

General Description

SY205231DWD is an ultra-low capacitance transient voltage suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With a typical capacitance of 0.28pF, SY205231DWD is designed to protect against over-voltage and over-current transient events. It complies with IEC61000-4-2 (ESD) ($\pm 20\text{kV}$ air, $\pm 20\text{kV}$ contact discharge), IEC61000-4-5 (surge) (10A, 8/20 μs).

The combined features of ultra-low capacitance, ultra-small size, and high ESD robustness make SY205231DWD ideal for high-speed data ports and high-frequency lines (e.g., USB3.x& DVI) applications. The low clamping voltage of the SY205231DWD guarantees minimum stress on the protected IC.

Each SY205231DWD device can protect one high-speed data line. The SY205231DWD is available in a small DFN1.0 $\times$ 0.6-2 package.

Features

- Protects One Data, Control, or Power Line
- Ultra-Low Capacitance: 0.28pF
- Low Clamping Voltage
- Transient Protection for High-Speed Data Lines
 - IEC61000-4-2 (ESD) $\pm 20\text{kV}$ (Air) $\pm 20\text{kV}$ (Contact)
 - IEC61000-4-5 (Surge) 10A (8/20 μs)
- For Operating Voltage of 5V and Below
- Package Optimized for High-Speed Lines
- Ultra-Small Package: DFN1.0 $\times$ 0.6-2
- Each I/O pin can withstand over 1000 ESD strikes for $\pm 8\text{kV}$ contact discharge.

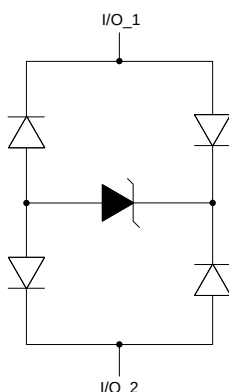
Applications

- USB Type-C
- USB 2.0 and 3.x
- HDMI 1.3, 1.4, and 2.0
- Serial ATA
- PCI Express
- Desktops, Servers, and Notebooks
- Display Ports
- Digital Visual Interfaces (DVI)

Mechanical Characteristics

- DFN1.0 $\times$ 0.6-2 Package
- Marking: Device Code, Date Code
- Packaging: Tape and Reel

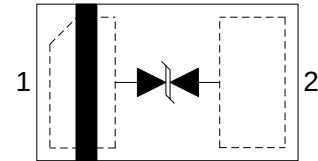
Circuit Diagram



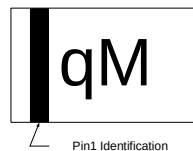
Ordering Information

Part Number	Package Type	Top Mark
SY205231DWD	DFN1.0×0.6-2 RoHS Compliant and Halogen Free	qM

Pinout (Top View)



Marking Codes



Note 1: “q” is device code, fixed.

Note 2: “M” is date code.

Absolute Maximum Rating				
Parameter	Symbol	Min	Max	Unit
Maximum Peak Pulse Current (8/20μs)	I_{PP}		10	A
Maximum Peak Pulse Power (8/20μs)	P_{PK}		65	W
ESD per IEC 61000-4-2 (Air)	V_{ESD}	-20	20	kV
ESD per IEC 61000-4-2 (Contact)				
Operating Temperature	T_{OPT}	-40	+85	°C
Storage Temperature	T_{STG}	-55	+150	°C

Electrical Characteristics $T_A = 25^\circ\text{C}$						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Nominal Reverse Working Voltage	V_{RWM}		-5		5	V
Reverse Leakage Current @ V_{RWM}	I_R	$V_R = 5V, T_A = 25^\circ\text{C}$		0.1		μA
Reverse Triggering Voltage @ I_{t1}	V_{t1}	$I_{t1} = 1\text{mA}$	5.5			V
Holding Voltage	V_h	$I_h = 100\text{mA}$	1.2		3	V
Clamping Voltage @ I_{PP}	$V_C(1)$	$I_{PP} = 16A, t_p = 10/100\text{ns}$		6		V
Clamping Voltage @ I_{PP}	$V_C(1)$	$I_{PP} = 10A, t_p = 8/20\mu\text{s}$		6.5		V
Dynamic Resistance	$R_{DYN(1,2)}$	$t_p = 10/100\text{ns}$		0.2		Ω
Parasitic Capacitance	$C_{ESD(1)}$	$V_R = 1V, f = 1\text{MHz}$		0.28		pF

Note 1: Guaranteed by design and not subject to production test.

Note 2: R_{DYN} calculated based on $I_{PP}=8A$ to $I_{PP}=16A, t_p = 10/100\text{ns}$.

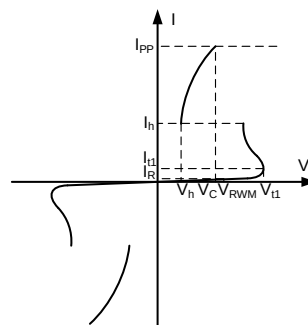
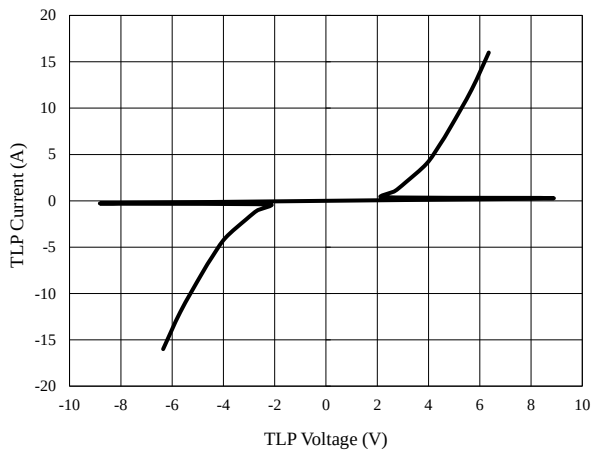


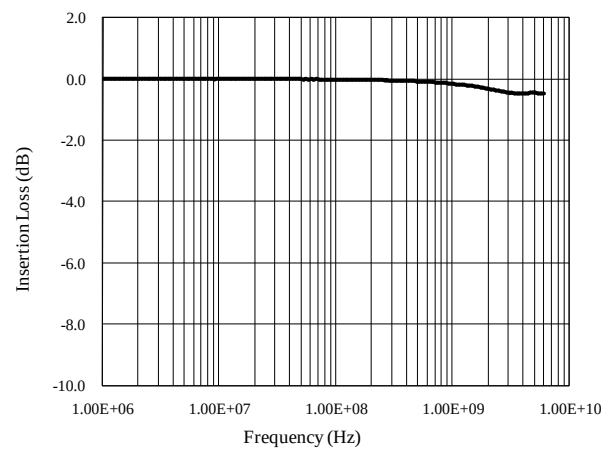
Figure 1. Bi-directional TVS

Typical Performance Characteristics

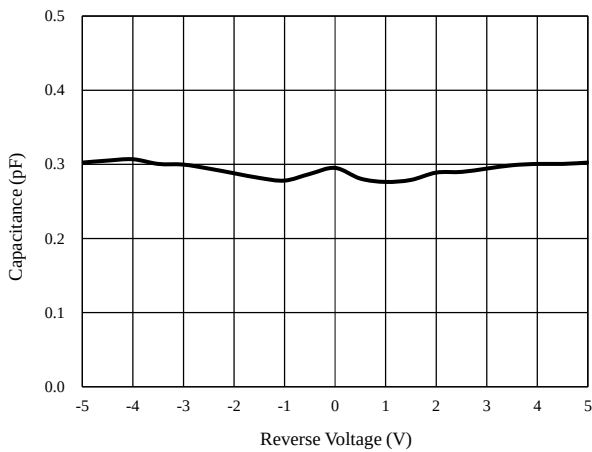
TLP Testing of I/O to I/O



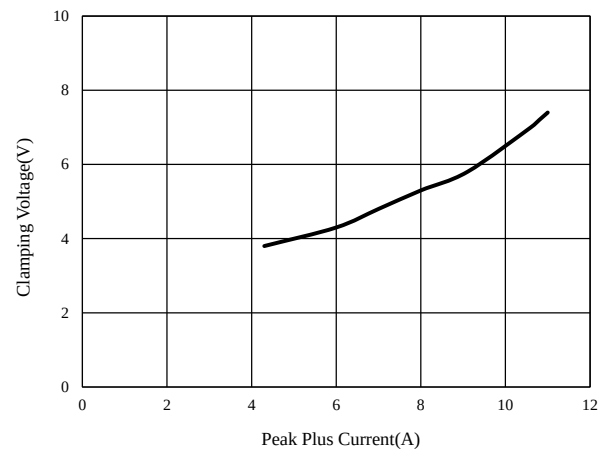
Insertion Loss S21 of I/O to I/O



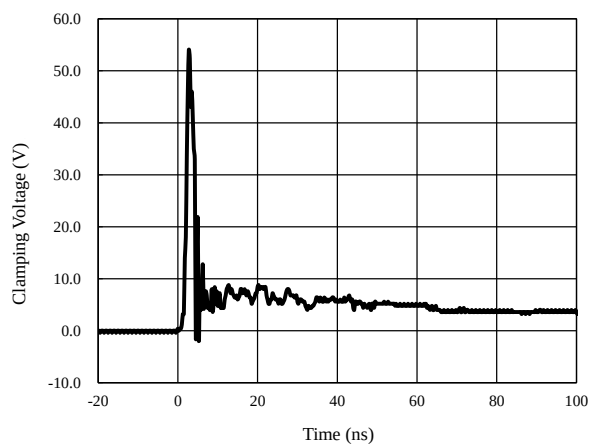
Capacitance vs. Voltage of I/O to I/O



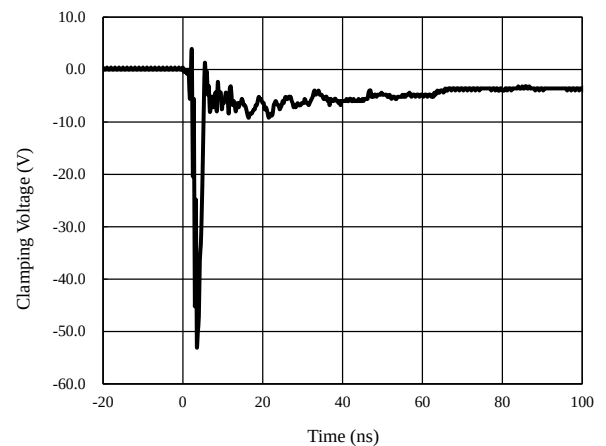
Clamping Voltage vs. Peak Pulse Current (8/20μs)



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



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



Application Information

USB Type-C Interface

The USB Type-C has top and bottom PCB connections, so it can support reversible plugs. USB Type-C has eight high-speed TX/RX lines, which can provide a data transfer rate of 20Gb/s for USB 3.2, 10Gb/s for USB 3.1, or 5Gb/s for USB 3.0. The USB Type-C also has four USB 2.0 D+/D- lines and supports USB 2.0 data transfer.

In addition to accommodating USB Type-C, which includes USB power delivery (PD), this system supports power levels of up to 20V and 5A. The USB Type-C interface uses one of the CC pins for the connection.

Pin Connections

The SY205231DWD provides ESD protection for USB 3.x TX/RX and USB 2.0 D+/D- data lines. One Type-C interface can use up to twelve SY205231DWD devices.

The pin connections are shown in Figure 2. Each SY205231DWD device is positioned between a data line and the ground.

In addition to data line protection, the following options are suggested to protect the other USB-C signals:

For the CC/SBU pin, a SY205207DXC with a V_{rwm} of 24V is used to enhance ESD protection. Additionally, SY205212SLC components are utilized to offer surge protection for VBUS lines. These SY205212SLC components, featuring a V_{rwm} of 20V and a surge IPP of 25A, effectively deliver both ESD and EOS protection for VBUS.

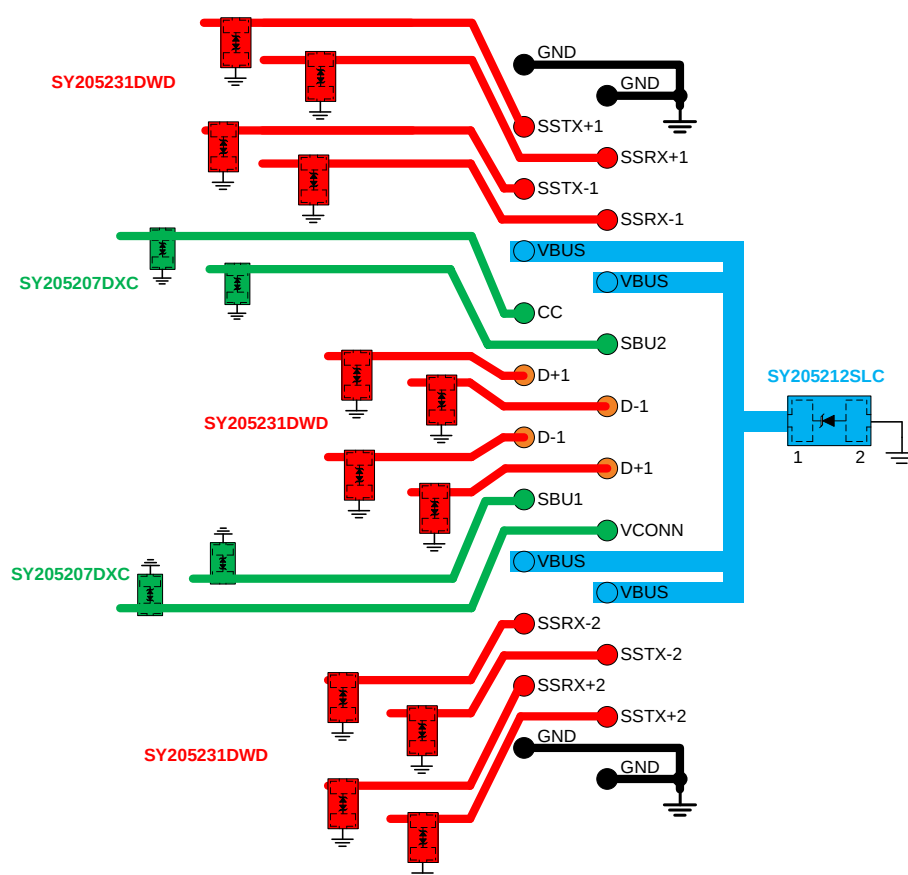


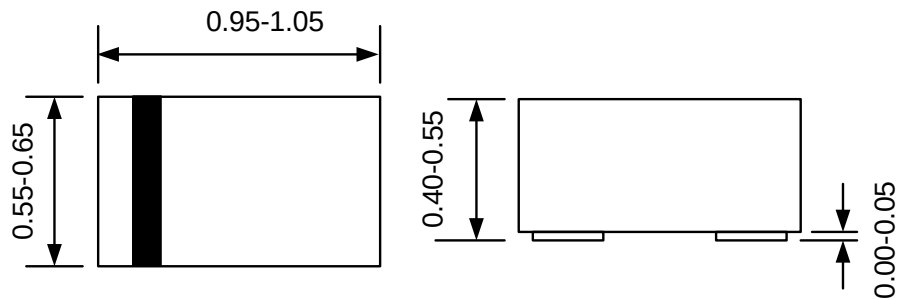
Figure 2. Typical ESD Protection for USB Type-C

PCB Layout Guidelines

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

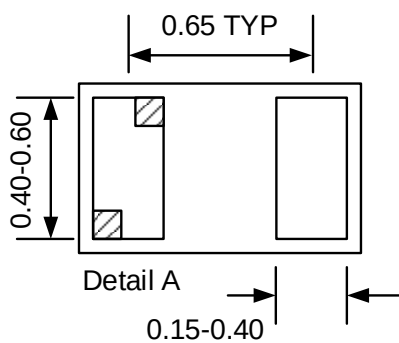
- Place SY205231DWD as close to the connector port as possible.
- Use a large via to connect the SY205231DWD pin to the ground.
- Avoid running critical signals near board edges.
- The distance between the SY205231DWD ground pin and the GND reference path should be as short as possible.

DFN1.0×0.6-2 Package Outline

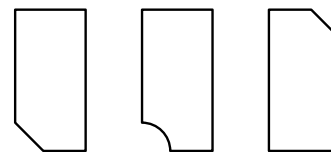


Top View

Side View

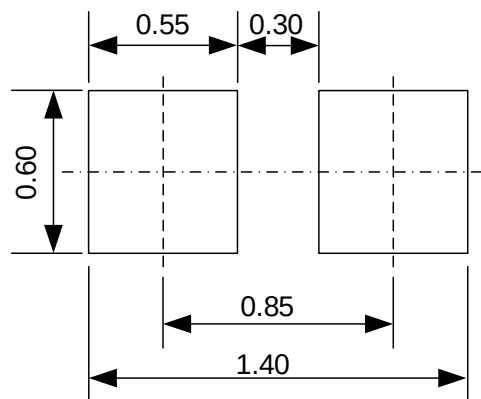


Bottom View



Pin1 Identifier: 3 options

Detail A

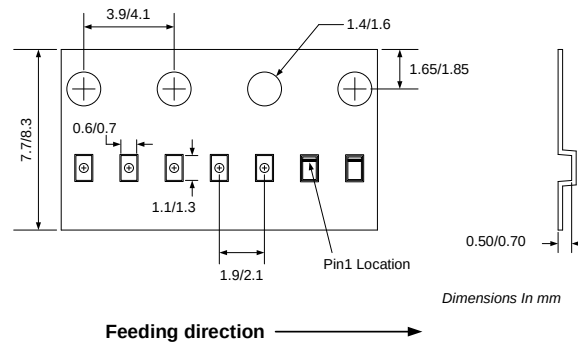


Recommended PCB Layout
(Reference only)

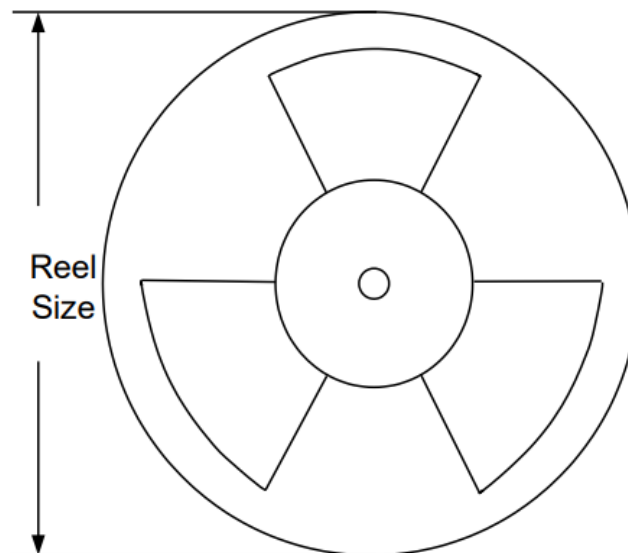
Note: All dimensions are in millimeters and exclude mold flash and metal burr.

Tape and Reel Specification

DFN1.0×0.6-2 Taping Orientation



Carrier Tape & Reel Specification for Packages



Package Types	Tape Width (mm)	Pocket Pitch(mm)	Reel Size (Inch)	Qty per Reel(pcs)
DFN1.0×0.6-2	8	2	7"	10000

Revision History

The revision history provided is for informational purpose only and is believed to be accurate, however, not warranted. Please make sure that you have the latest revision.

Revision Number	Revision Date	Description	Pages changed
0.9	12/23/2020	Initial Release	
1.0	12/23/2021	Production Release	

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