SY205222DVD

Ultra-Low Capacitance TVS Protection

General Description

SY205222DVD is a low-capacitance transient voltage suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With a typical capacitance of 0.5pF, SY205222DVD is designed to protect 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) (4.5A, 8/20μs).

The combined features of low capacitance, small size and high ESD robustness make SY205222DVD ideal for high-speed data ports and high-frequency lines (e.g., HDMI & DVI) applications. The low clamping voltage of the SY205222DVD guarantees minimum stress on the protected IC.

Each SY205222DVD device can protect four high-speed data lines. The SY205222DVD is available in a compact 2.5 mm ×1.0 mm DFN package.

Features

- Transient Protection for High-Speed Data Lines
  - IEC 61000-4-2 (ESD) ±30kV(Air)±30kV(Contact)
  - IEC 61000-4-5 (Surge) 4.5A (8/20μs)
- For Operating voltage of 5V and below
- Package optimized for High-speed lines
- Ultra-small Package (2.5mm x 1.0mm x 0.55mm)
- Protects four data lines
- Low Capacitance: 0.5pF (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.

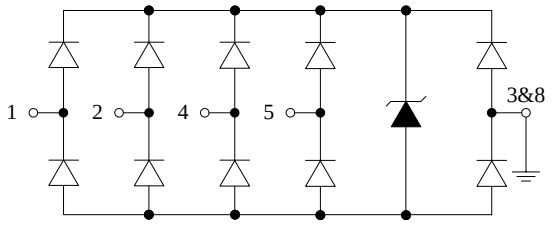
Applications

- 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 Code
- Packaging: Tape and Reel

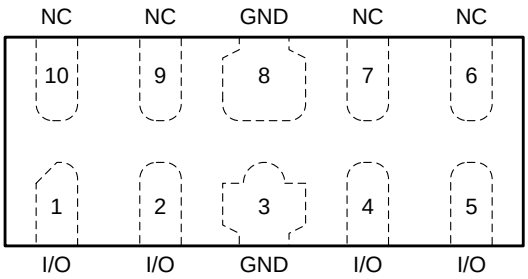
Circuit Diagram



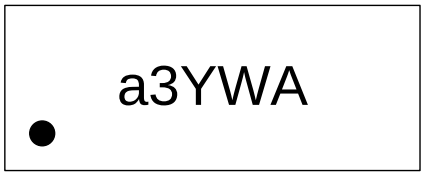
Ordering Information

Part Number	Package Type	Top Mark
SY205222DVD	DFN2.5×1.0-10 RoHS Compliant and Halogen Free	a3YWA

Pinout (Top View)



Marking Codes



Note 1: "a3" is device code, fixed.

Note 2: "YWA" is date code.

Absolute Maximum Rating				
Parameter	**Symbol**	**Min**	**Max**	**Unit**
Maximum Peak Pulse Current (8/20μs)	I_{PP}		4.5	A
Maximum Peak Pulse Power (8/20μs)	P_{PK}		45	W
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	-30	30	kV
Operating Temperature	T_{OPT}	-40	+125	°C
Storage Temperature	T_{STG}	-55	+150	°C

Electrical Characteristics (T_A = 25°C)						
Parameter	**Symbol**	**Test Condition**	**Min**	**Typ**	**Max**	**Unit**
Nominal Reverse Working Voltage	V_{RWM}				5	V
Reverse Leakage Current @ V_{RWM}	I_R	V_{RWM} = 5V, T_A = 25°C		0.01	0.1	μA
Reverse Triggering Voltage @ I_{t1}	V_{t1}	I_{t1} = 1μA	5.5			V
Holding Voltage @ I_h	V_h	I_h = 10mA	5.5		9.0	V
Clamping Voltage @ I_{PP}	V_C (1)	I_{PP} = 4.5A, t_p = 8/20μs		10		V
Clamping Voltage @ I_{PP}	V_C(1)	I_{PP} = 16A, t_p = 10/100ns		10		V
Dynamic Resistance	R_{DYN}(1) (2)	t_p = 10/100ns		0.25		Ω
Parasitic Capacitance	C_{ESD}(1)	V_R = 2.5V, f = 1MHz		0.50	0.65	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 = 10/100ns.

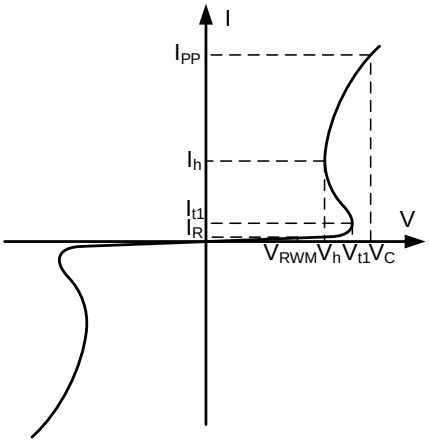
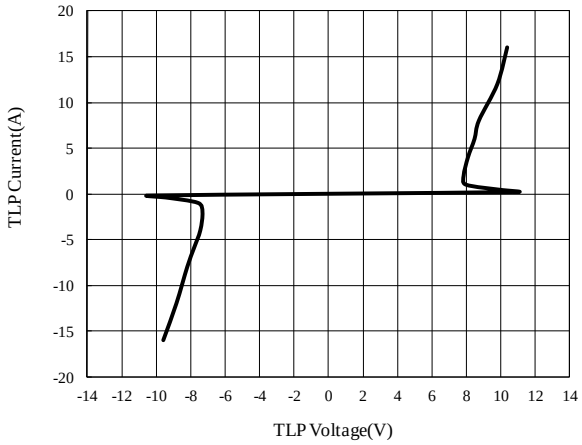


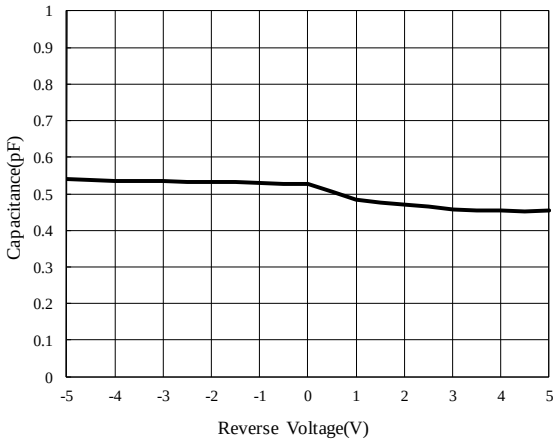
Figure 1. Bi-Directional TVS

Typical Characteristics

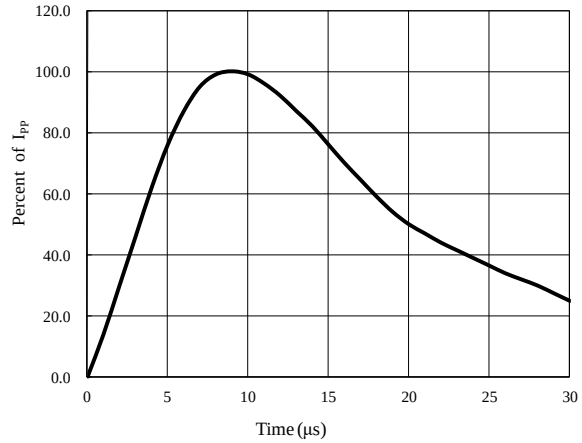
TLP Measurement



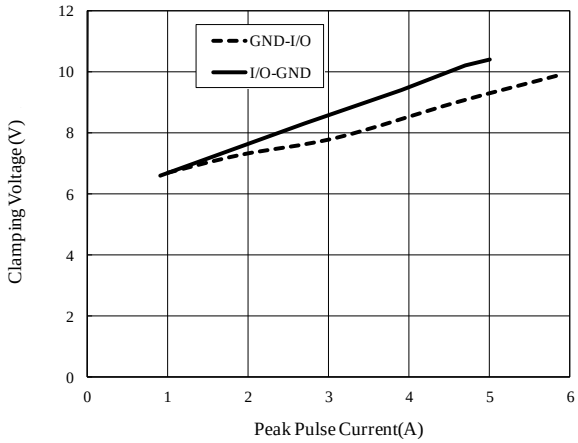
Capacitance vs. Voltage



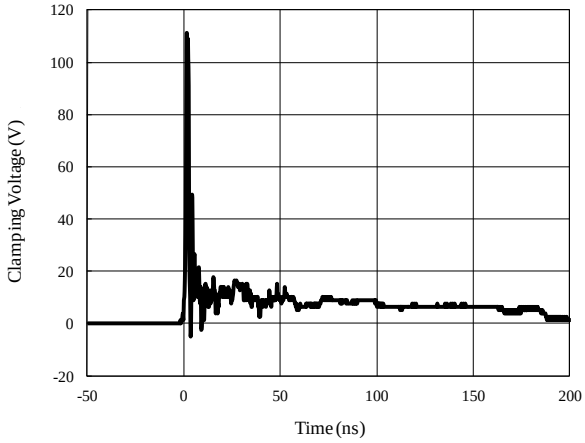
Pulse Waveform



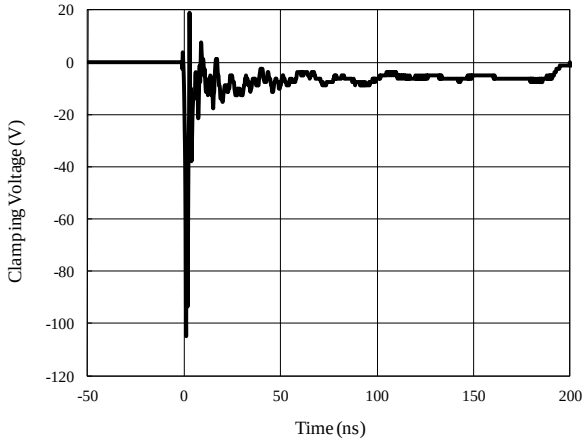
Clamping Voltage vs. Peak Pulse Current



ESD Clamping of I/O_1 to I/O_2 (+8kV Contact per IEC 61000-4-2)



ESD Clamping of I/O_1 to I/O_2 (-8kV Contact per IEC 61000-4-2)



Application Information

Pin Connections

SY205222DVD is designed to provide ESD protection for four data lines simultaneously. The pin connections are shown in Figure 2.

Four parallel data lines can be connected from the protected device to the I/O port connector through the four SY205222DVD I/O pins. Pin3 and Pin8 of SY205222DVD are the GND pins and should connect to the ground. The connection wires should be as short as possible to minimize the parasitic inductance.

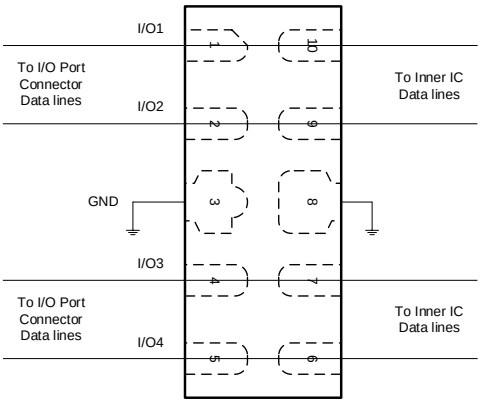


Figure 2. SY205222DVD Pin Connections in PCB

HDMI Application:

Refer to Figure 3 for the implementation of the SY205222DVD in HDMI applications. Utilize two SY205222DVD devices to protect the high-speed TMDS lines and CLK+/- lines. Additionally, use one SY205214ABC to provide protection for the remaining control lines.

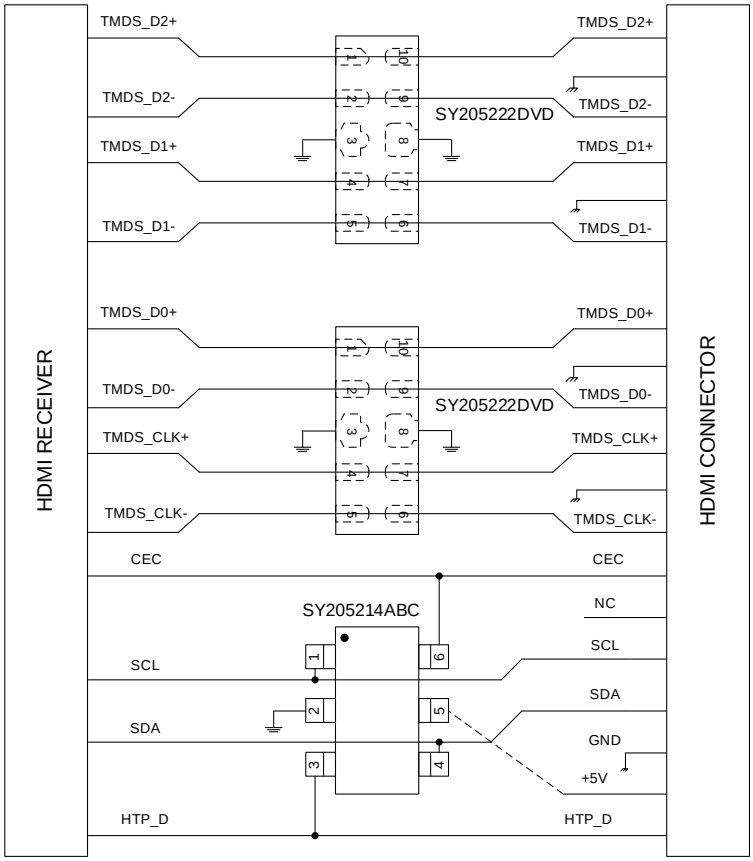


Figure 3. Layout Top View for HDMI Interface with SY205222DVD and SY205214ABC

PCB Layout Guidelines

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

- Place SY205222DVD as close to the connector port as possible.
- The distance between the SY205222DVD ground pin and the GND reference path should be as short as possible.
- Use a large via to connect the SY205222DVD GND pins to the ground.
- Avoid running critical signals near board edges.

Eye Diagram Measurement for HDMI2.1

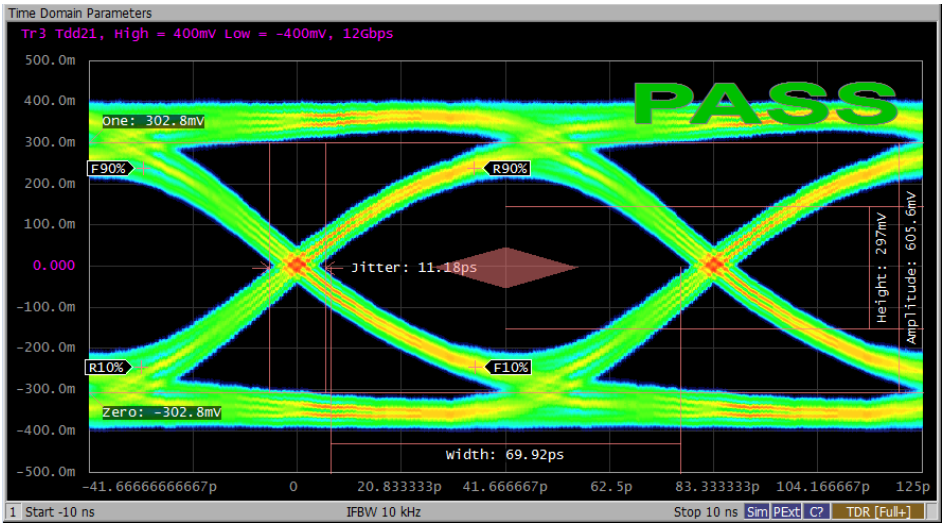


Figure 4. Data Rate 12Gb/s

HDMI2.1 Eye Diagram without SY205222DVD

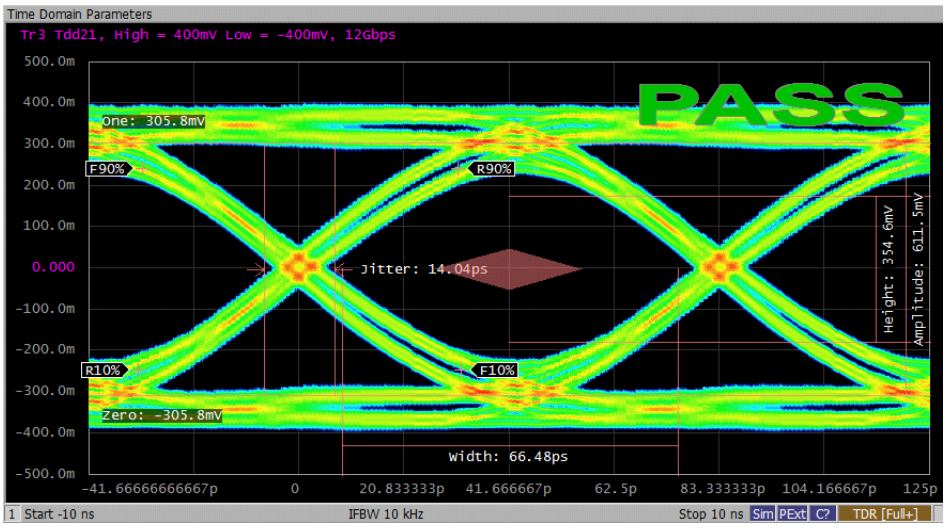
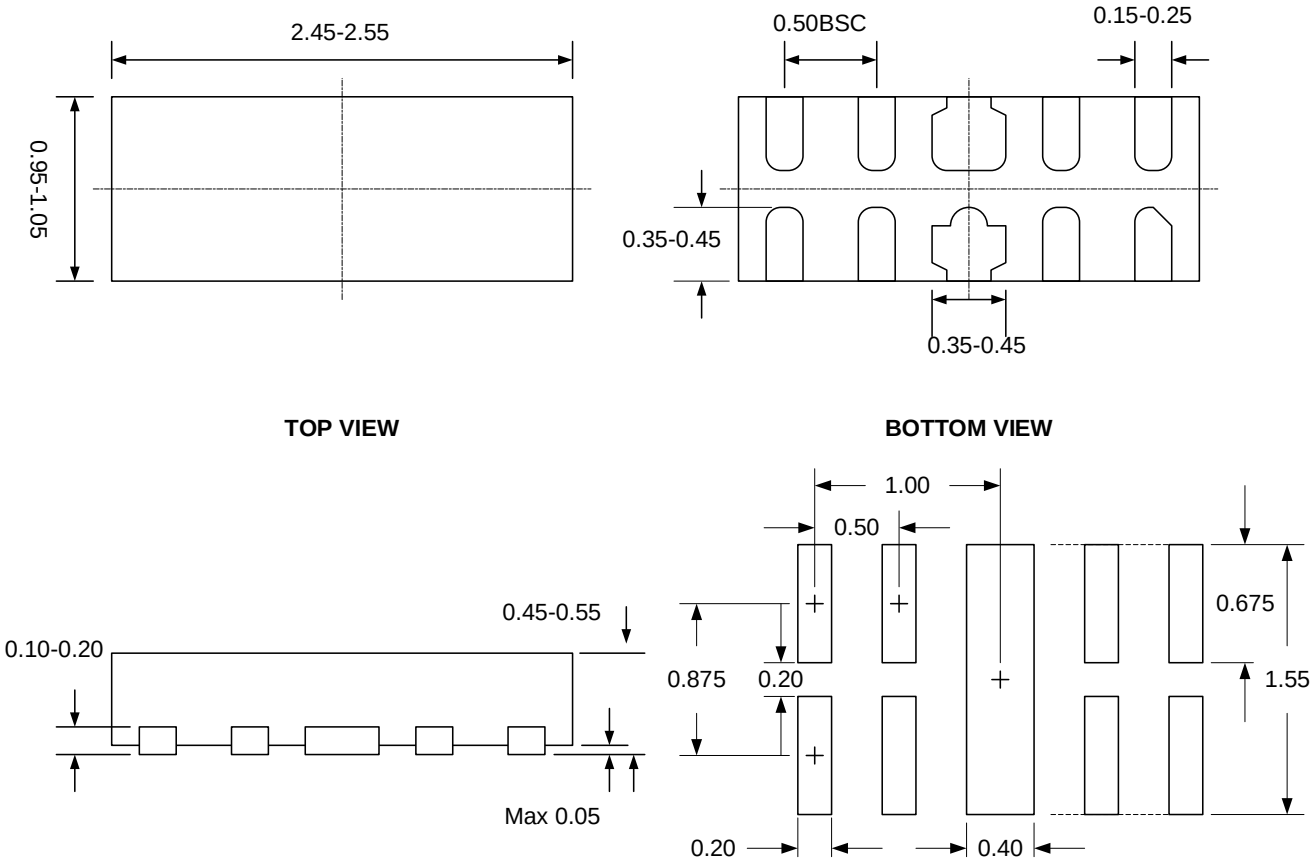


Figure 5. Data Rate 12Gb/s

HDMI2.1 Eye Diagram with SY205222DVD

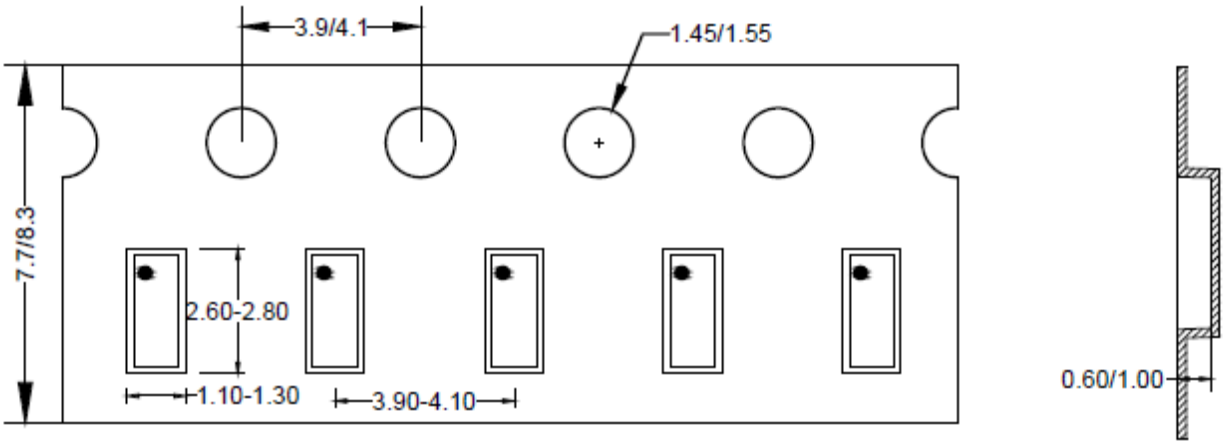
DFN2.5×1.0-10 Package Outline



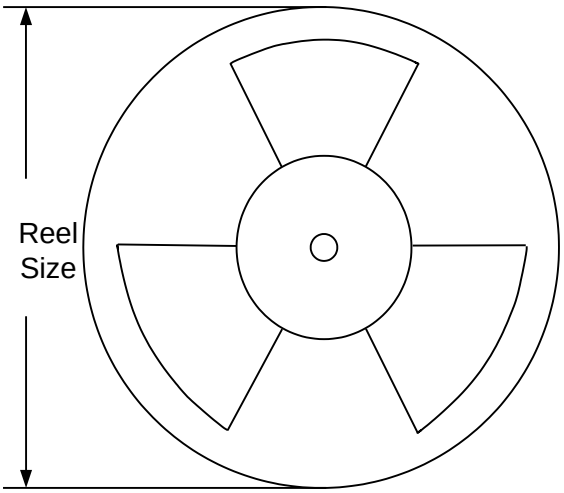
Note: *All dimensions are in millimeters and exclude mold flash and metal burr.*

Tape and Reel Specification

DFN2.5×1.0-10 Taping Orientation



Carrier Tape & Reel Specification for Packages



Package Types	Tape Width (mm)	Pocket Pitch(mm)	Reel Size (Inch)	Qty per Reel(pcs)
DFN2.5×1.0-10	8	4	7"	3000

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	02/25/2022	Initial Release	
1.0	02/25/2023	Production Release	

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