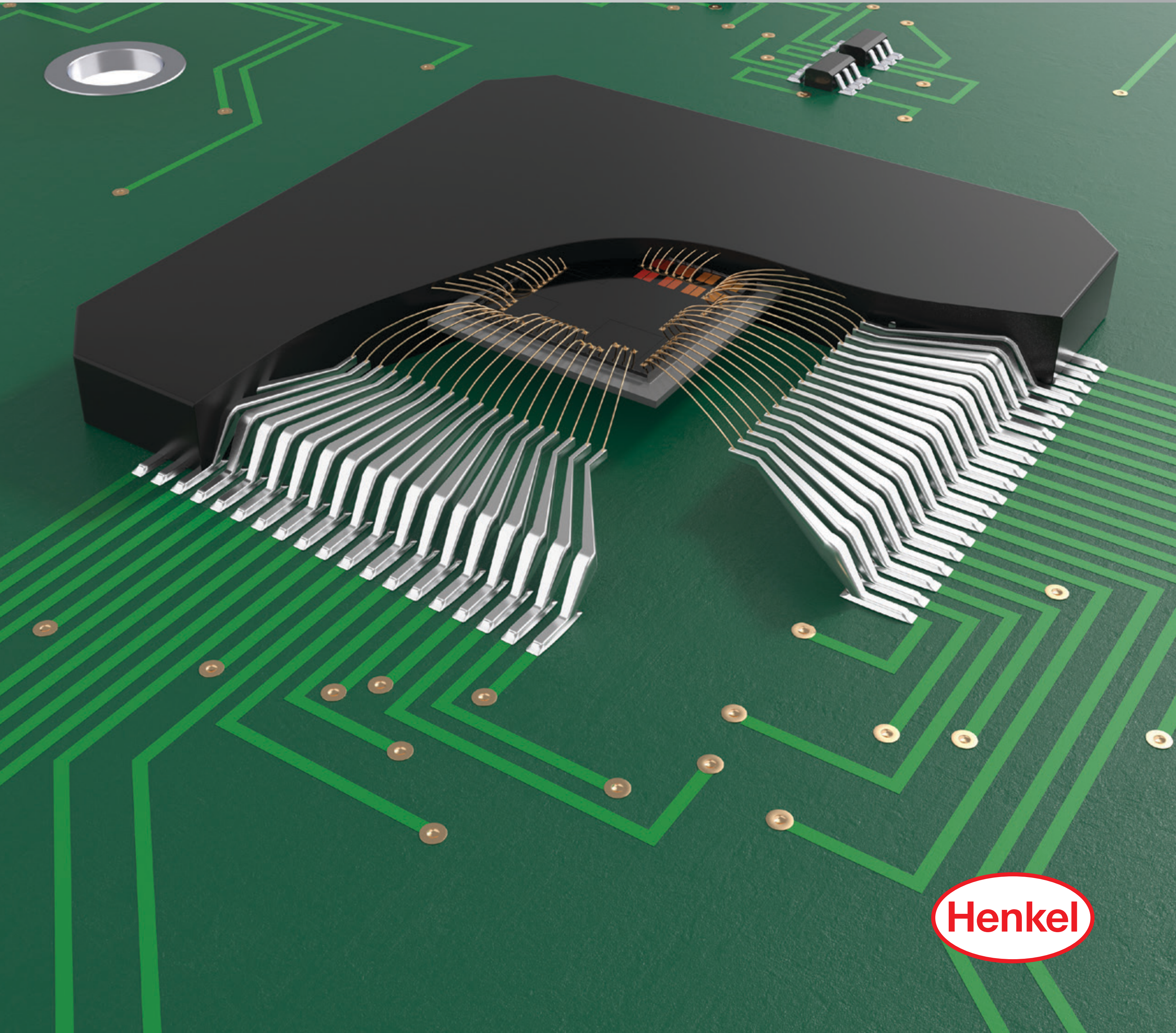
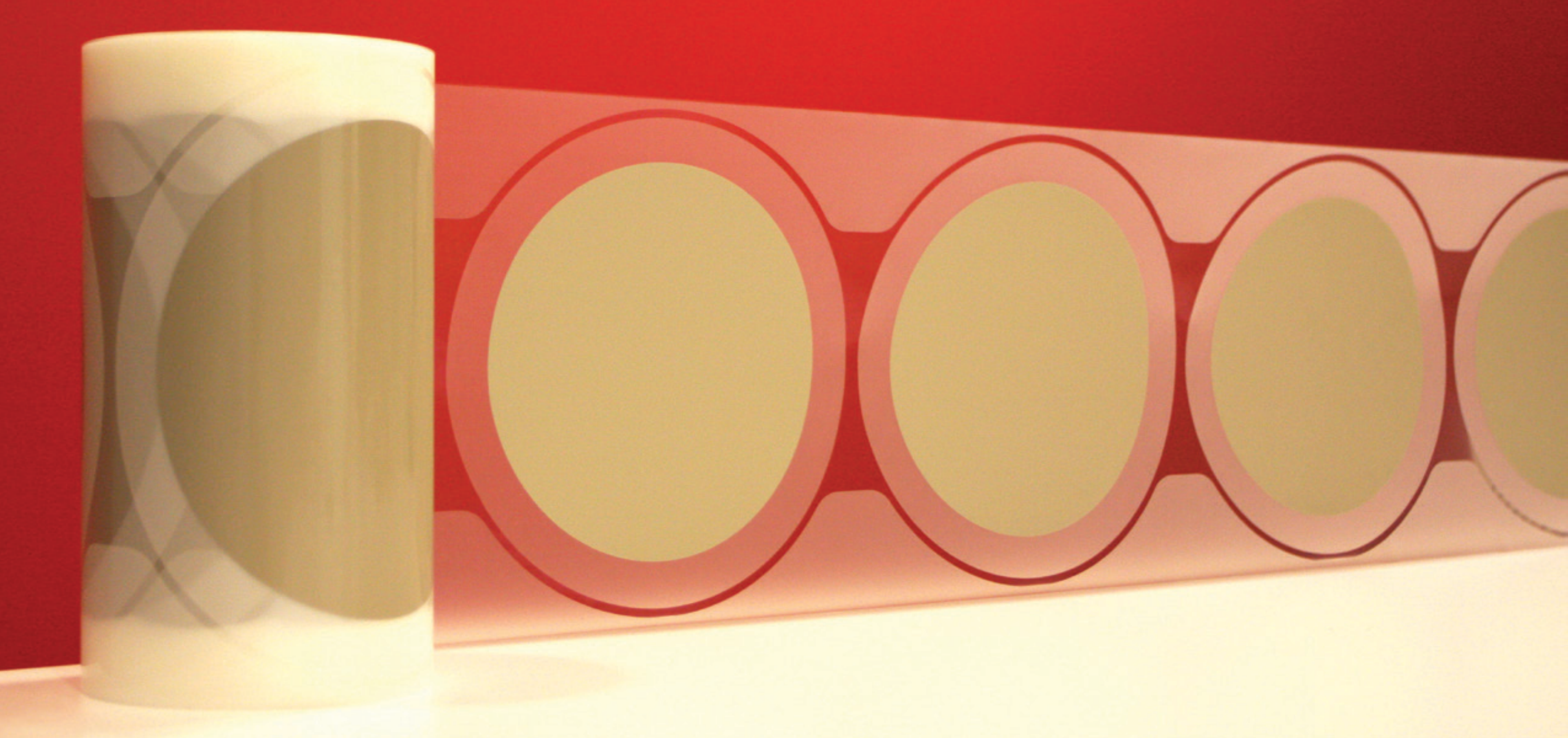
HENKEL'S SOLUTION TO CONTROL FLOW

CONDUCTIVE DIE ATTACH FILM





CONDUCTIVE DIE ATTACH FILM

Henkel was the first to develop and introduce conductive die attach film (CDAF) to the semiconductor market. A groundbreaking market development, this innovation was viewed by the semiconductor industry as a significant breakthrough that would enable more capable and cost-effective lead frame package designs. Indeed, this has been the result, as numerous semiconductor packaging specialists have leveraged Henkel's CDAF advantages for new and better package designs.

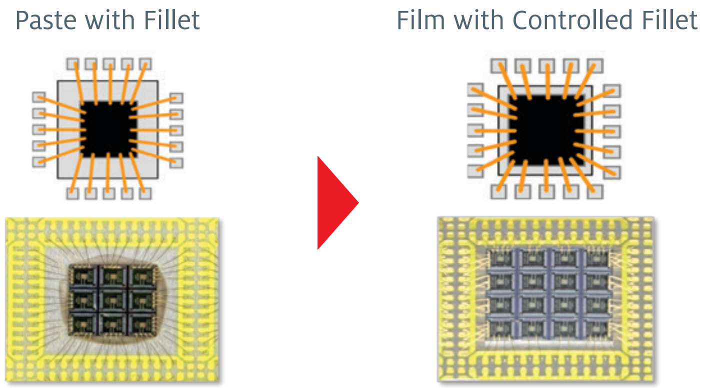
LOCTITE® *ABLESTIK* C100 was the premier material in Henkel's CDAF line, and, since then, the company has expanded the suite of conductive films to address various lead frame and laminate package requirements. Each material offers different properties and characteristics – from dicing die attach capability to varying thermal and electrical performance to cost competitiveness – but all of them deliver the undeniable advantages of film-based materials over that of conventional die attach paste.

Consumers continue to demand ever smaller and more capable devices, and Henkel's CDAF materials are making this ongoing product dynamic possible.

MARKET TRENDS	LIMITATIONS WITH DIE ATTACH PASTE	HENKEL'S CDAF SOLUTIONS
Miniaturized packages with increased die-to-pad ratio (close to 1.0 in some cases)	Fillet and bleed require minimum keep-out zone around the die and a consequently larger die pad size	No fillet or bleed, allowing for smaller die pad size
Higher density, multi-die packages, such as SiP (LGA/PBGA)	Package can fit fewer die with larger die pad sizes	Ability to integrate more die per package due to tight clearance between the die and die pad
Thinner packages due to thinner die	For thinner die, uneven fillet height can lead to kerf creep	No fillet or kerf creep, facilitating thinner die handling
Thinner packages due to thinner bondlines	Especially for smaller die, bondline control is challenging and leads to die tilt	Uniform and consistently thinner bondlines
Faster signal speed	Longer interconnection hinders signal speed	Shorter interconnection enables faster signal speed
Lower total cost of ownership due to materials	Cost of extra Au wire, lead frame and EMC needed to accommodate larger die pad size	Cost savings due to less Au wire, lead frame and EMC used
Lower total cost of ownership due to efficient processes	Challenging to optimize dispense patterns for various die sizes (0.2mm x 0.2mm to over 10mm x 10mm)	No dispensing necessary with precut format in wide die size range

DIE-TO-PAD RATIOS

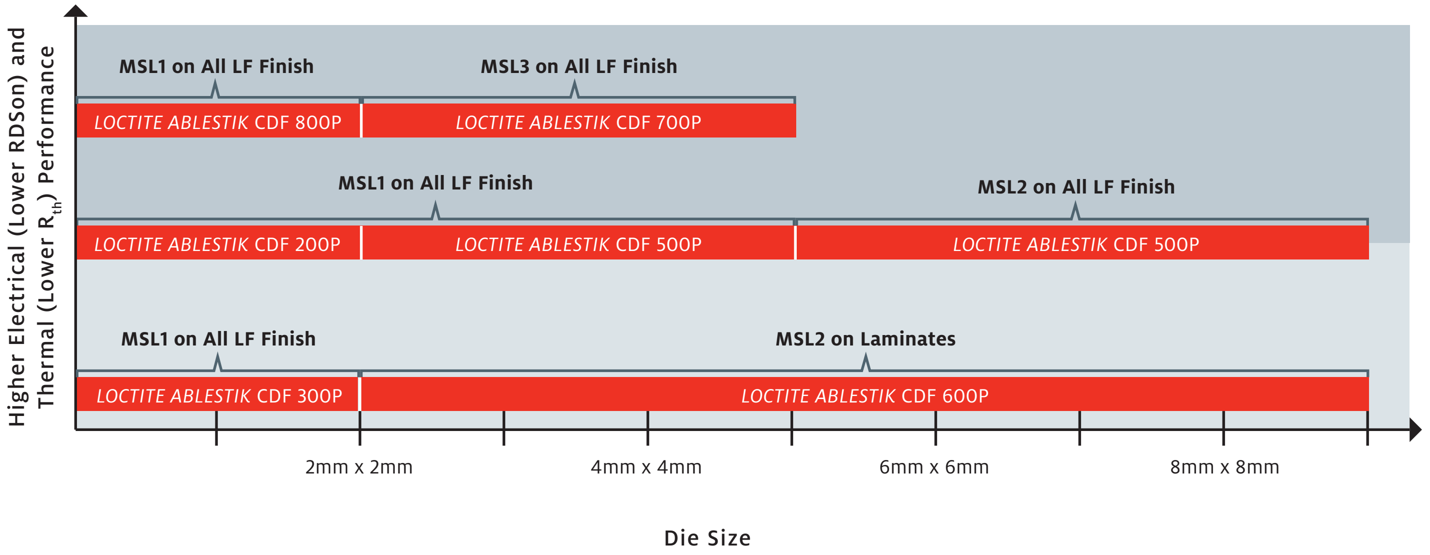
Paste versus film

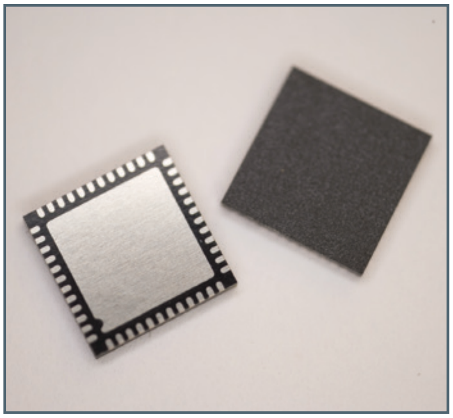


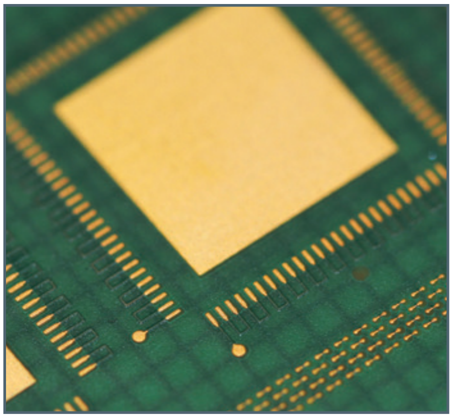
Conductive film technology enables tighter die-to-pad ratio.

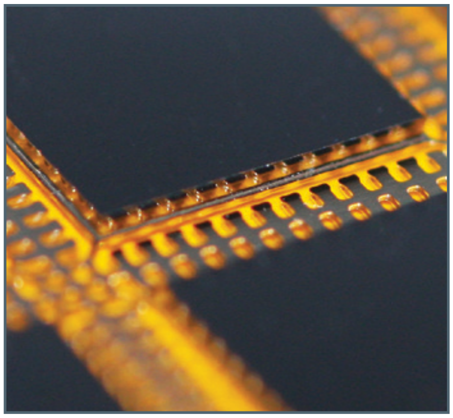
HENKEL'S SOLUTION TO CONTROL FLOW

Product space









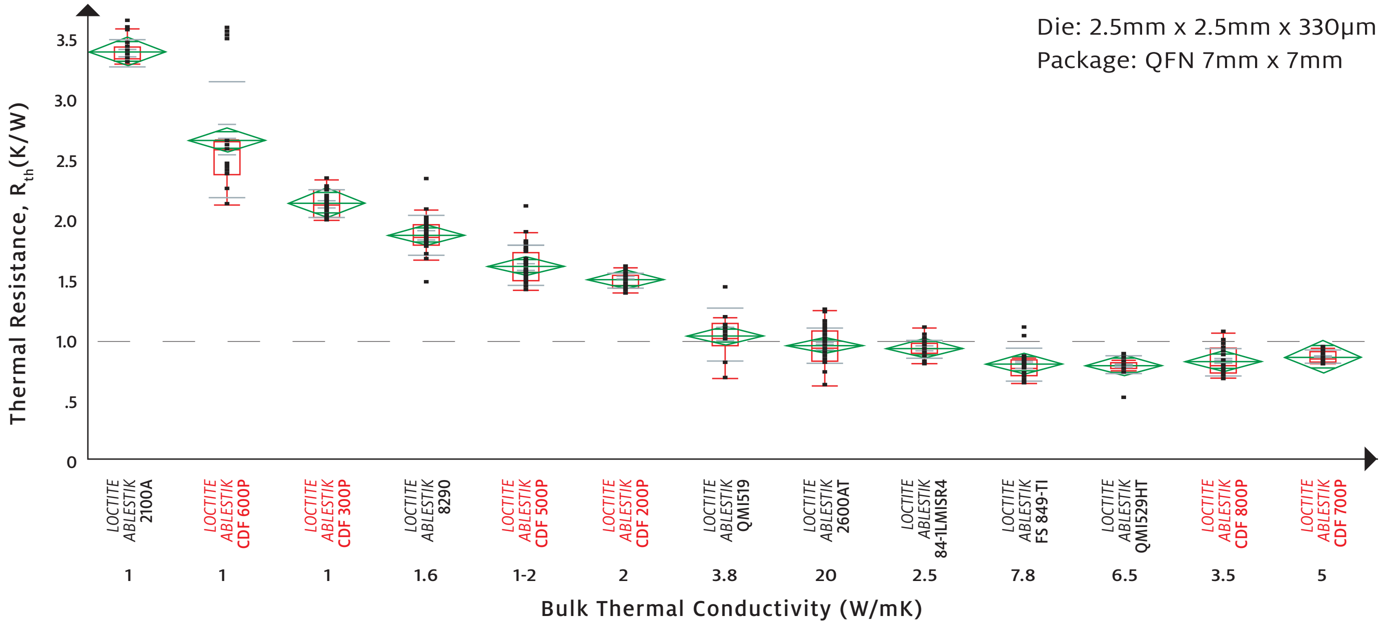
THERMAL PERFORMANCE

Stable in-package performance

- Thermal Conductivity (W/mK) is an intrinsic material property
- Thermal Resistance, R_{th} (K/W), is a geometry-dependent value that allows us to better compare materials in a functional package
- 70% - 90% of the R_{th} is due to the interfaces and is not captured in thermal conductivity values

THERMAL RESISTANCE (R_{th})

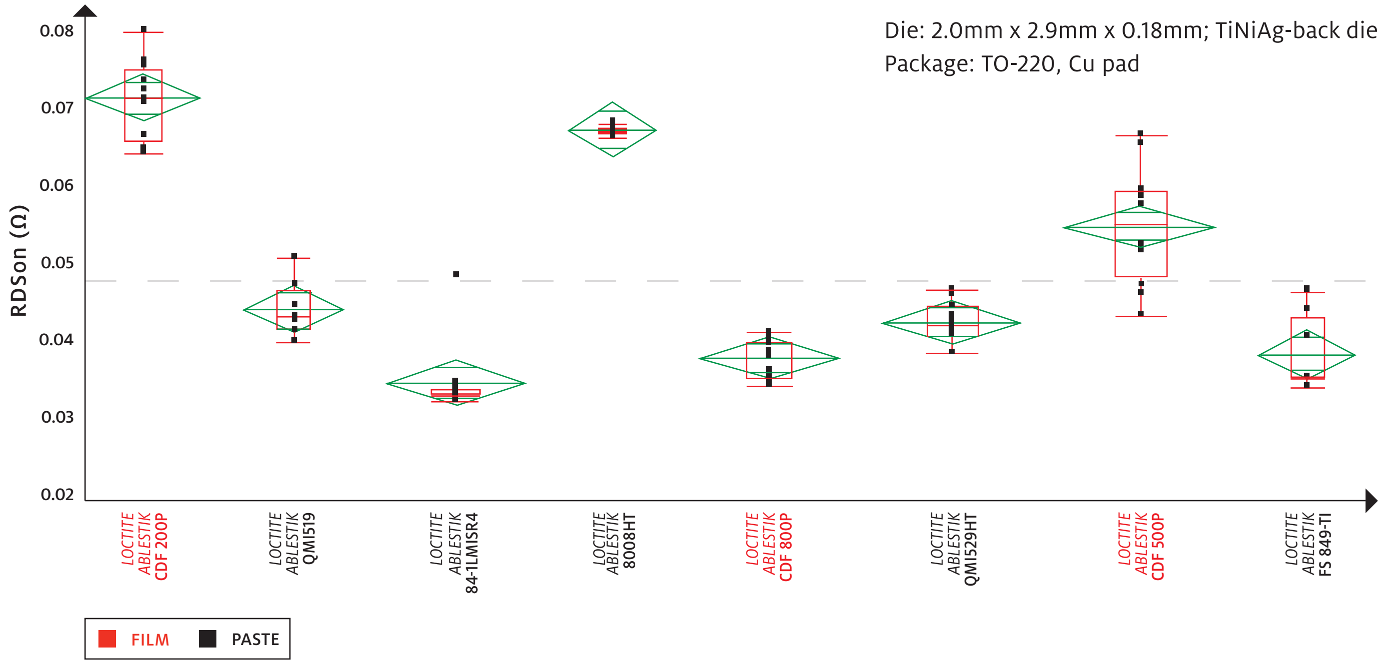
Comparison of paste and film materials



Die: 2.5mm x 2.5mm x 330μm
Package: QFN 7mm x 7mm

ELECTRICAL RESISTANCE (RDSon)

In-package performance comparison of paste and film materials



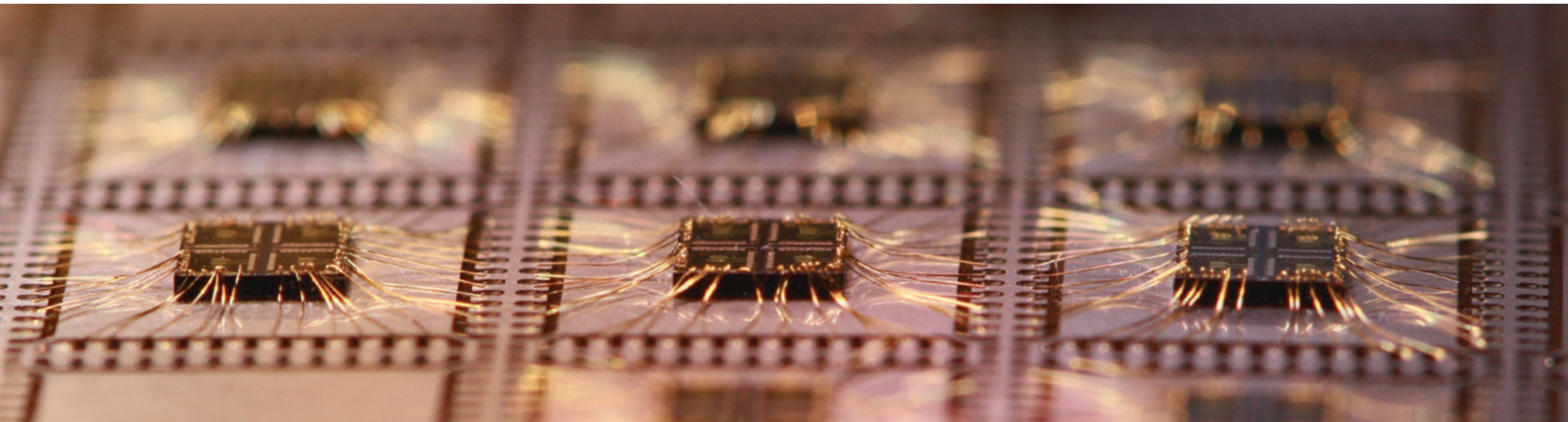
Die: 2.0mm x 2.9mm x 0.18mm; TiNiAg-back die
Package: TO-220, Cu pad

PORTFOLIO OF CDAF PRODUCTS

Film and paste performance comparison

	UNIT	LOCTITE® ABLESTIK CDF 200P	LOCTITE ABLESTIK QMI519	LOCTITE ABLESTIK 8290	LOCTITE ABLESTIK 8008HT	LOCTITE ABLESTIK CDF 800P	LOCTITE ABLESTIK CDF 700P	LOCTITE ABLESTIK QMI529HT	LOCTITE ABLESTIK CDF 500P	LOCTITE ABLESTIK CDF 600P	LOCTITE ABLESTIK 2100A	LOCTITE ABLESTIK CDF 300P
MATERIAL PROPERTY												
Volume Resistivity	Ωcm	0.0014	0.0001	0.008	0.00006	0.0003	0.0002	0.00004	0.0002	0.0008	0.05	0.0010
Thermal Conductivity	W/mK	2	3.8	1.6	11	3.5	5	6.5	1 - 2	1	1.35	1
CTE Alpha1	ppm/C	48	40	81	37	40	35	53	60	75	65	50
CTE Alpha2	ppm/C	120	140	181	62	118	160	156	245	320	200	200
Glass Transition Temperature	°C	15	75	38	264	11	30	3	10	-5	60	10
Modulus @ 25°C	MPa	5,400	5,300	3,034	6,659	7,100	6,400	3,300	6,300	3,000	3,200	5,400
Modulus @ 250°C	MPa	1,000	284	117	2,450	900	200	-	130	40	230	400
PERFORMANCE												
HDSS (260°C) on Ag	kg/mm^2	1.3	0.8	0.6	0.7	1.0	1.0	0.5	0.7	0.7	0.4	0.7
Room Temp. DSS on PPF	kg/mm^2	2.14	4.9	5.0	-	> 2.0	-	-	-	-	-	-
Room Temp. DSS on Ag	kg/mm^2	3.02	4.8	5.1	1.5	> 2.0	-	2.2	-	-	-	-
Room Temp. DSS on Cu	kg/mm^2	3.17	1.8	2.5	1.5	> 2.0	-	-	-	-	-	-
Failure Mode	N/A	Cohesive	Cohesive	Cohesive	-	Cohesive	Cohesive	Cohesive	Cohesive	Cohesive	Cohesive	Cohesive
Thermal Resistance, R_{th}	K/W	1.5	1.3	1.8	1.5	0.81	0.8	0.77	1.5	2.1	2.3	2.1
RDSon	Ωcm	0.075	0.044	-	0.067	0.032	-	0.042	0.055	-	-	0.052
RDSon Shift (500 TC)	%	2.2	-	-	-	5.7	-	42.0	-	-	-	-
RDSon Shift (1,000 TC)	%	6.6	-	-	-	6.4	-	42.0	-	-	-	-
JEDEC MSL 260°C on 7 x 7mm PPF QFN with 2.5 x 2.5 x 0.33mm die	MSL Level	1	MSL1 capable for small die	MSL1 capable for small die	3	1	1	MSL1 capable for small die	1	2 (PBGA)	2 (PBGA)	1
JEDEC MSL 260°C on 7 x 7mm PPF QFN with 5 x 5 x 0.36mm die	MSL Level	2	-	-	-	2	3	-	1	2 (PBGA)	2 (PBGA)	-
PROCESSING												
Cure	Profile	30 min. ramp + 60 min. soak @ 200°C	30 min. ramp + 60 min. soak @ 100°C & 15 min. ramp + 60 min. soak @ 200°C	30 min. ramp + 15 min. soak @ 175°C	20 sec. @ 280°C	30 min. ramp + 60 min. soak @ 200°C	30 min. ramp + 60 min. soak @ 200°C	30 min. ramp + 30 min. soak @ 185°C	30 min. ramp + 60 min. soak @ 200°C	30 min. ramp + 30 min. soak @ 100°C & 30 min. ramp + 60 min. soak @ 200°C	30 min. ramp + 15 min. soak @ 175°C	30 min. ramp + 60 min. soak @ 200°C

FILM **PASTE**



LOCTITE®

AMERICAS

UNITED STATES
Henkel Corporation
14000 Jamboree Road
Irvine, CA 92606
United States
Tel: +1.888.943.6535
Fax: +1.714.368.2265

Henkel Corporation
20021 Susana Road
Rancho Dominguez, CA 90221
United States
Tel: +1.310.764.4600
Fax: +1.310.605.2274

Henkel Corporation
18930 W. 78th Street
Chanhassen, MN 55317
United States
Tel: +1.952.835.2322
Tel: +1.800.347.4572
Fax: +1.952.835.0430

BRAZIL
Henkel Brazil
Av. Prof. Vernon Krieble, 91
06690-070 Itapevi, Sao Paulo
Brazil
Tel: +55.11.3205.7001
Fax: +55.11.3205.7100

ASIA-PACIFIC

CHINA
Henkel Management Center
Building 7, No. 99 Jiang Wan Cheng Road
Shanghai 200438,
China
Tel: +86.21.2891.8000
Fax: +86.21.2891.8952

ABLESTIK (Shanghai) LIMITED
No. 332 Meigui South Road
WaiGaoQiao Free Trade Zone, Pu Dong
Shanghai 200131,
China
Tel: +86.21.2702.5888
Fax: +86.21.5048.4169

JAPAN
Henkel Japan Ltd.
27-7, Shin Isogo-cho
Isogo-ku Yokohama, 235-0017
Japan
Tel: +81.45.286.0161
Email: jp.ae-csdesk@henkel.com

KOREA
Henkel Korea Co Ltd.
18th Floor of tower B, BYC High City Bldg
Gasan Digital 1-ro, Geumcheon-gu,
Seoul, 08506
South Korea
Tel: +82.2.6150.3000
Fax: +82.2.6947.5203

SINGAPORE
Henkel Singapore Pte Ltd.
401, Commonwealth Drive
#03-01/02 Haw Par Technocentre,
Singapore 149598
Tel: +65.6266.0100
Fax: +65.6472.8738 / +65.6266.1161

TAIWAN
Henkel Taiwan Ltd.
10F, No. 866, Zhongzheng Road,
Zhonghe District, New Taipei City, 23586
Taiwan
Tel: +866.2.2227.1988
Fax: +866.2.2226.8699

EUROPE

BELGIUM
Henkel Belgium N.V.
Nijverheidsstraat 7
B-2260 Westerlo
Belgium
Tel: +32.1457.5611
Fax: +32.1458.5530

UNITED KINGDOM
Henkel Ltd.
Adhesives Limited Technologies House
Wood Lane End
Hemel Hempstead
Hertfordshire HP2 4RQ
United Kingdom
Tel: +44.1442.278000
Fax: +44.1442.278071

Across the Board,
Around the Globe.
henkel-adhesives.com/electronics