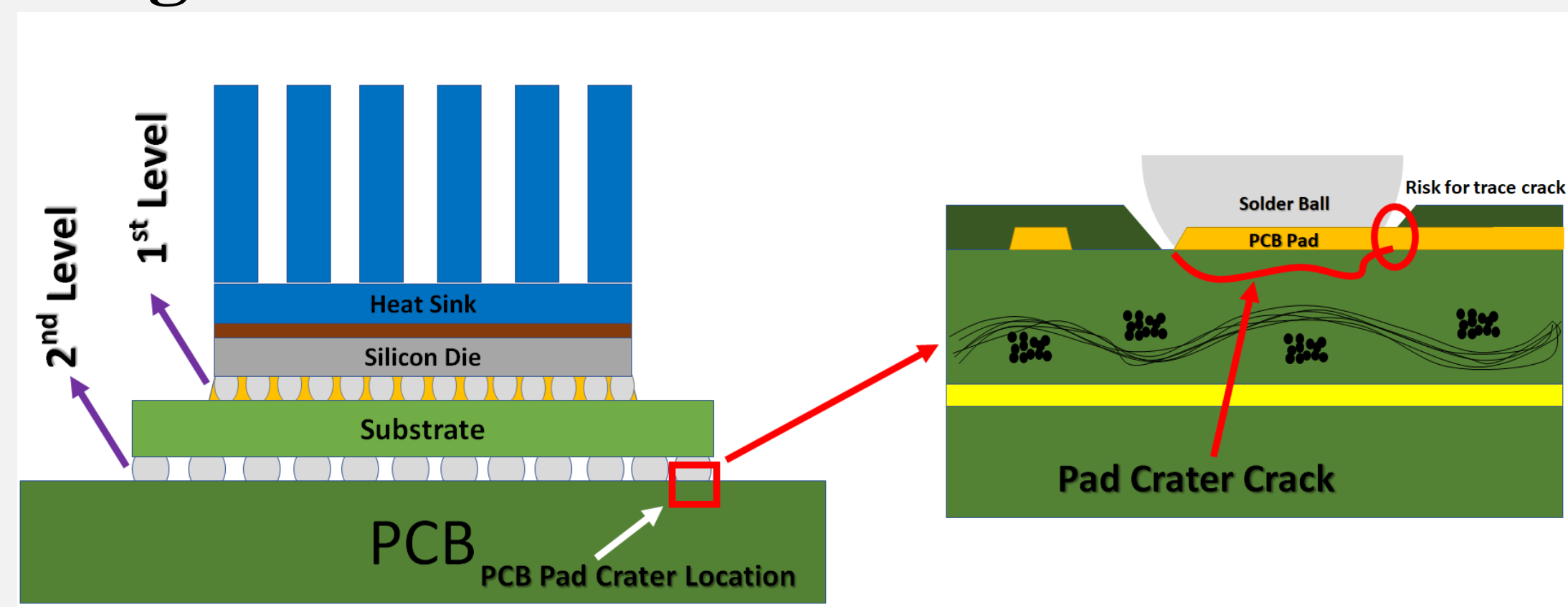




## Background

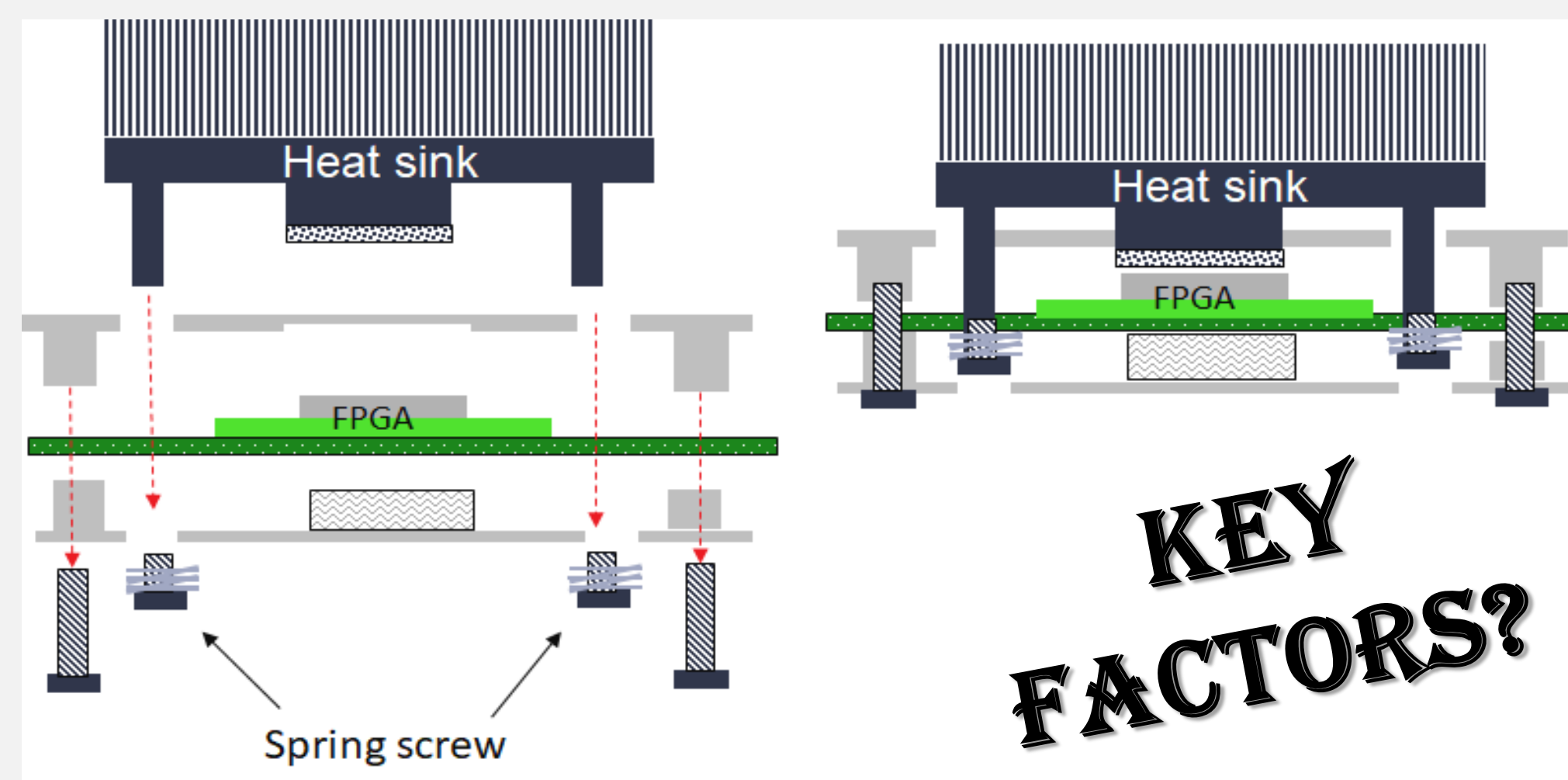
### Drivers of pad cratering

- Finer pitch
- Brittle laminates
- Stiffer solders
- Large heat sink



### Mitigation methods of pad cratering

- Solder mask defined
- Larger pad
- Limitations on board flexure
- Component location
- Edge bonding
- More compliant solder



## Objectives

To evaluate various factors' influence to the product level pad cratering risk

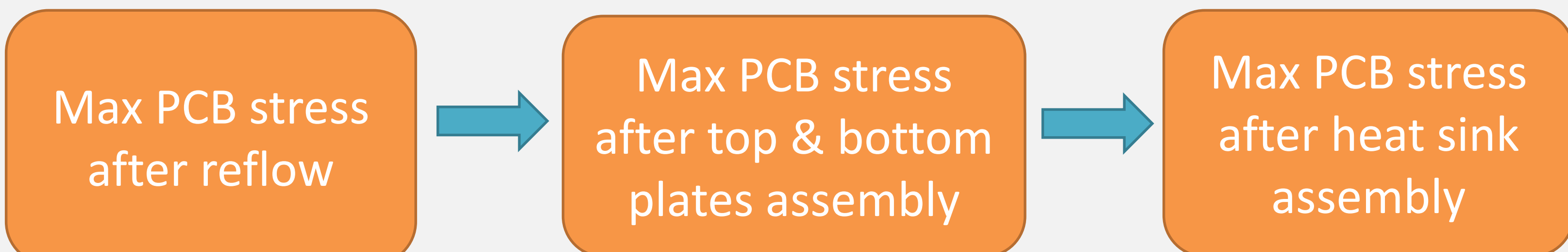
- SMD vs. NSMD
- Edge bonding effect
- Top plate material
- Heat sink weight

Case	SMD/NSMD	Edge Bonding	Top Plate Material	Heatsink
1(Ref)	NSMD	No	Al	1
2	SMD	\	\	\
3	\	Yes	\	\
4	SMD	Yes	\	\
5	\	\	Stainless Steel	\
6	\	\	Zinc Alloy	\
7	\	\	\	1.75

Design of experiments (\: same as reference case)

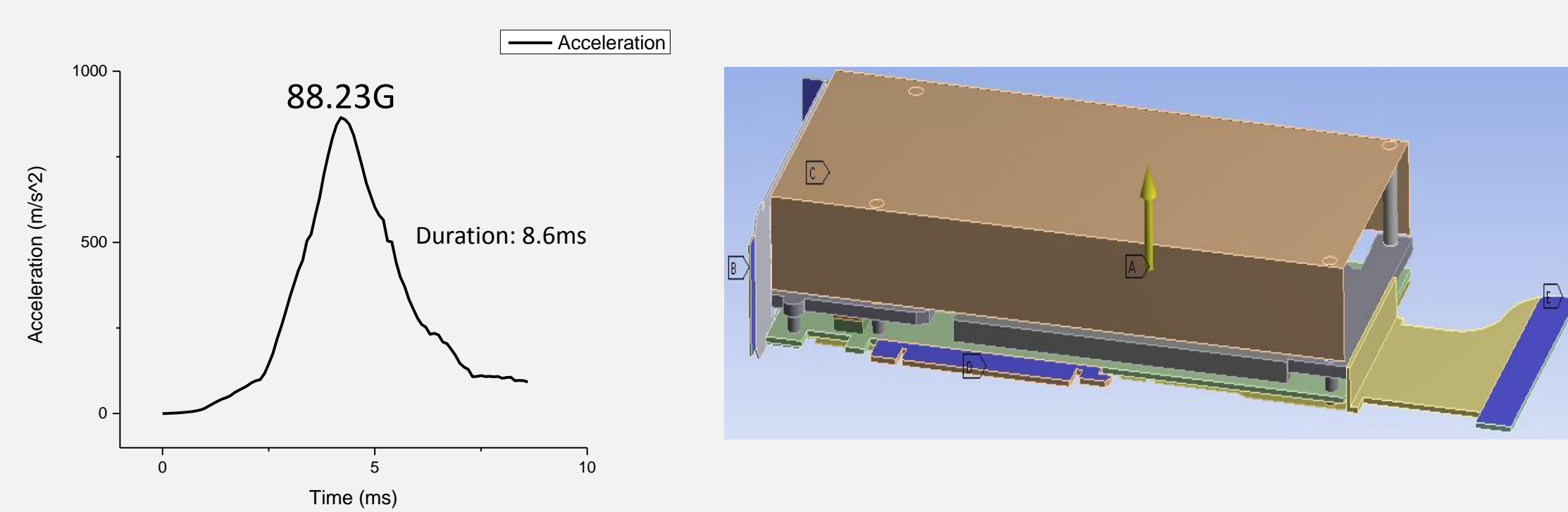
## Methodology

### Max stress on PCB in assembly process

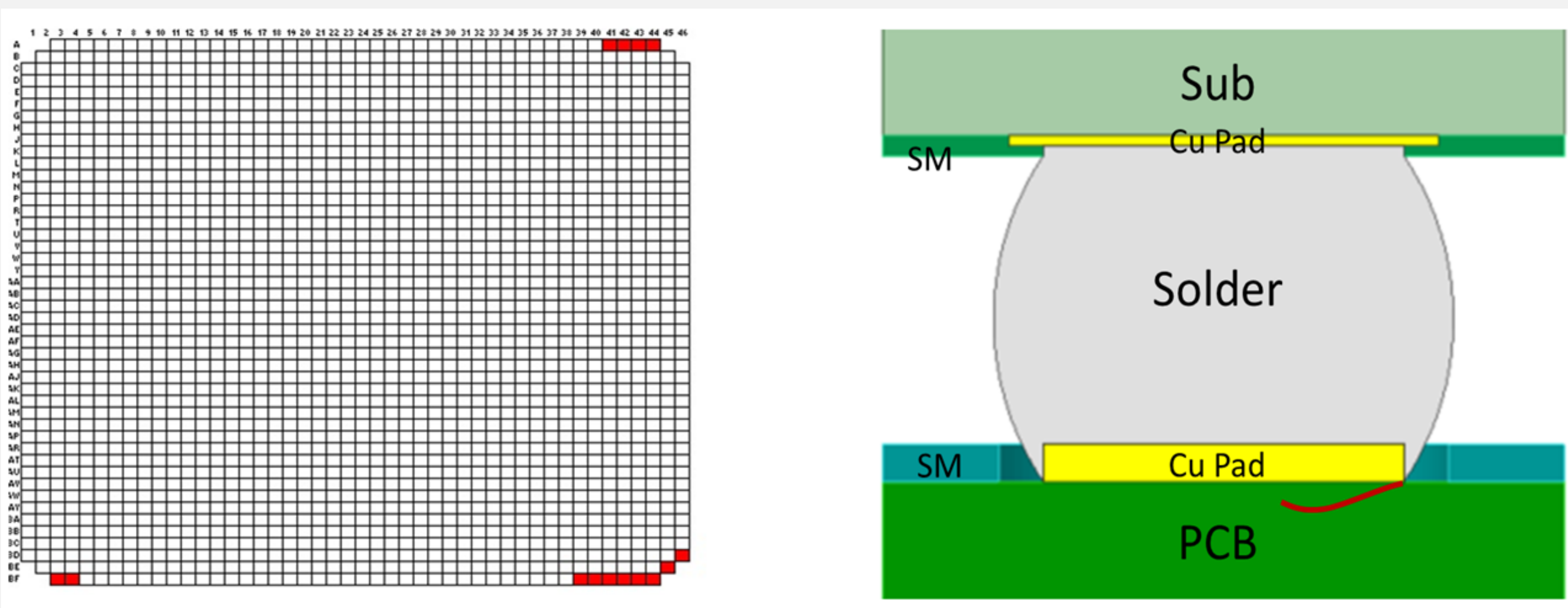


### Max stress on PCB during drop

- Free drop method
- Input-G method
- Input-D method
- **Direct acceleration input method**

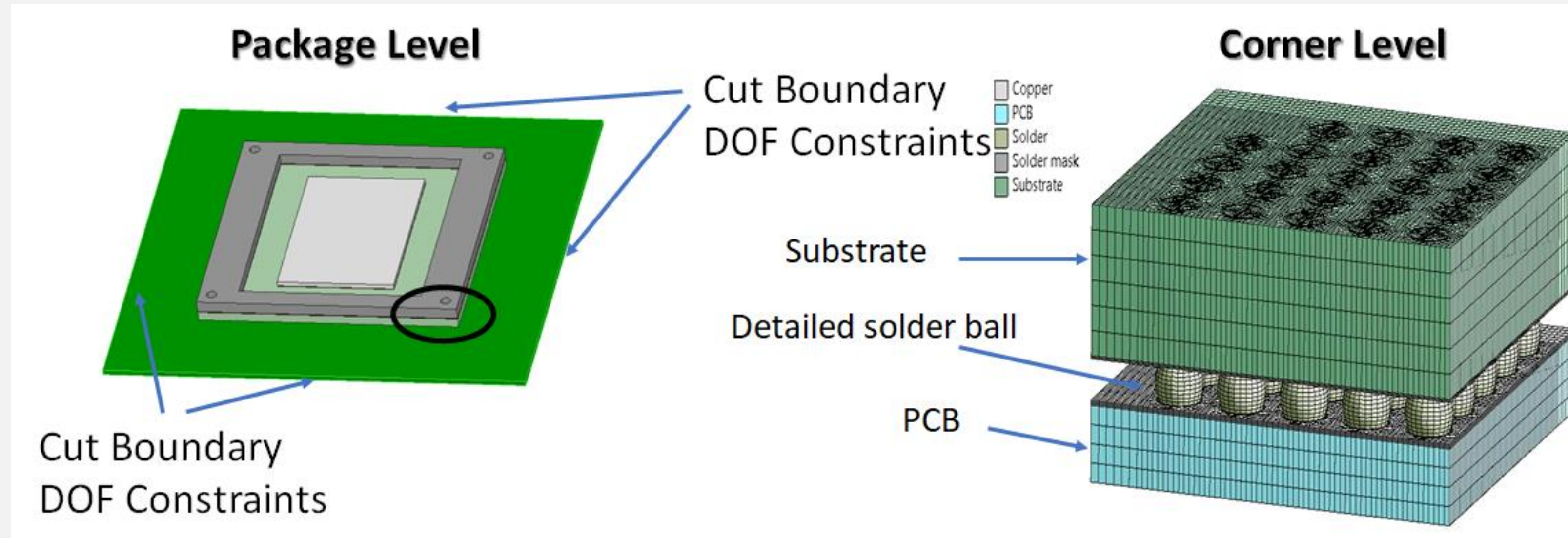


### Schematic of failure site observed during drop test

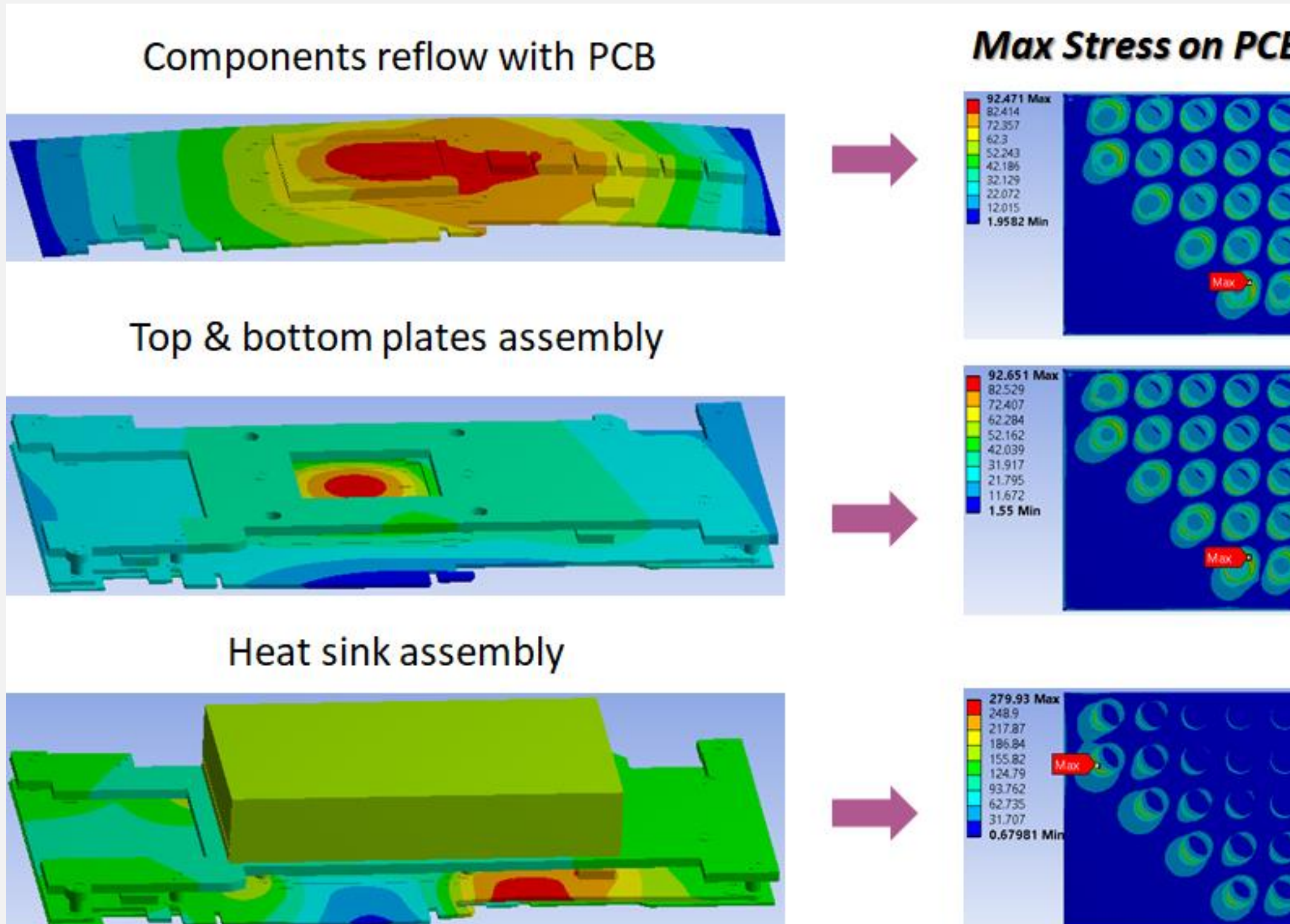


## Finite Element Modeling

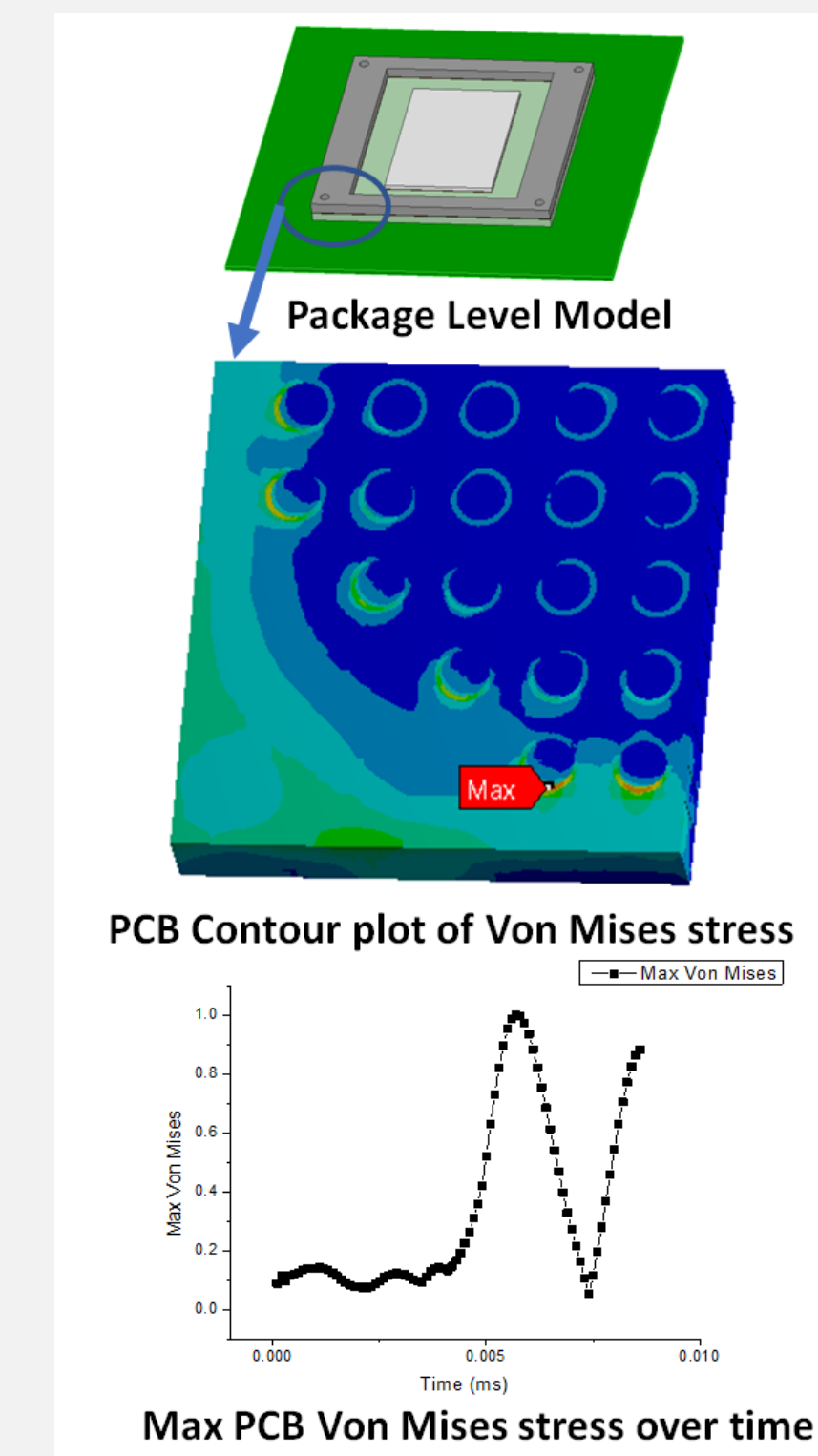
### Sub modeling to get max stress on PCB



### Max PCB stress change in assembly process

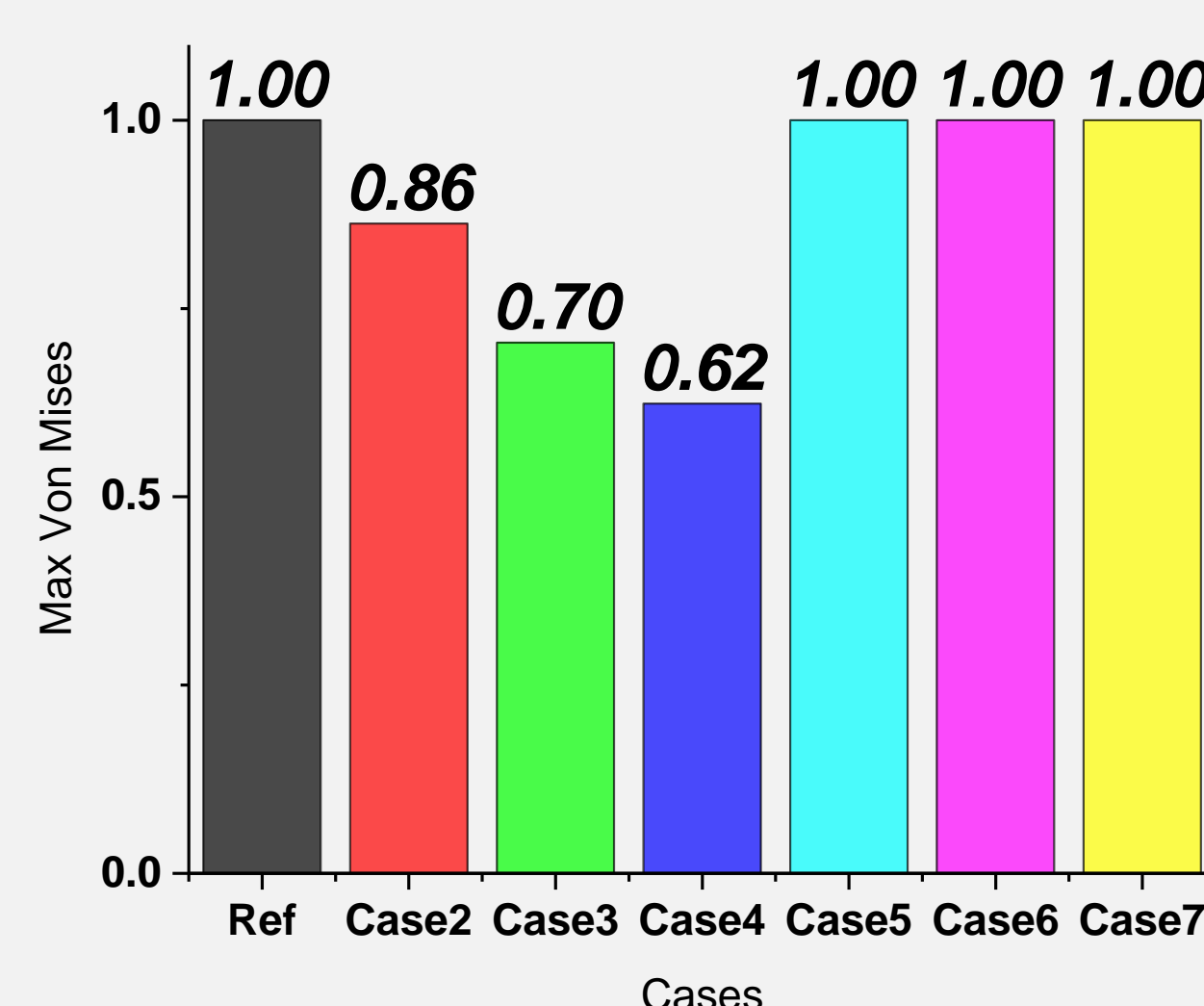


### Max PCB stress in drop test



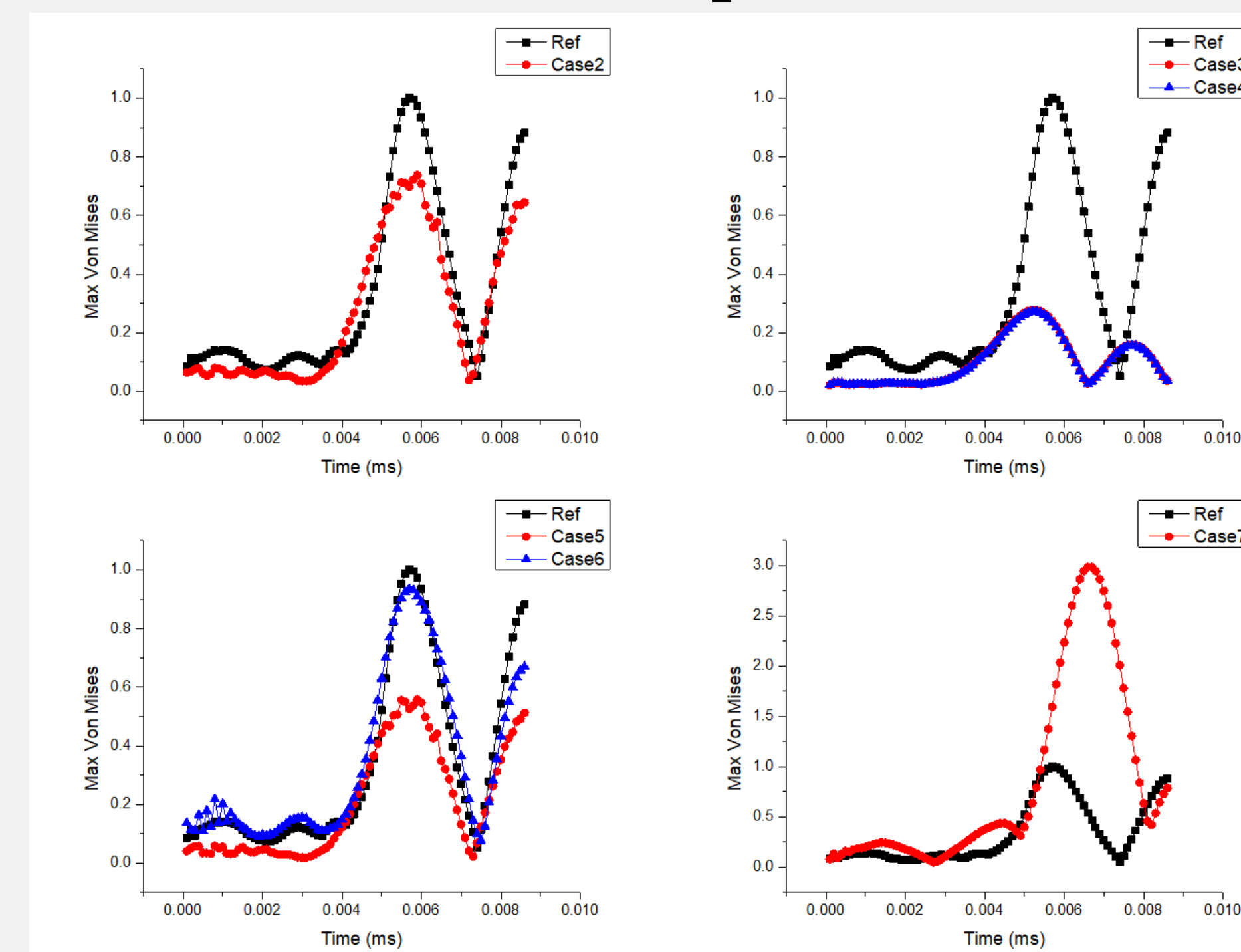
## Results

### Max PCB stress in assembly process



- SMD decreases the stress by 14%
- Edge bonding decreases the stress by 30%
- Combination of both can decrease the stress by 38%
- Top plate material and heatsink weight has no influence to the PCB stress

### Max PCB stress in drop test



- Heat sink weight has the most significant influence to the PCB stress during drop
- Edge bonding can effectively decrease the PCB stress during drop
- With the presence of edge bonding, the SMD's mitigation to the PCB stress is neglectable
- Stiffer top plate can reduce the PCB stress during drop

## Conclusion

- Both solder mask define and edge bonding can reduce PCB stress in assembly process
- Heat sink weight is the most influential factor to the PCB stress during drop
- With the presence of the edge bonding, SMD and NSMD yield the same max PCB stress
- Rigid reinforce plates can reduce the max PCB stress during drop
- Edge bonding, stainless steel plates and light heat sink design gives the best pad cratering reliability