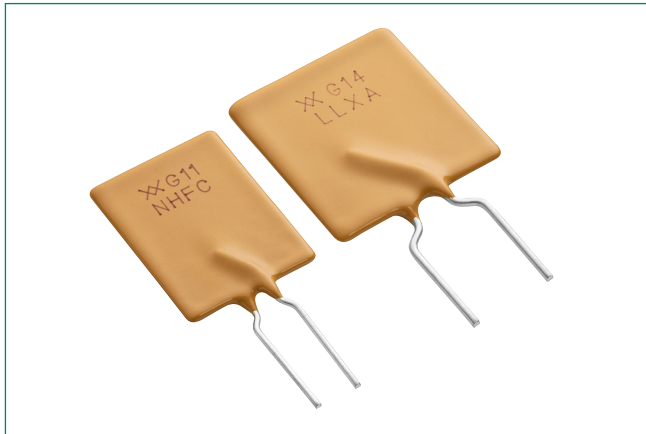


# AGRF Series

## Radial Leaded



### Description

The AGRF Series is a PPTC resettable device designed specifically for the automotive industry. It is a 16V lead-free, radial leaded resettable device that meets Littelfuse's Automotive qualification. This qualification is based on AEC-Q200: Stress Test Qualification for Passive Components.

### Applications

- Motor and motor circuit protection including power door-locks, mirrors, lumbar pumps, seats, sunroofs and windows
- Electronic Control Unit (ECU) I/O protection
- Heating, Ventilation and Cooling (HVAC) motor and I/O protection
- Telematics, infotainment and navigations systems
- Liquid Crystal Display (LCD) back-light heaters
- Power and cigarette lighter outlets, plugs and adapter/chargers
- Powered networks and buses
- Air-flow detection and overcurrent protection in HVAC and cooling fan systems
- Stall detection in express window and sunroof circuits
- Resettable overcurrent protection for power distribution, electrical centers and junction boxes
- Wire downsizing
- Motor electromagnetic interference (EMI) suppression
- Electrostatic discharge (ESD) damage protection
- Load dump and other transient voltage protection

### Additional Information



Resources



Accessories



Samples

### Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
|        | E74889             |

### Features & Benefits

- Overcurrent and overvoltage circuit protection devices
- Resettable and single-use overcurrent devices
- Wide range of form factor and termination methods
- Products meet applicable automotive industry standards
- Devices compatible with high-volume electronics assembly
- RoHS compliant, Lead-Free and Halogen-Free

### Electrical Characteristics

| Part Number | Ordering Part Number | $I_H(A)@$<br>( $R_{1MAX}$ ) | $I_H(A)@$<br>( $R_{nMAX}$ ) | $I_T$<br>(A) | $V_{MAX}$<br>( $V_{DC}$ ) | $I_{MAX}$<br>(A) | $P_{D Typ}$<br>(W) | Max Time-to-trip |     | $R_{MIN}$<br>( $\Omega$ ) | $R_{1MAX}$<br>( $\Omega$ ) | $R_{nMAX}$<br>( $\Omega$ ) | Lead Size<br>(mm <sup>2</sup> /<br>AWG) |
|-------------|----------------------|-----------------------------|-----------------------------|--------------|---------------------------|------------------|--------------------|------------------|-----|---------------------------|----------------------------|----------------------------|---|
| AGRF – 16V  |                      |                             |                             |              |                           |                  |                    |                  |     |                           |                            |                            |   |
| AGRF400     | RF3057-000           | 4.0                         | 3.0                         | 7.6          | 16                        | 100              | 2.5                | 20.0             | 2.0 | 0.0186                    | 0.0610                     | 0.0850                     | 0.52/20                                 |
| AGRF500     | RF3276-000           | 5.0                         | 4.3                         | 9.4          | 16                        | 100              | 2.7                | 25.0             | 2.5 | 0.0140                    | 0.0340                     | 0.0480                     | 0.52/20                                 |
| AGRF600     | RF3278-000           | 6.0                         | 5.3                         | 10.7         | 16                        | 100              | 2.8                | 30.0             | 3.5 | 0.0095                    | 0.0280                     | 0.0320                     | 0.52/20                                 |
| AGRF700     | RF3280-000           | 7.0                         | 6.5                         | 13.2         | 16                        | 100              | 3.0                | 35.0             | 4.0 | 0.0066                    | 0.0200                     | 0.0220                     | 0.52/20                                 |
| AGRF800     | RF3282-000           | 8.0                         | 7.6                         | 15.0         | 16                        | 100              | 3.2                | 40.0             | 5.5 | 0.0049                    | 0.0175                     | 0.0181                     | 0.52/20                                 |
| AGRF900     | RF3191-000           | 9.0                         | 8.6                         | 16.5         | 16                        | 100              | 3.4                | 45.0             | 6.0 | 0.0041                    | 0.0135                     | 0.0140                     | 0.52/20                                 |
| AGRF1000    | RF3285-000           | 10.0                        | 9.6                         | 18.5         | 16                        | 100              | 3.6                | 50.0             | 7.0 | 0.0034                    | 0.0102                     | 0.0106                     | 0.52/20                                 |
| AGRF1100    | RF3287-000           | 11.0                        | 10.5                        | 20.3         | 16                        | 100              | 3.7                | 55.0             | 7.5 | 0.0033                    | 0.0089                     | 0.0093                     | 0.52/20                                 |
| AGRF1200    | RF3290-000           | 12.0                        | 11.5                        | 22.1         | 16                        | 100              | 4.2                | 60.0             | 8.0 | 0.0030                    | 0.0086                     | 0.0091                     | 0.82/18                                 |
| AGRF1400    | RF3292-000           | 14.0                        | 13.0                        | 27.3         | 16                        | 100              | 4.6                | 70.0             | 9.0 | 0.0022                    | 0.0064                     | 0.0067                     | 0.82/18                                 |

#### Notes:

- $I_H$  : Hold current: maximum current device will pass without interruption in 25°C, unless otherwise specified.
- $I_T$  : Trip current: minimum current that will switch the device from low-resistance to high-resistance in 25°C still air, unless otherwise specified.
- $V_{MAX}$  : Maximum voltage device can withstand without damage at rated current.
- $I_{MAX}$  : Maximum fault current device can withstand without damage at rated voltage.
- $P_D$  : Power dissipated from device when in the tripped state in 25°C still air, unless otherwise specified.

- $R_{MIN}$  : Minimum resistance of device as supplied at 25°C, unless otherwise specified.
- $R_{1MAX}$  : Maximum resistance of device when measured one hour post trip at 25°C unless otherwise specified.
- $R_{nMAX}$  : Maximum functional resistance of device after being subjected to the stresses described in AEC-Q200 at 25°C, unless otherwise specified.
- $R_{sMIN}$  : Minimum functional resistance of device after being subjected to the stresses described in AEC-Q200 at 25°C, unless otherwise specified.
- \* Electrical characteristics determined at 25°C.

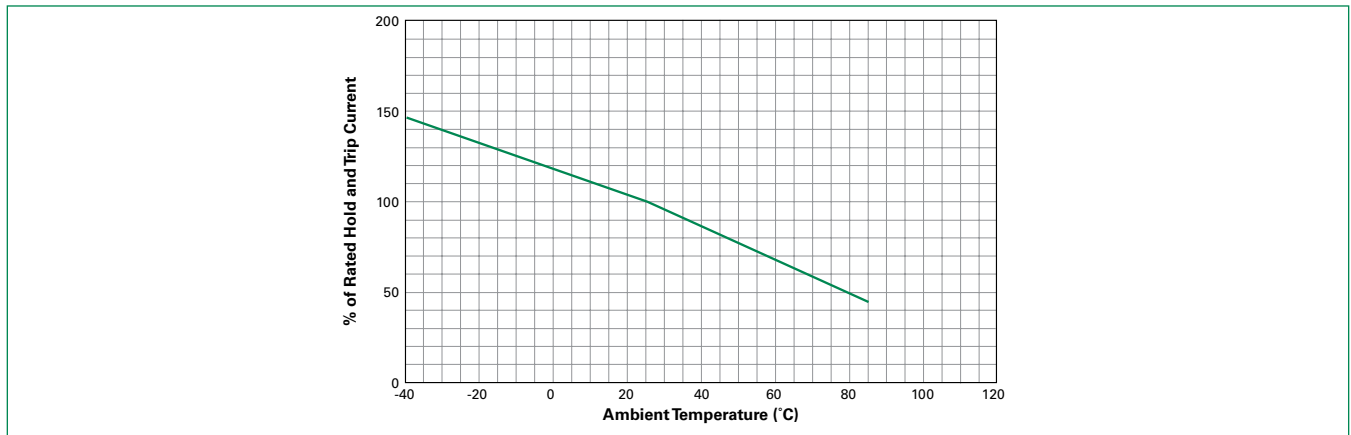
# AGRF Series

## Radial Leaded

### Temperature Derating

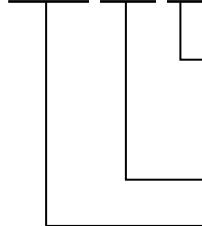
|                         | Maximum Ambient Temperature |       |      |      |      |      |      |      |      |      |
|-------------------------|-----------------------------|-------|------|------|------|------|------|------|------|------|
|                         | -40°C                       | -20°C | 0°C  | 20°C | 25°C | 40°C | 50°C | 60°C | 70°C | 85°C |
| <b>Hold Current (A)</b> |                             |       |      |      |      |      |      |      |      |      |
| AGRF – 16V              |                             |       |      |      |      |      |      |      |      |      |
| AGRF400                 | 5.9                         | 5.3   | 4.8  | 4.1  | 4.0  | 3.5  | 3.2  | 2.8  | 2.5  | 1.9  |
| AGRF500                 | 7.3                         | 6.6   | 6.0  | 5.2  | 5.0  | 4.4  | 4.0  | 3.6  | 3.1  | 2.4  |
| AGRF600                 | 8.8                         | 8.0   | 7.2  | 6.2  | 6.0  | 5.2  | 4.8  | 4.2  | 3.8  | 2.8  |
| AGRF700                 | 10.3                        | 9.3   | 8.4  | 7.3  | 7.0  | 6.2  | 5.6  | 5.0  | 4.4  | 3.3  |
| AGRF800                 | 11.7                        | 10.7  | 9.6  | 8.3  | 8.0  | 6.9  | 6.4  | 5.6  | 5.1  | 3.7  |
| AGRF900                 | 13.2                        | 11.9  | 10.7 | 9.4  | 9.0  | 7.9  | 7.2  | 6.4  | 5.6  | 4.2  |
| AGRF1000                | 14.7                        | 13.3  | 12.0 | 10.3 | 10.0 | 8.7  | 8.0  | 7.0  | 6.3  | 4.7  |
| AGRF1100                | 16.1                        | 14.6  | 13.1 | 11.5 | 11.0 | 9.7  | 8.8  | 7.8  | 6.9  | 5.2  |
| AGRF1200                | 17.6                        | 16.0  | 14.4 | 12.4 | 12.0 | 10.4 | 9.6  | 8.4  | 7.6  | 5.6  |
| AGRF1400                | 20.5                        | 18.7  | 16.8 | 14.5 | 14.0 | 12.1 | 11.2 | 9.8  | 8.9  | 6.5  |

### Temperature Derating Curve



### Part Ordering Number System

**AGRF 800 -2**



**Packaging Option**  
 (Blank) = Bulk  
 2 = Tape and Reel Packaging  
 AP = Ammo Pack

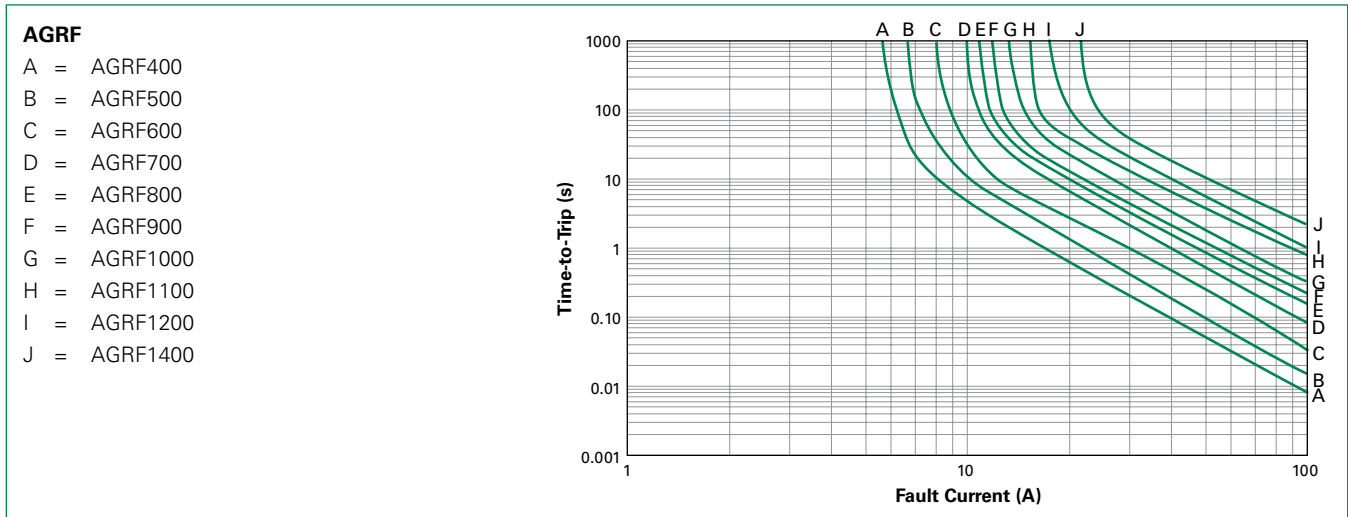
**Hold Current Indicator**

**Product Series**  
 An "F" at the End of the Series Indicates Pb-free Version of Product

# AGRF Series

## Radial Leaded

Typical Time-to-Trip Curves at 25°C



### Physical Specifications

|                                  |  |
|----------------------------------|--|
| <b>Lead Material</b>             | AGRF400 to AGRF1100 : Tin-plated Copper, 0.52mm <sup>2</sup> (20AWG) ø 0.8 mm/0.032in<br>AGRF1200 to AGRF1400 : Tin-plated Copper, 0.82mm <sup>2</sup> (18AWG) ø 1.0mm/0.040in         |
| <b>Soldering Characteristics</b> | Solderability per ANSI/J-STD-002 Category 3  |
| <b>Solder Heat Withstand</b>     | AGRF400:<br>Per IEC 60068-2-20, Test Tb, Method 1; Can withstand 5s at 260° C ± 5° C<br>AGRF500-AGRF1400:<br>Per IEC 60068-2-20, Test Tb, Method 1; Can withstand 10s at 260° C ± 5° C |
| <b>Insulating Material</b>       | Cured, Flame-retardant Epoxy Polymer; Meets UL 94V-0   |
| <b>Operation Temperature</b>     | -40°C~85°C   |

Note: See AEC-Q200 for other physical characteristics. Devices are not designed to be placed through a reflow process.

### Environmental Specifications

| Test                      | Conditions               | Resistance Change |
|---------------------------|--------------------------|-------------------|
| <b>Passive Aging</b>      | 70°C, 1000 hrs           | ±5%               |
|                           | 85°C, 1000 hrs           | ±5%               |
| <b>Humidity Aging</b>     | 85°C, 85% R.H., 1000 hrs | ±5%               |
| <b>Thermal Shock</b>      | 85°C, -40°C 10 times     | ±5%               |
| <b>Solvent Resistance</b> | MIL-STD-202, Method 215  | No change         |

Note: See AEC-Q200 for other environmental specifications.

|                                  |   |
|----------------------------------|---|
| <b>Moisture Resistance Level</b> | Level 1, J-STD-020  |
| <b>Storage Conditions</b>        | 40°C max, 70% RH max; devices should remain in original sealed bags prior to use. Devices may not meet specified values if these storage conditions are exceeded. |

# AGRF Series

## Radial Leaded

### Dimension Figures

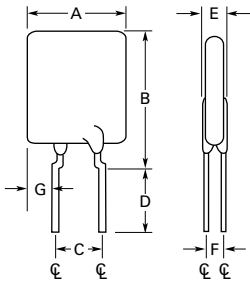


Figure 1

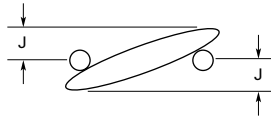


Figure 2

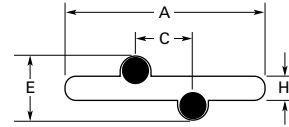


Figure 3

### Dimensions

| Part Number | Dimensions in Millimeters (Inches) |                  |     |                |               |                |              |     |     |               |               |     |     |                 |                 |               | Figure |
|-------------|------------------------------------|------------------|-----|----------------|---------------|----------------|--------------|-----|-----|---------------|---------------|-----|-----|-----------------|-----------------|---------------|--------|
|             | A                                  |                  | B   |                | C             |                | D            |     | E   |               | F             |     | G   |                 | H               | J             |        |
|             | Min                                | Max              | Min | Max            | Min           | Max            | Min          | Max | Min | Max           | Min           | Max | Min | Max             | Typ             | Typ           |        |
| AGRF – 16V  |                                    |                  |     |                |               |                |              |     |     |               |               |     |     |                 |                 |               |        |
| AGRF400     | —                                  | 8.9<br>(0.350)   | —   | 14.1<br>(0.56) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.15) | —   | —   | 3.10<br>(0.120) | 1.24<br>(0.049) | 1.4<br>(0.06) | 1,2,3  |
| AGRF500     | —                                  | 10.4<br>(0.410)  | —   | 15.6<br>(0.61) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 3.94<br>(0.155) | 1.24<br>(0.049) | 1.6<br>(0.06) | 1,2,3  |
| AGRF600     | —                                  | 10.7<br>(0.420)  | —   | 18.4<br>(0.73) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 4.07<br>(0.160) | 1.24<br>(0.049) | 1.6<br>(0.06) | 1,2,3  |
| AGRF700     | —                                  | 11.2<br>(0.440)  | —   | 21.0<br>(0.73) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 4.49<br>(0.177) | 1.24<br>(0.049) | 1.7<br>(0.07) | 1,2,3  |
| AGRF800     | —                                  | 12.7<br>(0.500)  | —   | 22.2<br>(0.88) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 5.08<br>(0.200) | 1.24<br>(0.049) | 1.8<br>(0.07) | 1,2,3  |
| AGRF900     | —                                  | 14.0<br>(0.550)  | —   | 23.0<br>(0.91) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 5.69<br>(0.224) | 1.24<br>(0.049) | 2.0<br>(0.08) | 1,2,3  |
| AGRF1000    | —                                  | 16.51<br>(0.650) | —   | 25.7<br>(1.01) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 6.96<br>(0.274) | 1.24<br>(0.049) | 2.0<br>(0.08) | 1,2,3  |
| AGRF1100    | —                                  | 17.5<br>(0.690)  | —   | 26.5<br>(1.04) | 4.3<br>(0.17) | 5.8<br>(0.20)  | 7.6<br>(0.3) | —   | —   | 3.0<br>(0.12) | 1.2<br>(0.05) | —   | —   | 7.47<br>(0.294) | 1.24<br>(0.049) | 2.4<br>(0.09) | 1,2,3  |
| AGRF1200    | —                                  | 17.5<br>(0.690)  | —   | 28.8<br>(1.14) | 9.4<br>(0.37) | 10.9<br>(0.43) | 7.6<br>(0.3) | —   | —   | 3.5<br>(0.14) | 1.4<br>(0.06) | —   | —   | 4.83<br>(0.190) | 1.45<br>(0.057) | 1.5<br>(0.06) | 1,2,3  |
| AGRF1400    | —                                  | 23.5<br>(0.925)  | —   | 28.7<br>(1.13) | 9.4<br>(0.37) | 10.9<br>(0.43) | 7.6<br>(0.3) | —   | —   | 3.5<br>(0.14) | 1.4<br>(0.06) | —   | —   | 7.82<br>(0.308) | 1.45<br>(0.057) | 1.9<br>(0.07) | 1,2,3  |

# AGRF Series

## Radial Leaded

### Packaging and Marking Information

| Part Number | Bag Quantity | Tape and Reel Quantity | Ammo Pack Quantity | Standard Package Quantity | Part Marking | Agency Recognition |
|-------------|--------------|------------------------|--------------------|---------------------------|--------------|--------------------|
| AGRF – 16V  |              |                        |                    |                           |              |                    |
| AGRF400     | 500          | —                      | —                  | 10,000                    | G4           | UL                 |
| AGRF400-2   | —            | 2,500                  | —                  | 12,500                    | G4           | UL                 |
| AGRF400-AP  | —            | —                      | 2,000              | 10,000                    | G4           | UL                 |
| AGRF500     | 500          | —                      | —                  | 10,000                    | G5           | UL                 |
| AGRF500-2   | —            | 2,000                  | —                  | 10,000                    | G5           | UL                 |
| AGRF500-AP  | —            | —                      | 2,000              | 10,000                    | G5           | UL                 |
| AGRF600     | 500          | —                      | —                  | 10,000                    | G6           | UL                 |
| AGRF600-2   | —            | 2,000                  | —                  | 10,000                    | G6           | UL                 |
| AGRF600-AP  | —            | —                      | 2,000              | 10,000                    | G6           | UL                 |
| AGRF700     | 500          | —                      | —                  | 10,000                    | G7           | UL                 |
| AGRF700-2   | —            | 1,500                  | —                  | 7,500                     | G7           | UL                 |
| AGRF700-AP  | —            | —                      | 1,500              | 7,500                     | G7           | UL                 |
| AGRF800     | 500          | —                      | —                  | 10,000                    | G8           | UL                 |
| AGRF800-2   | —            | 1,500                  | —                  | 7,500                     | G8           | UL                 |
| AGRF800-AP  | —            | —                      | 1,500              | 7,500                     | G8           | UL                 |
| AGRF900     | 500          | —                      | —                  | 10,000                    | G9           | UL                 |
| AGRF900-2   | —            | 1,000                  | —                  | 5,000                     | G9           | UL                 |
| AGRF900-AP  | —            | —                      | 1,000              | 5,000                     | G9           | UL                 |
| AGRF1000    | 250          | —                      | —                  | 5,000                     | G10          | UL                 |
| AGRF1000-2  | —            | 1,000                  | —                  | 5,000                     | G10          | UL                 |
| AGRF1000-AP | —            | —                      | 1,000              | 5,000                     | G10          | UL                 |
| AGRF1100    | 250          | —                      | —                  | 5,000                     | G11          | UL                 |
| AGRF1100-2  | —            | 1,000                  | —                  | 5,000                     | G11          | UL                 |
| AGRF1100-AP | —            | —                      | 1,000              | 5,000                     | G11          | UL                 |
| AGRF1200    | 250          | —                      | —                  | 5,000                     | G12          | UL                 |
| AGRF1200-2  | —            | 1,000                  | —                  | 5,000                     | G12          | UL                 |
| AGRF1200-AP | —            | —                      | 1,000              | 5,000                     | G12          | UL                 |
| AGRF1400    | 250          | —                      | —                  | 5,000                     | G14          | UL                 |
| AGRF1400-2  | —            | 1,000                  | —                  | 5,000                     | G14          | UL                 |
| AGRF1400-AP | —            | —                      | 1,000              | 5,000                     | G14          | UL                 |

**Note:** These devices are intended for use in automotive applications.

# AGRF Series

## Radial Ledged

### Tape and Reel Specifications

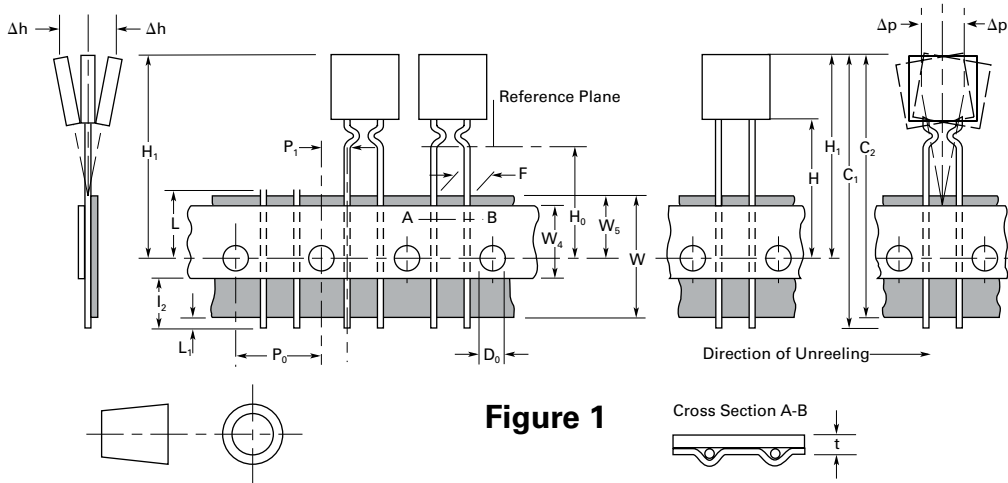
| Description   | EIA Mark       | Dimension (mm) | Tolerance  |
|---|----------------|----------------|------------|
| Carrier Tape Width  | W              | 18.0           | -0.5/+1.0  |
| Hold Down Tape Width  | W <sub>4</sub> | 11.0           | Minimum    |
| Top Distance between Tape Edges                             | W <sub>6</sub> | 3.0            | Maximum    |
| Sprocket Hole Position                                      | W <sub>5</sub> | 9.0            | -0.5/+0.75 |
| Sprocket Hole Diameter                                      | D <sub>0</sub> | 4.0            | ±0.2       |
| Abscissa to Plane (Kinked Lead) (AGRF400 to AGRF1400)       | H <sub>0</sub> | 16.0           | ±0.5       |
| Abscissa to Top (AGRF400 to AGRF600)                        | H <sub>1</sub> | 32.2           | Maximum    |
| Abscissa to Top (AGRF700 to AGRF1400)                       | H <sub>1</sub> | 45.0           | Maximum    |
| Overall Width with Lead Protrusion (AGRF400 to AGRF600)     | C <sub>1</sub> | 43.2           | Maximum    |
| Overall Width with Lead Protrusion (AGRF700 to AGRF1400)    | C <sub>1</sub> | 55.0           | Maximum    |
| Overall Width without Lead Protrusion (AGRF400 to AGRF600)  | C <sub>2</sub> | 42.5           | Maximum    |
| Overall Width without Lead Protrusion (AGRF700 to AGRF1400) | C <sub>2</sub> | 54.0           | Maximum    |
| Lead Protrusion   | L <sub>1</sub> | 1.0            | Maximum    |
| Protrusion of Cut-out                                       | L              | 11.0           | Maximum    |
| Protrusion Beyond Hold-Down Tape                            | I <sub>2</sub> | Not specified  | —          |
| Sprocket Hole Pitch   | P <sub>0</sub> | 12.7           | ± 0.3      |
| Device Pitch (AGRF400 to AGRF700)                           | —              | 12.7           | ± 0.3      |
| Device Pitch (AGRF800 to AGRF1400)                          | —              | 25.4           | ± 0.6      |
| Pitch Tolerance   | —              | 20 consec.     | ± 0.1      |
| Tape Thickness  | t              | 0.9            | Maximum    |
| Overall Tape and Lead Thickness (AGRF400 to AGRF1100)       | t <sub>1</sub> | 2.0            | Maximum    |
| Overall Tape and Lead Thickness (AGRF1200 to AGRF1400)      | t <sub>1</sub> | 2.3            | Maximum    |
| Splice Sprocket Hole Alignment                              | —              | 0              | ± 0.3      |
| Body Lateral Deviation                                      | h              | 0              | ± 1.0      |
| Body Tape Plane Deviation                                   | p              | 0              | ± 1.3      |
| Ordinate to Adjacent Component Lead (AGRF400 to AGRF1100)   | P <sub>1</sub> | 3.81           | ± 0.7      |
| Ordinate to Adjacent Component Lead (AGRF1200 to AGRF1400)  | P <sub>1</sub> | 7.62           | ± 0.7      |
| Lead Spacing (AGRF400 to AGRF1100)                          | F              | 5.05           | ± 0.75     |
| Lead Spacing (AGRF1200 to AGRF1400)                         | F              | 10.15          | ± 0.75     |
| Reel Width (AGRF400 to AGRF600)                             | w <sub>2</sub> | 56.0           | Maximum    |
| Reel Width (AGRF700 to AGRF1400)                            | w <sub>2</sub> | 63.5           | Maximum    |
| Reel Diameter   | A              | 370.0          | Maximum    |
| Arbor Hold Diameter   | c              | 26.0           | ±12.0      |
| Core Diameter*  | n              | 91.0           | Maximum    |
| Box   | —              | 64/372/362     | Maximum    |
| Consecutive Missing Places                                  | —              | None           | —          |
| Empty Places per Reel                                       | —              | 0.1%           | Maximum    |

\*Differs from EIA specification.

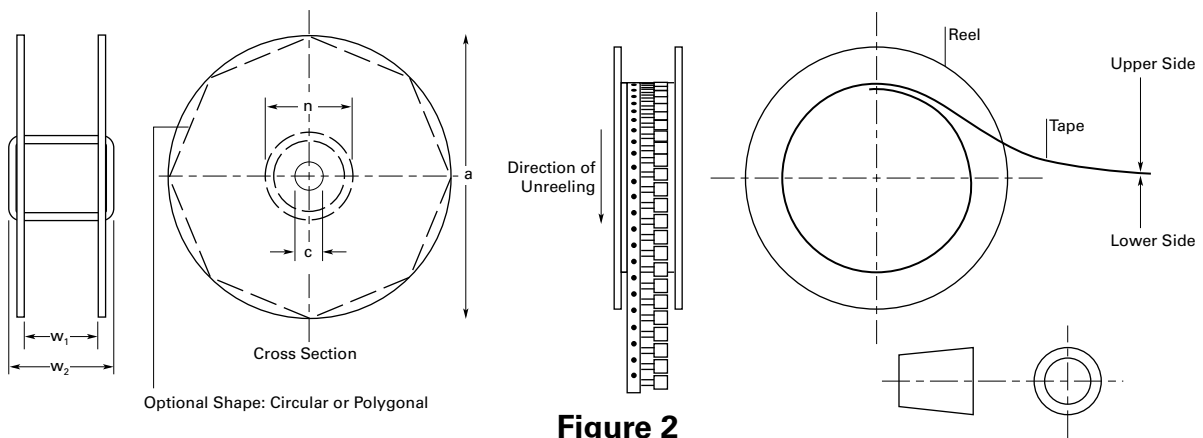
# AGRF Series

## Radial Leaded

### Tape and Reel Diagrams



**Figure 1**



**Figure 2**

AGRF devices are available in tape and reel packaging per EIA468-B/IEC286-2 and EIA 481-2 standards. See Figures 1 and 2 for details.

#### Warning

- Users should independently evaluate the suitability of and test each product selected for their own application.
- Operation beyond the maximum ratings or improper use may result in device damage and possible electrical arcing and flame.
- These devices are intended for protection against damage caused by occasional overcurrent or overtemperature fault conditions and should not be used when repeated fault conditions or prolonged trip events are anticipated.
- Contamination of the PPTC material with certain silicone-based oils or some aggressive solvents can adversely impact the performance of the devices.
- Device performance can be impacted negatively if devices are handled in a manner inconsistent with recommended electronic, thermal, and mechanical procedures for electronic components.
- PPTC devices are not recommended for installation in applications where the device is constrained such that its PTC properties are inhibited, for example in rigid potting materials or in rigid housings, which lack adequate clearance to accommodate device expansion.
- Operation in circuits with a large inductance can generate a circuit voltage ( $L di/dt$ ) above the rated voltage of the device.

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