

Quality Flows

Process Control

As shown in the following tables, each device is constructed by manufacturing processes which are under the surveillance of the Matra MHS Quality organization. Control of these processes is maintained by the use of statistical techniques such as capability studies and SPC. Results are computerized in accordance with standards, internal specifications, and procedures.

Matra MHS prepares and maintains suitable documentation covering all phases of conception and manufacturing. The customer may verify that suitable documentation exists and is being applied. Information designated as "Proprietary" will be made available to the customer or its representative only with the written permission of Matra MHS.

Audits and "self-audits" are used extensively to continuously improve quality by implementing corresponding corrective actions.

Process control is recognized as a vital part of the concept of "built-in quality." In addition to formal inspections, Matra MHS implements various monitoring systems such as scanning electron microscope (SEM) and glassivation layer integrity.

Wafer Fabrication: Quality Control Flow Chart

| Process Step | Typical Item | Frequency Standard flow / HiRel Flow | Sampling |
|--|--|---|-----------------------------------|
| Incoming Inspection of Silicon Wafers | Resistivity, Bow, TTV, Flatness Oxygen Content, Thickness, Particles | Monthly Monitoring of Each Supplier | 22 Wafers/Lot |
| Incoming Inspection of Masks and Reticules | Defects + Conformity | Every Mask and Reticule | |
| | Dimensions + Registration | Weekly Monitoring of Each Supplier | |
| Oxidation | Thickness | Every Run | 3 Wafers/Run 3 Parts/Wafer |
| | C(V) | Monitoring | |
| Ion Implant | Therma-Wave (+ Resistivity) | Every Lot | 2 Wafers/Lot |
| Diffusion | Thickness | Every Run | 3 Wafers/Run 3 Parts/Wafer |
| Si-Nitride Deposition and Etching | Thickness | Every Run | 3 Wafers/Run 5 Parts per Wafer |
| | Critical Dimensions | Every Lot | 3 Wafers/Run 5 Parts per Wafer |
| Gate-Oxidation | Thickness Vfb + Delta Vfb | Every Run | 3 Wafers/Run 3 Parts per Wafer |
| | C(V) | Every Run | 1 Wafers/Run 1 Parts per Wafer |
| Polysilicon Deposition and Etching | Thickness | Every Run | 3 Wafers/Run 3 Parts per Wafer |
| | Critical Dimensions | Every Lot | 3 Wafers/Run 5 Parts per Wafer |
| | SEM Inspection | Monitoring / 100% | |

Wafer Fabrication: Quality Control Flow Chart

| Process Step | Typical Item | Frequency Standard flow / HiRel Flow | Sampling |
|-------------------------------------|-----------------------|---|---|
| Metal Deposition and Etching | Resistivity | Every Week | 1 Wafer |
| | Reflectivity | Every Shift | |
| | Thickness | Every Lot | 1 Wafer/Lot 5 Parts/Wafer |
| | Critical Dimensions | Every Lot | 3 Wafers/Lot 5 Parts on the 3 Wafers |
| | SEM Inspection | Monitoring / 100% | |
| Glassivation Deposition and Etching | Thickness | Every Run | 1 Wafer/Run 3 Parts/Wafer |
| | Stress | Every Run | 1 Wafer/Run |
| | SEM Inspection | Monitoring / 100% | |
| Test Site | Electrical Parameters | Every Lot / visual inspection all lots | 100% Wafers 3 or 5 Site/Wafer |
| Wafer-Sort | Functional Test | Every Lot | 100% Wafers 100% Dice |
| QC Visual Inspection | Visual Defects | Monitoring / 100% | 5 Wafers/Lot |
| Lot Acceptance | | SPC results / Gate all lots | 5 Wafers/Lot |

Note: QA representatives may audit operations at any time.

Assembly: Quality Control Flow Chart

Various assembly process flows are used :

- L0: MIL-STD-883 Class B Compliant Hermetic Assembly
- L1, L2: MIL-STD-883 Class S / ESA SCC 9000 Space Hermetic Assembly
- L3: MHS Military Hermetic Assembly
- L4: Commercial/Industrial/Automotive Plastic Assembly
- L6: Prototype Hermetic Assembly
- L7: Commercial/Industrial/Automotive Hermetic Assembly

Note: QA representatives may audit operations at any time.

Hermetic Assembly: Quality Control Flow Chart

| Process Step | Typical Item | Frequency per Process | | | | Method |
|---|---|-----------------------------------|------------------------------------|------------|----------------------|--|
| | | L1 / L2 | L0 | L3 | L7 | |
| Incoming Inspection | Base/Frame/ Caps/ Bonding- Materials/ Wires | Every Raw Material Lot | | | | MHS Spec SCC9000 |
| First Optical | Visual | Every Lot/100% Wafers | | | | MHS Spec |
| 2nd Optical Inspection QA | Visual | 100% Cond. A ¹ | 100% Cond. B ¹ | AQL = 0.4% | | ¹ MIL-2010 MHS Spec |
| SEM Inspection | | Every Lot | - | | MIL-2018 SCC21400 | |
| QC Inspection AQL = 0.4% | Visual | Every Lot Cond. A ¹ | Every Lot Cond. B ¹ | Monitoring | NA | ¹ MIL-2010 MHS Spec |
| Die-Bonding | Visual | Same As Second Optical | | | | MIL-2010 |
| | Die-Shear | 4# per Lot | | | | MIL-2019 |
| | Stud-Pull | 7# per Lot | | | | MIL-2027 |
| | X-Ray | 100% | 10# per Lot | | NA | MIL-2012 |
| QC Inspection AQL = 0.4% | Visual | Every Lot Cond. A ¹ | Every Lot Cond. B ¹ | Monitoring | NA | ¹ MIL-2010 MHS Spec |
| Wire-Bonding | Visual | 100% Cond. A ¹ | 100% Cond. B ¹ | 100% | 100% | ¹ MIL-2010/ MHS Spec |
| | Bond-Pull | 4#/40 Wires/Every Lot | | | | MIL-2011 |
| | Loop-Height | 5#/Every Lot | | | | MHS Spec |
| QC Inspection AQL = 0.4% | Visual | Every Lot Cond. A ¹ | Every Lot Cond. B ¹ | Monitoring | NA | ¹ MIL-2010 MHS Spec |
| Third Optical | Visual (die) | 100% Cond. A ¹ | See W.B | AQL= 0.4% | NA | ¹ MIL-2010 MHS Spec |
| QC Inspection AQL = 0.4% | Visual | Every Lot Cond. A ¹ | Monitoring Cond. B ¹ | Monitoring | NA | ¹ MIL-2010 MHS Spec |
| Prestab Bake Sealing Stabilization Bake | Visual (L2 only) | 100% on Every Lot | | | | MHS Spec |
| Thermal Cycling | | Every Lot | | | | MIL-1010 Cond. C (x5 cycles for L7) |
| Constant Acceleration | Visual | 22# on Every Lot | | | NA | MIL-2001 Cond. E |
| Trimming/Forming | Visual and Dimensional | 1% on Every Lot | | | | MIL-2009 + SCC20500 |
| Solder-Dip | Visual Thickness | 100% on Every Lot 5# per Lot | | | | MIL-2009 |
| PIND Test | | 100% on Every Lot* | Monitoring | | NA | MIL-2020 |
| Fine/Gross Leak | | 100% on Every Lot | | | LTPD 1% | MIL-1014 |
| Marking (back-side) | Visual | 100% on Every Lot | | | | MHS Spec |
| Final Inspection | Visual | 100% on Every Lot | Every Lot LTPD = 2 | AQL = 0.4% | LTPD 7% | MIL-2009 + SCC 20500 |
| QC Inspection AQL = 0.4% | Visual | Every Lot | Monitoring | | NA | MIL-2009 + SCC 20500 |

* : L2 process only.

Plastic Assembly: Quality Control Flow Chart

| Process Step | Typical Item | Frequency | Sampling |
|--------------------------------|---|------------------------|--------------------------------|
| Incoming Inspection | Frame/Resin/Bonding-Materials/ Wires ... Thickness, Particles | Every Raw Material Lot | |
| 1st Optical Inspection QA | Visual | Every Lot/Sampling | MHS Spec AQL 0.65% or Lower |
| Dicing | DI Water Kerf Width Visual | SPC | |
| 2nd Optical Inspection QA | Visual | Every Lot/Sampling | MHS Spec AQL 0.65% or Lower |
| Die Bonding | Visual Die-Shear Cure Temperature | SPC | |
| Wire Bonding | Visual Bond-Pull Ball-Shear Bond Crater | SPC | |
| 3rd Optical Inspection QA | Visual | Every Lot/Sampling | MHS Spec AQL 0.65% or Lower |
| Molding | X-Ray Step Temperature and Time | SPC | |
| Marking (top side) Optional | Visual Cure-Temperature Permanency | SPC | |
| Solder Plating | Composition Thickness Solderability | SPC | |
| Marking (back-side) | Visual | SPC | |
| Trimming/Forming | Visual Dimensional incl. Coplanarity | SPC | |
| Final Inspection QA | Visual Coplanarity | Every Lot/Sampling | MHS Spec AQL 0.1% |
| Electrical Test | Open/Shorts | Monitoring | MHS Spec |

Note: QA representatives may audit operations at any time.

Die Form: Quality Control Flow Chart

All flows except DB

| Process Step | Typical Item | Frequency Standard flow / HiRel Flow | Sampling |
|-----------------------------------|---|---|--------------------------------|
| Wafer Fab Test Site | See Fab Control Flow Chart Electrical Characterization | 100% Wafers/5 PCM | |
| Dicing | Visual | 100% dice | MIL-2010 Cond. B |
| Optical Inspection QA | Visual | Every Lot/Sampling | MIL-2010 Cond. B AQL = 0.4% |
| Lot Acceptance Sample Assembly | | Optional | Flow L6 |
| Lot Acceptance Test | | Optional | MHS Spec |

DB Flow

| Process Step | Typical Item | Frequency Standard flow / HiRel Flow | Sampling |
|-----------------------------------|---|---|--------------------------------|
| Wafer Fab Test Site | See Fab Control Flow Chart Electrical Characterization | 100% Wafers/5 PCM | |
| Die Sorting | Static/Dynamic Functional Tests Visual | 100% Wafers 10% Wafers | MHS Spec MHS Spec |
| Dicing | Visual | 100% Dice | MIL-2010 Cond. B |
| Optical Inspection QA | Visual | Every Lot/Sampling | MIL-2010 Cond. B AQL = 0.4% |
| Lot Acceptance Sample Assembly | | | Flow L0 |
| Mechanical Conformance | Bond Pull Die Shear | 5 Parts - 10 Wires 3 Parts | MIL-2011 MIL-2019 |
| Electrical Conformance | Acc. to Specification | LTPD 10 - C = 1 | @ 25, 125, -55°C |

Other flows (DB & PS), compliant to Mil-Std 883 class S or ESA/PSS01608 are also available. Detailed information upon request.

Quality

Product Flows

Matra MHS offers a broad range of screening flows, such as commercial, industrial, automotive, military and space. Methods associated with each step are covered by

Matra MHS procedures or procedures defined in standards (MIL-STD-883) depending on the flow. The following tables describe these flows.

Commercial/Industrial/Automotive

| | Commercial 0 to 70°C | | Industrial -40 to 85°C | | Automotive -40 to 125°C | |
|-----------------------------|----------------------|------------------------------------|------------------------|------------------------------------|-------------------------|------------------------------------|
| | | with Burn In | | with Burn In | | with Burn In |
| Flows per Family | | | | | | |
| ASICs | -5 | -Q | -9 | -N | -A | |
| Memories | -5 | -Q | -9 | -N | -A | |
| New Memories | CMx— | CMX—D | IMx— | IMx—D | AMx— | AMx—D |
| Microcontrollers | _xxxxx | Qx— | Ix— | Lx— | Ax— | |
| Process Steps | | | | | | |
| QA Wafer Inspection | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring |
| Assembly Flow | L4/L7 | L4/L7 | L4/L7 | L4/L7 | L4/L7 | L4/L7 |
| Marking | Test Date Code | Test Date Code | Test Date Code | Test Date Code | Test Date Code | Test Date Code |
| Serialization | — | — | — | — | — | — |
| Pre Burn-In Test | — | — | — | — | — | — |
| Dynamic Burn-In | — | 100% 24h/140°C or Equivalent | — | 100% 24h/140°C or Equivalent | — | 100% 24h/140°C or Equivalent |
| Electrical Test | | | | | | |
| • Room Temperature | — | — | — | — | — | — |
| • High Temperature | 100% | 100% | 100% | 100% | 100% | 100% |
| • Low Temperature | — | — | — | — | — | — |
| • Drift | — | — | — | — | — | — |
| • Electrical PDA | — | 5% | — | 5% | — | 5% |
| • QA Electrical Gate | AQL 0.1% | AQL 0.1% | AQL 0.1% | AQL 0.1% | AQL 0.1% | AQL 0.1% |
| Gross and Fine Leaks | — | — | — | — | — | — |
| X-Ray Inspection | — | — | — | — | — | — |
| External Visual | 100% | 100% | 100% | 100% | 100% | 100% |
| Global PDA | — | — | — | — | — | — |
| Electrical Conformation | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring |
| Mechanical Conformation | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring |
| Reliability Conformation | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring | Monitoring |
| Customer Source Inspection | — | — | — | — | — | — |
| Certification of Compliance | — | — | — | — | — | — |
| Data Package | — | — | — | — | — | — |
| Shipping Inspection | All Deliveries | All Deliveries | All Deliveries | All Deliveries | All Deliveries | All Deliveries |

Military and Space

| | Military -55 to 125°C | | Space -55 to 125°C | | |
|-----------------------------|-----------------------|-------------------------------------|--------------------|--------------------|-------------------------------------|
| | MHS Mil Flow | SMD & MIL-883 Compliant | SCC 9000 Level C | SCC 9000 Level B | MIL-883 Class S |
| Flows per Family | | | | | |
| ASICs | -2 | .../883* | -SC | -SB | -MS |
| Memories | -2 | .../883* | -SC | -SB | -MS |
| New Memories | MMx— | MMx—/883* | SMx—SC | SMx—SB | SMx—MS |
| Microcontrollers | Mx— | Mx—/883* | Mx—SC | Mx—SB | Mx—MS |
| Process Steps | | | | | |
| Wafer fab. flow | Standard | Standard | HiRel | HiRel | HiRel |
| Assembly Flow | L3 | L0 | L2 | L2 | L2 |
| Marking | Test Date Code | Sealing Date Code | Sealing Date Code | Sealing Date Code | Sealing Date Code |
| Serialization | — | — | — | Yes | Yes |
| Pre Burn-In Test | — | 100% | 100% | 100% + Record | 100% + Record |
| Dynamic Burn-In | — | 100% 168h/125°C or Equivalent | 100% 168h/125°C | 100% 240h/125°C | 100% 240h/125°C or Equivalent |
| Electrical Test | | | | | |
| • Room Temperature | — | 100% | 100% | 100% + Record | 100% + Record |
| • High Temperature | 100% | 100% | 100% | 100% + Record | 100% + Record |
| • Low Temperature | 100% | 100% | 100% | 100% + Record | 100% + Record |
| • Drift | — | — | — | Yes | If Specified |
| • Electrical PDA | — | 5% @ Room Temp. | See Global PDA | See Global PDA | 5% @ Room Temp. (3% Functionnal) |
| • QA Electrical Gate | AQL 0.1% | NA | NA | NA | NA |
| Gross and Fine Leaks | — | — | 100% | 100% | 100% |
| X-Ray Inspection | — | — | — | 100% | 100% |
| External Visual | 100% | 100% | 100% | 100% | 100% |
| Global PDA | — | — | 5% | 5% | — |
| Electrical Conformation | Monitoring | Group A | LAT 3 | LAT 3 | Group A |
| Mechanical Conformation | Monitoring | Group B | LAT 3 | LAT 3 | Group B |
| Reliability Conformation | Monitoring | Group C/D | LAT 1 + 2 | LAT 1 + 2 | Group C/D |
| Customer Source Inspection | — | — | All Deliveries | All Deliveries | All Deliveries |
| Certification of Compliance | — | All Deliveries | All Deliveries | All Deliveries | All Deliveries |
| Data Package | — | All Deliveries | All Deliveries | All Deliveries | All Deliveries |
| Shipping Inspection | All Deliveries | All Deliveries | All Deliveries | All Deliveries | All Deliveries |

*Existing products in “-MB” flow keep their current name.