

Description

The SPCL3 series of high power TVS diode is specially designed for meeting severe surge test environment of both AC and DC line protection applications. It features a very fast response and ultra low clamping characteristics over traditional metal oxide varistor (MOV) solutions. They can be connected in series and / or parallel to create a very high surge current protection solution.

Applications

- Communication Equipment
- Security & Protection
- Industrial Control Equipment
- Power Supply
- Automotive Electronics
- New Energy
- Surge Protection

Features

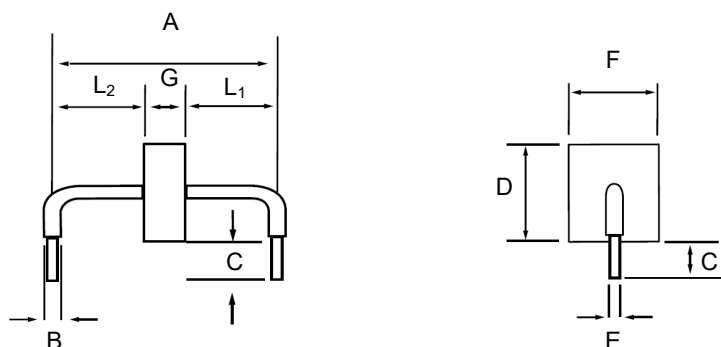
- Very low clamping voltage
- Sharp breakdown voltage
- Low slope resistance
- Bi-directional
- Snapback technology for superior clamping factor
- Symmetric in leads width for easier soldering during assembly
- IEC-61000-4-2 ESD 30 kV (Air), 30 kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Surge protection of lightning in accordance with IEC61000-4-5
- Halogen-free
- RoHS compliant
- Glass passivated junction
- Pb-free E4 means 2nd level interconnect is Pb-free and the terminal finish material is Silver

Functional Diagram



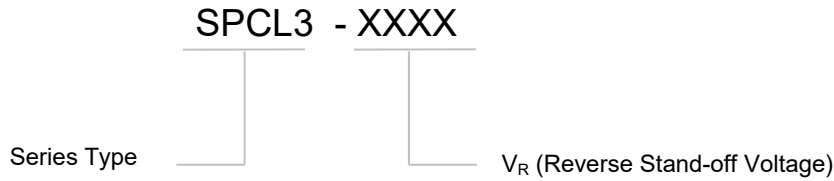
Bi-Directional

Package Outline Dimensions

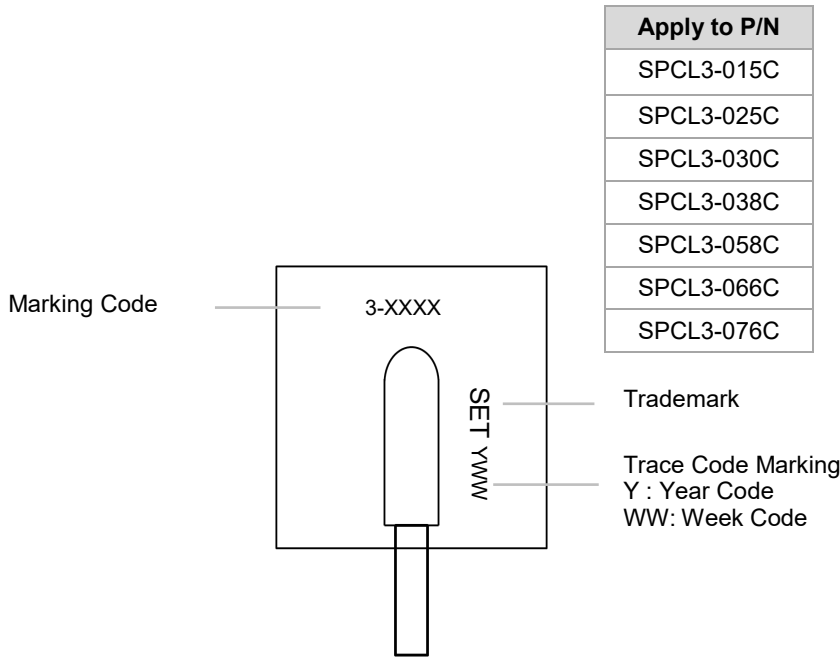


| Symbol | | Millimeters | Inches |
|---------------------------------|-----------------------|--|---------------|
| A | | 24.15 ± 1.00 | 0.951 ± 0.040 |
| B | | 2.50 ± 0.70 | 0.100 ± 0.028 |
| C | | 6.00 ± 1.00 | 0.236 ± 0.039 |
| | -208C | 3.68 ± 1.00 | 0.145 ± 0.040 |
| D | | 11.00 max. | 0.433 max. |
| E | | 1.28 ± 0.05 | 0.051 ± 0.002 |
| F | | 9.50 max. | 0.374 max. |
| G | -015C / -025C | 2.36 ± 1.00 | 0.093 ± 0.039 |
| | -030C / -038C | 3.30 ± 1.20 | 0.130 ± 0.047 |
| | -058C / -066C / -076C | 4.27 ± 1.20 | 0.168 ± 0.047 |
| | -150C | 9.72 ± 1.20 | 0.383 ± 0.047 |
| | -170C / -190C | 10.67 ± 1.20 | 0.420 ± 0.047 |
| | -208C | 9.10 ± 1.20 | 0.358 ± 0.047 |
| | -300C | 11.80 ± 1.20 | 0.465 ± 0.047 |
| | -380C / -430C | 13.50 ± 1.20 | 0.531 ± 0.047 |
| L ₁ / L ₂ | | L ₁ = L ₂ Tolerance ± 1.20 mm (0.047 inch) | |

Part Numbering System

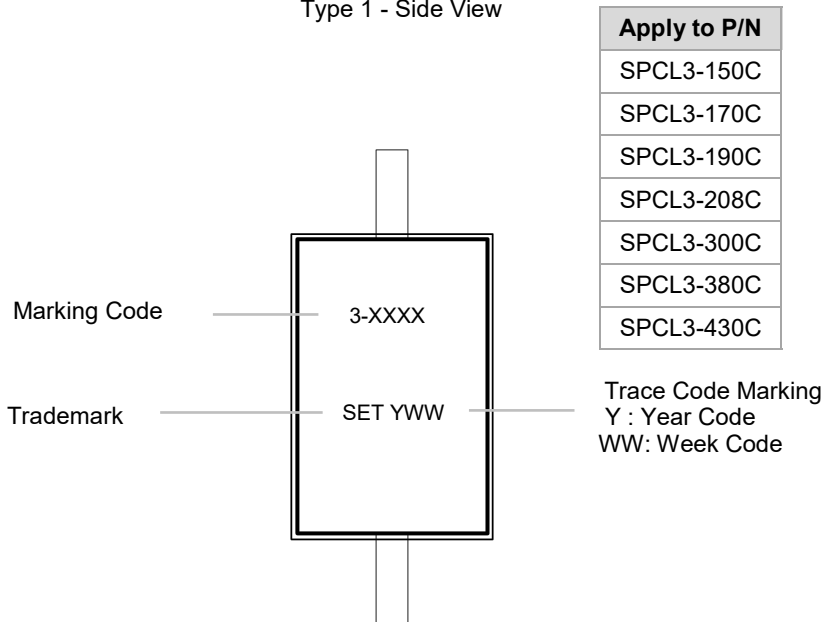


Marking



| Apply to P/N |
|--------------|
| SPCL3-015C |
| SPCL3-025C |
| SPCL3-030C |
| SPCL3-038C |
| SPCL3-058C |
| SPCL3-066C |
| SPCL3-076C |

Type 1 - Side View



| Apply to P/N |
|--------------|
| SPCL3-150C |
| SPCL3-170C |
| SPCL3-190C |
| SPCL3-208C |
| SPCL3-300C |
| SPCL3-380C |
| SPCL3-430C |

Type 2 - Top View

Electrical Characteristics (T_A = 25 °C unless otherwise noted)

| Part Number | Device Marking Code | Breakdown Voltage V _{BR@IT} | | Test Current I _T | Stand-off Voltage V _R | Max. Reverse Leakage I _{R@V_R} | Typical I _R @85°C | Max. Clamping Voltage V _{CL@I_{pp}} Peak Pulse Current (I _{pp}) (Note 1) | | Max. Temp Coefficient OF V _{BR} | Typ. Capacitance 0 Bias 10kHz |
|--------------|---------------------|--------------------------------------|-------|-----------------------------|----------------------------------|---|------------------------------|---|---------------------|--|-------------------------------|
| | | Min | Max | | | | | I _{pp} (A) | V _{CL} (V) | | |
| | | (V) | | | | | | | | | |
| SPCL3 - 015C | 3 - 015C | 16.0 | 19.0 | 10 | 15 | 10 | 15 | 3000 | 28 | 0.1 | 12.0 |
| SPCL3 - 025C | 3 - 025C | 28.0 | 31.0 | 10 | 25 | 10 | 15 | 3000 | 50 | 0.1 | 11.0 |
| SPCL3 - 030C | 3 - 030C | 32.0 | 37.0 | 10 | 30 | 10 | 15 | 3000 | 58 | 0.1 | 11.0 |
| SPCL3 - 038C | 3 - 038C | 40.0 | 46.0 | 10 | 38 | 10 | 15 | 3000 | 95 | 0.1 | 10.0 |
| SPCL3 - 058C | 3 - 058C | 64.0 | 70.0 | 10 | 58 | 10 | 15 | 3000 | 110 | 0.1 | 6.0 |
| SPCL3 - 066C | 3 - 066C | 72.0 | 80.0 | 10 | 66 | 10 | 15 | 3000 | 120 | 0.1 | 6.0 |
| SPCL3 - 076C | 3 - 076C | 85.0 | 95.0 | 10 | 76 | 10 | 15 | 3000 | 140 | 0.1 | 6.0 |
| SPCL3 - 150C | 3 - 150C | 158.0 | 194.0 | 10 | 150 | 10 | 15 | 3000 | 230 | 0.1 | 2.6 |
| SPCL3 - 170C | 3 - 170C | 179.0 | 220.0 | 10 | 170 | 10 | 15 | 3000 | 260 | 0.1 | 2.4 |
| SPCL3 - 190C | 3 - 190C | 200.0 | 245.0 | 10 | 190 | 10 | 15 | 3000 | 290 | 0.1 | 2.4 |
| SPCL3 - 208C | 3 - 208C | 223.0 | 246.0 | 10 | 208 | 10 | 15 | 3000 | 306 | 0.1 | 2.4 |
| SPCL3 - 300C | 3 - 300C | 330.0 | 366.0 | 10 | 300 | 10 | 15 | 3000 | 470 | 0.1 | 2.4 |
| SPCL3 - 380C | 3 - 380C | 401.0 | 443.0 | 10 | 380 | 10 | 15 | 3000 | 520 | 0.1 | 2.0 |
| SPCL3 - 430C | 3 - 430C | 440.0 | 490.0 | 10 | 430 | 10 | 15 | 3000 | 625 | 0.1 | 2.0 |

Note:
Using 8 / 20 μs wave shape as defined in IEC 61000-4-5.

Maximum Ratings and Characteristics

(T_A = 25 °C unless otherwise specified.)

| Parameter | Symbol | Value | Unit |
|--------------------------------------|------------------|------------|------|
| Operating Storage Temperature Range | T _{STG} | -55 to 150 | °C |
| Operating Junction Temperature Range | T _J | -55 to 125 | °C |
| Current Rating (Note 1) | I _{pp} | 3 | KA |

Note:
Rated I_{pp} measured with 8/20 μs pulse.

Ratings and Characteristic Curves ($T_A = 25^\circ\text{C}$ unless otherwise noted)

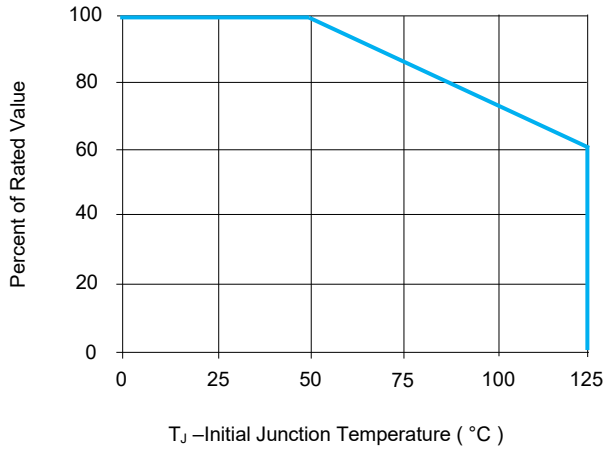


FIGURE 1 Peak Pulse Power Derating Curve

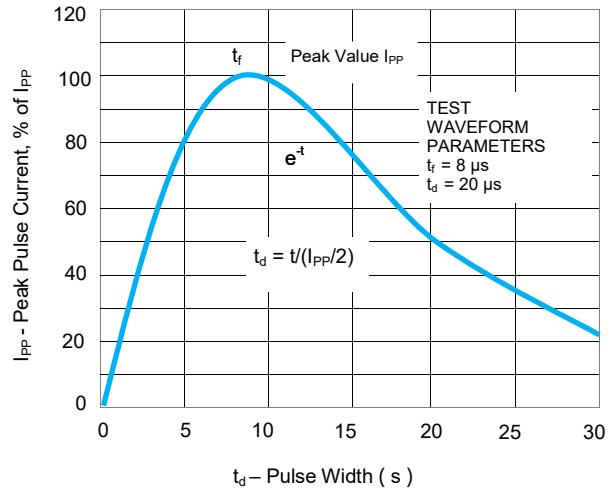


FIGURE 2 Pulse Waveform

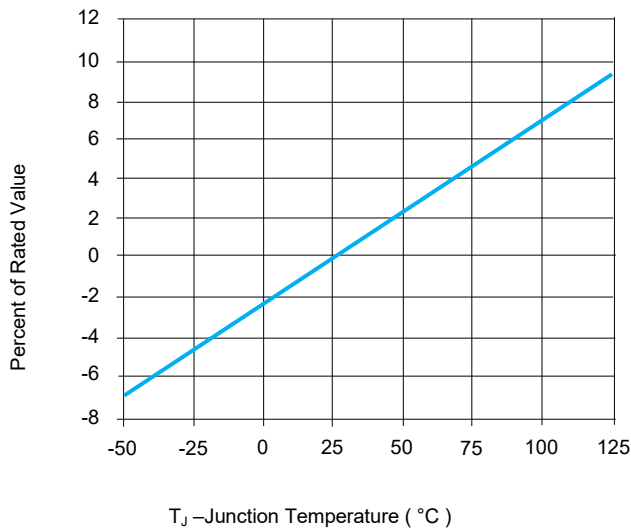


FIGURE 3 Typical V_{BR} Vs Junction Temperature

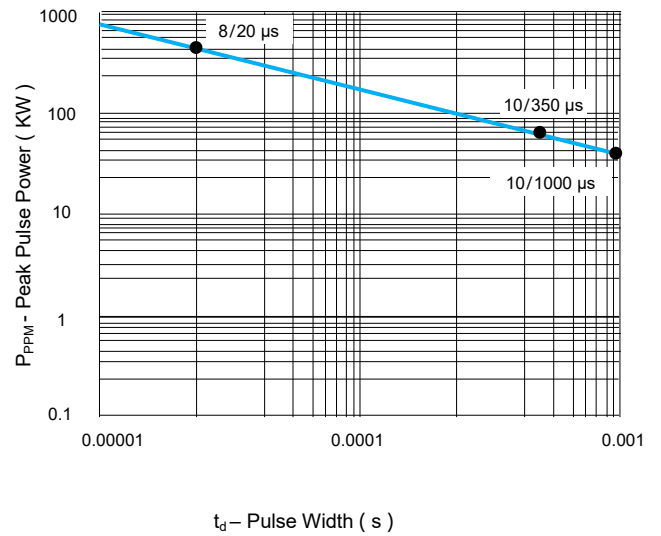
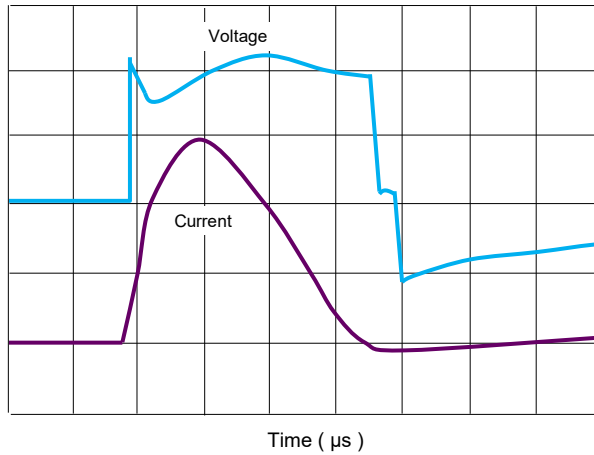


FIGURE 4 Peak Pulse Power Rating Curve



Note: The power dissipation causes a change in avalanche voltage during the surge and the avalanche voltage eventually returns to the original value when the transient has passed.

FIGURE 5 Surge Response (8/20 Surge current waveform)

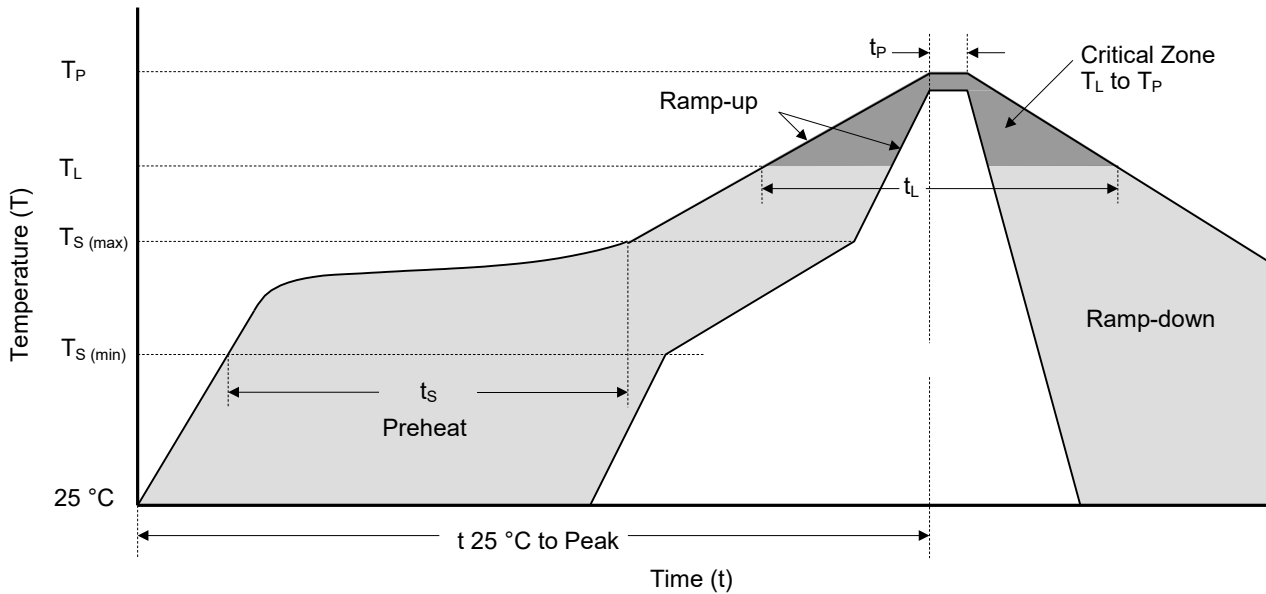
Flow/Wave Soldering (Solder Dipping)

Physical Specifications

| | |
|-------------------------|-------------------|
| Peak Temperature | 260 °C +0 / -5 °C |
| Dipping Time | 10 seconds |
| Soldering Number | 1 time |

| | |
|-----------------|---|
| Weight | Contact manufacturer |
| Case | Epoxy encapsulated |
| Terminal | Silver plated leads, solderable per MIL-STD-750 Method 2026 |

Soldering Parameters



Reflowing Condition

| Reflow Soldering Parameters | | Lead-Free Assembly |
|--|-----------------------------------|-------------------------|
| Pre-heat | Temperature Min ($T_{S (min)}$) | 150 °C |
| | Temperature Max ($T_{S (max)}$) | 200 °C |
| | Time (min to max) (t_s) | 60 ~ 120 seconds |
| Average Ramp Up Rate (Liquidus Temp (T_L) to Peak) | | 3 °C / second max. |
| $T_{S (max)}$ to T_L Ramp-up Rate | | 3 °C / second max. |
| Reflow | Temperature (T_L) (Liquidus) | 217 °C |
| | Time (min to max) (t_L) | 60 ~ 150 seconds |
| Peak Temperature (T_P) | | 260 ^{+0/-5} °C |
| Time of within 5 °C of Actual Peak Temperature (t_p) | | 20 ~ 40 seconds |
| Ramp-down Rate | | 6 °C / second max. |
| Time from 25 °C to Peak Temperature | | 8 Minutes max. |
| Do Not Exceed | | 260 °C |

Packaging Information

| Part Number | Package | Quantity | Packaging Option |
|---------------|--------------|--------------------|------------------|
| SPCL3-XXXX | SPCL Package | 56 PCS / Inner Box | Bulk |
| SPCL3-XXXX-12 | SPCL Package | 12 PCS / Inner Box | Bulk |

Glossary

| Item | Description |
|------------------|--|
| V_C | Clamping Voltage Voltage across TVS in a region of low differential resistance that serves to limit the voltage across the device terminals. |
| V_R | Reverse Stand-off Voltage Maximum voltage that can be applied to the TVS without operation. NOTE : It is also shown as V_{WM} (maximum working voltage (maximum d.c. voltage)) and known as rated stand-off voltage (V_{SO}). |
| I_R | Reverse Leakage Current Current measured at V_R . NOTE : Also shown as I_D for stand-by current. |
| V_{BR} | Breakdown Voltage Voltage across TVS at a specified current I_T in the breakdown region. |
| I_{PPM} | Rated Random Recurring Peak Impulse Current Maximum-rated value of random recurring peak impulse current that may be applied to a device. |
| $P_{M(AV)}$ | Rated Average Power Dissipation Maximum-rated value of power dissipation resulting from all sources, including transients and standby current, averaged over a short period of time. |
| P_{PPM} | Rated Random Recurring Peak Impulse Power Dissipation Maximum-rated value of the product of rated random recurring peak impulse current (I_{PPM}) multiplies by specified maximum clamping voltage (V_C). |
| C_J | Capacitance Capacitance across the TVS measured at a specified frequency and voltage. |
| V_{FS} | Peak Forward Surge Voltage Peak voltage across an TVS for a specified forward surge current (I_{FS}) and time duration. NOTE : Also shown as V_F . |
| I_{FS} | Forward Surge Current Pulsed current through TVS in the forward conducting region. NOTE : Also shown as I_F . |
| $\alpha_{V(BR)}$ | Temperature Coefficient of Breakdown Voltage The change of breakdown voltage divided by the change of temperature. |
| I_{PP} | Peak pulse Current Peak pulse current value applied across the TVS to determine the clamping voltage V_C for a specified wave shape. |
| I_T | Pulsed D.C. Test Current Test current for measurement of the breakdown voltage V_{BR} . This is defined by the manufacturer and usually given in milliamperes with a pulse duration of less than 40 ms. NOTE : Also shown as I_{BR} . |

—(GB-T 18802.321 / IEC 61643-321 / JESD210A)



ATTENTION

Usage

1. TVS must be operated in the specified ambient temp.
2. Do not clean the TVS with strong polar solvent such as ketone, esters, benzene and halogenated hydrocarbon, to avoid damaging the encapsulating layer.
3. Please do not apply severe vibration, shock or pressure to TVS, to avoid element cracking.

Replacement

1. If TVS is visually damaged, please replace it.
2. TVS is a non-repairable product. For safety sake, please use equivalent TVS for replacement.

Storage

1. Storage Temp. Range: (-55 to 150) °C.
2. Do not store the TVS at the high temp., high humidity or corrosive gas environment, to avoid influencing the solder-ability of the lead wires. The product shall be used up within 1 year after receiving the goods.

Environmental Conditions

1. TVS should not be exposed to the open air, nor direct sunshine.
2. TVS should avoid rain, water vapor or other condition of high temp. and high humidity.
3. TVS should avoid sand dust, salt mist, or other harmful gases.

Max. Typical Capacitance of TVS

The typical capacitance of TVS is listed in the specifications. Designers may refer to it when designing TVS in High frequency circuit.

Installation Mechanical Stress

1. Do not knock TVS when installing, to avoid mechanical damage.
2. Please do not apply severe vibration, shock or pressure to TVS, to avoid surface resin or element cracking.