

# 2016L Series

## Surface Mount



### Additional Information



Resources



Accessories



Samples

### Description

The 2016L Series PTC provides surface mount overcurrent protection for low voltage ( $\leq 60V$ ) applications where resettable protection is desired.

### Features

- RoHS compliant, lead-free and halogen-free
- High voltage
- Fast response to fault currents
- Low-profile

### Applications

- IEEE 1394 port protection
- Low voltage telecom equipment protection
- Powered ethernet port protection (IEEE 802.3 af)
- Automotive electronic control module protection

### Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
|        | E183209            |
|        | R50119118          |

### Electrical Characteristics

| Part Number | Marking  | $I_{hold}$ (A) | $I_{trip}$ (A) | $V_{max}$ (Vdc) | $I_{max}$ (A) | $P_d$ typ. (W) | Maximum Time To Trip |             | Resistance             |                         | Agency Approvals |   |
|-------------|----------|----------------|----------------|-----------------|---------------|----------------|----------------------|-------------|------------------------|-------------------------|------------------|---|
|             |          |                |                |                 |               |                | Current (A)          | Time (Sec.) | $R_{min}$ ( $\Omega$ ) | $R_{1max}$ ( $\Omega$ ) |                  |   |
| 2016L030    | LF030    | 0.30           | 0.60           | 60              | 20            | 1.40           | 1.5                  | 3.0         | 0.500                  | 2.300                   | X                | X |
| 2016L050    | LF050    | 0.55           | 1.10           | 60              | 20            | 1.40           | 2.5                  | 5.0         | 0.200                  | 1.000                   | X                | X |
| 2016L075/60 | LF075    | 0.75           | 1.50           | 60              | 20            | 1.40           | 8.0                  | 0.5         | 0.130                  | 0.900                   | X                | X |
| 2016L100    | LF100    | 1.10           | 2.20           | 15              | 40            | 1.40           | 8.0                  | 0.5         | 0.100                  | 0.400                   | X                | X |
| 2016L100/33 | LF100-33 | 1.10           | 2.20           | 33              | 40            | 1.40           | 8.0                  | 0.5         | 0.100                  | 0.400                   | X                | X |
| 2016L150    | LF150    | 1.50           | 3.00           | 15              | 40            | 1.40           | 8.0                  | 1.0         | 0.070                  | 0.180                   | X                | X |
| 2016L150/33 | LF150-33 | 1.50           | 3.00           | 33              | 40            | 2.0            | 8.00                 | 1.00        | 0.070                  | 0.180                   | X                | X |
| 2016L200    | LF200    | 2.00           | 4.20           | 6               | 40            | 1.40           | 8.0                  | 3.0         | 0.048                  | 0.100                   | X                | X |
| 2016L260/24 | LF260-24 | 2.60           | 5.00           | 24              | 40            | 1.6            | 8.00                 | 5.00        | 0.025                  | 0.075                   | X                | X |
| 2016L300/16 | LF300    | 3.00           | 5.00           | 16              | 40            | 1.6            | 8.00                 | 10.00       | 0.015                  | 0.048                   | X                | X |
| 2016L500    | LF500    | 5.00           | 10.00          | 6               | 100           | 2.0            | 25.00                | 2.00        | 0.005                  | 0.025                   | X                | X |

$I_{hold}$  = Hold current: maximum current device will pass without tripping in 20°C still air.

$I_{trip}$  = Trip current: minimum current at which the device will trip in 20°C still air.

$V_{max}$  = Maximum voltage device can withstand without damage at rated current ( $I_{max}$ )

$I_{max}$  = Maximum fault current device can withstand without damage at rated voltage ( $V_{max}$ )

$P_d$  = Power dissipated from device when in the tripped state at 20°C still air.

$R_{min}$  = Minimum resistance of device in initial (un-soldered) state.

$R_{typ}$  = Typical resistance of device in initial (un-soldered) state.

$R_{1max}$  = Maximum resistance of device at 20°C measured one hour after tripping or reflow soldering of 260°C for 20 sec.

**Caution:** Operation beyond the specified rating may result in damage and possible arcing and flame.

\* Agency Approval is Pending

#### Warning

- Users shall independently assess the suitability of these devices for each of their applications
- Operation of these devices beyond the stated maximum ratings could result in damage to the devices and lead to electrical arcing and/or fire
- These devices are intended to protect against the effects of temporary over-current or over-temperature conditions and are not intended to perform as protective devices where such conditions are expected to be repetitive or prolonged in duration

- Exposure to silicon-based oils, solvents, electrolytes, acids, and similar materials can adversely affect the performance of these PPTC devices
- These devices undergo thermal expansion under fault conditions, and thus shall be provided with adequate space and be protected against mechanical stresses
- Circuits with inductance may generate a voltage ( $L di/dt$ ) above the rated voltage of the PPTC device.

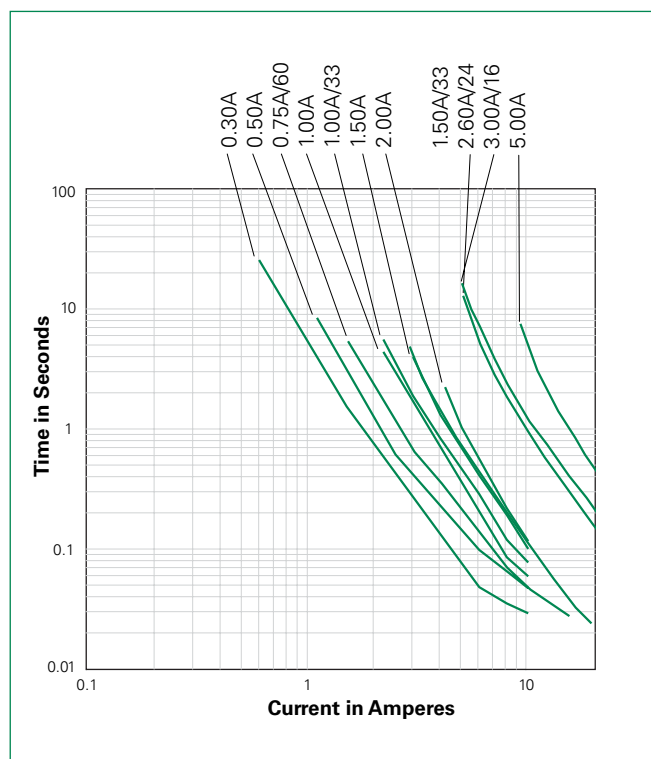
# 2016L Series

## Surface Mount

### Temperature Derating

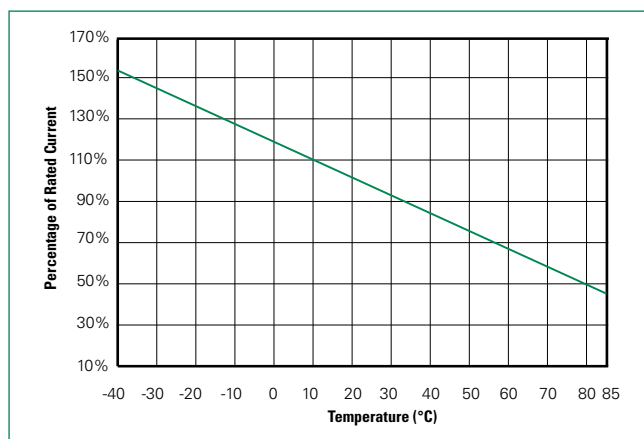
| Part Number | Ambient Operation Temperature |       |      |      |      |      |      |      |      |
|-------------|-------------------------------|-------|------|------|------|------|------|------|------|
|             | -40°C                         | -20°C | 0°C  | 20°C | 40°C | 50°C | 60°C | 70°C | 85°C |
|             | Hold Current (A)              |       |      |      |      |      |      |      |      |
| 2016L030    | 0.45                          | 0.40  | 0.35 | 0.30 | 0.25 | 0.23 | 0.20 | 0.18 | 0.14 |
| 2016L050    | 0.93                          | 0.95  | 0.65 | 0.55 | 0.42 | 0.38 | 0.33 | 0.30 | 0.23 |
| 2016L075/60 | 1.05                          | 1.06  | 0.85 | 0.75 | 0.60 | 0.55 | 0.45 | 0.40 | 0.30 |
| 2016L100    | 1.66                          | 1.47  | 1.29 | 1.10 | 0.91 | 0.83 | 0.73 | 0.64 | 0.50 |
| 2016L100/33 | 1.66                          | 1.47  | 1.29 | 1.10 | 0.91 | 0.83 | 0.73 | 0.64 | 0.50 |
| 2016L150    | 2.26                          | 2.00  | 1.76 | 1.50 | 1.24 | 1.13 | 1.00 | 0.87 | 0.68 |
| 2016L150/33 | 2.26                          | 2.00  | 1.76 | 1.50 | 1.24 | 1.13 | 1.00 | 0.87 | 0.68 |
| 2016L200    | 2.80                          | 2.50  | 2.19 | 2.00 | 1.84 | 1.74 | 1.50 | 1.34 | 1.14 |
| 2016L260/24 | 3.82                          | 3.46  | 3.06 | 2.60 | 2.24 | 2.03 | 1.82 | 1.60 | 1.26 |
| 2016L300/16 | 4.40                          | 3.96  | 3.52 | 3.00 | 2.65 | 2.43 | 2.20 | 1.96 | 1.59 |
| 2016L500    | 7.29                          | 6.57  | 5.86 | 5.00 | 4.38 | 4.02 | 3.66 | 3.26 | 2.66 |

### Average Time Current Curves



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.

### Temperature Derating Curve



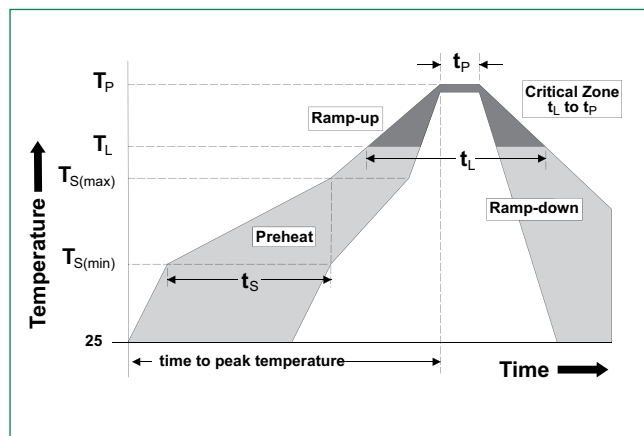
**Note:** Typical Temperature derating curve, refer to table for derating data

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## Surface Mount

### Soldering Parameters

|                                                                           |                                                  |                         |
|---------------------------------------------------------------------------|--------------------------------------------------|-------------------------|
| <b>Profile Feature</b>                                                    |                                                  | Pb-Free Assembly        |
| <b>Average Ramp-Up Rate (<math>T_{S(max)}</math> to <math>T_p</math>)</b> |                                                  | 3°C/second max          |
| <b>Pre Heat:</b>                                                          | <b>Temperature Min (<math>T_{S(min)}</math>)</b> | 150°C                   |
|                                                                           | <b>Temperature Max (<math>T_{S(max)}</math>)</b> | 200°C                   |
|                                                                           | <b>Time (Min to Max) (<math>t_s</math>)</b>      | 60 – 180 secs           |
| <b>Time Maintained Above:</b>                                             | <b>Temperature (<math>T_L</math>)</b>            | 217°C                   |
|                                                                           | <b>Temperature (<math>T_L</math>)</b>            | 60 – 150 seconds        |
| <b>Peak / Classification 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>      |                                                  | 20 – 40 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.          |



- All temperature refer to topside of the package, measured on the package body surface
- If reflow temperature exceeds the recommended profile, devices may not meet the performance requirements
- Recommended reflow methods: IR, vapor phase oven, hot air oven,  $N_2$  environment for lead
- Recommended maximum paste thickness is 0.25mm (0.010inch)
- Devices can be cleaned using standard industry methods and solvents
- Devices can be reworked using the standard industry practices

### Physical Specifications

|                           |                                                              |
|---------------------------|--------------------------------------------------------------|
| <b>Terminal Material</b>  | Solder-Plated Copper (Solder Material: Matte Tin(Sn))        |
| <b>Lead Solderability</b> | Meets EIA Specification RS186-9E, ANSI/J-STD-002 Category 3. |

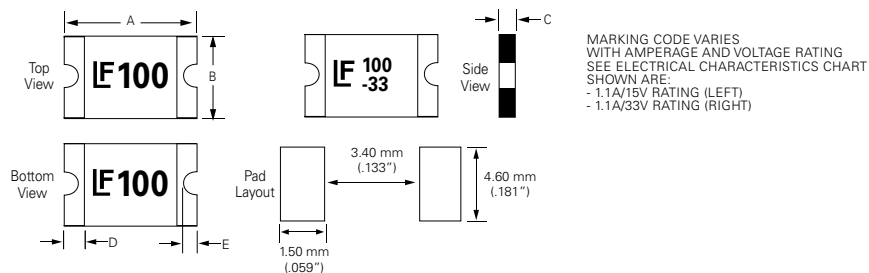
### Environmental Specifications

|                                                            |                                                                                   |
|------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <b>Operating Temperature</b>                               | -40°C to +85°C                                                                    |
| <b>Maximum Device Surface Temperature in Tripped State</b> | 125°C                                                                             |
| <b>Passive Aging</b>                                       | +85°C, 1000 hours<br>-/+5% typical resistance change                              |
| <b>Humidity Aging</b>                                      | +85°C, 85%, R.H., 1000 hours<br>-/+5% typical resistance change                   |
| <b>Thermal Shock</b>                                       | MIL-STD-202, Method 107<br>+85°C/-40°C 20 times<br>-30% typical resistance change |
| <b>Solvent Resistance</b>                                  | MIL-STD-202, Method 215<br>No change                                              |
| <b>Vibration</b>                                           | MIL-STD-883, Method 2007, Condition A<br>No change                                |
| <b>Moisture Sensitivity Level</b>                          | Level 1, J-STD-020                                                                |

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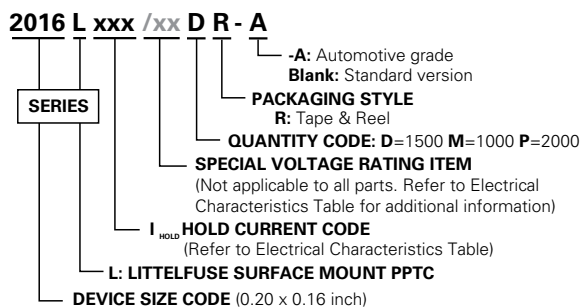
## Surface Mount

### Dimensions (mm)



| Part Number | A      |      |      |      | B      |      |     |      | C      |      |      |      | D      |      |     |     | E      |      |      |      |
|-------------|--------|------|------|------|--------|------|-----|------|--------|------|------|------|--------|------|-----|-----|--------|------|------|------|
|             | Inches |      | mm   |      | Inches |      | mm  |      | Inches |      | mm   |      | Inches |      | mm  |     | Inches |      | mm   |      |
|             | Min    | Max  | Min  | Max  | Min    | Max  | Min | Max  | Min    | Max  | Min  | Max  | Min    | Max  | Min | Max | Min    | Max  | Min  | Max  |
| 2016L030    |        |      |      |      |        |      |     |      | 0.03   | 0.05 | 0.75 | 1.25 |        |      |     |     |        |      |      |      |
| 2016L050    |        |      |      |      |        |      |     |      | 0.05   | 0.08 | 1.20 | 2.00 |        |      |     |     |        |      |      |      |
| 2016L075/60 |        |      |      |      |        |      |     | 4.43 | 0.05   | 0.08 | 1.20 | 2.00 |        |      |     |     |        |      |      |      |
| 2016L100    |        |      |      |      |        |      |     |      | 0.02   | 0.03 | 0.50 | 0.75 |        |      |     |     |        |      |      |      |
| 2016L100/33 |        |      |      |      |        |      |     |      | 0.03   | 0.05 | 0.75 | 1.25 |        |      |     |     |        |      |      |      |
| 2016L150    | 0.19   | 0.21 | 4.72 | 5.44 | 0.15   | 0.17 | 3.7 |      | 0.03   | 0.06 | 0.75 | 1.55 | 0.01   | 0.06 | 0.3 | 1.5 | 0.01   | 0.03 | 0.25 | 0.65 |
| 2016L150/33 |        |      |      |      |        |      |     | 4.43 | 0.03   | 0.06 | 0.80 | 1.60 |        |      |     |     |        |      |      |      |
| 2016L200    |        |      |      |      |        |      |     | 4.43 | 0.02   | 0.03 | 0.50 | 0.75 |        |      |     |     |        |      |      |      |
| 2016L260/24 |        |      |      |      |        |      |     |      |        |      |      |      |        |      |     |     |        |      |      |      |
| 2016L300/16 |        |      |      |      |        |      |     | 4.43 | 0.03   | 0.06 | 0.80 | 1.60 |        |      |     |     |        |      |      |      |
| 2016L500    |        |      |      |      |        |      |     |      |        |      |      |      |        |      |     |     |        |      |      |      |

### Part Ordering Number System



### Packaging

| Part Number | Ordering Number | Halogen Free | I <sub>hold</sub> (A) | I <sub>hold</sub> Code | Voltage Option | Packaging Option | Quantity | Quantity & Packaging Codes |
|-------------|-----------------|--------------|-----------------------|------------------------|----------------|------------------|----------|----------------------------|
| 2016L030    | 2016L030DR      | Yes          | 0.30                  | 030                    |                | Tape and Reel    | 1500     | DR                         |
| 2016L050    | 2016L050MR      | Yes          | 0.55                  | 050                    |                | Tape and Reel    | 1000     | MR                         |
| 2016L075/60 | 2016L075/60MR   | Yes          | 0.75                  | 075                    | /60            | Tape and Reel    | 1000     | MR                         |
| 2016L100    | 2016L100PR      | Yes          | 1.10                  | 110                    |                | Tape and Reel    | 2000     | PR                         |
| 2016L100/33 | 2016L100/33DR   | Yes          | 1.10                  | 110                    | /33            | Tape and Reel    | 1500     | DR                         |
| 2016L150    | 2016L150DR      | Yes          | 1.50                  | 150                    |                | Tape and Reel    | 1500     | DR                         |
| 2016L150/33 | 2016L150/33DR   | Yes          | 1.50                  | 150                    | /33            | Tape and Reel    | 1,500    | DR                         |
| 2016L200    | 2016L200PR      | Yes          | 2.00                  | 200                    |                | Tape and Reel    | 2000     | PR                         |
| 2016L260/24 | 2016L260/24MR   | Yes          | 2.60                  | 260                    | /24            | Tape and Reel    | 1,000    | MR                         |
| 2016L300/16 | 2016L300/16MR   | Yes          | 3.00                  | 300                    | /16            | Tape and Reel    | 1,000    | MR                         |
| 2016L500    | 2016L500DR      | Yes          | 5.00                  | 500                    | /6             | Tape and Reel    | 1,500    | DR                         |

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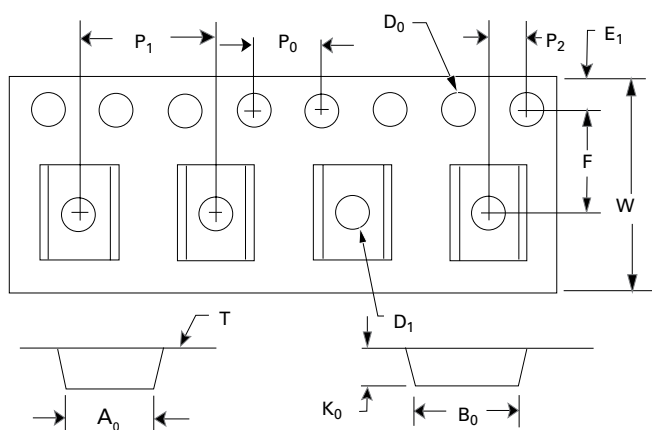
### Tape and Reel Specifications

| TAPE SPECIFICATIONS: EIA-481-1 (mm) |                      |                                                                |                                                       |
|-------------------------------------|----------------------|----------------------------------------------------------------|-------------------------------------------------------|
|                                     | 2016L100<br>2016L200 | 2016L030<br>2016L100/33<br>2016L150<br>2016L150/33<br>2016L500 | 2016L050<br>2016L075/60<br>2016L260/24<br>2016L300/16 |
| W                                   | 12.0+/-0.30          | 12.0+/-0.30                                                    | 12.0+/-0.30                                           |
| F                                   | 5.50+/-0.05          | 5.50+/-0.05                                                    | 5.50+/-0.05                                           |
| E <sub>1</sub>                      | 1.75+/-0.10          | 1.75+/-0.10                                                    | 1.75+/-0.10                                           |
| D <sub>0</sub>                      | 1.55+/-0.05          | 1.55+/-0.05                                                    | 1.55+/-0.05                                           |
| D <sub>1</sub>                      | 1.50 (MIN)           | 1.50+/-0.10                                                    | 1.50+/-0.10                                           |
| P <sub>0</sub>                      | 4.0+/-0.10           | 4.0+/-0.10                                                     | 4.0+/-0.10                                            |
| P <sub>1</sub>                      | 8.0+/-0.10           | 8.0+/-0.10                                                     | 8.0+/-0.10                                            |
| P <sub>2</sub>                      | 2.0+/-0.05           | 2.0+/-0.05                                                     | 2.0+/-0.05                                            |
| A <sub>0</sub>                      | 4.40+/-0.10          | 4.48+/-0.10                                                    | 4.45+/-0.10                                           |
| B <sub>0</sub>                      | 5.50+/-0.10          | 5.40+/-0.10                                                    | 5.48+/-0.10                                           |
| T                                   | 0.25+/-0.10          | 0.25+/-0.10                                                    | 0.25+/-0.10                                           |
| K <sub>0</sub>                      | 0.75+/-0.10          | 1.36+/-0.10                                                    | 1.86+/-0.10                                           |
| Leader Min.                         | 390                  | 390                                                            | 390                                                   |
| Trailer Min.                        | 160                  | 160                                                            | 160                                                   |

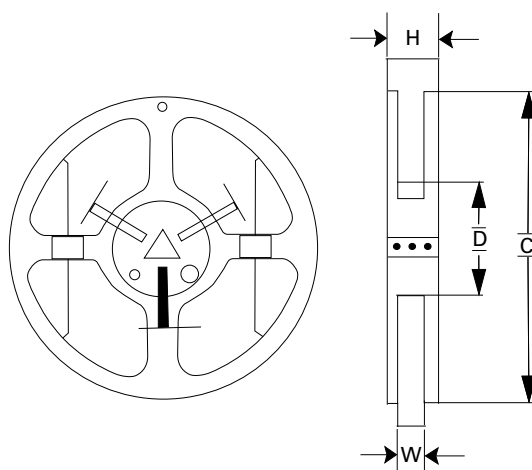
| REEL DIMENSIONS:<br>EIA-481-1 (mm) |              |
|------------------------------------|--------------|
| C                                  | Ø178.0+/-1.0 |
| D                                  | Ø60.2+/-0.5  |
| H                                  | 16.0+/-0.5   |
| W                                  | 13.2+/-1.5   |

### Tape and Reel Diagram

Tape Specifications



Reel Specifications



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[2016L260/24MR](#) [2016L300/16MR](#) [2016L150/33DR](#) [2016L500DR](#)