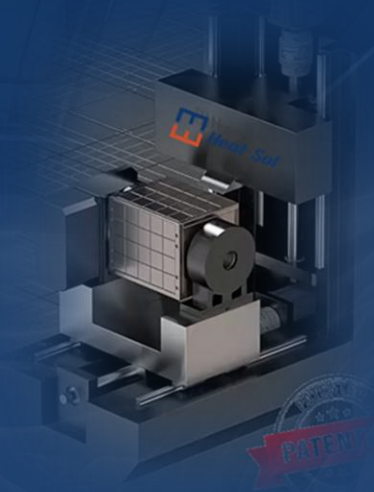
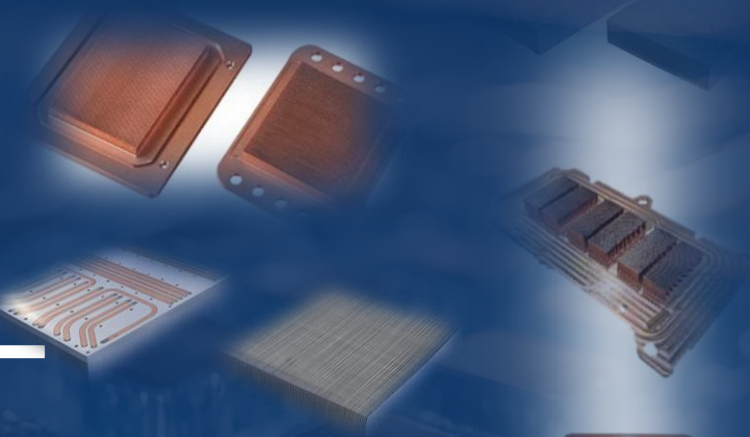


HEAT-SOL

SOLUTION FOR HEATSINK INNOVATION



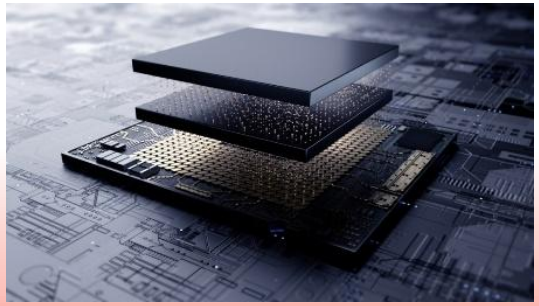
A specialist that creates ultra-fine cooling channels by using Skiving's forming technology

to maximize heat dissipation management from the heat-generating electronic devices in a limited space

Heat-Sol

A Growing Market Needs

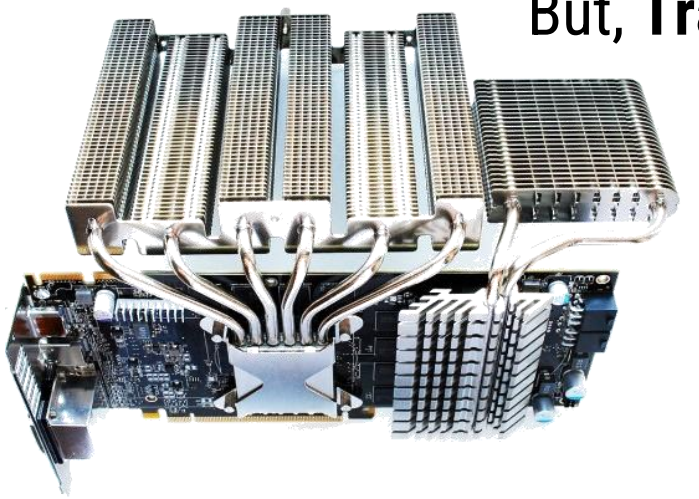
High Power → High Density → Compact → Light weight



Recently, electronic devices used in automobiles, electrical & electronic fields are required to be lighter, smaller, and more multifunctional.
As these electronic components become more highly integrated, more heat is generated.

Problem, Needs(Why?)

Heatsinks are the most important consideration for electronic products.



But, **Traditional heatsinks** have their limitations.

Simple, Compact & Slim, light weight, cost down,

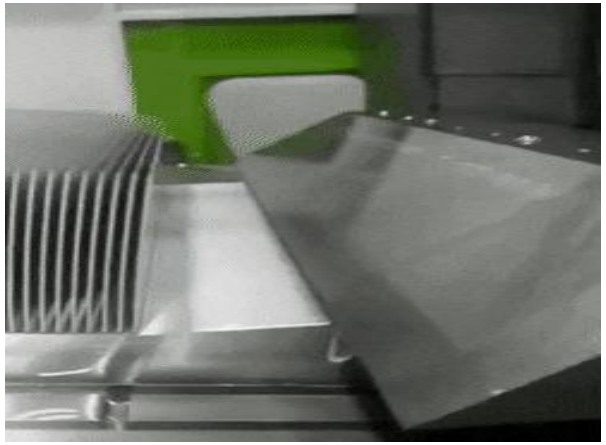
High thermal performance

HEAT SINK MARKET

7.5%
YEAR-ON-YEAR GROWTH

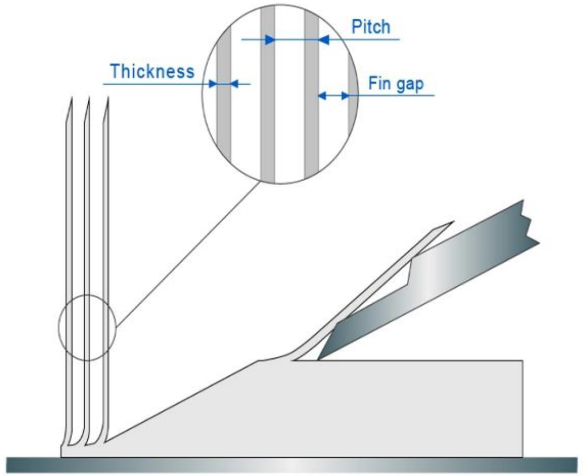
$11.8 Billion
in 2030

Precision Fin Skiving



Skiving heat sink manufacturing technology is a unique /most advanced metal forming process, made from a single block of material such as copper or aluminum suitable for high-power and precision heatsinks.
Using a precision-engineered blade tool with precise control, thin slices of specified/designated thickness are cut and then bent upward into an upright state to become heat dissipation fins at regular intervals that provides superior thermal conductivity, processibility and productivity offering 15~10% higher thermal efficiency compared to conventional heatsink

- Pure Copper C11000 (390-400 W/m-K): for high-conductivity and cost-sensitive applications.
- Pure Aluminum 1060/1070 (230-240 W/m-K): cost-effective solution with higher thermal conductivity.
- Skiving heatsink can avoid heat transfer loss due to integral structure(single solid block)
- It can have narrow pitch fins allowing larger surface area for maximizing heat dissipation
- High efficiency and performance enable compact/lightweight designs and cost savings for whole system
- ✓ High design flexibility to the needs of any design offers for products with 15-20% higher heat dissipation
- Tooling cost is minimal as only a sharp blade is used
- **Eco-friendly**(ESG value added) process due to low-waste processes and recyclable materials, no welding



Step #1 : Prepare “aluminum or copper raw material”, Inspect materials for surface defects, check dimensions according to drawing, place on the worktable & fix it
Step #2 : Set up the parameter on the control board and set the sharp & accurately controlled blade tool (blade alignment based on material and desired fin dimensions)
Step #3 : First shaves the solid block into thin slices in designated thickness and then lifts each individual fin vertical to the base simultaneously
Step #4 : Use Gear cutting machine dissects the Skiving material and cuts it to a designated length
Step #5 : After cutting, Skived heatsinks have sharp edges, scraps, and burrs. The gear generating grinder mills them out to smooth the surface and control product height.
Step #6 : Inspect fin thickness, height, spacing and uniformity

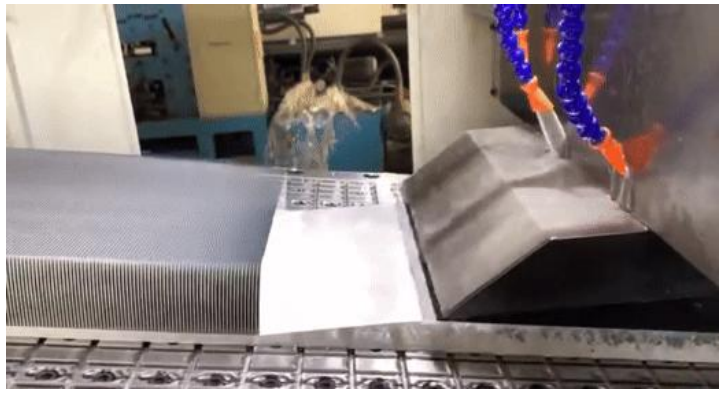
❖ Skiving heatsink process offers seamless integral structure of base and fins(No assembly, Welding,
❖ To prevent oxidation and corrosion, Surface Coating(anodizing, plating) is often used.

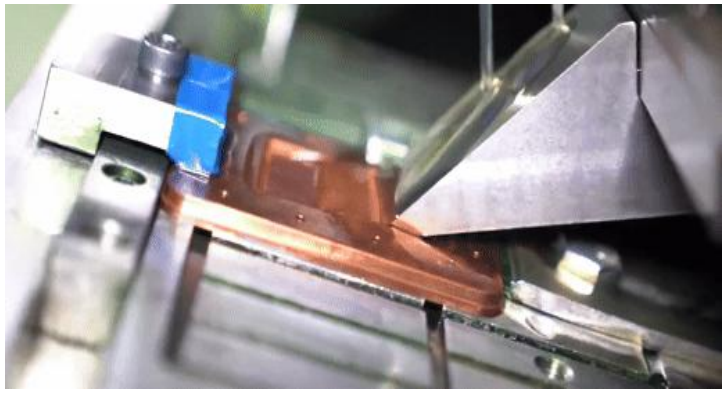
Advanced Cooling solution

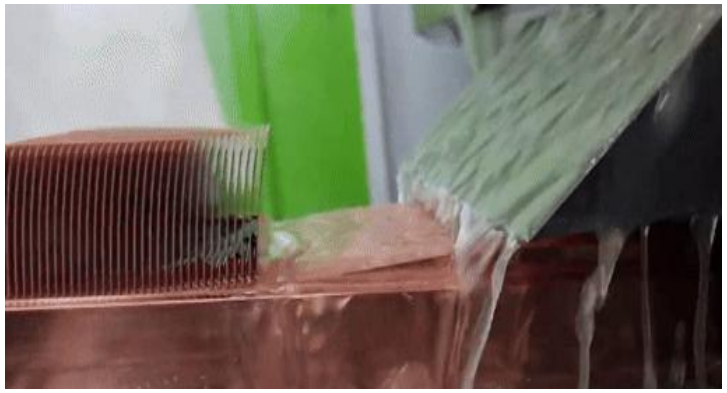
Heat dissipation performance is proportional to the surface area of the heat sink.

Skiving fabrication is a new and highly reliable technology that maximizes surface area.

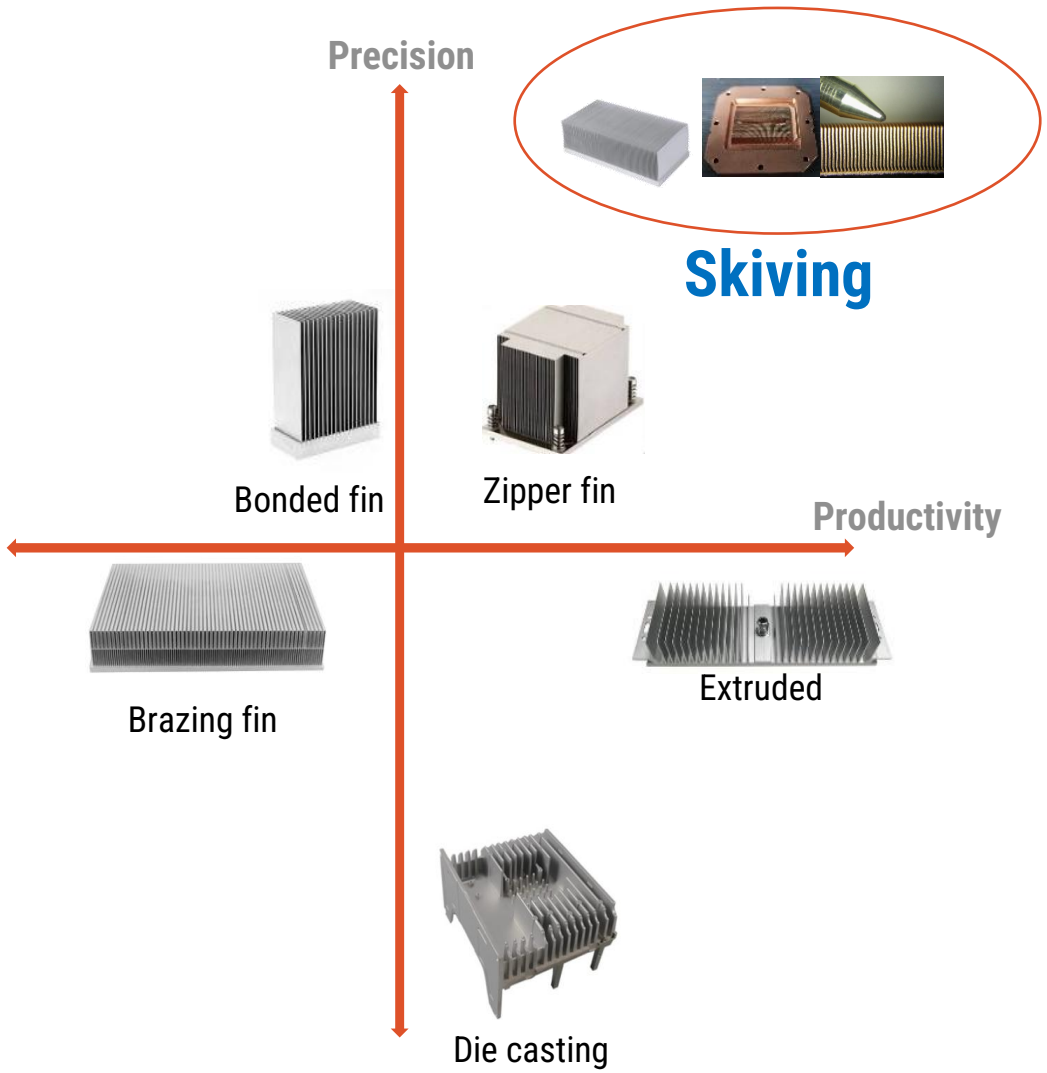
High productivity	Ultra-fine Fin	Scalability
Only 3sec per 1 fin!!	**50um thick !!** **Very thin fin**	Widening the usage of Copper

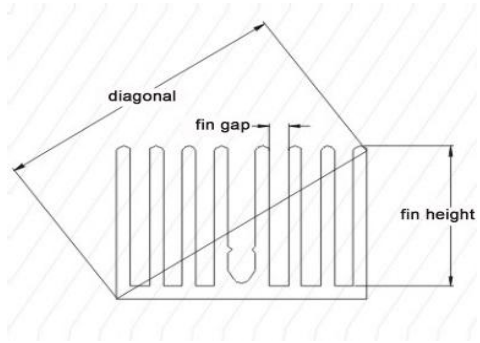
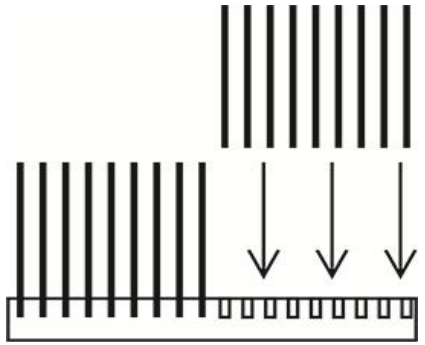
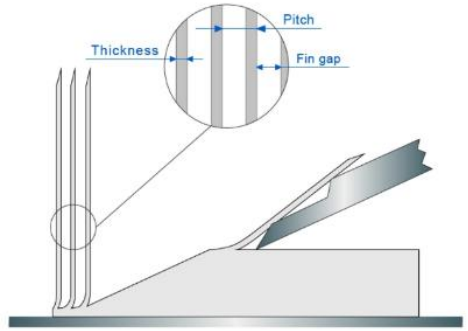
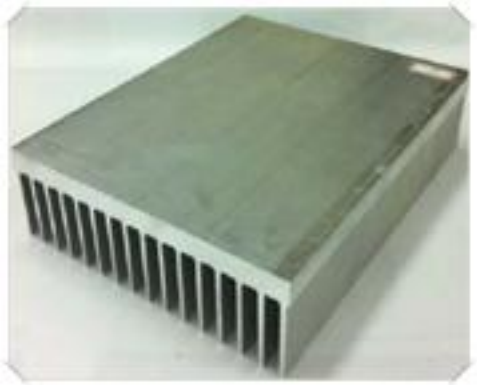
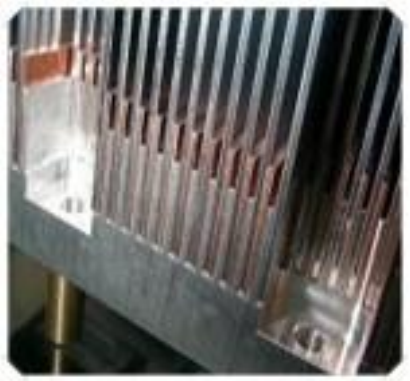
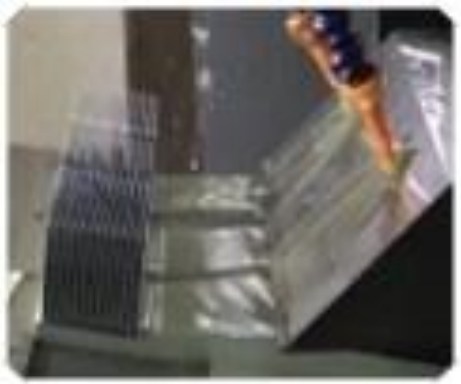




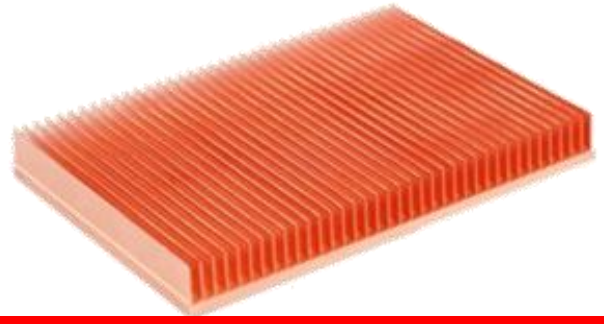
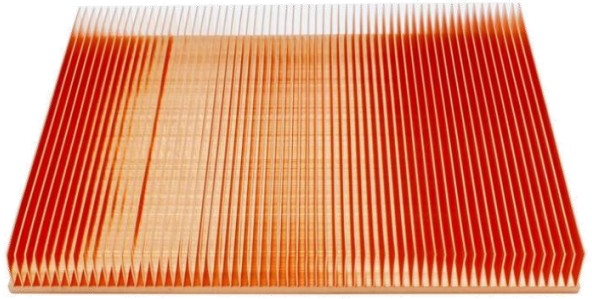


Competitive Position



Extruded Heatsink	Bonded Heatsink	Skived Heatsink
		
		
Cost-effective for M/P Limited Dimension High Initial Molding Cost Low Thermal Conductivity	Large Applications High molding cost High production Cost Contact resistance	Ultra-Thin Fins High Fin Density Minimum Tooling Costs High thermal conductivity High Design Flexbility Directional Sensitive

For example..

Processing		Traditional Metod	Skiving Method(Same size)	Skiving Method (High performance)
Raw material	Thickness	 15mm	 7mm	 8mm
	Weight	1.4kg	0.6kg (57%↓)	0.7kg (50%↓)
Finished goods	No. of fin	 39fin	 39fin	 **101fin**
	Processing time	33min	2min (94%↓)	5min (85%↓)
	Surface area	100,390mm^2	100,390mm^2	220,320mm^2(219%↓)
	Product price	US$ 40~44	USD$ 21~25 (41%↓)	USD$ 27 (about 35%↓)
	Cooling performance	100	100	120~200(20%~100%↓ deponds on ΔT)
	Shape			

Same surface area

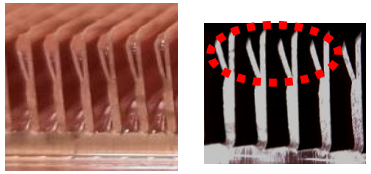
Maximize surface area

Sustainable Competitive Advantage

V-Fin

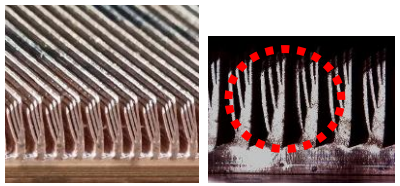
Suitable for forced air cooling

Y-Fin

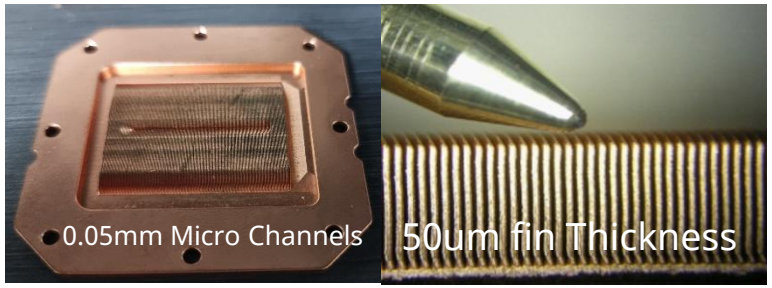


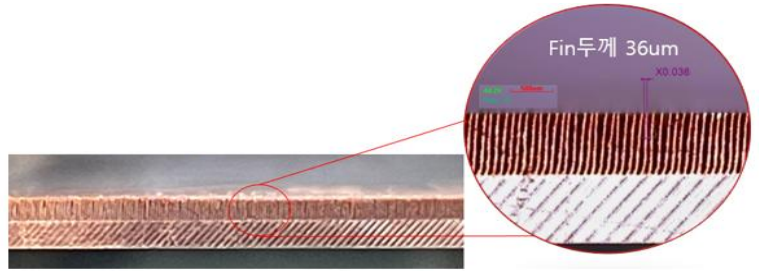
Suitable for Natural Convection cooling

Tree Fin



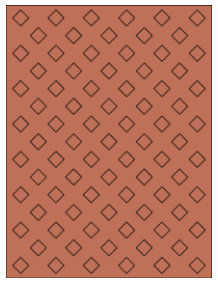
Suitable for forced water cooling





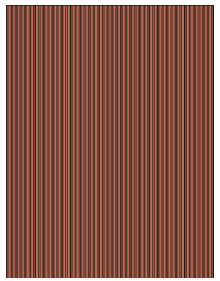
Sustainable Competitive Advantage

Pin-Fin

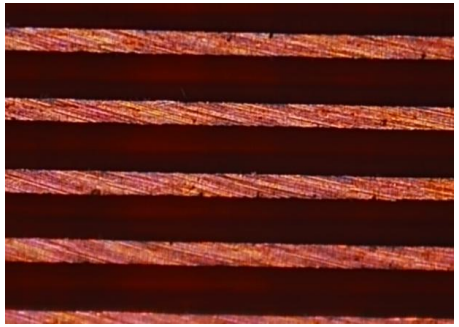


T	1.5	mm
P	3.3	mm
H	4.0	mm
Surface Area	4,076	mm^2
Volume	1,726	mm^3
Thermal Resistance	0.07984	℃/W

Skiving Straight Fin

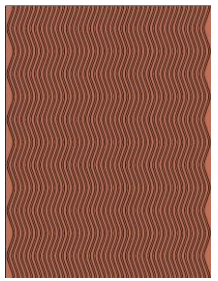


T	0.2	mm
P	0.6	mm
H	4.0	mm
Surface Area	15,406	mm^2
Volume	2,304	mm^3
Thermal Resistance	0.04404	℃/W

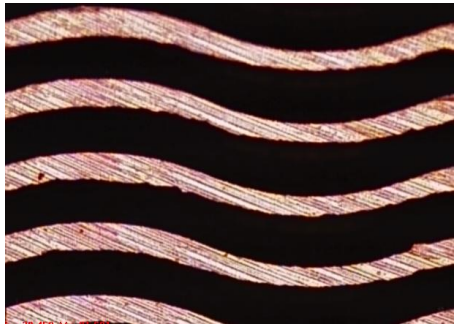


15x Actual (実測)

Skiving Wave Fin



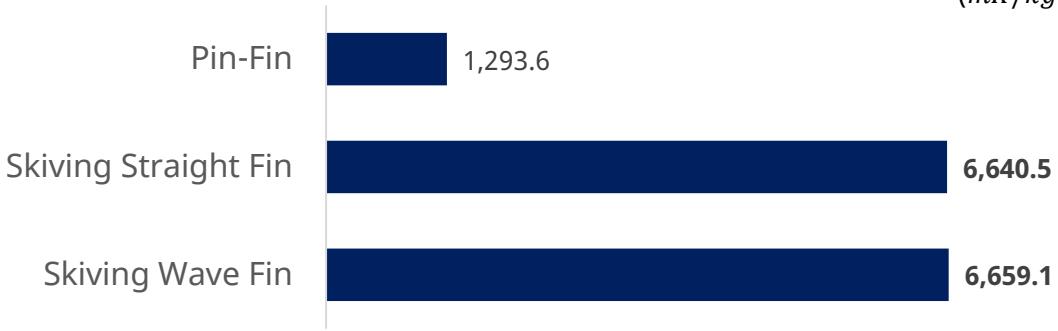
T	0.2	mm
P	0.6	mm
H	4.0	mm
Surface Area	15,339	mm^2
Volume	2,298	mm^3
Thermal Resistance	0.04384	℃/W



15x Actual (実測)

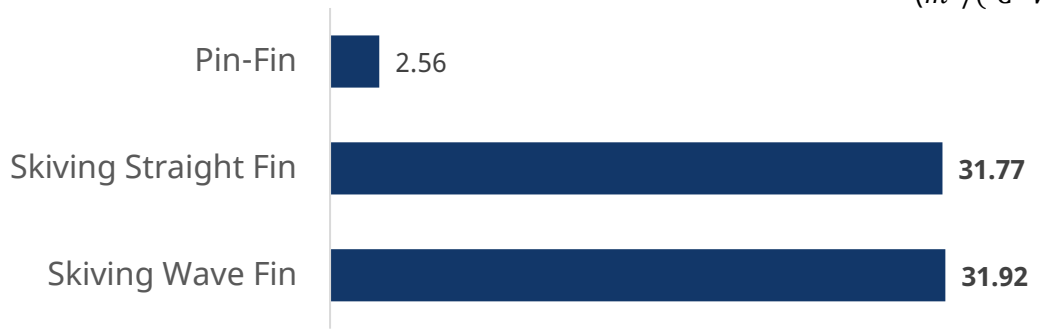
TPI (Thermal Performance Index)

$(mK/kg \cdot ℃)$



TEI (Thermal Efficiency Index)

$(m^2/(℃ \cdot W))$



PERFECT TEAM

Sunn, Baik

COO/PMP

19 years of experience
in QC/PM/Productions

James, Park

CEO

21 years of experience in R&D
Engineering Design

Brian, Shim

CMO/Sales director

19 years of experience
in power electronics sales

POWERFUL R&D MEMBER

JB, Lee

Senior Researcher

Completed Ph.D. program
in Environmental Engineering,
Native Chinese speaker

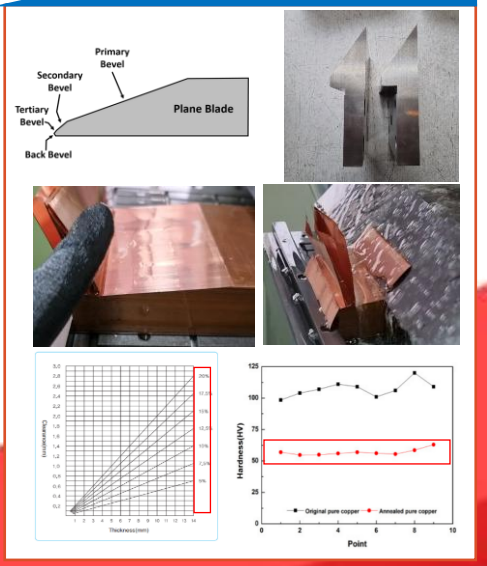
Smith, Hong

CTO

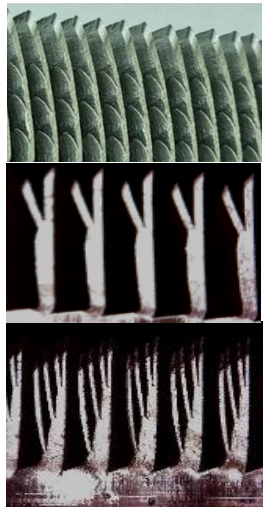
Master's degree in mechanical engineering,
Achieved Korean Government-approved
Machinery Processing & Electronics Skills

R&D Scale up

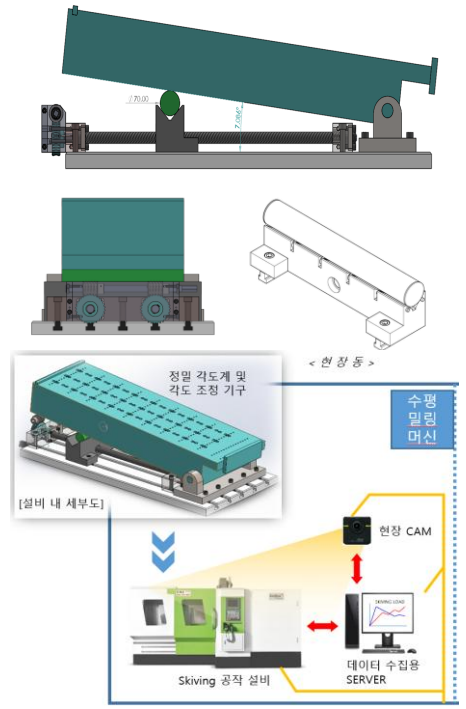
Heatsol leads the R&D of the skiving process & the only company specialized in root technology in Korea



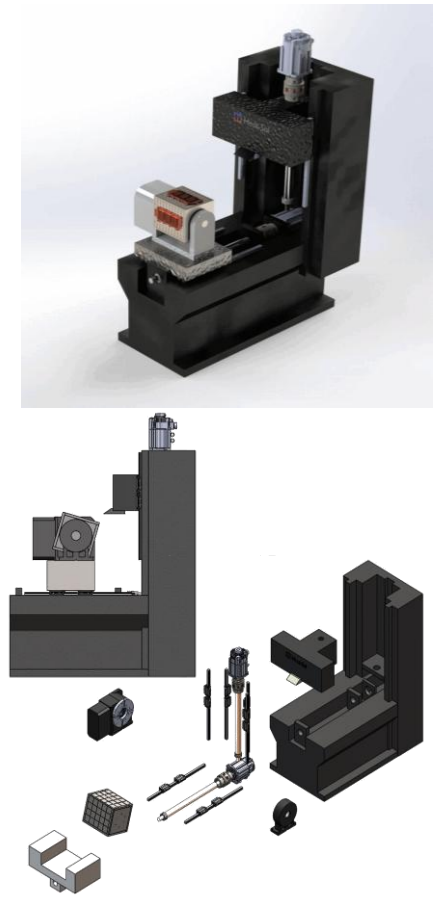
Processing technology research



Proprietary Special Shape & patent

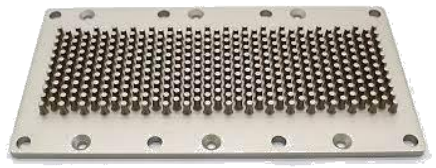


CNC machine improvement & Smart load

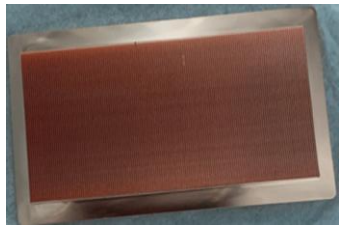


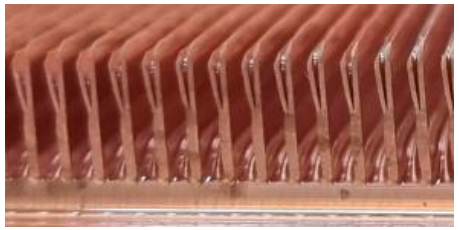
Initiation of Heat-Sol Equipment development

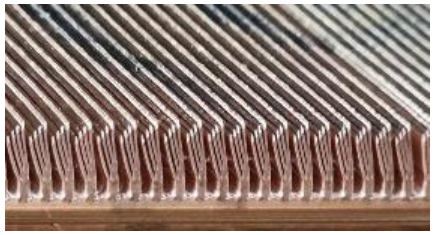
R&D Product Development Case 1

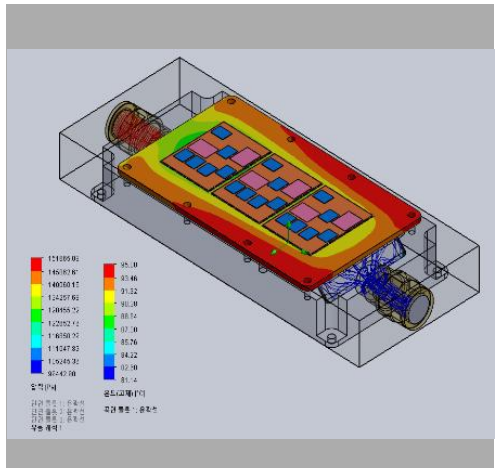


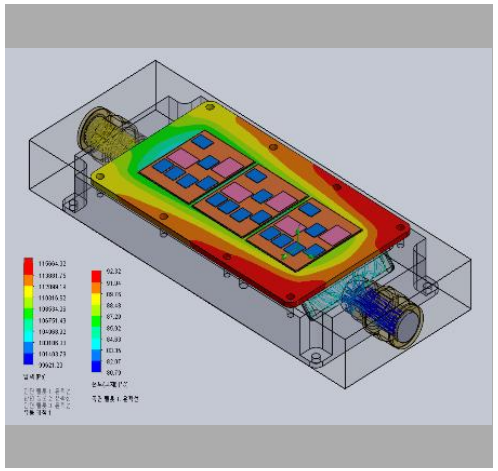
Pin-Fin

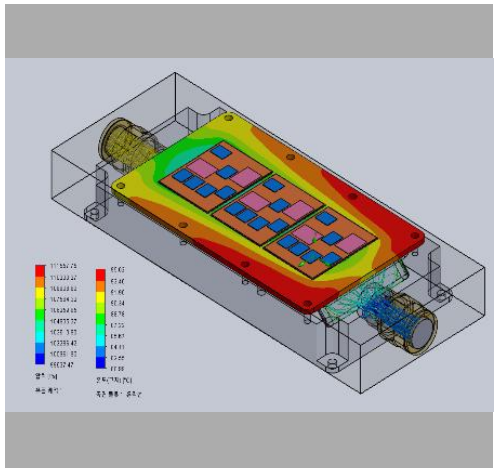


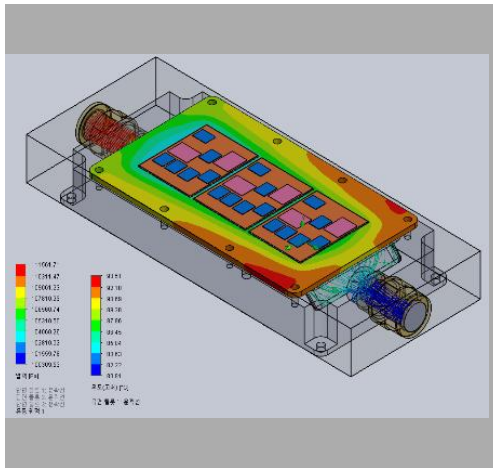












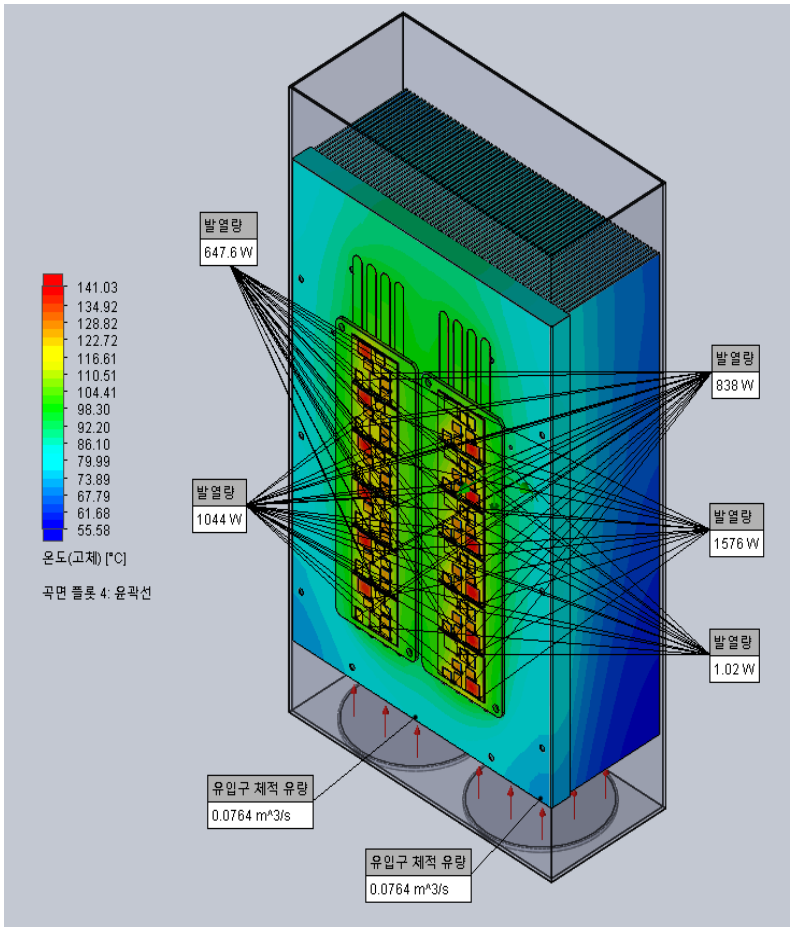
Pin-fin	V-fin	Y-fin	Tree-fin
100	106.8	106.4	107.4

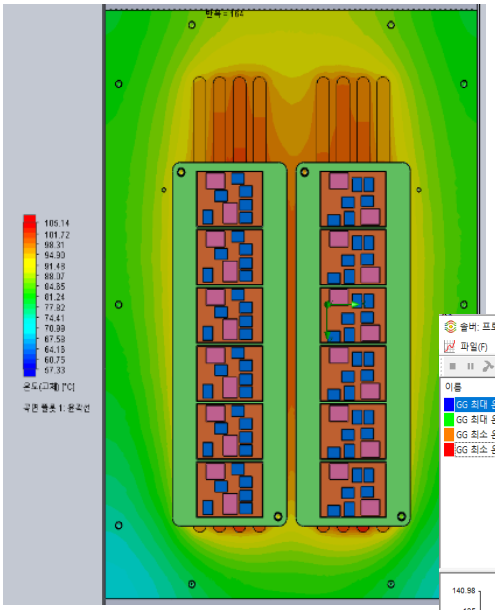
Heat-Sol

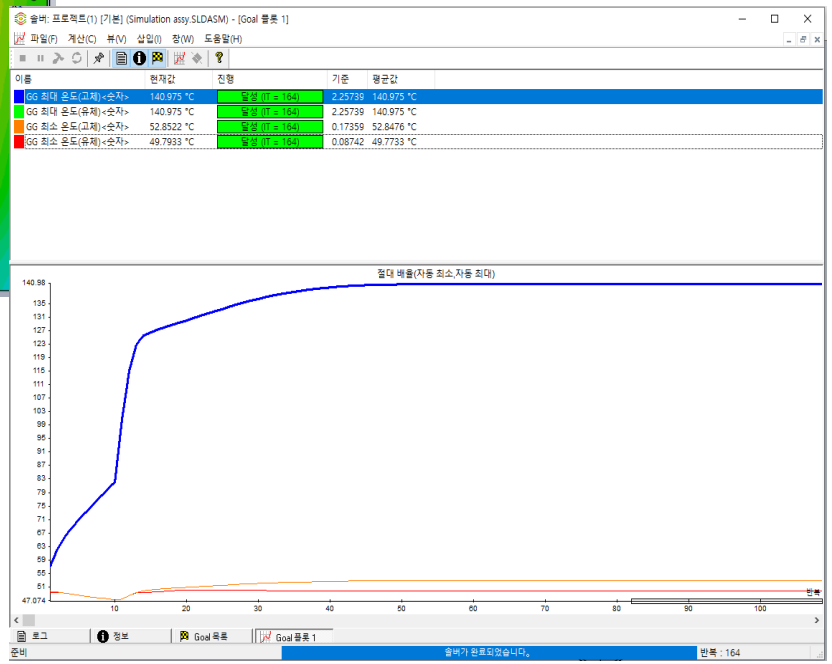
For the first time in the world, it succeeded in shaping it by skiving, and applied for a patent and design.
As a result of applying this to a water-cooled model of an electric vehicle inverter, it showed a better heat dissipation performance of about 7-8%. (Tree-fin)

R&D Product Development Case 2

Development of heat pipe press-fit skiving heat sink



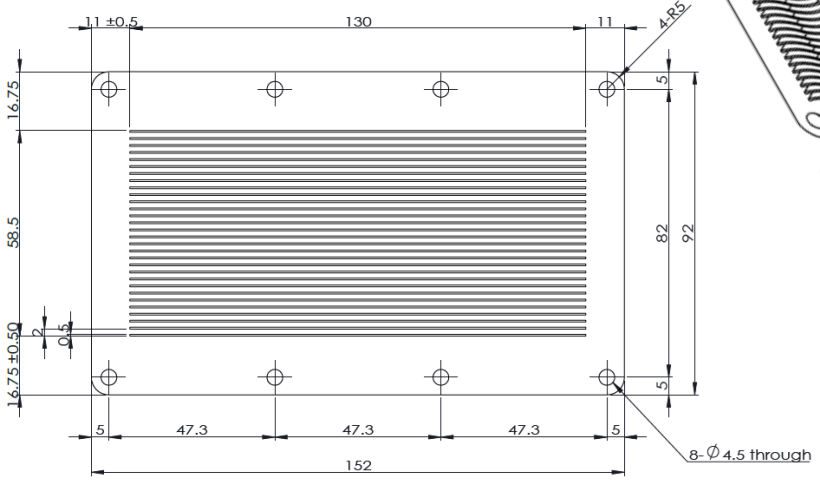




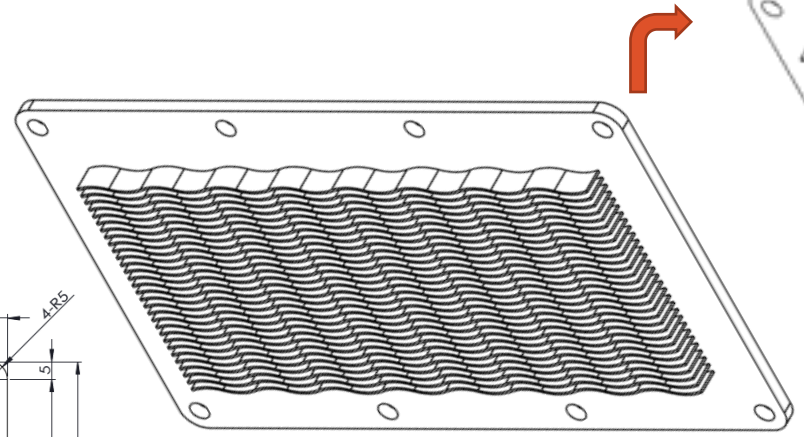
Heat-Sol provides thermal analysis through computational simulations based on long/profound/diverse experience

R&D Product Development Case 3

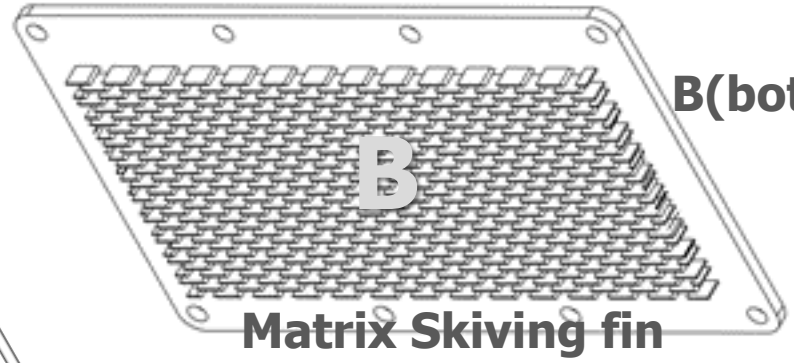
High efficiency water cooling module for power semiconductor device IGBT used in hydrogen fuel cell electric vehicles



Straight Skiving fin

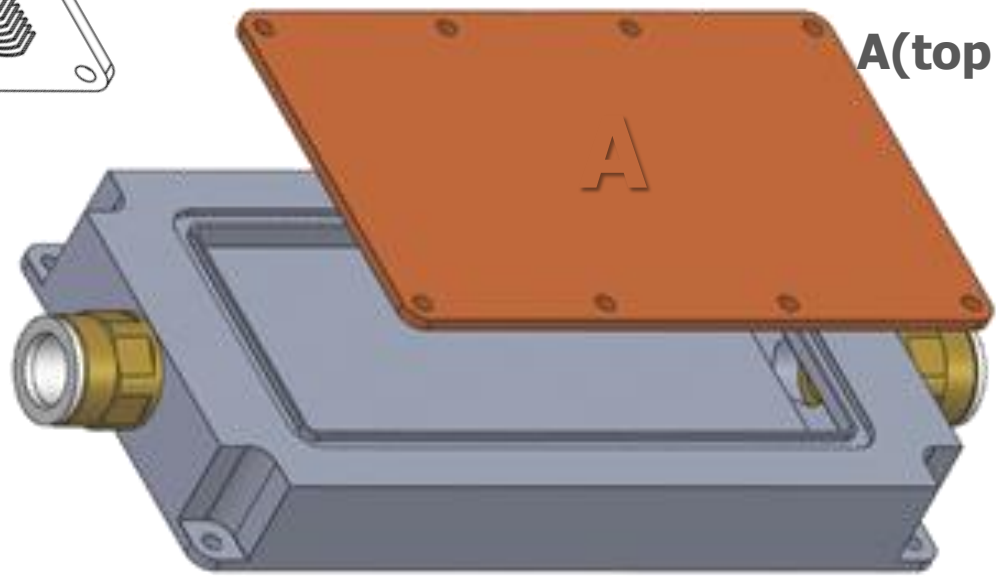


Wave Skiving fin



B(bottom view)

Matrix Skiving fin

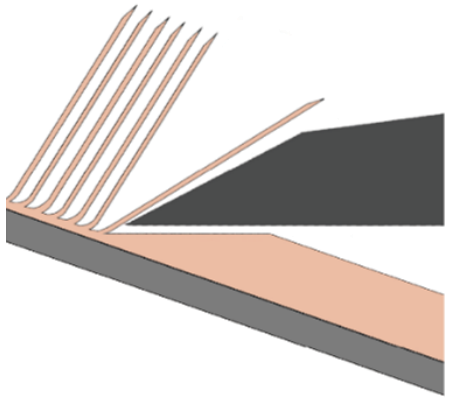


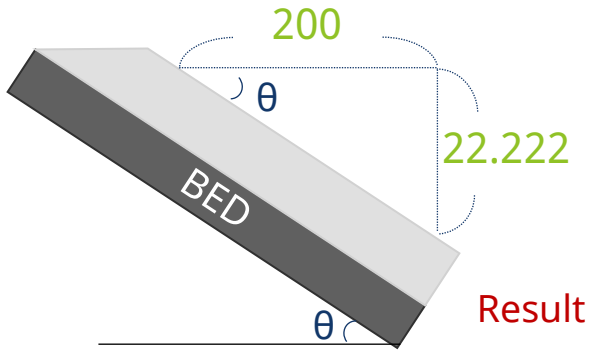
A(top view)

Heat-Sol is constinuously developing futuristic technology for efficient thermal management

R&D Product Development Case 4

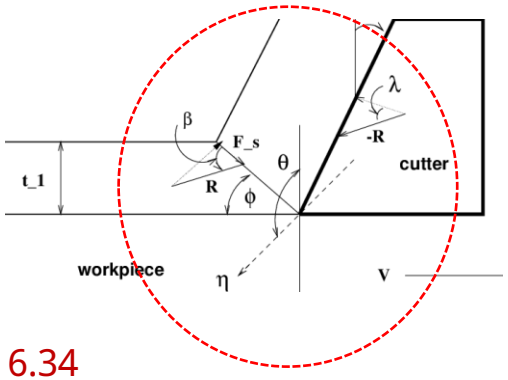
Development of the heat-sol's angle method
=> The core of the development and application of K-skiving equipment.

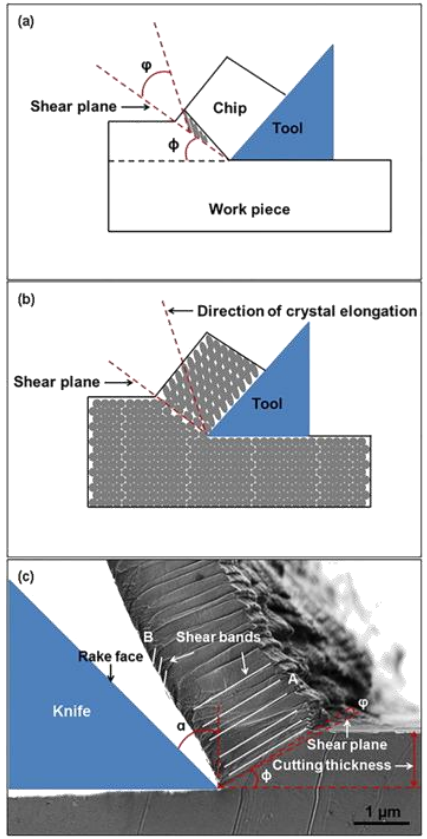


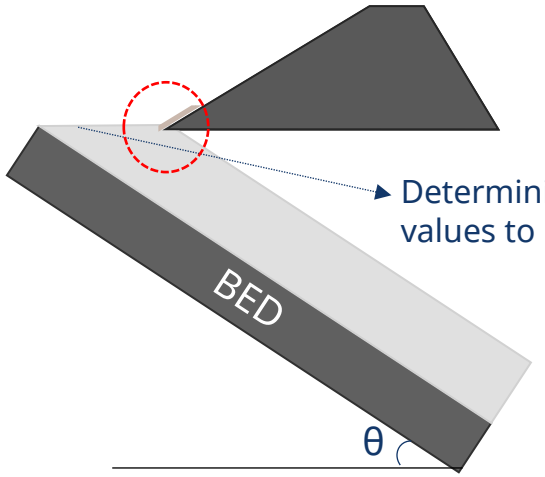


Result θ = 6.34

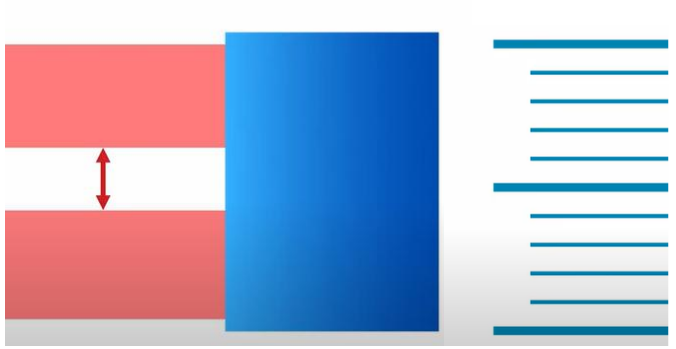
The angle is determined by the fin pitch, fin thickness and compression rate.







Determining the Y and Z values to create the vertical



By monitoring changes in thickness and pitch in a non-contact way,
With a resolution of 1/1000, it is possible to develop equipment for fine adjustment.

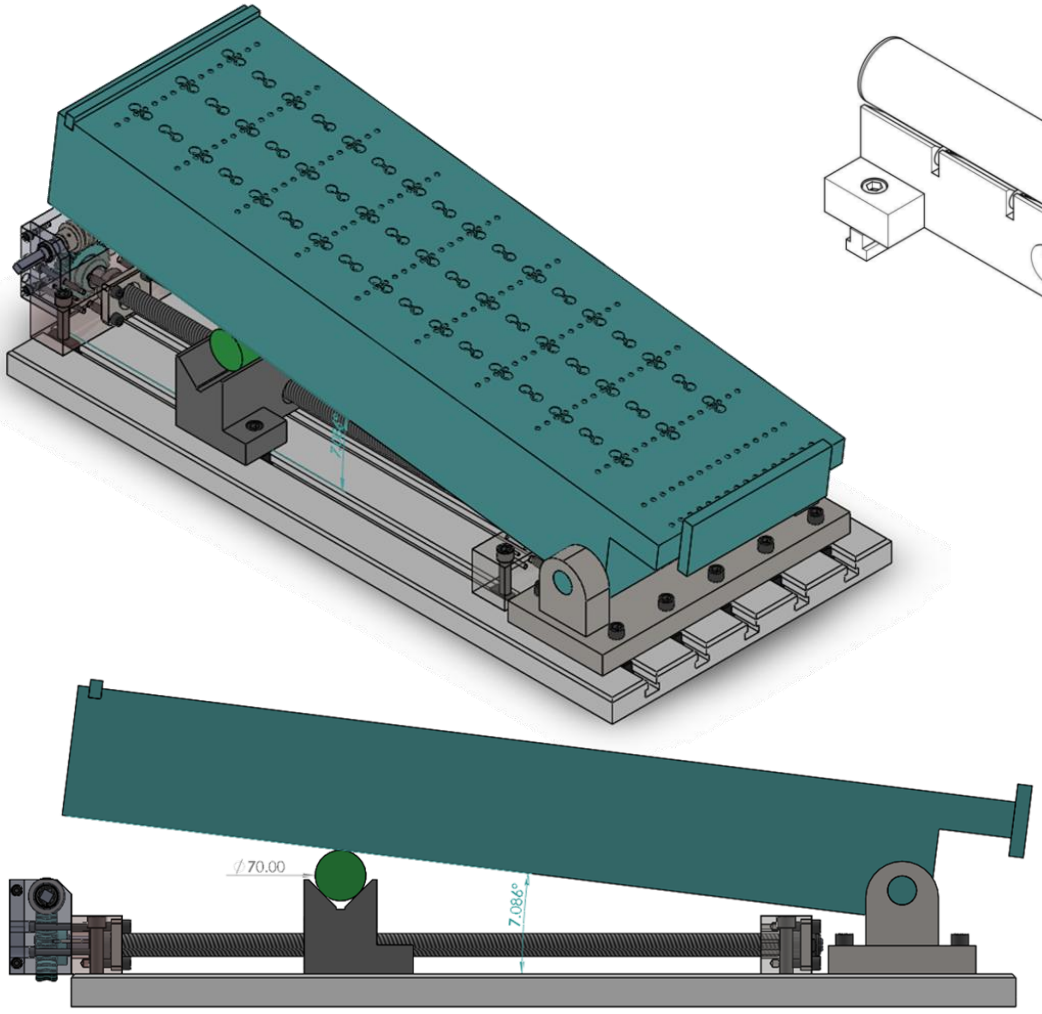
Automatic angle adjustment program logic can be designed!

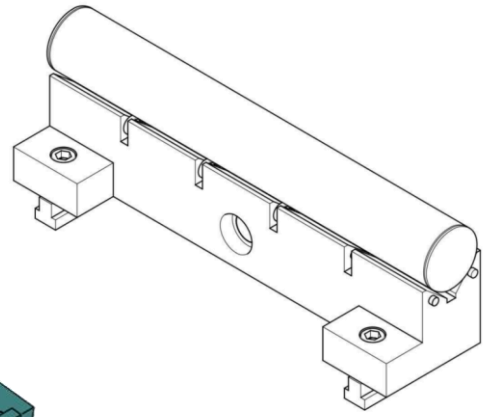
Heat-Sol

R&D Product Development Case 5

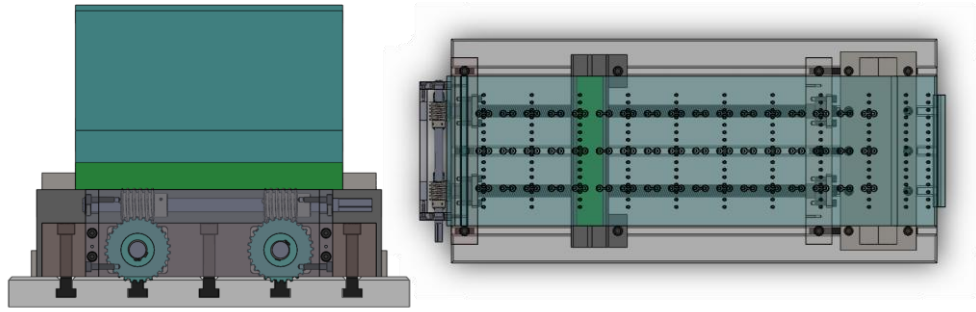
Heat-Sol's Skiving technology development

Skiving angle adjuster(Optional facility)



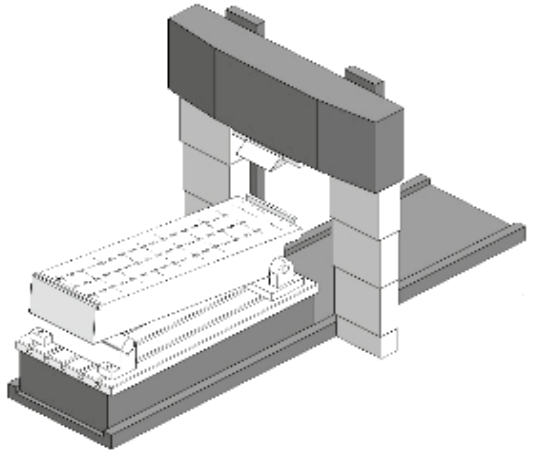


February 2023
Patent application, PCT application, design application completed

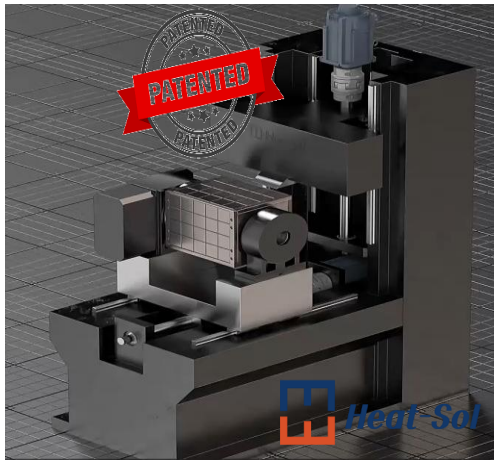


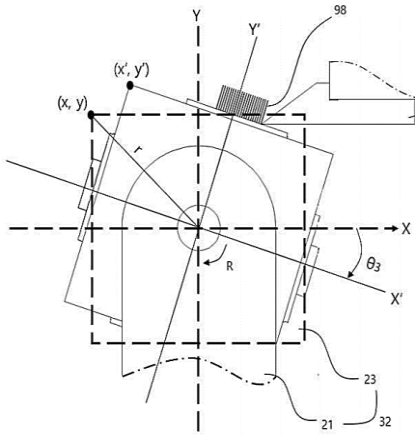
Heat-Sol provides an automatic adjustment device by the self-developed angle method as an option.

Advanced Smart K-Skiving CNC Launching *for 2026*



Existing equipment





Category	Existing equipment(China)	K-skiving CNC
Processing scope	5°≤θ≤18°	1.2°≤θ≤55°
Fin Thickness	Minimum ~250㎛	Minimum 40㎛

- Ultra-fine cooling channels can be implemented by expanding the slope of the bed.
- Special shapes and automation possible with bed rotation.
- Plans to add Smart monitoring & control system

June-25 — Final casting design for complete equipment

July-25 — Engineering alignment process & Technical demo session

October-25 — Design completed for high-speed/precision & multi-directional machining

November-25 — Complete mechanical core unit engineered for ultra-fine

March-26 — Final equipment assembly completed

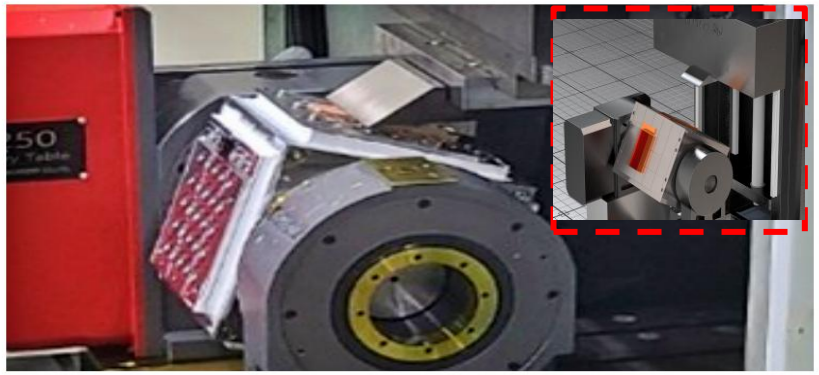
April-26 — Initiation of reliability & durability testing

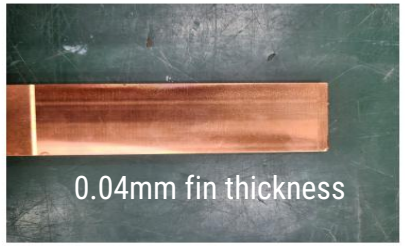
October-26 — KCs & CE certification acquired for global export

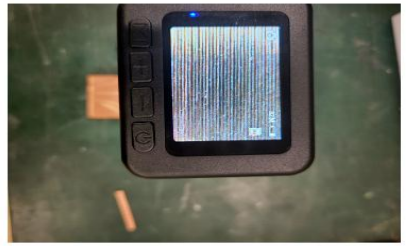
December-26 — Full-scale production readiness secured

Heat-Sol

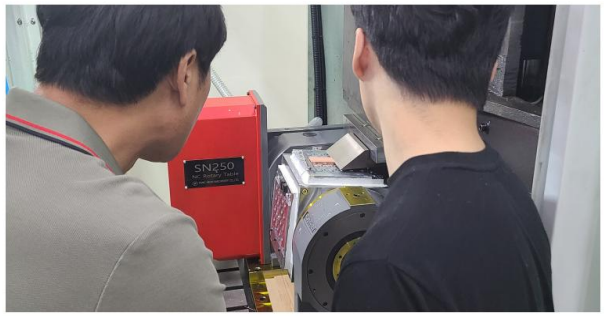

HCT 프로토타입 개발설비 시연회
주최 : 주식회사 히트솔
2025년 6월 13일 (금요일)
참여기업 : FANUC 한국화낙(주) (주)양헌기공 SSCENG 에스에스시이엔지 SCALE UP 스케일업파트너스




0.04mm fin thickness




CNC
SK-4012H


SN250


SN250

Market opportunity

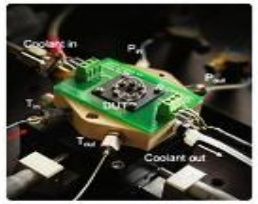




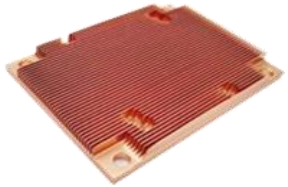
Medical

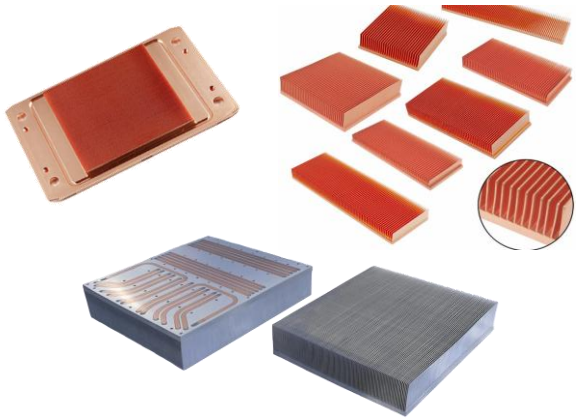

Laboratory


Wine & Beverage


Chip


Farming




Laser


Electronics


Van & Camping


Semiconductor


EV Battery

HEAT SINK MARKET

OPPORTUNITIES AND FORECAST, 2024-2030

Heatsink Market is expected to reach $11.8 Billion in 2030

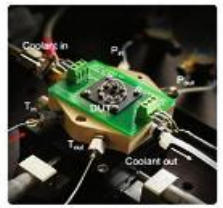
Growing at a CAGR of 7.5% (2024-2030)

Market opportunity


Medical


Laboratory


Wine & Beverage



Chip


Farming


Laser

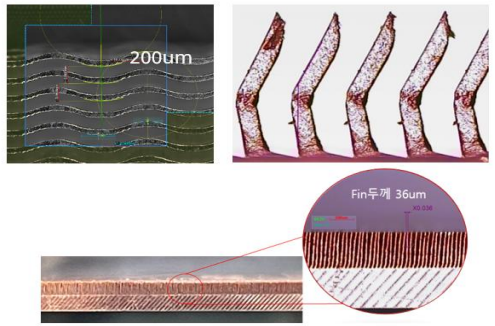

Electronics


Van & Camping

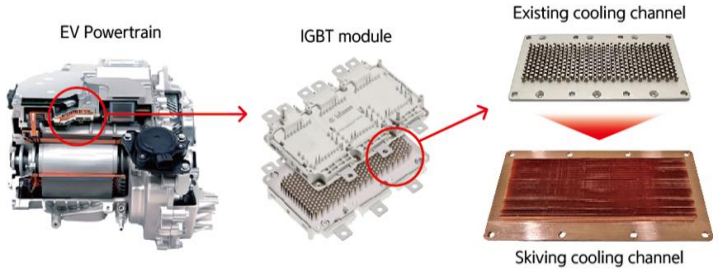

Semiconductor


EV Battery

Immersion Cooling solution for AI Data center

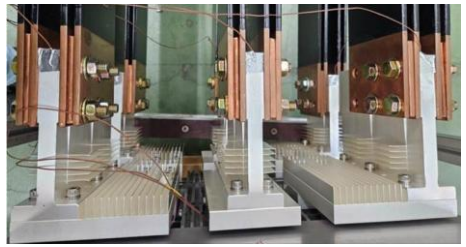


Cooling solution for EV Inverter

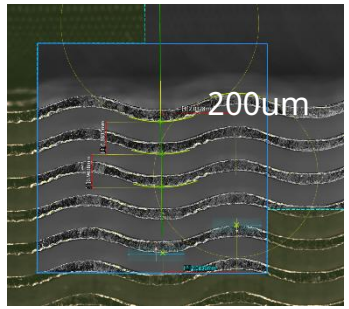


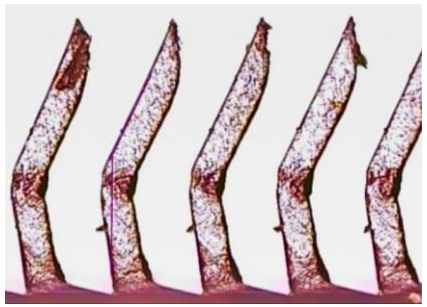

For Hi-Power 800V EV Inverter
For Thin-Type EV Inverter
For Motor Integrated Inverter

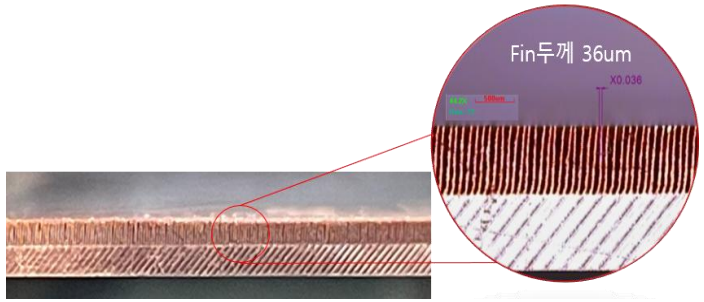
Cooling bar for Circuit Breaker



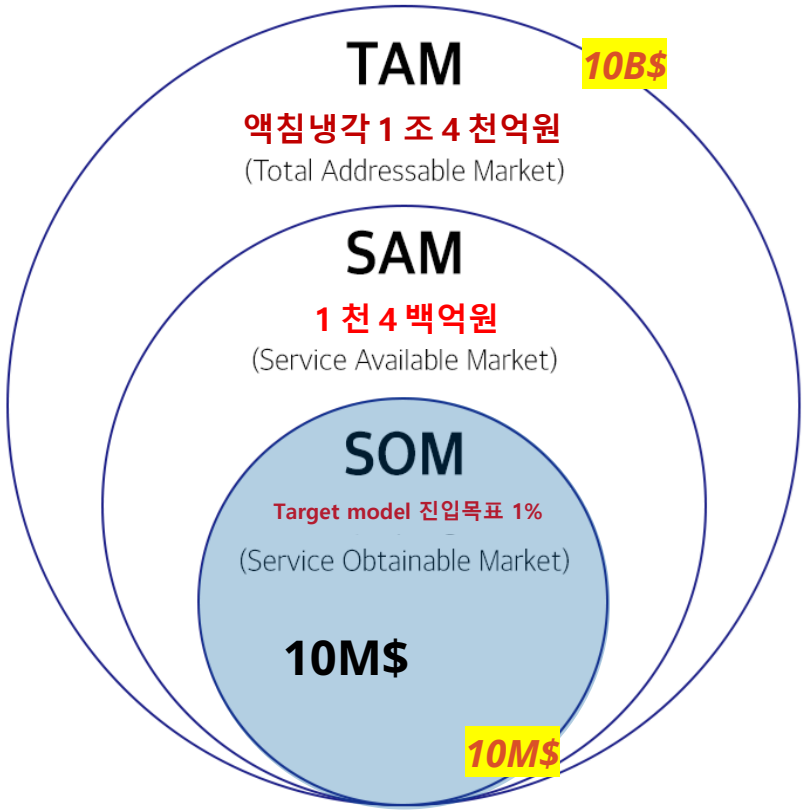
Target market & scalability







Immersion cooling Market, 2030



Immersion cooling is a type of liquid cooling used to moderate data center equipment temperature by submerging it in a cooling fluid

Key customer

LG Electronics

GRC

submer

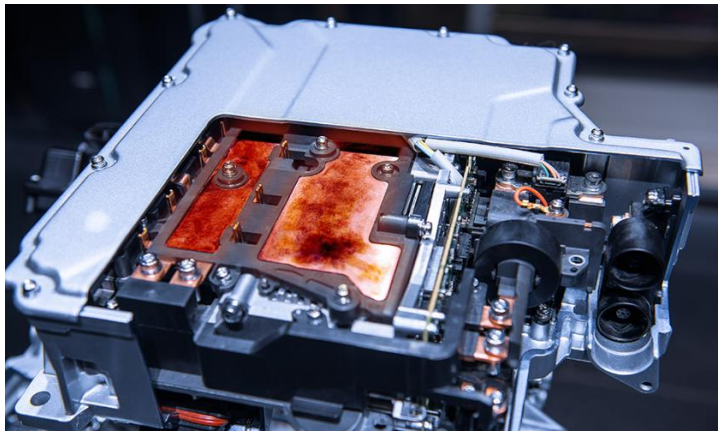
liquidstack

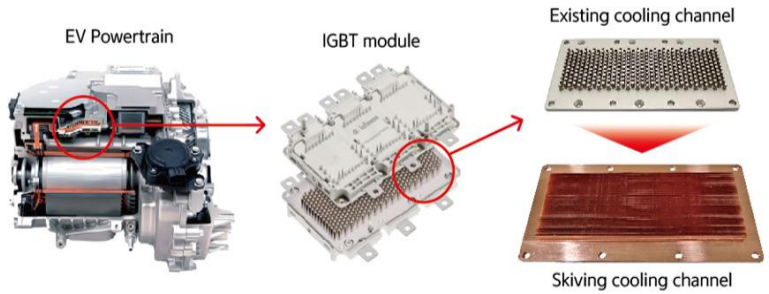
MIDAS IMMERSION COOLING

DCK

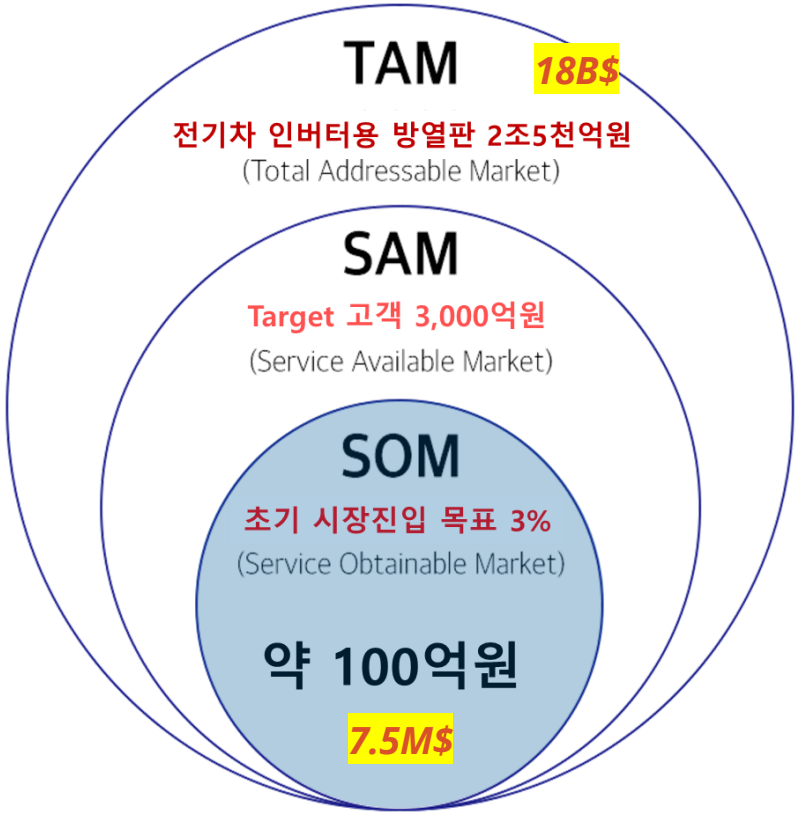
LiquidCool SOLUTIONS

Target market & scalability





EV inverter cooling Market, 2030



Key target customer

LG-MAGNA

HYUNDAI MOTOR GROUP

SL Corporation

HITACHI Astemo

STELLANTIS

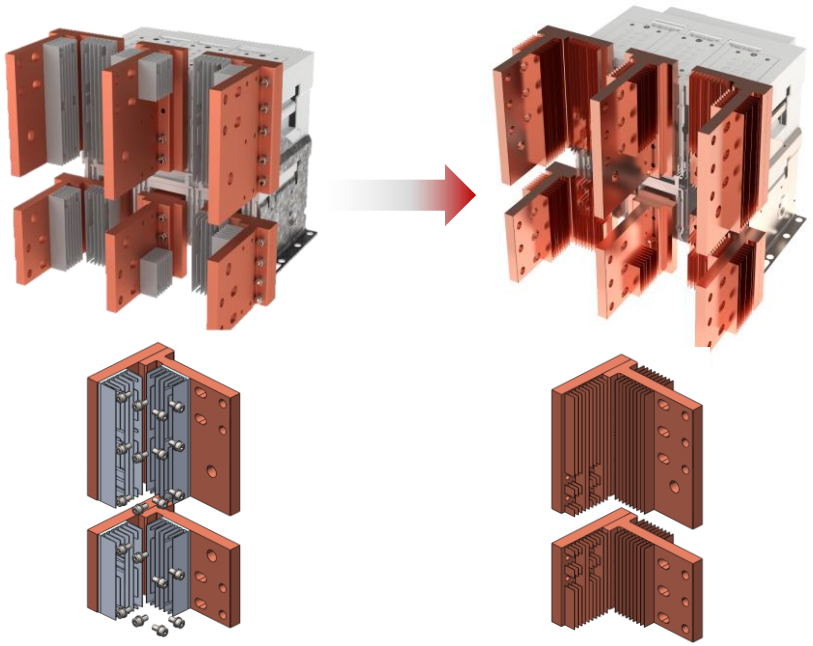
vitesco TECHNOLOGIES

DENSO

AISIN

MITSUBISHI MOTORS

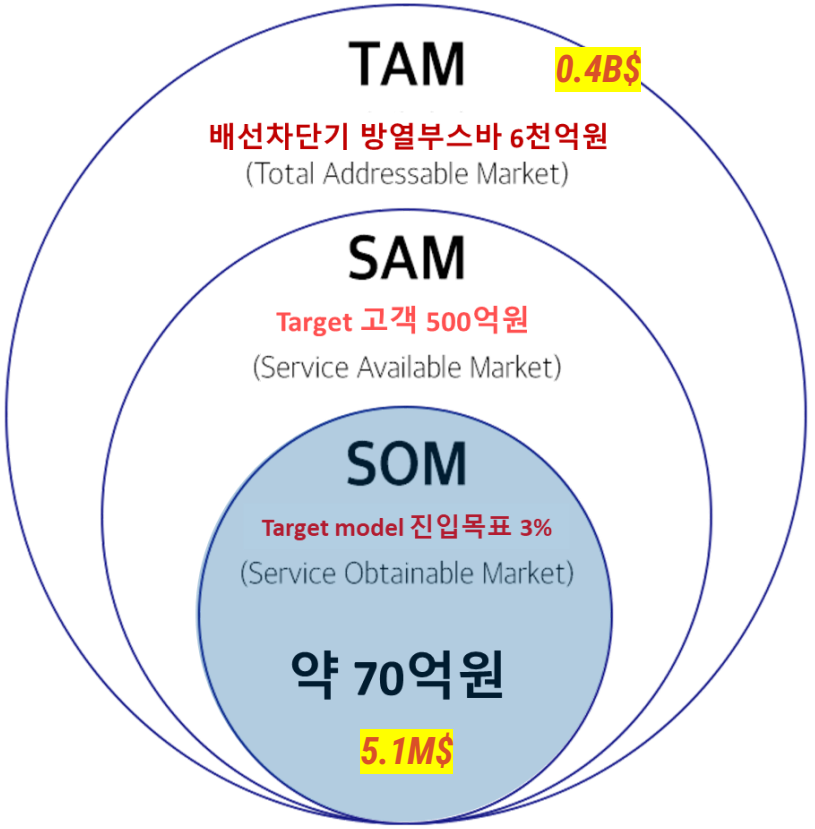
Target market & scalability



General Busbar

Integral Cooling Busbar

Circuit Breaker Market, 2030



The existing method of attaching a heat sink to a bus-bar has some disadvantages such as thermal interface joint, low design flexibility in limited spaces

Key target customer

LS ELECTRIC

Schneider Electric

SIEMENS

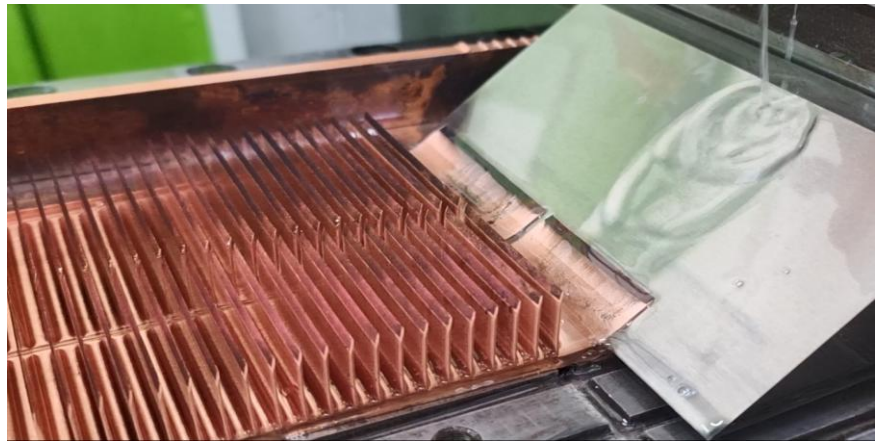
HD HYUNDAI ELECTRIC

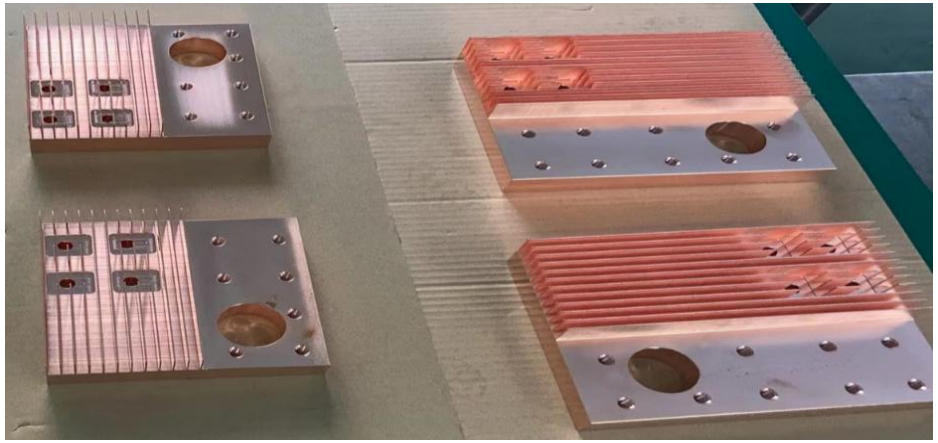
EATON

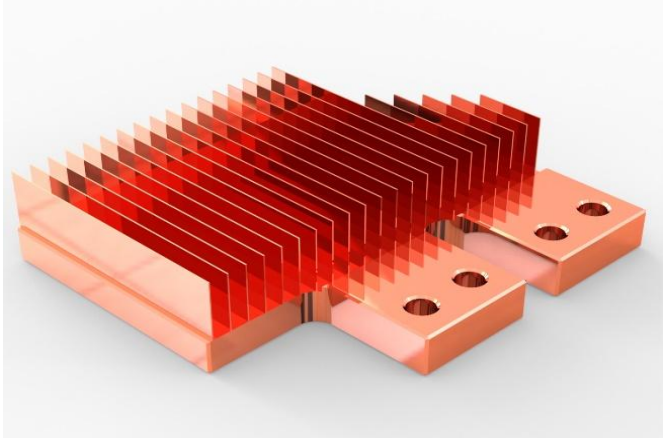
ABB

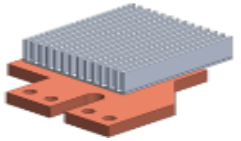
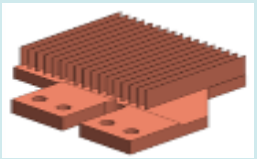
MITSUBISHI ELECTRIC

Circuit Breaker Cooling Bus-bar







Existing type	**Heat-sol proposal**
	
Extruded Heatsink + Copper busbar	Integral(single block) cooling busbar

Heat-sol is the world's first developer to apply Skived technology to Circuit Breaker Bus-bar.
We provided samples to a Circuit breaker manufacturing company in Korea to conduct verification tests.
The test result showed an approx. 10% improvement compared to the previous type.

Heat-sol’s achievement as the First Mover

Benefits of Skived Cooling Busbar

1) One-time forming with no need of further assembling or machining
- Easy assembly as an all-in-one unit(single block), reduce assembly/manufacturing process

❖ Traditional method is attaching the heat sink to the bus bar

2) It is a firm structure with no risk of getting loose or falling apart

3) No gap or Interfacial thermal resistance between joint and bolt that restricts proper heat-flow

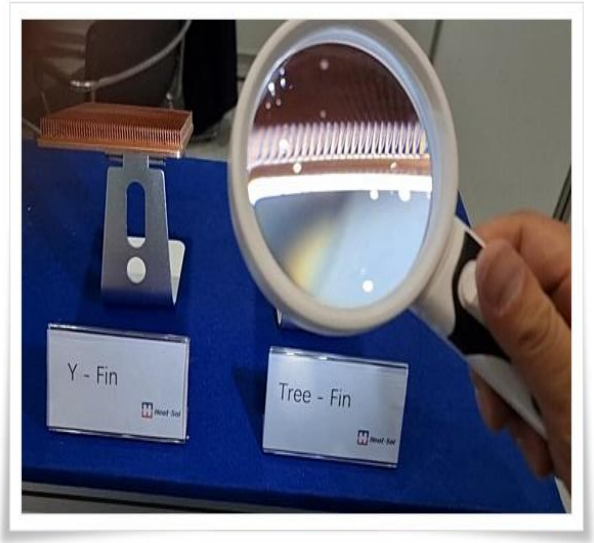
- The existing products customer uses have a thermal resistance from the use of thermal grease/bolt to attach the fins
(The use of solder is also relevant to the thermal resistance)

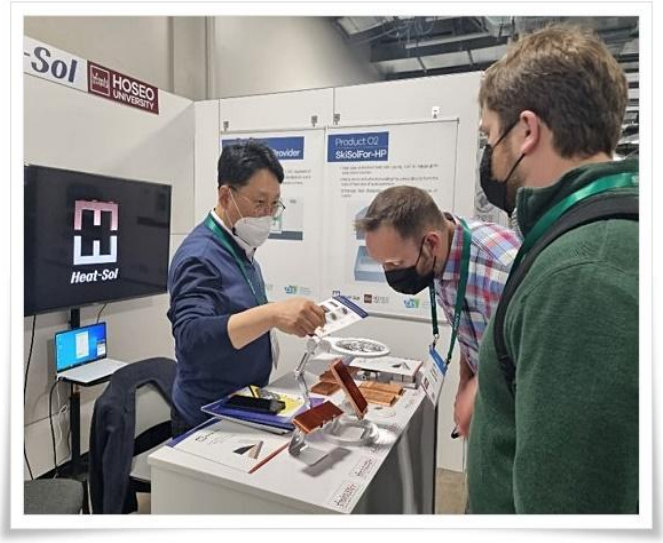
4) Customizable to the needs of any designs offers
- Rapid prototyping of new designs

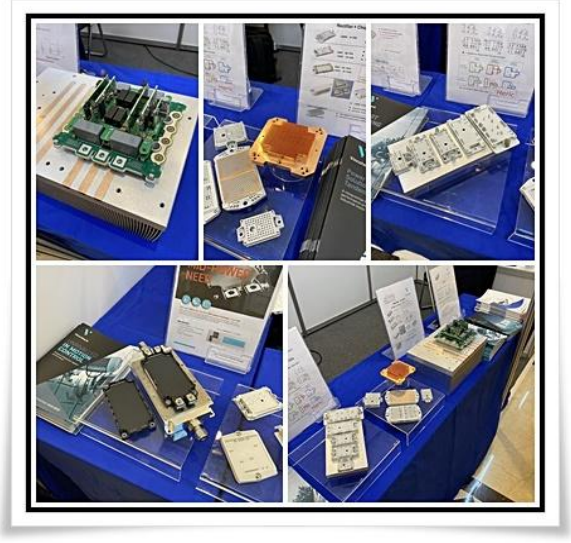
5) Compact structure and effective use of space

Marketing Activities

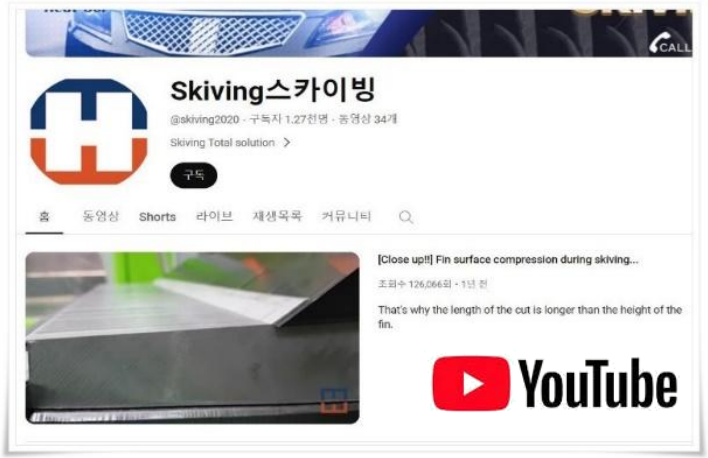
- **Participation in Domestic / International Exhibitions and Seminars**

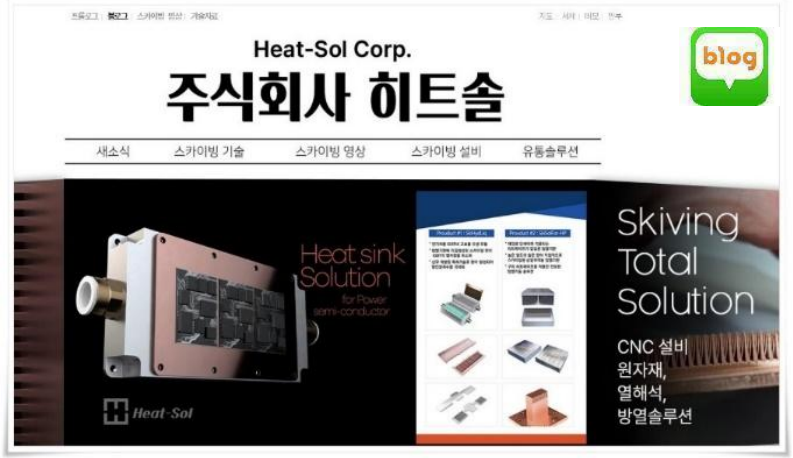


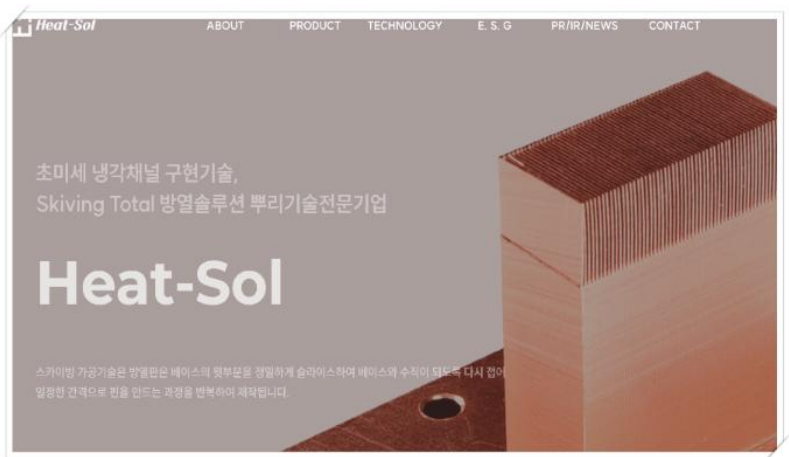




- **Promoting Skiving technology via YouTube & Blog web, Webpage launching in August**







Heat-Sol

The devil is in the detail.

Heat-Sol is a research and development-driven company specializing in heat dissipation solutions that surpass industry standards and push the boundaries of technological innovation.