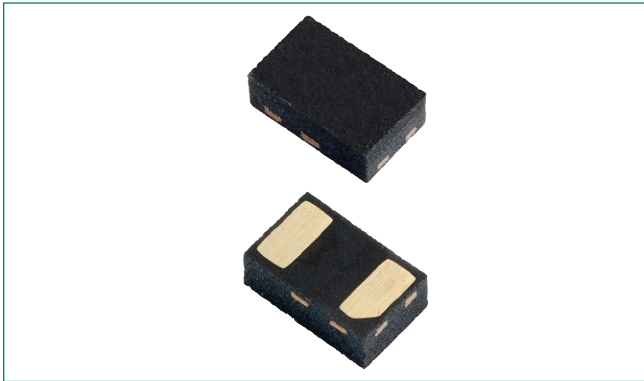


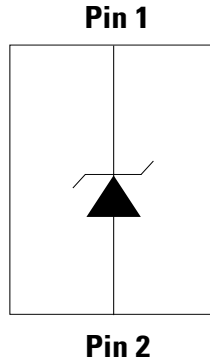
## SP11xx Series Discrete Unidirectional TVS Diode



### Description

Avalanche breakdown diodes fabricated in a proprietary silicon avalanche technology protect each I/O pin to provide a high level of protection for electronic equipment that may experience destructive electrostatic discharges (ESD). These robust diodes can safely absorb repetitive ESD strikes at  $\pm 30\text{kV}$  (contact and air discharge, IEC 61000-4-2) without performance degradation. Additionally, each diode can safely dissipate 80A (SP1105S) of 8/20 $\mu\text{s}$  surge current (IEC 61000-4-5 2<sup>nd</sup> edition) with very low clamping voltages.

### Pinout and Functional Block Diagram



### Features

- ESD, IEC 61000-4-2,  $\pm 30\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2<sup>nd</sup> edition, 80A ( $t_p=8/20\mu\text{s}$ , SP1105S)
- Low clamping voltage
- Low leakage current
- Moisture Sensitivity Level(MSL -1)
- Lead free and RoHS compliant
- AEC-Q101 qualified

### Applications

- Switches / Buttons
- Test Equipment / Instrumentation
- Point-of-Sale Terminals
- Medical Equipment
- Notebooks / Desktops / Servers
- Computer Peripherals
- Automotive Electronics

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.

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$T_{OP}$	Operating Temperature	-40 to 125	°C
$T_{STOR}$	Storage Temperature	-55 to 150	°C

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

### SP1105 Electrical Characteristics ( $T_{OP}=25^{\circ}C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$	-	-	5.0	V
Reverse Voltage Drop	$V_R$	$I_R = 1mA$	6.0	-	-	V
Leakage Current	$I_{LEAK}$	$V_R = 5V$	-	-	1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s, Fwd$	-	7.3	-	V
		$I_{PP} = 70A, t_p = 8/20\mu s, Fwd$	-	10.9	-	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns, I/O$ to GND	-	0.05	-	$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$	-	-	70	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 30$	-	-	kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$	-	-	kV
Diode Capacitance <sup>1</sup>	$C_D$	Reverse Bias=0V, f=1MHz	-	630	-	pF

### SP1105S Electrical Characteristics ( $T_{OP}=25^{\circ}C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$	-	-	5.0	V
Reverse Voltage Drop	$V_R$	$I_R = 1mA$	6.0	-	7.5	V
Leakage Current	$I_{LEAK}$	$V_R = 5V$	-	-	1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 40A, t_p = 8/20\mu s, Fwd$	-	8.3	-	V
		$I_{PP} = 80A, t_p = 8/20\mu s, Fwd$	-	9.2	-	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns, I/O$ to GND	-	0.05	-	$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$	-	-	80	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 30$	-	-	kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$	-	-	kV
Diode Capacitance <sup>1</sup>	$C_D$	Reverse Bias=0V, f=1MHz	-	630	-	pF

### SP1112 Electrical Characteristics ( $T_{OP}=25^{\circ}C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$	-	-	12.0	V
Reverse Voltage Drop	$V_R$	$I_R = 1mA$	13.3	-	-	V
Leakage Current	$I_{LEAK}$	$V_R = 12V$	-	-	1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s, Fwd$	-	15.2	-	V
		$I_{PP} = 40A, t_p = 8/20\mu s, Fwd$	-	26.5	-	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns, I/O$ to GND	-	0.05	-	$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p = 8/20\mu s$	-	-	40.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 30$	-	-	kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$	-	-	kV
Diode Capacitance <sup>1</sup>	$C_{D-GND}$	Reverse Bias=0V, f=1MHz	-	230	-	pF

### SP1115 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> ≤ 1 μA	-	-	15.0	V
Reverse Voltage Drop	V <sub>R</sub>	I <sub>R</sub> = 1 mA	16.7	-	-	V
Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> = 15V	-	-	1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20 μs, Fwd	-	19.3	-	V
		I <sub>PP</sub> = 30A, t <sub>p</sub> = 8/20 μs, Fwd	-	30.2	-	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> = 100ns, I/O to GND	-	0.05	-	Ω
Peak Pulse Current	I <sub>PP</sub>	t <sub>p</sub> = 8/20 μs	-	-	30.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC 61000-4-2 (Contact Discharge)	±30	-	-	kV
		IEC 61000-4-2 (Air Discharge)	±30	-	-	kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-GND</sub>	Reverse Bias=0V, f=1 MHz	-	180	-	pF

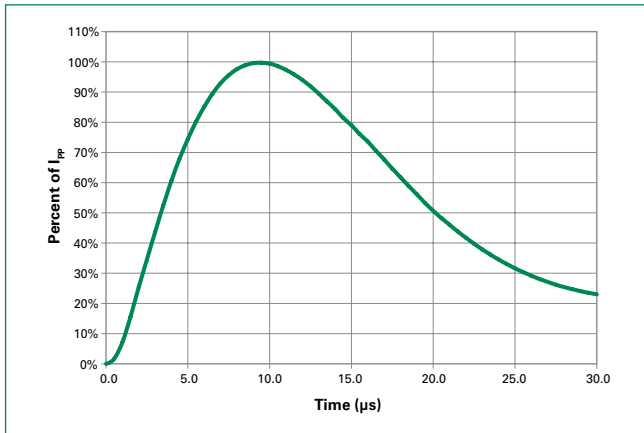
### SP1124 Electrical Characteristics (T<sub>OP</sub>=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> ≤ 1 μA	-	-	24.0	V
Reverse Voltage Drop	V <sub>R</sub>	I <sub>R</sub> = 1 mA	26.7	-	-	V
Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> = 24V	-	-	1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20 μs, Fwd	-	29.8	-	V
		I <sub>PP</sub> = 20A, t <sub>p</sub> = 8/20 μs, Fwd	-	44.7	-	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> = 100ns, I/O to GND	-	0.1	-	Ω
Peak Pulse Current	I <sub>PP</sub>	t <sub>p</sub> = 8/20 μs	-	-	20.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC 61000-4-2 (Contact Discharge)	±30	-	-	kV
		IEC 61000-4-2 (Air Discharge)	±30	-	-	kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-GND</sub>	Reverse Bias=0V, f=1 MHz	-	130	-	pF

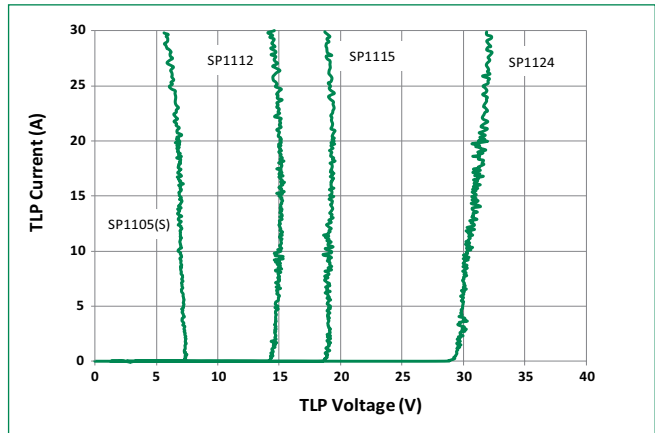
**Note:**

- Parameter is guaranteed by design and/or component characterization.
- Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2= 90ns

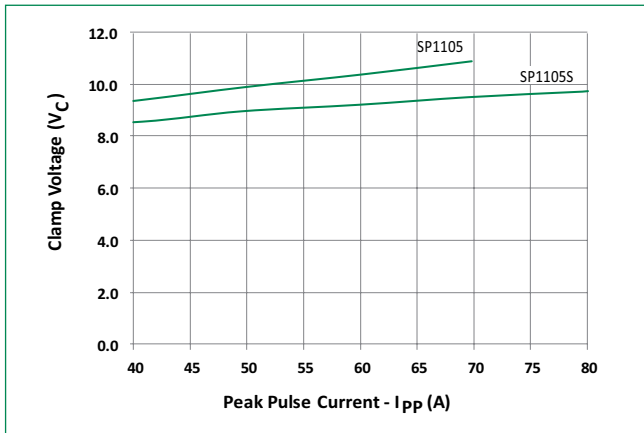
**8/20 $\mu$ s Pulse Waveform**



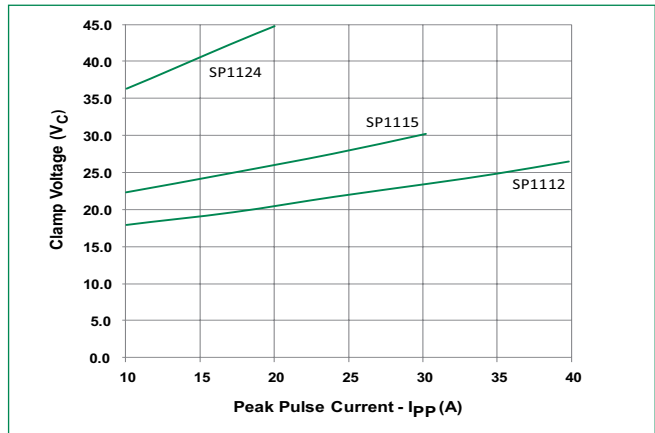
**Transmission Line Pulsing (TLP) Plot**



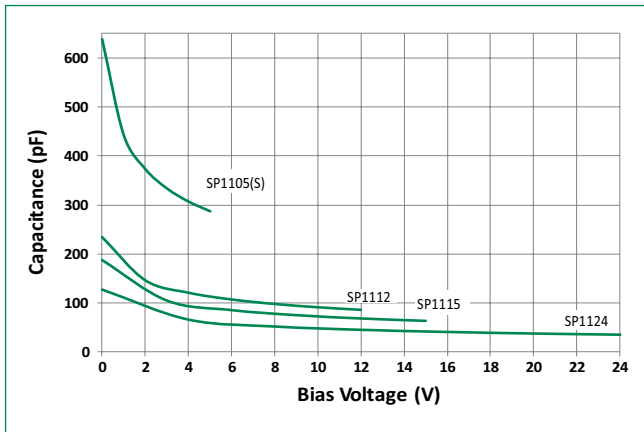
**SP1105, SP1105S Clamping voltage vs. I<sub>pp</sub> for 8/20 $\mu$ s waveshape**



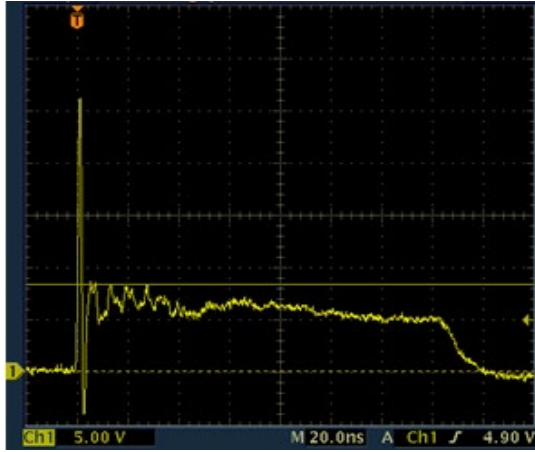
**SP1112, SP1115, SP1124 Clamping voltage vs. I<sub>pp</sub> for 8/20 $\mu$ s waveshape**



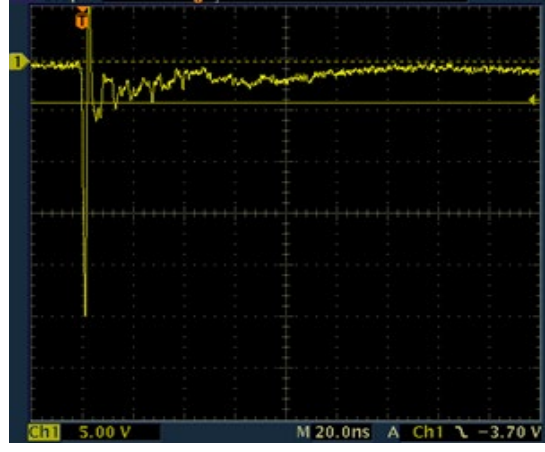
**Capacitance vs. Bias**



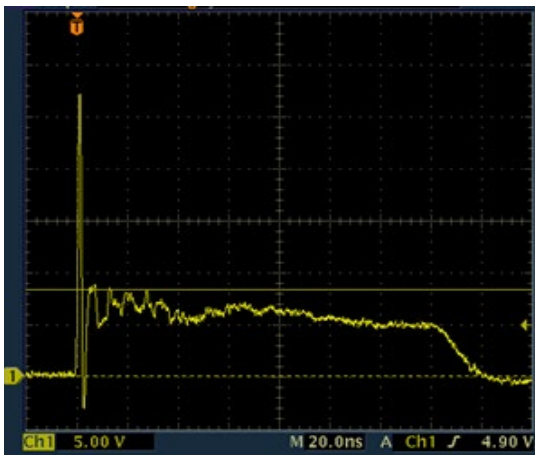
**SP1105 IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage**



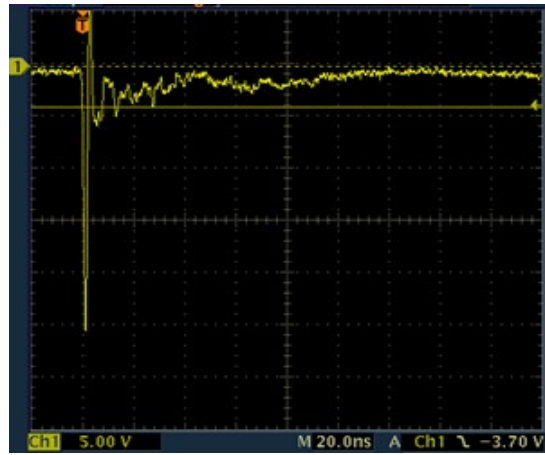
**SP1105 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage**



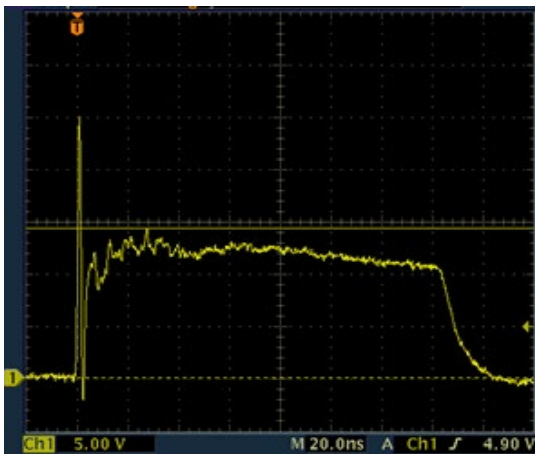
**SP1105S IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage**



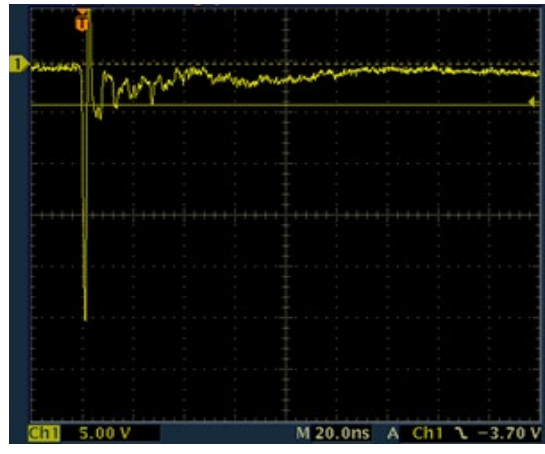
**SP1105S IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage**



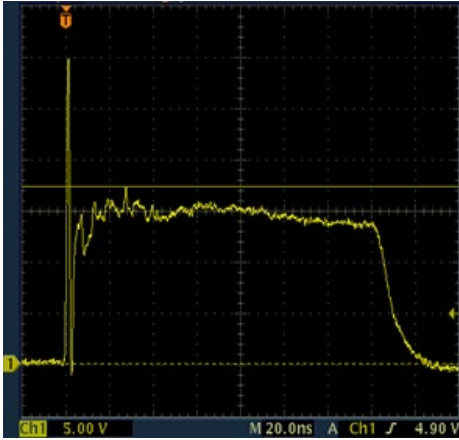
**SP1112 IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage**



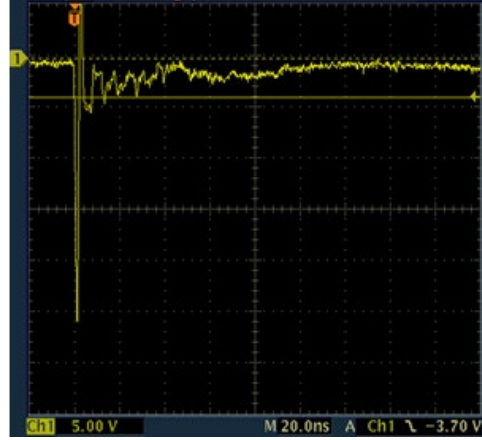
**SP1112 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage**



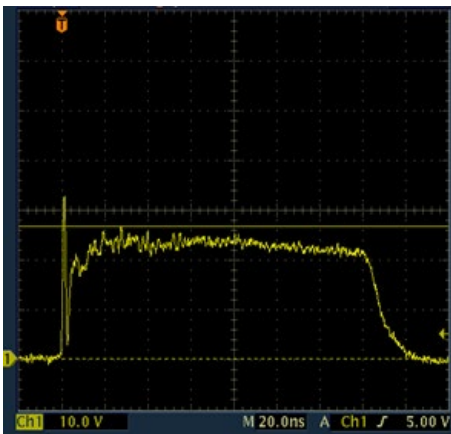
**SP1115 IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage**



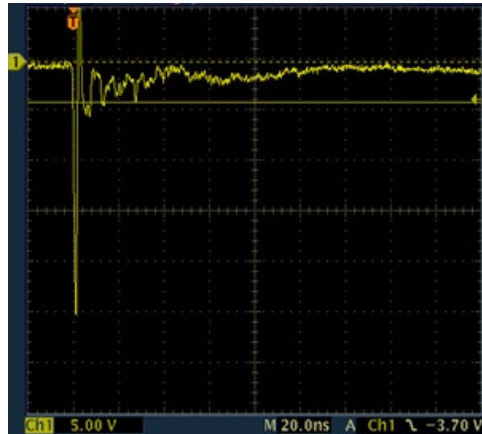
**SP1115 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage**



**SP1124 IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage**

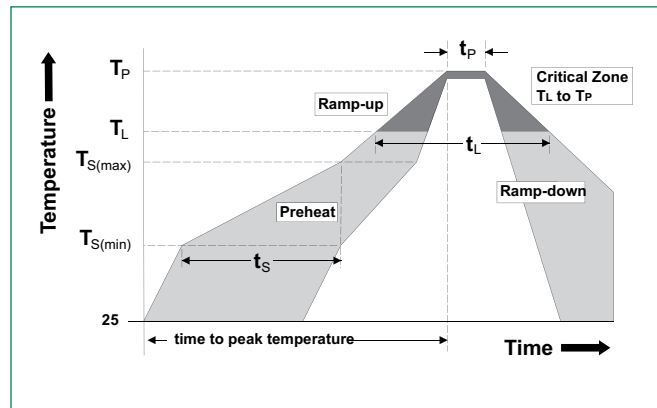


**SP1124 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage**

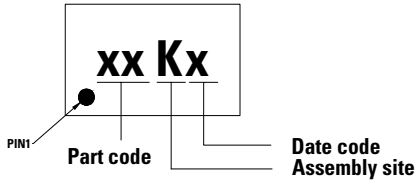


**Soldering Parameters**

<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_L$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		20 – 40 seconds
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C

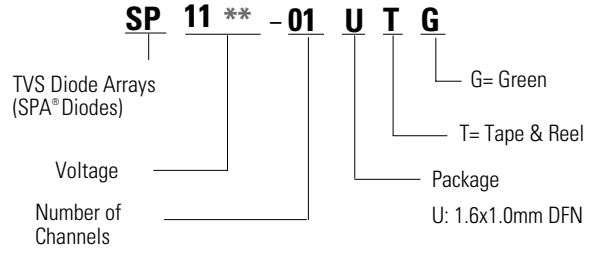


**Part Marking System**



**Part code :**  
**AA = SP1105-01UTG**  
**AB = SP1112-01UTG**  
**AC = SP1115-01UTG**  
**AD = SP1124-01UTG**  
**AE = SP1105S-01UTG**

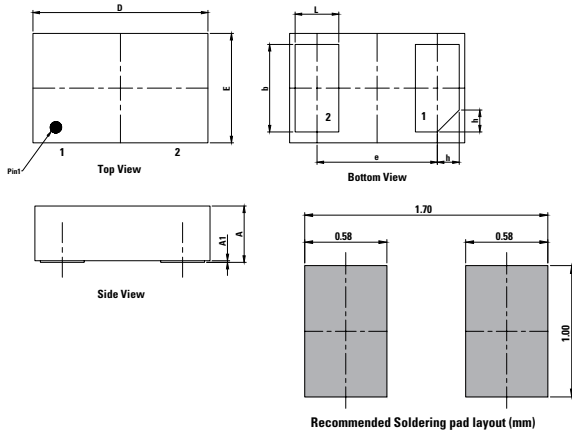
**Part Numbering System**



**Ordering Information**

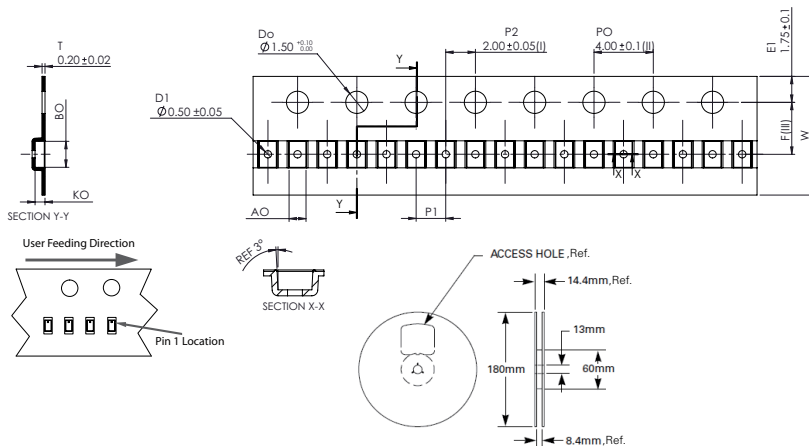
Part Number	Package	Marking	Min. Order Qty.
SP1105-01UTG	1.6x1.0mm DFN	AAKx	3000
SP1112-01UTG	1.6x1.0mm DFN	ABKx	3000
SP1115-01UTG	1.6x1.0mm DFN	ACKx	3000
SP1124-01UTG	1.6x1.0mm DFN	ADKx	3000
SP1105S-01UTG	1.6x1.0mm DFN	AEKx	3000

**Package Dimensions**



Symbol	1.6x1.0mm DFN		
	Millimeters		
	Min	Nor	Max
A	0.45	0.50	0.55
A1	-	0.02	0.05
D	1.55	1.60	1.65
E	0.95	1.00	1.05
b	0.75	0.80	0.85
L	0.35	0.40	0.45
e	1.10 BSC		
h	0.15	0.20	0.25

**Embossed Carrier Tape & Reel Specification**



Symbol	Millimeters
A0	1.14 +/- 0.03
B0	1.75 +/- 0.03
K0	0.67 +/- 0.05
F	3.50 +/- 0.05
P1	2.00 +/- 0.10
W	8.00 +/- 0.10