

What Laser Systems Are Used in Semiconductor Manufacturing?

There are multiple laser technologies used to support semiconductor manufacturing. The incredible ways semiconductors have advanced technology is done in part by cooperation with manufacturing methods. Laser technology has been a partner with the semiconductor industry for some time now by supporting semiconductor processing equipment and precision manufacturing of parts and components. It's ideal for many industries to harness the capabilities of lasers to cut, ablate and perform functions that other manufacturing systems cannot. For applications that require precision and repeatability, laser cutting for semiconductor companies, and their sub-contractors has proven to be a reliable and go to option. The types of semiconductor laser processing are paired to the laser systems that best fit the needs. There are numerous laser types, but not all have the right capabilities and characteristics to process materials needed for semiconductor manufacturing. Here is a breakdown of some of the key laser technologies and their applications:

- **UV or Ultraviolet Laser:** These lasers emit ultraviolet light, ideal for precise cutting and ablation (removal of material) on various materials like silicon wafers and thin films. Some systems have beam diameters of 20um. These pulsed lasers are used for cutting many gasketing materials and thin polymers, adhesives as well as metallics. They can hold tolerances from +/- 0.0127mm to 0.0508mm in many cases. They are commonly used for:
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 - **Wafer Dicing:** Separating individual chips from a wafer after fabrication.
 - **Via Formation:** Creating tiny holes that connect different layers within a chip.
 - **Gaskets:** For use in semiconductor processing equipment.
- **Fiber Laser:** Offer more control over pulse duration and power. Great for thicker gauges of metal alloys like copper, stainless steel, aluminum, titanium, tungsten. Systems can range in wattage from 50 to 10,000 watts or higher and often hold tolerance from +/- 0.0508mm to 0.0762mm. They find use in:
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 - **Annealing:** Improving the electrical properties of semiconductors by heating specific areas with a laser.
 - **Drilling:** Creating microscopic holes for connections within a chip.
 - **Marking:** Adding permanent identification codes or logos on components.
 - **Cutting:** For tooling, support plates, brackets, vacuum stages and other precision components.
- **CO2 Lasers:** These lasers can hold tolerances from +/- 0.0508mm to 0.127mm and are used for:
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- **Scribing:** Weakening specific areas of a wafer before dicing for easier separation.

Advantages of semiconductor laser cutting go beyond the capabilities to cut precise features or wafer dicing. With options that semiconductor manufacturers have, they rely on laser technology for not only the range of materials they can process and ability to hold tight tolerances, but also benefit from the following aspects of using laser technology:

Benefits of Laser Technology:

- **Heat Affected Zones (HAZ):** Lasers offer minimal heat-affected zones, crucial for delicate semiconductor structures. This is controlled by many adjustments to the settings or laser tool such as: laser power, dwell time, laser passes, laser frequency, laser focus and others.
- **Cleanliness:** Laser cutting, and ablation uses a beam of intensified light to cut and ablate. This non-mechanical means minimizes debris and contamination during processing.
- **Versatility:** Different lasers can be chosen based on the material, application, and desired outcome. Lasers in general do not require tooling for changes in the cut profile or material. The systems require only updates to the data. No tooling or die costs are incurred.
- **Repeatability:** Lasers ensure consistent and reliable results for high-volume manufacturing. For development of new products and processes, lasers have the flexibility to perform R&D and prototype projects. This capability gives semiconductor laser manufacturing a great edge to handle volumes at all levels.

Overall, laser cutting for the semiconductor companies and their supporting subcontractors plays a critical role in achieving the intricate features required in modern semiconductor manufacturing. With capabilities to support R&D and prototyping and move into volume demands, companies have learned the advantages of semiconductor laser processing to keep their technologies growing and in turn advance countless industries through product development, research, science and space exploration to name a few. Laser services are not the only answer to precision manufacturing, but they are a key part of so many new breakthroughs and ideas and perhaps your next project may benefit by using laser technology as well.

Please read more at:

[What Laser Systems Are Used in Semiconductor Manufacturing? - A-Laser Precision Laser Cutting](#)
[A-Laser Precision Laser Cutting - Laser Ablation, UV and IR Lasers](#)