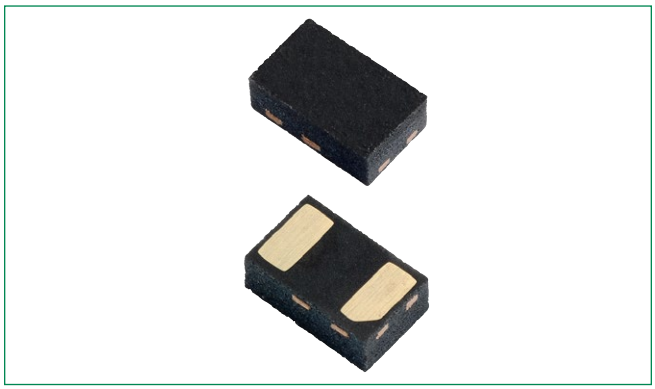
SP11xx Series Discrete Unidirectional TVS Diode

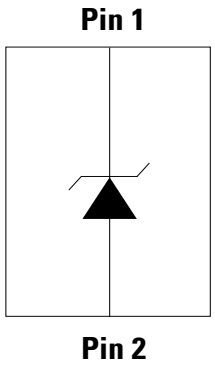
RoHS Pb GREEN



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 ±30kV (contact and air discharge, IEC 61000-4-2) without performance degradation. Additionally, each diode can safely dissipate 80A (SP1105S) of 8/20µs surge current (IEC 61000-4-5 2nd edition) with very low clamping voltages.

Pinout and Functional Block Diagram



Features

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2nd edition, 80A (t_P=8/20µs, 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

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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°C)

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

SP1105S Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA	-	-	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	µA
Clamp Voltage[1]	V_C	I_{PP}=40A, t_p=8/20µs, Fwd	-	8.3	-	V
		I_{PP}=80A, t_p=8/20µs, Fwd	-	9.2	-	V
Dynamic Resistance[2]	R_{DYN}	TLP, t_p=100ns, I/O to GND	-	0.05	-	Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs	-	-	80	A
ESD Withstand Voltage[1]	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	±30	-	-	kV
		IEC 61000-4-2 (Air Discharge)	±30	-	-	kV
Diode Capacitance[1]	C_D	Reverse Bias=0V, f=1MHz	-	630	-	pF

SP1112 Electrical Characteristics (T_{OP}=25°C)

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

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SP1115 Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA	-	-	15.0	V
Reverse Voltage Drop	V_R	I_R=1mA	16.7	-	-	V
Leakage Current	I_{LEAK}	V_R=15V	-	-	1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd	-	19.3	-	V
		I_{PP}=30A, t_p=8/20µs, Fwd	-	30.2	-	V
Dynamic Resistance[2]	R_{DYN}	TLP, t_P=100ns, I/O to GND	-	0.05	-	Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs	-	-	30.0	A
ESD Withstand Voltage[1]	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	±30	-	-	kV
		IEC 61000-4-2 (Air Discharge)	±30	-	-	kV
Diode Capacitance[1]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz	-	180	-	pF

SP1124 Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA	-	-	24.0	V
Reverse Voltage Drop	V_R	I_R=1mA	26.7	-	-	V
Leakage Current	I_{LEAK}	V_R=24V	-	-	1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd	-	29.8	-	V
		I_{PP}=20A, t_p=8/20µs, Fwd	-	44.7	-	V
Dynamic Resistance[2]	R_{DYN}	TLP, t_P=100ns, I/O to GND	-	0.1	-	Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs	-	-	20.0	A
ESD Withstand Voltage[1]	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	±30	-	-	kV
		IEC 61000-4-2 (Air Discharge)	±30	-	-	kV
Diode Capacitance[1]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz	-	130	-	pF

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

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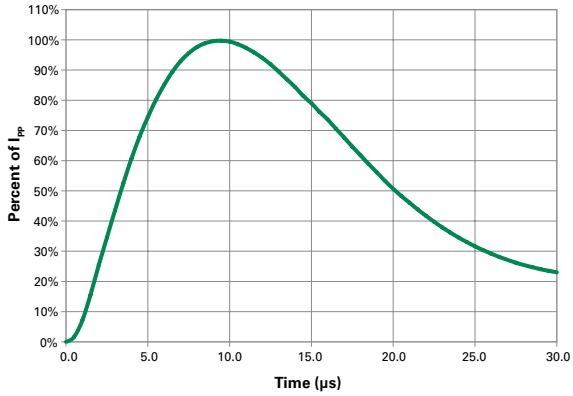
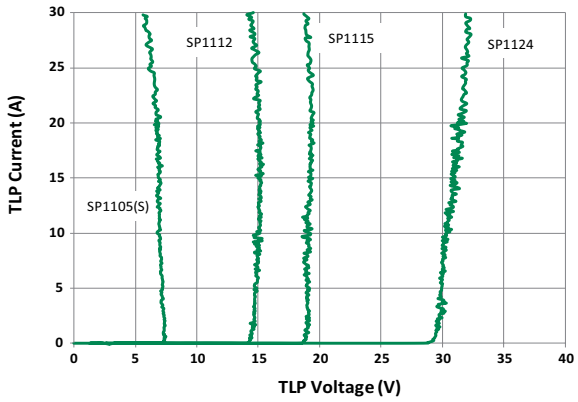
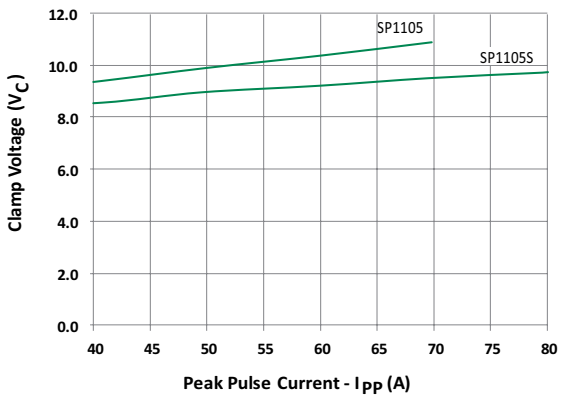
8/20µs Pulse Waveform



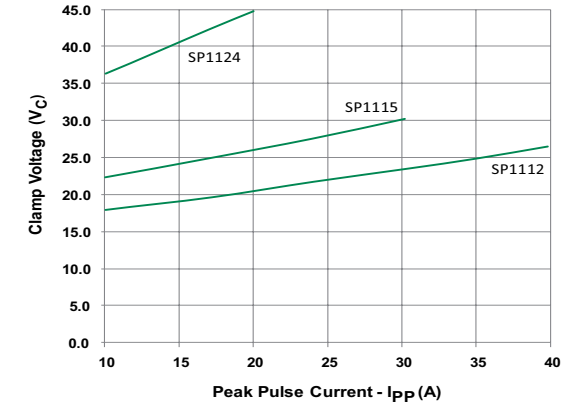
Transmission Line Pulsing (TLP) Plot



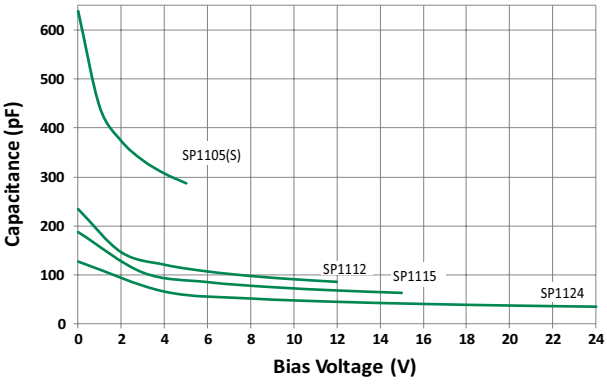
SP1105, SP1105S Clamping voltage vs. I_{PP} for 8/20µs waveshape



SP1112, SP1115, SP1124 Clamping voltage vs. I_{PP} for 8/20µs waveshape



Capacitance vs. Bias



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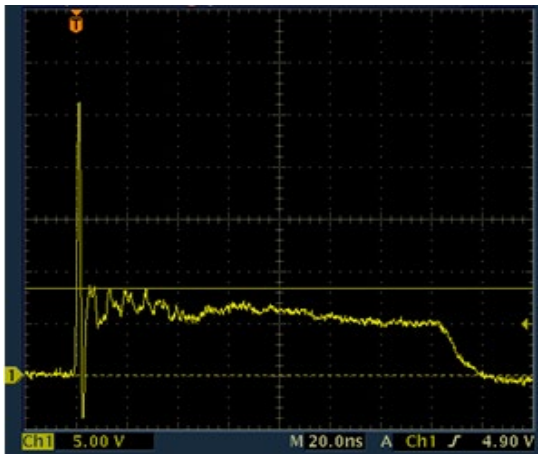
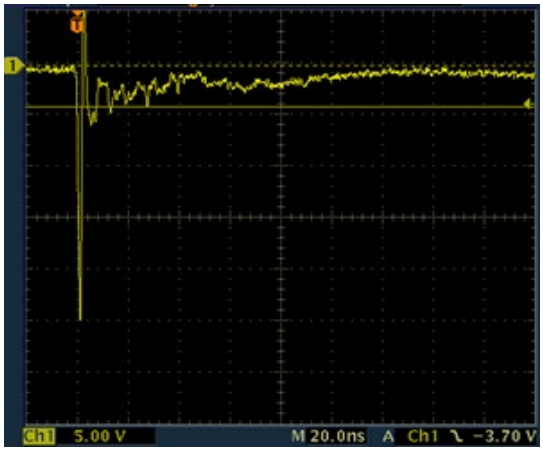
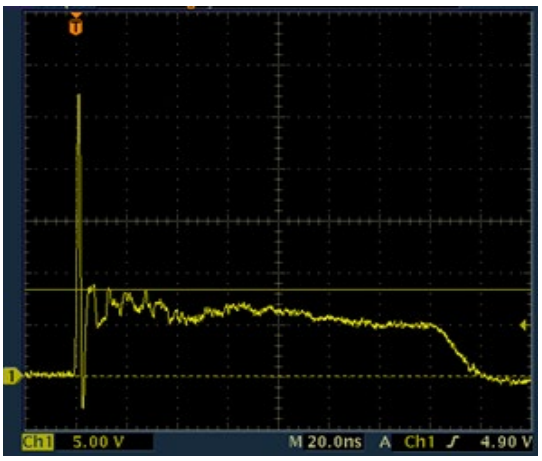
SP1105 IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage



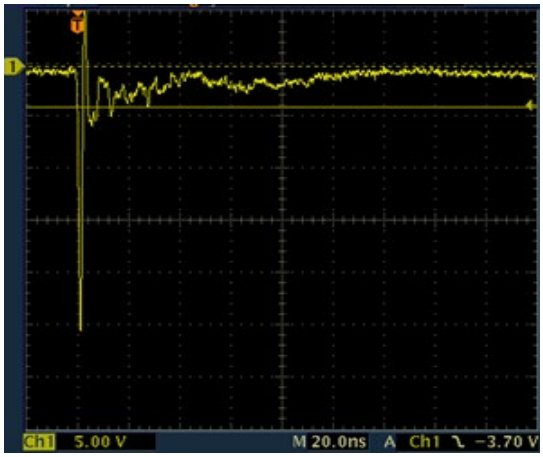
SP1105 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage



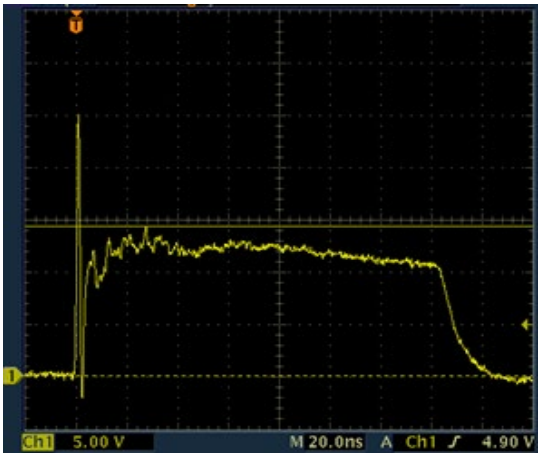
SP1105S IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage



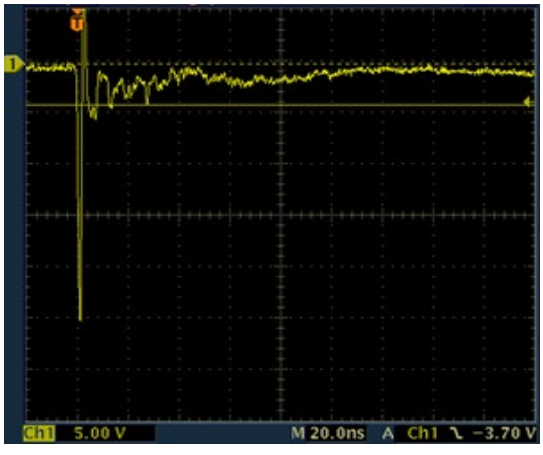
SP1105S IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage



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



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



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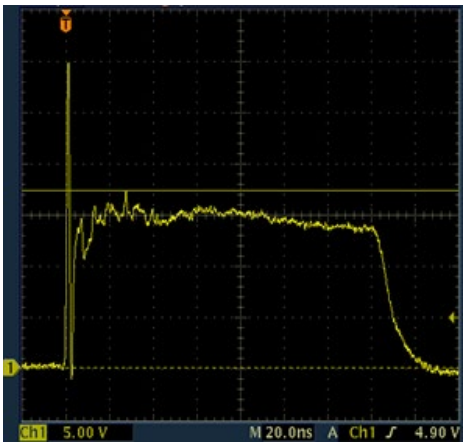
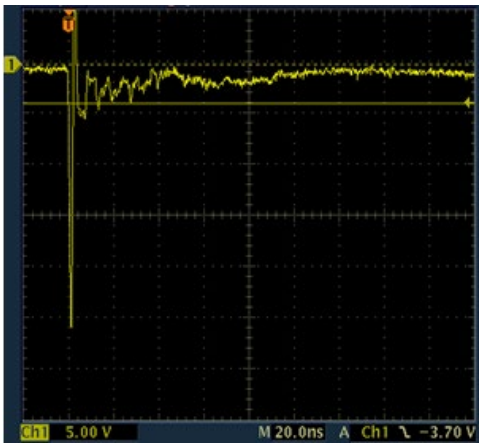
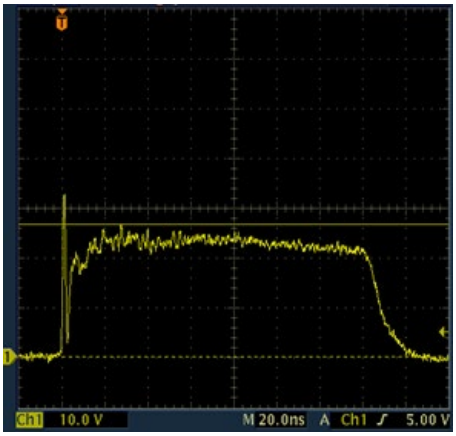
SP1115 IEC 61000 -4-2 +8 kV Contact ESD Clamping Voltage



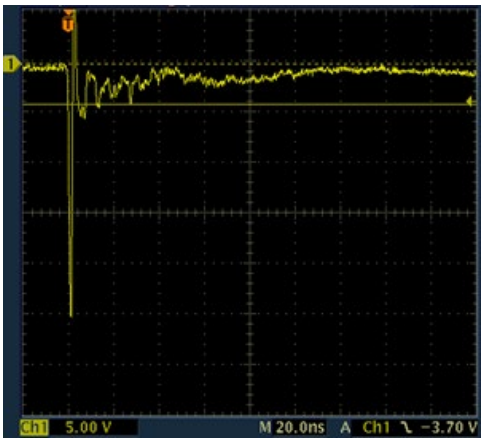
SP1115 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage



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

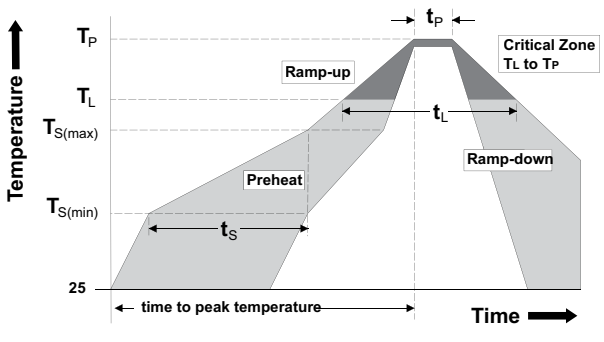


SP1124 IEC 61000 -4-2 -8 kV Contact ESD Clamping Voltage



Soldering Parameters

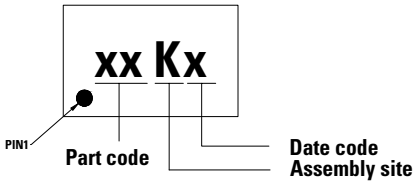
Reflow Condition		Pb – Free assembly
Pre Heat	**- Temperature Min ($T_{s(min)}$)**	150°C
	- Temperature Max ($T_{s(max)}$)	200°C
	- Time (min to max) (t_s)	60 – 180 secs
Average ramp up rate (Liquidus) Temp (T_L) to peak		3°C/second max
$T_{S(max)}$ to T_L - Ramp-up Rate		3°C/second max
Reflow	**- Temperature (T_L) (Liquidus)**	217°C
	- Temperature (t_L)	60 – 150 seconds
Peak Temperature (T_P)		$260^{+0/-5}$ °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



TVS Diode Array (SPA® Diodes)

General Purpose Surge Protection - SP11xx Series

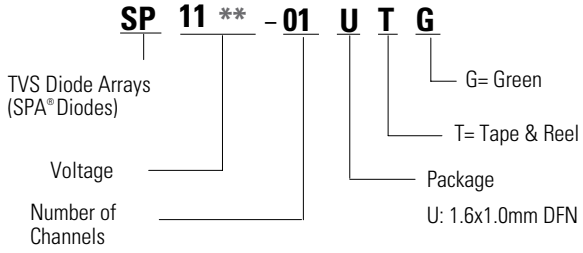
Part Marking System



Part code :

AA = SP1105-01UTG
AB = SP1112-01UTG
AC = SP1115-01UTG
AD = SP1124-01UTG
AE = SP1105S-01UTG

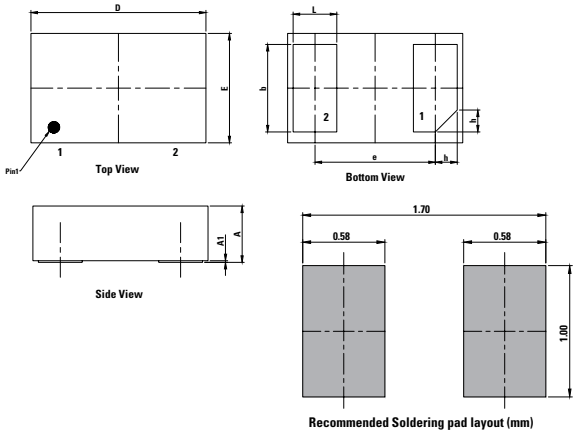
Part Numbering System



Ordering Information

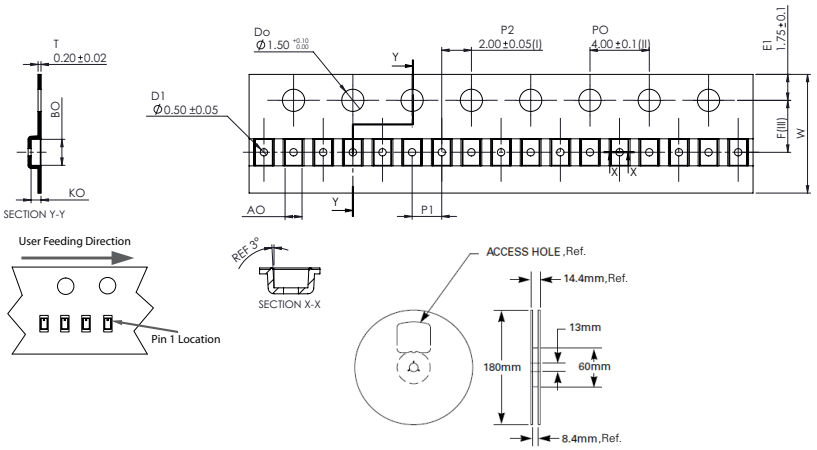
Part Number	Package	Marking	Min. Order Qty.
SP1105-01UTG	1.6x1.0mm DFN	AAKx	3000
SP1112-01UTG	1.6x1.0mm DFN	ABKx	3000
SP1115-01UTG	1.6x1.0mm DFN	ACKx	3000
SP1124-01UTG	1.6x1.0mm DFN	ADKx	3000
SP1105S-01UTG	1.6x1.0mm DFN	AEKx	3000

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

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