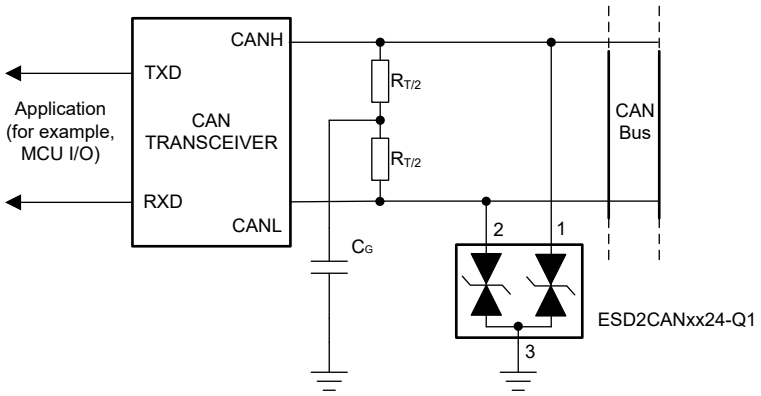
Product Overview

Protecting Automotive CAN Bus Lines

The Controller Area Network (CAN bus) is a message-based protocol designed to allow the Electronic Control Units (ECUs) to communicate with each other in a reliable priority-based system. CAN is a differential 2-wire interface, also referred to as the Main Bus in an automotive system.

Many CAN transceivers have built-in ESD protection cells, but to keep the size of the chip down, most of the CAN transceivers only protect only up to 8 kV. *CANH* and *CANL* lines in any CAN interface need to be protected against the unpredictable ESD strikes that can go as high as 30 kV. CAN ESD devices can be used to protect the CAN lines and the downstream components from catastrophic failure.



CAN ESD Application Diagram

Design Considerations

- 24-V working voltage (V_{RWM}), this voltage is high enough to account for short-to-battery protection for a 12-V battery system.
- Make sure the clamping voltage is lower than the absolute maximum voltage ratings (typically 58 V – 70 V) of the CANH and CANL pins of the CAN transceiver used.
- Requires a bidirectional diode to account for line faults and miswiring at the battery side.
- Line capacitance must be low enough to provide the signal integrity through the ESD protection diode with minimum signal degradation.

The CAN protocol comes in many different flavors and speeds ranging from 1Mbps for a CAN and up to 10Mbps – 20Mbps for CAN-XL.

The maximum allowable line capacitance of a diode is a function of the signal frequency being protected. When considering a system design, other components like filtering capacitance and input capacitance of the transceivers can add to the total bus capacitance. As a recommended guideline, a diode with < 12 pF to 15 pF is able to support CAN, CANFD, and CANXL protocols communication speed requirements for a majority of designs.

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Recommended Parts

CAN Device	Number of Channels	V_{RWM}	IEC61000-4-2 Contact (kV)	Line Capacitor (pF)	Protocols	Package
ESD2CAN24-Q1	2	24 V	±30	3	CAN CANFD CANXL	SOT-23 (2.92 × 2.37) SC-70 (2.0 × 1.25)
ESD2CANFD24-Q1	2	24 V	±25	2.5		SOT-23 (2.92 × 2.37)
ESD2CANXL24-Q1	2	24 V	±20	1.75		SOT-23 (2.92 × 2.37)

For more devices, browse through the online parametric tool where you can sort by desired voltage, channel numbers, on-state resistance, and other features.

Target Applications and End Equipment

- Front camera, Rear camera
- Drive assist ECU
- Telematics control unit
- Medium and short range radar
- Body control module (BCM) and Zonal module

Learn More

- Texas Instruments, *System-Level ESD Protection Guide Selection Guide*
- Texas Instruments, *Protecting Automotive CAN Bus Systems from ESD Overvoltage Events Application Note*
- Texas Instruments, *ESD Packaging and Layout Guide Application Note*
- Texas Instruments, *ESD fundamentals, part 4: ESD capacitance Technical Article*
- Need additional assistance? Ask our engineer a question on TI E2E™ *ESD and TVS Protection Devices: Key Collateral and FAQs*

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