LOCTITE® 3563™

February 2012

PRODUCT DESCRIPTION

LOCTITE® 3563™ provides the following product characteristics:

Technology	Epoxy
Chemical Type	Epoxy
Appearance (uncured)	Off-white to beige 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® 3563™ is a rapid curing, fast flowing, liquid epoxy designed for use as a capillary flow underfill for packaged ICs, such as CSPs and BGAs. Its rheology is designed to allow it to penetrate gaps as small as 25 µm. When fully cured, it minimizes induced stress at solder joint and thus improves thermal cycling performance.

TYPICAL PROPERTIES OF UNCURED MATERIAL

Specific Gravity @ 25 °C	1.52
Viscosity, Cone & Plate rheometer, 2 ° Cone, mPa·s (cP):	
Temperature: 25 °C, Shear Rate: 5 s^{-1}	5,000 to 12,000[LMS]
Temperature: 25 °C, Shear Rate: 20 s^{-1}	5,000 to 12,000
Capillary Flow Rate, seconds:	
Flow time, 100 °C, glass to glass, 25 µm:	
6.35 mm flow	≤15
12.7 mm flow	≤45[LMS]
25.4 mm flow	≤150
VOC, ASTM D 3960, g/l	<10
Moisture Content, ASTM D 4017, %	0.01
Total Volatile Content, ASTM D 2369, %	<1
Filler Content, %	40
Particle Size, µm:	
Average	1 to 2
Maximum	<10
Pot life @ 22 °C, hours	8 to 12
Flash Point - See MSDS	

Recommended Curing Conditions

>7 minutes @ 150 °C
>5 minutes @ 165 °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

Physical Properties:

Coefficient of Thermal Expansion, ISO 11359-2, K^{-1}:		
Pre Tg (Alpha 1)		35×10^{-6}
Post Tg (Alpha 2)		110×10^{-6}
Glass Transition Temperature, °C:		
(Tg) by DMTA		130
Water Absorption, ISO 62, %:		
2 hours in boiling water		<0.7
24 hours in water @ 22 °C		<0.4
Coefficient of Thermal Conductivity ASTM F 433, W/(m·K)		0.38
Extractable Ionic Content, µg/g:		
Chloride		<30
Potassium		<1
Sodium		<1
Shore Hardness, ISO 868, Durometer D		88
Volume Shrinkage, ASTM D 792, %		<3
Elongation, ISO 527-3, %		3
Tensile Strength, ISO 527-3	N/mm² (psi)	69 (10,000)
Tensile Modulus, ISO 527-3	N/mm² (psi)	2,800 (406,106)

Electrical Properties:

Volume Resistivity, IEC 60093, Ω·cm	1×10^{15}
Surface Resistivity, IEC 60093, Ω	1×10^{15}
Dielectric Breakdown Strength, IEC 60243-1, kV/mm	33.5
Dielectric Constant / Dissipation Factor, IEC 60250:	
1 kHz	3.56 / 0.005
10 kHz	3.53 / 0.009
100 kHz	3.46 / 0.014

TYPICAL PERFORMANCE OF CURED MATERIAL

Adhesive Properties

Cured for 30 minutes @ 150 °C, tested @ 22 °C

Lap Shear Strength, ISO 4587:		
G-10 Epoxyglass:		
0.127 mm gap	N/mm² (psi)	≥11[LMS] (≥1,595)

After 3 weeks @ 85 °C / 85% RH

Lap Shear Strength, ISO 4587:		
G-10 Epoxyglass	N/mm² (psi)	8.5 (1,200)

GENERAL INFORMATION

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

Handling Information

1. **Receiving Frozen Shipments**

   All shipping boxes are packed with dry ice to maintain temperature below -40 °C during transit.

   Due to the extremely low temperature of dry ice, appropriate care and precautions must be taken during

handling operations; thermally insulated gloves should be worn

2. **Thawing**
   To prevent introduction of air voids due to thermal shock, a new delivery of material must be maintained at -40 °C for a minimum period of eight hours before further handling. Following this "warming" period, product can be removed from the freezer and allowed to stand at room temperature (22±2 °C) for one hour: cartridges or syringes can then be removed from inner packages and allowed to equilibrate in tip-down orientation at room temperature (22±2 °C) for 1 to 2 hours before use (actual time required will vary with package size / volume).

   Do not loosen container lids, caps or covers until equilibration is complete. 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 pre-heated (typically to 90 to 100 °C for about 20 seconds) to allow fast capillary flow and facilitate leveling. The dispense nozzle may also be pre-heated (30 to 50 °C maximum) to further increase capillary flow.
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.

For Cleanup

Wipe the surface using a cotton swab soaked with a suitable solvent (e.g. LOCTITE® 7360™ or acetone). Repeat this step with a clean dry cotton swab.

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

Loctite Material Specification[LMS]
LMS dated May 14, 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.
Product shall be ideally stored at ≤-40 °C. 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
(°C x 1.8) + 32 = °F
kV/mm x 25.4 = V/mil
mm / 25.4 = inches
µm / 25.4 = mil
N x 0.225 = lb
N/mm x 5.71 = lb/in
N/mm² x 145 = psi
MPa x 145 = psi
N·m x 8.851 = lb·in
N·m x 0.738 = lb·ft
N·mm x 0.142 = oz·in
mPa·s = cP

Note
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Trademark usage

Reference 1.2