

### Description

- The 600R Series is designed to protect against power fault events typically found in telecom applications. This series is designed to be used in applications that need to meet the requirements of GR-1089-CORE and UL60950/EN60950/IEC60950. These resettable devices also help to meet the requirements of ITU K.20, K.21 and K.44.

### Features

- 0.15 – 0.16A hold current range, 60VDC operating voltage
- 600VAC interrupt rating
- Fast time-to-trip
- Binned and sorted narrow resistance ranges available
- RoHS compliant, Lead-Free and Halogen-Free\*

### Applications

- Secondary overcurrent protection for:
- Central Office Equipment (CO)
  - Customer Premises Equipment (CE)
  - Alarm systems
  - Set Top Boxes (STB)
  - Voice over IP (VOIP)
  - Subscriber Line Interface Circuit (SLIC)

### Agency Approvals

AGENCY      AGENCY FILE NUMBER





E183209



R50120008

### Electrical Characteristics

| Part Number | I <sub>hold</sub> (A) | I <sub>trip</sub> (A) | V <sub>max</sub><br>V <sub>int</sub> / V <sub>op</sub> | I <sub>max</sub> (A) | P <sub>d</sub> typ. (W) | Maximum Time To Trip |             | Resistance           |                      |                       | Agency Approvals  |   |
|-------------|-----------------------|-----------------------|--|----------------------|-------------------------|----------------------|-------------|----------------------|----------------------|-----------------------|---|---|
|             |                       |                       |  |                      |                         | Current (A)          | Time (Sec.) | R <sub>min</sub> (Ω) | R <sub>typ</sub> (Ω) | R <sub>1max</sub> (Ω) |  |  |
| 600R150     | 0.15                  | 0.30                  | 600/60   | 3                    | 1.00                    | 1                    | 4.0         | 6                    | 10                   | 17                    | X   | X   |
| 600R150-RA  | 0.15                  | 0.30                  | 600/60   | 3                    | 1.00                    | 1                    | 4.0         | 7                    | 10                   | 20                    | X   | X   |
| 600R150-RB  | 0.15                  | 0.30                  | 600/60   | 3                    | 1.00                    | 1                    | 3.0         | 9                    | 12                   | 22                    | X   | X   |
| 600R160     | 0.16                  | 0.32                  | 600/60   | 3                    | 1.00                    | 1                    | 10          | 4                    | 10                   | 18                    | X   | X   |
| 600R160-RA  | 0.16                  | 0.32                  | 600/60   | 3                    | 1.00                    | 1                    | 9.5         | 4                    | 7                    | 16                    | X   | X   |
| 600R160-R1  | 0.16                  | 0.32                  | 600/60   | 3                    | 1.00                    | 1                    | 9.0         | 4                    | 8                    | 17                    | X   | X   |

I<sub>hold</sub> = Hold current: maximum current device will pass without tripping in 23°C still air.  
 I<sub>trip</sub> = Trip current: minimum current at which the device will trip in 23°C still air.  
 V<sub>int</sub> = Maximum voltage the device can withstand without damage at rated current (I<sub>max</sub>)  
 V<sub>op</sub> = The device regular operation voltage  
 I<sub>max</sub> = Maximum fault current device can withstand without damage at rated voltage (V<sub>max</sub>)  
 P<sub>d</sub> = Power dissipated from device when in the tripped state at 23°C still air.

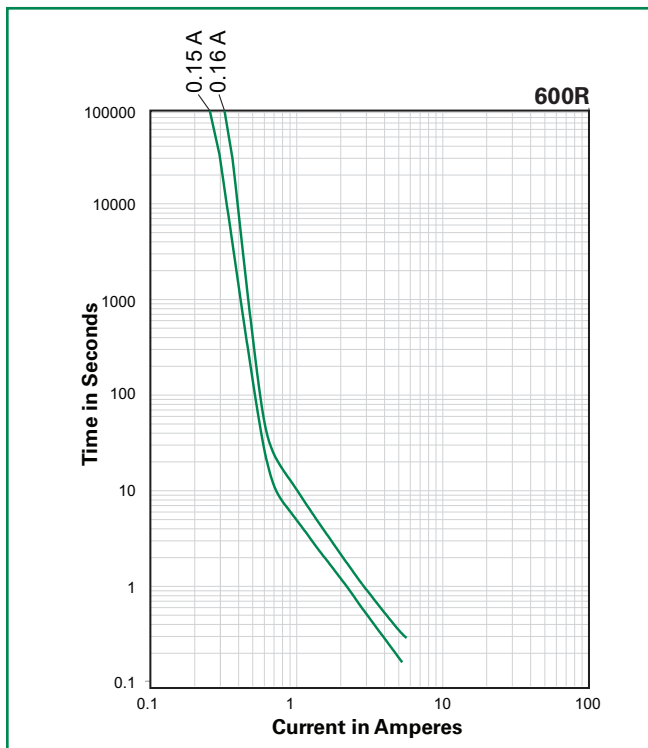
R<sub>min</sub> = Minimum resistance of device in initial (un-soldered) state.  
 R<sub>typ</sub> = Typical resistance of device in initial (un-soldered) state.  
 R<sub>1max</sub> = Maximum resistance of device at 20°C measured one hour after tripping.  
**Caution:** Operation beyond the specified rating may result in damage and possible arcing and flame.

\* Effective February 11, 2010 onward, all 600R PTC products will be manufactured Halogen Free (HF). Existing Non-Halogen Free 600R PTC products may continue to be sold, until supplies are depleted. This change will have no effect on 600R product specifications or performance.

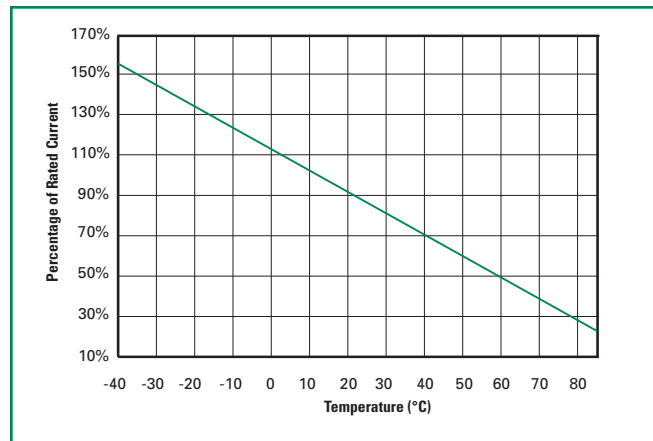
**Temperature Derating**

| Part Number | Ambient Operation Temperature |       |      |      |       |       |      |
|-------------|-------------------------------|-------|------|------|-------|-------|------|
|             | -40°C                         | -20°C | 0°C  | 23°C | 40°C  | 60°C  | 85°C |
| 600R150     | 0.26                          | 0.23  | 0.19 | 0.15 | 0.124 | 0.062 | 0.03 |
| 600R160     | 0.27                          | 0.24  | 0.20 | 0.16 | 0.13  | 0.07  | 0.05 |

**Average Time Current Curves**



**Temperature Derating Curve**



The average time current curves and Temperature Derating curve performance is affected by a number of variables, and these curves provided as guidance only. Customer must verify the performance in their application.

**Agency Specification Selection Guide For Telecom and Networking Applications**

| Part Number        | Lightning  | Power Cross  |
|--------------------|--|--|
| 600R150<br>600R160 | TIA-968-A – 1.5kV 10/160µs<br>800V 10/560µs<br><br>Telcordia GR 1089 – 1.0kV 10/1000µs<br>2.5kV 2/10µs | UL60950, 3rd Ed – 600Vac, 40A<br><br>Telcordia GR – 1089 – 600Vac, 60A |

Devices should be independently evaluated and tested for use in any specific application

**Protection Application Guide**

| Region/Specification                           | Application  | Device Selection   |
|--|--|--------------------|
| North America<br>Telcordia GR-1089             | *Access network equipment<br>Remote terminal<br>Repeaters<br>WAN equipment<br>Cross -connect                                       | 600R150<br>600R160 |
| North America<br>TIA-968-A, UL60950            | Customer and IT equipment<br>Analog modems<br>ADSL, XDSL modems<br>Phone sets, PBX systems<br>Internet appliances<br>POS terminals | 600R150<br>600R160 |
| North America<br>Telcordia GR-1089             | Central Office<br>POTS/ISDN linecards<br>T1/E1/J1 linecards<br>ADSL/VDSL splitters<br>CSU/DSU                                      | 600R150<br>600R160 |
| North America<br>Telcordia GR-1089             | *Intrabuilding communication systems<br>LAN, VOIP cards<br>Local loop handsets   | 600R150<br>600R160 |
| South America/Asia/Europe<br>ITU K.20 and K.21 |  |                    |

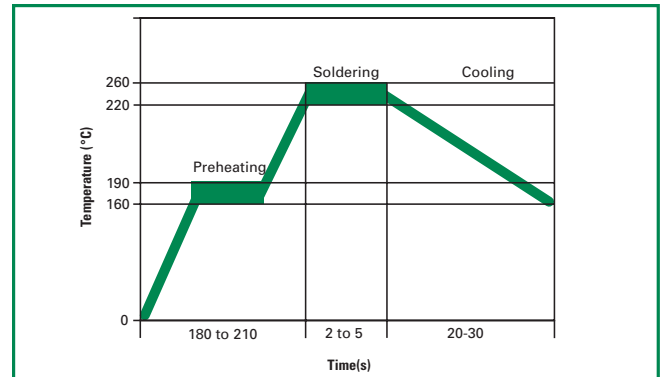
\*Resistance binned parts are recommended

**Soldering Parameters - Wave Soldering**

| Condition               | Wave Soldering    |
|-------------------------|-------------------|
| Peak Temp/ DurationTime | 260°C ≤ 5 Sec     |
| ≥ 220°C                 | 2 Sec ~ 20 Sec    |
| Preheat 140°C~ 180°C    | 180 Sec ~ 210 Sec |
| Storage Condition       | 0°C~35°C, ≤ 70%RH |

- Recommended soldering methods: heat element oven or N<sub>2</sub> environment for lead-free
- Devices are designed to be wave soldered to the bottom side of the board.
- Devices can be cleaned using standard industry methods and solvents.
- This profile can be used for lead-free device

**Note:** If soldering temperatures exceed the recommended profile, devices may not meet the performance requirements.

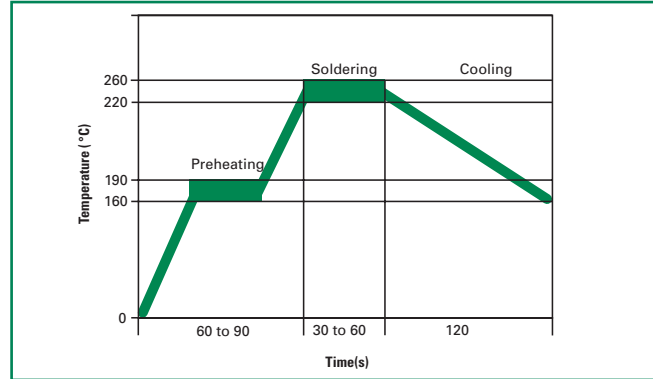


**Soldering Parameters - Solder Reflow**

|                         |                   |
|-------------------------|-------------------|
| Condition               | Reflow            |
| Peak Temp/ DurationTime | 260°C ≥ 5 Sec     |
| ≥ 220°C                 | 30 Sec ~ 60 Sec   |
| Preheat 160°C~ 190°C    | 60 Sec ~ 90 Sec   |
| Storage Condition       | 0°C~35°C, ≤ 70%RH |

- Recommended reflow methods: IR, vapor phase oven, hot air oven, N<sub>2</sub> environment for lead-free.
- Devices are not designed to be wave soldered to the bottom side of the board.
- Devices can be cleaned using standard industry methods and solvents.

**Note:** If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.



**Physical Specifications**

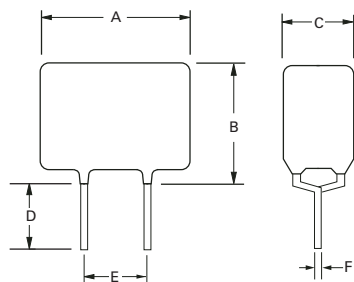
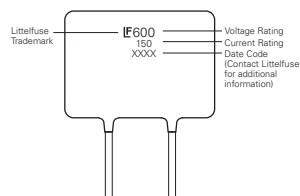
|                                  |  |
|----------------------------------|--|
| <b>Lead Material</b>             | Tin-plated Copper  |
| <b>Soldering Characteristics</b> | Solderability per MIL-STD-202, Method 208E                       |
| <b>Insulating Material</b>       | Cured, flame retardant epoxy polymer meets UL94V-0 requirements. |
| <b>Device Labeling</b>           | Marked with 'LF', voltage, current rating, and date code.        |

**Environmental Specifications**

|  |  |
|--|--|
| <b>Operating/Storage Temperature</b>                       | -40°C to +85°C                                     |
| <b>Maximum Device Surface Temperature in Tripped State</b> | 125°C  |
| <b>Passive Aging</b>                                       | 85°C/85°C, 1000 hours                              |
| <b>Humidity Aging</b>                                      | +85°C, 85% R.H., 1000 hours                        |
| <b>Thermal Shock</b>                                       | MIL-STD-202F, Method 107G +125°C to -55°C 10 times |
| <b>Solvent Resistance</b>                                  | MIL-STD-202, Method 215F                           |

**Part Ordering Number System**



**Dimensions**

**Part Marking System**


| Part Number                                  | A      |      | B      |      | C      |      | D      |      | E      |      | Physical Characteristics |      | Material |
|--|--------|------|--------|------|--------|------|--------|------|--------|------|--------------------------|------|----------|
|  | Inches | mm   | Inches | mm   | Inches | mm   | Inches | mm   | Inches | mm   | Lead (dia)               |      |          |
|  | Max.   | Max. | Max.   | Max. | Max.   | Max. | Min.   | Min. | Typ.   | Typ. | Inches                   | mm   |          |
| Device dimensions through February 10, 2010* |        |      |        |      |        |      |        |      |        |      |                          |      |          |
| 600R150                                      | 0.53   | 13.5 | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R150-RA                                   | 0.53   | 13.5 | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R150-RB                                   | 0.53   | 13.5 | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R160                                      | 0.63   | 16   | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R160-RA                                   | 0.63   | 16   | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R160-R1                                   | 0.63   | 16   | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| Device dimensions after February 11, 2010*   |        |      |        |      |        |      |        |      |        |      |                          |      |          |
| 600R150                                      | 0.35   | 9    | 0.49   | 12.5 | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R150-RA                                   | 0.35   | 9    | 0.49   | 12.5 | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R150-RB                                   | 0.35   | 9    | 0.49   | 12.5 | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R160                                      | 0.63   | 16   | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R160-RA                                   | 0.63   | 16   | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 600R160-R1                                   | 0.63   | 16   | 0.50   | 12.6 | 0.24   | 6    | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |

\* Littelfuse will be changing the form dimensions of 600R series devices. Effective February 11, 2010, all 600R series devices will be manufactured using the smaller dimensions listed. This change affects dimensions only, and will have no effect on electrical specification, quality or performance.

**Packaging**

| Part Number | Ordering Number | $I_{hold}$ (A) | $I_{hold}$ Code | Packaging Option | Quantity | Quantity & Packaging Codes |
|-------------|-----------------|----------------|-----------------|------------------|----------|----------------------------|
| 600R150     | 600R150F        | 0.15           | 150             | Bulk             | 200      | F                          |
|             | 600R150ZR       |                |                 | Tape and Ammo    | 600      | ZR                         |
| 600R150-RA  | 600R150-RAF     | 0.15           | 150             | Bulk             | 200      | F                          |
|             | 600R150-RAZR    |                |                 | Tape and Ammo    | 600      | ZR                         |
| 600R150-RB  | 600R150-RBF     | 0.15           | 150             | Bulk             | 200      | F                          |
|             | 600R150-RBZR    |                |                 | Tape and Ammo    | 600      | ZR                         |
| 600R160     | 600R160F        | 0.16           | 160             | Bulk             | 200      | F                          |
|             | 600R160UR       |                |                 | Tape and Ammo    | 500      | UR                         |
| 600R160-RA  | 600R160-RAF     | 0.16           | 160             | Bulk             | 200      | F                          |
|             | 600R160-RAUR    |                |                 | Tape and Ammo    | 500      | UR                         |
| 600R160-R1  | 600R160-R1F     | 0.16           | 160             | Bulk             | 200      | F                          |
|             | 600R160-R1UR    |                |                 | Tape and Ammo    | 500      | UR                         |

**Tape and Ammo Specifications**

Devices taped using EIA468-B/IE286-2 standards. See table below and Figure 1 for details.

| Dimension                              | EIA Mark             | IEC Mark             | Dimensions      |              |
|--|----------------------|----------------------|-----------------|--------------|
|  |                      |                      | Dim. (mm)       | Tol. (mm)    |
| Carrier tape width                     | <b>W</b>             | <b>W</b>             | 18              | -0.5 / +1.0  |
| Hold down tape width:                  | <b>W<sub>4</sub></b> | <b>W<sub>0</sub></b> | 11              | min.         |
| Top distance between tape edges        | <b>W<sub>6</sub></b> | <b>W<sub>2</sub></b> | 3               | max.         |
| Sprocket hole position                 | <b>W<sub>5</sub></b> | <b>W<sub>1</sub></b> | 9               | -0.5 / +0.75 |
| Sprocket hole diameter*                | <b>D<sub>0</sub></b> | <b>D<sub>0</sub></b> | 4               | -0.32 / +0.2 |
| Abscissa to plane(straight lead)       | <b>H</b>             | <b>H</b>             | 18.5            | -/+ 3.0      |
| Abscissa to plane(kinked lead)         | <b>H<sub>0</sub></b> | <b>H<sub>0</sub></b> | 16              | -/+ 0.5      |
| Abscissa to top                        | <b>H<sub>1</sub></b> | <b>H<sub>1</sub></b> | 32.2            | max.         |
| Overall width w/o lead protrusion      | <b>C<sub>1</sub></b> |                      | 42.5            | max.         |
| Overall width w/ lead protrusion       | <b>C<sub>2</sub></b> |                      | 43.2            | max.         |
| Lead protrusion                        | <b>L<sub>1</sub></b> | <b>I<sub>1</sub></b> | 1.0             | max.         |
| Protrusion of cut out                  | <b>L</b>             | <b>L</b>             | 11              | max.         |
| Protrusion beyond hold-down tape       | <b>I<sub>2</sub></b> | <b>I<sub>2</sub></b> | Not specified   |              |
| Sprocket hole pitch: 600R150 & 600R160 | <b>P<sub>0</sub></b> | <b>P<sub>0</sub></b> | 25.4            | -/+ 0.5      |
| Device pitch: 600R150 & 600R160        |                      |                      | 25.4            |              |
| Pitch tolerance                        |                      |                      | 20 consecutive. | -/+ 1        |
| Tape thickness                         | <b>t</b>             | <b>t</b>             | 0.9             | max.         |
| Tape thickness with splice             | <b>t<sub>1</sub></b> |                      | 2.0             | max.         |
| Splice sprocket hole alignment         |                      |                      | 0               | -/+ 0.3      |
| Body lateral deviation                 | <b>Δh</b>            | <b>Δh</b>            | 0               | -/+ 1.0      |
| Body tape plane deviation              | <b>Δp</b>            | <b>Δp</b>            | 0               | -/+ 1.3      |
| Ordinate to adjacent component lead*   | <b>P<sub>1</sub></b> | <b>P<sub>1</sub></b> | 3.81            | -/+ 0.7      |
| Lead spacing                           | <b>F</b>             | <b>F</b>             | 5.08            | -/+ 0.8      |

\*Differs from EIA Specification

**Tape and Ammo Diagram**



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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
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- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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