CAN bus protection

Is this presentation suited for you?

Where do you stand with CAN bus protection?

Beginner?	Intermediate?	Advanced?
I am not familiar with this subject. I am in the discovery phase and would like an overview and a basic understanding of the technology.	I have a basic understanding of this subject. I would like to go deeper in details and tackle more aspects of this subject.	I am very familiar with this subject. I would like to deepen my knowledge and become an expert.
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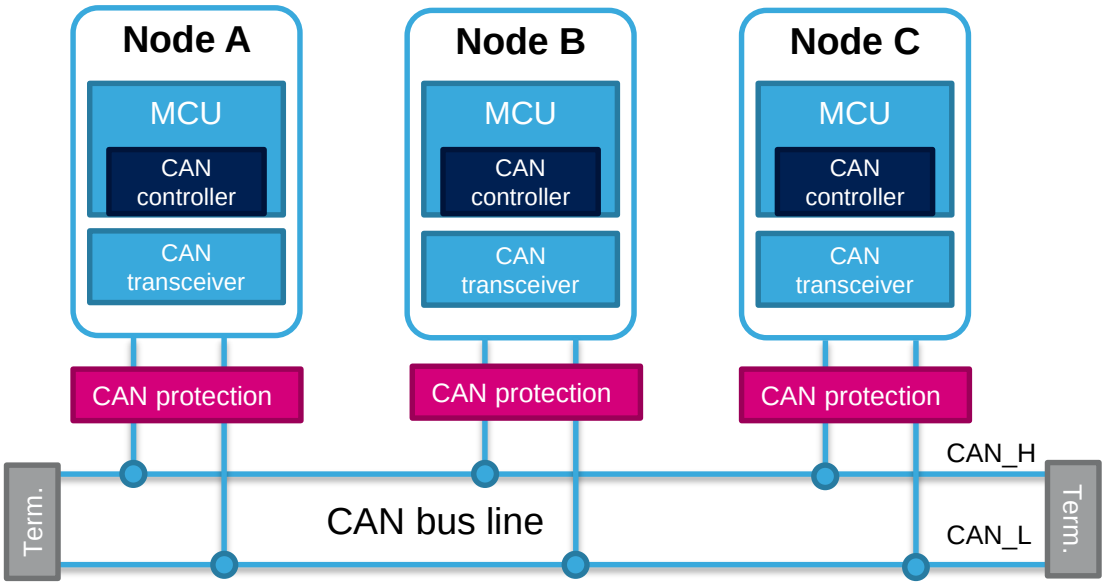
Overview	Basic	In depth

Basics on CAN bus

- CAN stands for Controller Area Network
- It is very popular in the automotive industry
- It is a serial bi-directional half-duplex multi-master communication bus
- 2 lines:
  - CAN_H (CAN High)
  - CAN_L (CAN Low)
- 2 standards:
  - Low-speed, fault-tolerant
  - High-speed

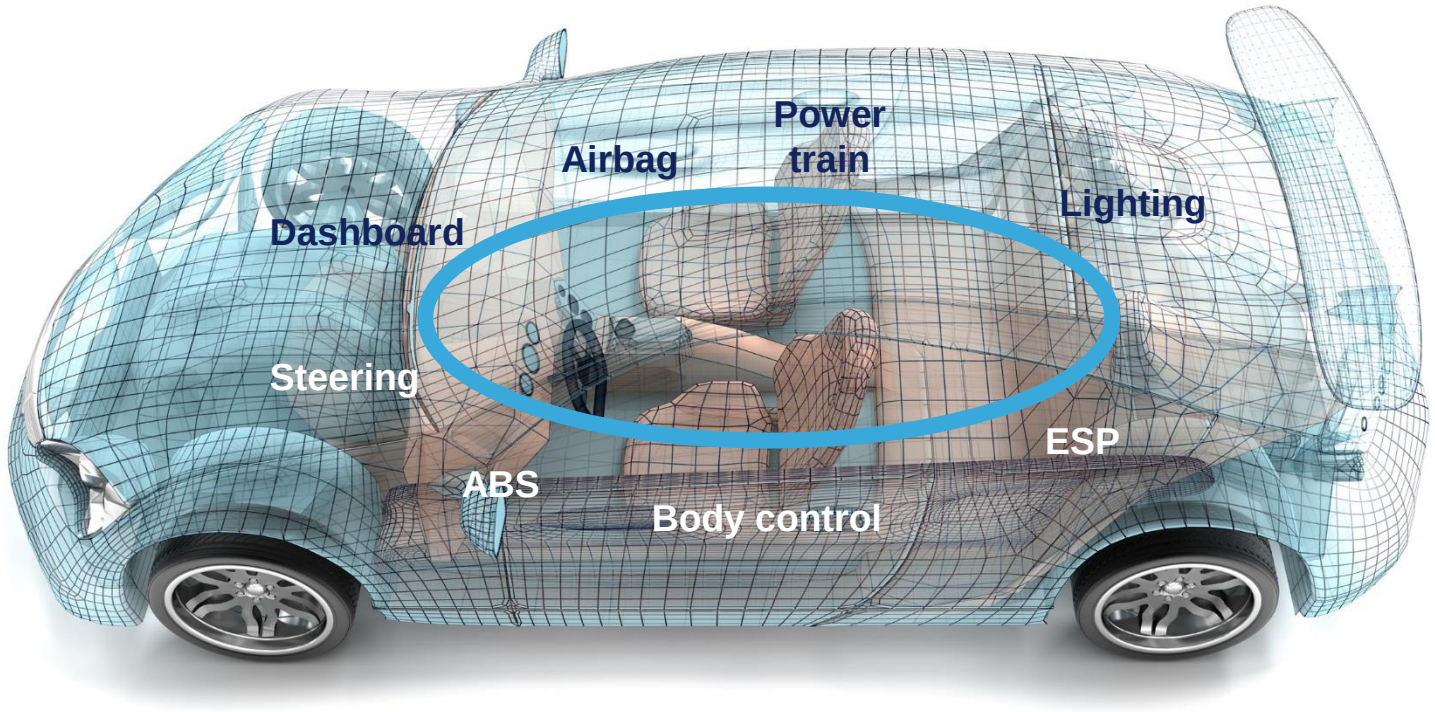


Benefits of CAN

- Cost-effective
- Light-weight
- Reliable / transmission safety
- Information available for all nodes

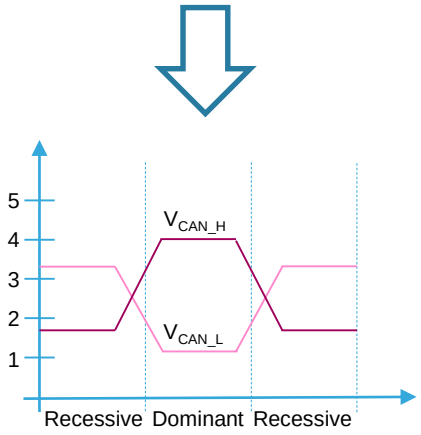
Where is CAN

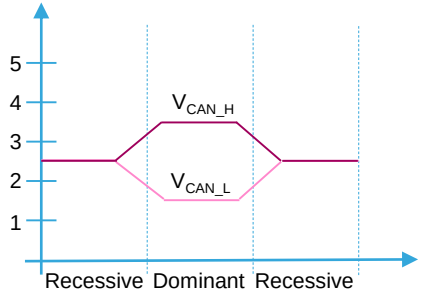
- As the CAN bus is reliable, it is used to connect together most of the modules in the car, including safety and critical functions



Basics on CAN bus

Parameters	High-speed CAN	Low-speed CAN
Physical layer standards	ISO 11898-2	ISO 11898-3
Data rate	Up to 1 Mbit/s	Up to 125 kbit/s
Maximum length	30 m	500 m
Termination	120 Ω shunt	2.2 kΩ serial on each line
Recessive voltage level	V_{CAN_H} = 1.75 V V_{CAN_L} = 3.25 V	V_{CAN_H} = V_{CAN_L} = 2.5 V
Dominant voltage level	V_{CAN_H} = 4 V V_{CAN_L} = 1 V	V_{CAN_H} - V_{CAN_L} = 2 V





Why protection is needed?

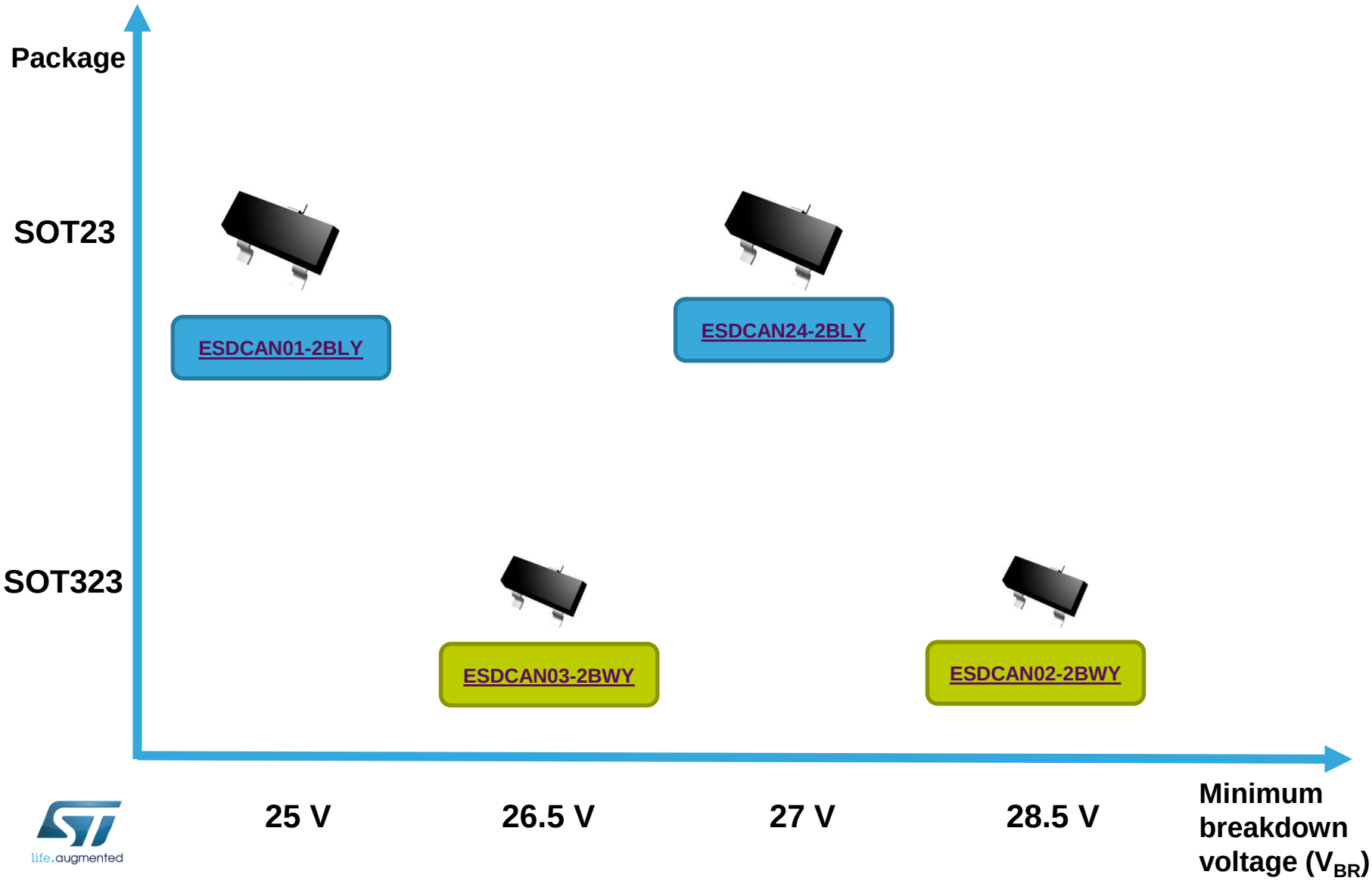
- Automotive systems require a high level of robustness and must be 100% reliable when they control safety devices.
- The automotive industry has defined standards to guarantee the robustness of car embedded electronics.

Why protection is needed?

CAN protection must comply with the following main standards

Hazards	Type	Standards
ESD protection	Voltage spikes due to electro-static discharges.	*ISO 10605*
Surge protection	Voltage spikes due to switching processes (influenced by capacitance and inductances of the wiring harness)	*ISO 7637-3 pulse 3a/3b*
Jump start	Application of 24 V on all inputs to simulate a jump start with a 24 V battery	*ISO 16750*
Reverse battery	Application of -28 V (during 60 s) to simulate a reversed battery connection in case of using an auxiliary starting device	*ISO 16750*

CAN protection portfolio



ESDCAN series versus standards

Hazards	Standards	ESDCAN24-2BLY	ESDCAN01-2BLY	ESDCAN02-2BWY	ESDCAN03-2BWY
ESD protection	*ISO 10605*	✓ +30 kV contact	✓ +30 kV contact	✓ +30 kV contact	✓ +30 kV contact
Surge protection	*ISO 7637-3 pulse 3a/3b*	✓	✓	✓	✓
Jump start	*ISO 16750*	✓ V_{BR} min (reverse) = 27 V	✓ V_{BR} min (reverse) = 25 V	✓ V_{BR} in (reverse) = 28.5 V	✓ V_{BR} in (reverse) = 26.5 V
Reverse battery	*ISO 16750*	✓ V_{BR} min (forward) = 27 V	✓ V_{BR} min (forward) = 25 V	✓ V_{BR} min (forward) = 28.5 V	✓ V_{BR} min (forward) = 26.5 V

ESDCAN series: quality of protection

- Not only protection features must comply with standards, but they must efficiently protect against surges.
- The quality of protection features is measured by its ability to clamp overvoltages and overcurrent, thus protect the IC (CAN controller) against EOS / ESD
- The lower the clamping voltage, the greater the circuit's ~~better~~ ESD immunity.

Let’s go further

In-depth information

Protection of automotive electronics - guidelines for design and component selection
Application note AN2689

Pspice models

Selection & sampling

Our **product selector**: Automotive dataline ESD protection

Our **selection guide**: Automotive-grade protection devices and rectifiers (.pdf)