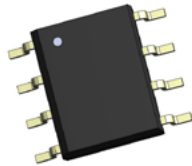


# STSP84XXXXXX

## TVS Diode array ESD suppressor



### Product features

- Protects four I/O lines
- Low clamping voltage
- Low operating voltage
- Meets moisture sensitivity level (MSL) 3
- Molding compound flammability rating: UL 94V-0
- Termination finish: Tin

### Applications

- WAN/LAN equipment
- Desktops, servers, notebooks & handhelds
- Switching systems
- Audio/video inputs
- 10/100/1000 ethernet
- Base stations

### Environmental compliance and general specifications

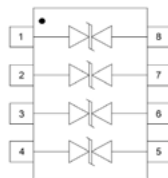
- IEC61000-4-2 (ESD)
  - Up to  $\pm 30$  kV (air)
  - Up to  $\pm 30$  kV (contact)
- IEC61000-4-5 (Lightning) Up to 50 A (8/20  $\mu$ s)



### Pin out/functional diagram

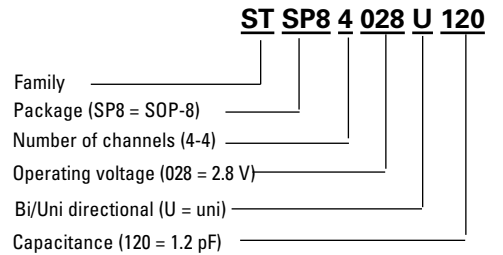


STSP84150B601

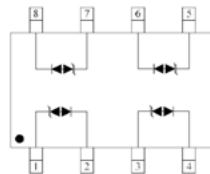


Pin Configuration (Top view)

### Ordering part number

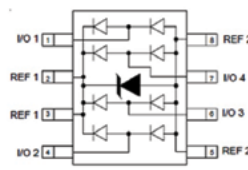


STSP84028U120  
STSP84028UL65

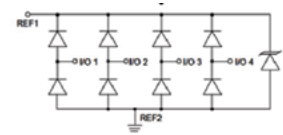


PIN Configuration

STSP84033U800  
STSP84050U800



Pin configuration



Circuit diagram

### Absolute maximum ratings

(+25 °C, RH=45%-75%, unless otherwise noted)

Parameter	Symbol	Value					Unit
		STSP84028 U120	STSP84028 UL65	STSP84033 U800	STSP84050 U800	STSP84150 B601	
Peak pulse power dissipation on 8/20 $\mu$ s waveform	$P_{pp}$	1000	600	500	500	300	W
ESD per IEC 61000-4-2 (Air)	$V_{ESD}$	+/-30	+/-30	+/-15	+/-15	+/-15	kV
ESD per IEC 61000-4-2 (Contact)		+/-30	+/-30	+/-8	+/-8	+/-8	
Lead soldering temperature	$T_L$	+260 (10 seconds)					°C
Operating junction temperature range	$T_J$	-55 to +125					°C
Storage temperature range	$T_{STG}$	-55 to +150					°C

### Electrical characteristics

(+25 °C)

#### STSP84028U120

Parameter	Test condition	Minimum	Typical	Maximum	Symbol (Units)
Reverse working voltage	-	-	-	2.8	$V_{RWM}$ (V)
Holding voltage	$I_h = 10$ mA	3.0	-	-	$V_h$
Reverse leakage current	$V_{RWM} = 2.8$ V	-	-	1	$I_R$ ( $\mu$ A)
Clamping voltage	$I_{pp} = 2$ A, $t_p = 8/20$ $\mu$ s	-	-	5.5	$V_c$ (V)
	$I_{pp} = 10$ A, $t_p = 8/20$ $\mu$ s	-	-	10	$V_c$ (V)
	$I_{pp} = 50$ A, $t_p = 8/20$ $\mu$ s	-	-	18	$V_c$ (V)
Junction capacitance	$V_{RWM} = 0$ V, $f = 1$ MHz	-	1.2	2.0	$C_J$ (pF)

#### STSP84028UL65

Parameter	Test condition	Minimum	Typical	Maximum	Symbol (Units)
Reverse working voltage	-	-	-	2.8	$V_{RWM}$ (V)
Reverse breakdown voltage	$I_T = 1$ mA	3.0	-	-	$V_{BR}$ (V)
Reverse leakage current	$V_{RWM} = 2.8$ V	-	0.01	0.1	$I_R$ ( $\mu$ A)
Clamping voltage	$I_{pp} = 2$ A, $t_p = 8/20$ $\mu$ s	-	-	7.6	$V_c$ (V)
	$I_{pp} = 20$ A, $t_p = 8/20$ $\mu$ s	-	14	20	$V_c$ (V)
Junction capacitance	$V_{RWM} = 0$ V, $f = 1$ MHz	-	0.65	1	$C_J$ (pF)

**STSP84033U800**

Parameter	Test condition	Minimum	Typical	Maximum	Symbol (Units)
Reverse working voltage	-	-	-	3.3	$V_{RWM}$ (V)
Reverse leakage current	$V_{RWM} = 3.3$ V	-	-	1	$I_R$ ( $\mu$ A)
Punch-through voltage	$I_{PT} = 2$ $\mu$ A	3.5	-	-	$V_{PT}$ (V)
Snapback voltage	$I_{SB} = 50$ mA	2.8	-	-	$V_{SB}$ (V)
Clamping voltage	$I_{pp} = 1$ A, $t_p = 8/20$ $\mu$ s	-	-	5.3	$V_C$ (V)
	$I_{pp} = 10$ A, $t_p = 8/20$ $\mu$ s	-	-	10	$V_C$ (V)
	$I_{pp} = 25$ A, $t_p = 8/20$ $\mu$ s	-	-	15	$V_C$ (V)
Junction capacitance	$V_{RWM} = 0$ V, $f = 1$ MHz	-	8	15	$C_J$ (pF)
	$V_{RWM} = 0$ V, $f = 1$ MHz; Between I/O pins and GND	-	4	-	$C_J$ (pF)

**STSP84050U800**

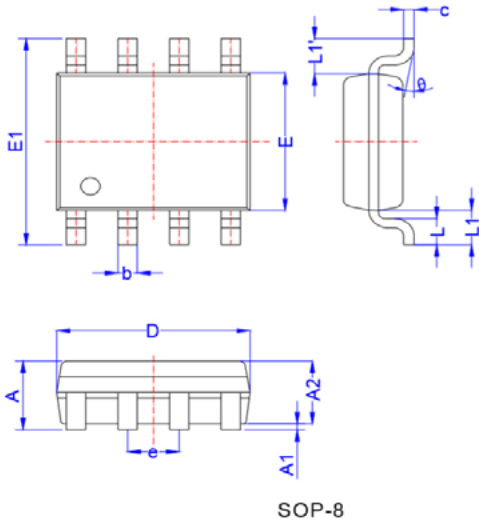
Parameter	Test condition	Minimum	Typical	Maximum	Symbol (Units)
Reverse working voltage	-	-	-	5	$V_{RWM}$ (V)
Reverse breakdown voltage	$I_T = 1$ mA	6	-	-	$V_{BR}$ (V)
Reverse leakage current	$V_{RWM} = 5$ V	-	-	10	$I_R$ ( $\mu$ A)
Clamping voltage	$I_{pp} = 1$ A, $t_p = 8/20$ $\mu$ s	-	-	9.8	$V_C$ (V)
	$I_{pp} = 10$ A, $t_p = 8/20$ $\mu$ s	-	-	12	$V_C$ (V)
	$I_{pp} = 25$ A, $t_p = 8/20$ $\mu$ s	-	-	20	$V_C$ (V)
Junction capacitance	$V_{RWM} = 0$ V, $f = 1$ MHz	-	8	15	$C_J$ (pF)
	$V_{RWM} = 0$ V, $f = 1$ MHz; Between I/O pins and GND	-	4	-	$C_J$ (pF)

**STSP84150B601**

Parameter	Test condition	Minimum	Typical	Maximum	Symbol (Units)
Reverse working voltage	-	-	-	15	$V_{RWM}$ (V)
Reverse breakdown voltage	$I_T = 1$ mA	16.5	-	-	$V_{BR}$ (V)
Reverse leakage current	$V_{RWM} = 15$ V	-	-	1	$I_R$ ( $\mu$ A)
Peak pulse current	$t_p = 8/20$ $\mu$ s	-	-	12	$I_{pp}$ (A)
Clamping voltage	$I_{pp} = 1$ A, $t_p = 8/20$ $\mu$ s	-	-	24	$V_C$ (V)
	$I_{pp} = 12$ A, $t_p = 8/20$ $\mu$ s	-	-	30	$V_C$ (V)
Junction capacitance	$V_{RWM} = 0$ V, $f = 1$ MHz	-	-	60	$C_J$ (pF)

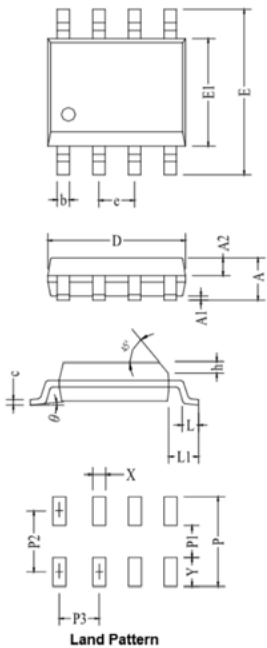
**Mechanical parameters, pad layout- mm/inches**

**STSP84033U800, STSP84050U800& STSP84150B601**



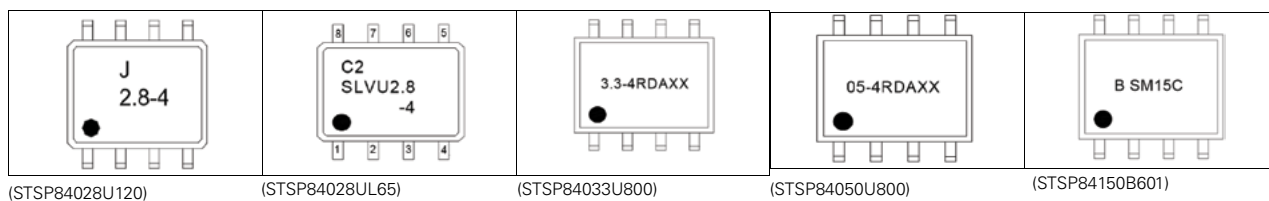
Dimension	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.40		1.70	0.055		0.067
A1	0.05		0.15	0.002		0.006
A2	1.35		1.55	0.053		0.061
b	0.31		0.51	0.012		0.020
c	0.17		0.25	0.007		0.010
D	4.70		5.10	0.185		0.201
E	3.80		4.00	0.150		0.157
E1	5.80		6.20	0.228		0.244
e	1.14	1.27	1.40	0.045	0.050	0.055
L	0.62		0.77	0.024		0.030
L1	1.00	1.02	1.04	0.039	0.040	0.041
L1-L1'			0.12			0.005
θ	0°		8°	0°		8°

**STSP84028U120&STSP84028UL65**



Dimension	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	0.67	0.77	0.026	0.030
b	0.33	0.51	0.013	0.020
c	0.17	0.25	0.007	0.010
D	4.70	5.10	0.185	0.201
e	1.27 BSC		0.05 BSC	
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
h	0.25	0.50	0.010	0.020
θ	0°	8°	0°	8°
L	0.40	1.27	0.016	0.050
L1	1.04 BSC		0.041 BSC	
X	0.60		0.24	
Y	2.20		0.037	
P	7.40		0.291	
P1	3.00		0.118	
P2	5.20		0.205	
P3	1.27		0.050	

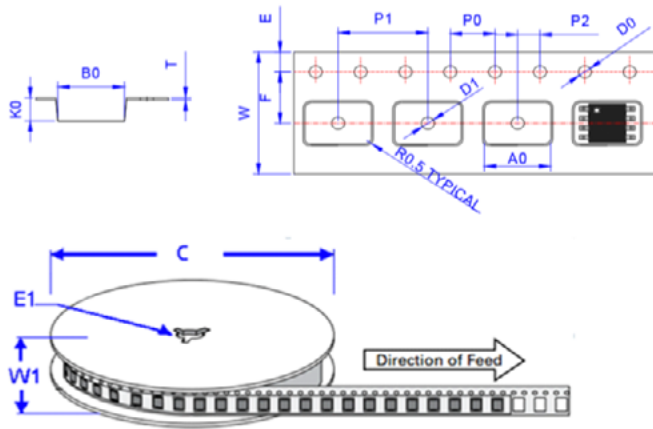
**Part marking**



**Packaging information mm/inches**

Drawing not to scale.

Supplied in tape and reel packaging, 2,500 parts per 7" diameter reel (EIA-481 compliant)

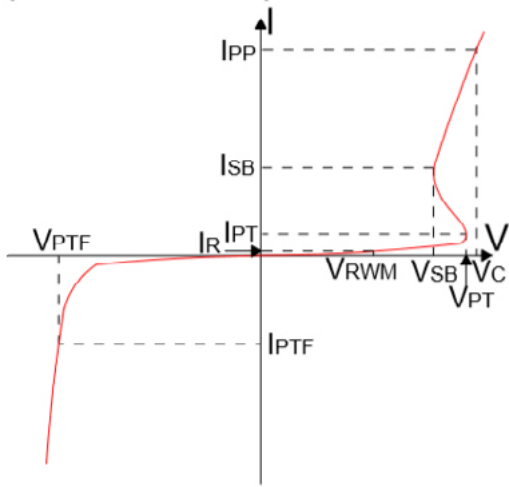


Ref.	Dimensions	
	Millimeters	Inches
A0	6.6±0.10	0.260 ± 0.004
B0	5.3±0.10	0.209 ± 0.004
C	330	13.0
D0	1.50±0.10	0.059 + 0.004
D1	1.50±0.10	0.059 + 0.004
E1	13.3±0.3	0.524± 0.012
E	1.75±0.1	0.069± 0.004
F	5.5±0.05	0.217 ± 0.002
K0	2.1±0.1	0.083 ± 0.004
P0	4.0±0.1	0.157± 0.004
P1	8.0±0.1	0.315± 0.004
P2	2.0±0.05	0.079 ± 0.002
T	0.24±0.1	0.009 ± 0.002
W	12.0±0.3	0.472 ± 0.012
W1	15.7±2.0	0.618 ± 0.079

**Ratings and V-I characteristic curves** (+25 °C unless otherwise noted)

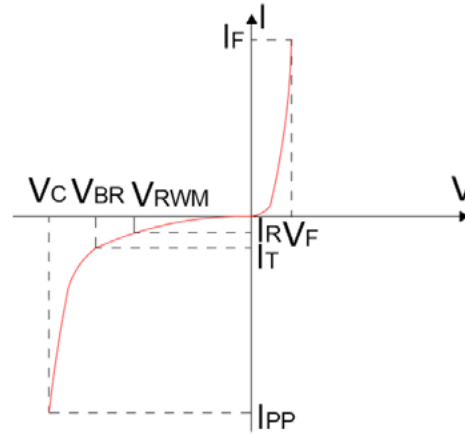
**V- I curve characteristics (Uni-directional)**

STSP84028U120, STSP84028UL65, STSP84033U800



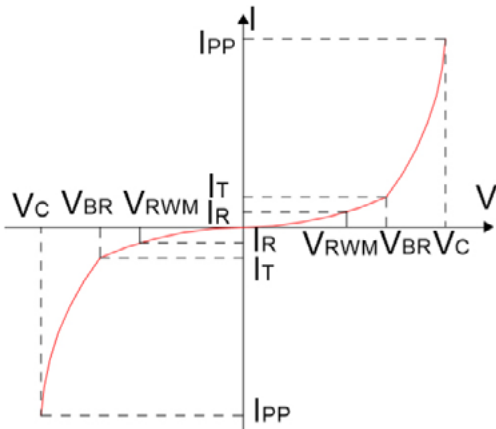
**V- I curve characteristics (Uni-directional)**

STSP84050U800

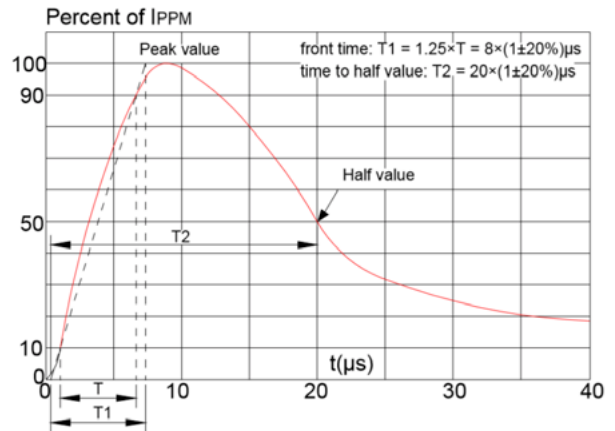


**V- I curve characteristics (Bi-directional)**

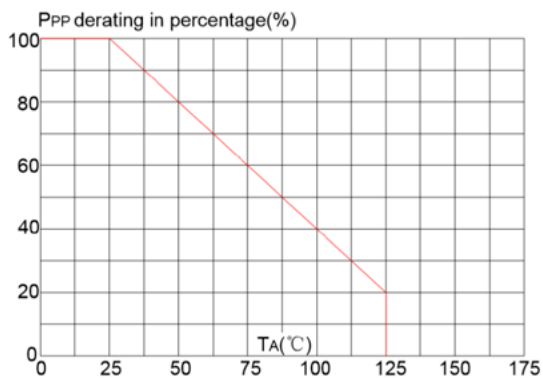
STSP84150B601



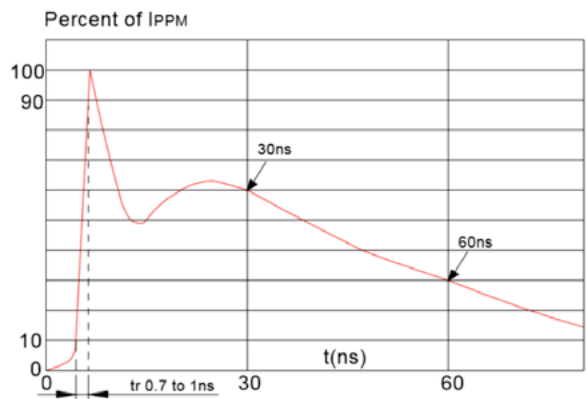
**Pulse waveform (8/20 μs)**



**Pulse derating curve**



**ESD waveform**

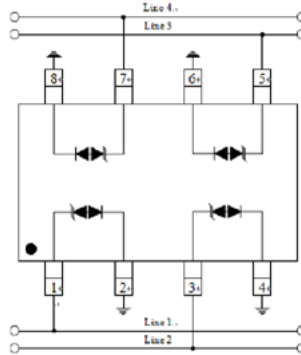


**Application information**

STSP84028U120 can be configured in different connections to meet the requirement of common-mode and differential-mode as shown in the diagrams below.

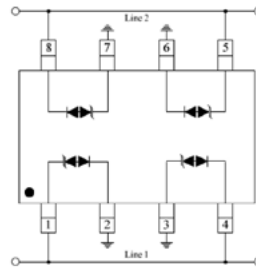
**Four line uni-directional common-mode protection**

- Pin 1 is connected to Line 1
- Pin 3 is connected to Line 2
- Pin 5 is connected to Line 3
- Pin 7 is connected to Line 4
- Pin 2, 4, 6 and 8 are connected to ground



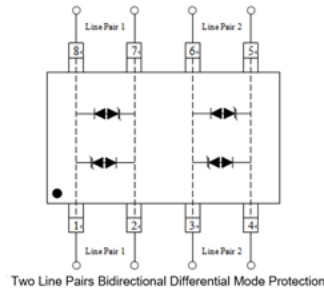
**Two Line bi-directional common-mode protection**

- Pin 1 & 4 is connected to Line 1
- Pin 5 & 8 is connected to Line 2
- Pin 2, 3, 6 and 7 are connected to ground

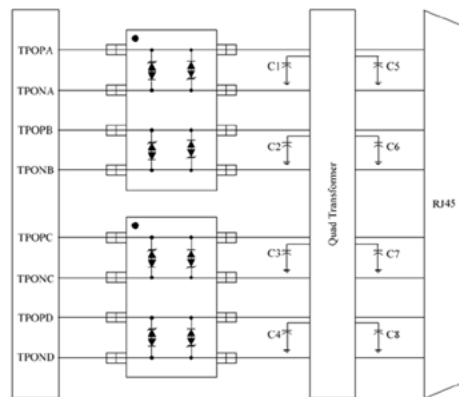


**Two line pairs bi-directional differential-mode protection**

- Pin 1, 2, 7 and 8 are connected to Line 1
- Pair 1 Pin 3, 4, 5 and 6 are connected to Line Pair 2

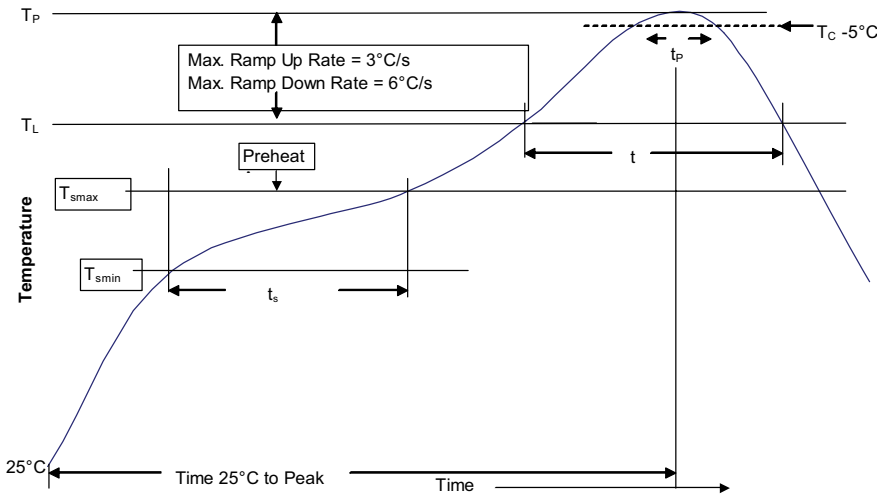


**Gigabit ethernet ESD/surge protection**



Schematic Diagram for Gigabit Ethernet ESD/ Surge Protection

### Solder reflow profile



**Table 1 - Standard SnPb solder ( $T_c$ )**

Package thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

**Table 2 - Lead (Pb) free solder ( $T_c$ )**

Package thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350 - 2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 – 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

### Reference J-STD-020

Profile feature	Standard SnPb solder	Lead (Pb) free solder
Preheat and soak	<ul style="list-style-type: none"> <li>Temperature min. (<math>T_{smin}</math>)</li> <li>Temperature max. (<math>T_{smax}</math>)</li> <li>Time (<math>T_{smin}</math> to <math>T_{smax}</math>) (<math>t_s</math>)</li> </ul>	<ul style="list-style-type: none"> <li>100 °C</li> <li>150 °C</li> <li>60-120 seconds</li> </ul>
Ramp up rate $T_L$ to $T_p$	3 °C/ second max.	3 °C/ second max.
Liquidous temperature ( $T_L$ ) Time ( $t_L$ ) maintained above $T_L$	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body temperature ( $T_p$ )*	Table 1	Table 2
Time ( $t_p$ )* within 5 °C of the specified classification temperature ( $T_c$ )	20 seconds*	30 seconds*
Ramp-down rate ( $T_p$ to $T_L$ )	6 °C/ second max.	6 °C/ second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

\* Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

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