

TVS

TVS

概述 Description

SPCL3系列高功率TVS二极管是专门为满足交直流线路保护应用的浪涌试验环境而设计的。与传统的金属氧化物(MOV)解决方案相比，它具有非常快的响应和超低箝位性能。将其串并联进行使用可作为超高浪涌的保护方案。

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.

应用 Applications

- | | |
|---------|------------------------------|
| ● 通信设备 | Communication Equipment |
| ● 安防 | Security & Protection |
| ● 工控设备 | Industrial Control Equipment |
| ● 电源 | Power Supply |
| ● 汽车电子 | Automotive Electronics |
| ● 新能源设备 | New Energy |
| ● 防雷保护 | Lightning Protection |

功能图 Functional Diagram

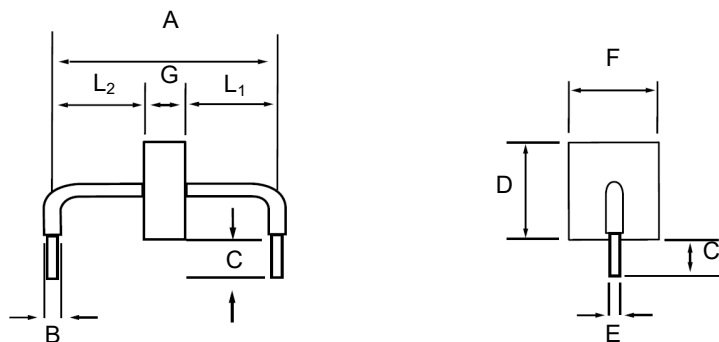


双向 Bi-Directional

特性 Features

- 极低的箝位电压
- 急速击穿响应
- 低斜率电阻
- 双向
- 采用叠层技术具有优异的箝位因子
- 引脚宽度对称，便于组装焊接
- IEC 61000-4-2 防静电：30 kV(空气放电),30 kV (接触放电)
- 符合IEC 61000-4-2标准的数据线路的ESD保护
- 符合IEC 61000-4-4标准的数据线路的EFT保护
- 无卤素
- 符合RoHS指令
- 玻璃钝化保护工艺
- 无铅E4：二级互连引线无铅，端子镀银
- 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 15 kV (Air), 8 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
- Halogen-free
- RoHS compliant
- Glass passivated junction
- Pb-free E4 means 2nd level interconnect is Pb-free and the terminal finish material is Silver

封装尺寸 Package Outline Dimensions



符号 Symbol	公制(毫米) Millimeters	英制(英寸) 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	11.0 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	13.90 ± 1.20	0.547 ± 0.047
	-430C	14.80 ± 1.20	0.583 ± 0.047
L ₁ / L ₂	L ₁ = L ₂ Tolerance ± 1.20 mm (0.047 inch)		

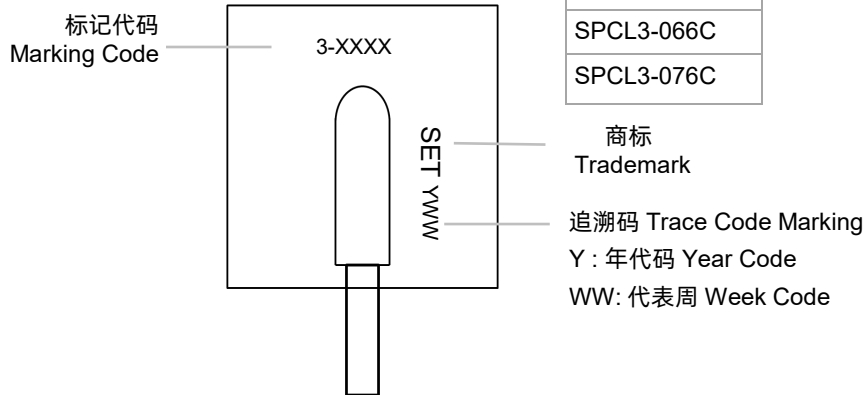
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型号规则 Part Numbering System

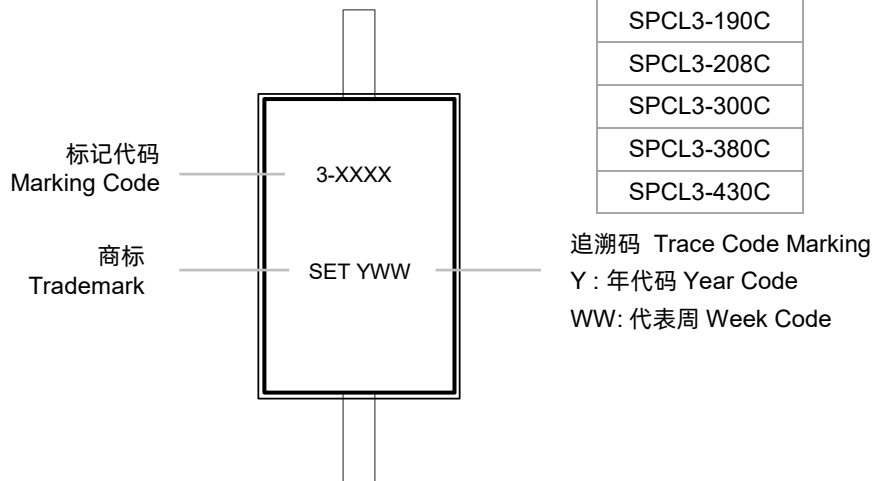


标记 Marking



适用于下列 P/N Apply to P/N
SPCL3-015C
SPCL3-025C
SPCL3-030C
SPCL3-058C
SPCL3-066C
SPCL3-076C

类型1 - 侧视图 Type 1 - Side View



适用于下列 P/N Apply to P/N
SPCL3-150C
SPCL3-170C
SPCL3-190C
SPCL3-208C
SPCL3-300C
SPCL3-380C
SPCL3-430C

类型2 - 俯视图 Type 2 - Top View

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术语 Glossary

项目 Item	描述 Description
V_C	箝位电压 Clamping Voltage TVS在低差阻区域内的电压，用于限制设备两端的电压。 Voltage across TVS in a region of low differential resistance that serves to limit the voltage across the device terminals.
V_R	反向关断电压 Reverse Stand-off Voltage TVS 在没有导通状态下最高电压。 Maximum voltage that can be applied to the TVS without operation. 注：也用 V_{WM} （最高直流工作电压）表示，也称为截止电压(V_{SO})。 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	反向漏电流 Reverse Leakage Current 量测 V_R 的电流。 Current measured at V_R . 注：也用 I_D 待机电流表示。 NOTE : Also shown as I_D for stand-by current.
V_{BR}	击穿电压 Breakdown Voltage 在击穿区以指定电流 I_T (测试电流)通过TVS的电压。 Voltage across TVS at a specified current I_T (test current) in the breakdown region.
I_{PPM}	额定随机重复峰值脉冲电流 Rated Random Recurring Peak Impulse Current 施加在设备上的随机重复峰值脉冲电流的最大额定值。 Maximum-rated value of random recurring peak impulse current that may be applied to a device.
$P_{M(AV)}$	额定平均功率 Rated Average Power Dissipation 所有电源(包括瞬态电流和待机电流)在短时间内平均产生的最大额定功耗。 Maximum-rated value of power dissipation resulting from all sources, including transients and standby current, averaged over a short period of time.
P_{PPM}	额定随机重复峰值脉冲功率 Rated Random Recurring Peak Impulse Power Dissipation 额定随机重复峰值脉冲电流(I_{PPM}) 和规定的最大箝位电压(V_C)乘积的最大额定值。 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	电容 Capacitance 在规定的频率和电压下所测量的TVS电容。 Capacitance across the TVS measured at a specified frequency and voltage.

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

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

SPCL3 Series (3 kA)

项目 Item	描述 Description
V_{FS}	<p>正向浪涌峰值电压 Peak Forward Surge Voltage</p> <p>在指定的正向浪涌电流(I_{FS})和持续时间下, 通过TVS的峰值电压。 Peak voltage across TVS for a specified forward surge current (I_{FS}) and time duration. 注: 也用V_F表示。 NOTE : Also shown as V_F.</p>
I_{FS}	<p>正向浪涌电流 Forward Surge Current</p> <p>在正向导通区域通过TVS的脉冲电流。 Pulsed current through TVS in the forward conducting region. 注: 也用I_F表示。 NOTE : Also shown as I_F.</p>
$\alpha_{V(BR)}$	<p>击穿电压温度系数 Temperature Coefficient of Breakdown Voltage</p> <p>击穿电压的变化与温度变化的比值。 The change of breakdown voltage divided by the change of temperature.</p>
I_{PP}	<p>峰值脉冲电流 Peak pulse Current</p> <p>施加在TVS上的峰值脉冲电流, 以确定箝位电压V_C的特定波形。 Peak pulse current value applied across the TVS to determine the clamping voltage V_C for a specified wave shape.</p>
I_T	<p>脉冲直流测试电流 Pulsed D.C. Test Current</p> <p>测量击穿电压V_{BR}的测试电流。该电流值由制造商确定, 通常以脉冲持续时间小于40 ms的毫安级电流给出。 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. 注: 也用I_{BR}表示。 NOTE : Also shown as I_{BR}.</p>

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

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

SPCL3 Series (3 kA)

电气特性 (除另有注释, 默认 $T_A=25^\circ\text{C}$)

Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted) Table 1

型号 Part Number	标记代码 Device Marking Code	击穿电压 Breakdown Voltage $V_{BR@I_T}$		测试电流 Test Current I_T	反向关断 电压 Stand-off Voltage V_R	最大反向 漏电流 Max. Reverse Leakage $I_R@V_R$	典型漏 电流 Typical $I_R@85^\circ\text{C}$	最大箝位电压 Max. Clamping Voltage $V_{CL}@I_{PP}$ Peak Pulse Current (I_{PP}) (Note 1)		最大 V_{BR} 温度系数 Max. Temp Coefficient OF V_{BR}	最大电容值 Max. Capacitance 0 Bias 10kHz
		Min	Max					I_{PP} (A)	V_{CL} (V)		
		(V)									
SPCL3 - 015C	3 - 015C	16	19	10	15	10	15	3,000	28	0.1	12.0
SPCL3 - 025C	3 - 025C	28	31	10	25	10	15	3000	50	0.1	11.0
SPCL3 - 030C	3 - 030C	32	37	10	30	10	15	3,000	58	0.1	11.0
SPCL3 - 038C	3 - 038C	40	46	10	38	10	15	3,000	95	0.1	10.0
SPCL3 - 058C	3 - 058C	64	70	10	58	10	15	3,000	110	0.1	6.0
SPCL3 - 066C	3 - 066C	72	80	10	66	10	15	3,000	120	0.1	6.0
SPCL3 - 076C	3 - 076C	85	95	10	76	10	15	3,000	140	0.1	6.0
SPCL3 - 150C	3 - 150C	158	194	10	150	10	15	3,000	230	0.1	2.6
SPCL3 - 170C	3 - 170C	179	220	10	170	10	15	3,000	260	0.1	2.4
SPCL3 - 190C	3 - 190C	200	245	10	190	10	15	3,000	290	0.1	2.4
SPCL3 - 208C	3 - 208C	223	246	10	208	10	15	3,000	306	0.1	2.4
SPCL3 - 300C	3 - 300C	330	366	10	300	10	15	3000	470	0.1	2.4
SPCL3 - 380C	3 - 380C	401	443	10	380	10	15	3,000	520	0.1	2.0
SPCL3 - 430C	3 - 430C	440	490	10	430	10	15	3,000	625	0.1	2.0

注释Note:

- 1.采用IEC 61000-4-5定义的8/20 μs 波形。
Using 8/20 μs wave shape as defined in IEC 61000-4-5.

额定参数与特性 (除有另外注释, 默认 $T_A=25^\circ\text{C}$)

Maximum Ratings and Thermal Characteristics ($T_A=25^\circ\text{C}$ unless otherwise specified.)

参数 Parameter	符号 Symbol	值 Value	单位 Unit
储存温度范围 Operating Storage Temperature Range	T_{STG}	-55 to 150	$^\circ\text{C}$
工作结温范围 Operating Junction Temperature Range	T_J	-55 to 125	$^\circ\text{C}$
额定电流(注释1) Current Rating (Note 1)	I_{PP}	3	KA

额定性能曲线 (除有另外注释, 默认 $T_A=25\text{ }^\circ\text{C}$)

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

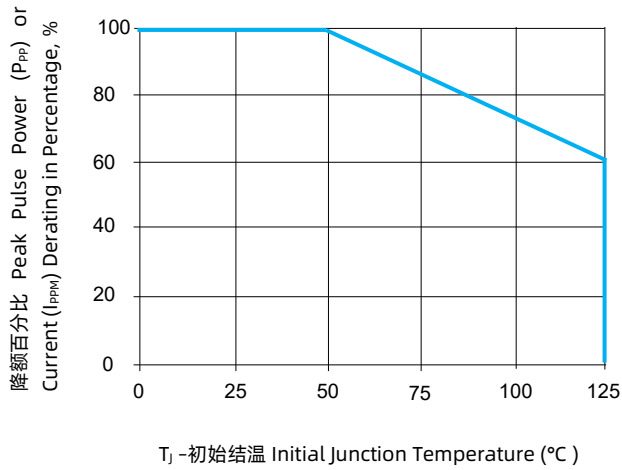


FIGURE 1 峰值脉冲功率降额曲线
Peak Power Derating

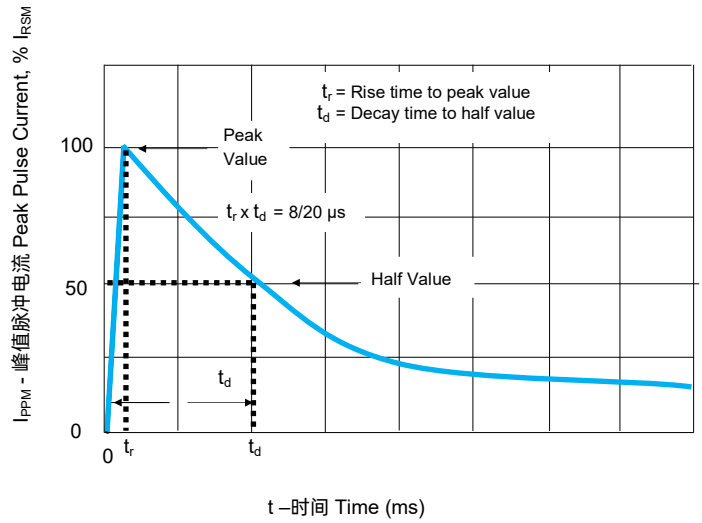
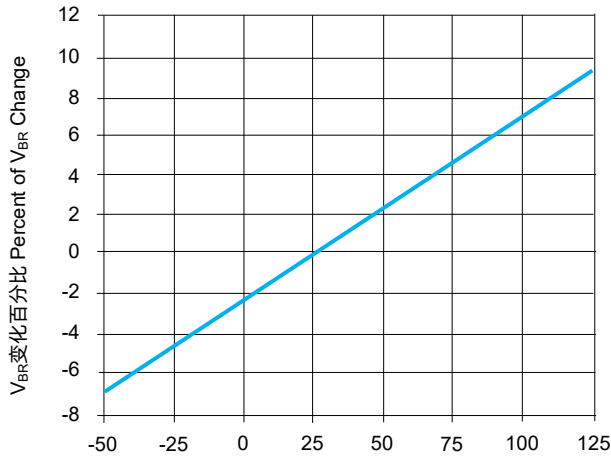


FIGURE 2 脉冲波形
Pulse Waveform

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T_J - 结点温度 Junction Temperature ($^{\circ}C$)

FIGURE 3 典型 V_{BR} 随结温变化曲线
Typical V_{BR} vs Junction Temperature

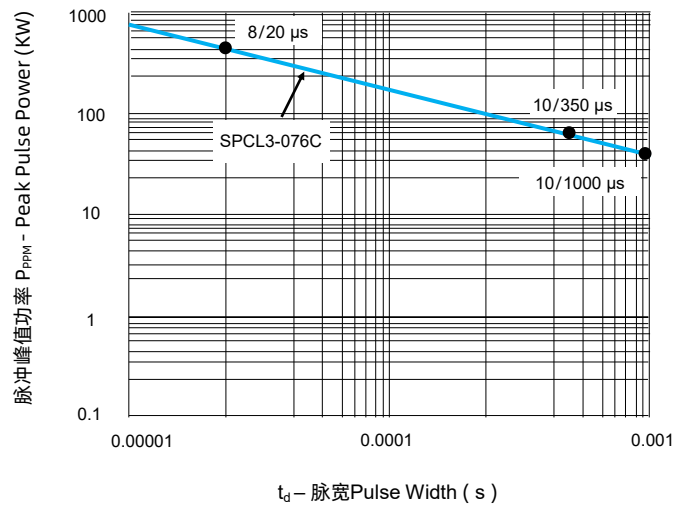


FIGURE 4 峰值脉冲功率额定曲线
Peak Pulse Power Rating Curve

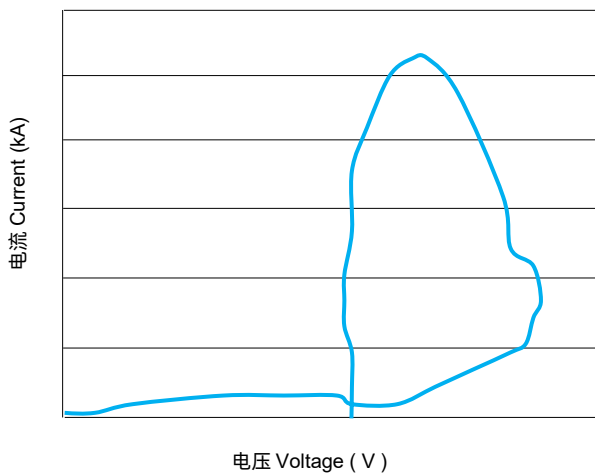
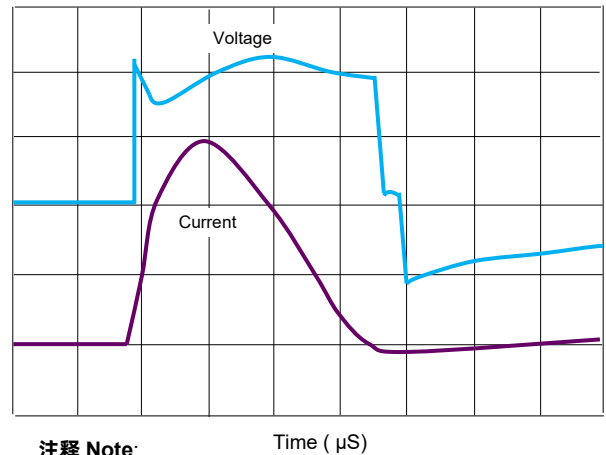


FIGURE 5 浪涌响应
Surge Response



注释 Note:
浪涌时能量耗散导致会雪崩电压改变, 但是浪涌过后雪崩电压又会恢复到初始值。
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 6 浪涌响应(8/20浪涌电流波形)
Surge Response (8/20 Surge current waveform)

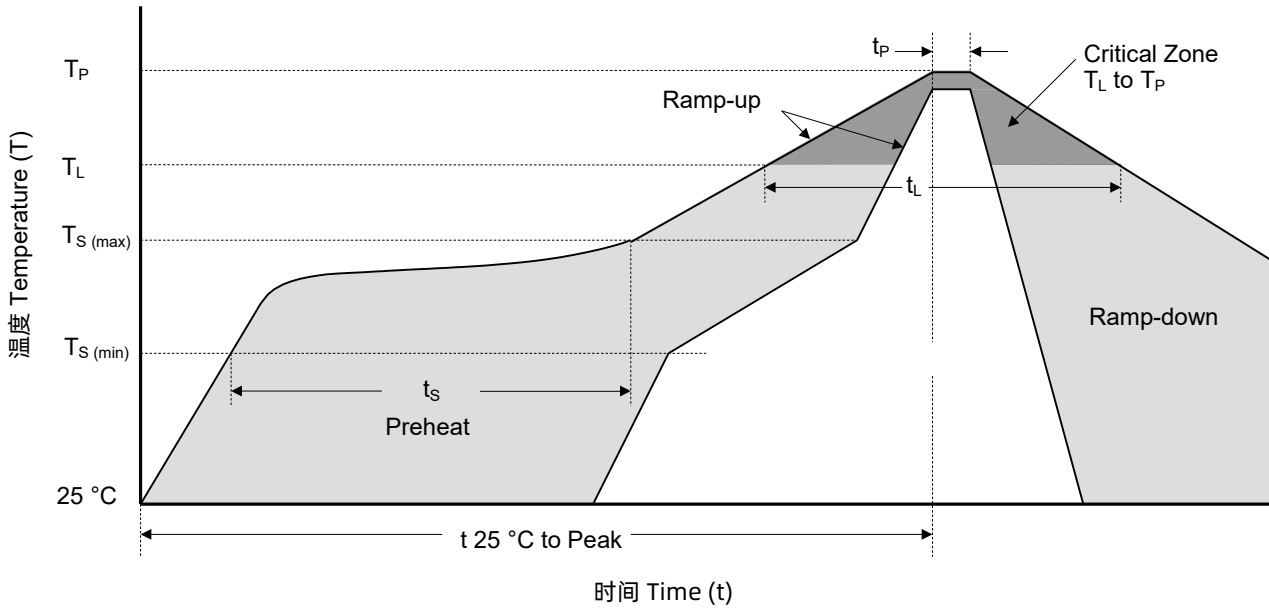
回流焊/波峰焊(浸焊) Flow/Wave Soldering (Solder Dipping)

峰值温度 Peak Temperature	260 $^{\circ}C$ +0 / -5 $^{\circ}C$
浸润时间 Dipping Time	10 seconds
焊接次数 Soldering Number	1 time

物理特性 Physical Specifications

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

焊接参数 Soldering Parameters



回流焊条件 Reflowing Condition

回流焊接参数 Reflow Soldering Parameters		无铅组装 Lead-Free Assembly
预热 Pre-heat	最低温($T_{S(min)}$) Temperature Min ($T_{S(min)}$)	150 °C
	最高温($T_{S(max)}$) Temperature Max ($T_{S(max)}$)	200 °C
	升温时长(t_s) Time (min to max) (t_s)	60 ~ 120 seconds
平均升温速率(液相温度(T_L)至峰值温度(T_P)) Average Ramp-up Rate (Liquidus Temp (T_L) to Peak Temp (T_P))		3 °C / second max.
$T_{S(max)}$ 到 T_L 升温速率 $T_{S(max)}$ to T_L Ramp-up Rate		3 °C / second max.
回流 Reflow	温度 Temperature (T_L) (Liquidus)	217 °C
	时长 Time (min to max) (t_L)	60 ~ 150 seconds
峰值温度 Peak Temperature (T_P)		260 ^{+0/-5} °C
实际峰值温度 (t_p) 5 °C 以内的时间 Time of within 5 °C of Actual Peak Temperature (t_p)		20 ~ 40 seconds
降温速率 Ramp-down Rate		6 °C / second max.
25 °C 至峰值温度时长 Time from 25 °C to Peak Temperature		8 Minutes max.
极限温度 Do Not Exceed		260 °C

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包装信息 Packaging Information

型号 Part Number	封装 Package	数量 Quantity	包装选项 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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注意

ATTENTION

使用方法 Usage

1. 请在规定的温度范围内使用TVS。
TVS must be operated in the specified ambient temp.
2. 请勿使用强极性溶剂清洗TVS以免破坏封装层。
Do not clean the TVS with strong polar solvent such as ketone, esters, benzene and halogenated hydrocarbon, to avoid damaging the encapsulating layer.
3. 请勿对TVS施加剧烈的振动，冲击或压力，以避免元件开裂。
Please do not apply severe vibration, shock or pressure to TVS, to avoid element cracking.

更换 Replacement

1. 若TVS出现可视化损伤，请将其更换。
If TVS is visually damaged, please replace it.
2. TVS为非修理型产品，安全起见，请更换同等规格的TVS。
TVS is a non-repairable product. For safety sake, please use equivalent TVS for replacement.

存储 Storage

1. 存储温度范围。
Storage Temp. Range: (-55 to 150) °C.
2. 请勿将TVS存放于高温高湿或腐蚀性气体环境中，已避免影响引脚的焊接性能，请于收货后一年内进行使用。
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.

环境条件 Environmental Conditions

1. 请勿暴露于室外阳光直射环境。
TVS should not be exposed to the open air, nor direct sunshine.
2. 请避免雨水，水汽等高温高湿环境。
TVS should avoid rain, water vapor or other condition of high temp. and high humidity.
3. 请避免沙尘，盐雾等有害环境。
TVS should avoid sand dust, salt mist, or other harmful gases.

TVS最大典型结电容 Max. Typical Capacitance of TVS

高频线路应用中请参照规格书中所给出的典型电容曲线。

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

安装机械应力 Installation Mechanical Stress

1. 安装TVS时请避免敲击，防止物理损伤。
Do not knock TVS when installing, to avoid mechanical damage.
2. 请不要对 TVS 施加剧烈的振动、冲击或压力，以免表面树脂或元件破裂。
Please do not apply severe vibration, shock or pressure to TVS, to avoid surface resin or element cracking.