3M™ Wafer Support System

Production Proven

Temporary wafer bonding for advanced IC packaging

- High yields
- High throughput
- Cost effective
- Effectively handles wafers thinned to 20 µm
The 3M™ Wafer Support System combines proprietary 3M temporary bonding technologies with world class equipment designed specifically to process wafers using 3M’s wafer support system materials – creating a complete, cost-effective solution for high-volume manufacturing of ultra-thin wafers for 3D TSV and related applications.

How the 3M™ Wafer Support System works

The heart of the system is 3M™ Liquid UV-Curable Adhesive – a family of 100% solids acrylic adhesives designed for temporary bonding of semiconductor wafers to a glass carrier plate. This provides a rigid, uniform support surface that minimizes stress on the wafer during the subsequent processing steps, resulting in less warpage, cracking, edge chipping and higher yields.

The bonded wafer is thinned using standard backgrinding processes. The wafer is fully supported throughout the process, reducing edge cracking, chipping and damage. After thinning, the bonded wafer stack can be processed through standard semiconductor and TSV processes. 3M adhesives are designed to withstand high temperatures, offer low outgassing in high vacuum semiconductor processes, and are resistant to typical process chemistries.

Because it uses no wet chemistry or soaking steps to de-bond the carrier, the 3M Wafer Support System (WSS) offers fast and clean temporary wafer bonding and debonding. And the 100% solids adhesive is recyclable, generating less waste by re-using the adhesive that does not remain on the wafer during the coating process.

After bonding and processing, a laser is used to debond the glass carrier, allowing easy, low force, chemical free separation of the support carrier from the adhesive surface. The adhesive is then peeled from the wafer using a simple peeling operation.

The 3M Wafer Support System offers a production-proven and cost effective solution for handling wafers down to 20 microns during the backgrinding and subsequent high temperature 3D TSV processes.

Process Flow (Bonding)

1. Bond
2. Backgrinding
3. Backside processing
4. Tape application

3M™ Liquid UV-Curable Adhesive is spin-coated onto the wafer. The wafer is then vacuum-bonded to the glass carrier, which has been treated with a release layer of 3M™ Light-To-Heat Conversion (LTHC) coating. During spin coating, the adhesive flows into the topography of the wafer front side, providing overall support – even on large bump wafers. The system is designed to accommodate a single dispense and spin cycle on wafers with large 100 µm features. Multiple spin and dry cycles are not needed. As a liquid, it also provides more control over the Total Thickness Variation (TTV). The adhesive is then quickly cured with UV light.

After the wafer is processed, standard dicing tape is applied to the back of the wafer. The wafer/glass carrier assembly is then placed in the debonding module, where it is supported on a vacuum chuck for debonding.

3M™ Wafer De-Taping Tape 3305 is used to peel the UV adhesive from the wafer. Residue levels on the wafer surface after adhesive removal are minimal, comparable to conventional backgrinding tapes. No post-peel cleaning is required. Removal of the adhesive in this fashion also creates very little stress to the thinned wafer, and is compatible with low-k dielectrics.
Process Flow (Debonding)

1 Bonding
2 Backgrinding
3 Backside processing
4 Tape application
5 Laser debonding
6 Glass Carrier Lift-off
7 Peel off UV adhesive layer

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After the wafer is processed, standard dicing tape is applied to the back of the wafer. The wafer/glass carrier assembly is then placed in the debonding module, where it is supported on a vacuum chuck for debonding.

The glass is separated from the adhesive using a laser debonding process. This is a low-stress process that utilizes no chemicals and is carried out at room temperature. After laser processing the glass carrier is separated from the adhesive layer with very low force. The carrier is then recycled, allowing it to be re-used multiple times.

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A complete solution for temporary bonding of 3D TSV wafers

- Designed for semiconductor processes – Compatible with high temperature/high vacuum processes, common process chemistries and low-k dielectric materials
- High yields – Minimizes grinding and debonding stress for less warpage, cracking, edge chipping
- High throughput – Uses no solvents and debonds at room temperature
- Less waste – Overspray from spin coating can be captured and recycled

3M’s Wafer Support System combines 3M materials and Authorized WSS equipment to support temporary wafer bonding and ultra-thin wafer processing for 3D TSV processes and 3D packaging applications.

3M is partnering with some of the world’s leading semiconductor equipment manufacturers to supply, service, and support the bonder, debonder, and glass recycling equipment used in the 3M Wafer Support System.

www.3M.com/wss

Designed to enable temporary bonding of wafers down to 20 microns with fast backgrinding speeds and high pressures.
3M™ Wafer Support System Materials

Temporary Bonding Adhesive

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Base Resin</th>
<th>Color</th>
<th>Viscosity</th>
<th>Recommended Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M™ UV-Curable Adhesive LC-3200</td>
<td>Acrylic</td>
<td>Clear, light yellow</td>
<td>3500 CP @25°C</td>
<td>Low-temps: 60+ min @ 150°C; several min @180°C*</td>
</tr>
<tr>
<td>3M™ UV-Curable Adhesive LC-4200</td>
<td>Acrylic, functional polymer</td>
<td>Clear, orange-brown</td>
<td>2150 CP @25°C</td>
<td>Intermediate temps: 90 min @ 180°C; several min @ 200°C*</td>
</tr>
<tr>
<td>3M™ UV-Curable Adhesive LC-5200</td>
<td>Acrylic, functional polymer</td>
<td>Clear, orange-brown</td>
<td>–2000 CP @25°C</td>
<td>High temps: 2 hrs @ 200°C; 1 hr @ 250°C + reflow cycles at 260°C*</td>
</tr>
</tbody>
</table>

*Thermal performance varies by wafer construction. Wafer evaluations should be used to validate performance in process.

Release Layer

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Composition</th>
<th>Color</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M™ Light-To-Heat-Conversion (LTHC) Release Coating</td>
<td>Thermoplastic resin</td>
<td>Black in solution; semi-transparent grey as coating</td>
<td>Allows clean release of adhesive/glass bond upon laser irradiation</td>
</tr>
</tbody>
</table>

Adhesive Removal

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Backing</th>
<th>Adhesive</th>
<th>Color</th>
<th>Standard Roll Length</th>
<th>Tape Thickness</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M™ Wafer De-Taping Tape 3305</td>
<td>Polyester</td>
<td>Rubber</td>
<td>Translucent cream</td>
<td>100 meters (109 yards)</td>
<td>2.7 mils (0.069 mm)</td>
<td>High instant adhesion. Allows for smooth unwind of roll.</td>
</tr>
</tbody>
</table>

Important Notice: Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use.

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