Flame Retardant Epoxy Encapsulating & Potting Compound 833FRB Technical Data Sheet

Encapsulating and Potting Epoxy Description

The 833FRB Flame Retardant Epoxy Encapsulating and Potting Compound is a UL 94V-0 recognized electric grade epoxy in the QMFZ2 category. This two parts epoxy provides a black and self-extinguishing finish with great insulation and protection value.

It protects against static discharges, shocks, vibrations, and mechanical impacts. It insulates against heat and conductivity. It is extremely resistant to environmental humidity, salt water, and many harsh chemicals.

Applications & Usages

The 833FRB epoxy is used to pot or encapsulate printed circuit assemblies in a protective block. The cured epoxy improves reliability, operational range, and lengthens the life of electrical and electronic parts. It also helps hide and restrict access to intellectual property.

Its primary applications are in the automobile, marine, aerospace, aviation, communication, instrumentation, and industrial control equipment.

Benefits

- **Certified *UL 94V-0*** (File # E334302)
- **Specification Verified as per *UL 746A***
- **Mix ratio 2A:1B** compatible with most dispensing equipment
- **Extreme resistance to water and humidity** allowing submersion if needed
- **Protects electronics from** moisture, corrosion, fungus, thermal shock, and static discharges
- **Strong Chemical Resistance** to brine, acids, bases, and aliphatic hydrocarbons
- **Free of solvents**

Curing & Work Schedule

Properties	*Value*
Working Life[a] Shelf Life	60 minute ≥3 year
Full Cure (at 20 °C [68 °F]) Full Cure (at 65 °C [149 °F])	24 hour 60 minute
Full Cure (at 80 °C [176 °F]) Full Cure (at 100 °C [212 °F])	45 minute 35 minute
Storage Temperature of Unmixed Parts	16 to 27 °C [60 to 80 °F]

a) Working life assumes room temperature. A 10 °C increase can decreases the pot life by half.

Service Ranges

Properties	*Value*
Service Temperature	-40 to +175 °C [-40 to +347 °F]
Max Withstand Temp.	-65 °C to +225 °C [-85 °F to +437 °F]
Constant Service Temp.	175 °C [347 °F]

Principal Components

Name	***CAS Number***
Part B: Curing Amine	*proprietary*
Part A: Epoxide Resin	*proprietary*
1,1-(ethane-1,2-diyl)bis(pentabromobenzene)	*84852-53-9*
Antimony Trioxide	*1309-64-4*
Alkyl glycidyl ether	*68609-97-2*

Properties of Cured 833FRB

Physical Properties	***Method***	***Value***[a]	
Color	Visual	Black	
Flammability	94V	94V-0	
Density (at 23 °C)	ASTM D 792	1.35 g/cm^3	
Compression Strength	ASTM D 695	128.46 N/mm^2	[18,632 lb/in^2]
Lap Shear Strength	ASTM D 1002	5.81 N/mm^2	[843 lb/in^2]
Flexural Strength	ASTM D 790	40.19 N/mm^2	[5,829 lb/in^2]
Tensile Impact	ASTM D 1822	20.54 kJ/m^2	[9.774 ft·lbf/in^2]
Izod Impact	ASTM D 256	1.10 kJ/m^2	[0.522 ft·lbf/in^2]
Hardness	(Shore D durometer)	83D to 84D	
Outgasing (Total Mass Loss)	ASTME 595	1.45%	
Ash Content	ISO 3451-1	1.27%	

Electric Properties	***Method***	***Value***	
Breakdown Voltage	ASTM D 149	32.1 kV @ avg. of 1.736 mm	
Dielectric Strength	"	18.5 kV/mm [471 V/mil]	
Breakdown Voltage @3.175 mm [1/8”]	Reference fit[b]	43.5 kV	
Dielectric Strength	"	13.7 kV/mm [348 V/mil]	
Volume Resistivity	ASTM D 257	2.71 x10^{15} Ω·cm	
Surface Resistivity	"	2 x10^{15} Ω	
Comparative Tracking Index	ASTM D 3628	322 V	
Dielectric Dissipation & Constant		*dissipation, D*	*constant, k’*
@60 Hz	ASTM D 150-98	0.018	3.45
@1 kHz	"	0.012	3.40
@10 kHz	"	0.013	3.31
@100 kHz	"	0.014	3.25
@1 MHz	"	0.014	3.18
Hot Wire Ignition		52.83 s	
High-Current Arc Ignition		94.80 arc	
High Voltage Arc Tracking Rate		48.07 mm/min	
High Voltage, Low Current, Dry …Arc Resistance	ASTM D 495	37.62 s	
High Voltage Arc Resist. to Ignition	ASTM D 495	4.67 s	

Note: Specifications are for epoxy samples cured at 65 °C for 1 hour, with additional curing time at room temperature for optimal results. For most tests, samples were conditioned at 23 °C and 50% RH.

a) N/mm2 = mPa; lb/in^2 = psi;

b) To allow comparison between products, the Tautschter equation was fitted to 5 experimental dielectric strengths and extrapolated to a standard reference thickness of 1/8” (3.175 mm).

Properties of Cured 833FRB (*Continued*)

Thermal Properties	*Method*	*Value*
Coefficient of Thermal Expansion		not established
Thermal Conductivity @25 °C	ASTM E 831	0.235 W/(m·K) [1.63 Btu ft/(h·ft^2·°F)]
Glass Transition Temperature (T_g)	ASTM D 3418	56 °C
Heat Deflection Temperature[c]	ASTM D 648	51.9 °C

c) HDT of plastic under a 455 kPa load

Properties of Uncured 833FRB

Physical Property	*Mixture (2A:1B)*	
Color	Black	
Viscosity* at 20 °C [73 °F]	11,500 cP [11.5 Pa·s]	
Density	1.28 g/mL	
Mix Ratio by weight (A:B)	2:1	
Mix Ratio by volume (A:B)	2:1	
Solids Content (w/w)	~96%	
Physical Property	*Part A*	*Part B*
Color	Dark Grey	Black
Viscosity* at 24°C [73 °F]	4,000 cP [4.0 Pa·s]	14,000 cP [14.0 Pa·s]
Density	1.34 g/mL	1.17 g/mL
Flash Point	190 °C [374 °F]	105 °C [221 °F]
Odor	Musty	Mild

*Brookfield viscometer at 50 RPM with spindle LV4

Compatibility

Adhesion—As seen in the substrate adhesion table, the 833FRB epoxy adheres to most materials found on printed circuit assemblies; however, it is not compatible with contaminants like water, oil, and greasy flux residues that may affect adhesion. If contamination is present, clean the printed circuit assembly with electronic cleaner such as MG Chemicals 4050 Safety Wash, 406B Superwash, or 824 Isopropyl Alcohol.

Substrate Adhesion in Decreasing Order

Physical Properties	*Adhesion*
Aluminum	Stronger
Steel	↓
Fiberglass	
Wood	
Glass	
Polycarbonate	
Acrylic	
Polypropylene[a]	Weaker

a) Does not bond to polypropylene

Chemical Resistance—*Integrity Testing Laboratories, Inc.* performed water absorbance and chemical resistance estimation of the 833FRB using the IPC-TM-650 method. The chemical solvent resistance table presents the percent weight change and effect notes for this method. The results show low water absorption and a high chemical resistance to salt water and most ionic species including low concentration of sulfuric and citric acids; and sodium hydroxide base. Softening and swelling occurs for aggressive organic solvents.

Continued on the next page

Chemical Solvent Resistance (IPC-TM-650)

Physical Properties	*Weight Change*	*Note*
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%	7.60%	Softened and Swelled
Carbon Tetrachloride	16.50%	Swelled
Acetone	17.67%	Softened and Swelled
Ethyl Acetate	18.70%	Softened and Swelled
Toluene	26.74%	Softened and Swelled
Ethylene Dichloride	Ruptured	Softened and Swelled

Storage

Store between 16 and 27 °C [60 and 80 °F] in dry area away from sunlight. Prolonged storage or storage at or near freezing temperatures can result in crystallization. If crystallization occurs, reconstitute the component to its original state by temporarily warming it to 50 to 60 °C [122 to 140 °F]. To ensure full homogeneity, stir thoroughly the warm component, reincorporating all settled material. Re-secure container lid and let cool down before use.

Health and Safety

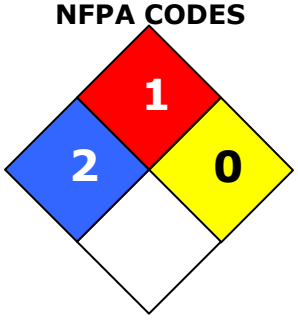
Please see the 833FRB **Material Safety Data Sheet** (MSDS) parts A and B for more details on transportation, storage, handling and other security guidelines. The 1,1-(ethane-1,2-diyl)bis(pentabromobenzene) component bioaccumulates; therefore avoid release in environment in uncured form.

Part A

HMIS RATING

HEALTH:	**2**
FLAMMABILITY:	**1**
PHYSICAL HAZARD:	**0**
PERSONAL PROTECTION:	

NFPA CODES

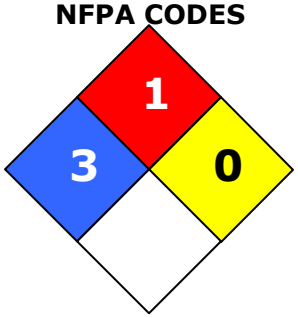


Part B

HMIS RATING

HEALTH:	**3**
FLAMMABILITY:	**1**
PHYSICAL HAZARD:	**0**
PERSONAL PROTECTION:	

NFPA CODES



Health and Safety: The 833 FRB parts can ignite if the liquid is heated, but once it is cured it is a self-extinguishing epoxy solid. Do not breathe in fumes of a cured epoxy block that is exposed to an external flames source because the flame retardant releases bromine to extinguish the flame.

Wear safety glasses or goggles and disposable polyvinyl chloride, neoprene, or nitrile gloves while handling liquids. Part B in particular causes skin burns and may cause sensitization if exposed over a long period of time. The epoxy is black and will not wash off once cured: wear protective work clothing. Wash hands thoroughly after use or if skin contact occurs. Do not ingest.

While the product has low volatility and moderate odor, use in well-ventilated area.

The cured epoxy resin presents no known hazard.

Application Instructions

Follow the procedure below for best results. If you have little or no experience with the 833FRB epoxy, please follow the long instructions instead. The short instructions provided here are not suitable for first time users.

To prepare 2:1 (A:B) epoxy mixture

1. Carefully scrape the settled material in the ***Part A*** container; and stir and fold material until fully homogenous.
2. Carefully scrape the settled material in the ***Part B*** container; and stir and fold material until fully homogenous.
3. Measure ***two*** parts by volume (or weight) of pre-stirred ***A***, and pour in the mixing container.
4. Measure ***one*** part by volume (or weight) of pre-stirred ***B***, and slowly pour in the mixing container while stirring.
5. Put in a vacuum chamber, bring to 25 Hg/in pressure, and wait for 2 minutes to de-air.
   —OR—
   Let sit for 30 minutes to de-air.
6. If bubbles are present at top, use the mixing paddle to gently break them.
7. Pour mixture into the mold or container containing the components to be encapsulated.

ATTENTION! Mixing >500 g [0.4 L] of Part *B* at a time into *A* decreases working life and promotes flash cure. Use of epoxy mixing machines with static stirrer recommended for large volumes. Limit size of hand-mixed batches.

To room temperature cure the 833FRB epoxy

Let stand for 24 hours.

To heat cure the 833FRB epoxy

Put in oven at 65 °C [149 °F] for 60 minutes.

–OR–

Put in oven at 80 °C [176 °F] for 45 minutes.

–OR–

Put in oven at 100 °C [212 °F] for 35 minutes.

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

Packaging and Supporting Products

Cat. No.	*Form*	*Net Volume*		*Net Weight*		*Shipping Weight*	
833FRB-375ML	Liquid	0.375 L	12 oz	0.5 kg	1.0 lb	0.65 kg	1.4 lb
833FRB-3L	Liquid	3 L	0.8 gal	3.8 kg	8.5 lb	4.2 kg	9.2 lb
833FRB-60L	Liquid	60 L	16 gal	78 kg	172 lb	80 kg	180 lb

Supporting Products

- 8328 Epoxy and Adhesive Cleaner
- 8329 Epoxy Mold Release (for temperature cures ≤85 °C)

Technical Support

Contact us regarding any questions, improvement suggestions, or problems with this product. Application notes, instructions, and FAQs are located at www.mgchemicals.com.

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Warranty

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