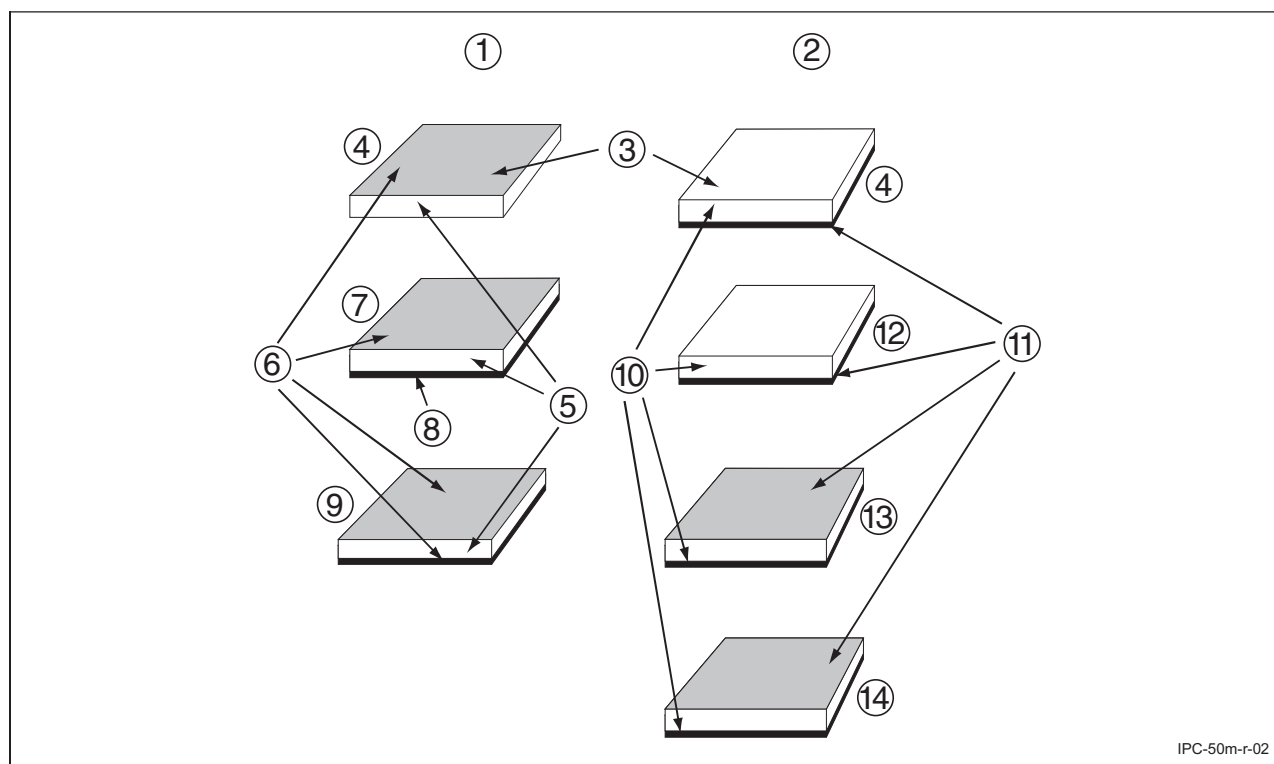
A mechanical method that removes a portion of the material outlining a printed board, using a cutting bit, in order to facilitate ease of breakout (removal) from the manufacturing/assembly panel.

Routing Mark

An artwork feature that is used to define the periphery of a printed board.

Roving

A collection of parallel strands of fibers or filaments assembled with or without an intentional twist.



IPC-50m-r-02

Figure R-2 Viewing Orientations

- | | | |
|---|--------------------------|--|
| 1. Printed Boards | 6. Copper | 11. Emulsion |
| 2. Film | 7. L2 – RR Up | 12. L2 – RR Down |
| 3. Viewing Side | 8. L3 – RR Down | 13. L3 – RR Up |
| 4. L1 – RR Up (Legend Correct Reading) | 9. L4 – RR Down | 14. L4 – RR Up (Legend Reverse Reading) |
| 5. Substrate | 10. Base Material | |

Notes:

1. A precise definition of image tone and orientation necessitates that the orientation of the pattern and the legend be separately identified. For example: Layer 1-Pos RR DN (Legend Corr. Read) or Layer 2-Pos RR UP (Legend Rev. Read) (There is no such thing as wrong reading.)
2. By definition, all layer patterns are viewed from the same direction. (This view defines RR for the pattern appearance of all layers; this is not the same as viewing the final board copper head on.)
3. Legend is usually correct reading when viewing the copper; therefore, on occasion alphanumerics must be reversed reading when the pattern is right reading by definition.
4. Production master emulsion must be presented against the board copper in the stack up. Therefore, production master emulsion orientation is opposite to individual copper layer orientation, i.e., if copper is RR UP by definition, corresponding production master must be RR DN.
5. When specifying artwork tone and orientation, remember the board layup and the purpose of the artwork, i.e., file copy, artwork master, or production master, etc.
6. In manual designs the artwork is usually prepared at an enlarged scale with tapes and other drafting aids. The artwork master is produced from the artwork by photographic reduction.
7. In semi-automated designs, there may be no artwork by definition. Typically, an enlarged color-coded printed wiring layout on a gridded format is prepared for subsequent digitizing and photoplotting. This procedure may yield intermediate phototools which can be photographically processed into an artwork master or it may directly yield an artwork master, working master, or production master.
8. In fully automated systems, there is usually no artwork or printed wiring layout prepared. A computerized procedure from a form of the electrical schematic by total computerization or a combination of computer and interactive design procedures. This procedure may yield intermediate phototools or the artwork master, working master, or production master directly.

Rubber Banding

A technique for displaying a straight line with one endpoint fixed and the other end following the commands of a manual data input device.

Run

The central line between a number of consecutive measuring points of a Statistical Process Control (SPC).

Run Chart

An analytical tool whereby a measured variable is plotted in a time sequence and with a central line developed from the mean or the median of these values.

Run Time

The time elapsed while a unit is in an inspection or testing machine.

Runout

The sum of the cumulative-pitch error across a number of functional patterns on a step-and-repeat phototool.

Runtime System

The collection of software programs required to perform the actual testing and diagnosis of a unit under test.

S**Sacrificial Protection**

The preferential corrosion of a metal coating in order to protect the base metal.

Sacrificial-Foil Laminate

A base material with a treated-metal foil which is subsequently removed, for the purpose of impressing a topography on the surface of the base material.

Safety Data Sheet (SDS)

Provided by the manufacturer, contains relevant properties of the material or product with regards to safety concerns. Previously known as a Material Safety Data Sheet (MSDS).

Sagging

See "Wire Sag."

Sample

A set or group of measurements taken from a population.

Sample Qualification

Producing a product with a given set of parameters intended for evaluation as a sample of manufacturing capability.

Sampling Plan

A statistically derived set of sample sizes, acceptance numbers, and/or reject numbers which will confirm that a given lot of materials meets established AQL or LTPD levels.

Saponifier

An aqueous organic- or inorganic solution with additives that promote the breakdown of fatty acids in rosin and/or water-soluble flux or other materials. It is used to remove flux.

Satin Weave

A fabric configuration where the surface is almost entirely made up of warp filling adjacent yarns, thereby producing a smooth surface. (The intersection points do not fall in a straight diagonal, or twill, but in a patterned formation.)

Scalar Processing

A method of processing data, one element at a time.

Scan Rate

The rate at which a machine scans the surface of the unit being evaluated, expressed in surface area per unit of time or time per unit area of surface.

Scan-Dead Time

The time during a scanning process when data is not being collected from the unit being evaluated.

Scanner, Test

A program controlled relay matrix used for connecting any unit-under-test circuit mode to the analog instrument bus.

Scanning Acoustical Microscopy (SAM)

A method of non-destructive inspection used for identifying buried interfaces of dissimilar materials. Also referred to as C-SAM.

Scanning Electron Microscope (SEM)

A microscope that makes use of a scanning beam of electrons to display details smaller than 100 angstroms in size (surface only).

Scatter Diagram

An analytical tool whereby two variables are plotted together to determine if there is a possible dependent or correlating relationship between the two variables.

Scavenged Air

Vapors and aerosols removed from a processing area to help ensure that there is no process fluid in the workplace.

Schematic Diagram

A drawing that shows, by means of graphic symbols, the electrical connections, components and functions of a specific circuit arrangement.

Scoop-Proof Connector

A connector that incorporates features for preventing contact damage during mating and unmating.

Screen Printing

The transferring of an image to a surface by forcing a suitable ink or other material with a squeegee through an imaged-screen mesh.

Scribe Coat

An opaque material applied to a stable base material, such as, glass or film.

Scribe Line

The area surrounding the die that is set aside on the wafer for the purposes of scribing and sawing the die from the wafer.

Scribing

The cutting of the opaque coating, but not the base material, on a scribe coat.

Scrubbing

The surface preparation of the lead wire and bonding land, in order to break up oxide layers and to improve bondability.

Scum

A resist residue remaining on the substrate's surface following development.

Sealing Plug

A plug that is inserted to fill an unoccupied contact aperture in a connector insert. Its function is to seal, especially in environmental connectors.

Search Height

The height of a bonding tool above the bonding area prior to it being lowered to make the termination.

Seating Plane

The surface on which a component rests.

Second Bond

The second termination in a sequence of bonds made to form a conductive path. (See also "First Bond.")

Secondary Relief

The clearance angle that is behind the primary relief of a drill point. (See Figure B-11.)

Secondary Side

That side of a packaging and interconnecting structure that is opposite the primary side. (See also "Primary Side.")

Sectional Specification (SS)

A document that describes the specific requirements pertaining to a portion of a set, family, or group of products, materials or services.

Seed Layer

See "Activating Layer."

Seeding

See "Activating."

Self Declaration

The manufacturer's view of its products and process capabilities in order to meet the customer's requirements, the requirements of a standard, and/or the applicable associated specification sheet(s).

Self Test

The ability of an analyzer to appraise itself prior to performing a test procedure.

Self-Alignment Effect

An effect that pulls an SMD to the center of the land by the surface tension of the solder during reflow soldering.

Selvage

The edge of the fabric where the body of the fabric ends as defined by the last warp yarn.

Semi-Additive Process

An additive process wherein the entire thickness of electrically-isolated conductors is obtained by the combined use of electroless metal deposition and electroplating, etching, or both. (See also "Fully-Additive Process.")

Semi-Rigid Cable

A coaxial cable that has a solid outer conductor.

Semiconductor

A solid material, such as silicon, that has a resistivity that is midway between that of a conductor and of a resistor.

Semiconductor Carrier

A package for semiconductor die.

Sensitivity Control

The provisions that allow a machine to be set to acceptance and rejection thresholds that correspond to the end-use requirements for the units being evaluated.

Sensitizing

See “Activating.”

Separable Component Part

A replaceable component part with a body that is not chemically bonded, excluding protective coatings, solder, and potting compounds, to the base material.

Sequential Lamination

The process of manufacturing multilayer printed boards in which multiple double-sided printed boards with interconnecting holes between conductive patterns on both sides are laminated or combined, after which additional layers (usually single-sided) are attached to the partially completed board buildup.

Sequentially-Laminated Multilayer Printed Board

A multilayer printed board that is formed by laminating together through-hole plated double-sided or multilayer boards. (Thus, some of its conductive layers are interconnected with blind or buried vias.)

Serial Number

A consecutive identifier of an individual unit of identical units.

Serpentine Cut

A trimming cut in a film resistor in the shape of a wavy (serpentine) pattern.

Service Loop

An extra length of wire or cable included in an electrical or electromechanical assembly for accessibility, freedom of movement or future serviceability.

Service Temperature (Flexible Circuits)

The maximum, continuous temperature exposure that a flexible printed wiring material may withstand without degradation beyond 50% of both initial peel strength and dielectric breakdown for a 100,000 hour lifetime.

Set-Up Time

The time required to change hardware and software, to set-up necessary windows, and to run calibration and verification tests in order to ensure that a system is ready for operation.

Shadowing, Etchback

A condition that occurs during an etchback process in which the dielectric material immediately next to the foil is not removed completely. (See Figure S-1.) (This can occur even though an acceptable amount of etchback may have been achieved elsewhere.)

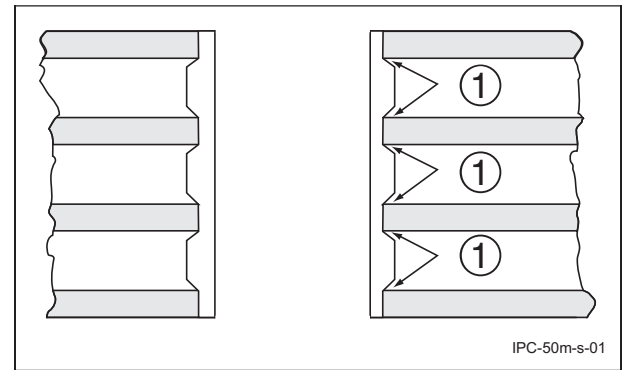


Figure S-1 Shadowing

1. Shadowing**Shadowless Illumination**

The illumination of the area of interest by the light source of a magnifying device so that no shadows fall on the area of interest from objects in the field of view that are not of prime interest.

Shank

The cylindrical part of a drill that is held in the spindle of a drilling machine.

Shank Diameter

The actual size of a drill shank.

Shank-to-Drill Body Concentricity

The total variation of the location of the shank diameter to the drill diameter.

Shear Strength

The force per unit area required to shear apart adhesively bonded (and cured) materials and/or components. (See also “Lap Shear Strength”)

Shear Test

Measurement of shear strength of a connection when shear stress is applied.

Sheath

The outer covering or jacket of a single or multiple conductor cable.

Sheet Capacitance

The electrical capacitance of a material as measured from one electrode to another, expressed in a unit of capacitance (e.g. farads or microfarads) per unit area.

Sheet Resistance

The electrical resistance of a planar film of a resistive material with uniform thickness as measured across opposite sides of a unit square pattern, expressed in ohms per square.

Sheet-Metal Contact

A type of connector contact that consists of flat spring metal that has been formed by either stamping or bending. (See also “Machined Contact.”)

Shelf Life

The length of time a material, substance, or product can be stored, under specific environmental conditions, while it meets all applicable specification requirements and remains suitable for its intended use.

Shell (Connector)

The outside case of a connector into which the insert and contacts are assembled.

Shield

A conductive material that is arranged around a conductor or a group of conductors with an insulating material between the two conductive materials, and intended to limit electromagnetic and/or electrostatic interferences.

Shield (Cable)

The material around a conductor or group of conductors that limits electromagnetic and/or electrostatic interference.

Shield (Adapter)

An intermediate device that allows the termination of the cable shield to the connector shell.

Shielding, Electronic

A physical barrier, usually electrically conductive, that reduces the interaction of electric or magnetic fields upon devices, circuits, or portions of circuits.

Short, Electrical

A fault that connects two or more points that are normally electrically separated.

Short-Term Capability

The capability of a process that exhibits statistical control over a brief period of time.

Shoulder Angle

The angle of the blended transition from the drill shank diameter to the drill body diameter.

Shrinkage Cavity

A cavity or crack occurring around the surface of a soldered area after solidification of the solder joint that does not penetrate into the inside of the soldered area.

Shrink SOP (SSOP)

A family of component packages with four sizes, each having the ability to provide lead pitches between 0.625 mm [0.0025 in] and 0.3 mm [0.012 in].

Shuttle

The device that holds the quill of the filling yarn and carries it back and forth across the width of the fabric, when using conventional weave technique.

Sigma (σ)

The symbol used to designate a standard deviation.

Signal

An electrical mechanism to transmit information from a source to a receiver; the information being contained within some characteristic or form such as, amplitude, polarity, frequency, phase, pulse width, or coding.

Signal Conductor

An individual conductor that is used to transmit an impressed electrical signal.

Signal Line

A conductor used to transmit a logic signal from one part of a circuit to another.

Signal Plane

A conductor layer that transmits electrical signals. (See also “Ground Plane” and “Voltage Plane.”)

Silkscreening

See “Screen Printing.”

Silver Migration

The ionic removal of silver and its redeposition in an adjacent area under the influence of migration-inducing conditions.

Silver Streak (Base Materials)

See “Tunnel Void.”

Simulated Aging

The artificial exposure of material to conditions of both high and low temperature and humidity in an attempt to produce changes that occur during its extended exposure to normal environmental conditions.

Simulated Datum

The surface or feature(s) on a fixture, used as a machine reference, which is correlated to the original board or assembly datum.

Single Chip Package (SCP)

An integrated circuit package containing only one semiconductor die.

Single-Image Production Master

A production master that is used in the process of making only one printed board. (See also “Multiple-Image Production Master.”)

Single-Inline Package (SIP)

A component package with one straight row of pins or wire leads.

Single-Layer Carrier Tape

The carrier for conductors used in tape-automated bonding that consists only of a metal foil. (See also “Multilayer Carrier Tape,” “Two-Layer Carrier Tape,” and “Three-Layer Carrier Tape.”)

Single-Point Bonding

The making of terminations one at a time. (See also “Gang Bonding.”)

Single-Sided Assembly

A packaging and interconnecting structure with components mounted only on one side. (See also “Double-Sided Assembly.”)

Single-Sided Printed Board

A printed board with a conductive pattern on only one side.

Singulate

The act of extracting one unit from a set, as in, stepped images and multiple embedded components.

Sink Mark

A depression in molded material that is caused by uneven cooling/solidification of a molded part.

Sizing

The method of applying size, i.e., starch, to the single filaments of a glass yarn immediately after leaving the drawing nozzles through which the glass filaments are drawn from the molten glass mass. Sizing improves strand integrity, strength and smoothness in order to withstand the rigors of weaving.

Skin Depth

The distance below the surface of a material at which the amplitude of electromagnetic radiation incident on that surface is reduced by a factor of $1/e$, where e is the base of natural logarithms. For a good conductor, skin depth δ may be calculated from the conductivity, magnetic permeability μ , and angular frequency of the radiation ω as $\delta = \sqrt{2/(\mu\sigma\omega)}$.

Skin Effect

The tendency of alternating electric current to concentrate near the surface of the conductor. As a consequence, resistance increases with higher frequencies.

Skip Via

A via that directly connects conductive layers of build-up/HDI layers that are not adjacent with each other.

Skipping

A condition where coating or resist does not cover the spaces between adjacent conductors.

Skiving

The controlled depth process of removing unwanted material, e.g., coverlay from conductive surfaces on a flexible printed board.

Slice

See “Wafer.”

Sliver

A slender portion of plating overhang that is partially or completely separated from a conductor edge.

Slump

The distance that a substance, e.g., adhesive, moves after it has been applied.

Small Outline J-Lead (SOJ)

A generic rectangular component package, whose chip cavity or mounting area occupies a major portion of the package area, with leads on two opposing sides that are formed in a “J” shape.

Small Outline No-Lead (SON)

A generic rectangular component package outline wherein the metal pad terminations are formed on two sides of the bottom of the package.

Small Outline Package (SOP)

A generic rectangular component package, whose chip cavity or mounting area occupies a major portion of the package area, with leads on two opposing sides.

Smear Removal

See “Desmear.”

Smeared Bond

A bond impression that has been distorted or enlarged by excess lateral movement of the bonding tool or holding device fixture.

Soak (Plastic Encapsulated SMDs)

The exposure of a component for a specified time at a specified temperature and humidity. See also “Accelerated Equivalent Soak.”

Socket Contact

A female connector contact.

Soft Error

A temporary electrical state error in a circuit caused by a transient event.

Softening (Cured Solder Mask)

A decrease in hardness as evidenced by a decrease in pencil (scratch) hardness test results.

Solder

A metal alloy with a melting temperature that is below 427 °C [800 °F].

Solder Ball

A small sphere of solder adhering to a laminate, resist, or conductor surface. (This generally occurs after wave solder or reflow soldering.)

Solder Bath

A container or vessel of molten solder into which component parts or assemblies are immersed.

Solder Bridging

The formation of a conductive path of solder between conductors.

Solder Bump

A round ball of solder used to make interconnections between a flip-chip component and a base material during controlled-collapse soldering.

Solder Coat

A layer of solder that is applied directly from a molten solder bath to a conductive pattern.

Solder Connection

A metallurgical connection serving electrical/mechanical/thermal functions that employs solder for the joining of two or more metal surfaces. (See also, "Cold Solder Connection," "Disturbed Solder Connection," "Excess Solder Connection," "Insufficient Solder Connection," "Overheated Solder Connection," "Preferred Solder Connection," and "Solder Connection Pinhole.")

Solder Connection Pinhole

A small hole that penetrates from the surface of a solder connection to a void of indeterminate size within the solder connection.

Solder Contact

A type of connector contact whose non-mating end is in the form of a hollow cylinder, cup, eyelet, or hook that can be soldered to a wire in contact with it.

Solder Cream

See "Solder Paste."

Solder Destination Side

The side of the printed board or mounting structure that the solder flows toward.

Solder Dissolution

A phenomenon whereby metals (i.e., Ag, Pd, Cu) are dissolved in the solder.

Solder Embrittlement

Degradation in mechanical properties of an alloy resulting from intermetallic growth or diffusion along grain boundaries.

Solder Fillet

The visible surface of the solder in a solder connection.

Solder Fillet Lifting

The phenomenon in which a solder fillet is lifted off from a land on a board mainly during the flow soldering process. Usually, the phenomenon is more likely to occur on the primary side rather than on the secondary side which is exposed to flow soldering.

Solder Fillet Tearing

The tearing of a solder fillet from a land (pad). The term often refers to a re-melting separation that happens in mixed component-mounting in lead-free soldering process.

Solder Flow-up

The phenomenon in which molten solder flows from the solder contact side, through a plated-through hole, and wets the non-solder contact periphery, spreading to the component terminations.

Solder Joint

See "Solder Connection."

Solder Leveling

Process of removal of excess solder by immersing a soldered printed board into molten solder and removal of excess solder on the board by heated compressed air.

Solder Luster

A state in which the surface of a solder fillet is smooth and lustrous.

Solder Mask

A heat-resisting coating material applied to selected areas to prevent the deposition of solder upon those areas during subsequent soldering.

Solder Mask Aperture

An opening in a solder mask.

Solder Meniscus

The contour of a solder shape that is the result of the surface-tension forces that take place during wetting.

Solder Paste

Finely divided particles of solder, with additives to promote wetting and to control viscosity, tackiness, slumping, drying rate, etc, that are suspended in a cream flux.

Solder-Paste Flux

Solder paste without the solder particles.

Solder Paste Printing Bleed

A spread of solder paste beyond the opening of screen mask.

Solder Paste Transfer Efficiency

Used to describe solder paste volume that is released from the stencil aperture, expressed as a percentage number based on the actual volume of solder paste released divided by the theoretical volume at 100% release.

Solder Plug

A core of solder in a plated-through hole.

Solder Powder

A small particle of solder having a spherical or irregular shape.

Solder Projection

An undesirable protrusion of solder from a solidified solder joint or coating.

Solder Reflow

See "Reflow Soldering."

Solder Resist

See "Solder Mask."

Solder Side

In a plated-through hole application, the side of the printed board to which solder is applied. (See also "Secondary Side.")

Solder, Silver-Tin

Lead-tin solder with a percent of silver added to prevent the silver dissolution phenomenon, thus increasing the melting point according to the silver content.

Solder Spread Test

The determination of a relative measure of solder flux efficiency that is obtained by determining the area of spread of a specified weight of solder that has been placed on a specially prepared and fluxed metallic surface.

Solder Source Side

The side of the printed board or mounting structure to which solder is applied.

Solder Sputter

Extraneous fragments of solder with an irregular shape.

Solder Terminal

An electrical/mechanical connection device that is used to terminate a discrete wire or wires by soldering. (See also "Bifurcated Solder Terminal," "Cup Solder Terminal," "Hook Solder Terminal," "Perforated (Pierced) Solder Terminal," and "Turret Solder Terminal.")

Solder Webbing

A film of solder that is parallel to, but not necessarily adhering to, a surface that should be free of solder.

Solder Wicking

The capillary movement of solder between metal surfaces, such as strands of wire.

Solderability

The ability of a metal to be wetted by molten solder.

Soldering

The joining of metallic surfaces with solder and without the melting of the base material.

Soldering Flux

See "Flux."

Soldering Iron

A hand tool used to heat the connection surfaces and to reflow solder.

Soldering Iron Tip

The portion of a soldering iron that is used for the application of the heat that melts the solder.

Soldering Oil (Blanket)

Liquid formulations that are used in intermix wave soldering and as coverings on static and wave soldering pots in order to eliminate dross and to reduce surface tension during the soldering operation.

Soldering Temperature Resistance

The ability of the material to withstand the exposure of being subjected to molten or reflow solder temperatures without changing the physical properties of the material in excess of an acceptance criteria.

Solderless Contact

See "Crimp Contact."

Solid-State Bond

See "Diffusion Bond."

Solid-Tantalum Chip Component

A capacitor in a leadless package whose dielectric material is solid tantalum.

Solidus (Soldering)

The temperature at which a solder alloy begins to melt.

Solvent

A non-reactive liquid substance that is capable of dissolving another substance.

Solvent Cleaning

The removal of organic and inorganic soils using a blend of polar and nonpolar organic solvents.

Solvent Extraction

The removal of one or more components from a liquid mixture by intimate contact with a second liquid that is nearly insoluble in the first liquid and which dissolves the impurities and not the substance that is to be purified.

Solvent Pop

Blistering caused by entrapped solvent.

Solvent Release

The ability to permit solvents to evaporate.

Solvent Wash

See "Solvent Cleaning."

Space (Bar code)

The light element of a bar code.

Spacing

See "Center-to-Center Spacing," "Conductor Spacing," "Edge Spacing," and "Pitch."

Spade Contact

A type of male connector contact that consists of flat metal that mates with a fork contact.

Spalling

The chipping, fragmenting or separation of a surface coating, or the cracking, breaking or splintering of materials, due to heat.

Span

The distance from the reference edge of the first conductor in a group of parallel conductors to the reference edge of the last conductor in the group.

Special Characters

Non-alphabetic or numeric characters in a bar code symbol.

Specific Gravity

The ratio of the weight of a given volume of a substance to the weight of an equal volume of water.

Specific Solderability

The ease with which a metal or alloy can be wetted under specific conditions.

Specification Drawings

A document that shows the dimensional limits that are applicable to any or all parts of a component and any other information that is necessary to describe the product to be fabricated.

Specimen

A material, device or circuit, representative of the production lot, which is selected for testing.

Specks

Ink splatter not part of a bar code pattern.

Splay

The tendency of a rotating drill bit to make off-center, out-of-round, holes that are not perpendicular to the drilling surface.

Splice

A process or device that permanently joins two or more conductors.

Split (Fabric)

An opening in a fabric that results from having either the pick or end breaking in two.

Spot Size

The diameter of the focused image of the emitter in bar code.

Spread

The distance a substance, e.g., adhesive, moves after it has been applied at ambient conditions.

Spread (Values)

A general concept for the extent by which values in a distribution differ from one another.

Sprocket Hole

A perforation along the edge of a carrier tape that is used to move and align the tape during the tape fabrication, assembly, and testing operations.

Spur

An undesirable projection from a photographic pattern.

Spurious Signal

An undesirable signal generated by non-linearity of circuits or signal transmitting media.

Sputtering

A method for producing a thin film on a substrate by bombardment of a target material by energetic particles in a vacuum, causing ejected atoms to deposit on the substrate.

Squeegee

A metal or rubber blade used to wipe a material (ink or solder paste) across a stencil or silk screen to force the material through the openings in the screen or stencil, onto the surface of a printed board or mounting structure.

Stabilization Period

A period of time in the temperature profile of a process, e.g. a reflow process, in which the temperature is constant and in which heated parts are allowed to equalize.

Stable Process

A process that is in statistical control.

Stack Pin

The metal pin used for fastening and positioning of a panel(s) in hole drilling or peripheral cutting.

Stacked Via/Microvia

A via/microvia structure formed by stacking one or more build-up vias/microvias in a build-up multilayer providing an interlayer connection between three or more conductive layers.

Staking, Adhesive

The bonding or attaching of components, or component elements, to a surface or together by the application of small quantities of adhesive material.

Staking, Mechanical

The attaching of metallic devices, such as solder terminals and eyelets, by mechanically deforming a portion of the device.

Stamped Printed Wiring

Wiring that is produced by die stamping and bonding a metal foil to a base material.

Stand-Off

A post or protrusion used to facilitate raising a surface mounting device above the surface of the substrate.

Standard Deviation

A measure of the distribution of a population or a sample about a mean value that is equal to the square root of the variance. (See also "Sigma.")

Standard Laboratory Conditions

A laboratory environment with a temperature of 23 ± 3 °C and a relative humidity of $55 \pm 10\%$.

Standard (Electrode) Potential

The potential of a reversible electrode when all products and reactants are at unit activity on a scale in which the potential for a standard hydrogen half-cell is zero.

Standoff Solder Terminal

See "Turret Solder Terminal."

Start/Stop Characters

Distinct characters at the beginning and end of each bar code symbol that provide directional information for the decoding logic.

Static Electricity

An electrical charge (potential) at rest.

Static Electricity Control

A technique where materials and systems are employed to eliminate/discharge static electricity buildup by providing continuous discharge paths.

Static Relative Permittivity

The ratio of the capacitance (C_x) of a given configuration of electrodes with a specified dielectric, filling all the region of electropotential field, to the capacitance (C_v) of the same electrode configuration with a vacuum (or air) as the dielectric.

Statistical Control

The condition describing a process from which assignable causes of variation have been eliminated and predominately random variation remains.

Statistical Hypothesis

In statistical testing, a supposition about a population being sampled. (See also "Alternative Hypothesis" and "Null Hypothesis.")

Statistical Process Control (SPC)

The use of statistical techniques for analyzing a process or its output, in order to take appropriate actions to optimize the process parameters and improve process capability.

Statistical Quality Control (SQC)

The use of statistical techniques to document and assure end product compliance with requirements.

Steam Aging

The exposure of a finish to an environment humidified by steam to precondition the finish for reliability.

Stencil (Solder Paste/Adhesive)

A thin sheet of material containing openings to reflect a specific pattern, designed to transfer a paste-like material to a substrate for the purpose of component attachment.

Stencil Border

Peripheral tensioned mesh, either polyester or stainless steel, which keeps the stencil foil flat and taut, connecting the foil to the frame.

Stencil Foil

The metal area of the stencil, which contains the print pattern.

Stencil Frame

A device onto which the stencil-foil is mounted. This may be tubular or cast aluminum with the border permanently mounted using an adhesive. Cast frame sizes are referenced from the inside. Tubular frame sizes are referenced from the outside.

Stencil (Solder Mask)

A thin sheet of material containing openings designed to transfer paste-like solder mask material to a substrate to form the protective pattern.

Step Plating

A plating phenomena wherein the plating does not plate to the edge (sidewall) of the plating resist.

Step Soldering

The making of solder connections by sequentially using solder alloys with successively-lower melting temperatures.

Step Stencil

A pattern-based stencil with more than one thickness level.

Step Wedge

See "Grey-Scale (Step Wedge)."

Step-and-Repeat

A method of dimensionally positioning multiples of the same or intermixed functional patterns accurately within a given area on the phototool or by repetitious contact, projection printing or photoplotting.

Stiffener Board

A material fastened to the surface of a printed board to increase its mechanical strength.

Stitch Bond

A bond made with a capillary-type bonding tool whereby the wire is not formed into a ball prior to bonding.

Straight-Through Lead

A component lead that extends through a hole and is terminated without subsequent forming.

Strain Relief (Cable)

A process or device that reduces the transmission of mechanical strain to a cable.

Strain Relief (Clamp)

A clamp that reduces the transmission of mechanical strain to a cable.

Strain Relief (Connector)

A feature that reduces mechanical strain on electrical connections within a connector.

Strand

One of a number of fibers, threads, conductors or yarns that are pleated or twisted together to form a wire or the like.

Strand Group

A bundle or collection of strands that make up a single conductor or wire.

Strands, Scraped

Strands that have been damaged due to a stripping instrument.

Stress Corrosion Cracking

Spontaneous cracking produced by the combined action of corrosion and residual or applied static stress.

Stress Relief

Slack in a component lead or wire that is formed in such a way as to minimize mechanical stresses.

Stress Relief (Clad Laminate)

The process used to reduce tension between the copper foil and the core material of a clad laminate.

Strike Plating

A thin plating used as a base for subsequent plating.

Stringing

The forming of a “tail” of adhesive as the dispensing tool pin or needle is withdrawn from the deposited adhesive.

Strip (Resist Stripping)

The process of removing unneeded masking material, such as a photoresist or metallic etch resist, after a processing step is completed.

Stripline

A transmission line structure that consists of a signal line that runs parallel to and is sandwiched between and separated from two reference planes by dielectric material. (See “Asymmetric Stripline.”)

Stub

A branch of the main signal line of a signal net that is usually used to reach a load that is not on the direct signal path.

Stud Via

A via formed with a conductive stud, or pin.

Stud-Mount Termination

See “Straight-Through Lead.”

Subassembly

An assembled unit forming a component within a larger assembly.

Subcomposite

In sequential lamination, a structure composed of more than two layers that have been laminated together, which will subsequently be laminated with other layers into a complete printed board.

Subnet

A single source and a single target point that, together with associated vias, lands, and preplaced items, are completely connected by route segments within one net.

Substrate

See “Base Material.”

Substrate Bending Test

A test applied to a substrate to determine its resistance to bending and the effects of bending to the substrate and any components mounted on the substrate.

Subsurface Corrosion

Formation of isolated particles of corrosion products beneath a metal surface.

Subtractive Process

The fabricating of a conductive pattern by the selective removal of unwanted portions of a conductive foil.

Supplier

The entity that provides a service or product to the user.

Support Ring

A ring made of a dielectric material used to hold beam leads in place relative to one another, outside of a packaged device.

Supported Hole

A hole in a printed board that has its inside surfaces plated or otherwise reinforced.

Supporting Plane

A planar structure that is a part of a packaging and interconnecting structure in order to provide mechanical support, thermo-mechanical constraint, thermal conduction and/or electrical characteristics. (It may be either internal or external to the packaging and interconnecting structure.) (See also “Constraining Core.”)

Surface Insulation Resistance (SIR)

The electrical resistance of an insulating material between a pair of contacts, conductors or grounding devices in various combinations, that is determined under specified environmental and electrical conditions.

Surface Mount Component (SMC)

A leaded or leadless device (part) that is capable of being attached to a printed board by surface mounting.

Surface Mount Device (SMD)

See “Surface Mount Component (SMC).”

Surface Mounting Technology (SMT)

The electrical connection of components to the surface of a conductive pattern that does not utilize component holes.

Surface Resistance

The ratio of DC voltage to the current flowing between two electrodes of specified configuration that contacts the same side of a material. Expressed in ohms.

Surface Tension

The natural, inward, molecular-attraction force that inhibits the spread of a liquid at its interface with a solid material.

Swaged Lead

A component termination whose projecting part is mechanically formed after passing it through a hole of a printed board to secure the component to the board.

Swell-and-Etch Process

The surface treatment of a base material in order to promote the adhesion of an electroless metal deposit by softening the surface with a solvent and then exposing the surface to an oxidizing solution in order to create a microporous surface.

Swelling (Cured Solder Mask)

An increase in volume, noted as an increase in solder mask thickness due to absorption of another material such as a solvent.

Symbology (Bar Code)

The structural characteristics of bar code symbols.

Synthetic Activated Flux

A highly-activated organic flux, not composed of natural resins, whose post-soldering residues are soluble in organic solvents.

Synthetic Resin

A synthetic organic polymer or a chemically-treated natural resin.

System

An assemblage or combination of parts forming a complex or unitary electronic whole.

System Effective Color Temperature

The effective color temperature measured using an optical system's light source to illuminate the target area.

System in Package (SiP)

A multi-chip package (MCP) that performs a system function.

T**Tab**

See "Printed Contact."

TAB

See "Tape Automated Bonding."

Tack Free

The point of time in drying at which the material surface is not adhesive or gummy to the touch.

Tackiness

The adhesion between solder paste applied on a land and a SMD component.

Tail, Bonding

The free end of wire extending beyond the bond impression of a wire bond from the heel.

Tail Pull

The removal of excess wire after a wedge or ultrasonic bond is made.

Tangency (Cross section)

An archaic term previously used to describe evidence of pad edge. The term is not an inspectable concept.

Tape

See "Carrier Tape."

Tape Automated Bonding

A technique that provides interconnections between die and substrate material with conductors that are stabilized on a carrier tape to facilitate automated placement. (See Figure T-1.)

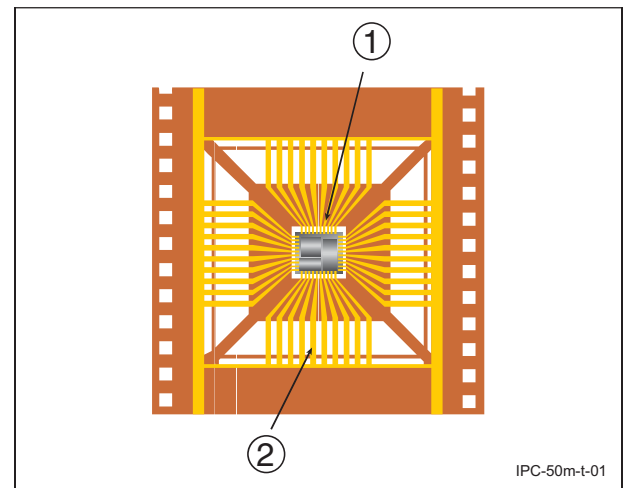


Figure T-1 Tape Automated Bonding

- 1. Inner Leads**
- 2. Outer Leads**

Tape Carrier Package (TCP)

A semiconductor package that has the TAB connection and is coated by a resin.

Taped Component

A component that is attached to a continuous tape in order to facilitate the use of automatic component incoming inspection, lead forming, assembling and testing.

Target Condition

The preferred condition. Note: This condition is not always achievable and may not be necessary to ensure the reliability of the assembly in its service environment.

Target Land (Via Bottom Land)

The internal land portion during formation of a blind or buried microvia. (See also "Capture Land.")

Tear (Base Materials)

A rip or split in either direction of the resin-coated reinforcement fabric in a base material dielectric structure.

Tear (Fabric)

A rip or separation in a fabric that is usually caused by excessive tension being applied during processing or caused by a weakness in the fabric.

Teardrop

The addition of conductive material at the interface between the conductor and the land. Also known as “Filletting.” (See Figure T-2.)

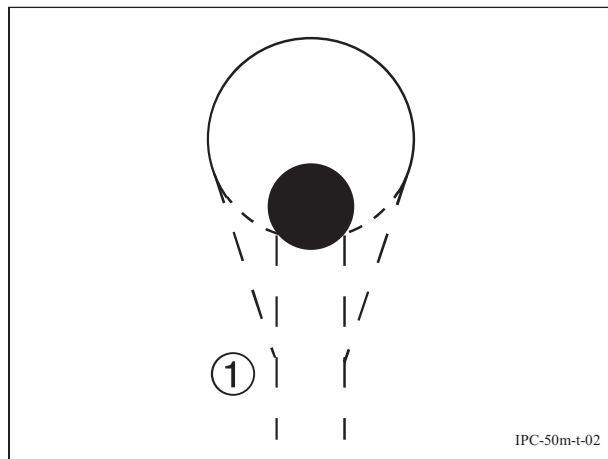


Figure T-2 Teardrop
1. Filletting

Technology Roadmap

A plan in support of a prediction of time sequential technology and status changes.

Temperature Delta (ΔT)

The range between upper and lower temperature limits as measured on a product (component, board or assembly) in a reflow heating process or end use environment.

Temperature Leveling

A process to make the temperature difference across a board as uniform as possible by preheating the board, or through the heating and melting of solder used in component attachment.

Temperature Profile

The depiction of the temperature that a selected point traverses as it passes through the reflow process.

Temperature, Reflow, Maximum

The maximum temperature that any portion of a product will reach during the reflow soldering process.

Tensile Strength

The resistance of a material to longitudinal stress, measured by the minimum amount of longitudinal stress required to rupture the material.

Tenter Frame

A part of a fabric drying machine that holds the fabric on both longitudinal edges by means of clips running on two parallel circulating chains.

Tenting

See “Via, Tented.”

Terminal

A metallic device that is used for making electrical connections. (See also “Solder Terminal.”)

Terminal Area

See “Land.”

Terminal Hole

See “Component Hole.”

Terminal Pad

See “Land.”

Termination

The end of a conductor that connects the conductor to a terminal, distributing frame, switch or matrix.

Terpenes

An organic solvent alternative used in cleaning electrical assemblies.

Test Board

A printed board or discrete-wiring board that is deemed to be suitable for determining the acceptability of a group of boards that were, or will be, produced with the same fabrication processes. (See also “Capability Test Board.”)

Test Coupon

A portion of quality conformance test circuitry that is used for a specific test, or group of related tests, in order to determine the acceptability of a product.

Test Coupon Set

A complement of test coupons that are comprised of various test coupon types, each of which is designed for a specific test, that are all made in the same manufacturing lot.

Test Language

A high-level language used to write a test program.

Test Pattern

A pattern that is used for inspection or testing purposes.

Test Point

A special point of access to an electrical circuit that is used for electrical testing purposes.

Test Program

A set of software instructions to a tester, that controls the testing procedure of the units being tested.

Test Set

The unique combination of test programs and test fixtures, that control the testing procedure of the units being tested.

Test Vectors

A series of test stimuli and expected responses applied to a device.

Test Vehicle

A test pattern for determining acceptance/reliability using a test method.

Testing Personnel

Those individuals that test products for the purpose of ascertaining the conformance of a product to applicable specifications.

Tetrafunctional Resins

Materials such as epoxide that have four reactive groups per molecule.

Thermal Coefficient of Expansion (TCE)

See “Coefficient of Thermal Expansion (CTE).”

Thermal Conductivity

A property of a material that describes the rate of heat flow through a unit area of a material for a given temperature difference per unit length.

Thermal Cure

A chemical reaction using heat energy that hardens organic substances such as adhesives and coating materials.

Thermal Expansion

Expansion of the material when subjected to a temperature increase.

Thermal Expansion Mismatch

The absolute difference between the thermal expansion of two materials. (See also “Coefficient of Thermal Expansion (CTE).”)

Thermal Mismatch

Difference in coefficients of thermal expansion of materials that are bonded together.

Thermal Plane

See “Heatsink Plane.”

Thermal Relief

A designed partial clearance around holes that are subject to soldering in large conductor areas (ground planes, voltage planes, thermal planes, etc.). Relief is required to provide an interruption to the heat flow through thermal resistance during the heating or soldering process. (See Figure T-3.)

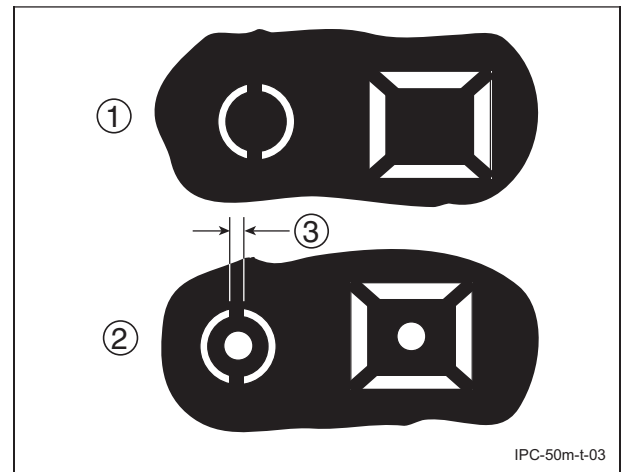


Figure T-3 Thermal Relief

1. Land Before Drilling
2. Land After Drilling
3. Web Width

Thermal Resistance

The resistance of a material to the passage of thermal energy usually measure in °C/W.

Thermal Shock Resistance

A measure of how well a material stands up to rapid changes in temperature.

Thermal Shock Test

One of the environmental tests to check the property changes of a product or material caused by rapid heating and cooling.

Thermal Shunt

See “Heatsink.”

Thermal Sonic Bonding

The bonding of wires to metal pads on an integrated circuit by means of heat and ultrasonic scrubbing of wire into the pad to create a metallurgic bond.

Thermal Stress (Printed Boards)

Exposure of a printed board or representative coupon to a relative thermal excursion to determine its ability to withstand the thermodynamic effects of high heat to which it may be exposed to during the assembly and rework process.

Thermal Via

A via designed for the sole purpose of assisting thermal conductivity.

Thermal Zone

An evaluation zone that extends a specified distance beyond the ends of the lands in a microsection of a vertical portion of a plated-through hole or other plated structures.

Thermocompression Bonding

The joining together of two metals without an intermediate material by the application of pressure and heat in the absence of electrical current.

Thermocouple (Cable)

A device for measuring temperature, consisting of two dissimilar metals in physical contact, which when heated will develop an electromotive force (EMF) output.

Thermode

A contact heating element that is used to generate reflow soldering heat, i.e., during hot bar soldering.

Thermode Temperature Gradient

The temperature difference between one end of a thermode and the other after steady-state temperatures are attained.

Thermode Temperature Variation

The maximum difference of temperatures of a point on a controlled-temperature thermode over a period of time.

Thermoplastic

A plastic that can be repeatedly softened and reshaped, without any significant change in inherent properties, by exposure to heat and hardened by cooling.

Thermoset

A plastic that undergoes a chemical reaction when exposed to elevated temperatures that leads to it having a relatively infusible or crosslinked state that cannot be softened or reshaped by subsequent heating.

Thermosonic Bonding

A low impact and low heat bonding process for making terminations by combining thermocompression and ultrasonic energy.

Thick Film

A film, greater than 0.1 mm [0.004 in] thick, deposited by screen printing and subsequently fired at high temperatures in order to fuse it into its final functional form.

Thick-Film Circuit

A microcircuit in which the interconnections or conductors and passive components of a ceramic-metal composition are formed on base material by screening and firing.

Thick-Film Hybrid Circuit

A hybrid circuit with thick-film components and interconnections. (See also "Hybrid Circuit.")

Thick-Film Network

A hybrid circuit comprised only of thick-film components and interconnections.

Thin Film

A film, less than 0.1 mm [0.004 in] thick, deposited by accretion process, such as vacuum or pyrolytic deposition.

Thin-Film Hybrid Circuit

A hybrid circuit with thin-film components and interconnections. (See also "Hybrid Circuit.")

Thin-Film Network

A hybrid circuit comprised only of thin-film components and interconnections.

Thin Foil

A metal sheet that is less than 0.0018 mm [0.0007 in] thick.

Thin Quad Flat Pack (TQFP)

A surface mount family of integrated circuit packages with a thin polymer body.

Thin Small Outline Package(TSOP)

A package that has the same features as the SOP package except that its thickness is reduced to 0.8 -1.2mm [0.0315 – 0.0472 in].

Thinner (Liquid)

A solvent or solvent system that is used to replace evaporated solvent or to reduce the solids concentration of the dissolved substance.

Thixotropy

A property of a gel or a viscous liquid, e.g., an adhesive system, that allows it to get thinner upon agitation and thicker upon subsequent rest.

Three-Layer Carrier Tape

The carrier for conductors used in tape-automated bonding that consists of a dielectric layer, an adhesive, and an etched metal-foil conductor layer. (See also “Multilayer Carrier Tape,” “Single-Layer Carrier Tape,” and “Two-Layer Carrier Tape.”)

Threshold

The magnitude of intensity that delineates that a signal is representative of a changed state.

Through Connection

The electrical connection to connect conductor patterns on the front side through to the back side of a printed board. See “Interfacial Connection.”

Through-Hole Mounting

See “Through-Hole Technology (THT).”

Through-Hole Technology (THT)

The electrical connection of components to a conductive pattern by the use of component holes.

Through Migration

See “Dendritic Migration.”

Throwing Power

The degree to which a given solution uniformly deposits the plating on any configuration of hole or circuitry pattern and panel shape or thickness.

Tie Bar

See “Plating Bar.”

Tie-In Tab

A piece of flexible or rigid-flex material left on the board in the form of a tab which continues to hold the finished board within the panel during routing of the flexible material.

Tin Whisker

A columnar or cylindrical filament emanating from the surface of a tin finish.

Tinning

The application of molten solder to a basis metal or surface finish in order to increase its solderability.

Titrimetry

See “Volumetric Analysis.”

Tolerance

The total amount by which a specific dimension is permitted to vary.

Tolerance, Statistical

A tolerance that is based on statistical models.

Toleranced Dimension

A dimension with a directly applied tolerance.

Tombstoned Component

A defective mounting condition whereby a leadless device has only one of its metallized terminations soldered to a land and has the other metallized termination elevated above and not soldered to its land. (See Figure T-4.)

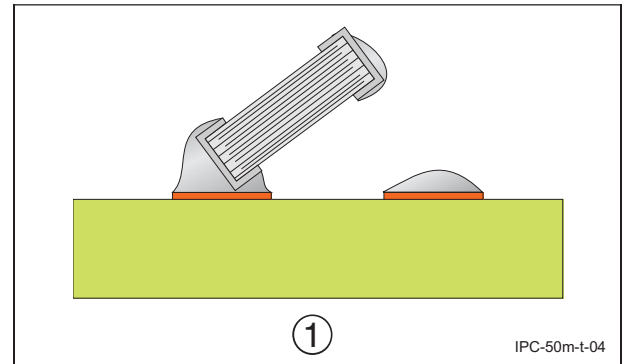


Figure T-4 Tombstoned Component

1. Tombstoned (Drawbridged) Component

Tooling Feature

A physical feature that is used to position a printed board or panel during a fabrication, assembly or testing process. (See also “Locating Edge,” “Locating Edge Marker,” “Locating Notch,” “Locating Slot,” and “Tooling Hole.”)

Tooling Hole

A tooling feature in the form of a hole in a printed board or fabrication panel.

Torque

A measure of the turning or twisting force on an object, which is a product of both the amount of pure force applied (in Newtons), and the distance from the center, which gives leverage (in meters).

Touch-Up

The identification and elimination of defects in a product.

Trace

See “Conductor.”

Traceability

The tracking of the manufacturer at a minimum or the manufacturing process of each element used in a unit.

Track

See “Conductor.”

Tracking Resistance

See “Arc Resistance.”

Transfer Adhesive (Pressure Sensitive Tape)

An unsupported pressure sensitive adhesive coated onto a release treated carrier. The adhesive is then applied to the desired substrate and the release liner removed before assembly.

Transfer-Bump Tape Automated Bonding

Tape automated bonding that uses discrete bumps between the die lands and carrier tape to facilitate inner-lead bonding.

Transistance

The characteristic that makes possible the control of voltages or currents so as to accomplish gain or switching action in a circuit; examples of transistance occur in transistors, diodes, and saturable reactors.

Transition Zone (Rigid-Flex Printed Boards)

The area centered on the edge of the rigid portion of a rigid-flex printed board from which the flexible portion extends. (See Figure T-5.)

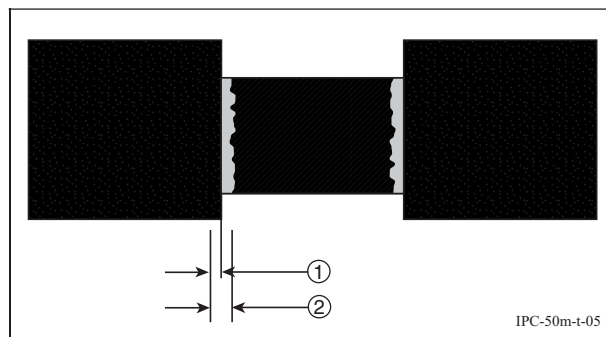


Figure T-5 Transition Zone (Rigid-Flex Printed Boards)

- 1. Edge of the rigid portion of the rigid-flex printed board.**
- 2. Transition zone.**

Transmission Cable

Two or more transmission lines in the form of an interconnection-wiring cable.

Transmission Line

A signal-carrying conductor structure with a controlled physical relationship consisting of two or more parallel conductors each separated by a dielectric. (See also “Balanced Transmission Line,” “Microstrip” “Stripline,” and “Unbalanced Transmission Line.”)

Transmissivity

The percentage of incident energy that is transmitted into a material.

Transmittance

The ratio of the amount of light that is transmitted through an object or material to the quantity of light that is incident upon it.

Tray

A pallet shape that contains SMD components in a form that makes it easy to feed them to an automatic component mounting machine.

Treater Dirt (Base Materials)

An inclusion which appears to be or is confirmed by analysis to be a type of resin particle which has been caught within the structure of the impregnation treater, to be picked up by a subsequent use of the treater; usually in some form of carbonization due to excessive exposure to the treaters heat.

Treatment Transfer

The transfer of copper-foil treatment to a base material as indicated by the presence of black, brown or red streaks after the copper has been removed by etching.

Treatment Transfer (Base Materials)

A dark streak or pattern of streaks within the core butter coat that is formed by the transfer of oxide treatment from the copper foil that may be linear, with the grain of the foil or crescent shaped (due to handling of the foil) and very occasionally of a fine 50 mm [1.97 in] regularly spaced streaky pattern (due to specially configured rollers in the foil treating process).

Treeing

A dendritic-type of plating growth that extends onto the surface that is adjacent to the edge of a conductive pattern. (This is normally caused by excessive plating current.)

Trim Lines (Pattern)

Lines that define the borders of a pattern. (See also “Corner Marks.”)

Trim Lines (Printed Board)

Lines that delineate the border of a printed board. (See also “Corner Marks.”)

Trimming

The removal of material from a film component by a laser beam or abrasive jet in order to modify its value.

Trimming Notch

See “Kerf.”

True Position

The theoretically-exact location for a feature, e.g., hole that is established by basic dimensions.

True Position Tolerance

The total permissible deviation from a true position.

Trumeter

A device used to accurately measure yardage passing a specific point of reference.

Tunnel Void, (Base Materials)

A thin vein or fine white line that appears to be within the fiber bundles of the reinforcement, usually a narrow pocket formed by poor non-wetting of a small area of the fiber bundle by the resin. Severe circumstances may result in “silver streaks” seen in the reinforcement.

Turnkey System

A self-contained hardware and software system that perform a specific task.

Turret Solder Terminal

A round post-type stud (stand-off) solder terminal with a groove or grooves around which one or more wires are wrapped prior to soldering. (See Figure T-6.)

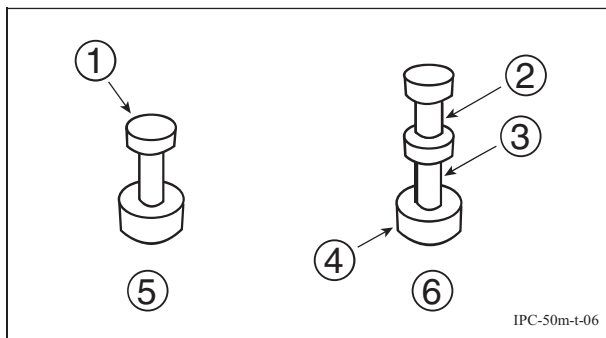


Figure T-6 Turret Solder Terminal

- | | |
|-------------------------|------------------|
| 1. Top Shoulder | 4. Base |
| 2. Upper Post Selection | 5. Single Turret |
| 3. Lower Post Selection | 6. Double Turret |

Twist

The deformation of a rectangular sheet, panel or printed board, that occurs parallel to a diagonal across its surface, such that one of the corners of the sheet is not in the plane that contains the other three corners.

Two-Layer Carrier Tape

The carrier for conductors used in tape-automated bonding that consists of a dielectric layer and a layer of plated or etched conductors. (See also “Multilayer Carrier Tape,” “Single-Layer Carrier Tape,” and “Three-Layer Carrier Tape.”)

Two-Piece Contact

A type of a discrete connector contact divided in two pieces that mates with another discrete formed-metal connector contact. (See also “Edge-Board Contact.”)

Two-Sided Board

See “Double-Sided Board.”

Type I Error

The rejection of a statistical hypothesis that is true, also known as “Producers Risk.” (See also “Alpha Error.”)

Type II Error

The accepting of a statistical hypothesis that is false, also known as “Consumers Risk.” (See also “Beta Error.”)

U**Ultra-Fine Pitch Technology**

A surface-mount assembly technology with component terminations on centers less than or equal to 0.40 mm [0.0157 in].

Ultrasonic Bond

A bond formed when a wire is pressed against the bonding pad and the pressing mechanism is ultrasonically vibrated at high frequency (above 10kHz).

Ultrasonic Bonding

A termination process that uses ultrasonic-frequency vibration energy and pressure to make the joint.

Ultrasonic Cleaning

Immersion cleaning that is done by passing high-frequency sound waves through a cleaning medium to cause microagitation.

Ultrasonic Soldering

Fluxless soldering wherein molten solder is vibrated at ultrasonic frequencies while making the joint.

Ultraviolet Cure

A cure of material by exposure to ultraviolet light.

Unbalanced Transmission Line

A transmission line that has distributed inductance, capacitance, resistance, and conductance elements that are not equally distributed between its conductors.

Uncased Device

A component without a package.

Unconditional Test

A test without limitations or restrictions on test mode, test time, etc.

Under Bump Metallization

The solder-wettable terminal area that defines the metallurgy size and area of a soldered connection, such as a solder bump.

Undercut

The distance, measured parallel to the surface of a printed board, from the outer edge of a conductor to the point of maximum point indentation on the same edge of the conductor. (See also Figure O-1.)

Undercut, Resist or Masking Material

A groove or a hollow formed on the side wall of a conductor pattern caused by etching.

Underfil

A compound used to fill the space underneath an electronic device.

Underplate

The plating made as a base of a surface over-plating usually required as a barrier to prevent leeching of two dissimilar metals into one another.

Underwriters Symbol

A logotype that denotes that a product has been recognized (accepted) by Underwriters Laboratories, Inc. (UL).

Unilateral Tolerance

A tolerance in which variation is permitted in one direction only from the specified dimension.

Unload Time

The time required to remove a unit from the evaluation equipment, to collect the evaluation data, and to make the system ready for the next unit.

Unsupported Hole

A hole in a printed board that does not contain plating or other type of conductive reinforcement.

Upload (Test)

The acceptance of test program data from a host computer.

Useable Resolution

The smallest separation of two neighboring points that can be produced, and subsequently processed, with a photore-sist.

Useable Tin

Tin that has not reacted to form intermetallic compounds.

User

The entity that receives a service or product from the supplier.

User Inspection Lot (Material)

All of the material of the same type and, as far as practical, of the same type designation that is produced from the same equivalent batches or lots of constituent material under essentially the same conditions and that is offered for inspection at one time.

V**V-Groove (Scoring)**

A mechanical method that removes a portion of the material outlining the board, in order to facilitate ease of breakout (removal) from the manufacturing or assembly panel. (See also "Breakaway.")

Vacuum (Vapor) Deposition

A family of processes used to deposit layers atom-by-atom or molecule-by-molecule at sub-atmospheric pressure (vacuum) on a solid surface.

Vacuum Evaporation

The evaporation of a material by heating in a vacuum for the purpose of deposition of the material film onto another solid material.

Vacuum Head

A handling instrument with a small vacuum cup which is used to pick up chip devices and other surface mounting devices.

Vapor Phase Reflow

See "Vapor Phase Soldering."

Vapor-Phase Soldering

A reflow soldering method that is based on the exposure of the parts to be soldered to hot vapors of a liquid that has a boiling-point that is sufficiently high to melt the solder being used.

Vapor Recovery

The retrieving of working fluid vapors and aerosols from scavenged air and turning them into reusable working fluids.

Vapor, Saturated

A fluid in its vapor state when it is being heated at a constant pressure at or above its boiling temperature.

Variable

A quantity or condition whose value may be subject to change and can usually be measured.

Variables Data

Data on characteristics that can assume different values along a continuous scale. Examples are size, weight, length and temperature.

Variance

A measure of dispersion that is equal to the average value of the squares of the deviations from a mean value.

Vendor Inspection Lot (Material)

All of the material of the same type that have been fabricated within a specified period of time using the same processing procedures and conditions that are offered for inspection at one time.

Verification Time

The time required to determine an anomalies location, to evaluate it, and to classify it with respect to predefined criteria.

Via

A plated hole that is used as an interlayer connection but is not intended for inserting a component lead or metallic part. (See also “Blind Via” and “Buried Via.”)

Via, Filled (Type V Via)

A via with material applied into the via targeting a full penetration and encapsulation of the hole.

Via, Filled and Capped (Type VII Via)

A Type V via with a secondary metallized coating covering the via. The metallization is on both sides.

Via, Filled and Covered (Type VI Via)

A Type V via with a secondary covering of material (liquid or dry film solder mask) applied over the via. It may be applied from either one side or both sides.

Via, Plugged (Type III Via)

A via with material applied allowing partial penetration into the via. It may be applied from either one side or both sides.

Via, Plugged and Covered (Type IV Via)

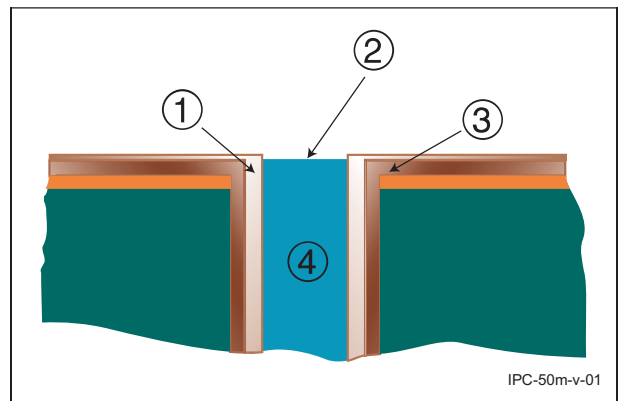
A Type III via with a secondary covering of material applied over the via. The secondary covering may be applied from either one side or both sides.

Via Planarization

The process of removing metallization and/or organic materials associated with the surface of a via structure. It is most commonly employed in filled via fabrication. (See Figure V-1.)

Via Protection, Bumped

Via protection where the hole plugging or fill material protrudes above the surface of the hole interface producing a convex shape.

**Figure V-1 Via Planarization**

- | | |
|----------------------|-----------------|
| 1. Panel Plating | 3. Wrap Plating |
| 2. Via Planarization | 4. Via Fill |

Via Protection, Dimpled

Via protection where the hole plugging or fill material recedes below the hole interface producing a concave shape.

Via Protection, Planarized

Via protection where the excess hole plugging or fill material protruding above the hole interface has been removed by a process to produce a coplanar surface.

Via, Tented (Type I Via)

A via with a mask material (typically dry film) applied bridging over the via wherein no additional materials are in the hole. It may be applied to one side or both.

Via, Tented and Covered (Type II Via)

A Type I via with a secondary covering of mask material applied over the tented via.

Virtual Condition

The maximum possible boundary that can be attained by a feature of size, considering all applicable geometric features and tolerances.

Viscosity

The internal friction of a fluid, caused by molecular attraction, which makes it resist a tendency to flow.

Visible Light (Band)

Electromagnetic radiation that occurs at wavelengths between 0.39 and 0.78 microns.

Visual Examination

The qualitative observation of physical characteristics with the unaided eye or within stipulated levels of magnification.

Void

The absence of any substances in a localized area.

Voids (Bar Code)

In bar code symbols, missing ink coverage; generally the width of the voids is more critical than the height.

Voids (Base Materials)

Circular pockets within the resinous area of the laminate, usually formed by entrapped air or volatiles; usually at or near the surface of the laminate.

Voltage Plane

A conductor layer, or portion thereof, that serves as a common voltage source at other than ground potential for an electrical circuit. (See also "Ground Plane" and "Signal Plane.")

Voltage Surge

A short transient voltage peak propagating along a line or in a circuit.

Volume Resistivity

The electrical resistance of a material with the unit of basis volume expressed in ohm-meters.

Volumetric Analysis

The quantitative determination of a component of a solution by measuring the volume of a suitable titrant added until the equivalence point is reached.

W

Wafer

A slice or flat disc of semiconductor material, such as pure silicon, onto which an electronic circuit may be formed.

Wafer Level Package (WLP)

A technique of partial encapsulation and protection of die while still on the wafer and before the wafer is divided into singulated dice.

Waffle Pack

An open compartmentalized container for holding surface-mount components that is suitable for loading the components into automatic handling equipment.

Wand (Bar Code)

A bar code scanner, usually hand held, used for reading bar codes; may not read from distances and on curved surfaces.

Warp

See "Bow."

Warper

A machine for preparing and arranging the yarns intended for the warp of the fabric.

Waste (Fabric)

A lump or collection of yarn or filament that is woven into a fabric where accumulated contamination off the loom has found its way into the fabric.

Water Vapor Transmission Rate (WVTR)

A measure of the permeability of plastic film or metallized plastic film material to moisture and considered an important rating for moisture barrier bags.

Water-Soluble Flux

A soldering flux that is soluble in water.

Wave Soldering

A soldering process wherein an assembled printed board is brought in contact with the surface of a continuously flowing and circulating mass of solder.

Waveguide

A tube, usually electrically conductive, for conducting radiofrequency signals between circuit or system elements.

Wavelength

The distance an electromagnetic wave propagates during one full cycle. It is the ratio of the propagation velocity in length units per unit time to the frequency in cycles per unit time.

Waviness

The existence of alternating thick and thin locations in cloth that is woven under varying tension that prevents the even placement of picks.

Waviness, (Base Materials)

The surface topography of the laminate, usually metallic-clad, which follows the structure of the reinforcement fabric in an undulating pattern.

Weave Exposure

A base material surface condition in which unbroken fibers of woven glass cloth are not completely covered by resin.

Weave Style (Fabric)

The fabric construction and configuration that interlaces the warp and fill yarn into a woven structure.

Weave Texture

A surface condition of base material in which a weave pattern of cloth is apparent although the unbroken fibers of woven cloth are completely covered with resin.

Web Taper

The continuous decrease of web thickness of a drill from the beginning of the flute at the drill shank to the drill point.

Web Thickness

The distance between the cutting edges of the flutes. (See Figure B-11.)

Wedge Bond

A wire bond made with a wedge tool. (See also “Ball Bond.”)

Wedge Tool

A bonding tool in the general form of a wedge, with or without a guide hole to position wire under its bonding face. (See also “Capillary Tool.”)

Wettability

The ease with which a metal or metal alloy can be wetted by molten solder.

Wetting

The formation of a relatively uniform and adherent film of liquid on a surface.

Wetting (Solder)

The formation of a relatively uniform, smooth, unbroken, and adherent film of solder to a base metal resulting in a metallurgical bond.

Wetting Balance

An instrument that is used to measure wetting performance and solderability.

Wetting, Solder

The formation of a relatively uniform, smooth, unbroken, and adherent film of solder to a base metal.

Whisker

A spontaneous columnar or cylindrical filament, usually of monocrystalline metal emanating from a plated metal surface.

Whisker Mitigation

Action taken to delay, reduce, or eliminate the formation of whiskers.

Wicking

Movement of a liquid by capillary action along the fibers of a material. (See also “Solder Wicking.”) Also, the plating deposited along fibers of a printed board substrate caused by wicking of the plating chemistry.

Wicking (Solder Mask)

A condition where uncured solder mask is drawn from the surface of a panel into the holes (via, mounting or component).

Window (Carrier Tape)

An opening in the dielectric of a carrier tape that exposes the conductors for bonding purposes.

Window (Process)

A range of values within which evaluation parameters are defined.

Wipe Soldering

The forming of a joint by applying semifluid solder and shaping the joint by rubbing with a greased cloth pad.

Wiping Action

The sliding action that occurs when connector contacts are mated.

Wire

A single, usually cylindrical, elongated string of metal.

Wire Bond

A completed wire connection that provides electrical continuity between the die and a terminal.

Wire Bond Degradation

A weakening of an integrated circuit ball bond due to stress caused by exposure to reflow soldering temperatures resulting in possible reduction in component reliability.

Wire Bond Pad (WBP)

Lands on a printed board that are designed for wire-connections by thermo compression, ultrasonic, or related techniques. These lands are used for chip-on-board (COB) applications.

Wire Bonding

An interconnection technology using metal wire e.g., Gold, Copper, etc. between a die pad and base material, lead frame, etc.

Wire Overcoat (Discrete Wiring)

A secondary polymeric coating of the wire applied over the insulation to aid in the bonding of wires during the wiring process.

Wire Overlap

A wire/lead that is wrapped more than 360 degrees and crosses over itself, i.e., does not remain in contact with the terminal post.

Wire Overwrap

A wire/lead that is wrapped more than 360 degrees and remains in contact with the terminal post.

Wire Poke-Through (Discrete Wiring)

A condition of the insulated wire breaking through the cover layer, exposing the insulated wire, especially at the wire cross-over.

Wire Sag

The failure of a wire to form the desired loop between its bonds.

Wire Stripping

The removal of a predetermined portion of insulation from an insulated wire without affecting the mechanical or electrical characteristics of the conductors of the remaining insulation.

Wire Stub (Discrete Wiring)

The short end of an insulating wire which extends beyond the wall of a plated-through hole.

Wire Wrap

The connecting of a solid wire to a terminal by tightly wrapping a solid-conductor wire around the terminal with a special tool.

Wiring Layer (Discrete Wiring)

A network of embedded insulated wires, forming a wiring layer.

Witness Mark

Evidence on a surface of contact from a probe.

Wobble Bond

A thermocompression, multi-contact bond made by rocking a bonding tool on a beam lead.

Working Master

A 1:1 scale reproduction of the production master used in image generation during the manufacturing of printed boards.

Working Time

The maximum time that an adhesive can be exposed to ambient conditions with its chemical and physical properties remaining within satisfactory limits for proper dispensing and bonding. Also referred to as "Pot Life."

Wrap Plating

The electrolytic hole plating deposition continuously extending onto the surface from a plated via structure. (See Figure W-1.)

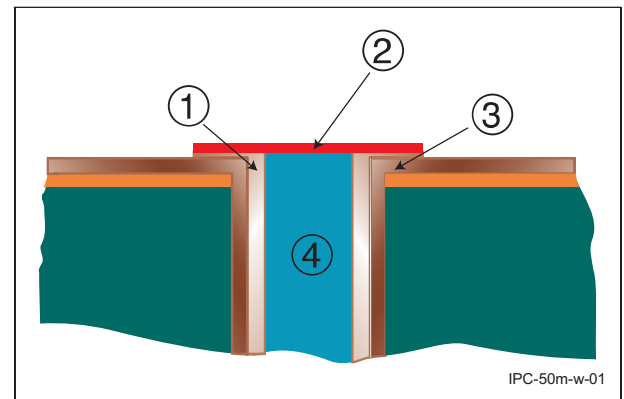


Figure W-1 Wrap Plating

- | | |
|------------------|-----------------|
| 1. Panel Plating | 3. Wrap Plating |
| 2. Cap Plating | 4. Via Fill |

Wrinkles

Ridges, creases or furrows in a coating or resist that are formed after the material has adhered to a metal, such as solder, that subsequently melts and resolidifies.

Wrought Foil

A metal foil that is formed by the rolling of cast metal.

X

X-Out

A method of identifying a defective part within an array to ensure it is not used (populated, further processed, etc.).

Z

Z Axis Expansion

Expansion in the direction of the board thickness.

Zigzag In-line Package

Package with in-line leads on one side which are arranged in zigzag fashion.

Appendix A

Commonly Used Acronyms

The acronyms listed here reflect the list of approved acronyms as of the time of release of this document. For a more frequently maintained list, go to www.ipc.org/acronyms.

— A —

AA	Antenna Array
AA	Automatic Acknowledge
AABUS	As Agreed Between User and Supplier
AAGR	Annual Average Growth Rate
ABS	Acrylonitrile-Butadiene-Styrene (Plastic)
AC	Alternate Current
AC	All Call
ACA	Anisotropically Conductive Adhesive
ACCU	Alternating Current Connection Unit
ACI	Automatic Component Inspection
AEC	Architecture, Engineering and Construction
ADHP	Aerospace, Defense and High Performance
ADJ	Adjust
AGC	Automatic Gain Control
AGR	Annual Average Growth Rate
AGV	Automated Guided Vehicle
AI	Artificial Intelligence
AIS	Adhesive Interconnect System
AL	Aluminum
AMP	Amperage/Ampere
AMT	Amount
ANG	Angle
ANOVA	Analysis of Variance
ANSI	American National Standards Institute
AOI	Automated Optical Inspection
AOQ	Average Outgoing Quality
APL	Applicable
APR	Automatic Phototool Registration
APT	Automatically Programmed Tools
AQL	Acceptable Quality Level
AR	Acrylic Resin
AR	Annular Ring
ARINC	Aeronautical Radio Incorporated
ARUR	Acrylic Resin and Urethane Resin
ASAP	As Soon as Possible
ASCII	American Standard Code for Information Interchange
ASIC	Application Specific Integrated Circuit

ASME	American Society Of Mechanical Engineers
ASQ	American Society For Quality
ASSY	Assembly
ASTM	American Society for Testing Materials
ATE	Automatic Test Equipment
ATG	Automatic Test Generation
ATR	Air Transport Rack
AU	Gold
AUTH	Authorize/Authorization
AUX	Auxiliary
AVG	Average
AVT	Accelerated Vesication Test
AW	Artwork
AWG	American Wire Gauge
AXI	Automated X-Ray Inspection

— B —

BBT	Bare Board Test
BC	Buried Capacitance
BD	Board
BDMA	Benzyltrimethylamine
BGA	Ball Grid Array
BICMOS	Bipolar Complementary Metal Oxide Semiconductor
BITE	Built-In Test Equipment
BK	Back
BKT	Bracket
BKPLN	Backplane
BKPNL	Back Panel
BLK	Black/Block
BLNK	Blank
BO	Breakout
BOD	Biochemical Oxygen Demand
BOM	Bill of Material
BTC	Bottom Terminated Component
BTO	Build To Order
BP	Backplane/Backpanel Blueprint
BRD	Board
BS	Backside
B&T	Bow and Twist

BT	Bismaleimide Triazine	CLR	Clear/Clearance
BTAB	Bumped Tape-Automated Bonding	CM	Contract Manufacturer
BTM	Bottom	CMC	Copper Moly Copper
BVL	Bevel	CMOS	Complimentary Metal-Oxide Semiconductor
— C —			
C&E	Cause And Effect	CMP	Component
C3	Command, Control and Communicate	CNC	Computer Numerical Control
C4	Controlled Collapse Component Connection	CNTR	Center
CAD	Computer-Aided Design	CNTRL	Control
CAE	Computer-Aided Engineering	COB	Chip-on-Board
CAF	Conductive Anodic Filaments	COD	Consumed Oxygen Demand
CAFM	Computer-Aided Facilities Management	COT	Configure To Order
CAGE	Commercial and Government Entity	COTS	Commercial Off The Shelf
CALC	Calculate	CoA	Certificate of Analysis
CALS	Computer-Aided Acquisition and Logistic Support (DOD)	CoC	Certificate of Compliance
CAM	Computer-Aided Manufacturing	COMP	Component
CAP	Capacitor/Capacity	COND	Conductor/Condition
CAPP	Computer-Aided Process Planning	CONF	Conference/Conformance
CAR	Computer-Aided Repair	CONN	Connector
CASE	Computer-Aided Software Engineering	CONT	Continue/Continuity
CAT	Computer-Aided Testing	Cp	Capability Performance
CBGA	Ceramic Ball Grid Array	CPK	Process Capability Index (range within specification)
CBORE	Counterbore	CPL	Capability Performance, Lower
CC	Conformal Coating	CPLD	Complex Programmable Logic Device
CCA	Circuit Card Assembly	CPN	Coupon
CCAPS	Circuit Card Assembly and Processing System	CPU	Capability Performance, Upper
CDA	Copper Development Association	CPU	Central Processing Unit (Computer)
CEE	Career Ending Event	CRC	Cyclic Redundancy Check
CEPM	Certified Ems Program Managers	CRT	Cathode-Ray Tube
CET	Certified Electronic Technician	CS	Component Side
CF	Copper Foil	CSA	Canadian Standards Agency
CFM	Continuous Flow Manufacturing	CSG	Constructive Solids Geometry
CFM	Cubic Feet per Minute	CSK	Countersink
CHAR	Character/Characteristic	CSP	Chip Scale Package
CHG	Change	CTE	Coefficient of Thermal Expansion
CHK	Check	CU	Copper
CI	Controlled Impedance	CVR	Cover
CIM	Computer-Integrated Manufacturing	CVS	Cyclic Voltammetry Stripping
CIRC	Circuit	— D —	
CISC	Complex Instruction Set Computing	DAB	Designated Audit Body
CITIS	Contractor Integrated Technical Information Services	DATC	Design Automation Technical Committee (IEEE)
CL	Class	DBMS	Database Management System
CLN	Clean	DC	Direct Current
		DCAS	Defense Contract Administration Service

		— E —	
DCMA	Defense Contract Management Agency	E-AU	Electroless Gold
DCMC	Defense Contract Management Command	E-NI	Electroless Nickel
DEC	Decimal	EA	Each
DEG	Degree	ECAD	Electronic Computer-Aided Design
DEP	Deposit/Deposition	ECC	Error Correction Code
DES	Develop-Etch-Strip/Design	ECCB	Electronic Components Certification Board
DESC	Defense Electronics Supply Center	ECL	Emitter-Coupled Logic
DF	Dryfilm/Difunctional	ECM	Electronic Countermeasures
DFM	Design for Manufacture	ECN	Engineering Change Notice
DFSM	Dry Film Solder Mask	ECO	Engineering Change Order
DIA	Diameter	ECR	Engineering Change Request
DIEL	Dielectric	ED	Electrodeposited
DIM	Data-Information Module	EDA	Electronic Design Automation
DIM	Dimension	EDIF	Electronic Design Interchange Format
DIN	Deutsches Institute for Normung	EDM	Electro-Discharge Machining
DIP	Dual-Inline Package	EDO	Extended Data Out
DIST	Distribute/Distribution	EIA	Electronic Industries Association
Dk	Dielectric Constant	EIS	Engineering Information System
DLA	Defense Logistics Agency (DOD)	ELD	Electro-Luminescent Diode
DMA	Direct Memory Access	EMC	Electromagnetic Compatibility
DMSA	Defense Manufacturers and Suppliers Association	EMF	Electro-Motive Force
DNC	Distributed (or Direct) Numerical Control	EMI	Electromagnetic Interference
DOC	Document	EMP	Electromagnetic Pulse
DOD	Department of Defense	EMPF	Electronics Manufacturing Productivity Facility
DOD	Dissolved Oxygen Demand	EMS	Electrical Manufacturing Services
DOE	Design Of Experiments	EMUL	Emulsion
DOP	Digital Optical Processing	ENIG	Electroless Nickel/Immersion Gold
DOS	Disc Operating System	EPA	Environmental Protection Agency
DP	Drill Program	EPR	Ethylene-Propylene (Copolymer) Resin
DRC	Design Rule Check	EPT	Ethylene-Propylene Terepolymer
DRL	Drill	Er	Relative Dielectric Constant
DRM	Drawing Requirements Manual	ESD	Electro-Static Discharge
DS	Dimensional Stability/Double-sided	ESDS	Electro-Static Discharge Sensitive Device
DSC	Differential Scanning Calorimetry	ESI	Early Supplier Involvement
DSP	Die Size Package	ESR	Equivalent Series Resistance
DSP	Digital Signal Processor	ET	Electrical Test
DTF	Double-Treat Foil	ETPC	Electrolytic Tough-Pitch Copper
DTL	Detail	EVAL	Evaluation/Evaluate
DTP	Diameter True Position	EX	Example
DTS	Dock To Stock	EXP	Expose/Exposure/Expire
DVM	Digital Voltmeter	EXT	External/Extension
DWV	Dielectric Withstanding Voltage	— F —	
DXF	Data Exchange Format	FA	First Article

FAA	Federal Aviation Administration	HIC	Humidity Indicator Card
FAB	Fabrication/Fabricate	HL	Hole
FAI	First Article Inspection	HLS	Holes
FAR	Failure Analysis Report	HRC	High Resin Content
FAR	First Article Report	HPGL	Hewlett Packard Graphic Language
FC-CBGA	Flip Chip Ceramic Ball Grid Array	HT	Height
FC-PBGA	Flip Chip Plastic Ball Grid Array	HTML	Hypertext Markup Language
FCC	Flat-Conductor Cable	HTE	High Temperature Elongation
FCT	Functional Circuit Test	HTTP	Hypertext Transfer Protocol
FEA	Finite-Element Analysis		
FEM	Finite-Element Modeling		— I —
FEP	Fluorinated Ethylene-Propylene (Teflon)	I/O	Input/Output (Terminations)
FET	Field-Effect Transistor	IC	Integrated Circuit
FFT	Fast Fourier Transform	IC	Ionic Contamination/Interconnect/Integrated Circuit
FGI	Finished Goods Inventory		
FHS	Finished Hole Size	ICA	Isotropically Conductive Adhesive
FLT	Flat	ICAM	Integrated Computer-Aided Manufacturing
FM	From	ICT	In-Circuit Test
FMEA	Fault Mode And Effect Analysis	ID	Inside Diameter
FNL	Final	IDC	Insulation Displacement Connection
FOD	Foreign Object Debris/Damage	IDENT	Identify/Identification
FPC	Flexible Printed Circuit	IEC	International Electrotechnical Commission
FPGA	Field Programmable Gate Array	IECQ	International Electronic Component Qualification System
FPT	Fine-Pitch Technology		
FPW	Flex Printed Wiring	IEDR	Initial Engineering Design Review
FREQ	Frequency	IEEE	Institute of Electrical and Electronic Engineers
FS	Farside		
FSCM	Federal Stock Code for Manufacturers	IEPS	International Electronic Packaging Society
FTIR	Fourier Transform Infra-Red (Spectroscopy)	IGES	Integrated Graphics Exchange System
FTP	File Transfer Protocol	IL	Innerlayer
FUNC	Function/Functional	ILB	Inner-Lead Bonding (TAB)
		IMG	Image
	— G —	IMM	Immersion
GaAs	Gallium Arsenide	IMMAU	Immersion Gold
GBIB	General Purpose Interface Bus	IMP	Impedance
GLS	Glass	INC	Incomplete/Incorrect/Incorporate
GMA	Gas Metal Arc (Welding)	INCL	Include
GND	Ground	INSP	Inspect/Inspection
GTA	Gas Tungsten Arc (Welding)	INT	Internal
GTPBGA	Glob Top Plastic Ball Grid Array	INV	Inventory
		IP	Internet Protocol
	— H —	IPD	Integrated Passive Device
HAL	Hot Air Level	IPM	Inches Per Minute
HASL	Hot Air Solder Leveling	IR	Infrared
HBM	Human Body Model	IR	Insulation Resistance/Infrared
HDI	High Density Interconnect	IS	Inside/Information Systems

ISCET	International Society Of Certified Electronics Technician	MBV	Micro-blind Via
ISHM	International Society for Hybrid Microelectronics	MCAD	Mechanical Computer Aided Design
ISO	International Standards Organization	MCAE	Mechanical Computer-Aided Engineering
ISS	Issue	MCM	Multi Chip Module
ITT	Inter-Test Time	MCM	One Thousand Circular Mils
IVH	Interstitial Via Hole	MCP	Multi Chip Package
— J —		MDA	Methylenedianiline
JEDEC	Joint Electronic Device Engineering Council	MED	Molecular Electronic Device
JIT	Just-in-Time (Manufacturing)	MEK	Methyl-Ethyl Ketone
— K —		MELF	Metal Electrode Face (Discrete Leadless Component)
KGB	Known Good Board	MEMS	Micro Electro Mechanical Systems
KGD	Known Good Die	MET	Manufacturer ???? s Exposure Time
— L —		MF	Multifunctional
LAN	Local Area Network	MFG	Manufacturing
LAM	Laminate/Lamination	MFR	Manufacturer
LBA	Logical Block Address	MIBK	Methyl-Isobutyl Ketone
LCC	Leadless Chip Carrier	MIN	Minimum
LCCC	Leadless Ceramic Chip Carrier	MIP	Manufacturing Instruction Procedure/ Multiple Inline Package
LCD	Liquid Crystal Display	MIR	Moisture & Insulation Resistance
LDA	Logic Design Automation	MITI	Ministry of International Trade and Industry (Japan)
LED	Light-Emitting Diode	ML	Multilayer
LEG	Legend	MLB	Multilayer Board
LIF	Low Insertion Force	MLC	Multilayer Chip Capacitor
LMC	Least Material Condition	MLPCB	Multilayer Printed Circuit Board
LOC	Locate/Location	MMC	Maximum Material Condition
LPI	Liquid Photoimageable	MMIC	Monolithic Microwave Integrated Circuit
LPI	Liquid Photoimageable Solder Mask	MOEMS	Micro Opto-Electro-Mechanical Systems
LRC	Low Resin Content	MOS	Metal-Oxide Semiconductor
LRU	Lowest Replaceable Unit	MRB	Material Review Board
LSI	Large Scale Integration (Integrated Circuit)	MRP	Material Requirement Planning
LSR	Laser	MRP II	Manufacturing Resource Planning
LTCC	Low Temperature Co-Fired Ceramic	MSI	Medium Scale Integration (Integrated Circuit)
LW	Line Width	MSDS	Material Safety Data Sheets
LYR	Layer	MSG	Message
— M —		MSL	Moisture Sensitivity Level
MA	Mechanical Advantage	MSTR	Master
MAC	Maximum Allowable Concentration	MTBF	Mean Time Between Failures
MAC	Media Access Control	MTL	Metal
MAP	Manufacturing Automation Protocol	MTTR	Mean Time To Repair
MATL	Material	— N —	
MATS	Material Transport Segment	NA	Not Applicable

NADCAP	National Aerospace and Defense Contractors Accreditation Procedures	OZ	Ounce
NASA	National Aviation and Space Administration	— P —	
NBR	Nitrile Butadiene-Acrylonitrile Rubber	P&IA	Packaging and Interconnecting Assembly
NBS	National Bureau of Standards	P&IS	Packaging and Interconnecting Structure
NC	Numerical Control	PAC	Pad Array Carrier
NCM	Non-Conforming Material	PB	Printed Board
NDT	Non-Destructive Testing	PBA	Printed Board Assembly
NECQ	National Electronics Component Qualification System	PBGA	Plastic Ball Grid Array
NEG	Negative	PBX	Private Branch Exchange
NEMA	National Electrical Manufacturers Association	PC	Personal Computer
NF	Non-Functional	PC	Printed Circuit/Production Control
NHS	Nominal Hole Size	PCA	Printed Circuit Assembly
NI	Nickel	PCB	Printed Circuit Board
NIST	National Institute for Science and Technology	PCBA	Printed Circuit Board Assembly
NMR	Normal-Mode Rejection	PCMCIA	Personal Computer Memory Card Industry Association
NOM	Nominal	PDES	Product Data Exchange Specification
NP	Non Plated	PDL	Page Description Language
NPI	New Product Introduction	PEM	Plastic Electronic Module
NPTH	Non Plated Through Hole	PEP	Post-Etch Punch
NS	Nearside	PERM (Pb)	Lead-Free Electronics Risk Management Council
NSA	National Security Agency	PGA	Pin Grid Array (Leaded Component Package)
NSTD	Non-Standard	PHIGS	Programmer's Hierarchical Interface Graphics Standard
NTS	Not-to-Scale	PID	Photo-Imageable Dielectric
— O —		PIP	Pin-In-Paste Technology
OA	Overall	PL	Parts List
OA	Organic Acid (Flux)	PLC	Place
OBE	Overcome By Events	PLCC	Plastic Leaded Chip Carrier
OCT	Optical Coherence Tomography	PLCS	Places
OD	Outside Diameter	PLD	Programmable Logic Device
ODM	Original Design Manufacturer	PLN	Plane/Plan
ODR	Oscillating Disk Rheometer	PLNG	Planning
OEM	Original Equipment Manufacturer	PLNR	Planner
OFHC	Oxygen-Free High-Conductivity Copper	PLT	Plate
OL	Outerlayer	PLTD	Plated
OLB	Outer-Lead Bonding (TAB)	PM	Preventive Maintenance
ORG	Organize/Organization/Orange	PNL	Panel
ORIG	Original	POS	Positive
OSHA	Occupational Safety Hazards Act	PP	Prepreg
OSI	Open Systems Interconnection	Pp	Process Performance (See Also Cp)
OSI	On-Screen Inspection	PPM	Parts Per Million
OSP	Organic Solderability Preservative (anti-oxidant coating)	PPO	Polyphenylene Oxide

PPS	Polyphenylene Sulfide (Plastic)
PQFP	Plastic Quad Flat Package
PQFN	Pull Back Quad Flat Pack No Lead
PROG	Program
PRT	Planar Resistor Technology
PSDS	Product Safety Data Sheet
PSF	Per Square Foot
PSI	Pounds Per Square Inch
PSI	Per Square Inch
PSL	Process Sensitivity Level
PSON	Pull Back Small Outline No Lead
PT	Positional Tolerance
PT	Perfect Test/Point
PTFE	Polytetrafluoroethylene (Teflon)
PTH	Plated-Through Hole
PTS	Points
PVC	Polyvinyl Chloride
PVT	Production Validation Test
PWA	Printed Wiring Assembly
PWB	Printed Wiring Board
PWBA	Printed Wiring Board Assembly

— Q —

QA	Quality Assurance
QC	Quality Control
QE	Quality Engineer
QFD	Quality Function Deployment
QFP	Quad Flat Pack
QFN	Quad Flat No Lead
QML	Qualified Manufacturers List
QPL	Qualified Products List
QPL	Quality Product Level
QTA	Quick Turn Around
QUAL	Qualification/Qualify

— R —

R&R	Repeatability And Reproducibility
RA	Rosin Activated (Flux)
RAD	Radius/Radii
RAM	Random Access Memory
RCC	Resin Coated Copper
REF	Reference
REG	Registration/Register
REL	Release
REM	Remove
REP	Representative/Represent

REQ	Request for Quotation
RF	Radio Frequency
RFI	Radio-Frequency Interference
REIN	Reinforce
RFP	Request for Proposal
RFQ	Request For Quote
REPL	Replace
RFS	Regardless of Feature Size
RISC	Reduced Instruction Set Computing
RMA	Rosin Mildly Activated (Flux)
RMK	Remake
RMS	Root Mean Square
ROM	Read Only Memory
RP	Rout Program
RPM	Revolutions Per Minute
RPR	Repair
RPT	Report
RSS	Ramp Soak Spike
RT	Rout
RTF	Reverse-Treat Foil
RTS	Ramp To Spike
RTT	Resistance From Point to Point
RTV	Room Temperature Vulcanizing
RWK	Rework
RwoH	Reliability without Hermeticity

— S —

S&R	Scrap and Rework
SAC305	A lead free soldering alloy consisting of Sn96.5, Ag3.0, Cu0.5
SAE	Society of Automotive Engineers
SB	Should/Shall Be
SBU	Sequential Buildup
SCP	Single Chip Package
SCRN	Screen
SDS	Safety Data Sheet
SEC	Solvent Extract Conductivity
SECT	Section
SEM	Scanning Electron Microscope
SEM	Standard Electronic Module (Navy)
SEP	Separate
SERA	Sequential Electrochemical Reduction Analysis
SFM	Surface Feet Per Minute
SHT	Sheet
SIG	Signal

SIP	Single Inline Package	T _d	Laminate Temperature of Decomposition
SIR	Surface Insulation Resistance (Resistivity)	TDR	Time-Domain Reflectometer
SLD	Solder	TEM	Transverse Electromagnetic Mode
SLDR	Solder	TEMP	Temperature
SLT	Slot	TF	Terafunctional
SMC	Surface-Mount Component	TFA	Tree-based Floorplanning Algorithm
SMD	Surface Mount Device	TFE	Tetrafluoroethylene (Teflon)
SMEMA	Surface Mount Equipment Manufacturers Association	T _g	Glass Transition Temperature
SMOBC	Solder Mask Over Bare Copper	TGA	Thermo Gravimetric Analysis
SMOGB	Solder Mask Over Gold Body	TGP	True Grid Position
SMC	Surface Mount Component	TGT	Target
SMP	Surface-Mount Pad	TH	Tooling Hole(s)
SMT	Surface Mount Technology	THK	Thickness
SMTA	Surface Mount Technology Association	THP	Through Hole Package
S/N	Serial Number	THT	Through-Hole Technology
SNA	Systems Network Architecture	TIFF	Tagged Image File Format
SOC	System On a Chip	TMA	Thermo Mechanical Analysis
SOIC	Small-Outline Integrated Circuit	TO	Transistor Outline
SON	Small Outline No Lead	TOL	Tolerance
SOS	Silicon-on-Sapphire	TOP	Technical and Office Protocol
SP	Space	TP	True Position
SPC	Statistical Process Control	TQM	Total Quality Management
SPEC	Specification	TR	Transfer
SPICE	Simulation Program, Integrated Circuit Emphasis	TST	Test
SQ	Square	T's & C's	Terms And Conditions
SQC	Statistical Quality Control	TTL	Transistor-Transistor Logic
SQFT	Square Foot	TU	Touch-Up
SQIN	Square Inch	TYP	Typical/Type
SQL	Structured Query Language	— U —	
SS	Solder Side	UAI	Use As Is
SSI	Small-Scale Integration (Integrated Circuit)	UBM	Under Bump Metallization
STD	Standard	UHF	Ultra-High Frequency
STEP	Standard for Exchange of Product Model Data	UL	Underwriter's Laboratories
STK	Stock/Stack	ULSI	Ultra-Large Scale Integration (Integrated Circuit)
SYM	Symbol	UOS	Unless Otherwise Specified
— T —		UPH	Unit Per Hour
TAB	Tape-Automatic Bonding	UR	Urethane Resin
TAL	Time Above Liquidus	URL	Uniform Resource Locator
TANG	Tangency	UUT	Unit Under Test
TCE	Thermal Coefficient of Expansion	— V —	
TCP/IP	Transmission Control Protocol / Internet Protocol	VAR	Value-Added Reseller
TCR	Temperature Coefficient of Resistance	VHDL	VHSIC Hardware Description Language
		VHF	Very-High Frequency

VHSIC	Very-High Speed Integrated Circuits
VLSI	Very-Large Scale Integration (Integrated Circuit)
VOC	Volatile Organic Compound
VOLT	Voltage
VME	Versa-Module Electronic
VSAG	VHDL Standardization and Analysis Group
VSVR (IEEE)	Voltage Standing Wave Ratio

— W —

W/	Width
W&T	Warp and Twist
WIP	Work In Process
WLP	Wafer Level Packaging
WSI	Wafer-Scale Integration
WVTR	Water Vapor Transmission Rate
WYSIWYG	What You See Is What You Get
WWW	World Wide Web

— X —

XIP	Execute In Place
XRF	X-Ray Fluorescence

— Z —

ZAF	Z-Axis Adhesive Film
ZIF	Zero-Insertion Force
ZIP	Zigzag Inline Package
Zo	Impedance Value

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- 50% discount on IPC standards
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- One copy of *IPC International Technology Roadmap for Electronic Interconnections*
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For companies that recognize the importance of giving multiple company locations access to IPC membership benefits, the Enterprise Package provides Classic Membership to all employees at select locations, plus:

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Features	Classic Membership	Technology Package	Business Package	Business & Technology Package
24/7 online access to members-only resources, including original articles and presentations on technical issues and industry/market trends	x	x	x	x
One single-user download of each new or revised IPC standard within 90 days of publication (with approximately 50 standards documents developed annually, that represents an average savings of more than \$2,400 each year)	x	x	x	x
50% discount on IPC standards	x	x	x	x
Significant discounts on IPC publications and training materials	x	x	x	x
Significant discount on exhibiting at IPC events, including IPC APEX EXPO	x	x	x	x
Reduced registration rates on IPC conferences and other educational events	x	x	x	x
Access to participate in IPC market research studies (along with complimentary report for each study in which company participates)	x	x	x	x
One All Access Package registration to IPC APEX EXPO		x	x	Includes two registrations
Your choice of one registration to IPC TechSummit or two registrations to other IPC technical conferences		x		x
One registration to IPC's annual Capitol Hill event			x	x
One copy of <i>IPC International Technology Roadmap for Electronic Interconnections</i>		x		x
One registration to an IPC management/business conference			x	x
Two registrations to IPC technology webinars		x		x
One copy of a Fast Facts market research study			x	x

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For more information about IPC's membership options and packages, visit www.ipc.org/membership or contact the Member Success team at membership@ipc.org.

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Visit www.IPC.org/offices for the locations of IPC offices worldwide.

"Juki gets tremendous value from our IPC membership ... we get quarterly market data which would cost us thousands of dollars if we commissioned it on our own. The industry standards generated by IPC committees allow us to design our equipment with certainty that it will meet industry requirements. The returns for our company are so great, they are beyond calculable."

Bob Black
President and CEO
Juki Automation Systems Inc.

Thank you for your decision to join IPC. Membership is **site specific**, which means that IPC member benefits are available to all individuals employed at the site designated on this application.

Company Name			
Street Address			
City	State	Zip/Postal Code	Country
Main Phone No.		Main Fax	
Company E-mail address		Website URL	
Number of Employees at this Site		Number of Employees Corporate-Wide	
Name of Primary Contact			
Title		Mail Stop	
Phone	Fax	E-mail	

To best serve your specific needs, please indicate the most appropriate member category for your facility. (Check one box only.)

☐ **Printed Board Manufacturer**

Facility manufactures and sells printed boards or other electronic interconnection products to other companies.

What products do you make for sale? (check all that apply)

- ☐ One and two-sided rigid, multilayer printed boards ☐ Flexible printed boards ☐ Other interconnections
☐ Printed electronics

☐ **Electronics Manufacturing Services (EMS) Company**

Facility manufactures printed board assemblies, on a contract basis, and may offer other electronic interconnection products for sale.

☐ **OEM — Original Equipment Manufacturer**

Facility purchases, uses and/or manufactures printed boards or other interconnection products for use in a final product, which we manufacture and sell.

What is your company's primary product line? _____

☐ **Industry Supplier**

Facility supplies raw materials, equipment or services used in the manufacture or assembly of electronic products.

Which industry segment(s) do you supply? ☐ PCB ☐ EMS ☐ Both ☐ Printed electronics

What products do you supply? _____

☐ **Government, Academia, Nonprofit**

Organization is a government agency, university, college or technical or nonprofit institution which is directly concerned with design, research and utilization of electronic interconnection devices.

☐ **Consulting Firm**

What services does the firm provide? _____



Application for Site Membership

Membership Packages and Dues

Membership will begin the day the application and dues payment are received, and will continue for one or two years (savings of 10%) based on the choice indicated below. All fees are quoted in U.S. dollars.

Please check one:

	Classic Membership		Business Package Membership		Technology Package Membership		Business & Technology Package Membership		Enterprise Package
	One year	Two years	One year	Two years	One year	Two years	One year	Two years	
Primary Facility/site: The first site of an organization to join IPC membership	☐ \$1,100	☐ \$1,980	☐ \$2,400	☐ \$4,320	☐ \$2,400	☐ \$4,320	☐ \$3,800	☐ \$6,840	Please call for a quote
Additional Facility/site: Membership for a facility of an organization that has a different location than its Primary Facility membership	☐ \$900	☐ \$1,620	☐ \$2,200	☐ \$3,960	☐ \$2,200	☐ \$3,960	☐ \$3,600	☐ \$6,480	
Company with annual revenue of less than \$5 million	☐ \$650	☐ \$1,170	☐ \$1,950	☐ \$3,510	☐ \$1,950	☐ \$3,510	☐ \$3,350	☐ \$6,030	
Government agency, academic institution or nonprofit organization	☐ \$300	☐ \$540							
Consulting firm (employing fewer than six individuals)	☐ \$650	☐ \$1,170							

Explanation of Packages

Classic Membership — IPC's classic membership provides core benefits to all employees at a company site/facility:

- 24/7 online access to members-only resources
- One single-user download of each new or revised IPC standard within 90 days of publication
- 50% discount on IPC standards
- Significant discounts on IPC publications and training materials
- Significant discount on exhibiting at IPC events, including the industry's flagship event IPC APEX EXPO
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- Access to participate in IPC market research studies (along with a complimentary report for each study in which company participates)

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- One All Access Package registration to IPC APEX EXPO®
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- One copy of a Fast Facts market research study

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- One copy of IPC International Technology Roadmap for Electronic Interconnections
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Enterprise Package — For companies that recognize the importance of giving multiple company locations access to IPC membership benefits, the Enterprise Package provides Classic Membership to employees at select locations.

Payment Information (Purchase orders not accepted as a form of payment)

Enclosed is a check for \$_____ Bill credit card: (check one)

☐ MasterCard ☐ American Express ☐ Visa ☐ Diners Club

Card No. _____ Expiration Date _____ Security Code _____

Authorized Signature _____

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**Overnight deliveries to this address only.*

Contact membership@ipc.org for wire transfer details.

Please attach business card
of primary contact here

07/14



Standard Improvement Form

IPC-T-50M

The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

IPC
3000 Lakeside Drive, Suite 105N
Bannockburn, IL 60015-1249
Fax: 847 615.7105
E-mail: answers@ipc.org
www.ipc.org/standards-comment

1. I recommend changes to the following:

___ Requirement, paragraph number _____
___ Test Method number _____, paragraph number _____

The referenced paragraph number has proven to be:

___ Unclear ___ Too Rigid ___ In Error
___ Other _____

2. Recommendations for correction:

3. Other suggestions for document improvement:

Submitted by:

Name _____ Telephone _____

Company _____ E-mail _____

Address _____

City/State/Zip _____ Date _____



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