ESD & TVS

TrEOS 1 & 2 High-Speed ESD Protection in µCSP

Ideal combination of low capacitance, low clamping voltage and high surge robustness to protect sensitive high-speed interfaces

Design benefit

- Maximizing the three pillars of ESD protection
  - *Low capacitance* for highest signal integrity
  - *Low clamping* for enhanced system protection
  - *High ESD & Surge robustness* against transients
- Snap-back technology allows for lowest clamping voltage
- Designed to fulfill IEC 61000 standard in final application

Key technical features & portfolio

- Extremely low capacitance down to 0.1 pF
- Extremely low clamping down to 0.1 Ω (R_{dyn})
- High ESD and surge robustness up to 20 A at 8/20 µs
- Extremely fast switching time under 1 ns

	Portfolio (Excerpt)	**Capacitance**	**Clamping**	**Surge**	**Package**
TrEOS 1	PESD3V3Z1BSF	0.28 pF	5.7 V	9.5 A	SOD962
	PESD3V3Z1BCSF	0.45 pF	4.6 V	15 A	SOD962
	PESD3V3W1BCSF	0.55 pF	3.8 V	20 A	SOD962
	PESD9V0C1BSF	0.20 pF	5.8 V	9 A	SOD962
TrEOS 2	PESD2V0Y1BSF	0.69 pF	4.6 V	6 A	SOD962
	PESD2V5Y1BSF	0.25 pF	6.1 V	4 A	SOD962
	PESD4V0Y1BSF	0.24 pF	6.5 V	4 A	SOD962

@ 16 A TLP

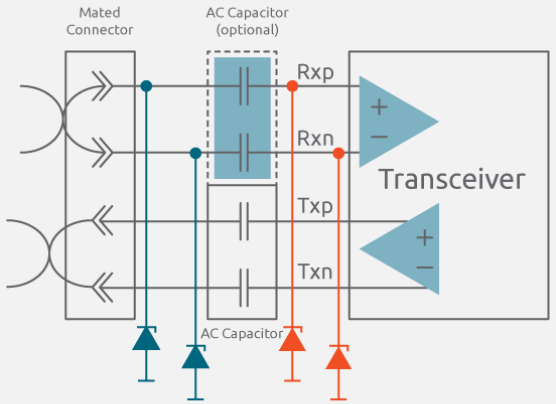
Functions & applications

Suitable for data-lines up to ~20Gbps

- USB Type-C (USB 3.2), MicroUSB
- Thunderbolt
- HDMI 2.1
- SD-Card protection
- All other sensitive I/Os

Application diagram

USB3.2 Rx/Tx Protection



Available packages (W x L x H in mm)

SOD962-2
(DSN0603-2)

0.6 x 0.3 x 0.3

Small-footprint package with low-inductance & extreme-robustness

Super-Speed Common Mode Filter in WLCSP

2 in 1 solution combining common-mode (CM) suppression with Nexperia's best-in-class TrEOS ESD protection

Design benefit

- Common-Mode Filter & ESD protection on one footprint
  - Best CM suppression at all GHz data-line signal fundamentals
  - Widest differential passband to keep signal integrity
  - Uncompromising TrEOS High-Speed ESD protection
- Reduces part count and accelerates PCB placement
- Portfolio of ESD-only devices with identical footprint allows system level EMI characterization with or without CMF

Key technical features & portfolio

- Leading common-mode suppression up to -38 dB
- Extremely wide differential pass-band up to 10 GHz
- High ESD ruggedness 15-20 kV, exceeding IEC 61000-4-2
- TrEOS ESD protection up to 15 kV contact discharge

Portfolio (Excerpt)	**Passband**[1)]	**Rejection**	**V_{ESD}**	**Package**
PCMFxUSB3S	6 GHz	-38 dB	15 kV	WLCSP5/10/15
PCMFxUSB3B/C	8 GHz	-36 dB	20 kV	WLCSP5/10/15
PCMFxUSB3BA/C	10 GHz	-35 dB	15 kV	WLCSP5/10/15
PESDxUSB3B/C	16.1 GHz	-	20 kV	WLCSP5/10/15
PESDxUSB3S	17 GHz	-	15 kV	WLCSP5/10/15

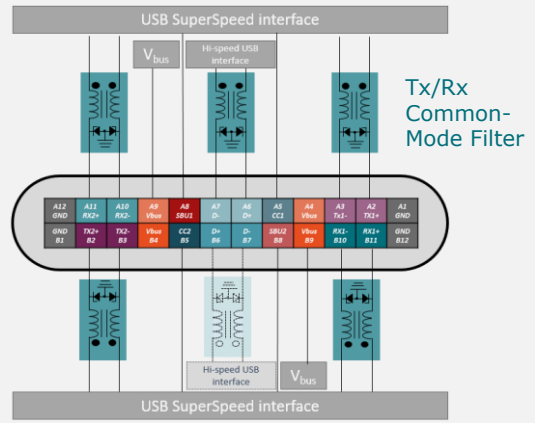
1) S21dd f3dB

Functions & applications

- Ultra-high-speed data-lines incl. USB 3.2
- HDMI 2.1
- MIPI CSI camera interface
- MIPI DSI display interface
- Thunderbolt

Application diagram

USB Type-C Dongle



Available packages (W x L x H in mm)

WLCSP5	WLCSP10	WLCSP15
		
0.8 x 1.2 x 0.6	1.6 x 1.2 x 0.6	2.4 x 1.2 x 0.6

- Smallest footprint & lowest inductive path to ground due to wafer level chip scale package
- Package design allows for optimal RF routing

Mobile Surge Protection in compact packages

Superior Protection against transient over-voltage with leading edge performance-to-space ratio

Design benefit

- High surge robustness devices for single-line protection
- Ultra-low clamping to safeguard sensitive ICs
- Wide-ranging product portfolio for various design needs
- All products in ultra flat & compact leadless packages
- Optimized design to avoid latch-up effect

Key technical features & portfolio

- High surge robustness up to 100 A at 8/20 µs pulse
- Range of reverse standoff voltages from 3.3 V to 26 V
- Low dynamical resistance down to 0.1 Ω (TLP)
- Protection against electrostatic discharge up to 30 kV

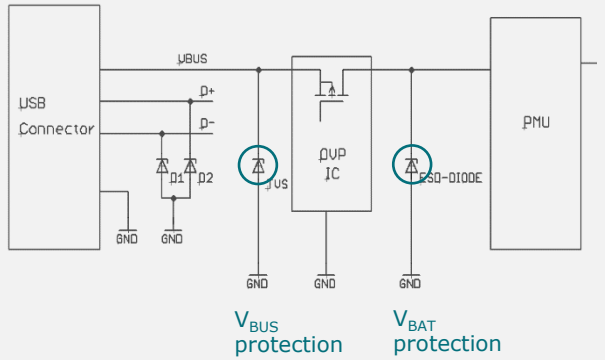
Portfolio (Excerpt)	**Voltage**	**Current**	**Clamping**	**Package**
PTVS5V5D1BL	5.5 V	35 A	10.3 V	DFN1006-2
PTVS3V3Z1BSC	3.3 V	70 A	11.0 V	DSN1006-2
PTVS5V0Z1BSC	5.0 V	60 A	12.0 V	DSN1006-2
PTVS5V0Z1USKP	5.0 V	100 A	17.2 V	DSN1608-2
PTVS26VZ1USK	26.0 V	32 A	47.9 V	DSN1608-2

Functions & applications

- USB – PD (Power Delivery)
- USB Type-C (CC-/SBU-line)
- Supply line
- Battery line
- Audio interface

Application diagram

V_{Bus} & V_{BAT} protection



Available packages (W x L x H in mm)

DFN1006-2 (SOD882)	**DSN1006-2** (SOD993)	**DSN1608-2** (SOD964)
		
1.0 x 0.6 x 0.5	1.0 x 0.6 x 0.27	1.6 x 0.8 x 0.29

In-Vehicle Network (IVN) protection

Automotive qualified

Family of ESD Protection diodes for automotive In-Vehicle-Network (IVN) lines

Design benefit

- New generation of protection technology, optimized for the latest generation of transceiver
- Drop in replacement for existing PESD1CAN and PESD1LIN – 2nd source in-house
- Approved by major automotive OEM

Key technical features & portfolio

- Handles higher surge current than predecessor
- Higher ESD robustness - withstands higher failure voltages
- Lower (=better) ESD clamping voltage offers improved system level protection
- 8 new products for CAN-FD – DFN package in 2H'19

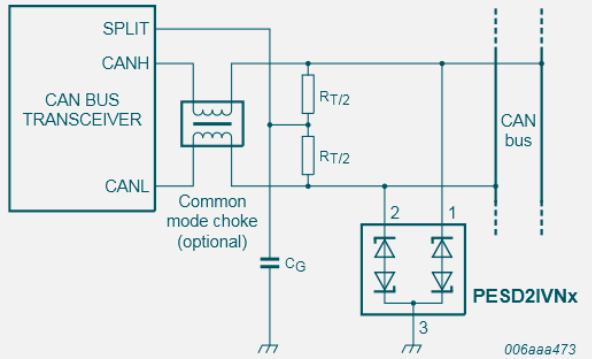
Portfolio (Excerpt)	V_{RWM}	lines	$C_{D\ max}$	Package
PESD1IVN2x-A	24/ 27	1	17 pF	SOD323
PESD1IVN27-U	27	1	17 pF	SOT323
PESD2IVN2x-T	24/ 27	2	17 pF	SOT23
PESD2IVN2x-U	24/ 27	2	17 pF	SOT323
PESD2CANFDVx-x	24/ 27	2	6 pF	SOT23/ SOT323
PESD2CANFDUx-x	24/ 27	2	3.5 pF	SOT23/ SOT323

Functions & applications

- Protection of transceiver devices at in-vehicle networks (IVN)
- Family of products for CAN, CAN-FD LIN, FlexRay, et.al. interfaces

Application diagram

ESD protection for CAN bus



Available packages (W x L x H in mm)

Package	SOT23	SOT323 (SC70)	SOD323 (SC76)
			
W x L x H (mm)	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95
P_{tot} (mW)	250	200	400

ESD & TVS

EFFICIENCY WINS.