TOSHIBA

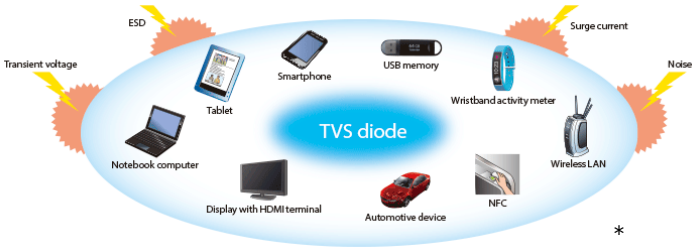
Mini catalog

Introduction to Toshiba TVS Diodes (ESD Protection Diodes) Line-up

Toshiba offers the strong solution for the TVS* Diodes of the wide lineup and excellent protective performance to the consumer, industry and automotive application.

Product destruction caused by ESD occurs anywhere around us.

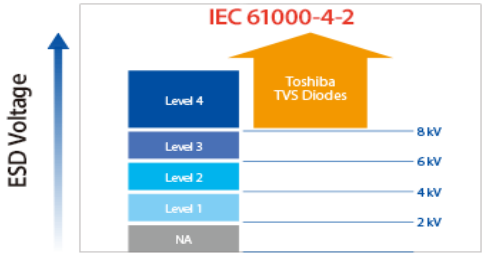
ESD* exist anywhere around us. For example, if the ESD enters into the set via the connector, it may cause problems such as internal destruction of devices and malfunction of the system. In order to prevent such problems, ESD countermeasures are important in set design, and ESD protection diodes are used in many cases.



*
TVS : Transient Voltage Suppressor
ESD : Electro-Static Discharge

Toshiba TVS Diodes(ESD Protection Diodes) protect equipment with high ESD protection performance

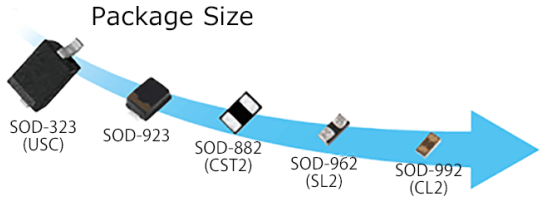
Many system-level immunity tests, such as those stipulated by IEC61000-4-2/4-5, have been adopted as an indicator of ESD tolerance. In recent years, however, similar tests have been required for TVS diodes themselves. Our products adopt system-level ESD tests and achieve ESD immunity higher than the Level 4 requirements of IEC61000-4-2 (Contact) standard, contributing robust protection of on-board devices.



*Based on our survey.

Wide support from high-speed signals to power supply lines

We have our own chip-processing technologies, and we have a wide range of lineups, from standard capacity type that can be used for protecting power lines and audio signals to low-capacity type that can be used for signal lines of high-speed communication standards such as USB 3.2, HDMI® 2.1 and Thunderbolt™ 3.



High-quality production of small packages in Japan and Thailand

We have a wide range of small packages that can be used in smaller sets and smaller PCBs. We respond to the needs of our customers by offering a variety of TVS Diodes through high-quality and stable production at our plants in Japan and Thailand.

Toshiba provides ESD protection diodes for various applications, including smartphones, PCs, tablets, wearable devices, IoT devices, consumer equipment, industrial equipment and automotive application. The next page is an example Toshiba TVS Diodes line-up.

TOSHIBA

Toshiba TVS Diodes (ESD Protection Diodes) Selection Guide(Single type)

Signal line Application	C_t(typ.)	V_{RWM} (MAX) (V)	SL2 (SOD-962) 1.0x0.6mm 	CST2 (SOD-882) 1.0x0.6mm 	SOD-923 1.0x0.6mm 	ESC (SOD-523) 1.6x0.8mm 	USC (SOD-323) 2.5x1.25mm 
USB 3.2(10Gbps) Thunderbolt 3(20Gbps) HDMI 2.1 (16Gbps) Wi-Fi®,Bluetooth® (2.4GHz)	0.1 ~0.15pF	3.6V	DF2B5M4ASL	-	-	-	-
		5.5V	DF2B6M4ASL DF2B7M3SL				
USB 3.1(10Gbps) HDMI 2.0(6Gbps)	0.2 ~0.35pF	3.6V, 3.3V	DF2B5M5SL DF2B5M4SL DF2S5M5SL DF2S5M4SL	DF2B5M4CT DF2B5M5CT DF2S5M4CT	-	-	-
		5.5V, 5V	DF2B6M5SL DF2B6M4SL DF2S6M5SL DF2S6M4SL	DF2B6M4CT DF2B6M5CT DF2S6M4CT DF2B6.8M1ACT	-	-	-
NFC, Senser		11V, 18.5V, 24V	DF2B12M4SL DF2B20M4SL DF2B26M4SL	-	DF2B20M4FS Under Development	-	-
USB 3.0(5Gbps)	0.5 ~0.6pF	3.3V	DF2S5M5SL	DF2S5M5CT	DF2S5M4FS	-	-
		5V	DF2S6M5SL	DF2S6M5CT	DF2S6M4FS		
USB 2.0(480Mbps)	0.9 ~1.5pF	5.5V,5V	DF2B6USL	DF2S6.8UCT	DF2S6.8UFS DF2S6.8MFS	-	-
		19V	-	DF2S24UCT	-		
	~45pF	5.5V	DF2B7BSL DF2B7ASL	DF2B7ACT DF2B7PCT	DF2B7AFS	DF2B6.8E	DF2B7AFU
		3.6V, 3.3V	DF2B5BSL DF2B5SL	DF2B5PCT			
Automotive CAN FlexRay/ LIN		Othes	DF2S5.1 ~8.2ASL	DF2S5.6~30CT	DF2S5.1~30FS	-	DF2S12FU DF2B18FU DF2B29FU DF2B36FU

Signal line Application	Ct(typ.)	VRWM (MAX) (V)	CST2C (SOD-963) 1.6x0.8mm 	USC (SOD-323) 2.5x1.25mm 	UDFN6B 2.0x2..0mm 
Power line (VCC,VBAS)	45pF~	5.5V	DF2S6P2CTC	DF2S6P2FU	DF6S25P3NU Under Development
		12.6V 21V,22V	DF2S14P2CTC DF2S23P2CTC	DF2S14P2FU DF2S23P2FU	

TOSHIBA

Toshiba TVS Diodes (ESD Protection Diodes) Selection Guide(Multibit type)

Signal line Application	C_t(typ.)	V_{RWM} (MAX) (V)	4 in 1	2 in 1
USB 3.0(5Gbps)	0.5pF	5V		DF3D6.8MS (SSM)
USB 2.0(480Mbps)	1.5pF~ 2pF	5V		DF3A6.8UFU (USM)
GPIO, Audio,I2C etc (100MHz~kHz)	6pF	5V	DF5A5.6~6.8LJE (ESV) DF5A5.6~6.8LFU (USV) DF5A6.8LF (SMV)	DF3A6.8LCT (CST3) DF3A5.6~6.8LFU (USM) DF3A5.6~6.8LFV(VESM)
Automotive CAN FlexRay/ LIN	7~9pF	12V 24V 28V		DF3D18FU (USM) DF3D29FU (USM) DF3D36FU (USM)
	25pF	3.5~5V	DF5A5.6~6.8CJE (ESV) DF5A5.6~6.8CFU (USV)	
	45pF	3.5~5V	DF5A5.6~6.8JE (ESV) DF5A5.6~6.8FU (USV) DF5A5.6~6.8F (SMV) DF6A6.8FU (US6)	DF3A5.6~6.8CT (CST3) DF3A5.6~6.8FV (VESM) DF3A5.6~6.8FU (USM) DF3A5.6~6.8F (S-Mini)

CST3 (SOT-883) 1.0x0.6mm 	VESM (SOT-723) 1.2x1.2mm 
SSM (SOT-416) 1.6x1.6mm 	ESV (SOT-553) 1.6x1.6mm 
USM (SOT-323) 2.0x2.1mm 	USV (SOT-353) 2.0x2.1mm 
US6 (SOT-363) 2.0x2.1mm 	
S-Mini (SOT-346) 2.5x2.9mm 	SMV (SOT-25) 2.5x2.9mm 

The example of reference products for USB Type-C®

Line	Product Number	V_{RWM} (MAX) (V)	Polarity	C_t (typ.)	V_{ESD}	Bit	Package	Where to buy
VBUS	DF2S23P2CTC	20V	Unidirectional	160pF	±30kV	Single	SOD-882(CST2C) 1.0x0.6mm 	Buy Online
D+/D	DF2B6USL	5.5V	Bidirectional	1.5pF	±10kV	Single	SL2(SOD-962) 1.0x0.6mm 	Buy Online
Tx/Rx	DF2B5M4ASL	3.6V	Bidirectional	0.15pF	±16kV	Single	SL2(SOD-962) 1.0x0.6mm 	Buy Online

LINK

- **Product page** Click
- **Parametric search** Click
- **Application Notes :**
  - **Basics of ESD Protection (TVS)Diodes** Click
  - **Overvoltage protection device Zener diode and ESD protection diode** Click
- **Frequently Asked Questions (FAQ) of diodes** Click
- **Online distributor purchase, inventory search page** Click

*HDMI is a trademark or registered trademark of HDMI Licensing Administrator, Inc.
*Thunderbolt is a trademark of Intel Corporation or its subsidiaries.
*Wi-Fi is a registered trademark of Wi-Fi Alliance.
*Bluetooth® word mark is a registered trademark owned by the Bluetooth SIG, Inc.
*USB Type-C®,and USB-C® are registered trademarks of USB Implementers Forum.
*All other company names, product names, and service names may be trademarks of their respective companies.

RESTRICTIONS ON PRODUCT USE

Toshiba Electronic Devices & Storage Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA".

Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.
- PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE"). Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, lifesaving and/or life supporting medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, and devices related to power plant. IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT. For details, please contact your TOSHIBA sales representative or contact us via our website.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.

Toshiba Electronic Devices & Storage Corporation

https://toshiba.semicon-storage.com/