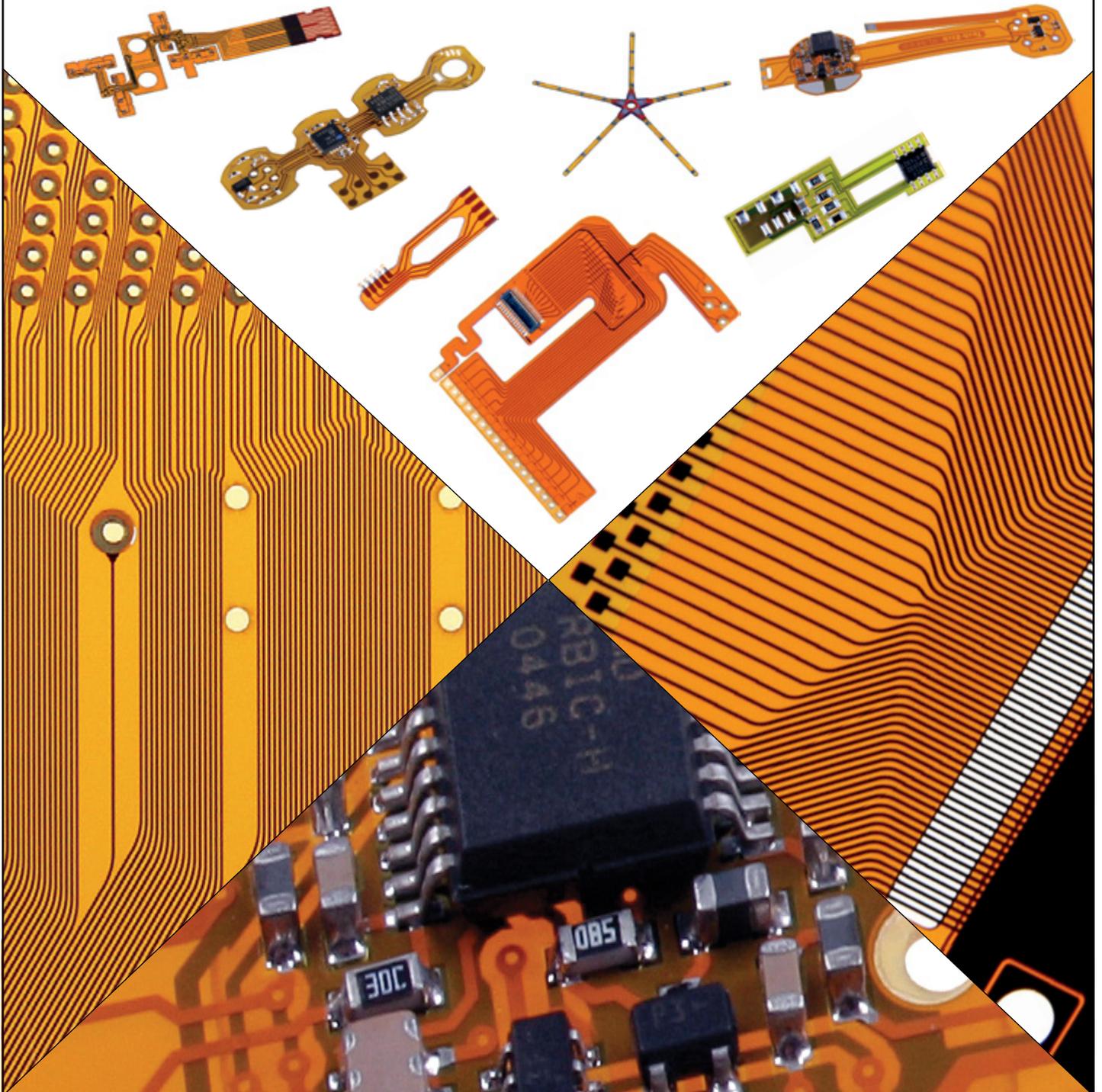


Tech-Etch

www.tech-etch.com/flex

Flexible Printed Circuits Design Guide

- o Multilayer
- o SMT Assembly
- o Selective Plating of Gold & Tin-Lead
- o Fine Line
- o Microvias
- o Cantilevered & Windowed Leads



MATERIALS

CONDUCTOR

Copper is the most commonly used material for circuit traces and offers the most cost effective solution. Thickness typically ranges from .0007" to .0028". Tech-Etch works with both adhesive based and adhesiveless substrate materials.

In addition, Tech-Etch has the capability to manufacture circuits from specialty metals to support specific applications. Some examples are stainless steel for corrosion resistance, BeCu for spring properties, Cupronickel for high resistance applications, and selective tungsten segments when radiopacity is desired.

INSULATOR

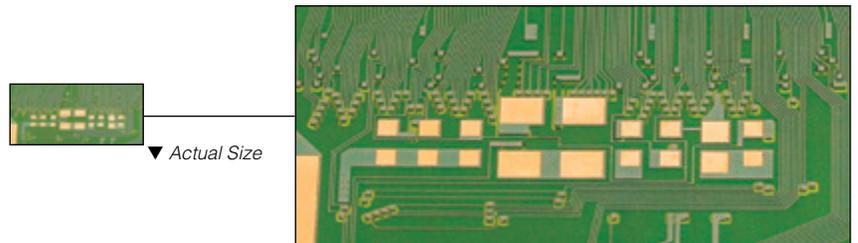
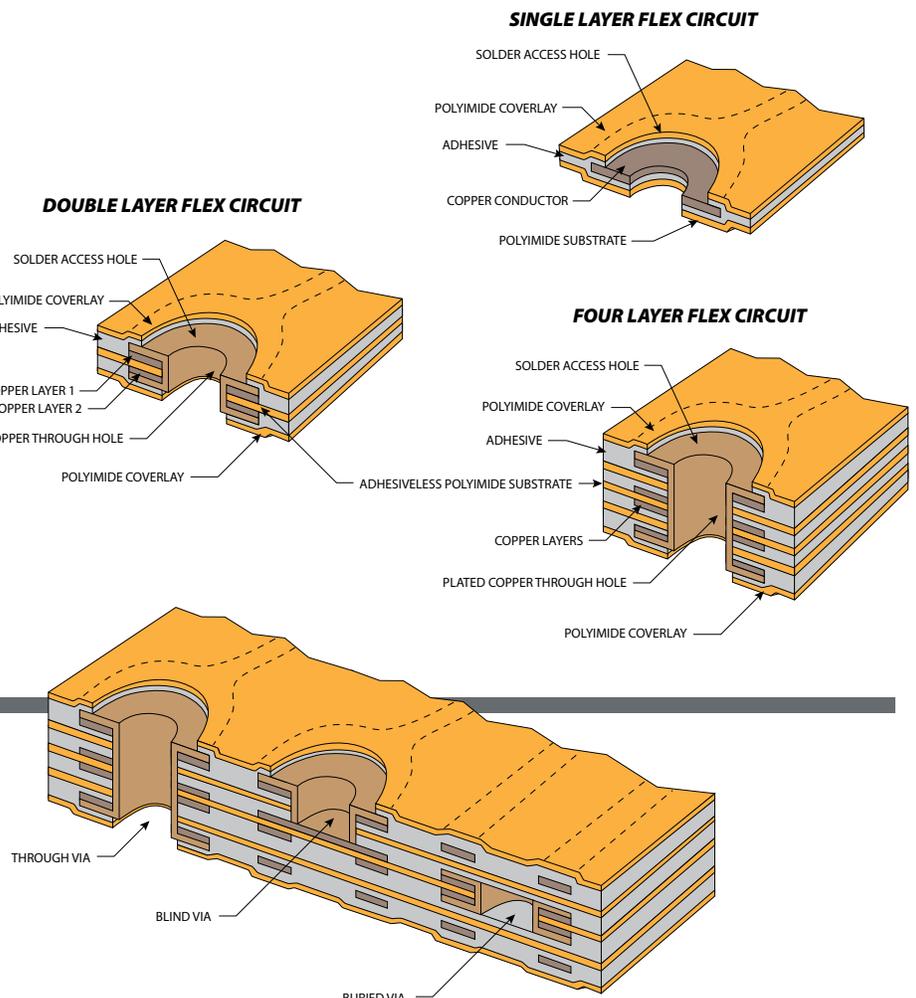
Polyimide film is the most common insulator material used for flex circuits. Tech-Etch uses this film as the base layer on single metal layer flex circuits and for inner layers of multilayer circuits.

PLATED THROUGH VIAS

Tech-Etch can provide circuits with plated through vias. A via is a metalized through hole that connects the conductive layers of a flexible circuit.

Tech-Etch can also produce blind vias where the via connects an outer layer with an inner layer, but does not go all the way through the circuit. Buried vias connect internal layers, but also do not connect to the outer layers. These advanced via types can help increase space within the circuit for other features such as component pads or additional trace routing.

Tech-Etch has the ability to drill vias as small as .001" diameter using laser drill technology. Reference Capabilities Matrix for via size limitations.

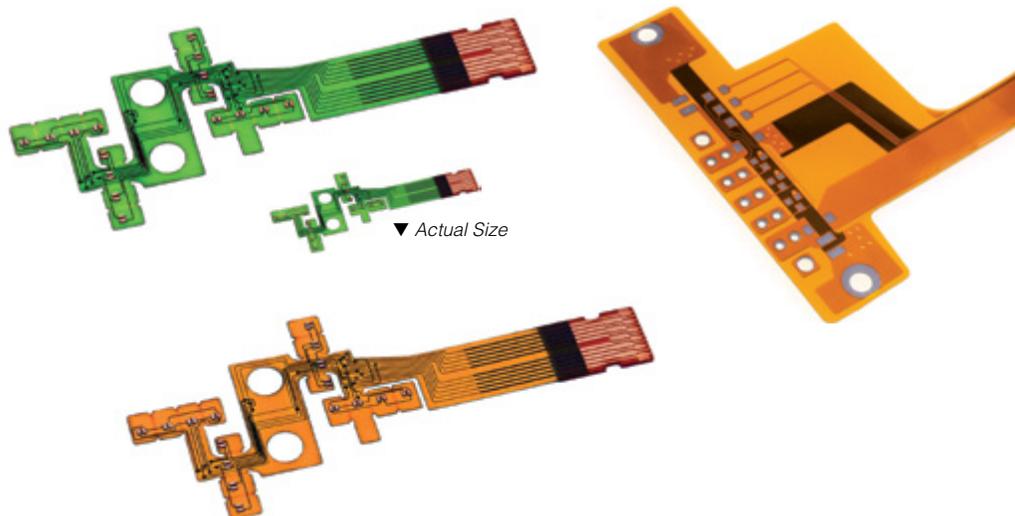


COVERLAYER

The coverlay is the insulating layer placed over the exposed conductors. It is typically constructed of a pre-cut piece of polyimide film laminated over the conductors using either acrylic or epoxy adhesive.

For high density applications Tech-Etch also has the ability to work with Photo Imageable Coverlayer. This material is coated over the conductors and does not require adhesive or lamination. Though not as resilient as polyimide film, it does support very small and dense access openings required by many of today's electronic components.

Photo Imageable Coverlayer can be tinted with either amber or green pigment as shown on the adjacent parts.

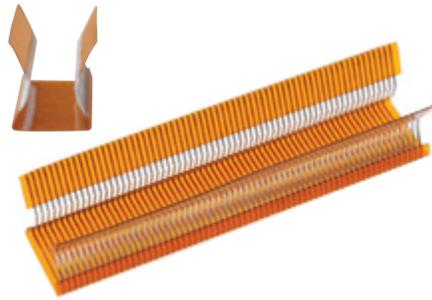


FINISH

Exposed pads will typically need a finish for corrosion resistance or compatibility with the assembly process or application. Electroplating is the most common finishing process. However, it can only be accomplished when all the conductors are connected to a common external bus during fabrication. Tech-Etch offers in-house electroplating of Tin, Tin Lead, Copper, Nickel, Soft Gold, and Hard Gold.

For designs where the traces cannot be bussed into the panel, electroless finishing options such as hot air solder leveling, immersion gold over electroless nickel (ENIG), and immersion tin are available as alternatives.

Tech-Etch flex circuits can be made RoHS compliant by selecting the proper finish. Our product engineers can help ensure the finish selected supports the intended application.



Beryllium Copper Circuits



Windowed Leads



Stainless Steel Circuits



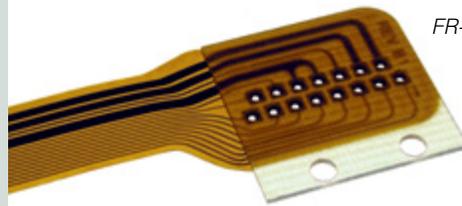
STIFFENERS

Stiffeners are added to rigidize areas of a circuit to strain relieve component attachment locations, provide a firm surface for mounting, or increase thickness of the circuit to correspond to the mechanical specifications (e.g. ZIF connector).

Polyimide film is used when the additional thickness required is .002"-.009". Polyimide stiffeners can have coincidental edges to the circuit outline.

FR-4 is used when the additional thickness required is greater than .010". The stiffener features are typically smaller than the corresponding circuit features by .015".

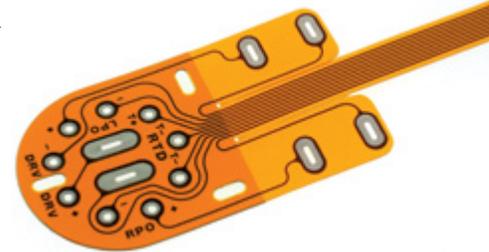
Other materials such as metal or molded plastic components can also be used as stiffeners for specific design requirements.



FR-4 Stiffener



Molded Plastic Stiffener



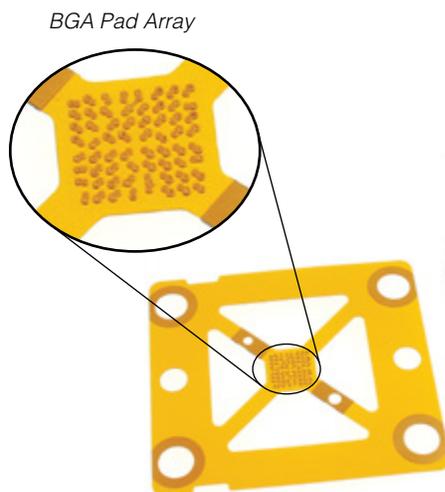
Polyimide Stiffeners

OUTLINING

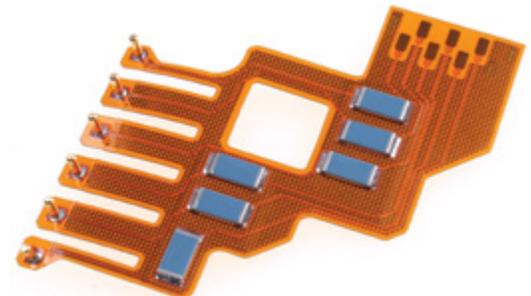
Tech-Etch has many different options for defining the circuit outline. Our product engineers will advise on the most cost effective solution based on required tolerances and feature sizes.

Tolerance on overall size and the minimum distance to the nearest copper feature are two of the measurements Tech-Etch considers when determining whether to use a Steel Rule Die or a Class 'A' Hard Tool. All hard tools are fabricated in house to our exacting standards.

For extremely small or tight tolerance applications, Tech-Etch has the capability to laser cut the outline.



BGA Pad Array



MECHANICAL PROPERTIES

Optimum Sizes

Tech-Etch provides circuits up to 16" long. Multi-layer circuits up to 6 conductive layers are available. Consult factory for larger sizes.

Shielding

For designs requiring shielding, additional layers of copper can be added in solid or grid patterns. Conductive ink shield layers are also available.

Flexibility

Dynamic regions on a Flex Circuit should be identified on the print to allow for manufacturing features that will enhance dynamic performance. The following are general guidelines that apply to non-dynamic applications where bends are for installation only.

Min. Bend Radius

Single Layer Circuit.....10x thickness

Multi-Layer Circuit.....20x thickness

Temperature

Most often the adhesive used is the limiting factor for high temperature rating continuous service. Typical values are 105C (221F) for epoxy adhesive and 120C (248F) for acrylic adhesive. Both systems will withstand normal soldering practices after a moisture driving bake.

ENGINEERING SUPPORT

At the onset of your project we recommend that you contact Tech-Etch with a preliminary sketch for quotation and feedback on manufacturability. Our engineers can provide design assistance to ensure a cost-effective production part. We can accommodate almost any file format such as DWG, DXF, Gerber, Pro-E, and Solid Works.



ASSEMBLY / TEST

Tech-Etch offers value added assembly to provide turnkey solutions. Surface mount component package sizes down to 0201 and leaded components down to .4mm pitch are attached using our automated pick & place equipment.

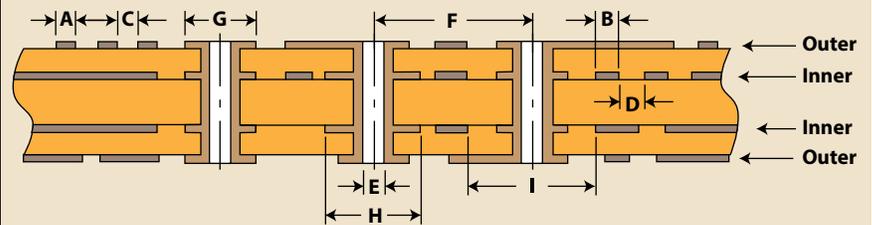
Tech-Etch also offers through hole component assembly as well as Single Point or Bar bonding for applications requiring significant process control for specialty components such as axial lead thermistors, piezo elements, wound coil antennas, and circuit pins.



CAPABILITIES MATRIX

Circuit Layer Design Guidelines

Attribute	Detail	Nominal	
		Minimum	Preferred
Line Width – Outer Layers	A	.0015"	.002"+
Line Width – Inner Layers	B	.001"	.002"+
Line to Line Space – Outer Layers	C	.0015"	.002"+
Line to Line Space – Inner Layers	D	.001"	.002"+
PTH Diameter – Drilled	E	.001" min	
PTH to PTH Pitch – Center to Center	F	Ø+.0065"	Ø+.0075"+
PTH Pad Diameter – Outer Layer	G	Ø+.002"	Ø+.003"+
PTH Internal Land Dia. – Inner Layers	H	Ø+.002"	Ø+.003"+
PTH Clearance Dia. – Inner Layers	I	Ø+.004"	Ø+.005"+



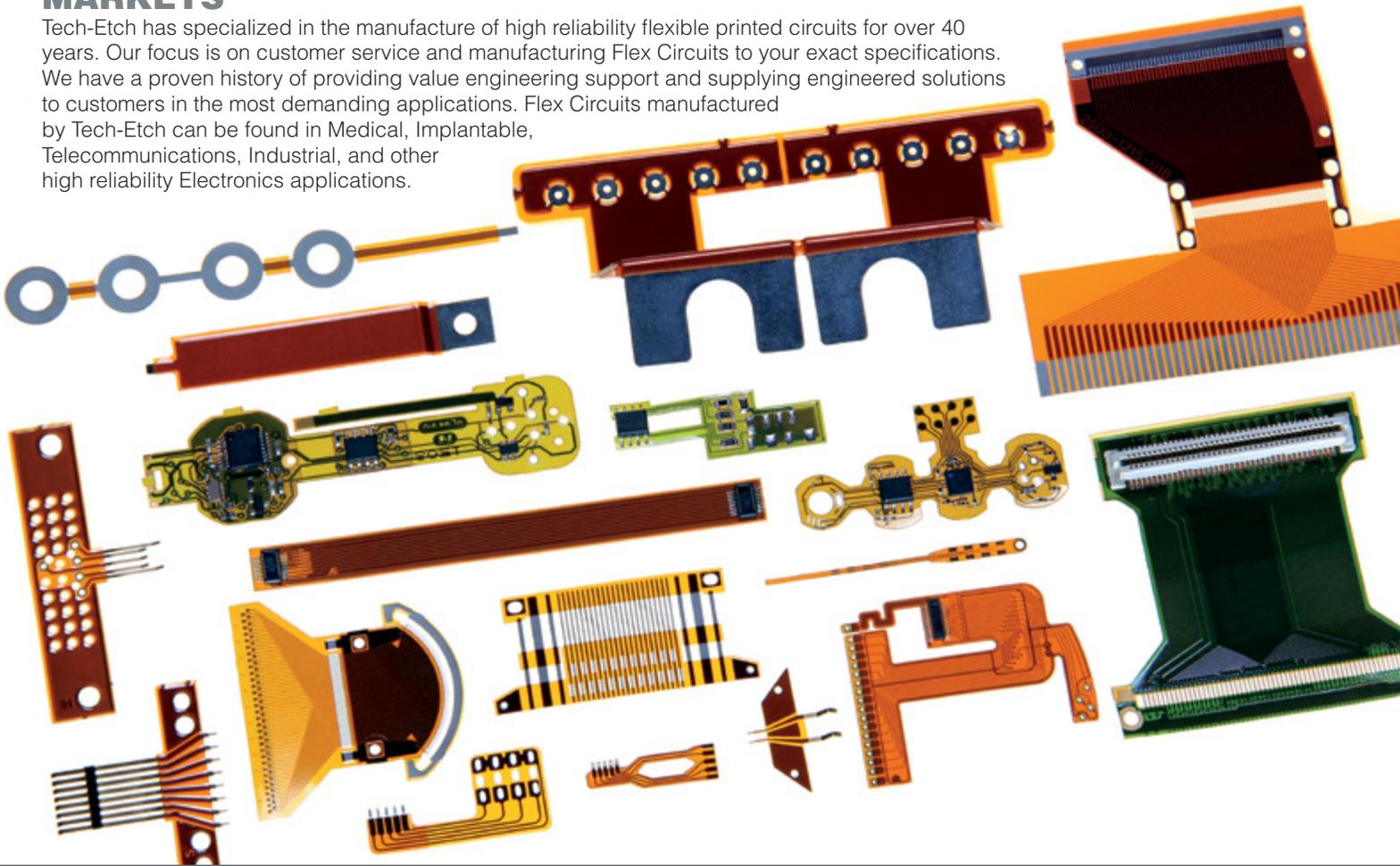
Coverlayer Design Guidelines

	Polyimide Coverlay				Photo Imageable Coverlay			
	Nominal		Tolerance		Nominal		Tolerance	
	Min.	Pref.	Min.	Pref.	Min.	Pref.	Min.	Pref.
Feature Size	.008"	.020"	± .001"	± .010"	.003"	.006"	± .001"	± .002"
Registration	-	-	± .005"	± .010"	-	-	± .001"	± .002"

If your design requirements exceed the capabilities stated above, please contact the factory to see if an alternate process or tooling are available.

MARKETS

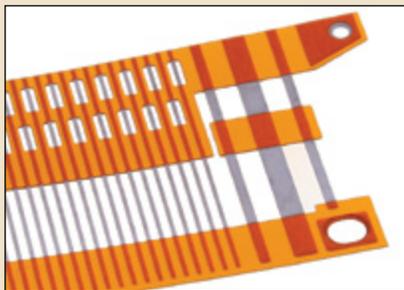
Tech-Etch has specialized in the manufacture of high reliability flexible printed circuits for over 40 years. Our focus is on customer service and manufacturing Flex Circuits to your exact specifications. We have a proven history of providing value engineering support and supplying engineered solutions to customers in the most demanding applications. Flex Circuits manufactured by Tech-Etch can be found in Medical, Implantable, Telecommunications, Industrial, and other high reliability Electronics applications.



FLEXIBLE CIRCUIT SPECIALTY PROCESSING

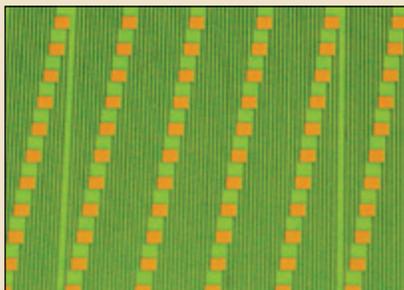
Polyimide Etching

By using our unique polyimide etching technology, Tech-Etch can supply circuits with conductors suspended across an open window in the polyimide film or cantilevered from the edge of the circuit. For circuits made with beryllium copper, cantilevered leads can be formed and used as integral contacts.



Additive Process

Tech-Etch uses both Semi-Additive and Subtractive processing techniques to manufacture trace patterns. Starting with copper as thin as 2 microns and selectively plating copper up to 1 oz. thick on adhesiveless polyimide substrates, Tech-Etch can produce fine line circuits with trace and space patterns as small as .001" in production volumes.



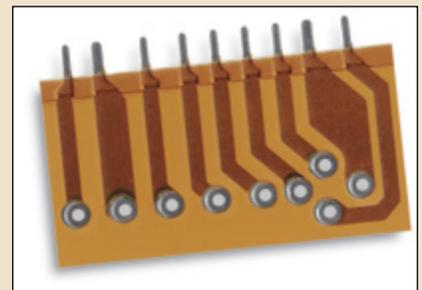
Selective Plating

By combining our in-house electroplating and precision imaging capabilities, Tech-Etch can provide circuits with selective finish plating. This process allows for different finishes plated on separate areas of the part. This is particularly useful when multiple assembly processes will be used (e.g. solder assembly and wire bond).



Contoured Circuits

By capitalizing on our experience with thick metal etching, Tech-Etch can supply Contoured Circuits with integral contact fingers up to .010" thick. The remaining metal in other areas of the circuit is etched down to approximately .004" thick. Particularly useful for applications where current carrying capacity is a requirement, this process also supports raised solder pads above the cover layer or circuits manufactured on material as thick as .020".



A TOTAL CAPABILITY

World Technology Leader

Tech-Etch manufactures precision parts for the medical device and equipment, military/aerospace, electronic, telecommunications, and measurement and control industries. Using the latest etching, metal fabrication and metal finishing equipment, Tech-Etch specializes in photo etching, forming and laminating engineered components, in addition to flexible circuits. The company has a long history of technological innovation, quality products, excellent customer service, and growth. From its beginnings as a research firm in 1964, Tech-Etch has expanded its product offerings, acquired new businesses, and constructed new facilities. Tech-Etch operates three manufacturing facilities and has over 500 employees. Corporate headquarters and most of the custom engineering and manufacturing are located in Plymouth, MA, just 40 miles south of Boston. Over 190,000 square feet of floor space, conference and training rooms, and state-of-the-art chemical processes and equipment make this Tech-Etch's centerpiece. The other facilities are located in Fall River, Massachusetts and Litchfield, Minnesota.

Wide Range of Processes

Tech-Etch performs a wide variety of processes, and this single-source capability enables it to assume total responsibility for the quality and delivery of our precision products. In-plant services include photo etching and chemical milling, artwork generation and phototooling, stamping from coil stock and forming from etched blanks, tool and die making, production heat treating, flexible circuit design and production, welding and soldering, metal finishing, plating, and laser cutting. Secondary operations such as soldering joints to seal seams, spot welding, and the application of pressure sensitive tapes and insulation materials are also available.

ISO 9001 and AS9100D Certification

Tech-Etch operates a Quality Management System that is registered to ISO 9001:2015 and AS9100D. This system is designed to control all business processes from Contract Review through the manufacturing processes to final inspection of product. The system seeks to identify and eliminate all nonconformities and prevent their recurrence through Corrective Action and Internal Auditing procedures. Process capability studies are available to guide you on part manufacturability.

★ Additional Products & Capabilities ★

EMI/RFI SHIELDING

Tech-Etch designs and manufactures a broad line of standard and custom EMI/RFI shielding products including BeCu and wire mesh gaskets, conductive elastomers, and board level shielding. Our catalog of standard products is available online or in print.



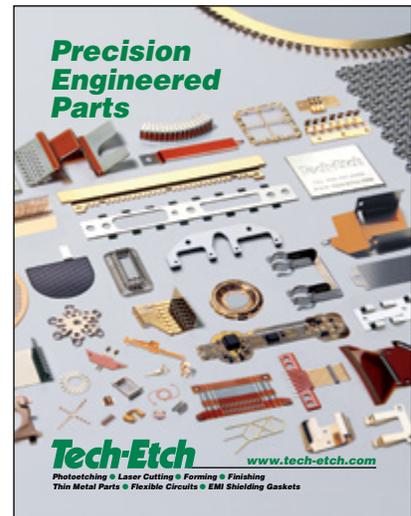
BOARD LEVEL SHIELDING

Tech-Etch uses cost-saving photo etching to manufacture Board Level Shielding components such as custom fences with removable covers. The photo etching process improves design flexibility, shortens lead times, and eliminates hard tooling costs.



PHOTO ETCHING

Tech-Etch specializes in the manufacture of light gauge parts from a wide range of materials. The photo etching process allows us to produce parts with high accuracy. Forming and value added finishing are offered to provide turnkey mechanical parts.



The data presented in this brochure is based on testing and to our knowledge is accurate and true. Since applications, test measures, and test procedures may vary, we recommend that users of our products perform their own tests to assure the suitability of these products for their specific applications.

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