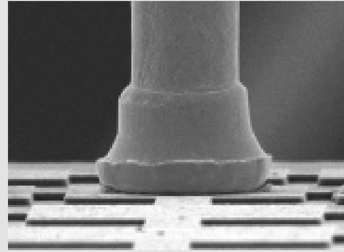
45µm Pad Pitch

BGA Bonding Application with 0.8mil Gold Wire

SPT Capillary Part Number : **DFX-24055-XXXX**

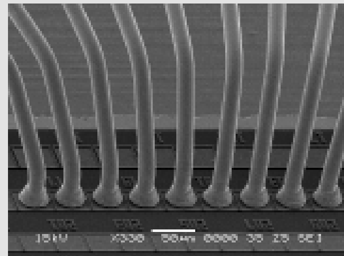
Wire Bonder : ASM 339 Eagle

Responses	Avg	Std Dev
Ball Size (µm)	35.1	0.51
Ball Height (µm)	7.5	0.63
Ball Shear (N/mm^2)	99.3	5.8
Stitch Pull (gf)	4.4	0.55



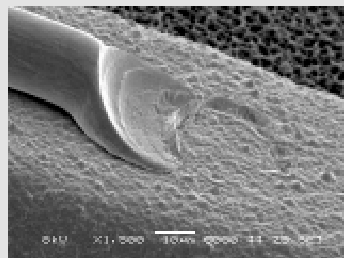
Wire Bonder : ESEC 3088

Responses	Avg	Std Dev
Ball Size (µm)	35.5	0.50
Ball Height (µm)	9.1	0.48
Ball Shear (N/mm^2)	100.1	7.4
Stitch Pull (gf)	4.2	0.64



Wire Bonder : KNS Maxum

Responses	Avg	Std Dev
Ball Size (µm)	35.4	0.53
Ball Height (µm)	9.2	0.71
Ball Shear (N/mm^2)	98.4	6.9
Stitch Pull (gf)	4.2	0.68



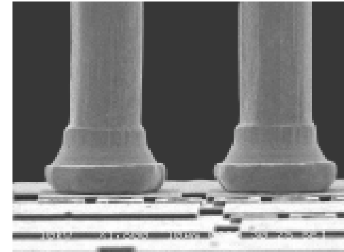
40µm Pad Pitch

BGA Bonding Application with 0.7mil Gold Wire

SPT Capillary Part Number : **DFX-21050-XXXX**

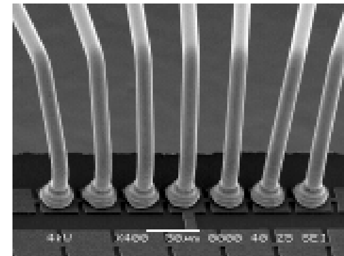
Wire Bonder : ASM 339 Eagle

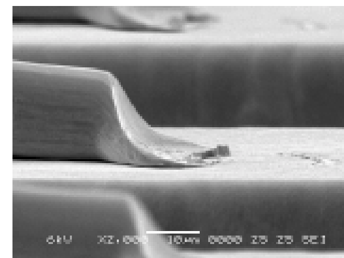
Responses	Avg	Std Dev
Ball Size (µm)	30.5	0.38
Ball Height (µm)	7.8	0.67
Ball Shear (N/mm^2)	99.3	6.5
Stitch Pull (gf)	3.4	0.50



Wire Bonder : ESEC 3088

Responses	Avg	Std Dev
Ball Size (µm)	30.2	0.36
Ball Height (µm)	8.2	0.70
Ball Shear (N/mm^2)	97.2	5.9
Stitch Pull (gf)	3.3	0.40





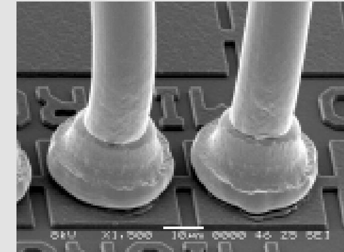
35µm Pad Pitch

BGA Bonding Application with 0.6mil Gold Wire

SPT Capillary Part Number : **DFX-19047-XXXX**

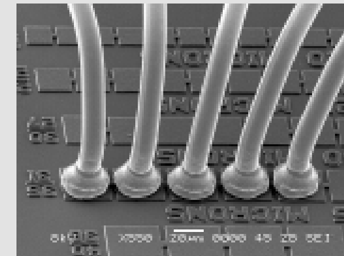
Wire Bonder : ASM 339 Eagle

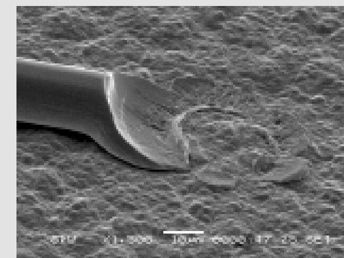
Responses	Avg	Std Dev
Ball Size (µm)	27.3	0.74
Ball Height (µm)	7.8	0.62
Ball Shear (N/mm^2)	95.5	5.8
Stitch Pull (gf)	2.2	0.33



Wire Bonder : ESEC 3088

Responses	Avg	Std Dev
Ball Size (µm)	28.0	0.61
Ball Height (µm)	8.0	0.74
Ball Shear (N/mm^2)	100.3	6.2
Stitch Pull (gf)	2.3	0.31



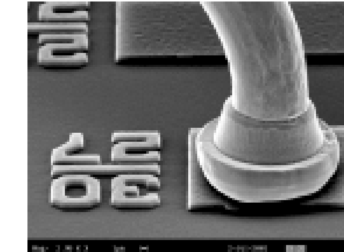


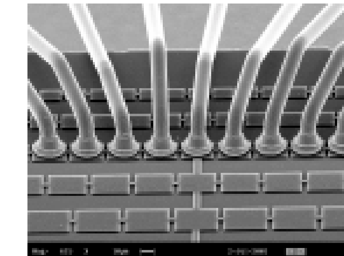
30µm Pad Pitch

BGA Bonding Application with 0.5mil Gold Wire

SPT Capillary Part Number : **DFX-15038-XXXX**

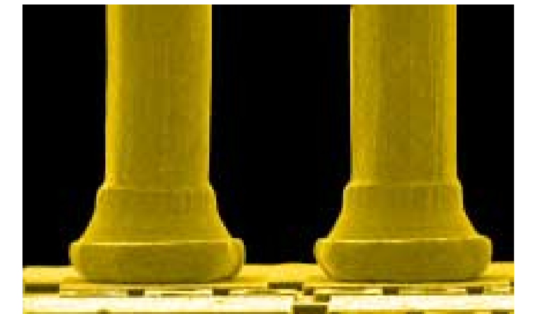
Responses	Avg	Std Dev
Ball Size (µm)	23.0	0.4
Ball Height (µm)	7.5	0.5
Ball Shear (N/mm^2)	105.0	6.0
Pull Force (gf)	2.4	0.3





We reserve the right to make changes to design or specifications at any time without notice.
Bonding responses shown may vary depending upon the bonding parameters, device metallization, substrate, etc, used.

Dfx Bond



Small Ball Large Wire Capability

www.smallprecisiontools.com

Back in 2000, when 50µm bond pad pitch was still in its development stage by many companies, SPT had foreseen the constrains when a large wire diameter of 23µm is used. This is mainly due to the dimensional limitation of the capillary. The design of the capillary has to be re-engineered to meet the ball size requirement when using a larger wire diameter. Through numerous analysis and experiments, SPT then developed the Dfx capillary for 50µm BPP and below, using larger wire diameter with controlled deformed ball size. Today, this design has been followed and recommended by our competition for ultra fine pitch bonding.

Typically, as ultra fine pitch bonding goes below 50µm BPP, the given bond pad pitch (BPP) and bond pad opening (BPO) requires a much smaller wire diameter (WD) of 20µm and below. While this offers the advantage of cost reduction and the use of a standard capillary design, wire sweep problems surfaced during the molding process. Most reverted back to using larger wire diameters of 23µm.

Due to the dimensional constraint on the hole and chamfer diameter of the capillary, SPT developed a unique capillary design, the 'Dfx' capillary specifically targetting to contain the gold squashed out during bonding. This design concept utilized a smaller chamfer angle (CA) to contain the Free Air Ball (FAB) inside the chamfer, thus resulting in a smaller mashed ball diameter (MBD) as shown below.

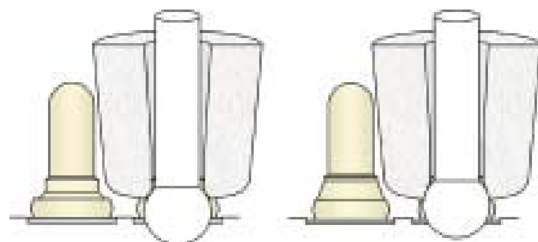


Figure 1: FAB deformation for conventional and DFX bonds

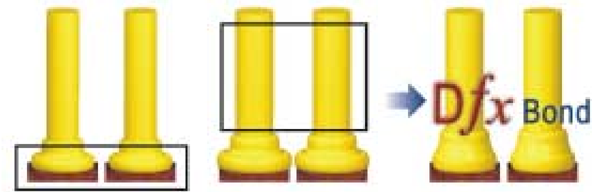


Figure 2: DFX capillary configuration for small ball large wire capability

Analysis and experiments of the ball deformation for the Dfx capillary was also simulated using Finite Element method. Based on the simulation results, the final design of the Dfx capillary was conceived. Figure 3 shows the result from the simulation.

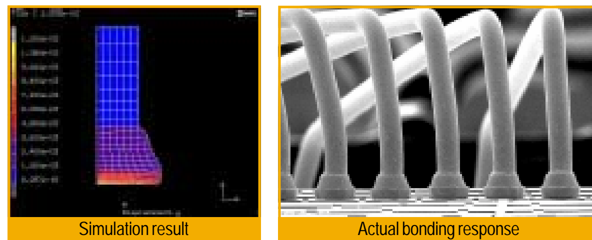


Figure 3: Bond deformation comparing simulation result and actual bonding response

The design of the Dfx capillary was conceptualized for controlled ball deformation during bonding. Based on lab evaluation and data from customers' production, the Dfx capillary has proven to improve the ball shear reading, especially for BGA device, hence reducing the occurrence of non-sticking on pad during bonding as shown in the following data.

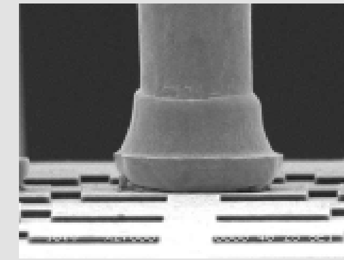
SPT Worldwide Offices
Switzerland : ++ 41 32 387 80 80
California : 1 707 765 4545
Singapore : 65 6253 5577
Philippines : 632 533-7067
China : 86 510 516 1968
Japan : +81 45 470 6288

50µm Pad Pitch — QFP Bonding Application with 0.9mil Gold Wire

SPT Capillary Part Number : **DFX-28068-XXXX**

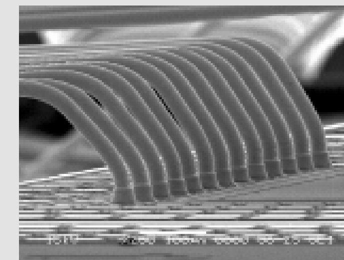
Wire Bonder : ASM 339 Eagle

Responses	Avg	Std Dev
Ball Size (µm)	39.8	0.68
Ball Height (µm)	10.4	0.74
Ball Shear (N/mm²)	107.2	7.5
Stitch Pull (gf)	5.2	0.68



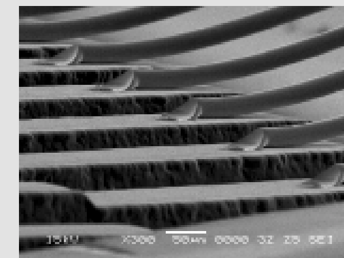
Wire Bonder : ESEC 3088

Responses	Avg	Std Dev
Ball Size (µm)	38.5	0.59
Ball Height (µm)	8.5	0.67
Ball Shear (N/mm²)	108.2	7.6
Stitch Pull (gf)	5.3	0.75



Wire Bonder : KNS Maxum

Responses	Avg	Std Dev
Ball Size (µm)	38.1	0.64
Ball Height (µm)	9.1	0.55
Ball Shear (N/mm²)	105.4	6.9
Stitch Pull (gf)	5.1	0.56

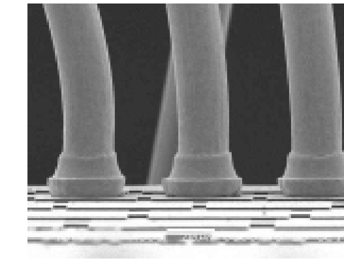


50µm Pad Pitch — BGA Bonding Application with 0.9mil Gold Wire

SPT Capillary Part Number : **DFX-28063-XXXX**

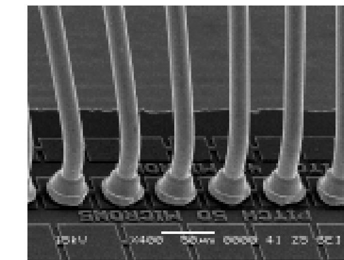
Wire Bonder : ASM 339 Eagle

Responses	Avg	Std Dev
Ball Size (µm)	37.9	0.68
Ball Height (µm)	9.5	0.72
Ball Shear (N/mm²)	105.3	0.63
Stitch Pull (gf)	5.9	0.35



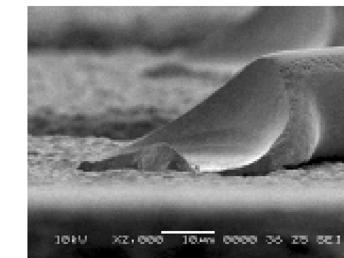
Wire Bonder : ESEC 3088

Responses	Avg	Std Dev
Ball Size (µm)	37.8	0.75
Ball Height (µm)	9.2	0.82
Ball Shear (N/mm²)	103.3	8.4
Stitch Pull (gf)	5.8	0.41



Wire Bonder : KNS Maxum

Responses	Avg	Std Dev
Ball Size (µm)	37.2	0.48
Ball Height (µm)	9.0	0.85
Ball Shear (N/mm²)	101.5	8.1
Stitch Pull (gf)	5.6	0.43

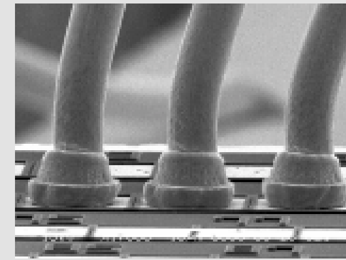


45µm Pad Pitch — QFP Bonding Application with 0.8mil Gold Wire

SPT Capillary Part Number : **DFX-24058-XXXX**

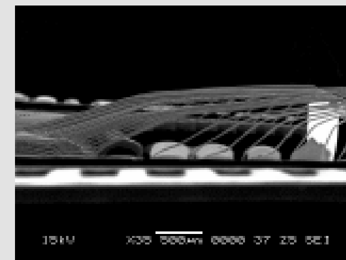
Wire Bonder : ASM 339 Eagle

Responses	Avg	Std Dev
Ball Size (µm)	34.8	0.48
Ball Height (µm)	9.2	0.41
Ball Shear (N/mm²)	105.2	6.9
Stitch Pull (gf)	3.6	0.35



Wire Bonder : ESEC 3088

Responses	Avg	Std Dev
Ball Size (µm)	34.5	0.56
Ball Height (µm)	8.8	0.44
Ball Shear (N/mm²)	103.9	7.1
Stitch Pull (gf)	3.6	0.48



Wire Bonder : KNS Maxum

Responses	Avg	Std Dev
Ball Size (µm)	35.0	0.46
Ball Height (µm)	9.9	0.73
Ball Shear (N/mm²)	100.9	6.9
Stitch Pull (gf)	3.5	0.56