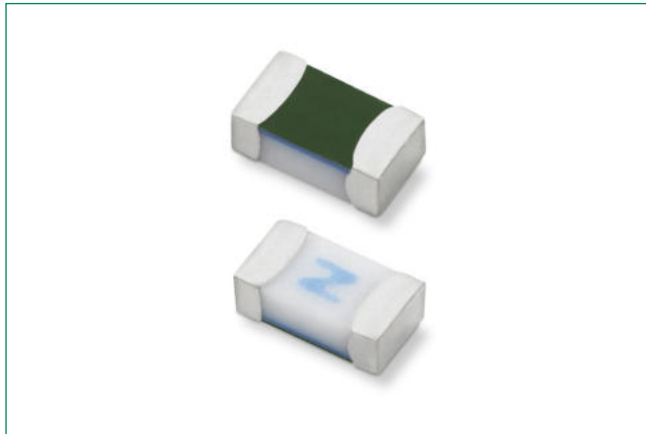


# 441A Series

## AEC-Q200 Qualified > 0603 High I<sup>2</sup>t Ceramic Fuse



### Description

The 441A series AEC-Qualified fuses are specifically tested to cater to secondary circuit protection needs of compact auto-electronics application.

The general design ensures excellent temperature stability and performance reliability.

This high I<sup>2</sup>t fuse series is designed to have ultra high inrush current withstand capability to avoid nuisance fuse open.

### Features & Benefits

- Operating Temperature from -55°C to 150°C
- 100% Lead-free, Halogen-Free and RoHS compliant
- Suitable for both leaded and lead-free reflow/wave soldering
- Ultra high I<sup>2</sup>t values
- Recognized to UL/CSA/NMX 248-1 and UL/CSA/NMX 248-14
- AEC-Q200 Qualified

### Web Resources



Download ECAD models, order samples, and find technical resources at [www.littelfuse.com](http://www.littelfuse.com)

### Agency Approvals

| Agency | Agency File Number | Ampere Range |
|--------|--------------------|--------------|
|        | E10480             | 2A - 6A      |
|        | 29862              | 2A - 6A      |

### Applications

- Li-ion Battery
- LED Head Lights
- Automotive Navigation System
- TFT Display
- Battery Management System (BMS)
- Instrument Clusters

### Electrical Characteristics

| % of Ampere Rating | Ampere Rating | Opening Time at 25°C |
|--------------------|---------------|----------------------|
| 100%               | 2A - 6A       | 4 Hours Minimum      |
| 350%               | 2A - 6A       | 5 Seconds Maximum    |

### Electrical Specifications by Item

| Ampere Rating (A) | Amp Code | Max. Voltage Rating (V) | Interrupting Rating | Nominal Resistance (Ohms) <sup>2</sup> | Nominal Melting I <sup>2</sup> t (A <sup>2</sup> Sec.) <sup>3</sup> | Nominal Voltage Drop At Rated Current (V) <sup>4</sup> | Nominal Power Dissipation At Rated Current (W) | Agency Approvals |   |
|-------------------|----------|-------------------------|---------------------|--|---|--|--|------------------|---|
|                   |          |                         |                     |  |   |  |  |                  |   |
| 2                 | 002.     | 32                      | 50 A @ 32 VDC       | 0.0302                                 | 0.3103  | 0.0551   | 0.110  | X                | X |
| 2.5               | 02.5     | 32                      |                     | 0.0200                                 | 0.5520  | 0.0534   | 0.134  | X                | X |
| 3                 | 003.     | 32                      |                     | 0.0158                                 | 0.8165  | 0.0531   | 0.159  | X                | X |
| 3.5               | 03.5     | 32                      |                     | 0.0117                                 | 0.9438  | 0.0468   | 0.164  | X                | X |
| 4                 | 004.     | 32                      |                     | 0.0097                                 | 1.2659  | 0.0475   | 0.190  | X                | X |
| 5                 | 005.     | 32                      |                     | 0.0073                                 | 1.6287  | 0.0472   | 0.236  | X                | X |
| 6                 | 006.     | 32                      |                     | 0.0056                                 | 2.6049  | 0.0464   | 0.278  | X                | X |

#### Notes:

- DC Interrupting Rating tested at rated voltage with time constant < 0.8 msec.
- Nominal Resistance measured with < 10% rated current.
- Nominal Melting I<sup>2</sup>t measured at 1 msec. opening time.
- Nominal Voltage Drop measured at rated current after temperature has stabilized.

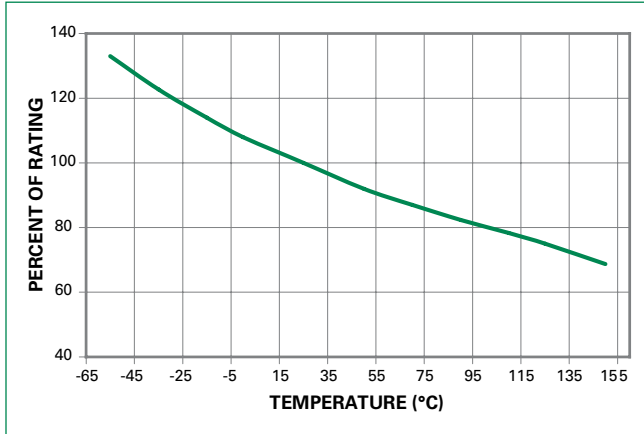
Devices designed to carry out rated current for 4 hours minimum. It is recommended that devices be operated continuously at no more than 80% rated current. See "Temperature Re-rating Curve" for additional re-rating information.

Devices designed to be mounted with marking code facing up.

# 441A Series

## AEC-Q200 Qualified > 0603 High I2t Ceramic Fuse

Temperature Re-rating Curve



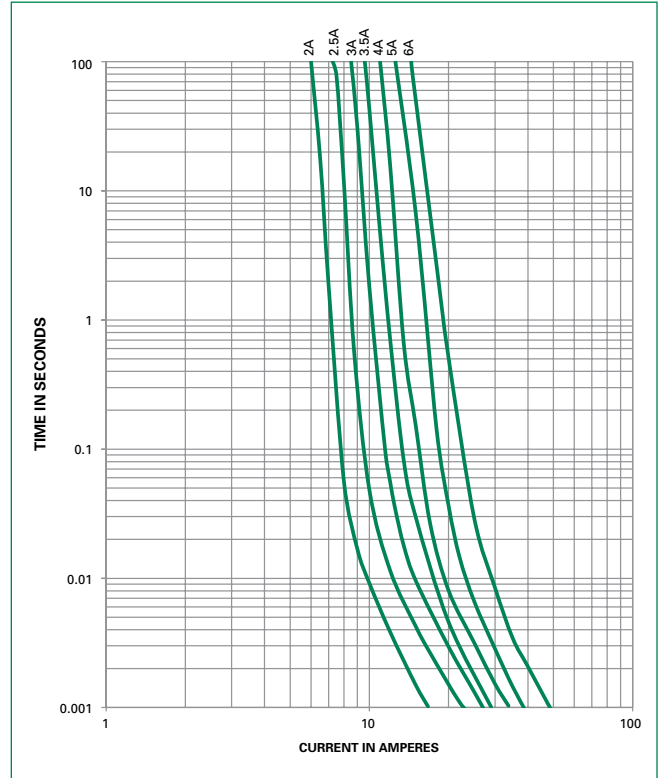
**Note:**

1. Re-rating depicted in this curve is in addition to the standard re-rating of 20% for continuous operation.

For continuous operation at 75 degrees celsius, the fuse should be rerated as follows:

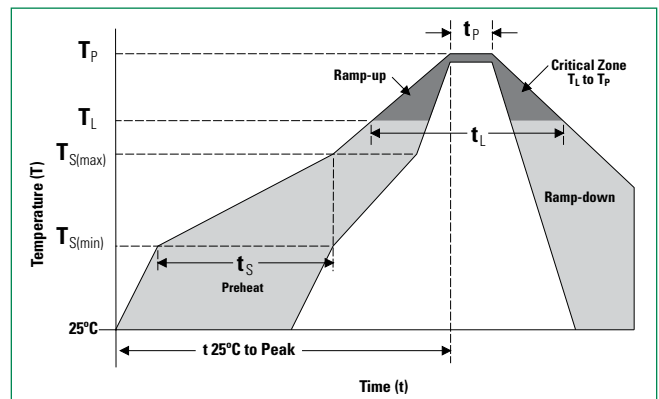
$$I = (0.80)(0.85)I_n = (0.68)I_n$$

Average Time Current Curves



### Soldering Parameters

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| <b>Reflow Condition</b>  |                                    | Pb – free assembly      |
| <b>Pre Heat</b>  | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|  | - Time (Min to Max) ( $t_s$ )      | 60 – 180 seconds        |
| <b>Average Ramp-up Rate (Liquidus Temp (<math>T_L</math>) to peak)</b> |                                    | 3°C/second max.         |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>      |                                    | 5°C/second max.         |
| <b>Reflow</b>  | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|  | - Temperature ( $t_l$ )            | 60 – 150 seconds        |
| <b>Peak Temperature (<math>T_p</math>)</b>                             |                                    | 260 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 10 – 30 seconds         |
| <b>Ramp-down Rate</b>  |                                    | 6°C/second max.         |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>                |                                    | 8 minutes max.          |
| <b>Do not exceed</b>   |                                    | 260°C                   |
| <b>Wave Soldering</b>  |                                    | 260°C, 10 seconds max.  |



# 441A Series

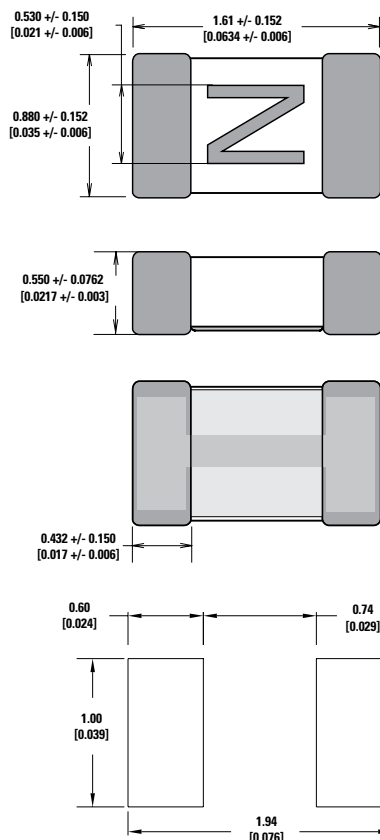
## AEC-Q200 Qualified > 0603 High I2t Ceramic Fuse

### Product Characteristics

|                                     |  |
|-------------------------------------|--|
| <b>Materials</b>                    | <b>Body:</b> Advanced Ceramic<br><b>Terminations:</b> Ag / Ni / Sn (100% Lead-free)<br><b>Element Cover Coating:</b> Lead-free Glass |
| <b>Moisture Sensitivity Level</b>   | IPC/JEDEC J-STD-020, Level 1   |
| <b>Solderability</b>                | IPC/ECA/JEDEC J-STD-002, Condition C   |
| <b>Humidity</b>                     | MIL-STD-202, Method 103, Conditions D  |
| <b>Resistance to Solder Heat</b>    | MIL-STD-202, Method 210, Condition B   |
| <b>Moisture Resistance</b>          | MIL-STD-202, Method 106  |
| <b>Thermal Shock</b>                | MIL-STD-202, Method 107, Condition B   |
| <b>Mechanical Shock</b>             | MIL-STD-202, Method 213, Condition A   |
| <b>Vibration</b>                    | MIL-STD-202, Method 201  |
| <b>Vibration, High Frequency</b>    | MIL-STD-202, Method 204, Condition D   |
| <b>Dissolution of Metallization</b> | IPC/ECA/JEDEC J-STD-002, Condition D   |
| <b>Terminal Strength</b>            | IEC 60127-4  |

|                                     |   |
|-------------------------------------|---|
| <b>High Temperature Storage</b>     | MIL-STD-202, Method 108 with exemptions                                   |
| <b>Thermal Shock Test</b>           | JESD22 Method JA-104, Test Conditions B and N                             |
| <b>Biased Humidity</b>              | MIL-STD-202, Method 103, 85C/85% RH with 10% operating power for 1000 hrs |
| <b>Operational Life</b>             | MIL-STD 202, Method 108, Test Condition D                                 |
| <b>Resistance to Solvents</b>       | MIL-STD-202, Method 215   |
| <b>Mechanical Shock</b>             | MIL-STD-202, Method 213, Test Condition C                                 |
| <b>High Frequency Vibration</b>     | MIL-STD-202, Method 204   |
| <b>Resistance to Soldering Heat</b> | MIL-STD-202, Method 210, Test Condition B                                 |
| <b>Solderability</b>                | JESD22-B102E, Method 1  |
| <b>Terminal Strength for SMD</b>    | AEC-Q200-006  |
| <b>Board Flex</b>                   | AEC-Q200-005  |
| <b>Electrical Characterization</b>  | Conducted at minimum, ambient and maximum temperatures                    |

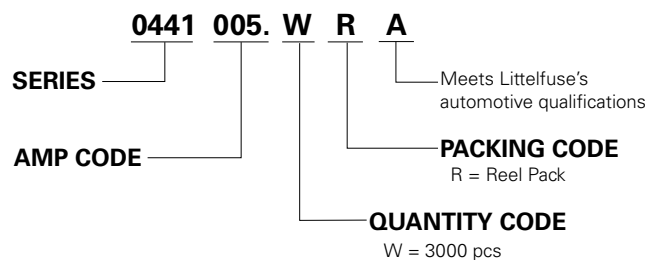
### Dimensions mm (inches)



### Part Marking System

| Amp Code | Marking Code |
|----------|--------------|
| 002.     | N            |
| 02.5     | O            |
| 003.     | P            |
| 03.5     | R            |
| 004.     | S            |
| 005.     | T            |
| 006.     | U            |

### Part Numbering System



### Packaging

| Packaging Option  | Packaging Specification | Quantity | Quantity & Packaging Code |
|-------------------|-------------------------|----------|---------------------------|
| 8mm Tape and Reel | EIA-481, IEC 60286-3    | 3000     | WR                        |

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