



ISO 9001 Registered Quality System.
Burlington, Ontario, Canada QMI File # 004008

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

833FRB

Description

The 833FRB *Flame Retardant Epoxy Encapsulating and Potting Compound* is an UL 94V-0 recognized electronic grade epoxy in the QMFZ2 category. This two-part 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 and Features

- **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**
- **Protects electronics from** moisture, corrosion, fungus, thermal shock, and static discharges
- **Strong chemical resistance** to brine, acids, bases, and aliphatic hydrocarbons
- **Volatile organic compound (VOC) and solvents free**

Usage Parameters

<i>Properties</i>	<i>Value</i>
Working Life ^{a)}	60 min
Shelf Life	5 y
Full Cure @22 °C [72 °F]	24 h
Full Cure @65 °C [149 °F]	60 min
Full Cure @80 °C [176 °F]	45 min
Full Cure @100 °C [212 °F]	35 min

a) Working life assumes room temperature for a 100 g sample. A 10 °C increase can decrease the work life by half.

Temperature Ranges

<i>Properties</i>	<i>Value</i>
Constant Service Temperature	-30 to 175 °C [-22 to 347 °F]
Maximum Temperature Extrema ^{b)}	200 °C [392 °F]
Storage Temperature of Unmixed Parts	16 to 27 °C [61 to 81 °F]

b) Maximum short-term exposure temperature toleration limit—not recommended as a sustained or repeated operation condition



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833FRB

Principal Components

Name	CAS Number
Part A: Epoxide Resin	28064-14-4, 25068-38-6
Alkyl glycidyl ether	68609-97-2
Part B: Curing Amine	68410-23-1
Triethylenetetramine	112-24-3

Properties of Cured 833FRB

<i>Physical Properties</i>	<i>Method</i>	<i>Value ^{a)}</i>	
Color	Visual	Black	
Density @21 °C [70 °F]	ASTM D 792	1.26 g/mL	
Flammability	94V	94V-0	
Tensile Strength	ASTM D 638	12 N/mm ²	[1 700 lb/in ²]
Compressive Strength	ASTM D 695	167 N/mm ²	[24 200 lb/in ²]
Lap Shear Strength (Stainless Steel)	ASTM D 1002	13 N/mm ²	[1 900 lb/in ²]
Lap Shear Strength (Aluminum)	"	15 N/mm ²	[2 200 lb/in ²]
Flexural Strength	ASTM D 790	40 N/mm ²	[5 800 lb/in ²]
Tensile Impact	ASTM D 1822	21 kJ/m ²	[10 ft·lb/in]
Izod Impact	ASTM D 256	1.1 kJ/m ²	[0.5 ft·lb/in]
Hardness	Shore D Durometer	77D	
Outgassing (Total Mass Loss)	ASTM E 595	1.45%	
Ash Content	ISO 3451-1	1.27%	
<i>Electrical Properties</i>	<i>Method</i>	<i>Value</i>	
Breakdown Voltage @68.11 mil (1.736 mm)		32.2 kV	
Dielectric Strength	ASTM D 149	471 V/mil	[18.5 kV/mm]
Breakdown Voltage @3.175 mm [1/8"]	Reference fit ^{b)}	43.5 kV	
Dielectric Strength	ASTM D 149	348 V/mil	[13.7 kV/mm]
Volume Resistivity	ASTM D 257	2.71 x 10 ¹⁵ Ω·cm	
Surface Resistivity	"	2 x 10 ¹⁵ Ω/sq	
Comparative Tracking Index (CTI)	ASTM D 3628	322 V	
Dissipation & Constant @60 Hz	ASTM D 150-98	<i>Dissipation (D)</i>	<i>Constant (k')</i>
	"	0.018	3.45
	"	0.012	3.40
	"	0.013	3.31
	"	0.014	3.25
"	"	0.014	3.18
Hot Wire Ignition (HWI)		52.8 s	
High-Current Arc Ignition (HAI)		94.8 arc	
High Voltage Arc Tracking Rate (HVTR)		48 mm/min	
High Voltage, Low Current, Dry Arc Resistance	ASTM D 495	37.6 s	
High Voltage Arc Resist. to Ignition (HVAR)	"	4.6 s	

a) N/mm² = mPa; lb/in² = psi;

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



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833FRB

<i>Thermal Properties</i>	<i>Method</i>	<i>Value</i>
Glass Transition Temperature (T _g)	ASTM D 3418	56 °C
Coefficient of Thermal Expansion (CTE) ^{a)}	ASTM E 831	
Before T _g	"	74 ppm/°C
After T _g	"	188 ppm/°C
Thermal Conductivity @25 °C [77 °F]	ASTM E 1461	0.28 W/(m·K)
@50 °C [122 °F]	"	0.29 W/(m·K)
@100 °C [212 °F]	"	0.29 W/(m·K)

a) ppm/°C = in/in/°C × 10⁻⁶ = unit/unit/°C × 10⁻⁶

Properties of Uncured 833FRB

<i>Physical Properties</i>	<i>Mixture (2A:1B)</i>	
Color	Black	
Viscosity @20 °C [73 °F] ^{a)}	11 500 cP [11.5 Pa·s]	
Density	1.30 g/mL	
Mix Ratio by weight (A:B)	2.0:1.0	
Mix Ratio by volume (A:B)	2.0:1.0	
Solids Content (w/w)	~100%	
<i>Physical Properties</i>	<i>Part A</i>	<i>Part B</i>
Color	Dark Grey	Black
Viscosity @24 °C [73 °F] ^{a)}	4 000 cP [4.0 Pa·s]	14 000 cP [14 Pa·s]
Density	1.31 g/mL	1.18 g/mL
Odor	Mild	Mild

a) Brookfield viscometer at 50 RPM with spindle 4

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.




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833FRB

Substrate Adhesion in Decreasing Order

<i>Physical Properties</i>	<i>Adhesion</i>
Aluminum	Stronger  Weaker
Steel	
Fiberglass	
Wood	
Glass	
Polycarbonate	
Acrylic	
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.

Chemical Solvent Resistance (IPC-TM-650)

<i>Physical Properties</i>	<i>Weight Change</i>	<i>Note</i>
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, Safety, and Environmental Awareness

Please see the 833FRB **Safety Data Sheet** (SDS) parts A and B for more details on transportation, storage, handling and other security guidelines.

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 may 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.

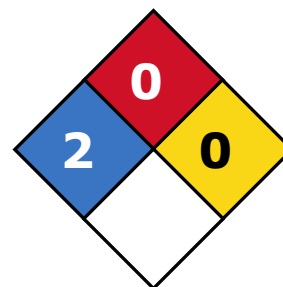
The cured epoxy resin presents no known hazard.

Part A

HMIS® RATING

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

NFPA® 704 CODES

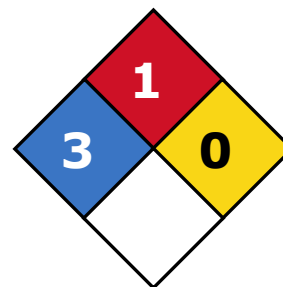


Part B

HMIS® RATING

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

NFPA® 704 CODES



Approximate HMIS and NFPA Risk Ratings Legend:

0 (Low or none); 1 (Slight); 2 (Moderate); 3 (Serious); 4 (Severe)

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

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

ATTENTION! If the parts have clumped (crystallized), pre-heat at 50 °C [122 °F] until fully re-liquefied. Let cool to room temperature before use.

TIP! The above mixing instructions assume 100 g and will give a working life of about 60 minutes. The working life decreases for mixing batches greater than 100 g, and increases for less than 100 g.

ATTENTION! Mixing >500 g [0.4 L] of Part **B** at time into **A** decreases working life and promotes flash cure. Use of epoxy mixing machines with static stirrer recommended for large volumes. Limit size to hand mixed batches. The maximum possible batch size is 1 kg and must be used immediately.

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.



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Packaging and Supporting Products

<i>Cat. No.</i>	<i>Packaging</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Packaging Weight</i>	
833FRB-375ML	Bottle	375 mL	12.6 fl oz	475 g	1.05 lb	0.6 g	1.2 lb
833FRB-3L	Bottle	3 L	3.17 qt	3.81 kg	8.39 lb	4.5 g	9.3 lb
833FRB-60L	Pail	60 L	16 gal	76.1 kg	167 lb	77 g	170 lb

Supporting Products

- *Epoxy and Adhesive Cleaner*: Cat. No. 8328-500ML, 8328-20L
- *Epoxy Mold Release (for temperature cures ≤85 °C)*: Cat. No. 8329-350G

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

M.G. Chemicals Ltd. warrants this product for 12 months from the date of purchase by the end user. *M.G. Chemicals Ltd.* makes no claims as to shelf life of this product for the warranty. The liability of *M.G. Chemicals Ltd.* whether based on its warranty, contracts, or otherwise shall in no case include incidental or consequential damage.

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