



LOCTITE® 3511™

May 2005

PRODUCT DESCRIPTION

LOCTITE® 3511™ provides the following product characteristics:

Technology	Epoxy
Chemical Type	Epoxy
Appearance (uncured)	Brown liquid ^{LMS}
Components	One component - requires no mixing
Cure	Heat cure
Cure Benefit	Production - high speed curing
Application	Underfill for flip chip devices
Dispense Method	Syringe
Key Substrates	SMD components to PCB
Reworkable	No

LOCTITE® 3511™ is a single component, epoxy adhesive designed for use as an underfill for CSP (FBGA) or BGA. It cures rapidly on exposure to heat. It is designed to give excellent protection of printed circuit boards from soldering failure due to impact and thermal cycling. The low viscosity allows filling in gaps under CSP or BGA.

TYPICAL PROPERTIES OF UNCURED MATERIAL

Specific Gravity @ 25 °C	1.17
Viscosity, Cone & Plate, mPa·s (cP), Temperature: 25 °C, Shear Rate: 36 s ⁻¹	3,000 to 5,500 ^{LMS}
Flash Point - See MSDS	

RECOMMENDED CURING CONDITIONS

15 minutes @ 120 °C
30 minutes @ 100 °C

Note: With all fast cure systems, the time required for cure depends on the rate of heating. Conditions where a hot plate or heat sink is used are optimum for fastest cure. Cure rates depend on the mass of material to be heated and intimate contact with the heat source. Use suggested cure conditions as general guidelines. Other cure conditions may yield satisfactory results.

TYPICAL PROPERTIES OF CURED MATERIAL

Cured for 1 hour @ 100 °C

Physical Properties:

Density @ 25 °C, g/cm ³	1.19
Shrinkage, %	2.4
Shore Hardness, ISO 868, Durometer D	88
Glass Transition Temperature, °C: (T _g) by TMA, ASTM E 1545	110
Coefficient of Thermal Expansion, ASTM E 831, K ⁻¹ : Pre T _g (alpha 1)	60×10 ⁻⁶
Post T _g (alpha 2)	180×10 ⁻⁶
Coefficient of Thermal Conductivity, ASTM E 1530, W/(m·K)	0.22
Water Absorption, ISO 62, %: 24 hours in water @ 25 °C	0.12
Elongation, at break, ISO 527, %	4.7

Tensile Strength, at break, ISO 527	N/mm ² 50 (psi) (7,250)
Tensile Modulus, ISO 527	N/mm ² 7,900 (psi) (1,145,800)

Electrical Properties:

Dielectric Breakdown Strength, IEC 60243-1, kV/mm	22
Volume Resistivity, IEC 60093, Ω·cm	61×10 ¹⁵
Surface Resistivity, IEC 60093, Ω	30×10 ¹⁵
Dielectric Constant / Dissipation Factor, IEC 60250: 0.001 MHz	3.6 / 0.019
1 MHz	3.4 / 0.024
10 MHz	3.3 / 0.029

TYPICAL PERFORMANCE OF CURED MATERIAL

Cured for 1 hour @ 100 °C, tested @ 22 °C

Lap Shear Strength, ISO 4587:

Mild steel (grit blasted)	N/mm ² ≥10 ^{LMS} (psi) (≥1,450)
G-10 Epoxyglass	N/mm ² 23 (psi) (3,335)

GENERAL INFORMATION

For safe handling information on this product, consult the Material Safety Data Sheet (MSDS).

Handling Information

1. Receiving Cold Shipments

All shipping boxes are packed with cold gel packs to maintain temperature below 8 °C during transit.

2. Temperature Equilibration

A new package of material can be brought to ambient conditions by allowing to stand at room temperature (22±2 °C) for 1 to 2 hours (actual time required will vary with package size / volume).

Do not loosen container lids, caps or covers: syringe packs must be allowed to equilibrate in tip down orientation. Heat must never be used as partial polymerization (curing) could occur.

Directions for use

Load product into dispensing equipment. A variety of application equipment types are suitable and include: hand dispense / time pressure valve; auger style valve; linear piston pump and jet valve. Selection of equipment should be determined by application requirements - for advice on equipment selection and process optimization, users should contact their Technical Service Center.

1. Ensure that air is not introduced to product during equipment set-up.
2. For best results, the substrate should be preheated (typically to 40 °C for about 20 seconds) to allow fast capillary flow and facilitate leveling.
3. Dispense product at moderate speed (2.5 to 12.7 mm/s). Ensure that needle tip is about 0.025 to 0.076 mm from substrate surface and from chip edge - this will ensure optimal flow conditions for the Underfill.

4. The dispense pattern is typically "I" along one side or "L" pattern along two sides, focused at the corner. Application should start at the location furthest away from the chip center - this helps ensure a void free fill underneath the die. Each leg of the "L" or "I" pattern should not exceed 80 % of the length of each die edge being dispensed.
5. In some cases second or third application of product may be necessary.

Do Not return product to refrigerated storage; any surplus product should be discarded

Loctite Material Specification^{LMS}

LMS dated November 02, 1999. Test reports for each batch are available for the indicated properties. LMS test reports include selected QC test parameters considered appropriate to specifications for customer use. Additionally, comprehensive controls are in place to assure product quality and consistency. Special customer specification requirements may be coordinated through Henkel Quality.

Storage

Store product in the unopened container in a dry location. Storage information may be indicated on the product container labeling.

Optimal Storage: 2 °C to 8 °C. Storage below 2 °C or greater than 8 °C can adversely affect product properties.

Material removed from containers may be contaminated during use. Do not return product to the original container. Henkel Corporation cannot assume responsibility for product which has been contaminated or stored under conditions other than those previously indicated. If additional information is required, please contact your local Technical Service Center or Customer Service Representative.

Conversions

$(^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$
 $\text{kV/mm} \times 25.4 = \text{V/mil}$
 $\text{mm} / 25.4 = \text{inches}$
 $\text{N} \times 0.225 = \text{lb}$
 $\text{N/mm} \times 5.71 = \text{lb/in}$
 $\text{N/mm}^2 \times 145 = \text{psi}$
 $\text{MPa} \times 145 = \text{psi}$
 $\text{N}\cdot\text{m} \times 8.851 = \text{lb}\cdot\text{in}$
 $\text{N}\cdot\text{m} \times 0.738 = \text{lb}\cdot\text{ft}$
 $\text{N}\cdot\text{mm} \times 0.142 = \text{oz}\cdot\text{in}$
 $\text{mPa}\cdot\text{s} = \text{cP}$

Trademark usage

Except as otherwise noted, all trademarks in this document are trademarks of Henkel Corporation in the U.S. and elsewhere. ® denotes a trademark registered in the U.S. Patent and Trademark Office.

Reference 1