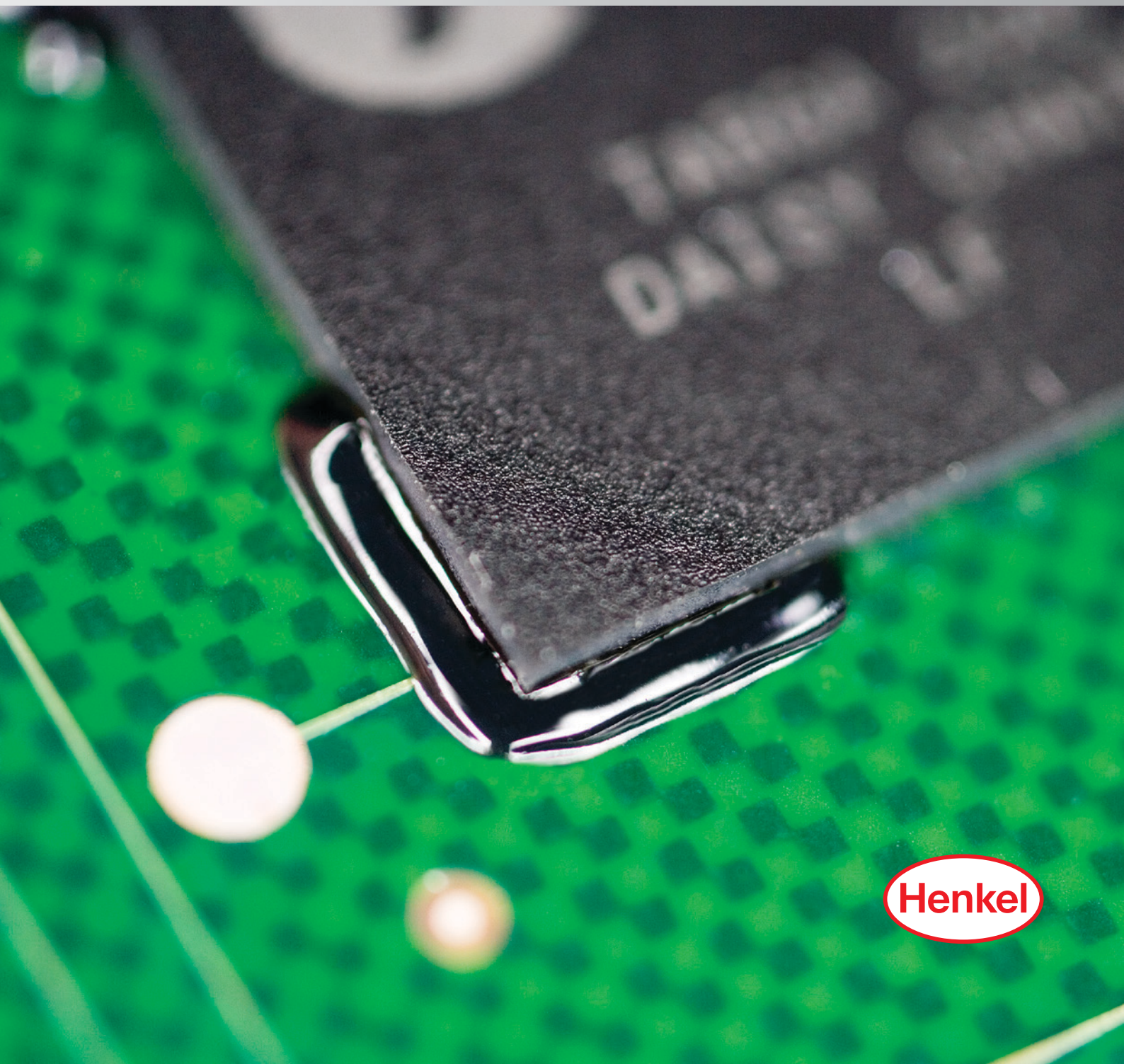
LOCTITE®

BOARD LEVEL

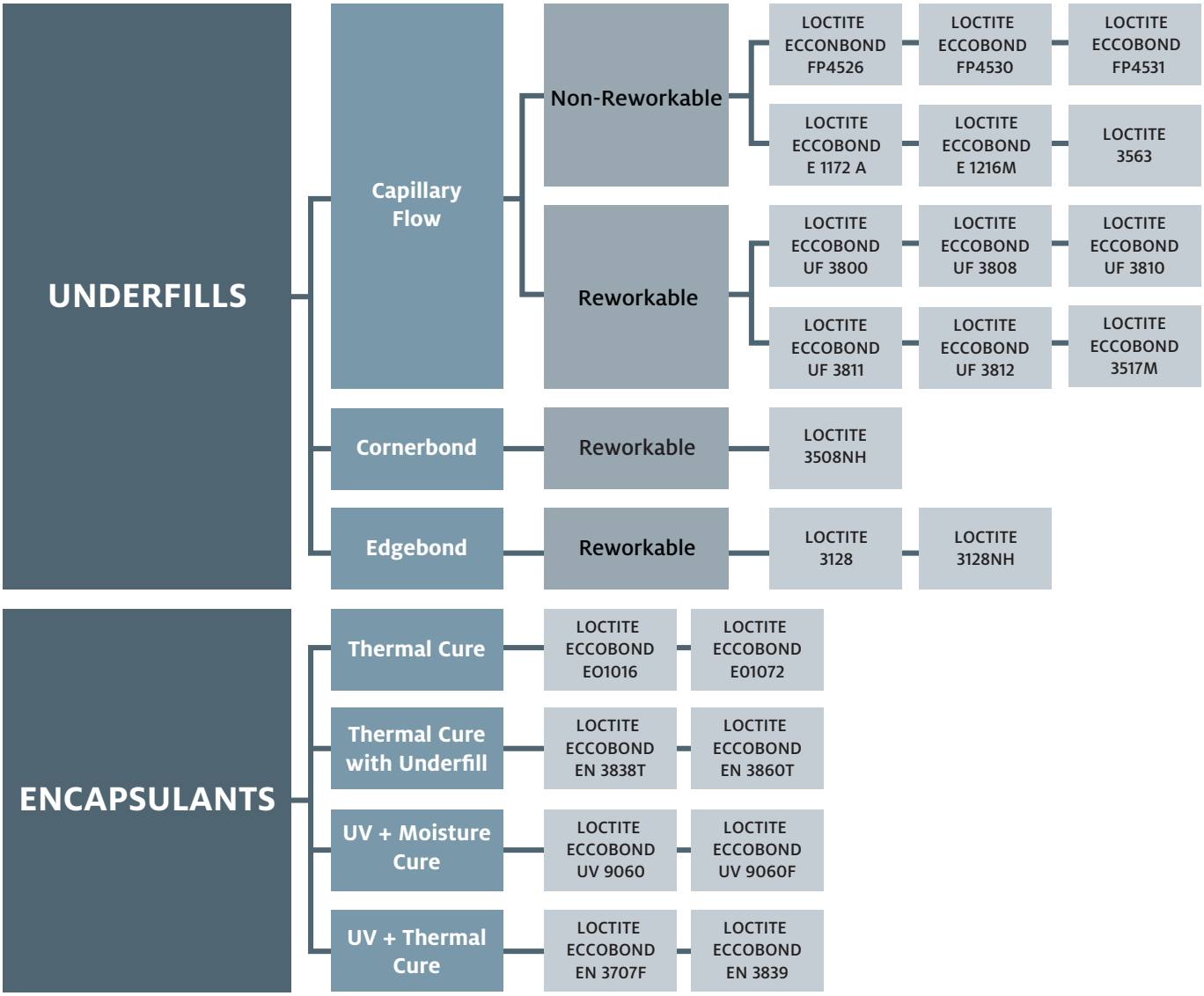
UNDERFILLS AND ENCAPSULANTS



INTRODUCTION

Protection from drop, thermal shock, water and other potentially damaging environmental influences is critical for long-term reliability of electronic products. This is even truer today, as smaller, higher-density designs, finer-pitched devices and increasingly delicate componentry are integrated into advanced assemblies. As the electronics market's premiere materials formulator and supplier, Henkel's expertise in underfill and encapsulant development is providing assembly specialists with materials that offer essential device protection, while accommodating ease-of-use and streamlined processing for safeguarding and reinforcement of BGAs, CSPs, PoPs, LGAs and WLCSPs. Characteristics such as fast cure, room temperature flowability, high reliability, reworkability and excellent SIR performance are built in to Henkel's broad portfolio of underfill, glob top and encapsulant materials, making them ideal for consumer, industrial, automotive, medical and aerospace applications.

PRODUCT PORTFOLIO

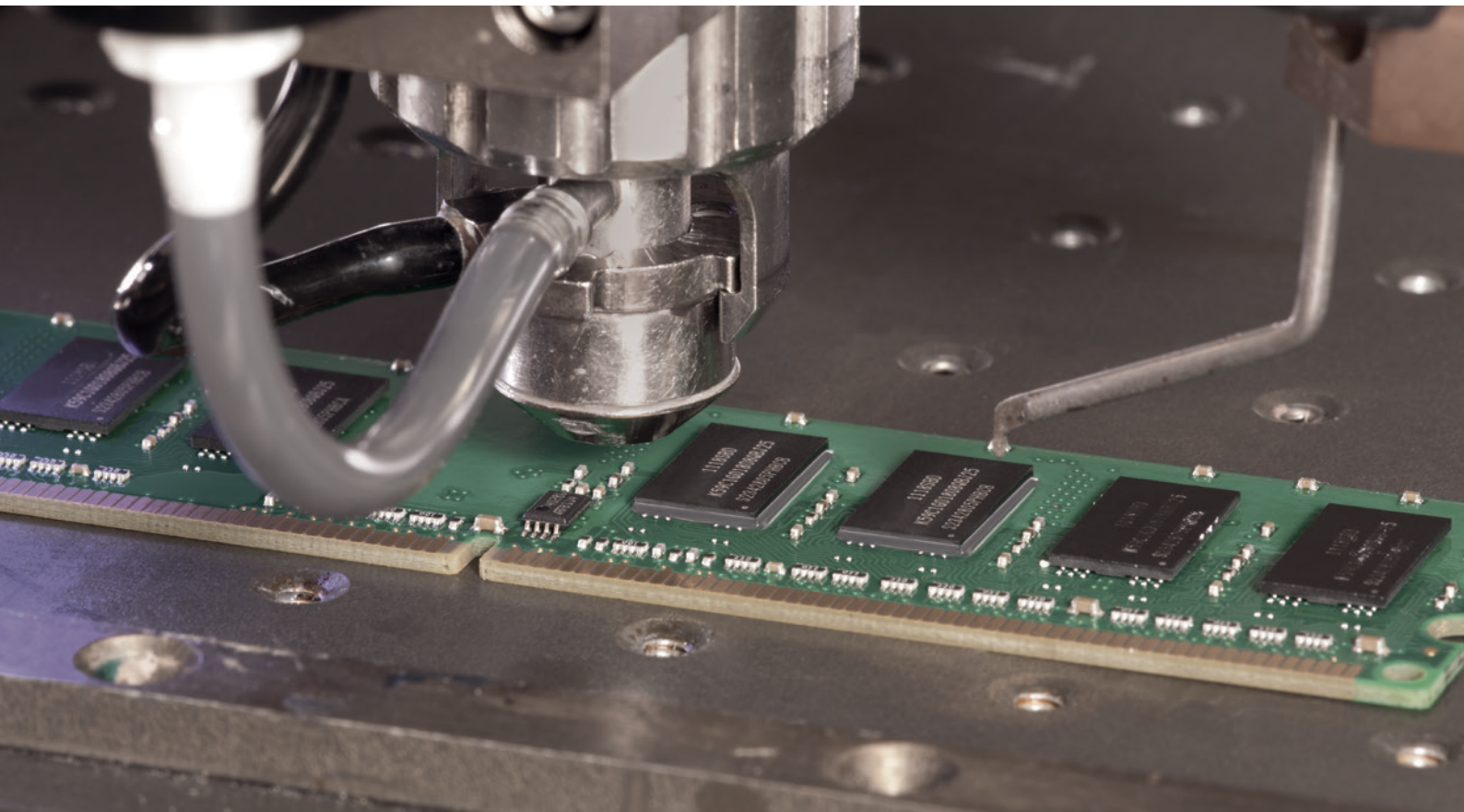


UNDERFILLS

Henkel has designed a broad range of underfill solutions to satisfy a variety of device reinforcement requirements. From capillary flow underfills for BGAs, CSPs, PoPs, LGAs and WLCSPs to materials that enhance flip chip reliability, our formulations alleviate interconnect stress while enhancing thermal and mechanical performance. For applications where full underfill is not required, LOCTITE cornerbond and edgebond technologies provide a cost-effective solution, with strong perimeter reinforcement and self-centering capability

NON-REWORKABLE CAPILLARY UNDERFILLS

Product	Key Attributes	Viscosity	Cure Condition	Reliability Rating	Coefficient Of Thermal Expansion, CTE (ppm/°C)		Glass Transition Temperature, T_g (°C)
					Below T_g	Above T_g	
LOCTITE ECCOBOND FP4526	• For capillary flow on flip chip applications with excellent reliability • Suitable for application that require high thermal cycling performance	4,700 cP at 10 rpm	15 min. at 165°C (heat sink or hot plate)	★★★★★	33	101	133
LOCTITE ECCOBOND FP4530	• For flip chip on flex applications with a 25 µm gap • Material color will change from blue to green when cured	3,500 cP at 20 rpm	7 min. at 160°C	★★★★★	46	150	145
LOCTITE ECCOBOND FP4531	• For flip chip on flex applications with a 25 µm gap	10,000 cP at 20 rpm	7 min. at 160°C	★★★★★	28	104	161
LOCTITE ECCOBOND E 1172 A	• For use with very fine area array devices with 25 µm geometries where transparent processing is critical • Uniform and void-free encapsulant underfill • minimizes induced stress at the solder joint to improve thermal cycling performance	17,000 cP at 5 rpm	6 min. at 135°C	★★★★★	27	85	135
LOCTITE ECCOBOND E 1216M	• For high volume assembly operations requiring a very fast flowing underfill that fully cures in a single reflow cycle, but is stable enough to be easily shipped and used in large volume cartridges • Formulated to eliminate anhydride-type curing agents	4,000 cP at 20 rpm	10 min. at 130°C	★★★★★	35	131	125
LOCTITE 3563	• Rapid curing, fast flowing, liquid epoxy designed for packaged integrated circuits such as CSPs and BGAs • Can penetrate gaps as small as 25 µm • When fully cured, it minimizes induced stress at the solder joint to improve thermal cycling performance	5,000 – 12,000 cP at 20 s^{-1}	7 min. at 150°C	★★★★☆	35	110	130



REWORKABLE CAPILLARY UNDERFILLS

Product	Key Attributes	Viscosity	Cure Condition	Reliability Rating	Reworkability Rating	Coefficient Of Thermal Expansion, CTE (ppm/°C)		Glass Transition Temperature, T_g (°C)
						Below T_g	Above T_g	
LOCTITE ECCOBOND UF 3800	• Designed for CSP and BGA applications • Cures quickly at moderate temperatures to minimize stress to other components • Good mechanical stress protection for solder joints	375 cP at 1000 s^{-1}	8 min. at 130°C	★★★☆☆	★★★★★	52	188	69
LOCTITE ECCOBOND UF 3808	• Cures quickly at low temperatures to minimize stress to other components • Excellent mechanical properties protect solder joints during thermal cycling	360 cP at 1000 s^{-1}	8 min. at 130°C	★★★★☆	★★★☆☆	55	171	113
LOCTITE ECCOBOND UF 3810	• Higher T_g version of LOCTITE ECCOBOND UF 3800 • Designed for CSP and BGA applications • Cures quickly at moderate temperatures to minimize stress to other components • Excellent mechanical properties protect solder joints during thermal cycling	394 cP at 1000 s^{-1}	8 min. at 130°C	★★★☆☆	★★★★☆	55	171	102
LOCTITE ECCOBOND UF 3811	• Designed for CSP and BGA applications • Low viscosity material flows at room temperature with no additional preheating required • Cures quickly at moderate temperatures to minimize stress to other components • High T_g while maintaining flexibility in order to protect solder joints during thermal cycling and drop testing	354 cP at 1000 s^{-1}	10 min. at 130°C	★★★☆☆	★★★★☆	61	190	124
LOCTITE ECCOBOND UF 3812	• Designed for CSP, WLCSP and BGA applications • Low viscosity material flows at room temperature with no additional preheating required • Cures quickly at moderate temperatures to minimize stress to other components • High T_g and high fracture toughness enable excellent protection of solder joints during thermal cycling	350 cP at 1000 s^{-1}	10 min. at 130°C	★★★★☆	★★★★☆	48	175	131

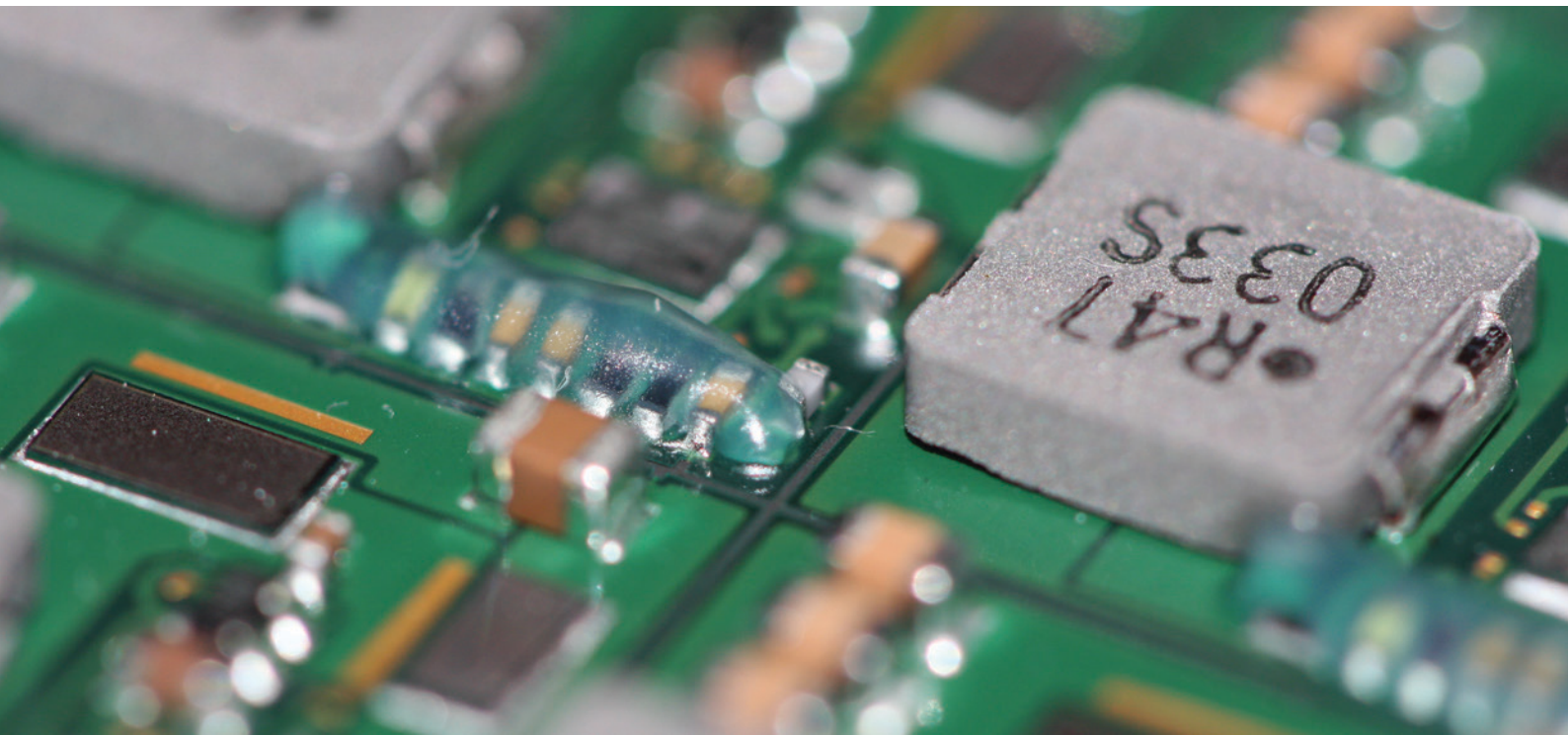
CORNERBOND AND EDGEBOND UNDERFILLS

Product	Key Attributes	Viscosity	Cure Condition	Reliability Rating	Reworkability Rating	Coefficient Of Thermal Expansion, CTE (ppm/°C)		Glass Transition Temperature, T_g (°C)
						Below T_g	Above T_g	
Cornerbond								
LOCTITE 3508NH	• Designed to cure during Pb-free solder reflow while allowing self-alignment of components • Can be pre-applied to the board at the corners of the pad site using a standard surface mount adhesive dispenser	70,000 cP at 36 s^{-1}	Lead-free profile at 245°C	★★★☆☆	★★★☆☆	65	175	118
Edgebond								
LOCTITE 3128	• One-part epoxy • Excellent adhesion on a wide range of materials in considerably short time • Typical applications include memory cards and image sensors • Low-temperature cure is ideal for heat sensitive components	35,000 cP at 5 rpm	20 min. at 80°C	★★★☆☆	★★★★☆	40	130	45
LOCTITE 3128NH	• Designed to add reliability to CSPs and other electronic components • Low-temperature cure is ideal for heat sensitive components	35,000 cP at 5 rpm	20 min. at 80°C	★★★☆☆	★★★★☆	40	130	45

ENCAPSULANTS

Henkel's epoxy-, acrylate- and silicone-based liquid glob tops and encapsulants deliver protection from moisture, water and solder overflow during thermal processing, while reinforcing mechanical strength. Highly versatile and adaptable, our materials provide excellent flow control, strong adhesion to a variety of substrates and can be cured with UV or heat.

Product	Key Attributes	Viscosity		Thixotropic Index	Reliability Rating	Reworkability Rating
		Measurement	Test Method			
Thermal Cure						
LOCTITE ECCOBOND EO1016	• Epoxy encapsulant with excellent handling properties • Cured material survives severe thermal shock and offers continuous service to 177 °C • Particularly suited for use on transistors and similar semiconductors • Can be used for encapsulation of watch integrated circuits	62,000 cP at 2 rpm	Brookfield Spindle 6	1.1 (2/20 rpm)	★★★★★	★☆☆☆☆
LOCTITE ECCOBOND EO1072	• Unique rheology allows the same product to be used as both a dam and fill encapsulant • For applications requiring excellent handling properties	100,000 cP at 2 rpm	Brookfield Spindle 7	1.25 (2/20 rpm)	★★★★★	★☆☆☆☆
Thermal Cure with Underfill						
LOCTITE ECCOBOND EN 3838T	• Flexible, low T_g material for encapsulating components on a circuit board • Material provides physical protection and stable electronic performance and protection in temperature/humidity/bias testing when cured	6,700 cP at 20 rpm	Brookfield CP51	5.8 (2/20 rpm)	★★★☆☆	★★★★★
LOCTITE ECCOBOND EN 3860T	• CSP/BGA encapsulant formulated to have low viscosity and good flow performance • Cures quickly at low temperatures to minimize thermal stress to other components and provide rapid device throughput	1,000 cP at 1000 s^{-1}	Physica CP50-1	1.0 (2/20 rpm)	★★★★☆	★★★★☆
UV + Moisture Cure						
LOCTITE ECCOBOND UV 9060	• No flow, UV + moisture cure encapsulant designed for local circuit board protection	2,000 cP at 50 s^{-1}	TA Rheometer, 2° cone	4.5 (5/50 s^{-1})	★★★☆☆	★★★☆☆
LOCTITE ECCOBOND UV 9060F	• No flow, UV + moisture cure encapsulant designed for local circuit board protection • Product is fluorescent when viewed with UV light	2,100 cP at 50 s^{-1}	TA Rheometer, 2° cone	5.2 (5/50 s^{-1})	★★★☆☆	★★★☆☆
UV + Thermal Cure						
LOCTITE ECCOBOND EN 3707F	• No flow encapsulant designed for local circuit board protection • Cures in seconds when exposed to the appropriate intensity of UV light • Contains a secondary thermal cure initiator	3,480 cP at 20 rpm	Brookfield CP51	4.1 (2/20 rpm)	★★★★☆	★★★☆☆
LOCTITE ECCOBOND EN 3839	• Flexible, low T_g material for encapsulating components on a circuit board • Provides physical and electrical protection and stable electronic performance in temperature/humidity/bias testing	7,871 cP at 5 rpm	Brookfield CP51	4.1 (0.5/5 rpm)	★★★★☆	★★☆☆☆



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