

# 834FRB Technical Data Sheet

## Black Flame Retardant Epoxy, Encapsulating & Potting Compound

#### Description

834FRB *potting and encapsulating compound* is a black, flame retardant, low viscosity two-part epoxy that offers extreme environmental, mechanical and physical protection for printed circuit boards and electronic assemblies.

This product is designed for applications where mechanical strength and self-extinguishing are required. Due to its low mixed viscosity, it can easily penetrate small gaps and cavities. It also provides excellent electrical insulation and protects components from static discharges, vibration, abrasion, thermal shock, environmental humidity, salt water, fungus, and many harsh chemicals.

This epoxy has a convenient 2:1 volume mix ratio, making it compatible with most dispensing equipment. 834FRB can be cured at room temperature or higher.

#### **Features and Benefits**

- *Certified UL 94V-0 (File # <u>E334302</u>)*
- Compliant with UL 746A
- Convenient 2A:1B volume mix ratio
- Low mixed viscosity of 2 600 cP
- Very high compressive and tensile strength
- Excellent adhesion to a wide variety of substrates including metals, composites, glass, ceramics, and many plastics
- High Comparative Tracking Index (>600 V, PLC=0)
- Excellent electrical insulating characteristics
- Solvent-free



### **Usage Parameters**

Properties	Value
Working life @22 °C [72 °F]	1 h
Shelf life	5 у
Full cure @22 °C [72 °F]	24 h
Full cure @65 °C [149 °F]	1 h
Full cure @80 °C [176 °F]	To be determined
Full cure @100 °C [212 °F]	To be determined

## **Temperature Ranges**

Properties	Value
Constant service temperature	-40 to 175 °C [-40 to 347 °F]
Maximum intermittent temperature <sup>a)</sup>	200 °C [392 °F]
Storage temperature of unmixed parts	16 to 27 °C [61 to 81 °F]

**a)** Temperature that can be withstood for short periods without sustaining damage.



### **Cured Properties**

Physical Properties	Method	Value <sup>a)</sup>
Color	Visual	Black
Flammability	94 V	94 V-0
Density @23 °C [73 °F]	ASTM D 792	1.39 g/mL
Hardness	Shore D Durometer	83D
Flexural strength	ASTM D 790	65 N/mm <sup>2</sup> [9 500 lb/in <sup>2</sup> ]
Tensile strength	ASTM D 638	23 N/mm <sup>2</sup> [3 400 lb/in <sup>2</sup> ]
Tensile impact	ASTM D 1822	16 kJ/m <sup>2</sup> [7.8 ft·lb/in <sup>2</sup> ]
Izod impact	ASTM D 256	2.39 kJ/m <sup>2</sup> [1.14 ft·lb/in <sup>2</sup> ]
Compressive strength	ASTM D 695	140 N/mm <sup>2</sup> [20 000 lb/in <sup>2</sup> ]
Lap shear strength (stainless steel)	ASTM D 1002	24 N/mm <sup>2</sup> [3 500 lb/in <sup>2</sup> ]
Lap shear strength (aluminum)	ASTM D 1002	25 N/mm <sup>2</sup> [3 600 lb/in <sup>2</sup> ]
Lap shear strength (copper)	ASTM D 1002	20 N/mm <sup>2</sup> [2 900 lb/in <sup>2</sup> ]
Lap shear strength (brass)	ASTM D 1002	21 N/mm <sup>2</sup> [3 000 lb/in <sup>2</sup> ]
Lap shear strength (ABS)	ASTM D 1002	1.8 N/mm <sup>2</sup> [260 lb/in <sup>2</sup> ]
Lap shear strength (polycarbonate)	ASTM D 1002	2.3 N/mm <sup>2</sup> [340 lb/in <sup>2</sup> ]

Note: Specifications are for epoxy samples cured at 65 °C for 1 hour and conditioned at ambient temperature and humidity.

**a)** N/mm<sup>2</sup> = mPa; Ib/in<sup>2</sup> = psi



#### **Cured Properties**

Physical Properties	Method	Value
Outgassing (total mass loss) @24 h	ASTM D 595	1.88%
Water vapor release	ASTM D 595	0.33%
Collectable volatile condensable material	ASTM D 595	0.06%
Electrical Properties	Method	Value
Breakdown voltage @1.29 mm	ASTM D 149	27 400 V [27.4 kV]
Dielectric strength @1.29 mm	ASTM D 149	540 V/mil [21.3 kV/mm]
Breakdown voltage @3.175 mm [1/8"]	Reference fit <sup>a)</sup>	43 000 V [43 kV]
Dielectric strength @3.175 mm [1/8"]	Reference fit <sup>a)</sup>	344 V/mil [13.7 kV/mm]
Volume resistivity	ASTM D 257	1.4 x 10 <sup>15</sup> Ω·cm
Volume conductivity	ASTM D 257	7.1 x 10 <sup>-16</sup> S/cm
Dielectric dissipation, D @1 MHz	ASTM D 150-11	0.011
Dielectric constant, k´@1 MHz	ASTM D 150-11	2.80

Note: Specifications are for epoxy samples cured at 65 °C for 1 hour and conditioned at ambient temperature and humidity.

**a)** To allow comparison between products, the dielectric strength was recalculated with the Tautscher equation fitted to 5 experimental values and extrapolated to a standard thickness of 1/8" (3.175 mm).



### **Cured Properties**

<b>Electrical Properties</b>		Method	Value
Comparative Trackin Performance Leve	g Index (CTI) el Class (PLC) = 1	ASTM D 3628	>600 V
Hot Wire Ignition (H)	WI)	ASTM D 3874, IEC 60695-2-20	45.24 s
High-Current Arc Igr	nition (HAI)	UL 746A	139.40 arc
High Voltage Arc Tra	cking Rate (HVTR)	UL 746A	24.58 mm/min
High Voltage, Low Cu	urrent, Dry Arc Resistance	ASTM D 495	69.24 s
High Voltage Arc Re	sist. to Ignition (HVAR)	ASTM D 495	27.33 s
	6		
Thermal Properties		Method	Value
Thermal Properties       Glass transition temp	perature (Tg)	Method ASTM D 3418	<b>Value</b> 39 °C [102 °F]
Thermal Properties         Glass transition temp         CTE a) prior Tg after Tg	perature (Tg)	MethodASTM D 3418ASTM E 831ASTM E 831	Value           39 °C [102 °F]           50 ppm/°C [122 ppm/°F]           178 ppm/°C [352 ppm/°F]
Thermal Properties         Glass transition temp         CTE * prior Tg after Tg         Thermal conductivity	perature (Tg) ( @25 °C [77 °F] @50 °C [122 °F] @100 °C [212 °F]	MethodASTM D 3418ASTM E 831ASTM E 1461ASTM E 1461	Value         39 °C [102 °F]         50 ppm/°C [122 ppm/°F]         178 ppm/°C [352 ppm/°F]         0.28 W/(m·K)         0.33 W/(m·K)         0.31 W/(m·K)
Thermal Properties         Glass transition temp         CTE * prior Tg after Tg         Thermal conductivity         Thermal diffusivity @	Derature (Tg) ( @25 °C [77 °F] @50 °C [122 °F] @100 °C [212 °F] @25 °C [77 °F]	MethodASTM D 3418ASTM E 831ASTM E 1461ASTM E 1461ASTM E 1461ASTM E 1461	Value         39 °C [102 °F]         50 ppm/°C [122 ppm/°F]         178 ppm/°C [352 ppm/°F]         0.28 W/(m·K)         0.33 W/(m·K)         0.31 W/(m·K)         1.43 mm²/s

Note: Specifications are for epoxy samples cured at 65 °C for 1 hour and conditioned at ambient temperature and humidity.

**a)** Coefficient of Thermal Expansion (CTE) units are in ppm/°C = in/in/°C  $\times 10^{-6}$  = unit/unit/°C  $\times 10^{-6}$ 



## **Uncured Properties**

Physical Properties	Mixture (A:B)
Color	Black
Viscosity @20 °C [68 °F]	2 600 cP [2.6 Pa·s] <sup>a)</sup>
Density	1.32 g/mL
Mix ratio by volume	2:1
Mix ratio by weight	2.4:1
Solids content (w/w)	~96%

a) Brookfield viscometer at 60 rpm with spindle LV S63

Physical Properties	Part A	Part B	
Color	Dark grey	Black	
Viscosity @24 °C [75 °F]	1 900 cP [1.9 Pa·s] <sup>a)</sup>	4 800 cP [4.81 Pa·s] <sup>b)</sup>	
Density	1.39 g/mL	1.17 g/mL	
Flash point	150 °C [302 °F]	148 °C [221 °F]	
Odor	Musty	Mild	

b) Brookfield viscometer at 100 rpm with spindle LV S64



#### Compatibility

Adhesion—As seen in the substrate adhesion table, 834FRB epoxy adheres to most plastics and metals used to house printed circuit assemblies; however, it is not compatible with contaminants like water, oil, or greasy flux residues that may affect adhesion. If contamination is present, first clean the surface to be coated with MG Chemicals 824 Isopropyl Alcohol.

**Chemical Resistance**— The water absorbency and chemical resistance was tested for seven days using the IPC-TM-650 method. The results show low water absorption and a high chemical resistance to salt water and most ionic species. Softening and swelling occurs for aggressive organic solvents.

#### Substrate Adhesion (In Decreasing Order)

Physical Properties	Adhesion
Aluminum	Stronger
Steel	1
Fiberglass	
Wood	
Glass	
Rubber	
Polycarbonate	
Acrylic	Weaker
Polypropylene	Does not bond

#### Chemical Solvent Resistance (IPC-TM-650)

Physical Properties	Weight Change
Water	0.23%
Heptane	0.25%
Salted water (NaCl), 10%	0.40%
Sodium hydroxide, 10%	0.42%
Citric acid, 10%	0.70%
Ammonium carbonate, 2%	0.70%
Sulfuric acid, 3%	0.75%
Sulfuric acid, 30%	0.74%
Ethanol	2.00%
Hydrochloric acid, 5%	1.40%
Nitric acid, 10%	1.80%
Phenol, 5% a)	7.60%
Carbon tetrachloride <sup>b)</sup>	16.50%
Acetone <sup>a)</sup>	17.67%
Ethyl acetate <sup>a)</sup>	18.70%
Toluene <sup>a)</sup>	26.74%
Ethylene dichloride <sup>a)</sup>	Ruptured
a) Softened and swelled	

**b)** Swelled



#### Storage

Store between 16 and 27 °C [61 and 81 °F] in a dry area, away from sunlight. Storage below 16 °C [61 °F] can result in crystallization.

If crystallization occurs, reconstitute the product to its original state by temporarily warming it to between 50 and 60 °C [122 and 140 °F]. To ensure full homogeneity, stir the warm product thoroughly. Make sure to reincorporate all settled material, close the lid, and then let cool before use.

#### **Health and Safety**

Please see the 834FRB Safety Data Sheet (SDS) parts A and B for further details on transportation, storage, handling, safety guidelines, and regulatory compliance.

#### **Application Instructions**

For best results, follow the procedure below.

#### Manual mixing:

- **1.** Scrape settled material free from the bottom and sides of the part A container; stir contents until homogenous.
- 2. Scrape settled material free from the bottom and sides of the part B container; stir contents until homogenous.

**3.** Measure 2 parts by volume of the pre-stirred part A, and pour into the mixing container. Ensure all contents are transferred by scraping the container.

- **4.** Measure 1 part by volume of the pre-stirred part B, and pour slowly into the mixing container while stirring. Ensure all contents are transferred by scraping the container.
- **5.** Thoroughly mix parts A and B together.
- 6. Let sit for 15 minutes to de-air.

—*OR*—

Put in a vacuum chamber at 25 inHg for 2 minutes to de-air.

- 7. If bubbles are present at the top, break and stir them gently with the mixing paddle.
- 8. Pour the mixture into a container holding the components to be protected.
- 9. Close the part A and B containers tightly between uses to prevent skinning.

#### Attention!

Mixing >500 g at a time decreases working life and can lead to a flash cure. Limit the size of hand-mixed batches. For large production volumes, contact MG Chemicals Technical Support for assistance.





#### **Cure Instructions**

#### Room temperature cure:

• Let cure at room temperature for 24 hours.

#### Heat cure:

• Put in oven at 65 °C [149 °F] for 1 hour.

#### Attention!

Due to exothermic reaction, heat cure temperatures should be at least 25% below the maximum temperature the most fragile PCB component can tolerate. For larger potting blocks, reduce heat cure temperature by greater margins.

### **Packaging and Support Products**

Cat. No.	Packaging	Net Volume	Packaged Weight
834FRB-375ML	2 Bottle kit	375 mL [12.7 fl oz]	0.6 kg [1.3 lb]
834FRB-3L	3 Can kit	2.55 L [0.68 gal]	4.5 kg [10 lb]
834FRB-60L	3 Pail kit	60 L [16 gal]	85 kg [187 lb]



### **Technical Support**

Please contact us regarding any questions, suggestions for improvements, or problems with this product. Application notes, instructions and FAQs are located at <u>www.mgchemicals.com</u>.

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