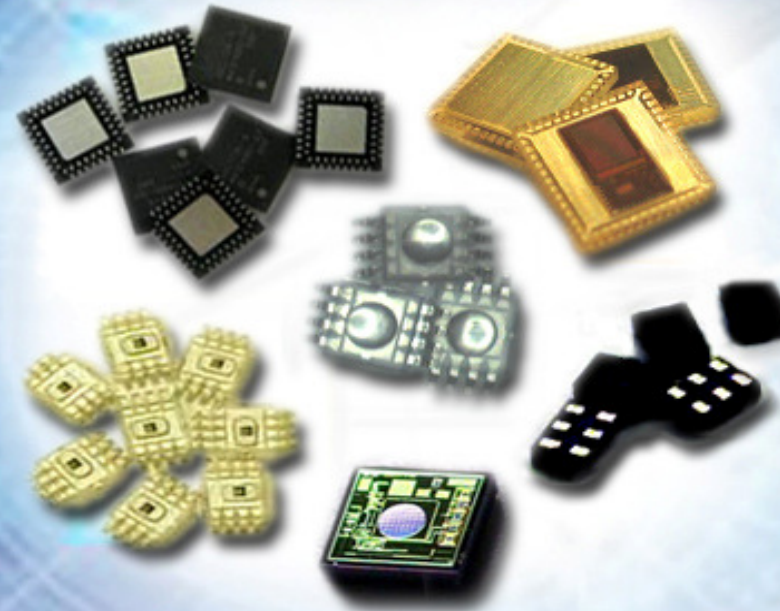




# Creating Value Through Innovation



## ST-380 3<sup>rd</sup> Generation Plating Qualification

*By STD. IC EOL Process Engineering Department*



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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# Outline

- Objectives
- Deposit Properties
- Solderability Performance
- Whisker Performance
- Summary and Conclusions



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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# Objective

- To upgrade the existing pure tin additive plating chemicals (ST200) to ST380



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# Key Process Targets

- Grain size 1-5 micron
- Plating thickness Cpk : >1.67
- Excellent solderability : >95% solder coverage
- Whisker growth resistance : 50 micron (for class 1) and 45 micron (for class 2) after temperature cycling of 1,500 cycles



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# DEPOSIT PROPERTIES

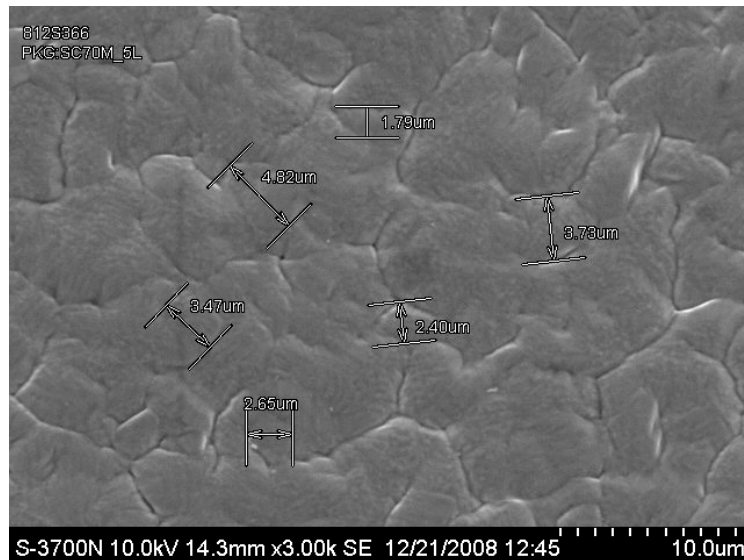


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# Morphology – Grain Size

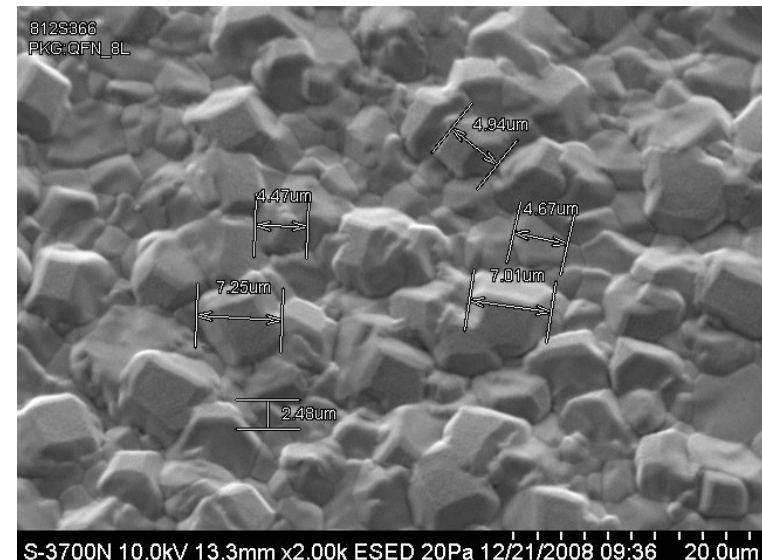
## SEM Image at 2 kX

SC70M 5L



Ave. grain size 2-5  $\mu\text{m}$

TDFN 8L



Ave. grain size 3-7  $\mu\text{m}$



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# Thickness Distribution

- Plating thickness: 400-800  $\mu$ -inch (10-20  $\mu$ m) for SC70M 5L
- Plating thickness: 315-800  $\mu$ -inch (8-20  $\mu$ m) TDFN 8L
- Measurement: 36 points

Plating Thickness ( $\mu$ m)	Mean	Min.	Max.	Standard deviation	Cpk
SC70M 5L	583.8	524.8	654.3	36.46	1.68
TDFN 8L	553.7	483.1	603.8	45.69	1.74



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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# SOLDERABILITY PERFORMANCE



## ST-380 3<sup>rd</sup> Generation Plating Qualification

# Solderability – Dip & Look

	SC70M 5L	TDFN 8L
215°C SnPb	PASS	PASS
245°C SnAgCu	PASS	PASS

Sample size: 22 leads/package refer to Hana spec. PMN001

### Test condition (norminal)

Parameters	Condition	
Precondition	8 hr - Steam aging	8 hr - Steam aging
Solder pot	215 $\pm$ 5°C SnPb	245 $\pm$ 5°C SnAgCu
Flux	R	ROL1 (RMA)
Immersion time	5s	5s
Pass criteria	>95% Solder coverage	>95% Solder coverage



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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# WHISKER PERFORMANCE



## ST-380 3<sup>rd</sup> Generation Plating Qualification

# Test conditions

### Reflow Preconditions:

Preconditions	Ambient	High Temp/Humidity	Thermal cycle
No Reflow	Y	N	N
SnPb Reflow	N	Y	Y
Pb free Reflow	N	Y	Y

Note: SnPb reflow spec. 200 - 220 °C Pb free reflow spec. 245 - 260 °C

### Storage Conditions:

Conditions	Details
Temp/Humidity (Ambient)	30 ± 2 °C / 60 ± 3% RH
High Temp/Humidity	55 ± 3 °C / 85 ± 3% RH
Thermal cycle	-55 +0/-10 °C to 85 +10/-0 °C, air to air; 10 minute soak; ~3 cycles/h

Note: Plated sample passed annealing cure at 150°C for 1 hr within 24 hrs. after plated.



## ST-380 3<sup>rd</sup> Generation Plating Qualification

# Ambient Storage

Precondition	Hours	SC70M 5L ( $\mu\text{m}$ )	TDFN 8L ( $\mu\text{m}$ )
No Reflow	1000	0	0
	2000	0	0
	3000	0	0
	4000	0	0

**PASS**

Sample size: 3 units/reading point refer to JESD201

Note: Maximum allowable whisker length as per JESD201

Class 1\* as 40  $\mu\text{m}$  and Class 2\*\* as 20  $\mu\text{m}$

\*Class 1: Industrial / consumer product

\*\*Class 2: Business critical applications such as automotive, High-end Servers, etc.



## ST-380 3<sup>rd</sup> Generation Plating Qualification

### High Temp/ Humidity Storage

Precondition	Hours	SC70M 5L ( $\mu\text{m}$ )	TDFN 8L ( $\mu\text{m}$ )
SnPb Reflow	1000	0	0
	2000	0	0
	3000	0	0
	4000	0	0
Pb free Reflow	1000	0	0
	2000	0	0
	3000	0	0
	4000	0	0

**PASS**

Sample size: 3 units/reading point refer to JESD201

Note: Maximum allowable whisker length as per JESD201

Class 1\* as 40  $\mu\text{m}$  and Class 2\*\* as 20  $\mu\text{m}$



## ST-380 3<sup>rd</sup> Generation Plating Qualification

### Thermal cycle

Precondition	Cycle	SC70M 5L ( $\mu\text{m}$ )	TDFN 8L ( $\mu\text{m}$ )
SnPb Reflow	500	12.70	9.38
	1000	16.80	19.30
	1500	26.2	20.9
Pb free Reflow	500	0	11.80
	1000	20.70	18.30
	1500	21.7	21.1

**PASS**

Sample size: 3 units/reading point refer to JESD201

Note: Maximum allowable whisker length as per JESD201

Class 1\* as 50  $\mu\text{m}$  and Class 2\*\* as 45  $\mu\text{m}$



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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# SUMMARY AND CONCLUSION



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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# Summary

- Average Grain size of ST-380 is 3-5 micron.
- Plating thickness Cpk is more than 1.67.
- Solderability performance is excellent as per dip & look result.
- Whisker performance is excellent, with length of less than 50 micron (for class 1) and 45 micron (for class 2) after temperature cycling of 1,500 cycles.



## ST-380 3<sup>rd</sup> Generation Plating Qualification

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THANK YOU