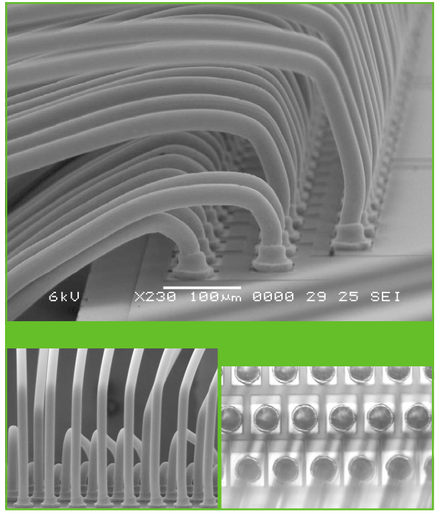
Multi-Tier Bonding

Tri-Tier, Quad Tier Bonding for Fine Pitch & Ultra Fine Pitch Application

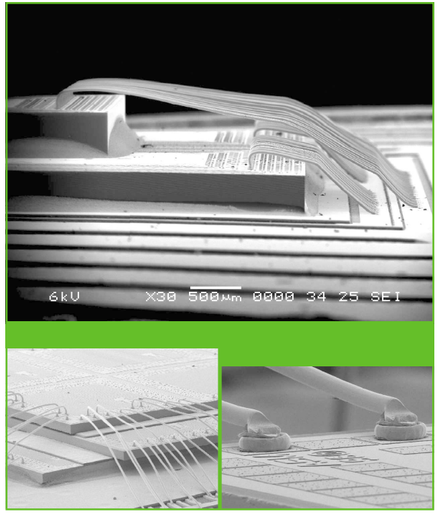


ADAPTABILITY

BPP	Useable Wire Ø (µm)	Recommended SPT Part Number
70	25	PI-33085-435F-ZP34T-375
60	25	PI-30075-355F-ZP34T-300
50	23	PI-28063-335F-ZP34T-250
	20	PI-25063-305F-ZP34T-250
45	20	PI-23055-281F-ZP34T-250

Stacked-Die Bonding

Advanced Stacked-Die Looping for Pyramid & Overhang Stacking

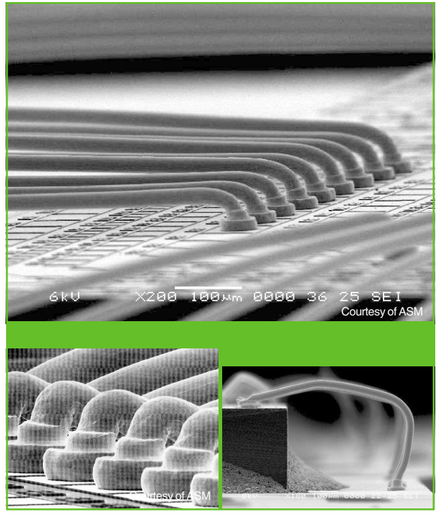


RELIABILITY

BPP	Useable Wire Ø (µm)	Recommended SPT Part Number
100	25	PI-35130-585F-ZP34T
90	25	PI-35120-535F-ZP34T
80	25	PI-35100-515F-ZP34T
70	25	PI-33090-435F-ZP34T
60	25	PI-30080-355F-ZP34T

Ultra Low Loop Bonding

Standard Forward, Standard Reversed & Special Low Loop

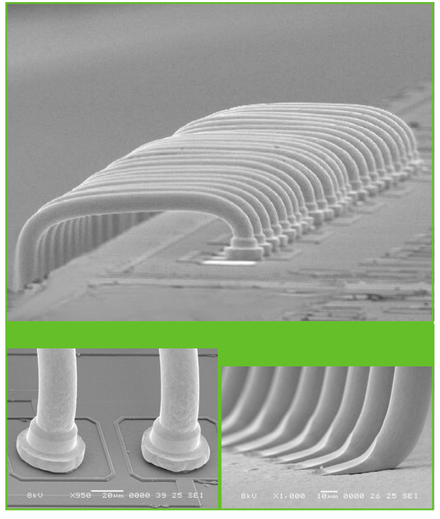


CAPABILITY

BPP	Useable Wire Ø (µm)	Recommended SPT Part Number
100	25	PI-35130-585F-ZP34T-XXX
90	25	PI-35120-535F-ZP34T-XXX
80	25	PI-35100-515F-ZP34T-XXX
70	25	PI-33090-435F-ZP34T-XXX
60	25	PI-30080-355F-ZP34T-XXX

Chip Scale Package Bonding

Low Loop & Short Wire Capability



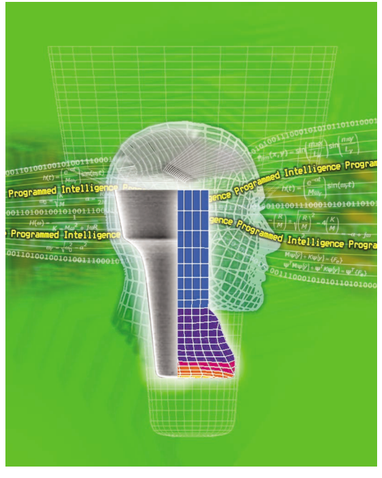
CONSISTENCY

BPP	Useable Wire Ø (µm)	Recommended SPT Part Number
100	25	PI-35130-585F-ZP34T-520
90	25	PI-35120-535F-ZP34T-520
80	25	PI-35100-515F-ZP34T-520
70	25	PI-33090-435F-ZP34T-520
60	25	PI-30080-355F-ZP34T-520

SPT small precision tools

P.I. CAPILLARY

PROGRAMMED INTELLIGENCE



Programmed with Your Solutions in Mind!

P.I. is Capillary 'Intelligence' Unprecedented

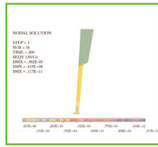
Designed with Advanced Process Diagnostic Tools

The advancement in bonding technology and the market demand for faster, smaller and better product, again poses new challenges for the wire bonding process. The transition from fine-pitch (FP) to ultra fine-pitch (UFP) volume production, and the emergence of stacked die, multi-tier and low-K bonding has increased the level of difficulties in the wire bonding process with more yield loss due to lifted ball, wire shorts, etc.

In compliance with these new bonding requirements, SPT has embarked on an extensive study to develop a new generation and high-performance capillary. Designed with advanced process diagnostic tools, the new capillary design, known as the PI (Programmed Intelligence) capillary has been extensively tested in a variety of wire bonders and packages. In all tests, the PI capillary has demonstrated superior bonding performance with good repeatability and portability using a wide range of bonding platform.

Programmed Intelligence P.I. Capillary

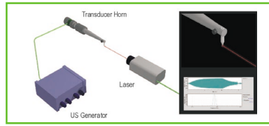
The PI capillary was derived from a series of physical modeling and finite element analysis (FEA) studies to analyze the stress level at the tip and transition profile for different designs, as these are locations where breakage is most likely to occur. An example of the analysis – in this case, for the PI design is as shown below. Among the options considered, the PI design showed the lowest overall stress. This result was validated through destructive test, which showed that the breaking load for the PI design is 7% higher as compared to other design option.



	Data Source	Design A	Design B	P.I. Design
Stress @ Transition ($x10^9$ Pa)	Simulation	0.6632	0.5687	0.5417
Stress @ Tip ($x10^{11}$ Pa)	Simulation	0.1269	0.1253	0.1167
Breakage Load (gf)	Simulation	228	238	245

Figure 1: Correlation of the simulation data with the results of destructive test

Laser interferometry technique is also used to determine the optimum capillary profile through amplitude of vibration measurement along the overall profile of the capillary. In wire bonding, the vibration characteristics of the capillary is an important factor as its indicates the efficiency of the transfer of the ultrasonic energy from the bonding tool to the bond pad interface. Through the various design optimization, the PI design has shown to be more responsive to the bonding parameters, producing better bond integrity.



Amplitude of Vibration (nm)		
Design A	Design B	P.I. Design
454	488	544

Figure 2: Laser interferometry test results

Based on the various simulation and diagnosis, the PI capillary design was conceived. Actual bonding responses were tested using standard QFP and BGA package for a 70um bond pad pitch (BPP). The PI capillary was shown to be more responsive to the bonding parameter producing better results on all the measures (ball size, ball shear and stitch pull). In contrast, other design options would require higher bond force and more ultrasonic power to achieve the same bond integrity. This observation correlated with the result from the laser interferometry test.

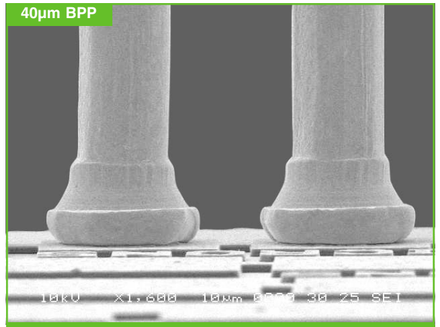
	Readings	Design A	Design B	P.I. Design
Ball size (µm)	25	52.6	53.3	53.8
Ball shear (gf) Standard deviation Failure mode	25	24.4 1.41 Ball sheared	25.0 1.48 Ball sheared	25.7 1.33 Ball sheared
Stitch pull (gf) Standard deviation Failure mode	25	7.32 100% Break @ stitch	7.41 100% Break @ stitch	7.54 100% Break @ stitch

Figure 3: Average results from actual bonding responses

Today, the PI capillary has been qualified and used in volume production by major assembly houses for a broad range of bonding applications. Depending on the specific bonding application, the PI design can be used together with any existing design feature, such as the DFX (for small ball large wire bonding), CSP (for short loop/low wire bonding, BSB (ball stitch on ball bonding), Infinity (extended tool life), etc. Indeed, the PI capillary has proved to be a new revolution in bonding solution.

Ultra Fine Pitch Bonding

BGA Bonding Application

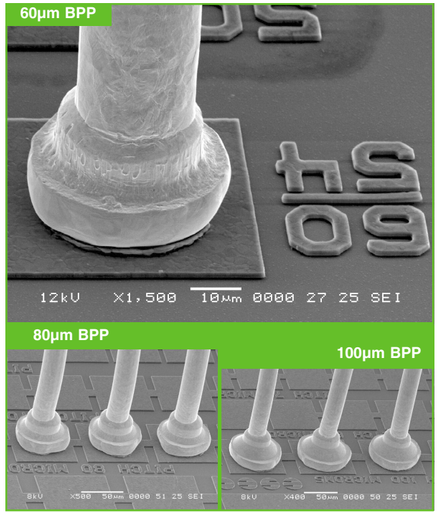


PORTABILITY

BPP	Useable Wire Ø (µm)	Recommended SPT Part Number
50	23 20	PI-28063-335F-ZP34T PI-25063-305F-ZP34T
45	20	PI-23055-281F-ZP34T
40	18	PI-21050-251F-ZP34T
35	15	PI-18045-221F-ZP34T
30	12	PI-15038-181F-ZP34T

Fine Pitch Bonding

BGA & QFP Bonding Application



REPEATABILITY

BPP	Useable Wire Ø (µm)	Recommended SPT Part Number
100	25	PI-35130-585F-ZP34T
90	25	PI-35120-535F-ZP34T
80	25	PI-35100-515F-ZP34T
70	25	PI-33090-435F-ZP34T
60	25	PI-30080-355F-ZP34T

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.

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