

Using FloEFD : Case Studies on Networking Devices for Thermal Design

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1. Introduction of networking devices
2. The environment variables of EFD
3. The process of thermal design
4. Simulation results

Introduction of networking devices

Main product

- DSL CPE
- Wireless Networking
- Fiber communication
- 3G/4G communication
- Digital home

FTTx PON

Fiber networking brings seamless Triple-Play services.



VDSL2 IAD

Take a convenience of faster internet surfing and HD video streaming.



IP SET-TOP BOX



802.11ac Router

Powerful puncture strength, better coverage, and less interference, its truly a "much-needed" for today's home network.



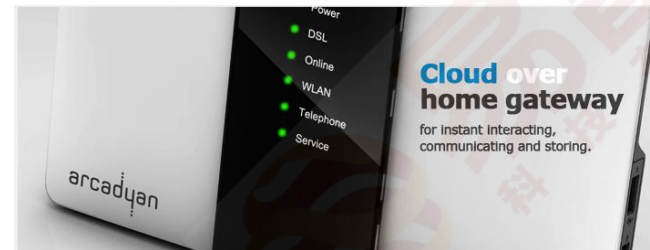
LTE Router

4G/LTE brings a new look of Mobile Broadband applications.



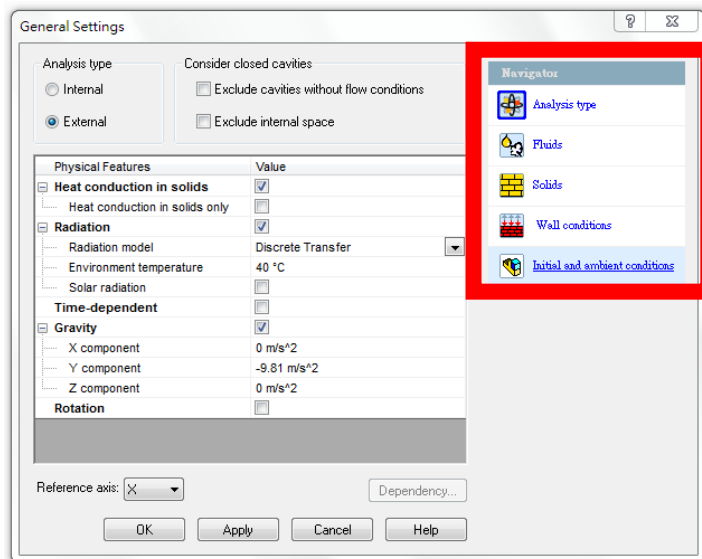
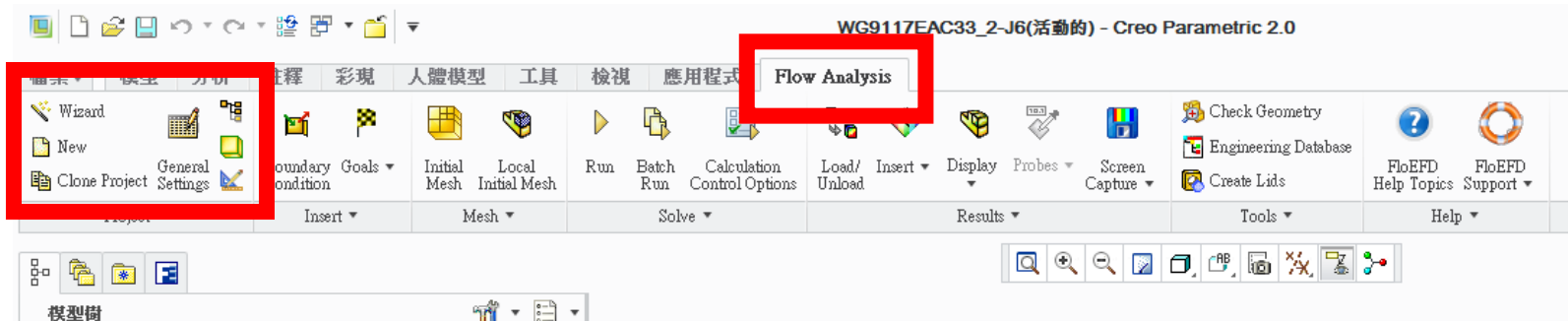
Deliver triple play services

including high speed data access, voice, IPTV and QoS



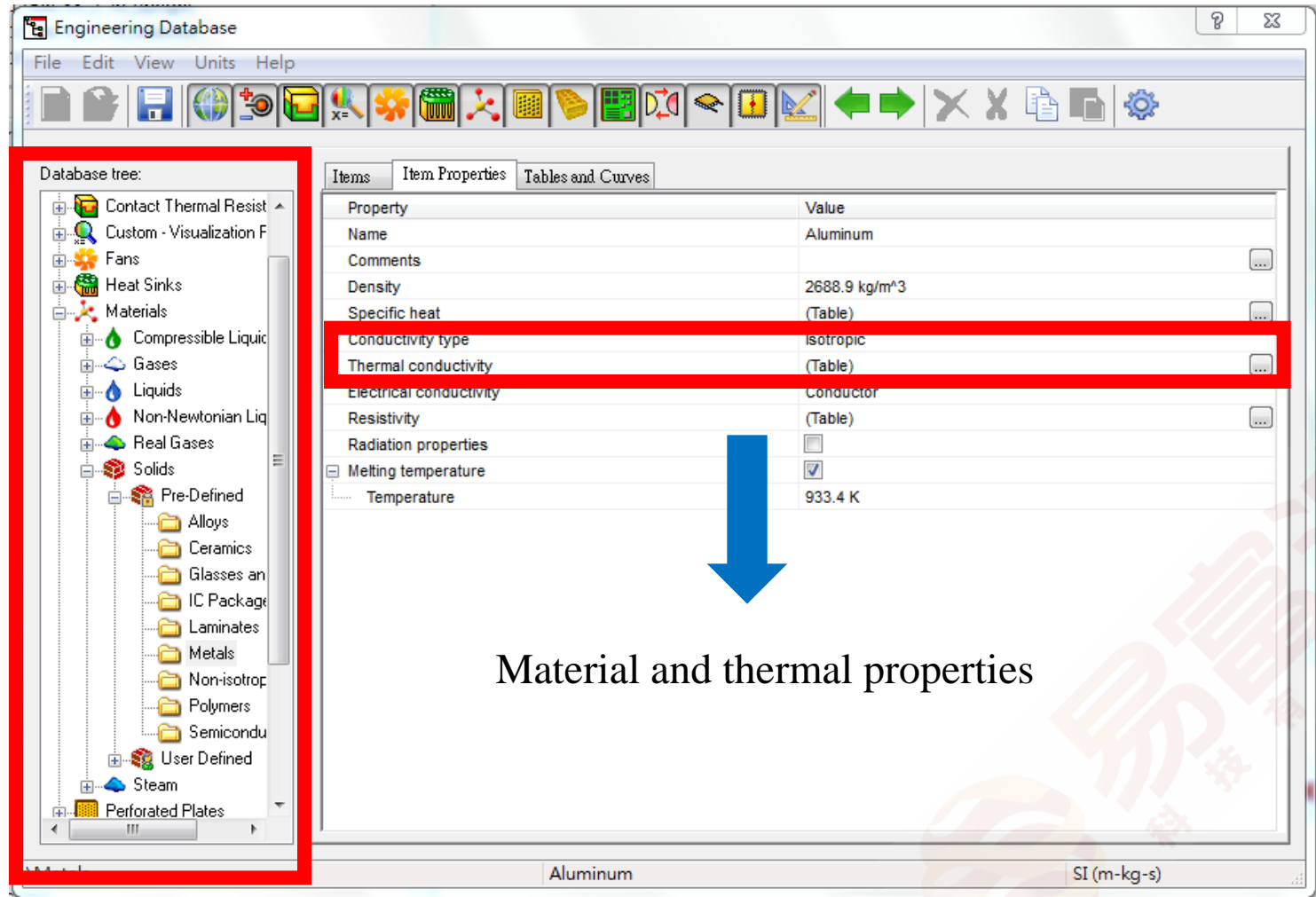
The environment setting of EFD

Using the Pro/e to design the 3D model to simulate.

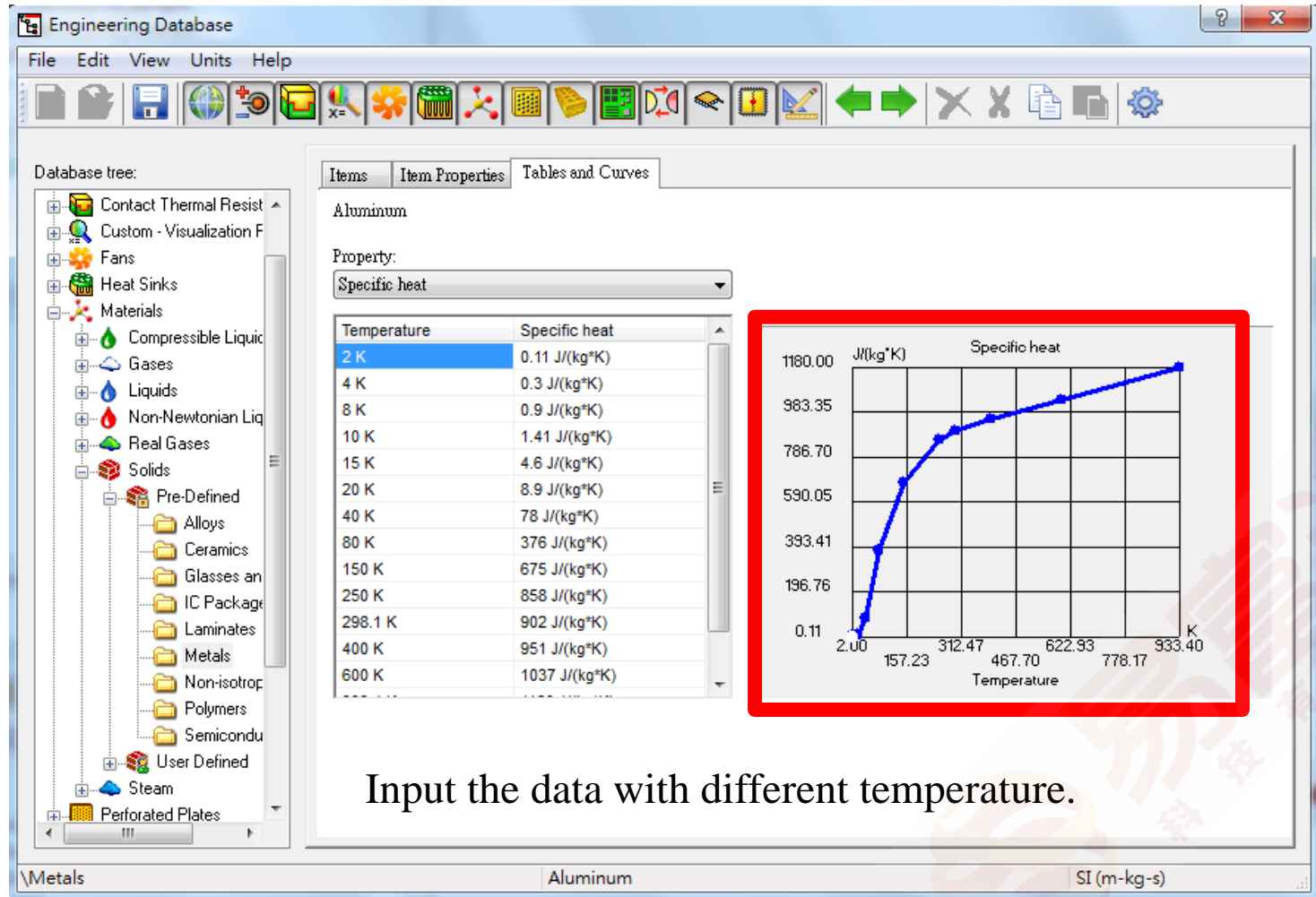


Follow the default process to setting the environment

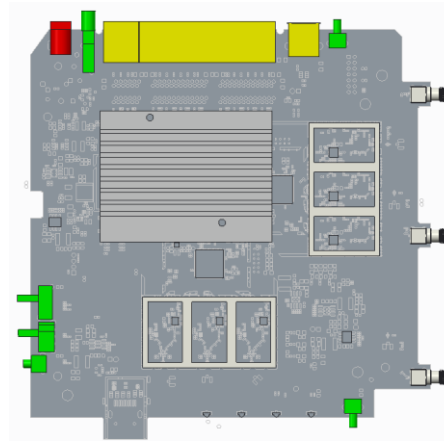
The environment setting of EFD



The environment setting of EFD



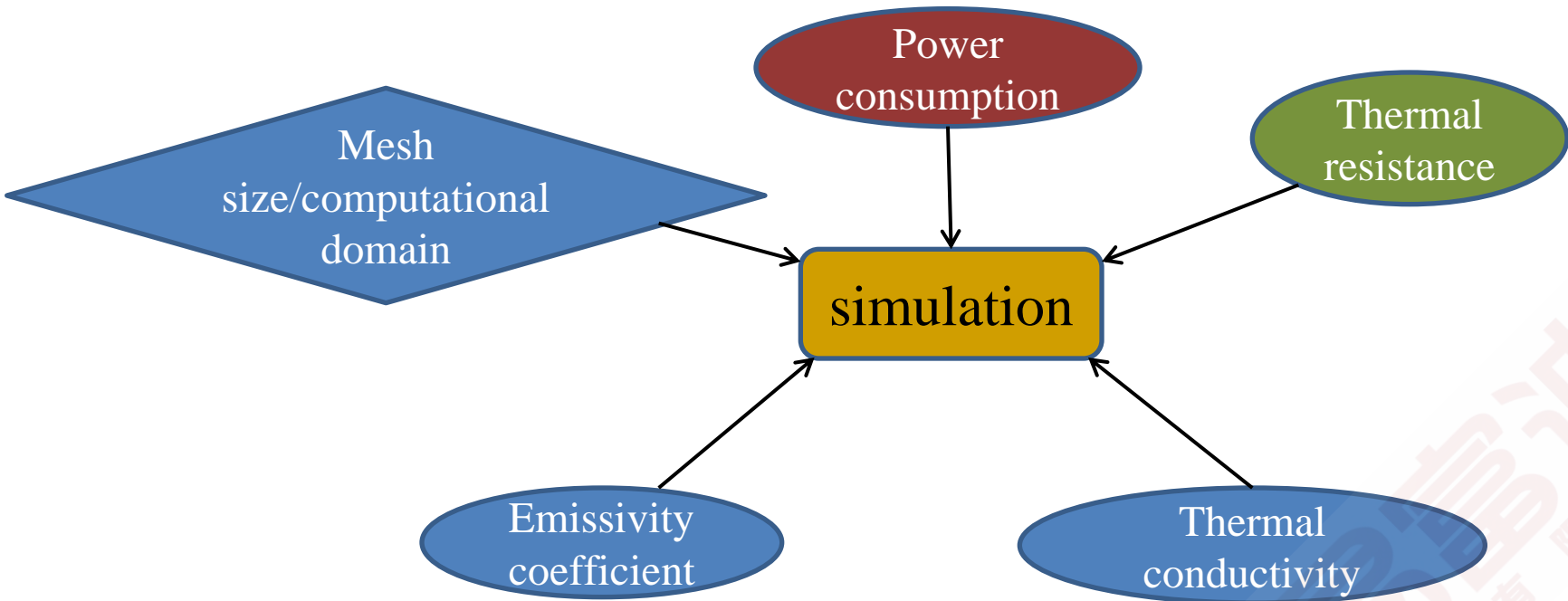
The environment setting of EFD



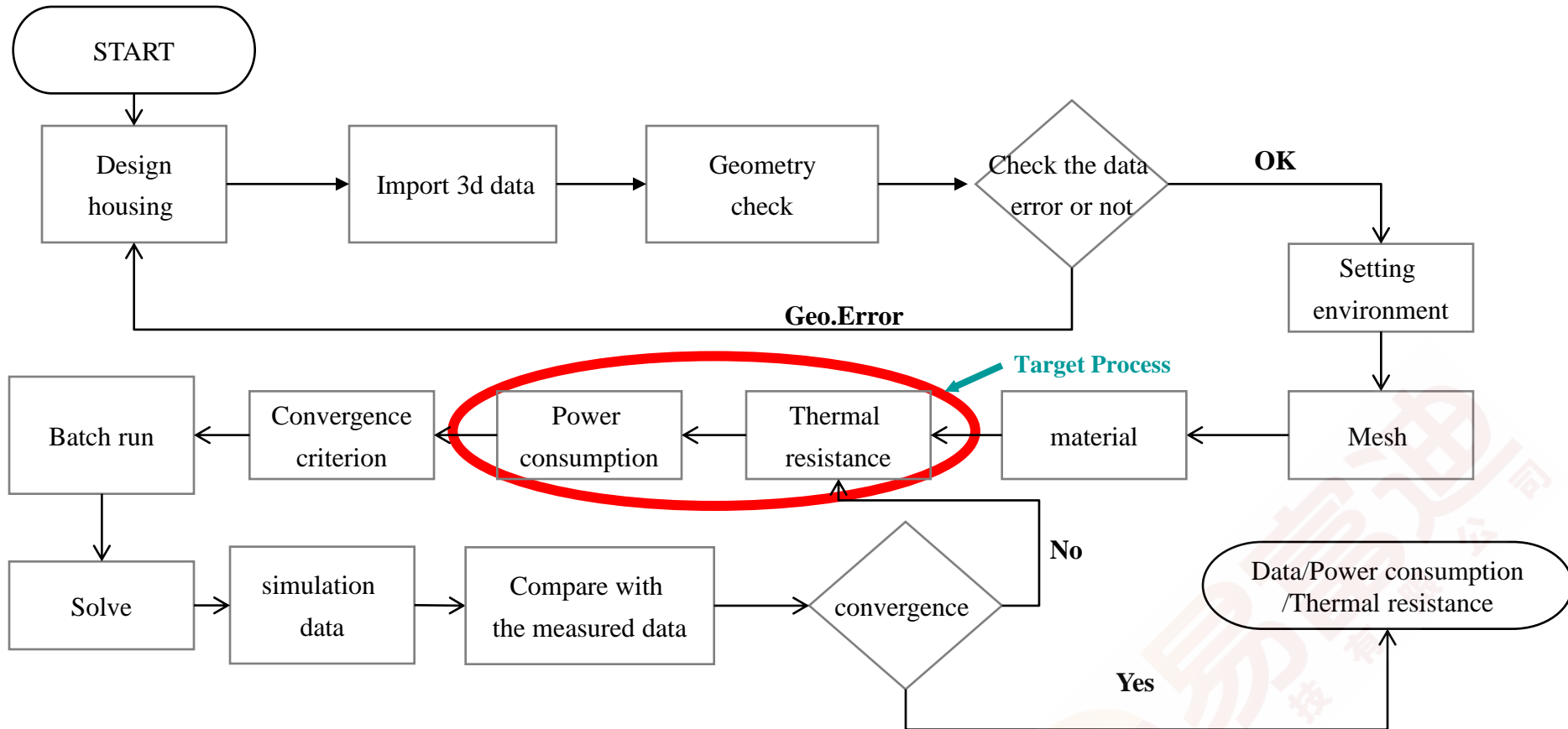
Input the data from layout to obtain the thermal conductivity

Conductor material density	8960 kg/m ³
Conductor material specific heat	385 J/(kg*K)
Conductor material conductivity	401 W/(m*K)
PCB total thickness	0.0016 m
Conducting layers	(Table)
In-plane (planar) conductivity	23.7149956 W/(m*K)
Through-plane (normal) conductivity	0.318603754 W/(m*K)
Effective density	1959.15766 kg/m ³
Effective specific heat	723.254549 J/(kg*K)
Number of conducting layers	4

The process of thermal design

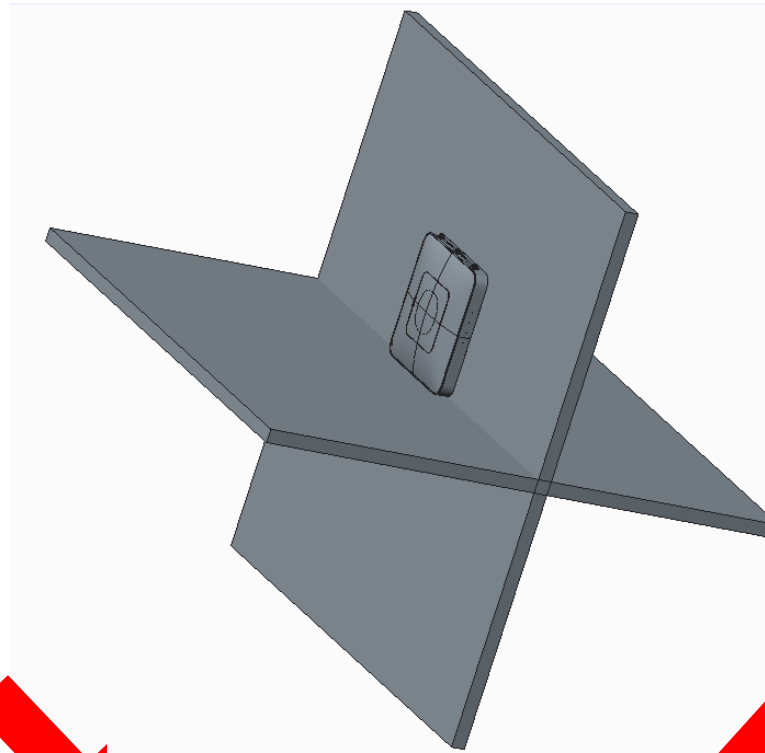


The process of thermal design



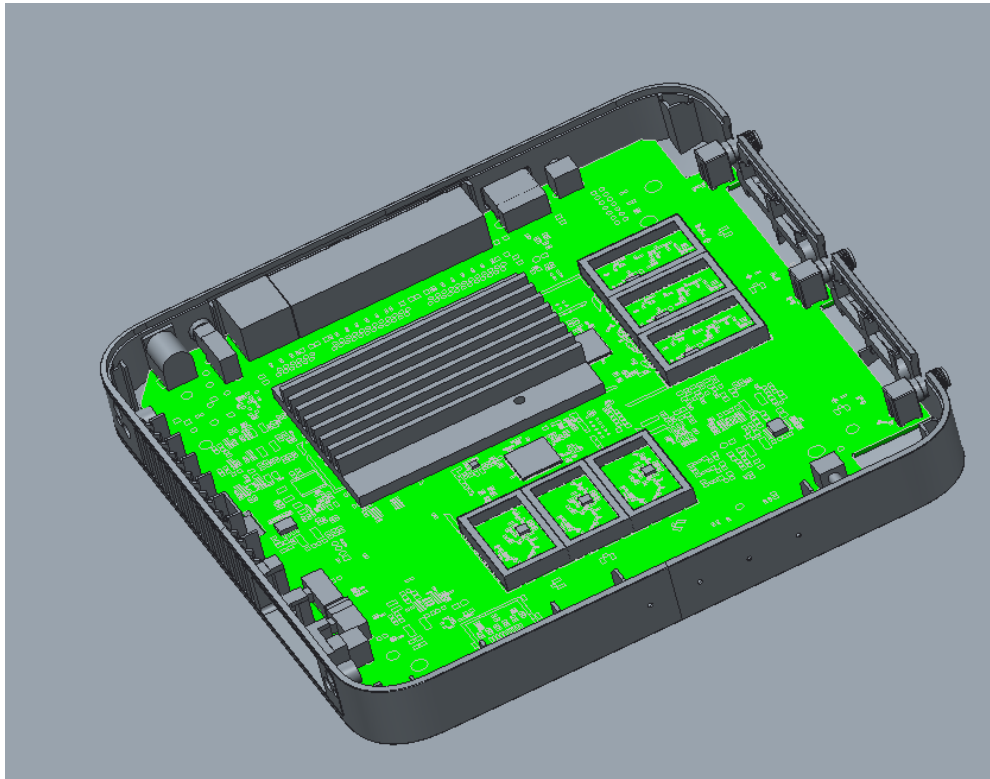
The process of thermal design

Using the same 3D model for different case



Simulate different case for lie-down and upright

The process of thermal design



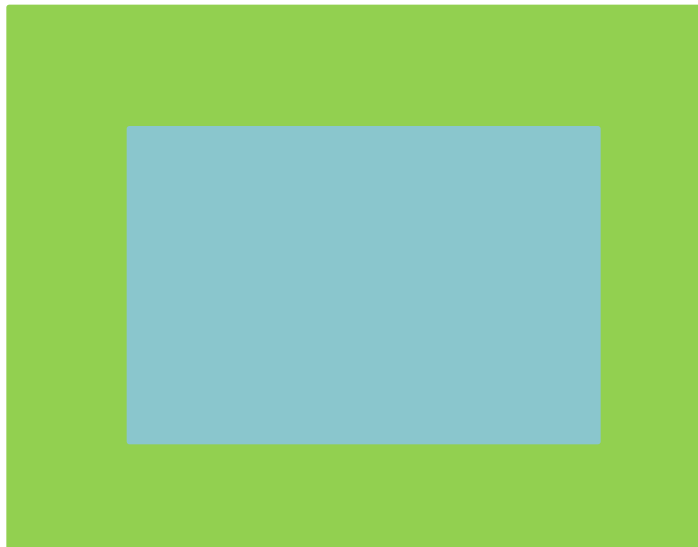
Model : natural convection (steady state)



Housing is simplified with removing unnecessary feature

The process of thermal design

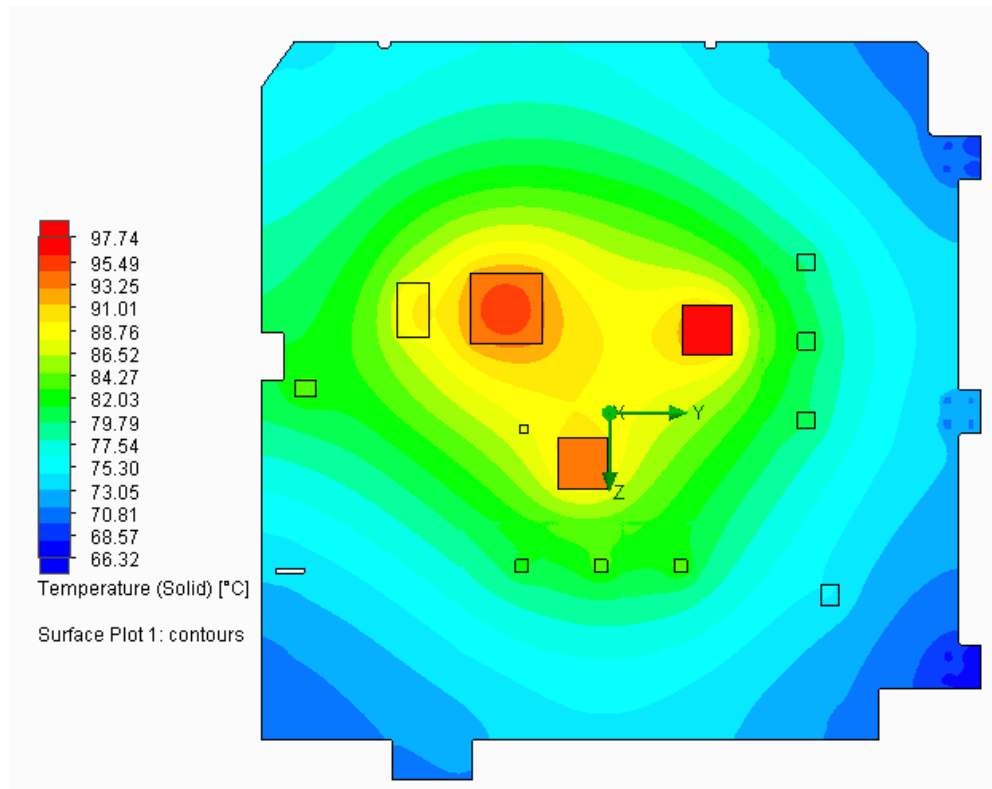
Use thermocouple to measured the chip data to obtain the properties of chip.



Using the temperature to obtain the properties of chip.(thermal resistance, power consumption...)

The process of thermal design

Temperature distribution

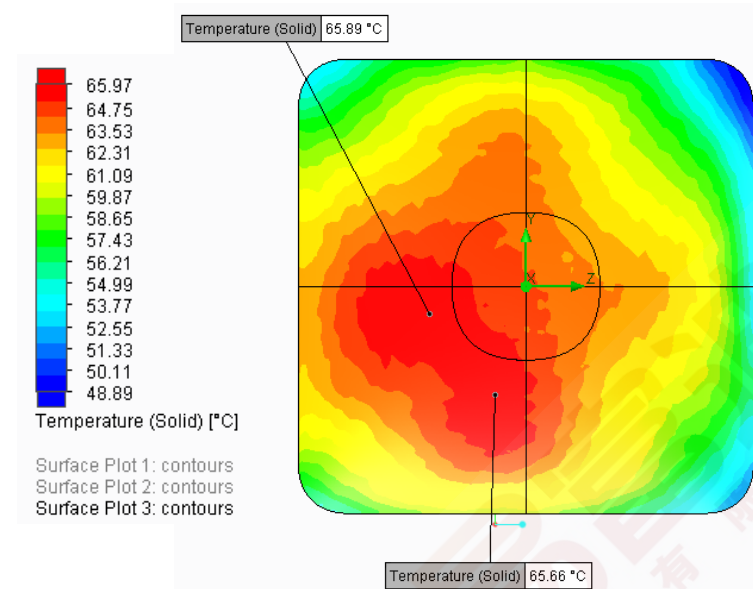
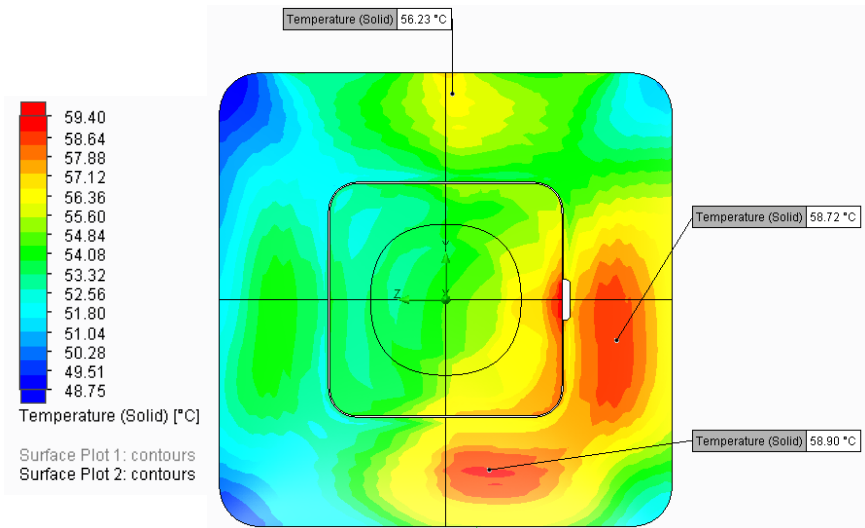


Tuning the thermal properties of chips and pc board

*Power consumption is reference on datasheet.

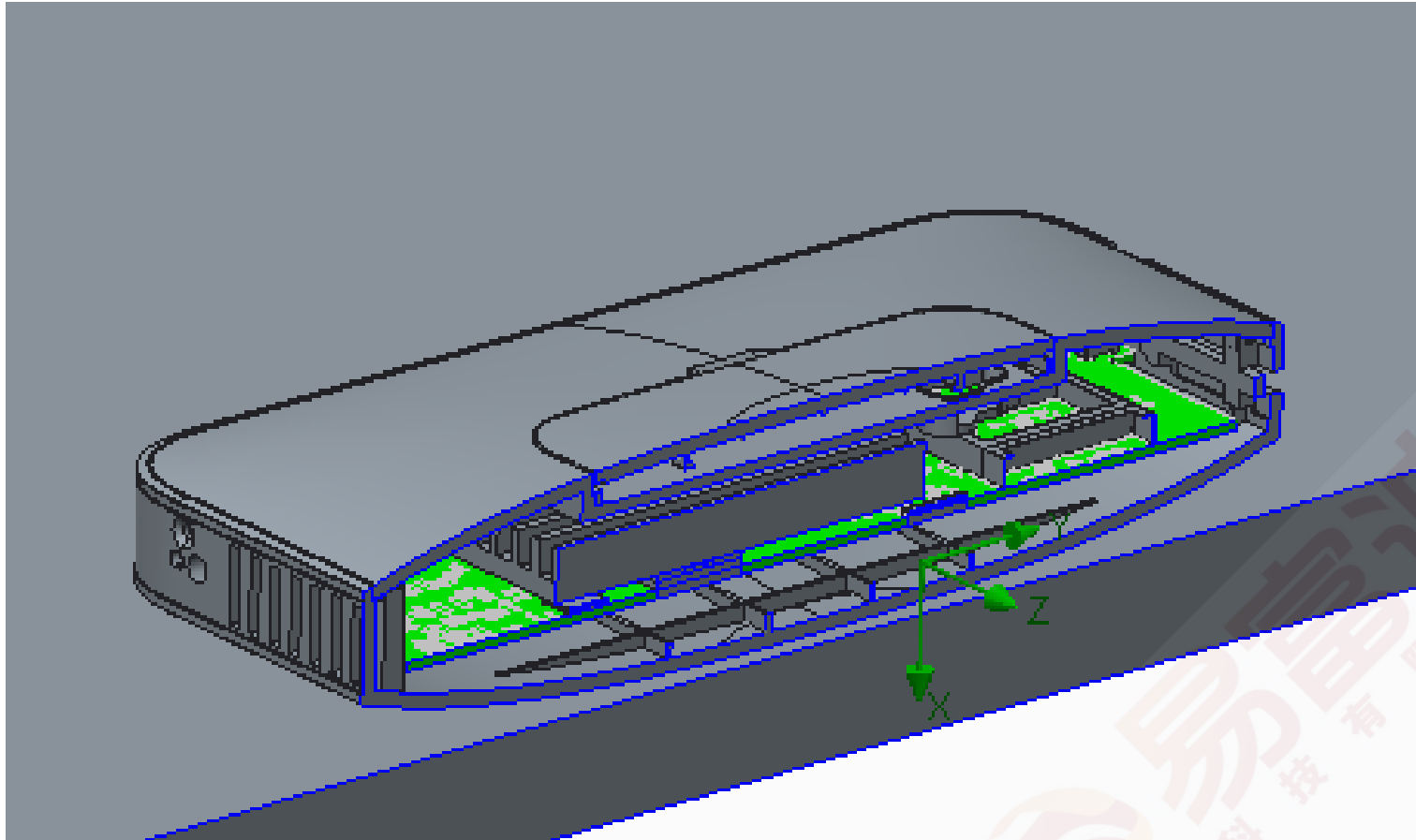
The process of thermal design

Housing temperature distribution



According to the temperature distribution to design the different feature and solution.

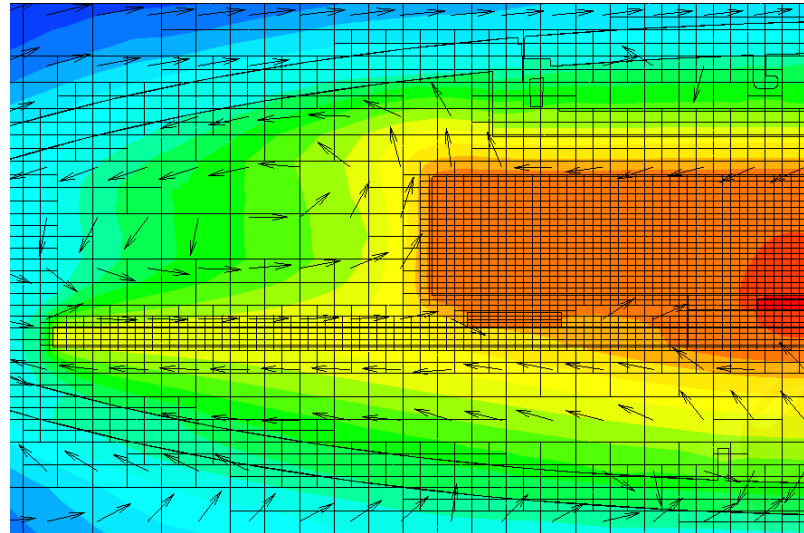
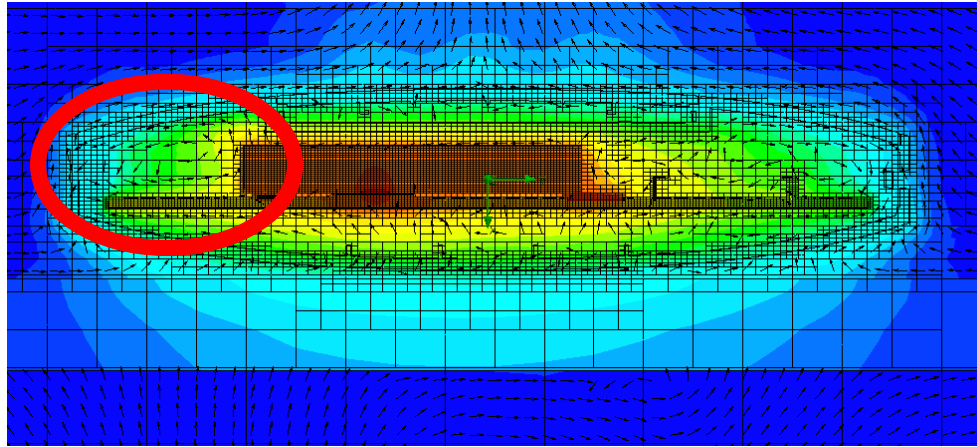
The process of thermal design



The 3D model of housing and pcba.

The process of thermal design

Partial cell : between solid and fluid

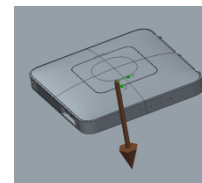


Simulation results



Upright

Component	Measured temp.(°C)	Simulation temp.(°C)	Error (°C)
CPU	90.41	91.35	0.94
2.4G	86.17	84.31	-1.86
5G	91.36	90.51	-0.85
BASE-CPU	53.15	54.24	1.09
COVER-CPU	65.78	65.22	-0.56
BASE-LED	52.27	52.14	-0.13
COVER-LED	49.42	50.12	0.7

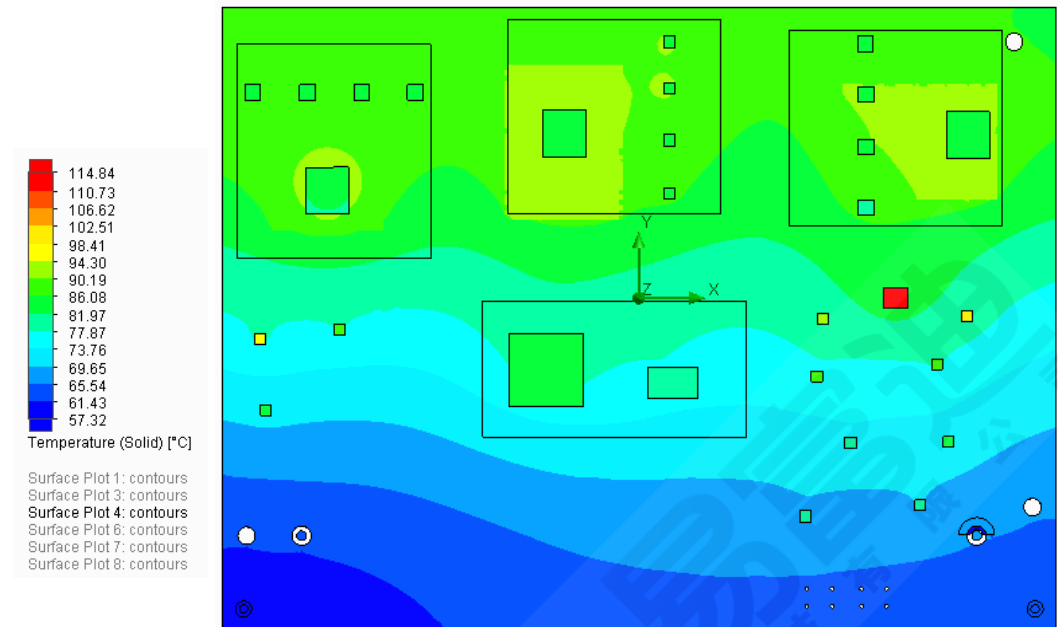
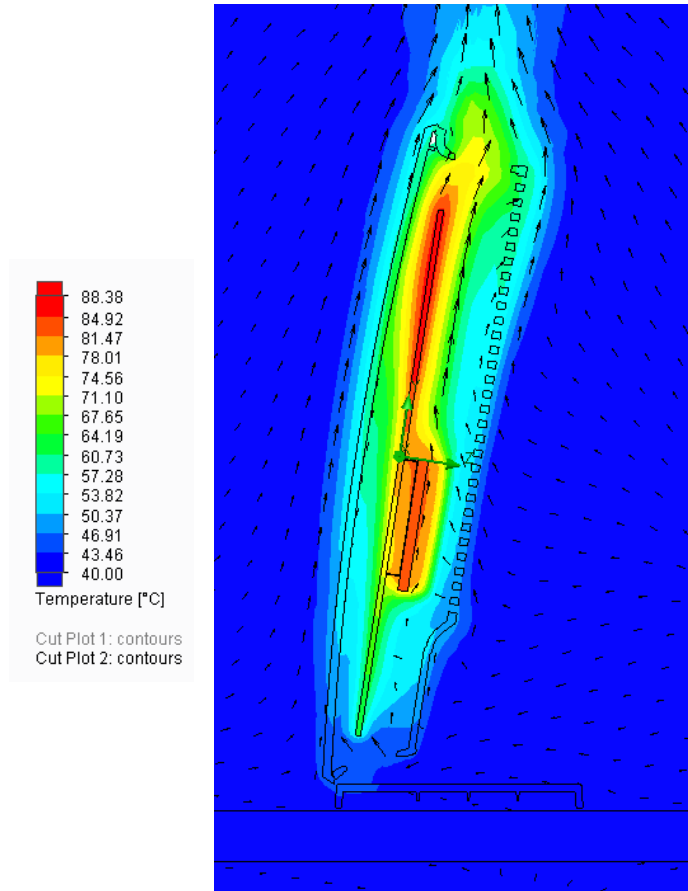


Lie-down

Component	Measured temp.(°C)	Simulation temp.(°C)	Error (°C)
CPU	100.19	100.96	0.77
2.4G	95.82	94.06	-1.76
5G	98.55	97.74	-0.81
BASE-CPU	67.20	65.52	-1.68
COVER-CPU	72.93	75.32	2.39
BASE-LED	60.24	58.89	-1.35
COVER-LED	51.72	51.86	0.14

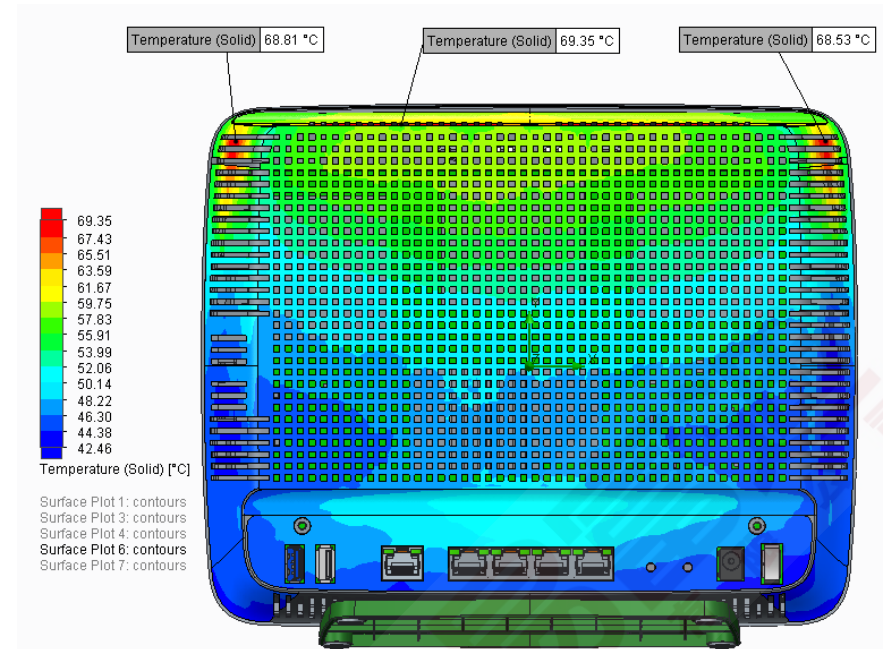
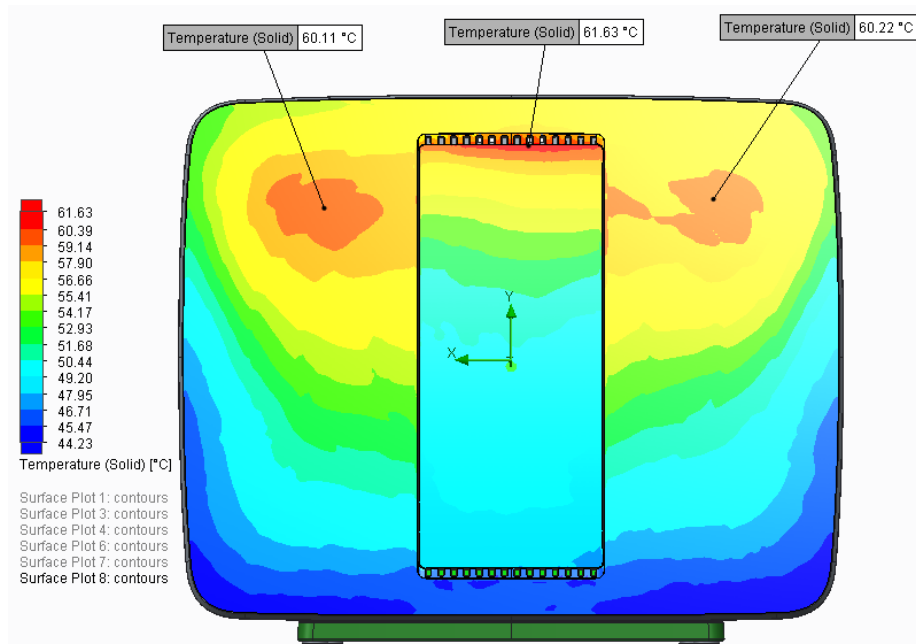
Simulation results

Post processing : showing the flow field and the temperature distribution of pcb



Simulation results

Post processing : put the temperature probe on housing



Thermal issue

- ◆ High performance with small housing.
- ◆ No venting hole with high power consumption.
- ◆ Power consumption, radiation and thermal resistance.
- ◆ Cost and lead time.

Thank you for your attention !