Features

- Transient protection for high-speed data lines
  - IEC 61000-4-2 (ESD) ±25kV (Air)
  - ±17kV (Contact)
  - IEC 61000-4-4 (EFT) 40A (5/50 ns)
  - Cable Discharge Event (CDE)
- Package optimized for high-speed lines
- Ultra-small package (2.5mmx1.0mmx0.55mm)
- Protects six data lines
- Low capacitance: 0.2pF Typical(I/O-I/O)
- Low leakage current: 0.1uA@V_{RWM} (Typical)
- Low clamping voltage
- Each I/O pin can withstand over 1000 ESD strikes for ±8kV contact discharge

Description

T0504SP is an ultra-low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 0.2 pF only, T0504SP is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC 61000-4-2 (ESD), Level 4 (±15kV air, ±8kV contact discharge), IEC 61000-4-4 (electrical fast transient - EFT) (40A,5/50 ns), very fast charged device model (CDM) ESD and cable discharge event (CDE), etc.

T0504SP uses ultra-small DFN2510-10L package. Each T0504SP device can protect four high-speed data lines The combined features of ultra-low capacitance, ultra-small size and high ESD robustness make T0504SP ideal for high-speed data ports and high-frequency lines (e.g.,HDMI & DVI) applications. The low camping voltage of the T0504SP guarantees a minimum stress on the protected IC.

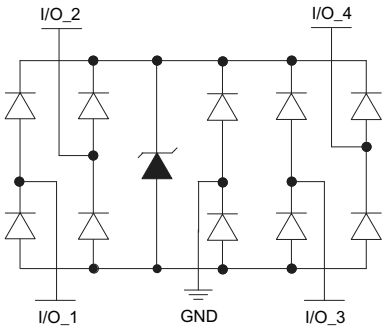
Applications

- Serial ATA
- PCI Express
- Desktops, Servers and Notebooks
- MDDI Ports
- USB 2.0/3.0 Power and Data Line Protection
- Display Ports
- High Definition Multi-Media Interface (HDMI)
- Digital Visual Interfaces (DVI)

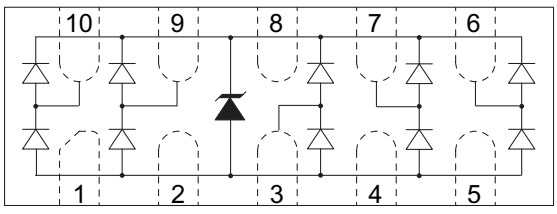
Mechanical Characteristics

- DFN2510-10L package
- Flammability Rating: UL 94V-0
- Marking: Part number
- Packaging: Tape and Reel

Circuit Diagram



Pin Configuration



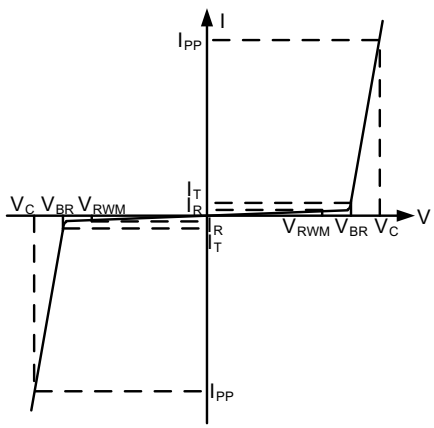
DFN2510-10L
(Top View)

Absolute Maximum Rating

Symbol	Parameter	Value	Units
V_{ESD}	ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	±25 ±17	kV
T_{OPT}	Operating Temperature	-55/+125	˚C
T_{STG}	Storage Temperature	-55/+150	˚C

Electrical Characteristics (T = 25˚C)

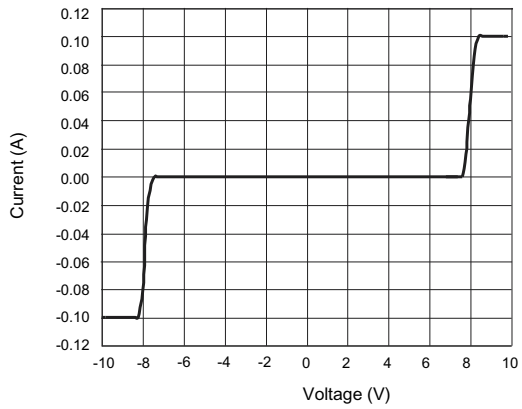
Symbol	Parameter
V_{RWM}	Nominal Reverse Working Voltage
I_R	Reverse Leakage Current @V_{RWM}
V_{BR}	Reverse Breakdown Voltage @I_T
I_T	Test Current for Reverse Breakdown
V_C	Clamping Voltage @ I_{PP}
I_{PP}	Maximum Peak Pulse Current
C_{ESD}	Parasitic Capacitance
V_R	Reverse Voltage
f	Small Signal Frequency
I_F	Forward Current
V_F	Forward Voltage @I_F



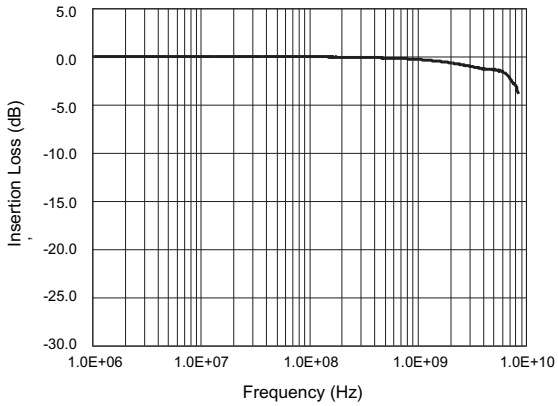
Bi-Directional TVS

Symbol	Test Condition	Minimum	Typical	Maximum	Units
V_{RWM}				5.0	V
I_R	V_{RWM} = 5V,T = 25 C Between I/O and GND		0.1	1.0	μA
V_{BR}	I_T = 1mA Between I/O and GND	7.0	9.0	11.0	V
V_C	I_{PP} = 1A, t_p = 8/20μs Between I/O and GND			12	V
C_{ESD}	V_R = 0V, f = 1MHz Between I/O and GND		0.2		pF
C_{ESD}	V_R = 0V, f = 1MHz Between I/O and I/O		0.2		pF

Voltage Sweeping of I/O to GND

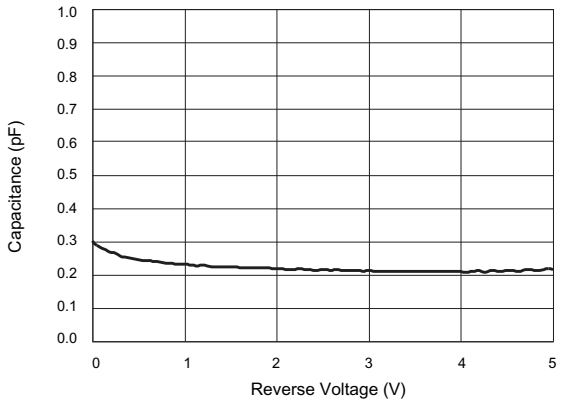


Insertion Loss S21 of I/O to GND

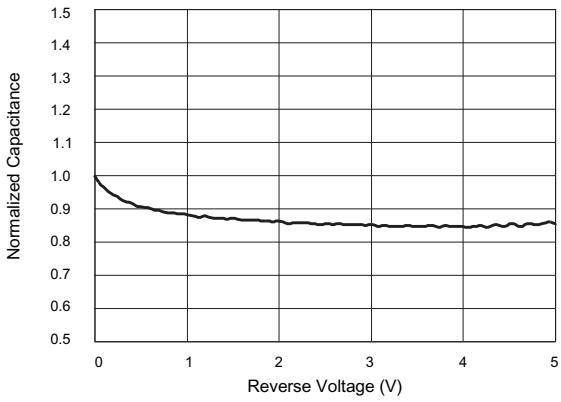


Capacitance *vs.* Voltage of I/O to GND (f = 1MHz)

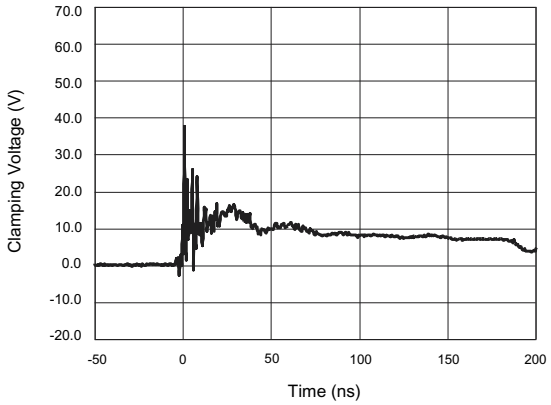
Capacitance *vs.* Reverse Voltage



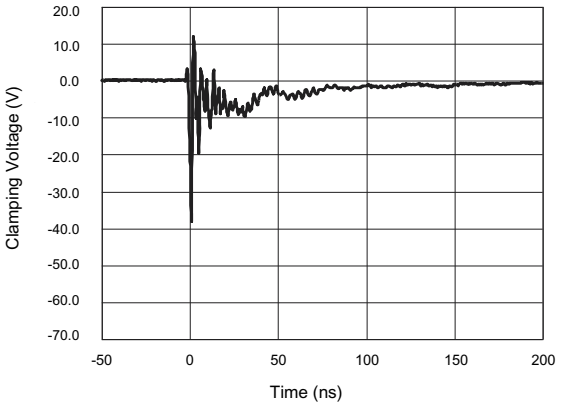
Normalized Capacitance *vs.* Reverse Voltage



ESD Clamping of I/O to GND (+8kV Contact per IEC 61000-4-2)



ESD Clamping of I/O to GND (-8kV Contact per IEC 61000-4-2)



Application Information

Pin Connection in PCB

T0504SP provides ESD protection for four data lines simultaneously. The pin connection is shown in the figure below.
Four parallel data lines, from inner IC to I/O port connector, coule connect to T0504SP four I/O pins directly. Pin 3 of T0504SP is the GND pin, which should connect to the GND of PCB. The wire should be as short as possible in order to minimize the parasitic inductance.

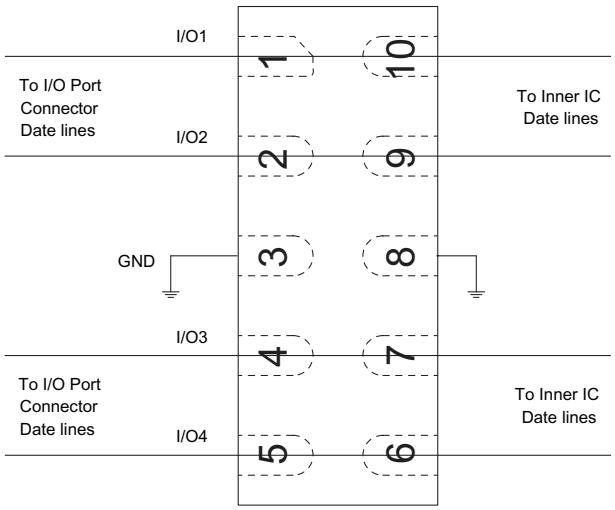


Figure 1 T0504SP pin connection in PCB

PCB Layout Guidelines

For optimum ESD protection and the whole circuit performance, the following PCB layout guidelines are recommended:

- T0504SP GND pin to the PCB GND rail path should be as short as possible. It could reduce the ESD transient return path to GND.
- The vias connecting T0504SP GND pins to the PCB GND should be wide
- Place T0504SP as close to the connector port as possible. It could reduce the parasitic inductance and restrict ESD coupling into adjacent traces.
- Avoid running critical signals near board edges.

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Application Information

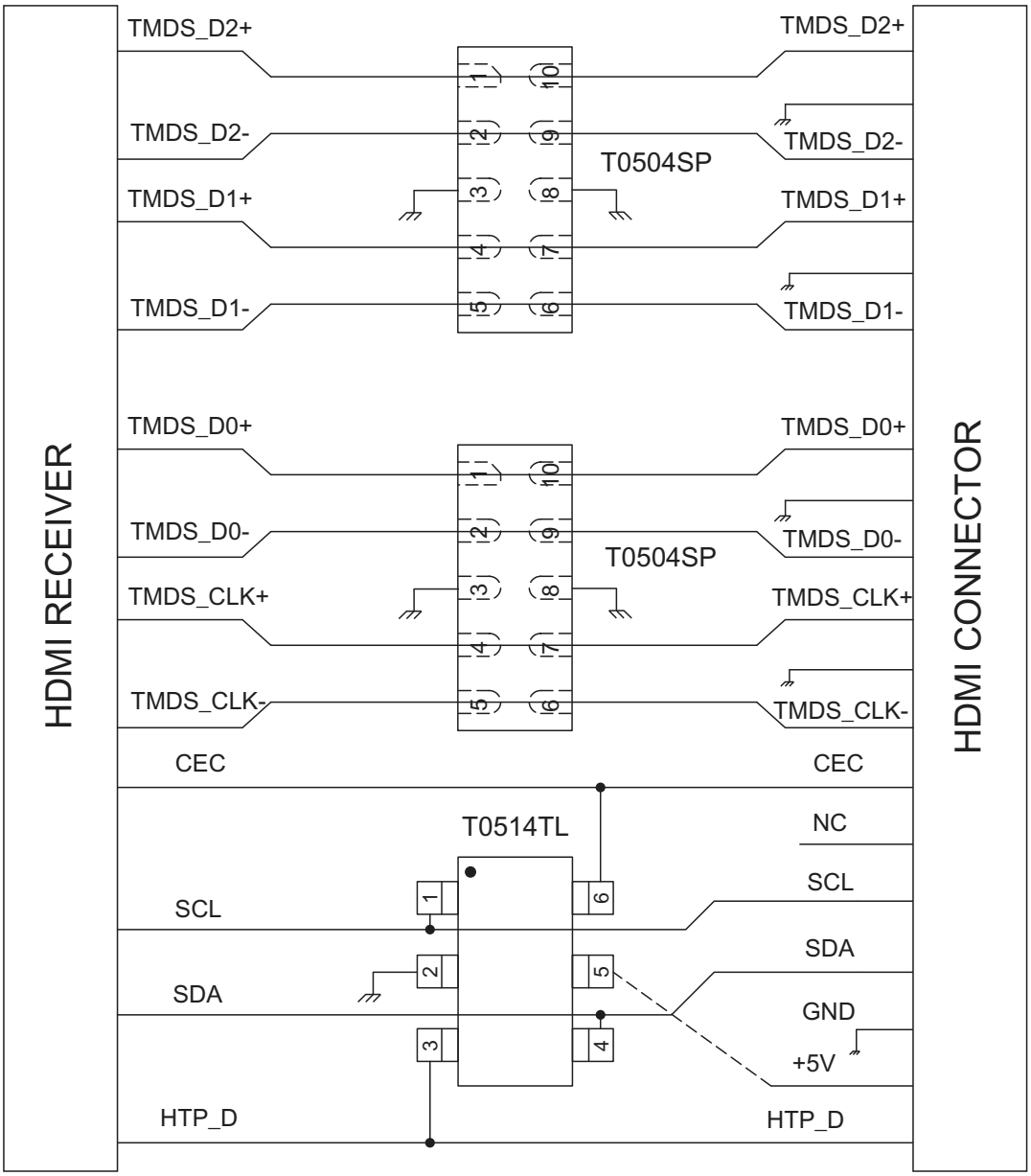
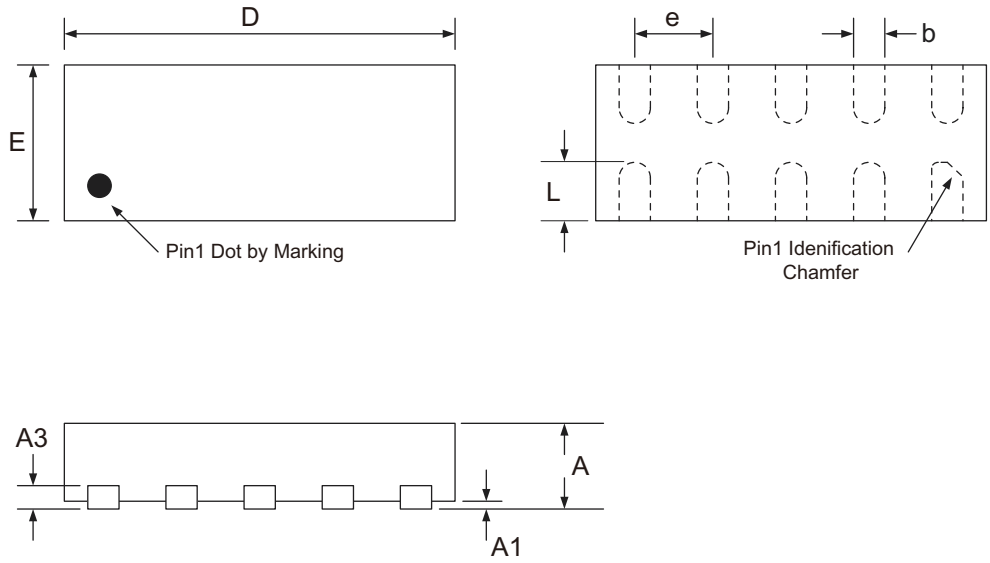


Figure 2 Layout Top View for HDMI Interface With T0504SP & T0514TL

Package Outline

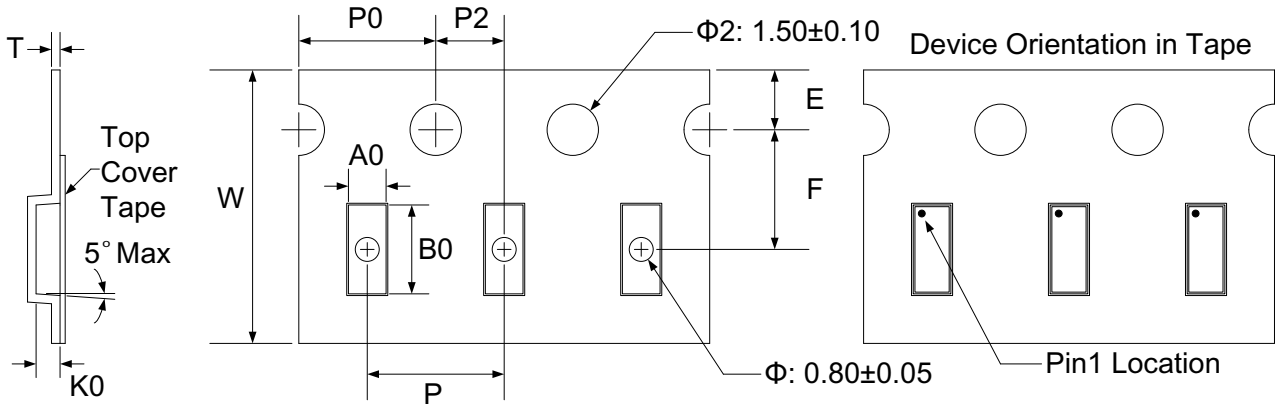
DFN2510-10L package
Thermally-Enhanced
MSL-1 Level



Package Dimensions (Controlling dimensions are in millimetes)

Symbol	Dimensions (mm)		Dimensions (inch)	
	Minimum	Maximum	Minimum	Maximum
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.150REF.		0.006REF.	
b	0.150	0.250	0.006	0.010
D	2.450	2.550	0.096	0.100
E	0.950	1.050	0.037	0.041
e	0.500 BSC		0.020 BSC	
L	0.300	0.400	0.012	0.016

Tape and Reel Specification



Symbol	W	A0	B0	K0	E	F	P	P0	P2	T
Dimensions (mm)	8.00+0.3 -0.1	1.23±0.05	2.7±0.05	0.7±0.05	1.75±0.1	3.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05	0.25±0.02

Marking Codes

Note:

(1) "T54SP" is part number, fixed.

Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
T0504SP	5V	3,000	7 Inch

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