



## WAFER LEVEL ENCAPSULATION

### LIQUID COMPRESSION MOLD (LCM) AND PRINTABLE ENCAPSULANT

As the geometry of electronic devices gets thinner and smaller, the processing requirements for semiconductor packaging become more and more challenging. For Wafer Level Packaging (WLP), there is a strong demand for overall warpage reduction in order to improve wafer handling, increase process UPH and achieve higher yields. The warpage issue is driven by the reduced package dimensions and the nature of CTE mismatch between thermoset encapsulant and silicon wafer. Henkel recently developed a new platform of anhydride-free encapsulant materials that can be used for molding or printing applications.

#### KEY BENEFITS OF HENKEL LCM

- Low viscosity for easy flow and better fill
- Better handling, no dust
- Ultra-low warpage, low CTE & low modulus for water handling & processing
- Low temperature and fast in-mold cure for increased UPH
- EU REACH compliant anhydride-free

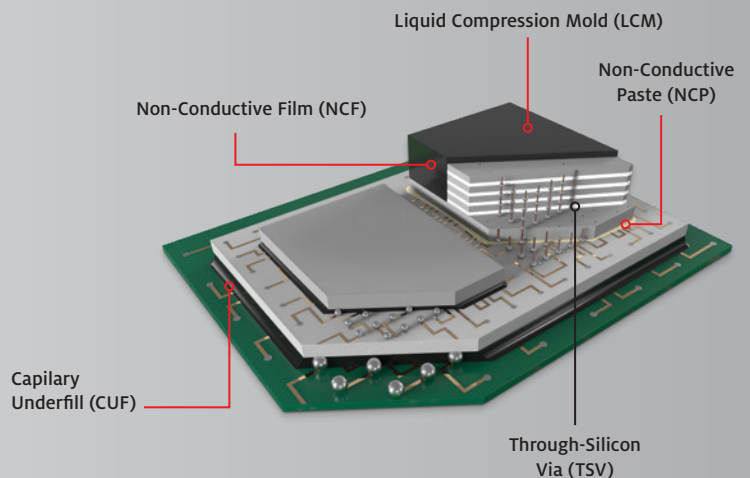
#### KEY APPLICATIONS

##### Chip-on-Wafer (CoW)

- 2.5D
- 3D TSV

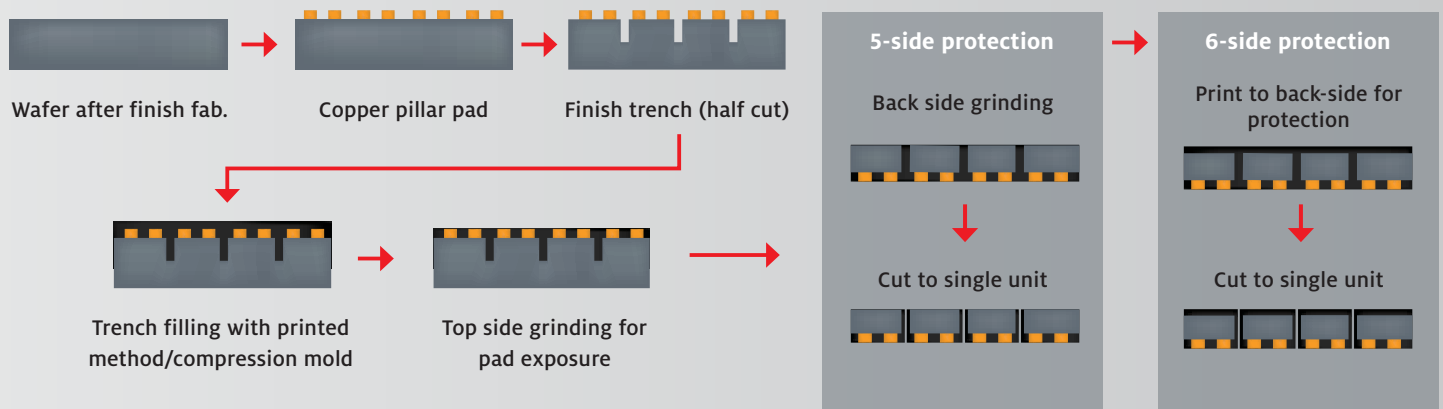
##### WL-CSP (Fan-in)

- 5 or 6-side protection
- Molding or Printing



## Printable Encapsulant for 5 or 6-Side Protection

### Molding Approach – Process Map



## Product Comparison

PRODUCT PROPERTIES	HENKEL'S LCM	OTHER LCM
<b>REACH Compliance Resin</b>	Anhydride-Free System (EU REACH compliant)	Contains Anhydride (EU REACH SVHC list)
<b>Warpage</b>	> 70% reduction (feedback from LCM customers)	Higher warpage observed (feedback from LCM customers)
<b>Gap Fill and Trench Fill</b>	Excellent for narrow gap filling and thin mold cap	Lower trench filling performance
<b>Solvent-Free (Printable EN)</b>	No solvent; Intrinsically no voids	Solvent-based; Voids difficult to remove
<b>Higher UPH</b>	4 min. at 120°C (LCM) 1 hr. at 150°C (Printable EN)	6 – 10 min. at 125°C (LCM) 2 – 3 hr. at 175°C (Printable EN)
<b>Chemical Resistance</b>	Survive (8% TMAH/DMSO at 1 hr. /80°C)	Decomposed
<b>Viscosity Stability</b>	> 24 hr.	~ 8 – 12 hr.

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