

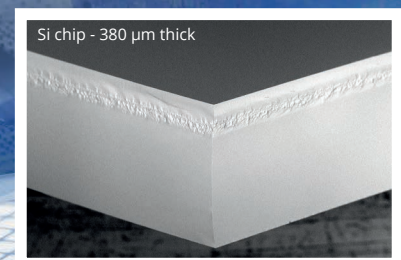
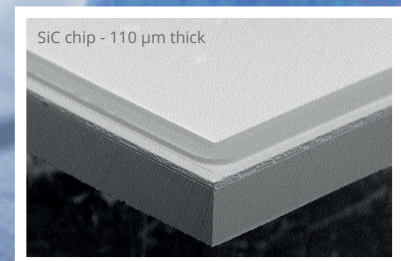
TLS-Dicing®

Enabling Dicing Technology for Fast, Clean, and Cost Effective Wafer Dicing

TLS-Dicing® (thermal laser separation) is a unique technology that uses thermally induced mechanical forces to separate brittle semiconductor materials, such as silicon (Si), silicon carbide (SiC), germanium (Ge) and gallium arsenide (GaAs), into dies with outstanding edge quality while increasing manufacturing yield and throughput. Compared to traditional separation technologies, such as saw dicing and laser ablation, TLS-Dicing enables a clean process, micro-crack-free edges, and higher resulting bending strength.

Capable of dicing speeds up to 300 mm per second, TLS-Dicing® provides up to a 10X increase in process throughput compared to traditional dicing methods and enables a true high-volume production process, especially for SiC-based devices.

In addition, TLS-Dicing® reduces the dicing cost per wafer by up to an order of magnitude or more compared to other wafer dicing approaches.



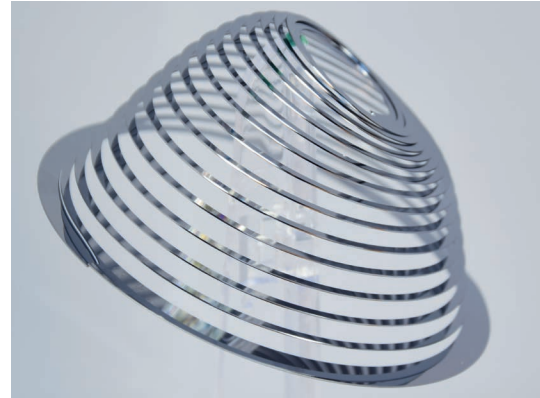
TLS-Dicing® is a Cleaving Process that Provides:

Perfect edge quality of diced chips

- Nearly no chipping and micro cracks
- Highest bending strength
- Best electrical characteristics

Cost advantages and efficiency

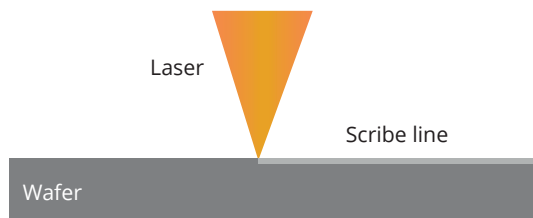
- High throughput due to high process speed
- Low cost of ownership due to no tool wear and nearly no consumables
- Zero kerf cleaving with nearly no particle generation



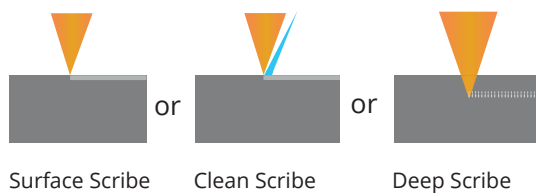
Resizing of Si wafer

TLS-Dicing® is a Two-Step Separation Process:

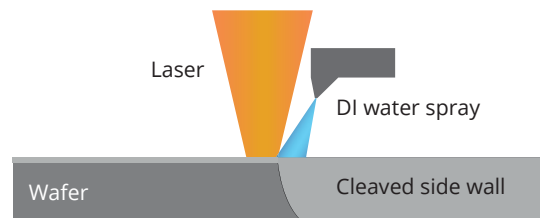
1. Scribing to target the cleaving direction



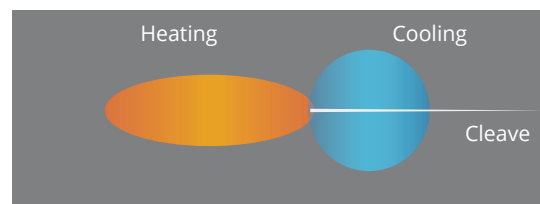
Methods of Scribing:



2. Cleaving for complete wafer separation



Top view:



Thermally induced mechanical stress by laser heating and DI water spray cooling leads to fully separation of the wafer material.