Wire Bond vs. Ribbon Bond

The two most accepted wire bond processes are ball bonding and wedge bonding. Both of these processes use ultrasonic energy to create an intermetallic interface bond, or weld, between the wire and the die pad or the substrate. When the wire used is gold, both processes use what is known as "Thermosonic" bonding. Although ball bonding is normally faster and is used in a variety of bonding applications, ribbon bonding (a form of wedge bonding) is gaining momentum in high frequency and optoelectronic applications. This is due to the larger surface area of a ribbon bond, as compared to a round wire.

"Minimizing interconnect inductance is critical to achieving performance requirements in high speed electronics," states Rick Sturdivant, Technical Product Manager at MultiLink. Rick goes on to explain, "Interconnect inductance can cause impedance mismatches, ringing, distortion pulses and worst of all to high speed circuits, reduced bandwidth. Because of this need for reduced inductance, ribbon bonding is often specified instead of wire bonds. This is especially true for wide band components where parameters such as group delay must be controlled over a very wide bandwidth. Ribbon bonds are preferred because a typical one has two to three times less inductance than a typical wire bond. It may seem that an alternative solution is to use multiple wire bonds. While this does improve the situation somewhat, it is not as effective as a ribbon bond. This is due to the fact that multiple wire bonds have a mutual inductance between them. This results in diminishing returns when multiple wire bonds are used. In other words, two wire bonds are not half the inductance of one. Therefore, the ribbon bond solution is fast becoming a critical requirement in high speed microelectronic assembly."

Gold Wire Bond vs. Gold Ribbon Bond

Parameter	Wire Bond	Ribbon Bond
Typical Size	0.001 " dia. Wire	.001" x .003" Ribbon
No. of Bonds (using Auto Bonder)	13,000 per Hour	4,000 per Hour
Bond Direction	360 Degrees	Diagonal Only
Pad Impact	Less	More
Average Stage Temp	150 Degrees C.	130 Degrees C.
Lowest Loop	0.006"	0.003"
Average Loop	0.012"	0.006"

High Frequency and Optoeletronic Packages

It seems like only yesterday when optoelectronic stock prices were going through the roof. Although there has been a significant change in the business climate, interest in small optoelectronic and high frequency packaging is still very strong. The designers in this industry have turned to the microelectronic industry to help package their exotic designs in efficient, reliable, repeatable packaging technologies that create the integrated, cost effective device that their industry demands.

Natel views these packages as classic hybrids with some very interesting interconnect wire/ribbon bond challenges. Precision is the name of the game, in both wire/ribbon bond and device placement. In most high frequency applications, precision wire lengths are necessary, as well as precision wire/ribbon placement. To control wire length (loop and step back), ribbon wedge bonding is necessary. The average high frequency die is .004" thick. Using ribbon bonding techniques, you can actually bond a ribbon as short as .010" long and this includes a loop. Because there is no ball to start the loop (as with ball bonding), the loop can start at the die interface instead of 2 or 3 mil in the air on top of the ball bond.

Ribbon Bonds

Loop starts at the die since there is no ball

Wire Bonds

Loop starts at 0.003" above the surface, due to the ball

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Low Cost

With over 25 years of microelectronics experience, Natel understands and has participated in most of the dramatic changes that have taken place in the manufacturing of products for the Defense, Medical, Opto-electronic and RF/Microwave industries, meeting the need for lower cost, high quality components produced by innovative techniques.

With automatic and, in most cases, hands-free assembly capabilities for modules, hybrids, MCM and chip-on-board, Natel has pioneered the precision capabilities necessary for 10G-40G high frequency products - products such as DWDM, clock drivers, transmitters/receivers and limiting amplifiers.

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Super Micro Line
Automatic Ribbon Bonding

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How can we help?

So that we can tailor an information package specific to your needs, please answer the following questions and **fax this page to Natel at 1-800-590-5764.**
For urgent need please call 1-800-590-5774.

What stage is your microcircuit module in?

- ☐ Initial design
- ☐ Prototype
- ☐ Product redesign
- ☐ Production

Would you consider packaging assistance?

- ☐ Essential
- ☐ Nice but not required
- ☐ No thank you

What type of module are you considering?

- ☐ Hybrid
- ☐ MCM
- ☐ Chip on board
- ☐ Flipchip/BGA
- ☐ Other _____

What type of package are you considering?

- ☐ Hermetic
- ☐ Non hermetic
- ☐ Metal
- ☐ Other _____

Comments:

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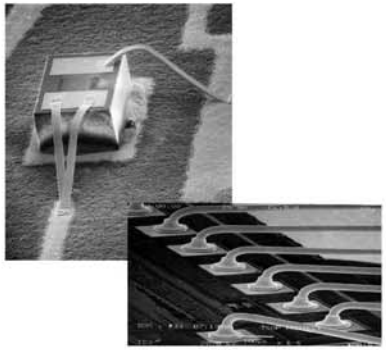
Design Guide #6

Quick Reference Design Guide



Ribbon Bond vs. Wire Bond

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