

Choosing the Right Flexible Circuit Supplier

Five Critical Considerations

By Dave Becker

Do you see flexible circuitry as a possible design solution for your application, but lack experience with circuitry suppliers? Being new to flexible circuit technology doesn't mean that you are destined to climb a steep learning curve and make expensive supply chain mistakes. However, it does require that you choose the right partner to meet your requirements.

Choosing a flexible circuit supplier can be a hit or miss proposition for companies inexperienced with flex circuit technology or the supply chain. Often times companies view flex circuitry as a "commodity" and award the business to the lowest bidder. This can be a costly mistake. To make the best choice, you need to understand that very few circuitry suppliers are good at everything; rather, they tend to develop a specialty. Ideally, you want your supplier to have a developed capability that dovetails with the requirements of your product.

There are five critical considerations to keep in mind during the selection process to ensure the "best fit". With these criteria in mind, you can make an informed decision with confidence.

1. Design and Applications Engineering Capability: Does your potential supplier have the technology and expertise to support your design needs?

Each circuit must function in a unique environment so it is important to identify key product characteristics for the application. This will need to include any manufacturing processes it must withstand. Key product characteristics will include:

Mechanical: If bent, what is the radius of the bend, the location of the bend, the number of cycles, and what direction? Is mechanical abrasion possible?

Chemical: What chemical exposure will this see both during assembly and during operation?

Thermal: What thermal exposure will the part see both during assembly and during operation?

Electrical: How much current is being carried? Is there shielding or controlled impedance? Does the circuit rest against a conductive surface?

Dimensional: How big is it? What size are the conductor traces and spaces? What is the cut line to edge tolerance? Maximum or minimum thickness?

Surface finish: How will this be connected to the rest of the world? What assembly processes will be employed?

The above information will allow the flex supplier to make good recommendations for tooling, processes and materials so the product meets the end use requirements. Various films, adhesives, and metal types perform best in certain applications, driven by key product characteristics

Many customers will supply the flex circuit manufacturer with completed Gerber files or a detailed schematic for the electronic design. Some of the more sophisticated suppliers can take a net list and convert it into a circuit lay out or redesign a wire bundle into an alternative flexible circuit design. The customer need for design assistance will vary considerably and is a key consideration when choosing a flex circuit supplier. Make sure your potential flexible circuitry supplier has the design software and engineering expertise to support your design needs.

2. Volume Capabilities: Do your volume requirements match with your supplier's capacity?

With initiatives to adopt lean manufacturing, suppliers are claiming to reduce cycle time, minimize waste, and improve set-up time. Are you looking for very high volume, quick-turn low volume, or something in between?

Manufacturers of high volume circuitry tend to be highly automated, using processes and materials geared toward lowest possible costs in very high volume consumer markets. High volume tends to be roll to roll, with specialized equipment to handle continuous rolls of thin, flexible material. These suppliers minimize labor content and may get better pricing on raw materials. Tooling costs are quite high and production run sizes are based on minimum roll sizes. Capital equipment costs are high, so square foot throughput is a necessity. These suppliers provide low volume and quick-turn circuits to support programs on the path to high volume serial production.

Low to medium volume suppliers process flexible circuits in rectangular shaped panels and employ equipment designed to support a wider variety of process flows and materials. Low cost tooling and compressed cycle times are more available with panel processing while the machine operations tend to be more flexible and operator intensive. These suppliers are more likely to build a diversified range of flexible circuitry. Extended length circuits, multiple plating surfaces, reverse bared flex and multilayer flex are examples of parts that generally require panelized processing.

3. Fabrication Capabilities: Can your supplier routinely handle your fabrication requirements?

There are four broad types of flex circuits: single sided, double sided, multilayer and rigid-flex. These types are characterized by the IPC (Institute for Interconnecting and Packaging Electronic Circuits), as Type I, Type II, Type III and Type IV respectively. Fabrication of any printed circuit consists of 20-40 sequential processes. As layers are added, the manufacturing complexity goes up significantly, as do the number of process steps. Multilayer circuitry requires process specialization with fixturing, plasma etching, registration, and inspection capability. Material stability is a key consideration in both tooling design, trace pattern layout, plating parameters and thru hole drilling processes.

Density requirements can be a significant consideration. Many flex manufacturers struggle as conductor features approach .003” lines and spaces. This degree of feature density is often supplied by “running for yield”, but limited capability will involve added costs and inconsistent vendor performance. Specialty equipment is available to handle such requirements and precision imaging systems with clean room manufacturing areas are musts.

An ability to accurately align features from among sequential processes is another critical requirement as density increases and circuit sizes shrink. Tooling to create precision features for zero insertion force connectors (ZIF) is critical as feature to feature requirements at <.004” are specified. This can be accomplished through the use of optical registration equipment, precision die tooling or laser ablation. Understanding vendor capability is good insurance against disappointing performance.

Circuit outline dimensional capability is important with extended length flex circuits. Effectively building a 10 foot long flex circuit requires a lithography process that can accurately create an oversize conductor pattern. Large format die cutting, laser cutting or CNC cutting may be required to define the circuitry cut line. The flex circuit supplier that specializes in building circuits for hand held electronic devices may not be capable of the large format. Many flex suppliers have a range of circuit sizes that they can do well; make sure that the size you are looking for is not outside their standard capability.

4. Post Fabrication Assembly: Has your flex supplier invested in the technology and expertise to adequately handle your component assembly needs?

Many users of flexible circuitry are also looking for a supplier to do component assembly. A flex circuit fabricator also providing assembly eliminates supply chain handoffs. Several manufacturers assemble circuitry requiring low component counts. As volume increases, pick and place automation, reflow soldering, wire bonding, through-hole assembly and functional testing are required to cost effectively provide assembly services. Key variables for process control are quite different for assembly versus fabrication. In addition,

supply chain management and storage control of electronic components become increasingly critical. Does the supplier understand ESD and reliability issues? Are they able to supply RoHS compliant assemblies? Assembling on a flex circuit is much different than assembly on hard boards primarily due to unique material handling and fixturing characteristics. Fabricators need to invest in the equipment, systems, and expertise to effectively assemble as well as fabricate.

5. Certifications and Quality Systems: Has your flex supplier demonstrated its capability and commitment by achieving certifications that are important in your industry?

Certain applications and industries may require adherence to specific protocols and requirements. While in some cases, the sub component supplier does not need to meet all the requirements and protocols that the end producer must meet, it still is vital that the supplier understand the end needs.

Companies that achieve certifications have demonstrated the ability to design and build product with quality and manufacturing systems adequate for a specific market. Probably the most common certification is ISO 9000 and ISO 9001. Below is a list of other certifications that a supplier may have or need:

- ISO 13485:2003- Medical device
- AS9100, AS9110 and AS9120- Aerospace
- ITAR- Military
- ISO/TS 16949, QS 9000- Automotive Market
- FDA Registrations- Medical Device
- TL 9000 – Telecommunications

Achieving the above certifications is not a trivial matter; it means that the flex supplier meets certain quality standards and is audited to those standards. The standards require a common discipline from the quality, operations and management functions of certified suppliers

Other Criteria

There are many other criteria to consider when choosing a flex supplier. While it may seem like common sense to ask these questions, they can be extremely important considerations.

Is the supplier willing to show you their customer list or share information about targeted markets? The industry and markets that encompass their existing customers is often revealing.

Does the supplier have many years of real experience building flexible circuitry, or are they a printed circuit board manufacturer “dabbling” in flexible circuits?

Is it possible to have a direct link to personnel within the manufacturing facility? Are you dealing with the flex circuit manufacturer, or is the supplier buying the product and reselling? Touring the facility can tell you a great deal about capabilities.

Suppliers today are challenged to implement improvements in process control, lean manufacturing, JIT manufacturing. A little investigation can help determine how successfully they are meeting continuous improvement initiatives.

In short, those who diligently research and select their flexible circuit supplier will have a much greater chance of success than one who just assumes they’re dealing with a commodity and awards business based on free tooling specials, first time buyer discounts or lowest bid pricing.

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