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.

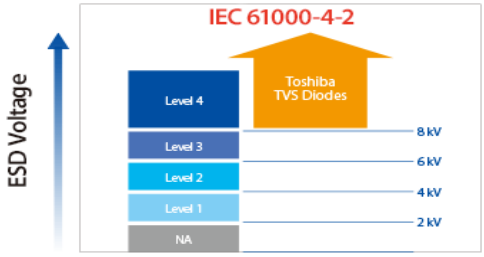
ESD* exist anywhere around us. For example, if the ESD enters into the set via the connector, it may cause problems such as internal destruction of devices and malfunction of the system. In order to prevent such problems, ESD countermeasures are important in set design, and ESD protection diodes are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

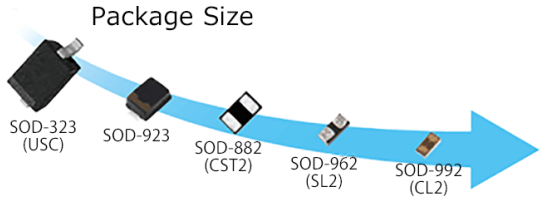
Many system-level immunity tests, such as those stipulated by IEC61000-4-2/4-5, have been adopted as an indicator of ESD tolerance. In recent years, however, similar tests have been required for TVS diodes themselves. Our products adopt system-level ESD tests and achieve ESD immunity higher than the 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

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.

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

Signal line Application	C_t(typ.)	V_{RWM} (MAX) (V)	SL2 (SOD-962) 0.62x0.32mm	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	DF2B6M4BSL DF2B6M4ASL DF2B7M3SL				
USB 3.1(10Gbps) HDMI 2.0(6Gbps)	0.2~ 0.35pF	3.6V, 3.3V	DF2B5M5SL DF2B5M4SL DF2S5M4SL	DF2B5M4CT DF2B5M5CT DF2S5M4CT	-	-	-
		5.5V, 5V	DF2B6M5SL DF2B6M4SL DF2S6M4SL	DF2B6M4CT DF2B6M5CT DF2S6M4CT DF2B6.8M1ACT	-	-	-
NFC, Sensor		11V, 18.5V, 24V	DF2B12M4SL DF2B20M4SL DF2B26M4SL	-	-	-	-
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	-	-	DF2S6.8MFS	-	-
	~45pF	5.5V	DF2B7BSL DF2B7ASL	DF2B7ACT DF2B7PCT	DF2B7AFS	DF2B7AE DF2B6.8E	DF2B7AFU
		3.6V, 3.3V	DF2B5BSL DF2B5SL	DF2B5PCT			
Automotive CAN FlexRay/ LIN		Others	DF2S5.1 ~30ASL	DF2S5.6 ~30CT	DF2S5.1 ~30FS	-	DF2S12FU DF2B18FU DF2B29FU DF2B36FU

Signal line Application	Ct(typ.)	VRWM (MAX) (V)	USC (SOD-323) 2.5x1.25mm	UDFN6B (SOT-1220) 2.0x2.0mm
Power line (VCC,VBUS)	45pF~	5.5V 10V 12.6V 21V,22V	DF2S6P2FU DF2S12P2FU DF2S14P2FU DF2S23P2FU	DF6S25P3NU

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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 3.1(10Gbps) HDMI 2.0(6Gbps) / USB 3.0(5Gbps) / USB 2.0(480Mbps)	0.2pF	3.6V	DF10G5M4N (DFN10)	
		5.5V	DF10G6M4N (DFN10)	
	0.5pF	5V	DF10G7M1N (DFN10)	DF3D6.8MS (SSM)
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)	DF3A6.8CT (CST3) DF3A6.2~6.8FV (VESM) DF3A5.6~6.8FU (USM) DF3A5.6~6.8F (S-Mini)

CST3 (SOT-883) 1.0x0.6mm	VESM (SOT-723) 1.2x1.2mm	DFN10 2.5x1.0mm
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	DF6S25P3NU	22V	Unidirectional	650pF	±30kV	Single	UDFN6B(SOT-1220) 2.0x2.0mm	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 TVS diodes (ESD protection diodes)** Click
- **Online distributor purchase, inventory search page** Click

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