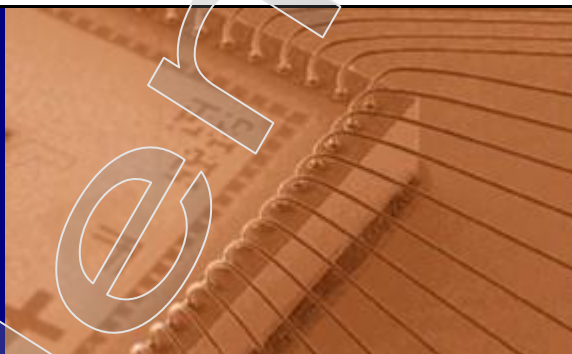


Copper Wire - Alternative to Gold.

Recent studies have shown that, in many applications, copper wire bonding can provide better performance and reliability than gold wire bonding. While copper wire and ribbon have been used in discrete and power devices for many years, these latest studies also show that successes in ball bonding thin copper wire to aluminum, silver-nickel plating and even bare copper, provide the potential for its use in high-end, fine-pitch packages with higher lead counts and smaller pad sizes. For these reasons, along with the lower inherent cost of copper material, Kulicke & Soffa Bonding Wire has developed and optimised two copper wire products: DHF copper wire for ball and wedge bonds in power devices and discrete packages; and iCu for fine-pitch or high-end IC applications.

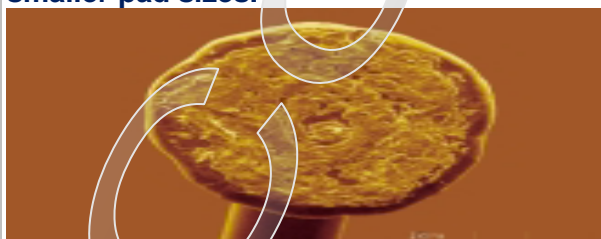
Copper Bonding Wires

Copper bonding wires have a high purity Cu matrix and achieve their excellent processing properties by means of defined addition elements. They distinguish themselves by stable mechanical properties and the high reliability of the bonding joint, in particular as regards the reduced formation of intermetallic phases in comparison with the usual Au-Al system.

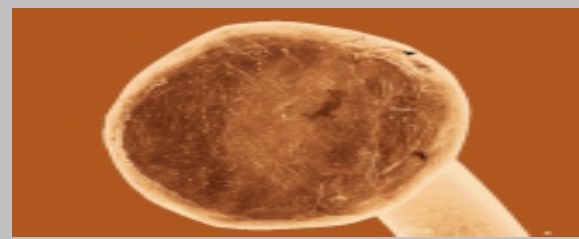


They are excellent for bonding with the ball / wedge process when using a reducing protective gas atmosphere. Processing is also possible in the wedge / wedge bonding process. Copper bonding wires are, therefore, both technically and economically an alternative to gold wires. A packaging concept tailor-made for Cu wires ensures that even after storage times of up to six months the wires can be readily processed.

Copper Fine Wires (<1.3 mil; <33 µm)
Excellent mechanical and electrical properties allow our ultra-fine copper wires to be used in a variety of high-end, fine-pitch devices with higher lead counts and smaller pad sizes.



Copper Wires (1.3-4 mil; 33-100 µm)
 In addition to the significantly lower cost of copper wires, slower intermetallic growth in copper bonds provides superior reliability in high-power and discrete packages.



Excellent Mechanical and Electrical Characteristics

Tempered and annealed iCu copper wire exhibits higher tensile strength and elongation than gold wire, resulting in better ball neck strength, reduced wire sag and excellent loop stability during encapsulation. Because copper exhibits better conductivity than gold, DHF wire allows for increased device power ratings and also accounts for better heat dissipation in packages.

Reduced Intermetallic Growth... Higher Reliability

Tests show that, after exposure at various temperatures, intermetallic growth is significantly slower in copper wire bonds than in gold wire bonds. This results in lower electrical resistance, lower heat generation and, ultimately, increased bond reliability and device performance. Tests also show that despite a lower amount of intermetallic penetration, pull force and shear testing show values that are equivalent to, or greater than, those obtained with gold wire.

DHF & iCu Copper Wire Benefits

- Mechanical and electrical properties comparable to gold and aluminum wire.
- Cost/unit length significantly less than gold wire.
- Excellent conductivity and reduced heat generation allow thinner diameters.
- Slower intermetallic growth results in lower electrical resistance and increased reliability.
- Availability in diameters as thin as 0.4 mil, or in excess of 4.0 mils, allows use in a wide range of applications.

DHF for Power Devices and Discrete Packages

Diameter	Mils	1.5	2.0	2.5	3.0
	Microns	38	50	65	75
Recommended Spec for Ball Bonding					
Elongation (%)		10-20	15-25	15-25	15-30
Breaking Load (g)		20-30	40-55	60-80	80-120

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