Solar-Rated Products by Application

**Solar Applications**

1. **Micro Inverter**
   - 600 V to 1000 V Fuses
   - TVS Diodes/SCRs
   - Varistor Products

2. **Small Inverter**
   - 600 V to 1500 V Fuses
   - TVS Diodes/SCRs
   - Varistor Products

3. **Central Inverter**
   - 600 V to 1500 V Fuses
   - DC Earth Leakage/Sound-Fault Relays
   - Varistor Products
   - Surge Protection Devices

4. **String Inverter**
   - 600 V to 1000 V Fuses
   - TVS Diodes/SCRs
   - Varistor Products

5. **Wiring Harness**
   - 1000 V to 1500 V In-Line Fuses

6. **Combiner Box**
   - 1000 V to 1000 V Fuses
   - TVS Diodes/SCRs
   - Varistor Products

7. **Array Combiner**
   - 1000 V to 1500 V Fuses
   - Fuse Blocks
   - Touch-Safe Fuse Holders
   - Surge Protection Devices

With over 25 million devices installed in photovoltaic power systems, Littelfuse understands the global challenges of the solar market. Littelfuse offers numerous circuit-protection products that are uniquely suited to protect the equipment and systems subject to the harsh environments of standard photovoltaic installations.

---

**Sales and Technical Support**

- **United States and Mexico**
  - Phone: +1 800 TEC FUSE
  - Fax: +1 800 832 3873

- **Brazil**
  - Phone: +55 11 4427 6261

- **Canada**
  - Phone: +1 308 373 5505

- **China**
  - Hong Kong Phone: +852 2810 5099
  - Shanghai Phone: +86 21 2327 6000
  - Shenzhen Phone: +86 755 8207 0760
  - Taiwan Phone: +886 2 8751 1234
  - Europe Phone: +49 4244 819149

- **India**
  - Phone: +91 45 478 1088

- **Japan**
  - Phone: +81 45 478 1088

- **Singapore**
  - Phone: +65 6885 9188

- **South Korea**
  - Phone: +82 2 6000 8600

- **United Arab Emirates (UAE)**
  - Phone: +971 4341 3660

---

**Protection Relays & Controls Catalog (PF130N)**

This comprehensive line of electronic and microprocessor-based protection relays, timers, and fashers safeguard equipment and personnel to prevent expensive damage, downtime or injury due to electrical faults.

**Fuses & Fuse Holders Catalog (PF101N)**

Littelfuse offers a complete circuit protection portfolio of industrial power fuses, including time-saving indication products for an instant visual blown-fuse identification.

**Surge Protection Devices Catalog (PF612)**

These surge protection devices safeguard components from transient overvoltage or surges.

---

Follow this link to access the latest updates on approvals, certifications, and new products:

[Visit our website](Littelfuse.com/Solar)
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**SPXV SERIES STRING SOLAR FUSE**

1500 V dc • 1–60 A

**Description**
The Littelfuse SPXV solar string fuse is designed specifically for 1–60 A 1500 V dc applications.

**Features/Benefits**
- UL 248-19 Listed
- Up to 50,000 A interrupting rating

**Applications**
- Inverters
- Combiner boxes

**Web Resources**
Download technical resources at: Littelfuse.com/spxv

**Specifications**

- **Voltage Rating**: 1500 V dc
- **Amperage Rating**: 1, 2, 2.25, 2.5, 3, 3.5, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30, 32, 35, 40, 45, 50, 55, 60 A
- **Interrupting Rating**
  - SPXV 1 A-30 A: 30 kA (50 kA Self-Certified)
  - SPXV 35 A-60 A: 50 kA
- **Time Constant**: ≤ 1ms
- **Material**
  - Body: melamine
  - Caps: copper alloy (nickel plated)
- **Approvals**
  - UL 248-19 Listed (File: E339112)
  - RoHS Compliant
  - REACH

**Country of Origin**
Mexico

**SPXV Dimensions mm (in)**

<table>
<thead>
<tr>
<th>Ampere Code</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–20 A</td>
<td>84.65 (3.333) x 10.31 (0.406)</td>
</tr>
<tr>
<td>25–30 A</td>
<td>84.65 (3.333) x 13.72 (0.540)</td>
</tr>
<tr>
<td>35–60 A</td>
<td>127.00 (5.000) x 10.00 (0.394)</td>
</tr>
</tbody>
</table>

**SPXV-M Dimensions mm (in)**

<table>
<thead>
<tr>
<th>Ampere Code</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>25–32 A</td>
<td>84.65 (3.333) x 10.31 (0.406)</td>
</tr>
</tbody>
</table>

**Part Numbering System**

- **Series**
  - SPXV
- **Ampere Code**
  - Refer to Ampere Code Column in Ordering Information Table
- **Options**
  - Blank = 1–20 A 10 x 85 mm
  - 25–30 A 14 x 85 mm
  - 35–60 A 20 x 127 mm
  - XM = 25–32 A 10 x 85 mm
- **Package Quantity**
  - T = 10
  - L = 50

**Web Resources**
Download technical resources at: Littelfuse.com/spxv
**SPXI SERIES IN-LINE SOLAR FUSES**

1500 V dc • 2.5–60 A

---

**Description**

The Littelfuse SPXI solar fuse is designed to integrate into an in-line assembly within a wire harness. The fuse provides photovoltaic (PV) protection that meets UL 248-19 for photovoltaic applications. The SPXI can be electrically insulated by either overmolding or using heat-shrink.

**Features/Benefits**

- UL 248-19 Recognized
- 50,000 A interrupting rating
- No fuse holder required

**Applications**

- Photovoltaic high-capacity homerun, truck harness, and wire harness

---

**Specifications**

- **Voltage Rating**: 1500 V dc
- **Amperage Rating**: 2.5, 3.5, 4, 4.5, 5, 6, 8, 10, 12, 15, 20, 25, 30, 32, 35, 40, 45, 50, 55, 60 A
- **Interrupting Ratings**:
  - SPXI and SPXI-B 2.5–30 A: 30 kA
  - SPXI and SPXI-B 35–60 A: 50 kA
  - SPXI-M and SPXI-BM 25–32A: 50 kA
- **Time Constant**: ≤ 1ms
- **Material**:
  - Body: melamine
  - Caps: copper alloy (nickel plated)
- **Approvals**:
  - UL 248-19 Recognized (File: E339112)
  - RoHS Compliant
  - REACH
- **Country of Origin**: Mexico
- **US Patent**: 9,564,281

---

**Part Numbering System**

- **Series**: SPXI
- **Ampere Code**:
  - Refer to Ordering Number column in Ordering Information Table
- **Options**:
  - Refer to Ordering Number column in Ordering Information Table
- **Package Quantity**:
  - T = 10
  - L = 50

---

**Web Resources**

Download additional technical information and view the complete solar portfolio: [Littelfuse.com/spxi](http://Littelfuse.com/spxi)

---

**SPXI Dimensions mm (in)**

<table>
<thead>
<tr>
<th>Ampere Range</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5–4 A</td>
<td>3.56 (0.140)</td>
</tr>
<tr>
<td>4.5–20 A</td>
<td>3.56 (0.140)</td>
</tr>
</tbody>
</table>

---

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SPXI SERIES IN-LINE SOLAR FUSES

25–30 A

35–60 A

SPXI-B Dimensions mm (in)

2.5–4 A

4.5–20 A

35–60 A

SPXI-M Dimensions mm (in)

25–32 A
SPNH SERIES SOLAR FUSE
1500 V dc • 50-400 A • NH Style

Description
The SPNH series has been designed to meet the emerging circuit protection needs for 1500 volt photovoltaic (PV) systems. These fuses provide full range protection for all potential overcurrent conditions that exist in PV applications. Suitable for PV inverter protection and array combiner applications.

Features/Benefits
- Meets UL and IEC photovoltaic standards
- Compact NH XL Sizes
- Low watt Loss Design
- 1500 V dc rating for emerging market needs
- Designed to protect against a full range of overcurrents

Applications
- Inverters
- Re-combiner boxes
- Array/re-combiner application
- PV inverter dc input protection

Web Resources
Download technical documents: Littelfuse.com/spnh

Specifications
- **Voltage Rating**: 1500 V dc
- **Amperage Rating**: 50, 63, 80, 100, 125, 160, 200, 250, 315, 350, 400
- **Interrupting Rating**: 30 kA
- **Time Constant**: ≤ 2 ms
- **Material**: Body: Ceramic End Bells: Copper Alloy
- **Approvals**: UL 248-19 Listed (File: E339112, Vol. 4) IEC 60269-6
- **Environmental**: RoHS Compliant

Part Numbering System

<table>
<thead>
<tr>
<th>SPNH</th>
<th>XXX</th>
<th>X</th>
<th>X</th>
<th>DL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Amp Code</td>
<td>Package Quantity</td>
<td>CATALOG NUMBER</td>
<td>ORDERING NUMBER</td>
</tr>
<tr>
<td>Refer to Amp Code Column in Electrical Specifications Table</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recommended Accessories

**1XL Case Size**
- **Fuse Holder**: LFNH152001CST
- **Fuse Terminal Covers**: LFNH15200FBC

**2XL Case Size**
- **Fuse Holder**: LFNH154001CST
- **Fuse Terminal Covers**: LFNH15400FBC

**3L Case Size**
- **Fuse Holder**: LFNH156301CST
- **Fuse Terminal Covers**: LFNH15630FBC

**Microswitch**
- MSSPNH1500X

*Solid blade option for 1XL case size does not require a case or termination designator for the part number.
**Dimensions Millimeters (in)**

Size: 1 XL

![Diagram of Dimensions (in)](image)

---

**Microswitch**

**MSSPNH1500X**

**Dimensions Millimeters (in)**

![Diagram of Microswitch Dimensions (in)](image)
Description
The Littelfuse LFPXV fuse holder is designed to hold 1500 V 10x85 mm fuses.

Features/Benefits
- Finger-safe design offers personnel protection
- No fuse pullers or tools required for fuse removal
- 35 mm DIN-rail mountable
- Evaluated for use with copper alloy busbars
- Compact design

Recommended Fuses
Littelfuse SPXV/SPXV-S Fuses

Web Resources
Download the complete datasheet and other technical documents: Littelfuse.com/LFPXV

Ordering Information

<table>
<thead>
<tr>
<th>SERIES</th>
<th>VOLTAGE (V dc)</th>
<th>POLES</th>
<th>CATALOG NUMBER</th>
<th>ORDERING NUMBER</th>
<th>PACK QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFPXV</td>
<td>1500</td>
<td>1</td>
<td>LFPXV001</td>
<td>LFPXV0001Z</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERMINAL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TERMINAL TYPE</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Box Lug</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

*Must be the same cross-sectioned size

Specifications
- Voltage Ratings: 1500 V dc
- Amperage Rating: 30 A UL, 32 A Littelfuse self-certified
- SCCR Rating: 50 kA
- Power Dissipation: 8W maximum
- Fuse Type: 10 x 85 mm
- Material: Thermoplastic
- Fuse Clip: Silver-plated copper alloy Screws: Zinc-plated steel
- Operating Temperature: -55 °C to +125 °C
- Flammability Rating: UL94 V-0
- Temperature Stability: Body: 130 °C Carrier: 140 °C
- Approvals: UL 4248-19 Listed (File: E345481) IEC 60269-6
- Environmental: RoHS compliant, Lead (Pb) free, REACH
- Recommended DIN Rail: TH 35-7.5 per IEC 60715

Material and Temp Rating

<table>
<thead>
<tr>
<th>WIRE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stranded</td>
</tr>
<tr>
<td>UL Class B and Class C wire</td>
</tr>
<tr>
<td>AlphaWire PV Series Photovoltaic Wire</td>
</tr>
<tr>
<td>IEC Class 5 Flexible Wire</td>
</tr>
</tbody>
</table>

Busbar Specifications

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>THICKNESS</th>
<th>WIDTH</th>
<th>TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>0.188 in (4.78 mm)</td>
<td>0.290 in (7.37 mm)</td>
<td>24-28 lb-in (2.71-3.16 N-m)</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.125 in (3.18 mm)</td>
<td>0.200 in (5.08 mm)</td>
<td></td>
</tr>
</tbody>
</table>

Solar Products
1500 V Rated Products

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LFPXV TOUCH-SAFE FUSE HOLDERS

Dimensions Millimeters (in)

Side View

Top View

Front View

87.17 REF. [3.432]

22.10 REF. [0.87]

138.00 REF. [5.433]
**Solar Products**

**1500 V Rated Products**

**LFNH SERIES FUSE BLOCK**

---

**Description**

The LFNH series fuse block is specifically designed for the Littelfuse SPNH 1500 V solar fuse. It meets UL electrical requirements, is available in multiple case sizes and has an optional cover to enclose the lugs.

**Features/Benefits**

- Narrow width increases space savings
- Range of amperages to match all SPNH fuse options

**Specifications**

- **Voltage Rating**: 1500 V dc
- **Ampere Rating**: 200, 400, 630 A
- **Interrupt Rating**: 30 kA
- **Termination Type**: Stud Mount
- **Base Temp Rating**: UL4248-1
- **Approvals**: UL4248-19
  - FILE: E345481 Vol. 2
  - RoHS Compliant
- **Environmental**
  - Material: Fuse Clip: Silver-Plated Copper
  - Spring: Zinc-Plated Steel
  - Mounting Plate: Zinc-Plated Steel
  - Insulator: Ceramic

**Recommended Fuses**

SPNH Series

**Web Resources**

For sample requests, downloadable CAD drawings, dimensions and other technical information:

[Littelfuse.com/LFNH](http://Littelfuse.com/LFNH)

For a comprehensive overview of solar market solutions, visit:

[Littelfuse.com/solar](http://Littelfuse.com/solar)

**Ordering Information**

<table>
<thead>
<tr>
<th>AMPERAGE</th>
<th>ORDERING NUMBER</th>
<th>FUSE SIZE</th>
<th>RECOMMENDED TORQUE</th>
<th>TERMINAL COVER ORDERING NUMBER*</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>LFNH152001CST</td>
<td>NH1XL</td>
<td>283 in-lb (32 N-m)</td>
<td>132 in-lb (15 N-m)</td>
</tr>
<tr>
<td>400</td>
<td>LFNH154001CST</td>
<td>NH2XL</td>
<td>283 in-lb (32 N-m)</td>
<td>132 in-lb (15 N-m)</td>
</tr>
<tr>
<td>630</td>
<td>LFNH156301CST</td>
<td>NH3L</td>
<td>283 in-lb (32 N-m)</td>
<td>132 in-lb (15 N-m)</td>
</tr>
</tbody>
</table>

*Terminal covers sold separately*
Dimensions Millimeters (in)

Fuse Block
LFNH152001CST

Fuse Terminal Cover
LFNH15200FBC

Specifications
Voltage Rating: 1500 V
Ampere Rating: 200 amperes
Flammability Rating: UL 94 V-0
Material: V0-rated Nylon
Packaging: Sold in pairs
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LFNH SERIES FUSE BLOCK

Dimensions Millimeters (in)

Fuse Block
LFNH154001CST

Fuse Terminal Cover
LFNH15400FBC

Specifications
Voltage Rating: 1500 V
Ampere Rating: 400 amperes
Flammability Rating: UL 94 V-0
Material: V0-rated Nylon
Packaging: Sold in pairs
Dimensions Millimeters (in)

Fuse Block
LFNH156301CST

Fuse Terminal Cover
LFNH15630FBC

Specifications
Voltage Rating: 1500 V
Ampere Rating: 630 amperes
Flammability Rating: UL 94 V-0
Material: V0-rated Nylon
Packaging: Sold in pairs
**SPFJ SERIES SOLAR FUSE**

1000 V dc • 70–450 A

---

### Description

The SPFJ series is the smallest 1000 V dc 70–450 A photovoltaic (PV) fuse available in the market. The SPFJ series is manufactured in Class J case sizes that allows for both fuse holder and busbar mounting configuration. The SPFJ meets both UL and IEC requirements.

### Features/Benefits

- Meets UL and IEC photovoltaic standards
- Small footprint reduces panel size
- Flexibility of fuse holder or busbar mounting
- Higher amperage solar fuses in standard sizes
- UL Listed branch and feeder circuit rated
- Class J case sizes for the 125-450 A ratings

### Applications

- Inverters
- Re-combiner boxes

### Recommended Fuse Holder

LFJ1000 Solar Series

### Web Resources

Download technical documents: **Littelfuse.com/spfj**

---

### Specifications

- **Voltage Rating**: 1000 V dc
- **Amperage Rating**: 600 V ac (125–450 A)
- **Interrupting Rating**:
  - Ac: 200 kAIC (125–450 A)
  - Dc: 70-200 A: 20 kAIC
  - 250-400 A: 10 kAIC
  - 450 A: 20 kAIC
- **Time Constant**: ≤ 1 ms
- **Material**:
  - Body: Melamine
  - End Bells: Copper Alloy
- **Approvals**:
  - UL 248-19 Listed (File: E339112)
  - UL 248-8, Class J (125–450 A)
  - cULus (125-450 A)
  - IEC 60269-6 (125-450 A)
- **Environmental**:
  - RoHS Compliant
- **Country of Origin**: Mexico

### Part Numbering System

**SPFJ** xxx X

<table>
<thead>
<tr>
<th>Amp Code</th>
<th>Package Quantity</th>
<th>Catalog Number</th>
<th>Ordering Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>1</td>
<td>SPFJ070</td>
<td>SPFJ070.X</td>
</tr>
<tr>
<td>200</td>
<td>1</td>
<td>SPFJ200</td>
<td>SPFJ200.XXL</td>
</tr>
</tbody>
</table>

---

### Dimensions Inches (mm)

![FUSE DIMENSIONS](image)

### Table: Dimensions in Inches (mm)

<table>
<thead>
<tr>
<th>AMPERAGE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-100</td>
<td>3.02 (76.5)</td>
<td>4.38 (111.3)</td>
<td>5.75 (146.1)</td>
<td>1.5 (38.1)</td>
<td>1.125 (28.3)</td>
<td>.335 (8.5)</td>
<td>.189 (4.8)</td>
</tr>
<tr>
<td>125-200</td>
<td>3.02 (76.5)</td>
<td>4.38 (111.3)</td>
<td>5.75 (146.1)</td>
<td>1.5 (38.1)</td>
<td>1.125 (28.3)</td>
<td>.281 (7.1)</td>
<td>.189 (4.8)</td>
</tr>
<tr>
<td>250-400</td>
<td>3.37 (85.7)</td>
<td>5.25 (133.4)</td>
<td>7.125 (181.0)</td>
<td>2.0 (50.8)</td>
<td>1.63 (41.3)</td>
<td>.406 (10.3)</td>
<td>.252 (6.4)</td>
</tr>
<tr>
<td>450</td>
<td>3.75 (95.3)</td>
<td>5.98 (152.0)</td>
<td>8.0 (203.2)</td>
<td>2.5 (63.5)</td>
<td>2.0 (50.8)</td>
<td>.531 (13.5)</td>
<td>.374 (9.5)</td>
</tr>
</tbody>
</table>

* SPFJ L option = 8.5 mm (UL 248-19 approval only)
Description

The SPF Solar Protection Fuse series has been specifically designed for the protection of photovoltaic (PV) systems. This family of midget-style fuses (10 x 38 mm) can safely protect PV modules and conductors from reverse-overcurrent conditions. As PV systems have grown in size, so have the corresponding voltage requirements. This increase in system voltage has typically been intended to minimize power loss associated with long conductor runs. Standard circuit protection devices are not designed to completely protect photovoltaic panels. However, the SPF series is UL Listed to safely interrupt faulted circuits up to this demanding voltage level.

Littelfuse offers 14 ampere ratings to match specific requirements in a variety of applications.

Features/Benefits

- Meets UL and IEC photovoltaic standards
- UL 248-19 Listed 1000 V dc maximum
- 1-30 A ratings available
- 20,000 A Interrupting Rating - 1 A - 20 A
- 50,000 A Interrupting Rating - 25 A - 30 A
- Both PCB mount and dead-front holder options available

Applications

- Inverters
- Combiner boxes
- Battery charge controllers

Recommended Accessories

Fuse Holder: LPHV 1000 V dc POWR-Safe Series
Fuse Clips: 125004/125005

Web Resources

Download technical documents: littelfuse.com/spf
Solar Products
1000 V DC Rated Products

SPFI SERIES IN-LINE SOLAR FUSE

1000 V dc • 2–30 A

Description
The Littelfuse SPFI solar fuse is designed to integrate into an in-line assembly within a wire harness. The fuse provides photovoltaic (PV) protection that meets UL 248-19 for photovoltaic applications. The SPFI can be electrically insulated by either overmolding or using approved heat-shrink.

Features/Benefits
- UL 248-19 Recognized
- Meets IEC 60269-6 electrical performance requirements
- 20,000 A Interrupting Rating
- No fuse holder required

Applications
- Photovoltaic wire harness

Specifications
- Voltage Rating: 1000 V dc
- Amperage Rating: 2, 2.5, 3, 3.5, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30 A
- Interrupting Rating: 20 kA
- Time Constant: ≤ 1 ms
- Material
  - Body: Melamine
  - Caps: Copper Alloy (Nickel Plated)
- Approvals
  - UL 2579 Recognized (File: E339112)
  - RoHS Compliant
  - REACH
- Environmental
  - RoHS Compliant
- Country of Origin: Mexico
- US Patent: 9,564,281

Part Numbering System

<table>
<thead>
<tr>
<th>SPFI</th>
<th>Amp Code</th>
<th>Package Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>T = 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L = 50</td>
</tr>
</tbody>
</table>

Refer to datasheet for amp code

<table>
<thead>
<tr>
<th>SERIES</th>
<th>AMPERAGE</th>
<th>PACKAGE QUANTITY</th>
<th>CATALOG NUMBER</th>
<th>ORDERING NUMBER</th>
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<tbody>
<tr>
<td>SPFI</td>
<td>2</td>
<td>10</td>
<td>SPF002</td>
<td>SPF002.T</td>
</tr>
<tr>
<td>SPFI</td>
<td>3.5</td>
<td>10</td>
<td>SPF03.5</td>
<td>SPF03.5T</td>
</tr>
<tr>
<td>SPFI</td>
<td>20</td>
<td>50</td>
<td>SPF020</td>
<td>SPF020.L</td>
</tr>
</tbody>
</table>

Web Resources
Downloadable CAD drawings and other technical information:
littelfuse.com/spfi

Recommended Crimping Tool
T&B Sta-Kon ERG4002

Dimensions mm (in)
**Description**

The LFJ1000 series fuse block is specifically designed for the Littelfuse SPFJ 1000 V Solar Fuse. It meets UL electrical requirements, is available in multiple amperages, and comes in a variety of fuse mounting and termination configuration: fuse clip to box lug, fuse stud to wire stud and fuse clip to wire stud.

**Features/Benefits**

- Narrow width increases space savings
- Range of amperages to match all SPFJ fuse options
- Box lug termination style accommodates a wide range of cable sizes
- Stud-mounted option increases convenience
- Approval for use with copper or aluminum lugs allowing for design flexibility

**Ordering Information**

**(Clip-to-Box Lug 1000 V)**

<table>
<thead>
<tr>
<th>AMPERAGE</th>
<th>ORDERING NUMBER</th>
<th>INTERRUPT RATING</th>
<th>WIRE RANGE STANDARD (METRIC)</th>
<th>WIRE TYPE</th>
<th>RECOMMENDED TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>LFJ102001C</td>
<td>20 kA</td>
<td>250 kcmil - #6 (127 mm² - 16 mm²)</td>
<td>Cu/Al Solid/Stranded</td>
<td>275 in-lb (31.1 N-m)</td>
</tr>
<tr>
<td>400</td>
<td>LFJ104001C</td>
<td>10 kA</td>
<td>350 kcmil - 1/0 (177 mm² - 55 mm²)</td>
<td></td>
<td>275 in-lb (31.1 N-m)</td>
</tr>
<tr>
<td>450</td>
<td>LFJ104501C</td>
<td>20 kA</td>
<td>500 kcmil - #4 (253 mm² - 25 mm²)</td>
<td></td>
<td>375 in-lb (42.4 N-m)</td>
</tr>
</tbody>
</table>

**(Stud-to-Stud 1000 V)**

<table>
<thead>
<tr>
<th>AMPERAGE</th>
<th>ORDERING NUMBER</th>
<th>INTERRUPT RATING</th>
<th>RECOMMENDED TORQUE FUSE TERMINAL</th>
<th>MAX. BUSBAR THICKNESS</th>
<th>RECOMMENDED BASE TORQUE BOLT SIZE BOLT TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>LFJ102001STST</td>
<td>20 kA</td>
<td>200 in-lb (22.8 N-m) .774” (19.66 mm)</td>
<td></td>
<td>1/4” 5/16” 30-40 in-lb 40-50 in-lb</td>
</tr>
<tr>
<td>400</td>
<td>LFJ104001STST</td>
<td>10 kA</td>
<td>200 in-lb (22.8 N-m) .555” (14.10 mm)</td>
<td></td>
<td>1/4” 5/16” 30-40 in-lb 40-50 in-lb</td>
</tr>
<tr>
<td>450</td>
<td>LFJ104501STST</td>
<td>20 kA</td>
<td>300 in-lb (33.9 N-m) .570” (14.18 mm)</td>
<td></td>
<td>1/4” 5/16” 30-40 in-lb 40-50 in-lb</td>
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</tbody>
</table>

**(Clip-to-Stud 1000 V)**

<table>
<thead>
<tr>
<th>AMPERAGE</th>
<th>ORDERING NUMBER</th>
<th>INTERRUPT RATING</th>
<th>RECOMMENDED TORQUE FUSE TERMINAL</th>
<th>MAX. BUSBAR THICKNESS</th>
<th>RECOMMENDED BASE TORQUE BOLT SIZE BOLT TORQUE</th>
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</thead>
<tbody>
<tr>
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<td>LFJ102001CST</td>
<td>20 kA</td>
<td>200 in-lb (22.6 N-m) .774” (19.66 mm)</td>
<td></td>
<td>1/4” 5/16” 30-40 in-lb 40-50 in-lb</td>
</tr>
<tr>
<td>400</td>
<td>LFJ104001CST</td>
<td>10 kA</td>
<td>200 in-lb (22.6 N-m) .555” (14.10 mm)</td>
<td></td>
<td>1/4” 5/16” 30-40 in-lb 40-50 in-lb</td>
</tr>
<tr>
<td>450</td>
<td>LFJ104501CST</td>
<td>20 kA</td>
<td>300 in-lb (33.9 N-m) .570” (14.18 mm)</td>
<td></td>
<td>1/4” 5/16” 30-40 in-lb 40-50 in-lb</td>
</tr>
</tbody>
</table>

**Specifications**

- **Voltage Rating**: 1000 V dc
- **Ampere Rating**: 200, 400, 450 A
- **Flammability Rating**: UL 94 V-0
- **Termination Type**: Box Lug or Stud Mount
- **Base Temp Rating**: 130 °C
- **Approvals**: UL 4248-18 Listed
  
  File: E345481 Vol. 1

**Environmental**

- **RoHS Compliant**

**Recommended Fuses**

SPFJ Solar Series

**Web Resources**

Sample requests, downloadable CAD drawings, dimensions and other technical information:

Littelfuse.com/LFJ1000

For a comprehensive overview of solar market solutions visit:

Littelfuse.com/solar
Description
The Littelfuse LPHV fuse holder is designed to house 1000 V fuses. It is not designed for load break but is ideal for isolating photovoltaic (PV) module strings for maintenance and meets UL requirements for 1000 V solar fuse protection.

Features/Benefits
- Touch-safe design offers protection when replacing fuses
- Compact design
- 35 mm DIN-rail mountable
- Available in 1-, 2-, 3- and 4-pole configurations
- No fuse pullers or tools required for fuse removal

Ordering Information

<table>
<thead>
<tr>
<th>SERIES</th>
<th>POLES</th>
<th>CATALOG NUMBER</th>
<th>ORDERING NUMBER</th>
<th>TERMINAL TYPE</th>
<th>WIRE TYPE</th>
<th>WIRE RANGE</th>
<th>TERMINAL TORQUE</th>
<th>ROHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPHV</td>
<td>1</td>
<td>LPHV001</td>
<td>LPHV0001Z</td>
<td>Pressure Plate</td>
<td>75 °C or 90 °C</td>
<td>#8-14 AWG (2-10 mm²) / (#10-14 AWG (2-6 mm²))</td>
<td>17.7 in-lbs (2 N-m)</td>
<td>•</td>
</tr>
<tr>
<td>LPHV</td>
<td>2</td>
<td>LPHV002</td>
<td>LPHV0002Z</td>
<td>Stranded / Solid</td>
<td>[CU Only]</td>
<td>(#8-14 AWG (2-10 mm²)) / (#10-14 AWG (2-6 mm²))</td>
<td>17.7 in-lbs (2 N-m)</td>
<td>•</td>
</tr>
<tr>
<td>LPHV</td>
<td>3</td>
<td>LPHV003</td>
<td>LPHV0003Z</td>
<td>Stranded / Solid</td>
<td>[CU Only]</td>
<td>(#8-14 AWG (2-10 mm²)) / (#10-14 AWG (2-6 mm²))</td>
<td>17.7 in-lbs (2 N-m)</td>
<td>•</td>
</tr>
<tr>
<td>LPHV</td>
<td>4</td>
<td>LPHV004</td>
<td>LPHV0004Z</td>
<td>Stranded / Solid</td>
<td>[CU Only]</td>
<td>(#8-14 AWG (2-10 mm²)) / (#10-14 AWG (2-6 mm²))</td>
<td>17.7 in-lbs (2 N-m)</td>
<td>•</td>
</tr>
</tbody>
</table>

Dimensions Inches (mm)

Specifications
- Voltage Rating: 1000 V dc
- Amperage Rating: 30 A
- SCCR Rating: 20 kA
- Power Dissipation: 4 W Maximum
- Fuse Type: 10 X 38 mm up to 1000 V dc
- Material: Thermoplastic
- Flammability Rating: UL 94 V-0
- Approval: Self-certified 1000 V dc
- IEC 60269-2, -4, -6
- Environmental: RoHS compliant, Lead (Pb) Free

Multi-Pole Assembly Kit
Kits are used to create multi-pole holders from 1-pole LPHV fuse holders. Please contact factory for more information.

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYHP001</td>
<td>20 Connector Pincers &amp; 10 Handle Pins</td>
</tr>
<tr>
<td>CYHP002</td>
<td>Connector Pincer Only</td>
</tr>
<tr>
<td>CYHP003</td>
<td>Handle Pin Only</td>
</tr>
</tbody>
</table>

Web Resources
Sample requests, downloadable CAD drawings and other technical information: Littelfuse.com/lphv

More information about solar applications: Littelfuse.com/solar

Recommended Fuses
10 x 38 mm 1000 V dc Fuses
SPF 1000 V Series
FLU 1000 V Series
Description
A key objective for panel designers is safe distribution of power to multiple fuse holders in a compact design. The Littelfuse UL 508 Listed bus bar system eliminates most wire terminations in a timesaving package. A power distribution block and associated conductors are no longer needed to feed multiple POWR-safe fuse holders.

Features/Benefits
- Touch-safe design offers protection when replacing fuses
- Compact design
- 35mm DIN-rail mountable
- Available in one and three phase configurations
- Can be cut down to optimal size

Recommended Fuse Holders
Littelfuse LFPSM / LFPSC / LPSM / LPSC (600 V)
Littelfuse LPHV (1000 V)

Web Resources
Download technical documents: Littelfuse.com/busbar

Specifications
Voltage Ratings  600 V ac/dc
1000 V dc*

Current Ratings

<table>
<thead>
<tr>
<th>CROSS SECTION (mm²)</th>
<th>18 mm²</th>
<th>25 mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>END FED</td>
<td>80 A</td>
<td>100 A</td>
</tr>
<tr>
<td>CENTER FED</td>
<td>160 A</td>
<td>200 A</td>
</tr>
</tbody>
</table>

SCCR  10 kA, 100 kA¹
Conductor  Copper
Pitch  17.8 mm
Approvals  UL 508 Listed (File E328654)
Environmental  RoHS Compliant
Lead (Pb) free

*1 Phase 18 mm² rated 1000 V dc up to 160 A when center fed
1 Phase 25 mm² rated 1000 V dc up to 200 A when center fed
1 When protected directly upstream by Class J 175 amperes max (18 mm² bus bar) and Class J 200 amperes max (25 mm² bus bar).

Ordering Information

<table>
<thead>
<tr>
<th>1 PHASE, 18 mm²</th>
<th>LENGTH (mm)</th>
<th>ORDERING NUMBER</th>
<th>POLES</th>
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<tbody>
<tr>
<td>1PH3P18mm</td>
<td>3</td>
<td>50</td>
<td>1P3P25mm</td>
</tr>
<tr>
<td>1PH4P18mm</td>
<td>4</td>
<td>79</td>
<td>1P4P25mm</td>
</tr>
<tr>
<td>1PH6P18mm</td>
<td>6</td>
<td>104</td>
<td>1P6P25mm</td>
</tr>
<tr>
<td>1PH9P18mm</td>
<td>9</td>
<td>155</td>
<td>1P9P25mm</td>
</tr>
<tr>
<td>1PH12P18mm</td>
<td>12</td>
<td>208</td>
<td>1PH12P25mm</td>
</tr>
<tr>
<td>1PH15P18mm</td>
<td>15</td>
<td>270</td>
<td>1PH15P25mm</td>
</tr>
<tr>
<td>1PH5P18mm</td>
<td>57</td>
<td>1009</td>
<td>1PH5P25mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1 PHASE, 25 mm²</th>
<th>LENGTH (mm)</th>
<th>ORDERING NUMBER</th>
<th>POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1PH3P25mm</td>
<td>3</td>
<td>50</td>
<td>1P3P25mm</td>
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<tr>
<td>1PH4P25mm</td>
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<td>1PH6P25mm</td>
<td>6</td>
<td>104</td>
<td>1P6P25mm</td>
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<tr>
<td>1PH9P25mm</td>
<td>9</td>
<td>155</td>
<td>1P9P25mm</td>
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<tr>
<td>1PH12P25mm</td>
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<tr>
<td>1PH15P25mm</td>
<td>15</td>
<td>270</td>
<td>1PH15P25mm</td>
</tr>
<tr>
<td>1PH5P25mm</td>
<td>57</td>
<td>1009</td>
<td>1PH5P25mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 PHASE, 18 mm²</th>
<th>LENGTH (mm)</th>
<th>ORDERING NUMBER</th>
<th>POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3PH3P18mm</td>
<td>6</td>
<td>104</td>
<td>3P3P25mm</td>
</tr>
<tr>
<td>3PH9P18mm</td>
<td>6</td>
<td>158</td>
<td>3PH9P25mm</td>
</tr>
<tr>
<td>3PH12P18mm</td>
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<td>214</td>
<td>3PH12P25mm</td>
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<tr>
<td>3PH15P18mm</td>
<td>15</td>
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<td>3PH15P25mm</td>
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<tr>
<td>3PH5P18mm</td>
<td>57</td>
<td>1009</td>
<td>3PH5P25mm</td>
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<table>
<thead>
<tr>
<th>3 PHASE, 25 mm²</th>
<th>LENGTH (mm)</th>
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<th>POLES</th>
</tr>
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<tr>
<td>3PH3P25mm</td>
<td>6</td>
<td>104</td>
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<td>3PH9P25mm</td>
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<td>3PH12P25mm</td>
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<tr>
<td>3PH15P25mm</td>
<td>15</td>
<td>266</td>
<td>3PH15P25mm</td>
</tr>
<tr>
<td>3PH5P25mm</td>
<td>57</td>
<td>1009</td>
<td>3PH5P25mm</td>
</tr>
</tbody>
</table>

Endcaps are standard with all 3 phase configurations except 57-pole.
Endcaps are not needed for the 1 phase configurations from the factory or if the copper bus is trimmed per the supplied instructions.
Pole feed lugs and protective covers are extra.

Accessories

Power Feed Lug

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>AMPERAGE RATING</th>
<th>VOLTAGE (ac/dc)</th>
<th>WIRE RANGE</th>
<th>WIRE TYPE</th>
<th>TORQUE</th>
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<tbody>
<tr>
<td>BB17</td>
<td>115</td>
<td>1000</td>
<td>#10 - 1/0 AWG</td>
<td>CU</td>
<td>50 lb-in</td>
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<tr>
<td>BB18</td>
<td>115</td>
<td>1000</td>
<td>#10 - 1/0 AWG</td>
<td>CU</td>
<td>50 lb-in</td>
</tr>
<tr>
<td>BB19</td>
<td>115</td>
<td>1000</td>
<td>#10 - 1/0 AWG</td>
<td>CU</td>
<td>50 lb-in</td>
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<tr>
<td>BB20</td>
<td>115</td>
<td>1000</td>
<td>#10 - 1/0 AWG</td>
<td>CU</td>
<td>50 lb-in</td>
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Endcaps

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>PHASE</th>
<th>QUANTITY</th>
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<tbody>
<tr>
<td>EDCP42</td>
<td>Single</td>
<td>50</td>
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<tr>
<td>EDCP7</td>
<td>Three</td>
<td>50</td>
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</tbody>
</table>

Pole Protective Covers

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTPT5</td>
<td>5</td>
</tr>
</tbody>
</table>
### Features/Benefits
- Indicating and non-indicating options available
- 1-, 2-, 3- and 4-pole configurations
- Easy installation and fuse removal with no additional pullers or tools required
- 35 mm DIN-rail mountable
- Ventilated design for cooler operation

### Specifications
- **Voltage Rating**: 600 V ac/dc
- **Ampere Rating**: 30 A
- **Interrupting Rating**: 200 kA (Class CC) 100 kA (midget)
- **Terminal Type**: Pressure plate
- **Suggested Torque**: 17.7 in–lbs
- **Wire Range**: #8–#14 CU
- **Material**: Thermoplastic
- **Flammability Rating**: UL 94 V-0
- **Approvals**: UL Listed (LPSC File: E14721)  
  UL Recognized (LPSM File: E14721)  
  CSA Certified (LPSC/LPSM File: LR7316)
- **Environmental**: RoHS compliant, Lead (Pb) Free

### Ordering Information

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<th></th>
<th><strong>INDICATING</strong></th>
<th></th>
<th><strong>NON-INDICATING</strong></th>
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<th><strong>FUSE TYPE</strong></th>
<th><strong>POLES</strong></th>
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<tbody>
<tr>
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<td><strong>ORDERING NUMBER</strong></td>
<td></td>
<td><strong>CATALOG NUMBER</strong></td>
<td><strong>ORDERING NUMBER</strong></td>
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<tr>
<td>LPSC002ID</td>
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<td>LPSC0002Z</td>
<td>Class CC</td>
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<tr>
<td>LPSC003ID</td>
<td>LPSC0003ZXID</td>
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<td>LPSC0003Z</td>
<td>Class CC</td>
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<td>LPSM0003Z</td>
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<td>LPSM0004ZXID</td>
<td>LPSM004</td>
<td>LPSM0004Z</td>
<td>Midget</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Multi Pole Assembly Kit**  
Ordering No. CYHP0001Z-KIT  
(Kit contains 20 connector pincers & 10 handle pins)

### Web Resources
Download CAD drawings and other technical information:  
[liettelfuse.com/lpsc](http://liettelfuse.com/lpsc)  
[liettelfuse.com/lpsm](http://liettelfuse.com/lpsm)

### Recommended Fuses
- **Class CC**
- **Midget-style (10 x 38 mm)**
KLKD SERIES 10 X 38 FUSES

600 V ac/V dc • ¼10–30 A • Fast Acting

Description
The KLKD fuse series is fast-acting with a high dc voltage rating. This family of midget-style fuses (10 x 38 mm) is used in solar combiner boxes and in circuits with dc fault currents up to 50,000 amperes. KLKD fuses are available in standard and board-mount configurations.

In addition, the KLKD series has been designed to meet both the UL and IEC photovoltaic (PV) fuse standards. Littelfuse offers a wide range of ampere ratings to match specific requirements in a variety of applications.

Features/Benefits
- Designed to UL and IEC photovoltaic specifications
- 1/10 – 30 A ratings available
- 50,000 A Interrupting Rating
- Available in ferrule or PCB mount options
- 1-5 A meets UL 1741 GFDI requirements

Applications
- Combiner boxes and inverters
- Power supplies
- Desktop meters

Dimensions Inches (mm)
Ferrule Version | PCB 1-Tab
| | |
| | |

Specifications
- Voltage Rating: 600 V ac/V dc
- Ampere Rating: ¼10, ¼8, ½10, ½, ¾10, ¾, 1½, 2½, 3, 3½, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30
- Interrupting Ratings:
  - AC: 100 kA
  - 200 kA Littelfuse self-certified
  - DC: 1/10-30: 10 kA (UL 2579)
  - 1/10-50: 50 kA (UL 248-14)
- Material: Body: Melamine / Caps: Copper Alloy
- Operating Temperature: See rerating curve
- Approvals:
  - UL 2579 Listed (File: E339112)
  - IEC 60269-6 (2-25 A)
  - VDE Certified (No. 40033094)
  - UL 248-14 Listed (File: E10480)
  - CSA Certified Ferrule only (File: LR29862)
- Environmental:
  - RoHS Compliant
  - Country of Origin: Mexico

Part Numbering System

<table>
<thead>
<tr>
<th>SERIES</th>
<th>AMPERAGE</th>
<th>PACKAGE QUANTITY</th>
<th>MOUNTING METHOD</th>
<th>CATALOG NUMBER</th>
<th>ORDERING NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>KLKD</td>
<td>1/8</td>
<td>10</td>
<td>FERRULE</td>
<td>KLKD.125</td>
<td>KLKD.125T</td>
</tr>
<tr>
<td>KLKD</td>
<td>5</td>
<td>100</td>
<td>FERRULE</td>
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<td>KLKD005H</td>
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<td>KLKD</td>
<td>15</td>
<td>10</td>
<td>PCB 1-TAB</td>
<td>KLKD015R</td>
<td>KLKD015TXR</td>
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</tbody>
</table>

Recommended Fuse Holders
- Littelfuse LPSM and LFPSM dead-front series
- Littelfuse L60030M open-face series

Web Resources
Download CAD drawings and other technical information: littelfuse.com/klkd
POWR-BLOKS

Distribution Blocks • Splicer Blocks • Covers

Connectors
Box lug connectors are designed for use with a single or multiple, solid or class B or C stranded conductor. For UL approved use of more than one conductor per connector opening, contact Littelfuse Technical Service. Manufacturers of cable terminations can furnish crimp-on sleeves for fine stranded conductors which permit these conductors to be used with box lugs.

Ampere Ratings
The ampere rating per pole for power distribution blocks is based on the line ampacity of 75 °C insulated conductors per NEC* Table 310.16. If 60 °C insulated conductors are used, load must not exceed the ampacity of 60 °C conductors. Use of conductors rated in excess of 75 °C is permitted (for example 90 °C), however, load must not exceed the ampacity of 75 °C conductors.

Specifications
Voltage Rating 600 V
Current Rating Based on NEC Table 310.16, using 75 °C copper wire
SCCR Consult factory
Material Phenolic rated at 150 °C and Thermoplastic rated at 125 °C (LD1400 and LS1300 series only)
Connector Aluminum: Highly conductive aluminum, tin plated
Copper: Highly conductive copper, tin plated
Flammability Rating UL 94 V-0
Approvals UL Recognized - 0LD/0LS Series (File: E171395)
LFD/LFS Series (File: E309688)
CSA Certified - 0LD/0LS Series (File: LR700111)
LFD/LFS Series (File: 007316_0_000)
UL Listed - 0LD57xxxx (File: E482231)
Environmental RoHS compliant, Lead (Pb) free

Web Resources
For dimension, CAD and 3-D drawings, visit: littelfuse.com/powrbloks

*NEC is a trademark of its respective owner
Description
Half-Bridge Circuit IGBT Modules offer the high efficiency and fast switching speeds of modern IGBT technology in a robust and flexible format. Used for power control applications, Littelfuse offers IGBT modules for flexible and efficient motor control and inverter applications.

Features
- Ultra low loss
- High ruggedness
- High short-circuit capability
- Positive temperature coefficient
- With fast free-wheeling diodes

Benefits
- High efficiency and switching speed
- High reliability in demanding applications
- Reduced protection needs
- Easily paralleled
- Integrated solution in compact module package

Applications
- AC motor control
- Inverter
- Motion/servo control
- Power supplies
- Photovoltaic/fuel cell

Web Resources
Download the complete datasheet and other technical information: littelfuse.com

Specifications
Voltage Rating: 600 / 1200 V
Amperage Rating:
- S Package: 75, 100, 150, 200
- D Package: 100, 150, 200, 300, 400
- WB Package: 225, 300, 450, 600
Circuit Type: Half-Bridge
Approvals: UL Listed (File: E71639)
Environmental: RoHS Compliant

Part Numbering System
Product Type
M: Power Module
G: IGBT
Module Type
2x (IGBT + FWD)
Voltage Rating
06: 600 V
12: 1200 V
Current Rating

Ordering Information

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>VOLT</th>
<th>AMPERAGE</th>
<th>PACKAGE TYPE</th>
<th>MOUNTING METHOD</th>
<th>M.O.Q.</th>
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<tr>
<td>MG1250S-BA1MM</td>
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<td>50</td>
<td>S</td>
<td>SCREW</td>
<td>100</td>
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<td>100</td>
<td>S</td>
<td>SCREW</td>
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<td>150</td>
<td>S</td>
<td>SCREW</td>
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<td>200</td>
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<td>SCREW</td>
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<td>MG12250S-BN2MM</td>
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<td>MG12300S-BN2MM</td>
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<td>D</td>
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<td>MG12400D-BN2MM</td>
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<td>MG06600WB-BN4MM</td>
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<td>WB</td>
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<td>WB</td>
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<td>MG12450WB-BN2MM</td>
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<td>450</td>
<td>WB</td>
<td>PRESS FIT</td>
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</tbody>
</table>

Dimensions Inches (mm)

S Package Type

D Package Type

WB Package Type
What Are Voltage Transients?

Voltage transients are unwanted short duration surges of electrical energy. They may result from the sudden release of previously stored energy, and can come from internal and external sources. If the voltage magnitude of the transient is large enough, circuit component damage or malfunction of the circuit may result.

Transients can occur either repeatedly or as random impulses. Repeatable transients are frequently caused by the operation of other system components, such as motors, generators or the switching of reactive circuit components. Random transients, are often caused by lightning, electrostatic discharge (ESD), and other outdoor environment events.

Transients originate from the outside utility power grid may pass through the main circuit panel and cabling to the inverter.

Transient Voltage Suppression Diodes

TVS Diodes are used to protect semiconductor components from high-voltage transients. Their p-n junctions have a larger cross-sectional area than those of a normal diode, allowing them to conduct large currents to ground without sustaining damage. Littelfuse supplies TVS Diodes with peak power ratings from 200 W to 30 kW, and reverse standoff voltages from 5 V to 512 V. For more information visit Littelfuse.com/tvsdiodes

TVS and Solar Inverter Protection

Integration of Transient Voltage Suppression (TVS) components within solar system designs help to prevent the damaging effects of transient events and assure compliance to safety and reliability standards. Solar power inverters are vulnerable to transient voltage events and its direct connection to other system components allows transient voltage transfer. For example:

- Lightning-induced transient events may pass through the solar array and outdoor cabling to the inverter
- Transients originating from the outside utility power grid may pass through the main circuit panel and cabling to the inverter
- Startup of motorized equipment enables vulnerabilities produced by repeated load changes
- Electrostatic discharge events generated internally and externally to the system may pass between the inverter and sensitive electronic control equipment

It is important to build surge protection in the inverter and at other locations before damaging transients may reach sensitive equipment.

TVS (TRANSIENT VOLTAGE SUPPRESSION) DIODES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>VOLTAGE</th>
<th>CURRENT</th>
<th>RISE-TIME</th>
<th>DURATION</th>
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<tr>
<td>Lightning</td>
<td>25 kV</td>
<td>20 kA</td>
<td>10 µs</td>
<td>50 ms</td>
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<td>Load Switching</td>
<td>600 V</td>
<td>500 A</td>
<td>50 µs</td>
<td>500 ms</td>
</tr>
<tr>
<td>Electromagnetic Pulse (EMP)</td>
<td>1 kV</td>
<td>300 kV</td>
<td>20 ns</td>
<td>1 ms</td>
</tr>
<tr>
<td>Electrostatic Discharge (ESD)</td>
<td>15 kV</td>
<td>30 A</td>
<td>1–5 ns</td>
<td>100 ns</td>
</tr>
</tbody>
</table>

Transient Diodes are used to protect semiconductor components from high-voltage transients. Their p-n junctions have a larger cross-sectional area than those of a normal diode, allowing them to conduct large currents to ground without sustaining damage.

Littelfuse supplies TVS Diodes with peak power ratings from 200 W to 30 kW, and reverse standoff voltages from 5 V to 512 V. For more information visit Littelfuse.com/solar/TVSDiodes
OVERVOLTAGE SUPPRESSION VARISTORS

Protection Application and Needs

Description:
Microprocessor-controlled inverter with the ac output synchronized to the ac grid stores energy in utility company and maximizes photovoltaic (PV) array energy output.

Threats:
• Power surges on ac or dc input and ac output
• ESD threats through the communication network

Solutions:
1. Ac Input: Fuse / MOV / GDT
2. Dc Input: Dc-rated fuse / Unidirectional TVS / MOV
3. Ac Output: Fuse / TVS / MOV
4. Local Ethernet: MLV / SPA
5. Outside Ethernet: SEP series SIDACtor® device

Example: Hybrid Solar Inverter Configuration

Varistor Products

Varistors possess characteristics that divert transient currents away from sensitive components. Littelfuse offers two types: Miniature surface mount Multi-Layer Varistors (MLVs) for small electronics applications and Metal Oxide Varistors (MOVs) for higher energy applications. For more information visit Littelfuse.com/varistor

<table>
<thead>
<tr>
<th>SERIES NAME</th>
<th>PHOTO</th>
<th>OPERATING V AC RANGE</th>
<th>OPERATING V DC RANGE</th>
<th>PEAK CURRENT RANGE (A)</th>
<th>PEAK ENERGY RANGE (J)</th>
<th>OPERATING TEMPERATURE</th>
<th>MOUNT/FORM FACTOR</th>
<th>DISC SIZE</th>
<th>AGENCY APPROVALS</th>
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<td>ML</td>
<td>![Photo]</td>
<td>2.7-107</td>
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<td>CH</td>
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<td>18-369</td>
<td>100-400</td>
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<td>369-675</td>
<td>1200</td>
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<td>RADIAL LEADED MOV</td>
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<td>UltraMOV™</td>
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<td>170-825</td>
<td>1750-10000</td>
<td>12.5-720</td>
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<td>UltraMOV™ 2SS</td>
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<td>115-750</td>
<td>150-970</td>
<td>22000</td>
<td>230-890</td>
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<td>C-III</td>
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<td>–</td>
<td>3500-9000</td>
<td>40-530</td>
<td>-55 to +85 °C</td>
<td>Radial Leaded</td>
<td>10, 14, 20 mm</td>
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<td>1200-6500</td>
<td>11-380</td>
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<td>5.5-615</td>
<td>50-6500</td>
<td>0.1-52</td>
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<td>5, 7, 14, 20 mm</td>
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<td>THERMALLY PROTECTED MOV</td>
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<td>SMOV™ 25S</td>
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<td>115-750</td>
<td>150-970</td>
<td>20000</td>
<td>170-670</td>
<td>-45 to +75 °C</td>
<td>Industrial Packaged Radial Leads</td>
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<td>SMOV™ 34S</td>
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<td>115-750</td>
<td>150-970</td>
<td>40000</td>
<td>280-1200</td>
<td>-45 to +75 °C</td>
<td>Industrial Packaged Radial Leads</td>
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<tr>
<td>TMOV® 25S</td>
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<td>115-750</td>
<td>150-970</td>
<td>20000</td>
<td>170-670</td>
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<td>25 mm</td>
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<tr>
<td>TMOV® 34S</td>
<td>![Photo]</td>
<td>115-750</td>
<td>150-970</td>
<td>40000</td>
<td>235-1050</td>
<td>-55 to +65 °C</td>
<td>Radial Leaded</td>
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<td>TMOV®/TMOV®</td>
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<td>115-750</td>
<td>150-970</td>
<td>6000-10000</td>
<td>35-480</td>
<td></td>
<td></td>
<td>14, 20 mm</td>
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</tbody>
</table>
Description
The SE-601 is a microprocessor-based ground-fault relay for ungrounded dc systems. It provides sensitive ground-fault protection without the problems associated with nuisance tripping. Ground-fault current is sensed using an SE-GRM Series Ground-Reference Module—a resistor network that limits ground-fault current to 25 mA. The SE-601 is used on ungrounded dc systems ranging from industrial 24 V dc control circuits to 1000 V dc solar and transportation systems.

Features & Benefits

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustable pickup (1-20 mA)</td>
<td>Ten settings provide a wide range of low-level protection</td>
</tr>
<tr>
<td>Adjustable time delay (50 ms - 2.5 s)</td>
<td>Adjustable trip delay allows quick protection or delayed response</td>
</tr>
<tr>
<td>Output contacts</td>
<td>Form A and Form B output contacts for operation of separate annunciation and trip circuits</td>
</tr>
<tr>
<td>Analog output [0-5 V]</td>
<td>Provides means for connecting to a meter (PGA-0500) or a control system</td>
</tr>
<tr>
<td>Non-volatile trip memory</td>
<td>Retains trip state when de-energized to simplify troubleshooting</td>
</tr>
<tr>
<td>Selectable contact operating mode</td>
<td>Selectable fail-safe or non-fail-safe operating modes allow connection to shunt or undervoltage breaker coil</td>
</tr>
<tr>
<td>Microprocessor-based</td>
<td>No calibration required saves on maintenance cost</td>
</tr>
</tbody>
</table>

Accessories

**SE-GRM Series Ground-Reference Module**
Required accessory, used to connect the SE-601 dc Ground-Fault Monitor to the dc bus.

**PGA-0500 Analog % Current Meter**
Optional panel-mounted analog meter displays ground-fault current as a percentage of 22 mA.

Specifications

- **IEEE Device Numbers**: Dc Overcurrent Relay (76G)
- **Input Voltage**: See ordering information
- **Dimensions**
  - H 75 mm (3.0”)
  - W 55 mm (2.2”)
  - D 115 mm (4.5”)
- **Trip Level Settings**: 1-20 mA
- **Trip Time Settings**: 0.05 - 2.5 s
- **Output Contacts**: Isolated Form A and Form B
- **Contact Operating Mode**: Selectable fail-safe or non-fail-safe
- **Test Button**: Local
- **Reset Button**: Local and remote
- **Analog Output**: 0-5 V
- **Conformally Coated**: Consult factory
- **Approvals**: CSA certified, UL Listed (E340889), CE (European Union), C-Tick (Australian)
- **Warranty**: 5 years
- **Mounting**: DIN, surface (standard) Panel (with PMA-55 or PMA-60 adapter)

**Ordering Information**

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>CONTROL POWER</th>
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<tbody>
<tr>
<td>SE-601-OU</td>
<td>120/240 V ac/V dc</td>
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<tr>
<td>SE-601-OD</td>
<td>12/24 V dc</td>
</tr>
<tr>
<td>SE-601-OT</td>
<td>48 V dc</td>
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</table>

<table>
<thead>
<tr>
<th>ACCESSORIES</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE-GRM SERIES</td>
<td>Required</td>
</tr>
<tr>
<td>PGA-0500</td>
<td>Optional</td>
</tr>
<tr>
<td>PMA-55</td>
<td>Optional</td>
</tr>
<tr>
<td>PMA-60</td>
<td>Optional</td>
</tr>
</tbody>
</table>

Note: For optional conformal coating please consult factory.
EL731 SERIES

Ac/Dc Sensitive Earth-Leakage Relay

Description
The EL731 is a microprocessor-based ac/dc Sensitive Earth-Leakage Relay that offers complete coverage for all frequencies from 0 to 6,000 Hz. Two CTs are required for the entire frequency range, or one CT can be used for only low- or high-frequency detection. An RTD/PTC sensor input allows over-temperature protection for a motor or drive. The EL731 offers metering, password-protected alarm and trip settings and optional network communications. It is primarily used to add low-level ground-fault protection to variable-speed drives, and to dc circuits.

Simplified Circuit Diagram

Ordering Information

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>CONTROL POWER</th>
<th>COMMUNICATIONS</th>
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</thead>
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<td>EL731-01-X0</td>
<td>120/240 V ac/V dc</td>
<td>DeviceNet*</td>
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<td>EL731-02-X0</td>
<td>120/240 V ac/V dc</td>
<td>Profibus*</td>
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<td>EL731-03-X0</td>
<td>120/240 V ac/V dc</td>
<td>EtherNet/IP*</td>
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<td>EL731-04-X0</td>
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<td>Modbus* TCP</td>
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<td>None</td>
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<td>EL731-11-X0</td>
<td>48 V dc &amp; 24 V ac</td>
<td>DeviceNet</td>
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<td>EL731-12-X0</td>
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<td>Profibus</td>
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<td>EL731-13-X0</td>
<td>48 V dc &amp; 24 V ac</td>
<td>EtherNet/IP</td>
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<td>EL731-14-X0</td>
<td>48 V dc &amp; 24 V ac</td>
<td>Modbus TCP</td>
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<td>EL731-21-X0</td>
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<td>EL731-22-X0</td>
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<td>Modbus TCP</td>
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Accessories

EFCT Series Earth-Fault Current Transformer
Required zero-sequence current transformer specifically designed for low-level detection.

AC700-CUA Series Communication Adapter
Optional network-interface and firmware-upgrade communications adapters field-install in EL731.

AC700-SMK DIN-rail & Surface-mount Adapter
EL731 plugs into adapter for back-plane mounting.

Note: When building a part number, replace the “X” with “1” for AS/NZS 2081:2011 Compliant product, “0” otherwise.

*DeviceNet, Profibus, EtherNet/IP and Modbus TCP are trademarks of their respective owners.
**SPD2 PV SERIES**

Type 2/Type 1CA Pluggable Multi-Pole for PV Systems

**Description**

Surge protection devices (SPDs) provide equipment protection from transient overvoltage events lasting micro-seconds. By limiting the overvoltage to the equipment during these events, costly damage and downtime can be mitigated.

The surge protection devices for solar string box and inverter applications are available in 1100 and 1500 V dc in the 3+0 configuration.

**Features & Benefits**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability to clamp and withstand high-energy transients</td>
<td>Ensures low-residual voltage during high-energy surge events and higher nominal discharge current to prevent disruption, downtime, and degradation or damage to equipment</td>
</tr>
<tr>
<td>No additional overcurrent protection devices required in UL applications</td>
<td>Reduces the number of components and costs required for protection</td>
</tr>
<tr>
<td>Compact footprint</td>
<td>Increases panel design flexibility</td>
</tr>
<tr>
<td>Visual life indicator</td>
<td>Quick visual determines module replacement status to avoid loss of protection</td>
</tr>
<tr>
<td>Pluggable modules</td>
<td>Fast and simple to replace, minimizing maintenance and downtime. No tools required</td>
</tr>
<tr>
<td>Thermal protection</td>
<td>Eliminates catastrophic failure</td>
</tr>
<tr>
<td>IP20 protection rating</td>
<td>Finger-safe design increases worker protection</td>
</tr>
</tbody>
</table>

**Internal Configuration**

![Internal Configuration Diagram]

**Legend**

- Protective Earth
- RC Optional Remote Contact
- TD Thermal Disconnection

**Module & Base Ordering Information**

<table>
<thead>
<tr>
<th>Ordering Number</th>
<th>IEC Electrical</th>
<th>UL Electrical</th>
<th>Single Unit Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Continuous Operating DC Voltage (U_{CPV})</td>
<td>Nominal Discharge Current (8/20 µs) (I_{n})</td>
<td>Maximum Discharge Current (8/20 µs) (I_{max})</td>
</tr>
<tr>
<td>SPD2-PV11-3P0-R</td>
<td>1100 V</td>
<td>20 kA</td>
<td>40 kA</td>
</tr>
<tr>
<td>SPD2-PV15-3P0-R</td>
<td>1500 V</td>
<td>15 kA</td>
<td>40 kA</td>
</tr>
</tbody>
</table>
Module & Base Part Numbering System

SPD2 PV VV X XPZ R
- Series: SPD2
- Photovoltaic: PV
- Optional Remote Contact
- Neutral: (1=yes or 0=no)
- Number of Poles

Module Only Part Numbering System

SPD2 PV VV M
- Series: SPD2
- Photovoltaic: PV
- Module Only
- DC Voltage

Replacement Module Ordering Information

<table>
<thead>
<tr>
<th>Ordering Number</th>
<th>IEC Electrical</th>
<th>UL Electrical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Continuous Operating DC Voltage (U_{CPV})</td>
<td>Nominal Discharge Current (8/20 µs) (I_{n})</td>
</tr>
<tr>
<td>SPD2-PV550-M</td>
<td>1100 V</td>
<td>20 kA</td>
</tr>
<tr>
<td>SPD2-PV750-M</td>
<td>1500 V</td>
<td>15 kA</td>
</tr>
</tbody>
</table>

Specifications

- Mode of Protection: ( + ) - PE, ( - ) - PE, ( + ) - ( - )
- Nominal Discharge Current (8/20 µs) (I_{n}): 20 kA
- Maximum Discharge Current (8/20 µs) (I_{max}): Up to 40 kA
- Protective Elements: High Energy MOV
- Response Time (t_{A}): < 25 ns
- Number of Poles: 1

Operating State/Fault Indication
- Green Flag/No Green Flag

Remote Contact Switching Capacity
- AC: 250 V/1 A, 125 V/1 A
- DC: 48 V/0.5 A, 24 V/0.5 A, 12 V/0.5 A

Remote Contact Conductor Cross Section (max): 1.5 mm² (16 AWG) (Solid)

Standards Passed
- UL 1449 4th Edition; E320116

Product Dimensions

3TE Module and Base: H 90.7 mm (3.57”); W 53.8 mm (2.11”);
D 66.1 mm (2.60”)
1TE Replacement Module: H 45.0 mm (1.77”); W 18.0 mm (0.71”);
D 57.2 mm (2.25”)

Package Dimensions

3TE Module and Base: H 102.0 mm (4.01”); W 64.0 mm (2.52”);
D 110.0 mm (4.33”)
1TE Replacement Module: H 102.0 mm (4.01”); W 28.0 mm (1.10”);
D 110.0 mm (4.33”)

Solar-Rated Products by Application

With over 25 million devices installed in photovoltaic power systems, Littelfuse understands the global challenges of the solar market. Littelfuse offers numerous circuit-protection products that are uniquely suited to protect the equipment and systems subject to the harsh environments of standard photovoltaic installations.

Look for this logo to indicate products that are used in solar applications. Visit our website Littelfuse.com/Solar for the latest updates on approvals, certifications, and new products.

Protection Relays & Controls Catalog (PF130N)
The comprehensive line of electronic and microprocessor-based protection relays, timers, and fashers safeguard equipment and personnel to prevent expensive damage, downtime or injury due to electrical faults.

Fuses & Fuse Holders Catalog (PF101N)
Littelfuse offers a complete circuit-protection portfolio of industrial power fuses, including time-saving indication products for an instant visual blown-fuse identification.

Surge Protection Devices Catalog (PF612)
These surge protection devices safeguard components from transient overvoltage or surges.

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