SYT46S03DVD

Ultra-Low Capacitance TVS Protection

Features

- Transient protection for high-speed data lines
  IEC 61000-4-2 (ESD) ±30kV(Air)
  ±30kV(Contact)
  IEC 61000-4-5 (Surge) 7A (8/20 μs)
- For 3.3V and below operating voltage
- Package optimized for high-speed lines
- Ultra-small package (2.5mm*1.0mm*0.55mm)
- Protects four data lines
- Low capacitance: 0.4pF (Typical)
- Low leakage current: 0.01μA @ V_{RWM} (Typical)
- Low clamping voltage
- Each I/O pin can withstand over 1000 ESD strikes for ±8kV contact discharge

Description

SYT46S03DVD 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 0.4pF only, SYT46S03DVD is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC 61000-4-2 (ESD) (±30kV air, ±30kV contact discharge), IEC 61000-4-5 (Surge) (7 A, 8/20μs), etc.

SYT46S03DVD uses small DFN2.5×1.0-10 package. Each SYT46S03DVD device can protect four high-speed data lines. The combined features of ultra-low capacitance, ultra-small size and high ESD robustness make SYT46S03DVD ideal for high-speed data ports and high-frequency lines (e.g., HDMI & DVI) applications. The low clamping voltage of the SYT46S03DVD guarantees a minimum stress on the protected IC.

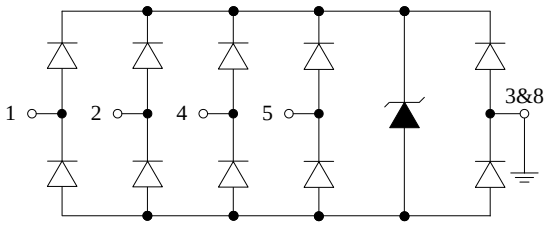
Applications

- Serial ATA
- PCI Express
- Desktops, Servers and Notebooks
- MDDI Ports
- USB2.0, 3.0 and 3.1
- Display Ports
- HDMI 1.3, 1.4, 2.0 and 2.1
- Digital Visual Interfaces (DVI)

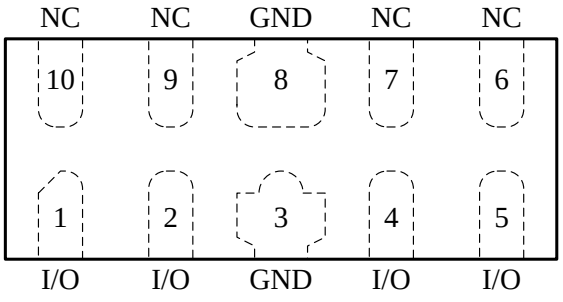
Mechanical Characteristics

- DFN2.5×1.0-10 package
- Marking: Device code, Date
- Packaging: Tape and Reel

Circuit Diagram



Pin Configuration



DFN2.5×1.0-10
(Top View)

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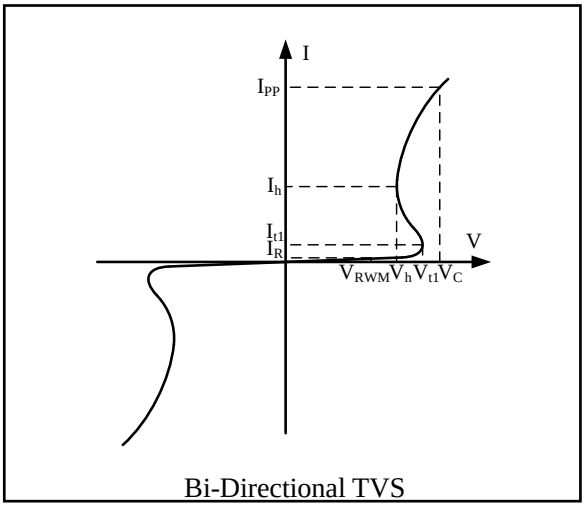
Absolute Maximum Rating

Symbol	Parameter	Value	Units
V_{ESD}	ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	±30 ±30	kV
I_{PP}	Peak Pulse Current (8/20μs)	7	A
P_{PK}	Peak Pulse Power (8/20μs)	56	W
T_{OPT}	Operating Temperature	-40/+125	°C
T_{STG}	Storage Temperature	-55/+150	°C

Electrical Characteristics (T_A = 25°C)

Symbol	Parameter
V_{RWM}	Nominal Reverse Working Voltage
I_R	Reverse Leakage Current @ V_{RWM}
V_{t1}	Triggering Voltage @ I_{t1}
I_{t1}	Test Current for Triggering Voltage
V_C	Clamping Voltage @ I_{PP}
I_{PP}	Maximum Peak Pulse Current
C_{ESD}	Parasitic Capacitance
V_h	Holding Voltage @ I_h
f	Small Signal Frequency



Bi-Directional TVS

Symbol	Test Condition	Minimum	Typical	Maximum	Units
V_{RWM}		-3.3		3.3	V
I_R	V_{RWM} = 3.6V, T_A = 25°C		0.01	0.1	μA
V_{t1}[1]	I_{t1} = 1μA	3.7			V
V_h	I_h = 100mA	3.3		6.3	V
V_C[1]	I_{PP} = 7A, t_p = 8/20μs		8.0		V
V_C[1]	I_{PP} = 16A, t_p = 10/100ns		7.5		V
R_{DYN}[1,2]	t_p = 10/100ns		0.20		Ω
C_{ESD}[1]	V_R = 1.65V, f = 1MHz		0.40	0.50	pF

NOTES

[1]Guaranteed by design and not subject to production test.

[2]R_{DYN} calculated based on I_{PP}=8A to I_{PP}=16A, t_p = 10/100ns.

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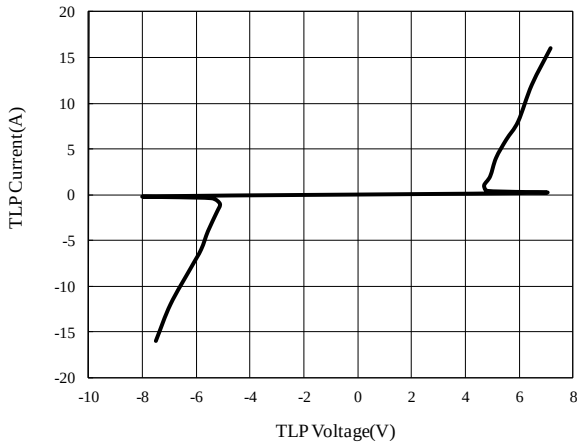
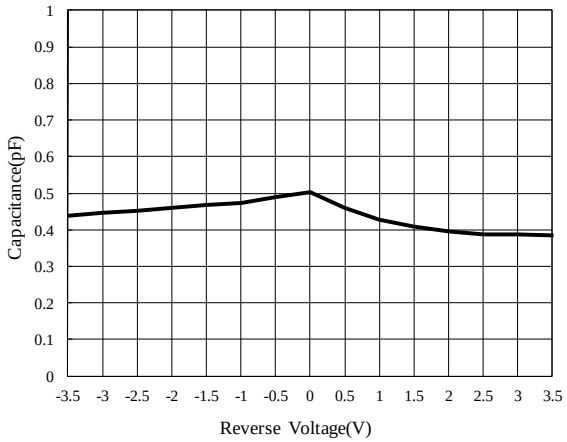
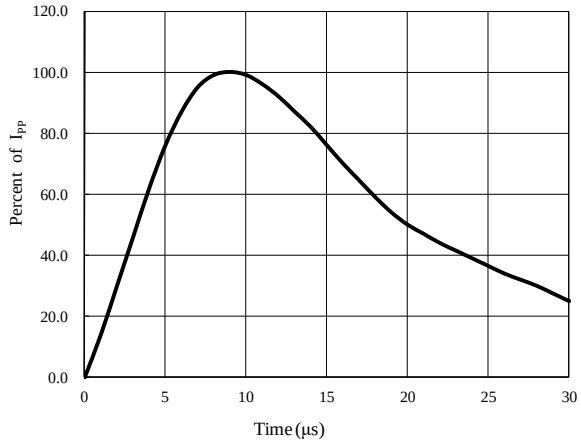
TLP Measurement



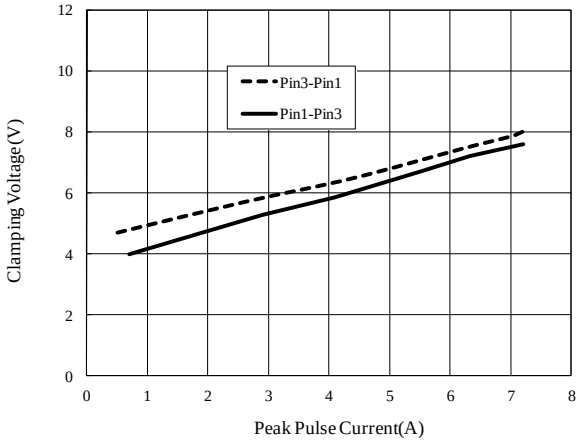
Capacitance vs. Voltage



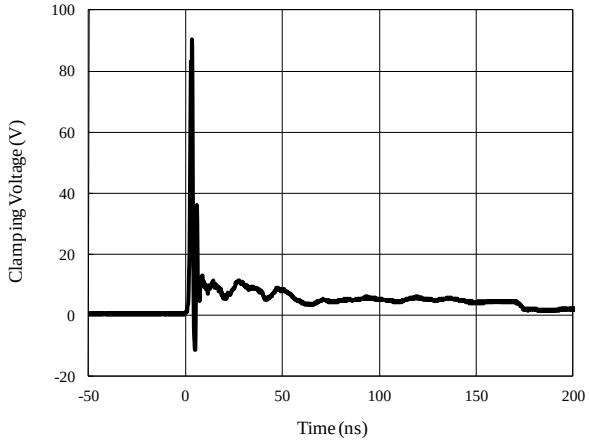
Pulse Waveform



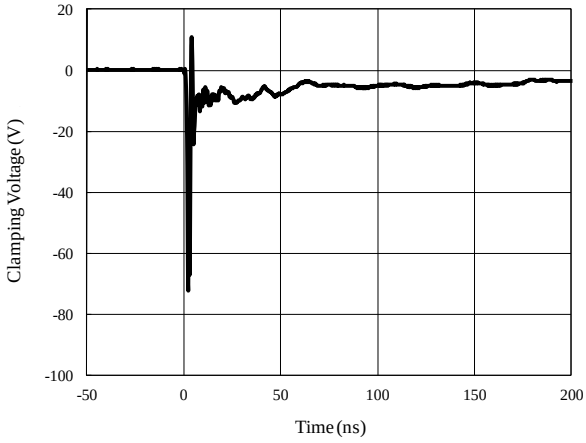
Clamping Voltage vs. Peak Pulse Current



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)



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Application Information

Pin Connection in PCB

SYT46S03DVD 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, could connect to SYT46S03DVD four I/O pins directly. Pin 3&8 of SYT46S03DVD 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.

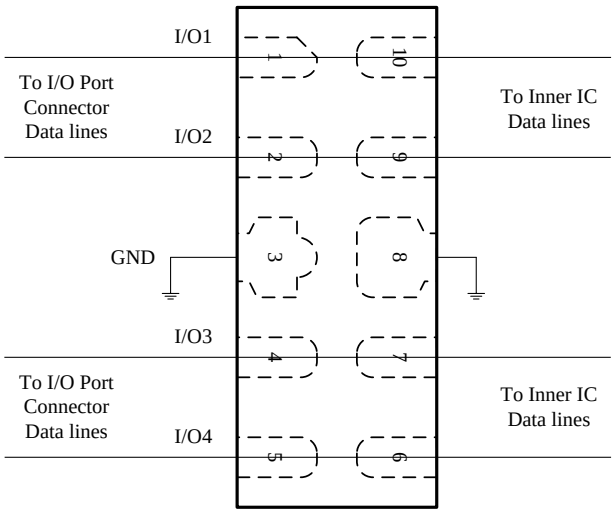

Figure 1 SYT46S03DVD pin connection in PCB

PCB Layout Guidelines

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

- SYT46S03DVD 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 SYT46S03DVD GND pins to the PCB GND should be wide.
- Place SYT46S03DVD 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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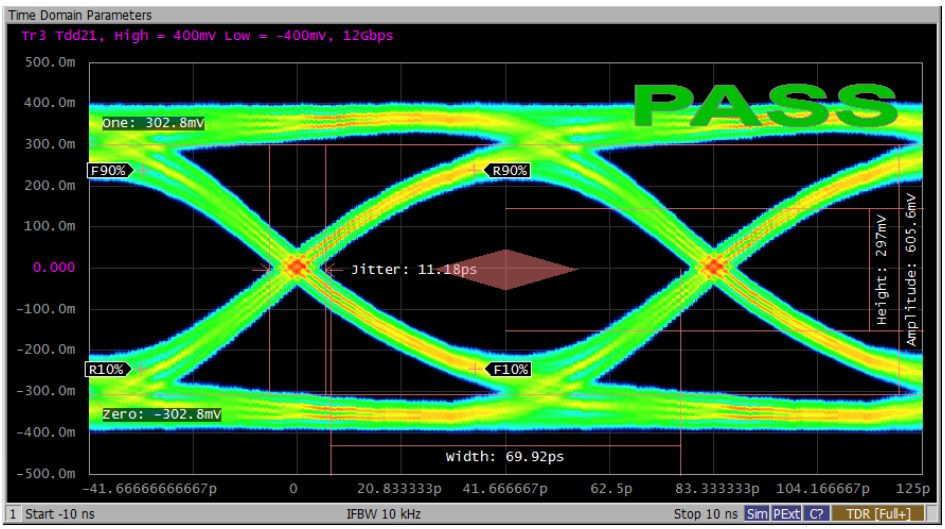
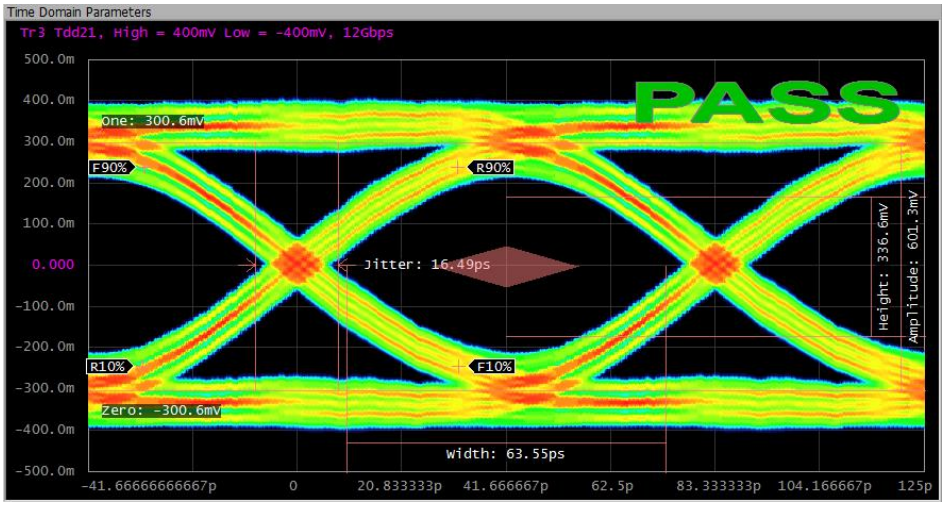
Eye Diagram Measurement for HDMI2.1



Data rate 12Gb/s

HDMI2.1 Eye Diagram without SYT46S03DVD



Data rate 12Gb/s

HDMI2.1 Eye Diagram with SYT46S03DVD

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Application Information

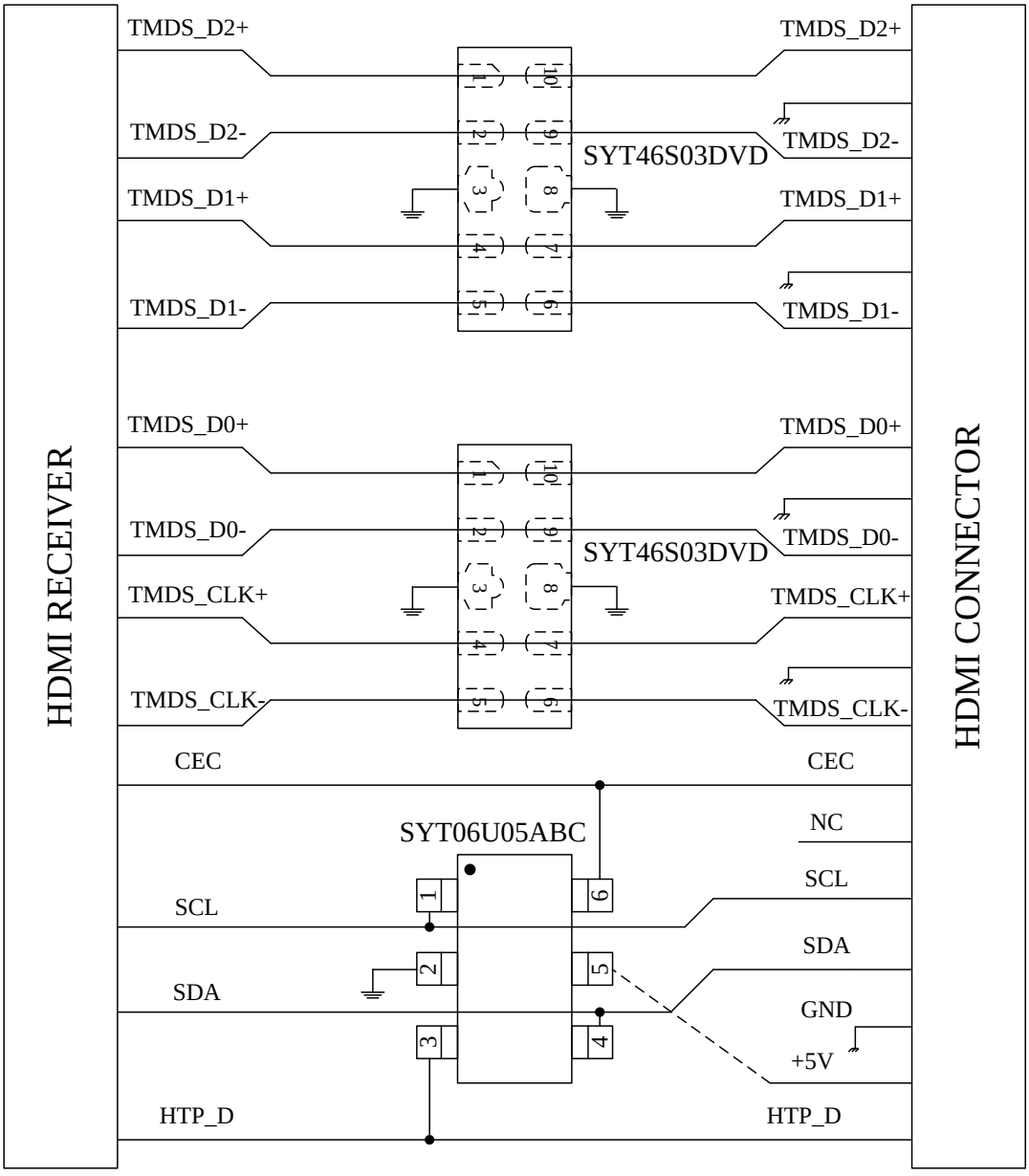

Figure 2 Layout Top View for HDMI Interface with SYT46S03DVD & SYT06U05ABC

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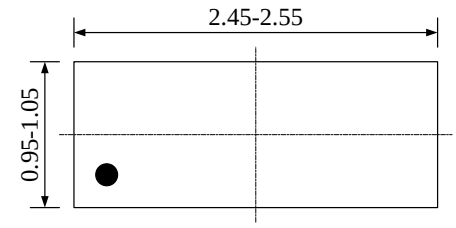
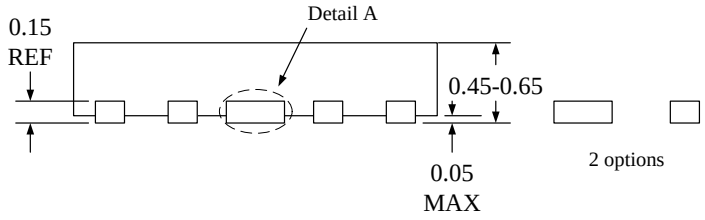
Package Outline

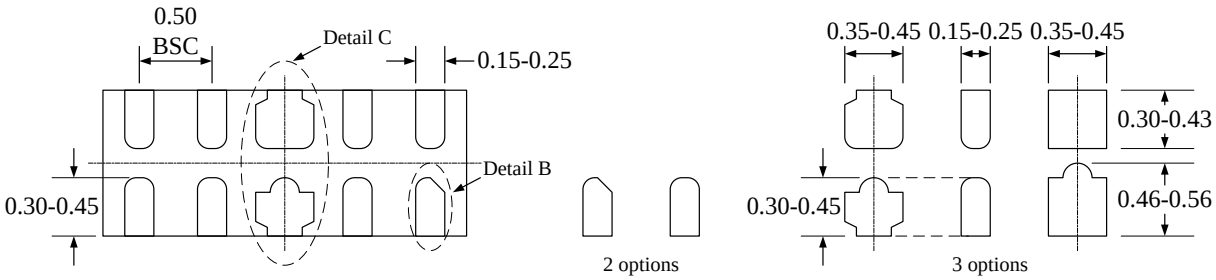
- DFN2.5×1.0-10 package



TOP VIEW



SIDE VIEW **Detail A**



BOTTOM VIEW **Detail B** **Detail C**

Package Dimensions (Controlling dimensions are in millimeters)

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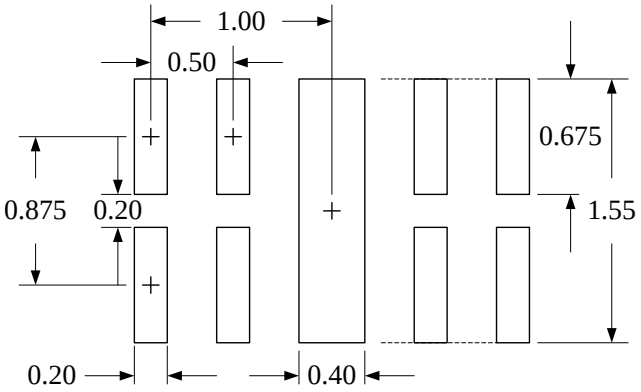
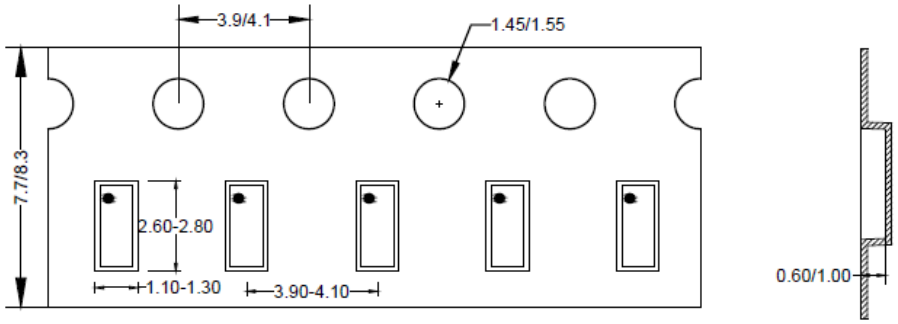
PCB Layout Pattern



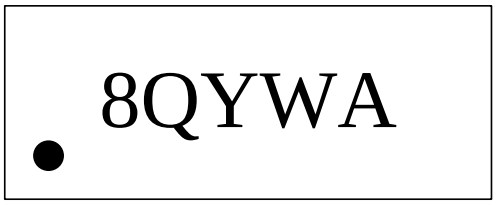
Notes: All dimension in millimeter

Tape and Reel Specification



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Qty per reel (pcs)
DFN2.5×1.0-10	8	4	7"	3000

Marking Codes



Note:

(1) "8Q" is device code, fixed.

(2) "YWA" is date code.

Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
SYT46S03DVD	3.3V	3,000	7 Inch

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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
0.9	04/16/2021	Initial Release
0.9A	06/25/2021	Add Eye Diagram Measurement for HDMI2.1
1.0	04/16/2022	Production Release

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