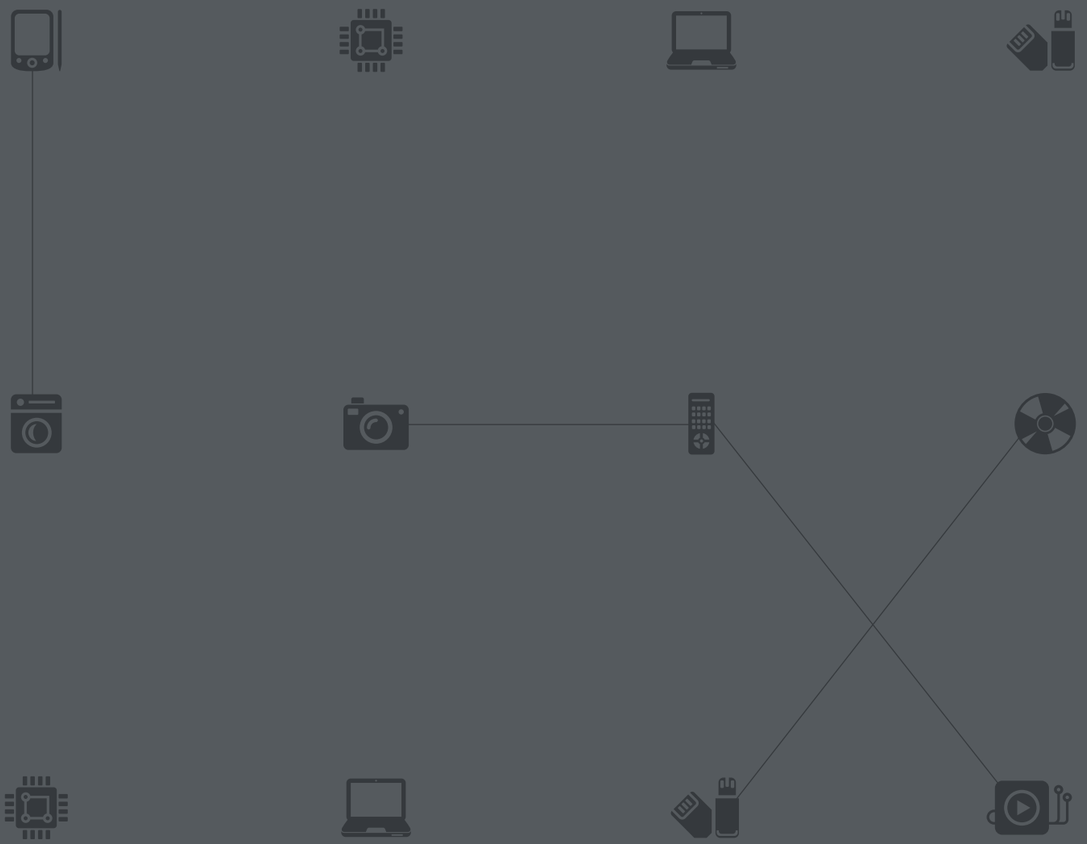

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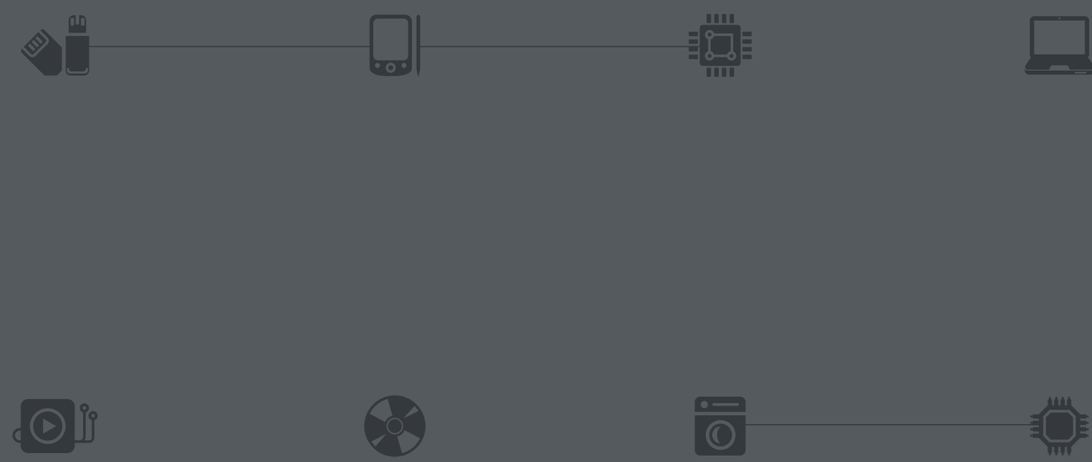

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About KCC

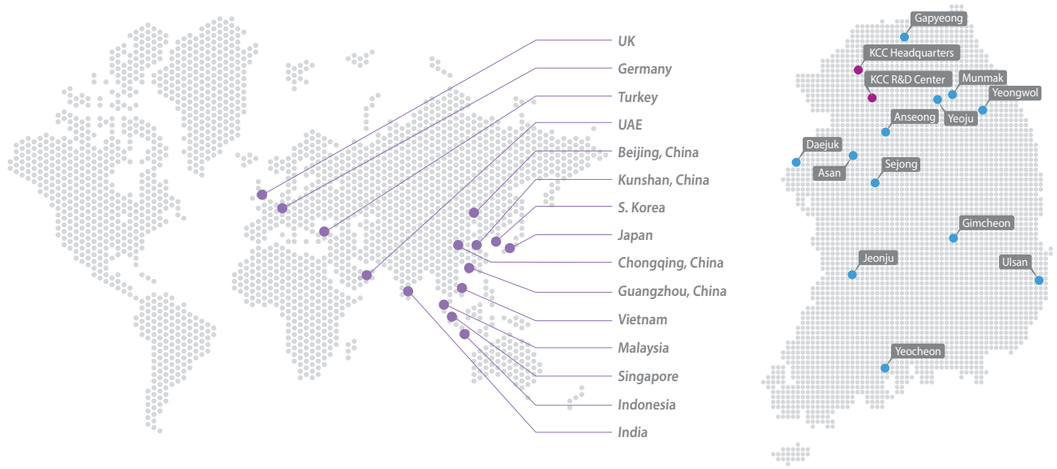
A Precision chemical corporation growing rapidly based on customer's confidence

With state-of-the-art technology and ultra-modern production facilities, KCC seeks for perfection in the quality of its products and customer services. Each and every product that it introduces to its customers on the marketplace is always the result of creative and intensive R&D activities satisfying the diversified customer needs. KCC always remains deeply committed to ever upgrading the living environment by leading the building and industrial materials industry through continued research and development precisely reflecting the market trends and user- wishes.

KCC History

1958 Kumgang Slate Industries established
1973 Kumgang listed stocks
1974 Korea Chemical established. Paint production started
1985 Korea Chemical listed stocks
1985 Gypsum board production started
1987 Float Glass production started
1989 Kumgang Construction Co. established
2000 Kumgang and Korea Chemical Co. merged into Kumgang Korea Chemical Company.
Korea Auto Glass (JV with Asahi Glass) established
2001 Obtained the best credit rating of BBB-from S&P
Obtained the best credit rating of Baa3 from Moody's
2003 The best company among the listing (for profit / Korea Listed Companies Association)
2004 Silicone production started(1st factory : 2004, 2nd factory : 2007)
2005 Company name changed to KCC Corporation
2008 KAM(Korea Advanced Material) established by J/V between KCC and Hyundai Heavy Industries. Polysilicon pilot production started
2009 KCC and KAM polysilicon plants under construction
2010 Mass production of polysilicon to be started
2011 KCC Basildon mergers and acquisitions
2014 Awarded Industrial Service Medal for merit in development of new environmentally friendly housing construction materials
2017 Awarded the Prime Minister's Prize for the "2017 National Sharing Grand Awards"

KCC Domestic and Global Network



KCC, Your Solution Partner

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Ceramic Substrate / AM

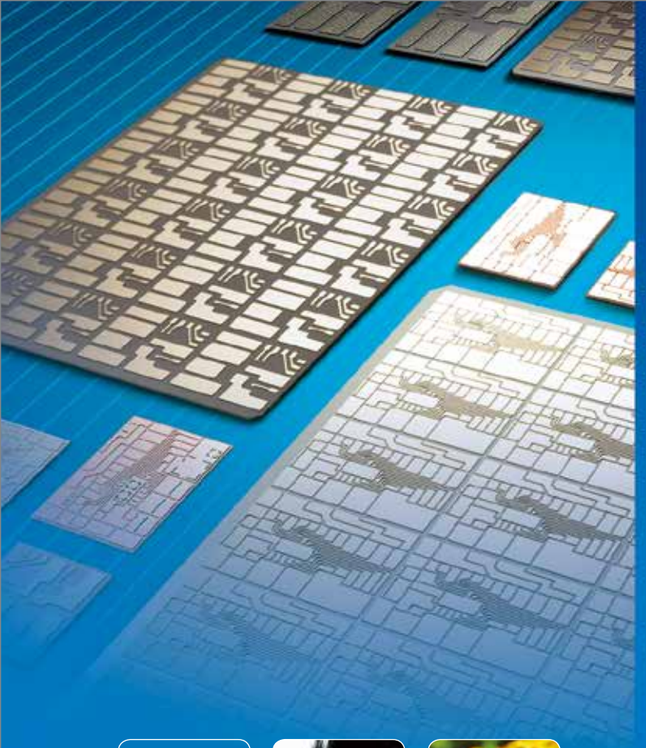
DCB Substrate

ZTA

Si_3N_4 AMB

Hybrid Intergrated
Circuit Substrate

Metallized Ceramics



DCB Substrate

DCB substrate is a directly bonded material composed of ceramic substrate (Al_2O_3 or AlN) and copper which are tightly joined together through hypo-eutectic process.

Material Property

- High Thermal Conductivity
- Low Thermal Expansion
- High Strength
- High Wettability for Solder

Applied Area

Applied Area >>


Automotive


Power Electronics


Home Appliance


Industrial


PC/IT

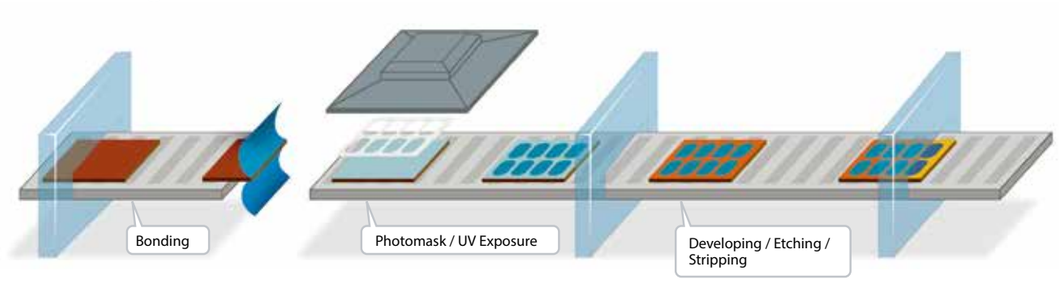

Aerospace


Environmental Technology

- **Automotive**
  ABS, Power Steering, DC/DC Converter, LED Lighting, Ignition Control
- **Power Electronics**
  IGBT, MOSFET, Thyristor Module, Solid-state Relay, Diode, Power Transistors
- **Home Appliance**
  Air Conditioner, Peltier Cooler
- **Industrial**
  LED Displays, Welding Machine
- **Aerospace**
  Laser, Power Supply for Satellites and Aircrafts
- **Environmental Technology**
  Local Power Generation, Electric Vehicle, Traction Control System, Photovoltaic Units, Wind Power
- **PC/IT**
  Power Supply, UPS System

DCB Substrate

Patterning Process



Material Specifications & Properties

Item		Unit	Spec.	Method
Alumina	Alumina Content	%	96	
	Density	g/cc	3.8	ASTM C20-80
	Thermal Conductivity	W/mK	>24	ASTM C480
	Electrical Resistivity	Ωcm	$>10^{14}$	
	Dielectric Constant		9.8	
	Dielectric Strength	kV/mm	26	ASTM D149
	Dielectric Loss (1 MHz)		0.0003	
	Flexural Strength	MPa	550	ASTM F417
	Young's Modulus	GPa	340	
	Coefficient of Thermal Expansion	10^{-6}/℃	6.8 (20~600℃)	ASTM D257
		10^{-6}/℃	7.8 (20~1000℃)	ASTM D257
AlN	Density	g/cc	3.34	ASTM C20-80
	Thermal Conductivity	W/mK	>170	ASTM C480
	Electrical Resistivity	Ωcm	$>10^{14}$	
	Dielectric Constant		9.0	
	Dielectric Strength	kV/mm	20	ASTM D149
	Dielectric Loss (1MHz)		0.0005	
	Application Temperature	℃	-55~850	
			<400 (at H2)	
	Flexural Strength	Mpa	450	ASTM F417
	Coefficient of Thermal Expansion	10^{-6}/℃	4.6 (20~400℃)	ASTM D257
	Electrical Conductivity of Copper Surface	S/m	58×10^6	

KCC DCB Design Guide

Item	Unit	Method
Master Card Size	As fired : 5.5″×7.5″	
	Usable Area : 5.1″×6.7″	
Dimension (Laser Scribed)	+0.2/-0.05	
	±2 % for master card 5.5″×7.5″ as	
Copper Free Perimeter (Lasered Side)	±0.2 (≥0.5mm)	
	±0.15 (0.3~0.5mm)	
Pattern Mismatch	≤0.2mm	
Flatness of Master Card	1.0mm	7″ long
Etch Factor	≥2	
Etching Tolerance	±0.2mm	
Chip	L : max.1×t, W&D : 0.5 t	
Total Thickness	±7 %	
Surface Roughness	Ra≤2㎛	
Bonding Area	≥90 %	
Plating Thickness	2㎛~10㎛(Ni)	Ni-8 %P, Au, Ag
Solder Stop (PSR)	±0.3mm	

Available Material Thickness and Combination

Alumina (96 %) Al_2O_3 thickness	Copper thickness					
	0.127	0.20	0.25	0.30	0.40	0.50
0.25	P	P	P			
0.32	P	P	P	P		
0.38	P	P	P	P		
0.5	P	P	P	P	P	P
0.635	P	P	P	P	P	P
1.0	P	P	P	P	P	P

Alumina Nitride AlN thickness	Copper thickness					
	0.127	0.20	0.25	0.30	0.40	0.50
0.38	P	P	P	P		
0.635	P	P	P	P	P	P
1.0	P	P	P	P	P	P

Process & Quality Control

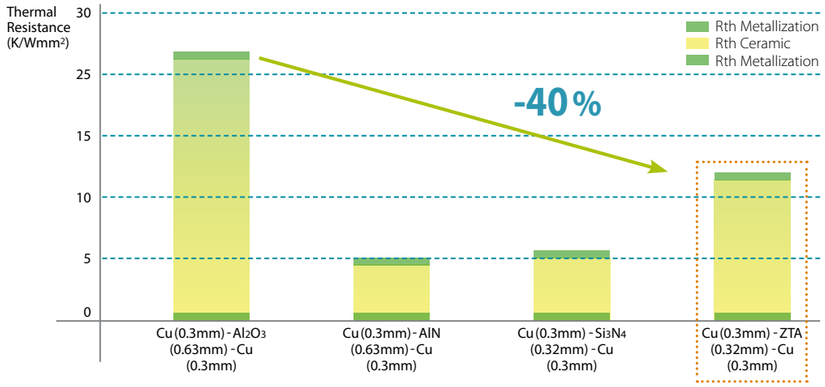
Process	Process Control Items	Quality Control Items
Slurry Preparation	Material Weight, Milling Time	Viscosity, Particle Size Distribution
Tape Casting	Thickness, Drying Profile, Forming Speed	Green Density, Thickness, Width
Sintering	Sintering Profile	Density, Dimension
Bonding	Kiln Profile, Atmosphere	Peel Strength, Solderability, Bonding Area, Surface Roughness
Laminating / UV Curing	UV Intensity, Temperature	Pattern Mismatch
Etching	Density, Temperature	Etch Factor
Plating	Concentration, Time, Temperature	Thickness
Scribing	Laser Power, Speed	Dimension, Appearance

ZTA

ZTA substrates have good bending strength compared normal Al_2O_3 substrate. They are mainly used in applications where a long life time and high reliability.

Decreased thermal resistance without nitride ceramics

ZTA substrates can have thinner isolator thickness compared to alumina because of afore mentioned higher bending strength and Fracture toughness; in addition, its cost of manufacture is much more aligned with standard alumina DBC, rather than the more expensive and involved manufacture of nitride ceramics.



Increased reliability compared to plain alumina substrates

ZTA substrates offer superior bending strength and fracture toughness compared to alumina and AlN substrates. These qualities combined with good heat dissipation means that they are ideal for power modules for automotive and sustainable energy technologies.

ZTA DBC can be produced in a similar fashion to alumina DBC, avoiding the high bill of material of nitride ceramics.

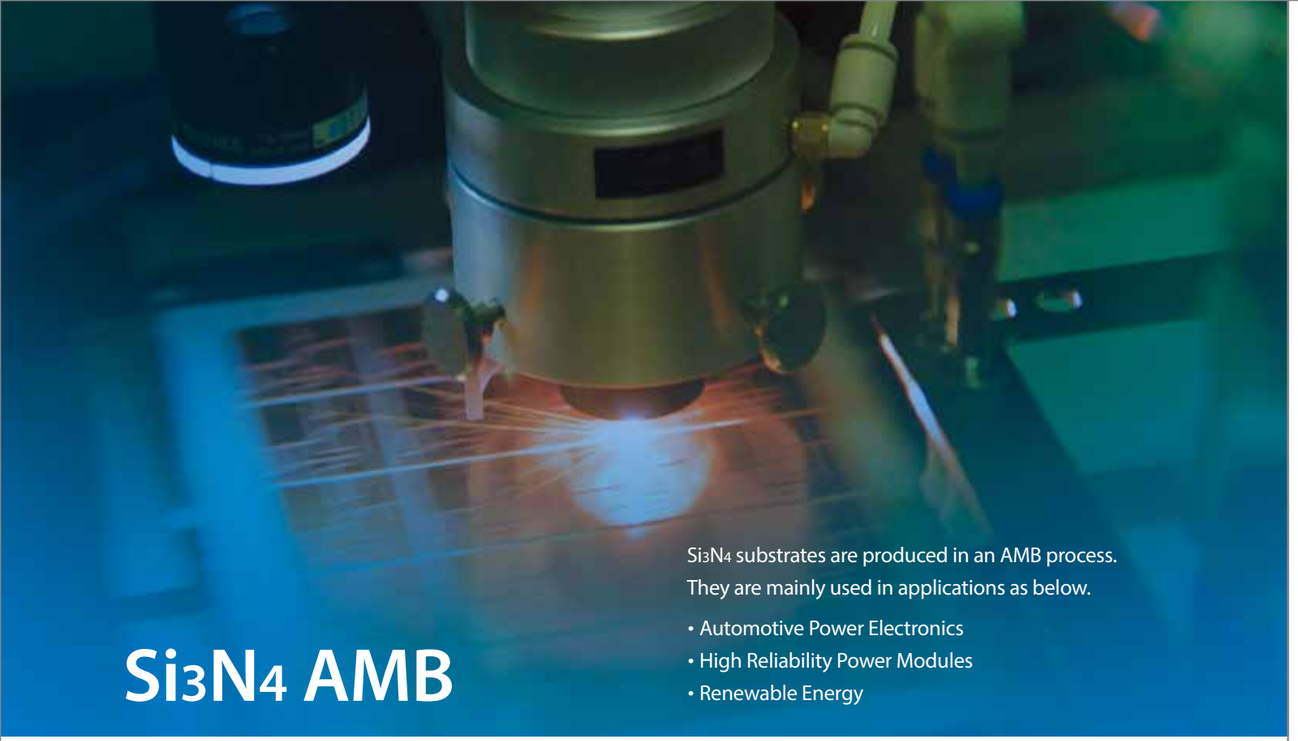
Ceramic	Copper	Cycles										
		60	80	100	120	140	160	180	200	220	240	260
Al_2O_3	A											
	B											
ZTA Conventinal (9%)	A											
	B											
ZTA Improved (10.5%)	A											
	B											

Material Specifications & Properties

	Item	Unit	Spec	Method
ZTA	Alumina Content	%	88~90	
	Density	g/cc	4.05	ASTM C20-80
	Thermal Conductivity	W/mK	>24	ASTM C408
	Electrical Resistivity	Ωcm	$>10^{14}$	
	Dielectric Constant		9.8	
	Dielectric Strength	KV/mm	26	ASTM D149
	Dielectric Loss (1MHz)		0.0003	
	Flexural Strength	MPa	700	ASTM F417
	Young's Modulus	GPa	340	
	Coefficient of Thermal Expansion	10^{-6}/℃	6.8 (20~600℃)	ASTM D257

Available Material Thickness and Combination

ZTA Ceramic thickness	Copper thickness				
	0.127	0.20	0.25	0.30	0.40
0.25	P	P	P	P	
0.32	P	P	P	P	P

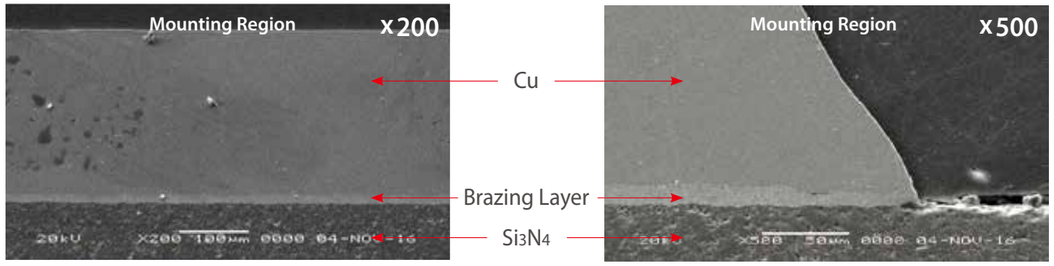


Si_3N_4 AMB

Si_3N_4 substrates are produced in an AMB process.
They are mainly used in applications as below.

- Automotive Power Electronics
- High Reliability Power Modules
- Renewable Energy

Cross section microstructure for Si_3N_4 AMB



Great Reliablity of thermal cycle test

Ceramic		Al_2O_3	ZTA	AlN	AlN	Si_3N_4
Bonding		DCB	DCB	DCB	AMB	AMB
SAM Images	100 Cycles					
	200 Cycles	-		-		
	1000 Cycles	-		-		
	2000 Cycles	-	-	-	-	
	3000 Cycles	-	-	-	-	
	4000 Cycles	-	-	-	-	
	5000 Cycles	-	-	-	-	

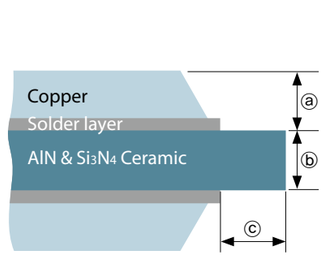
PASS FAIL

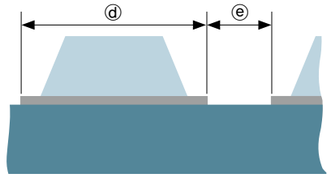
Dimensions

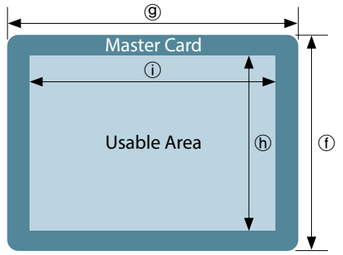
Items	Mark	Unit	Value	Tolerance
Copper Thickness	ⓐ	mm	0.127 / 0.2 / 0 .25 / 0.3 / 0.4 / 0.5 / 0.8	±0.05mm
Ceramic Thickness	ⓑ	mm	0.32 / 0.25	±0.05mm
Copper Free Perimeter	ⓒ	mm	≥0.50 (Depends on Cu Thickness)	±0.20mm
Pattern Width	ⓓ	mm	≥0.50 (Depends on Cu Thickness)	±0.20mm
Gap between Pattern to Pattern	ⓔ	mm	≥0.50 (Depends on Cu Thickness)	±0.20mm
Outside Dimension of Snap	-	mm	Customer Drawings	-0.05~0.20mm
Total Dimensions of Master Card	ⓘ×ⓖ	mm	Si_3N_4 190×138	±2.0%
Max. Usable Area	ⓗ×ⓘ	mm	Si_3N_4 176×130	-

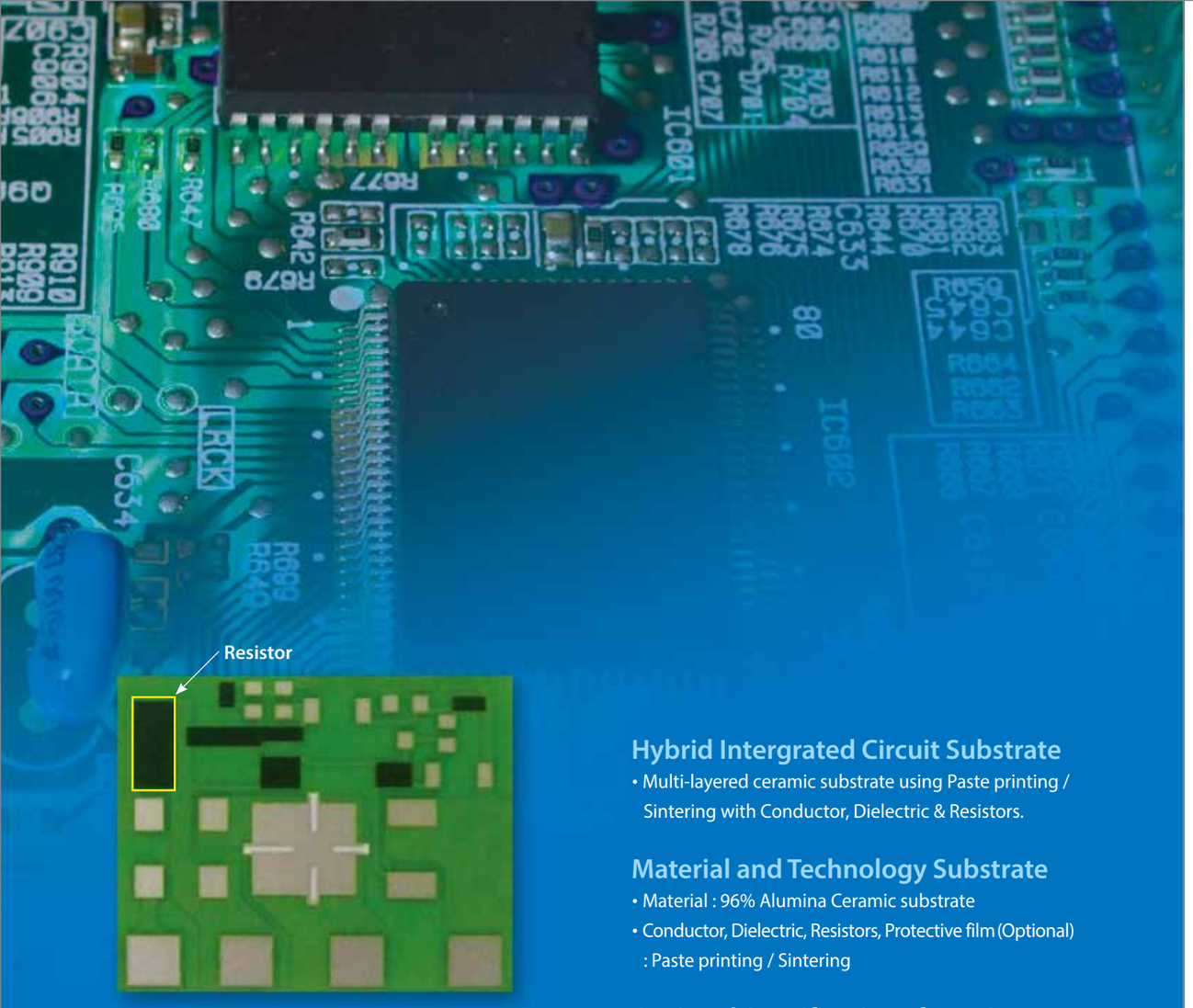
Properties

Items	Si_3N_4 AMB
Plating	Ni Plating : 2㎛~10㎛ (Phosphorus type) Au Plating : 0.01~0.07㎛ Ag Partial Plating : 0.2~0.5㎛
Application Temperature	-55℃ to 650℃ depending on atmosphere (Critical at H2 with > 400℃)
Dielectric Strength	Test method : Isolation test (Must be isolated) Condition : 1.5kV AC 1min • After etching process Direction : Front to back • Snap form • Unusual inspection
Insulation Resistance	Test method : Isolation test (Must be isolated) Condition : 1000V, >1 × 10^9Ω 5sec Direction : Pattern to pattern (Min 0.7mm) • Unusual inspection
Copper Peeling Strength	≥ 9.8 N/mm @ 50 mm/min • Unusual inspection
Solderability	≥ 95% wetting - Bare Copper : SnCu3In0.5-Preform / 250℃ / With N2 and vacuum - Ni plating / Au plating : PbSn5Ag2.5-Preform / 340℃ With formic gas (95% N2, 5% H2) and vacuum
Bonderability	> 1000 gf : Thick wire shear test Thick wire : 300㎛ Ø Al-wire (Type : H-11) Shear speed : 200㎛/s Shear height : 30㎛
*Thermal Cycle Test	Temperature condition : -50℃ (15min)→150℃ (15min), 5000 cycles Test method : Check delamination from the copper edge • Unusual inspection
*Partial Discharge	Condition : 10pc >, 6.5kV AC 5sec • After etching process Direction : Front to back • Snap form • Unusual inspection









Hybrid Intergrated Circuit Substrate

Hybrid Intergrated Circuit Substrate

• Multi-layered ceramic substrate using Paste printing / Sintering with Conductor, Dielectric & Resistors.

Material and Technology Substrate

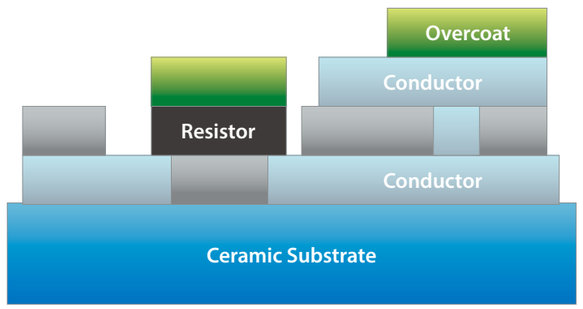
• Material : 96% Alumina Ceramic substrate
• Conductor, Dielectric, Resistors, Protective film (Optional)
: Paste printing / Sintering

Optional Specifications from Customer

• Paste : Conductor, Dielectric, Overcoat Paste item Number
• Thickness : Classified by each layer
• Design : Designing with ordered product composition

Application

• Automobile field : EWP (Electric Water Pump) Module
• Components for Tele-communication

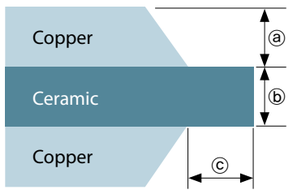


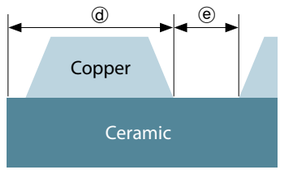
Properties of HIC substrate

Item	Rule (Data)			Remark
Ceramic Substrate	Al_2O_3	AlN	ZTA	
Electric Resistivity	2.62 x 10-8Ωm			
Thermal Conductivity	25 W/mK	170 W/mK	25 W/mK	290 W/mK (Cu Paste)
Warpage Variation	Very Low			28℃ → Max 280℃ → 28℃
TCT (Thermal Cycle Test)	> 3,000	> 2,000	> 3,000	1 Cycle Condition : -50℃ ~ +150℃ 30min (-50℃ : 15min, +150℃ : 15min) Change ± ℃ time : 15sec
Plating	Ni, Pd, Au			
Solderability	> 95%			
Bondability Al Wire	> 1,000kgf			300㎛ Al Wire, Shear test
Bondability	> 900kgf			300㎛ Al Wire, Shear test after Ni plating
Adhesion Strength	> 5N/mm			Adhere to Cu Wire at 5 x 5mm pad using CuSn solder 280℃ Soldering → Pull Test

Design Rule

Properties		Unit	Value			Tolerance	Remark
Ceramic Substrate			Al_2O_3	AlN	ZTA		
Ceramic Thickness ⓑ		mm	0.25, 0.32, 0.38, 0.5, 0.68, 0.8, 1.0	0.38, 0.63	0.25, 0.32	±10%	
Cu Thickness ⓐ		㎛	20 ~ 60			± 5㎛ ~ ± 20㎛ (Depends on Cu THK)	* Special Min. THK = 10㎛
Cu Free Perimeter ⓒ		㎛	250			±50	
Min. Pattern Width ⓓ & Gap Between Pattern ⓔ		㎛	150				
Plating	Material		Ni, NiAu, NiPdAu				Electroless Plating, (Phosphorus type, P content : 8% ± 2%)
	Thickness	㎛	Ni : 2 ~ 7㎛ Pd : 0.03 ~ 0.1㎛ Au : 0.01 ~ 0.07㎛				
Roughness		㎛	Ra ≤ 1.0				





Metallizing on ceramic surface is a very important technique for brazing with metal parts.
Mo/Mn paste developed by KCC is used for the metallization.

Available Ceramic Composition

- Al_2O_3 94%, 97%, 99.5%
- Paste : Mo / Mn

Brazed Ceramics Available

- Metal : Alloy42, Copper, Kovar

Specification

- Metallization Thickness : 25 ± 10㎛
- Nickel Thickness : 2 ~ 10㎛
- Pin-pull Strength : 4,200kgf/㎟ avg. (at ¢3.0㎜ Pin)

Application

- Vacuum Interrupters
- SCR Housing
- Industrial Magnetron
- Relay for Electric Vehicle
- X-ray Tubes
- High-power Receptacles
- Feed-through
- Insulating Rings & Cylinders

Metallized Ceramics

Metallizing Process

POWDER → PRESS / CIP → FORMING → SINTERING → GLAZING

Materials
- Al_2O_3 94%, 97%, 99.5%

PRINTING → METALLIZE → PLATING

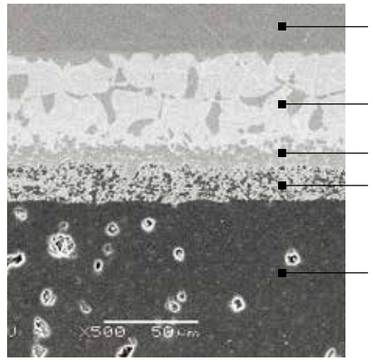
Paste
- Mo/Mn

Materials
- Ni

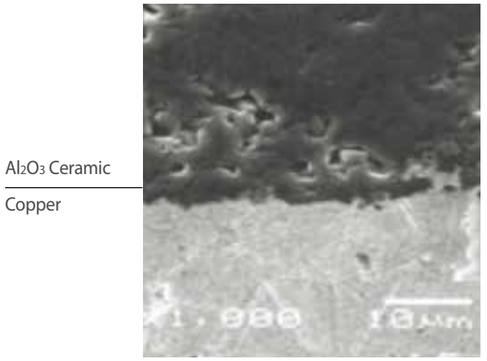
Method
- Electric & Chemical

Cross-Section Analysis

Brazed Ceramic



DCB Substrate



Material Specifications & Properties

Properties		Unit	Alumina			Test Method
			AM94	AM94	AM94	
Mechanical	Alumina Content	%	94	97	99.5	-
	Bulk Density	g/㎤	3.70	3.80	3.90	ASTM C2O-83
	Average Crystalline Size	㎛	4	4	6	ASTM E112-88
	Flexural Strength (20℃)	MPa	350	350	360	ASTM F417-78
	Elastic Modulus	GPa	290	340	360	ASTM C773-82
	Poisson's Ratio	-	0.22	0.22	0.22	ASTM C773-82
	Compressive Strength	MPa	2,100	2,100	2,300	ASTM C773-82
	Hardness	-	12	12	14	Knoop 1kg
	Fracture Toughness	$MPa \cdot m^{1/2}$	3-4	4-5	4-5	Noched Beam
Thermal	Thermal Conductivity (20℃)	W/mK	21	25	28	ASTM C4O8-82
	Coefficient of Thermal Expansion (20-1,000℃)	$\times 10^{-6}$/℃	8.1	8.2	8.2	ASTM C372-81
	Specific Heat	㎈/g℃	0.2	0.2	0.2	ASTM C351-82
	Thermal Shock Resistance	℃	200	200	200	Customer
	Max. Use Temperature	℃	1,600	1,600	1,650	-
Electrical	Dielectric Strength	KV/㎜	≥12	≥15	≥15	ASTM D116-76
	Dielectric Constance (1MHz, 25℃)	-	9.2	9.7	9.7	ASTM D 150-81
	Dielectric Loss (Tan delta, 1MHz, 25℃)	-	0.0004	0.0002	0.0002	ASTM D150-81
	Volume Resistivity (25℃)	Ω㎝/㎝	$> 10^{14}$	$> 10^{14}$	$> 10^{14}$	ASTM D1829-66

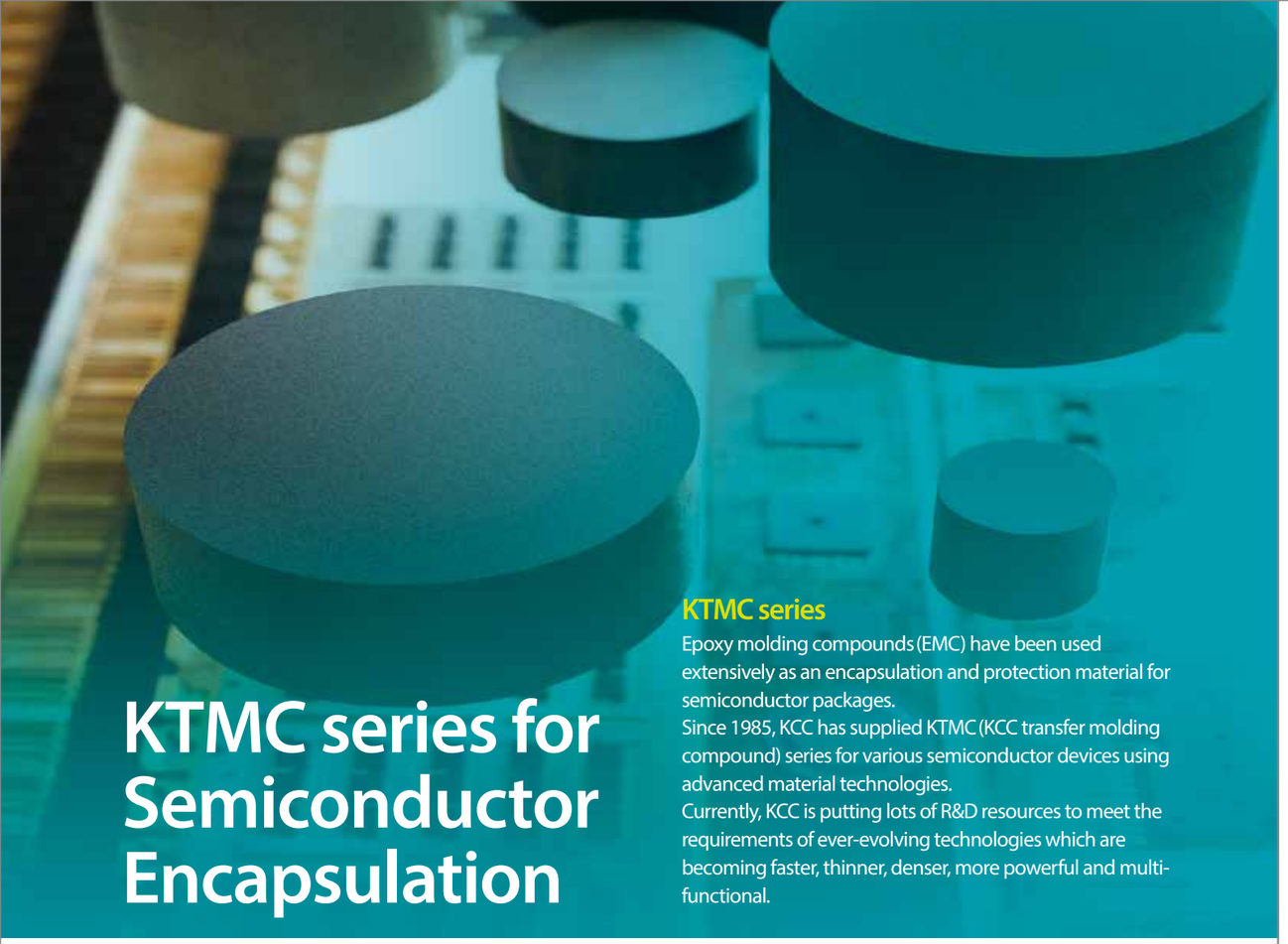
KCC,
Your Solution Partner

EMC

KTMC series for
Semiconductor Encapsulation

KTMC for Power Modules &
High Power Packages

KTMC for
Specialty Molding Compound

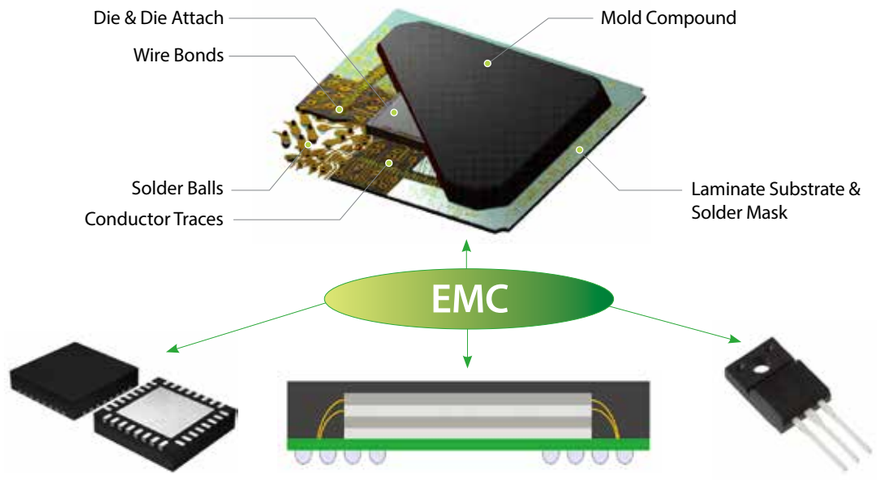


KTMC series for Semiconductor Encapsulation

KTMC series

Epoxy molding compounds (EMC) have been used extensively as an encapsulation and protection material for semiconductor packages.
Since 1985, KCC has supplied KTMC (KCC transfer molding compound) series for various semiconductor devices using advanced material technologies.
Currently, KCC is putting lots of R&D resources to meet the requirements of ever-evolving technologies which are becoming faster, thinner, denser, more powerful and multi-functional.

Examples of KTMC Use



KTMC Series Classification

KTMC Series	Features	Components			Remarkable Properties
		Main Epoxy	Main Silica	Ash(wt%)	
KTMC-1000	Low stress	EOCN	Fused (Angular)	72~80	Thermal expansion : 15 ppm/℃ ↑
KTMC-3000	High thermal conductivity	EOCN	Crystal	72~87	Thermal conductivity : 1.5 W/mK ↑
KTMC-5000	Ultra low stress	Special	Fused (Spherical)	80~90	Thermal expansion : 15 ppm/℃ ↓

KTMC series selection guide (Memory devices)

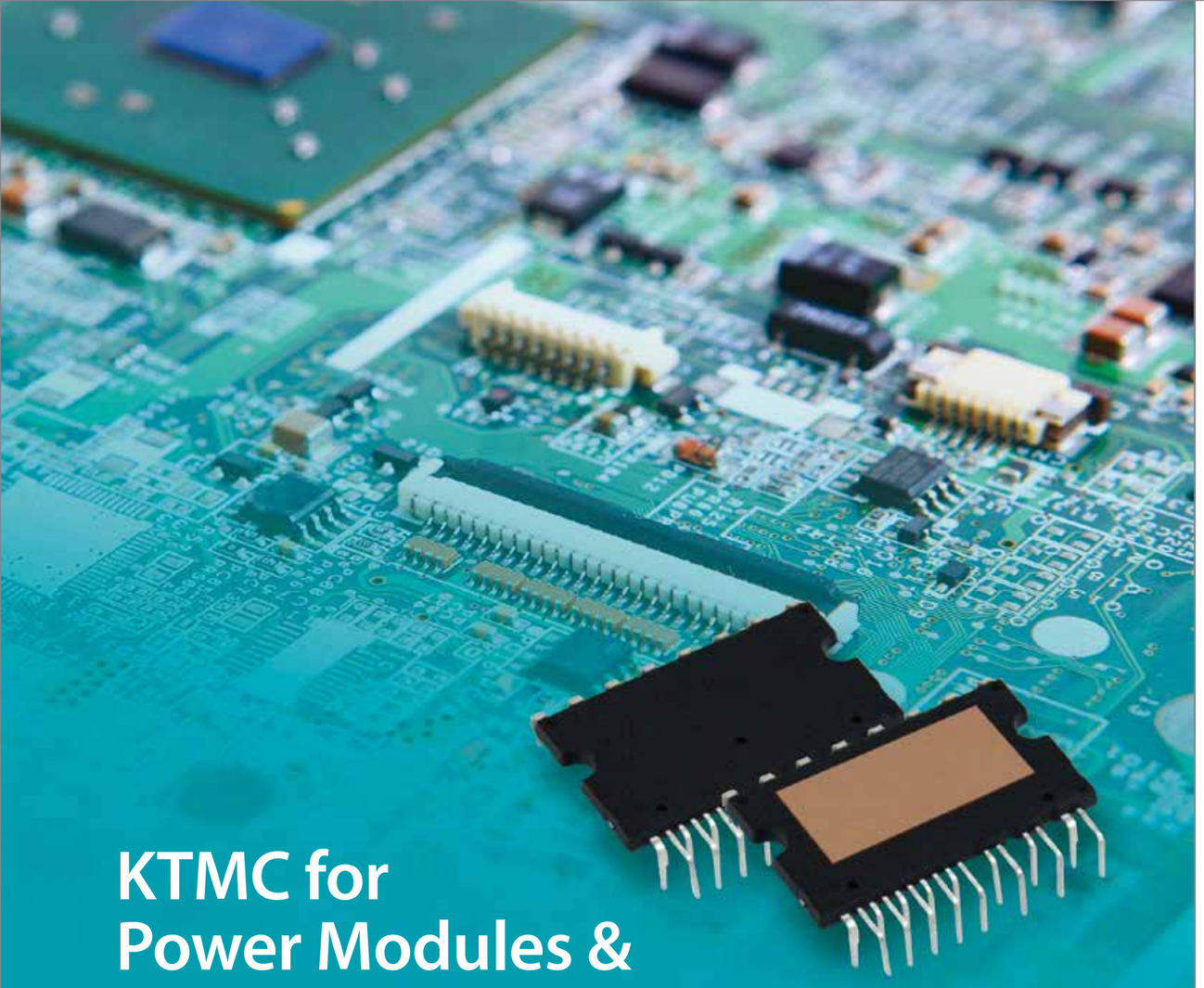
	BOC	SSD	e-MCP	e-MMC	PoP	SD-Card	MUF	TYPE (Granule)
5900GUD	●							
5950GC		●	●					
5900GJU		●		●				
5700GF				●				
5900GSP					●			
5800G						●		
5600GWH		●	●	●				●
5300GH							●	

KTMC series selection guide (LSI devices)

	Type		Package	Product	Features
	Lead Frame	Substrate			
LSI Devices	○	-	SOIC	KTMC-5800GQS	MSL 1 & Applicable to Cu wire
	○	○	QFN / QFP	KTMC-5950GQ	MSL 1 & Good warpage performance
	-	○	Sensor (FPS)	KTMC-5800GW	Good sensitivity performance (Dk=4, for C-mold)
	-	○	Sensor (FPS)	KTMC-3500GT	Good sensitivity performance (Dk=7, for T-mold)
	-	○	Sensor (FPS)	KTMC-3500GQS	Good sensitivity performance (Dk=7, for C-mold)
	-	○	FOWLP	KTMC-5900GV	Good warpage performance (for C-mold)

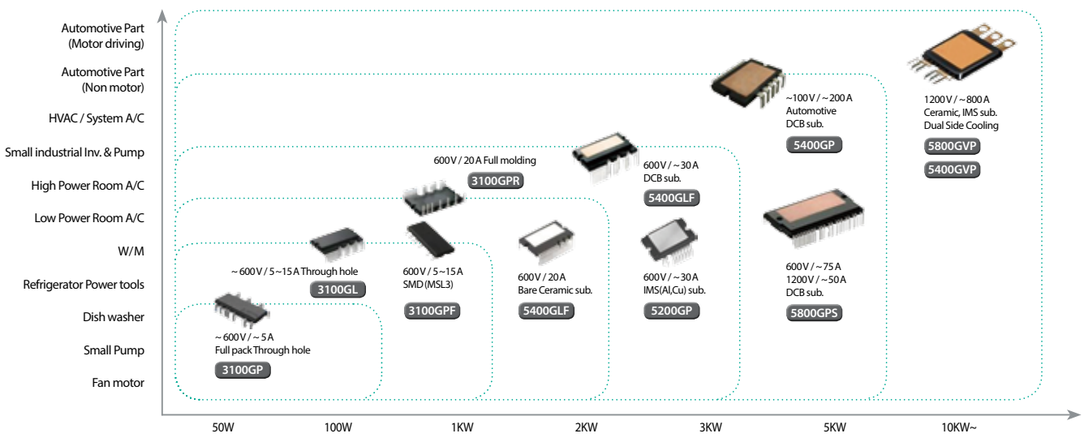
KTMC series selection guide (Discrete Package)

	Product	Insertion Type Packages						SMD Type Packages		
		TO-220	TO-3P	TO-247	TO-264	TO-220F	TO-3PF	SOT-23	D/D2-PAK	DFN
Discrete	1050GE							MSL3		
	1050GF									
	5200GF								MSL3	
	3097GX									
	3097GR									
	5800GR								MSL1	MSL1
	5800GQL							MSL1		



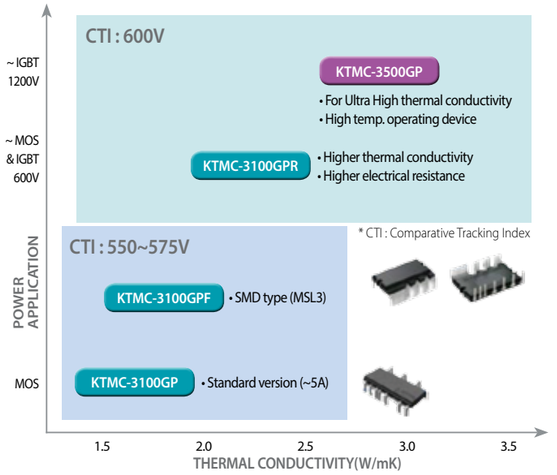
KTMC for Power Modules & High Power Packages

Power Module Application



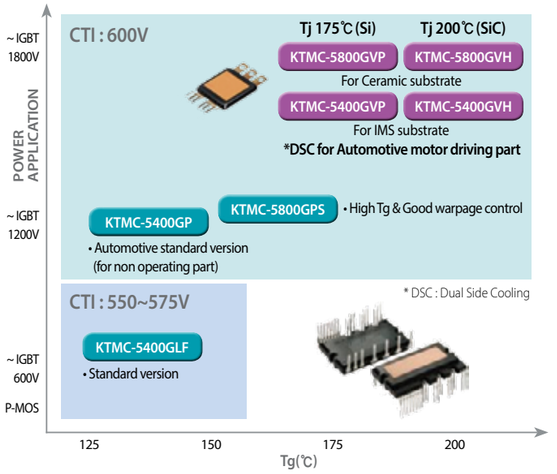
Power Module

For Full Pack type in detail



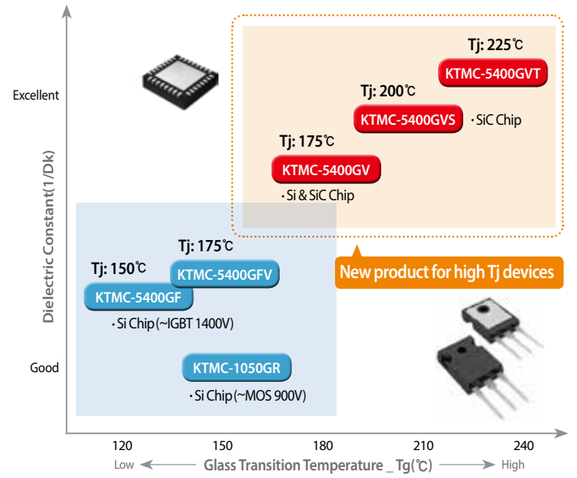
Item		3100GP	3100GPR	3500GP
Spiral Flow	inch	45	30	40
Gel Time	sec.	40	35	35
C.T.E 1	ppm/℃	18	23	15
Tg (@TMA)	℃	145	155	155
Flexural Modulus (@RT)	Kgf/mm^2	2,000	2,000	2,450
Volume Resistivity (@150℃)	Ωcmx10^{13}	1.0	2.0	2.0
CTI	-	PLC 1	PLC 0	PLC 0
Thermal Conductivity	W/mK	1.7	2.3	3.0
Water Absorption (PCT 24hrs)	%	0.34	0.35	0.29
Specific Gravity	-	2.12	2.18	2.8

For Substrate type in detail

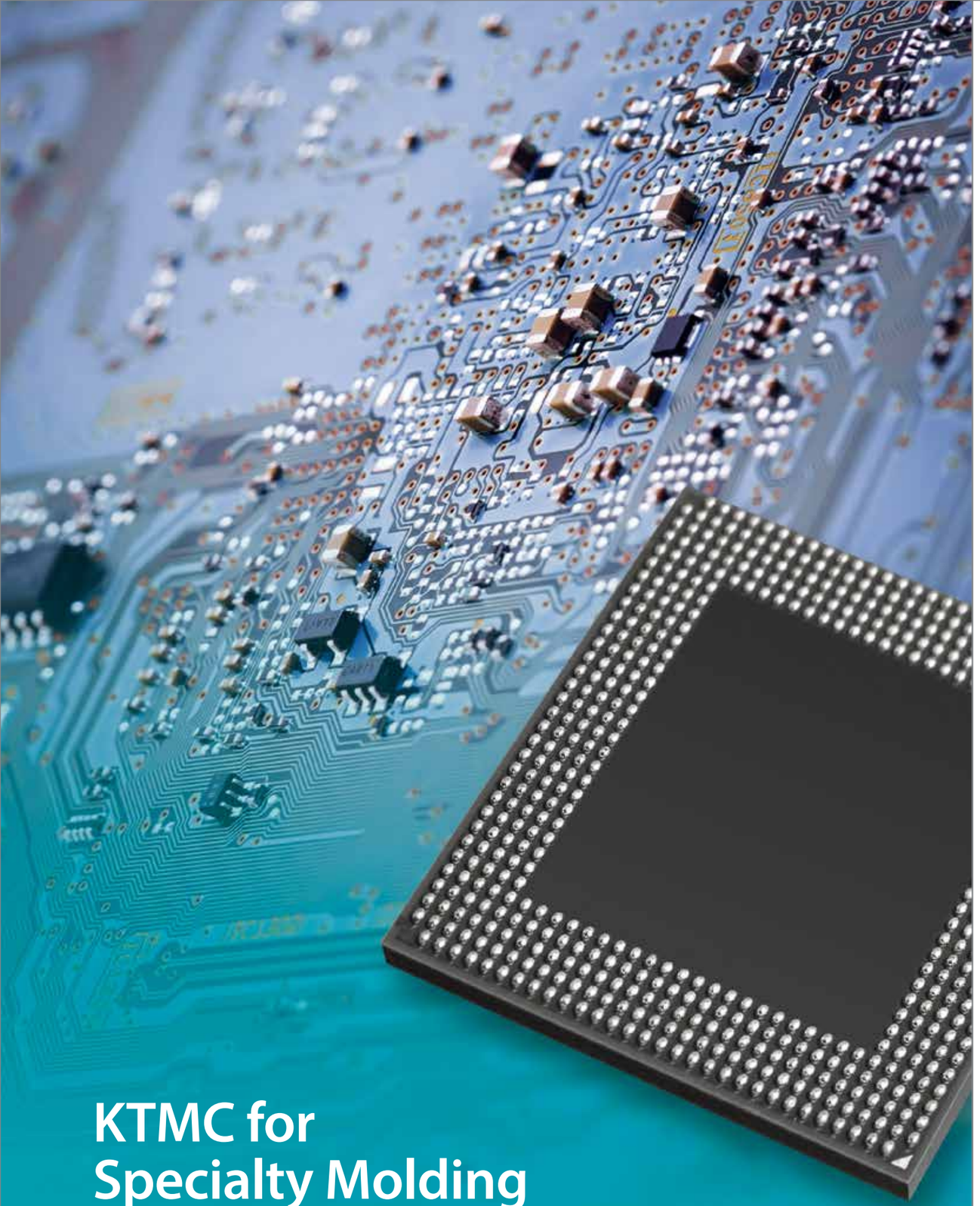


Item		5400GP	5400GVP	5800GVP
Spiral Flow	inch	40	40	40
Gel Time	sec.	35	35	35
C.T.E 1	ppm/℃	10	14	10
Tg (@TMA)	℃	140	185	180
Flexural Modulus (@RT)	Kgf/mm^2	2,150	1,800	2,200
Volume Resistivity (@150℃)	Ωcmx10^{13}	1.5	2.1	2.3
Dielectric Constant (1Hz, @175℃)	-	5.1	4.4	4.4
CTI	-	PLC 0	PLC 0	PLC 0
Water Absorption (PCT 24hrs)	%	0.31	0.36	0.33
Specific Gravity	-	1.97	1.95	1.98

Discrete



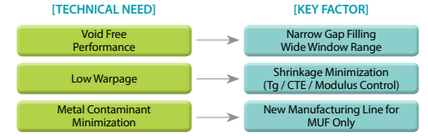
Item		5400GV	5400GVS	5400GVT
Spiral Flow	inch	30	30	30
Gel Time	sec.	30	30	25
C.T.E 1	ppm/℃	11	11	10
Tg (@TMA)	℃	185	210	230
Volume Resistivity (@150℃)	Ωcmx10^{13}	2.1	2.4	3.7
Dielectric Constant (1Hz)	@175℃	-	4.4	4.4	4.3
	@200℃	-	5.2	5.1	4.8
CTI		-	PLC 0	PLC 0	PLC 0
Water Absorption (PCT 24hrs)		%	0.33	0.35	0.42
Specific Gravity		-	1.97	1.97	1.96



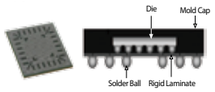
KTMC for Specialty Molding Compound

For Molded Underfill

Key Technology for Molded Underfill



Application



Filling-ability

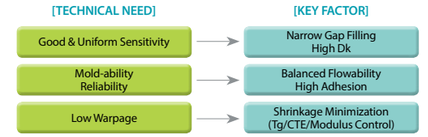
	KTMC - 5300GH	
Gap Thickness(mm)	0.05	0.05
Filler Cut(um)	20	30
Void		

Bump Pitch(um)	120~150	80~110	60~100
Bump Height(um)	~ 70	~ 40	below 40
Filler Cut Size	Representative(20㎛)	Fine(10㎛)	Much Finer(5㎛)
MUF Status	Mass Production	Ready for Production	Feasibility Study

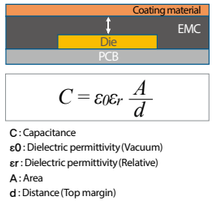
Item		5300GH	5300GT
Spiral Flow	inch	70	65
Gel Time	sec	52	55
Hot Hardness	-	80	75
C.T.E 1	ppm/℃	14	14
C.T.E.2	ppm/℃	55	57
Tg(TMA)	℃	155	155
Water Absorption	%	0.42	0.42
Specific Gravity	-	1.91	1.91

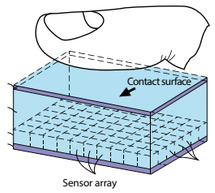
For Finger Print Sensor

Key Technology for Finger Print Sensor



Equation of Capacitance

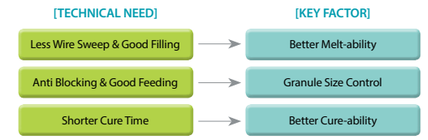




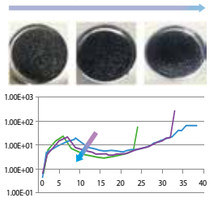
Item		5800GW	3500GT	3500GQS
Application PKG		FPS (Finger Print Sensor)		
Filler	Max. size	20㎛ (Powder Type)	20㎛ (Al_2O_3) (Pellet Type)	20㎛ (Al_2O_3) (Powder Type)
Dk	-	4	7	7
Spiral Flow	inch	50	50	65
Gel Time	sec	45	45	50
Hot Hardness	-	80	70	75
C.T.E 1	ppm/℃	8	13	13
C.T.E.2	ppm/℃	39	45	45
Tg(TMA)	℃	145	145	145
Mold Shrinkage	%	0.15	0.34	0.30
Specific Gravity	-	1.99	2.89	2.89

For Compression Mold

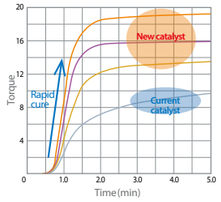
Key Technology for Granule EMC



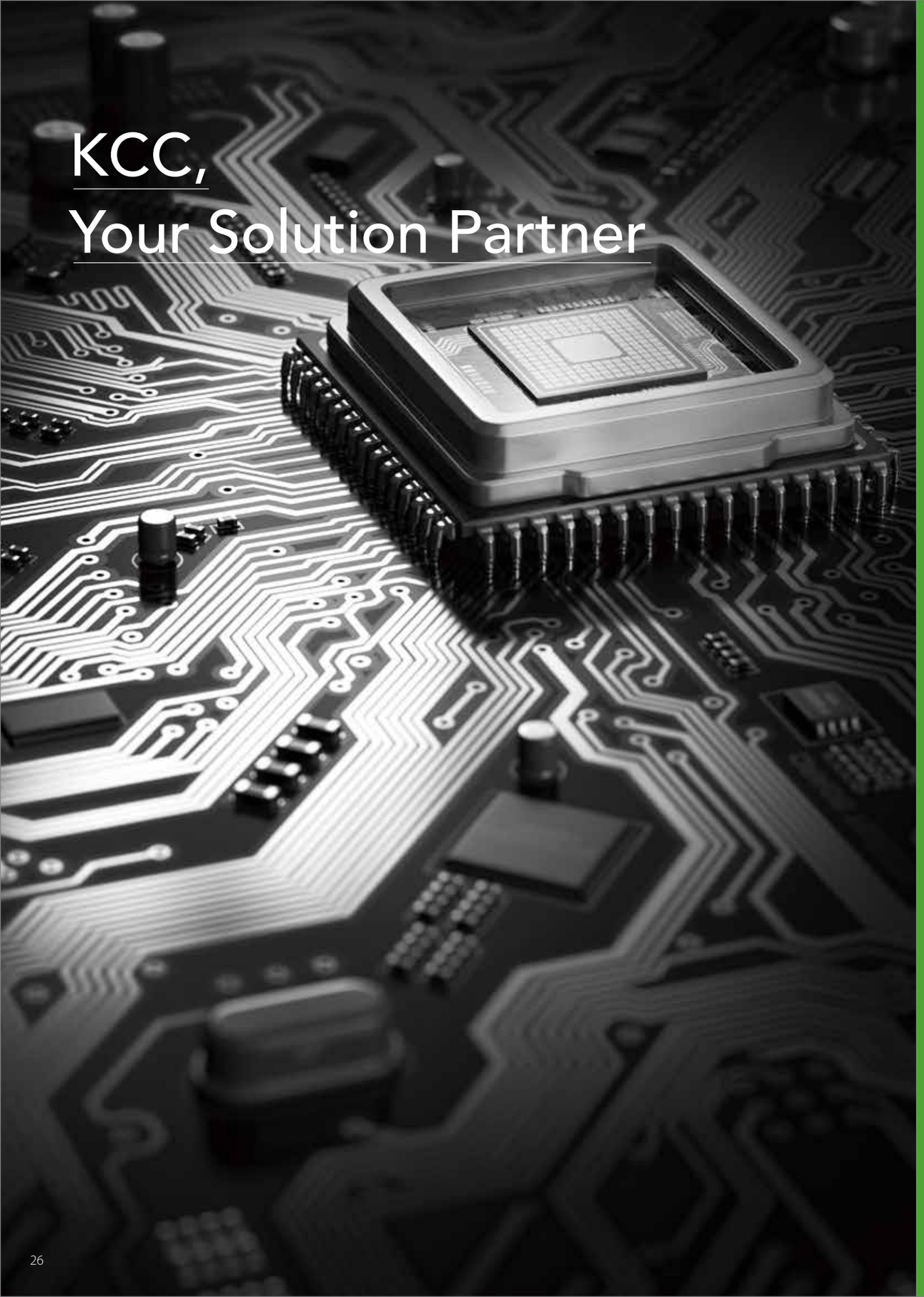
Melt-ability



Cure-ability



Item		5400GWH	5600GWH
Application PKG		e-MCP, e-MMC, SSD	
Spiral Flow	inch	86	100↑
Gel Time	sec	41	75
Hot Hardness	-	86	84
C.T.E 1	ppm/℃	14	13
C.T.E.2	ppm/℃	49	48
Tg(TMA)	℃	133	138
Melt Viscosity	Poise	35	40
Mold Shrinkage	%	0.43	0.39
Specific Gravity	-	1.93	1.94



KCC,
Your Solution Partner

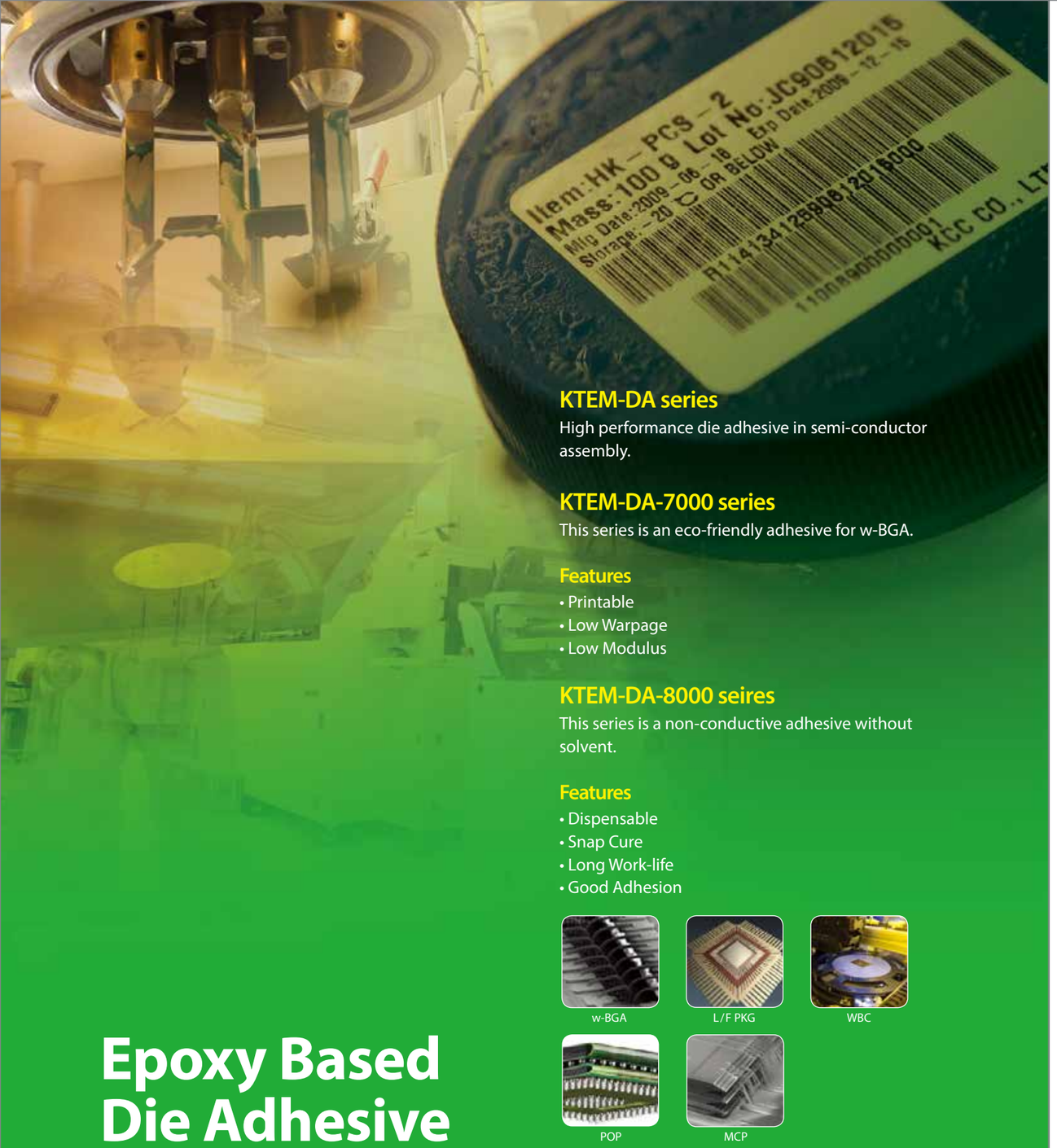
Epoxy Adhesive Materials

Epoxy Based
Die Adhesive

Underfill for
Semiconductor

Thermal Conductive
Material (TCM)

Camera Module
Adhesive



KTEM-DA series

High performance die adhesive in semi-conductor assembly.

KTEM-DA-7000 series

This series is an eco-friendly adhesive for w-BGA.

Features

- Printable
- Low Warpage
- Low Modulus

KTEM-DA-8000 seires

This series is a non-conductive adhesive without solvent.

Features

- Dispensable
- Snap Cure
- Long Work-life
- Good Adhesion

w-BGA

L/F PKG

WBC

POP

MCP

Epoxy Based Die Adhesive

Manufacturing Process

Organic & Inorganic Complex

Adhesive Compound

Key Properties of Epoxy Die Attach Adhesive

General Properties of Solvent Type DAAs

Item	Unit	KTEM-DA-7607	KTEM-DA-7800	HK-PCS-2G	HK-ETA-4G
Feature	-	Bleed minimized	Bleed minimized	Post-cure skip	Low moisture uptake
Application		BOC	BOC	BOC	BOC
Appearance	-	White	White	Ivory	Ivory
Viscosity	mPa.s, 25℃	32,000	22,000	14,000	14,000
Thixotropic Index	-	2.5	2.5	3.0	3.0
B-stage Condition	-	90min@125℃	90min@125℃	30min@125℃	30min@125℃
Pre-Dry	-	10min@95℃	10min@95℃	Skip	5min@125℃
Cure Schedule	-	RT→100℃→175℃ →RT / 180 min	RT→100℃→175℃ →RT / 180 min	Skip (DDP PKG, FOW cure)	RT→175℃→RT / 120 min
Coefficient of Thermal Expansion	ppm/℃	Below Tg : 70 Above Tg : 250	Below Tg : 60 Above Tg : 250	Below Tg : 20 Above Tg : 410	Below Tg : 70 Above Tg : 230
Modulus	25℃, MPa	3	3	6	10
Tg (by DMA)	℃	14	10	0	15
Moisture Absorption	%	0.8	0.8	0.6	0.4
Lap Shear Strength (Al to Al)	MPa	> 5.0	> 5.0	> 0.8	> 0.8
Work Life	hr@25℃	24	24	24	24
Shelf Life	month@-20℃	6	6	6	6

General Properties of Non-solvent Type DAAs

Item	Unit	KTEM-DA-8800	KTEM-DA-8900
Feature	-	High adhesion	Low modulus (Stacked Die)
Application		QFP, QFN, TSOP, CSP	
Appearance	-	Red	Red
Viscosity	mPa.s, 25℃	11,000	10,000
Thixotropic Index	-	5.0	3.7
Cure Schedule	-	Ramp Up : RT to 175℃ / 35min Hold : 175℃ / 15min	Ramp Up : RT to 175℃ / 35min Hold : 175℃ / 15min
Coefficient of Thermal Expansion	ppm/℃	Below Tg : 70 Above Tg : 125	Below Tg : 30 Above Tg : 140
Tg (by DMA)	℃	65	32
Modulus	MPa, 25℃	2,100	250
Moisture Absorption	%	0.5	0.5
Die Shear strength (3×3 Si Die)	Kgf, 25℃	21	6
Work Life (25℃)	hr@25℃	72	24
Shelf Life	month@-20℃	6	6

Capillary Underfill (CUF)
KTEM UF-series

KTEM UF-series is a flip chip underfill. It flows by capillary action into the gap between IC chip circuit with conductive bumps and mounting board.

Features

- Void-free
- Stable Workability
- High Reliability Performance
- Low Fume Gas Emission

Applied Area

- FC-CSP / BGA / POP PKG

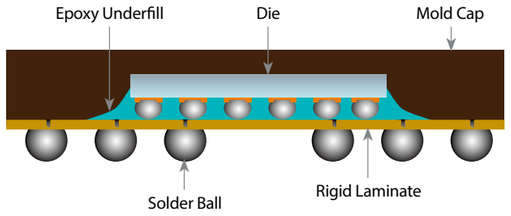
Board Level / Secondary Underfill (SUF)
KTEM-SF series

An insulating encapsulation material as a reinforcing agent Use to improve durability and reliability when CSP/BGA Package is placed in a secondary chamber on the main board.

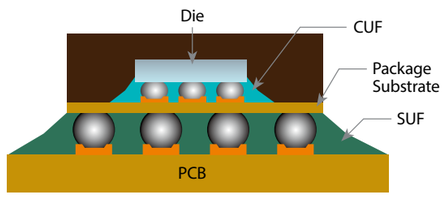
Features

- Impact Resistance (Drop-test qualification)
- Thermal Resistance
- Snap Cure
- Reworkability

Underfill for Semiconductor



Capillary Underfill (CUF)



Board Level / Secondary Underfill (SUF)

Key Properties of Epoxy Die Attach Adhesive

General Properties of Capillary Underfill

Tech. Inform.		Unit	KTEM-UF-3000	KTEM-UF-4002	KTEM-UF-5016	KTEM-UF-5100
Hardener		-	Phenol type	Anhydride type	Amine type	Amine type
Feature		-	Large IC	Low viscosity, Fast cure	High Reliability	Narrow Gap
Appearance		-	Dark gray	Dark gray	Dark gray	Dark gray
Viscosity		mPa.s	30,000	9,000	40,000	9,000
Specific Gravity		-	1.6	1.6	1.6	1.6
Cure Time		-	150℃ / 2h	150℃ / 1h	150℃ / 2h	165℃ / 1h
Filler Size (Ave/Max)		um	1.50 / 5.00	0.60 / 3.00	1.50 / 5.00	0.30 / 1.00
Filler Content		wt%	50~55	50~55	60~65	50~55
Tg	(TMA)	℃	70	125	120	135
CTE	α1	ppm/℃	30	30	30	35
	α2	ppm/℃	120	90	90	125
Modulus		GPa (25℃)	3.30	5.70	6.70	5.70
		GPa (130℃)	0.26	0.13	5.40	2.80
		GPa (260℃)	0.03	0.14	0.87	0.11
Ion Impurity	Na	ppm	1.52	1.55	1.48	1.46
	K	ppm	< 0.1	< 0.1	< 0.1	< 0.1
	Cl	ppm	5.27	4.90	4.67	4.44
α-ray Emission		cph/cm²	< 0.001	< 0.001	< 0.001	< 0.001

General Properties of CSP / BGA Board Level Underfill (SUF)

Tech. Inform.		Unit	KTEM-SF-6000	KTEM-SF-6100
Feature		-	Reworkable	Low modulus
Viscosity		mPa.s	2,500	3,000
TI		-	1.1	1.1
Tg	(TMA)	℃	82	30
CTE	α1	ppm/℃	65	55
	α2	ppm/℃	190	190
Modulus		MPa @ 25℃	3,000	4
Pot life		day @ 25℃	3	7
Cure Schedule		℃ / min	150 / 3	150 / 3

Phase Change Adhesive

- PCA is thermal interface material (TIM) related to heat transfer between two components
- Phase change at 40-50℃ from solid to liquid

Features

- Low Phase Change Temperature range
- Good Thermal Conductivity (3.8 W/mK)
- Stensil Printable
- Good Surface Wetting / Spreading
- Long-term Reliability

Application

- Power Electronics
  IGBT, MOSFET, Diode, Power Transistor
- PC / IT
  Power supply, UPS

Thermal Conductive Material (TCM)

Thermal Conductive Adhesive

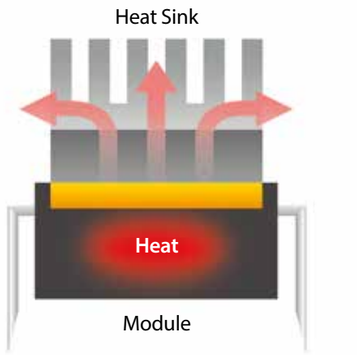
An adhesive that effectively releases heat.

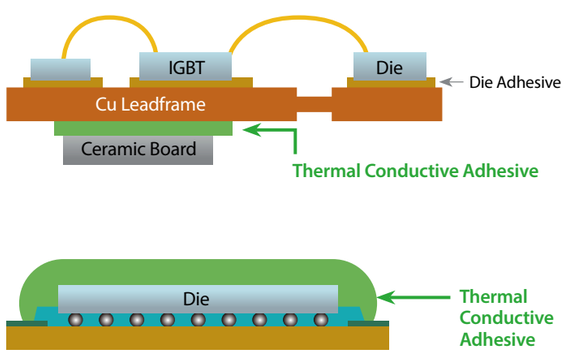
Features

- Good Thermal Conductivity (2~5 W/mK)
- High Adhesion
- Low Molecular Siloxane Free

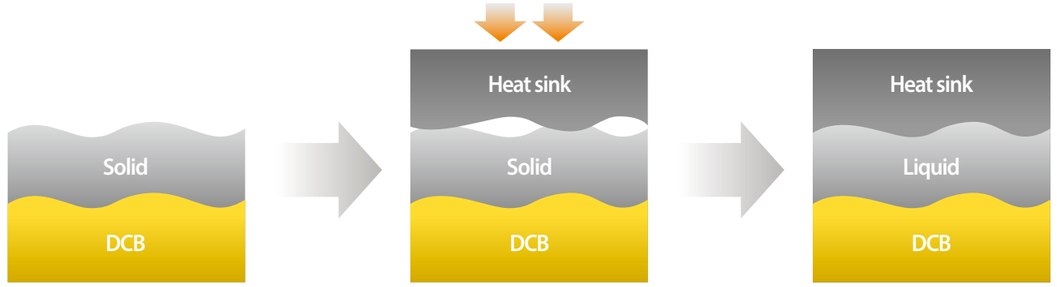
Application

- Drive IC, COF





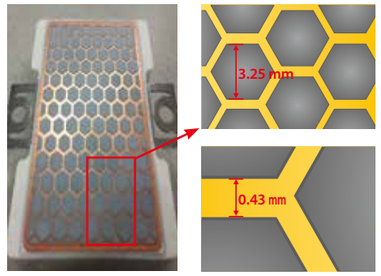
Advantage of Phase Change Adhesive



Room Temp | Heat & Pressure | Phase Change Air poket forced out Efficiently heat transfer

Product	Description	Color	Viscosity@25℃ (mPa·s)	Thermal Conductivity (W/mK)	Phase Change Temp.(℃)
KTEM-PC-3500C	Non Insulating Paste	Gray	50,000	3.8	45

Printability

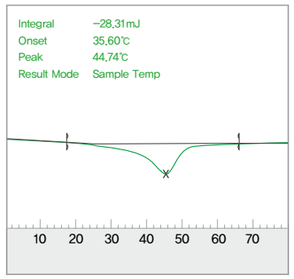


- Printed module

Spreading

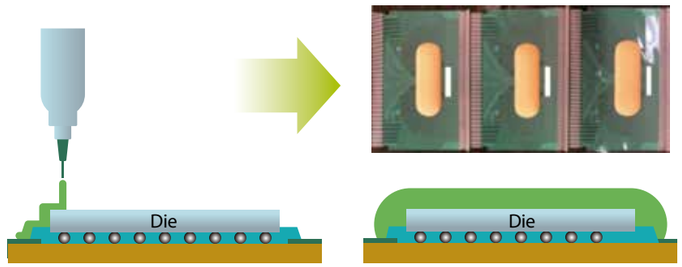
- Printing & Dry
- Operating temp. 80 ~ 90℃
- Torque 2 ~ 3Nm

- Well spreading leads to elimination of void
- Low thermal resistance



- Melting temperature range (40~50℃)

Chip Mold



Chip Mount

Dispensing Adhesive

Mounting Ceramic Board

Product	Description	Viscosity (cP)	TI	Thermal Conductivity (W/mK)	Die Shear Strength (kgf)
KTEM-TA-2000	High Adhesion	73,000	1.6	2.1	26 (250℃)
KTEM-TA-3000	High Adhesion	92,000	1.2	3.3	53 (250℃)
KTEM-TA-4000	Chip Mold	110,000	1.6	5.0	5 (25℃)

Camera Module Adhesive

KTEM-CA series

KTEM-CA series has been designed to bond the mount to substrate.

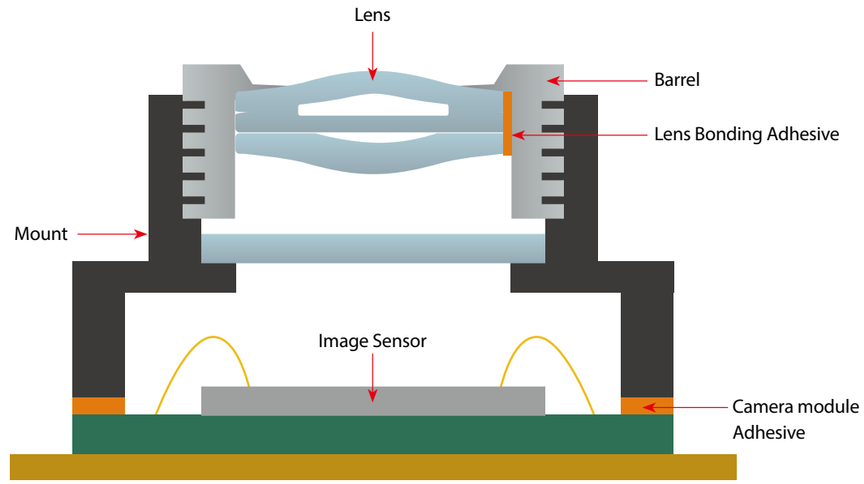
Features

- Fast cure at low temperature
- High Reliability
- Dispensable

Camera Module

General Properties of Camera Module Adhesive

Tech. Inform.		Unit	KTEM-CA-1000
Feature		-	Fast cure at low temperature
Appearance		-	Black
Viscosity		mPa.s	8,000
TI		-	3.0
Tg	(TMA)	℃	25
CTE	α1	ppm/℃	60
	α2	ppm/℃	170
Modulus		MPa @25℃	3,000
Pot Life		day @25℃	3
Cure Schedule		℃ / min	80 / 5



KCC,
Your Solution Partner

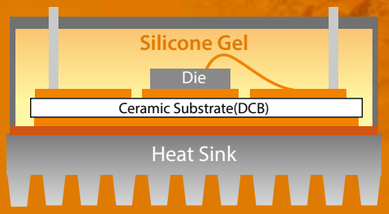
Silicone

Silicone Gel for
Power Module

Silicone for PCB

Silicone Adhesive for
Semiconductor

Silicone Thermal
Interface Materials

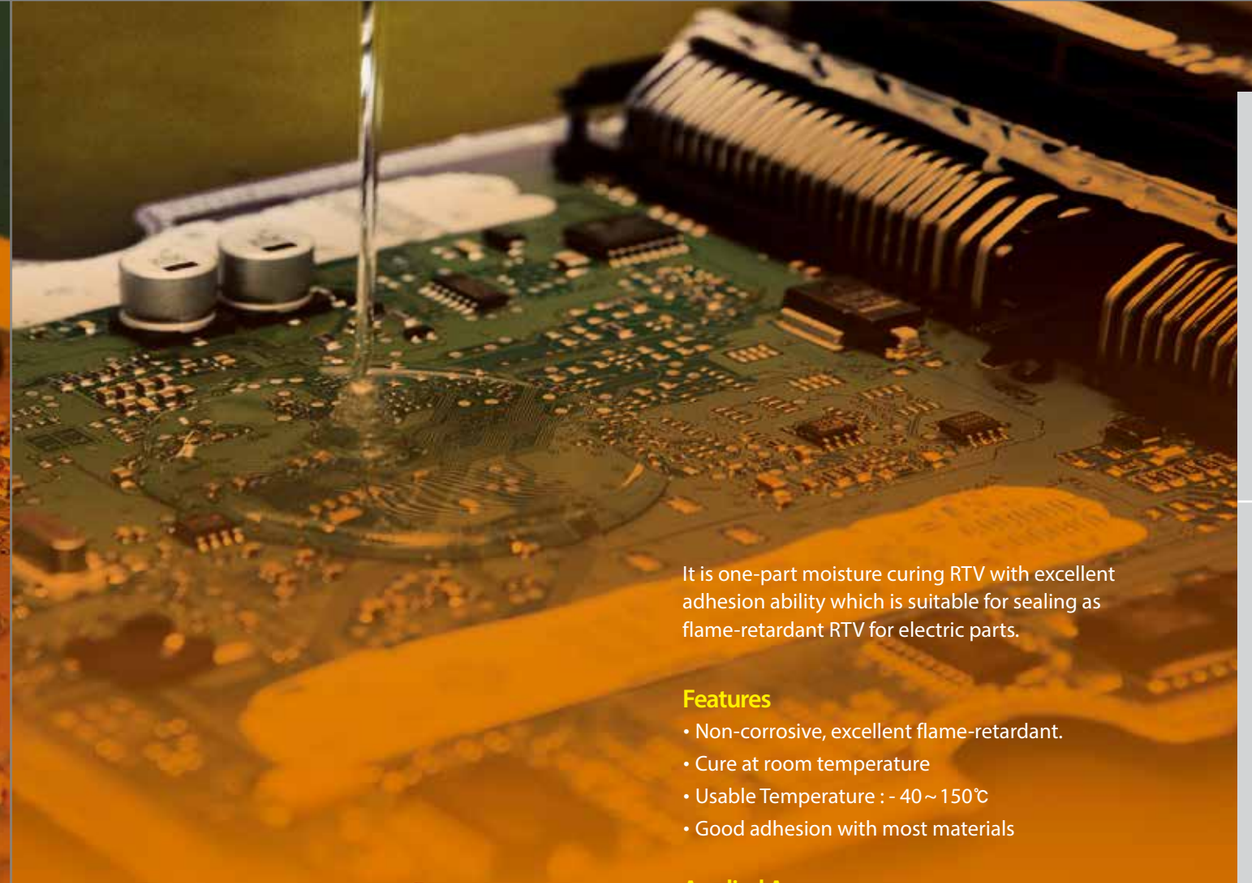


Silicone Gel for Power Module

KCC Silicone gel provides the protection on sensitive components against external influences, and has water-repellent and high electric strength.

Product	Color	Component	Viscosity [mPa·s (cP)]	Penetration (1/10mm)	Room Temp. cure (min)	Heat Cure (min)	Pot life (hour)	UL Certi.	Characteristic
SL5176	Transparent	2 Part	1,000	10	25℃ × 90-100	50℃ × 10-15 75℃ × 3-8	10-12 min	UL94 V-1 eq.	Hard gel, Rapid cure
SL5177	Transparent	2 Part	1,000	50	25℃ × 90-100	50℃ × 10-15 75℃ × 3-8	10-12 min	UL94 V-1 eq.	Soft gel, Rapid cure
SL5171	Transparent	2 Part	1,000	57	25℃ × 90-100	100℃ × 60 130℃ × 30	2	UL94 V-1	Standard gel
SL5271S	Transparent	1 Part	1,000	85	-	125℃ × 60 150℃ × 30	4 week	UL94 V-1 eq.	Soft gel
SL5282	Transparent	1 Part	1,000	85	-	100℃ × 240 125℃ × 120 150℃ × 60	3 week	-	Standard gel
SL5183	Light Yellow Transparent	2 Part	600	60	-	100℃ × 60	3 week	-	Heat Resistance
SL5283	Light Yellow Transparent	1 Part	600	60	-	100℃ × 60	3 week	-	Heat Resistance

* Penetration [1/10mm] : Quarter Cone (ASTM D1403)



Silicone for PCB

It is one-part moisture curing RTV with excellent adhesion ability which is suitable for sealing as flame-retardant RTV for electric parts.

Features

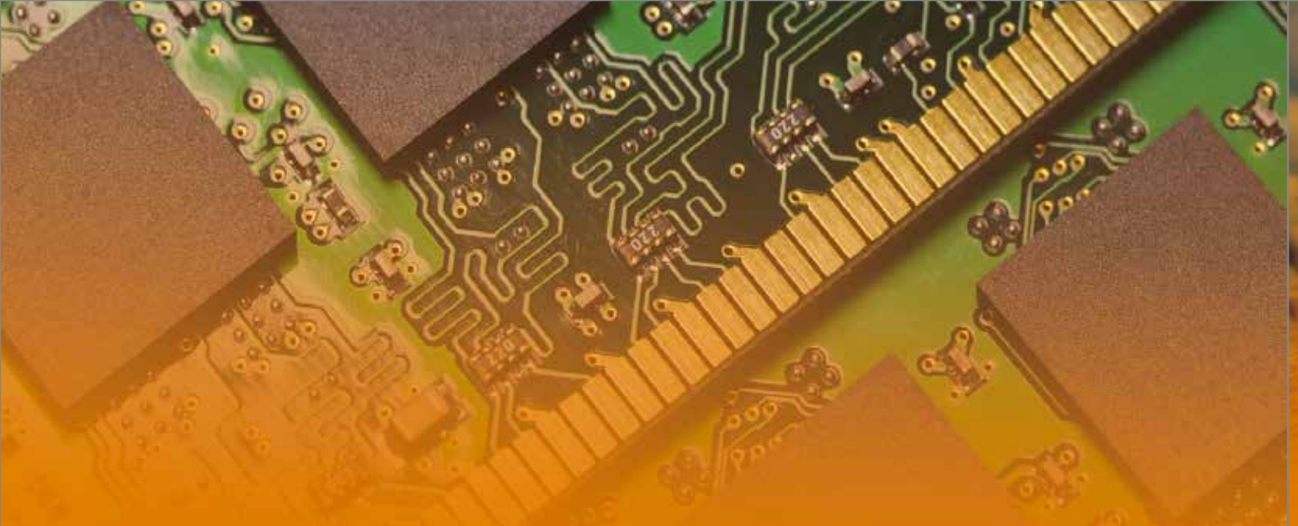
- Non-corrosive, excellent flame-retardant.
- Cure at room temperature
- Usable Temperature : - 40 ~ 150℃
- Good adhesion with most materials

Applied Area

- Flame-retardant, Sealing material to protect electric parts or lids of Power Supplies, Connector, Sensor, Relay, High Voltage Resistor Pack.
- Part fixing on Hybrid PCB and the CASE.

Properties of Silicone for PCB

Property	Unit	Conformal Coating		Adhesive	
		SS7065	SJ7000P	SS4000IH	SS9912
Classification	-	Standard	Solvent Type	Lead Protection	Part Fixing Adhesive
Curing Condition	-	1 component, Room Temp.	1 component, Room Temp.	1 component, Room Temp.	1 component, Room Temp.
Specific Gravity (25℃)	-	0.95	0.95~1.12	1	1.54
Viscosity (25℃)	cP	150	900~1,500	5,500	Non-Flowable
Tackiness Free Time	Minute	7	<2	17	16
Hardness	Shore A	32	Shore D 15	15	40
Tensile Strength	MPa	-	-	-	2
Dielectric Strength	KV/mm	21.6	>20	26	18
Volume Resistivity	Ohm-cm	2.91×10^{15}	>5E+13	7.5×10^{14}	1.1×10^{14}
Shelf Life	Month	12	12	12	9
UL Certification	-	UL V-0	V-0 (Preparing)	UL HB	UL V-0
Others	-	Easy to visual inspection under the UV light after coating process due to UV pigment		-	Thermal Conductivity : 0.6W/mK



Silicone Adhesive for Semiconductor

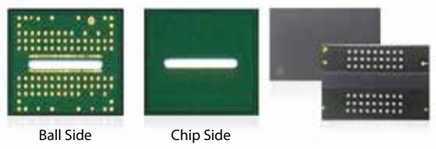
It's heat curable one-component silicone adhesive for semiconductor. It enables fast cure with excellent adhesion to a variety of materials.

Silicone Adhesive for BOC Die Bonding

KCC Silicone Adhesive for BOC Die Bonding can skip the B-stage & post cure process, and has low moisture absorption.

Property

Item	Unit	SL3131SP
Appearance (Color)	-	Milky White
Viscosity (@25℃.50%RH)	Pa.s	80
Thixo Index	-	1.42
Working Time (@25℃.50%RH)	Day	> 4
Shelf Life (@-65~-15℃)	Month	6
Specific Gravity	-	1.11
Hardness	Shore A	50
Tensile Strength	MPa	5.0
Elongation	%	300
Young's Modulus	MPa	1.9
Lap Shear Strength (@Al to Al)	MPa	5.0
Die Shear Strength (@Die to Adhesive)	kgf/cm²	89
C.T.E (@0~50℃)	ppm	279
Volume Resistivity	Ω.cm	7.30E + 14
Dielectric Breakdown	kV	24
Ionic Impurities Contents	ppm	≤ 10

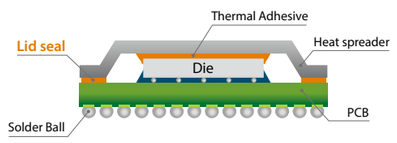


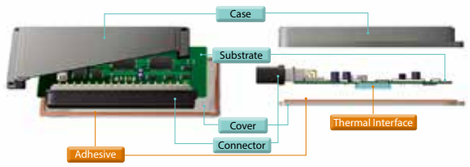
Silicone Adhesive for Lid Seal or Case Seal

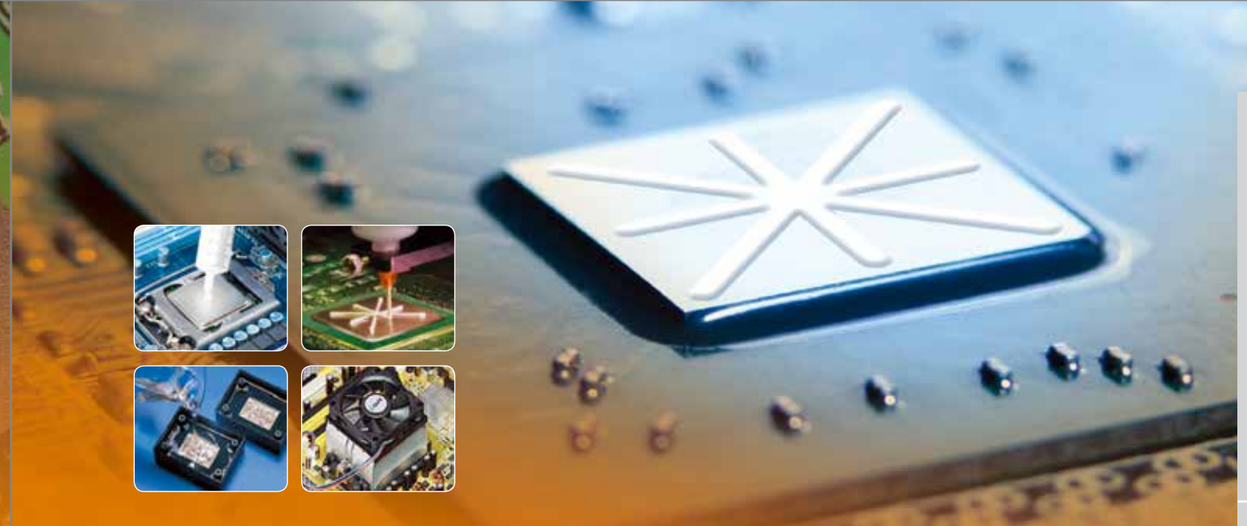
KCC Lid Sealing Adhesive is one-component heat curable silicone and rapidly cured at elevated temperature.

Property

Item	Unit	SL3137
		Non-flowable (High thixo index)
		Low Viscosity
Appearance (Color)	-	Beige
Viscosity (@25℃.50%RH)	mPa.s	45,000
Thixo Index	-	3.4
Cure Condition (@150℃)	min	60
Shelf Life (1~10℃)	Month	6 (Below -15℃)
Specific Gravity	-	1.1
Hardness	Shore A	55
Tensile Strength	MPa	5
Elongation	%	150
Young's Modulus	MPa	2.5
Volume Resistivity	Ω.cm	1.0 x 10^{13}
Dielectric Breakdown	kV/mm	20
Lap Shear Strength (@Al/Al)	MPa	5.0







Silicone Thermal Interface Materials

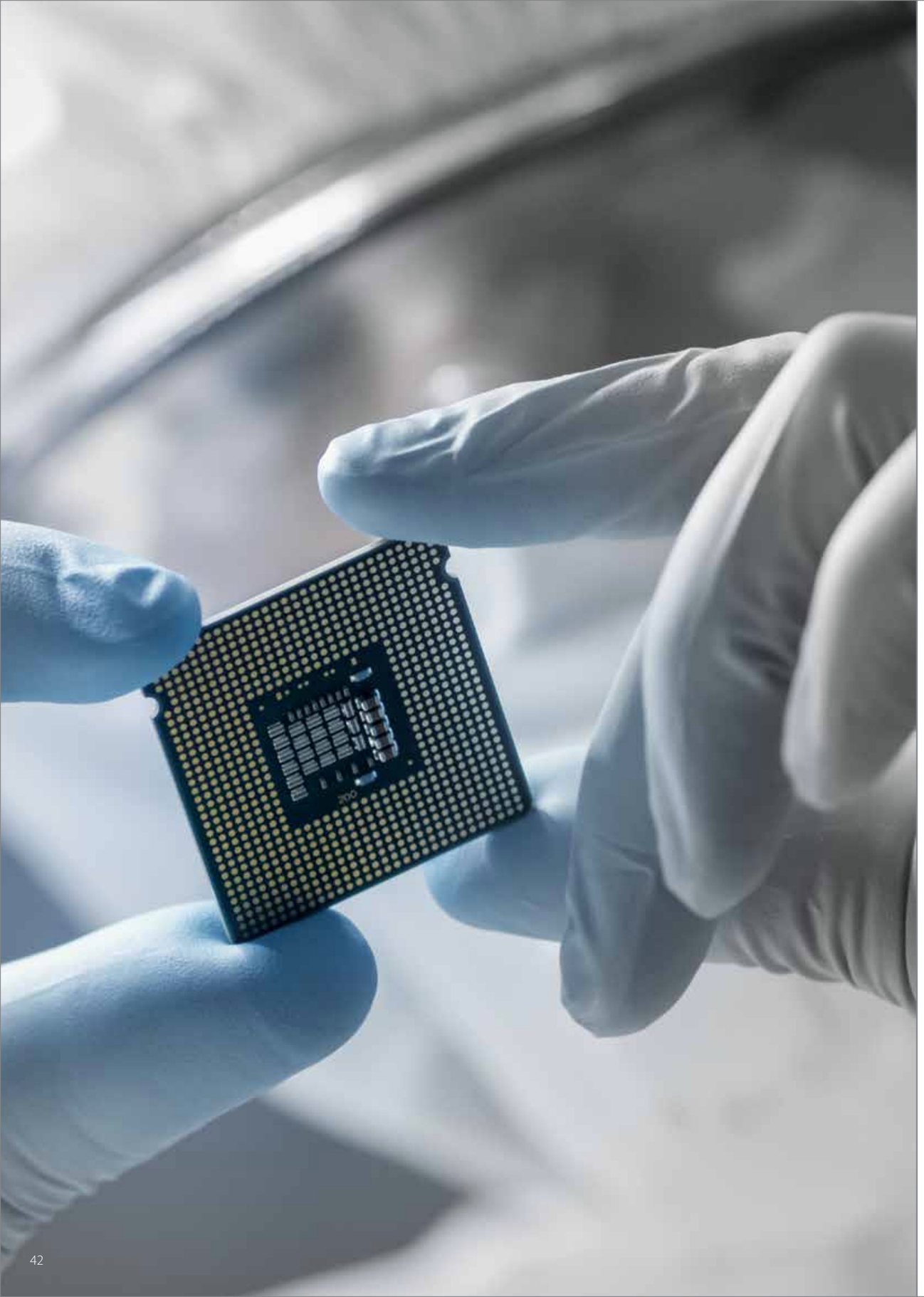
KCC thermal interface materials offer optimized thermally conductive performance and effective dual role-dissipating the heat of the device to the heat sink and forming mechanical bond.

Silicone Thermal Adhesive

Item	Unit	TIM 1	High k		Room Temp. Curable
		TCA-210	TCA-510	TCA-710	TCG-510
UNCURED COMPOUND					
Color	-	Gray	Gray	Gray	White
Viscosity (@10 s^{-1})	mPa·s (cP)	45,000	50,000	90,000	120,000
T.I (1/10)	-	2.5	3.5	4.0	3.4
Snap Cure	℃/min	150/2	150/2	150/2	
Full Cure	℃/min	150/120	150/120	150/120	
Pot Life (@25℃)	hr	24	24	24	
Shelf Life (@-15℃)	month	6	6	6	6
CURED COMPOUND					
Specic Gravity		2.8	3.3	3.5	3.1
Hardness	Shore A	90	92	92	78
Volume Resistivity	㎛	45	45	50	100
Thermal Conductivity	Ω.cm	1.0 x10^{14}	1.0 x10^{14}	1.0 x10^{15}	1.0 x10^{14}
Thermal Conductivity	W/mK	2.4	5.0	7.2	4.2
Tensile Strength	MPa	5	1.5	1.5	-
Elongation	%	17	15	11	-
Al Lap Shear Strength	MPa	3.0	1.0	0.7	2

Silicone Thermal Grease / Gel / Pottant

Item	Unit	Thermal Grease		Thermal Gap Filler			Thermal Pottant
		GB-100	GB-500	LGF-110S	LGF-177	LGF-179	LTP-141
UNCURED COMPOUND							
Color	-	Gray	Gray	Gray	Gray	Gray	Gray
Viscosity (@10 s^{-1})	mPa·s (cP)	45,000	100,000	90,000	200,000	80,000	35,000
Curing Condition	℃/min	-	-	150/30	150/30	150/30	150/30
Pot Life (@25℃)	hr	-	-	2	2	2	2
Shelf Life (@-15℃)	month	12	6	6	6	6	12
CURED COMPOUND							
Specic Gravity		3.20	3.30	3.30	3.00	3.20	1.57
Hardness	-	-	-	20 (Asker C)	20 (Asker C)	20 (Asker C)	55 (Shore A)
Volume Resistivity	Ω.cm	1.0 x10^{14}	1.0 x10^{13}	1.0 x10^{13}	1.0 x10^{13}	1.0 x10^{13}	1.0 x10^{15}
Thermal Conductivity	W/mK	3.0	4.8	3.1	3.2	5.0	0.7
Tensile Strength	MPa	-	-	-	-	2.0	2.6
Elongation	%	-	-	-	-	20	111
Al Lap Shear Strength	MPa	-	-	-	-	1.0	2.0



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