JCET

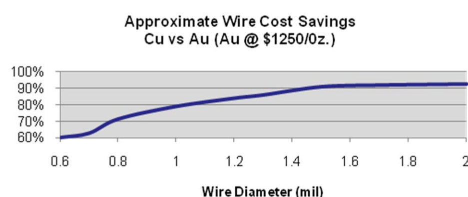
Copper Wirebond

Highlights

- FBGA, FBGA-SD, FBGA-MD, FBGA-SS, LGA, PBGA, QFNp, QFNs, QFN-dr, QFNs-st, QFNs-st-mr, QFP and TSOP package types supported
- Full turnkey services available
- Advanced design rules supported for bond pad opening (BPO), bond pad pitch (BPP), stacked die and die-to-die bonding
- Advanced assembly processes and materials including 0.6 mil Cu wire
- Assembly yields with Pd-coated Cu wire comparable to Au at >99.9%

Cost Benefits

- Copper wire offers significant cost savings over gold wire
- Best Value BOM (BVB) available for each package for the most cost-effective copper wirebond solution



Description

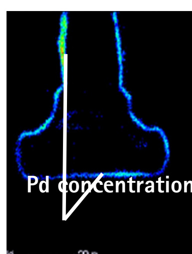
Cost reduction has been the primary driver for the industry's conversion to copper (Cu) wire, replacing traditional gold (Au) wire interconnects to achieve lower cost without sacrificing performance, quality and reliability. Increasingly implemented as a low risk replacement for gold wire in many mobile, consumer and computing applications, copper wire provides similar electrical characteristics and performance to gold wire, and also offers lower resistivity which can be a benefit where lower bond wire resistance is needed for device performance. We have focused on material and process enhancements such as Palladium (Pd) coated wire and ultra high density substrates to drive cost reduction and enable customers to realise the full benefits of copper wire interconnect.

We have been in high volume production with copper wirebond since 2003 and have shipped more than 132 billion packages for our customers. We offer copper wirebond solutions in a wide range of leaded and laminate packages. Our copper wire offering includes die-to-die bonding and a range of 3D package configurations including stacked die, side-by-side die and a combination of stacked plus side-by-side die packages.

Palladium Coated Copper Wire

Palladium-coated copper wire (Pd-Cu) recommended for all applications, fab nodes and development programs

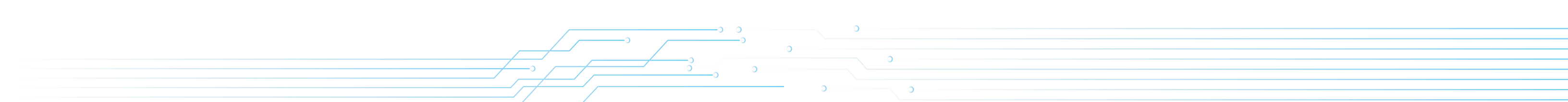
- Provides enhanced reliability
- Improves corrosion resistance



Copper Wire Considerations

With significant experience in copper wire conversions, we understand the requirements for successful copper wirebonding. While the customer's existing structure can be successfully utilized in many cases, we recommend the following "ideal" guidelines:

- Thicker aluminum pad (>0.8mm, ideally >1.0mm)
- Thick barrier metal layer under pad (Ti or W)
- 0.4mm larger bond pad vs Au to allow for metal splash



Specifications

Standard Wire Diameter	18mm/0.7mil - 20mm/0.8mil
Optional Wire Diameter	15mm/0.6mil - 50mm/2.0mil
Wafer Nodes	>28nm; non-Low-K, Low-K, 40 - 28/32nm; Low-K, Extra Low-K
CUP Support	Both CUP and non-CUP devices

Package Support by Site

	China	Korea	Singapore
FBGA/*HS	•	•	•
FBGA-SD	•	•	•
FBGA-MD	•	•	•
FBGA-SS	•	•	•
PBGA/*HS	•		
LGA	•		
QFNp	•		•
QFNs	•		
QFNp-dr			•
QFNs-st-mr			•
QFP	•		
TSOP	•		
Discrete	•		

Note: HVM is HIgh Volume Manufacturing

Copper Wire Characteristics

Wire Material	Melting Point (Deg, °C)	Thermal Cond (W/m-c)	Electrical Resistance (ohm-m)	Young's Modulus (Gpa)	Tensile Strength (Mpa)	Hardness @ Ball (Hv)
Gold (Au)	1064	315	2.33×10^{8}	80	240	60 - 80
Copper (Cu)	1083	393	1.72×10^{8}	120	290	80 - 90
Pd Coated Copper	1083	393	1.8×10^{8}	120	290	85 - 95

R Wire/mm (mOhms/mm)

Bondwire Diameter	Frequency DC	Frequency 10MHz	Frequency 25MHz	Frequency 75MHz	Frequency 500MHz	Frequency 1GHz	Frequency 10GHz	L Wire (nH / mm)	C Wire (pF/mm)
0.8mil	72.49	72.75	73.29	76.08	129.37	175.50	518.58	0.82	0.06
1.0mil	46.48	46.77	47.44	51.33	101.52	138.06	416.80	0.78	0.06
1.3mil	27.61	27.94	28.86	34.39	76.53	105.16	324.29	0.73	0.06

Pd-Coated Copper (Conductivity = 5.55×10^{7} siemens / meter; R Wire / mm (mOhms / mm)

Bondwire Diameter	Frequency DC	Frequency 10MHz	Frequency 25MHz	Frequency 75MHz	Frequency 500MHz	Frequency 1GHz	Frequency 10GHz	L Wire (nH / mm)	C Wire (pF/mm)
0.8mil	56.04	56.32	56.92	60.31	112.46	152.55	456.54	0.82	0.06
1.0mil	35.95	36.26	37.04	41.71	88.20	120.56	367.86	0.78	0.06
1.3mil	21.38	21.75	22.84	29.13	66.85	92.24	287.11	0.73	0.06

Copper (Conductivity = 5.8×10^{7} siemens / meter)

Bondwire Diameter	Frequency DC	Frequency 10MHz	Frequency 25MHz	Frequency 75MHz	Frequency 500MHz	Frequency 1GHz	Frequency 10GHz	L Wire (nH / mm)	C Wire (pF/mm)
0.8mil	53.68	53.96	54.58	58.08	109.84	149.06	447.20	0.82	0.06
1.0mil	34.45	34.76	35.56	40.36	86.17	117.88	360.31	0.78	0.06
1.3mil	20.48	20.86	21.98	28.38	65.37	90.26	281.37	0.73	0.06

Reliability

Item	MRT MSL3	MRT MSL2aA	µHAST	PCT	TC"C"	HTST
Condition	30°C / 60% 192hrs / 260°C	85°C / 85% 8hrs / 260°C	130°C / 85% RH after MSL3, 168hrs	121°C / 100% RH after MSL3, 168hrs	-65°C ~ 100°C after MSL3, 1000hrs	150°C w/o Pre-con, 1000 hrs

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