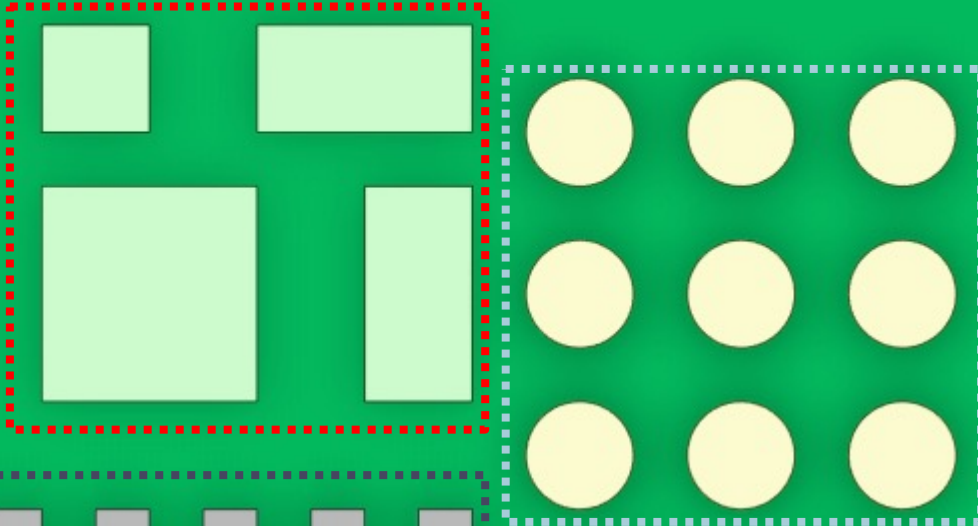# Project ----Thermal Management of Printed circuit board

Printed Circuit Board (PCB) is the cornerstone of electronics industry, which is widely used in almost all electronic devices. PCB provides a way to fix and connect various electronic components, including resistors, capacitors, transistors, chips, etc., to achieve specific electronic functions. The PCB boards are often accompanied by heat generation during operation. When the temperature of PCB board exceeds 50°C, it may cause damage to electronic components on the printed circuit board and accelerate its aging. High temperature may also lead to solder joints melting, causing circuit shortages.

The liquid cooling technology is a commonly used method to cool down PCB. In addition, phase change materials (PCMs) are also usually applied for thermal management of electronic devices owing to its nearly constant temperature during solid-liquid phase change process. In this project, the water liquid cooling coupled with phase change material is required to be designed for thermal management of PCB.

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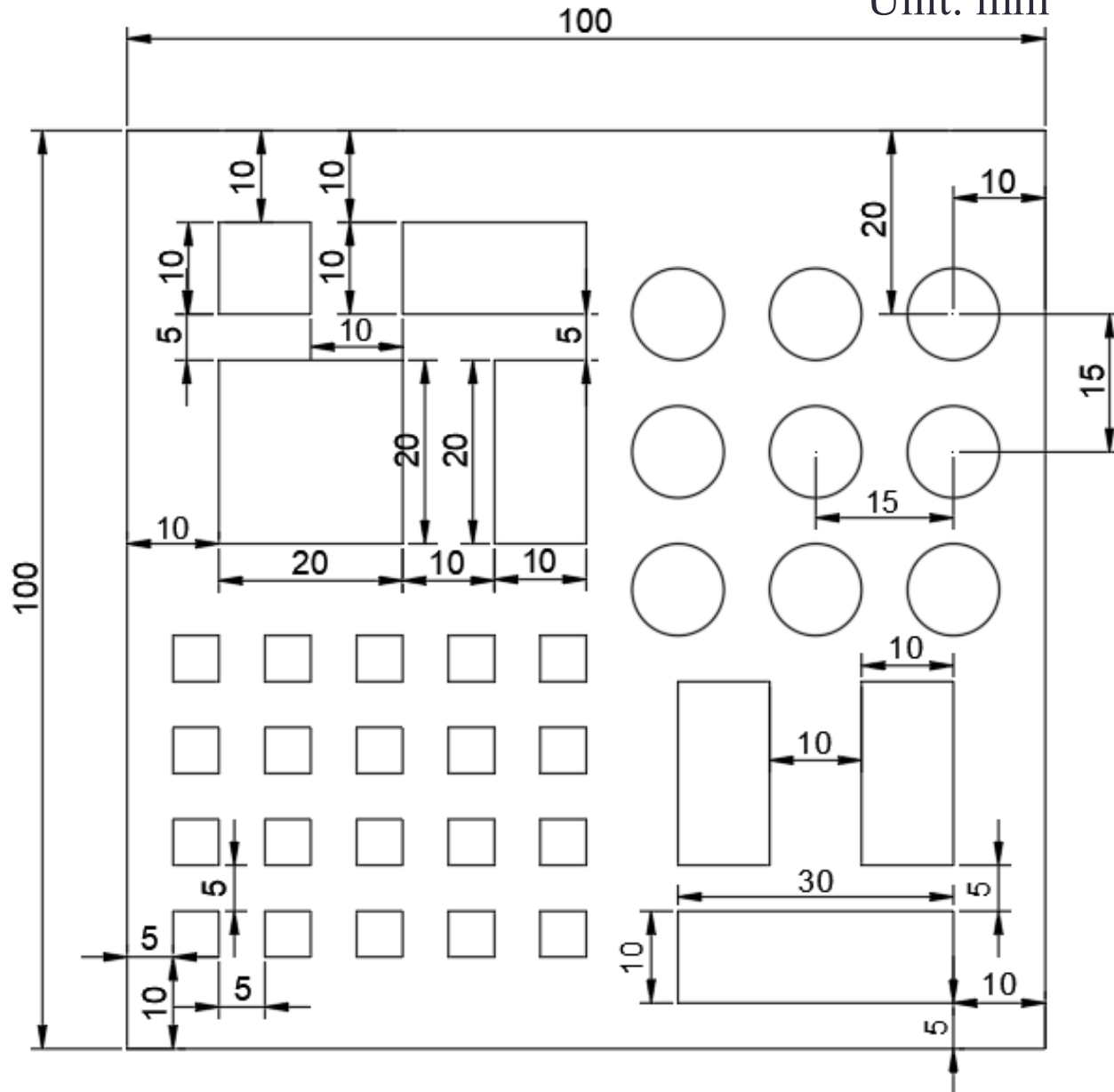

chips   cylindrical capacitors

resistors   square capacitors

This project simplifies the PCB board and divides it into five components: substrate, square capacitors, cylindrical capacitors, resistors, and chips.

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Unit: mm

Known: The physical and model parameters of each component are as follows. During the operation, the outer surface is set as the convective boundary condition with a heat transfer coefficient of h=10 W/(m²·K) and an incoming air temperature of 25℃.

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Name	Density [kg/m³]	Cp [J/(kg K)]	Thermal Conductivity [W/(m K)]	Height [mm]	Viscosity [kg/(m s)]	Thermal Expansion Coefficient [K⁻¹]	Pure Solvent Melting Heat [J/kg]	Solidus Temperature [°C]
capacitor	5175	620	11.18	10				
resistor	3970	910	38	5				
substrate	1794	1465.38	0.29	2				
chip	2330	706.74	131.8	2				
PCM	780	2000	0.2	/	0.000365	0.0003085	255000	35

The heat source term of each component is defined as follows: Unit：W/m³

the tail number of student ID	0/5	1/6	2/7	3/8	4/9
resistor	25000	20000	20000	20000	20000
cylindrical capacitor	15000	20000	15000	15000	15000
square capacitor	10000	10000	15000	10000	10000
chip	5000	5000	5000	10000	5000
substrate	50000	50000	50000	20000	55000

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Find： This project focuses on thermal management of PCB and sets up five different operation conditions. Select the corresponding operation condition for simulation according to **the tail number of student ID**. The cooling method utilizes a hybrid phase change materials(PCM) and liquid cooling technology. Please design the configuration of PCM unit and liquid cooling channel to cool the PCB to satisfy the following requirements: as the PCB starts to work from 25 ℃ and after continuous operation of 30 minutes, the maximum temperature is required to be below 50 ℃. Write down the governing equations and boundary conditions; Nondimensionalize all equations to get dimensionless governing parameters. Post-process and analyze the results such as temperature field, velocity vectors, solid-liquid interface an so on. Please write the project report according to the template of Journal of Xi'an Jiaotong University.