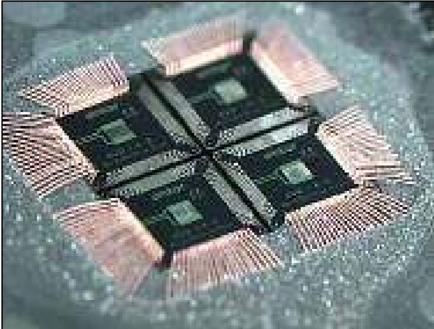
Copper (Cu) Wire Bonding



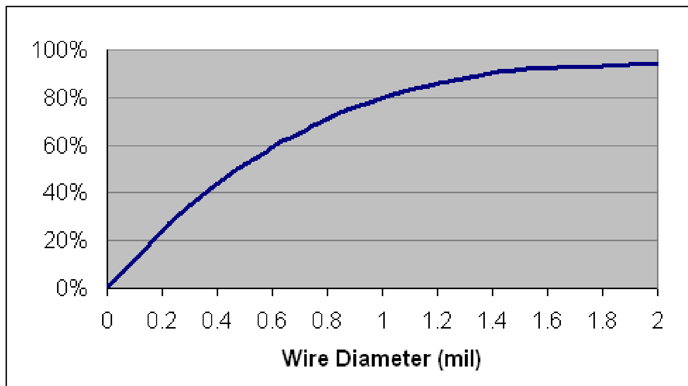
Copper (Cu) wire has long been used as a method of connecting a silicon die to the package terminals. With the recent increase in gold (Au) wire cost, Cu wire is an attractive way to manage overall package cost.

Copper Wire Benefits

Cu wire offers significant cost advantage over Au wire. It is also an excellent replacement for Au wire due to its similar electrical properties. Self inductance and self capacitance are nearly the same for Au and Cu wire and Cu wire has lower resistivity. In applications where resistance due to bond wire can negatively impact circuit performance, using Cu wire can offer improvement.

Wire Dia (µm)	Current Carrying Capacity (Amps)				3D Electrical Parasitic Parameters					
	Wire Length > 40 mil (1 mm)				Wire Length = 40 mil (1 mm)					
	Wire type				R11 (mΩ) @ 1 GHz		C11 (pF)		L11 (nH)	
	Au wire (4-9's)	Au wire (3-9's)	Au wire (2-9's)	Cu wire (4-9's)	Au wire	Cu wire	Au wire	Cu wire	Au wire	Cu wire
51	1.83	1.81	1.61	1.83	73.9	62.2	0.119	0.119	0.515	0.515
25	0.63	0.62	0.55	0.63	144.4	116	0.081	0.081	0.69	0.677
23	0.56	0.55	0.49	0.56	154.1	128.7	0.078	0.078	0.707	0.687
20	0.45	0.45	0.4	0.45	172.9	145	0.075	0.075	0.728	0.724
18	0.39	0.38	0.34	0.39	196.3	163.2	0.071	0.071	0.76	0.751
15	0.29	0.29	0.26	0.29	234.3	194.7	0.067	0.067	0.811	0.801
Resistivity (µohm-cm)	2.3	2.5	3	1.7						

Wire Material Cost Savings Copper (Cu) versus Gold(Au)



Minimum Bond Pad Size by Wire Diameter (T = Bond Pad Metal Thickness)

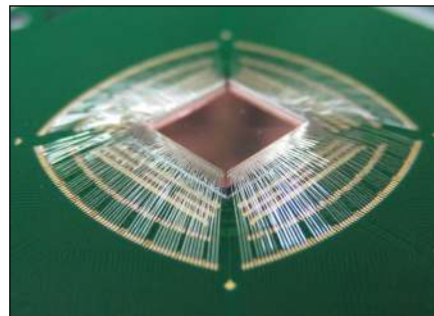
	Wire (µm)	0.7 ≤ T ≤ 1.5 µm				1.6 ≤ T ≤ 2.5 µm				2.6 ≤ T ≤ 4.0 µm			
		FWD		SSB		FWD		SSB		FWD		SSB	
		BPO	BPP	BPO	BPP	BPO	BPP	BPO	BPP	BPO	BPP	BPO	BPP
Recommended	15	≥35	≥40	≥39	≥46	≥37	≥42	≥42	≥49	≥39	≥44	≥44	≥51
	18	≥40	≥45	≥45	≥52	≥42	≥47	≥48	≥55	≥44	≥49	≥50	≥57
	20	≥44	≥50	≥49	≥57	≥46	≥52	≥52	≥60	≥48	≥54	≥54	≥62
	23	≥52	≥58	≥57	≥65	≥54	≥60	≥60	≥68	≥56	≥62	≥62	≥70
	25	≥56	≥62	≥62	≥70	≥58	≥64	≥65	≥73	≥60	≥66	≥67	≥75
Minimum	15	≥34	≥38	≥38	≥45	≥36	≥40	≥40	≥47	≥37	≥41	≥42	≥49
	18	≥39	≥43	≥44	≥51	≥41	≥45	≥46	≥53	≥42	≥46	≥48	≥55
	20	≥43	≥47	≥48	≥56	≥45	≥49	≥50	≥58	≥46	≥50	≥52	≥60
	23	≥51	≥55	≥56	≥64	≥52	≥56	≥58	≥66	≥54	≥58	≥60	≥68
	25	≥55	≥59	≥61	≥69	≥56	≥60	≥63	≥71	≥58	≥62	≥65	≥73

Wafer Technology Node and Cu Wire Readiness

	>60 nm	55/60 nm	45/40 nm	28 nm	<28 nm
Non-Low-K or Low-K	Low-K	Low-K	Ultra Low-K	Ultra Low-K	Ultra Low-K
Reliability Status	Customer Qualified	Customer Qualified	Customer Qualified	Customer Qualified	In Process
Production Status	HVM	HVM	HVM	HVM	Development

Package Family and Factory Qualification

Package Family	Cu Wire HVM Plant
CABGA	C3, K4, P3, J1
LQFP	K1, P1, T1, J1
MLF	C3, K1, P3
MQFP	P1, T1
PBGA	C3, K4, P3
PDIP	P1
PLCC	P1
PSOP	P1
SC70	P1
SCSP	C3, K4, J1
SOIC	P1
SOT-23	P1
SSOP	P1
TQFP	K1, P1, T1, J1
TSSOP	P1



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