ASA P-1® In Situ

5-AXIS DIGITAL MILL & POLISHER

Mesh Modeling
Curvature Compensation
Thermal Relaxation

Video Overlays
RST Measurement
In Situ Microscope

An Expanded Toolkit for the Sample Prep of Modern ICs...
NEW FEATURES

Brand New OS
Drop-down Menus enable...
- Digital Zoom
- Advanced Set Points
- Image Capture
- Timer & End-Points
- Video Capture
- Curve & Mesh Models
- Image Enhance
- Recipe Load & Save

Image Overlays
Live view can be overlaid with saved X-Ray or C-Sam images to further improve targeting.

Automatic Lubricant System
Available for dispensing and collection of polishing fluids, abrasives, and lubricants. Effective Control of lubricants and particulates greatly improves the quality of processing visual monitoring.

Two 4K (UHD) cameras are fitted as standard. A third 4K (UHD) Microscope Camera is added at the RST measurement position. It is made available with the new addition of the UT-F3 Spectrometer.
NEW FEATURES  MESH & CURVATURE

In Situ RST Spectrometers

<table>
<thead>
<tr>
<th>Product</th>
<th>Spectrometer Type</th>
<th>Minimum Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>UT-F3</td>
<td>1280-1340nm NIR</td>
<td>8 microns</td>
</tr>
<tr>
<td>UT-VIS</td>
<td>Visible Light Extension</td>
<td>8 nanometers</td>
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</table>

Two options are available for measuring In Situ remaining silicon thickness (RST).

5-Point Tilt & Curve Measurement

Initial Measurement

After Tilt-Table Auto-Align

The new 4.X System OS provides the user with Interactive Plots to compare the ACTUAL RST Map to a 3D-MODEL. The map takes into account the 3D Mesh generated of the surface profile, programmed X & Y Curvature and convolution of the polishing bit due to its size and type.

Through subsequent polishing iterations - with attendant modifications of the MESH MODEL - the ACTUAL sample thickness and uniformity converges with the refined MODEL after final polishing.

Flex Measurement - Another new feature is a measurement of the device's flex during touch-off procedures. Flex is an indicator of the quality of sample mounting and/or the seating of a board-level component. Excessive flex should lead to part remounting, or as a guide to achieving optimal loading force during prep.
**A** Starting Point - Initial Thinning

- Large Flip-Chip BGA package
  - Initial die thickness = 750 microns

**Thinning Process Conditions**
- Die size X = 15 mm
- Y = 10 mm
- 5260.3 3mm dia fine diamond tool
- Spiral polishing pattern
- Thermal relax at 80°C
- Curvature compensation
- Tool force = 300g

**B** “50 Micron” Process Mid-Point

- Target Camera View of Die @ 50 microns +/- 5
- Contour Map of RST Points
- Graphical Plot of RST

**C** Standard Thinning Range (50 microns to 20 microns)

- 3mm Tool Model
- 2mm Tool Model

**Note:** The map selected has calculations for tool convolution to minimize radius error. In this instance a 3mm tool was chosen.

**Process Conditions**
- 5260.3 3mm dia fine diamond tool
- 5265.3 3mm dia superfine diamond tool
- Mix of Spiral and ASAP-1® polishing patterns
- Curvature compensation
- Polishing force = 300g
Ultra Thin and Polish - Adaptive (20 microns to 5 microns)

Curvature + Mesh Model

Curvature + Refined Mesh Model

Note: Additional polishing passes may be required. RST is measured and the 3D mesh is refined after each cycle.

Process Conditions
5295.3 3mm dia Xylem tool
2382.5 blue diamond paste
2385.5 yellow diamond paste
ASAP-1® series polishing patterns
Polishing force = 300g
Final polish with 5299.3 Xybove 3mm tool with colloidal silica/alumina

Total Process Time = 2 to 4 hours

Note: For even thinner requirements, the final thin and polish procedures are extended in D.
LEGACY UPGRADES

Thermal Relaxation

In situ thermal modification of the packaged device, during sample prep, has been long proven as a safe and effective tool to optimize the ultimate silicon die uniformity. Thermal Relax can be used either alone, or more frequently in conjunction with supplementary methods such as Curvature Compensation and 3D-Mesh.

The Thermal Stage is (6686.1) is a standard upgrade for ASAP-1® In Situ. It also incorporates a Hot Plate Mode for sample mount/demount with Crystal Wax.

Moiré fringe patterns on identical devices prepared at increasing temperatures show an increase in final thickness uniformity.

End-Point Techniques

In addition to a range of TIME and PRESSURE based process end-points. ASAP-1® In Situ offers a unique suite of Capacitance/Resistance-derived, ELECTRONIC End-pointing features.

By grounding the part to the optional end-point stage, the capacitive build-up between the approaching electrically-charged diamond tool and an embedded feature of interest (die circuitry, bond wires) can be used as the automatic trip for a topside decap process.

Use of the method allows for fast, accurate and repeatable process end-points to be achieved without the need for time consuming visits to/from an optical microscope.
### CORE SYSTEM SPECIFICATIONS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Vertical Direction Precision</td>
<td>0.04 microns (40 nanometers) minimum step-size</td>
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<tr>
<td>Table Precision (X &amp; Y Travel)</td>
<td>0.2 microns (200 nanometers) minimum step-size</td>
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<tr>
<td>Table Travel Amplitude</td>
<td>100mm x 100mm (max.)</td>
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<tr>
<td>Polishing Method</td>
<td>Patented ASAP-1® Float-down head, with Z-lock, enhanced with electronic sensors and tool patterns (ASAP-1® Classic, ASAP-1® X, ASAP-1® Swap, Serpentine, User-defined X-Y, Spiral, Frame, and Relief)</td>
</tr>
<tr>
<td>Sample Tilt Control</td>
<td>Automated 2-circle tilt control (+/- 5 degrees)</td>
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<tr>
<td>Force Control</td>
<td>1000 grams (max) with 1gram precision. Overall accuracy +/- 10 grams</td>
</tr>
<tr>
<td>Video</td>
<td>Realtime 10.1inch (255mm) touchscreen monitor, overlaid with stage and process variables. HDMI Video-Out for (optional) external monitor. 4.25inch (108mm) secondary touchscreen</td>
</tr>
<tr>
<td>Programming Input Method</td>
<td>Touchscreen, joystick and 3 physical rotary encoders. Optional wireless keyboard and mouse. File load/save to flash drive</td>
</tr>
<tr>
<td>Core Software Features</td>
<td>Drop-down menu interface for File handling, Cam Select, zoom, and image enhancement, Overlays, Tool Diameter, Pattern Select, Force Control, timers, Illumination, Set-points, Touch-off. Additional purchased options unlock menus for RST, 3D controls, thermal, end-point</td>
</tr>
<tr>
<td>Process Camera</td>
<td>4K UHD Camera provides real-time video at 45 degrees to tool/surface interface</td>
</tr>
<tr>
<td>Target Camera</td>
<td>4K UHD Camera provides top-down video for positional targeting</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>Universal: 100-120VAC; 200-240VAC (Single Phase). Power Consumption: 300 Watts Maximum in use</td>
</tr>
<tr>
<td>Footprint</td>
<td>19 inches (480mm) Width x 27.5 inches (698 mm) Depth x 27 Inches (685mm) Height</td>
</tr>
<tr>
<td>Weight</td>
<td>200lbs (91 kg)</td>
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## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Item</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>6760.5</td>
<td>ASAP-1® IN SITU (2019 Model)</td>
<td>DIGITAL Selected Area Preparation System, (100-240V, 50/60Hz). Includes: X-Y table, tool spindle drive with sub-micron Z-resolution, +5/-5 degree automated tilt-table, integrated real-time machine vision, min 10-inch touchscreen LCD monitor, set of 2mm and 3mm tools, 6389.1 Force Feedback module. Two 4K UHD Cameras (Target &amp; Process)</td>
</tr>
<tr>
<td>6394.3</td>
<td>3D Module - Curvature &amp; Mesh</td>
<td>System software upgrade to add processing and compensation for sample surface curvature with adaptive mesh overlay</td>
</tr>
<tr>
<td>6686.1</td>
<td>Heat &amp; Cool Thermal Relaxation</td>
<td>Hardware and Software Upgrade to add thermal relaxation capability. Touch-Panel screen controls. Peltier-based heating plate, Chiller unit. Includes cables, and two mounting plates. Hot Plate Mode</td>
</tr>
<tr>
<td>6675.1</td>
<td>Machine Vision Monitor</td>
<td>24-inch (min) monitor machine vision upgrade for improved In Situ view of polishing tip/sample surface interface, includes mounting stand (VESA)</td>
</tr>
<tr>
<td>6677.1</td>
<td>Lubricant System</td>
<td>Auto dispense and collect system for polishing fluids and abrasives</td>
</tr>
</tbody>
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### Characterization Modules

**UT-F3**

- **RST (Through-Silicon) Measurement System**
  - Non-contact measurement (1280-1340nm) of silicon and other semiconductors. Includes: Thickness-Solving Software. 4K Video camera (microscope); Si thickness standard. Note: Customer supplies own PC/tablet – Windows 10 required – measures down to approx. 10 microns RST

**UT-VIS**

- **VIS Extension for thin films**
  - 2nd “VIS” Spectrometer can be added to the UT-F3 system to allow for measurements down to approx 10nm RST

**6368.1**

- **Capacitive/Resistive End-Point Module**
  - Hardware and Software Upgrade to add end-pointing for enhancement of decapsulation performance

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**Polishing Technologies, Helping Your Lab to Shine...**

ULTRA TEC is proud to operate a continuous product improvement program. Product specifications and appearance are subject to modification without prior notification.

Note: ASAP-1® is a Registered Trademark. Portions of the Technology are covered under US and related Worldwide patents - 6,630,369; 6,781,232; 7,066,788; 9,157,935 & 6,245,586. More patents are pending. All other trademarks remain with original trademark holders.