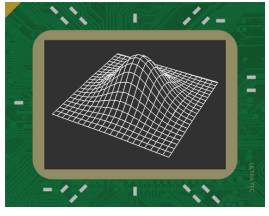
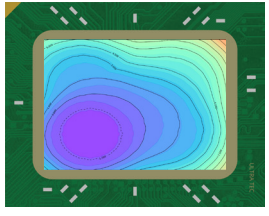
ASAP-1® In Situ

5-AXIS DIGITAL MILL & POLISHER

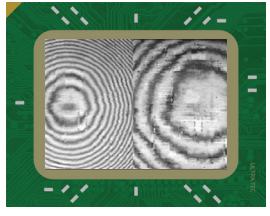




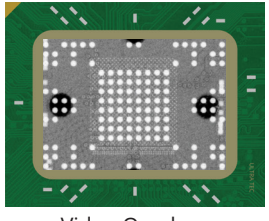
Mesh Modeling



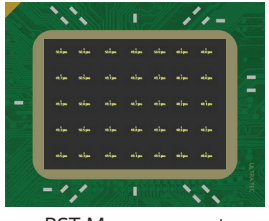
Curvature Compensation



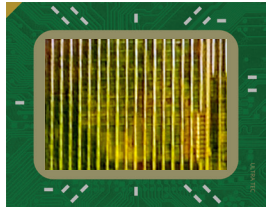
Thermal Relaxation



Video Overlays



RST Measurement



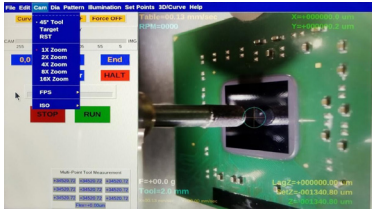
In Situ Microscope

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

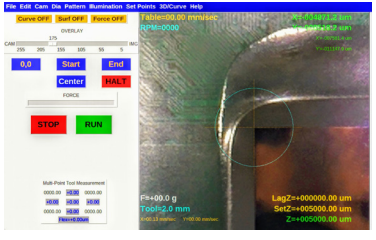
ULTRA TEC MANUFACTURING, INC.

NEW FEATURES ENHANCED VIDEO

ASAP-1® In Situ



45° Process Camera



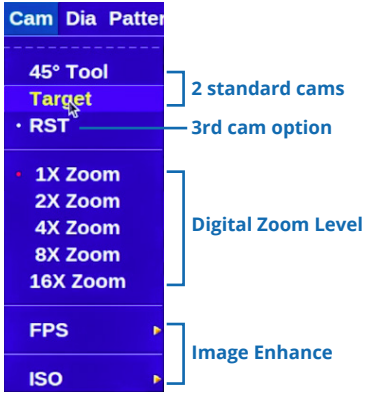
Target Camera



Microscope Camera (Option)
@ RST Position

Advanced In Situ Imaging

Two 4K (UHD) cameras are fitted as standard. A third 4K (UHD) Microscope Camera can be added at the RST measurement position.

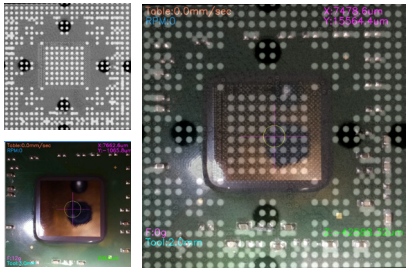


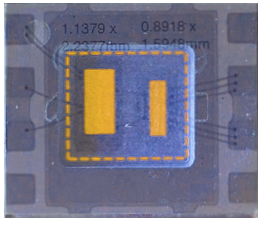
Brand New OS

Drop-down Menus enable...

Digital Zoom
Image Capture
Video Capture
Image Enhance
Advanced Set Points
Timer & End-Points
Curve & Mesh Models
Recipe Load & Save

Image Overlays





The live Target Cam view can be overlaid with saved X-Ray, C-Sam, previous parts or bonding/design images to further improve targeting. Image manipulation, such as scaling and rotation, can be made with In Situ software.

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 live process visual monitoring.



NEW FEATURES MESH & CURVATURE

ASAP-1® In Situ

In Situ RST Spectrometers



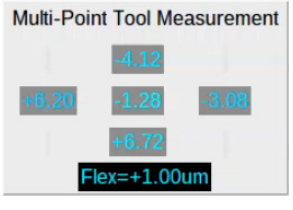
Code	Spectrometer	Minimum RST
UT-F3	1280-1340nm NIR	8 microns
UT-VIS	Visible Light Extension	8 nanometers



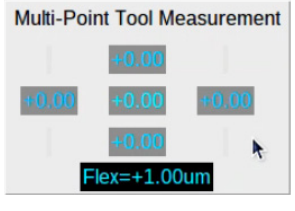
Two In Situ options are available for measuring remaining silicon thickness (RST).

Tilt & Curve Measurement

Initial Measurement

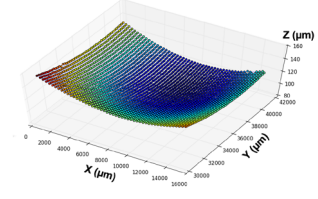


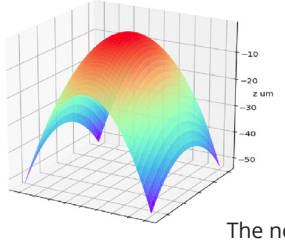
After Tilt-Table Auto-Align

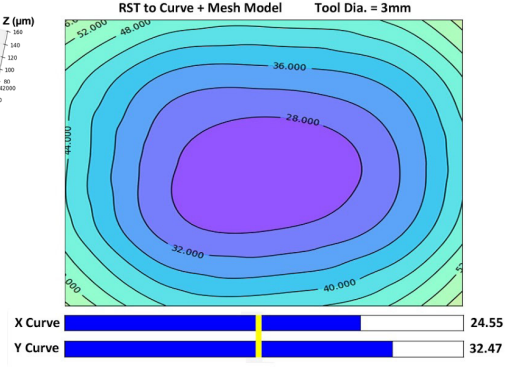


Flex Measurement - Another new feature is the measurement of a device's flex during touch-off measurement procedures. Flex is an indicator of the quality of sample mounting and/or the seating of a board-level component.

Interactive Curve & Mesh Controls







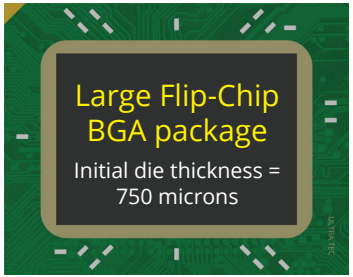
The new System OS provides the user with **Interactive Plots** to compare the **ACTUAL RST Map** to a **3D-MODEL** (optional upgrade). The map takes into account the 3D Mesh generated of the surface profile, programmed X & Y Curvature and convolution of the polishing bit due to its size and type.

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.**

ASAP-1® In Situ

TYPICAL ULTRATHIN & POLISH SEQUENCE

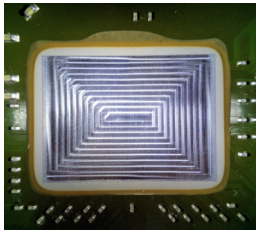
A Starting Point - Initial Thinning



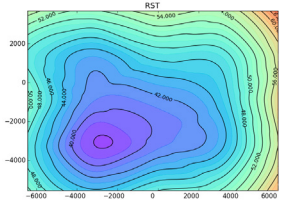
Thinning Process Conditions

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

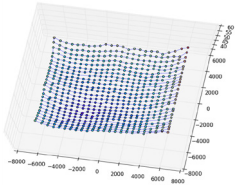
B "50 Micron" Process Mid-Point



Target Camera View of Die @ 50 microns +/- 5



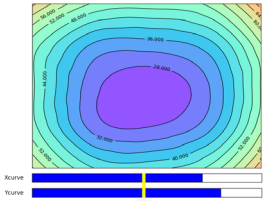
Contour Map of RST Points



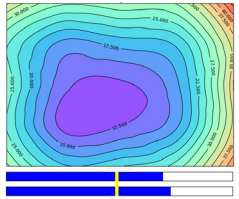
Graphical Plot of RST

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.



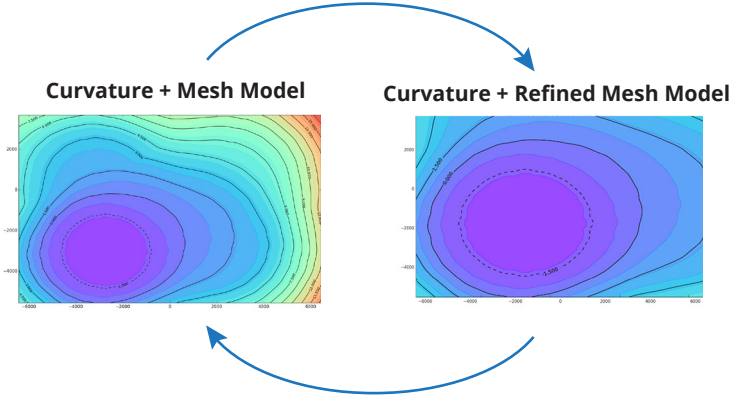
Process Conditions

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

USING CURVE & MESH MODELS

ASAP-1® In Situ

D Ultra Thin and Polish - Adaptive (~20 microns to ~5 microns)

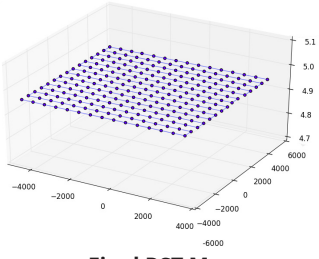


Note: Additional polishing passes may be required. RST is measured and the 3D mesh is refined after each cycle.

Process Conditions

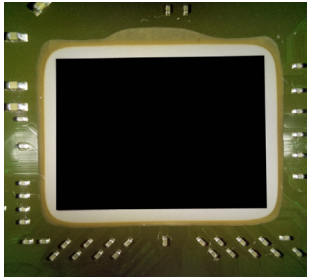
5295.3 3mm dia Xylem tool
2382.5 blue diamond paste
2385.5 yellow diamond paste
ASAP-1® series polishing patterns
Polishing force = 300g
Final polish with 5299.3 Xybove 3mm tool with colloidal silica/alumina

E Final Result

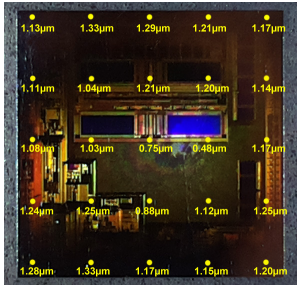


Final RST Map





Target camera image of final 5 micron RST surface



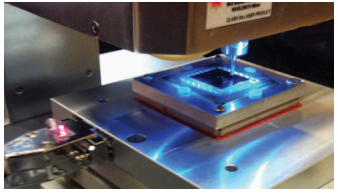
Note: For ultimate thinning requirements, the final process is extended in **D**. **Shown above is a whole die thinned to 1 +/-0.5 microns RST.**

Typical Process Time = 2 to 4 hours

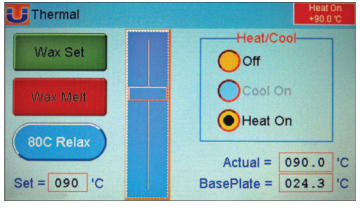
LEGACY UPGRADES

ASAP-1® In Situ

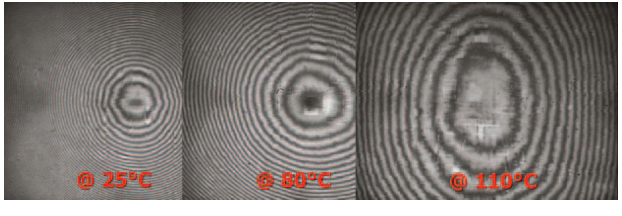
Thermal Relaxation



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.

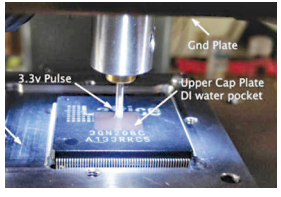


The Thermal Stage (6686.1) is a standard upgrade for ASAP-1® In Situ. It also incorporates a Hot Plate Mode for sample mount/ demount with Crystal Wax.

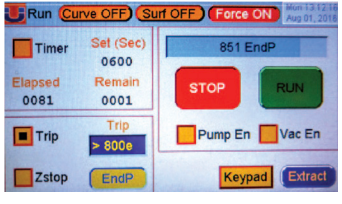


Moiré fringe patterns on identical devices prepared at increasing temperatures show an increase in final thickness uniformity.

End-Point Techniques

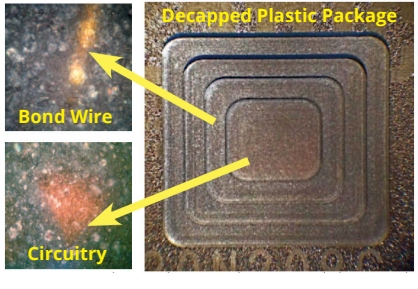


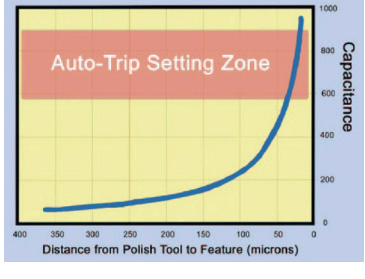
In addition to a range of TIME and PRESSURE based process end-points, ASAP-1® In Situ offers a unique suite of Capacitance/Resistance-derived, ELECTRONIC End-pointing features.



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.

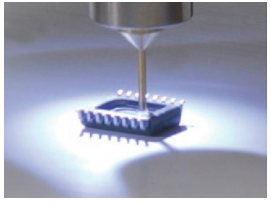


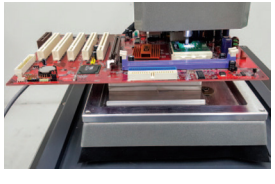


CORE SYSTEM SPECIFICATIONS

ASAP-1® In Situ





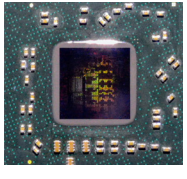


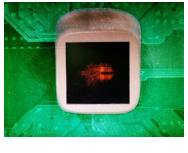
Feature	Specification
Z-Vertical Direction Precision	0.04 microns (40 nanometers) minimum step-size
Table Precision (X & Y Travel)	0.2 microns (200 nanometers) minimum step-size
Table Travel Amplitude	100mm x 100mm (max.)
Polishing Method	Patented ASAP-1® Float-down head, with Z-lock, enhanced with electronic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

ORDERING INFORMATION

ASAP-1® In Situ







Code	Item	Description
6760.5	**ASAP-1® IN SITU (2019 Model)**	**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 & Process)
6394.3	**3D Module - Curvature & Mesh**	System software upgrade to add processing and compensation for sample surface curvature with adaptive mesh overlay
6686.1	**Heat & Cool Thermal Relaxation**	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
6675.1	**Machine Vision Monitor**	24-inch (min) monitor machine vision upgrade for improved In Situ view of polishing tip/sample surface interface, includes mounting stand (VESA)
6677.1	**Lubricant System**	Auto dispense and collect system for polishing fluids and abrasives
		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 from full wafer thickness down to approx. 8 microns RST**
UT-VIS	**VIS Extension for thin films**	2nd "VIS" Spectrometer addition to the UT-F3 system to allow for ultra thinning applications. **Adds measurement down to approx. 8nm RST**
UT-F3-MICRO	**Microscope/3rd Camera**	Adds 3rd UHD camera position with enhanced microscope imaging quality. Note: Item is included with UT-F3
6368.1	**Capacitive/Resistive End-Point Module**	Hardware and Software Upgrade to add end-pointing for enhancement of decapsulation performance

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.

November 2019 Edition

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