EMBEDDED AUTOMOTIVE

1. ADAS (Advanced Driver Assistance System) : It refers to a category of tech and systems designed to assist drivers in the operation of the vehicle and enhance the safety by providing features like adaptive cruise control, lane keeping assist, automotive parking and collission avoidance.

ADAS systems uses sensors such as cameras, radar, lidar, ultrasonic sensors to monitor the vehicle's surroundings and provide real time assistance to the driver.

ADAS systems includes adaptive cruise control, lane departure warning, blindspot monitoring and automatic emergency braking.

2. AUTOSAR(Automotive Open system Architecture): It is an open and standardized software architecture framework primarily focused on the development of software for Electronic control units(ECUs) within vehicles.

AUTOSAR defines a common platform, standards and specifications for automotive software development, aiming to make automotive software more modular, scalable and reusable.

AUTOSAR focuses on the overall software architecture communication, communication protocols, interfaces and development methodologies for building software systems in vehicles.

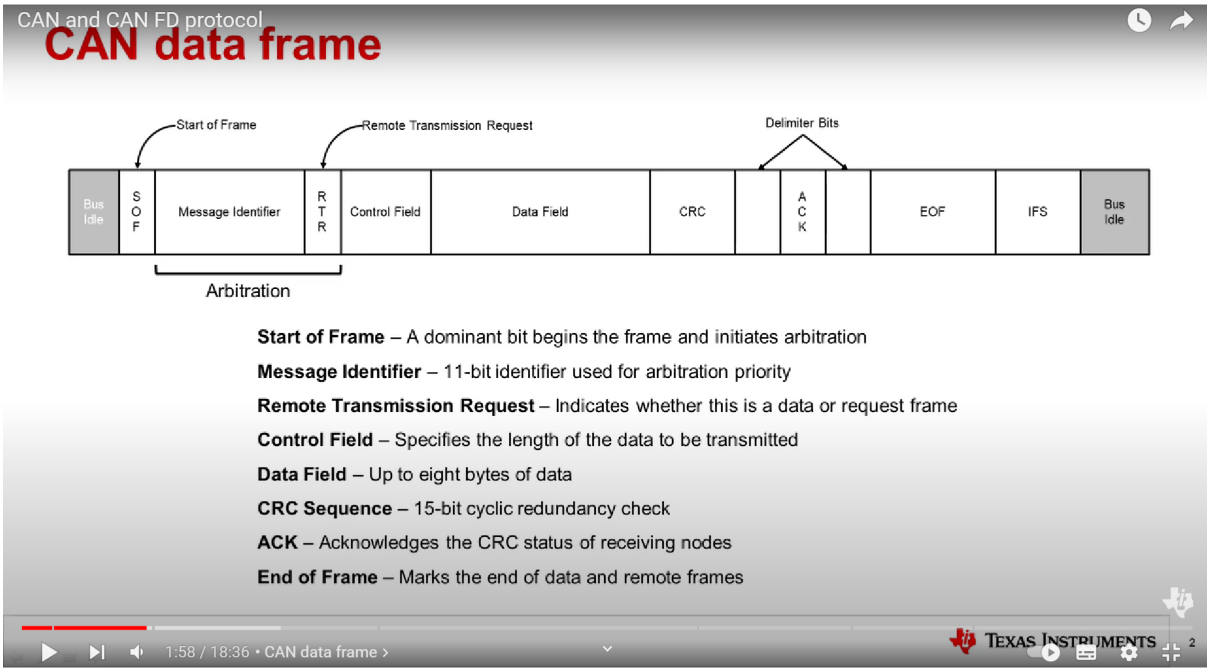
AUTOSAR is used to standardise and manage the software components responsible for functions like engine control, infotainment systems and more.

3. CAN(Controller Area Network) Networking:

It was developed to facilitate the communication between electronic control units(ECUs) in vehicles enabling them to exchange data without a central computer.

CAN typically uses a bus topology where multiple devices are connected to a single communication line. CAN high and CAN low are two bus lines kept at 3.75 V and 1.25 V.

Message frame from CAN are structured into frames, consisting of an identifier(ID), data length code(DLC), CRC(Cycle redundancy check) and Acknowledgment bits.



7 bit IFS seperates every CAN message. SOF is always dominant 0 and is used to synchronize the bus after the idle state.

CAN uses differential signaling where the state of a bit is determined by the voltage difference between two wires(CAN-high) and (CAN-low). This provides more noise immunity

CAN uses a priority based arbitration mechanism. When two devices attempt to transmit simultaneously, the one with the lower ID wins the bus and transmits the message.

Dominant bit is logical 0 and recessive bit is logical 1. Logical 0 overrides Logical 1 in AND operation.

CAN has robust error detection and error handling mechanisms including cyclic redundancy checks(CRC) and acknowledgment mechanisms.

Data Rate : CAN supports various data rates such as 125 kbps, 250 kbps, 500 kbps and 1 Mbps, allowing flexibility in communication speed.

Extended CAN : It introduces 29 bit identifiers(instead of standard 11 bit) increasing the number of unique message IDs and enabling more complex network.

CAN FD: It is CAN with Flexible Data rate which extends the original CAN protocol by allowing variable data lengths and faster data rates. This is especially useful for high bandwidth applications.

Bit Stuffing : A bit of opposite polarity is inserted after five consecutive identical bits.

OSI(Open System Interconnection) model

CAN has a seven layer model, the CAN lower layers cover some functions of the transport layer(eg. automatic retransmission of faulty frames)

Layer 1 - Physical layer 2 - Data link layer, Layer 3 - Network layer, 4 - Transport layer, 5 - Session , Layer 6 - Presentation Layer 7 - Appllication

4. CAN Physical Layer

The CAN physical layer is a critical component of the CAN protocol, responsible for transmitting data between devices on the network. It defines how bits are physically transmitted over the communication medium, ensuring reliability and robustness.

- Differential Signaling : It uses a differential signaling scheme which means it transmits data by measuring the voltage difference between two wires.

CAN High(CAN- H) - This wire carries a voltage that is higher than the reference voltage during a dominant bit(logical 0)

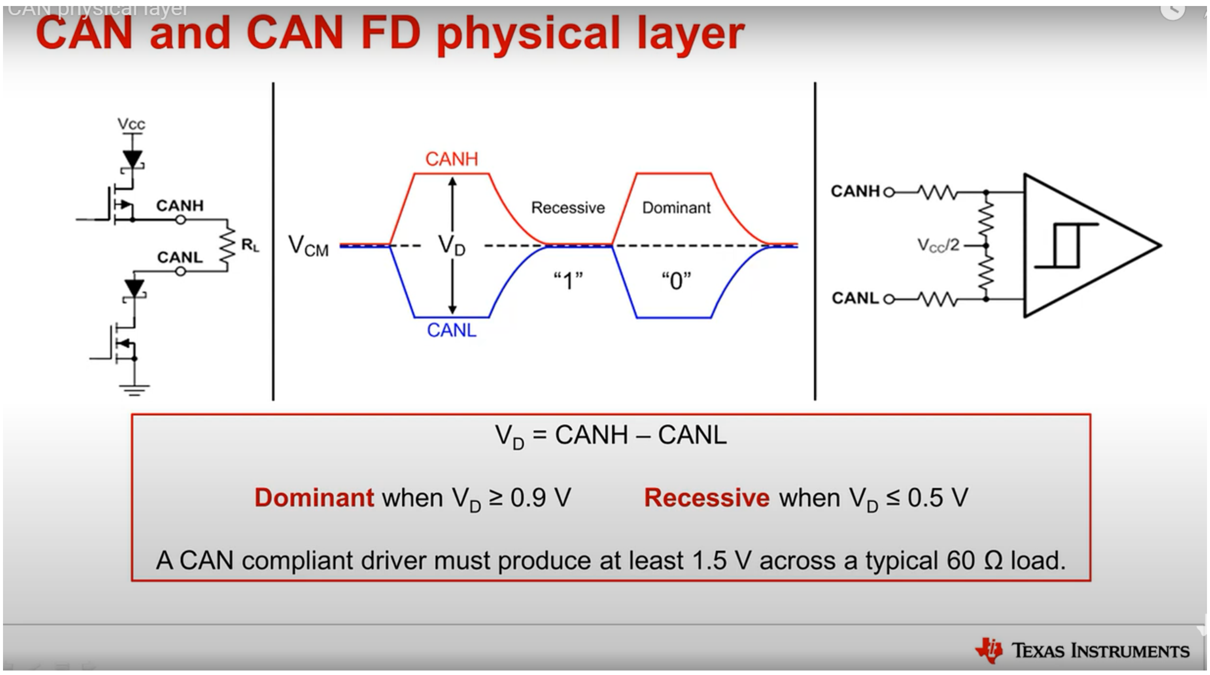
CAN Low(CAN L) : This wire carries a voltage that is lower than the reference voltage during a dominant bit(logical 0)

- Voltage levels

In differential mode, a dominant bit(0) is represented when CAN-H is greater than CAN-L whereas a recessive bit(1) is represented when CAN-H and CAN-L are approximately at same voltage levels.

Termination : Proper termination is essential in the CAN physical layer to minimize signal reflections and ensure signal integrity. Termination resistors(120 ohm) are placed at both ends of the resistors to match the characteristics impedance of the transmission line.

Bit Timing - CAN uses a bit time synchronization mechanism to ensure that all nodes on the network are in sync. It defines the length of time for each bit and the timing of the sampling points for bit reception. It is an asynchronous model.



The wiring of CAN are twisted together to reduce electromagnetic interference and form a differential signal. The wires are connected to each device on the bus through a transceiver that converts the logic level signals to the bus level signals

Connectors used in CAN networks are typically standardized such as Deutsch DT series or the AMP Superseal series.

Baud rate refers to the speed at which data is transmitted over the network, and is typically measured in bits per second(bps)

5. Introduction to Vector Tools

CANoe and CANalyzer are vector tools used for CAN network simulation, analysis and debugging.

- CANoe is a comprehensive tool that allows users to create and simulate a CAN network scenario. It provides features such as creating ECU nodes, CAPL scripting and advanced analysis capabilities. CANoe is used for simulating complex scenarios and iis suitable for intermediate to advanced users.

- CANalyzer : It is another vector tool that focuses on analyzing and debugging CAN traffic. It offers advanced logging techniques, data analysis capabilities and features like filters and triggers for in-depth analysis. It is suitable for users who require advanced logging and analysis capabilities.