FUNCTIONAL SAFETY COURSE #2

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NXP

SECURE CONNECTIONS FOR A SMARTER WORLD

General Agenda

- Course #1 :

Functional Safety awareness

- Course #2 :

Brainstorming on power inverter architecture, potential failures and safety mechanisms (ie. safety concept)

- Course #3:

Continue on Safety Concept

- Course #4:

How to prove our concept and assess it

Course #1 agenda

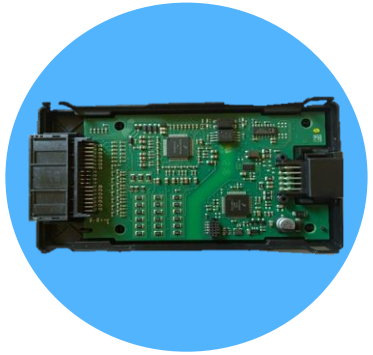
- Introduction
- Safety Goals for electric vehicle ?
- Functional Concept
- Technical Safety Concept
- Conclusion

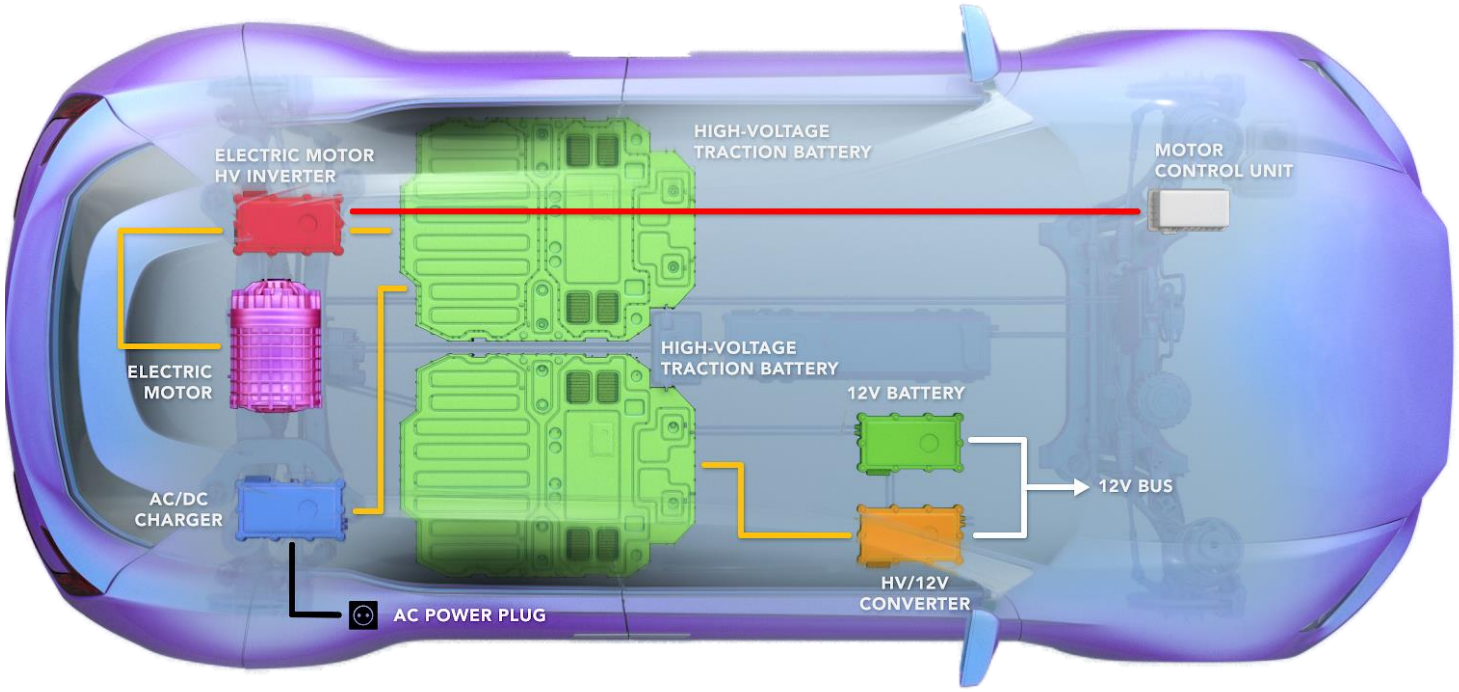
01.
Introduction

Efficient Electric Vehicle Power Control by NXP

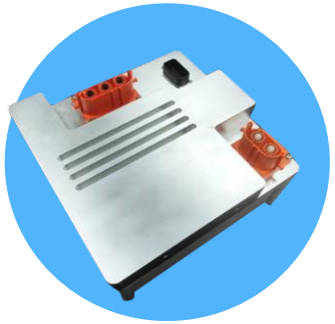
Leveraging leadership portfolio in power control
Creating xEV power control system reference platforms

Battery Management with State-of-the-Art Cell Charge Control



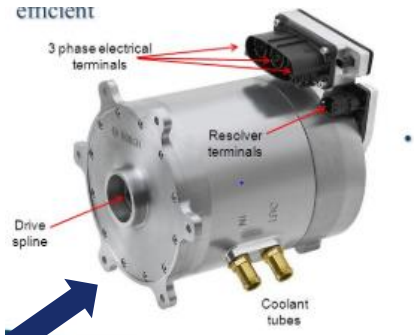


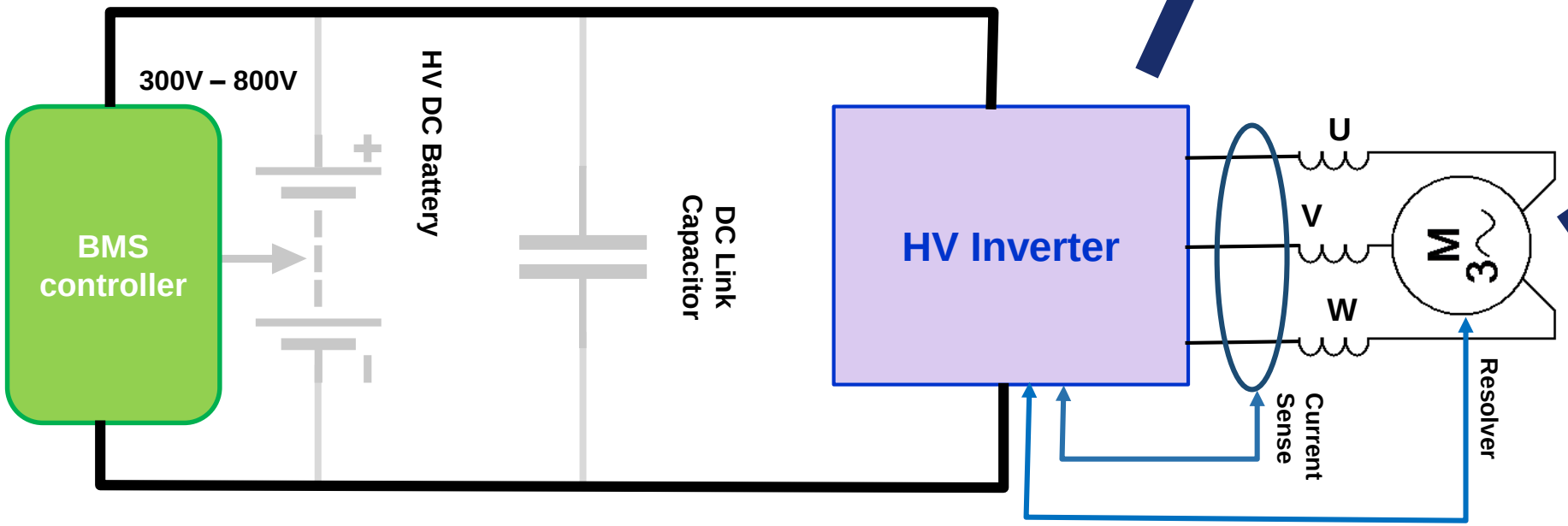
New xEV ASIL-D Power Inverter Control Reference Platform



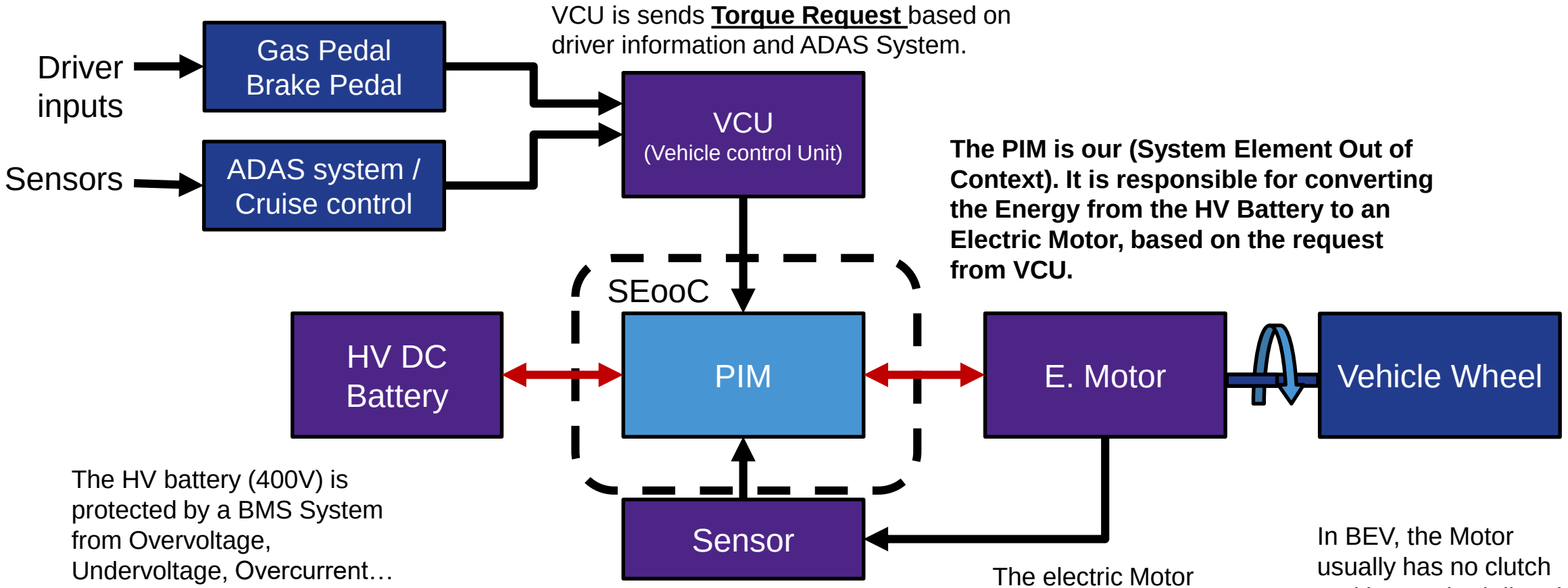
What's an Inverter?

- Converts DC voltage to AC voltage or AC voltage to DC voltage.
- The main traction inverter:
  - converts high DC voltage (from battery) to high current 3-phase AC voltage to drive and control a traction motor
- Must be output power & power density (kW/L) efficient as battery voltages move >350V
- Support more powerful (>80kW) traction motors which may also require more than 3 phases.
- Must support requirements for ASIL C/ ASIL D functional safety

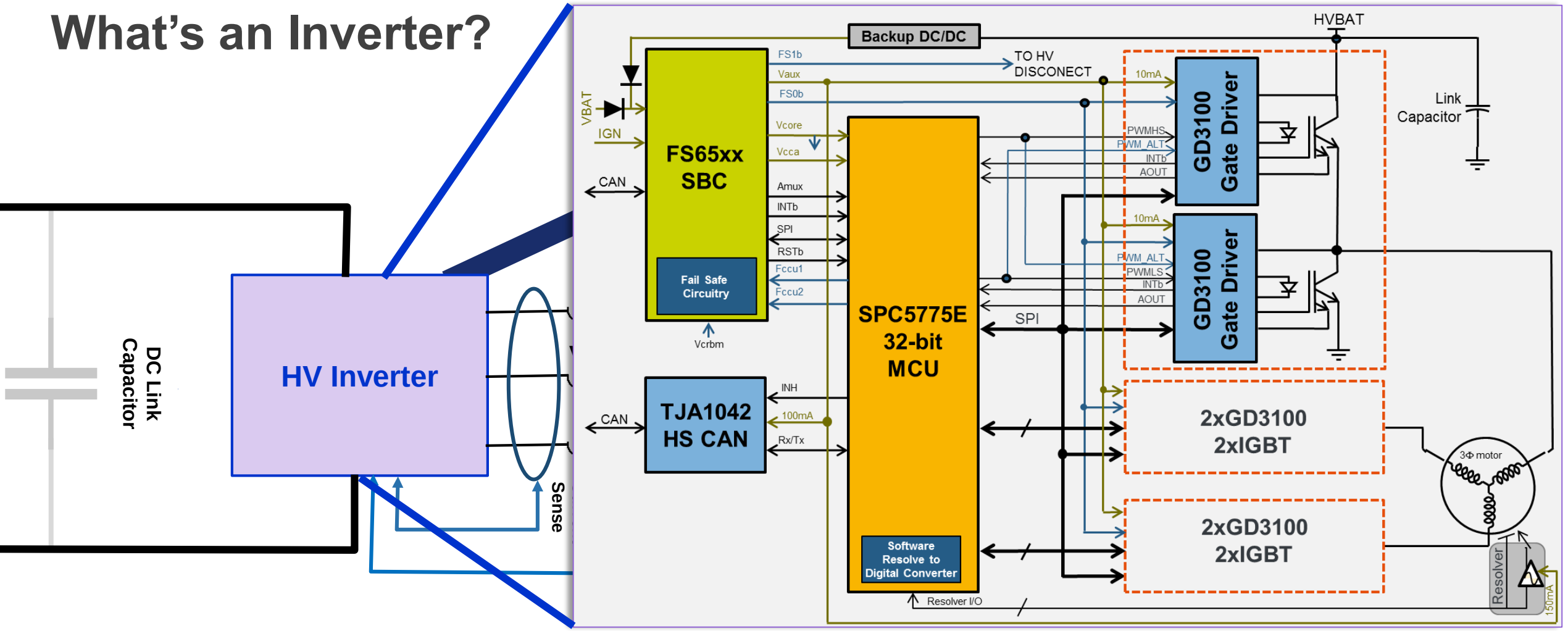




Item definition assumption



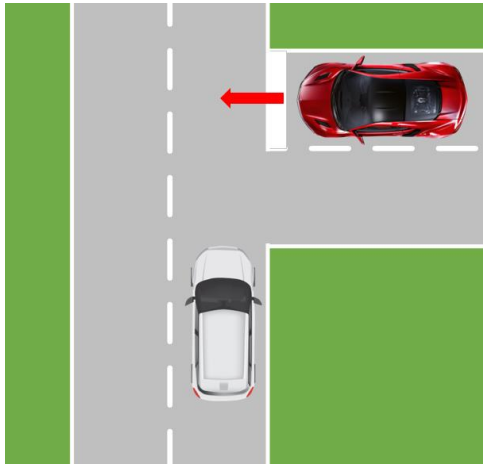
What's an Inverter?



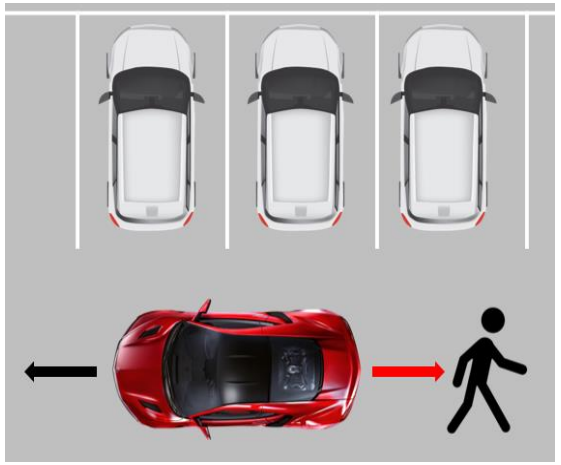
02.

Safety Goals for Electric vehicle ?

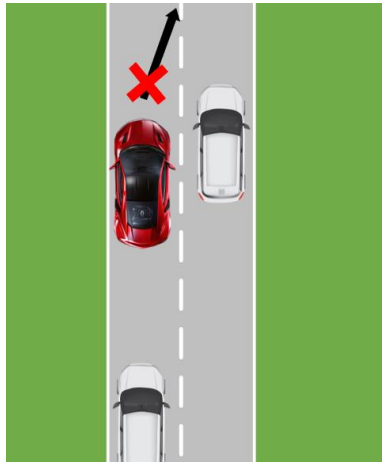
Possible traction Hazards –HARA example



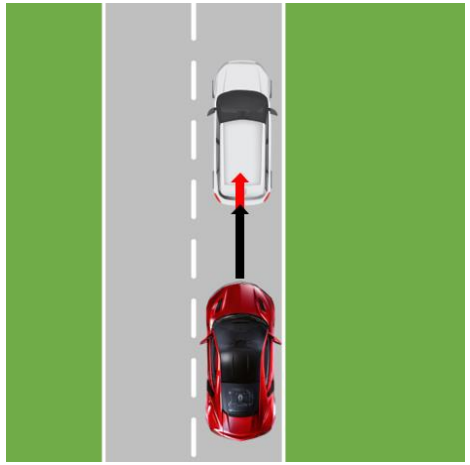
Unintended self acceleration



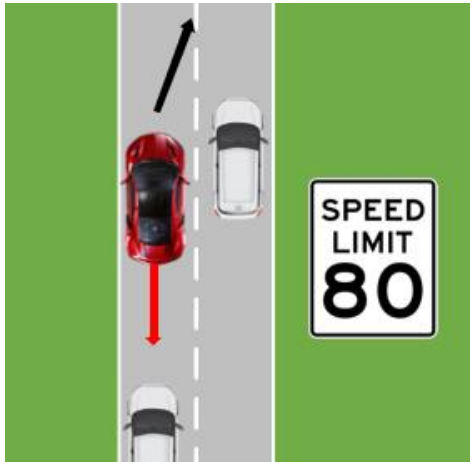
Unintended reverse speed wheel



Unintended loss of torque



Unintended over torque while driving



Unintended braking

Safety goal (can be different for other assumption)

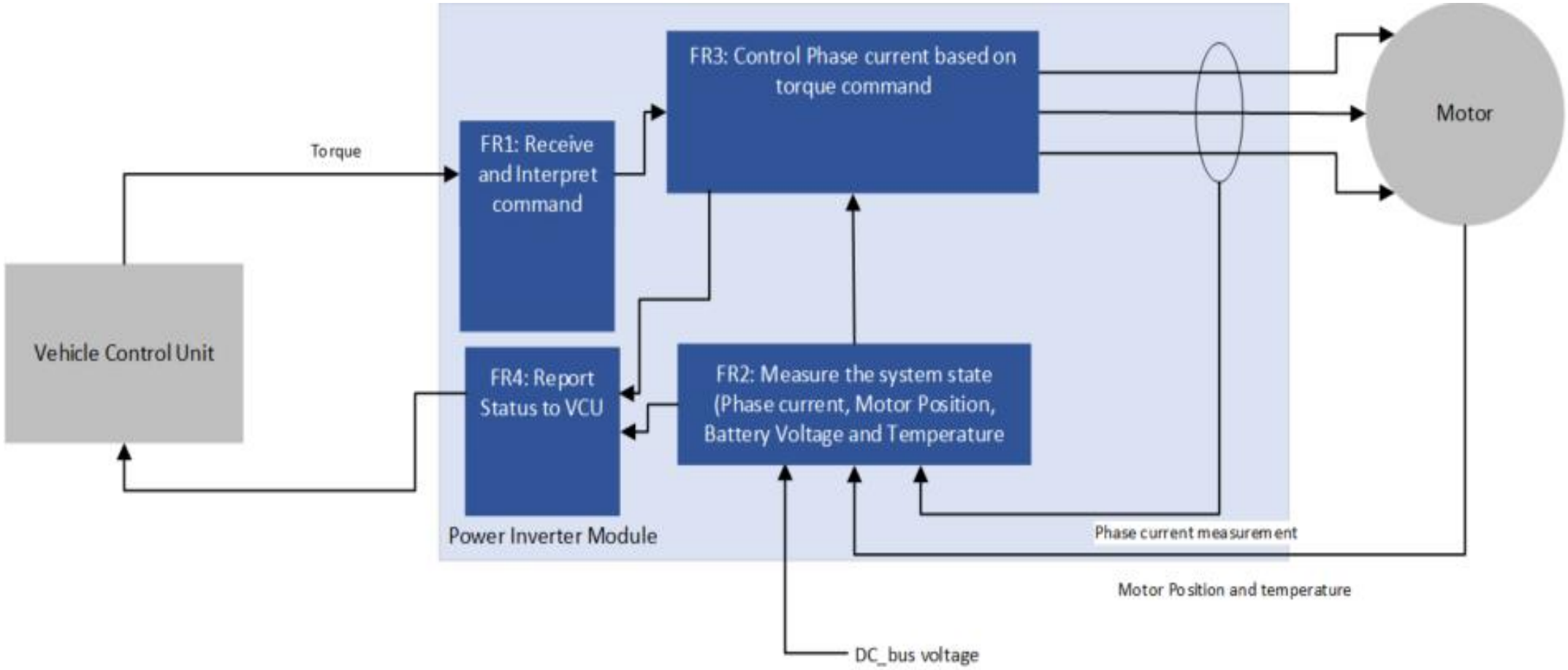
Safety goal	ASIL	
SG1: Avoid unintended acceleration while in stop	D	Traction
SG2: Avoid unintended acceleration , torque lock or over acceleration torque while driving	B	
SG3: Avoid reverse torque	D	
SG4: Avoid sudden loss of acceleration torque	B	
SG5: Avoid self-braking torque while driving at high speed	D	Braking / Regeneration
SG6: Avoid self-braking torque while driving at low speed	B	

03.

Functional concept

Functional requirements

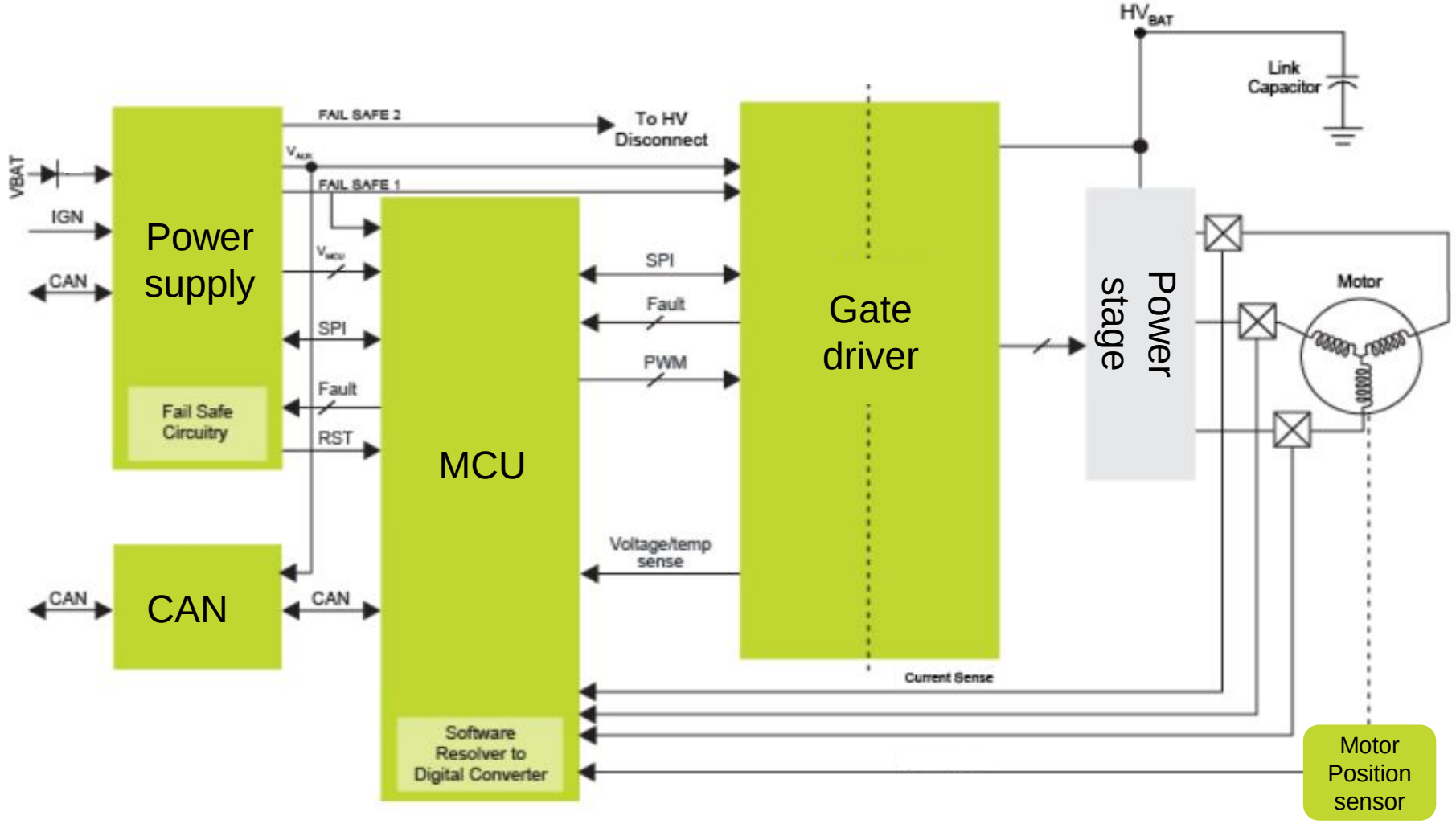
- What do we need to make the system achieve his main function?



04.

Technical safety concept

Technical safety concept



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