



V400ACE™ Focused Ion Beam

High performance circuit edit and design debug solution

The V400ACE™ Focused Ion Beam (FIB) system incorporates the latest developments in ion column design, gas delivery and end point detection to provide fast, efficient, cost-effective editing on advanced integrated circuits. Circuit editing allows product designers to reroute conductive pathways and test the modified circuits in hours, rather than the weeks or months that would be required to generate new masks and process new wafers. Fewer, shorter modification and test cycles allow manufacturers to ramp new processes to profitable high volume yields faster, and be first to market with premium priced new products. The V400ACE is specifically designed to meet the challenges of advanced designs and processes: smaller geometries, higher circuit densities, exotic materials and complex interconnect structures. The V400ACE can be configured for backside editing with an optional IR microscope and bulk silicon trenching package.

Tomahawk™ Ion Column

FEI's Tomahawk™ Ion Column delivers unrivalled capability and flexibility with seamless operation from 30 kV to 2 kV. High current density milling at 30 kV ensures rapid material removal and increased throughput, while low kV operation is useful for selective etching of copper.

NanoChemix™ Gas Delivery

FIB circuit editing tools use controlled amounts of specific gases, injected near the beam at the sample surface, to enhance the speed and selectivity of the milling process, and to deposit conductive and insulating materials in precisely controlled patterns. The V400ACE's innovative NanoChemix™ gas delivery system increases editing flexibility with variable pressure control and a wide variety of solid, liquid or gas precursor materials. Its unique tri-nozzle design ensures a symmetric, high-flux flow of agents. A dedicated central nozzle delivers precursor for metal depositions. Dual opposing nozzles deliver etch gases and eliminate the shadowing that occurs in trenches milled using single-nozzle systems. Gas mixtures are used to improve electrical performance of insulator depositions. Automated purge routines and controlled gas volumes provide fast, easy switching between gases and shorten pump down times. Integrated toxic gas monitors and complete compliance with SEMI S2 standards ensure operator safety.

Key benefits

- Fast, precise circuit modifications allow design changes in hours without processing new silicon
- NanoChemix gas delivery system provides improved speed, flexibility, uniformity, and quality in material removal and deposition
- Tomahawk ion column delivers more current to a smaller spot for faster, more precise milling
- Simultaneous plots of SE and specimen current improve end point detection
- Fast, accurate cross sectioning reveals defects and subsurface features
- Electrical feedthroughs for probing and chip testing applications
- Optional backside editing capability with near infrared microscope and Si trenching package

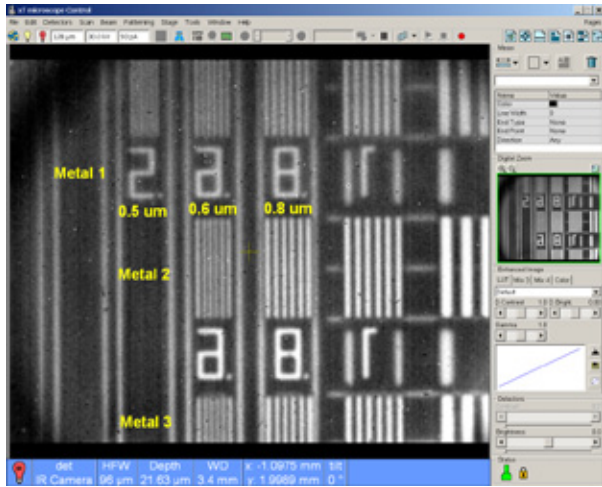


Figure 1: View of circuitry through the backside silicon using integrated IR microscope showing resolution <0.5 μm

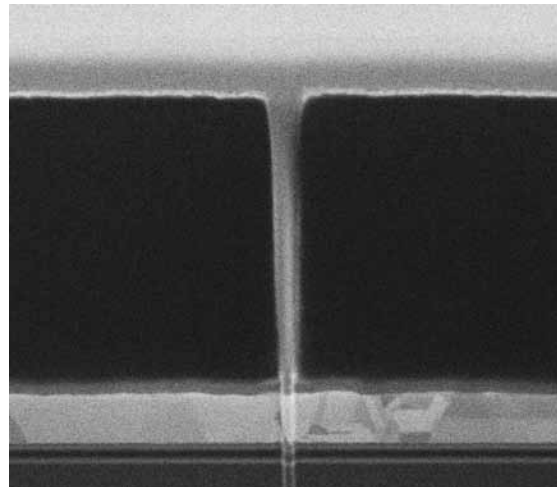


Figure 2: High aspect ratio via formed through oxide and endpointed on copper metal line using V400ACE's improved ion optics. Minimum dimension here is 50 nm.

Backside Edit Option

A near infrared microscope permits imaging of target structures through front side dielectric and backside bulk silicon for fast, accurate navigation. Devices with backside silicon up to full thickness can be imaged allowing editing devices sensitive to thinning or with package elements that prevent polishing. The bulk silicon trenching package includes a special coaxial gas delivery nozzle that accelerates bulk silicon etching for faster access to circuitry from the backside for circuit editing or failure analysis.

End Point Detection

The V400ACE's simultaneous, auto scaled plots of secondary electron and specimen current signals ensure reliable, accurate end point detection when the milling procedure reaches the target structure.

Specifications

Ion Column	Tomahawk, Ga liquid metal 1000 hour lifetime
Acc. Voltage	0.5 kV - 30 kV
Beam Current	1.1 pA - 65 nA
Image Resolution	4.5 nm
Stage	5-axes motorized eucentric X, Y motion 100 mm Tilt -10° to 60° Rotation 360°
End Point Detect	Simultaneous SE/specimen current auto scaled plots
Operating System	Windows® based

Enhanced Navigation and Automation

A five axis, piezo driven stage and seamless integration with CAD software provide fast, accurate navigation. The CAD polygons can be overlaid on the IR microscope or FIB image to accurately target sub-surface features. The stage accommodates a wide range of samples from packaged parts to wafers pieces. Electrical feedthroughs enable *in situ* electrical connections. Optional automation software includes AutoFIB™ for multi site cross sectioning.

Key Options

Hardware

- Charge Neutralizer (electron flood gun)
- Bulk Si Trenching
- IR Microscope
- Electrical Feedthroughs

Software

- AutoFIB (with drift compensation)
- CAD Navigation

NanoChemix Gas Delivery	
XeF ₂	Insulator and low k etch
H ₂ O, O ₂	Organics and copper etch
Cl ₂	Aluminum and silicon etch
TMCTS	Insulator deposition
W(CO) ₆	Tungsten deposition

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