Product Description
DuPont™ GreenTape™ 951 is a low-temperature cofired ceramic tape. Green Tape™ 951 system comprises a complete cofireable family of gold and silver metallizations, buried passives, and encapsulants. GreenTape™ 951 is available in multiple thicknesses and is designed for use as an insulating layer in:
- Multichip modules
- Single chip packages
- Ceramic printed wiring boards
- RF modules

The GreenTape™ 951C2, GreenTape™ 951PT, GreenTape™ 951P2 and GreenTape™ 951PX products are provided on a base film with improved punching characteristics.

Product Benefits
When used with compatible metallizations, GreenTape™ 951 offer the following benefits:
- Component integration – buried resistors, capacitors, and inductors
- Hermetic packaging
- Low temperature brazing
- Cavities
- High density interconnections
- Cofire processing and refire stability

System Capability
The GreenTape™ 951 system is designed to deliver line and space resolution of 100 µm, via diameters of 100 µm, and maximum layer counts in excess of 100.

Printing
Following blanking and preconditioning of GreenTape™ 951 green sheets, print compatible compositions directly onto unfired GreenTape™ 951 using thick film printing methods and a vacuum stone or other support structure that uniformly distributes vacuum. Follow specific printing and drying recommendations described on individual composition product data sheets.

Inspection
Inspect via, conductor and other prints prior to collation and lamination.

Typical Process Flow

Processing Design
For detailed recommendations on use of GreenTape™ 951, see the GreenTape™ Design and Layout Guidelines (GreenTape™ 951 section). For compatible metallizations and their recommended use see the GreenTape™ 951 Product Selector Guide.
Lamination and Firing
Laminate multiple sheets of DuPont™ GreenTape™ 951 low-temperature cofired ceramic tape according to processing parameters detailed in the GreenTape™ Design and Layout Guidelines (GreenTape™ 951 section). Recommended parameters for lamination are 3000 psi at 70°C for 10 minutes. Cofire laminates of 951 using the recommended firing profile and a belt or box furnace.

Post-fire Processing
Print compatible compositions onto cofired substrate surface and refire.

Singulation
Singulate multi-up substrates either in the green state using a hot-knife or after cofire using either a diamond saw (preferred) or laser scribe.

Storage and Shelf Life
Tape rolls, or boxes of sheeted tape, should be stored tightly sealed in a clean, stable environment at room temperature (<25°C). Shelf life of material in unopened containers is six months.

Safety and Handling
For Safety and Handling information pertaining to this product, read the Material Safety Data Sheet (MSDS).

Typical Tape Properties

<table>
<thead>
<tr>
<th>Test</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td></td>
</tr>
<tr>
<td>Unfired Thickness (µm)</td>
<td>50 ± 3 (951C2)</td>
</tr>
<tr>
<td></td>
<td>114 ± 8 (951PT)</td>
</tr>
<tr>
<td></td>
<td>165 ± 11 (951P2)</td>
</tr>
<tr>
<td></td>
<td>254 ± 13 (951PX)</td>
</tr>
<tr>
<td>X, Y Shrinkage (%)</td>
<td>12.7 ± 0.3 (951 PT, P2, PX)</td>
</tr>
<tr>
<td>Z Shrinkage (%)</td>
<td>13.0 ± 0.2 (951C2)</td>
</tr>
<tr>
<td>TCE(25 to 300°C), ppm/ºC</td>
<td>5.8</td>
</tr>
<tr>
<td>Density (g/cm³)</td>
<td>3.1</td>
</tr>
<tr>
<td>Camber, inch/inch</td>
<td>Conforms to setter</td>
</tr>
<tr>
<td>Surface Roughness, µm</td>
<td>&lt;0.34</td>
</tr>
<tr>
<td>Thermal Conductivity, W/m-K</td>
<td>3.3</td>
</tr>
<tr>
<td>Flexural Strength, MPa (1)</td>
<td>230</td>
</tr>
<tr>
<td>Young’s Modulus, GPa</td>
<td>120</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
</tr>
<tr>
<td>Dielectric constant @ 3 GHz (2)</td>
<td>7.8 ± 0.2</td>
</tr>
<tr>
<td>Dielectric constant @ 10 GHz (3)</td>
<td>7.5 ± 0.2</td>
</tr>
<tr>
<td>Loss Tangent @ 3 GHz</td>
<td>0.006</td>
</tr>
<tr>
<td>Insulation resistance at 100VDC,Ω</td>
<td>&gt;10¹²</td>
</tr>
<tr>
<td>Breakdown voltage, V/µm</td>
<td>&gt; 1000/25</td>
</tr>
</tbody>
</table>

Notes:
(1) Four point bend
(2) T-resonator with gold conductor
(3) Split cavity measurement method

This table shows anticipated typical physical properties for GreenTape™ 951 based on specific controlled experiments in our labs and are not intended to represent the product specifications, details of which are available upon request.
For more information on DuPont™ GreenTape™ 951 or other DuPont Microcircuit Materials products, please contact your local representative:

**Americas**
DuPont Microcircuit Materials
14 T.W. Alexander Drive
Research Triangle Park, NC 27709
Tel.: 800-284-3382

**Europe**
Du Pont (U.K.) Limited
Coldharbour Lane
Bristol BS16 1QD
U.K.
Tel.: 44-117-931-3191

**Asia**
DuPont Kabushiki Kaisha
Sanno Park Tower, 11-1
Nagata-cho 2-chome
Chiyoda-ku, Tokyo 100-611
Japan
Tel.: 81-3-5521-8650

DuPont Taiwan Ltd
45, Hsing-Pont Road,
Taoyuan, Taiwan 330
Tel.: 886-3-377-3616

DuPont China Holding Co. Ltd
Bldg 11, 399 Keyuan Rd., Zhangji Hi-Tech Park,
Pudong New District, Shanghai 201203, China
Tel.: 86-21-6386-6366 ext.2202

DuPont Korea Inc.
3~5th Floor, Asia tower #726,
Yeoksam-dong, Gangnam-gu
Seoul 135-719, Korea
Tel.: 82-10-6385-5399

E. I. DuPont India Private Limited
7th Floor, Tower C, DLF Cyber Greens,
Sector-25A, DLF City, Phase-III,
Gurgaon 122 002 Haryana, India
Tel.: 91-124-4091818

Du Pont Company (Singapore) Pte Ltd
1 HarbourFront Place, #11-01
HarbourFront Tower One,
Singapore 098633
Tel.: 65-6586-3022

http://www.mcm.dupont.com