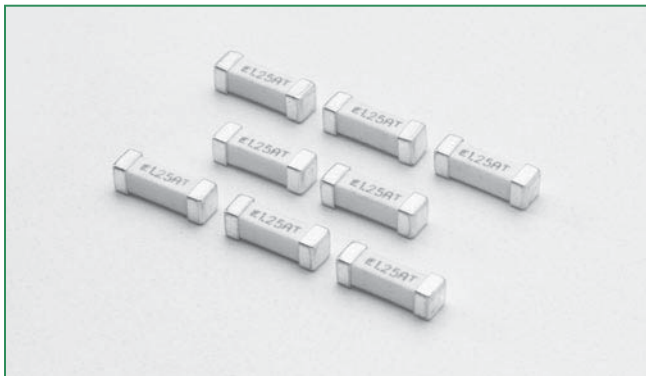


## RoHS HF 461 Series TeleLink® Fuse



### Description

The Littelfuse 461 Series TeleLink® Surface Mount, Surge Resistant Fuse, offers over-current protection for a wide range of telecom applications without requiring a series resistor. When used in conjunction with a Littelfuse SIDACtor® Transient Voltage Suppressor (TVS) or a Greentube™ Gas Plasma Arrestor, this combination provides a compliant solution for standards and recommendations such as GR-1089-Core, TIA-968-A, UL/EN/IEC 60950, and ITU K.20 and K.21. The coordination requirement contained in GR-1089-Core, and ITU K.20/21 may require a series of impedance devices.

### Agency Approvals

| AGENCY                                                                            | AGENCY FILE NUMBER | AMPERE RANGE |
|-----------------------------------------------------------------------------------|--------------------|--------------|
|  | E10480             | 500mA - 2A   |
|  | LR29862            | 500mA - 2A   |

### Electrical Characteristics for Series

| % of Ampere Rating | Opening Time                  |
|--------------------|-------------------------------|
| 100%               | 4 hours, Minimum              |
| 250%               | 1 sec., Min.; 120 secs., Max. |

### Maximum Temperature Rise

| Telecom Nano <sup>2</sup> ® Fuse | Temperature Reading |
|----------------------------------|---------------------|
| 04611.25                         | < 82°C (180°F)      |
| 0461002.                         | < 50°C (122°F)      |

Higher Currents and PCB layout designs can affect this parameter.  
 Readings are measured at rated current after temperature stabilizes.

### Features

- Surface mount surge resistant Slo-Blo® fuse
- Meet UL 60950 3rd Edition power cross requirements standard alone
- Designed to allow compliance with Telcordia GR-1089-CORE and TIA-968-A (formerly FCC Part 68) Surge Specifications
- Provide coordinated protection with Littelfuse SIDACtor® Transient Voltage Suppressor (TVS) or a Greentube™ Gas Plasma Arrestor, without series resistors
- Designed to serve the requirements of a wide range of telecommunication and networking equipment
- 2A rating has improved temperature rise performance under 2.2A surge current testing when compared with 1.25A rating
- Product is Halogen Free and RoHS compliant and compatible with lead-free solder and higher temperature profiles when ordered with Standard Silver Plated Brass Caps
- Standard product is RoHS Compliant and compatible with lead-free solders and higher temperature profiles

### Applications

- T1/E1/J1 and HDSL2/4
- SLIC interface portion of Fiber to the Curb (FTTC) and Fiber to the Premises (FTTP)
- Non-Fiber SLIC interface for Central Office (CO) locations and Remote Terminals (RT)
- xDSL applications such as ADSL, ADSL2+, VDSL, and VDSL2+
- Ethernet 10/100/1000BaseT
- POTS applications such as modems, answering machines, telephones, fax machines, and security systems
- ISDN "U" interface
- Baystation T1/E1/J1, T3 (DS3) trunk cards

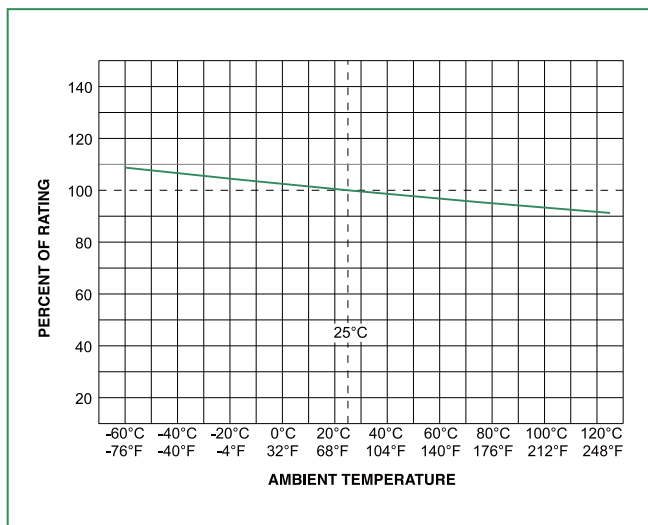
### Electrical Specifications by Item

| Ampere Rating (A) | Amp Code | Max Voltage Rating (V) | Interrupting Rating | Nominal Cold Resistance (Ohms) | Nominal Melting I <sup>2</sup> t (A <sup>2</sup> sec) | Agency Approvals                                                                    |                                                                                     |
|-------------------|----------|------------------------|---------------------|--------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                   |          |                        |                     |                                |                                                       |  |  |
| 0.500             | .500     | 600                    | 60 A @600 VAC       | 0.560                          | 0.840 <sup>1</sup>                                    | x                                                                                   | x                                                                                   |
| 1.25              | 1.25     | 600                    |                     | 0.110                          | 16.5 <sup>1</sup>                                     | x                                                                                   | x                                                                                   |
| 2.00              | 002.     | 600                    |                     | 0.050                          | 17.5 <sup>1</sup>                                     | x                                                                                   | x                                                                                   |

<sup>1</sup> I<sup>2</sup>t is calculated at 10 msec. or less. I<sup>2</sup>t at 10 times rated current has a typical value of: 24 A<sup>2</sup>sec (2.0A), 22 A<sup>2</sup>sec (1.25A), 1.3 A<sup>2</sup>sec (0.5A).

- Typical inductance <40nH up to 500 MHz.
- Resistance changes 0.5% for every °C.
- Resistance is measured at 10% rated current.

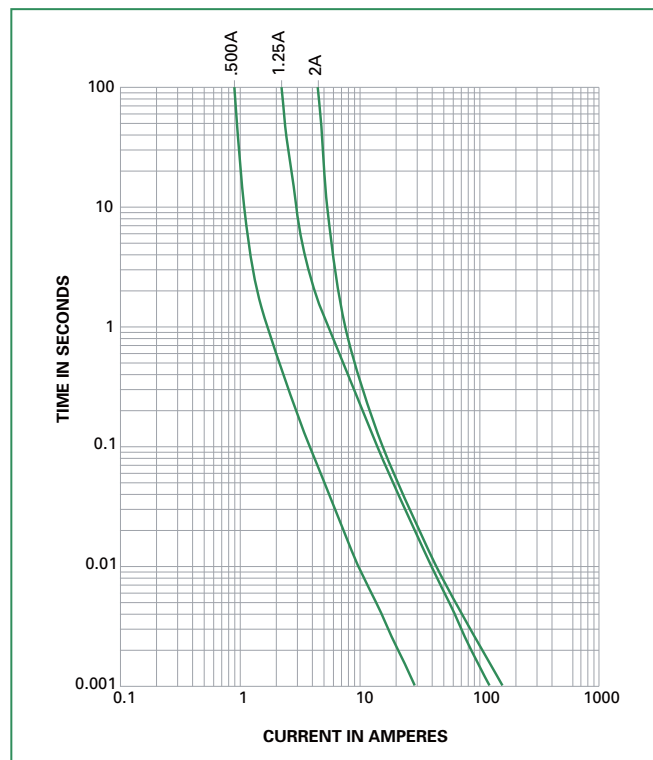
### Temperature Derating Curve



Note:

1. Derating depicted in this curve is in addition to the standard derating of 25% for continuous operation.

### Average Time Current Curves



### GR 1089 Inter-building requirements

#### GR 1089 1st level lighting surge inter-building (Equipment under test can not be damaged and must continue to operate properly)

| Surge | Minimum Peak Voltage (V) | Minimum Peak Current (A) | Max. Rise/Min. Decay (μs) | Repetitions Each Polarity | Fuse Choices   |
|-------|--------------------------|--------------------------|---------------------------|---------------------------|----------------|
| 1     | 600                      | 100                      | 10/1000                   | 25                        | 1.25, 2.0      |
| 2     | 1000                     | 100                      | 10/360                    | 25                        | 1.25, 2.0      |
| 3     | 1000                     | 100                      | 10/1000                   | 25                        | 1.25, 2.0      |
| 4     | 2500                     | 500                      | 2/10                      | 10                        | 1.25, 2.0      |
| 5     | 1000                     | 25                       | 10/360                    | 5                         | 0.5, 1.25, 2.0 |

If sufficient series resistance is used, then the 0.5 fuse may be used in test conditions 1-4.

#### GR 1089 2nd level lightning surge telecom port (Equipment under test shall not become a fire or electrical safety hazard)

| Surge       | Minimum Peak Voltage (V) | Minimum Peak Current (A) | Max. Rise/Min. Decay (μs) | Repetitions Each Polarity | Fuse Choices   |
|-------------|--------------------------|--------------------------|---------------------------|---------------------------|----------------|
| 1           | 5000                     | 500                      | 2/10                      | 1                         | 0.5, 1.25, 2.0 |
| Alternative | 5000                     | 500/8=625                | 8/10                      | 1                         | 0.5, 1.25, 2.0 |

The 0.5 fuse will open during these test conditions. The 1.25 & 2.0 will not open thus providing operational compliance.

## GR 1089 AC power fault 1st level inter-building (fuse not allowed to open)

| Test | Vrms         | Short Circuit Current (A) | Hits | Duration  | Primary Protector | Fuse Choices |
|------|--------------|---------------------------|------|-----------|-------------------|--------------|
| 1    | 50           | 0.33                      | 1    | 15 min.   | removed           | 1.25, 2.0    |
| 2    | 100          | 0.17                      | 1    | 15 min.   | removed           | 1.25, 2.0    |
| 3    | 200,400, 600 | 1                         | 60   | 1 sec.    | removed           | 1.25, 2.0    |
| 4    | 1000         | 1                         | 60   | 1 sec.    | operative         | 1.25, 2.0    |
| 5    | Diagram      | Diagram                   | 60   | 5 secs.   | removed           | 1.25, 2.0    |
| 6    | 600          | 0.5                       | 1    | 30 secs.  | removed           | 1.25, 2.0    |
| 7    | 440          | 2.2                       | 5    | 2 secs.   | removed           | 1.25, 2.0    |
| 8    | 600          | 3                         | 1    | 1.1 secs. | removed           | 1.25, 2.0    |
| 9    | 1000         | 5                         | 1    | 0.4 sec.  | in place          | 1.25, 2.0    |

## GR 1089 AC power fault 2nd level (fuse can open but must open in a safe and controlled manner)

| Test Circuit | Vrms    | Short Circuit Current (A) | Duration | Fuse           |
|--------------|---------|---------------------------|----------|----------------|
| 1            | 120,277 | 25                        | 15 min.  | 0.5, 1.25, 2.0 |
| 2            | 600     | 60                        | 5 secs.  | 0.5, 1.25, 2.0 |
| 3            | 600     | 7                         | 5 secs.  | 0.5, 1.25, 2.0 |
| 4            | 100-600 | 2.2                       | 15 min.. | 0.5, 1.25, 2.0 |
| 5            | Diagram | Diagram                   | 15 min.  | 0.5, 1.25, 2.0 |

Fuse must open before wiring simulator fuse (MDL 2.0).

## TIA -968-A (formerly FCC Part 68) Surge Waveforms (fuse can not open during type B events)

| Surge          | Voltage (V) | Waveform (µs) | Current (A) | Repetitions    | Recommended Fuse |
|----------------|-------------|---------------|-------------|----------------|------------------|
| Metallic A     | 800         | 10 x 560      | 100         | 1 ea. polarity | 1.25             |
| Longitudinal A | 1500        | 10 x 160      | 200         | 1 ea. polarity | 1.25             |
| Metallic B     | 1000        | 9 x 720       | 25          | 1 ea. polarity | 1.25             |
| Longitudinal B | 1500        | 9 x 720       | 37.5        | 1 ea. polarity | 1.25             |

For the type A events the 0.5 fuse will open, providing non-operational compliance. The 1.25 & 2.0 will not open, providing for operational compliance with TIA-968-A type A surge events.

## UL 60950 requirements

### UL60950 (EN 60950) (formerly UL 1950) Power Cross (L = longitudinal, M = metallic)

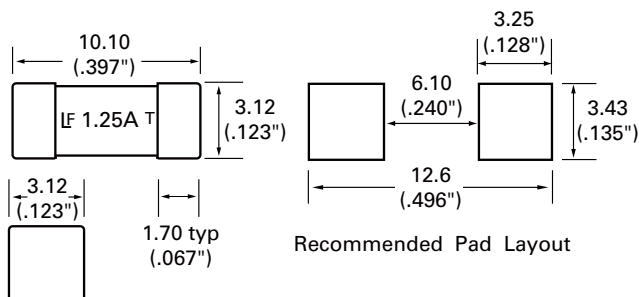
| Test Number | Voltage (V) | Current (A) | Time      | Fuse Choices   |
|-------------|-------------|-------------|-----------|----------------|
| L1          | 600         | 40          | 1.5 secs. | 0.5, 1.25, 2.0 |
| L2          | 600         | 7           | 5 secs.   | 0.5, 1.25, 2.0 |
| L3          | 600         | 2.2         | 30 min.   | 0.5, 1.25, 2.0 |
| L4          | 200         | 2.2         | 30 min.   | 0.5, 1.25, 2.0 |
| L5          | 120         | 25          | 30 min.   | 0.5, 1.25, 2.0 |
| M1          | 600         | 40          | 1.5 secs. | 0.5, 1.25, 2.0 |
| M2          | 600         | 7           | 5 secs.   | 0.5, 1.25, 2.0 |
| M3          | 600         | 2.2         | 30 min.   | 0.5, 1.25, 2.0 |
| M4          | 600         | 2.2         | 30 min.   | 0.5, 1.25, 2.0 |

Selection of test number depends on current limiting F fire enclosure/spacing of end product

- 26 AWG line cord removes L1/M1 test requirement
- L5 conducted only if product does not pass section 6.1.2
- L2,M2,L3,M3,L4,M4 conducted if not in a fire enclosure

Fuse must open before the wiring simulator fuse (MDL 2.0).

## Dimensions

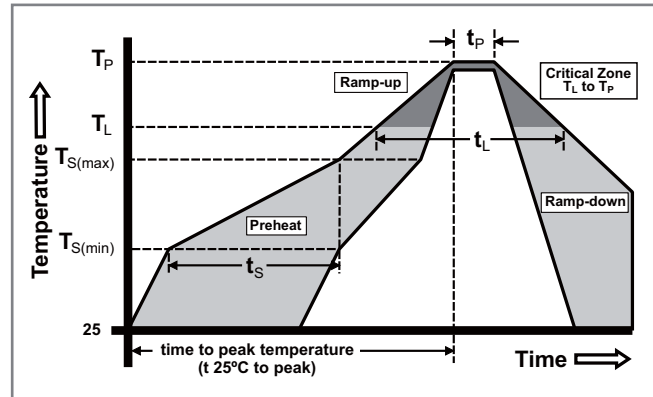


## UL60950 (EN 60950) (formerly UL 1950) Impulse Test and Steady-State Electric Strength Test

| Test                | Voltage (V) | Current (A) | Waveform   | Repetitions            | Fuse Choices   |
|---------------------|-------------|-------------|------------|------------------------|----------------|
| <b>Impulse</b>      |             |             |            |                        |                |
| For handheld units  | 2500        | 62.5        | 10 x 700ms | +/- 10 w/60 secs. rest | 0.5, 1.25, 2.0 |
| Non handheld        | 1500        | 37.5        | 10 x 700ms | +/- 10 w/60 secs. rest | 0.5, 1.25, 2.0 |
| <b>Steady-State</b> |             |             |            |                        |                |
| For handheld units  | 1500        |             | 60Hz       |                        | 0.5, 1.25, 2.0 |
| Non handheld        | 1000        |             | 60Hz       |                        | 0.5, 1.25, 2.0 |

### Soldering Parameters

|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Pb – free assembly      |
| Pre Heat                                               | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                        | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                        | - Time (Min to Max) ( $t_s$ )      | 60 – 120 seconds        |
| Average Ramp-up Rate (Liquidus Temp ( $T_L$ ) to peak) |                                    | 5°C/second max.         |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 5°C/second max.         |
| Reflow                                                 | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                        | - Temperature ( $t_L$ )            | 60 – 90 seconds         |
| Peak Temperature ( $T_p$ )                             |                                    | 250 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds         |
| Ramp-down Rate                                         |                                    | 6°C/second max.         |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes max.          |
| Do not exceed                                          |                                    | 260°C                   |

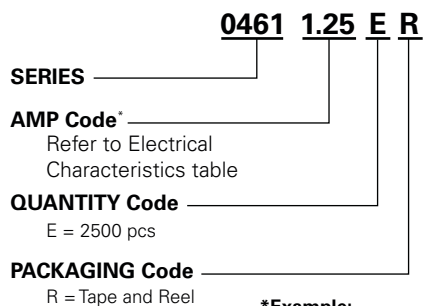


### Product Characteristics

|                                                   |                                                                 |
|---------------------------------------------------|-----------------------------------------------------------------|
| <b>Materials</b>                                  | <b>Body:</b> Ceramic<br><b>Terminations:</b> Silver-plated Caps |
| <b>Product Marking</b>                            | Brand Logo, Ampere Rating                                       |
| <b>Operating Temperature</b>                      | -55°C to 125°C                                                  |
| <b>Moisture Sensitivity Level</b>                 | Level 1, J-STD-020C                                             |
| <b>Solderability</b>                              | IEC-60127-4 (215°C immersion, 3 seconds)                        |
| <b>Resistance to Dissolution of Metallization</b> | IPC / EIA J-STD-002A-Test D 260°C for 120 seconds               |

|                                 |                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------|
| <b>Thermal Shock</b>            | MIL-STD-202, Method 107, Test Condition B, -55°C to +125°C, 30 minutes @ each extreme |
| <b>Mechanical Shock</b>         | MIL-STD-202, Method 213, Test Condition A - Half Sine, 50 G's, 11 msecs. duration     |
| <b>High Frequency Vibration</b> | MIL-STD-202, Method 204, Test Condition D                                             |
| <b>Moisture Resistance</b>      | MIL-STD-202, Method 106, 50 cycles                                                    |
| <b>Terminal Strength</b>        | Board deflection per EIA / IS-722, 1mm deflection for 1 minute                        |
| <b>Terminal Attachment</b>      | MIL-STD-202, Method 211, Test Condition A, 5 lbs applied to end caps                  |

### Part Numbering System



**\*Example:**  
 2 amp product is 0461**002**,ER  
 (1.25 amp product shown above)

### Packaging

| Packaging Option   | Packaging Specification        | Quantity | Quantity & Packaging Code |
|--------------------|--------------------------------|----------|---------------------------|
| 24mm Tape and Reel | EIA RS-481-2 (IEC 286, part 3) | 2500     | ER                        |