

## 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-part epoxy provides a black, self-extinguishing finish with great insulation and protection value.

It protects against static discharges, shocks, vibrations, and mechanical impacts. It insulates against heat and electrical 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 <sup>a</sup>            | 60 minute                 |
| Shelf Life                           | ≥3 year                   |
| Full Cure (at 20 °C [68 °F])         | 24 hour                   |
| Full Cure (at 65 °C [149 °F])        | 60 minute                 |
| Full Cure (at 80 °C [176 °F])        | 45 minute                 |
| Full Cure (at 100 °C [212 °F])       | 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 decrease the pot life by half.

## Service Ranges

| Properties                        | Value                                    |
|-----------------------------------|------------------------------------------|
| Service Temperature               | -40 to +175 °C<br>[-40 to +347 °F]       |
| Max Withstand Temp. <sup>b)</sup> | -65 °C to +225 °C<br>[-85 °F to +437 °F] |

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



## 833FRB

## Name

Alkyl glycidyl ether

68609-97-2

| <b>Physical Properties</b>                          | <b>Method</b>              | <b>Value<sup>a</sup></b>                                |
|-----------------------------------------------------|----------------------------|---------------------------------------------------------|
| Color                                               | Visual                     | Black                                                   |
| Flammability                                        | 94V                        | 94V-0                                                   |
| Density (at 23 °C)                                  | ASTM D 792                 | 1.35 g/cm <sup>3</sup>                                  |
| Compression Strength                                | ASTM D 695                 | 128.46 N/mm <sup>2</sup> [18,632 lb/in <sup>2</sup> ]   |
| Lap Shear Strength                                  | ASTM D 1002                | 5.81 N/mm <sup>2</sup> [843 lb/in <sup>2</sup> ]        |
| Flexural Strength                                   | ASTM D 790                 | 40.19 N/mm <sup>2</sup> [5,829 lb/in <sup>2</sup> ]     |
| Tensile Impact                                      | ASTM D 1822                | 20.54 kJ/m <sup>2</sup> [9.774 ft·lbf/in <sup>2</sup> ] |
| Izod Impact                                         | ASTM D 256                 | 1.10 kJ/m <sup>2</sup> [0.522 ft·lbf/in <sup>2</sup> ]  |
| Hardness                                            | (Shore D durometer)        | 83D to 84D                                              |
| Outgasing (Total Mass Loss)                         | ASTME 595                  | 1.45%                                                   |
| Ash Content                                         | ISO 3451-1                 | 1.27%                                                   |
|                                                     |                            |                                                         |
| <b>Electric Properties</b>                          | <b>Method</b>              | <b>Value</b>                                            |
| Breakdown Voltage @1.736 mm                         | ASTM D 149                 | 32.1 kV                                                 |
| Dielectric Strength @1.736 mm                       | "                          | 18.5 kV/mm [471 V/mil]                                  |
| Breakdown Voltage @3.175 mm [1/8"]                  | Reference fit <sup>b</sup> | 43.5 kV                                                 |
| Dielectric Strength @3.175 mm [1/8"]                | "                          | 13.7 kV/mm [348 V/mil]                                  |
| Volume Resistivity                                  | ASTM D 257                 | 2.71 x10 <sup>15</sup> Ω·cm                             |
| Surface Resistivity                                 | "                          | 2 x10 <sup>15</sup> Ω                                   |
| Comparative Tracking Index                          | ASTM D 3628                | 322 V                                                   |
| Dielectric Dissipation & Constant                   |                            | <i>dissipation, D      constant, k'</i>                 |
| @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<br>...Arc Resistance | ASTM D 495                 | 37.62 s                                                 |
| High Voltage Arc Resist. to Ignition                | ASTM D 495                 | 4.67 s                                                  |

b) To allow comparison between products, the Tauschter 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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## Properties of Cured 833FRB (Continued)

| <i>Thermal Properties</i>                      | <i>Method</i> | <i>Value</i>                                           |
|------------------------------------------------|---------------|--------------------------------------------------------|
| Coefficient of Thermal Expansion               | ASTM E 831    | not established                                        |
| Thermal Conductivity @25 °C                    |               | 0.235 W/(m·K)<br>[1.63 Btu·in/(h·ft <sup>2</sup> ·°F)] |
| Glass Transition Temperature (T <sub>g</sub> ) | ASTM D 3418   | 56 °C                                                  |
| Heat Deflection Temperature <sup>c)</sup>      | ASTM D 648    | 51.9 °C                                                |

c) HDT of plastic under a 455 kPa load

## Properties of Uncured 833FRB

| <i>Physical Property</i>    | <i>Mixture (2A:1B)</i>                                                               |                       |
|-----------------------------|--------------------------------------------------------------------------------------|-----------------------|
| 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%                                                                                 |                       |
|                             |  |                       |
| <i>Physical Property</i>    | <i>Part A</i>                                                                        | <i>Part B</i>         |
| 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



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

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## 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

| <i>Physical Properties</i> | <i>Adhesion</i>                                                                   |
|----------------------------|-----------------------------------------------------------------------------------|
| Aluminum                   | Stronger                                                                          |
| Steel                      |  |
| Fiberglass                 |                                                                                   |
| Wood                       |                                                                                   |
| Glass                      |                                                                                   |
| Polycarbonate              |                                                                                   |
| Acrylic                    |                                                                                   |
| Polypropylene <sup>a</sup> | 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)

| <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 **Material Safety Data Sheet** (MSDS) 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 exposed to flames, 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.

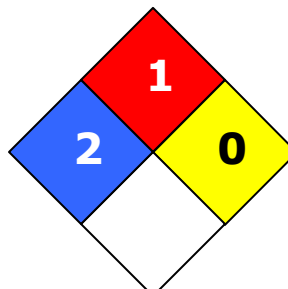
The cured epoxy resin presents no known hazard.

### Part A

#### HMIS® RATING

|                      |   |
|----------------------|---|
| HEALTH:              | 2 |
| FLAMMABILITY:        | 1 |
| PHYSICAL HAZARD:     | 0 |
| PERSONAL PROTECTION: |   |

#### NFPA® 704 CODES

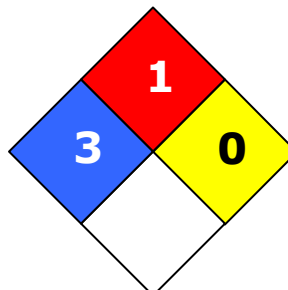


### Part B

#### 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)

**Environment:** The 1,1-(ethane-1,2-diyl)bis(pentabromobenzene) component bioaccumulates; therefore avoid environmental release of the uncured epoxy parts.

## 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.



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

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## Packaging and Supporting Products

| <i>Cat. No.</i>     | <i>Form</i> | <i>Net Volume</i> | <i>Net Weight</i> | <i>Shipping Weight</i> |
|---------------------|-------------|-------------------|-------------------|------------------------|
| <b>833FRB-375ML</b> | Liquid      | 0.375 L 12 oz     | 0.5 kg 1.0 lb     | 0.65 kg 1.4 lb         |
| <b>833FRB-3L</b>    | Liquid      | 3 L 0.8 gal       | 3.8 kg 8.5 lb     | 4.2 kg 9.2 lb          |
| <b>833FRB-60L</b>   | 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  $\leq 85^{\circ}\text{C}$ )

## 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](http://www.mgchemicals.com).

Email: [support@mgchemicals.com](mailto:support@mgchemicals.com)

Phone: 1-800-340-0772 Ext. 130 (Canada, Mexico & USA)

1-905-331-1396 Ext. 130 (International)

Fax: 1-905-331-2862 or 1-800-340-0773

Mailing address: **Manufacturing & Support**  
1210 Corporate Drive  
Burlington, Ontario, Canada  
L7L 5R6

**Head Office**  
9347-193rd Street  
Surrey, British Columbia, Canada  
V4N 4E7

## 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.

## Disclaimer

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