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Cooling Modules

SUNON Europe Marketing Issue March 2021

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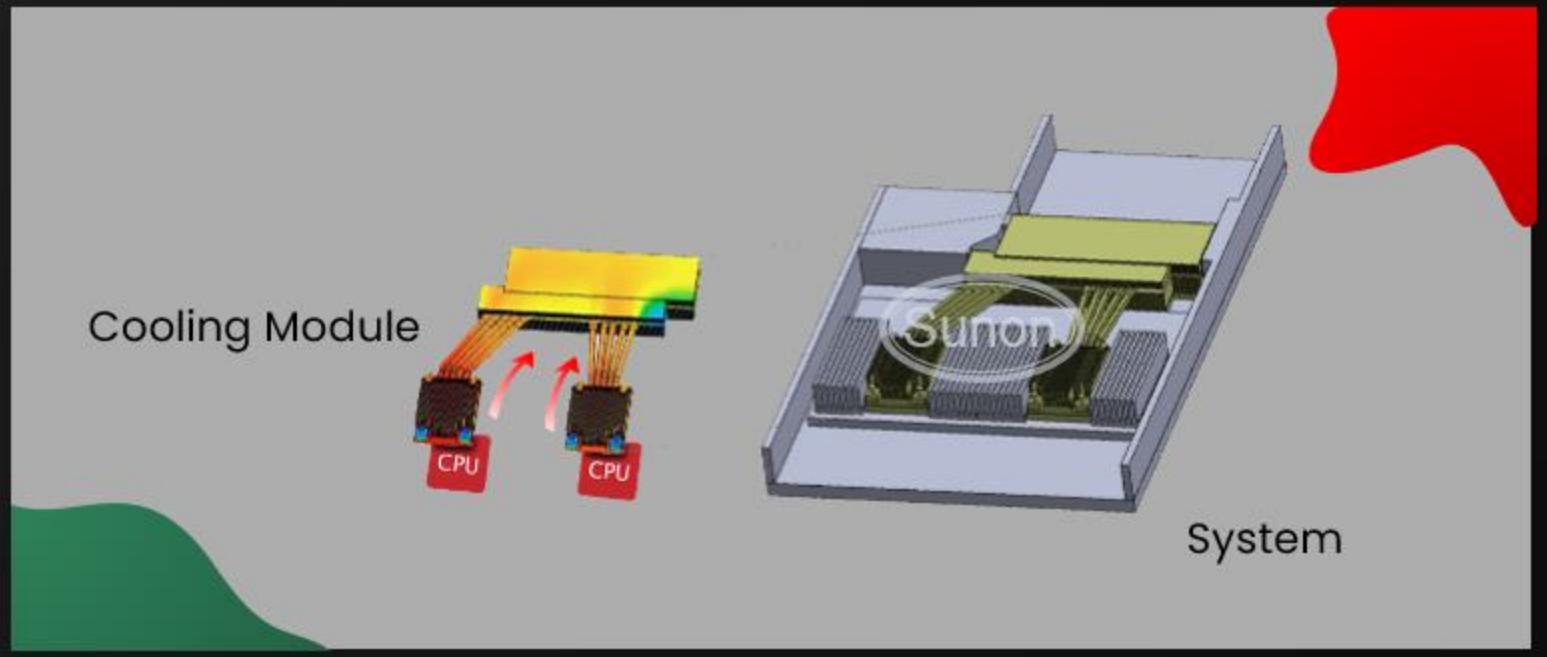
What is the cooling module

A device designed to regulate and lower the temperature of a heat generating device or system.



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Cooling Module Concept

Heat Transfer

Heat Removed

1 Heat Source

2 Thermal Interface Material

3 Metal Plate (Conductor)

4 Heat Pipe (Conductor)

5 Heat Sink (Radiator)

6 Fan (Flow Driver)

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Thermal Resistance

Thermal resistance is a property related to heat, which refers to the ability of an object to resist heat transfer when there is a temperature difference.

The better the thermal conductivity of the object, the lower the thermal resistance is usually.

On the same basis, the thermal resistance value (unit: °C/W) represents the increase in CPU temperature for every 1 watt increase in CPU power consumption.

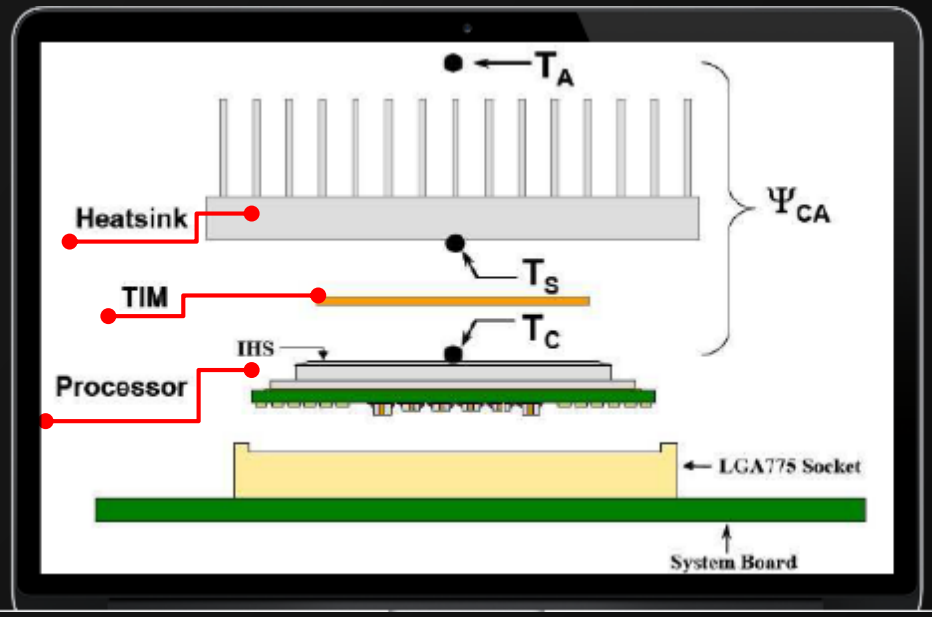
Therefore, the lower the thermal resistance value, the better the heat sink suppresses the temperature rise of the CPU.

❖ Rca = (Tc-Ta) / W

- Rca : Total resistance (unit: °C/W)
- Tcase : Chip Case Surface Temperature (°C)
- Ta : Ambient Temperature (°C)
- W : Power (watts)

➢ Example : Ta MAX = 25 °C, Tc MAX = 75 °C, Power =30W

→ R = (75−25)/30 = 1.5 °C/W



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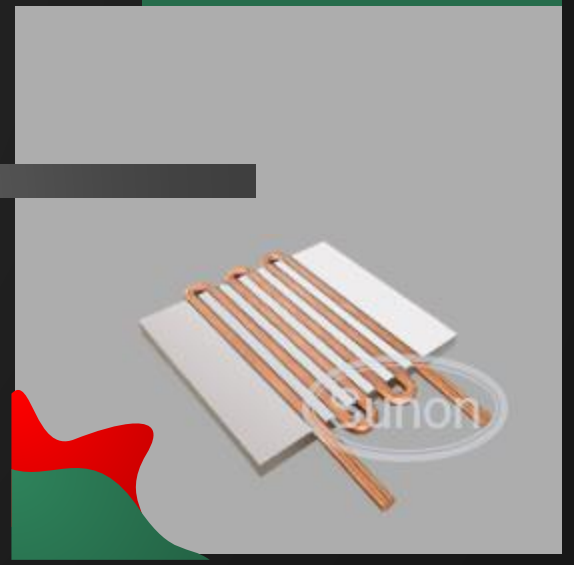
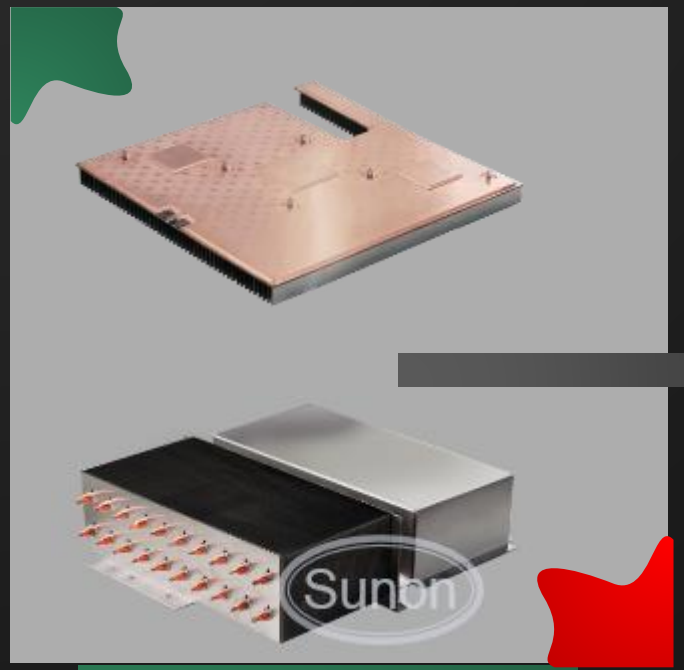
Cooling Module Range

SUNON have two ranges of cooling module, passive cooling and active cooling.

Active Cooling

Liquid Cooling

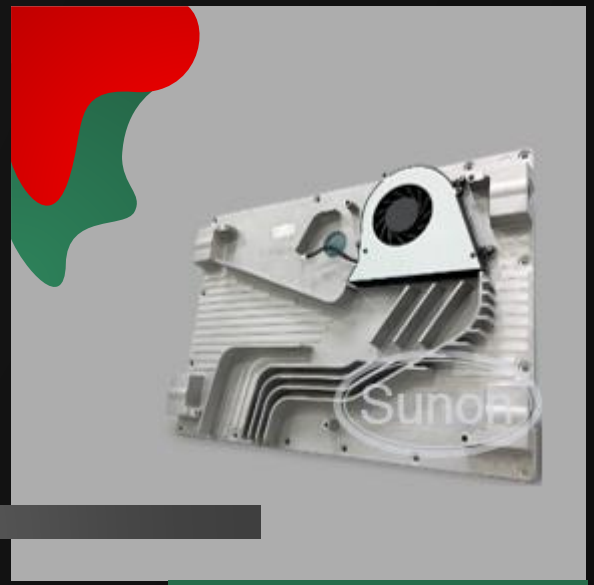




Thermal Conduction

Passive Cooling

Air Cooling



Active Cooling

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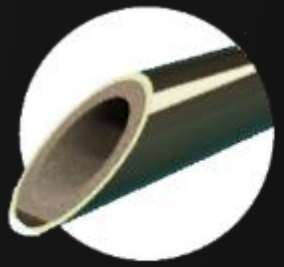
Heat Pipe (HP)

A heat pipe is an extremely efficient thermal conductor. It can transfer large quantities of heat over a long distance essentially at a constant temperature.

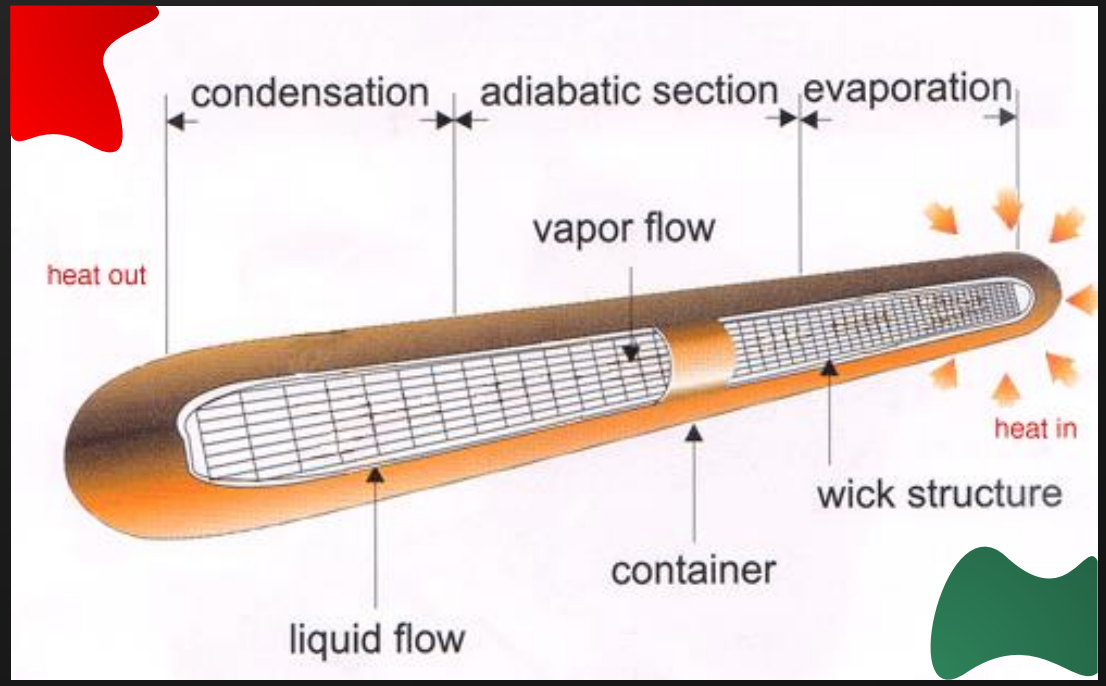
Mesh

Grooved



Sintered Powder

Composite



- Basic element of the heat pipe :
  - ✓ Container (closed and vacuum)
  - ✓ Wick structure (Capillary construction)
  - ✓ Working fluid
- Passive two-phase heat transfer
- High thermal conductivity
- Flexibility to be formed to fit geometries

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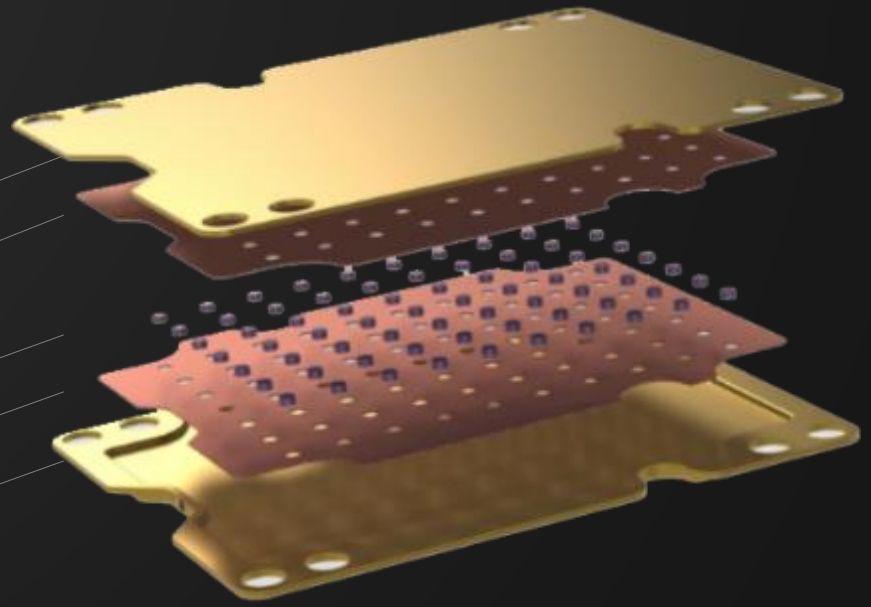
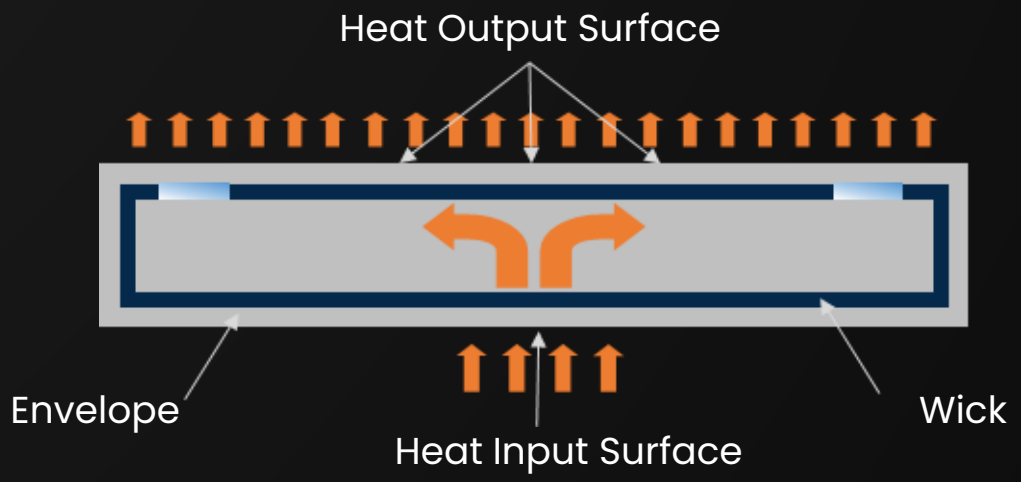
Vapor Chamber (VC)



Vapor Chambers or High Conductivity Plates are used to collect heat from larger area sources, and either spread the heat, or conduct it to a cold rail for cooling.

Vapor Chambers are generally used for high heat flux applications, or when genuine two-dimensional spreading is required.



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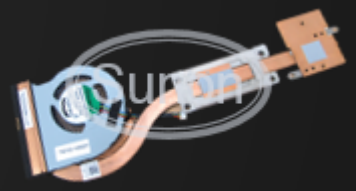
Heat Pipe



Vapor Chamber

Heat Pipe		Vapor Chamber
Suitable for long distance heat transfer	**Application**	Suitable for large heat flux, limit space and high power system
Round Ø2,Ø4,Ø5,Ø6,Ø8,Ø10 Flat, bent in customized direction	**Shape**	Customized in X and Y direction with pedestals
Min.0.4 mm	**Thickness**	0.4mm ~ 5mm
5W~95W	**Qmax**	40W~1000W
Additional fixture plate	**Fixtures**	Through hole in vapor chamber
Flexible in shape design	**Advantage**	Support high power system

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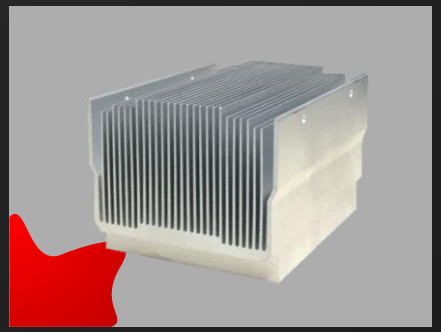
Heat Sink

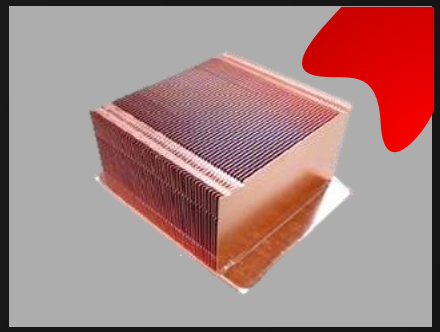


Extrusion Sink

01 EX , Mat'l : AL6061,AL6063
K : 151~201 (W/m.K)

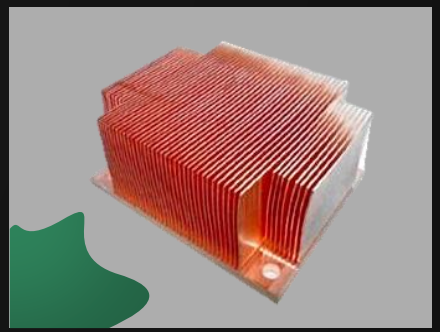
Die Casting Sink

02 EX , Mat'l : ADC12,ADC10
K : 96 (W/m.K)



Stacked Fin Sink

03 EX, Mat'l : AL1050,C1100
K : 209, 391 (W/m.K)



Skived Fin Sink

04 EX , Mat'l : AL6063,C1100
K : 201, 391 (W/m.K)

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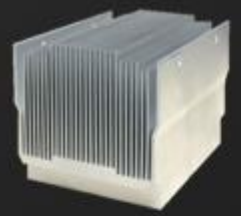
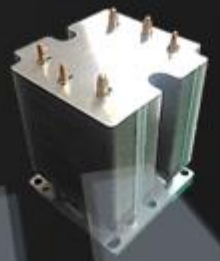
Thermal Solutions



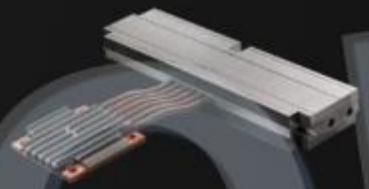
- 100W
- Extrusion Fin
- Die Casting Fin
- Forge/Skived Fin
- Stacked Fin

【Traditional】
Heat sink solution



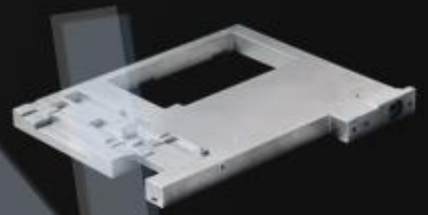
- 100W – 400W
- Heat Pipe
- Vapor Chamber
- EVAC

【Enhanced】
Phase-changed solution



- 400W – 1000W
- High Power HP
- Vapor Chamber (3D)

【Advanced】
Cooling solution



- 1000W +
- Cold Plate
- Immersion Cooling

【Liquid】
Cooling solution

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High Power Cooling Module

High capability of delivering heat energy

POWER

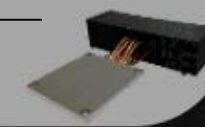
R=0.08 ℃ / W at 80CFM

Size:360 x 345 x 36 mm HP: D8x10pcs

950W

R=0.055 ℃/W at 240CFM

Size:360x320x85 mm
HP: D8x10pcs



800W

R=0.08 ℃/W at 160CFM

Size:180x175x30 mm HP: D8x5pcs

600W

R=0.036 ℃/W at flow rate 1L/min

Size:120x78x13.7 mm (Liquid cooling)

400W

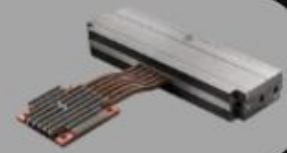
250W

R=0.16 ℃/W at 30CFM

Size:183 x 160.5 x 24.7 mm
HP: D5x6pcs

R=0.06 ℃/W at 100CFM

Size: 286x266x40 mm HP: D8x6pcs



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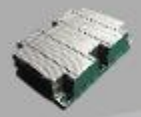
INTEL Server CPU Solution

2018 – 2019

Skylake
Cascade Lake



1U 165W
R 0 . 259 °C/W
Airflow : 11.4 CFM

2U 165W
R 0 . 187 °C/W
Airflow : 21.5 CFM

Immersion
205W
R 0 . 047 °C/W

2020

Cooper Lake
Ice Lake

1U 165W
R 0 . 228 °C/W
Airflow : 12 CFM

2U 205W
R 0 . 138 °C/W
Airflow : 22 CFM

EVAC 270W
R 0 . 16 °C/W
Airflow : 30 CFM

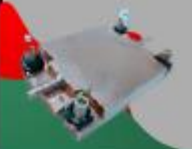
2021

Sapphire Rapids

1U 205W
R 0 . 225 °C/W
Airflow : 11 CFM

2U 300W
R 0 . 128 °C/W
Airflow : 27 CFM

EVAC 450W
R 0 . 07 °C/W
Airflow : 130 CFM



Cold Plate 600W
R 0 . 036 °C/W
Flow Rate: 1 l/m

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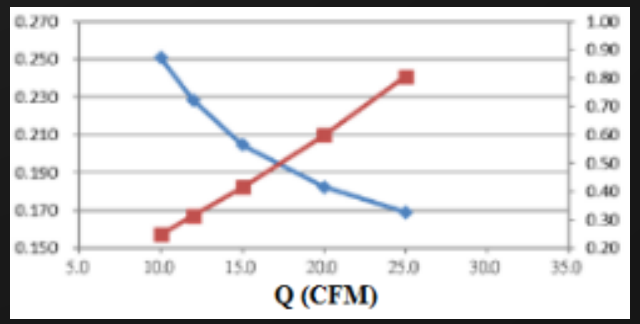
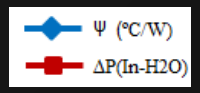
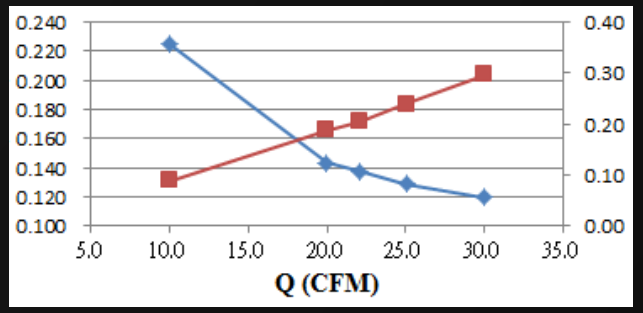
Ice Lake Solution

165W → **205W**





205W → **300W**



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Applications

Netcom & Serveur	3C • Computer • Communication • Consumer	Automotive	Industry	Medical
Telecom	Entertainment	Energy	Home & Office	Lighting

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Netcom Telecom

SUNON disposes a vide range of cooling modules to netcom and telecom applications.

Active Cooling

Passive Cooling

Cold Plate

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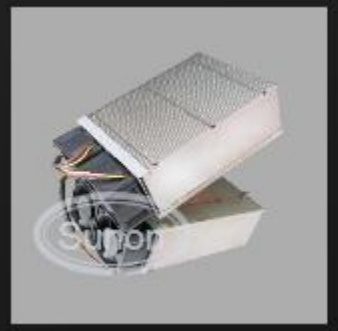
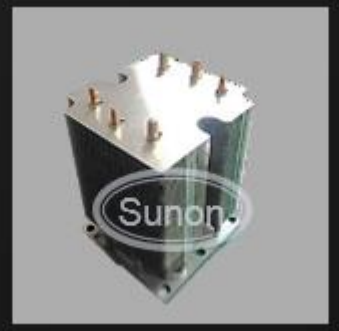
Industrial PC

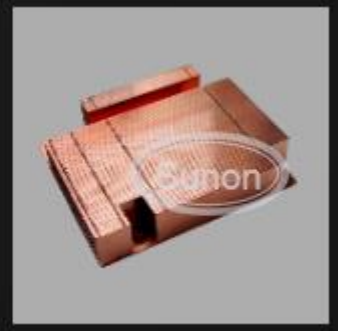
SUNON disposes a vide range of cooling modules to Industrial PC applications.



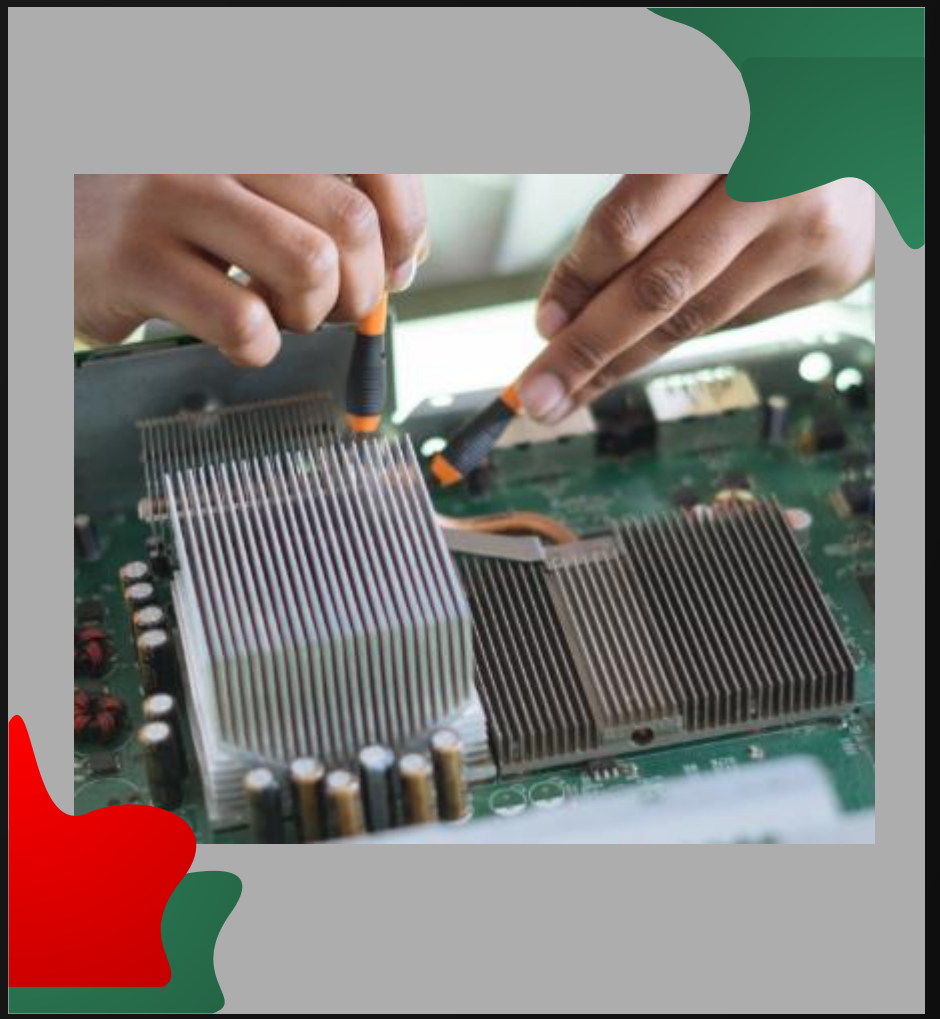
Active Cooling



Heat Pipe



Vapor Chamber



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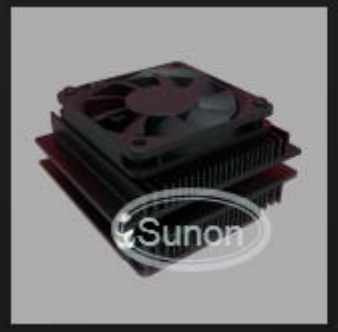
3C Products

Computer & Communication & Consumer

SUNON cooling modules are widely used in computer, communication and consumer products.



Active Cooling

Passive Cooling

Heat Pipe

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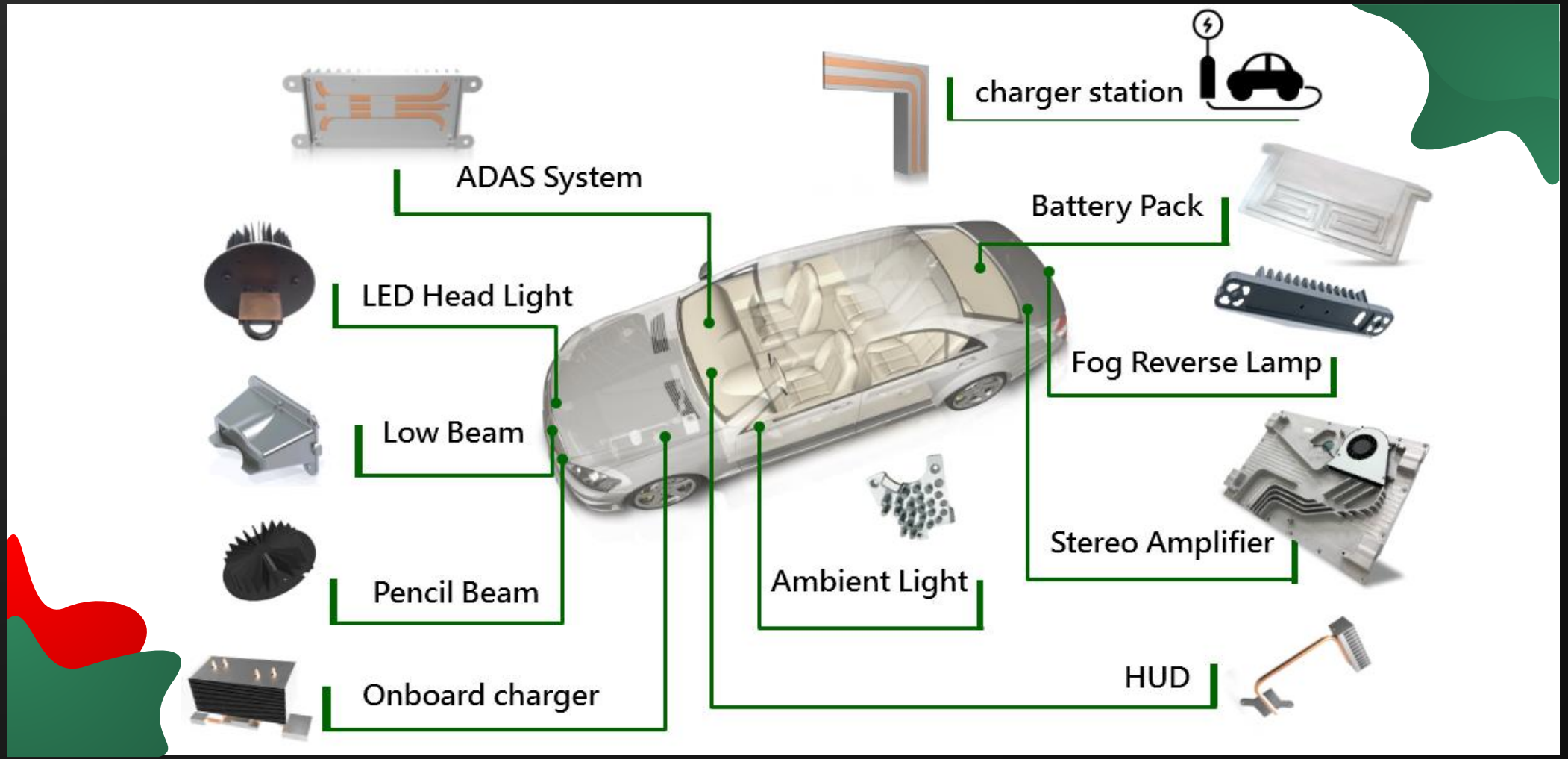
Automotive



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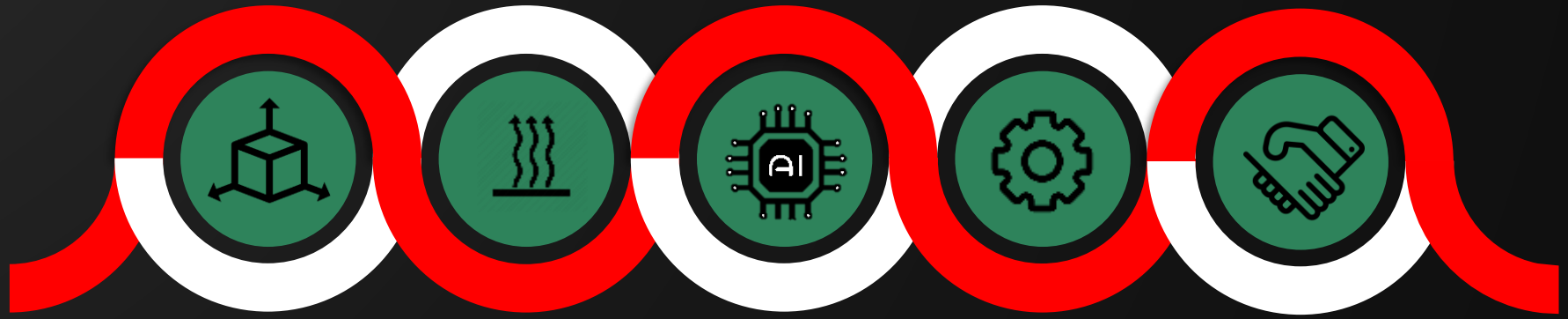
Project Requirement

1 Dimension

- Design Space
- Location

2 Limitation

- Passive / Active
- Weight
- Oration



3 Heat Source

- Power
- Location / Size
- Thermal Target (Ta, Tc)

4 System

- 3D (stp)
- Air Flow(CFM)

5 Business info

- Application
- EAU
- Target Price
- Schedule
- Competitor

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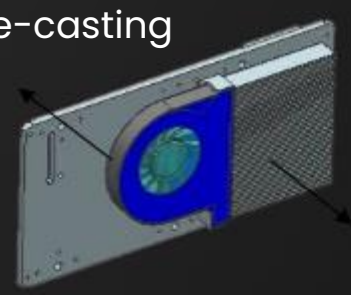
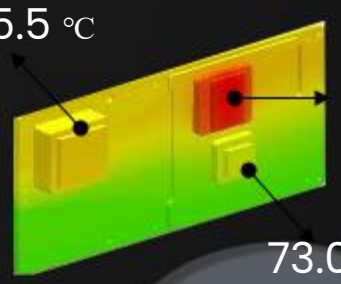
High-Efficiency Transfer Heat

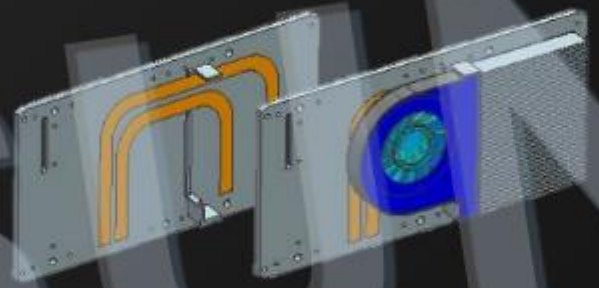
Original

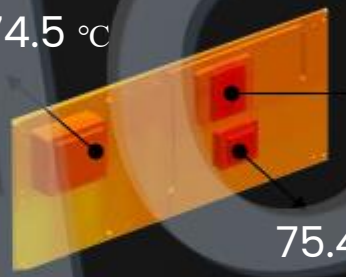




6% Improved

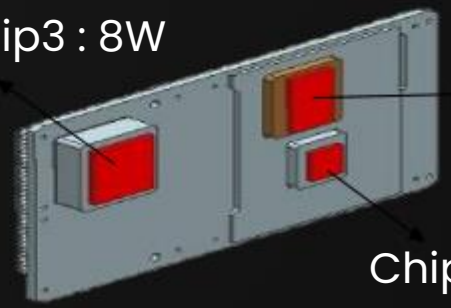
New Solution





CONDICTION

- Power Watt: 40+6+8, total 54W
- Module Size: 200x100x20mm
- Ta: 50℃
- Tc: Chip1 <80℃, Chip2&3 <110 ℃



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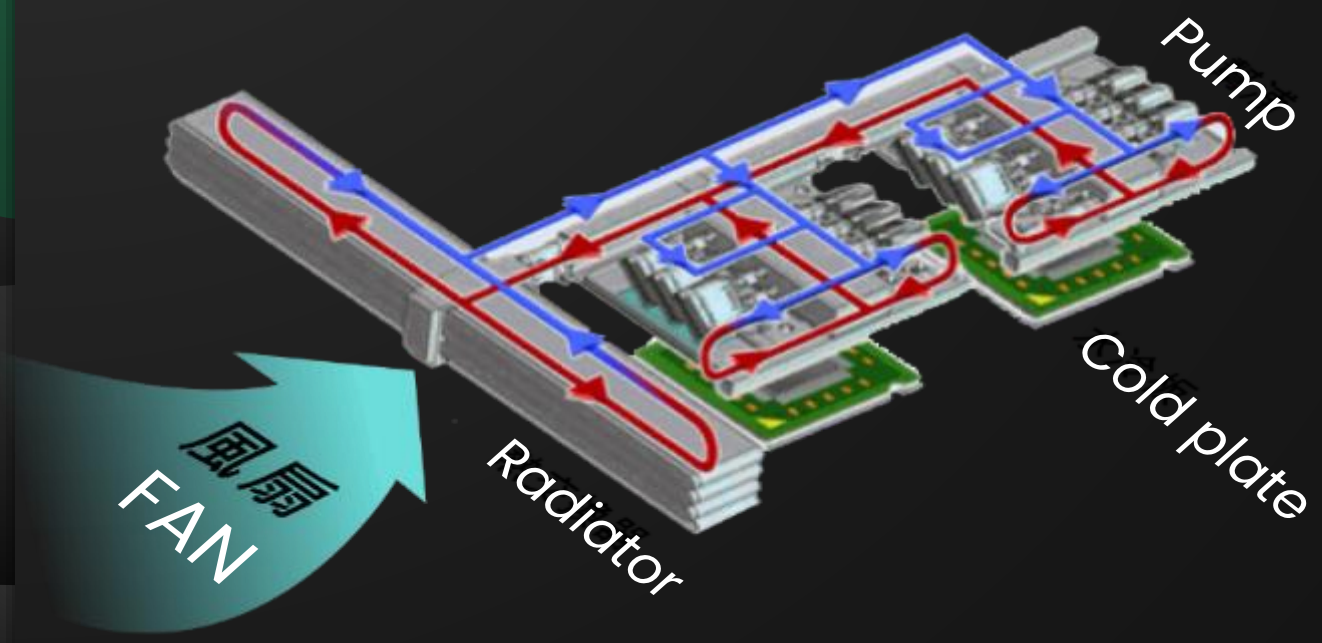
What is the Liquid Cooling System?



A liquid cooling system is a technique used to keep a device's temperature low using water as the cooling medium.

This cooling mechanism provides efficient cooling and helps to minimize the noise.

Liquid cooling systems transfer heat up to four times better than an equal mass of air. This allows higher performance cooling to be provided with a smaller system.

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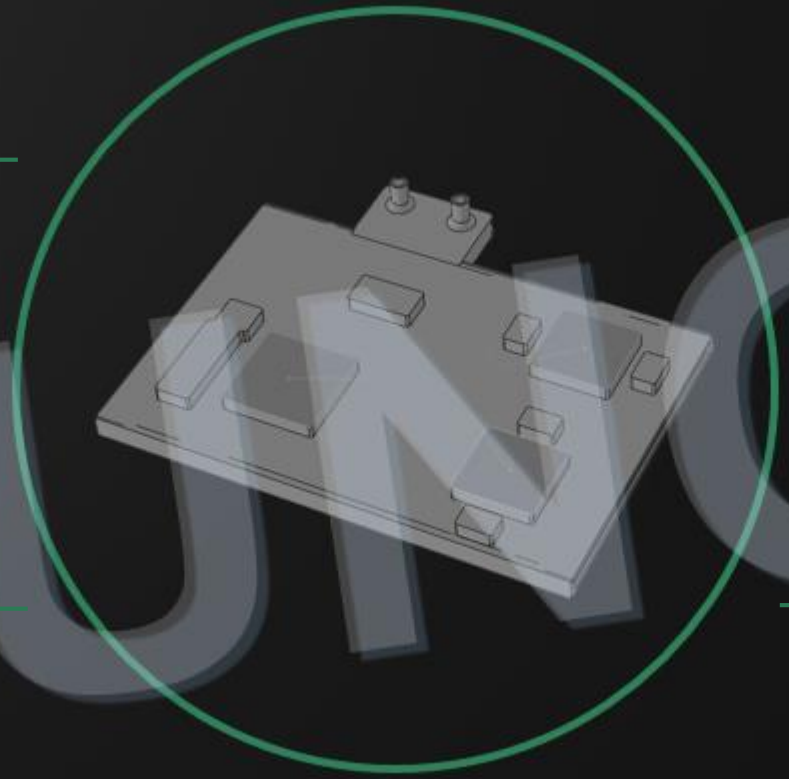
Cold Plate Advantage

Multi Heat Sources

High Power Density



Large Power

Integrated Solution

Thermal Efficiency

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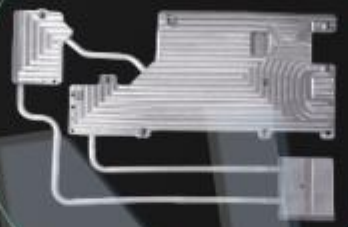
Cold Plate Types

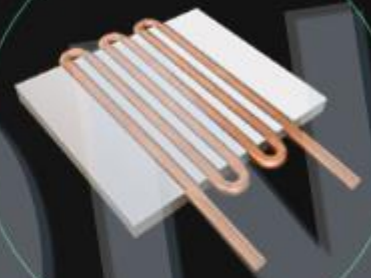
Integral Type

The water chanel and HEX Fins are integrated in one piece



Pipelining Type

The water channel is made of aluminum tube and brazed to the cold plate



Embedded Type

The copper tube is embedded in the aluminum base plate

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HEX Fins Types

CNC

The HEX Fins can be flexibly produced by different shapes via CNC processing

Skived Fins

The skived fins are one of the design options as per the thermal requirement

Folded Fins

The Folded fins are also one of the HEX Fin design options

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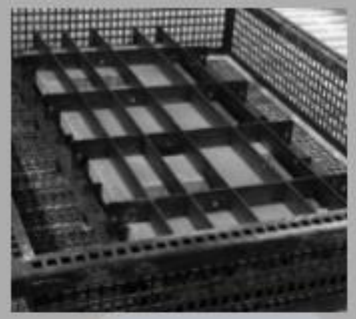
Brazing Technology



Vaccum Brazing

❖ Vacuum Brazing

Vacuum brazing is a precision brazing technique used to join critical assemblies, many of which employ delicate or intricate features.

❖ FSW (Friction Stir Welding)

Friction stir welding (FSW) is a solid state joining process that uses frictional heat generated by a rotating tool to join materials.

FSW (Friction Stir Welding)

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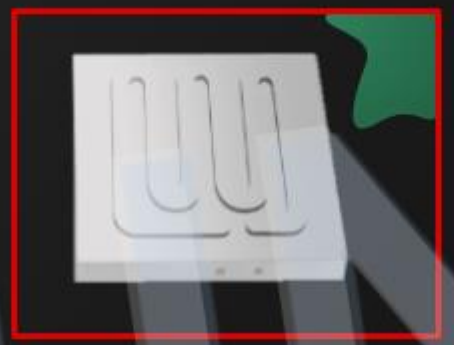
FSW (Friction Stir Welding)

Metal Plate
(Cu/Al)

01



CNC
the plate
to have the
runner

02

Put on the cover

03

Use the FSW to
brazing the cover
and plate

04

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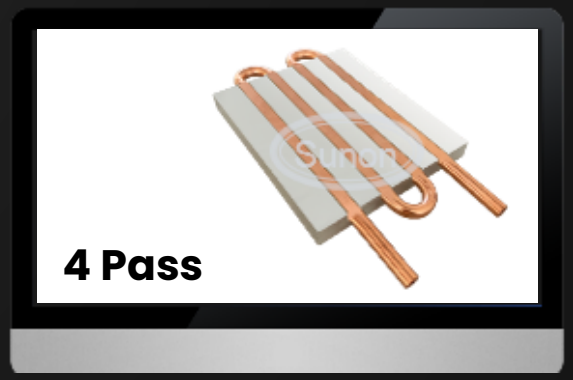
Industry Application

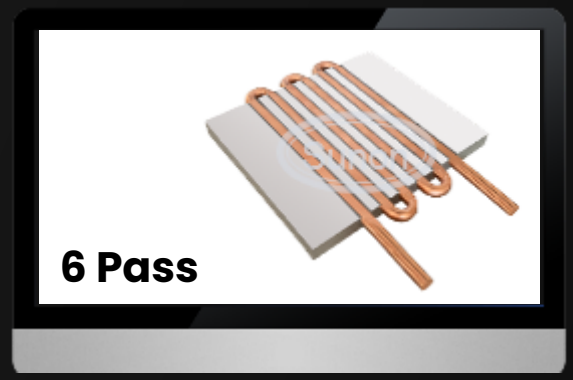
Power Watt : 500W

Size : 133.4*57.2*15.6mm



Power Watt : 1000W

Size : 228.6*127*16.8mm



Power Watt : 1000W

Size : 233.4*177.8*15.6mm

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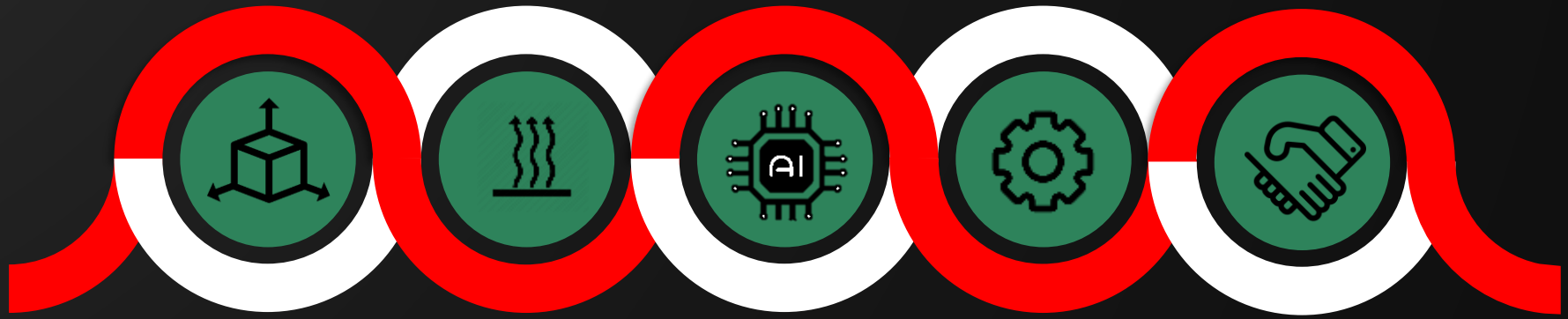
Project Requirement

1 Dimension

- Design Space
- Location

2 Limitation

- Passive / Active
- Weight
- Oration



3 Heat Source

- Power
- Location / Size
- Thermal Target (Ta, Tc)

4 System

- 3D (stp)
- Flow Rate
- Tinlet / ΔT
- Parameters
- Pressure Drop

5 Business info

- Application
- EAU
- Target Price
- Schedule
- Competitor

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Thank You

For more information please contact your local SUNON sales office or visit sunon website www.sunon.com