Making the Right I/O Connection

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How well you design the I/O interconnect ‘bridge’ between equipment can positively or detrimentally affect the performance of your or your user’s system.

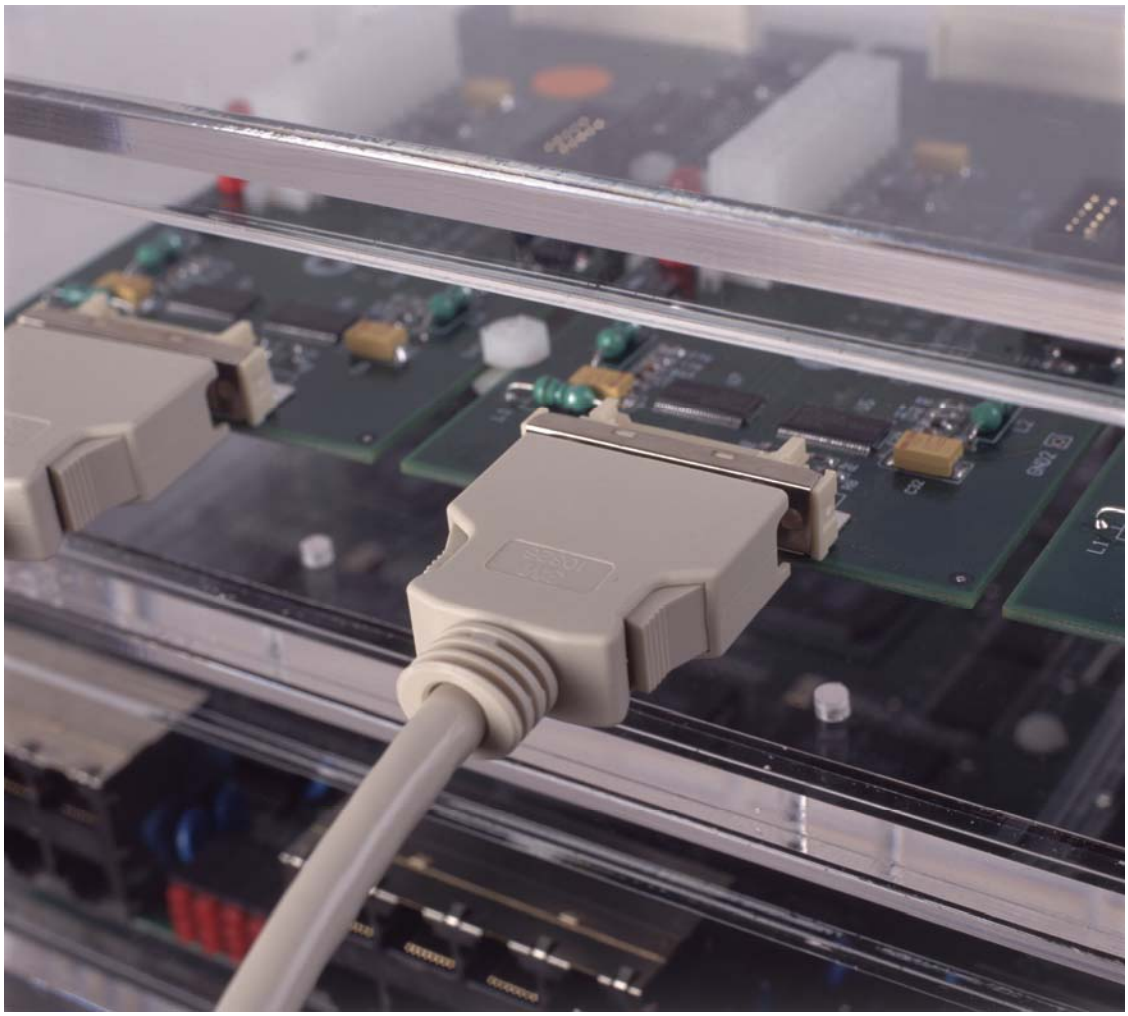

Figure 1: Stackable Ethernet Switch using 3M™ Mini Delta Ribbon connectors and cable.

Connectors do one of two jobs: they connect boards together or equipment together. Typically attached to a length of cable, the input/output or I/O connector is the mechanism by which one device is physically connected to another where there may be some distance between them (fig. 1). It is the physical interface of the equipment, providing an electrical pathway. How well you design the I/O interconnect 'bridge' can positively or detrimentally affect the performance of your or your user's system.

There are several attributes to consider when selecting a connector for I/O applications. Giving thought to intended use, current form factors and industry standards, cable construction and electrical performance, shielding from electro-magnetic and radio frequency interference, connector contact design and mechanical aspects, and anticipating repair and replacement issues, will best equip you to make informed connectivity choices.

Connectors broadly divide into two types based on the design of the wiping contacts: pin/socket and ribbon-style. In pin/socket connectors, a round or square profile pin wipes against a socket contact formed of bent metal to make a complete circuit. However, in .050" pitch and smaller, the pins become fragile and more prone to breakage. For this reason, most high density, high speed I/O connectors are of the ribbon-style design. The precise geometries of the pre-loaded ribbon contacts ensure reliable connection, while the supporting insulator reduces the risk of damage during insertion and withdrawal, even in sub 1.00 mm versions.

The Delta or 'D' Ribbon connector combines the virtues of the ribbon-style contact with many of the positive attributes of the common D Sub connector. It is widely used for low speed parallel port connections meeting IEEE 1284-B, such as to connect legacy storage devices, or communications equipment between shelves or cabinets. The 3M™ 3000 Series, for example, is offered in popular sizes with metal shells for protection from EMI/RFI when mounted at the I/O slot.

On the wire termination side, the choices are typically solder, crimp and poke or insulation displacement. The 3M™ D Ribbon 3000 Series connector uses the proven insulation displacement or IDC contact allowing multiple conductors of a ribbon cable to be terminated in a quick and simple termination process.

Mini Delta Ribbon or 'MDR' is a half pitch version of the D Ribbon connector, based on .050" or 1.27mm pitch. In wide use since the late-1980s, MDR is a proven, reliable I/O platform used for system to system or "box to box" communications with an installed base of millions of ports to date. MDR connector is available from 3M, which claims the industry's largest array of product options for 1.27mm pitch ribbon style connectors.

MDR is the I/O platform of choice for many equipment makers. 3M offers boardmount and wiremount connectors, as well as a range of shell kits and accessories to facilitate and enhance use. With pin counts from 14 to 100, thru-hole, surface mount and press fit mounting styles, and multiple connector orientations, the 3M™ MDR boardmount product line offers engineers great flexibility when designing I/O interfaces.

On the wiremount side, MDR comes in both IDC and solder termination versions. Note that in the MDR system, the wiremount or cable connector is generally a plug (male). To support the wiremount products, 3M offers a range of EMI Junction shells in a variety of materials and cable exit angles, different attachment methods; as well as assembly tooling.

The MDR connector is designed around a fine pitch ribbon style contact for reliable electrical connection.

Most MDR connectors feature 360 degree shielding around the entire interface to help improve EMI and RFI protection in sensitive applications. The integral dimples of the MDR metal shell ensure proper grounding of the shroud before mating, reducing the possibility of a destructive ESD event between the boardmount and wiremount connectors.

Figure 2: Pay special attention to connector panel cut-outs to avoid creating EMI hotspots.

MDR Boardmount connectors are available in a wide variety of pin counts and mounting styles; and feature either latch stands to allow latching of a quick-release backshell, or threaded holes to allow thumbscrew attachment (with the proper hardware).

For cable assemblies, MDR wiremount connectors are designed to accommodate a wide variety of cables types. Choices include unshielded flat ribbon and Pleated Foil Covered cable in .050" and .025" pitch; and round, discrete cable types such as shielded twisted pair, unshielded twisted pair, and twin-axial styles.

Consideration should be given to how the connectors are latched together at the interface. Quick-release finger latches are preferred for use in office, lab or medical environments, while thumbscrew backshell configurations are favored for industrial and transportation equipment applications.

3M™ MDR Cable Assemblies are also available in a secure overmolded configuration for robustness and reliability in the field.

Your choice of MDR connector should be compatible with your chosen board processing technology. Boardmount MDR connectors are available in through-hole, surface mount and straddle mount versions which require soldering. Press-fit versions, using a compliant pin or eye of the needle design contact, secure the contact in the circuit board without the need for soldering. To ensure proper placement during board processing, consider the board retention options that are available to ensure they are compatible with your – or your contractor's – processing capabilities.

I/O connectors are the external interface of equipment. Pay special attention to panel cut-outs to avoid creating EMI hotspots (fig 2.). Follow 3M's recommendations for MDR cut out patterns and dimensions, and allow for cable assembly attachment hardware such as latch locks and thumbscrews.

The flexibility and versatility of the MDR platform is reflected in the number of organizations which have adopted it as their I/O of choice.

3M™ High-speed Mini Delta Ribbon Digital Data Transmission System has been used for low voltage differential signaling or 'LVDS' applications with great results. Indeed, this interconnect system is featured in National Semiconductor®'s evaluation kits for its Channel Link 48-bit and LDI chipsets.

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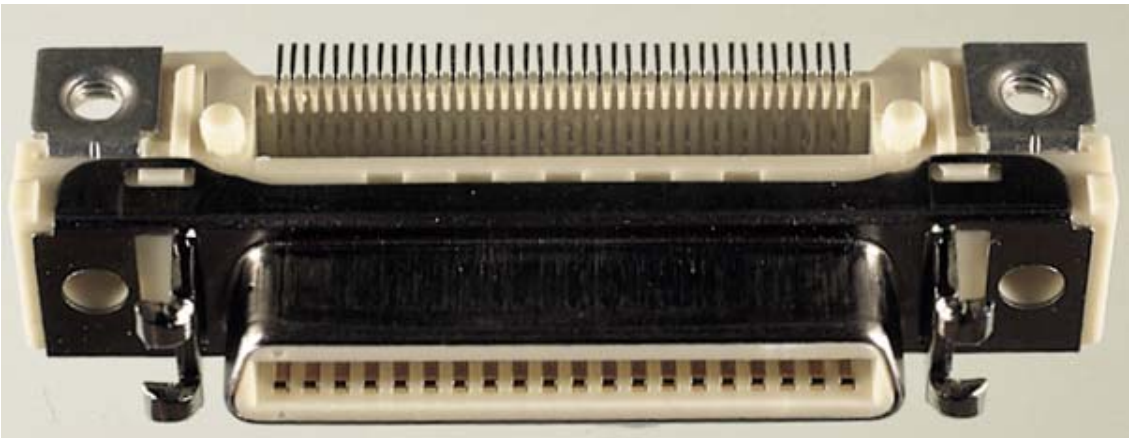

Figure 3: Inline solder tails reduce skew in this 3M™ Mini Delta Ribbon receptacle connector.

LVDS is used in a wide array applications, including network switches and test equipment where low skew is important to ensure optimum performance (fig 3.). LVDS technology can also be found in industrial environments such as machine vision systems, where Camera Link® compliant devices ensure interoperability between digital cameras and frame grabber boards. The 3M™ MDR Connector is offered in a surface mount option that has very low skew between all the pins. Different cable types are supported for LVDS applications.

Summary

How well you design the I/O interconnect 'bridge' between equipment can positively or detrimentally affect the performance of your or your user's system**.** Mini Delta Ribbon or 'MDR' from 3M is a half pitch version of the D Ribbon connector, based on .050" or 1.27mm pitch. MDR is a proven, reliable I/O platform used for system to system or "box to box" communications with an installed base of millions of ports to date. MDR connector is available from 3M, which claims the industry's largest array of product options for 1.27mm pitch ribbon style connectors for use with a wide variety of round and flat cables to suit your application.

For more information about I/O connectors and cabling solutions, contact your 3M authorized distributor or go to http://www.3M.com/io

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