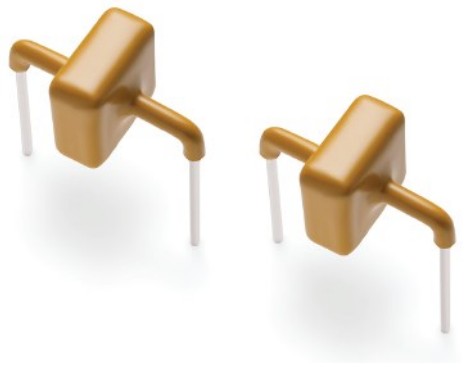
TVS Diodes

Transient Voltage Suppression Diodes

SPCL3 Series (3 kA)



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.

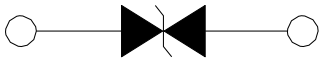
Applications

- 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

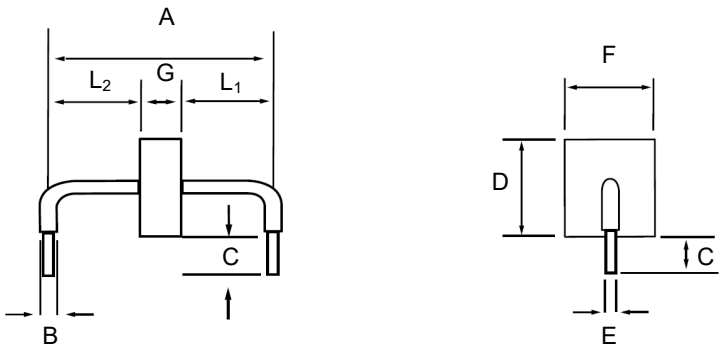
Functional Diagram



Bi-Directional

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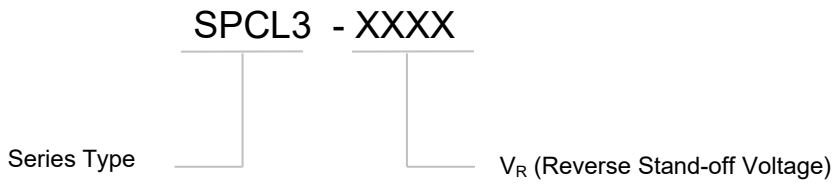
Package Outline Dimensions



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
	-240C	11.50 ± 1.20	0.453 ± 0.047
	-300C	11.80 ± 1.20	0.465± 0.047
	-380C / -430C	13.50 ± 1.20	0.531 ± 0.047
	-470C	14.60 ± 1.20	0.575 ± 0.047
	-530C	16.80 ± 1.20	0.661 ± 0.047
	-560C	17.50 ± 1.20	0.689 ± 0.047
L_1 / L_2		L_1 = L_2 Tolerance ± 1.20 mm (0.047 inch)	

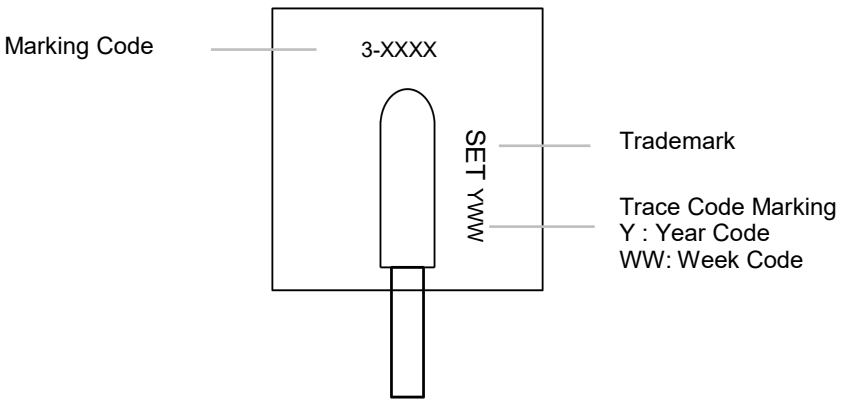
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Part Numbering System



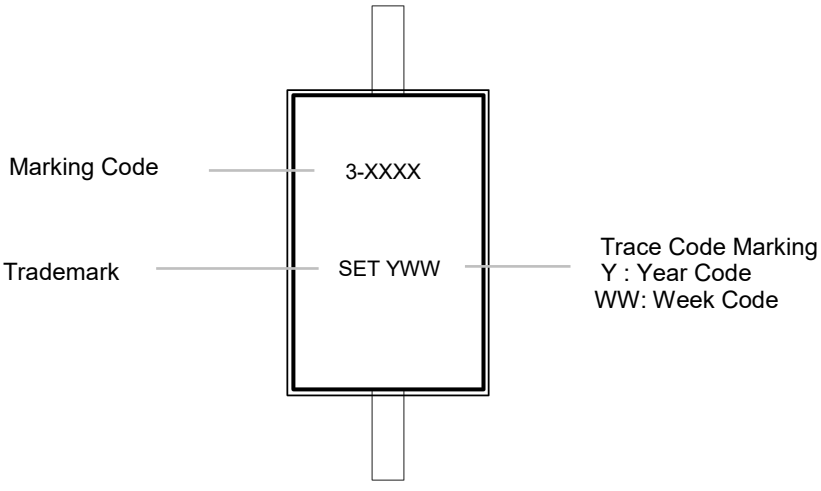
Marking

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
SPCL3-240C
SPCL3-300C
SPCL3-380C
SPCL3-430C
SPCL3-470C
SPCL3-530C
SPCL3-560C



Type 2 - Top View

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

Part Number	Device Marking Code	Breakdown Voltage V_{BR}@I_T		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								
		(V)		(mA)	(V)	(μA)	(μA)	I_{PP}(A)	V_{CL}(V)	(%/°C)	(nF)
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 - 240C	3 - 240C	250.0	285.0	10	240	10	15	3000	340	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
SPCL3 - 470C	3 - 470C	470.0	540.0	10	470	10	15	3000	680	0.1	1.5
SPCL3 - 530C	3 - 530C	558.0	620.0	10	530	10	15	3000	725	0.1	1.0
SPCL3 - 560C	3 - 560C	585.0	650.0	10	560	10	15	3000	790	0.1	1.0

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

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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 °C unless otherwise noted)

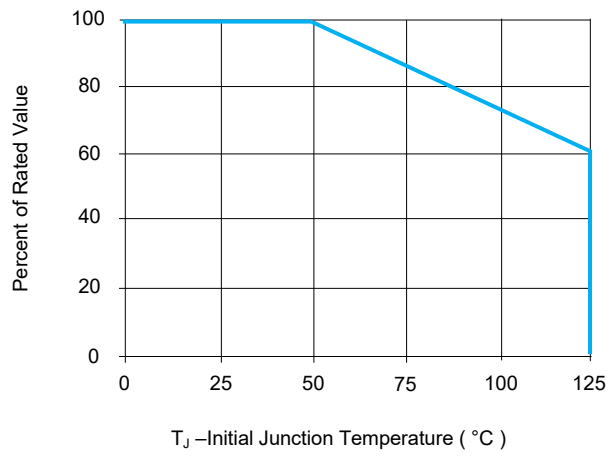


FIGURE 1 Peak Pulse Power Derating Curve

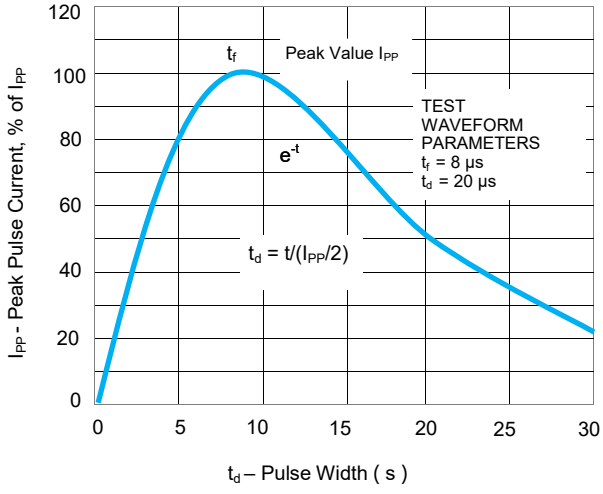


FIGURE 2 Pulse Waveform

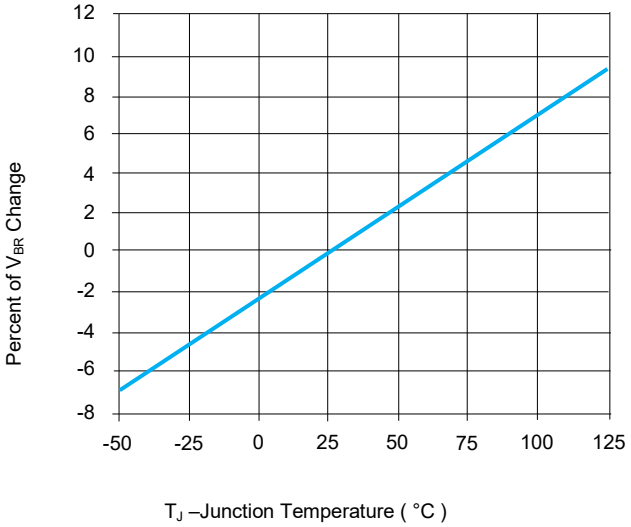


FIGURE 3 Typical V_{BR} Vs Junction Temperature

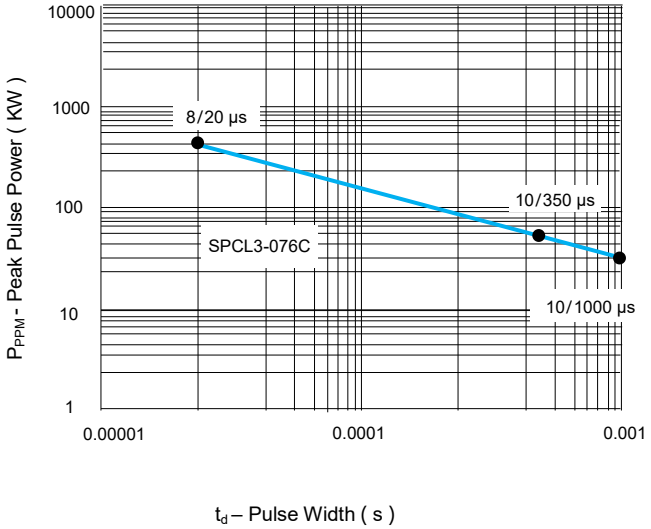
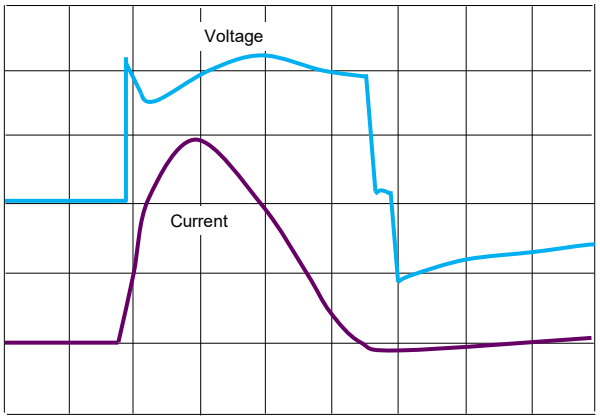


FIGURE 4 Peak Pulse Power Rating Curve

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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)

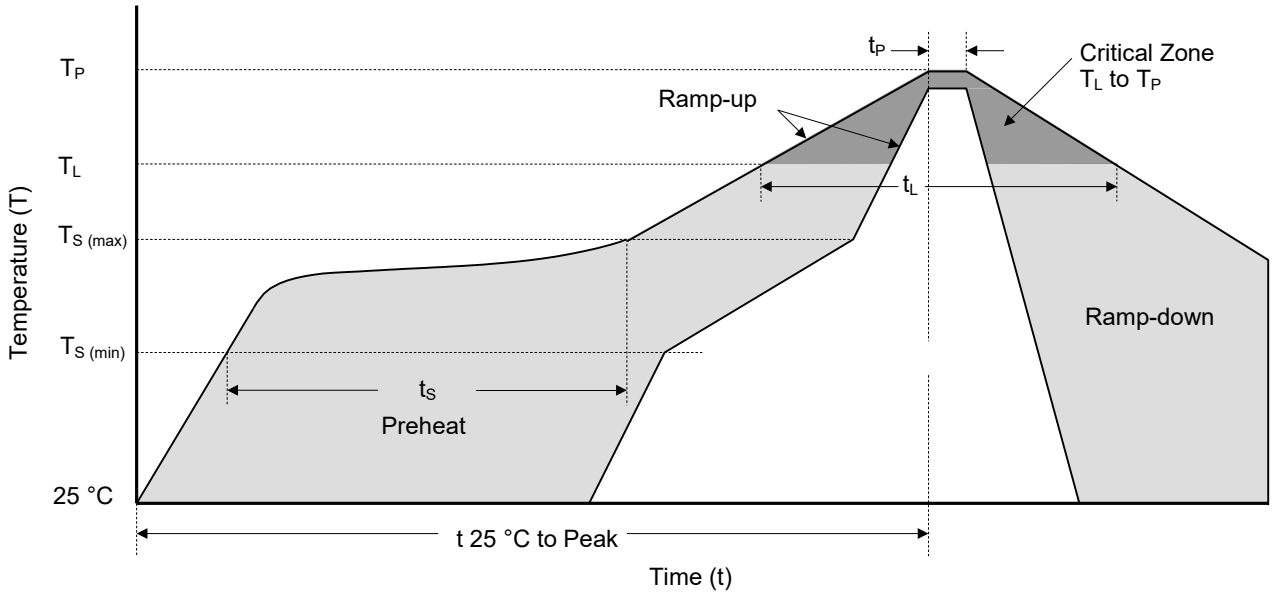
Peak Temperature	260 °C +0 / -5 °C
Dipping Time	10 seconds
Soldering Number	1 time

Physical Specifications

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

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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 (TL) 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

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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)

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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.

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