



# PRODUCT/PROCESS CHANGE NOTIFICATION

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PCN APG-BOD/07/3019  
Notification Date 10/30/2007

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**SOT-223 CARSEM New Wire Bond Equipment**

**BOD - CAR BODY**

**Table 1. Change Identification**

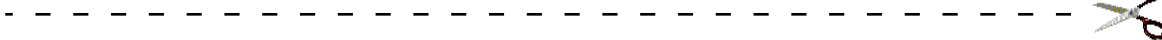
Product Identification (Product Family/Commercial Product)	see enclosed
Type of change	Equipment change
Reason for change	To improve Quality
Description of the change	Looking at the continuous improvement approach in terms of Quality on VN79 silicon line, housed in SOT-223 (CARSEM Subcontractor), a new wire bonding machine will be adopted. CARSEM will substituted KAIJO bonder with ASM bonder machine.
Product Line(s) and/or Part Number(s)	See attached
Description of the Qualification Plan	See attached
Change Product Identification	Data code
Manufacturing Location(s)	

**Table 2. Change Implementation Schedule**

Forecasted implementation date for change	31-Jan-2008
Forecasted availability date of samples for customer	23-Oct-2007
Forecasted date for <b>STMicroelectronics</b> change Qualification Plan results availability	23-Oct-2007
Estimated date of changed product first shipment	31-Jan-2008

**Table 3. List of Attachments**

Customer Part numbers list	
Qualification Plan results	



Customer Acknowledgement of Receipt		PCN APG-BOD/07/3019
Please sign and return to STMicroelectronics Sales Office		Notification Date 10/30/2007
<input type="checkbox"/> Qualification Plan Denied <input type="checkbox"/> Qualification Plan Approved  <input type="checkbox"/> Change Denied <input type="checkbox"/> Change Approved	Name:	
	Title:	
	Company:	
	Date:	
	Signature:	
Remark ..... ..... ..... ..... ..... ..... ..... ..... ..... .....		

## DOCUMENT APPROVAL

Name	Function
Russo, Alfio	Division Marketing Manager
Aparo, Sebastiano	Division Product Manager
Parrino, Emanuele	Division Q.A. Manager



# PRODUCT/PROCESS CHANGE NOTIFICATION

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**CAR BODY DIVISION - VIPower Business Unit - Catania**

**Subject: SOT-223 CARSEM New Wire Bond Equipment.**

**INVOLVED P&L FAMILY: 30**

**WHAT:** Looking at the continuous improvement approach in terms of Quality on VN79 silicon line, housed in SOT-223 (CARSEM Subcontractor), a new wire bonding machine will be adopted.  
CARSEM will substituted KAIJO bonder with ASM bonder machine.

**WHY:** In order to solve the cratering problem.

**WHO:** DELPHI Customer using VN79 housed in SOT-223.

**WHEN:** Change will be implemented in according to the below schedule:

**Qualification report:**

-Included to this PCN.

**Samples availability:**

-Samples are already available.

**Start production / 1<sup>st</sup> shipment:**

-January 2008.

Shipment of changed products may occur prior this date upon Customer agreement (according to Jedec JESD46C standard).

**WHERE:** Plant involved in this change is CARSEM (Subcontractor).



## **PRODUCT/PROCESS CHANGE NOTIFICATION**

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Attached:

- CARSEM PCN Report
- CARSEM DOE Report



**Carsem (M) Sdn. Bhd.**  
A Member of the Hong Leong Group Malaysia (124522-U)

# PROCESS/ PRODUCT CHANGE NOTICE

Pre-Alert

Final PCN

**Title:**

VN79: Wire Bonder & Capillary Change

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**Change Owner:**

Michael Phoon

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**Department:**

POWER

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**PCN No.:**

M070908

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**Date:**

2007-SEP-26

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**CARSEM CONFIDENTIAL**

# CARSEM

## Process/ Product Change Notification

<b>PCN No.:</b>	M070908	<b>Date:</b>	2007-SEP-26
<b>*Change Class:</b>	<input checked="" type="radio"/> Major <input type="radio"/> Minor	<b>Change Type:</b>	Equipment & Components ▼
<b>Package/ Lead Count:</b>	SOT223 3L	<b>Device Type:</b>	VN79
<b>*Customer Consent:</b>	<input checked="" type="checkbox"/> Approval <input type="checkbox"/> Notification <input type="checkbox"/> Approval Not Required (Justify why)		
Justify why:	_____		

**1) Change Description**  
**Current:**  
All SGC VN79 devices using Kaijo 118 with capillary: 1570-25-137P (p/n:454249)

**Proposed:**  
All SGC VN79 devices to use AB339 with capillary: 1570N-25-437P (TBA)

**PCN is applicable to Carsem:**  M Site  S Site  Suzhou **Proposed Date of Change:** 2007 NOV 01

**2) Reason for Change**  
Quality/ Yield Improvement ▼  
Others (Pls specify): To improve the intermetallic gap thickness

<b>3) This change affects:</b>	<b>(Describe)</b>
<input checked="" type="checkbox"/> Cost of product	Product cost increase
<input checked="" type="checkbox"/> Parts inventory (Attach milestone plan to deplete off old inventory. If no attachment, pls specify why)	1570N-25 to replace 1570-25 (use for other cust)
<input type="checkbox"/> Tool/ Die inventory	N/A
<input type="checkbox"/> Supplies & chemical inventory	N/A
<input type="checkbox"/> Others (Pls specify)	N/A

\* Not applicable to Customer Initiated Ad-Hoc Change



**\*4) Justification for change:**

a) Quality (PPM):	Before: N/A	After: N/A
b) Capability index (Cpk):	Before: N/A	After: N/A
c) Yield:	Before: N/A	After: N/A
d) FMEA review (State specification no.):	ASY003121	
e) Report(s) attached:		
<input type="checkbox"/> Reliability Report	Report #: N/A	(Test requirement as per QCG000045)
<input type="checkbox"/> Qualification Report	Report #: N/A	(Assembly qualification requirements as per ASY000032)
<input checked="" type="checkbox"/> Other Report (Pls specify):	Report #: DOE rpt	
Change Owner:	Signature:	Date:
Michael Phoon		2007 SEP 26

**Note:**

- 1) This notification has been compiled by the originator to the best of his/ her knowledge and is distributed for your approval. If you see anything that may have been inadvertently omitted that will affect your area of control, then it is your responsibility to contact the originator for clarification on changes or adjustments within 24 hours.
- 2) This is a notification of intended change only and is not an authorization to change. Changes can only be made upon customer approval/ acknowledgement of this PCN and the implementation checklist being signed off by all relevant functions.

**Approved By**

Engineering/ Product Manager:	Steven Woo	Signature and Date:	
*Operations Manager:	Sharon Ko	Signature and Date:	
*Materials Manager:	HL Khor	Signature and Date:	
*Sales Manager:	Ruth Lim	Signature and Date:	
Equipment Engineering Manager:	N/A	Signature and Date:	
QRA Manager:	Siva K	Signature and Date:	

**Note:**

Indicate "N/A" at column where approval is not required.

\* Not applicable to Customer Initiated Ad-Hoc Change

## Process/ Product Change Approval/ Notification Form\*

PCN No.: M070908

Dear Sir/ Madam,

We intend to make a change in our process/ product and seek your Approval/ Acknowledgement\* of the message received.

Change description:

Title: VN79: Wire Bonder & Capillary Change

Current: All SGC VN79 devices using Kaijo 118 with cap: 1570-25-137P (p/n:454249)

Proposed: All SGC VN79 devices to use AB339 with 1570N-25 capillary (TBA)

Please acknowledge approval/ notification and return to:

Customer Service

Carsem (M-Site)  
Jalan Lapangan Terbang,

P.O. Box 204, 30720  
Ipoh, Perak, Malaysia

Tel: 05-3123333

Fax: 6-05-3125333

Customer Service

Carsem (S-Site)  
Lot 52986, Taman Meru Industrial  
Estate,

Jelapang, P.O. Box 380,  
30720 Ipoh, Perak, Malaysia

Tel: 60-5-5262333

Fax: 6-05-5265333

Customer Service

Carsem Semiconductor (Suzhou) Co. Ltd.  
Plot 73021, Shen Hu Road in District 2,

Suzhou Industrial Park,  
Jiangsu 215021, P.R. China

Tel: 86-512-62588883

Fax: 86-512-62588885

Contact person:

Contact person:  
Sharen Karta

Contact person:

E-mail ID:

E-mail ID:  
SHAENKART@s.carsems.com.my

E-mail ID:

Customer approval/ acknowledgement\* and remarks:

Customer:

Approvee's name:

Approvee's title:

Approvee's signature:

Date:

Customers are required to respond to Carsem as per following timeline to support the PCN (JEDEC Standard No. 46):

a) Customer should acknowledge receipt of the PCN within 30 calendar days from date receive of the PCN.

~~b) Lack of acknowledgement of the PCN within 30 calendar days constitutes acceptance of the changes.~~

~~c) After acknowledgement, lack of additional response within 90 calendar days period constitutes acceptance of the changes.~~

\* Delete whichever not applicable

Form #: QCG0000001-3 Rev. H

Retention Required

Page 1 of 1

<b>Revision History</b>		
<b>Date</b>	<b>Change Description</b>	<b>Revised By</b>
2007-SEP-26	New	Michael Poon



**Carsem (M) Sdn. Bhd. (M-Site)**

A Member of the Hong Leong Group Malaysia (124522-U)

# ***E N G I N E E R I N G E V A L U A T I O N R E P O R T***

**CUSTOMER** : SGC  
**PACKAGE TYPE** : SOT223  
**DEVICE** : ADLL\*VN79  
**LOT #** : N/A  
**COMPLETION DATE** : 2007 AUG  
**REFERENCE #** : N/A

**CARSEM CONFIDENTIAL**

1) Objective of the Assembly Qualification:

*To improve LTO gap using AB339 with capillary 1570N-25-437P*

Executive Summary :

*[Briefly describe the outcome of this qualification and if its objective has been met]*

**PROBLEM: Intermetallic layer touching onto oxide layer**  
**OBJECTIVE: Evaluate different wire type and parameter**

**EXP 1:**

Materials:

1. Capillary: 1570-25-437
2. Bonder: Kaijo 118 (60khz)
3. Wire type: **RADIX Vs Y-type**
4. Parameter: **Existing paramaters Vs Proposed parameter from ST Muar**
5. Bond pad metalization thickness : 3um

**Existing Spec:**

	Setting
Bond Force 1	98
US Time 1	15
US Power 1	25
Initial Ball	137
Post US Time 1	17
Post US Power 1	80
Search Height	250
Search Speed	2
Temperature	230°C

**Propose Parameter:**

	Setting
Bond Force 1	>120
US Time 1	10
Post US Time 1	10
Initial Ball	110

**EXP 1**

Run	Wire Type	Bond Force 1	US Time 1	Post US Time 1	Initial Bal	X - section analysis (5 balls)					IM Touching? (qty)	Cratering after w/b	Intermettalic coverage	
						Good ball (qty)	Metal gap (um)							
							1	2	3	4				5
<b>P3</b>	Y-Type	98	15	17	137	1	0.00	0.00	0.00	0.00	<b>0.46</b>	4	0/30	>60%
<b>P2</b>	Y-Type	130	10	10	110	2	0.00	0.00	0.00	<b>0.68</b>	<b>0.76</b>	3	0/30	>60%
<b>P1</b>	Y-Type	150	10	10	110	4	0.00	<b>0.46</b>	<b>0.68</b>	<b>0.46</b>	<b>0.76</b>	1	0/30	>60%
<b>R3</b>	<b>RADIX</b>	98	15	17	137	0	0.00	0.00	0.00	0.00	0.00	5	0/30	>60%
<b>R2</b>	<b>RADIX</b>	130	10	10	110	0	0.00	0.00	0.00	0.00	0.00	5	0/30	>60%
<b>R1</b>	<b>RADIX</b>	150	10	10	110	0	0.00	0.00	0.00	0.00	0.00	5	0/30	>60%

**Analysis/ Conclusion:**

\*\*Ball shear failure mode for radix wire found exposed underlying oxide layer. Thus RADIX was not considered in EXP 2.

**A) Ball shear reading (s/s:2 unit)**

Run	P3	P2	P1	R3	R2	R1	
Ball Shear (gm)	1	118.0	126.4	129.4	110.2	158.6	120.2
	2	150.8	151.8	158.8	99.4	163.6	149.2
	3	162.6	139.4	171.0	83.2	173.0	168.8
	4	144.8	137.4	171.2	99.4	163.4	166.6
	5	110.0	105.8	133.0	140.8	114.2	117.8
	6	137.2	124.4	133.0	139.4	119.0	173.4
	7	141.4	129.8	117.4	147.8	120.4	165.6
	8	138.0	161.4	118.2	150.2	130.4	164.8
	min	110.0	105.8	117.4	83.2	114.2	117.8
	max	162.6	161.4	171.2	150.2	173.0	173.4
	avg	<b>137.9</b>	<b>134.6</b>	<b>141.5</b>	<b>121.3</b>	<b>142.8</b>	<b>153.3</b>

Remark:- Spec limit 80.0gm, Target: 150.0gm

**B) Ball thickness (mils) s/s: 2 unit / 8 ball**

Run	P3	P2	P1	R3	R2	R1	
Ball thickness (mils)	1	2.3	1.5	1.6	2.1	1.7	1.5
	2	2.4	1.6	1.5	2.3	1.7	1.4
	3	2.6	1.7	1.6	2.2	1.5	1.5
	4	2.4	1.6	1.6	2.1	1.7	1.7
	5	2.3	1.6	1.7	2.3	1.6	1.7
	6	2.3	1.7	1.7	2.3	1.6	1.8
	7	2.3	1.7	1.7	2.3	1.6	1.7
	8	2.4	1.5	1.7	2.3	1.7	1.7
	min	2.3	1.5	1.5	2.1	1.5	1.4
	max	2.6	1.7	1.7	2.3	1.7	1.8
	avg	<b>2.4</b>	<b>1.6</b>	<b>1.6</b>	<b>2.2</b>	<b>1.6</b>	<b>1.6</b>

Remark:- Target: 1.2 - 1.4mils

**C) Ball size (mils) s/s: 2 unit / 8 ball**

Run	P3	P2	P1	R3	R2	R1	
Ball size (mils)	1	5.7	5.5	5.3	5.5	5.0	5.5
	2	5.8	5.2	5.2	5.3	5.0	5.0
	3	5.5	5.2	5.3	5.5	5.1	5.2
	4	5.7	5.5	5.8	5.6	5.0	4.9
	5	5.9	5.3	5.2	5.3	5.0	5.2
	6	5.6	5.5	5.3	5.5	5.0	5.2
	7	5.7	5.3	5.3	5.5	5.2	5.1
	8	5.7	5.3	5.3	5.5	5.1	5.1
	min	5.5	5.2	5.2	5.3	5.0	4.9
	max	5.9	5.5	5.8	5.6	5.2	5.5
	avg	<b>5.7</b>	<b>5.4</b>	<b>5.3</b>	<b>5.5</b>	<b>5.0</b>	<b>5.2</b>

Remark: Target: 5.5 mils

**PROBLEM:** Intermetallic layer touching onto oxide layer  
**OBJECTIVE:** To evaluate 120deg capillary and parameter

**EXP 2:**

Materials:

1. Capillary: 1570-25-437 Vs 1570N-25-437
2. Bonder: Kaijo 118 (60khz)
3. Wire type: Y-type
4. Parameter: Existing paramaters Vs Proposed parameter from ST Muar
5. Bond pad metalization thickness : 3um

**Existing Spec:**

	Setting
Bond Force 1	98
US Time 1	15
US Power 1	25
Initial Ball	137
Post US Time 1	17
Post US Power 1	80
Search Height	250
Search Speed	2
Temperature	230°C

**Propose Parameter:**

	Setting
Bond Force 1	>120
US Time 1	10
Post US Time 1	10
Initial Ball	110

**EXP 2**

Run	Capillary	Bond Force 1	US Time 1	Post US Time 1	Initial Bal	X - section analysis (5 balls)					IM Touching? (qty)	Cratering after w/b	Intermettalic coverage	
						Good ball (qty)	Metal gap (um)							
							1	2	3	4				5
P3	1570-25-437	98	15	17	137	1	0.00	0.00	0.00	0.00	<b>0.46</b>	4	0/30	>60%
P2	1570-25-437	130	10	10	110	2	0.00	0.00	0.00	0.68	<b>0.76</b>	3	0/30	>60%
P1	1570-25-437	150	10	10	110	4	0.00	<b>0.46</b>	<b>0.68</b>	<b>0.46</b>	<b>0.76</b>	1	0/30	>60%
Q3	<b>1570N-25-437</b>	98	15	17	137	0	0.00	0.00	0.00	0.00	0.00	5	0/30	>60%
Q2	<b>1570N-25-437</b>	130	10	10	110	4	0.00	<b>0.99</b>	<b>0.30</b>	<b>0.84</b>	<b>0.53</b>	1	0/30	>60%
Q1	<b>1570N-25-437</b>	150	10	10	110	5	<b>0.76</b>	<b>0.30</b>	<b>0.76</b>	<b>0.53</b>	<b>0.68</b>	0	0/30	>60%

**Analysis/ Conclusion:**

1570N giving flatter ball profile and better performance as compared to 1570

**A) Ball shear reading (s/s:2 unit)**

Run	P3	P2	P1	Q3	Q2	Q1	
Ball Shear (gm)	1	118.0	126.4	129.4	117.0	142.6	152.6
	2	150.8	151.8	158.8	144.2	108.6	155.6
	3	162.6	139.4	171.0	135.8	134.4	171.6
	4	144.8	137.4	171.2	132.8	168.8	184.2
	5	110.0	105.8	133.0	122.8	136.0	136.6
	6	137.2	124.4	133.0	170.0	150.8	155.6
	7	141.4	129.8	117.4	147.2	135.0	141.0
	8	138.0	161.4	118.2	149.8	111.0	174.0
	min	110.0	105.8	117.4	117.0	108.6	136.6
	max	162.6	161.4	171.2	170.0	168.8	184.2
avg	<b>137.9</b>	<b>134.6</b>	<b>141.5</b>	<b>140.0</b>	<b>135.9</b>	<b>158.9</b>	

Remark:- Spec limit 80.0gm, Target: 150.0gm

**B) Ball thickness (mils) s/s: 2 unit / 8 bal**

Run	P3	P2	P1	Q3	Q2	Q1	
Ball thickness (mils)	1	2.3	1.5	1.6	2.7	1.3	1.3
	2	2.4	1.6	1.5	2.6	1.2	1.2
	3	2.6	1.7	1.6	2.6	1.3	1.3
	4	2.4	1.6	1.6	2.7	1.3	1.3
	5	2.3	1.6	1.7	2.4	1.3	1.4
	6	2.3	1.7	1.7	2.4	1.4	1.5
	7	2.3	1.7	1.7	2.4	1.5	1.6
	8	2.4	1.5	1.7	2.6	1.5	1.6
	min	2.3	1.5	1.5	2.4	1.2	1.2
	max	2.6	1.7	1.7	2.7	1.5	1.6
avg	<b>2.4</b>	<b>1.6</b>	<b>1.6</b>	<b>2.5</b>	<b>1.3</b>	<b>1.4</b>	

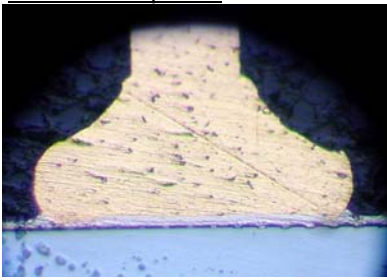
Remark:- Target: 1.2 - 1.4mils

**C) Ball size (mils) s/s: 2 unit / 8 ball**

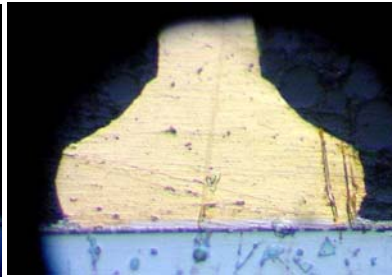
Run	P3	P2	P1	Q3	Q2	Q1	
Ball size (mils)	1	5.7	5.5	5.3	5.3	5.4	5.3
	2	5.8	5.2	5.2	5.7	6.0	5.5
	3	5.5	5.2	5.3	5.6	5.6	5.5
	4	5.7	5.5	5.8	5.7	6.0	5.0
	5	5.9	5.3	5.2	5.3	5.2	5.7
	6	5.6	5.5	5.3	5.3	5.3	5.2
	7	5.7	5.3	5.3	5.4	5.2	5.1
	8	5.7	5.3	5.3	5.5	5.2	5.2
	min	5.5	5.2	5.2	5.3	5.2	5.0
	max	5.9	5.5	5.8	5.7	6.0	5.7
avg	<b>5.7</b>	<b>5.4</b>	<b>5.3</b>	<b>5.5</b>	<b>5.5</b>	<b>5.3</b>	

Remark: Target: 5.5 mils

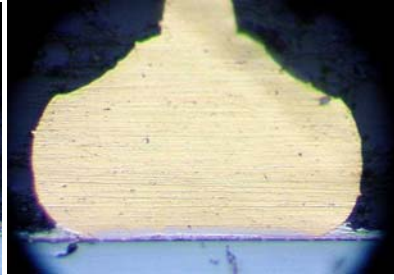
Ball visual comparison



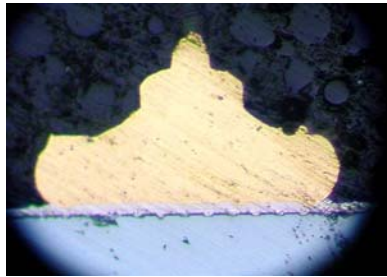
P1



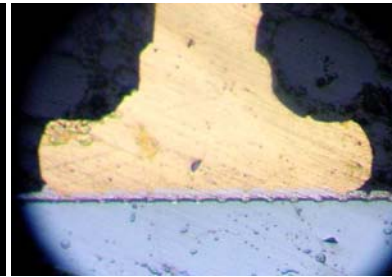
P2



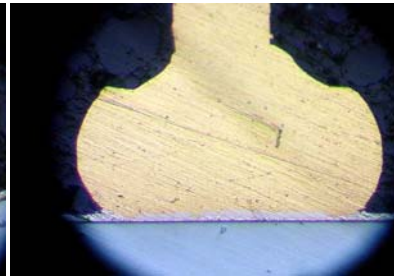
P3



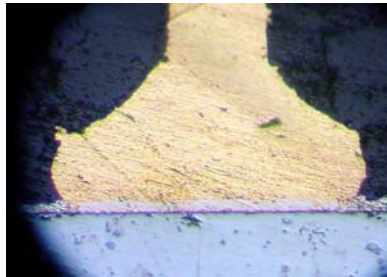
Q1



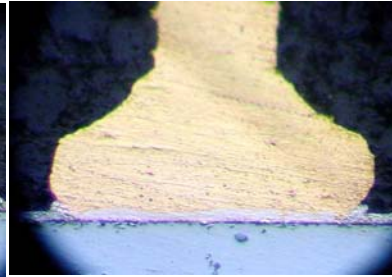
Q2



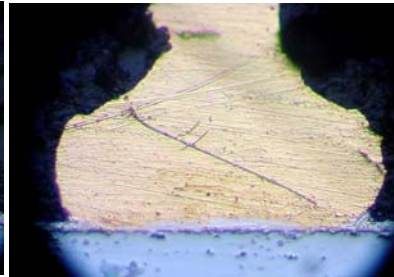
Q3



R1



R2



R3



**PROBLEM:** Intermetallic layer touching onto oxide layer  
**OBJECTIVE:** Evaluate AB339 bonder with 120deg capillary and y-type wire  
**EXP 3:** (existing capillary aborted from trial due to visual abnormality)

- Materials:  
 1. Capillary: 1570N-25-437  
 2. Bonder: AB339 (138khz)  
 3. Wire type: Y-type & Radix  
 4. Parameter: New parameter.  
 5. Bond pad metalization thickness : 3um

New parameter:

	Setting
Time Base 1	10 - 14
Power Base 1	58 - 62
Force Base 1	33 - 43

EFO current	999
EFO Gap Voltage	5020
Ball Thickness	55
Ball Size	25
Temperature	200°C

EXP 3A: Parameter DOE using 1570N and Y-type

Run	Wire Type	Time Base 1	Power Base 1	Force Base 1
1	Y Type	10	58	33
2	Y Type	10	58	43
3	Y Type	10	62	33
4	Y Type	10	62	43
5	Y Type	14	58	33
6	Y Type	14	58	43
7	Y Type	14	62	33
8	Y Type	14	62	43

EXP 3A: RESULTS

A) Ball shear reading (gm) s/s:22 balls

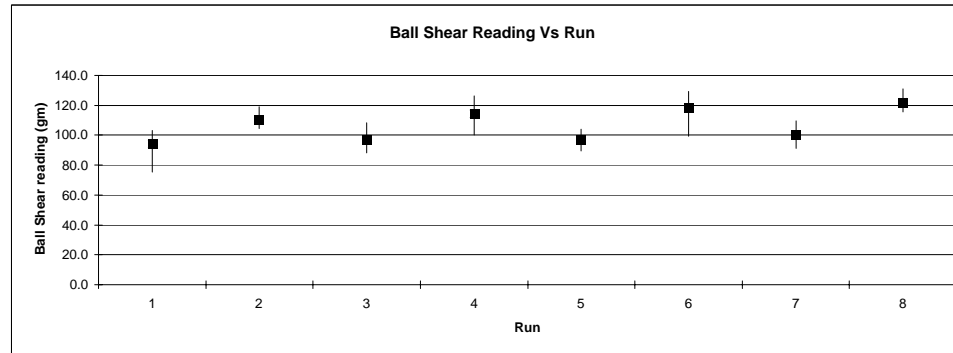
Run	1	2	3	4	5	6	7	8
Ball Shear (gm)	75.2	110.0	88.2	109.0	96.8	110.8	99.0	117.0
	95.6	104.6	104.4	119.0	103.4	122.2	109.8	121.4
	90.6	116.4	108.2	113.2	101.4	111.8	102.8	127.2
	88.6	105.8	97.2	111.6	104.2	117.2	98.4	121.6
	94.8	113.2	95.0	115.2	99.2	125.1	92.2	124.0
	96.2	111.8	96.8	115.4	101.8	115.0	99.2	119.8
	88.6	108.6	103.4	114.2	94.6	120.0	101.0	119.2
	90.0	119.0	102.4	126.2	103.2	114.8	103.0	124.2
	97.6	117.4	94.8	119.8	101.4	119.0	104.6	130.8
	98.0	116.6	95.4	114.0	93.2	124.0	104.4	128.6
	102.0	106.4	100.5	109.2	92.2	127.6	96.8	122.4
	98.8	112.4	99.2	113.8	90.6	126.6	95.4	123.2
	98.8	106.0	97.6	104.6	99.6	116.6	105.6	120.6
	80.4	114.6	88.0	100.2	89.6	99.2	96.8	118.8
	92.0	106.4	93.2	107.6	95.6	116.4	91.0	119.4
	97.4	106.6	95.0	125.2	96.8	126.0	99.2	124.2
	99.2	113.2	94.4	119.0	99.8	117.8	102.4	123.4
	101.8	109.6	90.4	116.6	90.0	129.2	98.6	119.4
	99.4	109.8	101.8	119.4	89.4	117.4	103.2	115.6
	103.2	107.8	88.2	113.6	97.6	116.0	98.4	119.8
	93.0	107.6	96.4	115.0	102.0	113.8	100.4	121.8
	94.1	109.4	95.0	113.0	97.0	118.0	100.0	121.9
min	75.2	104.6	88.0	100.2	89.4	99.2	91.0	115.6
max	103.2	119.0	108.2	126.2	104.2	129.2	109.8	130.8
avg	94.3	110.6	96.6	114.3	97.2	118.4	100.1	122.0

Remark:- Spec limit 80.0gm, Target: <150gm

B) Ball thickness (mils) s/s: 22 balls

Run	1	2	3	4	5	6	7	8
Ball thickness (mils)	2.2	2.0	2.3	2.1	2.2	2.0	2.0	2.0
	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.0
	2.2	2.0	2.3	2.2	2.2	2.1	2.3	2.0
	2.2	2.0	2.3	2.2	2.2	2.1	2.2	2.0
	2.2	2.0	2.2	2.1	2.1	2.2	2.3	2.1
	2.3	2.0	2.2	2.2	2.2	2.0	2.2	2.1
	2.3	2.0	2.3	2.1	2.2	1.8	2.2	2.1
	2.3	2.1	2.1	2.0	2.2	2.0	2.1	1.8
	2.2	2.0	2.1	2.1	2.3	2.2	2.3	2.0
	2.2	2.0	2.2	2.2	2.3	2.0	2.2	2.0
	2.3	2.1	2.3	2.0	2.2	2.2	2.2	2.0
	2.2	2.2	2.3	2.0	2.3	2.1	2.3	2.2
	2.3	2.1	2.3	1.8	2.2	2.1	2.3	2.1
	2.2	2.2	2.3	2.0	2.3	2.1	2.3	2.2
	2.2	2.1	2.0	2.1	2.3	2.2	2.3	2.2
	2.2	2.2	2.3	2.0	2.2	2.2	2.2	2.0
	2.1	2.0	2.3	2.1	2.2	2.2	2.2	2.2
	2.3	2.2	2.3	2.0	2.1	2.1	2.1	2.2
	2.3	2.2	2.3	2.2	2.3	2.2	2.2	2.2
	2.3	2.2	2.2	2.0	2.2	2.0	2.2	2.2
min	2.1	2.0	2.0	1.8	2.0	1.8	2.0	1.8
max	2.3	2.2	2.3	2.2	2.3	2.2	2.3	2.2
avg	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1

Remark:- Target: >2.0 mils



EXP 3B: Confirmation Run for EXP 3A						X - section analysis (5 balls)					Cratering check			
Run	Wire Type	Time Base 1	Power Base 1	Force Base 1	Good ball (qty)	1	2	Metal gap (um)			IM Touching? (qty)	Cratering after w/b	Cratering after mold/PMC	Intermetallic coverage
C1	Y Type	10	58	33	0	0.00	0.00	0.00	0.00	0.00	5	0/30	0/5	>80%
C2	Y Type	12	60	38	0	0.00	0.00	0.00	0.00	0.00	5	0/30	0/5	>80%
C3	Y Type	14	62	43	0	0.00	0.00	0.00	0.00	0.00	5	0/30	0/5	>80%

**PROBLEM:** Intermetallic layer touching onto oxide layer  
**OBJECTIVE:** Evaluate AB339 bonder with 120deg capillary and RADIX wire

- EXP 3:**  
 Materials:  
 1. Capillary: 1570N-25-437  
 2. Bonder: AB339 (138khz)  
 3. Wire type: Y-type & Radix  
 4. Parameter: New parameter.  
 5. Bond pad metalization thickness : 3um

EXP 3C: Using 1570N & Radix wire						X - section analysis (5 balls)					Cratering check			
Run	Wire Type	Time Base 1	Power Base 1	Force Base 1	Good ball (qty)	1	2	Metal gap (um)			IM Touching? (qty)	Cratering after w/b	Cratering after mold/PMC	Intermetallic coverage
W1	Radix	10	58	33	0	0.00	0.00	0.00	0.00	0.00	5	0/30	0/5	>80%
W2	Radix	12	60	38	0	0.00	0.00	0.00	0.00	0.00	5	0/30	0/5	>80%
W3	Radix	14	62	43	0	0.00	0.00	0.00	0.00	0.00	5	0/30	0/5	>80%

**Analysis/ Conclusion:**  
 Ball visual not flat thus unable to achieve gap.

EXP 3B: RESULTS  
**A) Ball shear reading (gm) s/s:22 balls**

Run	C1	C2	C3
1	75.2	108.0	117.0
2	95.6	109.8	121.4
3	90.6	102.0	127.2
4	88.6	114.4	121.6
5	94.8	113.8	124.0
6	96.2	118.8	119.8
7	88.6	120.4	119.2
8	90.0	120.6	124.2
9	97.6	120.0	130.8
10	98.0	106.8	128.6
11	102.0	118.2	122.4
12	98.8	116.4	123.2
13	98.8	108.6	120.6
14	80.4	121.6	118.8
15	92.0	91.0	119.4
16	97.4	111.4	124.2
17	99.2	113.0	123.4
18	101.8	106.8	119.4
19	99.4	104.0	115.6
20	103.2	98.6	119.8
21	93.0	104.8	121.8
22	94.1	110.0	121.8
min	75.2	91.0	115.6
max	103.2	121.6	130.8
avg	94.3	110.9	122.0

Remark:- Spec limit 80.0gm, Target: <150gm

**B) Ball thickness (mils) s/s: 22 balls**

Run	C1	C2	C3
1	2.2	2.3	2.0
2	2.2	2.2	2.0
3	2.2	2.1	2.0
4	2.2	2.2	2.0
5	2.2	2.1	2.1
6	2.3	2.0	2.1
7	2.3	2.1	2.2
8	2.3	2.2	2.1
9	2.3	2.2	1.8
10	2.2	2.2	2.0
11	2.2	2.2	2.0
12	2.3	2.2	2.0
13	2.2	2.2	2.2
14	2.3	2.2	2.1
15	2.2	2.2	2.2
16	2.2	2.2	2.2
17	2.2	2.2	2.0
18	2.2	2.0	2.1
19	2.1	2.0	2.2
20	2.3	2.1	2.2
21	2.3	2.0	2.2
22	2.3	2.0	2.2
min	2.1	2.0	1.8
max	2.3	2.3	2.2
avg	2.2	2.1	2.1

Remark:- Target: >2.0 mils

EXP 3C: RESULTS  
**A) Ball shear reading (gm) s/s:22 balls**

Run	W1	W2	W3
1	86.4	114.6	118.4
2	109.6	118.2	119.0
3	101.2	108.0	124.6
4	92.0	116.2	113.0
5	97.0	113.4	111.6
6	94.0	108.0	112.0
7	91.6	111.2	121.0
8	87.2	99.8	123.8
9	91.0	111.8	113.0
10	90.4	93.4	119.2
11	91.8	97.0	122.4
12	75.4	104.0	118.4
13	87.4	104.2	118.6
14	80.0	81.6	99.4
15	88.2	92.2	120.2
16	88.6	102.6	125.6
17	92.0	107.0	112.8
18	88.8	106.6	117.0
19	91.6	105.6	110.0
20	92.8	107.0	121.8
21	81.8	103.2	110.0
22	95.8	106.8	121.8
min	75.4	81.6	99.4
max	109.6	118.2	125.8
avg	90.7	105.1	117.0

Remark:- Spec limit 80.0gm, Target: <150gm

**B) Ball thickness (mils) s/s: 22 balls**

Run	W1	W2	W3
1	2.0	2.1	2.0
2	2.4	2.2	2.1
3	2.1	2.1	2.1
4	2.2	2.2	2.1
5	2.2	2.2	1.9
6	2.2	2.2	1.9
7	2.2	2.2	2.1
8	2.2	2.1	2.0
9	2.4	2.0	2.0
10	2.4	2.1	1.9
11	2.4	2.2	2.0
12	2.3	2.1	2.1
13	2.3	2.2	2.2
14	2.3	2.1	1.8
15	2.3	2.2	2.1
16	2.3	2.2	2.1
17	2.3	2.2	2.2
18	2.2	2.1	2.2
19	2.3	2.1	1.9
20	2.2	2.0	2.0
21	2.2	2.3	2.0
22	2.2	2.2	2.0
min	2.0	2.0	1.8
max	2.4	2.3	2.2
avg	2.3	2.2	2.0

Remark:- Target: >2.0 mils

**PROBLEM:** Intermetallic layer touching onto oxide layer  
**OBJECTIVE:** Evaluate AB339 bonder with 120° ICA capillary and thin ball requirement

**EXP 3.2:**

- Materials:  
 1. Capillary: 1570N-25-437  
 2. Bonder: AB339 (138khz)  
 3. Wire type: Y-type  
 4. Parameter: New parameter with thin ball requirement  
 5. Bond pad metalization thickness : 3um

**EXP 3.2. Using 1570N & Y-type wire**

Run	Wire Type	Time Base 1	Power Base 1	Force Base 1	X - section analysis (6 balls)						Cratering check			Intermetallic coverage	
					Good ball (qty)	1	2	3	4	5	6	IM Touching? (qty)	Cratering after w/b		Cratering after mold/PMC
Y1	Y-type	10	36	80	6	1.26	1.06	1.13	1.67	1.01	1.36	0	0/30	0/5	>60%
Y2	Y-type	11	39	85	6	1.21	1.13	1.21	1.62	1.59	1.24	0	0/30	0/5	>60%
Y3	Y-type	12	40	90	6	1.13	1.19	1.14	0.83	0.76	0.67	0	0/30	0/5	>60%

Note: Refer to FA report on cross sec (NEXT PAGE)

**EXP 3.2A: RESULTS**

**A) Ball shear reading (gm) s/s: 22 balls**

Run	Y1	Y2	Y3
1	117.6	124.8	140.0
2	127.8	130.0	151.4
3	119.6	135.4	147.8
4	127.0	132.0	155.0
5	122.4	93.2	160.2
6	128.6	145.2	147.6
7	129.6	127.6	146.6
8	101.2	123.0	135.4
9	128.8	124.8	141.6
10	126.4	129.0	135.8
11	129.0	103.4	120.6
12	127.4	100.4	106.8
13	111.4	100.6	101.4
14	99.0	105.8	111.0
15	109.0	115.6	103.0
16	118.6	139.2	134.5
17	116.4	127.2	145.0
18	128.8	120.2	138.4
19	121.6	135.0	152.4
20	118.6	137.0	150.2
21	121.0	136.6	146.2
22	120.0	123.0	136.0
min	99.0	93.2	101.4
max	129.6	145.2	160.2
avg	120.3	123.1	136.7

Remark:- Spec limit 80.0gm, Target: 150.0gm

**B) Ball thickness (mils) s/s: 22 balls**

Run	Y1	Y2	Y3
1	1.4	1.4	1.2
2	1.6	1.3	1.3
3	1.4	1.4	1.3
4	1.4	1.7	1.2
5	1.4	1.3	1.3
6	1.3	1.4	1.4
7	1.5	1.4	1.3
8	1.5	1.5	1.3
9	1.4	1.3	1.3
10	1.2	1.5	1.4
11	1.4	1.3	1.3
12	1.6	1.5	1.2
13	1.2	1.2	1.1
14	1.2	1.1	1.1
15	1.3	1.2	1.1
16	1.2	1.3	1.2
17	1.3	1.2	1.1
18	1.4	1.3	1.3
19	1.4	1.3	1.3
20	1.3	1.4	1.4
21	1.3	1.4	1.2
22	1.4	1.4	1.3
min	1.2	1.1	1.1
max	1.6	1.7	1.4
avg	1.4	1.4	1.3

Remark:- Target: 1.2 - 1.4mils

**C) Ball size (mils) s/s: 22 balls**

Run	Y1	Y2	Y3
1	5.3	5.1	5.4
2	5.1	5.4	5.6
3	5.1	5.4	5.4
4	5.1	5.2	5.5
5	5.4	5.4	5.5
6	5.4	5.1	5.0
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
min	5.1	5.1	5.0
max	5.4	5.4	5.6
avg	5.2	5.3	5.4

Remark:- Target: 5.5mils



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# PRODUCT ANALYSIS REPORT

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Y1-Minimum Parameter		Y2-Medium Parameter		Y3-Maximum Parameter	
After PMC		After PMC		After PMC	
Source Ball#1	Source Ball#2	Source Ball#1	Source Ball#2	Source Ball#1	Source Ball#2
LTO gap :1.26 $\mu\text{m}$ Mag: 1000x	LTO gap :1.06 $\mu\text{m}$ Mag: 1000x	LTO gap :1.21 $\mu\text{m}$ Mag: 1000x	LTO gap :1.13 $\mu\text{m}$ Mag: 1000x	LTO gap :1.13 $\mu\text{m}$ Mag: 1000x	LTO gap :1.19 $\mu\text{m}$ Mag: 1000x
Source Ball#3	Source ball#4	Source Ball#3	Source ball#4	Source Ball#3	Source ball#4
LTO gap :1.13 $\mu\text{m}$ Mag: 1000x	LTO gap :1.67 $\mu\text{m}$ Mag: 1000x	LTO gap :1.21 $\mu\text{m}$ Mag: 1000x	LTO gap :1.62 $\mu\text{m}$ Mag: 1000x	LTO gap :1.14 $\mu\text{m}$ Mag: 1000x	LTO gap :0.83 $\mu\text{m}$ Mag: 1000x
Source Ball#5	Source Ball#6	Source Ball#5	Source Ball#6	Source Ball#5	Source Ball#6
LTO gap :1.01 $\mu\text{m}$ Mag: 1000x	LTO gap :1.36 $\mu\text{m}$ Mag: 1000x	LTO gap :1.59 $\mu\text{m}$ Mag: 1000x	LTO gap :1.24 $\mu\text{m}$ Mag: 1000x	LTO gap :0.76 $\mu\text{m}$ Mag: 1000x	LTO gap :0.67 $\mu\text{m}$ Mag: 1000x

- Materials:  
 1. Capillary: 1570N-25-437  
 2. Bonder: AB339 (138khz)  
 3. Wire type: Y-type  
 4. Parameter: New parameter with thin ball requirement  
 5. Bond pad metallization thickness : 3um

Conclusion:  
 Before Storage: All reading above spec limit.

**New Parameter**

1) Base parameter	1st bond	2nd Bond
Time Base (um):	10-12	12-14
Power Base (Dac):	36-40	110-120
Force Base (g):	80-90	120-130
Standby Power (Dac):	0	0
Power Factor (g):	0	0

2) EFO Parameter

Ball size :	50
Ball Thickness :	15
EFO Delay :	5
EFO Current :	850
Auto EFO Time :	YES
EFO Gap Volt :	5020

3) Bond Parameter

	1st bond	2nd Bond
Power Delay (ms):	0	0
Contact Time (ms):	3	3
Contact Power (Dac):	50	55
Contact Force (g):	50	55

**BEFORE STORAGE**  
Spec limit: 80um

No	Ball shear Reading					
	Low (Y1)	Mode	Nominal (Y2)	Mode	High (Y3)	Mode
1	99.2	1	104.8	1	116.0	1
2	97.8	1	120.8	1	125.2	1
3	99.6	1	121.6	1	141.0	1
4	103.0	1	113.8	1	136.2	1
5	101.0	1	117.8	1	134.0	1
6	106.6	1	128.8	1	137.8	1
7	98.8	1	114.4	1	114.6	1
8	122.2	1	111.2	1	116.6	1
9	126.4	1	121.2	1	100.2	1
10	119.0	1	118.6	1	105.2	1
11	132.4	1	120.0	1	103.8	1
12	120.4	1	123.4	1	104.4	1
13	116.0	1	126.2	1	109.2	1
14	140.4	1	133.0	1	116.6	1
15	105.4	1	126.8	1	124.2	1
16	116.8	1	121.0	1	123.2	1
17	108.2	1	134.0	1	119.4	1
18	94.6	1	124.6	1	147.6	1
19	94.0	1	133.8	1	160.2	1
20	102.2	1	130.4	1	152.8	1
21	99.8	1	116.4	1	153.0	1
22	101.0	1	108.2	1	150.0	1
23	113.6	1	117.4	1	144.6	1
24	118.6	1	126.4	1	151.2	1
25	101.8	1	142.0	1	128.0	1
26	102.4	1	123.2	1	136.4	1
27	96.4	1	114.0	1	149.2	1
28	104.4	1	134.4	1	142.0	1
29	93.0	1	138.4	1	141.8	1
30	112.6	1	149.0	1	137.2	1
31	107.6	1	141.2	1	143.4	1
32	105.6	1	134.6	1	119.4	1
33	102.6	1	121.8	1	144.4	1
34	106.2	1	137.4	1	117.4	1
35	101.4	1	118.2	1	119.2	1
36	115.2	1	108.6	1	127.8	1
37	126.0	1	105.6	1	121.8	1
38	125.2	1	109.8	1	120.6	1
39	136.4	1	111.6	1	125.4	1
40	124.4	1	111.0	1	130.0	1
41	124.4	1	109.8	1	144.4	1
42	126.8	1	114.4	1	145.4	1
43	111.4	1	121.0	1	132.4	1
44	107.4	1	123.6	1	140.4	1
45	109.4	1	117.4	1	131.8	1
46	117.4	1	130.4	1	111.2	1
47	133.2	1	117.4	1	118.2	1
48	133.8	1	130.2	1	109.6	1
49	129.8	1	136.4	1	118.8	1
50	134.4	1	151.0	1	114.2	1
51	141.2	1	142.6	1	118.6	1
52	132.8	1	142.2	1	114.6	1
53	131.4	1	135.4	1	127.8	1
54	93.0	1	151.8	1	146.0	1
55	125.4	1	119.6	1	147.4	1
56	116.4	1	121.4	1	140.8	1
57	99.8	1	121.6	1	133.2	1
58	91.8	1	141.0	1	132.6	1
59	105.8	1	145.6	1	151.6	1
60	114.8	1	130.2	1	112.6	1
61	111.8	1	121.2	1	118.6	1
62	115.0	1	146.2	1	110.6	1
63	106.2	1	141.6	1	109.6	1
64	107.2	1	137.2	1	115.4	1
65	103.4	1	135.6	1	115.2	1
66	102.4	1	138.2	1	113.0	1
67	103.6	1	143.6	1	115.4	1
68	115.8	1	132.5	1	126.4	1
69	104.6	1	136.2	1	118.0	1
70	99.4	1	130.4	1	114.2	1
71	96.8	1	135.4	1	114.6	1
72	107.4	1	140.6	1	115.0	1
73	108.8	1	132.2	1	108.8	1
74	105.6	1	119.4	1	127.2	1
75	125.6	1	131.0	1	130.0	1
76	127.4	1	106.2	1	148.2	1
77	130.8	1	115.2	1	140.4	1
78	126.0	1	113.6	1	136.4	1
79	119.6	1	108.2	1	122.8	1
80	118.0	1	116.4	1	133.2	1
81	123.2	1	121.0	1	137.0	1
82	118.2	1	113.4	1	138.5	1
83	102.8	1	128.5	1	149.0	1
84	99.8	1	126.9	1	150.8	1
<b>Avg</b>	112.6		126.1		128.5	
<b>Min</b>	91.8		104.8		100.2	
<b>Max</b>	141.2		151.8		160.2	
<b>Stdev</b>	12.6		11.8		14.6	

**BEFORE STORAGE**  
Spec limit: 7.5gm

No	Wire Pull Reading					
	Low (Y1)	Mode	Nominal (Y2)	Mode	High (Y3)	Mode
1	35.6	1	29.4	1	36.8	1
2	35.0	1	35.2	1	32.6	1
3	37.5	1	33.4	1	29.8	1
4	36.5	1	36.5	1	32.9	1
5	38.1	1	34.8	1	33.1	1
6	33.8	1	33.7	1	30.0	1
7	36.8	1	31.0	1	33.1	1
8	30.3	1	31.2	1	33.6	1
9	34.1	1	30.3	1	33.1	1
10	36.5	1	33.6	1	33.9	1
11	34.3	1	34.7	1	7.6	1
12	37.4	1	32.6	1	32.1	1
13	35.0	1	36.4	1	33.5	1
14	34.5	1	35.2	1	34.5	1
15	31.7	1	33.3	1	34.1	1
16	36.2	1	30.3	1	33.4	1
17	37.6	1	32.9	1	32.3	1
18	34.3	1	33.0	1	29.3	1
19	36.8	1	32.6	1	30.5	1
20	35.4	1	34.0	1	31.1	1
21	34.7	1	33.7	1	33.6	1
22	32.0	1	35.2	1	32.6	1
23	35.4	1	30.7	1	34.2	1
24	35.9	1	33.2	1	32.9	1
25	31.9	1	35.2	1	35.3	1
26	36.8	1	32.8	1	33.3	1
27	34.2	1	34.4	1	33.0	1
28	34.2	1	32.6	1	34.0	1
29	30.0	1	31.6	1	31.5	1
30	34.2	1	33.5	1	32.3	1
31	35.9	1	31.5	1	35.9	1
32	32.2	1	37.0	1	32.2	1
33	34.0	1	34.2	1	31.0	1
34	36.4	1	34.4	1	31.1	1
35	35.8	1	34.5	1	33.0	1
36	29.4	1	34.7	1	31.9	1
37	34.2	1	30.8	1	32.3	1
38	34.7	1	34.7	1	33.9	1
39	31.4	1	34.5	1	35.1	1
40	33.6	1	35.5	1	26.9	1
41	33.7	1	36.1	1	31.5	1
42	37.3	1	34.2	1	32.1	1
43	28.3	1	37.5	1	35.4	1
44	32.5	1	29.4	1	31.3	1
45	34.6	1	33.2	1	33.2	1
46	30.1	1	36.3	1	32.3	1
47	32.7	1	39.3	1	31.0	1
48	31.6	1	37.2	1	35.0	1
49	35.2	1	31.3	1	36.6	1
50	30.0	1	31.9	1	30.8	1
51	30.0	1	30.0	1	31.4	1
52	32.3	1	31.9	1	35.6	1
53	32.4	1	32.4	1	36.1	1
54	35.6	1	30.9	1	32.6	1
55	34.1	1	33.6	1	34.3	1
56	34.1	1	32.9	1	33.2	1
57	29.4	1	35.7	1	30.9	1
58	35.7	1	31.8	1	31.9	1
59	35.2	1	33.2	1	34.9	1
60	34.5	1	34.7	1	32.0	1
61	33.4	1	36.1	1	34.4	1
62	33.5	1	35.6	1	33.9	1
63	35.2	1	32.7	1	32.8	1
64	32.4	1	36.2	1	32.2	1
65	33.0	1	32.0	1	32.4	1
66	35.4	1	32.5	1	32.9	1
67	34.0	1	34.2	1	31.8	1
68	33.7	1	34.2	1	35.6	1
69	32.2	1	33.0	1	33.5	1
70	33.0	1	30.0	1	31.7	1
71	31.4	1	33.4	1	30.8	1
72	35.4	1	31.0	1	32.6	1
73	34.2	1	30.2	1	33.7	1
74	37.4	1	36.4	1	34.6	1
75	35.8	1	34.2	1	35.1	1
76	33.3	1	34.2	1	36.2	1
77	35.5	1	33.5	1	29.7	1
78	31.3	1	30.8	1	30.3	1
79	34.2	1	29.3	1	30.5	1
80	36.7	1	31.1	1	33.5	1
81	33.6	1	35.0	1	31.5	1
82	32.5	1	31.2	1	36.3	1
83	35.2	1	36.4	1	29.6	1
84	38.6	1	33.3	1	33.9	1
<b>Avg</b>	34.1		33.4		32.6	
<b>Min</b>	28.3		29.3		7.6	
<b>Max</b>	38.6		39.3		36.8	
<b>Stdev</b>	2.2		2.1		3.3	

**Note.**  
 Wire pull failure mode definition:  
 1 : Wire break at neck point.  
 2 : Wire break at the point other than neck.  
 3 : Lifted bond.  
 4 : Lifted weld.

Ball shear failure mode definition:  
 1 : <25.0% of gold remaining on pad.  
 2 : >25.5% of gold remaining on pad.  
 3 : Lifted bond.  
 4 : Exposed underlying material.

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