SYT07S05SBC

Ultra-Low Capacitance TVS Protection

Features

- Transient protection for super-speed data lines
  IEC 61000-4-2 (ESD) ±20kV (Air)
  ±20kV (Contact)
- ESD protection for super-speed differential signal (above 5Gb/s) channels
- Fast turn-on and low clamping voltage
- Protects six data lines and one VCC line
- Ultra-low capacitance: 0.20pF Typical (I/O-I/O)
- Low leakage current: 0.1μA @ V_{RWM} (Typical)
- Back-drive protection for power-down mode
- Each I/O pin can withstand over 1000 ESD strikes for ±8kV contact discharge

Description

SYT07S05 is an ultra-low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for super-speed data interfaces. With typical capacitance of 0.20pF only, SYT07S05 is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC 61000-4-2 (ESD) (±20kV air, ±20kV contact discharge).

SYT07S05 uses a DFN4120-10L package. Each SYT07S05 device can protect six super-speed data lines and one VCC line. The combined features of ultra-low capacitance, small size and high ESD robustness make SYT07S05 ideal for super-speed data ports and high-frequency lines (e.g., HDMI & DVI) applications. The low clamping voltage of the SYT07S05 guarantees a minimum stress on the protected IC.

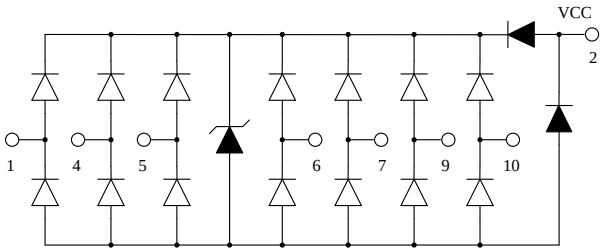
Applications

- USB3.0 Power and Data Line Protection
- Desktops, Servers and Notebooks
- MDDI Ports
- Display Ports
- High Definition Multi-Media Interface (HDMI)
- Digital Visual Interfaces (DVI)

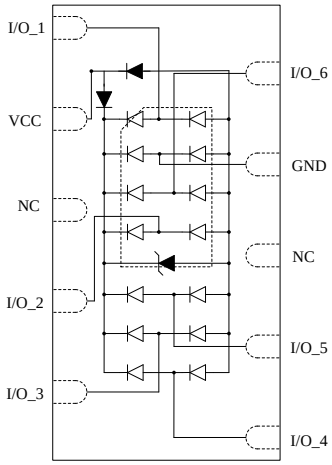
Mechanical Characteristics

- DFN4120-10L package
- Flammability Rating: UL 94V-0
- Marking: Part number, Date
- Packaging: Tape and Reel

Circuit Diagram



Pin Configuration



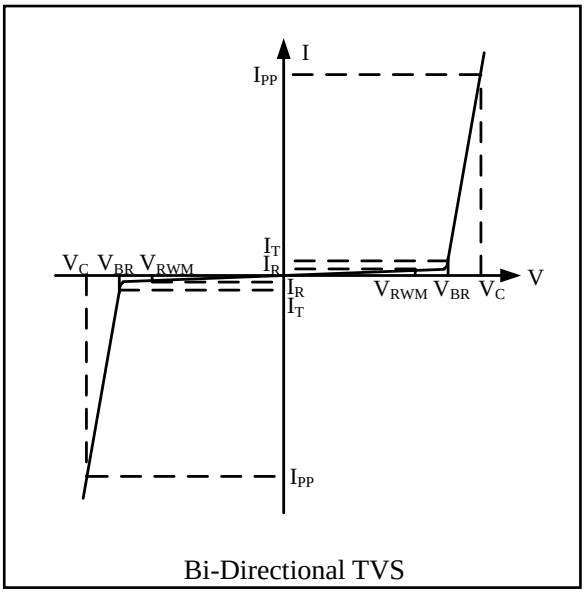
DFN4120-10L
(Top View, not to scale)

Absolute Maximum Rating

Symbol	Parameter	Value	Units
V_{ESD}	ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	±20 ±20	kV
T_{OPT}	Operating Temperature	-55/+125	°C
T_{STG}	Storage Temperature	-55/+150	°C

Electrical Characteristics (T = 25°C)

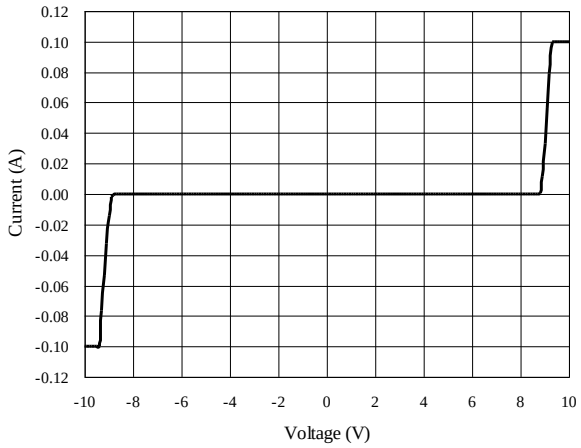
Symbol	Parameter
V_{RWM}	Nominal Reverse Working Voltage
I_R	Reverse Leakage Current @ V_{RWM}
V_{BR}	Reverse Breakdown Voltage @ I_T
I_T	Test Current for Reverse Breakdown
V_C	Clamping Voltage @ I_{PP}
I_{PP}	Maximum Peak Pulse Current
C_{ESD}	Parasitic Capacitance
V_R	Reverse Voltage
R_{Dyn}	Dynamic Turn on Resistance
I_F	Forward Current
V_F	Forward Voltage @ I_F



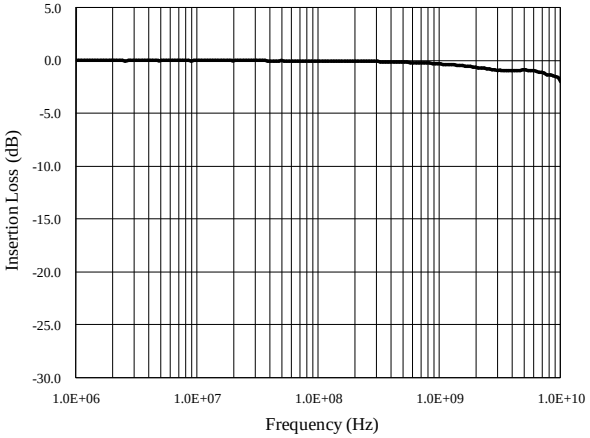
Bi-Directional TVS

Symbol	Test Condition	Minimum	Typical	Maximum	Units
V_{RWM}				5.0	V
I_R	V_{RWM} = 5V, Between Any Pin and GND		0.1	1.0	µA
$I_{R\_I/O-I/O}$	V_{RWM} = 5V, Between Any I/O Pins		0.1	1.0	µA
V_{BR}	I_T = 1mA, Between Any Pin and GND	6.0			V
V_F	I_F = 15mA, TVS Diode Forward Voltage		0.8	1.2	V
$V_{C\_I/O}$	IEC 61000-4-2 Contact +6kV, Between Any I/O and GND		11		V
V_{C_VCC}	IEC 61000-4-2 Contact +6kV, Between VCC and GND		10		V
R_{Dyn}	IEC 61000-4-2 Contact +6kV, Between Any Pin and GND		0.3		ohm
V_C	I_{PP} = 1A, t_p = 8/20µs Between Any Pin and GND			12	V
C_{ESD}	V_R = 0V, f = 1MHz Between Any Pin and GND		0.20	0.35	pF
$C_{ESD\_I/O-I/O}$	V_{VCC} = 5V, V_{GND}=0V, V_R=2.5V, f = 1MHz, Between Any I/O Pins			0.05	pF

Voltage Sweeping of I/O to GND

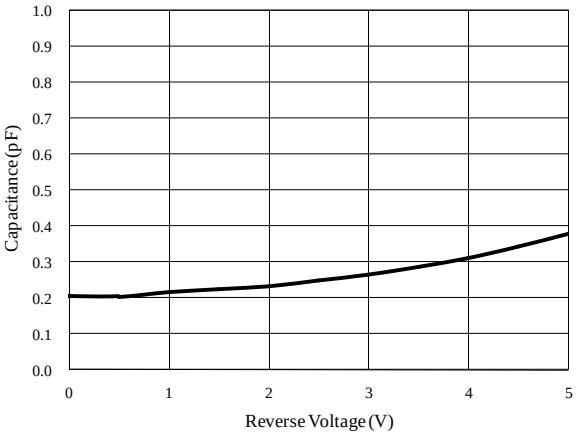


Insertion Loss S21 of I/O to GND

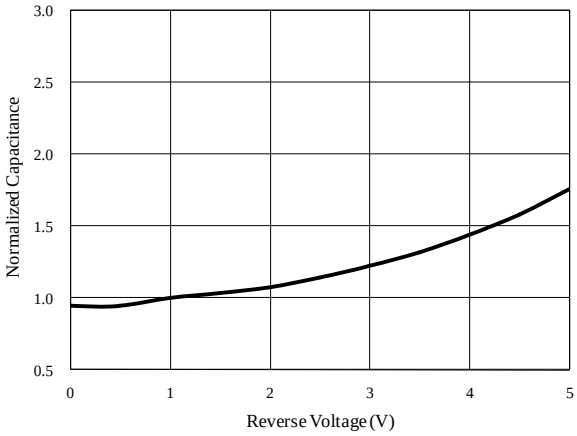


Capacitance *vs.* Voltage of I/O to GND (f = 1MHz)

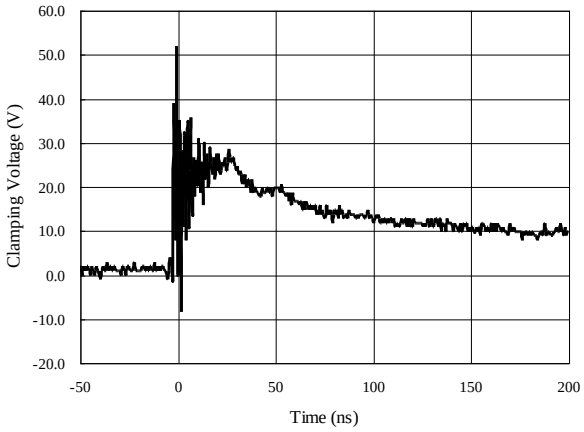
Capacitance *vs.* Reverse Voltage



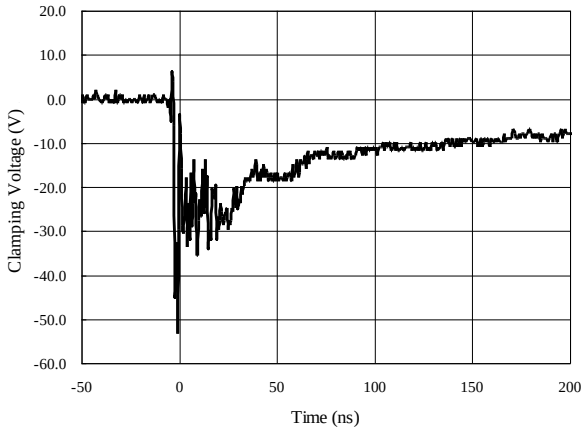
Normalized Capacitance *vs.* Reverse Voltage



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

SYT07S05 provides ESD protection for six data lines and one power rail line simultaneously. The pin connection is shown in Figure 1.

Six parallel data lines, from inner IC to I/O port connector, could connect to SYT07S05 six I/O pins directly. Pin 9 of SYT07S05 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. Pin 2 of SYT07S05 is the VCC pin, which should connect to the VCC rail of PCB.

In some cases, systems are not allowed to be reset or restart after zapping ESD stress at the I/O port connector. Under this situation, to enhance the sustainable ESD level, a 0.1μF capacitor can be used between the VCC and GND rails. Place the capacitor as close as possible to SYT07S05.

In some cases, VCC rail is not presented on the PCB. Under this situation, the pin 2 of SYT07S05 can be left as floating. The pin connection is shown in Figure 2.

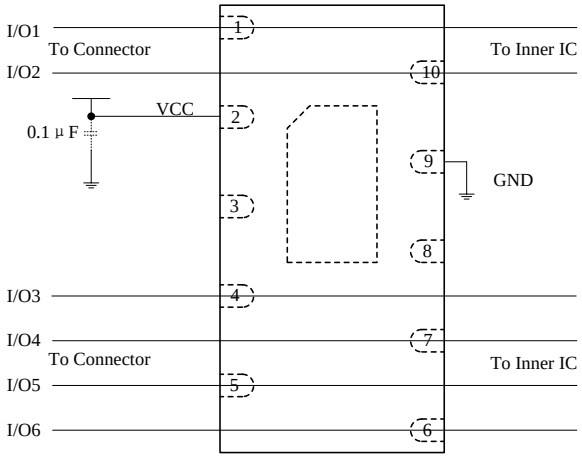


Figure 1 SYT07S05 pin connection in PCB providing data lines and power rail line protection.

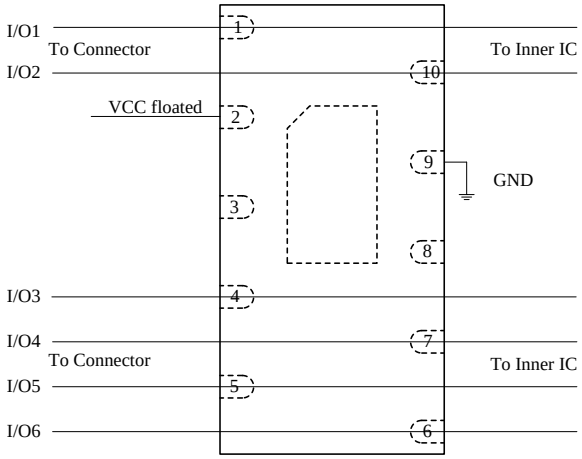


Figure 2 SYT07S05 pin connection in PCB providing data line protection.
VCC pin is left as floating when no VCC rail is presented in PCB.

Application Information

USB3.0 Protection for Super Speed Differential signals

SYT07S05 provides ESD protection for super-speed data lines. Thus, a lot of kinds of high speed I/O ports can be the applications of SYT07S05, especially, the USB3.0 port.

USB3.0 is expected to transmit and receive above 5Gb/s data, which needs differential signaling. For differential signaling, keep the differential impedance at constant is the most importance.

ESD protection devices have an inherent junction capacitance. Usually, this added capacitance on a USB3.0 port will drop the impedance of the differential pair to interfere with the signaling. SYT07S05 presents only 0.4pF maximum capacitance to each differential signal while being rated to handle 8kV ESD contact/air discharges as outlined in IEC 61000-4-2 and providing a low clamping voltage to protect the downstream devices.

Therefore, SYT07S05 is the most suitable ESD protector for USB3.0 I/O ports and other high speed, above 5Gb/s, I/O ports in any electronic product. Figure 3 shows the pin connection example for USB3.0 I/O ports.

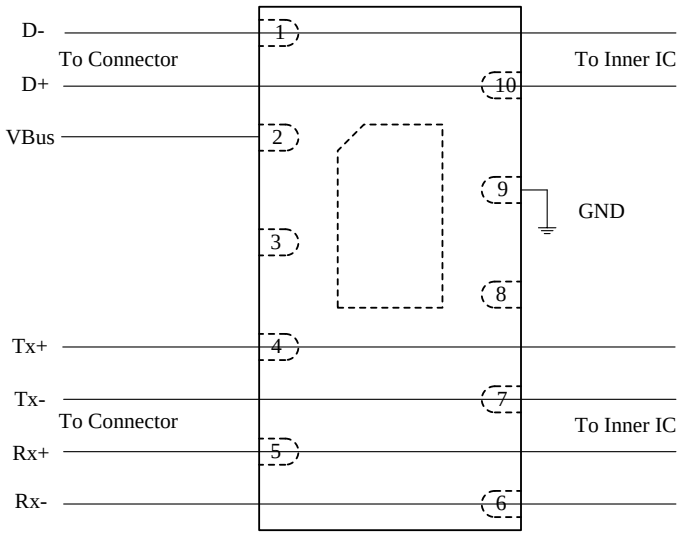
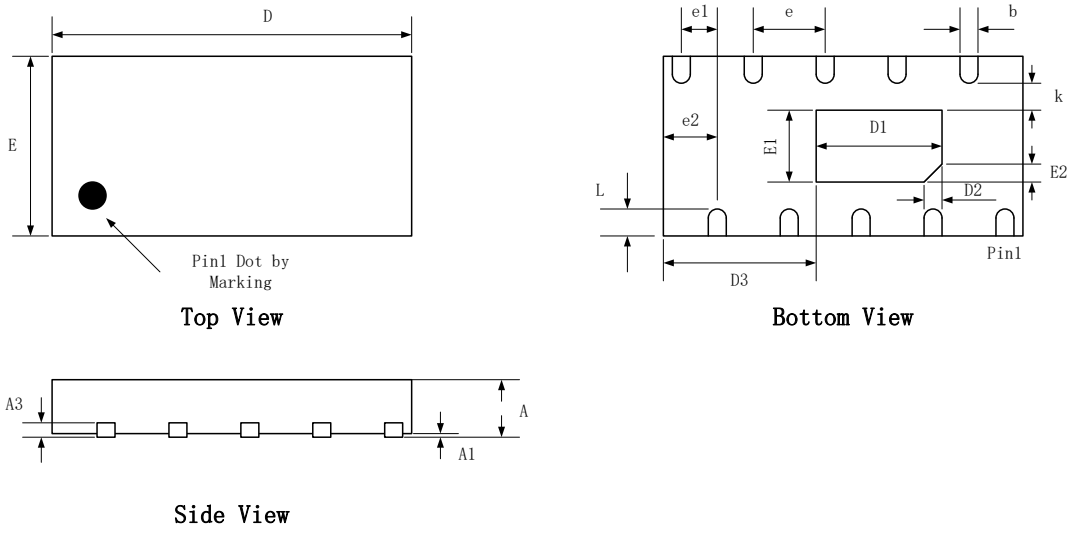


Figure 3 SYT07S05 pin connection for USB3.0 protection.

Package Outline

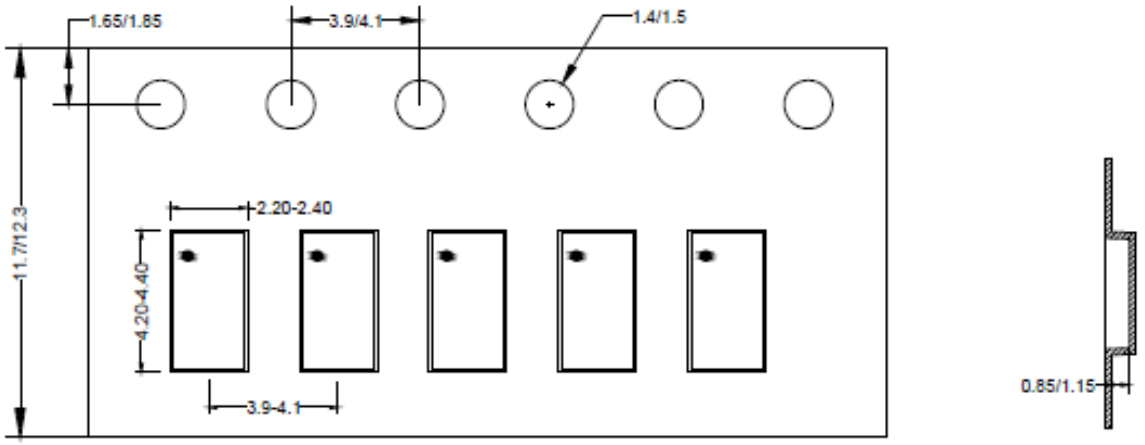
- DFN4120-10L package



Package Dimensions (Controlling dimensions are in millimeters)

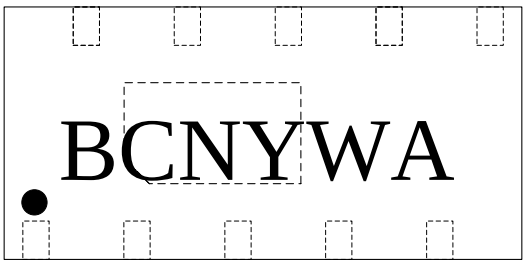
Symbol	Dimensions (mm)		Dimensions (Inches)	
	Minimum	Maximum	Minimum	Maximum
A	0.450	0.650	0.018	0.026
A1	0.000	0.050	0.000	0.002
A3	0.152REF		0.006REF	
D	4.050	4.150	0.159	0.163
E	1.950	2.050	0.077	0.081
D1	1.300	1.500	0.051	0.059
E1	0.700	0.900	0.028	0.035
D3	1.650	1.850	0.065	0.073
D2	0.200REF		0.008REF	
E2	0.200REF		0.008REF	
k	0.200MIN		0.008MIN	
b	0.150	0.250	0.006	0.010
e	0.800TYP		0.031TYP	
e1	0.350	0.450	0.014	0.018
e2	0.600	0.700	0.024	0.028
L	0.250	0.350	0.010	0.014

Tape and Reel Specification



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer * length(mm)	Leader * length (mm)	Qty per reel (pcs)
DFN4.1*2-10	12	4	13"	400	400	5000

Marking Codes



Note:

(1) BCN is the part number, fixed.

(2) "Y" is year code, from 0 to 9;
"W" is date code, from A to Z.

(3) "A" is the production lot number, from A to Z.

Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
SYT07S05SBC	5V	5,000	13 Inch

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