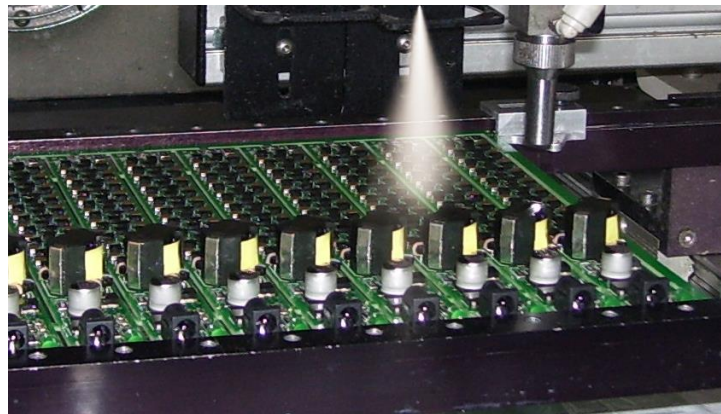


+44 (0)1706 758811

Conformal Coatings

EMC and Thermal Management Solutions



Fothershield

UNIT 3 GORRELLS WAY, TRANSPENNINE TRADING ESTATE,
ROCHDALE, LANCS, UK. OL11 2PX

E info@fothershield.co.uk

T +44 (0)1706 758811

W www.fothershield.co.uk

CONFORMAL COATINGS

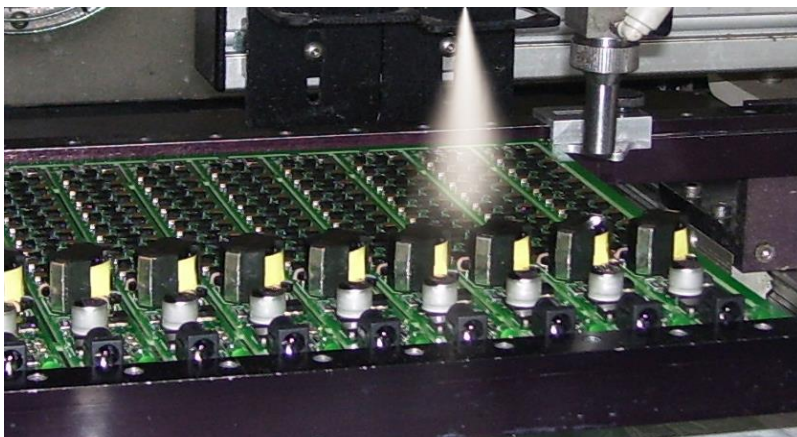
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Why use conformal coatings?

Conformal Coatings are designed to protect assembled printed circuit board circuitry from harsh environmental conditions such as salt spray, debris/dust, moisture, chemicals and other environmental contaminants. Electrically insulating, they also extend surface insulation to preserve the long term integrity of components by preventing high voltage arcing, shorts and static discharge and allow traces to be put closer together for miniaturisation. Available in acrylic, urethane, or modified silicone to meet various applications. All of our conformal coatings are RoHS compliant.

What is arcing?

Arcing occurs when voltage jumps from one surface to another due to the close proximity of parallel currents, resulting in board failure or damaged components. Arcing may occur on any printed circuit board (PCB) which has not been coated.



Conformal Coatings Comparison Chart

Part Number	FS-419C	FS-419D	FS-422B	FS-4223	FS-4223D FS-4223F (Xylene Free)
Type	Acrylic	Acrylic	Modified Silicone	Urethane	Urethane
Uncured Working Properties					
Formats	Liquid Aerosol	Liquid	Liquid Aerosol	Liquid	Liquid
Colour	Clear	Clear	Clear	Clear Amber	Clear Amber
Solid % Liquid (w/w)	16	29.5	25	32	44.8
Solid % Aerosol	8.4	-	15	-	-
Density (g/mL)	0.87	0.92	0.90	0.94	0.97
Viscosity (cP)	7.2	100	13	200	300
VOC (Liquid g/L)	581	647	430	571	534
Shelf life (years)	≥3	≥3	≥3	≥3	≥3
Coverage & Application Properties					
Coverage per litre	>67.8 ft ² *	>62ft ² *	>117 ft ² *	>136 ft ² *	>123 ft ² *
Coverage per 340g spray can	>13.7 ft ² *		>28 ft ² *		
Dry to touch (min)	3-5	10-15	5-7	60	10-15
Recoat time (min)	2	2	5	30	3
Cure time at room temp. (h)	24	24	48	24	-
Cure time at 65°C (min)	30	60	20	60	-
Cure time at 80°C (h)	-	-	-	-	24
Physical Properties					
Solderability	Excellent	Excellent	Excellent	Good	Good
Fungus Resistance	Excellent	Excellent	Excellent	Excellent	Excellent
Chemical Resistance	Poor	Poor	Poor	Excellent	Excellent
Electrical Properties					
Dielectric Strength (V/mil)	-	1100	1056	1800	1020
Dielectric Withstand Voltage (V)	>1500	>1500	>1500	>1500	>1500
Insulation Resistance 24h (ohm)	5 x 10 ¹²	~10 ¹²	-	~10 ¹²	~10 ¹²
Thermal Properties					
Constant service temp. (°C)	(-40 to 200)	(-40 to 200)	(-40 to 200)	(-40 to 200)	(-40 to 200)
[°F]	[-40 to 248]	[-40 to 248]	[-40 to 392]	[-40 to 293]	[-40 to 293]
Tg (°C) (Glass Transition Temperature)	46	43	32	-	-
UL 94 Flammability Classification	V-0	V-0	V-0	V-1	V-0

*Based on 1mil thickness, 65% transfer efficiency

FS-419C – ACRYLIC CONFORMAL COATING II – FAST CURE

IPC-CC-830B certified (Institute for Printed Circuits, the association connecting electronic industries), this xylene and toluene free fast drying acrylic conformal coating is a one part coating and is easy to apply. Ideal for rework and repair applications the coating can be used in high moisture environments.

The coating gives protection against moisture, thermal shocks, short circuits, dirt, dust and scratches that could damage the electric component. It also gives insulation against high voltage arcing, shorts and static discharge. Providing a high dielectric withstand voltage, traces may be put closer together enabling miniaturisation.

- Fast cure for reduced production times
- Xylene and toluene free
- Qualified to IPC-CC-830B, Pacific Laboratories Inc
- UL 94 V0 (E203094)
- Smooth, clear finish
- Protection from static discharges, moisture, fungus and corrosion
- Fluoresces under ultraviolet light (UV-A backlight)
- Can solder through coating for easy rework and repairs (remove with thinner/cleaner FS-435-1L or conformal coating stripper (FS-8310A)

Curing and Work Schedule

	Test Method	Result
Aerosol		
Tack free		3 – 5 minutes
Recoat time		2 minutes
Full cure	@25°C (77°F)	24 hours
Full cure	@65°C (149°F)	30 minutes
Service temperature		-65°C to +120°C (-85°F to +248°F)
Max coverage for 25µm [1mil]		<12,800cm ² [<13.ft ²]
Liquid		
Tack free		3 – 5 minutes
Recoat time		2 minutes
Full cure	@25°C (77°F)	24 hours
Full cure	@65°C (149°F)	30 minutes
Service temperature		-65°C to +120°C (-85°F to +248°F)
Max coverage per 1L for 25µm [1 mil]		<63,000cm ² [<67.8 ft ²]

Cured Properties – Physical

	Test Method	Result
Colour	Visual	Crystal clear
Solderability	-	Excellent
Weather resistance	-	Excellent
Fungus resistance	IPC-TM-650 2.6 1.1	Excellent
Flexibility	IPC-TM-650 2.4 5.1	Excellent
Flammability	UL registered	94V-0

Cured Properties – Electrical

	Test Method	Result
Dielectric withstand voltage per	IPC-TM-650	>1,500V
Insulation resistance after 24 hours	IPC-TM-650 Test 2.6.3.4	$5 \times 10^{12}\Omega$

Environmental and Aging Study

	Test Method	Result
Salt spray test 7 days @ 35°C + salt/fog	ASTM B117-2001	
<ul style="list-style-type: none"> Cross-hatch adhesion 	ASTM D3359-2009	5B = 0% area removed
<ul style="list-style-type: none"> Cracking, unwashed area 	ASTM D661-93	None
<ul style="list-style-type: none"> Visual colour, unwashed area 	ASTM D1729-96	No change
<ul style="list-style-type: none"> Peeling, unwashed area 	ASTM D1729-96	None

Uncured Properties

	Test Method	Result
Odour	-	Ether like, gasoline and minty
Viscosity @23°C [73°F]	Brookfield SP1	7.2cP [0.0072 Pa.s]
Density	MIL-STD-45662A	0.874 g/mL
Flash point	Closed cup	-19°C [-2.2°F]
Boiling point	-	$\geq 66^\circ\text{C}$ [$\geq 150^\circ\text{F}$]
Solids content (w/w)	-	15.8%

How to Order

Part No.	Packaging	Size
FS-419C-55ML	Bottle	55ml
FS-419C-340G	Aerosol	340g
FS-419C-1L	Liquid	1L

FS-419D – PREMIUM ACRYLIC CONFORMAL COATING

Fast drying, xylene and toluene free, FS-419D is a one part coating giving an excellent finish and is ideal for high moisture environments and repair and rework applications.

Protecting electric circuits against thermal shocks, moisture, dust, dirt and scratches that could damage electric components, it insulates against high voltage arcing, shorts and static discharges as well as providing high dielectric voltage allowing traces to be put closer together for miniaturisation.

- Xylene and toluene free
- UL 94V0 (E202094)
- Smooth clear coating
- Protects against static discharges, moisture, corrosion and fungus
- Fluoresces under back light (ultraviolet light)
- Easy rework and repairs, can be soldered through coating (remove with thinner/cleaner, thinner 4 or conformal coating stripper)

Curing and Work Schedule

	Test Method	Result
Dry to touch		10-15 minutes
Shelf life		3 years
Recoat time		2-3 minutes
Full cure	@room temp.	24 hours
Full cure	@65°C (149°F)	60 minutes
Storage temperature limits		-5°C to +40°C [+23°F to +104°F]
Service temperature		-40°C to +120°C (-40°F to +248°F)
Maximum coverage per litre		<75,500cm ² [<62ft ²]

Cured Properties – Physical

	Test Method	Result
Colour	Visual	Crystal clear
Solderability	-	Excellent
Weather resistance	-	Excellent
Fungus resistance	IPC-TM-650 2.6 1.1	Excellent
Flexibility	IPC-TM-650 2.4 5.1	Excellent
Flammability	In house 94V testing	94V-0

Cured Properties – Electrical

	Test Method	Result
Dielectric withstand voltage per	IPC-TM-650	>1,500 V
Insulation resistance after 24 hours	IPC-TM-650 Test 2.6.3.4	~ 10 ¹² Ω



Uncured Properties

	Test Method	Result
Odour	-	-
Viscosity @23°C [73°F]	Brookfield SP1	100 cP [0.10 Pa.s]
Density	ASTM D 1475	0.92g/mL
Flash point	Closed cup	-3°C [26°F]
Boiling point	-	≥80°C [≥176°F]
Solids content (w/w)	-	29.5%

How to Order

Part No.	Packaging	Size
FS-419D-1L	Liquid	945ml
FS-419D-4L	Liquid	3.8L

FS-422B – SILICONE CONFORMAL COATING

FS-422B is a flexible finish silicone conformal coating ideal for high temperature environments and provides protection against thermal shock, moisture and corrosion. It also protects and insulates electronic and electrical components and assemblies including transformers, solenoid coils, relays, generators and motors. The liquid can also be thinned (up to one half part thinner to one part coating) to allow spraying.

- UL94-V0 (E203094)
- Maximum temperature 200°C
- Tack free in 6 minutes (room temperature), full cure after 20 minutes at 65°C
- Protects against static discharge, moisture, thermal shock, corrosion and fungus
- Fluoresces blue at 457nm ± 65nm under ultraviolet light
- Long shelf life
- Easy for rework and repairs (solder through coat removable with FS-435 thinner or FS-8310A stripper)

Curing and Work Schedule

	Test Method	Result
Aerosol		
Dry to touch		5-7 minutes
Shelf life		5 years
Full cure	@20°C (68°F)	48 hours
Full cure	@65°C (149°F)	20 minutes
Service temperature		-40°C to +200°C (-40°F to +392°F)
Max coverage for 25µm [1mil]		<26,000cm ² [<28 ft ²]
Liquid		
Dry to touch		5 - 7 minutes
Shelf life		3 years
Full cure	@20°C (68°F)	48 hours
Full cure	@65°C (149°F)	20 minutes
Service temperature		-40°C to +200°C (-40°F to +392°F)
Max coverage per 1L for 25µm [1 mil]		<109,000cm ² [<117 ft ²]

Cured Properties – Physical

	Test Method	Result
Colour	Visual	Clear
Solderability	-	Fair
Flexibility		Excellent
Flammability	94V (UL File E203094)	94V-0
UV inspection absorption max	Absorption spectrum	375nm (near UV)
UV inspection fluorescence max	Emission spectrum	437nm (blue)

Cured Properties – Electrical

	Test Method	Result
Dielectric strength at 0.0150 inches	IPC-TM-650 Test 2.5.6.1	>1,056 V/mil
Volume resistivity @ 23°C 50% RH	ASTM D 257-07	$1.2 \times 10^{15} \Omega \cdot \text{cm}$
Surface resistivity	ASTM D 257-07	$4.5 \times 10^{16} \Omega / \text{sq}$
Dielectric constant @ 60 Hz & 25°C	ASTM D 150-98	2.35
Dielectric constant @ 1MHz & 25°C	ASTM D 150-98	1.99
Dissipation factor @ 60 Hz & 25°C	ASTM D 150-98	0.037
Dissipation factor @ 1 MHz & 25°C	ASTM D 150-98	0.012

Cured Properties – Thermal

	Test Method	Result
Coefficient of thermal expansion	IPC-TM-650 Test 2.4.24	253.3 ppm/°C
Softening point	IPC-TM-650 Test 2.4.24	31.4°C [88.5°F]

Environmental & Aging Study

	Test Method	Result
Salt spray test: 7 days @35°C + salt/fog	ASTM B117-2011	
• Cross hatch adhesion	ASTM D3359-2009	5B = 0% area removed
• Cracking, unwashed area	ASTM D661-93	None
• Visual colour, unwashed area	ASTM D1729-96	No change
• Peeling, unwashed area	ASTM D1729-96	None

Uncured Properties

	Test Method	Result
Odour	-	Ethereal
Viscosity @ 23°C [73°F]	Brookfield SP1	13cP [0.013Pa.s]
Density		0.90 g/mL
Flash point	Closed cup	-18°C [-0.40°F]
Boiling point	-	55°C [131°F]
Solids content (w/w)	-	27% liquid, 17% aerosol

How to Order

Part No.	Packaging	Size
FS-422B-55ML	Liquid	55ml
FS-422B-340G	Aerosol	34 g
FS-422B-1L	Liquid	950ml
FS-422B-4L	Liquid	4L
FS-422B-P	Pen	5m

FS-4223 – POLYURETHANE CONFORMAL COATING

A highly chemical resistant finish that meets UL standards for indoor conformal coatings, FS-4223 is a one part coating and is ideal for extremely corrosive environments.

Protecting against corrosive chemicals, thermal shocks, moisture, dirt and scratches, it also insulates against high voltage arcing, static discharge and shorts.

- Excellent chemical resistance
- Meets UL indoor conformal coating specifications
- UL 94V-0 flammability
- Temperature rating class F (160°C)
- Transparent
- Protection from chemical corrosion, static discharge, oil, fungus, moisture
- Fluoresces under ultraviolet light

Curing and Work Schedule

	Test Method	Result
Dry to touch		30 minutes
Shelf life		3 years
Full cure	@ 20°C	24 hours
Full cure	@ 65°C (149°F)	60 minutes
Service temperature		-40°C to +160°C (-40°F to +320°F)
Maximum coverage for 25µm [1 mil]		<127,000cm ² [<136 ft ²]

Cured Properties – Physical

	Test Method	Result
Colour	Visual	Clear amber
Solderability	-	Good
Fungus resistance	MIL-V-1730-2	Meets
Flexibility	-	Good
Flammability	UL94	Meets 94V-1
Abrasion resistance	-	Superior

Cured Properties – Electrical

	Test Method	Result
Dielectric strength (dry)	ASTM D 115	1,800 V/mil
Dielectric strength (wet)	ASTM D115	1,200 V/mil
Dielectric withstand voltage (V)	-	>1500
Insulation resistance 24h (ohm)	-	~ 10 ¹²

Uncured Properties

	Test Method	Result
Odour	-	Aromatic
Viscosity @ 23°C [73°F]	Brookfield SP1	200cP
Density	-	0.90g/mL
Flash point	ASTM D 3278	27°C [81°F]
Boiling point	-	Not established
Solids content (w/w)	-	32%
Dry film thickness per dip	-	~25 to 38 m
Dry film thickness per dip	-	~1 to 1.5 mil

Chemical Resistance

	Test Method	Result
Water	-	Good
Acid (10% sulfuric acid)	-	Excellent
Alkali (1% sodium hydroxide)	-	Excellent
Salt water	-	27°C [81°F]
Oil	ASTM D-115	Passed
Copper corrosion	-	None

How to Order

Part No.	Packaging	Size
FS-4223-55ML	Liquid	55ml

FS-4223D – PREMIUM POLYURETHANE CONFORMAL COATING

A heat curing one part product providing excellent chemical and scratch resistance. The coating protects electric circuits against aggressive chemicals, thermal shocks, moisture, dust, dirt and scratches. It also insulates against high voltage arcing shorts, static discharges and allows traces to be placed nearer to each other.

The coating is particularly suitable for corrosive environments such as oil, marine, mining and smelting industries. They can be used with transformers, generators, relays and also fire alarm components, automotive electronics, sensors, electrical connectors and porcelain.

- UL 746E (E203094) recognised
- Resists most household chemicals, water, and solvents
- Corrosion, fungus, moisture and static discharge protection
- Fluoresces under back light (ultraviolet)
- Solderable through coating
- Isocyanate free
- Abrasion resistant

Curing and Work Schedule

	Test Method	Result
Dry to touch		10 - 15 minutes
Recoat time		2 – 3 minutes
Shelf life		2 years
Full cure	@ 80°C	24 hours
Service temperature		-40°C to +145°C (-40°F to +293°F)
Storage temperature limits		-5°C to 40°C [+23°F to +104°F]
Maximum coverage per litre		≥114,000 cm ² [<123 ft ²]

Cured Properties – Physical

	Test Method	Result
Colour	Visual	Clear, amber tint
Solderability	-	Good
Fungus resistance	IPC-TM-650 2.6.1.1	Pending
Flexibility	IPC-TM-650 2.4.5.1	Pending
Flammability	In house 94V testing	94V-0
Chemical resistance	-	Excellent
Weather resistance	-	Excellent



Cured Properties – Electrical

	Test Method	Result
Dielectric strength (Volts/mil)	-	1,020
Dielectric withstand voltage (V)	Per PIC-TB-650	>1,500
Insulation resistance after 24h	IPC-TM-650 Test 2.6.3.4	~ 101

Uncured Properties

	Test Method	Result
Odour	-	Mild, pungent
Viscosity @ 25°C [77°F]	Brookfield SP1	330cP [0.330Pa.s]
Density	ASTM D 1475	0.97g/mL
Flash point	Closed cup	-3°C [26°F]
Boiling point	-	≥80°C [≥176°F]
Solids content (w/w)	-	44.8%

How to Order

Part No.	Packaging	Size
FS-4223D-1L	Liquid	945ml
FS-4223D-4L	Liquid	3.8L

FS-4223F – PREMIUM POLYURETHANE CONFORMAL COATING – XYLENE & TOLUENE FREE

FS-4223F is a xylene and toluene free version of FS-4223D polyurethane conformal coating. It exhibits the same performance as FS-4223D in its cured state and is a heat curing one part product giving excellent chemical and scratch resistant properties.

FS-4223F protects against moisture, thermal shocks, dirt, dust and scratches as well as giving protection against aggressive chemicals. Insulating against high voltage arcing, static discharge and shorts, this allows traces to be placed closer to one another.

- UL 94V0 (E203094)
- Chemical resistance to most household chemicals, water and solvents
- Protection against static discharge, moisture, corrosion and fungus
- Fluoresces under black light (ultraviolet)
- Solderable through coating
- Isocyanate free
- Smooth, flexible, mar resistant

Curing and Work Schedule

	Test Method	Result
Dry to touch		10 - 15 minutes
Recoat time		2 – 3 minutes
Shelf life		1 years
Full cure	@ 80°C	24 hours
Service temperature		-40°C to +145°C (-40°F to +293°F)
Storage temperature limits		-5°C to 40°C [+23°F to +104°F]
Maximum coverage per litre		≥114,000cm ² [<123 ft ²]

Cured Properties – Physical

	Test Method	Result
Colour	Visual	Clear, amber tint
Solderability	-	Good
Fungus resistance	IPC-TM-650 2.6.1.1	Pass
Flexibility	IPC-TM-650 2.4.5.1	Pass
Flammability	In house 94V testing	94V-0
Chemical resistance	-	Excellent
Weather resistance	-	Excellent

Cured Properties – Electrical

	Test Method	Result
Dielectric strength (Volts/mil)	-	1,020
Dielectric withstand voltage (V)	Per PIC-TB-650	>1,500
Insulation resistance after 24h	IPC-TM-650 Test 2.6.3.4	~10 ¹² Ω

Uncured Properties

	Test Method	Result
Odour	-	Mild, pungent
Viscosity @ 25°C [77°F]	Brookfield SP1	330cP [0.330Pa.s]
Density	ASTM D 1475	0.88g/mL
Flash point	Closed cup	-3°C [26°F]
Boiling point	-	≥80°C [≥176°F]
Solids content (w/w)	-	44.8%

How to Order

Part No.	Packaging	Size
FS-4223F-312G	Aerosol	312g
FS-4223F-1L	Liquid	945ml

Application instructions – spray gun

For best results, please follow the procedures detailed below.

To apply the required thickness by weight:

1. Mix thoroughly and spray a test pattern to ensure a good flow quality and to gauge the appropriate distance needed to avoid runs.
2. Hold the gun at a distance of around 20-25cm and at a 45° angle. Spray a thin, even coat onto the horizontal board using spray and release in an even motion to avoid over spray.
3. Rotate the board 90° before re-coating.
4. To avoid trapping solvent between coats, leave 2 minutes in between coats.
5. Apply other coats until desired thickness is achieved (follow step 3).
6. Air dry 3-5 minutes (flash off time) at room temperature.

To cure at room temperature: Air dry for 24 hours.

To accelerate cure by heat: After flash off put under heat lamp or oven for 60 minutes at $\geq 65^{\circ}\text{C}$.

Attention

Do not exceed 65°C if heat curing as this may cause surface defects due to the solvents evaporating too quickly. Coats that are applied very thickly will require more drying time.

All technical data herein is accurate to the best of our knowledge based on our most up to date testing information and material specifications. This information is not presented as a warranty or guarantee and is not intended to be all inclusive as to conditions of use. The data herein represents typical properties and is not to be used as a basis for a specification.