



## Product Change Notification - ASER-21VJMM384

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**Date:**

24 Jan 2020

**Product Category:**

Interface- LIN Transceiver; Interface- Controller Area Network (CAN)

**Affected CPNs:****Notification subject:**

CCB 3167 Final Notice: Qualification of an additional fabrication site (Microchip – FAB 4) for selected Atmel ATA663231xxx, ATA6634xxx, ATA663254xxx and ATA6560xxx device families available in 8L VDFN (3x3x1.0mm), 16L VDFN (3x5.5x1mm) and 8L SOIC (6x4.9x1.75mm) packages.

**Notification text:****PCN Status:**

Final notification

Note: This final PCN only pertains to the products listed in this PCN. Additional final PCNs may be issued for additional catalog part numbers (CPN).

**PCN Type:**

Manufacturing Change

**Microchip Parts Affected:**

Please open one of the icons found in the Affected CPNs section above.

NOTE: For your convenience Microchip includes identical files in two formats (.pdf and .xls).

**Description of Change:**

Qualification of an additional fabrication site (Microchip - FAB 4) for selected Atmel ATA663231xxx, ATA6634xxx, ATA663254xxx and ATA6560xxx device families available in 8L VDFN (3x3x1.0mm), 16L VDFN (3x5.5x1mm) and 8L SOIC (6x4.9x1.75mm) packages.

**Pre Change:**

Fabricated at United Microelectronics Corporation (UMC) site.

**Post Change:**

Fabricated at United Microelectronics Corporation (UMC) or Microchip Technology Gresham (Fab 4) site.

**Pre and Post Change Summary:**

|                                          | Pre Change                                   | Post Change                                  |                                              |
|------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|
| <b>Fabrication Supplier and Location</b> | United Microelectronics Corporation<br>(UMC) | United Microelectronics Corporation<br>(UMC) | Microchip Technology Gresham Fab 4<br>(GRTM) |
| <b>Die Size</b>                          | No change                                    | No change                                    | No change                                    |
| <b>Wafer Diameter</b>                    | 8 inches                                     | 8 inches                                     | 8 inches                                     |

**Impacts to Data Sheet:**



None

**Change Impact:**

None

**Reason for Change:**

To improve manufacturability and on-time delivery performance by qualifying a second fabrication source at Microchip Technology Gresham (Fab 4) which will remove anticipated capacity constraints of these product(s).

**Change Implementation Status:**

In Progress

**Estimated First Ship Date:**

March 20, 2020 (date code: 2012)

NOTE: Please be advised that after the estimated first ship date customers may receive pre and post change parts.

**Time Table Summary:**

|                               | January 2020 |   |   |   |   | --> | March 2020 |    |    |    |    |
|-------------------------------|--------------|---|---|---|---|-----|------------|----|----|----|----|
| Workweek                      | 1            | 2 | 3 | 4 | 5 |     | 18         | 19 | 20 | 21 | 22 |
| Qual Report Availability      |              |   |   | X |   |     |            |    |    |    |    |
| Final PCN Issue Date          |              |   |   | X |   |     |            |    |    |    |    |
| Estimated Implementation Date |              |   |   |   |   |     |            |    |    | X  |    |

**Method to Identify Change:**

Traceability code

**Qualification Report:**

Please open the attachments included with this PCN labeled as PCN\_#\_Qual\_Report.

**Revision History:**

**January 24, 2020:** Issued final notification.

The change described in this PCN does not alter Microchip's current regulatory compliance regarding the material content of the applicable products.

**Attachment(s):**

[PCN\\_RMES-28HHPV827\\_Qual\\_Report.pdf](#)

[PCN\\_RMES-28HHPV827\\_Qual\\_Report.pdf](#)

Please contact your local [Microchip sales office](#) with questions or concerns regarding this notification.



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If you wish to change your PCN profile, including opt out, please go to the [PCN home page](#) select login and sign into your myMicrochip account. Select a profile option from the left navigation bar and make the applicable selections.



## **QUALIFICATION REPORT SUMMARY**

**PCN #: RMES-28HHPV827**

**Date:  
April 15, 2019**

**Qualification of an additional fabrication site (Microchip – FAB 4) for selected Atmel ATA663231xxx, ATA6634xxx and ATA6560xxx device families available in 8L VDFN (3x3x1.0mm), 16L VDFN (3x5.5x1mm) and 8L SOIC (6x4.9x1.75mm) packages.**



**Purpose:** Qualification of an additional fabrication site (Microchip – FAB 4) for selected Atmel ATA663231xxx, ATA6634xxx and ATA6560xxx device families available in 8L VDFN (3x3x1.0mm), 16L VDFN (3x5.5x1mm) and 8L SOIC (6x4.9x1.75mm) packages.

## A. Process Qualification

### I. Qualification Material:

|                                        |                            |                            |                            |                            |
|----------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| <b>Device</b>                          | ATA663254                  |                            |                            |                            |
| <b>Mask</b>                            | 77A06                      |                            |                            |                            |
| <b>Document Control Number and Rev</b> | ML012019000T Rev. B        |                            |                            |                            |
| <b>CCB No.</b>                         | 3167                       |                            |                            |                            |
| <b>Test Lot</b>                        | <b>Lot 1</b>               | <b>Lot 2</b>               | <b>Lot 3</b>               | <b>Lot 4</b>               |
| <b>Wafer Fab</b>                       | Gresham 8 inch fabrication | Gresham 8 inch fabrication | Gresham 8 inch fabrication | Gresham 8 inch fabrication |
| <b>Wafer Process</b>                   | 8" 150nm                   | 8" 150nm                   | 8" 150nm                   | 8" 150nm                   |
| <b>Wafer Lot</b>                       | GRSM418343304.100          | GRSM418481951.200          | GRSM419053817.200          | GRSM418532916.100          |
| <b>Assembly Lot</b>                    | EV87980 / EV87280          | EV88040                    | 1927DCF-1                  | EV88230                    |

### II. Qualification Data

| Test Name                           | Test Method             | Test Condition   | Sample Size                                          | Result                                    | Comments                                             |
|-------------------------------------|-------------------------|------------------|------------------------------------------------------|-------------------------------------------|------------------------------------------------------|
| Early Life Failure Rate             | AEC Q100                | 125°C/48 hours   | (800 ea. Min)<br>Lot1: 800<br>Lot2: 800<br>Lot3: 800 | Lot1: 0/800<br>Lot2: 0/800<br>Lot3: 0/800 | Pre- & Post Testing was done @ +25°C and +125°C.     |
| High Temperature Operation Lifetime | MIL-STD 883 Method 1005 | 125°C/1000 hours | (77 ea. Min)<br>Lot1: 77<br>Lot2: 77<br>Lot3: 77     | Lot1: 0/77<br>Lot2: 0/77<br>Lot3: 0/77    | Pre- & Post Testing was done @ +25°C, -40°C, +125°C. |



| Test Name     | Reference Method             | Sample Size/Lot                                  | Result                |
|---------------|------------------------------|--------------------------------------------------|-----------------------|
| ESD – HBM     | AEC Q100-002E<br>JS-001-2017 | Lot1                                             | Standard<br>+/- 4500V |
|               |                              | Standard                                         |                       |
|               |                              | 0/3 +/- 250V                                     |                       |
|               |                              | 0/3 +/- 500V                                     |                       |
|               |                              | 0/3 +/- 750V                                     |                       |
|               |                              | 0/3 +/- 1000V                                    |                       |
|               |                              | 0/3 +/- 1250V                                    |                       |
|               |                              | 0/3 +/- 1500V                                    |                       |
|               |                              | 0/3 +/- 1750V                                    |                       |
|               |                              | 0/3 +/- 2000V                                    |                       |
|               |                              | 0/3 +/- 2250V                                    |                       |
|               |                              | 0/3 +/- 2500V                                    |                       |
|               |                              | 0/3 +/- 3000V                                    |                       |
|               |                              | 0/3 +/- 3500V                                    |                       |
|               |                              | 0/3 +/- 4000V                                    |                       |
|               |                              | 0/3 +/- 4500V                                    |                       |
|               |                              |                                                  |                       |
|               |                              | Lot 1                                            |                       |
|               |                              | HBM2_VS (7) and LIN (6) versus GND (5)           |                       |
|               |                              |                                                  |                       |
|               |                              | 0/3 +/- 250V                                     |                       |
|               |                              | 0/3 +/- 500V                                     |                       |
|               |                              | 0/3 +/- 750V                                     |                       |
|               |                              | 0/3 +/- 1000V                                    |                       |
|               |                              | 0/3 +/- 1250V                                    |                       |
|               |                              | 0/3 +/- 1500V                                    |                       |
|               |                              | 0/3 +/- 1750V                                    |                       |
|               |                              | 0/3 +/- 2000V                                    |                       |
|               |                              | 0/3 +/- 2250V                                    |                       |
|               |                              | 0/3 +/- 2500V                                    |                       |
|               |                              | 0/3 +/- 3000V                                    |                       |
|               |                              | 0/3 +/- 3500V                                    |                       |
| 0/3 +/- 4000V |                              |                                                  |                       |
| 0/3 +/- 4500V |                              |                                                  |                       |
| 0/3 +/- 5000V |                              |                                                  |                       |
| 0/3 +/- 5500V |                              |                                                  |                       |
| 0/3 +/- 6000V |                              |                                                  |                       |
| 0/3 +/- 6500V |                              |                                                  |                       |
| 0/3 +/- 7000V |                              |                                                  |                       |
| 0/3 +/- 7500V |                              |                                                  |                       |
| 0/3 +/- 8000V |                              |                                                  |                       |
|               |                              |                                                  |                       |
| ESD – HBM     | AEC Q100-002E<br>JS-001-2017 | Lot4<br>Standard<br>0/3 +/- 250V<br>0/3 +/- 500V | Standard<br>+/- 4500V |



**MICROCHIP**

| Test Name | Reference Method              | Sample Size/Lot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Result                                                     |
|-----------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|           |                               | 0/3 +/- 750V<br>0/3 +/- 1000V<br>0/3 +/- 1250V<br>0/3 +/- 1500V<br>0/3 +/- 1750V<br>0/3 +/- 2000V<br>0/3 +/- 2250V<br>0/3 +/- 2500V<br>0/3 +/- 3000V<br>0/3 +/- 3500V<br>0/3 +/- 4000V<br>0/3 +/- 4500V<br><br>Lot 4<br>HBM2_VS (7) and LIN (6) versus GND (5)<br><br>0/3 +/- 250V<br>0/3 +/- 500V<br>0/3 +/- 750V<br>0/3 +/- 1000V<br>0/3 +/- 1250V<br>0/3 +/- 1500V<br>0/3 +/- 1750V<br>0/3 +/- 2000V<br>0/3 +/- 2250V<br>0/3 +/- 2500V<br>0/3 +/- 3000V<br>0/3 +/- 3500V<br>0/3 +/- 4000V<br>0/3 +/- 4500V<br>0/3 +/- 5000V<br>0/3 +/- 5500V<br>0/3 +/- 6000V<br>0/3 +/- 6500V<br>0/3 +/- 7000V<br>0/3 +/- 7500V<br>0/3 +/- 8000V | HBM2_VS (7) and LIN (6)<br>versus GND (5)<br><br>+/- 8000V |
| ESD-MM    | AEC-Q100-003E<br>JESD22-A115C | Lot 4<br>0/3 +/- 50V<br>0/3 +/- 100V<br>0/3 +/- 150V<br>0/3 +/- 200V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MM Standard<br>+/- 200V                                    |
| ESD-CDM   | AEC-Q100-011C1<br>(ANSI/ESD)  | Lot 1<br>0/3 +/- 125V<br>0/3 +/- 250V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | +/- 1250V                                                  |



**MICROCHIP**

| Test Name | Reference Method                                       | Sample Size/Lot                                                                                                                                        | Result                            |
|-----------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|           | 5.3.1-2009)<br>JS-002-2014                             | 0/3 +/- 375V<br>0/3 +/- 500V<br>0/3 +/- 625V<br>0/3 +/- 750V<br>0/3 +/- 875V<br>0/3 +/- 1000V<br>0/3 +/- 1250V                                         |                                   |
| ESD-CDM   | AEC-Q100-011C1<br>(ANSI/ESD 5.3.1-2009)<br>JS-002-2014 | Lot4<br>0/3 +/- 125V<br>0/3 +/- 250V<br>0/3 +/- 375V<br>0/3 +/- 500V<br>0/3 +/- 625V<br>0/3 +/- 750V<br>0/3 +/- 875V<br>0/3 +/- 1000V<br>0/3 +/- 1250V | +/- 1250V                         |
| Latch-up  | AEC Q100-004D<br>JEDEC JESD78E                         | Lot1<br>0/6 +25°C<br>0/6 +125°C                                                                                                                        | Pass – Ta=25°C<br>Pass – Ta=125°C |
| Latch-up  | AEC Q100-004D<br>JEDEC JESD78E                         | Lot4<br>0/6 +25°C<br>0/6 +125°C                                                                                                                        | Pass – Ta=25°C<br>Pass – Ta=125°C |

Pre- & Post Testing was done @ +25°C and +125°C.





**QUALIFICATION REPORT SUMMARY**  
RELIABILITY LABORATORY

**PCN #: RMES-28HHPV827**

**Date:**  
**April 15, 2019**

**Qualification of an additional fabrication site (Microchip – FAB 4) for selected Atmel ATA663231xxx, ATA6634xxx and ATA6560xxx device families available in 8L VDFN (3x3x1.0mm), 16L VDFN (3x5.5x1mm) and 8L SOIC (6x4.9x1.75mm) packages.**



**Purpose:** Qualification of an additional fabrication site (Microchip – FAB 4) for selected Atmel ATA663231xxx, ATA6634xxx and ATA6560xxx device families available in 8L VDFN (3x3x1.0mm), 16L VDFN (3x5.5x1mm) and 8L SOIC (6x4.9x1.75mm) packages.

|                             |                          |                                       |
|-----------------------------|--------------------------|---------------------------------------|
| <b><u>Misc.</u></b>         | <b>Assembly site</b>     | ASCL                                  |
|                             | <b>BD Number</b>         | ATA663254G-N33NBP<br>ATA663231-P33NBP |
|                             | <b>MP Code (MPC)</b>     | 77A06YQ8BVG6                          |
|                             | <b>Part Number (CPN)</b> | ATA663254-GBQW<br>ATA663231-GBQW      |
|                             | <b>CCB Number</b>        | 3167                                  |
| <b><u>Lead-Frame</u></b>    | <b>Paddle size</b>       | 1.9 x 2.6mm                           |
|                             | <b>Material</b>          | C7025                                 |
|                             | <b>Surface</b>           | Ag-ring                               |
|                             | <b>Treatment</b>         | rough                                 |
|                             | <b>Process</b>           | etched                                |
|                             | <b>Lead-lock</b>         | No                                    |
|                             | <b>Part Number</b>       | 0008SN046F08                          |
|                             | <b>Lead Plating</b>      | Matte tin                             |
|                             | <b>Strip Size</b>        | 78x258mm                              |
|                             | <b>Strip Density</b>     | 15x56                                 |
| <b><u>Bond Wire</u></b>     | <b>Material</b>          | CuPdAu                                |
|                             | <b>Wire Diameter</b>     | 0.8                                   |
| <b><u>Die Attach</u></b>    | <b>Part Number</b>       | EN4900                                |
|                             | <b>Conductive</b>        | Yes                                   |
| <b><u>Mold Compound</u></b> | <b>Part Number</b>       | G700LA                                |
| <b><u>PKG</u></b>           | <b>PKG Type</b>          | VDFN wettable flanks                  |
|                             | <b>Pin/Ball Count</b>    | 8                                     |
|                             | <b>PKG width/size</b>    | 3x3mm                                 |
| <b><u>MSL</u></b>           | <b>MSL</b>               | 1                                     |



### Manufacturing Information

| Lot No. | Device            | Assembly Lot No. | QTY In | QTY Out | Assembly Yield               |
|---------|-------------------|------------------|--------|---------|------------------------------|
| 1       | ATA663254G-N33NBP | EV87230          | 1000   | 996     | 99.60%                       |
| 2       | ATA663254G-N33NBP | EV88230          | 16412  | 16406   | 99.96%                       |
| 3       | ATA663254G-N33NBP | EV88260          | 15638  | 15507   | 99.16%                       |
| 4       | ATA663231-P33NBP  | 1927DCF          | 15529  | 15524   | 99.97%                       |
|         |                   |                  |        |         | <b>Average Yield: 99.67%</b> |

**Result** ☒ Pass ☐ Fail ☐

Grade 1 Qualification of ATA663254 DFN08 for 77k Technology transfer to Fab 4, pass reliability test per AEC-Q006 which was conducted at MPHL rel lab. This package is qualified Moisture/Reflow Sensitivity Classification Level 1 at 260°C reflow temperature per IPC/JEDEC J-STD-020D standard.

# PACKAGE QUALIFICATION REPORT

| Test Number<br>(Reference)                                                              | Test Condition                                                                                                                                                                                                                                                                                                       | Standard<br>/ Method | Qty.<br>(Acc.)          | Def/S<br>S                                                                      | Result                                   | Remarks |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------|---------------------------------------------------------------------------------|------------------------------------------|---------|
| <b>Moisture/Reflow<br/>Sensitivity<br/>Classification<br/>Test (At MSL<br/>Level 1)</b> | 85°C/85%RH Moisture Soak 168 hrs.<br>System: Climats Excal 5423-HE<br>3x Convection-Reflow 265°C max<br>System: Mancorp CR.5000F<br><br>(IPC/JEDEC J-STD-020D)                                                                                                                                                       | IPC/JEDEC<br>C       | 22 units<br>per lot     | Lot 1<br>0/22<br><br>Lot 2<br>0/45<br><br>Lot 3<br>0/45                         | Pass<br><br>Pass<br><br>Pass             |         |
| <b>Precondition<br/>Prior Perform<br/>Reliability Tests<br/>(At MSL Level 1)</b>        | <b>Electrical Test:</b> +25°C, +125°C<br>System: LTX/RASCO<br><br>Bake 125°C, 24 hrs<br>System: HERAEUS<br><br>85°C/85%RH Moisture Soak 168hrs.<br>System: Climats Excal 5423-HE<br><br>3x Convection-Reflow 260°C max<br>System: Mancorp CR.5000F<br><br><b>Electrical Test:</b> +25°C, +125°C<br>System: LTX/RASCO | JESD22-<br>A113      | 300<br>units<br>per lot | Lot 1<br>0/200<br><br>Lot 2<br>0/290<br><br>Lot 3<br>0/290<br><br>Lot 4<br>0/95 | Pass<br><br>Pass<br><br>Pass<br><br>Pass |         |

# PACKAGE QUALIFICATION REPORT

| PACKAGE QUALIFICATION REPORT                                                                                |                                                                                                            |                     |                      |                |               |                                                                           |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|---------------------|----------------------|----------------|---------------|---------------------------------------------------------------------------|
| Test Number<br>(Reference)                                                                                  | Test Condition                                                                                             | Standard/<br>Method | Qty.<br>(Acc.)       | Def/SS         | Result        | Remarks                                                                   |
| Temperature<br>Cycle                                                                                        | <b>Stress Condition:</b> (Standard)<br>-65°C to +150°C, 500 Cycles<br>System: Votsch VTS <sup>2</sup> 7012 | JESD22-<br>A104     | 100 units<br>per lot | Lot 1<br>0/100 | Pass          |                                                                           |
|                                                                                                             |                                                                                                            |                     |                      | Lot 2<br>0/100 | Pass          |                                                                           |
|                                                                                                             |                                                                                                            |                     |                      | Lot 3<br>0/100 | Pass          |                                                                           |
|                                                                                                             | <b>Acoustic Microscopy</b>                                                                                 |                     | 22 units<br>per lot  | Lot 1<br>0/22  | Pass          |                                                                           |
|                                                                                                             |                                                                                                            |                     |                      | Lot 2<br>0/22  | Pass          |                                                                           |
|                                                                                                             |                                                                                                            |                     |                      | Lot 3<br>0/22  | Pass          |                                                                           |
|                                                                                                             | <b>Internal Package Analysis</b>                                                                           |                     | 4 units<br>per lot   | Lot 1<br>0/4   | Pass          | 2018 - 003090                                                             |
|                                                                                                             |                                                                                                            |                     |                      | Lot 2<br>0/4   | Pass          | 2018 - 006580                                                             |
|                                                                                                             |                                                                                                            |                     |                      | Lot 3<br>0/4   | Pass          | 2018 - 006581                                                             |
|                                                                                                             | <b>Bond Strength:</b><br>Wire Pull (>4.0g)<br>Bond <i>Shear</i> (>10g)<br>System: Dage                     |                     | 6 units<br>per lot   | Lot 1<br>0/6   | Pass          | See attachment<br>Wire pull & bond<br>shear after<br>500cyc Temp<br>Cycle |
|                                                                                                             |                                                                                                            |                     |                      | Lot 2<br>0/6   | Pass          |                                                                           |
|                                                                                                             |                                                                                                            |                     |                      | Lot 3<br>0/6   | Pass          |                                                                           |
| <b>Stress Condition:</b> (Standard)<br>-65°C to +150°C, 1000 Cycles<br>System: Votsch VTS <sup>2</sup> 7012 | JESD22-<br>A104                                                                                            | 90 units<br>per lot | Lot 1<br>0/89        | Pass           |               |                                                                           |
|                                                                                                             |                                                                                                            |                     | Lot 2<br>0/90        | Pass           |               |                                                                           |
|                                                                                                             |                                                                                                            |                     | Lot 3<br>0/90        | Pass           |               |                                                                           |
| <b>Acoustic Microscopy</b>                                                                                  |                                                                                                            | 22 units<br>per lot | Lot 1<br>0/22        | Pass           |               |                                                                           |
|                                                                                                             |                                                                                                            |                     | Lot 2<br>0/22        | Pass           |               |                                                                           |
|                                                                                                             |                                                                                                            |                     | Lot 3<br>0/22        | Pass           |               |                                                                           |
| <b>Internal Package Analysis</b>                                                                            |                                                                                                            | 4 units<br>per lot  | Lot 1<br>0/4         | Pass           | 2018 - 003714 |                                                                           |
|                                                                                                             |                                                                                                            |                     | Lot 2<br>0/4         | Pass           | 2018 - 006829 |                                                                           |
|                                                                                                             |                                                                                                            |                     | Lot 3<br>0/4         | Pass           | 2018 - 006828 |                                                                           |

# PACKAGE QUALIFICATION REPORT

| Test Number<br>(Reference) | Test Condition                                                                                                                                                                   | Standard/<br>Method | Qty.<br>(Acc.)      | Def/SS                                                  | Result                       | Remarks                                                                       |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------|
|                            | <b>Bond Strength:</b><br>Wire Pull (>4.0g)<br>Bond <i>Shear</i> (>10g)<br>System: Dage                                                                                           |                     | 6 units<br>per lot  | Lot 1<br>0/6<br><br>Lot 2<br>0/6<br><br>Lot 3<br>0/6    | Pass<br><br>Pass<br><br>Pass | See<br>attachment<br>Wire pull &<br>bond shear<br>after 1000cyc<br>Temp Cycle |
| HAST                       | <b>Stress Condition:</b> (Standard)<br>+ 130°C, 85%RH, 96hrs. VOLTS=5.0V<br>System: HIRAYAMA HASTEST PC-422R8<br><br><b>Electrical Test:</b> +25°C, +125°C<br>System: LTX/RASCO  | JESD22-<br>A118     | 90 units<br>per lot | Lot 2<br>0/90<br><br>Lot 3<br>0/90<br><br>Lot 4<br>0/94 | Pass<br><br>Pass<br><br>Pass |                                                                               |
|                            | <b>Acoustic Microscopy</b>                                                                                                                                                       |                     | 22 units<br>per lot | Lot 2<br>0/22<br><br>Lot 3<br>0/22<br><br>Lot 4<br>0/22 | Pass<br><br>Pass<br><br>Pass |                                                                               |
|                            | <b>Internal Package Analysis</b>                                                                                                                                                 |                     | 4 units<br>per lot  | Lot 2<br>0/4<br><br>Lot 3<br>0/4<br><br>Lot 4<br>0/4    | Pass<br><br>Pass<br><br>Pass | 2019 - 001326<br><br>2019 - 001327<br><br>2019 - 001315                       |
|                            | <b>Bond Strength:</b><br>Wire Pull (>4.0g)<br>Bond <i>Shear</i> (>10g)<br>System: Dage                                                                                           |                     | 6 units<br>per lot  | Lot 2<br>0/6<br><br>Lot 3<br>0/6<br><br>Lot 4<br>0/6    | Pass<br><br>Pass<br><br>Pass | See<br>attachment<br>Wire pull &<br>bond shear<br>after 96h<br>HAST           |
|                            | <b>Stress Condition:</b> (Standard)<br>+ 130°C, 85%RH, 192hrs. VOLTS=5.0V<br>System: HIRAYAMA HASTEST PC-422R8<br><br><b>Electrical Test:</b> +25°C, +125°C<br>System: LTX/RASCO | JESD22-<br>A118     | 80 units<br>per lot | Lot 2<br>0/79<br><br>Lot 3<br>0/78<br><br>Lot 4<br>0/80 | Pass<br><br>Pass<br><br>Pass |                                                                               |
|                            | <b>Acoustic Microscopy</b>                                                                                                                                                       |                     | 22 units<br>per lot | Lot 2<br>0/22<br><br>Lot 3<br>0/22<br><br>Lot 4<br>0/22 | Pass<br><br>Pass<br><br>Pass |                                                                               |
|                            |                                                                                                                                                                                  |                     |                     |                                                         |                              |                                                                               |
|                            |                                                                                                                                                                                  |                     |                     |                                                         |                              |                                                                               |
|                            |                                                                                                                                                                                  |                     |                     |                                                         |                              |                                                                               |
|                            |                                                                                                                                                                                  |                     |                     |                                                         |                              |                                                                               |

# PACKAGE QUALIFICATION REPORT

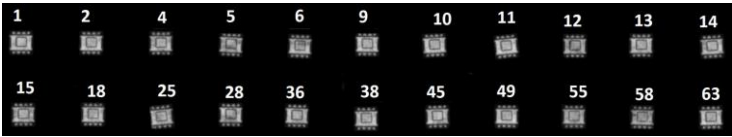
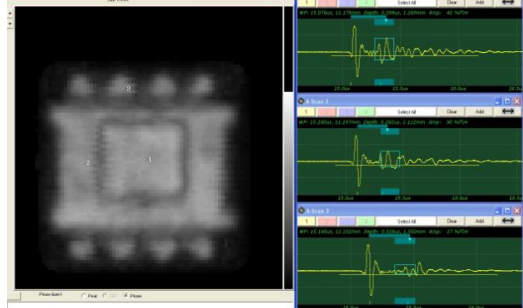
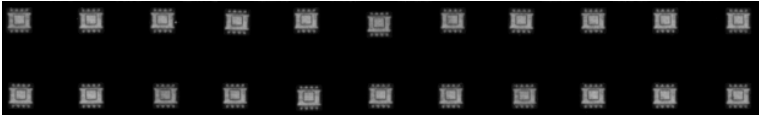
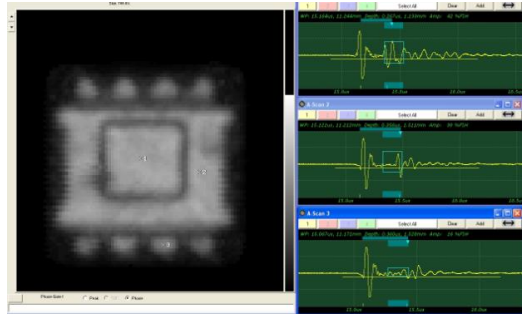
| Test Number<br>(Reference) | Test Condition                                                                                               | Standard/<br>Method | Qty.<br>(Acc.)       | Def/S<br>S.    | Result | Remarks                                                        |
|----------------------------|--------------------------------------------------------------------------------------------------------------|---------------------|----------------------|----------------|--------|----------------------------------------------------------------|
|                            | <b>Internal Package Analysis</b>                                                                             |                     | 4 units<br>per lot   | Lot 2<br>0/4   | Pass   | 2019 - 001424                                                  |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/4   | Pass   | 2019 - 001422                                                  |
|                            |                                                                                                              |                     |                      | Lot 4<br>0/4   | Pass   | 2019 – 001489                                                  |
|                            | <b>Bond Strength:</b><br>Wire Pull (>4.0g)<br>Bond <i>Shear</i> (>10g)<br>System: Dage                       |                     | 6 units<br>per lot   | Lot 2<br>0/6   | Pass   | See attachment<br>Wire pull & bond<br>shear after 192h<br>HAST |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/6   | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 4<br>0/6   | Pass   |                                                                |
| <b>UHAST</b>               | <b>Stress Condition:</b> (Standard)<br>+ 130°C, 85%RH, 96hrs. no bias<br>System: HIRAYAMA HASTEST PC-422R8   | JESD22-A118         | 100 units<br>per lot | Lot 1<br>0/100 | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 2<br>0/100 | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/100 | Pass   |                                                                |
|                            | <b>Internal Package Analysis</b>                                                                             |                     | 4 units<br>per lot   | Lot 1<br>0/4   | Pass   | 2018 - 003087                                                  |
|                            |                                                                                                              |                     |                      | Lot 2<br>0/4   | Pass   | 2018 - 006382                                                  |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/4   | Pass   | 2018 - 006383                                                  |
|                            | <b>Bond Strength:</b><br>Wire Pull (>4.0g)<br>Bond <i>Shear</i> (>10g)<br>System: Dage                       |                     | 6 units<br>per lot   | Lot 1<br>0/6   | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 2<br>0/6   | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/6   | Pass   |                                                                |
|                            | <b>Stress Condition:</b> (Standard)<br>+ 130°C, 85%RH, 192 hrs. no bias<br>System: HIRAYAMA HASTEST PC-422R8 | JESD22-A118         | 90 units<br>per lot  | Lot 1<br>0/90  | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 2<br>0/100 | Pass   |                                                                |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/100 | Pass   |                                                                |
|                            | <b>Internal Package Analysis</b>                                                                             |                     | 4 units<br>per lot   | Lot 1<br>0/4   | Pass   | 2018 - 003449                                                  |
|                            |                                                                                                              |                     |                      | Lot 2<br>0/4   | Pass   | 2018 - 006576                                                  |
|                            |                                                                                                              |                     |                      | Lot 3<br>0/4   | Pass   | 2018 - 006575                                                  |

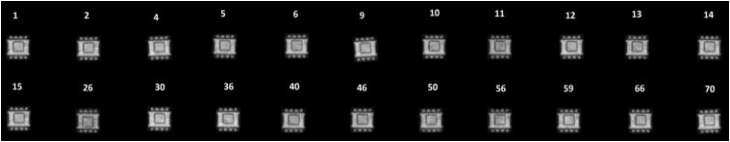
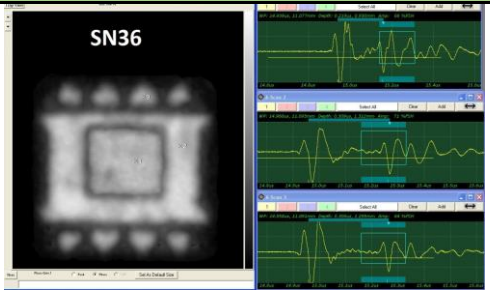
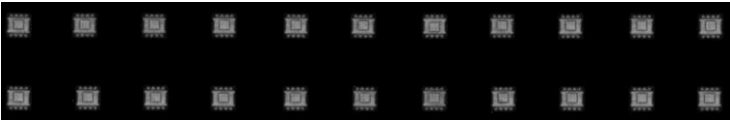
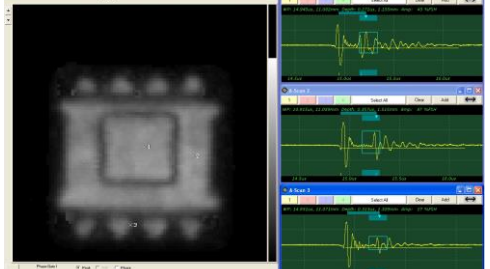
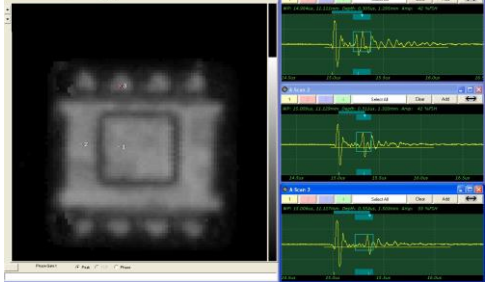
# PACKAGE QUALIFICATION REPORT

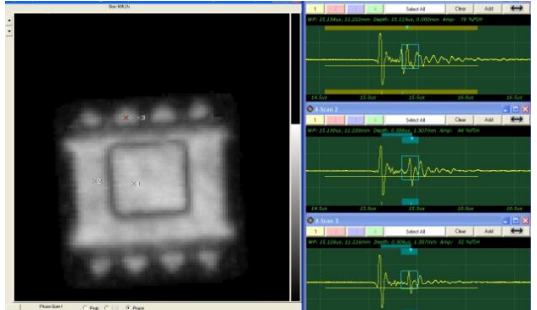
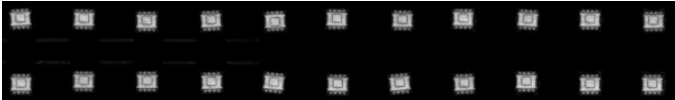
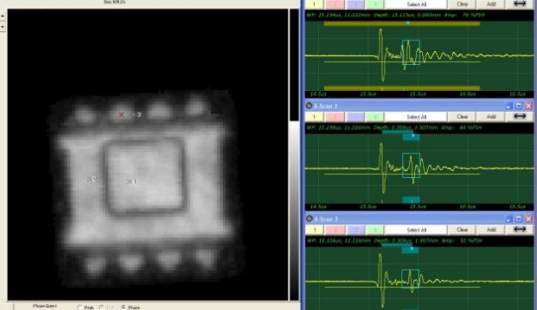
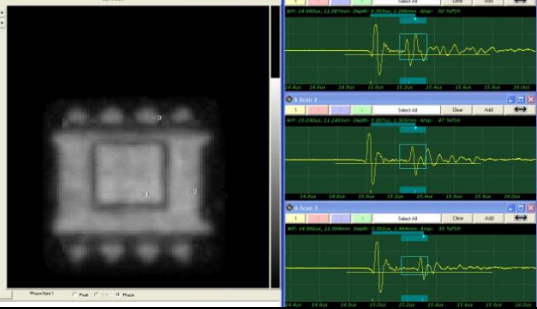
| Test Number<br>(Reference) | Test Condition                                                                                                                         | Standard/<br>Method | Qty. (Acc.)                     | Def/SS.                                                 | Result                       | Remarks                                                 |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------|---------------------------------------------------------|------------------------------|---------------------------------------------------------|
|                            | <b>Bond Strength:</b><br>Wire Pull (>4.0g)<br>Bond <i>Shear</i> (>10g)<br>System: Dage                                                 |                     | 6 units per<br>lot              | Lot 1<br>0/6<br><br>Lot 2<br>0/6<br><br>Lot 3<br>0/6    | Pass<br><br>Pass<br><br>Pass |                                                         |
| <b>HTSL</b>                | <b>Stress Condition:</b><br>Bake 175°C, 500 hrs.<br>System: HERAEUS<br><br><b>Electrical Test:</b> +25°C, +125°C<br>System: LTX/RASCO  | JESD22-<br>A103     | 58 units<br>per lot             | Lot 2<br>0/60<br><br>Lot 4<br>0/60                      | Pass<br><br>Pass             |                                                         |
|                            | <b>Internal Package Analysis</b>                                                                                                       |                     | 4 units per<br>lot              | Lot 2<br>0/4<br><br>Lot 4<br>0/4                        | Pass<br><br>Pass             | 2019 - 000732<br><br>2019 - 000730                      |
|                            | <b>Stress Condition:</b><br>Bake 175°C, 1000 hrs.<br>System: HERAEUS<br><br><b>Electrical Test:</b> +25°C, +125°C<br>System: LTX/RASCO | JESD22-<br>A103     | 58 units<br>per lot             | Lot 2<br>0/49<br><br>Lot 3<br>0/58<br><br>Lot 4<br>0/49 | Pass<br><br>Pass<br><br>Pass |                                                         |
|                            | <b>Internal Package Analysis</b>                                                                                                       |                     | 4 units per<br>lot              | Lot 2<br>0/4<br><br>Lot 3<br>0/4<br><br>Lot 4<br>0/4    | Pass<br><br>Pass<br><br>Pass | 2019 - 001186<br><br>2018 – 007286<br><br>2019 - 001187 |
| <b>Bond Strength</b>       | <b>Wire Pull (&gt;4.0g)</b><br><b>Bond Shear (&gt;10g)</b><br><br>System: Dage                                                         |                     | 5 unit<br>1 lot<br><br>30 bonds | Lot2<br>0/5                                             | Pass                         | Wire Pull and Bond<br>Shear: CPK>1.67                   |



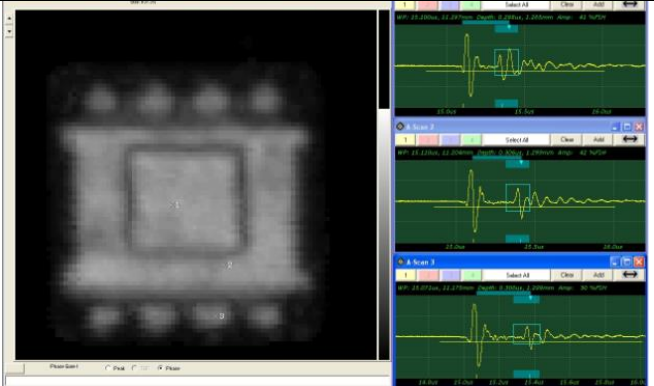
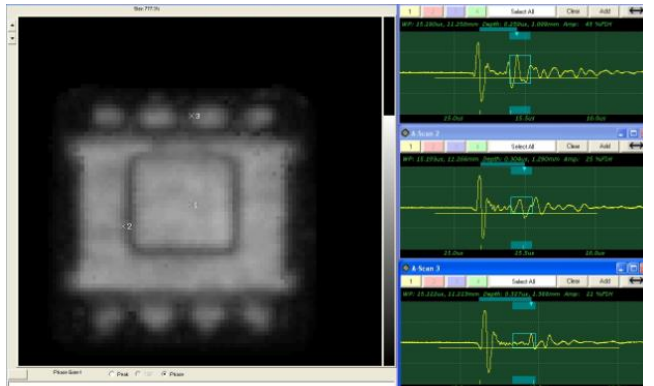
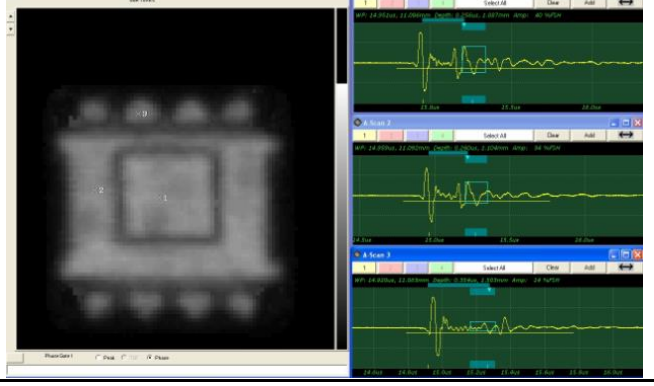
Attachment  
Acoustic Microscopy

| 500cyc TC |                                                                                      |                                                                                      |
|-----------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|           | C-Scan                                                                               | A-Scan                                                                               |
| EV87230   |     |   |
| EV88230   |     |   |
| EV88260   |  |  |

| 1000cyc TC |                                                                                     |                                                                                      |
|------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|            | C-Scan                                                                              | A-Scan                                                                               |
| EV87230    |   |   |
| EV88230    |   |   |
| EV88260    |  |  |

| 96h HAST |                                                                                     |                                                                                     |
|----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          | C-Scan                                                                              | A-Scan                                                                              |
| EV88230  |    |   |
| EV88260  |    |   |
| 1927DCF  |  |  |

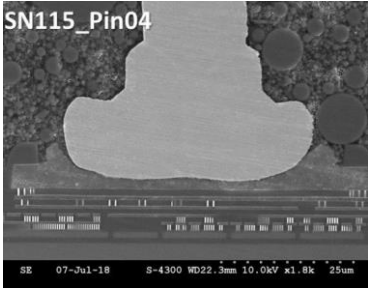
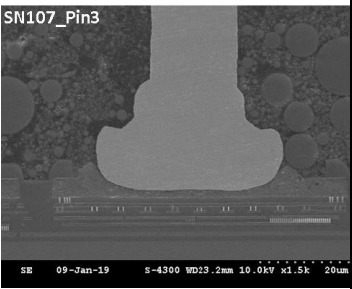
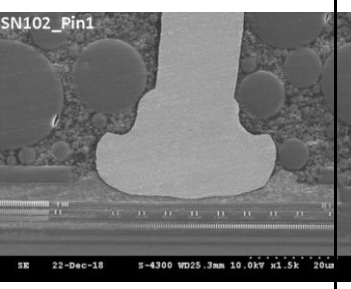
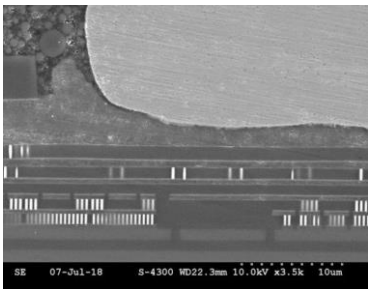
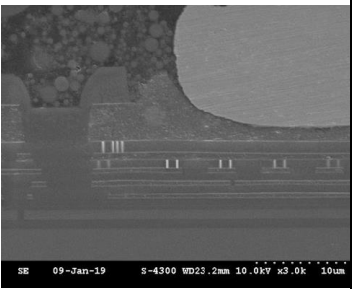
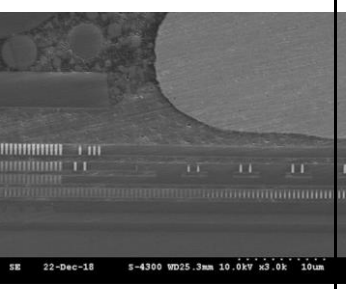
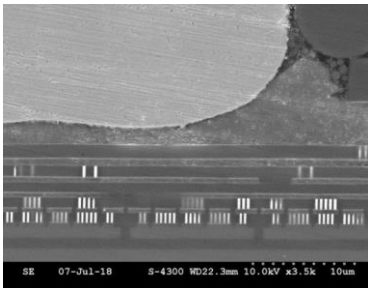
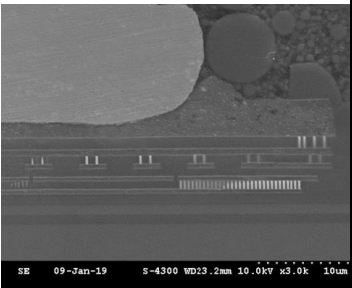
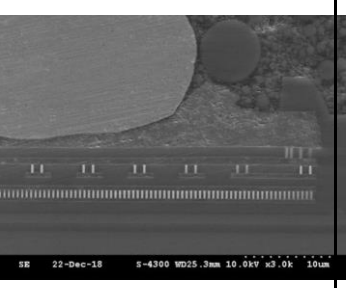
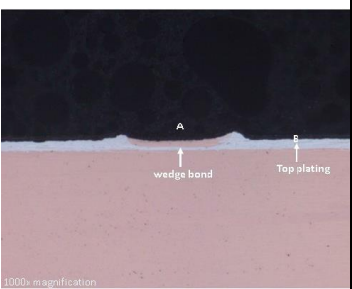
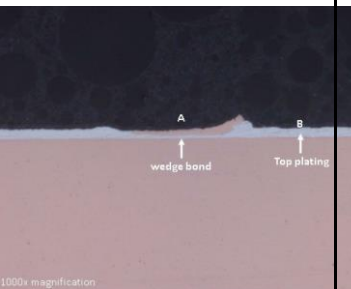
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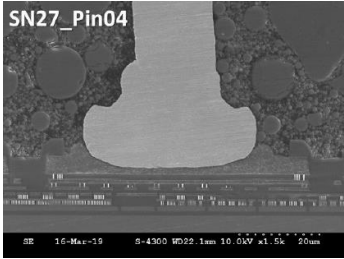
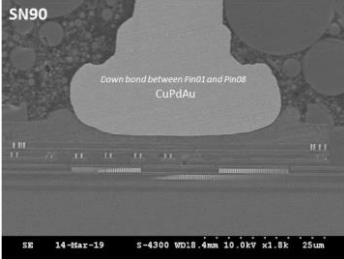
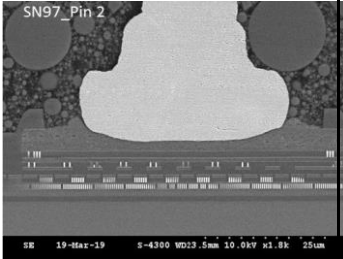
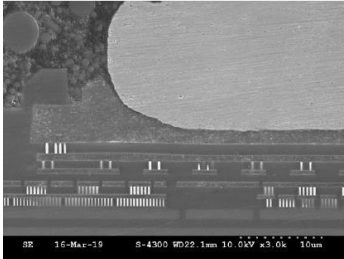
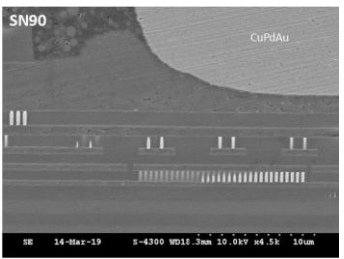
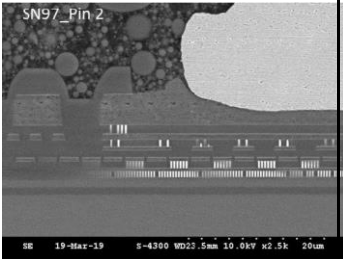
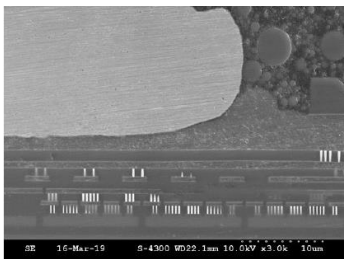
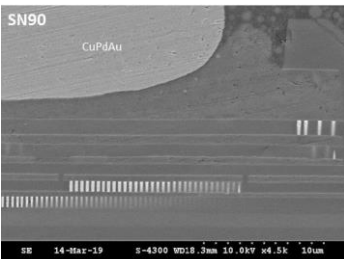
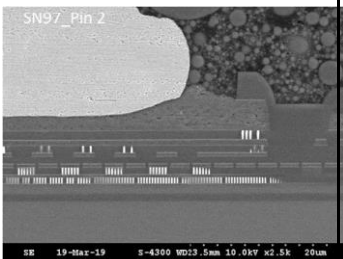
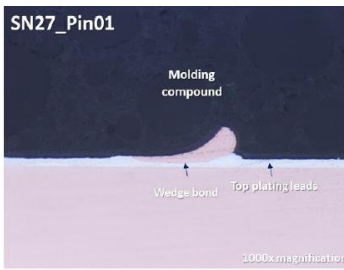
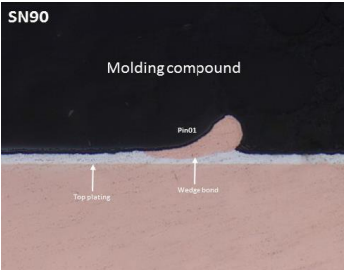
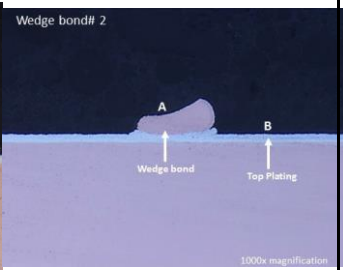
|         | C-Scan                                                                              | A-Scan                                                                               |
|---------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| EV88230 |    |    |
| EV88260 |    |   |
| 1927DCF |  |  |

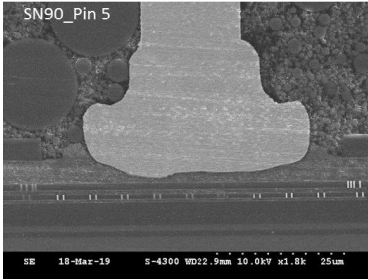
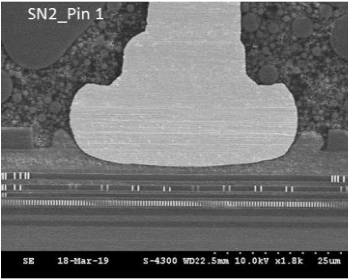
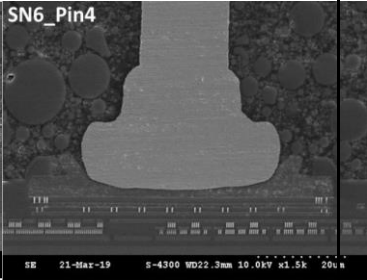
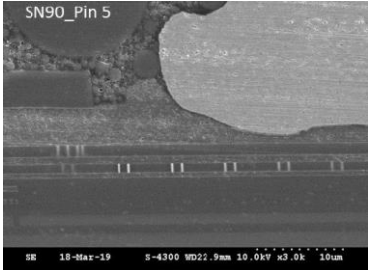
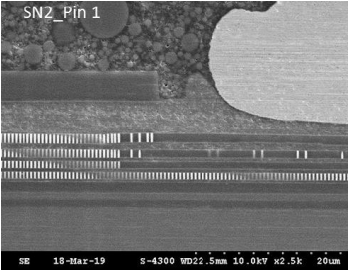
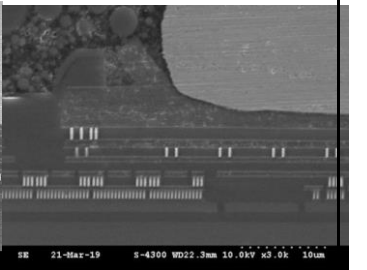
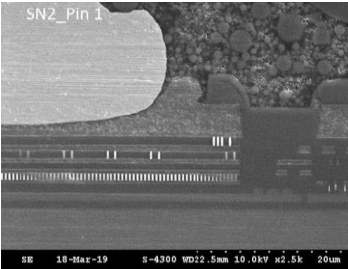
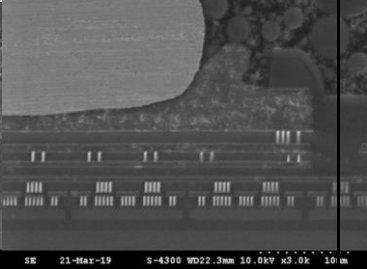
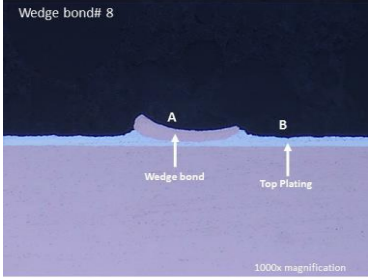
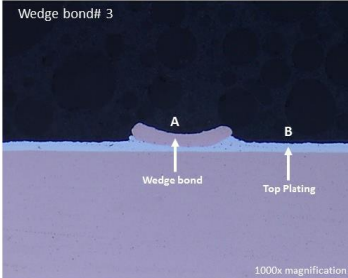
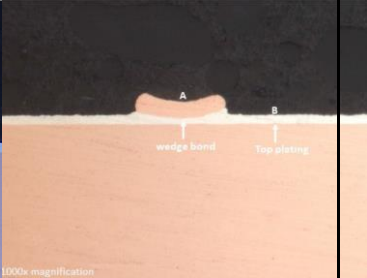
## Cross Section

| 500cyc TC |         |         |         |
|-----------|---------|---------|---------|
|           | EV87230 | EV88230 | EV88260 |
| <b>1</b>  |         |         |         |
| <b>2</b>  |         |         |         |
| <b>3</b>  |         |         |         |
| <b>4</b>  |         |         |         |
|           | PASS    | PASS    | PASS    |

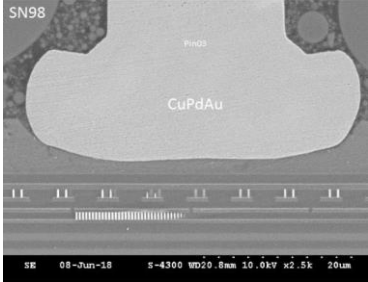
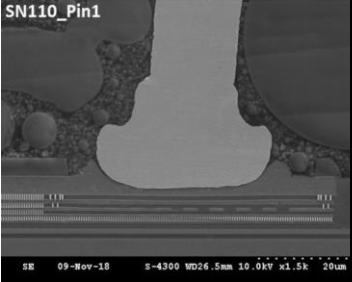
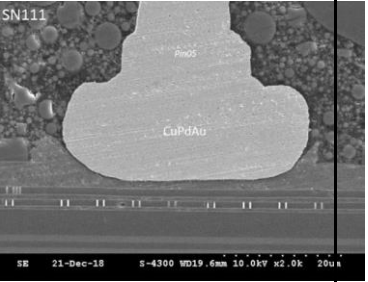
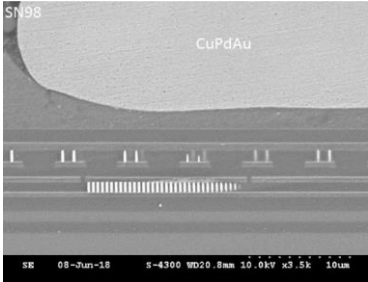
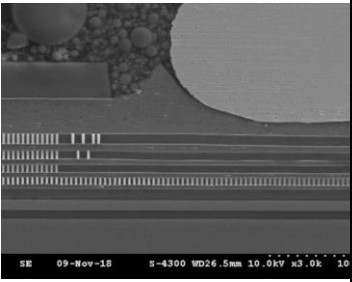
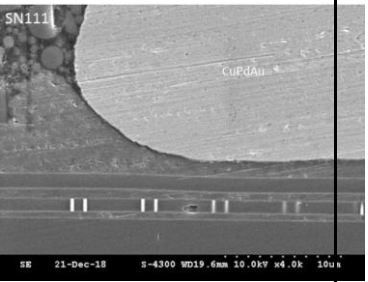
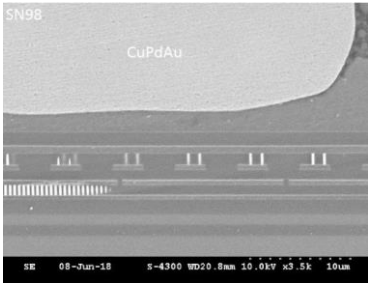
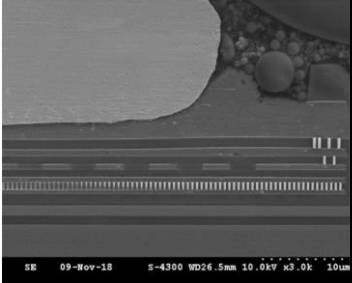
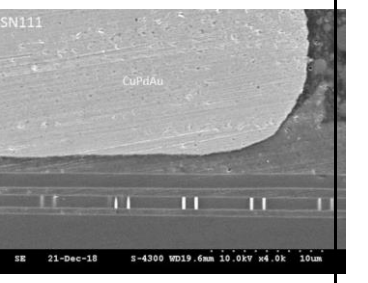
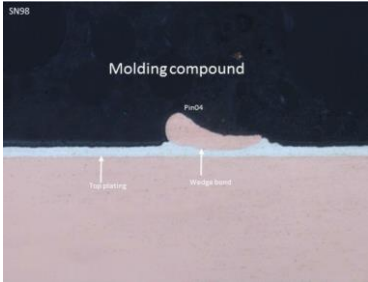
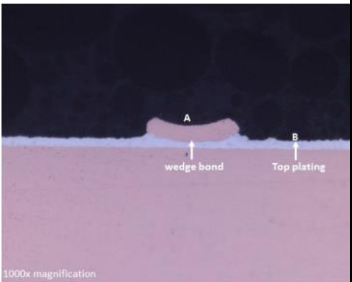
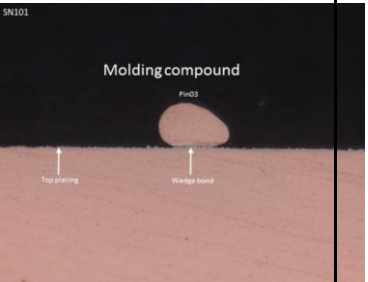


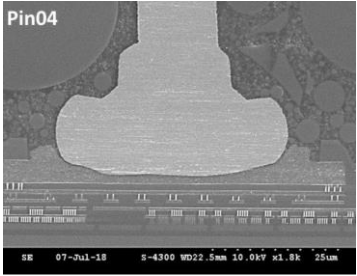
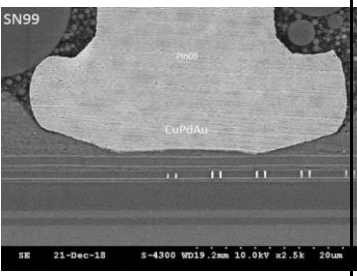
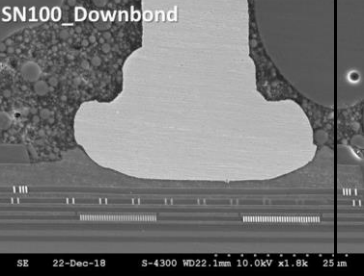
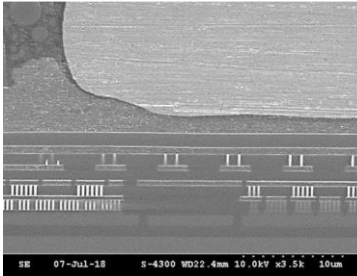
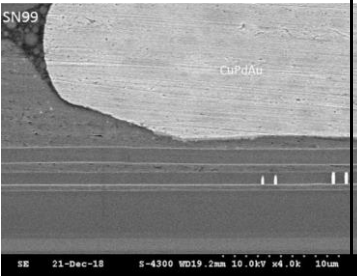
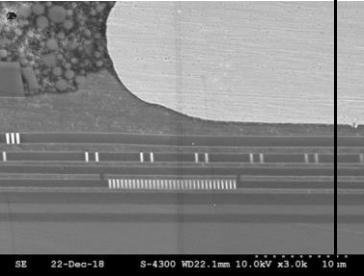
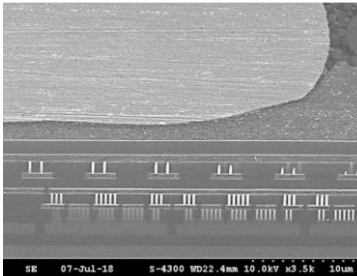
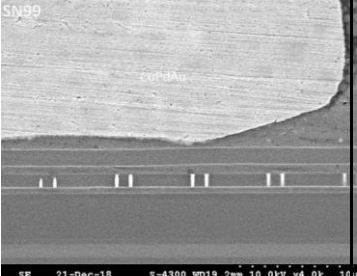
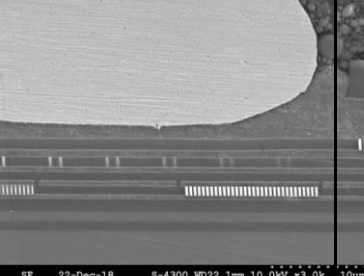
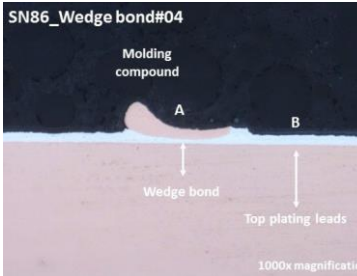
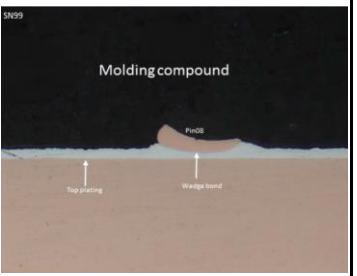
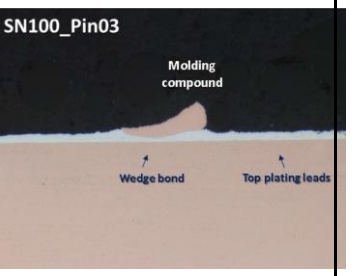
| 1000cyc TC |                                                                                                                                                                                                      |                                                                                                                                                                        |                                                                                                                                                                         |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | EV87230                                                                                                                                                                                              | EV88230                                                                                                                                                                | EV88260                                                                                                                                                                 |
| <u>1</u>   |  <p>SN115_Pin04</p> <p>SE 07-Jul-18 S-4300 WD22.3mm 10.0kV x1.8k 25um</p>                                           |  <p>SN107_Pin3</p> <p>SE 09-Jan-19 S-4300 WD23.2mm 10.0kV x1.5k 20um</p>             |  <p>SN102_Pin1</p> <p>SE 22-Dec-18 S-4300 WD25.3mm 10.0kV x1.5k 20um</p>             |
| <u>2</u>   |  <p>SE 07-Jul-18 S-4300 WD22.3mm 10.0kV x3.5k 10um</p>                                                              |  <p>SE 09-Jan-19 S-4300 WD23.2mm 10.0kV x3.0k 10um</p>                               |  <p>SE 22-Dec-18 S-4300 WD25.3mm 10.0kV x3.0k 10um</p>                               |
| <u>3</u>   |  <p>SE 07-Jul-18 S-4300 WD22.3mm 10.0kV x3.5k 10um</p>                                                            |  <p>SE 09-Jan-19 S-4300 WD23.2mm 10.0kV x3.0k 10um</p>                             |  <p>SE 22-Dec-18 S-4300 WD25.3mm 10.0kV x3.0k 10um</p>                             |
| <u>4</u>   |  <p>SN115_Pin04</p> <p>Molding compound</p> <p>Top plating leads</p> <p>Wedge bond</p> <p>1000x magnification</p> |  <p>A</p> <p>wedge bond</p> <p>Top plating</p> <p>B</p> <p>1000x magnification</p> |  <p>A</p> <p>wedge bond</p> <p>Top plating</p> <p>B</p> <p>1000x magnification</p> |
|            | PASS                                                                                                                                                                                                 | PASS                                                                                                                                                                   | PASS                                                                                                                                                                    |

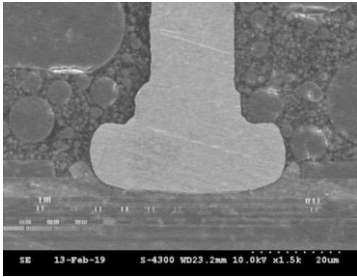
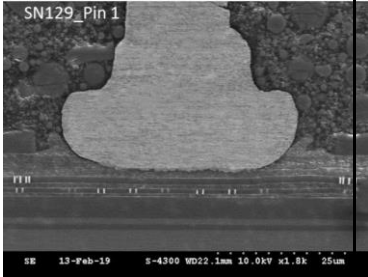
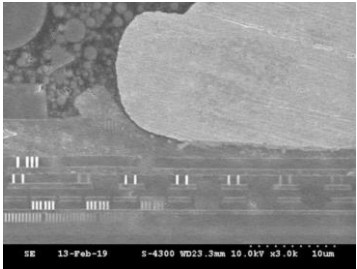
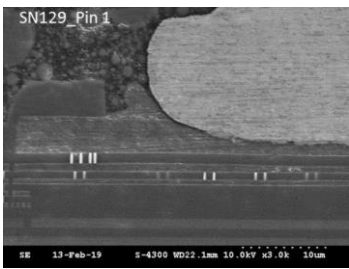
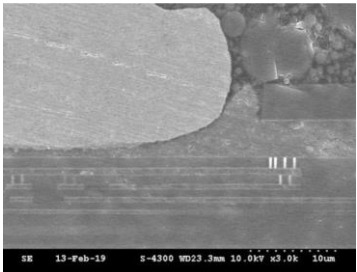
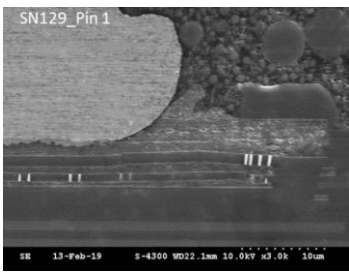
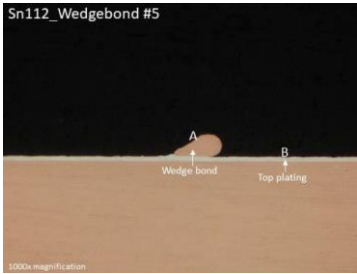
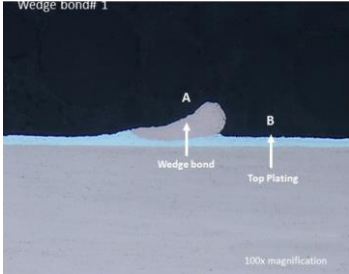
| 96h HAST |                                                                                     |                                                                                      |                                                                                       |
|----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|          | EV88230                                                                             | EV88260                                                                              | 1927DCF                                                                               |
| 1        |    |    |    |
| 2        |    |    |    |
| 3        |   |   |   |
| 4        |  |  |  |
|          | PASS                                                                                | PASS                                                                                 | PASS                                                                                  |

| 192h HAST |                                                                                     |                                                                                      |                                                                                       |
|-----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|           | EV88230                                                                             | EV88260                                                                              | 1927DCF                                                                               |
| 1         |    |    |    |
| 2         |    |    |    |
| 3         |   |   |   |
| 4         |  |  |  |
|           | PASS                                                                                | PASS                                                                                 | PASS                                                                                  |



| 96h UHAST |                                                                                     |                                                                                      |                                                                                       |
|-----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|           | EV87230                                                                             | EV88230                                                                              | EV88260                                                                               |
| 1         |    |    |    |
| 2         |    |    |    |
| 3         |   |   |   |
| 4         |  |  |  |
|           | PASS                                                                                | PASS                                                                                 | PASS                                                                                  |

| 192h UHAST |                                                                                     |                                                                                      |                                                                                       |
|------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|            | EV87230                                                                             | EV88230                                                                              | EV88260                                                                               |
| 1          |    |    |    |
| 2          |    |    |    |
| 3          |   |   |   |
| 4          |  |  |  |
|            | PASS                                                                                | PASS                                                                                 | PASS                                                                                  |

|          | 500h HTSL                                                                           |                                                                                      |
|----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|          | EV88230                                                                             | 1927DCF-1                                                                            |
| <u>1</u> |    |    |
| <u>2</u> |    |    |
| <u>3</u> |   |   |
| <u>4</u> |  |  |
|          | PASS                                                                                | PASS                                                                                 |

| 1000h HTSL |         |         |           |
|------------|---------|---------|-----------|
|            | EV88230 | EV88260 | 1927DCF-1 |
| <b>1</b>   |         |         |           |
| <b>2</b>   |         |         |           |
| <b>3</b>   |         |         |           |
| <b>4</b>   |         |         |           |
|            | PASS    | PASS    | PASS      |

# MECHANICAL TESTS

| Bond Pull-0h |                       |             |        |
|--------------|-----------------------|-------------|--------|
| EV88230      |                       |             |        |
| unit #       | Bond#                 | Break Force | B-Mode |
| Unit# 1      | 1                     | 8.217       | 2      |
|              | 2                     | 8.832       | 2      |
|              | 3                     | 8.428       | 2      |
|              | 4                     | 8.603       | 2      |
|              | GND1                  | 8.538       | 2      |
|              | 5                     | 10.088      | 2      |
|              | 6                     | 9.986       | 2      |
|              | 7                     | 9.102       | 2      |
|              | 8                     | 8.631       | 2      |
|              | GND2                  | 11.133      | 2      |
| Unit# 2      | 1                     | 7.773       | 2      |
|              | 2                     | 8.581       | 2      |
|              | 3                     | 9.291       | 2      |
|              | 4                     | 8.211       | 2      |
|              | GND1                  | 10.304      | 2      |
|              | 5                     | 9.521       | 2      |
|              | 6                     | 10.394      | 2      |
|              | 7                     | 10.232      | 2      |
|              | 8                     | 7.876       | 1      |
|              | GND2                  | 9.565       | 2      |
| Unit# 3      | 1                     | 7.977       | 4      |
|              | 2                     | 9.486       | 2      |
|              | 3                     | 9.528       | 2      |
|              | 4                     | 8.642       | 2      |
|              | GND1                  | 10.279      | 2      |
|              | 5                     | 10.786      | 2      |
|              | 6                     | 10.393      | 2      |
|              | 7                     | 10.817      | 2      |
|              | 8                     | 8.252       | 2      |
|              | GND2                  | 10.837      | 2      |
| Unit# 4      | 1                     | 8.323       | 4      |
|              | 2                     | 8.334       | 2      |
|              | 3                     | 9.107       | 2      |
|              | 4                     | 8.562       | 2      |
|              | GND1                  | 10.587      | 2      |
|              | 5                     | 10.103      | 2      |
|              | 6                     | 10.395      | 2      |
|              | 7                     | 10.675      | 2      |
|              | 8                     | 7.796       | 2      |
|              | GND2                  | 10.993      | 2      |
| Unit# 5      | 1                     | 8.492       | 2      |
|              | 2                     | 7.993       | 2      |
|              | 3                     | 9.650       | 2      |
|              | 4                     | 9.369       | 2      |
|              | GND1                  | 10.910      | 2      |
|              | 5                     | 10.328      | 2      |
|              | 6                     | 10.139      | 2      |
|              | 7                     | 10.754      | 2      |
|              | 8                     | 7.934       | 2      |
|              | GND2                  | 10.378      | 2      |
|              | Min                   | 7.773       |        |
|              | Max                   | 11.133      |        |
|              | Avg                   | 9.403       |        |
|              | Std                   | 1.052       |        |
|              | Spec                  | 4.000       |        |
|              | cpk <sub>L_Side</sub> | 1.71        |        |

| Ball Shear - 0h |                       |             |        |
|-----------------|-----------------------|-------------|--------|
| EV88260         |                       |             |        |
| unit #          | Bond#                 | Break Force | B-Mode |
| Unit# 6         | 1                     | 25.18       | 2      |
|                 | 2                     | 24.36       | 2      |
|                 | 3                     | 30.08       | 2      |
|                 | 4                     | 25.39       | 2      |
|                 | 5                     | 26.74       | 2      |
|                 | 6                     | 23.20       | 2      |
|                 | 7                     | 26.85       | 2      |
|                 | 8                     | 26.89       | 2      |
|                 | GND2                  | 25.55       | 2      |
| Unit# 7         | 1                     | 29.94       | 2      |
|                 | 2                     | 28.75       | 2      |
|                 | 3                     | 23.83       | 2      |
|                 | 4                     | 22.53       | 2      |
|                 | 5                     | 29.74       | 2      |
|                 | 6                     | 30.49       | 2      |
|                 | 7                     | 30.45       | 2      |
|                 | 8                     | 31.75       | 2      |
|                 | GND2                  | 32.12       | 2      |
| Unit# 8         | 1                     | 26.91       | 2      |
|                 | 2                     | 27.82       | 2      |
|                 | 3                     | 23.03       | 2      |
|                 | 4                     | 24.12       | 2      |
|                 | 5                     | 26.39       | 2      |
|                 | 6                     | 24.85       | 2      |
|                 | 7                     | 23.28       | 2      |
|                 | 8                     | 26.57       | 2      |
|                 | GND2                  | 29.86       | 2      |
| Unit# 9         | 1                     | 22.25       | 2      |
|                 | 2                     | 30.34       | 2      |
|                 | 3                     | 28.54       | 2      |
|                 | 4                     | 28.21       | 2      |
|                 | 5                     | 23.88       | 2      |
|                 | 6                     | 25.48       | 2      |
|                 | 7                     | 31.60       | 2      |
|                 | 8                     | 29.22       | 2      |
|                 | GND2                  | 22.67       | 2      |
| Unit# 10        | 1                     | 25.48       | 2      |
|                 | 2                     | 27.09       | 2      |
|                 | 3                     | 26.34       | 2      |
|                 | 4                     | 25.58       | 2      |
|                 | 5                     | 24.30       | 2      |
|                 | 6                     | 27.58       | 2      |
|                 | 7                     | 26.44       | 2      |
|                 | 8                     | 25.37       | 2      |
|                 | GND2                  | 22.56       | 2      |
|                 |                       |             |        |
|                 | Min                   | 22.25       |        |
|                 | Max                   | 32.12       |        |
|                 | Avg                   | 26.66       |        |
|                 | Std                   | 2.77        |        |
|                 | Spec                  | 10.00       |        |
|                 | cpk <sub>L_Side</sub> | 2.00        |        |



| Bond Pull MSL |      |        |   |           |      |        |   |          |      |        |   |
|---------------|------|--------|---|-----------|------|--------|---|----------|------|--------|---|
| EV87230       |      |        |   | EV88260   |      |        |   | EV88230  |      |        |   |
| Unit# 18      | 1    | 8,659  | 2 | Unit# 115 | 1    | 7,74   | 2 | Unit# 50 | 1    | 9,053  | 2 |
|               | 2    | 9,656  | 2 |           | 2    | 8,509  | 2 |          | 2    | 9,592  | 2 |
|               | 3    | 8,443  | 4 |           | 3    | 8,931  | 2 |          | 3    | 9,745  | 2 |
|               | 4    | 10,36  | 2 |           | 4    | 8,266  | 2 |          | 4    | 10,386 | 2 |
|               | GND1 | 6,656  | 2 |           | GND1 | 7,658  | 2 |          | GND1 | 9,102  | 2 |
|               | 5    | 7,345  | 2 |           | 5    | 9,211  | 2 |          | 5    | 10,744 | 2 |
|               | 6    | 9,868  | 2 |           | 6    | 9,93   | 2 |          | 6    | 11,205 | 2 |
|               | 7    | 10,943 | 1 |           | 7    | 9,782  | 1 |          | 7    | 11,243 | 2 |
|               | 8    | 7,193  | 2 |           | 8    | 7,587  | 2 |          | 8    | 10,372 | 2 |
| Unit# 19      | 1    | 9,055  | 2 | Unit# 116 | 1    | 8,528  | 2 | Unit# 51 | 1    | 8,876  | 1 |
|               | 2    | 8,633  | 2 |           | 2    | 9,093  | 2 |          | 2    | 9,566  | 2 |
|               | 3    | 9,86   | 2 |           | 3    | 9,554  | 2 |          | 3    | 9,866  | 2 |
|               | 4    | 7,408  | 2 |           | 4    | 9,52   | 2 |          | 4    | 10,403 | 2 |
|               | GND1 | 7,605  | 2 |           | GND1 | 7,545  | 2 |          | GND1 | 9,998  | 2 |
|               | 5    | 8,332  | 2 |           | 5    | 8,964  | 2 |          | 5    | 9,904  | 2 |
|               | 6    | 10,56  | 2 |           | 6    | 8,625  | 1 |          | 6    | 10,555 | 1 |
|               | 7    | 10,151 | 2 |           | 7    | 9,437  | 2 |          | 7    | 11,476 | 2 |
|               | 8    | 6,921  | 1 |           | 8    | 7,685  | 1 |          | 8    | 8,177  | 2 |
| Unit# 20      | 1    | 8,389  | 2 | Unit# 117 | 1    | 8,905  | 2 | Unit# 52 | 1    | 9,252  | 2 |
|               | 2    | 7,346  | 2 |           | 2    | 8,183  | 2 |          | 2    | 9,101  | 2 |
|               | 3    | 8,465  | 2 |           | 3    | 8,372  | 2 |          | 3    | 9,882  | 2 |
|               | 4    | 8,533  | 2 |           | 4    | 8,661  | 2 |          | 4    | 10,444 | 2 |
|               | GND1 | 7,041  | 2 |           | GND1 | 6,796  | 2 |          | GND1 | 8,038  | 2 |
|               | 5    | 10,259 | 2 |           | 5    | 8,945  | 2 |          | 5    | 10,601 | 2 |
|               | 6    | 9,781  | 2 |           | 6    | 10,037 | 2 |          | 6    | 11,523 | 2 |
|               | 7    | 10,702 | 2 |           | 7    | 9,813  | 2 |          | 7    | 11,984 | 2 |
|               | 8    | 7,158  | 2 |           | 8    | 7,059  | 2 |          | 8    | 8,159  | 2 |

|         |      |
|---------|------|
| Min     | 6,7  |
| Max     | 12   |
| Average | 9,1  |
| Stdev   | 1,25 |
| cpk     | 1,76 |

Cpk was calculated with the microchip spec value of 2,5g (higher than MIL Std. of 1,75g)

| Ball Shear MSL |         |          |   |           |         |          |   |          |         |          |   |
|----------------|---------|----------|---|-----------|---------|----------|---|----------|---------|----------|---|
| EV87230        |         |          |   | EV88260   |         |          |   | EV88230  |         |          |   |
| Unit# 21       | 1       | 32,20    | 2 | Unit# 118 | 1       | 23,43    | 2 | Unit# 53 | 1       | 21,58    | 2 |
|                | 2       | 34,11    | 2 |           | 2       | 20,43    | 2 |          | 2       | 22,37    | 2 |
|                | 3       | 30,14    | 2 |           | 3       | 24,77    | 2 |          | 3       | 24,95    | 2 |
|                | 4       | 25,63    | 2 |           | 4       | 25,31    | 2 |          | 4       | 24,77    | 2 |
|                | 5       | 32,49    | 2 |           | 5       | 23,67    | 2 |          | 5       | 23,81    | 2 |
|                | 6       | 26,49    | 2 |           | 6       | 23,58    | 2 |          | 6       | 26,01    | 2 |
|                | 7       | 28,31    | 2 |           | 7       | 22,08    | 2 |          | 7       | 25,61    | 2 |
|                | 8       | 33,24    | 2 |           | 8       | 20,47    | 2 |          | 8       | 23,77    | 2 |
|                | GND2    | 33,79    | 2 |           | GND2    | 26,02    | 2 |          | GND2    | 21,08    | 2 |
| Unit# 22       | 1       | 27,58    | 2 | Unit# 119 | 1       | 22,27    | 2 | Unit# 54 | 1       | 22,60    | 2 |
|                | 2       | 28,17    | 2 |           | 2       | 22,39    | 2 |          | 2       | 26,40    | 2 |
|                | 3       | 29,47    | 2 |           | 3       | 24,64    | 2 |          | 3       | 21,53    | 2 |
|                | 4       | 29,79    | 2 |           | 4       | 25,20    | 2 |          | 4       | 28,12    | 2 |
|                | 5       | 26,34    | 2 |           | 5       | 25,08    | 2 |          | 5       | 21,76    | 2 |
|                | 6       | 31,65    | 2 |           | 6       | 25,36    | 2 |          | 6       | 26,97    | 2 |
|                | 7       | 29,11    | 2 |           | 7       | 22,13    | 2 |          | 7       | 29,19    | 2 |
|                | 8       | 32,46    | 2 |           | 8       | 21,86    | 2 |          | 8       | 27,69    | 2 |
|                | GND2    | 30,50    | 2 |           | GND2    | 25,39    | 2 |          | GND2    | 28,40    | 2 |
|                |         |          |   | Unit# 120 | 1       | 24,54    | 2 | Unit# 55 | 1       | 25,59    | 2 |
|                |         |          |   |           | 2       | 25,67    | 2 |          | 2       | 26,27    | 2 |
|                |         |          |   |           | 3       | 23,43    | 2 |          | 3       | 23,53    | 2 |
|                |         |          |   |           | 4       | 24,09    | 2 |          | 4       | 29,90    | 2 |
|                |         |          |   |           | 5       | 23,21    | 2 |          | 5       | 27,98    | 2 |
|                |         |          |   |           | 6       | 24,39    | 2 |          | 6       | 28,84    | 2 |
|                |         |          |   |           | 7       | 20,58    | 2 |          | 7       | 26,20    | 2 |
|                |         |          |   |           | 8       | 21,44    | 2 |          | 8       | 24,33    | 2 |
|                |         |          |   |           | GND2    | 25,48    | 2 |          | GND2    | 29,77    | 2 |
|                | Min     | 25,63    |   |           | Min     | 20,43    |   |          | Min     | 21,08    |   |
|                | Max     | 34,11    |   |           | Max     | 26,02    |   |          | Max     | 29,9     |   |
|                | Average | 30,08167 |   |           | Average | 23,58926 |   |          | Average | 25,51926 |   |
|                | Stdev   | 2,65     |   |           | Stdev   | 1,71     |   |          | Stdev   | 2,69     |   |
|                | cpk     | 2,53     |   |           | cpk     | 2,65     |   |          | cpk     | 1,92     |   |

## Bond Pull TC - 500cyc

| EV87230   |       |             |        | EV88230   |       |             |        | EV88260   |       |             |        |
|-----------|-------|-------------|--------|-----------|-------|-------------|--------|-----------|-------|-------------|--------|
| unit #    | Bond# | Break Force | B-Mode | unit #    | Bond# | Break Force | B-Mode | unit #    | Bond# | Break Force | B-Mode |
| Unit# 121 | 1     | 8.271       | 2      | Unit# 115 | 1     | 8.686       | 2      | Unit# 108 | 1     | 8.354       | 2      |
|           | 2     | 8.541       | 2      |           | 2     | 9.072       | 2      |           | 2     | 7.25        | 4      |
|           | 3     | 8.424       | 2      |           | 3     | 9.692       | 2      |           | 3     | 7.09        | 2      |
|           | 4     | 6.584       | 2      |           | 4     | 9.073       | 2      |           | 4     | 6.873       | 4      |
|           | 5     | 9.139       | 2      |           | GND1  | 7.142       | 2      |           | GND1  | 7.206       | 2      |
|           | 6     | 7.766       | 2      |           | 5     | 8.919       | 2      |           | 5     | 9.038       | 2      |
|           | 7     | 8.711       | 2      |           | 6     | 10.012      | 2      |           | 6     | 8.887       | 2      |
|           | 8     | 7.471       | 2      |           | 7     | 8.3         | 2      |           | 7     | 9.691       | 2      |
|           | GND   | 9.4         | 2      |           | 8     | 6.717       | 2      |           | 8     | 7.208       | 2      |
|           |       |             |        |           | GND2  | 7.268       | 2      |           | GND2  | 9.406       | 2      |
| Unit# 122 | 1     | 6.772       | 2      | Unit# 116 | 1     | 8.383       | 2      | Unit# 115 | 1     | 7.802       | 2      |
|           | 2     | 8.225       | 2      |           | 2     | 6.998       | 2      |           | 2     | 8.252       | 2      |
|           | 3     | 8.033       | 2      |           | 3     | 6.646       | 2      |           | 3     | 9.576       | 2      |
|           | 4     | 7.642       | 2      |           | 4     | 6.88        | 2      |           | 4     | 9.809       | 2      |
|           | 5     | 8.371       | 2      |           | GND1  | 8.032       | 2      |           | GND1  | 7.721       | 2      |
|           | 6     | 9.826       | 2      |           | 5     | 9.007       | 2      |           | 5     | 7.484       | 2      |
|           | 7     | 8.456       | 1      |           | 6     | 9.471       | 2      |           | 6     | 9.132       | 2      |
|           | 8     | 8.546       | 2      |           | 7     | 6.919       | 2      |           | 7     | 8.209       | 2      |
|           | GND   | 7.575       | 2      |           | 8     | 6.91        | 2      |           | 8     | 7.204       | 2      |
|           |       |             |        |           | GND2  | 7.458       | 2      |           | GND2  | 9.419       | 2      |
| Unit# 123 | 1     | 8.526       | 2      | Unit# 117 | 1     | 8.216       | 2      | Unit# 116 | 1     | 8.115       | 2      |
|           | 2     | 7.526       | 2      |           | 2     | 7.147       | 2      |           | 2     | 7.69        | 2      |
|           | 3     | 8.284       | 2      |           | 3     | 7.996       | 2      |           | 3     | 7.951       | 2      |
|           | 4     | 9.465       | 2      |           | 4     | 9.011       | 2      |           | 4     | 9.159       | 2      |
|           | 5     | 7.426       | 2      |           | GND1  | 7.195       | 2      |           | GND1  | 8.234       | 2      |
|           | 6     | 9.075       | 2      |           | 5     | 9.585       | 2      |           | 5     | 9.074       | 2      |
|           | 7     | 8.195       | 2      |           | 6     | 9.382       | 2      |           | 6     | 9.611       | 2      |
|           | 8     | 7.595       | 2      |           | 7     | 9.624       | 2      |           | 7     | 9.456       | 2      |
|           | GND   | 9.48        | 2      |           | 8     | 7.028       | 2      |           | 8     | 6.951       | 2      |
|           |       |             |        |           | GND2  | 8.646       | 2      |           | GND2  | 10.07       | 2      |
|           | Min   | 6.58        |        |           | Min   | 6.65        |        |           | Min   | 6.87        |        |
|           | Max   | 9.83        |        |           | Max   | 10.01       |        |           | Max   | 9.81        |        |
|           | Avg   | 8.27        |        |           | Avg   | 8.16        |        |           | Avg   | 8.34        |        |
|           | Std   | 0.811       |        |           | Std   | 1.090       |        |           | Std   | 0.965       |        |
|           | Spec  | 4.00        |        |           | Spec  | 4.00        |        |           | Spec  | 4.00        |        |



## Ball Shear TC - 500cyc

| EV87230   |       |            |        | EV88230   |       |            |        | EV88260   |       |            |        |
|-----------|-------|------------|--------|-----------|-------|------------|--------|-----------|-------|------------|--------|
| unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode |
| Unit# 124 | 1     | 24.43      | 2      | Unit# 118 | 1     | 19.63      | 2      | Unit# 117 | 1     | 25.21      | 2      |
|           | 2     | 21.21      | 2      |           | 2     | 20.63      | 2      |           | 2     | 20.68      | 2      |
|           | 3     | 21.61      | 2      |           | 3     | 19.89      | 2      |           | 3     | 26.79      | 2      |
|           | 4     | 23.19      | 2      |           | 4     | 20.58      | 2      |           | 4     | 20.91      | 2      |
|           | 5     | 22.27      | 2      |           | 5     | 23.52      | 2      |           | 5     | 19.66      | 2      |
|           | 6     | 21.65      | 2      |           | 6     | 23.13      | 2      |           | 6     | 23.93      | 2      |
|           | 7     | 19.86      | 2      |           | 7     | 24.33      | 2      |           | 7     | 21.88      | 2      |
|           | 8     | 18.37      | 2      |           | 8     | 23.70      | 2      |           | 8     | 25.36      | 2      |
|           | GND   | 19.96      | 2      |           | GND   | 24.05      | 2      |           | GND   | 20.59      | 2      |
| Unit# 125 | 1     | 19.46      | 2      | Unit# 119 | 1     | 24.62      | 2      | Unit# 118 | 1     | 19.80      | 2      |
|           | 2     | 19.84      | 2      |           | 2     | 19.40      | 2      |           | 2     | 23.62      | 2      |
|           | 3     | 19.06      | 2      |           | 3     | 24.58      | 2      |           | 3     | 18.57      | 2      |
|           | 4     | 18.79      | 2      |           | 4     | 27.22      | 2      |           | 4     | 22.09      | 2      |
|           | 5     | 18.68      | 2      |           | 5     | 26.60      | 2      |           | 5     | 26.53      | 2      |
|           | 6     | 19.71      | 2      |           | 6     | 26.98      | 2      |           | 6     | 27.58      | 2      |
|           | 7     | 19.78      | 2      |           | 7     | 27.20      | 2      |           | 7     | 27.56      | 2      |
|           | 8     | 17.94      | 2      |           | 8     | 27.33      | 2      |           | 8     | 21.33      | 2      |
|           | GND   | 19.16      | 2      |           | GND   | 22.94      | 2      |           | GND   | 19.34      | 2      |
| Unit# 126 | 1     | 19.98      | 2      | Unit# 120 | 1     | 24.49      | 2      | Unit# 119 | 1     | 26.13      | 2      |
|           | 2     | 20.45      | 2      |           | 2     | 24.45      | 2      |           | 2     | 25.71      | 2      |
|           | 3     | 20.45      | 2      |           | 3     | 25.01      | 2      |           | 3     | 22.77      | 2      |
|           | 4     | 23.10      | 2      |           | 4     | 28.65      | 2      |           | 4     | 22.07      | 2      |
|           | 5     | 23.56      | 2      |           | 5     | 22.73      | 2      |           | 5     | 23.49      | 2      |
|           | 6     | 20.92      | 2      |           | 6     | 25.32      | 2      |           | 6     | 24.56      | 2      |
|           | 7     | 21.01      | 2      |           | 7     | 20.04      | 2      |           | 7     | 22.00      | 2      |
|           | 8     | 18.14      | 2      |           | 8     | 21.73      | 2      |           | 8     | 24.88      | 2      |
|           | GND   | 20.26      | 2      |           | GND   | 24.82      | 2      |           | GND   | 23.66      | 2      |
|           | Min   | 17.94      |        |           | Min   | 19.40      |        |           | Min   | 18.57      |        |
|           | Max   | 24.43      |        |           | Max   | 28.65      |        |           | Max   | 27.58      |        |
|           | Avg   | 20.48      |        |           | Avg   | 23.84      |        |           | Avg   | 23.21      |        |
|           | Std   | 1.708      |        |           | Std   | 2.615      |        |           | Std   | 2.629      |        |
|           | Spec  | 10.00      |        |           | Spec  | 10.00      |        |           | Spec  | 10.00      |        |

## Bond Pull TC - 1000cyc

| EV87230   |       |            |        | EV88230   |       |            |        | EV88260  |       |            |        |
|-----------|-------|------------|--------|-----------|-------|------------|--------|----------|-------|------------|--------|
| unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode | unit #   | Bond# | Break Forc | B-Mode |
| Unit# 108 | 1     | 7.328      | 1      | Unit# 99  | 1     | 7.109      | 2      | Unit# 96 | 1     | 7.998      | 2      |
|           | 2     | 7.900      | 2      |           | 2     | 9.272      | 2      |          | 2     | 7.908      | 2      |
|           | 3     | 8.205      | 2      |           | 3     | 9.147      | 2      |          | 3     | 8.339      | 2      |
|           | 4     | 8.545      | 2      |           | 4     | 9.301      | 2      |          | 4     | 9.603      | 2      |
|           | GND1  | 8.083      | 2      |           | GND1  | 7.387      | 2      |          | GND1  | 8.202      | 2      |
|           | 5     | 9.065      | 2      |           | 5     | 8.700      | 2      |          | 5     | 7.789      | 2      |
|           | 6     | 9.506      | 2      |           | 6     | 8.617      | 2      |          | 6     | 9.321      | 2      |
|           | 7     | 6.531      | 2      |           | 7     | 8.511      | 2      |          | 7     | 6.837      | 1      |
|           | 8     | 7.458      | 2      |           | 8     | 7.222      | 2      |          | 8     | 5.911      | 1      |
|           | GND2  | 10.101     | 2      |           | GND2  | 9.889      | 2      |          | GND2  | 6.268      | 1      |
| Unit# 109 | 1     | 7.956      | 2      | Unit# 100 | 1     | 8.114      | 2      | Unit# 98 | 1     | 8.824      | 2      |
|           | 2     | 9.231      | 2      |           | 2     | 7.727      | 2      |          | 2     | 8.817      | 2      |
|           | 3     | 9.488      | 2      |           | 3     | 9.815      | 2      |          | 3     | 10.293     | 2      |
|           | 4     | 9.401      | 2      |           | 4     | 9.351      | 2      |          | 4     | 10.985     | 2      |
|           | GND1  | 6.375      | 2      |           | GND1  | 8.931      | 2      |          | GND1  | 11.823     | 2      |
|           | 5     | 8.612      | 2      |           | 5     | 6.796      | 2      |          | 5     | 7.460      | 2      |
|           | 6     | 8.232      | 2      |           | 6     | 7.769      | 2      |          | 6     | 8.726      | 2      |
|           | 7     | 8.802      | 2      |           | 7     | 7.267      | 2      |          | 7     | 6.406      | 2      |
|           | 8     | 7.784      | 2      |           | 8     | 7.344      | 2      |          | 8     | 8.932      | 2      |
|           | GND2  | 10.174     | 2      |           | GND2  | 7.264      | 2      |          | GND2  | 10.313     | 2      |
| Unit# 110 | 1     | 8.610      | 2      | Unit# 102 | 1     | 8.966      | 2      | Unit# 99 | 1     | 10.440     | 2      |
|           | 2     | 8.366      | 2      |           | 2     | 9.044      | 2      |          | 2     | 8.039      | 2      |
|           | 3     | 8.395      | 2      |           | 3     | 8.501      | 2      |          | 3     | 9.577      | 2      |
|           | 4     | 9.009      | 2      |           | 4     | 7.227      | 2      |          | 4     | 11.232     | 2      |
|           | GND1  | 8.010      | 2      |           | GND1  | 10.319     | 2      |          | GND1  | 10.157     | 2      |
|           | 5     | 10.182     | 2      |           | 5     | 7.675      | 2      |          | 5     | 6.901      | 2      |
|           | 6     | 9.670      | 2      |           | 6     | 9.878      | 2      |          | 6     | 10.570     | 2      |
|           | 7     | 10.553     | 2      |           | 7     | 10.381     | 2      |          | 7     | 8.850      | 2      |
|           | 8     | 7.609      | 2      |           | 8     | 9.182      | 2      |          | 8     | 6.842      | 2      |
|           | GND2  | 9.644      | 2      |           | GND2  | 7.284      | 2      |          | GND2  | 7.574      | 2      |
|           | Min   | 6.38       |        |           | Min   | 6.80       |        |          | Min   | 5.91       |        |
|           | Max   | 10.55      |        |           | Max   | 10.38      |        |          | Max   | 11.82      |        |
|           | Avg   | 8.59       |        |           | Avg   | 8.51       |        |          | Avg   | 8.74       |        |
|           | Std   | 1.052      |        |           | Std   | 1.064      |        |          | Std   | 1.588      |        |
|           | Spec  | 4.00       |        |           | Spec  | 4.00       |        |          | Spec  | 4.00       |        |

## Ball Shear TC - 1000cyc

| EV87230   |       |             |        | EV88230   |       |             |        | EV88260   |       |             |        |
|-----------|-------|-------------|--------|-----------|-------|-------------|--------|-----------|-------|-------------|--------|
| unit #    | Bond# | Break Force | B-Mode | unit #    | Bond# | Break Force | B-Mode | unit #    | Bond# | Break Force | B-Mode |
| Unit# 111 | 1     | 21.70       | 2      | Unit# 103 | 1     | 21.59       | 2      | Unit# 105 | 1     | 22.15       | 2      |
|           | 2     | 22.46       | 2      |           | 2     | 28.52       | 2      |           | 2     | 25.83       | 2      |
|           | 3     | 19.81       | 2      |           | 3     | 24.54       | 2      |           | 3     | 25.63       | 2      |
|           | 4     | 21.58       | 2      |           | 4     | 24.31       | 2      |           | 4     | 25.49       | 2      |
|           | 5     | 24.20       | 2      |           | 5     | 26.71       | 2      |           | 5     | 26.21       | 2      |
|           | 6     | 25.85       | 2      |           | 6     | 23.71       | 2      |           | 6     | 20.83       | 2      |
|           | 7     | 19.61       | 2      |           | 7     | 26.82       | 2      |           | 7     | 28.45       | 2      |
|           | 8     | 25.43       | 2      |           | 8     | 26.60       | 2      |           | 8     | 25.41       | 2      |
|           | GND   | 25.82       | 2      |           | GND   | 28.40       | 2      |           | GND   | 19.07       | 2      |
| Unit# 112 | 1     | 23.04       | 2      | Unit# 104 | 1     | 23.56       | 2      | Unit# 106 | 1     | 29.88       | 2      |
|           | 2     | 20.41       | 2      |           | 2     | 26.29       | 2      |           | 2     | 22.71       | 2      |
|           | 3     | 19.02       | 2      |           | 3     | 22.25       | 2      |           | 3     | 26.44       | 2      |
|           | 4     | 26.98       | 2      |           | 4     | 26.18       | 2      |           | 4     | 20.42       | 2      |
|           | 5     | 23.79       | 2      |           | 5     | 27.19       | 2      |           | 5     | 21.82       | 2      |
|           | 6     | 26.75       | 2      |           | 6     | 25.72       | 2      |           | 6     | 26.24       | 2      |
|           | 7     | 19.53       | 2      |           | 7     | 26.11       | 2      |           | 7     | 25.42       | 2      |
|           | 8     | 26.04       | 2      |           | 8     | 22.71       | 2      |           | 8     | 25.94       | 2      |
|           | GND   | 23.58       | 2      |           | GND   | 26.90       | 2      |           | GND   | 25.25       | 2      |
| Unit# 113 | 1     | 25.64       | 2      | Unit# 105 | 1     | 21.67       | 2      | Unit# 110 | 1     | 20.92       | 2      |
|           | 2     | 22.41       | 2      |           | 2     | 24.85       | 2      |           | 2     | 27.83       | 2      |
|           | 3     | 20.50       | 2      |           | 3     | 19.54       | 2      |           | 3     | 26.81       | 2      |
|           | 4     | 21.71       | 2      |           | 4     | 25.06       | 2      |           | 4     | 24.57       | 2      |
|           | 5     | 26.77       | 2      |           | 5     | 19.51       | 2      |           | 5     | 24.78       | 2      |
|           | 6     | 26.40       | 2      |           | 6     | 19.57       | 2      |           | 6     | 30.75       | 2      |
|           | 7     | 20.31       | 2      |           | 7     | 20.23       | 2      |           | 7     | 22.71       | 2      |
|           | 8     | 24.36       | 2      |           | 8     | 20.89       | 2      |           | 8     | 28.01       | 2      |
|           | GND   | 25.80       | 2      |           | GND   | 23.41       | 2      |           | GND   | 25.06       | 2      |
|           | Min   | 19.02       |        |           | Min   | 19.51       |        |           | Min   | 19.07       |        |
|           | Max   | 26.98       |        |           | Max   | 28.52       |        |           | Max   | 30.75       |        |
|           | Avg   | 23.31       |        |           | Avg   | 24.18       |        |           | Avg   | 24.99       |        |
|           | Std   | 2.624       |        |           | Std   | 2.769       |        |           | Std   | 2.882       |        |
|           | Spec  | 10.00       |        |           | Spec  | 10.00       |        |           | Spec  | 10.00       |        |

## Bond Pull HAST - 96h

| EV88230 |       |             |        | EV88260  |       |             |        | 1927DCF  |       |             |        |
|---------|-------|-------------|--------|----------|-------|-------------|--------|----------|-------|-------------|--------|
| unit #  | Bond# | Break Force | B-Mode | unit #   | Bond# | Break Force | B-Mode | unit #   | Bond# | Break Force | B-Mode |
| Unit# 2 | 1     | 8.538       | 2      | Unit# 89 | 1     | 7.462       | 2      | Unit# 89 | 1     | 6.943       | 2      |
|         | 2     | 8.610       | 2      |          | 2     | 7.461       | 2      |          | 2     | 7.763       | 2      |
|         | 3     | 8.125       | 2      |          | 3     | 7.938       | 2      |          | 3     | 7.782       | 2      |
|         | 4     | 7.511       | 2      |          | 4     | 7.494       | 2      |          | 4     | 7.786       | 2      |
|         | GND1  | 8.086       | 2      |          | GND1  | 8.670       | 2      |          | GND1  | 7.991       | 2      |
|         | 5     | 9.254       | 2      |          | 5     | 9.103       | 2      |          | 5     | 8.551       | 2      |
|         | 6     | 7.515       | 2      |          | 6     | 9.247       | 2      |          | 6     | 7.829       | 2      |
|         | 7     | 8.092       | 2      |          | 7     | 9.059       | 2      |          | 7     | 8.296       | 2      |
|         | 8     | 7.028       | 2      |          | 8     | 7.697       | 2      |          | 8     | 7.279       | 2      |
|         | GND2  | 9.365       | 2      |          | GND2  | 9.026       | 2      |          | GND2  | 7.842       | 2      |
| Unit# 3 | 1     | 8.255       | 2      | Unit# 90 | 1     | 6.959       | 2      | Unit# 90 | 1     | 6.578       | 2      |
|         | 2     | 7.769       | 2      |          | 2     | 7.628       | 2      |          | 2     | 6.920       | 2      |
|         | 3     | 8.165       | 2      |          | 3     | 7.910       | 2      |          | 3     | 7.543       | 2      |
|         | 4     | 7.922       | 2      |          | 4     | 7.611       | 2      |          | 4     | 7.362       | 2      |
|         | GND1  | 9.269       | 2      |          | GND1  | 8.460       | 2      |          | GND1  | 8.393       | 2      |
|         | 5     | 7.075       | 2      |          | 5     | 9.464       | 2      |          | 5     | 8.060       | 2      |
|         | 6     | 8.795       | 2      |          | 6     | 8.604       | 2      |          | 6     | 8.127       | 2      |
|         | 7     | 9.248       | 2      |          | 7     | 6.990       | 2      |          | 7     | 8.004       | 2      |
|         | 8     | 7.827       | 2      |          | 8     | 8.570       | 2      |          | 8     | 6.612       | 2      |
|         | GND2  | 9.163       | 2      |          | GND2  | 8.784       | 2      |          | GND2  | 8.712       | 2      |
| Unit# 4 | 1     | 7.613       | 2      | Unit# 91 | 1     | 7.879       | 2      | Unit# 91 | 1     | 6.969       | 2      |
|         | 2     | 7.209       | 2      |          | 2     | 7.526       | 2      |          | 2     | 6.873       | 2      |
|         | 3     | 6.832       | 2      |          | 3     | 7.897       | 2      |          | 3     | 6.558       | 2      |
|         | 4     | 7.878       | 2      |          | 4     | 7.764       | 2      |          | 4     | 7.074       | 2      |
|         | GND1  | 9.589       | 2      |          | GND1  | 7.130       | 2      |          | GND1  | 8.514       | 2      |
|         | 5     | 7.573       | 2      |          | 5     | 9.200       | 2      |          | 5     | 9.303       | 2      |
|         | 6     | 6.948       | 2      |          | 6     | 9.161       | 2      |          | 6     | 7.054       | 2      |
|         | 7     | 6.899       | 2      |          | 7     | 8.552       | 2      |          | 7     | 7.687       | 2      |
|         | 8     | 7.138       | 2      |          | 8     | 6.459       | 2      |          | 8     | 7.110       | 2      |
|         | GND2  | 8.374       | 2      |          | GND2  | 9.194       | 2      |          | GND2  | 9.111       | 2      |
|         | Min   | 6.83        |        |          | Min   | 6.46        |        |          | Min   | 6.56        |        |
|         | Max   | 9.59        |        |          | Max   | 9.46        |        |          | Max   | 9.30        |        |
|         | Avg   | 8.04        |        |          | Avg   | 8.13        |        |          | Avg   | 7.64        |        |
|         | Std   | 0.837       |        |          | Std   | 0.812       |        |          | Std   | 0.704       |        |
|         | Spec  | 4.00        |        |          | Spec  | 4.00        |        |          | Spec  | 4.00        |        |

## Ball Shear HAST - 96h

| EV88230 |       |             |        | EV88260  |       |             |        | 1927DCF  |       |             |        |
|---------|-------|-------------|--------|----------|-------|-------------|--------|----------|-------|-------------|--------|
| unit #  | Bond# | Break Force | B-Mode | unit #   | Bond# | Break Force | B-Mode | unit #   | Bond# | Break Force | B-Mode |
| Unit# 5 | 1     | 28.02       | 2      | Unit# 92 | 1     | 33.48       | 2      | Unit# 92 | 1     | 33.48       | 2      |
|         | 2     | 27.91       | 2      |          | 2     | 26.13       | 2      |          | 2     | 26.13       | 2      |
|         | 3     | 28.15       | 2      |          | 3     | 26.04       | 2      |          | 3     | 26.04       | 2      |
|         | 4     | 25.48       | 2      |          | 4     | 24.26       | 2      |          | 4     | 24.26       | 2      |
|         | 5     | 25.09       | 2      |          | 5     | 32.85       | 2      |          | 5     | 32.85       | 2      |
|         | 6     | 27.44       | 2      |          | 6     | 26.20       | 2      |          | 6     | 26.20       | 2      |
|         | 7     | 28.67       | 2      |          | 7     | 31.78       | 2      |          | 7     | 31.78       | 2      |
|         | 8     | 25.88       | 2      |          | 8     | 28.14       | 2      |          | 8     | 28.14       | 2      |
|         | GND   | 23.73       | 2      |          | GND   | 30.62       | 2      |          | GND   | 30.62       | 2      |
| Unit# 6 | 1     | 23.80       | 2      | Unit# 93 | 1     | 29.47       | 2      | Unit# 93 | 1     | 29.47       | 2      |
|         | 2     | 23.43       | 2      |          | 2     | 31.22       | 2      |          | 2     | 31.22       | 2      |
|         | 3     | 29.27       | 2      |          | 3     | 27.92       | 2      |          | 3     | 27.92       | 2      |
|         | 4     | 25.31       | 2      |          | 4     | 28.89       | 2      |          | 4     | 28.89       | 2      |
|         | 5     | 19.81       | 2      |          | 5     | 30.93       | 2      |          | 5     | 30.93       | 2      |
|         | 6     | 25.45       | 2      |          | 6     | 25.60       | 2      |          | 6     | 25.60       | 2      |
|         | 7     | 24.51       | 2      |          | 7     | 33.20       | 2      |          | 7     | 33.20       | 2      |
|         | 8     | 27.02       | 2      |          | 8     | 28.08       | 2      |          | 8     | 28.08       | 2      |
|         | GND   | 23.70       | 2      |          | GND   | 22.24       | 2      |          | GND   | 22.24       | 2      |
| Unit# 7 | 1     | 23.84       | 2      | Unit# 94 | 1     | 26.26       | 2      | Unit# 94 | 1     | 26.26       | 2      |
|         | 2     | 27.83       | 2      |          | 2     | 32.95       | 2      |          | 2     | 32.95       | 2      |
|         | 3     | 26.58       | 2      |          | 3     | 32.56       | 2      |          | 3     | 32.56       | 2      |
|         | 4     | 33.55       | 2      |          | 4     | 21.02       | 2      |          | 4     | 21.02       | 2      |
|         | 5     | 26.04       | 2      |          | 5     | 23.31       | 2      |          | 5     | 23.31       | 2      |
|         | 6     | 28.45       | 2      |          | 6     | 27.63       | 2      |          | 6     | 27.63       | 2      |
|         | 7     | 28.85       | 2      |          | 7     | 26.72       | 2      |          | 7     | 26.72       | 2      |
|         | 8     | 27.36       | 2      |          | 8     | 27.92       | 2      |          | 8     | 27.92       | 2      |
|         | GND   | 25.98       | 2      |          | GND   | 26.62       | 2      |          | GND   | 26.62       | 2      |
|         | Min   | 19.81       |        |          | Min   | 21.02       |        |          | Min   | 21.02       |        |
|         | Max   | 33.55       |        |          | Max   | 33.48       |        |          | Max   | 33.48       |        |
|         | Avg   | 26.34       |        |          | Avg   | 28.22       |        |          | Avg   | 28.22       |        |
|         | Std   | 2.601       |        |          | Std   | 3.445       |        |          | Std   | 3.445       |        |
|         | Spec  | 10.00       |        |          | Spec  | 10.00       |        |          | Spec  | 10.00       |        |

# Bond Pull HAST - 192h

| EV88230  |       |            |        | EV88260 |       |            |        | 1927DCF  |       |            |        |
|----------|-------|------------|--------|---------|-------|------------|--------|----------|-------|------------|--------|
| unit #   | Bond# | Break Forc | B-Mode | unit #  | Bond# | Break Forc | B-Mode | unit #   | Bond# | Break Forc | B-Mode |
| Unit# 66 | 1     | 8.994      | 2      | Unit# 7 | 1     | 7.062      | 2      | Unit# 24 | 1     | 8.148      | 2      |
|          | 2     | 9.677      | 2      |         | 2     | 6.681      | 1      |          | 2     | 8.632      | 2      |
|          | 3     | 9.329      | 2      |         | 3     | 8.268      | 2      |          | 3     | 8.099      | 2      |
|          | 4     | 8.943      | 2      |         | 4     | 8.474      | 2      |          | 4     | 8.879      | 1      |
|          | GND1  | 10.052     | 2      |         | GND1  | 7.316      | 2      |          | GND1  | 8.630      | 2      |
|          | 5     | 7.883      | 2      |         | 5     | 6.911      | 2      |          | 5     | 10.192     | 2      |
|          | 6     | 8.113      | 2      |         | 6     | 7.962      | 2      |          | 6     | 9.686      | 2      |
|          | 7     | 9.687      | 1      |         | 7     | 7.422      | 2      |          | 7     | 10.069     | 2      |
|          | 8     | 7.782      | 2      |         | 8     | 6.612      | 2      |          | 8     | 8.245      | 2      |
|          | GND2  | 10.715     | 2      |         | GND2  | 8.473      | 4      |          | GND2  | 9.935      | 2      |
| Unit# 94 | 1     | 8.311      | 2      | Unit# 8 | 1     | 7.427      | 2      | Unit# 27 | 1     | 8.605      | 2      |
|          | 2     | 8.449      | 2      |         | 2     | 7.279      | 1      |          | 2     | 7.934      | 2      |
|          | 3     | 8.140      | 2      |         | 3     | 7.674      | 2      |          | 3     | 9.212      | 2      |
|          | 4     | 8.670      | 2      |         | 4     | 6.755      | 2      |          | 4     | 9.539      | 2      |
|          | GND1  | 8.230      | 2      |         | GND1  | 8.673      | 2      |          | GND1  | 8.391      | 2      |
|          | 5     | 8.629      | 2      |         | 5     | 7.949      | 4      |          | 5     | 7.772      | 2      |
|          | 6     | 7.200      | 1      |         | 6     | 6.834      | 2      |          | 6     | 11.030     | 2      |
|          | 7     | 7.314      | 1      |         | 7     | 7.732      | 2      |          | 7     | 10.396     | 2      |
|          | 8     | 7.243      | 2      |         | 8     | 6.515      | 1      |          | 8     | 8.040      | 2      |
|          | GND2  | 9.930      | 2      |         | GND2  | 7.517      | 2      |          | GND2  | 10.013     | 2      |
| Unit# 95 | 1     | 7.806      | 2      | Unit# 9 | 1     | 7.170      | 2      | Unit# 28 | 1     | 6.946      | 2      |
|          | 2     | 8.487      | 2      |         | 2     | 7.041      | 2      |          | 2     | 7.952      | 1      |
|          | 3     | 7.989      | 2      |         | 3     | 6.998      | 2      |          | 3     | 8.011      | 2      |
|          | 4     | 7.909      | 2      |         | 4     | 6.873      | 2      |          | 4     | 7.655      | 2      |
|          | GND1  | 11.046     | 2      |         | GND1  | 8.081      | 2      |          | GND1  | 8.902      | 2      |
|          | 5     | 7.765      | 2      |         | 5     | 7.386      | 1      |          | 5     | 8.705      | 2      |
|          | 6     | 9.972      | 2      |         | 6     | 6.960      | 2      |          | 6     | 9.300      | 2      |
|          | 7     | 9.817      | 2      |         | 7     | 6.783      | 2      |          | 7     | 9.391      | 2      |
|          | 8     | 7.612      | 2      |         | 8     | 7.437      | 2      |          | 8     | 7.935      | 2      |
|          | GND2  | 8.904      | 2      |         | GND2  | 9.202      | 2      |          | GND2  | 8.535      | 2      |
|          | Min   | 7.20       |        |         | Min   | 6.52       |        |          | Min   | 6.95       |        |
|          | Max   | 11.05      |        |         | Max   | 8.67       |        |          | Max   | 11.03      |        |
|          | Avg   | 8.68       |        |         | Avg   | 7.39       |        |          | Avg   | 8.84       |        |
|          | Std   | 1.055      |        |         | Std   | 0.603      |        |          | Std   | 0.975      |        |
|          | Spec  | 4.00       |        |         | Spec  | 4.00       |        |          | Spec  | 4.00       |        |

## Ball Shear HAST - 192h

| EV88230  |       |            |        | EV88260  |       |            |        | 1927DCF  |       |            |        |
|----------|-------|------------|--------|----------|-------|------------|--------|----------|-------|------------|--------|
| unit #   | Bond# | Break Forc | B-Mode | unit #   | Bond# | Break Forc | B-Mode | unit #   | Bond# | Break Forc | B-Mode |
| Unit# 96 | 1     | 30.33      | 2      | Unit# 10 | 1     | 29.86      | 2      | Unit# 29 | 1     | 22.43      | 2      |
|          | 2     | 26.81      | 2      |          | 2     | 18.59      | 2      |          | 2     | 28.37      | 2      |
|          | 3     | 28.85      | 2      |          | 3     | 29.95      | 2      |          | 3     | 24.57      | 2      |
|          | 4     | 23.12      | 2      |          | 4     | 21.56      | 2      |          | 4     | 26.18      | 2      |
|          | 5     | 26.78      | 2      |          | 5     | 24.14      | 2      |          | 5     | 23.17      | 2      |
|          | 6     | 31.90      | 2      |          | 6     | 25.78      | 2      |          | 6     | 26.11      | 2      |
|          | 7     | 31.71      | 2      |          | 7     | 25.91      | 2      |          | 7     | 32.02      | 2      |
|          | 8     | 27.18      | 2      |          | 8     | 26.33      | 2      |          | 8     | 24.43      | 2      |
|          | GND   | 31.82      | 2      |          | GND   | 27.84      | 2      |          | GND   | 30.00      | 2      |
| Unit# 97 | 1     | 24.19      | 2      | Unit# 11 | 1     | 24.17      | 2      | Unit# 30 | 1     | 19.87      | 2      |
|          | 2     | 25.09      | 2      |          | 2     | 24.75      | 2      |          | 2     | 26.04      | 2      |
|          | 3     | 27.86      | 2      |          | 3     | 23.17      | 2      |          | 3     | 27.54      | 2      |
|          | 4     | 31.19      | 2      |          | 4     | 27.10      | 2      |          | 4     | 29.59      | 2      |
|          | 5     | 24.00      | 2      |          | 5     | 22.24      | 2      |          | 5     | 23.37      | 2      |
|          | 6     | 24.88      | 2      |          | 6     | 23.75      | 2      |          | 6     | 29.71      | 2      |
|          | 7     | 25.84      | 2      |          | 7     | 29.58      | 2      |          | 7     | 24.95      | 2      |
|          | 8     | 26.41      | 2      |          | 8     | 29.21      | 2      |          | 8     | 23.65      | 2      |
|          | GND   | 26.11      | 2      |          | GND   | 25.80      | 2      |          | GND   | 29.63      | 2      |
| Unit# 98 | 1     | 22.44      | 2      | Unit# 12 | 1     | 27.80      | 2      | Unit# 31 | 1     | 26.84      | 2      |
|          | 2     | 28.22      | 2      |          | 2     | 26.96      | 2      |          | 2     | 25.94      | 2      |
|          | 3     | 29.30      | 2      |          | 3     | 24.97      | 2      |          | 3     | 27.09      | 2      |
|          | 4     | 21.89      | 2      |          | 4     | 31.67      | 2      |          | 4     | 26.44      | 2      |
|          | 5     | 26.84      | 2      |          | 5     | 23.95      | 2      |          | 5     | 23.17      | 2      |
|          | 6     | 32.64      | 2      |          | 6     | 28.02      | 2      |          | 6     | 24.75      | 2      |
|          | 7     | 31.23      | 2      |          | 7     | 24.73      | 2      |          | 7     | 25.58      | 2      |
|          | 8     | 29.89      | 2      |          | 8     | 24.23      | 2      |          | 8     | 21.16      | 2      |
|          | GND   | 23.63      | 2      |          | GND   | 25.68      | 2      |          | GND   | 22.35      | 2      |
|          | Min   | 21.89      |        |          | Min   | 18.59      |        |          | Min   | 19.87      |        |
|          | Max   | 32.64      |        |          | Max   | 31.67      |        |          | Max   | 32.02      |        |
|          | Avg   | 27.41      |        |          | Avg   | 25.84      |        |          | Avg   | 25.74      |        |
|          | Std   | 3.183      |        |          | Std   | 2.899      |        |          | Std   | 2.930      |        |
|          | Spec  | 10.00      |        |          | Spec  | 10.00      |        |          | Spec  | 10.00      |        |

## Bond Pull UHAST - 96h

| EV87230   |       |            |        | EV88230   |       |            |        | EV88260   |       |            |        |
|-----------|-------|------------|--------|-----------|-------|------------|--------|-----------|-------|------------|--------|
| unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode |
| Unit# 110 | 1     | 7.515      | 2      | Unit# 115 | 1     | 9.051      | 2      | Unit# 115 | 1     | 7.534      | 2      |
|           | 2     | 9.963      | 2      |           | 2     | 9.313      | 2      |           | 2     | 7.882      | 2      |
|           | 3     | 10.705     | 2      |           | 3     | 10.561     | 2      |           | 3     | 7.751      | 2      |
|           | 4     | 11.052     | 2      |           | 4     | 8.667      | 2      |           | 4     | 7.410      | 2      |
|           | GND1  | 6.887      | 2      |           | GND1  | 7.315      | 2      |           | GND1  | 7.576      | 2      |
|           | 5     | 8.200      | 2      |           | 5     | 8.033      | 2      |           | 5     | 8.136      | 2      |
|           | 6     | 8.587      | 2      |           | 6     | 9.531      | 2      |           | 6     | 7.868      | 2      |
|           | 7     | 8.277      | 2      |           | 7     | 9.889      | 2      |           | 7     | 8.466      | 2      |
|           | 8     | 8.587      | 2      |           | 8     | 7.657      | 2      |           | 8     | 6.677      | 2      |
|           | GND2  | 8.548      | 2      |           | GND2  | 9.284      | 2      |           | GND2  | 9.703      | 2      |
| Unit# 111 | 1     | 7.411      | 2      | Unit# 116 | 1     | 9.283      | 2      | Unit# 116 | 1     | 7.096      | 2      |
|           | 2     | 9.655      | 2      |           | 2     | 9.245      | 2      |           | 2     | 7.911      | 1      |
|           | 3     | 9.200      | 2      |           | 3     | 8.141      | 2      |           | 3     | 7.596      | 2      |
|           | 4     | 9.384      | 2      |           | 4     | 8.037      | 1      |           | 4     | 7.520      | 2      |
|           | GND1  | 8.665      | 2      |           | GND1  | 9.894      | 2      |           | GND1  | 7.253      | 1      |
|           | 5     | 9.721      | 2      |           | 5     | 10.168     | 1      |           | 5     | 7.815      | 2      |
|           | 6     | 8.522      | 2      |           | 6     | 11.292     | 2      |           | 6     | 8.541      | 2      |
|           | 7     | 8.522      | 2      |           | 7     | 7.106      | 2      |           | 7     | 8.518      | 2      |
|           | 8     | 10.302     | 2      |           | 8     | 9.453      | 2      |           | 8     | 6.444      | 2      |
|           | GND2  | 9.881      | 2      |           | GND2  | 8.937      | 2      |           | GND2  | 9.805      | 1      |
| Unit# 112 | 1     | 7.421      | 2      | Unit# 117 | 1     | 9.823      | 2      | Unit# 117 | 1     | 7.681      | 2      |
|           | 2     | 7.151      | 2      |           | 2     | 9.548      | 2      |           | 2     | 8.329      | 2      |
|           | 3     | 8.557      | 2      |           | 3     | 9.470      | 2      |           | 3     | 7.255      | 2      |
|           | 4     | 8.557      | 2      |           | 4     | 7.847      | 2      |           | 4     | 7.950      | 2      |
|           | GND1  | 7.687      | 2      |           | GND1  | 10.055     | 1      |           | GND1  | 9.013      | 2      |
|           | 5     | 7.906      | 2      |           | 5     | 10.439     | 1      |           | 5     | 8.856      | 2      |
|           | 6     | 8.714      | 2      |           | 6     | 11.165     | 2      |           | 6     | 9.121      | 1      |
|           | 7     | 7.805      | 2      |           | 7     | 6.985      | 2      |           | 7     | 9.212      | 1      |
|           | 8     | 7.678      | 2      |           | 8     | 8.058      | 2      |           | 8     | 7.605      | 2      |
|           | GND2  | 9.812      | 2      |           | GND2  | 8.458      | 2      |           | GND2  | 8.439      | 1      |
|           | Min   | 6.89       |        |           | Min   | 6.99       |        |           | Min   | 6.44       |        |
|           | Max   | 11.05      |        |           | Max   | 11.29      |        |           | Max   | 9.81       |        |
|           | Avg   | 8.66       |        |           | Avg   | 9.11       |        |           | Avg   | 8.02       |        |
|           | Std   | 1.072      |        |           | Std   | 1.155      |        |           | Std   | 0.828      |        |
|           | Spec  | 4.00       |        |           | Spec  | 4.00       |        |           | Spec  | 4.00       |        |



## Ball Shear UHAST - 96h

| EV87230   |       |            |        | EV88230   |       |            |        | EV88260   |       |            |        |
|-----------|-------|------------|--------|-----------|-------|------------|--------|-----------|-------|------------|--------|
| unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode |
| Unit# 113 | 1     | 23.09      | 2      | Unit# 118 | 1     | 20.34      | 2      | Unit# 118 | 1     | 22.75      | 2      |
|           | 2     | 20.10      | 2      |           | 2     | 24.35      | 2      |           | 2     | 20.57      | 2      |
|           | 3     | 25.97      | 2      |           | 3     | 23.49      | 2      |           | 3     | 19.69      | 2      |
|           | 4     | 23.09      | 2      |           | 4     | 24.69      | 2      |           | 4     | 24.90      | 2      |
|           | 5     | 27.14      | 2      |           | 5     | 25.32      | 2      |           | 5     | 25.71      | 2      |
|           | 6     | 27.23      | 2      |           | 6     | 19.36      | 2      |           | 6     | 24.18      | 2      |
|           | 7     | 25.43      | 2      |           | 7     | 20.15      | 2      |           | 7     | 21.20      | 2      |
|           | 8     | 20.79      | 2      |           | 8     | 28.44      | 2      |           | 8     | 22.96      | 2      |
|           | GND2  | 19.29      | 2      |           | GND2  | 22.18      | 2      |           | GND2  | 20.34      | 2      |
| Unit# 114 | 1     | 19.53      | 2      | Unit# 119 | 1     | 20.45      | 2      | Unit# 119 | 1     | 23.01      | 2      |
|           | 2     | 20.15      | 2      |           | 2     | 23.63      | 2      |           | 2     | 19.88      | 2      |
|           | 3     | 23.06      | 2      |           | 3     | 18.67      | 2      |           | 3     | 20.06      | 2      |
|           | 4     | 23.94      | 2      |           | 4     | 18.33      | 2      |           | 4     | 22.99      | 2      |
|           | 5     | 25.65      | 2      |           | 5     | 22.43      | 2      |           | 5     | 23.04      | 2      |
|           | 6     | 21.07      | 2      |           | 6     | 22.49      | 2      |           | 6     | 25.42      | 2      |
|           | 7     | 21.52      | 2      |           | 7     | 19.86      | 2      |           | 7     | 19.82      | 2      |
|           | 8     | 22.83      | 2      |           | 8     | 24.60      | 2      |           | 8     | 23.08      | 2      |
|           | GND2  | 26.09      | 2      |           | GND2  | 24.49      | 2      |           | GND2  | 20.82      | 2      |
| Unit# 115 | 1     | 23.47      | 2      | Unit# 120 | 1     | 23.82      | 2      | Unit# 120 | 1     | 20.74      | 2      |
|           | 2     | 27.70      | 2      |           | 2     | 24.73      | 2      |           | 2     | 20.78      | 2      |
|           | 3     | 27.13      | 2      |           | 3     | 24.17      | 2      |           | 3     | 21.65      | 2      |
|           | 4     | 25.84      | 2      |           | 4     | 24.12      | 2      |           | 4     | 18.46      | 2      |
|           | 5     | 23.92      | 2      |           | 5     | 23.41      | 2      |           | 5     | 21.21      | 2      |
|           | 6     | 27.20      | 2      |           | 6     | 21.32      | 2      |           | 6     | 22.22      | 2      |
|           | 7     | 22.74      | 2      |           | 7     | 23.12      | 2      |           | 7     | 19.06      | 2      |
|           | 8     | 22.79      | 2      |           | 8     | 23.37      | 2      |           | 8     | 23.67      | 2      |
|           | GND2  | 22.64      | 2      |           | GND2  | 24.42      | 2      |           | GND2  | 22.50      | 2      |
|           | Min   | 19.29      |        |           | Min   | 18.33      |        |           | Min   | 18.46      |        |
|           | Max   | 27.70      |        |           | Max   | 28.44      |        |           | Max   | 25.71      |        |
|           | Avg   | 23.68      |        |           | Avg   | 22.81      |        |           | Avg   | 21.88      |        |
|           | Std   | 2.587      |        |           | Std   | 2.338      |        |           | Std   | 1.934      |        |
|           | Spec  | 10.00      |        |           | Spec  | 10.00      |        |           | Spec  | 10.00      |        |

## Bond Pull UHASt - 192h

| EV87230  |       |            |        | EV88230   |       |            |        | EV88260   |       |            |        |
|----------|-------|------------|--------|-----------|-------|------------|--------|-----------|-------|------------|--------|
| unit #   | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode | unit #    | Bond# | Break Forc | B-Mode |
| Unit# 89 | 1     | 9.767      | 2      | Unit# 103 | 1     | 9.122      | 2      | Unit# 104 | 1     | 7.702      | 2      |
|          | 2     | 8.176      | 2      |           | 2     | 9.818      | 2      |           | 2     | 8.231      | 2      |
|          | 3     | 9.336      | 2      |           | 3     | 10.699     | 2      |           | 3     | 8.213      | 2      |
|          | 4     | 6.370      | 2      |           | 4     | 6.528      | 2      |           | 4     | 8.154      | 2      |
|          | GND1  | 9.774      | 2      |           | GND1  | 7.036      | 2      |           | GND1  | 7.516      | 2      |
|          | 5     | 5.879      | 2      |           | 5     | 8.961      | 2      |           | 5     | 6.427      | 1      |
|          | 6     | 8.300      | 2      |           | 6     | 10.703     | 2      |           | 6     | 7.979      | 1      |
|          | 7     | 8.713      | 2      |           | 7     | 10.246     | 2      |           | 7     | 8.063      | 2      |
|          | 8     | 10.260     | 2      |           | 8     | 6.768      | 2      |           | 8     | 6.574      | 1      |
|          | GND2  | 6.589      | 2      |           | GND2  | 8.573      | 2      |           | GND2  | 8.785      | 2      |
| Unit# 91 | 1     | 6.521      | 2      | Unit# 104 | 1     | 10.419     | 2      | Unit# 105 | 1     | 7.634      | 2      |
|          | 2     | 10.666     | 2      |           | 2     | 9.981      | 2      |           | 2     | 7.891      | 2      |
|          | 3     | 10.130     | 2      |           | 3     | 10.878     | 2      |           | 3     | 8.609      | 1      |
|          | 4     | 11.137     | 2      |           | 4     | 10.539     | 2      |           | 4     | 8.601      | 2      |
|          | GND1  | 8.351      | 2      |           | GND1  | 7.339      | 2      |           | GND1  | 6.436      | 2      |
|          | 5     | 10.091     | 2      |           | 5     | 9.615      | 2      |           | 5     | 7.813      | 1      |
|          | 6     | 8.205      | 2      |           | 6     | 10.782     | 2      |           | 6     | 9.374      | 2      |
|          | 7     | 6.930      | 2      |           | 7     | 9.993      | 2      |           | 7     | 8.044      | 1      |
|          | 8     | 6.853      | 2      |           | 8     | 6.631      | 2      |           | 8     | 6.975      | 1      |
|          | GND2  | 7.548      | 2      |           | GND2  | 11.027     | 2      |           | GND2  | 9.136      | 1      |
| Unit# 92 | 1     | 8.121      | 2      | Unit# 105 | 1     | 7.551      | 2      | Unit# 106 | 1     | 6.847      | 2      |
|          | 2     | 7.619      | 2      |           | 2     | 9.290      | 2      |           | 2     | 6.698      | 2      |
|          | 3     | 6.860      | 2      |           | 3     | 10.363     | 2      |           | 3     | 6.764      | 2      |
|          | 4     | 7.474      | 2      |           | 4     | 9.850      | 2      |           | 4     | 7.132      | 2      |
|          | GND1  | 6.762      | 2      |           | GND1  | 7.158      | 2      |           | GND1  | 6.213      | 2      |
|          | 5     | 7.064      | 2      |           | 5     | 10.213     | 2      |           | 5     | 8.503      | 1      |
|          | 6     | 8.855      | 2      |           | 6     | 9.221      | 2      |           | 6     | 7.681      | 2      |
|          | 7     | 7.017      | 2      |           | 7     | 10.987     | 1      |           | 7     | 7.966      | 2      |
|          | 8     | 9.103      | 2      |           | 8     | 7.761      | 2      |           | 8     | 6.258      | 2      |
|          | GND2  | 6.197      | 2      |           | GND2  | 11.588     | 2      |           | GND2  | 7.870      | 2      |
|          | Min   | 5.88       |        |           | Min   | 6.53       |        |           | Min   | 6.21       |        |
|          | Max   | 11.14      |        |           | Max   | 11.03      |        |           | Max   | 9.37       |        |
|          | Avg   | 8.22       |        |           | Avg   | 9.24       |        |           | Avg   | 7.66       |        |
|          | Std   | 1.457      |        |           | Std   | 1.494      |        |           | Std   | 0.881      |        |
|          | Spec  | 4.00       |        |           | Spec  | 4.00       |        |           | Spec  | 4.00       |        |

## Ball Shear UHASt - 192h

| EV87230  |       |             |        | EV88230   |       |             |        | EV88260   |       |             |        |
|----------|-------|-------------|--------|-----------|-------|-------------|--------|-----------|-------|-------------|--------|
| unit #   | Bond# | Break Force | B-Mode | unit #    | Bond# | Break Force | B-Mode | unit #    | Bond# | Break Force | B-Mode |
| Unit# 94 | 1     | 21.21       | 2      | Unit# 106 | 1     | 22.94       | 2      | Unit# 107 | 1     | 21.58       | 2      |
|          | 2     | 25.87       | 2      |           | 2     | 25.91       | 2      |           | 2     | 24.88       | 2      |
|          | 3     | 25.92       | 2      |           | 3     | 20.97       | 2      |           | 3     | 21.33       | 2      |
|          | 4     | 22.96       | 2      |           | 4     | 18.43       | 2      |           | 4     | 21.26       | 2      |
|          | 5     | 20.32       | 2      |           | 5     | 26.78       | 2      |           | 5     | 19.21       | 2      |
|          | 6     | 25.58       | 2      |           | 6     | 24.56       | 2      |           | 6     | 25.59       | 2      |
|          | 7     | 24.14       | 2      |           | 7     | 25.07       | 2      |           | 7     | 24.80       | 2      |
|          | 8     | 19.48       | 2      |           | 8     | 22.76       | 2      |           | 8     | 23.20       | 2      |
|          | GND2  | 24.62       | 2      |           | GND2  | 20.84       | 2      |           | GND2  | 27.42       | 2      |
| Unit# 95 | 1     | 23.02       | 2      | Unit# 107 | 1     | 22.23       | 2      | Unit# 108 | 1     | 21.37       | 2      |
|          | 2     | 24.51       | 2      |           | 2     | 18.33       | 2      |           | 2     | 19.75       | 2      |
|          | 3     | 25.62       | 2      |           | 3     | 19.75       | 2      |           | 3     | 19.11       | 2      |
|          | 4     | 25.84       | 2      |           | 4     | 22.79       | 2      |           | 4     | 22.28       | 2      |
|          | 5     | 22.90       | 2      |           | 5     | 22.79       | 2      |           | 5     | 24.16       | 2      |
|          | 6     | 24.15       | 2      |           | 6     | 22.99       | 2      |           | 6     | 23.30       | 2      |
|          | 7     | 23.21       | 2      |           | 7     | 23.41       | 2      |           | 7     | 19.46       | 2      |
|          | 8     | 24.61       | 2      |           | 8     | 27.19       | 2      |           | 8     | 22.01       | 2      |
|          | GND2  | 21.57       | 2      |           | GND2  | 26.92       | 2      |           | GND2  | 26.40       | 2      |
| Unit# 96 | 1     | 19.04       | 2      | Unit# 108 | 1     | 24.92       | 2      |           |       |             |        |
|          | 2     | 22.58       | 2      |           | 2     | 23.36       | 2      |           |       |             |        |
|          | 3     | 23.99       | 2      |           | 3     | 23.76       | 2      |           |       |             |        |
|          | 4     | 23.20       | 2      |           | 4     | 18.93       | 2      |           |       |             |        |
|          | 5     | 25.27       | 2      |           | 5     | 20.81       | 2      |           |       |             |        |
|          | 6     | 22.60       | 2      |           | 6     | 20.62       | 2      |           |       |             |        |
|          | 7     | 25.71       | 2      |           | 7     | 23.23       | 2      |           |       |             |        |
|          | 8     | 29.94       | 2      |           | 8     | 21.25       | 2      |           |       |             |        |
|          | GND2  | 29.50       | 2      |           | GND2  | 21.20       | 2      |           |       |             |        |
|          | Min   | 19.04       |        |           | Min   | 18.33       |        |           | Min   | 19.11       |        |
|          | Max   | 29.94       |        |           | Max   | 27.19       |        |           | Max   | 27.42       |        |
|          | Avg   | 23.98       |        |           | Avg   | 22.69       |        |           | Avg   | 22.62       |        |
|          | Std   | 2.539       |        |           | Std   | 2.485       |        |           | Std   | 2.520       |        |
|          | Spec  | 10.00       |        |           | Spec  | 10.00       |        |           | Spec  | 10.00       |        |

| Stich/ Wedge Pull |      |          |                     |
|-------------------|------|----------|---------------------|
| Lot               | Test | Duration | Min. Value<br>grams |
| EV87230           | TC   | 500x     | 6.11                |
|                   | TC   | 1000x    | 6.38                |
| EV88230           | TC   | 500x     | 6.65                |
|                   | TC   | 1000x    | 6.80                |
| EV88260           | TC   | 500x     | 6.87                |
|                   | TC   | 1000x    | 5.91                |
| EV88230           | HAST | 96hrs    | 6.83                |
|                   | HAST | 192hrs   | 7.20                |
| EV88260           | HAST | 96hrs    | 6.46                |
|                   | HAST | 192hrs   | 6.52                |
| 1927DCF           | HAST | 96hrs    | 6.56                |
|                   | HAST | 192hrs   | 6.95                |

## Break modes:

| Wire Bond Pull |                            | Reject |
|----------------|----------------------------|--------|
| 0              | no reading                 |        |
| 1              | neck break                 | No     |
| 2              | span break                 | No     |
| 3              | ball bond fail             | Yes    |
| 4              | wedge bond fail/heel break | No     |
| 5              | ball metal lift            | Yes    |
| 6              | wedge metal lift           | Yes    |
| 7              | die fracture               | Yes    |
| 8              | substrate fracture         | Yes    |

| Wire Ball Shear |               | Reject |
|-----------------|---------------|--------|
| 0               | no reading    |        |
| 1               | ball lift     | Yes    |
| 2               | ball shear    | No     |
| 3               | pad lift      | Yes    |
| 4               | cratering     | Yes    |
| 5               | wire shear    | *      |
| 6               | intermetallic | Yes    |
| 7               | reweld        | *      |
| 8               | other         |        |

\*wire shear and reweld modes are considered as process failure.