

Description

The SPCL10 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
- Lightning Protection

Features

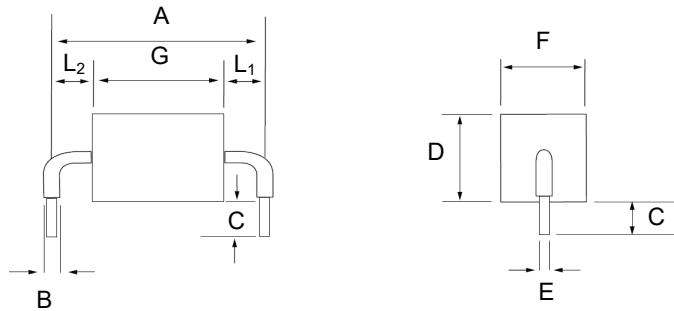
- Very low clamping voltage
- Sharp breakdown voltage
- Low slope resistance
- Bi-directional
- Snapback technology for superior clamping factor
- Symmetric in leads width for easier soldering during assembly
- IEC-61000-4-2 ESD 30 kV (Air), 30 kV (Contact)
- ESD protection of data lines in accordance 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



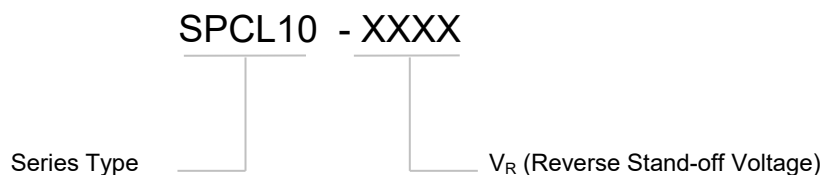
Bi-Directional

Package Outline Dimensions

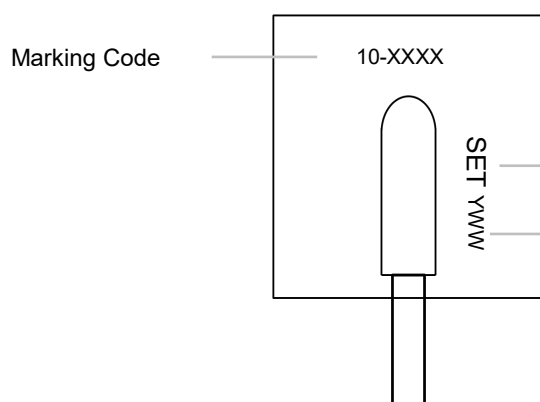


Symbol	Millimeters	Inches
A	24.15 ± 1.00	0.950 ± 0.040
A - 530C	34.70 ± 2.00	1.370 ± 0.080
A - 530C-24	24.15 ± 1.00	0.950 ± 0.040
B	2.50 ± 0.70	0.100 ± 0.028
C	6.00 ± 1.00	0.236 ± 0.040
D	14.48 max.	0.570 max.
E	1.28 ± 0.05	0.051 ± 0.002
F	12.70 max.	0.500 max.
G - 015C	3.60 ± 1.00	0.142 ± 0.040
G - 030C / - 033C / - 045C	4.23 ± 1.00	0.167 ± 0.040
G - 058C / -066C / - 076C	5.08 ± 1.00	0.200 ± 0.040
G - 076C - F	5.88 ± 1.00	0.232 ± 0.040
G - 170C / - 190C	9.20 ± 1.00	0.362 ± 0.040
G - 240C	10.67 ± 1.00	0.420 ± 0.040
G - 380C / - 430C	14.50 ± 1.20	0.571 ± 0.047
G - 530C	27.00 ± 1.50	1.060 ± 0.060
G - 530C-24	17.50 ± 1.50	0.689 ± 0.060
L ₁ / L ₂	L ₁ = L ₂ Tolerance ± 1.0 mm(0 .04 inch)	

Part Numbering System



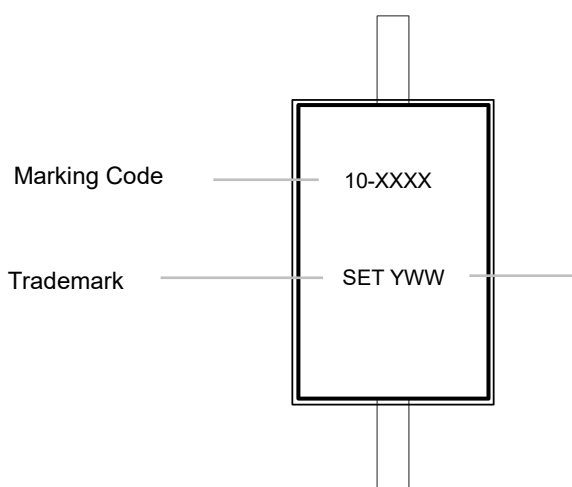
Marking



Type 1 - Side View

Apply to P/N
SPCL10-015C
SPCL10-030C
SPCL10-033C
SPCL10-045C
SPCL10-058C
SPCL10-066C
SPCL10-076C
SPCL10-076C-F

Trademark
Trace Code Marking
Y : Year Code
WW: Week Code



Type 2 - Top View

Apply to P/N
SPCL10-170C
SPCL10-190C
SPCL10-240C
SPCL10-380C
SPCL10-430C
SPCL10-530C
SPCL10-530C-24

Trace Code Marking
Y : Year Code
WW: Week Code

Electrical Characteristics ($T_A = 25\text{ }^\circ\text{C}$ 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 $^\circ\text{C}$	Max. Clamping Voltage V_{CL} @ Ipp 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)									
SPCL10-015C	10-015C	16.0	19.0	10	15	10	15	10000	28	0.1	40.0
SPCL10-030C	10-030C	32.0	37.0	10	30	10	15	10000	58	0.1	20.0
SPCL10-033C	10-033C	36.0	40.0	10	33	10	15	10000	53	0.1	20.0
SPCL10-045C	10-045C	48.0	55.0	10	45	10	15	10000	80	0.1	20.0
SPCL10-058C	10-058C	64.0	70.0	10	58	10	15	10000	110	0.1	10.0
SPCL10-066C	10-066C	72.0	80.0	10	66	10	15	10000	120	0.1	10.0
SPCL10-076C	10-076C	85.0	95.0	10	76	10	15	10000	140	0.1	6.5
SPCL10-076C-F	10-076C-F	85.0	95.0	10	76	10	15	10000	140	0.1	6.5
SPCL10-170C	10-170C	180.0	220.0	10	170	10	15	10000	260	0.1	4.0
SPCL10-190C	10-190C	200.0	245.0	10	190	10	15	10000	290	0.1	3.0
SPCL10-240C	10-240C	250.0	285.0	10	240	10	15	10000	340	0.1	2.2
SPCL10-380C	10-380C	401.0	443.0	10	380	10	15	10000	520	0.1	2.0
SPCL10-430C	10-430C	440.0	490.0	10	430	10	15	10000	625	0.1	1.4
SPCL10-530C	10-530C	560.0	619.0	10	530	10	15	10000	750	0.1	1.0
SPCL10-530C-24	10-530C-24	560.0	619.0	10	530	10	15	10000	750	0.1	1.0

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

Maximum Ratings and Characteristics

($T_A = 25\text{ }^\circ\text{C}$ unless otherwise specified.)

Parameter	Symbol	Value	Unit
Operating Storage Temperature Range	T_{STG}	-55 to 150	$^\circ\text{C}$
Operating Junction Temperature Range	T_J	-55 to 125	$^\circ\text{C}$
Current Rating (Note 1)	I_{PP}	10	kA

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

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

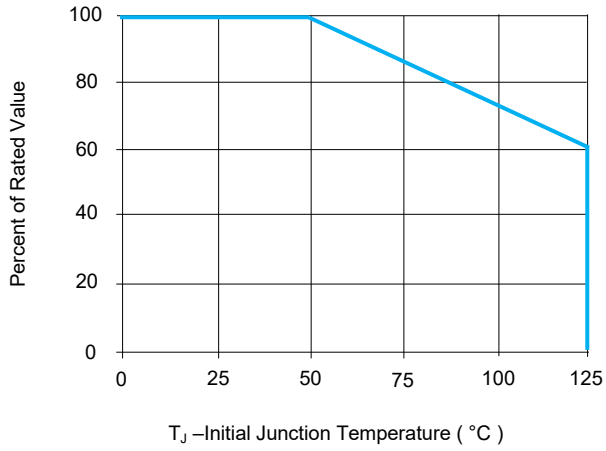


FIGURE 1 Peak Pulse Power Derating Curve

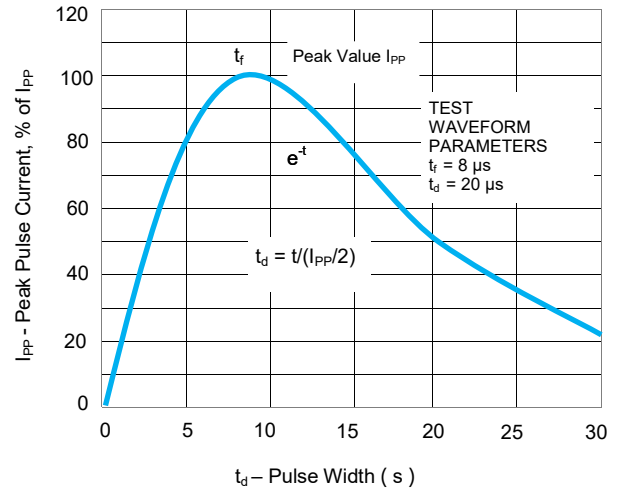


FIGURE 2 Pulse Waveform

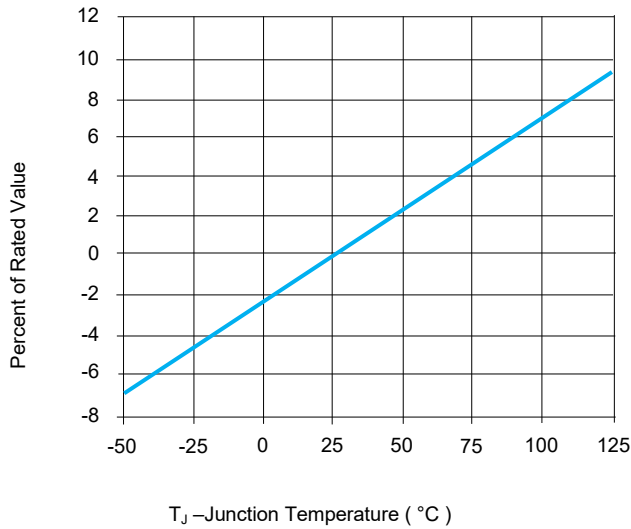


FIGURE 3 Typical V_{BR} Vs Junction Temperature

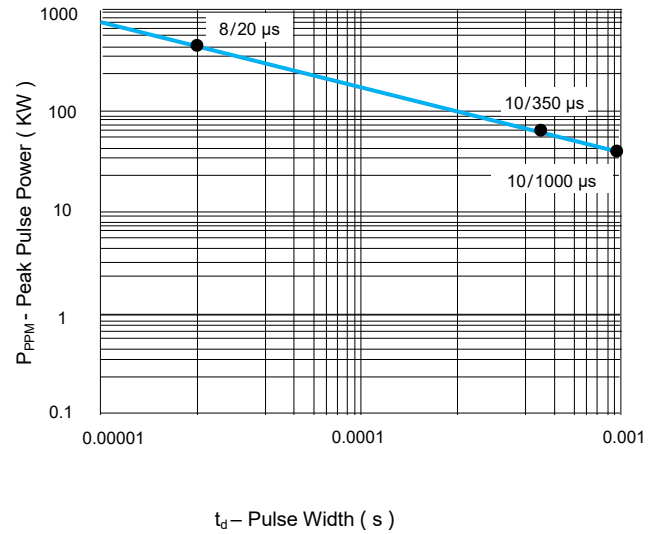
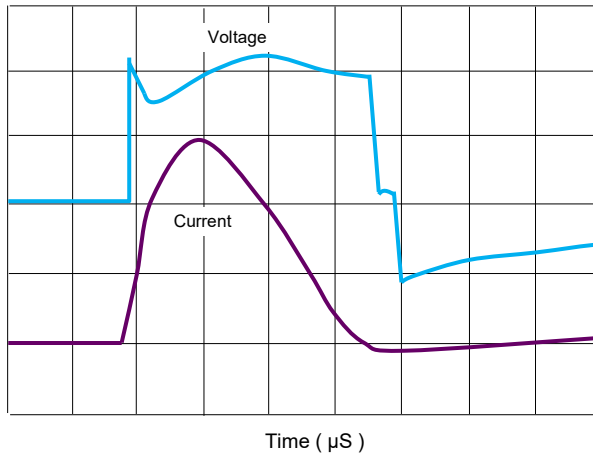


FIGURE 4 Peak Pulse Power Rating Curve



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)

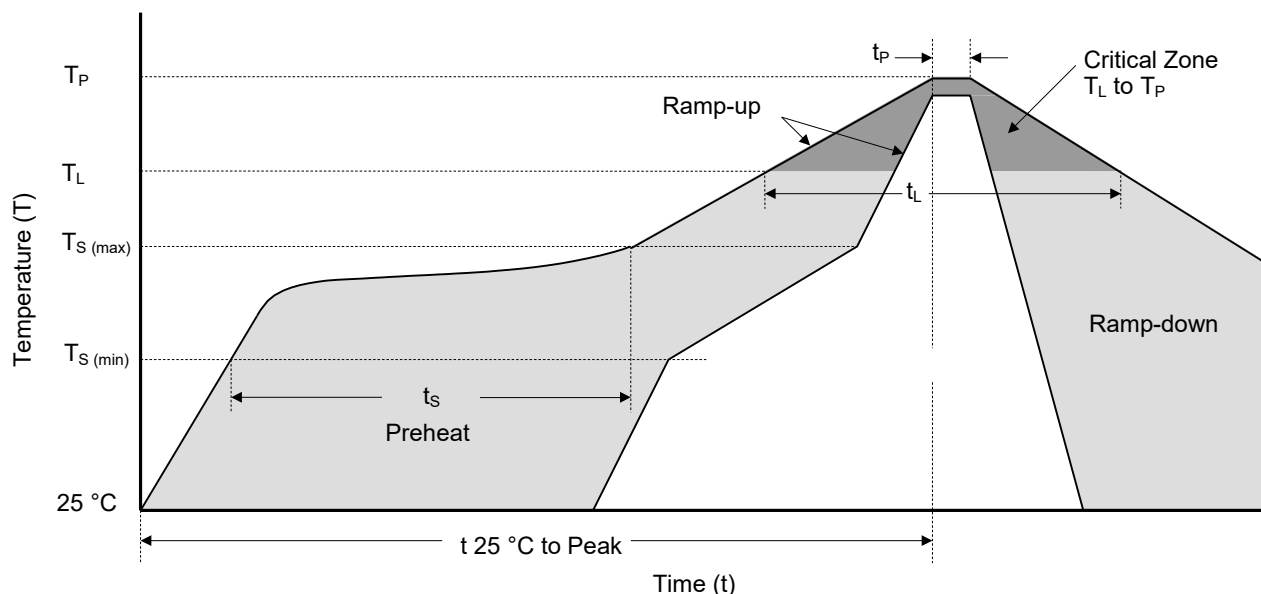
Flow/Wave Soldering (Solder Dipping)

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, solderability 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
SPCL10-XXXX	SPCL Package	56 PCS / Inner Box	Bulk
SPCL10-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.

Transient Voltage Suppressor (Surface Mount) Features Overview

Package Type						SMA6L				Series
DO-221AC	○	○	○	○	○	SMA6L	○	○	○	
DO-214AA	○	○	○	○	○	○	SACB	SMBJ	P6SMB	
DO-214AB	○	○	○	○	○	○	○	○	○	
DO-214AC	○	○	SMAJ	P4SMA	SMA6J	○	○	○	○	
SOD-123FL	SMF	P4SMF	○	○	○	○	○	○	○	
SMT0-218	○	○	○	○	○	○	○	○	○	
Product Outline (mm)										
V_R / V_{WM} (V) Reverse Stand-off Voltage	5.0 ~ 250	5.0 ~ 85	5.0 ~ 440	5.8 ~ 468	5.0 ~ 250	5.0 ~ 50	5.0 ~ 440	5.8 ~ 512		
P_{PPM} (W) (10/1000 μ s) Rated Peak ImPulse Power Dissipation	200		400		600	500	600			
I_{PPM} (kA) (8/20 μ s) Rated Peak ImPulse Current					○					
Operating Temperature (°C)	-55 to +150									

Transient Voltage Suppressor (Surface Mount) Features Overview

Package Type	Series									
	DO-221AC	DO-214AA	DO-214AB	DO-214AC	SOD-123FL	SMT0-218	SPC1	SPC3	SPC6	SPC10
	○	○	○	○	○	○	○	○	○	○
	○	○	○	○	○	○	○	○	○	○
	SMCJ	1.5SMC	3.0SMCJ	SMDJ	5.0SMDJ					
	○	○	○	○	○					
	○	○	○	○	○					
	○	○	○	○	○	SPC1	SPC3	SPC6	SPC10	
Product Outline (mm)										
V_R / V_{WM} (V) Reverse Stand-off Voltage	5.0 ~ 440	5.8 ~ 512	5.0 ~ 440	12 ~ 170	380 / 430	66	58 ~ 76	58 ~ 86		
P_{PPM} (W) (10/1000 μ s) Rated Peak ImPulse Power Dissipation	1500	3000	5000							
I_{PPM} (kA)(8/20 μ s) Rated Peak ImPulse Current						1	3	6	10	
Operating Temperature (°C)	-55 to +150					-55 to +125				

Transient Voltage Suppressor (Axial Lead) Features Overview

Package Type	Series																
	DO-201	DO-41	DO-15	P600	Radial lead	1.5KE	LCE										
	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	P4KE	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○	SAC	P6KE	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○	○	○	○	○	○	○	5KP	15KPA	20KPA	30KPA	○	○	○	○	○	
	○	○	○	○	○	○	○	○	○	○	○	SPCL1	SPCL3	SPCL6	SPCL10	SPCL15	SPCL20
Product Outline (mm)																	
V_R / V_{WM} (V) Reverse Stand-off Voltage	5.8 ~ 468	5.0 ~ 50	5.8 ~ 512	5.8 ~ 512	6.5 ~ 90	5.0 ~ 250	17 ~ 280	20 ~ 300	28 ~ 360	76	15 ~ 430	30 ~ 430	15 ~ 530	58 ~ 380	16 ~ 76		
P_{PPM} (W) (10/1000 μ s) Rated Peak Impulse Power Dissipation	400	500	600	1500	5000	15000	20000	30000					○				
I_{PPM} (kA)(8/20 μ s) Rated Peak Impulse Current					○					1	3	6	10	15	20		
Operating Temperature (°C)					-55 to +150									-55 to +125			