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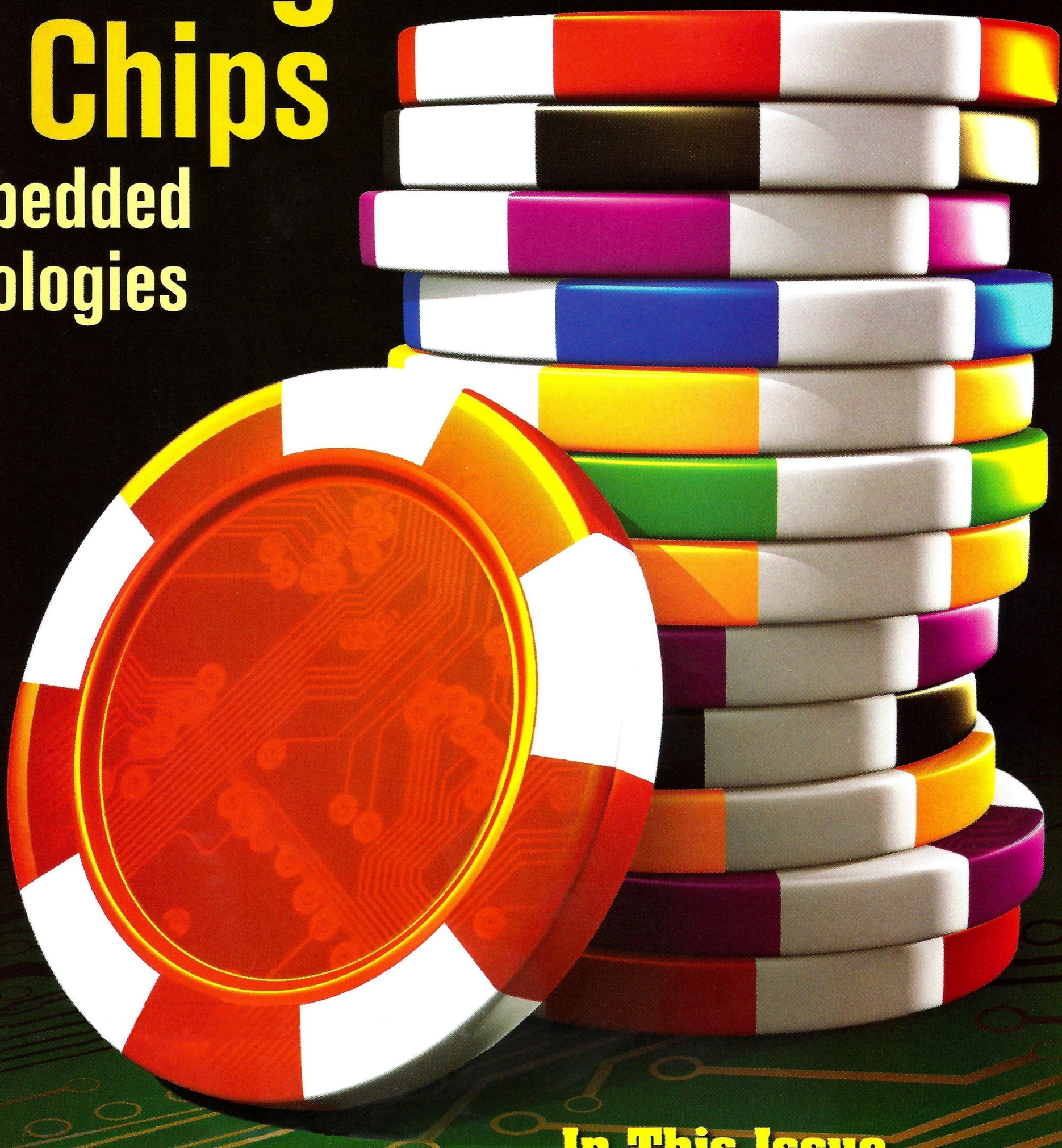

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By Mark Finstad

Terminating Flex Circuits

Q: ***What is the best way to terminate a flex circuit? Can you get flex circuit connectors that are made especially for flexible circuits?***

A: Yes. There are many connectors that are manufactured specifically for use with flexible circuits and flat flexible cables. Zero insertion force (ZIF) connectors and insulation displacement connectors (Figure 1) are both good examples. They offer reliable and inexpensive ways to terminate a flexible circuit. At the same time, virtually any connector that can be used on a rigid PCB can also be installed on a flexible circuit as long as certain design rules are followed. If you chose a through-hole-style connector, the flexible circuit should be rigidized in the connector area with an FR-4 stiffener on the same side as the connector. However, if an SMT connector is going to be used, the rigidizing stiffener needs to be laminated to the side of the flex circuit opposite the connector.

There are many ways to terminate flexible circuits. The most popular methods fall into three main categories: supported and unsupported finger (male type) contacts, insulation displacement connectors, and standard through-hole and surface mount PCB connectors. Unsupported fingers can be either an extension of the copper conductors with the insulation removed or thicker metallic fingers that are attached to the circuit conductors via brazing or high-temp soldering. The fingers can be bent 90 degrees for a parallel installation or left straight for a perpendicular installation. In either case, the connection will be fragile, so it is advisable to encapsulate the soldered finger area of the assembly with an epoxy to make it more rugged. It is important that the epoxy completely encapsulates the fingers and at least a portion of the polyimide insulation. Failure to do this will result in a stress concentration point between the epoxy and polyimide, resulting in broken

Figure 1 ZIF and LIF Connectors Can Be an Inexpensive and Reliable Way to Terminate a Flexible Circuit

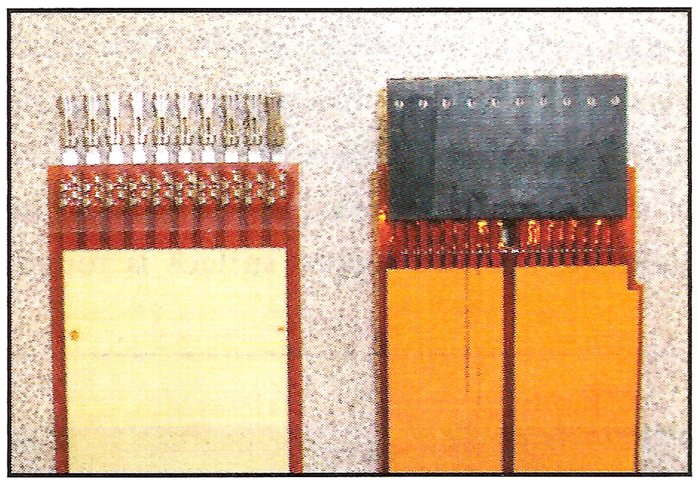

Figure 2 When Used in Conjunction With Plastic Housings, Insulation Displacement Contacts Form a Robust Connector

fingers. Unsupported fingers are usually used in cases where it is desirable to solder the fingers directly into a plated through-hole. Unsupported fingers are often used with a hot-bar process to eliminate the need for a connector. Supported fingers are most commonly used in ZIF or low insertion force (LIF) connector applications, but they can also be used with an anisotropic (z-axis) adhesive and bonded directly to a rigid PCB. When using supported fingers in conjunction with a ZIF connector, it is important to specify important circuit features on the drawing, such as overall thickness in the finger area (usually 275 to 325 µm [0.011 to 0.013 in]) and circuit edge to finger tolerance. When the flex circuit is constructed properly, ZIF connectors can be an inexpensive and reliable way to provide termination. However, if the flex drawing fails to alert the flex circuit manufacturer that a finger pattern will be used with a ZIF connector, the result may be a circuit that will not make proper connection to the ZIF contacts.

Insulation displacement connectors use barbs to pierce through the cover insulation and make contact with the copper conductor below (Figure 2). While not uncommon, insulation displacement connectors are not employed nearly as much as standard through-hole and SMT connectors.

Standard PCB connectors of the through-hole and SMT variety are far and away the most common method of terminating a flex circuit. Some of the more common varieties are connectors such as D sub, micro D, and M55302. There are also many custom PCB connectors that can be installed on flexible circuitry. Keep in mind that if you chose a custom connector for your application, it will most likely be very expensive, and you may be stuck with a single supplier for the life of your program. This does not give you much leverage when you are looking for price concessions when the volumes increase. Also, the lead times on custom connectors can be very long (12 to 18 weeks is not uncommon). When choosing connectors, it is a good idea to talk to the prospective suppliers to see what the average lead time would be or if the connector you are planning to use is stocked by distributors.

Unfortunately, in most cases, the flex circuit is the last component to be designed in the system, so most of the termination choices have already been made by others. You will usually be locked into connectors that mate with the other connectors previously designed into the system. This is why it is so important to start considering the interconnect methods (i.e., flex circuits, connectors, etc.) early in the design process. A few smart decisions early on can save you a boatload of money without sacrificing quality or reliability! ☐

The Flexperts are Mark Finstad and Mark Verbrugge