The X-Mill™ is a mechanical milling instrument, featuring state-of-the-art technology, to precisely and efficiently prepare samples for electrical and physical failure analysis applications. This easy-to-use and highly versatile system mills the “true” physical profile, needed to support the analysis of complex integrated circuits and packages.

- Backside Device Thinning: FIB/Laser/Photon/SIMS
- Stacked Die Package Deprocessing
- Multi-Chip Module Preparation
- Pre-Chemical Decapsulation
- Package Substrate Delayering
- Frontside Circuit Delayering
**Intuitive Operation**

X-Mill™ features an easy-to-use navigation wizard that helps even the infrequent user obtain expert results.

The X-Mill™ features a GUI that guides the user efficiently through a sequence of screens to setup the processing parameters, ensuring nothing is forgotten or overlooked prior to operation.

User-definable parameters include milling region, leveling tolerance, tool pattern & overlap, notching, tool type & diameter, X/Y travel rate, Z depth & increment, Force and RPM with additional help screens at every process step. All of the parameters can then be easily stored in a memory location or on a compact flash card for later recall.

![Live camera with cross-hair used for X/Y milling boundary definition.](image)

![Multiple tool pattern and overlap options ensure desired material is removed in as little as one pass.](image)

**Automatic Sample Leveling**

X-Mill™ features a motorized, dual-axis leveling stage used to automatically correct mounting error and/or packaged die tilt.

Measurement of the sample plane is performed using three-point light physical contact with a tool or ruby-tipped probe. The leveling stage automatically adjusts the plane to the user-defined tolerance (1 micron minimum), providing unmatched planarity.

Illustration below shows a molded device where there is a non-planar alignment between die and die attach. Once the die attach has been removed, a successful leveling routine ensures planarity to the physical die.

![Uncorrected Die Tilt](image)

![Corrected Die Tilt](image)
Z-Axis Control Modes

**X-Mill** is the only instrument of its kind to offer two modes of precision Z-control: **Force Mode** and **Position Mode**.

In force mode, a user-defined amount of force is applied continuously with a Z-limit, to prevent overshooting the desired target depth. Unlike floating head or lead screw based systems, tool position is maintained electronically to absorb and dampen vibration, eliminate tool chatter and prevent sample cracking.

In position mode, the tool automatically indexes following a user-defined increment to the final target. This mode enables the tool to maintain z-position (even off the sample) eliminating the risk of cracking or chipping the sample edges.

![Diagram of Force Mode](Image1)

**Force Mode**

![Diagram of Position Mode](Image2)

**Position Mode**

3D Thinning and Delayering

**X-Mill** can be equipped with the additional capability of 3D machining to address warped or bowed substrates.

The X-Mill™ can self-acquire the profile of a sample or data can be imported from an external source, through the CF card interface, to create a profile map for the tool to follow. Additionally, data collected from the X-Mill™ profiling can be exported, manipulated using the Excel macros supplied and imported for additional contour refinement.

Even as the sample exhibits relaxation through the thinning process, the remaining silicon thickness (RST), once measured, can be automatically or manually updated to provide a corrected milling profile.

![3D Profile Before and After](Image3)

3D profile of a bowed die before thinning

3D profile of the die after removing 600 µm
**X-Mill Technical Specifications**

**X & Y Control**
- Closed-loop, servo-control, 1 µm resolution,
- Multiple milling pattern options: Left-to-Right, Front-to-Back, Inside/Out Spiral, Cross-combo
- Selectable X/Y rate: 0.1 mm/s to 20 mm/s
- Adjustable tool index/overlap
- X/Y travel: 100 mm x 100 mm milling region

**Z-Axis Control**
- Closed-loop, 1 µm accuracy, 100 nm resolution
- 50 nm encoder
- Force and Position Mode
- Z-force control, 0.15 – 10 N

**Automated Sample Leveling**
- Closed-loop, dual-axis
- 1 µm over 100 mm distance (>0.002° per axis), 5° range (+/- 2.5°)

**Operation**
- 12” Color LCD touch-screen
- Wizard-guided GUI, requires no external PC
- Color CCD camera - 640 x 480
- Store and Recall of Steps & Sequences on removable CF card

**Spindle**
- Variable spindle RPM: 5,000 – 100,000
- Pneumatic tool change, 3 mm collet
- Precision ceramic bearings, extreme accuracy
- Lubricated for life
- Air sealed
- Electronic balancing, vibration-free
- Powerful 3-phase AC current
- Uses tools with 3 mm Ø shank x 38 mm L

Allied High Tech Products Inc reserves the right to change specifications due to continuous performance improvement of our products.

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