NEXT GENERATION LASER SCRIBING

8000 Series

NextStep

Laser Scribing System

A technology-enabler, cost-effective solution for scribing complex silicon wafers

- Removal of low-k dielectric materials, copper and TEG (Test Element Group) layers in the wafer streets
- Cost-effective alternative to the first step in the step-cut method

ADT Dicing
Advanced Dicing Technologies

8000 Series

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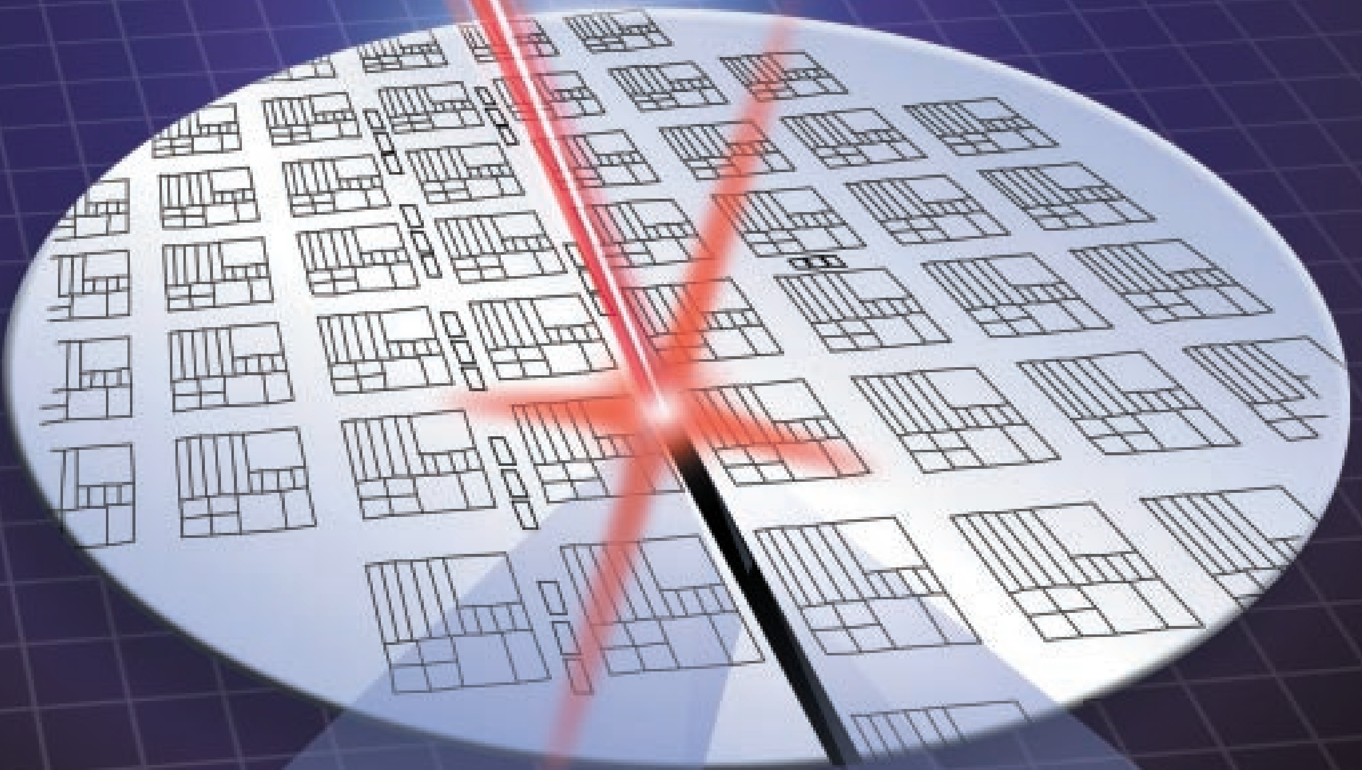
Laser Scribing System

System Highlights

- Minimal heat-affected zone (transparency of silicon to the wavelength)
- No micro-cracking and no delamination
- One pass, 600 mm/s process provides scribed wafers for two to three twin systems
- Integral protective coating system
- Attractive Cost of Ownership (CoO)



IC Evolution Impacts Dicing

To increase transistor density, IC manufacturers have incorporated a number of changes to the silicon wafer manufacturing process. Primarily, they have replaced aluminum metal interconnects with copper and have substituted the traditional silicon dioxide inner metal dielectrics for low-k dielectrics. Mechanically diced, low-k dielectric materials and high conductivity metals such as copper, crack easily causing top-side chipping, back-side chipping and delamination.

The current step-cut method for dicing complex wafers is based upon a two-step process:

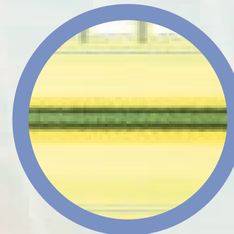
- Shallow cut to remove the non-silicon layers using a wide blade
- Cut made all the way through using a thinner blade

Disadvantages of the step-cut methodology:

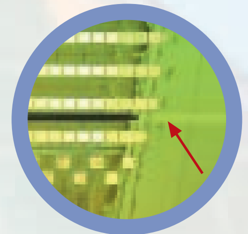
- Despite the low feed rates used and the attempts of blade manufacturers to offer specific products for dicing wafers with low-k materials, copper and TEG, this first cut is often accompanied by severe micro-cracking and layer delamination
- Slow, time-consuming process resulting in excess capital expenses

Back-side chipping after the standard step-cut process

Back-side chipping after scribe and dice process



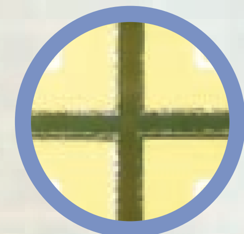
Scribing of low-k material in the streets



Transparency of silicon to the radiation

Laser Process Advantages

- Effective removal of non-silicon layers
- Outstanding consequent dicing quality
- Reduced Cost of Ownership (CoO)
- Increased UPH
- Enhanced die strength
- Built-in, protective coating system

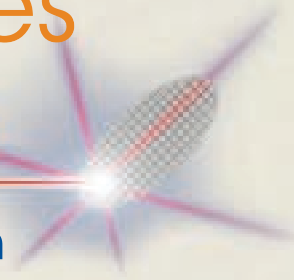


Scribe and dice process showing a well-confined dicing kerf within the laser kerf

Unique Protective Coating System

- Non-hazardous, water-based coating film protects the wafer surface from debris created during the laser process
- Environmentally-friendly, water soluble coating material, filtered and dionized for semiconductor purposes
- Uniform, spray-coating procedure guarantees optimal coverage
- Self-maintaining system via an automatic cleaning cycle
- Fully integrated module for increased throughput

8000 Series



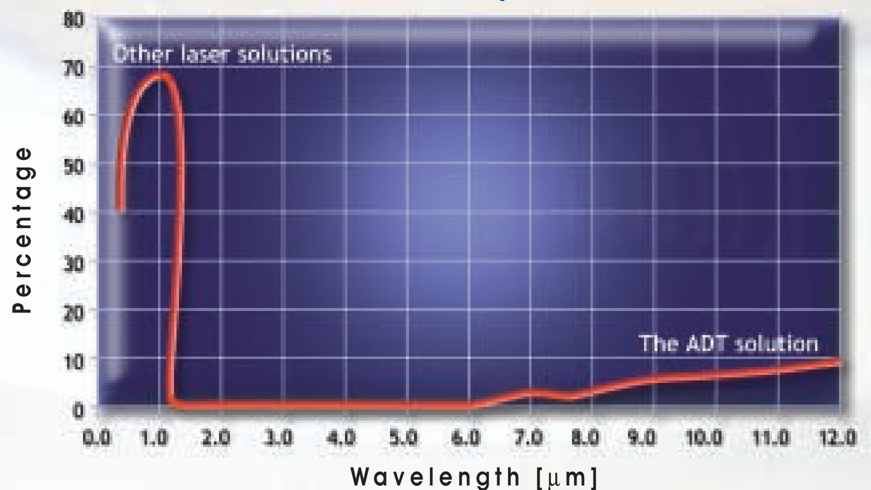
NextStep

Laser Scribing System

The **NextStep** patented technology introduced by ADT makes use of a low-power CO_2 laser to remove only the non-silicon layers in the wafer streets. Since the silicon is transparent to the specific wavelength used, it remains virtually unaffected by the radiation. Not only does the radiation have no direct effect on the silicon, but unlike other laser-based systems that have a detrimental effect on die strength, secondary thermal effects in the **NextStep** system are negligible due to the very limited heat-affected zone of the CO_2 laser. Moreover, instead of using highpulse, which induces thermal shock, **NextStep** works with harmless, yet effective continuous wave (CW).

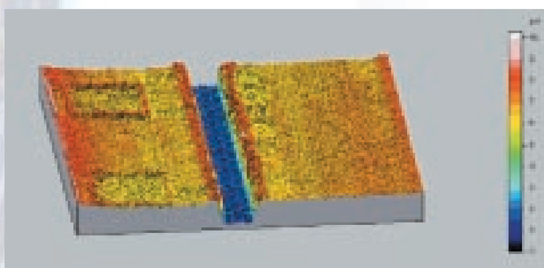
Upon completion of the first laser- based step, the clean-street wafer can be mechanically diced on a dicing saw. Due to the unprecedented feed-rate of up to 600 mm/s at one pass, **NextStep can provide scribed wafers for two to three twin dicing systems**.

Radiation Absorption of Si



This graph illustrates the radiation absorption of undoped silicon at room temperature as a function of wavelength

NextStep Scribing



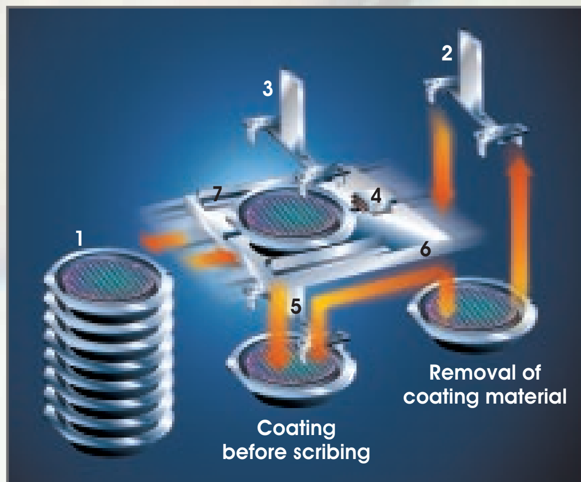
*A 3D measurement of the **NextStep** scribing process showing complete removal of non silicon elements from the street leaving the rest of the wafer intact*

*This SEM image shows a cross section of an IC wafer after laser scribing with **NextStep**. The image shows the clean trench left by the CO_2 laser*

SCRIBING

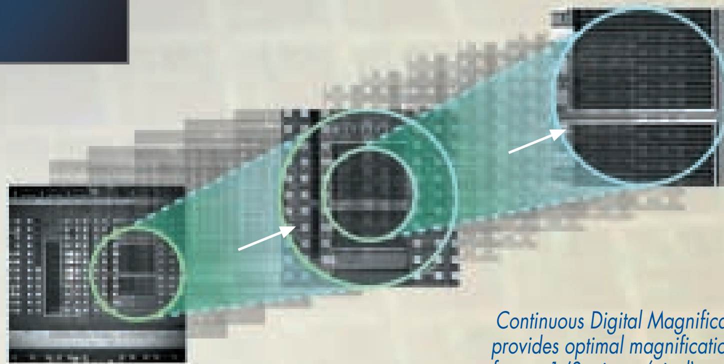
Helping you manage your dicing operation to its full potential!

ADT's proprietary **NextStep** system offers a unique combination of innovative laser technology and advanced, tried and true dicing methodology developed by ADT personnel over the past three decades.



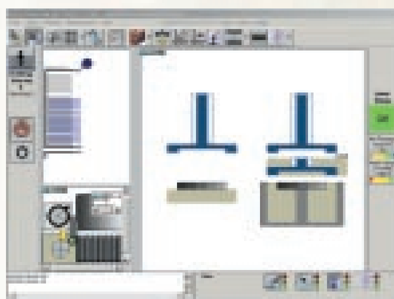
WX3 Wafer Handling System

- Advanced automation capabilities including automatic vision and automatic alignment
- Robust hardware platform for high reliability and low maintenance
- Heavy-duty, cast-iron base structure for superior accuracy
- Increased yield, throughput and process control
- User-friendly, Windows XP based software platform
- Small footprint minimizes plant floor use to comply with semiconductor manufacturing standards

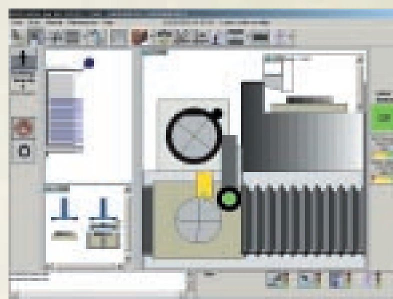


Continuous Digital Magnification Vision System, provides optimal magnification for any eye-point, from x 1 (8 micron/pixel) to x 8 (1 micron/pixel)

User-friendly Interface



Main Screen (WX3 Animation View)



Main Screen (Machine View)

Main Screen (Video View)

NextStep

Specifications

Workpiece Size	Ø 200/300 mm
Laser	CO_2
Indexing Axis (Y)	
Drive	Ball bearing lead screw with stepper motor
Control	Linear encoder
Resolution	0.2 µm
Cumulative accuracy	1.5 µm/300 mm
Indexing accuracy	1.0 µm
Feed Axis (X)	
Drive	Ball bearing lead screw with DC-brushless motor
Feed rate	Up to 700 mm/s
Focus Axis (Z)	
Drive	Ball bearing lead screw with stepper motor
Resolution	0.2 µm
Accuracy	2.0 µm
Repeatability	1.0 µm
Rotary Axis (T)	
Drive	Closed-loop, Direct-drive, DC-brushless
Accuracy	4 arc-sec (0.001 deg.)
Repeatability	4 arc-sec (0.001 deg.)
Stroke	350 deg.
Protective Coating System	
Coverage	Ø 200/300 mm
Material	Water soluble, filtered and deionized for semiconductor purposes
Capacity	4 liters (refill with no downtime)
Vision System	Digital camera High bright LED illumination (vertical & oblique) Continuous Digital Magnification from x70 to x280 or, from x35 to x140
Cleaning Station	Full rinse and dry cycle
Spinning speed	100-2500 RPM
High pressure	Up to 10 MPa
	Atomizing capabilities
Wafer Handling System	300 mm load port (SEMI E-15.1) Slot-to-slot integrity Inspection drawer UV curing station (optional) Barcode reader (optional) SECS-GEM host communication (optional)
User Interface	Flat 15" touch screen Graphical User Interface (GUI) Multilanguage support Keyboard & Mouse
Peripheral Equipment	Mist treatment Suction Filtration
Dimensions (WxDxH)	700 x 700 x 1,500 mm (per application requirements)
Utilities*	
Electrical	200-240 single phase VAC 50/60 Hz
Air/N2	700 L/min @ 5.5 bar 500 L/min compressed air, 200 L/min process Air/N2
Laser coolant	4 L/min tap water
Cleaning water	2 L/min
* Pending on model & application	
Dimensions (WxDxH)	1,100 x 1,740 x 1,725 mm
Weight	1,200 kg

Specifications may change without notice.

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Laser Safety Aspects
- Visible and invisible laser radiation. Avoid eye or skin exposure to direct or scattered radiation
- Do not place shiny objects in the beam path

NextStep complies with CE and CDRH regulations.

Headquarters
Advanced Dicing Technologies Ltd.
Advanced Technology Center, Haifa 31905, Israel
Tel: 972-4-8545222
Fax: 972-4-8550001
Email: sales@adt-co.com
www.adt-dicing.com

USA Subsidiary
Advanced Dicing Technologies Inc.
143 Witmer Road, Horsham, PA 19044, USA
Toll Free: 800-604-4950
Tel: 215-773-9155
Fax: 215-773-9844
Email: us-support@adt-co.com

Nordic Europe
BITA ELEKTRONIK SVENSKA AB
POB 3434
SE-10368 STOCKHOLM
Sweden
Ph. +46 (8) 319000
Fax:+46 (8) 326064
Email: info@bita.se, www.bita.se

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