



# WS03-4TP

## Transient Voltage Suppressor

### Features

- Solid-state silicon-avalanche technology
- Low operating and clamping voltage
- Up to four I/O lines of protection
- Low leakage
- Low operating voltage:3.3V

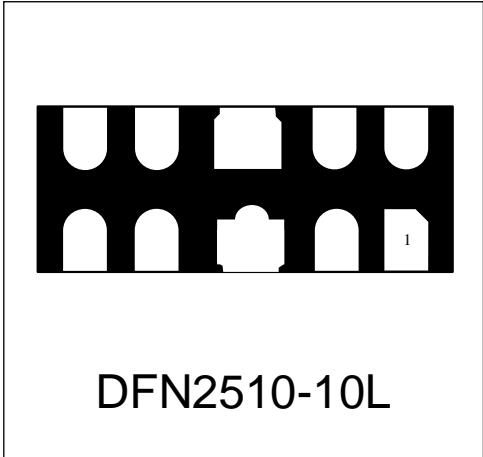
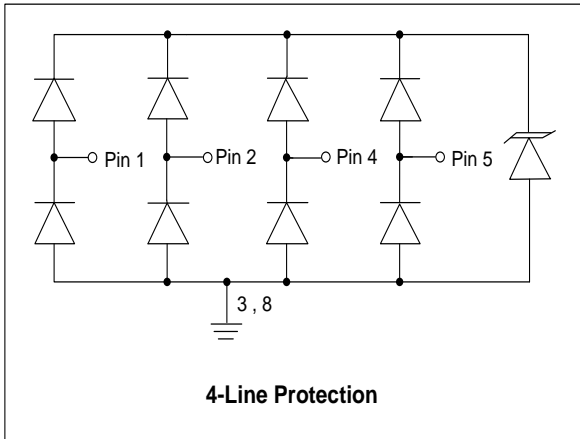
### IEC COMPATIBILITY (EN61000-4)

- IEC 61000-4-2 (ESD) ±15kV (air), ±15kV (contact)
- IEC 61000-4-4 (EFT) 40A (5/50ns)
- IEC 61000-4-5 (Lightning) 8A (8/20µs)

### Mechanical Characteristics

- DFN2510-10L package
- Marking: Marking Code
- Packaging: Tape and Reel
- RoHS Compliant

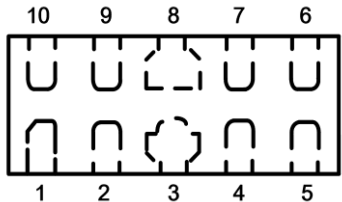
### Circuit Diagram



### Applications

- USB2.0 and USB 3.0
- HDMI 1.3, HDMI 1.4
- SATA and eSATA
- DVI
- IEEE 1394
- PCI Express
- Portable Electronics and Notebooks

### Schematic & PIN Configuration



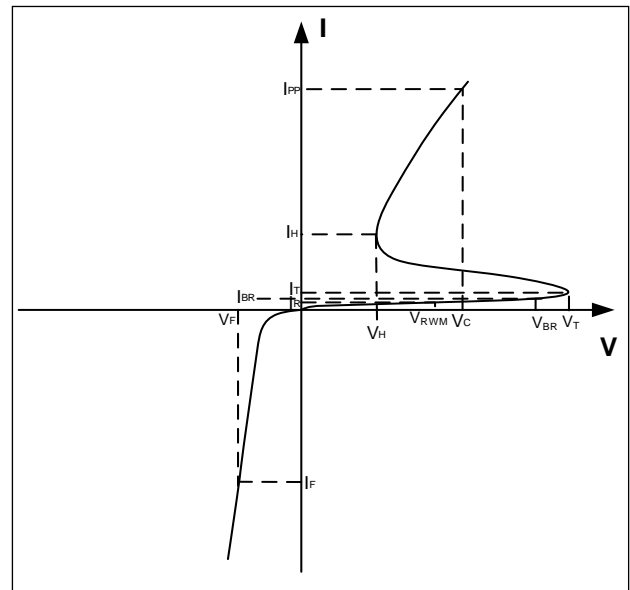
| Pin      | Identifaion                              |
|----------|--|
| 1,2,4,5  | Input Lines                              |
| 6,7,9,10 | Output Lines<br>(No Internal Connection) |
| 3,8      | Ground                                   |

### Absolute Maximum Rating

| Rating                                   | Symbol    | Value        | Units |
|--|-----------|--------------|-------|
| Peak Pulse Power ( $t_p = 8/20\mu s$ )   | $P_{PP}$  | 32           | Watts |
| Peak Pulse Current ( $t_p = 8/20\mu s$ ) | $I_{pp}$  | 8            | A     |
| Operating Temperature                    | $T_J$     | -55 to + 125 | °C    |
| Storage Temperature                      | $T_{STG}$ | -55 to +150  | °C    |

### Electrical Parameters

| Symbol    | Parameter                  |
|-----------|----------------------------|
| $I_{PP}$  | Reverse Peak Pulse Current |
| $V_C$     | Clamping Voltage           |
| $V_{RWM}$ | Reverse Stand-Off Voltage  |
| $I_{BR}$  | Reverse Breakdown Current  |
| $I_R$     | Reverse Leakage Current    |
| $V_{BR}$  | Reverse Breakdown Voltage  |
| $V_T$     | Reverse Trigger Voltage    |
| $I_T$     | Reverse Trigger Current    |
| $V_H$     | Reverse Holding Voltage    |
| $I_H$     | Reverse Holding current    |
| $V_F$     | Forward Voltage            |
| $I_F$     | Forward Current            |



### Electrical Characteristics(T=25°C unless otherwise noted)

| WS03-4TP                          |           |   |         |         |         |          |
|-----------------------------------|-----------|---|---------|---------|---------|----------|
| Parameter                         | Symbol    | Conditions  | Minimum | Typical | Maximum | Units    |
| Reverse Stand-Off Voltage         | $V_{RWM}$ | Any I/O pin to ground                               |         |         | 3.3     | V        |
| Reverse Breakdown Voltage         | $V_{BR}$  | $I_T = 1mA$<br>Any I/O pin to ground                | 3.7     |         |         | V        |
| Reverse Leakage Current           | $I_R$     | $V_{RWM} = 3.3V$<br>Any I/O pin to ground           |         |         | 500     | nA       |
| Holding current                   | $I_H$     | $T=25^\circ C$                                      |         | 2       |         | mA       |
| Clamping Voltage                  | $V_C$     | $I_{pp}=8A, t_p=8/20\mu s$<br>Any I/O pin to ground |         | 3.5     | 4       | V        |
| ESD Clamping Voltage <sup>1</sup> | $V_C$     | $I_{PP} = 4A,$<br>$t_p = 0.2/100ns$ (TLP)           |         | 2.3     |         | V        |
| ESD Clamping Voltage <sup>1</sup> | $V_C$     | $I_{PP} = 16A,$<br>$t_p = 0.2/100ns$ (TLP)          |         | 5.1     |         | V        |
| Dynamic Resistance <sup>1,2</sup> | $R_{DYN}$ | TLP=0.2/100ns                                       |         | 0.23    |         | $\Omega$ |
| Junction Capacitance              | $C_j$     | $V_R = 1.5V, f = 1MHz$<br>I/O pin to GND            |         | 0.55    | 0.65    | pF       |
|                                   |           | $V_R = 1.5V, f = 1MHz$<br>Between I/O pins,         |         | 0.35    | 0.45    | pF       |

Notes : 1、 TLP Setting :  $t_p=100ns, t_r=0.2ns, I_{TLP}$  and  $V_{TLP}$  sample window: $t_1=70ns$  to  $t_2=90ns$ .  
 2、 Dynamic resistance calculated from  $I_{PP}=4A$  to  $I_{PP}=16A$  using "Best Fit".

Typical Characteristics

Figure 1: Peak Pulse Power vs. Pulse Time

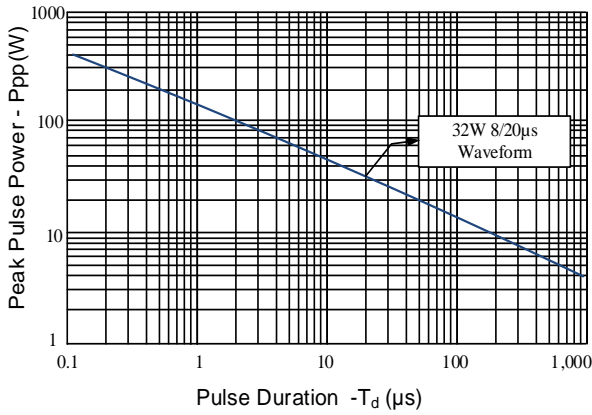


Figure 2: Power Derating Curve

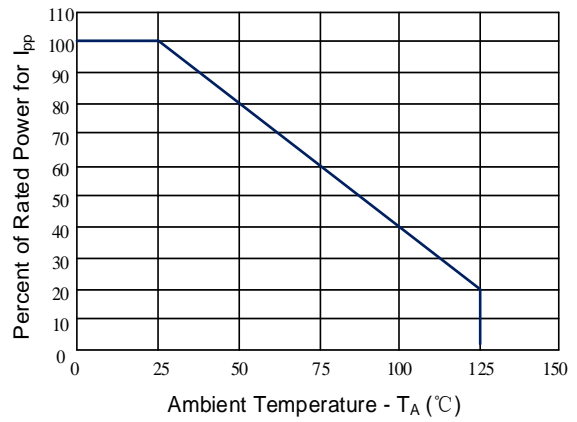


Figure 3: Clamping Voltage vs. Peak Pulse Current

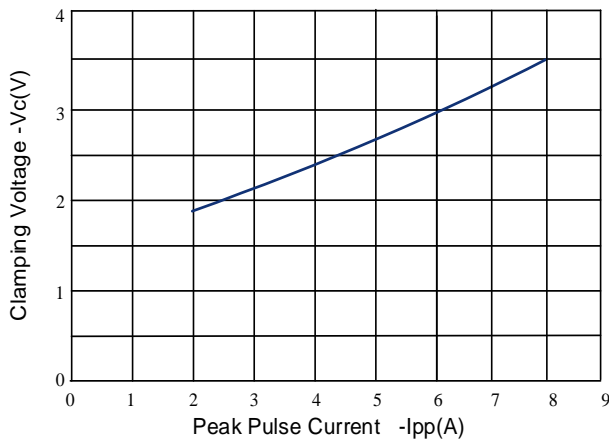


Figure 4: Normalized Junction Capacitance vs. Reverse Voltage

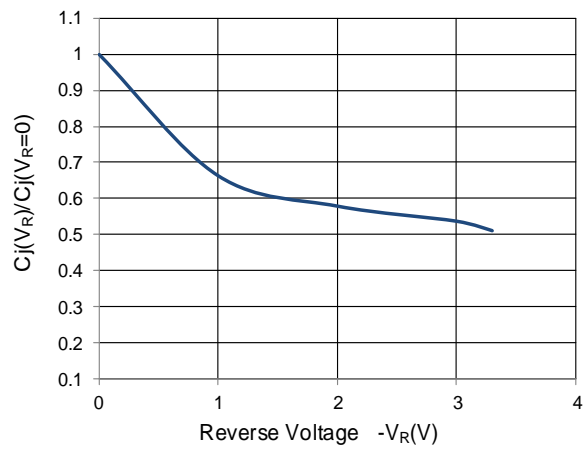


Figure 5: 8/20μs Pulse Waveform

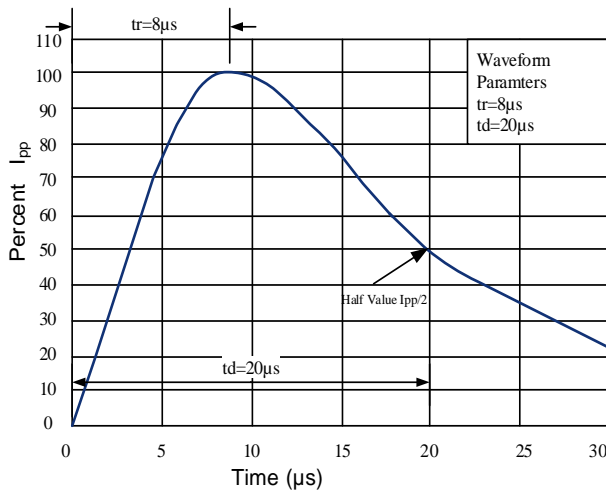
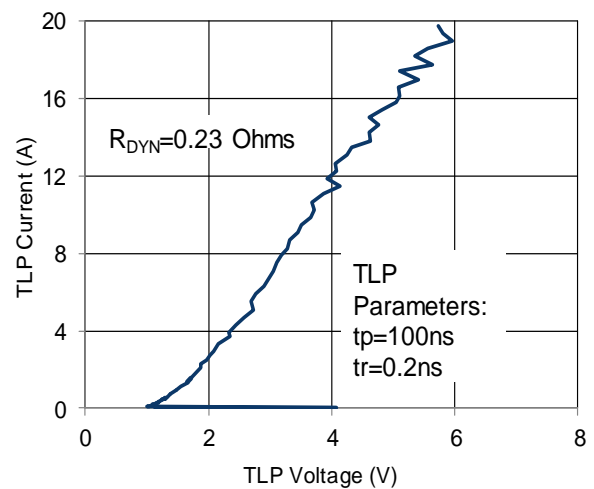
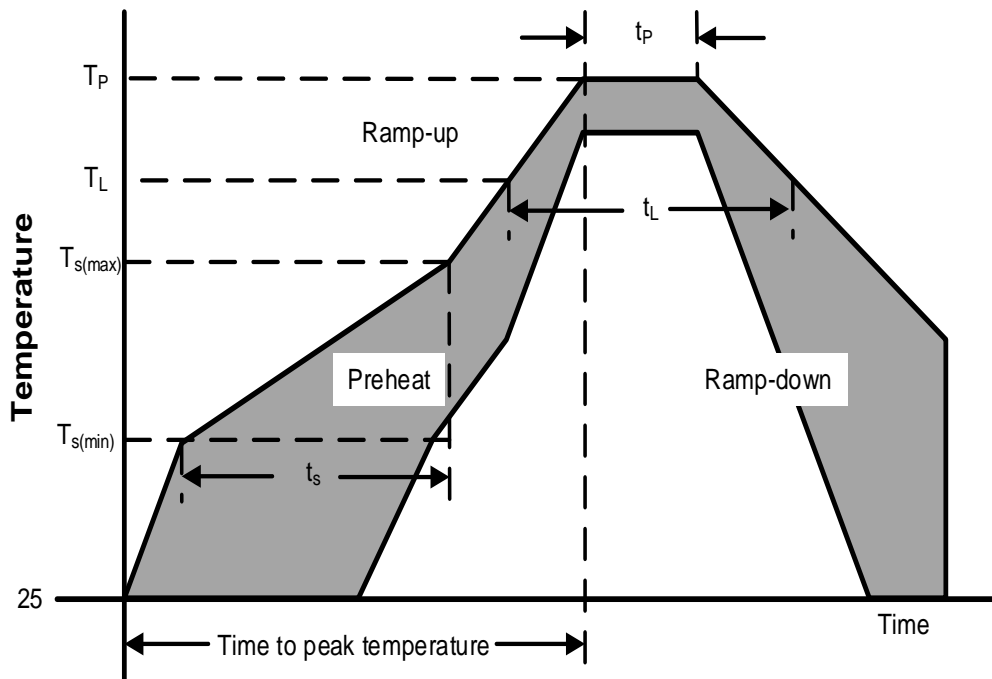


Figure 6: TLP I-V Curve

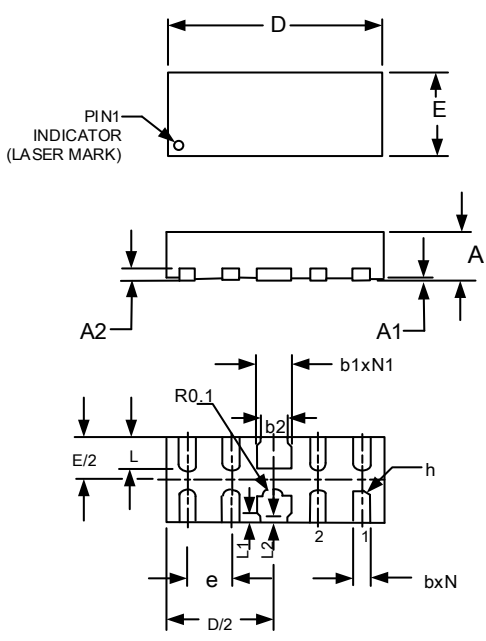



Soldering Parameters

| 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 – 190 secs      |
| Average ramp up rate (Liquidus Temp) ( $T_L$ ) to peak |                                  | 5°C/second max     |
| $T_{s(max)}$ to $T_L$ — Ramp-up Rate                   |                                  | 5°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 actual peak Temperature ( $t_p$ )          |                                  | 20 – 40 seconds    |
| Ramp-down Rate   |                                  | 5°C/second max     |
| Time 25°C to peak Temperature ( $T_P$ )                |                                  | 8 minutes Max.     |
| Do not exceed  |                                  | 280°C              |



Outline Drawing –DFN2510-10L

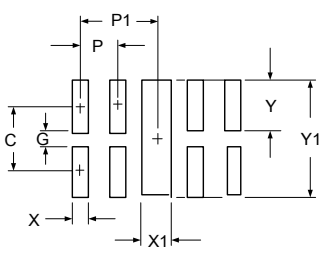




**DFN2.5x1-10L**

DIMENSIONS

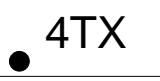
| DIM | INCHES    |       |       | MILLIMETERS |       |      |
|-----|-----------|-------|-------|-------------|-------|------|
|     | MIN       | NOM   | MAX   | MIN         | NOM   | MAX  |
| A   | 0.018     | 0.020 | 0.022 | 0.45        | 0.50  | 0.55 |
| A1  | 0.000     | 0.001 | 0.002 | 0.00        | 0.02  | 0.05 |
| A2  | 0.006     |       |       | 0.15        |       |      |
| b   | 0.006     | 0.008 | 0.010 | 0.15        | 0.20  | 0.25 |
| b1  | 0.014     | 0.016 | 0.018 | 0.35        | 0.40  | 0.45 |
| b2  | 0.008     | 0.010 | 0.018 | 0.20        | 0.25  | 0.45 |
| D   | 0.096     | 0.098 | 0.100 | 2.45        | 2.50  | 2.55 |
| E   | 0.037     | 0.039 | 0.041 | 0.95        | 1.00  | 1.05 |
| e   | 0.020 BSC |       |       | 0.50 BSC    |       |      |
| L   | 0.014     | 0.016 | 0.018 | 0.35        | 0.40  | 0.45 |
| L1  | 0.000     | 0.003 | 0.004 | 0.00        | 0.075 | 0.10 |
| L2  | 0.000     | 0.002 | 0.003 | 0.00        | 0.05  | 0.08 |
| h   | 0.000     | 0.005 | 0.006 | 0.00        | 0.12  | 0.15 |
| N   | 8         |       |       | 8           |       |      |
| N1  | 2         |       |       | 2           |       |      |



| DIMENSIONS |        |             |
|------------|--------|-------------|
| DIM        | INCHES | MILLIMETERS |
| C          | 0.034  | 0.875       |
| G          | 0.008  | 0.20        |
| P          | 0.020  | 0.50        |
| P1         | 0.039  | 1.00        |
| X          | 0.010  | 0.25        |
| X1         | 0.018  | 0.45        |
| Y          | 0.027  | 0.675       |
| Y1         | 0.061  | 1.55        |

**Notes:**  
Controlling Dimension: Millimeter.

Marking Codes

|              |  |
|--------------|--|
| Part Number  | WS03-4TP   |
| Marking Code | <div style="border: 1px solid black; padding: 5px; display: inline-block;">  </div><br>X=Month Code |

Package Information

Qty: 3k/Reel

CONTACT INFORMATION

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The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.  
Users should verify actual device performance in their specific applications.

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[>>WAY-ON\(维安\)](#)