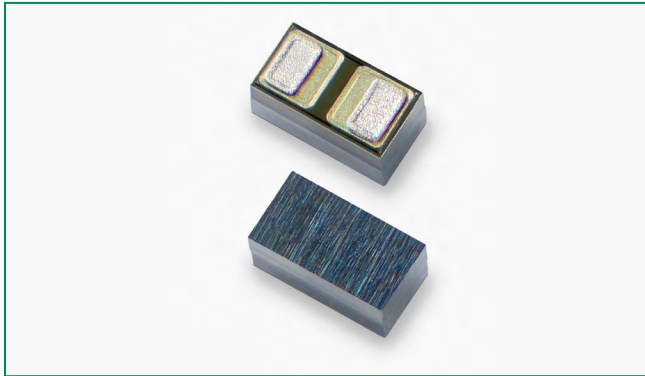
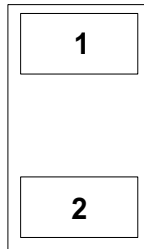


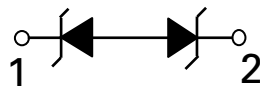
**SPxx Series 100W Discrete Bidirectional TVS Diode**



**Pinout**



**Functional Block Diagram**



Life Support Note:

**Not Intended for Use in Life Support or Life Saving Applications**

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

**Description**

The SPxx-01WTG-C-HV series is designed to improve ESD protection in portable applications, LED backlighting modules, and low speed I/Os. It will protect sensitive equipment from damage due to electrostatic discharge (ESD) and other overvoltage transients.

The SPxx-01WTG-C-HV series can safely absorb repetitive ESD strikes above the maximum level of the IEC61000-4-2 international standard (Level 4, ±8kV contact discharge) without performance degradation and safely dissipate up to 8A (SP12-01WTG-C-HV) of induced surge current (IEC61000-4-5,  $t_p=8/20\mu s$ ) with very low clamping voltages.

**Features**

- ESD, IEC61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC61000-4-4, 40A (5/50ns)
- Lightning, IEC61000-4-5 2<sup>nd</sup> edition, 8A ( $t_p=8/20\mu s$ , SP12-01WTG-C-HV)
- Low clamping voltage
- Low leakage current
- Halogen free, Lead free and RoHS compliant

**Applications**

- LED Backlighting Modules
- Portable Instrumentation
- General Purpose I/O
- Mobile & Handhelds
- RS232 / RS485

## Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$P_{pk}$	Peak Pulse Power ( $t_p=8/20\mu s$ )	100	W
$T_{OP}$	Operating Temperature	-40 to 125	°C
$T_{STOR}$	Storage Temperature	-55 to 150	°C

Notes:

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

## Thermal Information

Parameter	Rating	Units
Storage Temperature Range	-55 to 150	°C
Maximum Junction Temperature	150	°C
Maximum Lead Temperature (Soldering 20-40s)	260	°C

## SP12-01WTG-C-HV Electrical Characteristics ( $T_{OP}=25^\circ C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$ , 1 pin to GND			12.0	V
Reverse Breakdown Voltage	$V_{BR}$	$I_R = 1mA$ , 1 pin to GND	13.3			V
Leakage Current	$I_{LEAK}$	$V_R = 12V$ , 1 pin to GND			0.1	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A$ , $t_p = 8/20\mu s$ , Fwd		16		V
		$I_{PP} = 8A$ , $t_p = 8/20\mu s$ , Fwd		19		V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns$ , 1 pin to GND		0.4		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$			8.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC61000-4-2 (Contact Discharge)	$\pm 30$			kV
		IEC61000-4-2 (Air Discharge)	$\pm 30$			kV
Diode Capacitance <sup>1</sup>	$C_{D-GND}$	Reverse Bias=0V, f=1MHz		26	30	pF

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) test setting : Std.TDR(50 $\Omega$ ),  $t_p=100ns$ ,  $tr=0.2ns$  ITLP and VTLP averaging window: star  $t1=70ns$  to end  $t2=80ns$

## SP15-01WTG-C-HV Electrical Characteristics ( $T_{OP}=25^\circ C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$ , 1 pin to GND			15.0	V
Reverse Breakdown Voltage	$V_{BR}$	$I_R = 1mA$ , 1 pin to GND	16.7			V
Leakage Current	$I_{LEAK}$	$V_R = 15V$ , 1 pin to GND			0.1	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A$ , $t_p = 8/20\mu s$ , Fwd		21		V
		$I_{PP} = 5A$ , $t_p = 8/20\mu s$ , Fwd		27		V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns$ , 1 pin to GND		0.43		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$			5.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC61000-4-2 (Contact Discharge)	$\pm 30$			kV
		IEC61000-4-2 (Air Discharge)	$\pm 30$			kV
Diode Capacitance <sup>1</sup>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		21	24	pF

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) test setting : Std.TDR(50 $\Omega$ ),  $t_p=100ns$ ,  $tr=0.2ns$  ITLP and VTLP averaging window: star  $t1=70ns$  to end  $t2=80ns$

**SP24-01WTG-C-HV Electrical Characteristics (T<sub>OP</sub>=25°C)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> ≤ 1μA, 1 pin to GND			24.0	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> = 1mA, 1 pin to GND	26.7			V
Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> = 24V, 1 pin to GND			0.1	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20μs, Fwd		32		V
		I <sub>PP</sub> = 3.0A, t <sub>p</sub> = 8/20μs, Fwd		40		V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> = 100ns, 1 pin to GND		0.7		Ω
Peak Pulse Current	I <sub>PP</sub>	t <sub>p</sub> = 8/20μs			3.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC61000-4-2 (Contact Discharge)	±18			kV
		IEC61000-4-2 (Air Discharge)	±24			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-GND</sub>	Reverse Bias=0V, f=1MHz		13	17	pF

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) test setting : Std.TDR(50Ω),tp=100ns, tr=0.2ns ITLP and VTLP averaging window: star t1=70ns to end t2=80ns

**SP36-01WTG-C-HV Electrical Characteristics (T<sub>OP</sub>=25°C)**

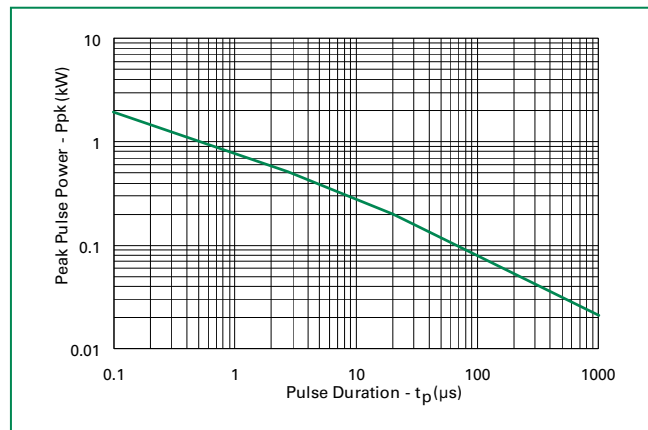
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> ≤ 1μA, 1 pin to GND			36.0	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> = 1mA, 1 pin to GND	40.0			V
Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> = 36V, 1 pin to GND			0.1	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20μs, Fwd		48		V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> = 100ns, 1 pin to GND		1.4		Ω
Peak Pulse Current	I <sub>PP</sub>	t <sub>p</sub> = 8/20μs			1.5	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC61000-4-2 (Contact Discharge)	±10			kV
		IEC61000-4-2 (Air Discharge)	±15			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-GND</sub>	Reverse Bias=0V, f=1MHz		10	13	pF

Note:

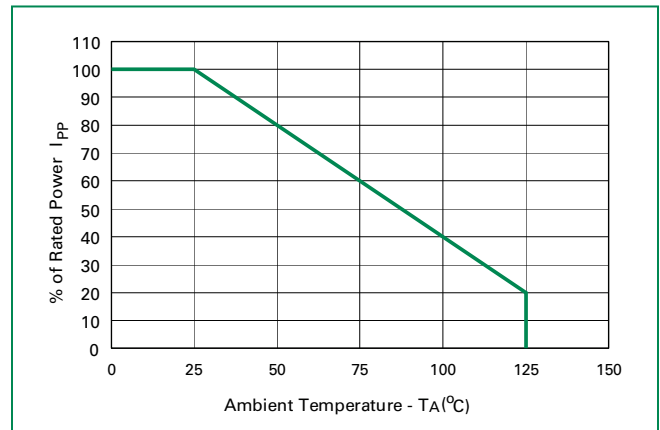
<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) test setting : Std.TDR(50Ω),tp=100ns, tr=0.2ns ITLP and VTLP averaging window: star t1=70ns to end t2=80ns

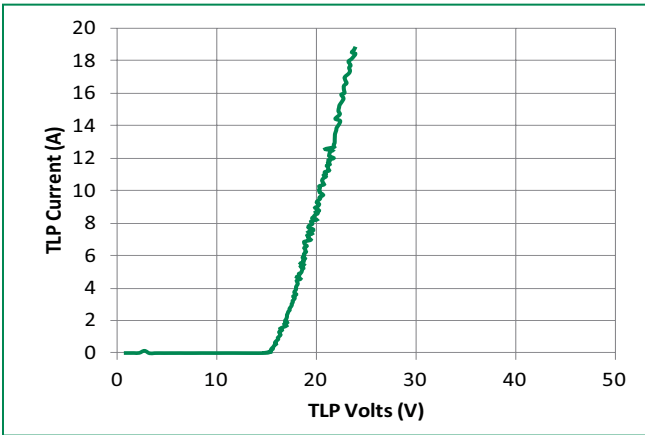
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



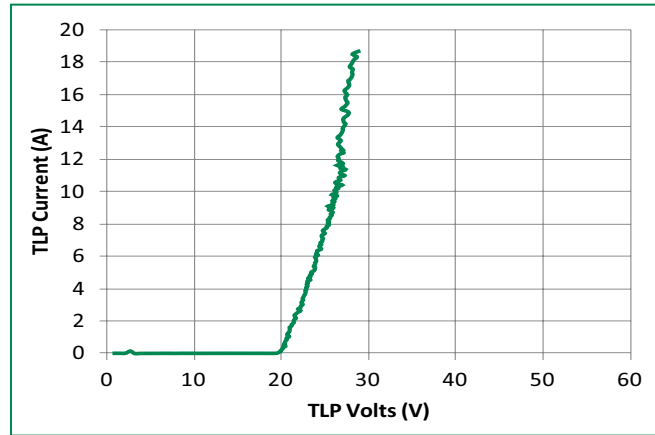
**Power Derating Curve**



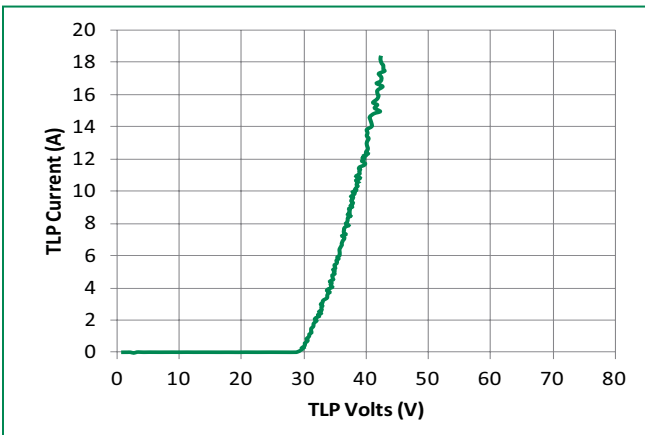
**SP12-01WTG-C-HV Transmission Line Pulsing(TLP) Plot**



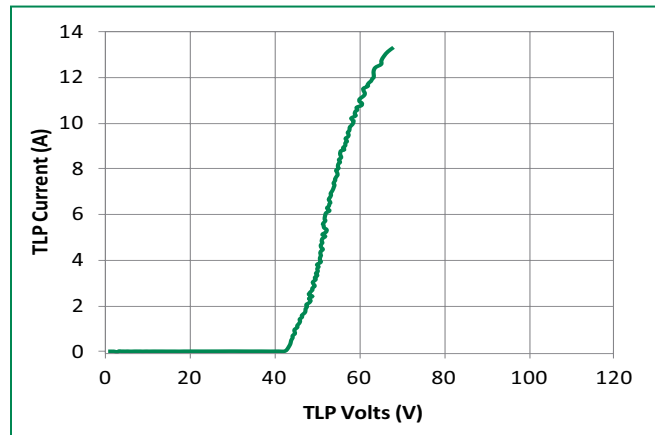
**SP15-01WTG-C-HV Transmission Line Pulsing(TLP) Plot**



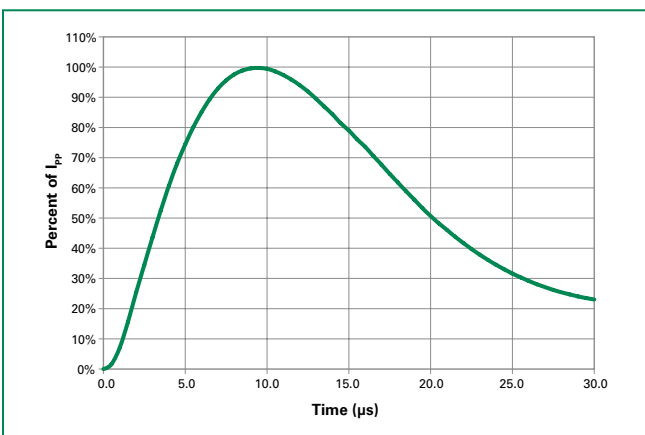
**SP24-01WTG-C-HV Transmission Line Pulsing(TLP) Plot**



**SP36-01WTG-C-HV Transmission Line Pulsing(TLP) Plot**

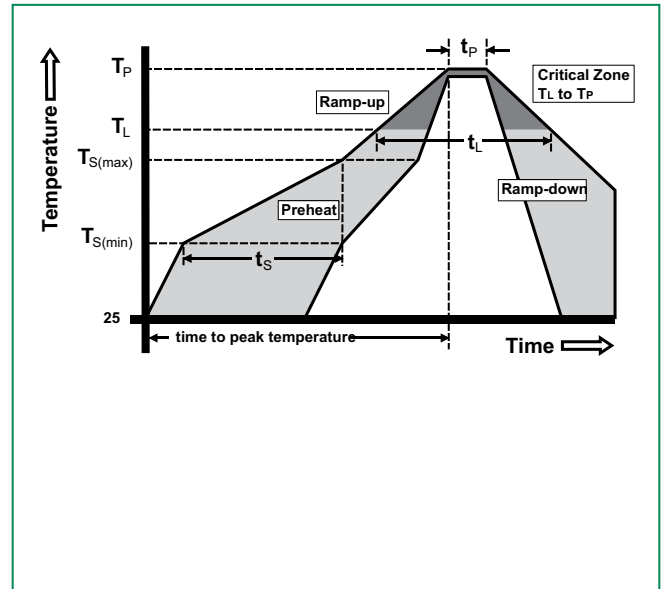


**Pulse Waveform**



**Soldering Parameters**

Reflow Condition		Pb – 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 – 180 secs
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
	- Temperature ( $t_l$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °C
Time within 5°C of actual peak Temperature ( $t_p$ )		20 – 40 seconds
Ramp-down Rate		6°C/second max
Time 25°C to peak Temperature ( $T_p$ )		8 minutes Max.
Do not exceed		260°C



**Product Characteristics**

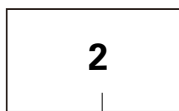
<b>Lead Plating</b>	Pre-Plated Frame
<b>Lead Material</b>	Copper Alloy
<b>Lead Coplanarity</b>	0.0004 inches (0.102mm)
<b>Substitute Material</b>	Silicon
<b>Body Material</b>	Molded Epoxy
<b>Flammability</b>	UL 94 V-0

- Notes :
1. All dimensions are in millimeters
  2. Dimensions include solder plating.
  3. Dimensions are exclusive of mold flash & metal burr.
  4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
  5. Package surface matte finish VDI 11-13.

**Ordering Information**

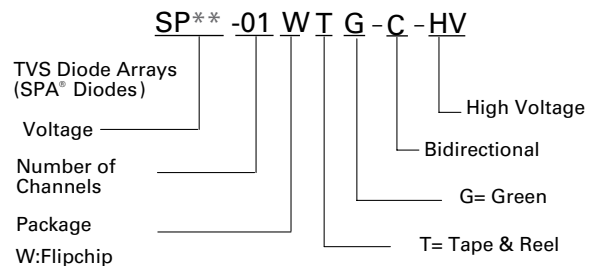
Part Number	Package	Marking	Min. Order Qty.
SP12-01WTG-C-HV	FLIPCHIP	2	10000
SP15-01WTG-C-HV	FLIPCHIP	5	10000
SP24-01WTG-C-HV	FLIPCHIP	4	10000
SP36-01WTG-C-HV	FLIPCHIP	6	10000

**Part Marking System**

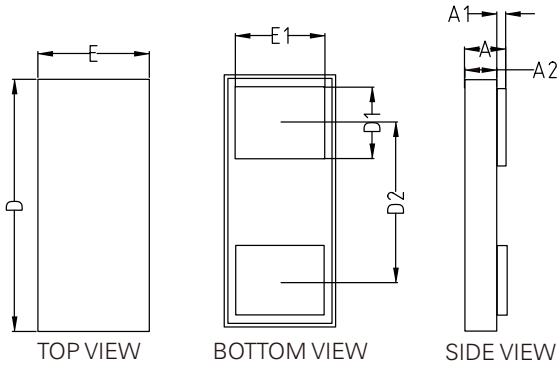


- 2: SP12-01WTG-C-HV
- 5: SP15-01WTG-C-HV
- 4: SP24-01WTG-C-HV
- 6: SP36-01WTG-C-HV

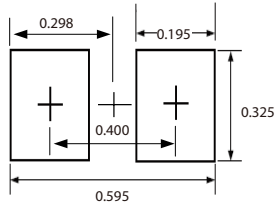
**Part Numbering System**



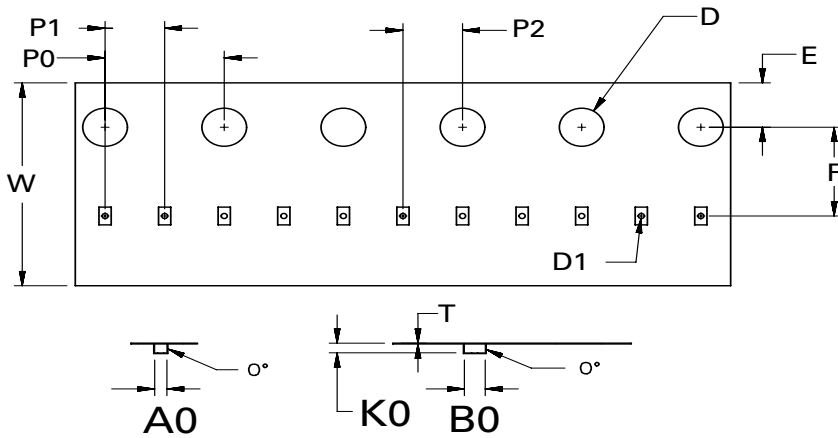
**Package Dimensions – FLIPCHIP**



Symbol	0201 Flipchip			
	Millimeters		Inches	
	Min	Max	Min	Max
<b>D</b>	0.605	0.655	0.0238	0.0258
<b>E</b>	0.305	0.355	0.0120	0.0140
<b>D1</b>	0.145	0.155	0.0057	0.0061
<b>E1</b>	0.245	0.255	0.0096	0.0100
<b>D2</b>	0.400 BSC		0.0157 BSC	
<b>A</b>	0.273	0.329	0.0107	0.0130
<b>A2</b>	0.265	0.315	0.0104	0.0124
<b>A1</b>	0.008	0.014	0.0003	0.0006



**Embossed Carrier Tape & Reel Specification – FLIPCHIP**



Symbol	Millimeters
<b>A0</b>	0.41 +/- 0.03
<b>B0</b>	0.70 +/- 0.03
<b>D</b>	∅ 1.50 + 0.10
<b>D1</b>	∅ 0.20 +/- 0.05
<b>E</b>	1.75 +/- 0.10
<b>F</b>	3.50 +/- 0.05
<b>K0</b>	0.38 +/- 0.03
<b>P0</b>	4.00 +/- 0.10
<b>P1</b>	2.00 +/- 0.05
<b>P2</b>	2.00 +/- 0.05
<b>W</b>	8.00 + 0.30 - 0.10
<b>T</b>	0.23 +/- 0.02