

**ELECTRONICS IN  
AUTOMOTIVE INDUSTRY –  
REQUIREMENTS / INFLUENCE  
ON PROJECT /  
INTRODUCTION TO MARKET.**

**Automotive electronics  
designing is...**

**...easy  
or hard?**

**...interesting or  
boring?**

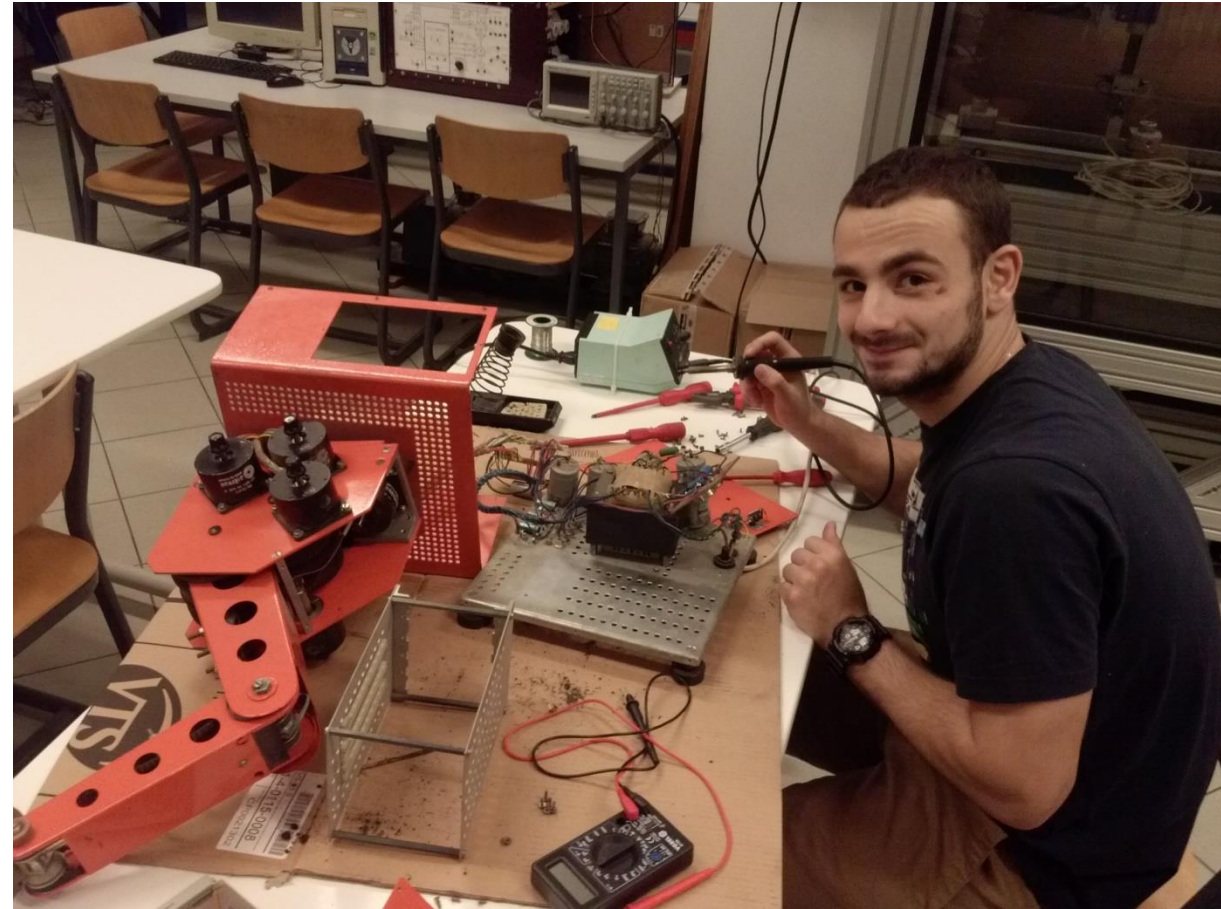


**• APTIV •**

# Mateusz Pluta

## Education:

- Warsaw University of Technology
- Technical School in Radom





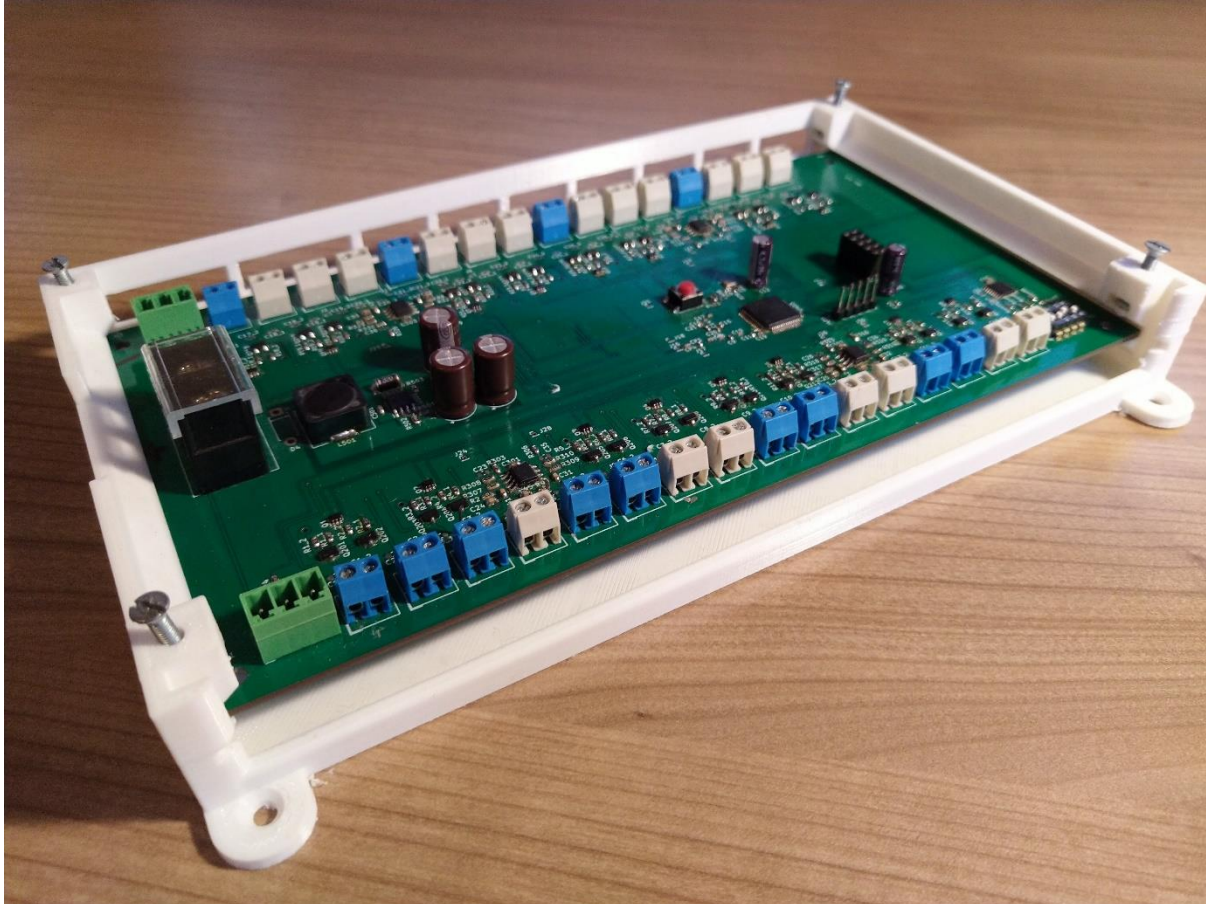
# LOTNISKO WARSZAWA-RADOM

## Work:

- ~10 years at industry







## Hobby related to engineering:

- Blog
- Own projects

## Hobby unrelated to engineering:

- BJJ,
- Mountains,
- Cycling.



# About Aptiv

ADDRESSING MOBILITY'S TOUGHEST CHALLENGES

 **48**  
COUNTRIES

 **200,000+**  
PEOPLE

 **11**  
TECHNICAL  
CENTERS

 **131**  
MANUFACTURING  
FACILITIES





# AUTOMOTIVE ELECTRONICS CHALLENGES

**Long  
lifetime**

**Reliability**

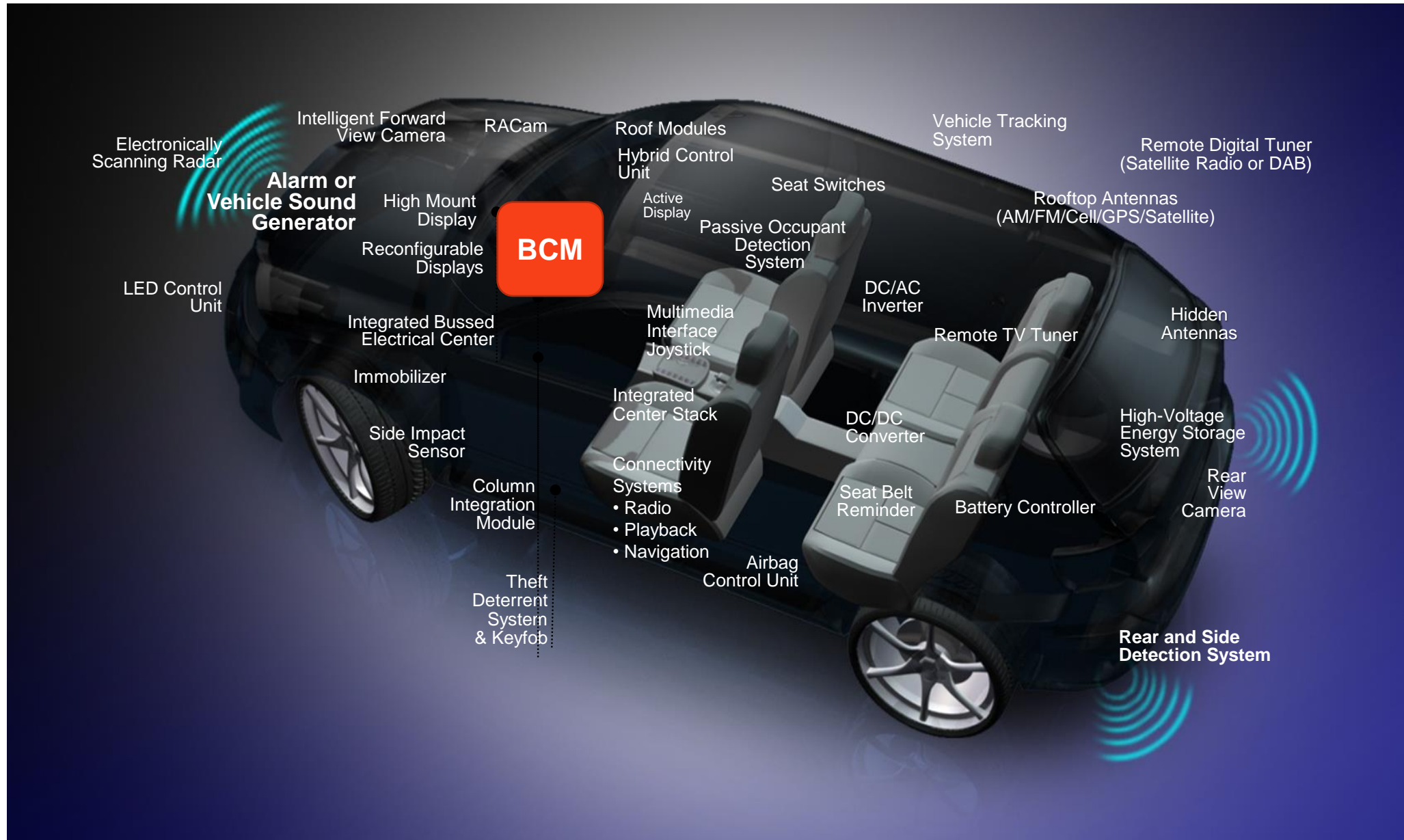
**EMC**

**Low cost**

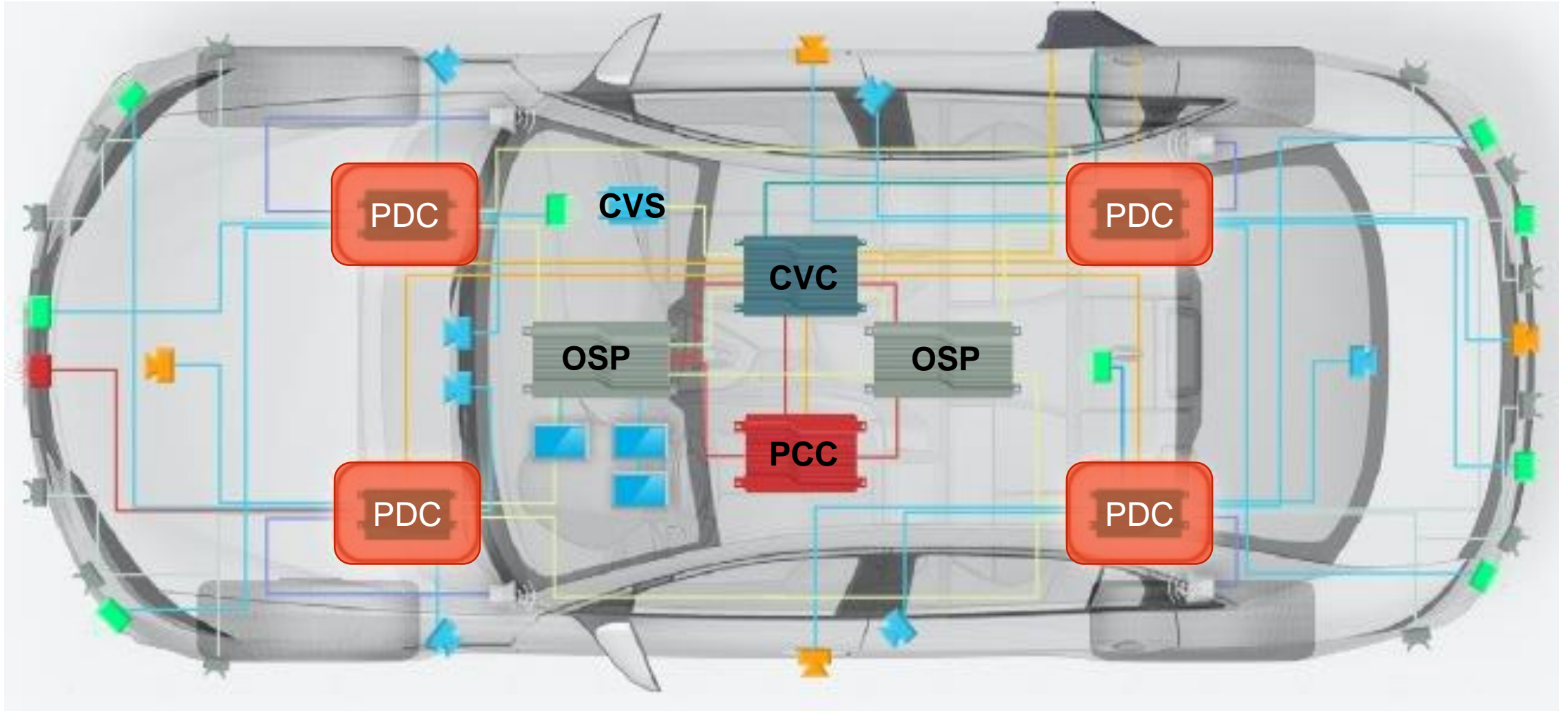
**High volume**

# CAR ARCHITECTURE



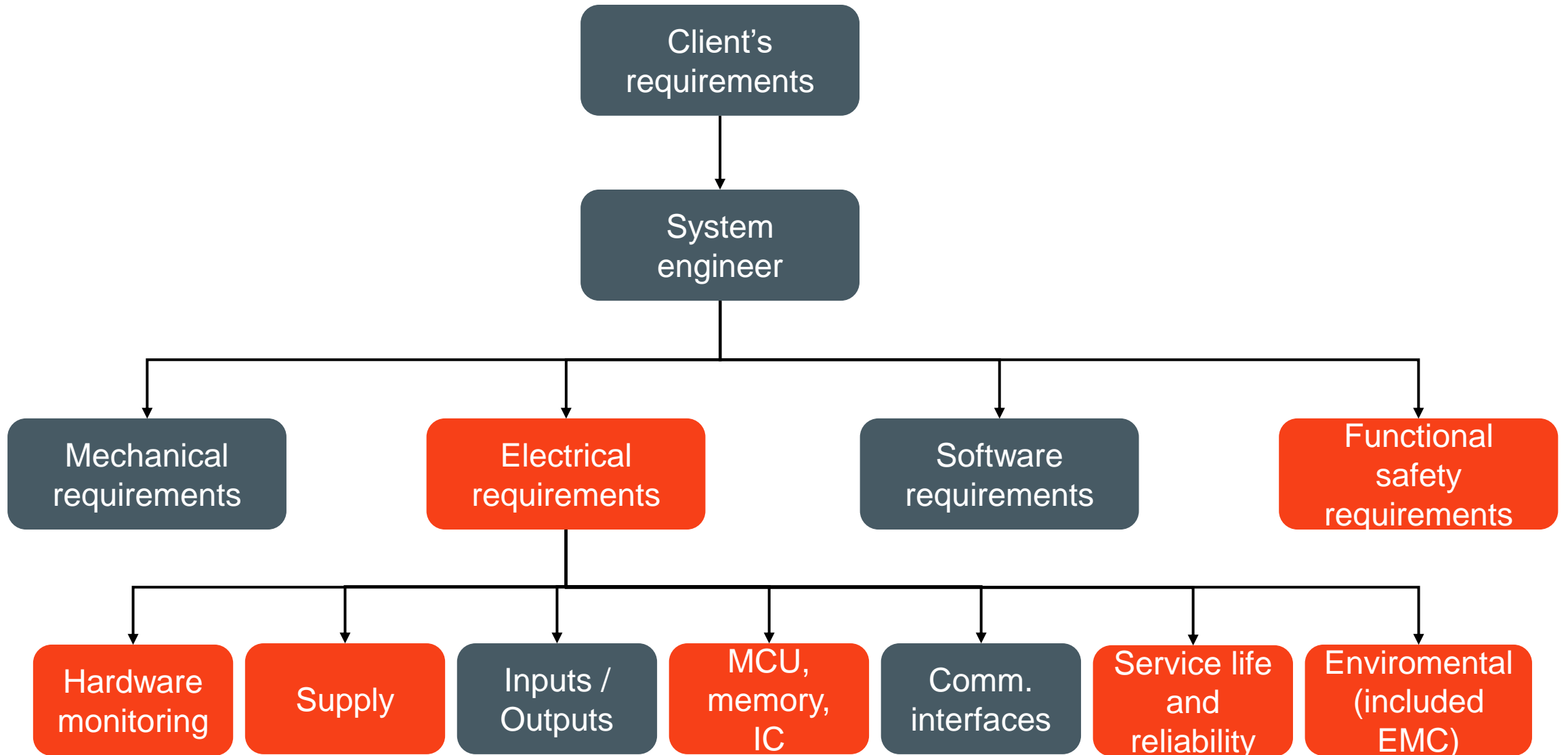


# FOUR ZONE CONTROLLERS



# REQUIREMENTS





# FUNCTIONAL SAFETY REQUIREMENTS

**ASIL (Automotive Safety Integrity Level)**

**ASIL D**



**ASIL A**  
**QM**

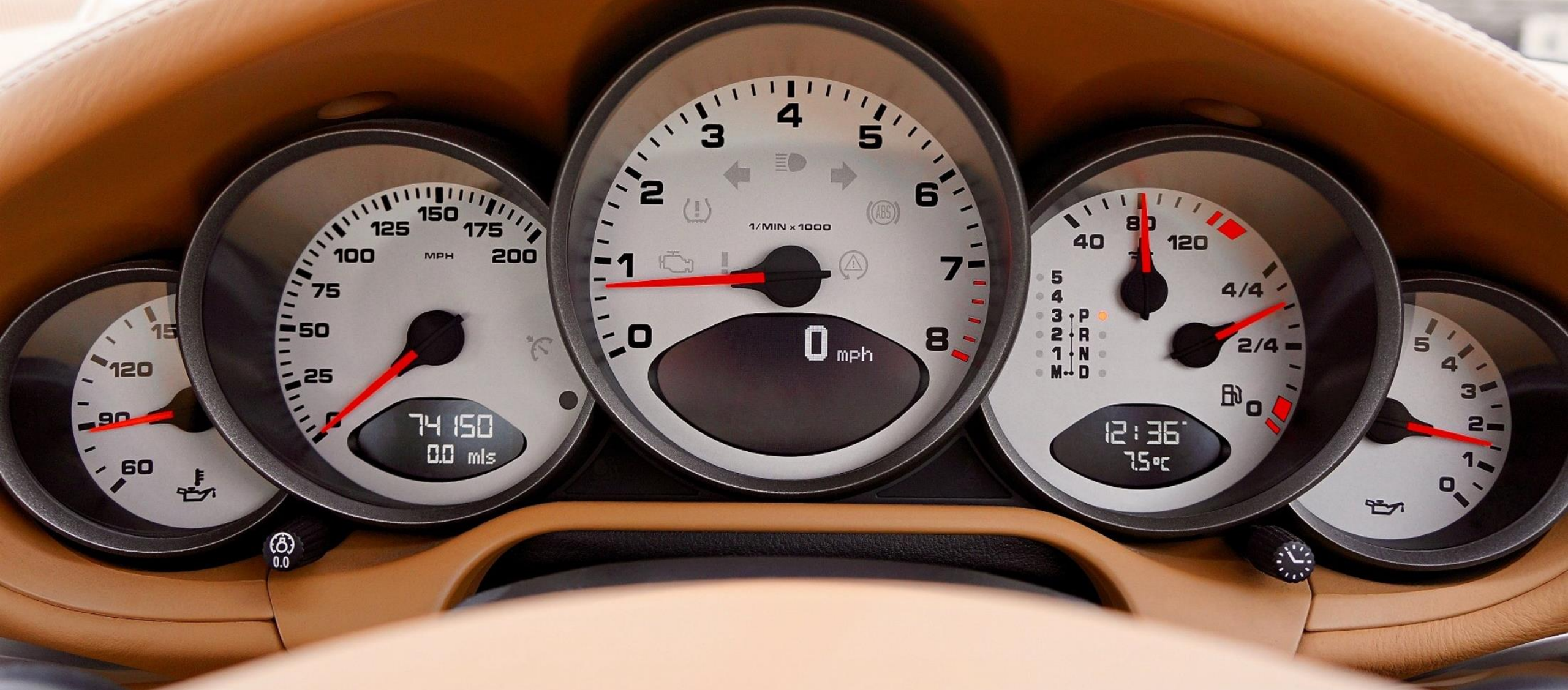


**Severity**

**Exposure**

**Controlability**

# ASIL-A or ASIL-B



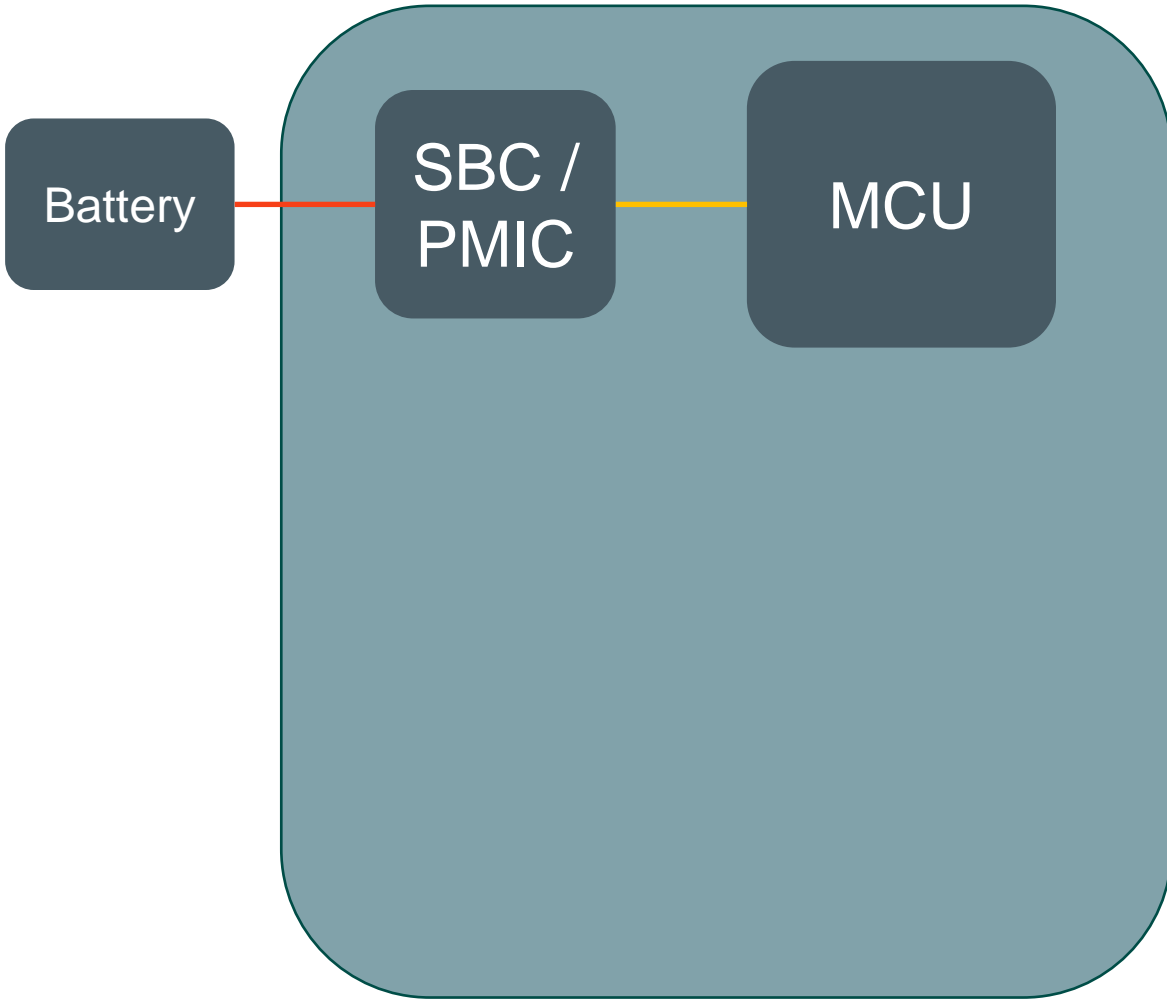


# ASIL-D

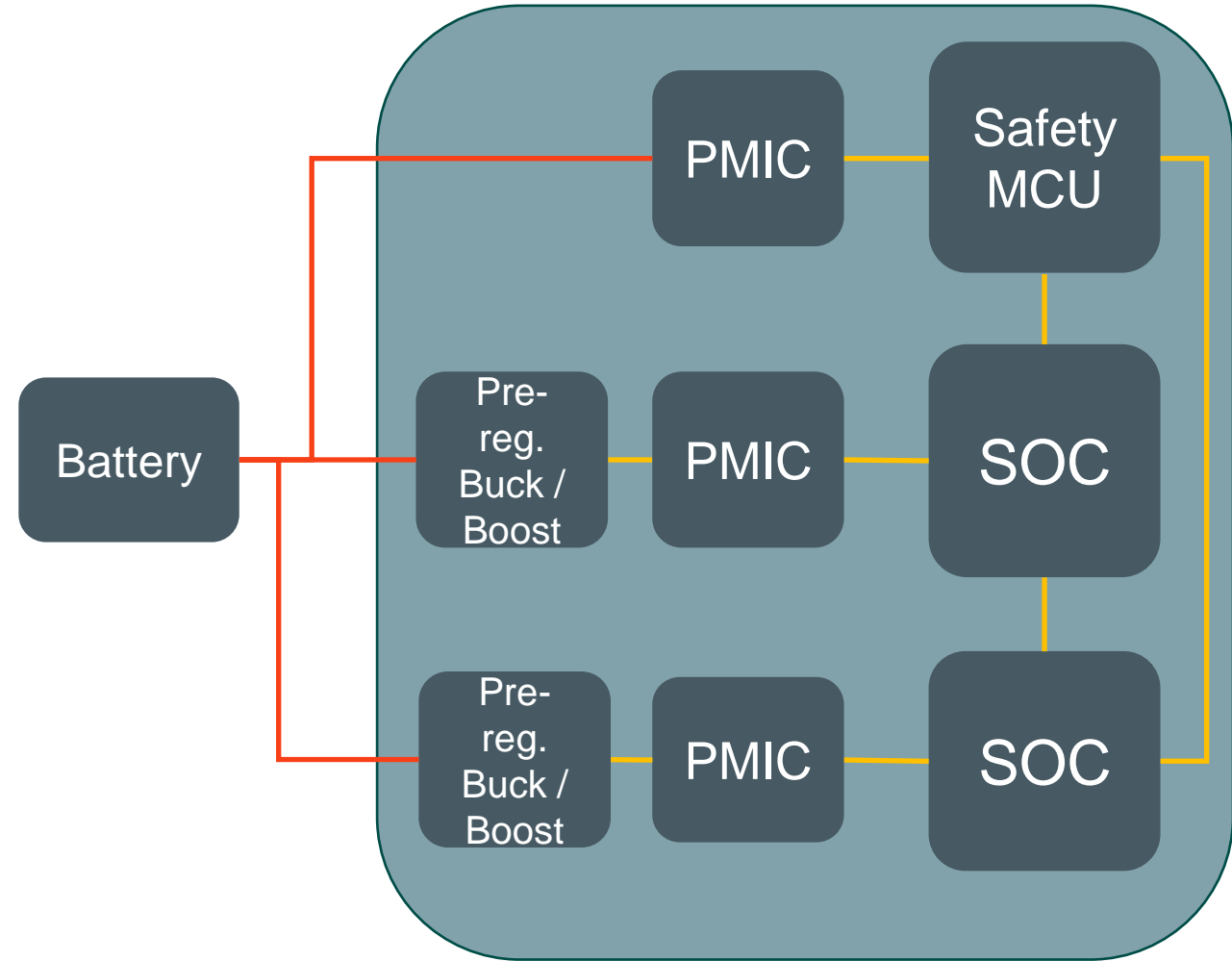


# ARCHITECTURE

## Classic Body Computer

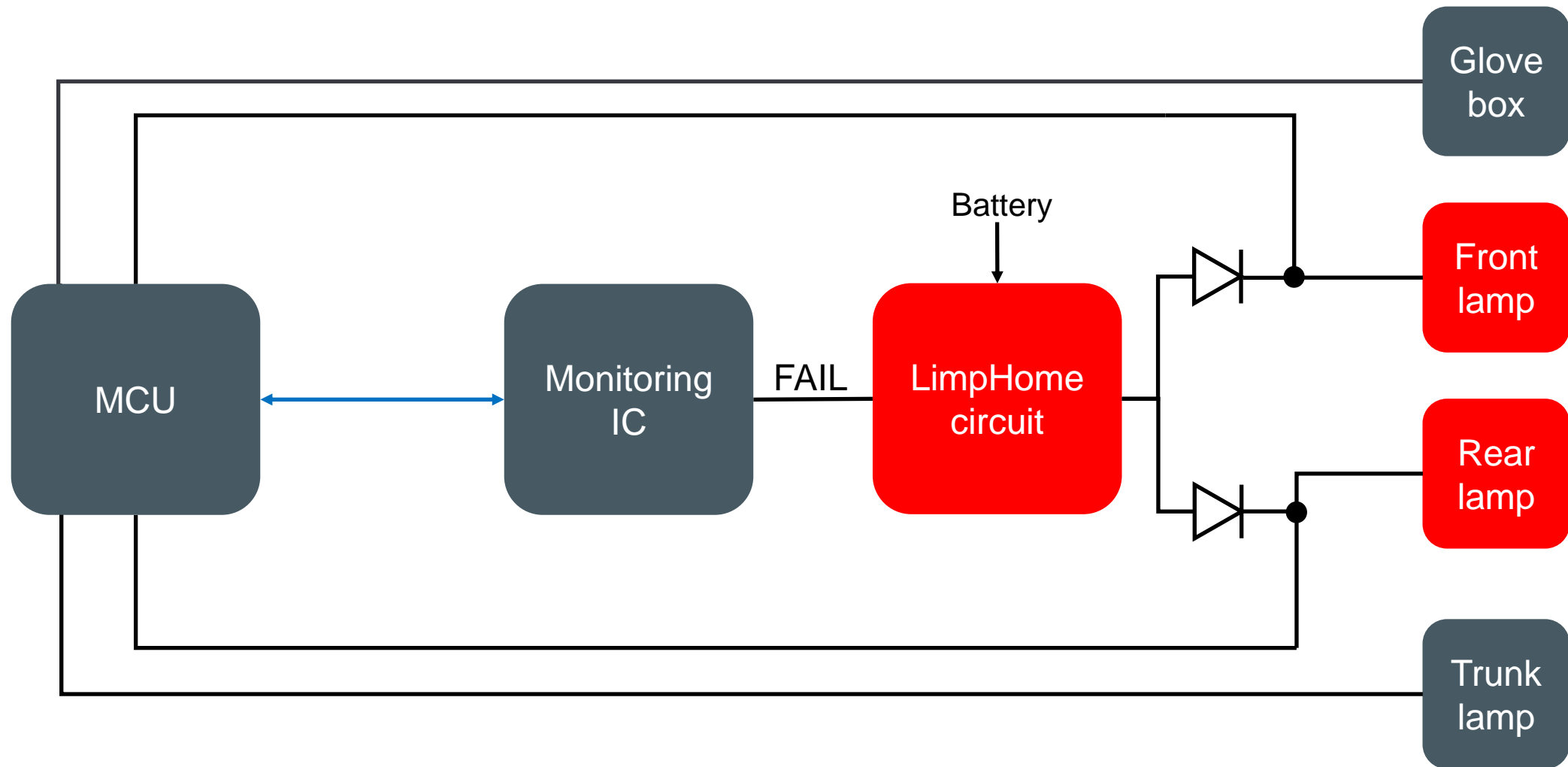


## Active Safety Project / High Performance Compute

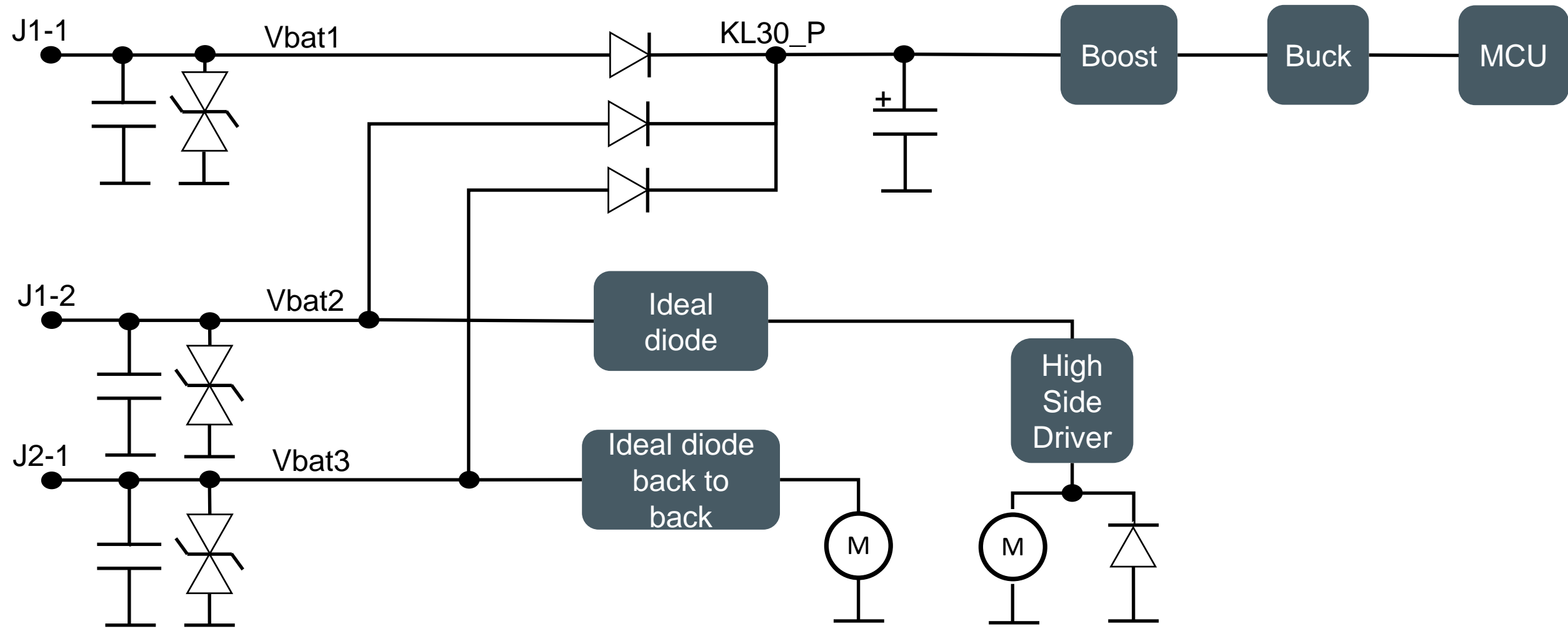




# HARDWARE MONITORING



# SCHEMATIC



# SERVICE LIFE AND RELIABILITY: ANALYSIS



**Analysis**

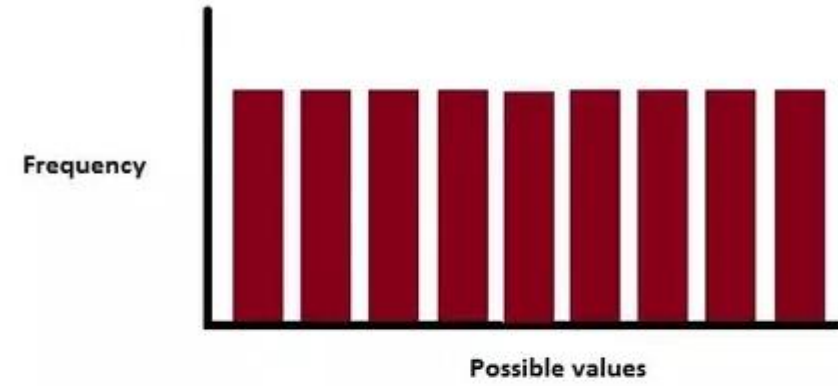
```
graph TD; A[Analysis] --> B[Schematic / Pre-layout]; A --> C[Post-layout];
```

**Schematic /  
Pre-layout**

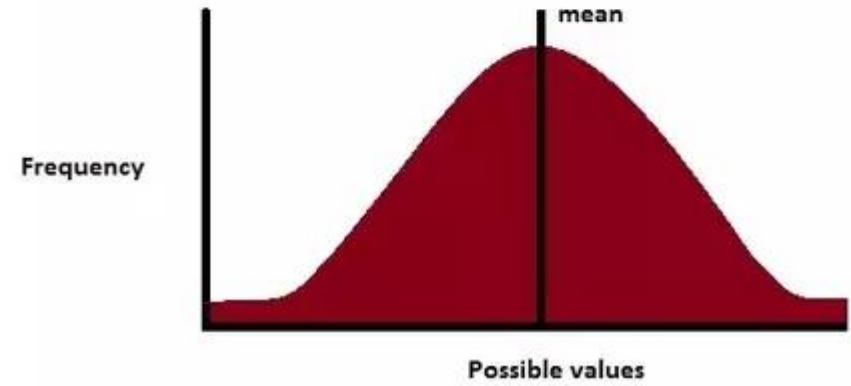
**Post-layout**

	WCA	Root Sum Squares	Monte Carlo
Pro's	<ul style="list-style-type: none"> <li>+ The fastest and the easiest</li> <li>+ Lead to very reliable product</li> </ul>	<ul style="list-style-type: none"> <li>+ Lead to reality results</li> <li>+ Faster than MC</li> </ul>	<ul style="list-style-type: none"> <li>+ Lead to reality results</li> <li>+ More precise than RSS</li> </ul>
Con's	<ul style="list-style-type: none"> <li>- Lead to non realistic results with big margin</li> </ul>	<ul style="list-style-type: none"> <li>- Risk when distributions are not normal</li> </ul>	<ul style="list-style-type: none"> <li>- Risk when distributions are not normal</li> <li>- Need big calculation power</li> </ul>

UNIFORM DISTRIBUTION

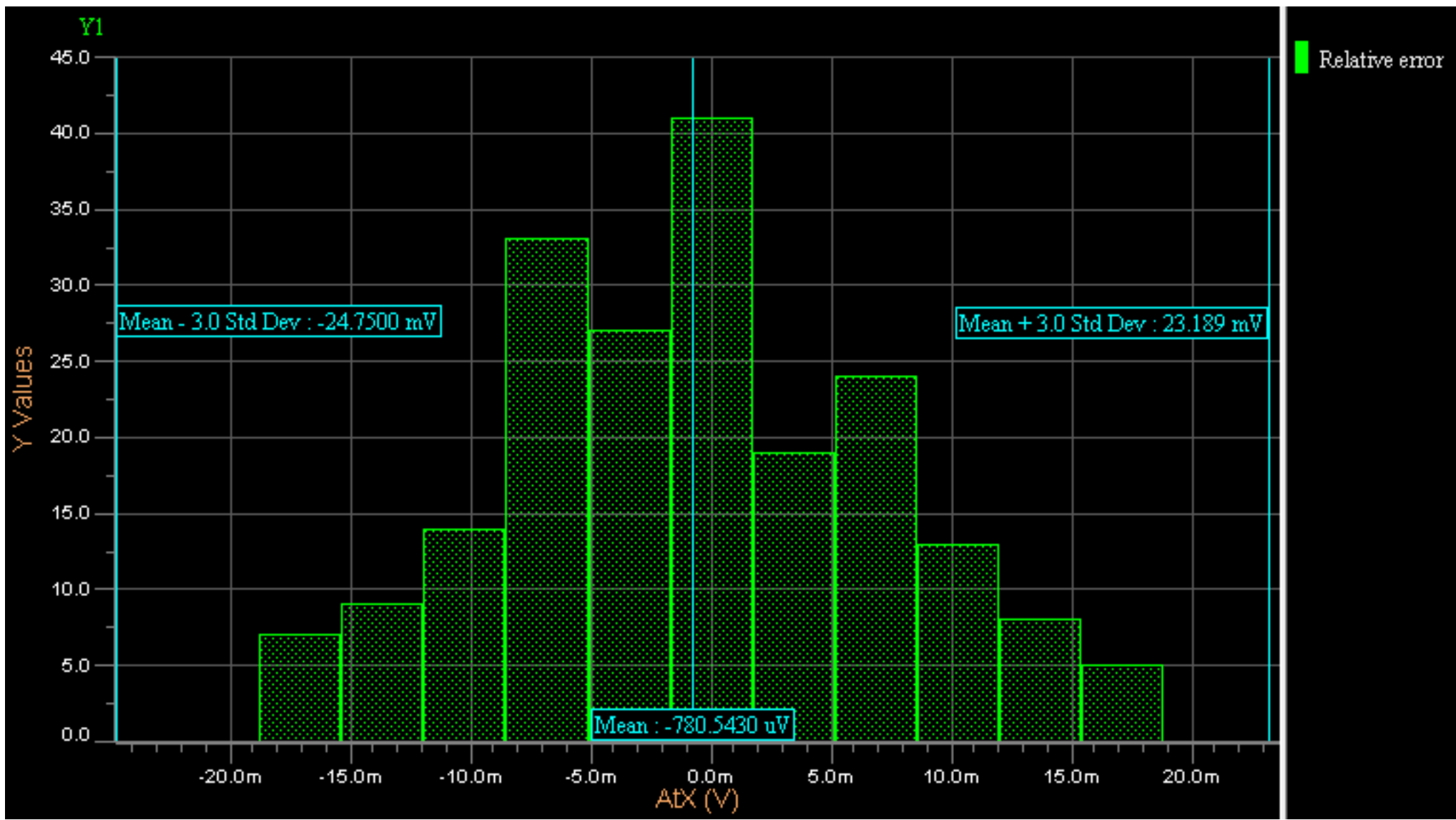


NORMAL DISTRIBUTION



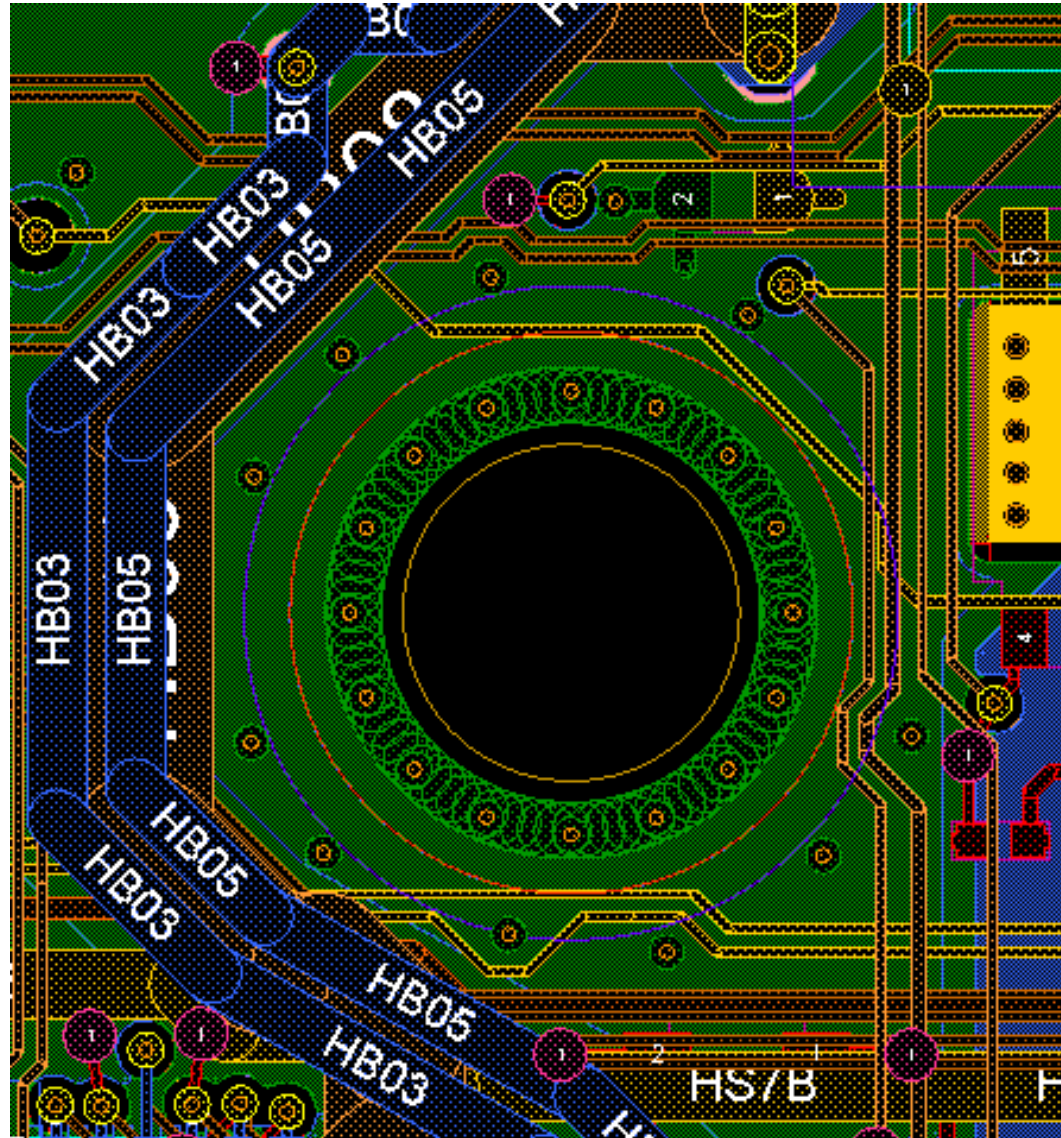
[3]

Specifications		EVA Results			Monte-Carlo Results (20000 runs)			Unit	Design Margin		Process Capability		Results	
Min	Max	Min	Nom	Max	Min	Nom	Max		Lower	Upper	Lower	Upper	EVA	MCA
N/A	N/A	144.5	363.6	898.2	114.1	409.3	704.5	mW	No Specs	No Specs	No Specs	No Specs	N/A	N/A
-	150	108.8	114.5	128.4	107.9	115.7	123.4	degC	No Lower Spec	14.431 %	No Lower Spec	8.879	Pass	Pass



# LAYOUT





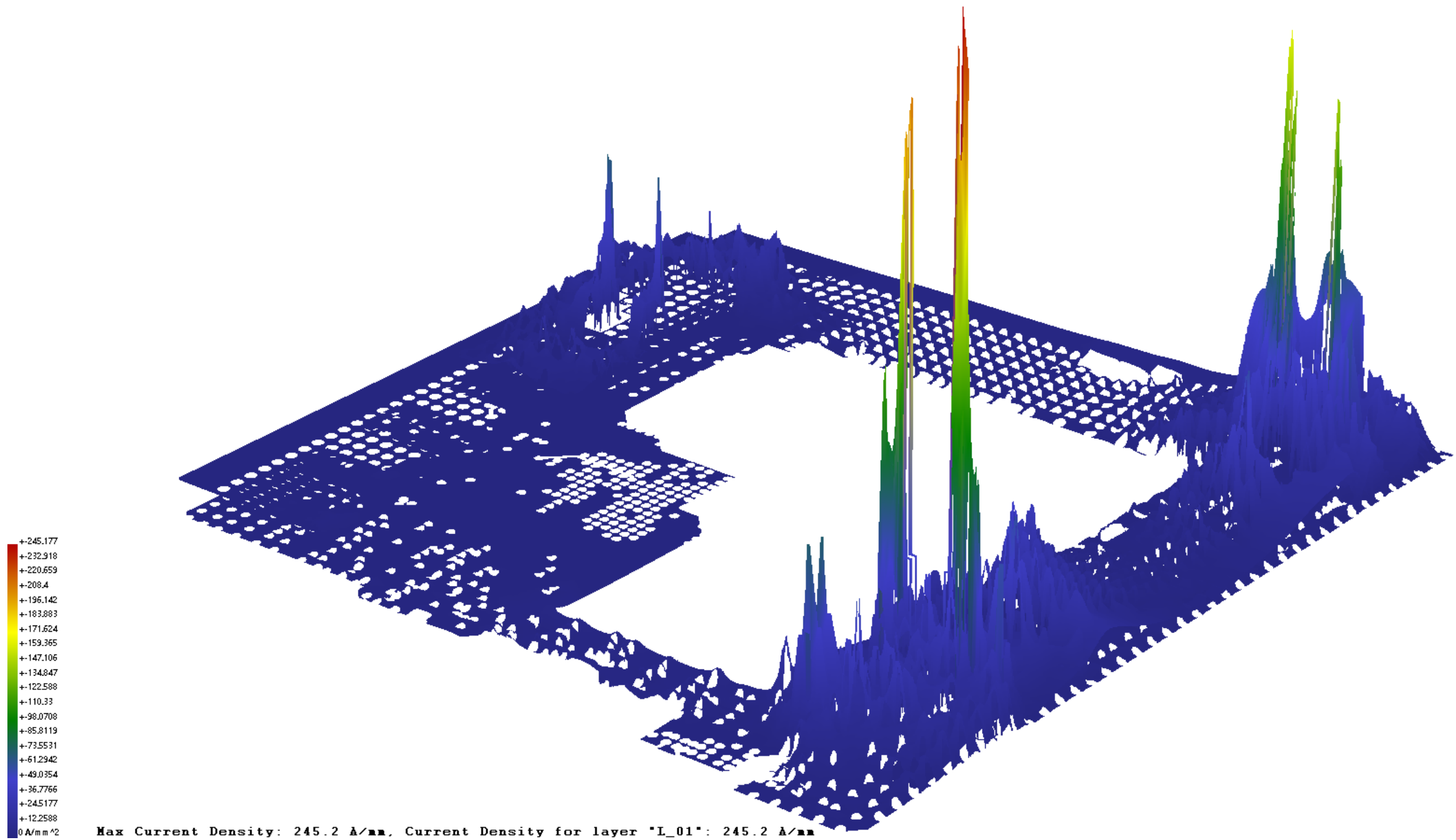
# SERVICE LIFE AND RELIABILITY: PCB SIMULATION

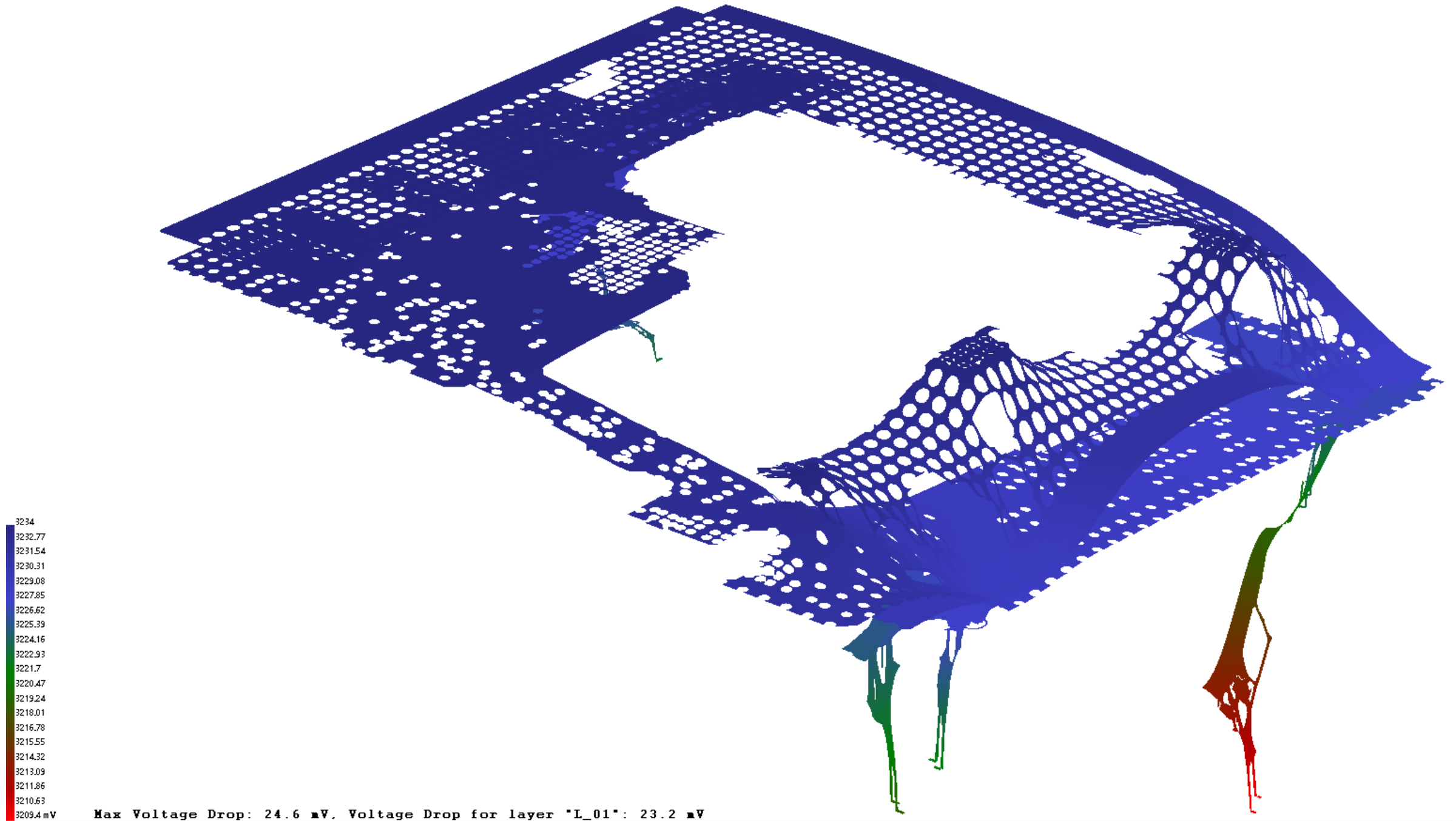
**Analysis**

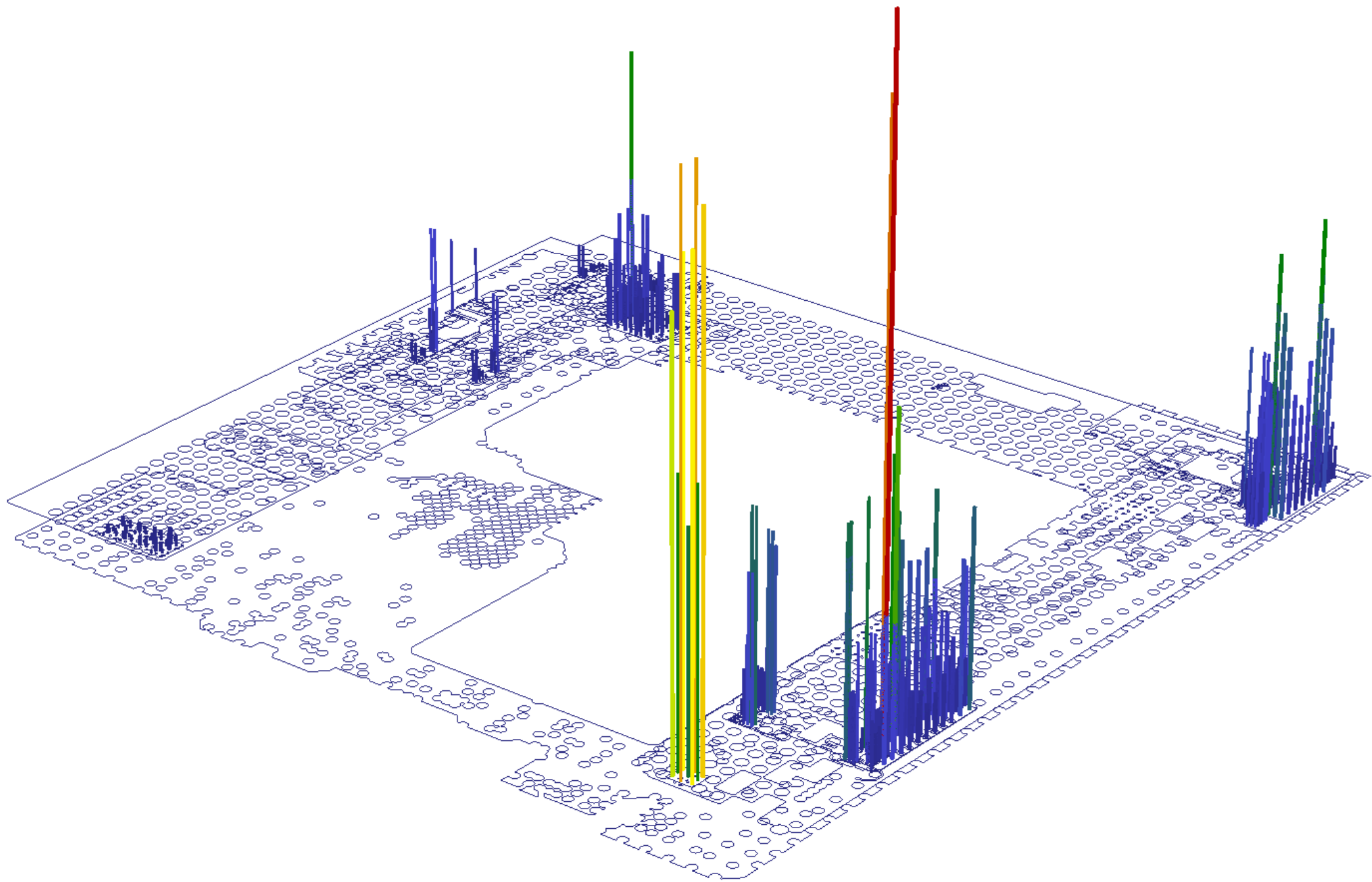
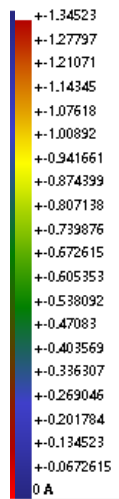
```
graph TD; A[Analysis] --> B[Schematic / Pre-layout]; A --> C[Post-layout];
```

**Schematic /  
Pre-layout**

**Post-layout**



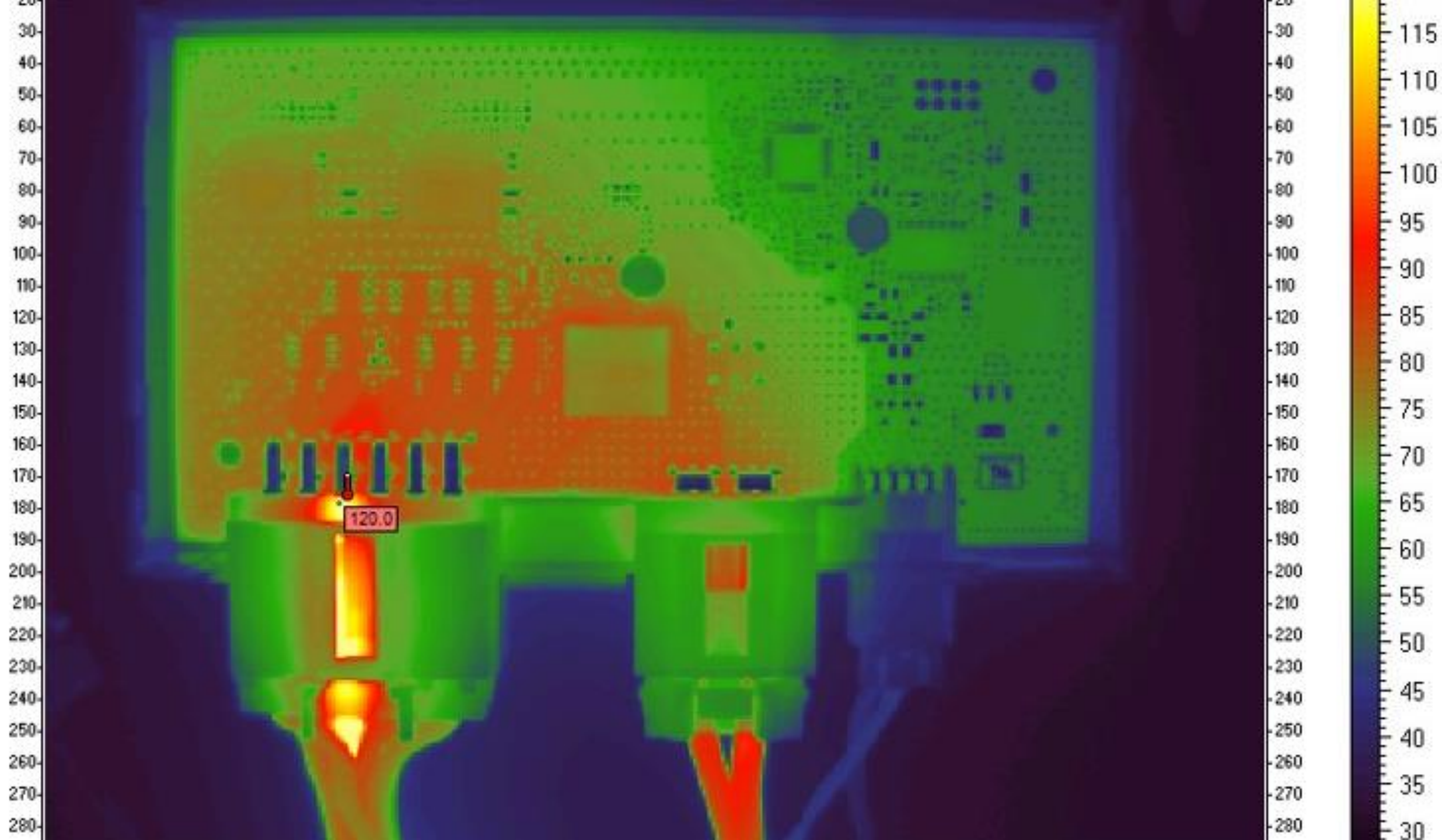


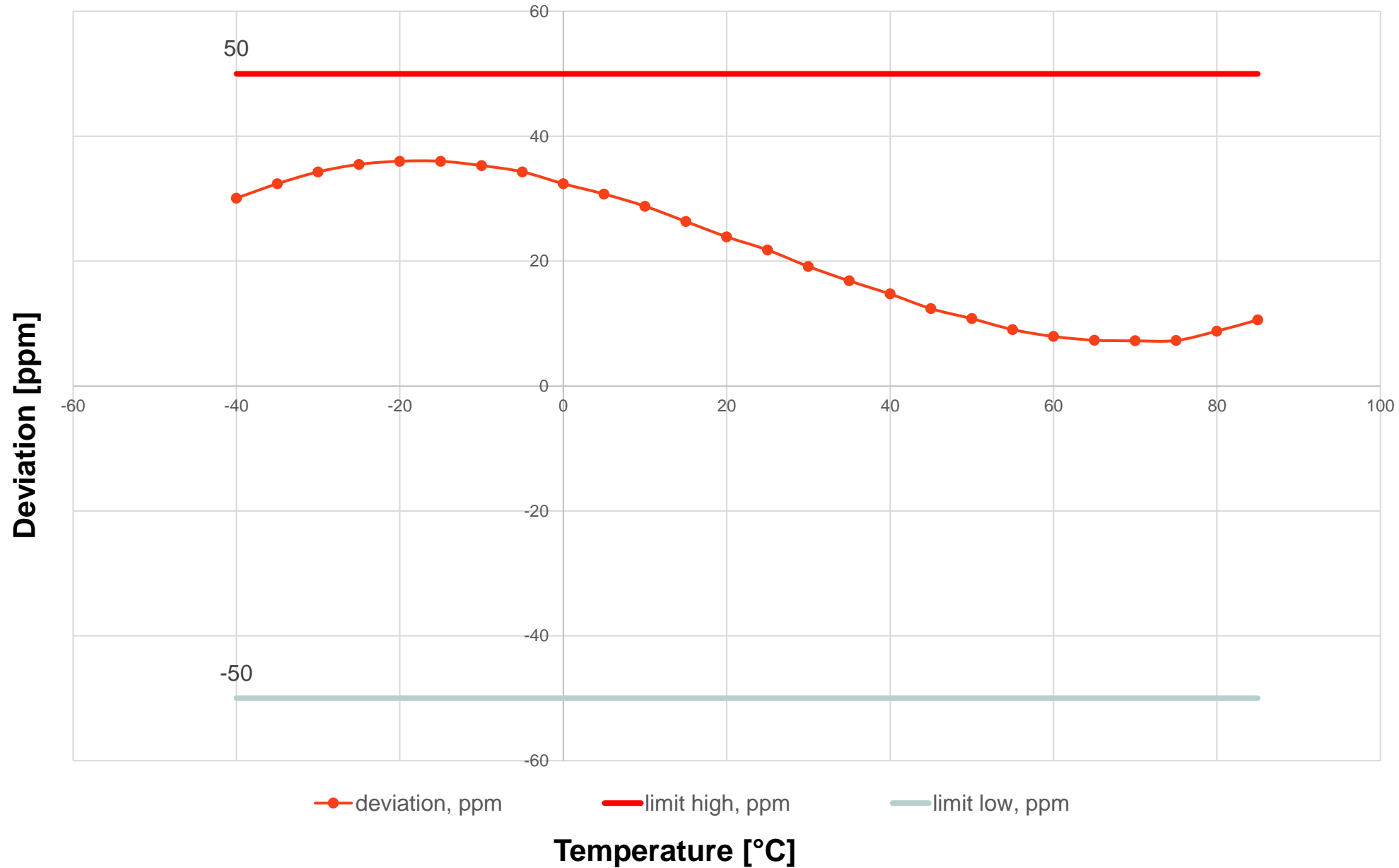






# SERVICE LIFE AND RELIABILITY: VERIFICATION



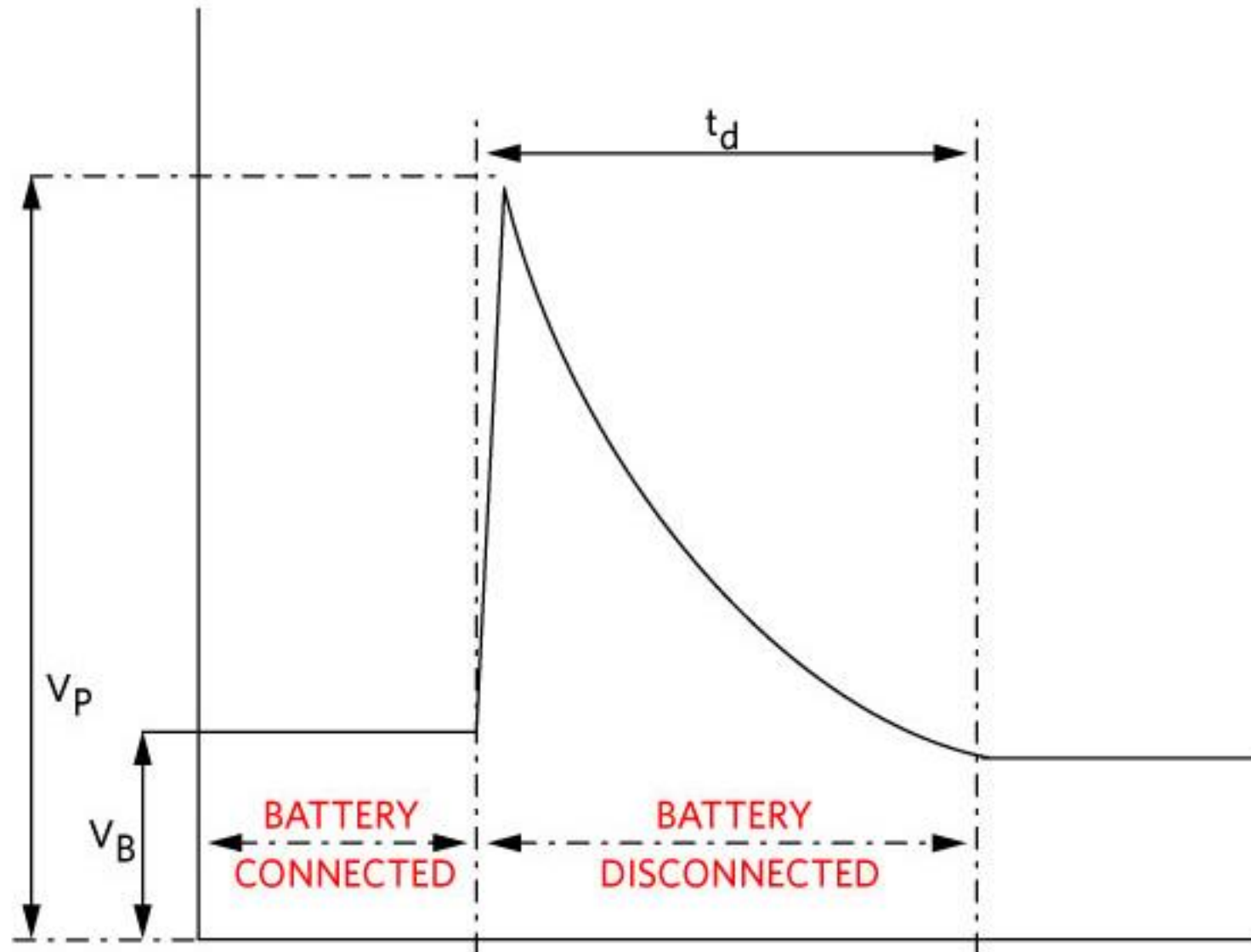


# SERVICE LIFE AND RELIABILITY: EMC

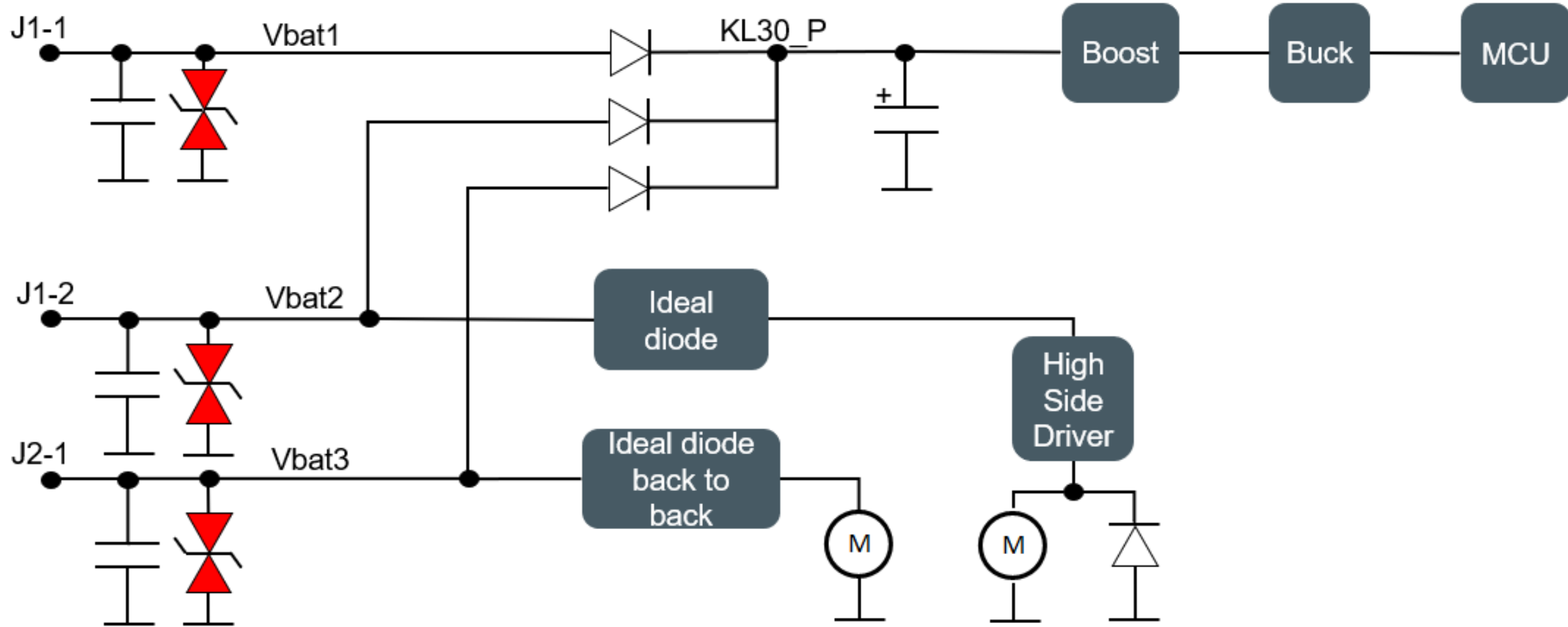


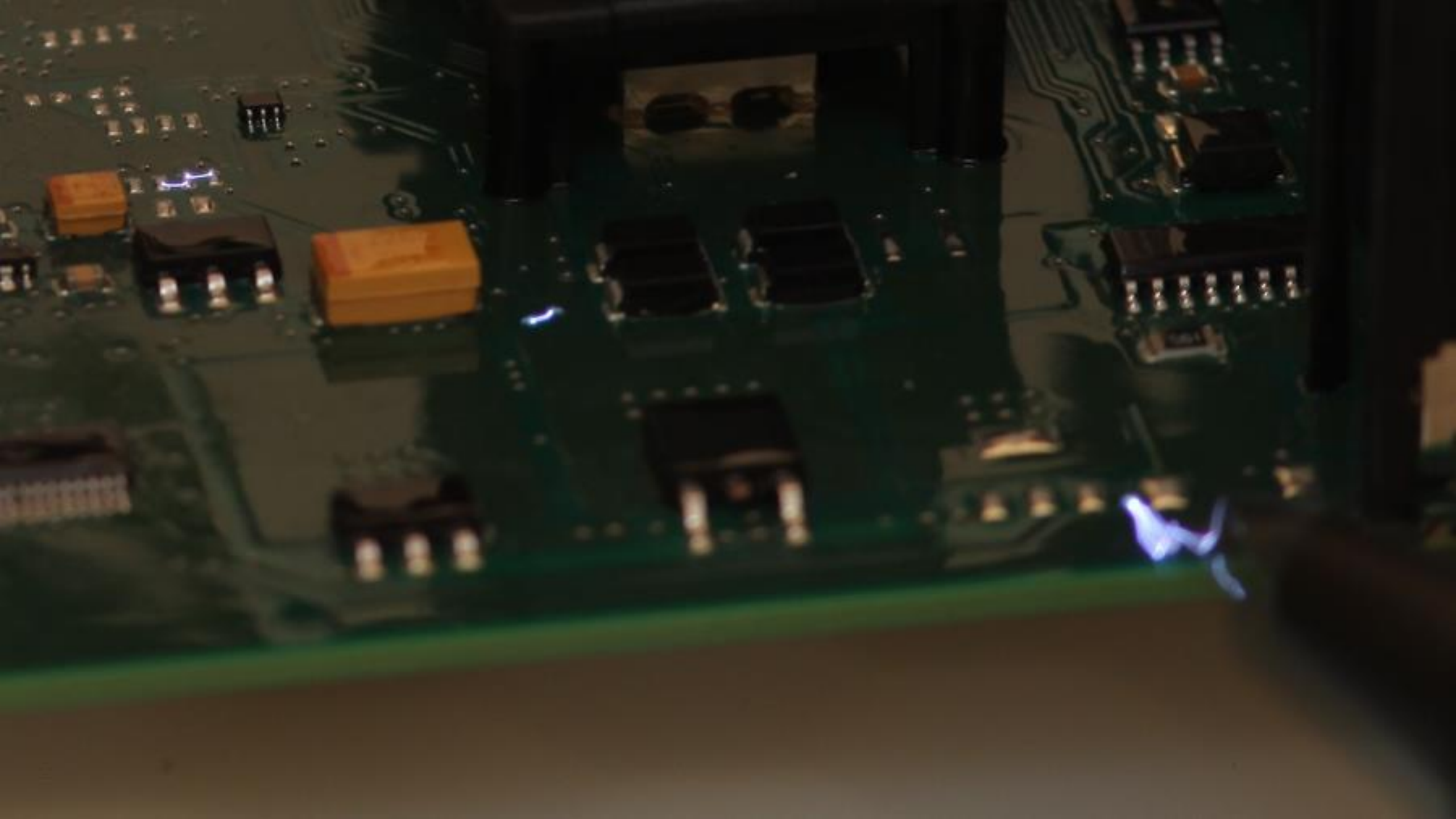


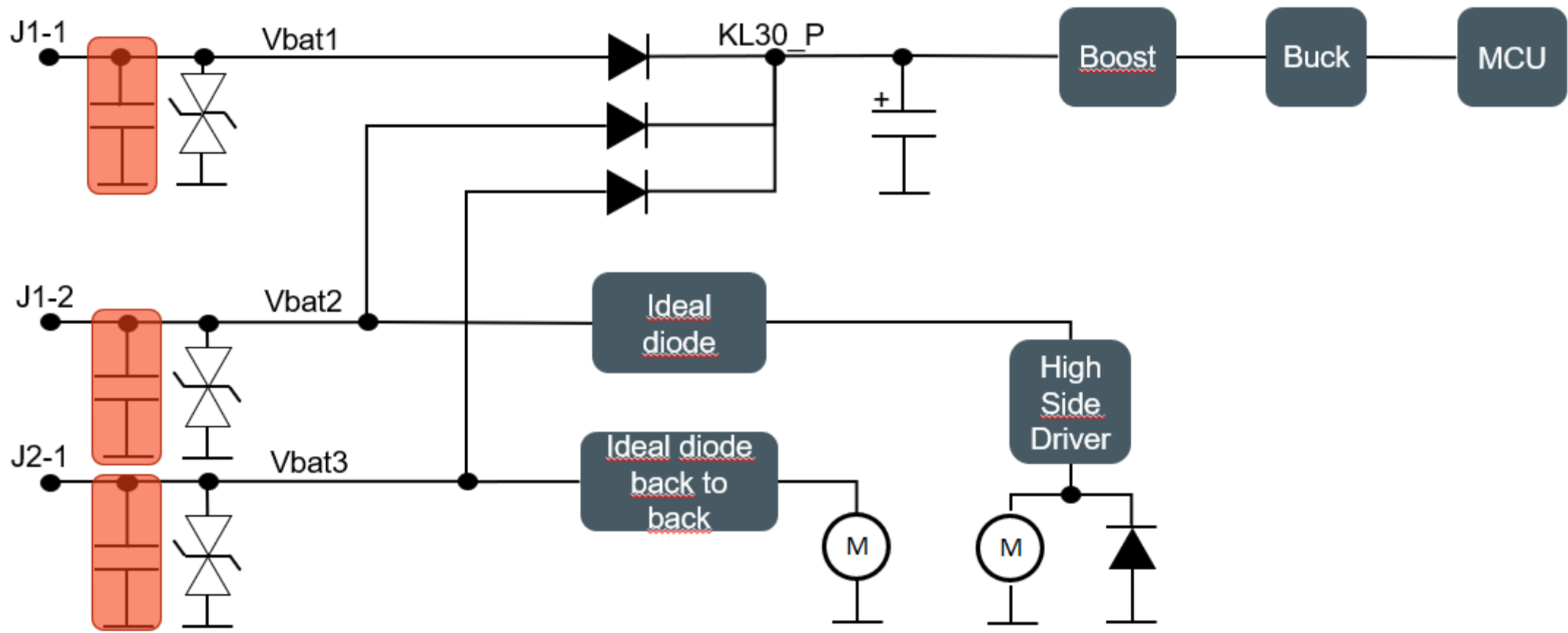




[4]





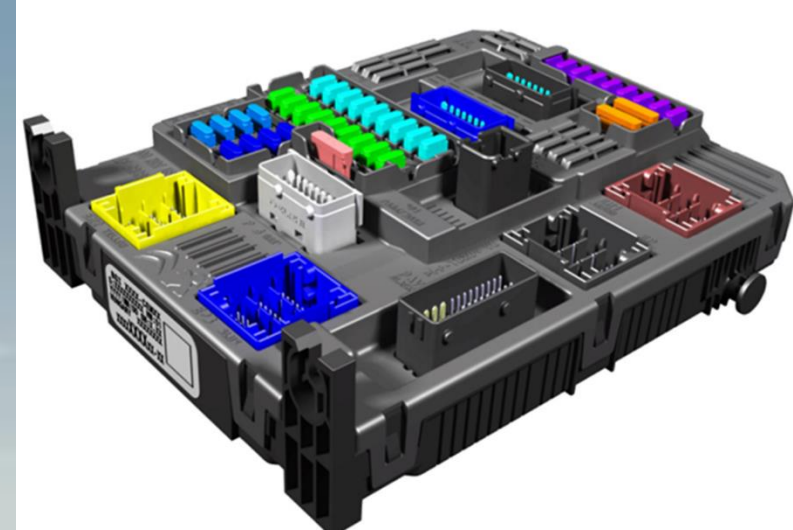


# FINAL PRODUCTS

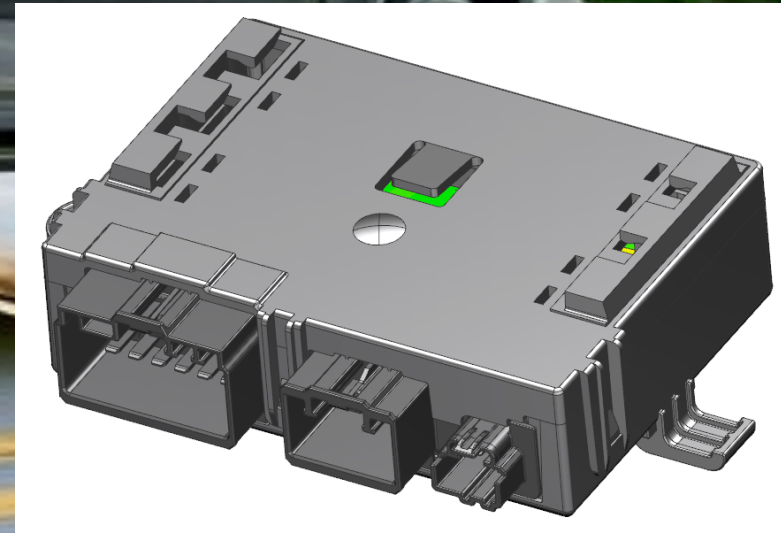












# Reference

- [1] **Internet access:** <https://www.bankier.pl/wiadomosc/Lotnisko-Warszawa-Radom-otwarte-Morawiecki-Inwestycja-ma-ogromny-sens-8530723.html>
- [2] **Internet access:** <https://dziennikzachodni.pl/system-video-tolling-na-autostradzie-a4-katowice-krakow-stalexport-autostrada-malopolska-sa-robi-testy-kiedy-zaplacimy-telefonem/ga/c3-14220519/zd/36748481>
- [3] **Internet access:** <https://www.quora.com/What-is-the-difference-between-normal-distribution-and-uniform-distribution>
- [4] **Internet access:** <https://www.analog.com/en/technical-articles/load-dump-protection-for-24v-automotive-applications.html>
- [5] **Internet access:** <https://www.media.stellantis.com/at-de/opel/press/vorausschauend-das-night-vision-system-im-neuen-opel-grandland>
- [6] **Internet access:** <https://www.media.stellantis.com/pl-pl/peugeot/press/peugeot-3008-hybrid-i-5008-hybrid-z-nowa-technologia-napedu-hybrydowego-48-v-sa-juz-dostepne-w-polsce>
- [7] **Internet access:** <https://www.jdpower.com/cars/shopping-guides/2022-ford-f-150-vs-2022-ford-ranger-comparison>

# Questions



**Thank you.**