

SUNON®

SUNON® GROUP



**SUNON®**

# **Sunon – The worldwide leader in total thermal solutions**

**Your specialist in thermal management**

**[www.sunon.com](http://www.sunon.com)**

Copyright © 2015 SUNON All rights reserved

# Sunon Total Thermal Solution

36 years of design and cooperation experience with major multinational Corporations.



# Content

---

## **Cooling Module Business Division Introduction**

- Business Division Organization
- R&D Support Team

## **Sunon Cooling Module Products & Core Competencies**

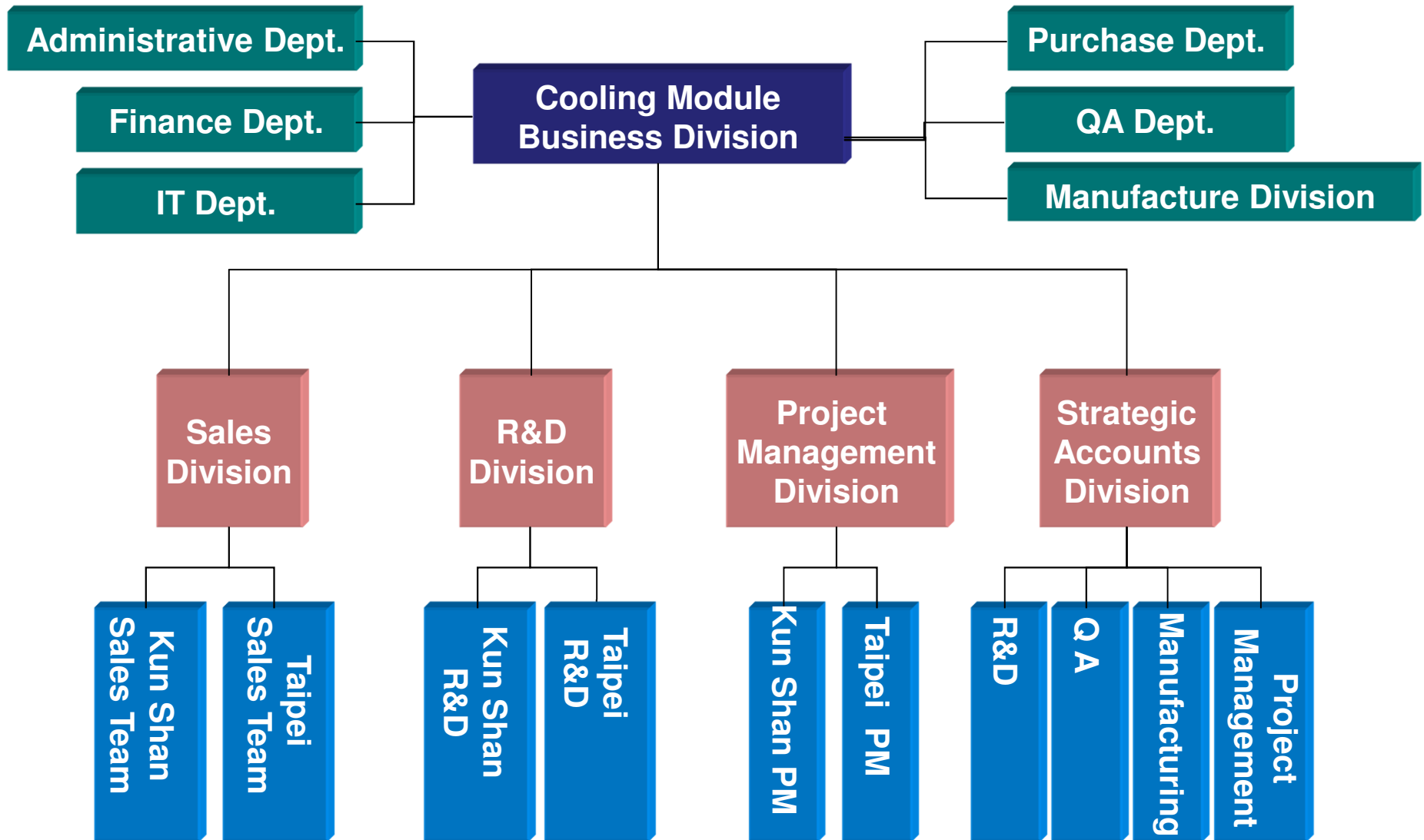
- Major Valued Customers
- Cooling Module Introduction
- Sunon Thermal Solution products
- Sunon Heat Pipe Introduction
- Sunon Vapor Chamber Introduction
- RD Capability

## **Production**

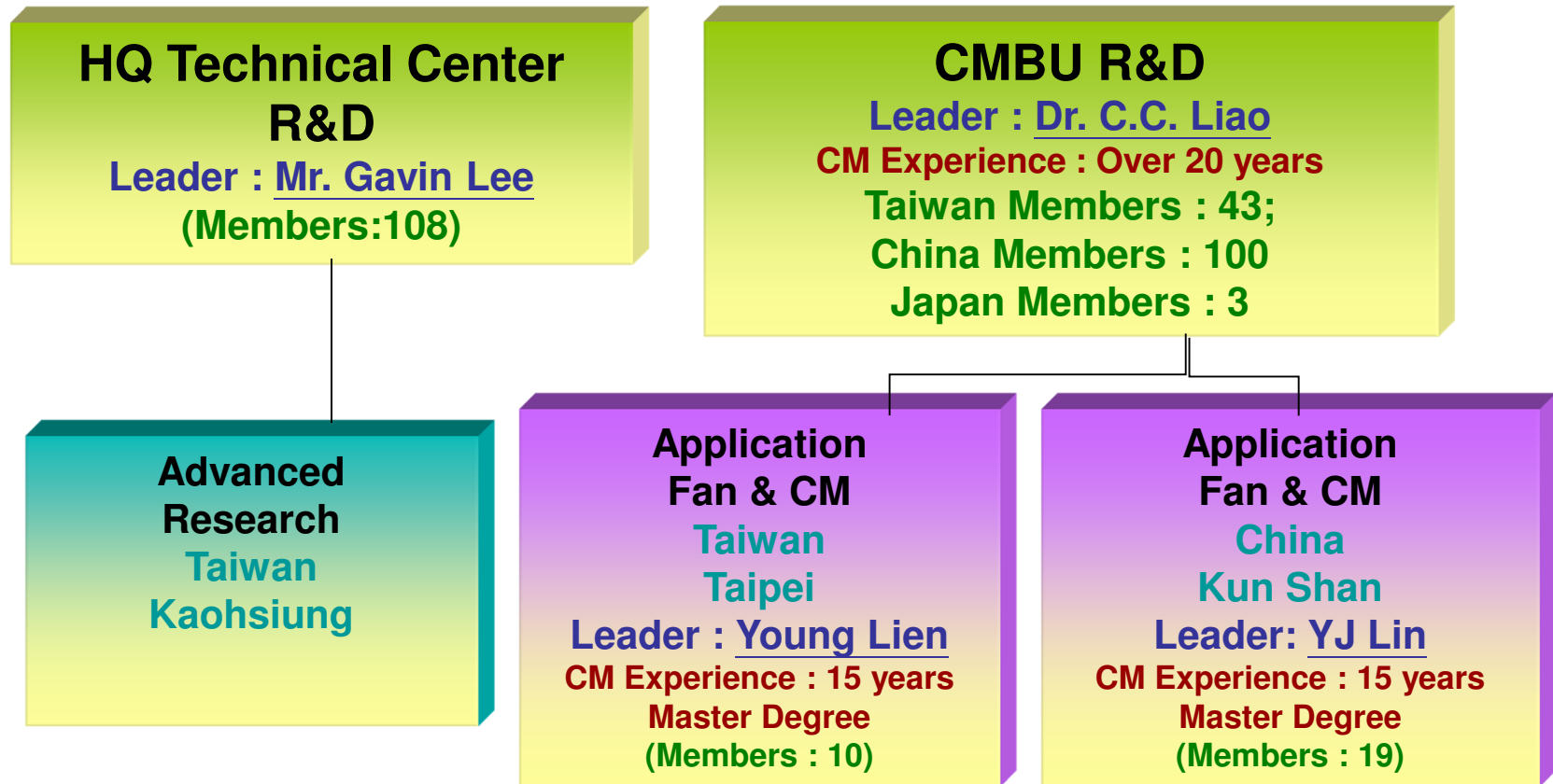
- Production Capability
- Capacity & Plan
- Reliability Equipment Introduction
- Production Line Introduction

## **Conclusions**

# Cooling Module Business Division

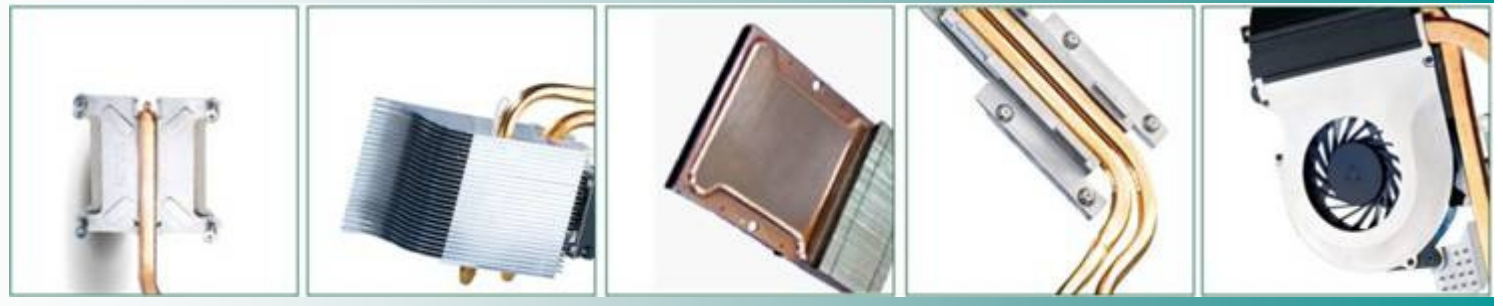


# Cooling Module R&D Support Team



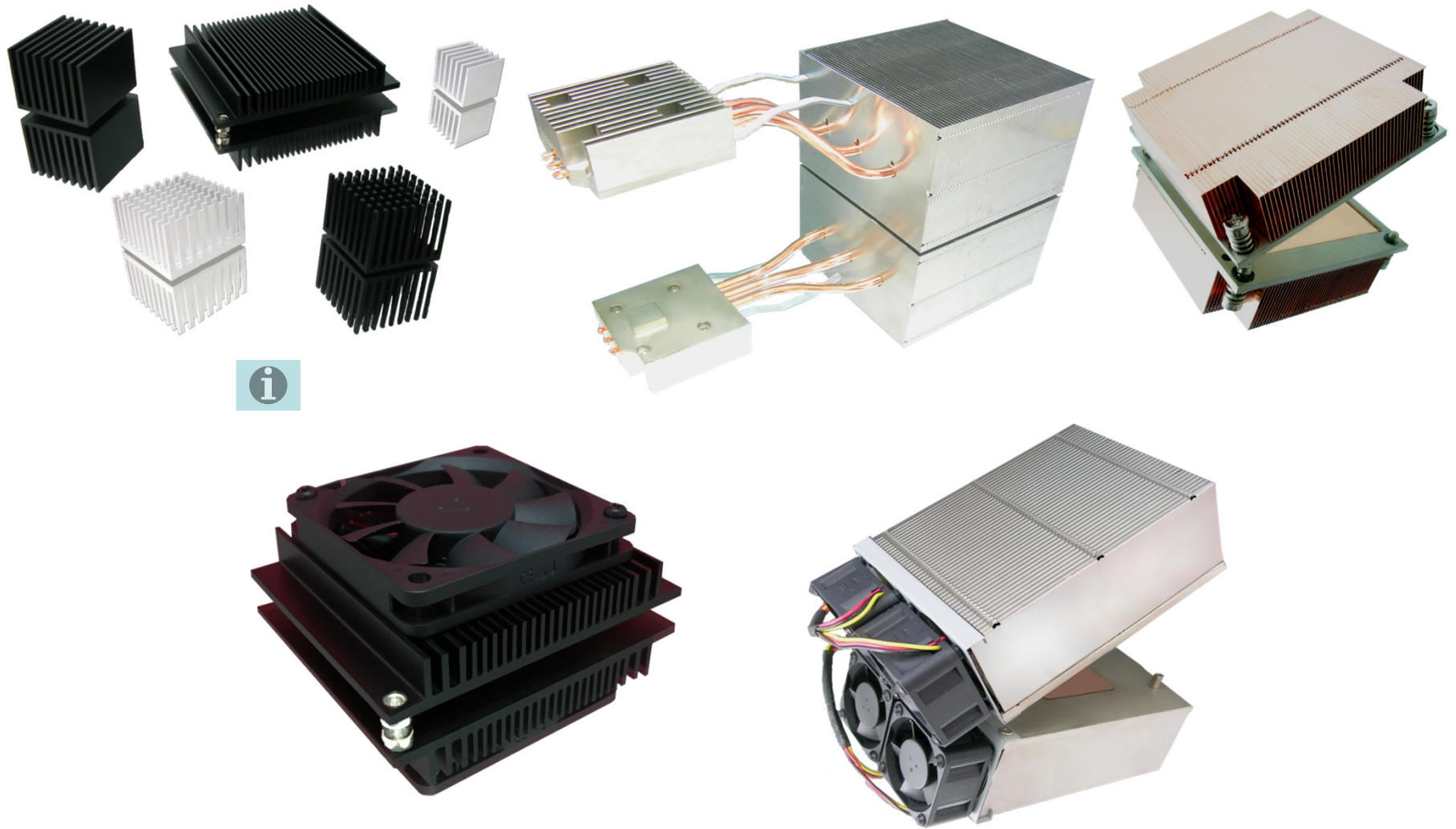
## \* Notes :

1. Mock up Sample Deliver L/T : 5 ~ 7 Days
2. Tooling L/T : 4 Weeks
3. Order L/T (MP) : 4 Weeks



# Sunon Cooling Module Products & Core Competencies

# Cooling Module Introduction

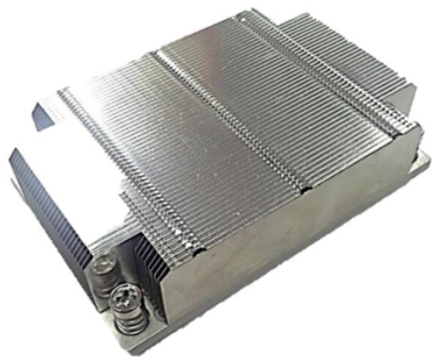
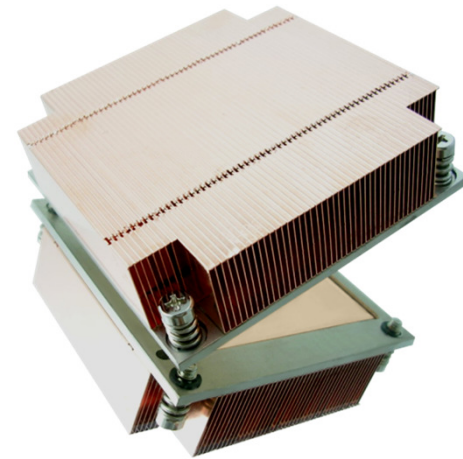
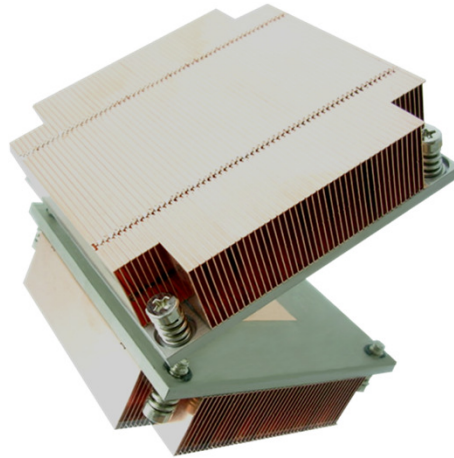
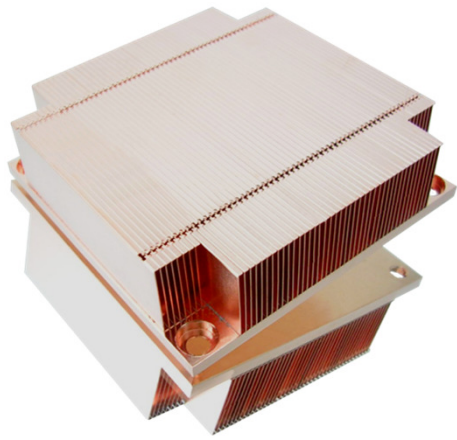


# Total Thermal Solution-NB Application

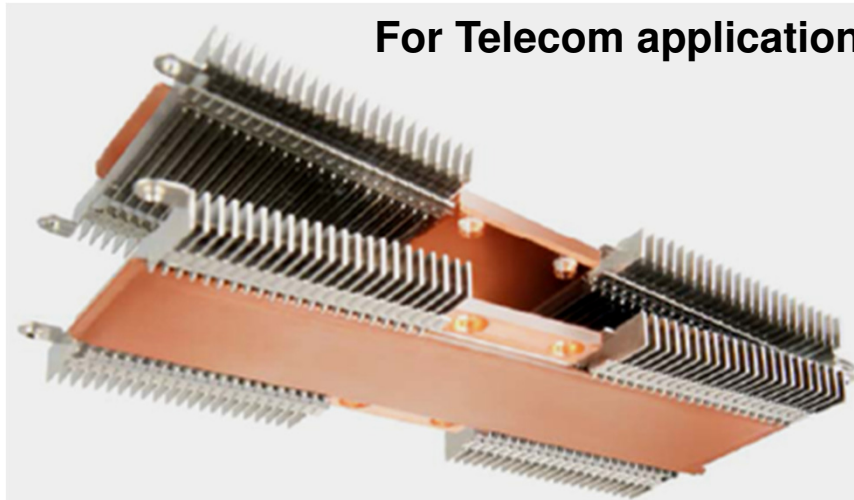


# Total Thermal Solution-Server & Telecom Application

For Server application

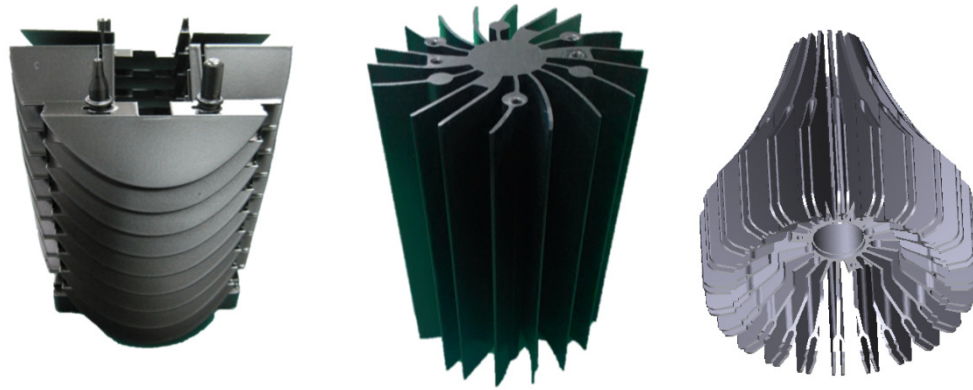


For Telecom application



# Total Thermal Solution-LED Lighting Application

LED Spot Lighting



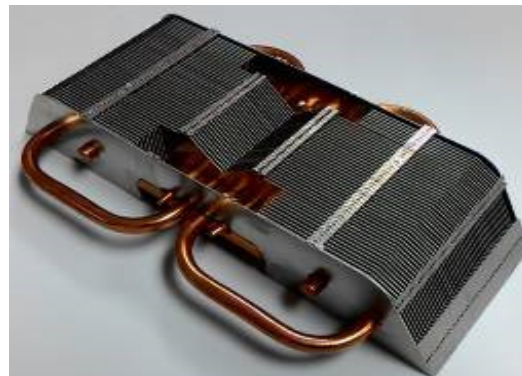
LED Street Lighting



LED Down Lighting



LED Stage Lighting



Automotive Lighting

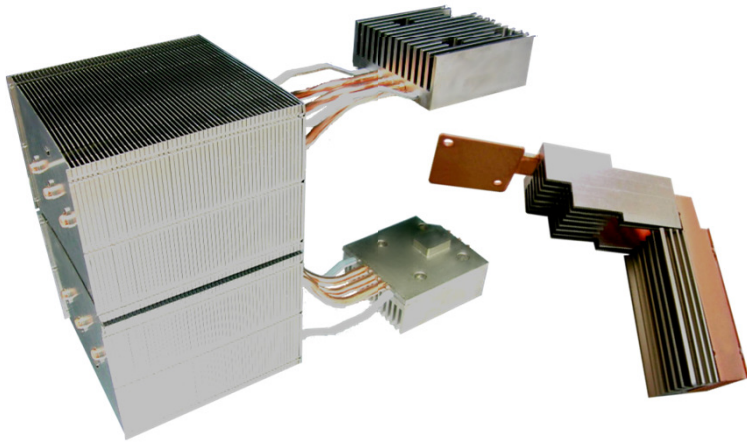


# Total Thermal Solution-VGA Card Application

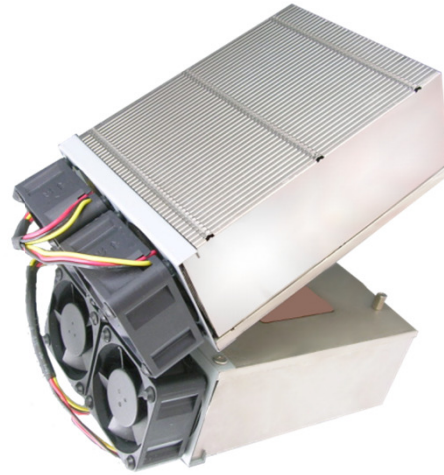


# Total Thermal Solution-Others Application

Projector



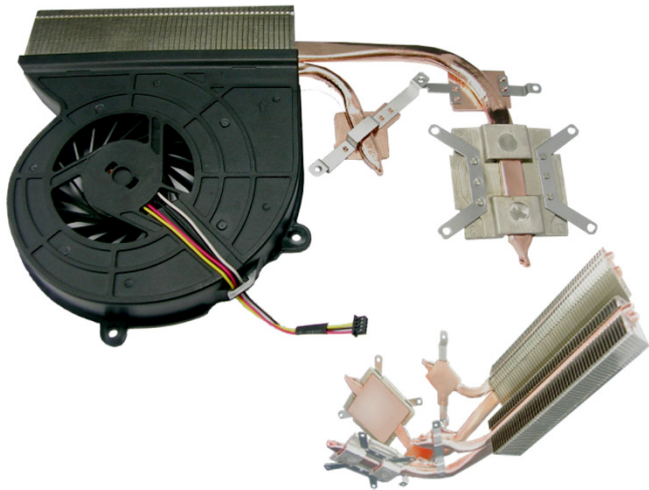
Industrial PC



Consumer



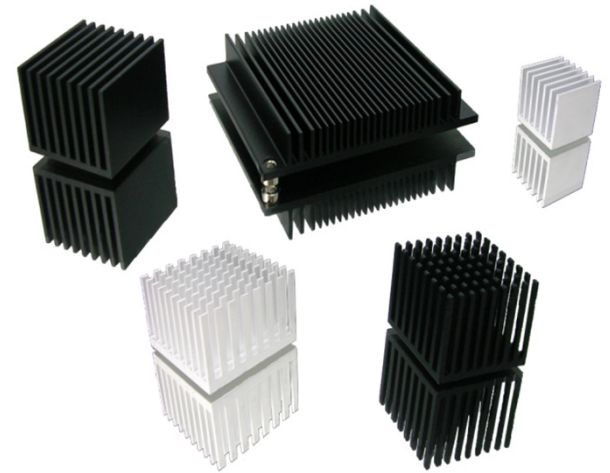
All in One PC



Gaming



Set Top Box



# *Sunon Heat Pipe Introduction*

---

- *Application*
- *Introduction*
- *Products*
- *Design Guideline & Performance Table*
- *0.5T Design Guide*
- *Process and Equipment*

# Application

**Railway**



**NB**



**Mobile**



**Battery Charger**



**Video Game**



**Server**



**Cold Drink Machine**



**LED**



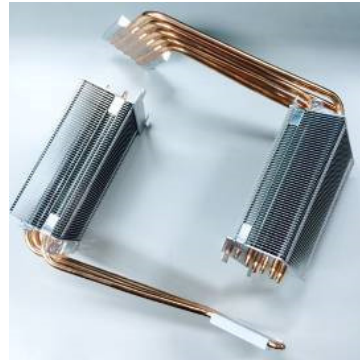
# Application



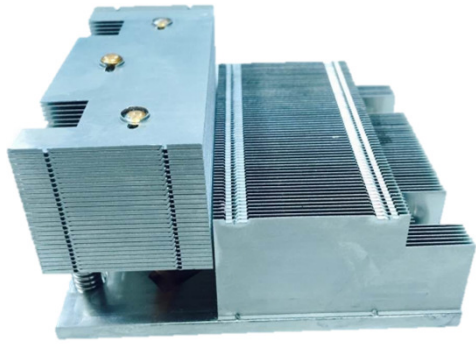
NB



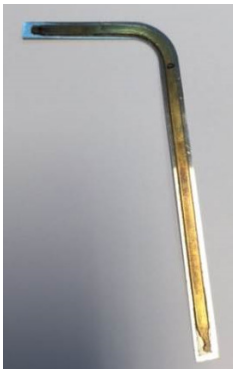
AIO



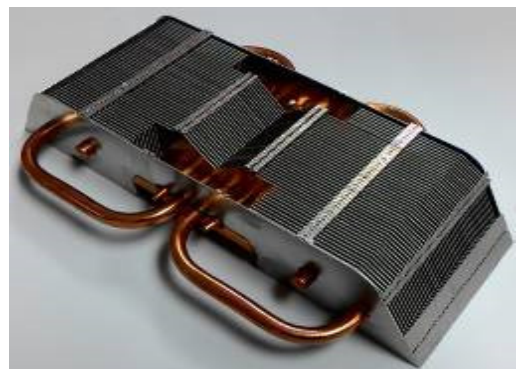
Cold Drinking Machine



Server



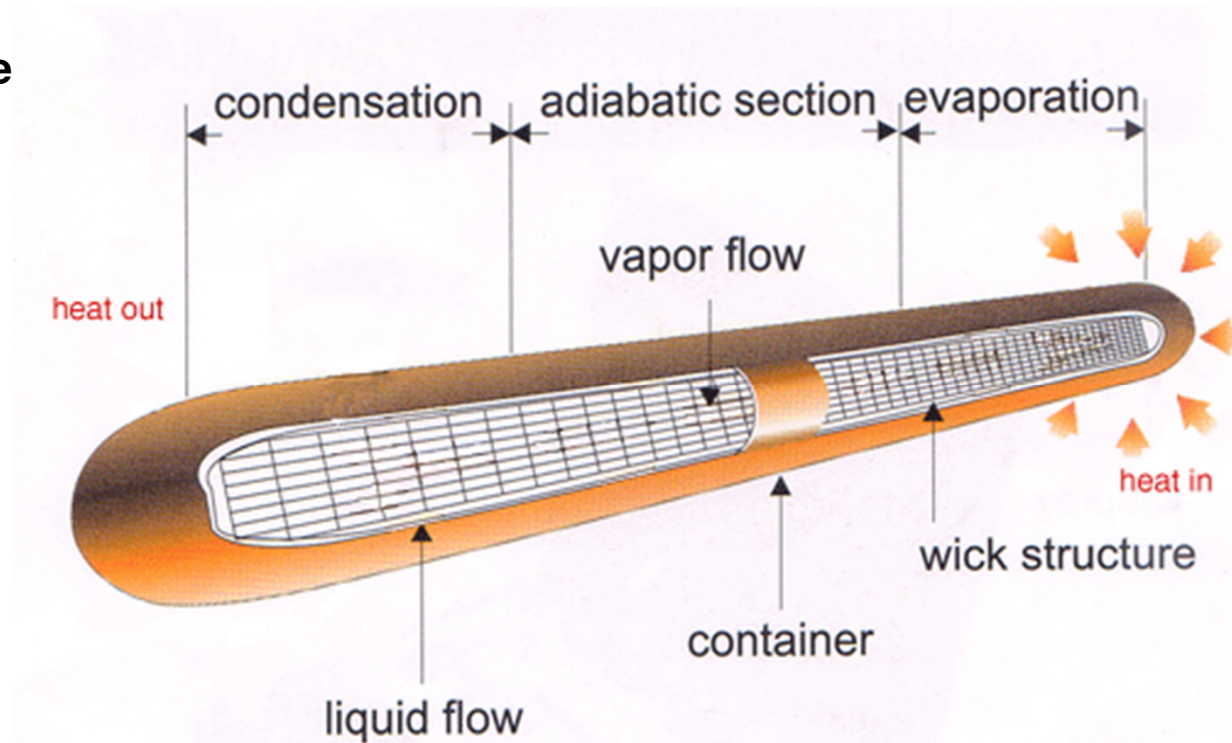
Mobile



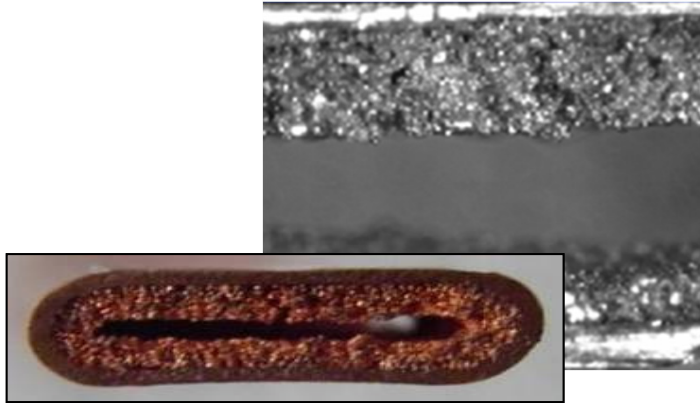
Stage Lighting

# Heat Pipe Introduction

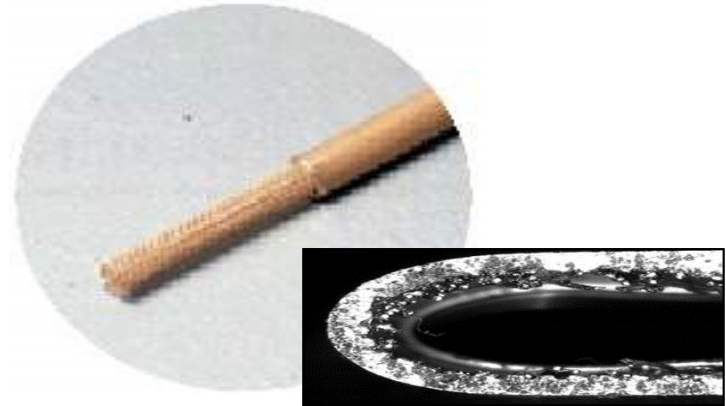
- Basic Element of the Heat Pipe.
  - Container (Closed and Vacuum)
  - Working Fluid
  - Wick (Capillary Construction)
- High Thermal Conductivity
- Just only transfer heat
- Passive Solution
- Working Principle



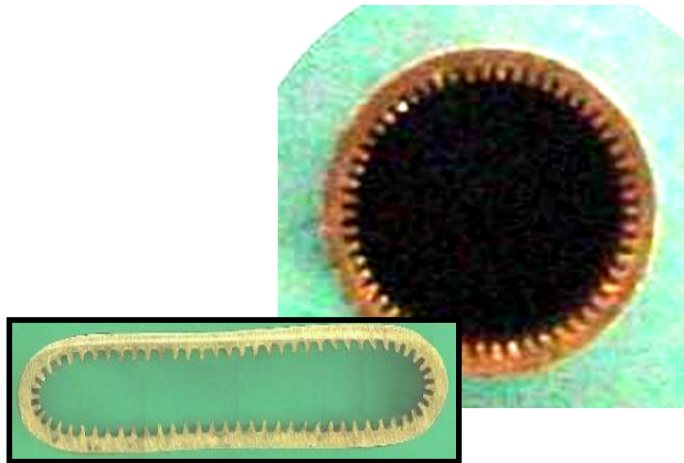
# Products (By Wick)



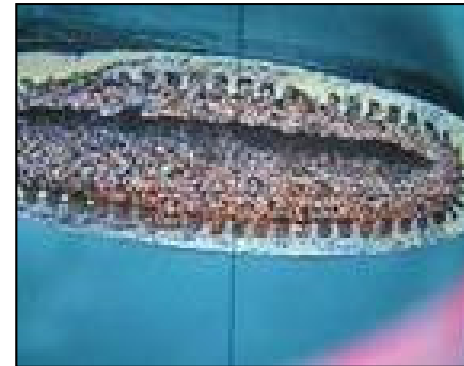
Sintering Powder



Mesh



Groove

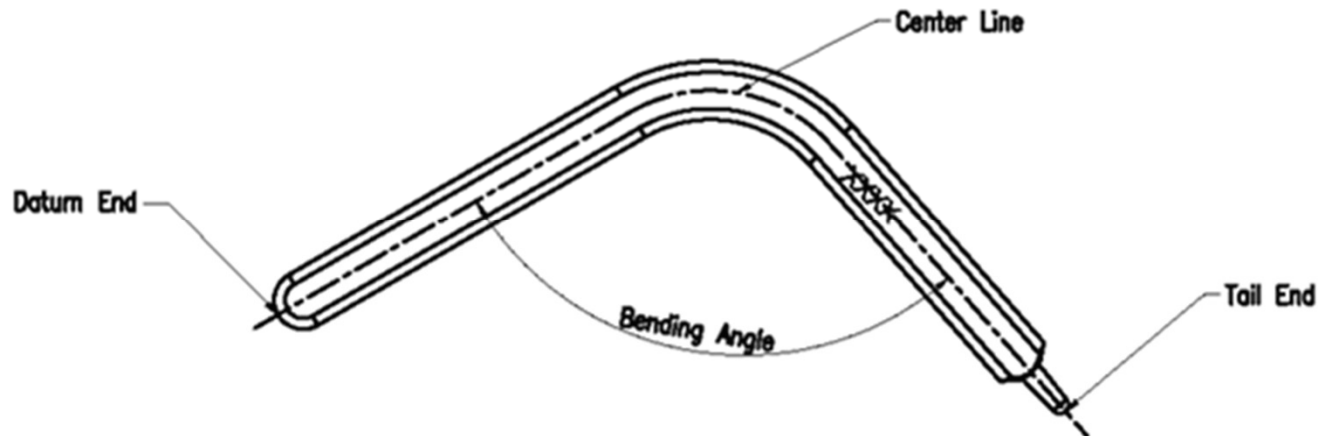


Composite

# Bending and Flatten Suggestion

( Units: mm, Bending Angle :  $>90^\circ$  )

Pipe Diameter	Types	Suggestion Minimum Radius	Special Radius *
Ø6	Flatten ( <4mm)	R: 18 mm	R: 15 mm
	Round	R: 15 mm	R: 12 mm
Ø8	Flatten ( <6mm)	R: 24 mm	R: 20 mm
	Round	R: 20 mm	R: 16 mm



# Q-max Test Method and Performance Table

Pipe Types	6mm	8mm
T=1.2mm	15W	20W
T=1.5mm	20W	30W
T=2.0mm	25W	35W
T=2.5mm	30W	40W
T=3mm	35W	50W

- **Sample Spec.:** L = 200 mm ; Bending 90°
- **Test Condition:** Heating length: 39mm; Cooling length: 50mm;
- **Working temp.:**60°C; Inclined angle: 0°

# 0.5T Design Guide

Thin Heat Pipe (thickness=0.5mm ; L=100 mm)					
Diameter	Q max (W)	Bending Radius (mm)	Bending Angle ( ° )	Width (mm)	Ineffective Region of Heat Pipe (mm)
D2	2~3	$\geq 10$	$\geq 120$	3.01	6
D3	3~4	$\geq 15$		4.58	7
D5	5~6	$\geq 25$		7.74	9

- **Notes :** The heat pipe performance is subject to change upon testing methodology and condition. So, the real performance must be verified based on customer's application.

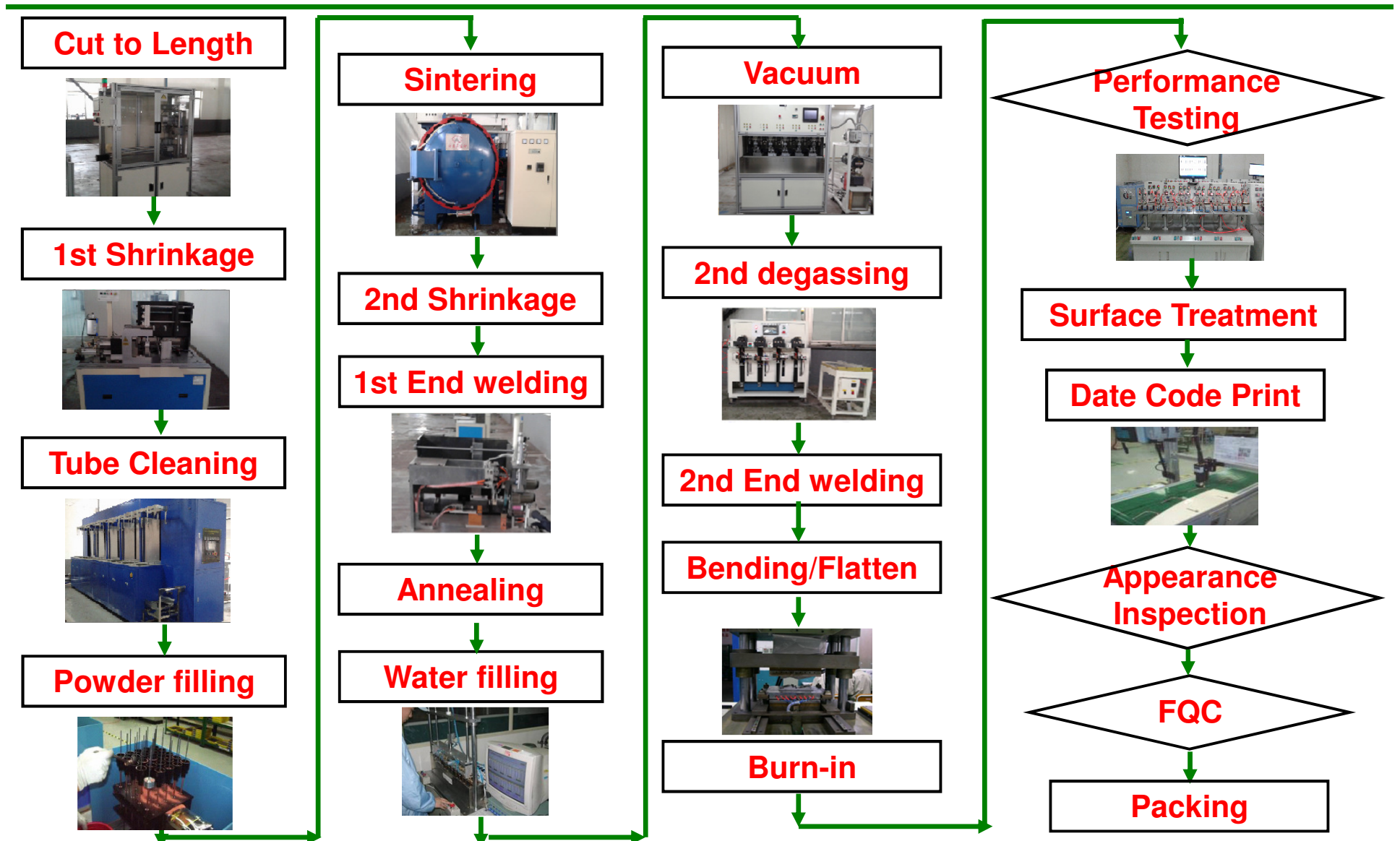
# $\phi$ 5 HP Study - Qmax & Rth

- Heat pipe spec :  $\phi 5 \times L100$  mm

Item	Flattened thickness			
	1.2mm	1.0mm	0.8mm	0.5mm
Qmax (W)	15W	12.5W	8W	5W
R <sub>th</sub> (°C /W)	0.33	0.64	1.25	2.0

\* R<sub>th</sub> data is based on heat pipe Q<sub>max</sub> condition and 60°C operation temperature.

# Major Process



# *Sunon Vapor Chamber Introduction*

---

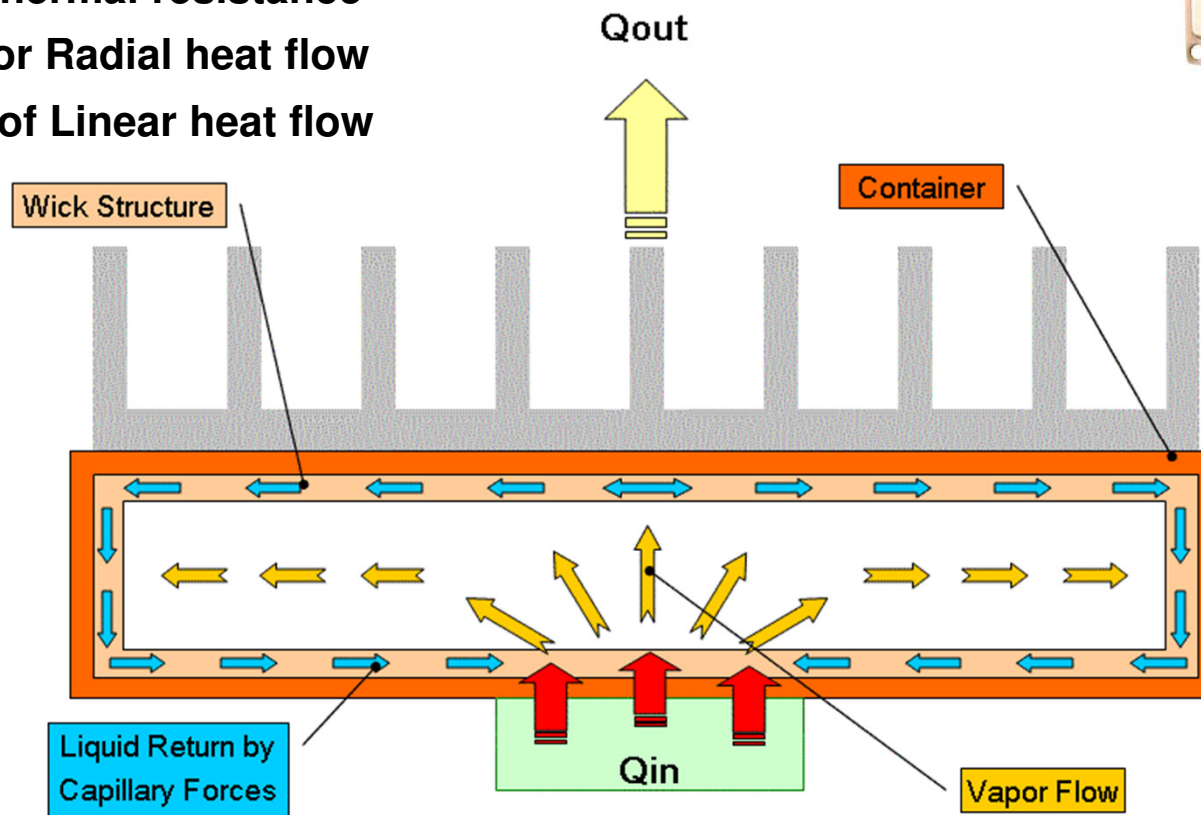
● *Introduction*

● *Products*

# Vapor Chamber Introduction

## Advantage

- High  $Q_{max}$
- High power density
- Lower thermal resistance
- Planar or Radial heat flow instead of Linear heat flow



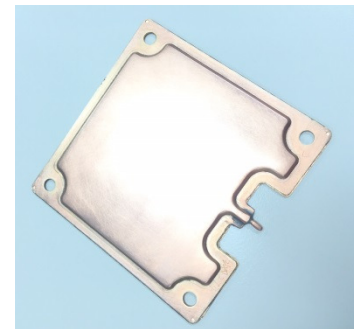
# Products

- **Products**

- VC Thickness : 0.6mm ~ 3mm
- 3D VC : Heat Pipe Combine with VC



*Normal vapor chamber*



*Normal vapor chamber*



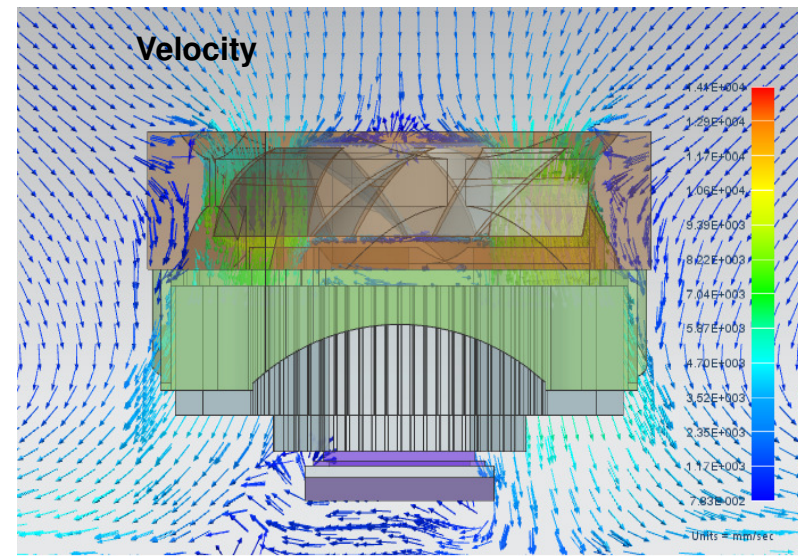
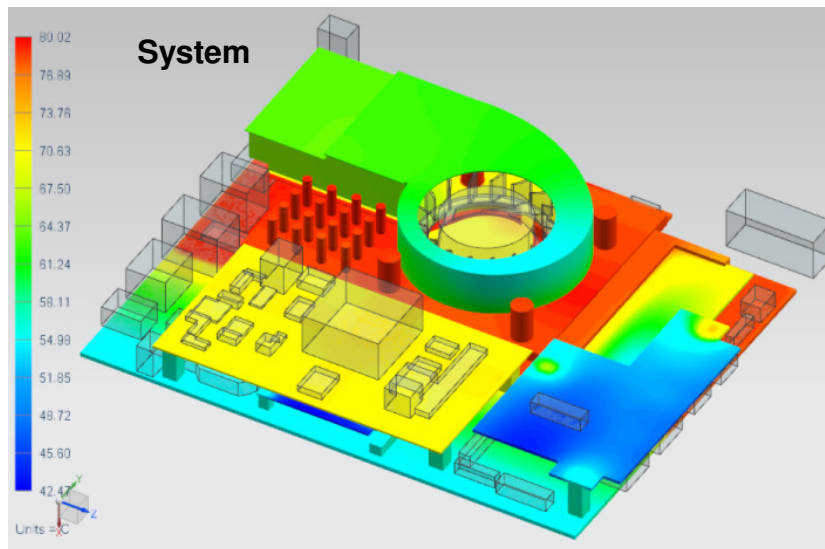
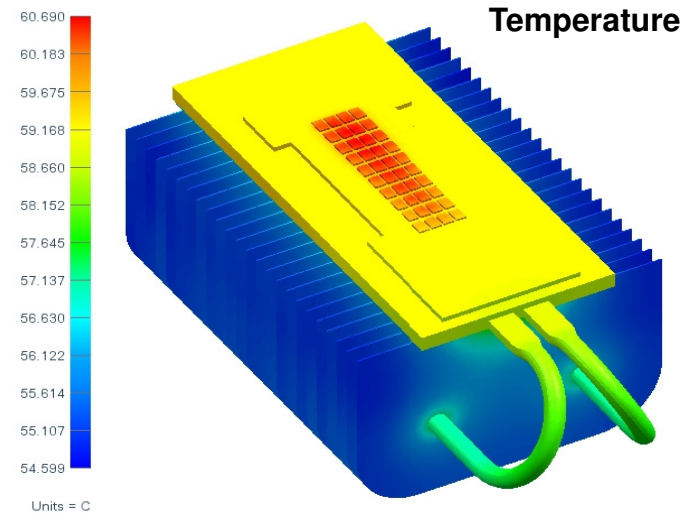
*Thin vapor chamber*



*3D vapor chamber*

# Total Thermal Solution Provider

- ❑ Individual module and system thermal analysis
- ❑ Customized CM design
- ❑ Vent Optimization
- ❑ Temperature distribution
- ❑ Velocity profile
- ❑ Pressure distribution

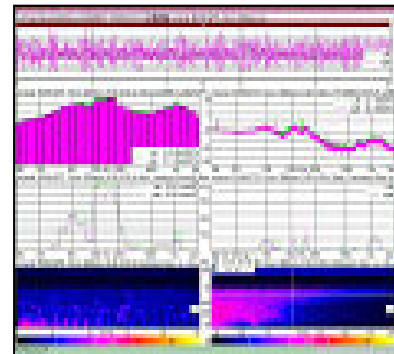


# Sound Quality Analysis and Research

Sunon's sound quality analysis and research is performed by the Head Measurement System (HMS) manufactured by Head Acoustic of Germany. This system uses 24-bit digital processing technology, which is capable of simulating the senses of the human ear: measuring sound, vibration, spin speed, and electronic signals. The signals are then analyzed through time-domain/frequency spectrum and psycho acoustic analysis.

Sunon has been using this system since the year 2000. As a result, the team of engineers have acquired a multitude of experience and accomplished many milestones in related research work that have made Sunon's product's user-friendly and created motors, fans, and cooling modules that are pleasing to the human ear.

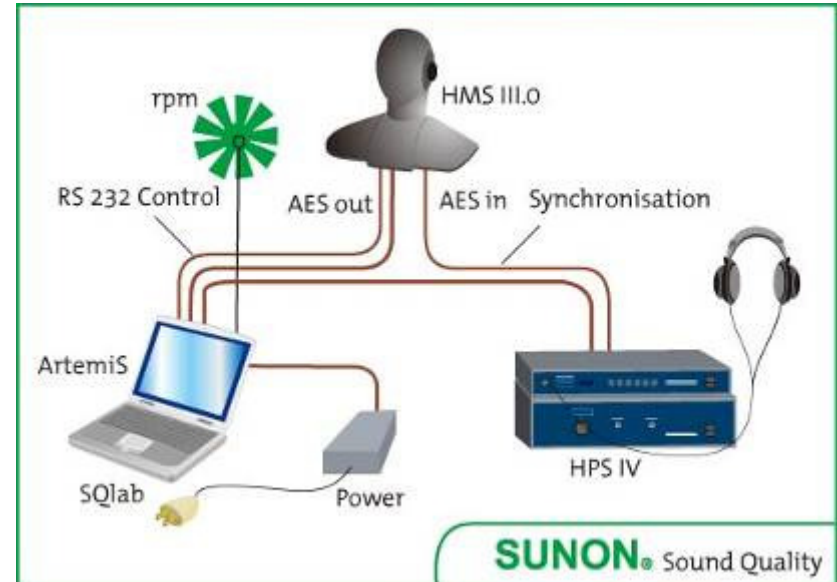
## System Level Spectrum



Spectrum of sound quality



Sound quality test



# Airflow Analysis and Research



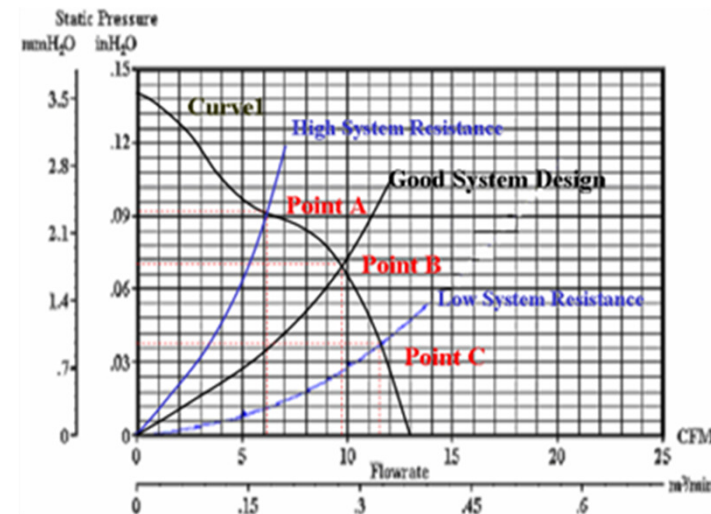
Programmable Temperature & Humidity Chamber



Wind Tunnel

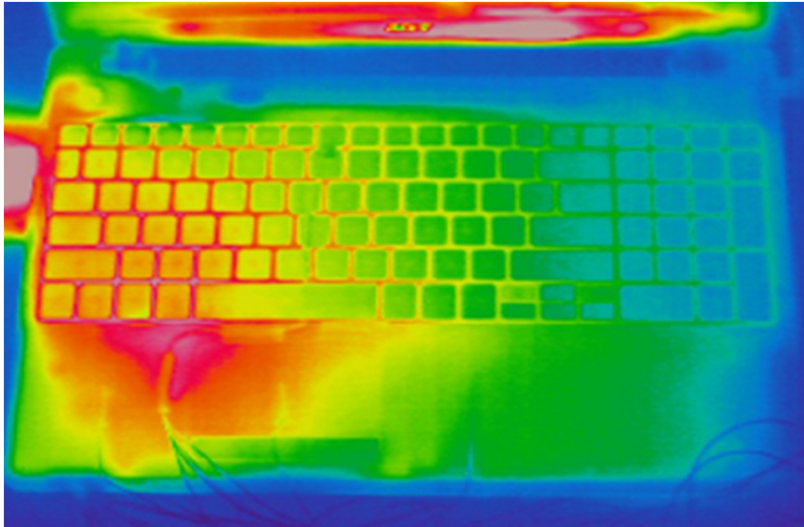


Wind Tunnel

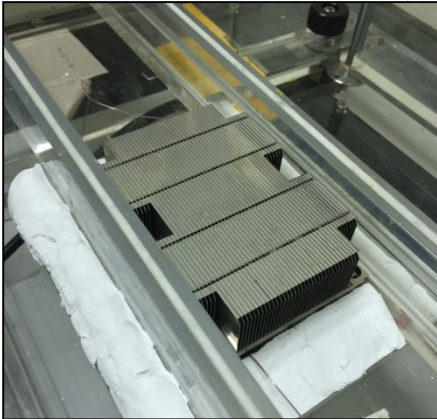


# IR Thermograph

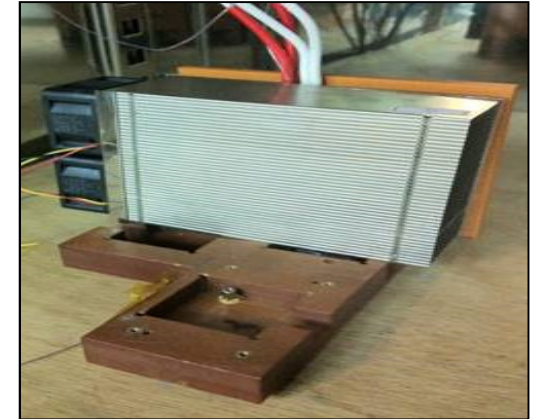
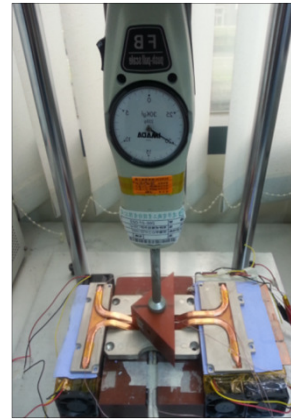
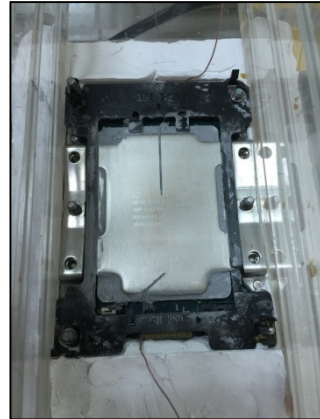
---



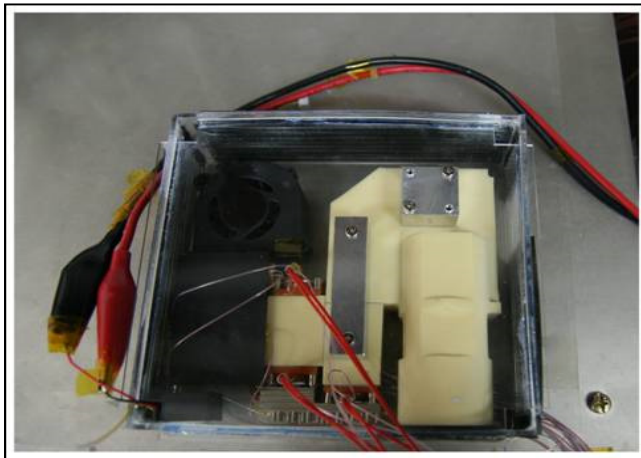
# Analysis and Research



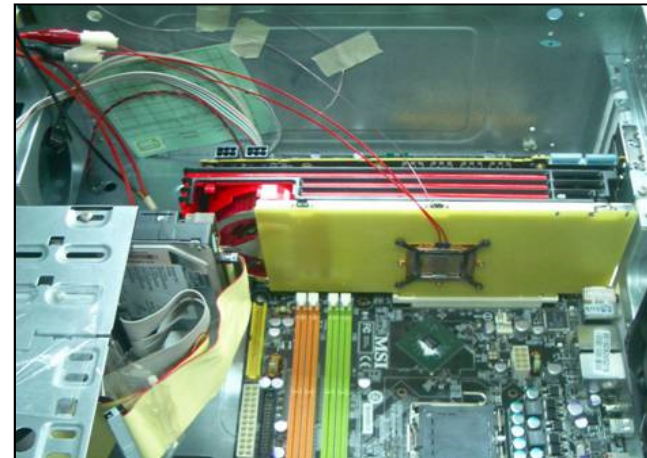
**Module Test (Server)**



**Module Test (Industrial PC)**



**Dummy Test (Projector)**



**System Test (VGA Card)**



# Sunon Cooling Module Production

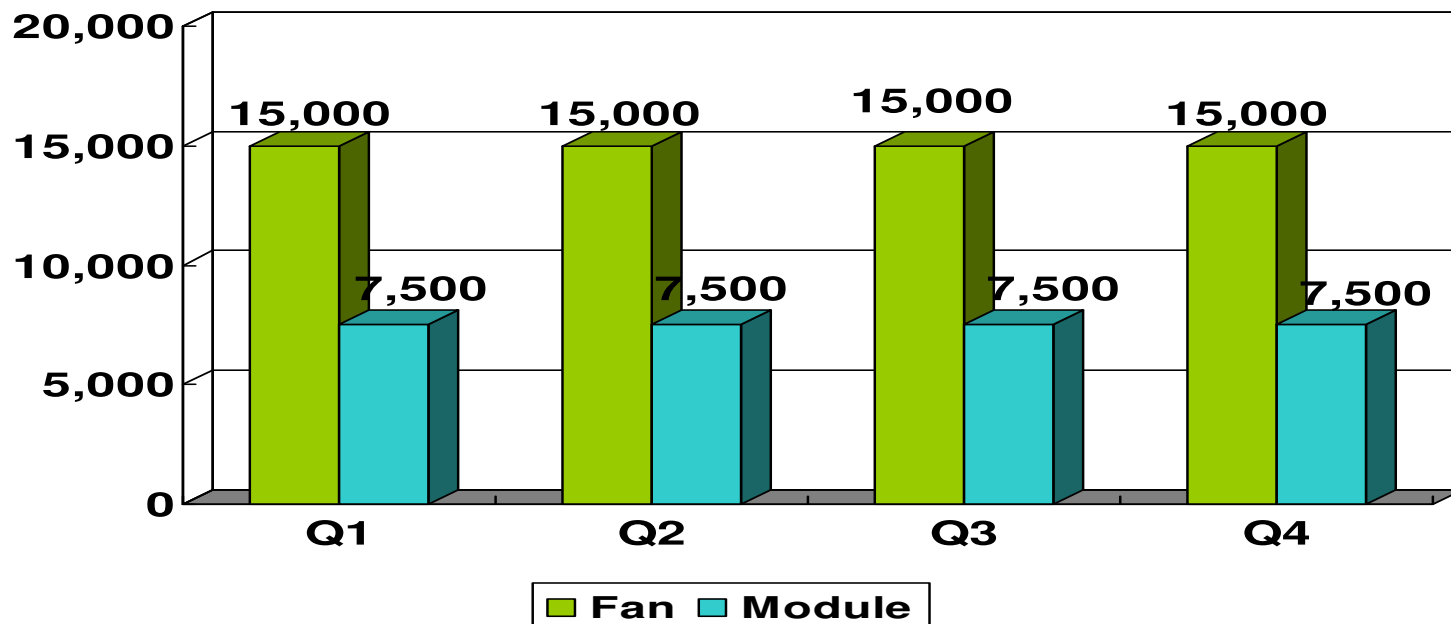
# Wide Production Capability

## 4 factories in Taiwan and China

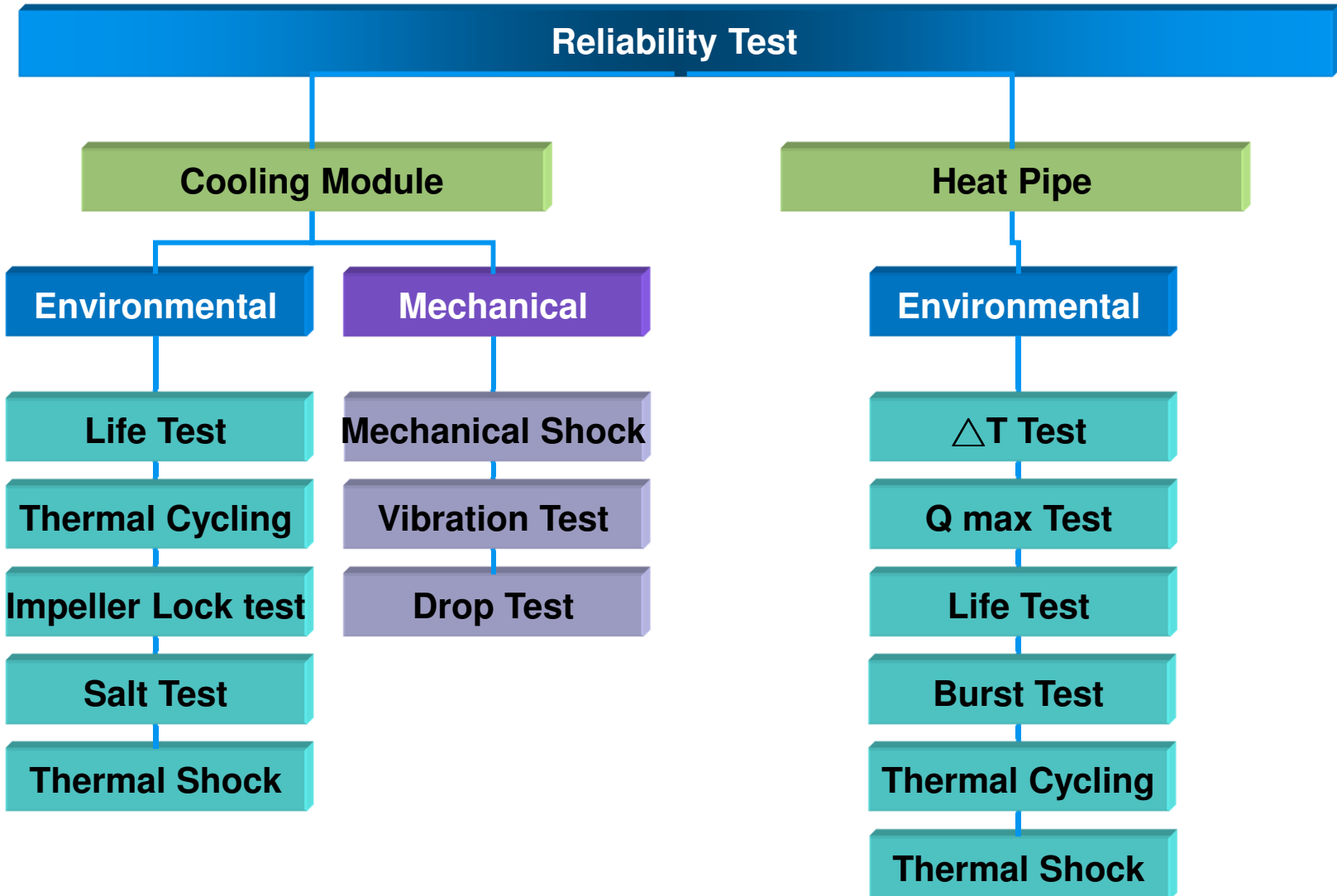


# Production Monthly Capacity & Plan

	2016			
	Q1	Q2	Q3	Q4
DC Fan Product Capacity	5,000K /M	5,000K /M	5,000K /M	5,000K/M
Module Product Capacity	2,500K /M	2,500K /M	2,500K /M	2,500K /M



# Cooling Module Reliability Introduction



# Reliability Equipment



High Temperature Chambers



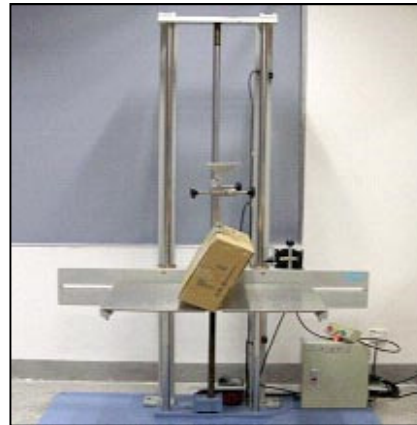
Auto Test Measurement



Thermal Inspection



Temperature/ Humidity Chamber



Drop Test



Vibration Test

# Feature of Production



- Perfect traceability of product (Bar code label)
- Test by 6 point heat source
- Test by precise pressure
- Test by constant fan speed (Fan PWM Control)

# Feature of Production

型號:MS1452

1 準備終了				2 準備終了				3 準備終了			
項目	OK	異常発生	20.7	項目	OK	異常発生	20.8	項目	OK	異常発生	20.9
測定温度	判定	判定	判定	測定温度	判定	判定	判定	測定温度	判定	判定	判定
3000.000 1.04°C/WAVE T	50.0	1.04	OK	3000.000 1.04°C/WAVE T	50.0	1.08	OK	3000.000 1.04°C/WAVE T	50.0	1.03	OK
3000.000 2.04°C/WAVE T	54.0	1.04	OK	3000.000 2.04°C/WAVE T	54.0	1.00	OK	3000.000 2.04°C/WAVE T	51.5	1.00	OK
300	-	-	-	300	-	-	-	300	-	-	-
製品番号:MS1452-0000-0000				製品番号:MS1452-0000-0000				製品番号:MS1452-0000-0000			
日付	時間	電圧	電流	日付	時間	電圧	電流	日付	時間	電圧	電流
4/14	10:00	OK	OK	4/14	10:00	OK	OK	4/14	10:00	OK	OK
準備中止	準備中止	準備中止	準備中止	準備中止	準備中止	準備中止	準備中止	準備中止	準備中止	準備中止	準備中止

4 準備終了      5 準備終了      6 準備終了

印刷機

Test by 6 point heat source



Perfect traceability of product (Bar code label)



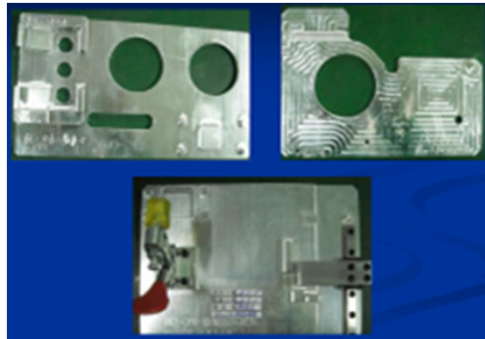
# Thermal Module Equipment



Automated 3D solder paste printing machine



Solder paste blender



Reflow & inspection fixture



Print Fixture



Functional Test

# Production Line



Module Assembly line



Module Assembly line



Listening Room



IR Reflow Machine



Reflow Line



Thermal Test

# Production Line

Dustproof



Water Curtain



# Conclusions

---

- **SUNON is the professional Fan & Cooling Module provider. Based on this advantage, we have the confidence that we can provide the Total Thermal Solution to our valued customers.**
- **SUNON have the sufficient & powerful R&D resources in Taipei and China, so that we can provide the efficient & strong support to customers.**
- **SUNON have complete equipment and can do all necessary tests for both Fan and Cooling Module products. We can provide professional service to our customers.**

---

# SUNON®

## Thanks for Your Attention!!

For more information  
please contact your local Sunon sales office  
or visit sunon website:

[www.sunon.com](http://www.sunon.com)