Electronics
Solutions

DOW CORNING

Advanced Silicone Materials for Electric Vehicle Electronics

IMAGINE

Improved Thermal Management,
Reliability and Cost-Effectiveness
for Electric Vehicle Electronics

IMAGINE

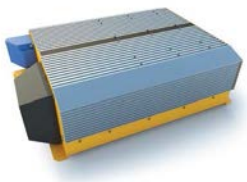
Designs for the Future … Today

The market for plug-in hybrid and battery-powered electric vehicles (xEV) has the potential to grow exponentially in the coming years. But realizing that potential will depend on a number of factors, including the industry's ability to meet consumer expectations for performance and value.

This will challenge battery makers to design for the large-volume production of lithium battery packs that are smaller, lighter and less expensive. These higher-energy-density packs will be capable of delivering more power, longer, through better thermal control.

Manufacturers and designers of other xEV components – including battery management systems, power control units, DC/DC converters and electric motors – face many of the same thermal management, assembly and protection challenges.

Dow Corning can help, with an extensive portfolio of proven, innovative and emerging silicone technologies for xEV electronics.

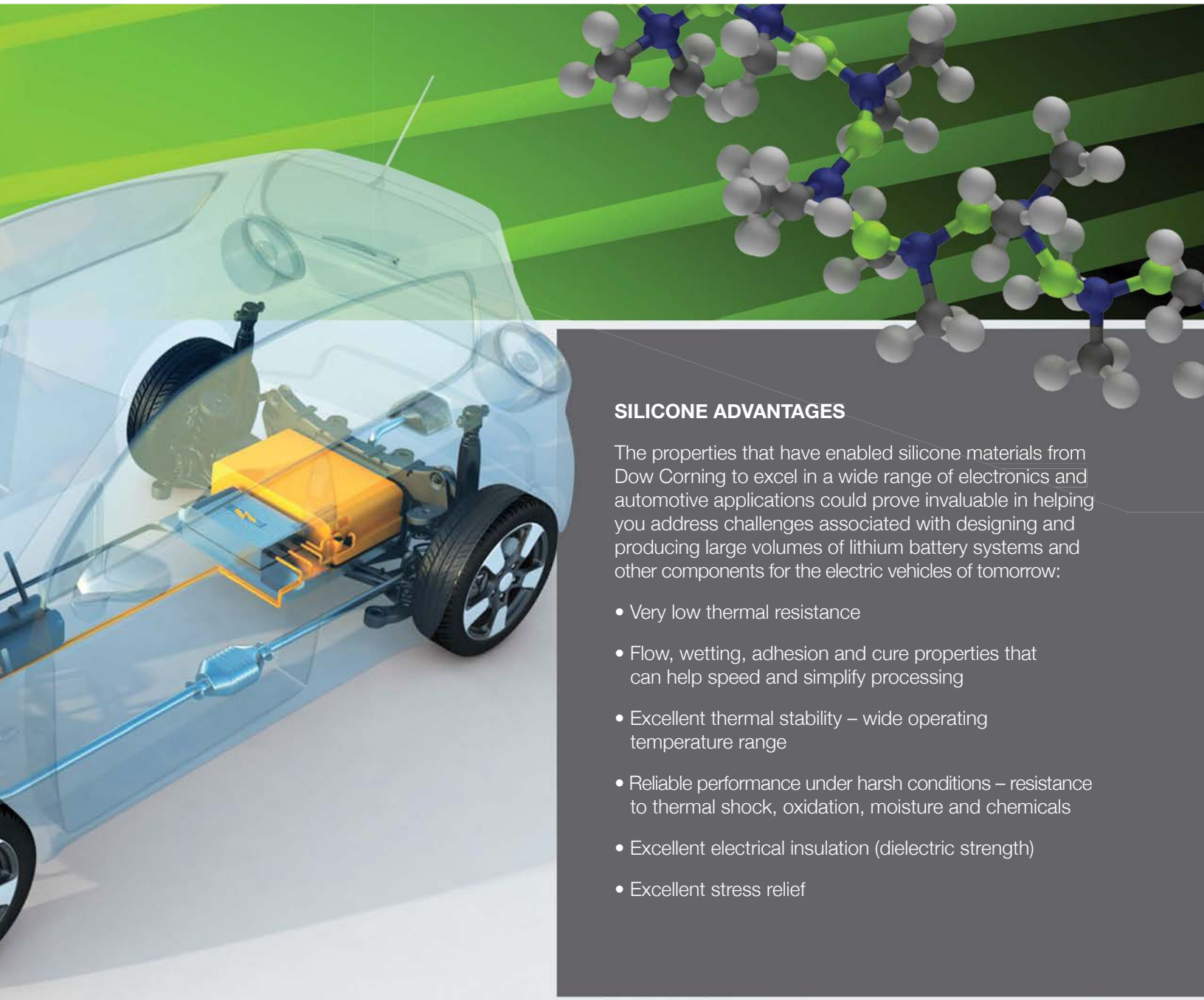


AC/DC Charger

Inverter/Converter

Motor/Generator

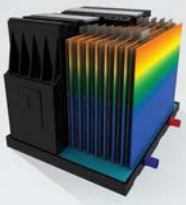
Electric Compressor for Air Conditioner



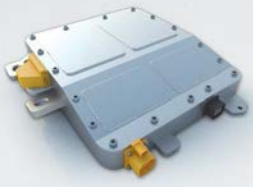
SILICONE ADVANTAGES

The properties that have enabled silicone materials from Dow Corning to excel in a wide range of electronics and automotive applications could prove invaluable in helping you address challenges associated with designing and producing large volumes of lithium battery systems and other components for the electric vehicles of tomorrow:

- Very low thermal resistance
- Flow, wetting, adhesion and cure properties that can help speed and simplify processing
- Excellent thermal stability – wide operating temperature range
- Reliable performance under harsh conditions – resistance to thermal shock, oxidation, moisture and chemicals
- Excellent electrical insulation (dielectric strength)
- Excellent stress relief



Battery Module

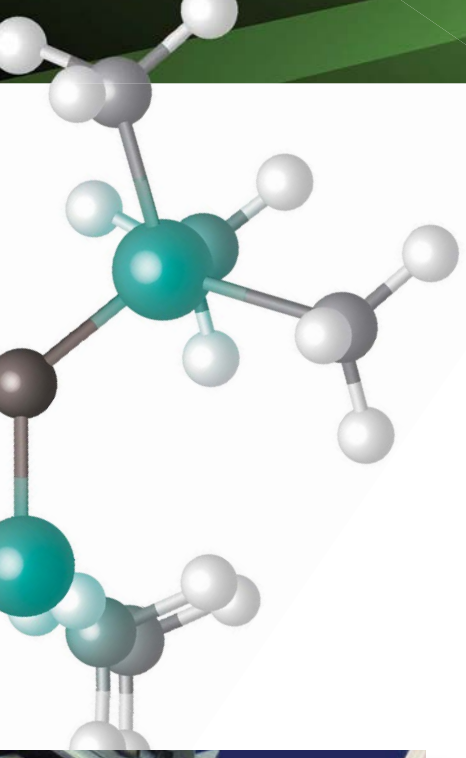


DC/DC Converter

Sheath Heater

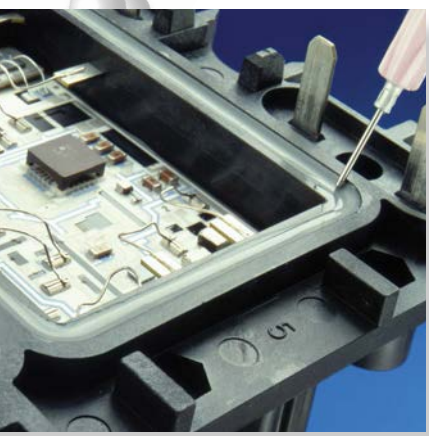
PTC Heater

Battery Management System (BMS)



Enabling & Problem-Solving Silicone Materials

Silicone is an amazingly versatile material that can be produced in many forms. Dow Corning is a silicone pioneer and a global leader in engineering silicones to meet specific performance and processing requirements.

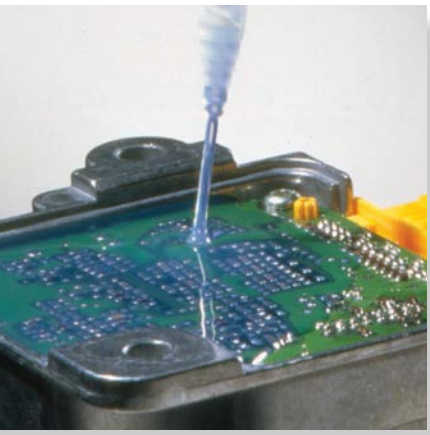


FOR THERMAL MANAGEMENT

Thermally conductive silicone materials from Dow Corning have properties that can help you reduce operating temperatures and extend the life and performance of batteries and other electric vehicle electronic components.

Dow Corning offers a wide range of thermal interface materials with the potential for creating effective, efficient designs and assembly applications. Examples of leading technologies include:

- **Thermally conductive silicone adhesives** for coupling the battery pack to the heat sink; also may be appropriate for use within or between cells
- **Noncuring thermally conductive silicone compounds**, with a possible applied temperature range of -40 to 150°C, for conducting heat from the battery cells to the heat sink
- **Thermally conductive silicone gels and encapsulants** are flowable materials that facilitate high-volume processes in automated production; can be used as an alternative to precured pads to couple cells and modules to heat sinks or as conformable gap-fillers



FOR OTHER CHALLENGES

Dow Corning offers proven and innovative materials to help you meet a wide range of electric vehicle application challenges.

- **Silicone gels** for potting of electronics in the battery pack's power management system
- **Adhesives** for a variety of bonding applications, including staking large capacitors for vibration control, extra support for large components on circuit boards, and housing sealing
- **Conformal coatings** for protecting electronic circuit boards in the power management system
- **Engineered elastomers** for heat-resistant sealing and gasketing

BREAKTHROUGH Technologies

To meet needs for performance, design flexibility and cost control

Dow Corning® EA-7100 Adhesive

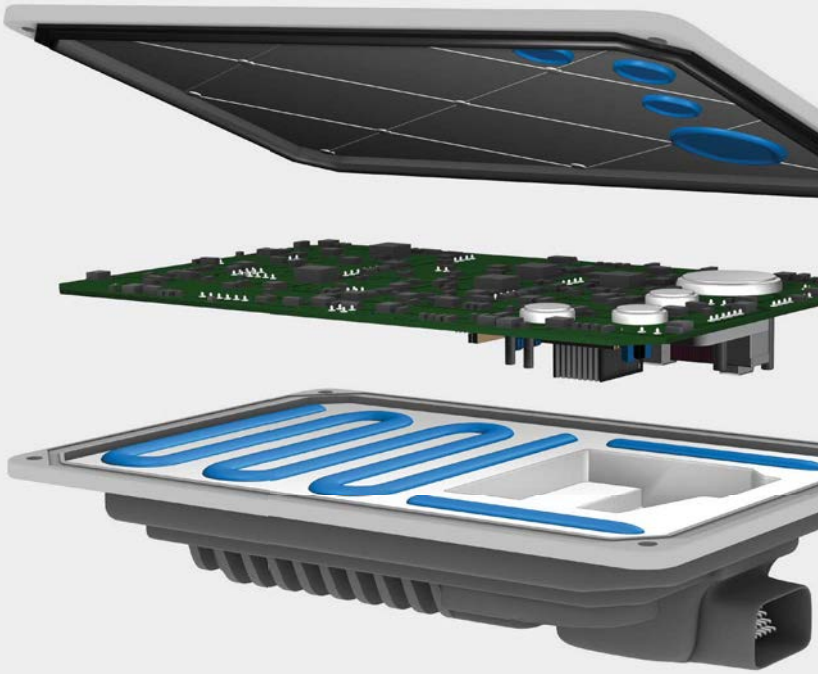
A Thermal Radical Cure™ *adhesive for use in the assembly of electronics housings and for attaching connectors, electronic control units or sensors to substrates*

Dow Corning® EA-7100 Adhesive cures much faster at moderate temperatures than conventional heat-curable silicones, and it may allow you to eliminate some cleaning steps, enabling faster throughput and lower energy costs. Plus, it offers durable adhesion to a broad range of diverse substrates for greater design flexibility. Other quality- and performance-enhancing benefits include adhesion in harsh environments, low void formation, superior anti-corrosion performance and less sensitivity to contamination.

Dow Corning® TC-4525 Thermally Conductive Gap Filler

A cost-effective way to manage the rising heat in next-generation electronics designs

Dow Corning® TC-4525 Thermally Conductive Gap Filler is a soft and compressible silicone material designed to dissipate heat from electronic devices. This high-performing new silicone technology delivers thermal conductivity of 2.5 W/m.K, greatly improved dispensability and stable performance for more reliable electronics in harsh automotive underhood environments.



xEV Battery Pack

THERMAL MANAGEMENT

Product		1 or 2 Part	Color	Thermal Conductivity, W/m.K	Thermal Resistance, °C/W
Thermally Conductive Gap Fillers	*Dow Corning*® TC-4515 Thermally Conductive Gap Filler†	In development: 1.8 W/m.K silicone gap filler material for automotive electronics			
	Dow Corning® TC-4525 Thermally Conductive Gap Filler	2 part (1:1 mix ratio)	Part A: White Part B: Blue	2.6	0.42 @ 85 µm 0.73 @ 115 µm 1.23 @ 309 µm
	Dow Corning® TC-4525 GB Thermally Conductive Gap Filler	Glass bead option (180 micron) for *Dow Corning*® TC-4525 Thermally Conductive Gap Filler			
	Dow Corning® TC-4525 CV Thermally Conductive Gap Filler	2 part (1:1 mix ratio)	Part A: White Part B: Blue	2.6	-
	Dow Corning® TC-4529 Thermally Conductive Gap Filler	1 part	Gray	3.2	0.44 @ 78 µm 0.58 @ 100 µm 1.84 @ 400 µm
	Dow Corning® TC-4530 Thermally Conductive Gap Filler†	In development			
Thermally Conductive Adhesives	*Dow Corning*® TC-2030 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Gray	2.7	-
	Dow Corning® TC-2035 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Part A: White Part B: Reddish brown	3.3	0.25 @ 50 µm 0.44 @ 100 µm
	Dow Corning® SE 4485 Thermally Conductive Adhesive	1 part	White	2.8	-
	Dow Corning® SE 4485 L Thermally Conductive Adhesive	1 part	White	2.2	-
	Dow Corning® SE 4486 Thermally Conductive Adhesive	1 part	White	1.6	-
Thermally Conductive Encapsulants	*Dow Corning*® TC-4605 Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Gray	1	-
	Dow Corning® TC-4605 HLV Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Gray	1	-

(1)Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

ASSEMBLY

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3
Adhesives	*Dow Corning*® EA-5151 *QiC*™ Adhesive(1)†	1 part	-	60,000 @ 120°C	1.08
	Dow Corning® 7091 Adhesive/Sealant(2)	1 part	Black, white, gray	-	1.4
	Dow Corning® SE 9168 RTV Adhesive	1 part	Gray	-	Cured: 1.32
	Dow Corning® SE 9185 Clear or White Adhesive	1 part	Clear or white	-	Cured: 1.05
	Dow Corning® EA-1236 Base and Catalyst Special Black Adhesive	2 part; (base-to-catalyst mix ratio by weight: 100 to 14)	Base: White Catalyst: Black	180,000 @ 0.5 s^{-1} 160,000 @ 5 s^{-1}	Base: 1.31 Catalyst: 1.05 Cured: 1.28
Silicone Foam	*Dow Corning*® 3-8209 Silicone Foam(5)	2 part (1:1 mix ratio)	Part A: Dark gray Part B: Colorless	Part A: 11,000-17,000 Part B: 12,000-17,000	Part A: 1.07 Part B: 1.01 Density: 200-280 (cured @ 23°C and tested after 24 hr)

(1)Developmental product data. *QiC*™: quick-in-connect adhesive. Utilizes silicone technology to achieve instant green strength when dispensed and cures to a strong moisture-cured silicone adhesive.
(2)Used as formed-in-place gasket (FIPG) material. Mechanical properties: cured 7 days in air at 23°C (73°F) and 50% relative humidity.
(3)Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.
(4)Measured after 7-day cure at room temperature.
(5)Designed to be dispensed and cured directly on parts to form an integrated compression gasket.

	Lap Shear	Cure, time/temp.	Viscosity, cP	Density, g/cm^3	Durometer	CTE, ppm/K	Notes
	In development: 1.8 W/m.K silicone gap filler material for automotive electronics						
	-	120 min/25°C 20 min/50°C 10 min/80°C	Part A: 207,000 Part B: 193,000 Mixed: 217,000	2.9	55 (Shore 00)	-50 to 80°C: 95 -50 to 150°C: 123	-
	Glass bead option (180 micron) for *Dow Corning*® TC-4525 Thermally Conductive Gap Filler						
	-	120 min/25°C 10 min/80°C	Part A: 223,000 Part B: 216,000 Mixed: 217,000	Cured: 2.9	40 (Shore 00) 32 (Asker C)	-	-
	-	Noncuring	300,000	3.1	-	-	-
	In development						
	Al: 435 psi, 3 MPa, 300 N/cm^2	60 min/130°C	Part A: 250,000 Part B: 200,000 Mixed: 220,000	-	92 (Shore A)	-	-
	Al: 381 psi, 2.63 MPa, 263 N/cm^2 Cu: 416 psi, 2.87 MPa, 287 N/cm^2	30 min/125°C 10 min/150°C	Part A: 130,000 Part B: 118,000 Mixed: 125,000	Wet: 3	95 (Shore A [JIS Type A]) 45 (Shore D)	-50 to 200°C: 92	-
	Glass to glass: 168 psi, 1.2 MPa, 120 N/cm^2	Tack-free time(1) @ 25°C: 10 min	Fluidity: 54 mm	Cured: 2.9	90 (Shore A [JIS])	-	UL 94 V-0
	Glass to glass: 262 psi, 1.8 MPa, 180 N/cm^2	Tack-free time(1) @ 25°C: 8 min	Fluidity: 47.4 mm	Cured: 2.84	90 (Shore A [JIS])	-	-
	Glass to glass: 240 psi, 1.65 MPa, 165 N/cm^2	Tack-free time(1) @ 25°C: 4 min	19,600 Fluidity: 60 mm	Cured: 2.6	81 (Shore A [JIS])	-	-
	Al: 110 psi	60 min/120°C	Part A: 3,100 Part B: 2,500 Mixed: 2,900	Cured: 1.67	30 (Shore A)	-	UL flammability @ 1.5 mm: 94 V-0
	Anodized Al: 220 psi	60 min/120°C	Part A: 1,600 Part B: 1,400 Mixed: 1,900	Cured: 1.67	60 (Shore A)	-	UL flammability @ 1.5 mm: 94 V-0

†Dow Corning developmental material. The composition, features, benefits and other properties are subject to change. The future availability of this product is not guaranteed. You are responsible to determine the suitability of the Product for your contemplated use. The Product is provided "AS IS" WITH ALL FAULTS, AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

	Cure, time/temp.	Lap Shear	Durometer	Tensile Strength, MPa	Elongation, %	Notes
	Room temperature cure when exposed to moisture in the air	Polycarbonate lap shear adhesion: 1 day: 0.5 MPa 7 days: 1.7 MPa	55-57 (Shore A)	4.5-4.7	>900	Can be used with standard hot-melt dispensing equipment
	Room temperature cure when exposed to moisture in the air; tack-free time(3): 28 min	-	32 (Shore A)	2.5	680	FIPG(2)
	Room temperature cure when exposed to moisture in the air; tack-free time(3) @ 25°C: 6.5 min	Glass: 275 psi, 1.9 MPa, 189 N/cm^2	44 (Shore A [JIS])	3.69	363	UL 94 V-0
	Room temperature cure when exposed to moisture in the air; tack-free time(3) @ 25°C: 8 min	Glass: 120 N/cm^2	31 (Shore A)	3	515	-
	Room temperature cure; tack-free time(3): 10 min	-	36 (Shore A)(4)	2.2	300	Fast room-temperature cure
	Room temperature cure when exposed to moisture in the air; tack-free time(3) @ 25°C: max 10 min	-	45 (Shore 00)	-	-	Compression set @ 50% compression, 22 hr @ 70°C: • Non-post-cured: 32% • Post-cured 1 hr @ 100°C: 4% • Stress-strain characteristics in compression, 50% compression: 74 KPa

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xEV Battery Pack *(continued)*

CONNECTOR

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	
Encapsulants	*Sylgard*® 170 Silicone Elastomer	2 part (1:1 mix ratio)	Black	Part A: 3,160 Part B: 1,110 Mixed: 2,135	Part A, Uncured: 1.37 Part B, Uncured: 1.37	
	Sylgard® 170 Fast Cure Silicone Elastomer	2 part (1:1 mix ratio)	Black	Part A: 3,436 Part B: 1,287 Mixed: 2,361	Part A, Uncured: 1.38 Part B, Uncured: 1.38	
	Sylgard® 567 Silicone Encapsulant	2 part (1:1 mix ratio)	Black	Part A: 2,060 Part B: 570	Uncured: 1.24	
Adhesive	*Dow Corning*® SE 9186 Clear or White Adhesive	1 part	Clear or white	64,000	Cured: 1.03	
Silicone Foam	*Dow Corning*® 3-6548 Silicone RTV Foam[(2)]	2 part	Black	Part A: 40,000-60,000 Part B: 50,000-75,000	Part A: 1.05-1.11 Part B: 1.05-1.11 Cured: 0.22-0.32	

[(1)]Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.
[(2)]Silicone RTV foam for fire-resistant penetration seals.

Battery Management System (BMS)

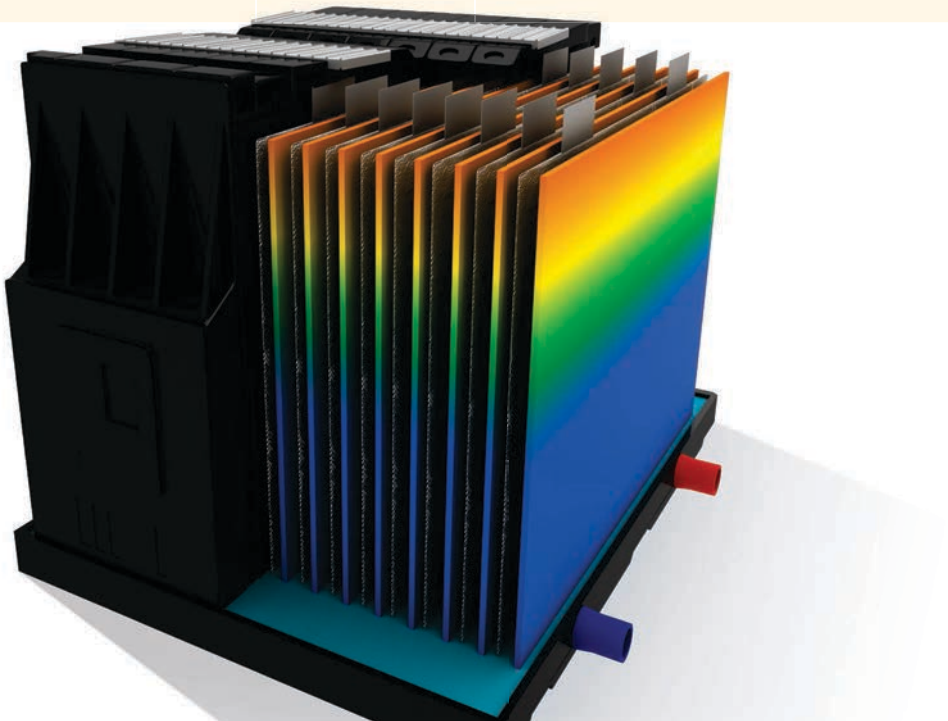
PCB PROTECTION

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	
Conformal Coatings	*Dow Corning*® 3-1953 Conformal Coating	1 part	Translucent	350	Cured: 0.98	
	Dow Corning® 3-1965 Conformal Coating	1 part	Translucent	115	Cured: 0.99	
	Dow Corning® 1-2577 Low VOC Conformal Coating	1 part	Transparent	1,050	Cured: 1.12	

[(1)]Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

	Cure, time/temp.	Lap Shear	Durometer	Tensile Strength, MPa	Elongation, %	Notes
	24 hr/25°C 25 min/70°C 10 min/100°C	-	47 (Shore A)	-	-	Thermal conductivity: 0.48 W/m.K
	0.2 hr/25°C	-	41 (Shore A)	-	-	Thermal conductivity: 0.4 W/m.K
	180 min/70°C 120 min/100°C	-	40 (Shore A)	-	-	Thermal conductivity: 0.29 W/m.K
	Room temperature cure when exposed to moisture in the air; tack-free time[3] @ 25°C: max 10 min	Glass: 360 psi, 2.5 MPa, 25 N/cm^2	20 (Shore A)	2.5	550	-
	-	-	-	228,000 N/m^2, 33 psi	-	Compression deflection: • @ 20% compression: 35,900 N/m^2, 5.2 psi • @ 40% compression: 69,600 N/m^2, 10.1 psi • @ 60% compression: 146,000 N/m^2, 21.2 psi

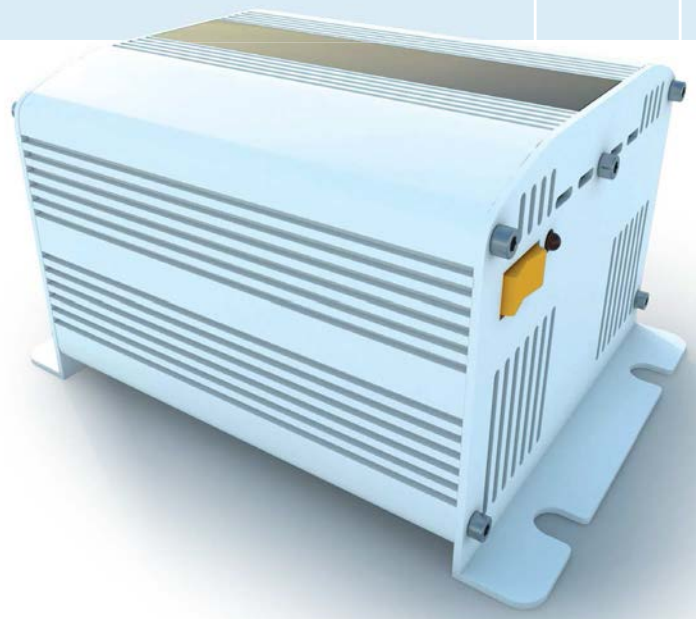
	Tack-Free Time[1], time/temp.	Nonvolatile Content (NVC), %	Durometer	Notes
	8 min/25°C 0.5 min/60°C (15% RH)	99.4	34 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E
	6 min/25°C	-	33 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830 with Amendment 1
	6 min/25°C 1.5 min/60°C (15% RH)	NVC – forced draft volatility: 33.6	85 (Shore A) 25 (Shore D)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E



Power Control Unit (PCU), Including Inverter, Converter, Etc.

THERMAL MANAGEMENT

Product		1 or 2 Part	Color	Thermal Conductivity, W/m.K	Thermal Resistance, °C/W	
Thermally Conductive Compounds	*Dow Corning*® TC-5026 Thermally Conductive Compound	1 part	Gray	2.9	0.03°C-cm²/W @ 7 µm (40 psi)	
	Dow Corning® TC-5625 C Thermally Conductive Compound	1 part	Green gray	2.6	0.1°C-cm²/W (20 psi)	
	Dow Corning® SC 4471 CV Thermally Conductive Compound	1 part	White	2	-	
Thermally Conductive Gap Fillers	*Dow Corning*® TC-4515 Thermally Conductive Gap Filler†	In development: 1.8 W/m.K silicone gap filler material for automotive electronics				
	Dow Corning® TC-4525 Thermally Conductive Gap Filler	2 part (1:1 mix ratio)	Part A: White Part B: Blue	2.6	0.42 @ 85 µm 0.73 @ 115 µm 1.23 @ 309 µm	
	Dow Corning® TC-4525 GB Thermally Conductive Gap Filler	Glass bead option (180 micron) for *Dow Corning*® TC-4525 Thermally Conductive Gap Filler				
	Dow Corning® TC-4525 CV Thermally Conductive Gap Filler	2 part (1:1 mix ratio)	Part A: White Part B: Blue	2.6	-	
	Dow Corning® TC-4529 Thermally Conductive Gap Filler	1 part	Gray	3.2	0.44 @ 78 µm 1.84 @ 400 µm	
	Dow Corning® TC-4530 Thermally Conductive Gap Filler†	In development				
Thermally Conductive Adhesives	*Dow Corning*® Q1-9226 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Gray	0.8	-	
	Dow Corning® 1-4174 Thermally Conductive Adhesive	1 part	Gray	1.78	-	
	Dow Corning® TC-2030 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Gray	2.7	-	
	Dow Corning® TC-2035 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Part A: White Part B: Reddish brown	3.3	0.25 @ 50 µm 0.44 @ 100 µm	



	Lap Shear	Cure, time/temp.	Viscosity, cP	Density, g/cm^3	Durometer	CTE, ppm/K	Notes
	-	Noncuring	102,118	Uncured: 3.5	-	-	-
	-	Noncuring	81,757	Uncured: 4.2	-	-	-
	-	Noncuring	116,000	Cured: 2.76	-	-	-
	In development: 1.8 W/m.K silicone gap filler material for automotive electronics						
	-	120 min/25°C 20 min/50°C 10 min/80°C	Part A: 207,000 Part B: 193,000 Mixed: 217,000	2.9	55 (Shore 00)	-50 to 80°C: 95 -50 to 150°C: 123	-
	Glass bead option (180 micron) for *Dow Corning*® TC-4525 Thermally Conductive Gap Filler						
	-	120 min/25°C 10 min/80°C	Part A: 223,000 Part B: 216,000 Mixed: 217,000	Cured: 2.9	40 (Shore 00) 32 (Asker C)	-	
	-	Noncuring	300,000	3.1	-	-	-
	In development						
	Al: 375 psi, 2.6 MPa, 260 N/cm^2	Heat cure (100°C or above)	Part A: 48,000 Part B: 43,000 Mixed: 59,000	Cured: 2.14	67 (Shore A)	-	-
	Al: 646 psi, 4.5 MPa, 445 N/cm^2	90 min/100°C 30 min/125°C 20 min/150°C	62,300	Uncured: 2.71	92 (Shore A)	125 ppm/°C	UL 94-V0
	Al: 435 psi, 3 MPa, 300 N/cm^2	60 min/130°C	Part A: 250,000 Part B: 200,000 Mixed: 220,000	-	92 (Shore A)	-	-
	Al: 381 psi, 2.63 MPa, 263 N/cm^2 Cu: 416 psi, 2.87 MPa, 287 N/cm^2	30 min/125°C 10 min/150°C	Part A: 130,000 Part B: 118,000 Mixed: 125,000	Wet: 3	95 (Shore A [JIS Type A]) 45 (Shore D)	-50 to 200°C: 92	-

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Power Control Unit (PCU), Including Inverter, Converter, Etc. *(continued)*

ASSEMBLY

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm³	Cure, time/temp.
Adhesives	*Dow Corning*® EA-7100 Adhesive[1]	1 part	Gray	360,000	Cured: 1.09	15 min/100°C
	Dow Corning® EA-5151 *QiC*™ Adhesive[2]†	1 part	-	60,000 @ 120°C	1.08	Room temperature cure when exposed to moisture in the air
	Dow Corning® EA-6060 Adhesive†	In development				
	Dow Corning® 3-6265 Thixotropic Adhesive	1 part	Black	Low shear: 1,020,000 High shear: 235,000	Cured: 1.34	60 min/125°C 30 min/150°C
	Dow Corning® 3-6265 HP Adhesive	1 part	Black	1,070 Pa-sec	Cured: 1.33	240 min/100°C 25 min/125°C 10 min/150°C
	Dow Corning® 3-1598 HP Adhesive	1 part	Black	82,000	Cured: 1.31	180 min/100°C 30 min/125°C 15 min/150°C
	Dow Corning® 866 Primerless Silicone Adhesive	1 part	Gray	48,000	Cured: 1.29	60 min/125°C 30 min/150°C
	Dow Corning® 7091 Adhesive/Sealant[3]	1 part	Black, white, gray	Extrusion rate: 185 g/min	1.4	Room temperature cure when exposed to moisture in the air; tack-free time[4]: 28 min
	Dow Corning® 744 RTV Sealant	1 part	-	Extrusion rate: 184 g/min	Cured: 1.42	Room temperature cure; tack-free time[4]: 55 min
	Dow Corning® EA-1236 Base and Catalyst Special Black Adhesive	2 part (base-to-catalyst mix ratio by weight: 100 to 14)	Base: White Catalyst: Black	180,000 @ 0.5 s^{-1} 160,000 @ 5 s^{-1}	Base: 131 Catalyst: 1.05 Cured: 1.28	Room temperature cure; tack-free time[4]: 10 min
Silicone Foam	*Dow Corning*® 3-8209 Silicone Foam[6]	2 part (1:1 mix ratio)	Part A: Dark gray Part B: Colorless	Part A: 11,000-17,000 Part B: 12,000-17,000	Part A: 1.07 Part B: 1.01 Density: 200-280 (cured @ 23°C and tested after 24 hr)	Room temperature cure when exposed to moisture in the air; tack-free time[4] @ 25°C: max 10 min

[1]Durable adhesion to a wide variety of substrates, including plastics, metals, cured silicones and other substrates (contact Dow Corning for details).
[2]Developmental product data. *QiC*™: quick-in-connect adhesive. Utilizes silicone technology to achieve instant green strength when dispensed and cures to a strong moisture-cured silicone adhesive.
[3]Used as formed-in-place gasket (FIPG) material. Mechanical properties: cured 7 days in air at 23°C (73°F) and 50% relative humidity. Extrusion rate measured using 3.18 mm diameter nozzle at 0.62 MPa.
[4]Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.
[5]Measured after 7-day cure at room temperature.
[6]Designed to be dispensed and cured directly on parts to form an integrated compression gasket.

ASSEMBLY *(continued)*

Product		1 or 2 Part	Color	Extrusion Rate, g/min	Density, g/cm³	Cure, time/temp.
CIPGs (Cured-in-Place Gaskets)	*Dow Corning*® RBL-9694-20P A & B Silicone Elastomer	2 part (1:1 mix ratio)	Part A: Black Part B: White	[1]Part A: 119 Part B: 282	1.17	165 sec/115°C, T90%
	Dow Corning® RBL-9694-30P A & B Silicone Elastomer	2 part (1:1 mix ratio)	Part A: Black Part B: White	[1]Part A: 75 Part B: 178	1.2	Part A: 46 sec/115°C, T90% Part B: 92 sec/115°C
	Dow Corning® RBL-9694-45M Kit Silicone Elastomer	2 part (1:1 mix ratio)	Part A: Black Part B: White	[2]Part A: 77 Part B: 98	1.2	34 sec/115°C, T90%

[1]Extrusion rate: 3.2 mm nozzle at 0.63 MPa.
[2]Extrusion rate: 90 psi, 1/8-inch orifice.

PCB PROTECTION

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm³
Conformal Coatings	*Dow Corning*® 3-1953 Conformal Coating	1 part	Translucent	350	Cured: 0.98
	Dow Corning® 3-1965 Conformal Coating	1 part	Translucent	115	Cured: 0.99
	Dow Corning® 1-2577 Low VOC Conformal Coating	1 part	Transparent	1,050	Cured: 1.12

[1]Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

Lap Shear	Durometer	Tensile Strength, MPa	Elongation, %	CTE, ppm/°C	Notes
Al: 350 psi, 2.4 MPa, 240 kg/cm^2 PBT: 375 pcs, 2.6 MPa, 260 N/cm^2	43 (Shore A)	3.4	260	247	Durable adhesion to a wide variety of substrates
Polycarbonate lap shear adhesion: 1 day: 0.5 MPa 7 days: 1.7 MPa	55-57 (Shore A)	4.5-4.7	>900	-	Can be used with standard hot-melt dispensing equipment
In development					
Al: 611 psi	60 (Shore A)	4.8	165	275	UV indicator for inspection
Al: 825 psi, 5.7 MPa, 568 N/cm^2	68 (Shore A)	5.8	275	215	High tensile strength
Al: 712 psi, 4.97 MPa, 497 N/cm^2	57 (Shore A)	5.4	260	277	Able to flow, fill or self-level after dispensing
Al: 774.5 psi, 5.34 MPa, 534 N/cm^2	57 (Shore A)	6.4	210	350	High tensile strength
-	32 (Shore A)	2.5	680	-	FIPG[3]
Al: 430 psi, 3 MPa, 296 N/cm^2	37 (Shore A)	2.7	590	-	Bonding large components to circuit boards
-	36 (Shore A)[5]	2.2	300	-	Fast room-temperature cure
-	45 (Shore 00)	-	-	-	Compression set @ 50% compression, 22 hr @ 70°C: • Non-post-cured: 32% • Post-cured 1 hr @ 100°C: 4% • Stress-strain characteristics in compression, 50% compression: 74 KPa

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Durometer	Tensile Strength, MPa	Elongation @ Break, %	Modulus 100%, MPa	Tear Strength, kN/m	Compression Set @ -25%, %	Lap Shear Adhesion, MPa
21 (Shore A)	Die C, 5.9	925	0.39	Die B, 13	Compression for 22 hr @ 132°C: 36	Vinyl ester (10 min/150°C): 1.3
32 (Shore A)	Die C, 7.2	820	0.8	Die B, 14	Compression for 22 hr @ 177°C: 31	Al (10 min/150°C): 1.0
45 (Shore A)	Die C, 7.25	600	1.45	Die B, 45	Compression for 22 hr @ 177°C: 29	Al (10 min/150°C): 1.64 PA66 GF30 (10 min/150°C): 1.35

Tack-Free Time[1], time/temp.	Nonvolatile Content (NVC), %	Durometer	Notes
8 min/25°C 0.5 min/60°C (15% RH)	99.4	34 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E
6 min/25°C	-	33 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830 with Amendment 1
6 min/25°C 1.5 min/60°C (15% RH)	NVC – forced draft volatility: 33.6	85 (Shore A) 25 (Shore D)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E

Electric Motor

PROTECTION

Product		1 or 2 Part	Color	Thermal Conductivity, W/m.K	Thermal Resistance, °C/W	
Thermally Conductive Encapsulants	*Dow Corning*® CN-8760 G Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Dark gray	0.67	-	
	Dow Corning® TC-4605 Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Gray	1	-	
	Dow Corning® TC-4605 HLV Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Gray	1	-	

PROTECTION *(continued)*

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	
Conformal Coatings	*Dow Corning*® 3-1953 Conformal Coating	1 part	Translucent	350	Cured: 0.98	
	Dow Corning® 3-1965 Conformal Coating	1 part	Translucent	115	Cured: 0.99	
	Dow Corning® 1-2577 Low VOC Conformal Coating	1 part	Transparent	1,050	Cured: 1.12	
	Dow Corning® LDC-2577D Dispersion Coating	1 part	Transparent	104	Cured: 1.0	

(1)Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

CONTROL UNIT THERMAL MANAGEMENT

Product		1 or 2 Part	Color	Thermal Conductivity, W/m.K	Thermal Resistance, °C/W	
Thermally Conductive Encapsulant	*Dow Corning*® TC-6020 Thermally Conductive Encapsulant(1)†	2 part (1:1 mix ratio)	Gray	2.7	-	

(1)Developmental product data.

	Lap Shear	Cure, time/temp.	Viscosity, cP	Density, g/cm^3	Durometer	CTE, ppm/K	Notes
	-	24 hr/25°C	Part A: 2,900 Part B: 3,200 Mixed: 3,200	Cured: 1.58	45 (Shore A)	-	UL 94 V-0; UL RTI rating: 150°C
	Al: 110 psi	60 min/120°C	Part A: 3,100 Part B: 2,500 Mixed: 2,900	Cured: 1.67	30 (Shore A)	-	UL flammability @ 1.5 mm: 94 V-0
	Anodized Al: 220 psi	60 min/120°C	Part A: 1,600 Part B: 1,400 Mixed: 1,900	Cured: 1.67	60 (Shore A)	-	UL flammability @ 1.5 mm: 94 V-0

	Tack-Free Time(1), time/temp.	Nonvolatile Content (NVC), %	Durometer	Notes
	8 min/25°C 0.5 min/60°C (15% RH)	99.4	34 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E
	6 min/25°C	-	33 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830 with Amendment 1
	6 min/25°C 1.5 min/60°C (15% RH)	NVC – forced draft volatility: 33.6	85 (Shore A) 25 (Shore D)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E
	5 min/25°C 2 min/60°C (15% RH)	-	23 (Shore D)	-

	Lap Shear	Cure, time/temp.	Viscosity, cP	Density, g/cm^3	Durometer	CTE, ppm/K	Notes
	Al: 40.5 psi	23 min/60°C, T90% 13 min/80°C, T90% 5 min/100°C, T90%	Part A: 10,800 Part B: 9,960 Mixed: 10,640	2.926	63 (Shore A)	-	-

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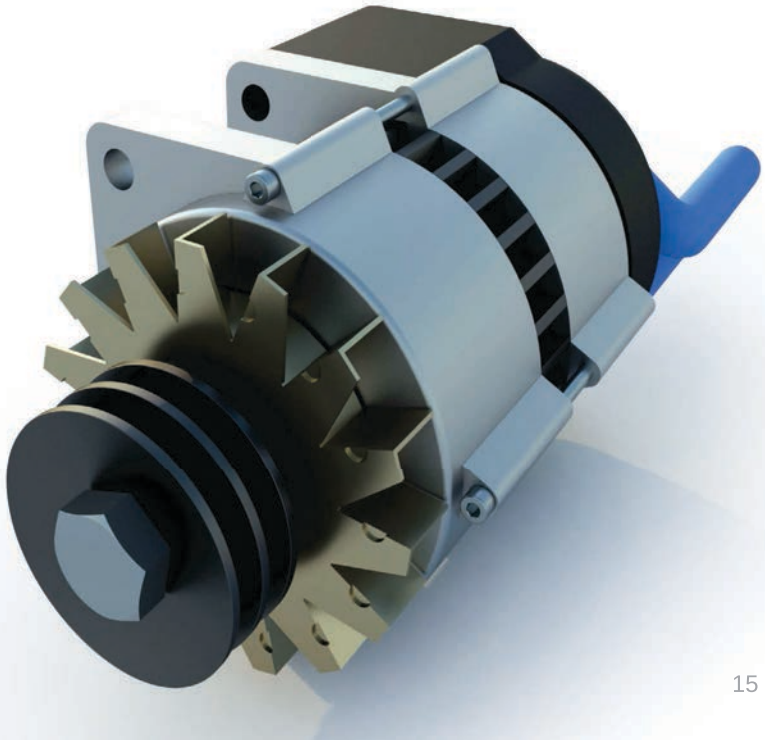

On-Board Charger

THERMAL MANAGEMENT

Product		1 or 2 Part	Color	Thermal Conductivity, W/m.K	Thermal Resistance, °C/W	
Thermally Conductive Encapsulants	*Dow Corning*® TC-4605 Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Gray	1	-	
	Dow Corning® TC-4605 HLV Thermally Conductive Encapsulant	2 part (1:1 mix ratio)	Gray	1	-	
	Dow Corning® TC-6020 Thermally Conductive Encapsulant[(1)†]	2 part (1:1 mix ratio)	Gray	2.7	-	

[(1)]Developmental product data.

ASSEMBLY

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	Cure, time/temp.	
Adhesive	*Dow Corning*® EA-9189 H White RTV Adhesive	1 part	White	-	Cured: 1.68	Room temperature cure when exposed to moisture in the air; tack-free time[(1)] @ 25°C: 2 min	

[(1)]Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

PROTECTION

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	
Conformal Coatings	*Dow Corning*® 3-1953 Conformal Coating	1 part	Translucent	350	Cured: 0.98	
	Dow Corning® 3-1965 Conformal Coating	1 part	Translucent	115	Cured: 0.99	
	Dow Corning® 1-2577 Low VOC Conformal Coating	1 part	Transparent	1,050	Cured: 1.12	

[(1)]Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

	Lap Shear	Cure, time/temp.	Viscosity, cP	Density, g/cm^3	Durometer	CTE, ppm/K	Notes
	Al: 110 psi	60 min/120°C	Part A: 3,100 Part B: 2,500 Mixed: 2,900	Cured: 1.67	30 (Shore A)	-	UL flammability @ 1.5 mm: 94 V-0
	Anodized Al: 220 psi	60 min/120°C	Part A: 1,600 Part B: 1,400 Mixed: 1,900	Cured: 1.67	60 (Shore A)	-	UL flammability @ 1.5 mm: 94 V-0
	Al: 0.5 psi	23 min/60°C, T90% 13 min/80°C, T90% 5 min/100°C, T90%	Part A: 10,800 Part B: 9,960 Mixed: 10,640	2.926	63 (Shore A)	-	-

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	Lap Shear	Durometer	Tensile Strength, MPa	Elongation, %	CTE, ppm/°C	Notes
	Al: 327 psi, 2.2 MPa, 225 N/cm^2 Cu: 343 psi, 2.3 MPa, 236 N/cm^2 PC: 187 psi, 1.2 MPa, 128 N/cm^2 FR4: 349 psi, 2.4 MPa, 240 N/cm^2	80 (Shore A)	3.9	32	-	Thermal conductivity: 0.88 W/m.K UL 94 V-0

	Tack-Free Time[(1)], time/temp.	Nonvolatile Content (NVC), %	Durometer	Notes
	8 min/25°C 0.5 min/60°C (15% RH)	99.4	34 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E
	6 min/25°C	-	33 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830 with Amendment 1
	6 min/25°C 1.5 min/60°C (15% RH)	NVC – forced draft volatility: 33.6	85 (Shore A) 25 (Shore D)	UL 94 V-0; MIL I-46058C Amend 7 IPC-CC-830B; UL 746E

PTC Heater

THERMAL MANAGEMENT AND ASSEMBLY

Product		1 or 2 Part	Color	Thermal Conductivity, W/m.K	Thermal Resistance, °C/W	
Thermally Conductive Adhesives	*Dow Corning*® Q1-9226 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Gray	0.8	-	
	Dow Corning® SE 4402 Thermally Conductive Adhesive	1 part	Gray	0.9	-	
	Dow Corning® TC-2035 Thermally Conductive Adhesive	2 part (1:1 mix ratio)	Part A: White Part B: Reddish brown	3.3	0.25 @ 50 µm 0.44 @ 100 µm	

Electric Compressor

PROTECTION

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	
Conformal Coatings	*Dow Corning*® 3-1953 Conformal Coating	1 part	Translucent	350	Cured: 0.98	
	Dow Corning® 3-1965 Conformal Coating	1 part	Translucent	115	Cured: 0.99	
	Dow Corning® 1-2577 Low VOC Conformal Coating	1 part	Transparent	1,050	Cured: 1.12	

(1)Tack-free time is the time required for the product to develop a nontacky surface based on adhesion to a polyethylene film.

Sheath Heater

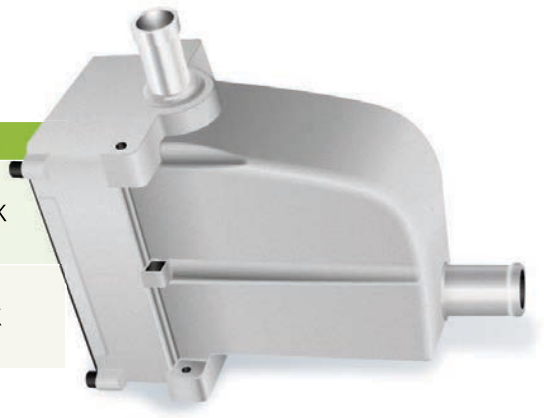
PROTECTION

Product		1 or 2 Part	Color	Viscosity, cP	Density, g/cm^3	
Encapsulants	*Sylgard*® 170 Silicone Elastomer	2 part (1:1 mix ratio)	Black	Part A: 3,160 Part B: 1,110 Mixed: 2,135	Part A, Uncured: 1.37 Part B, Uncured: 1.37	
	Sylgard® 170 Fast Cure Silicone Elastomer	2 part (1:1 mix ratio)	Black	Part A: 3,436 Part B: 1,287 Mixed: 2,361	Part A, Uncured: 1.38 Part B, Uncured: 1.38	

	Lap Shear	Cure, time/temp.	Viscosity, cP	Density, g/cm^3	Durometer	CTE, ppm/K	Notes
	Al: 375 psi, 2.6 MPa, 260 N/cm^2	Heat cure (100°C or above)	Part A: 48,000 Part B: 43,000 Mixed: 59,000	Cured: 2.14	67 (Shore A)	-	-
	Al: 530 psi, 3.65 MPa, 365 N/cm^2	30 min/150°C	32,000	Cured: 2.2	75 (Shore A)	-	-
	Al: 381 psi, 2.63 MPa, 263 N/cm^2 Cu: 416 psi, 2.87 MPa, 287 N/cm^2	30 min/125°C 10 min/150°C	Part A: 130,000 Part B: 118,000 Mixed: 125,000	Wet: 3	95 (Shore A [JIS Type A]) 45 (Shore D)	-50 to 200°C: 92	-

	Tack-Free Time[1], time/temp.	Nonvolatile Content (NVC), %	Durometer	Notes
	8 min/25°C 0.5 min/60°C (15% RH)	99.4	34 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E
	6 min/25°C	-	33 (Shore A)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830 with Amendment 1
	6 min/25°C 1.5 min/60°C (15% RH)	NVC – forced draft volatility: 33.6	85 (Shore A) 25 (Shore D)	UL 94 V-0; MIL I-46058C Amend 7; IPC-CC-830B; UL 746E

	Cure, time/temp.	Durometer	Notes
	24 hr/25°C 25 min/70°C 10 min/100°C	47 (Shore A)	Thermal conductivity: 0.48 W/m.K
	0.2 hr/25°C	41 (Shore A)	Thermal conductivity: 0.4 W/m.K



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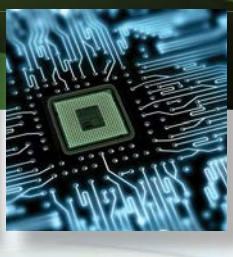

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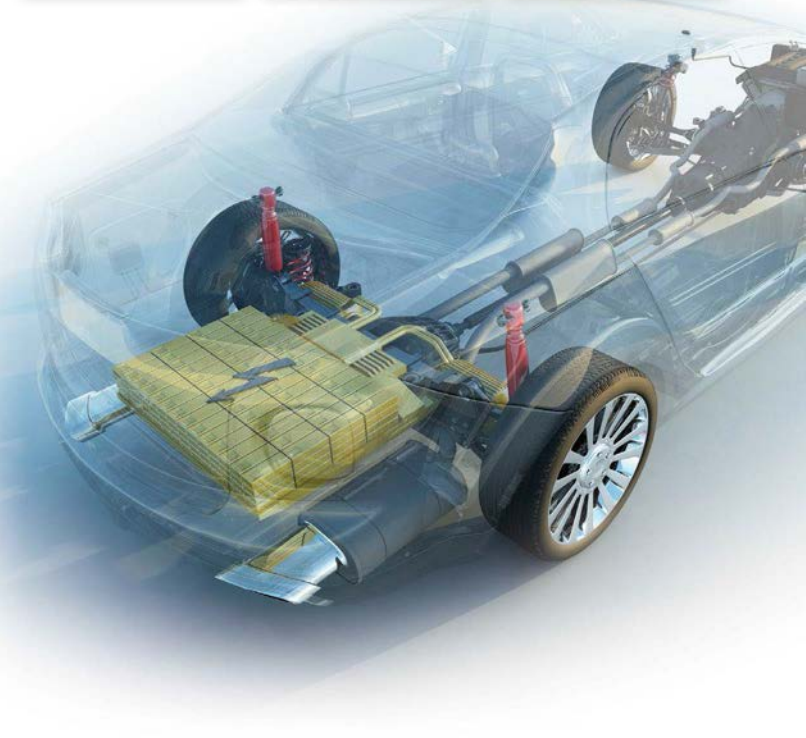

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