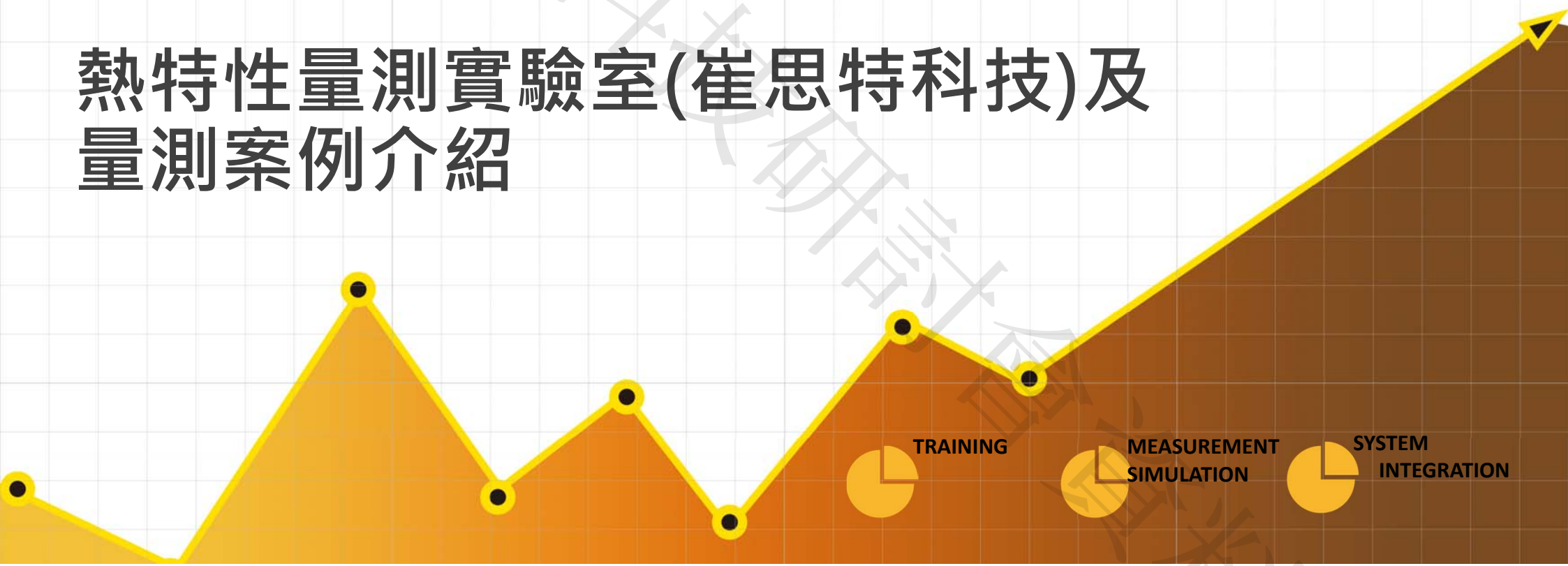




T3STech Corporation
Technical Consultant
Kris Tsai
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Mobile: +886-983-476-005

熱特性量測實驗室(崔思特科技)及 量測案例介紹

A decorative graphic at the bottom of the slide. It features a yellow line graph with several peaks and valleys, set against a brown background. Below the graph, there are three pie charts, each with a small section removed. The first pie chart is labeled "TRAINING", the second is labeled "MEASUREMENT SIMULATION", and the third is labeled "SYSTEM INTEGRATION".

TRAINING

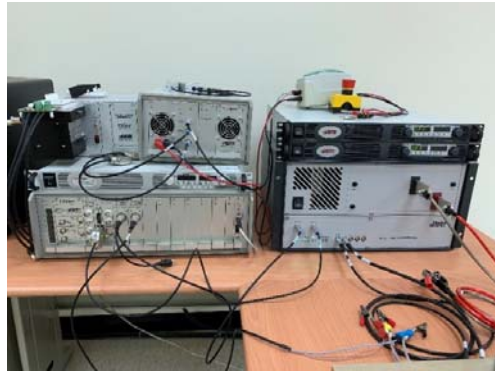
MEASUREMENT
SIMULATION

SYSTEM
INTEGRATION

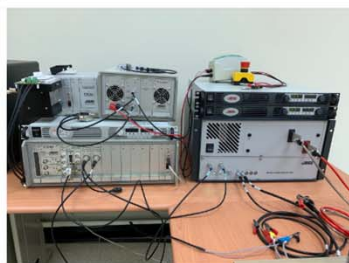
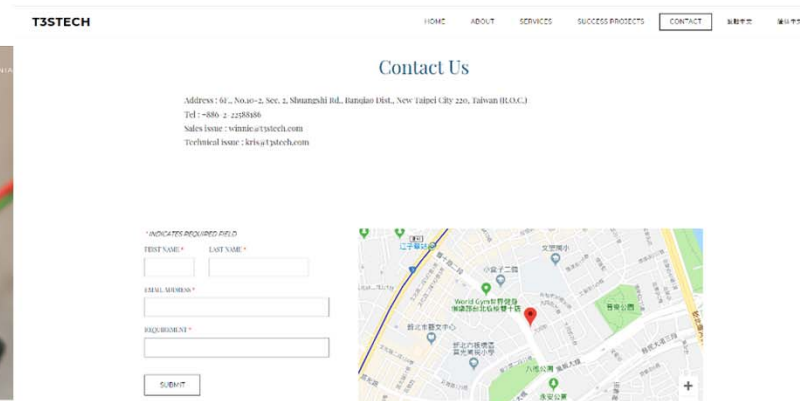
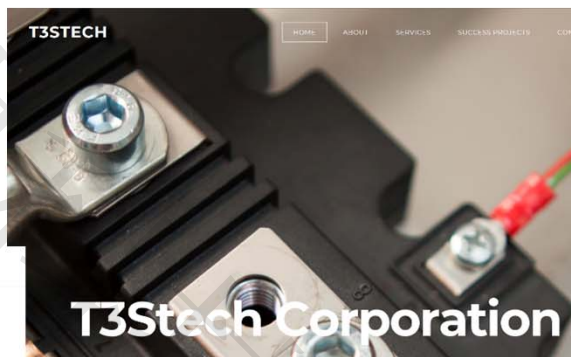


➤ 熱特性量測實驗室介紹及服務內容

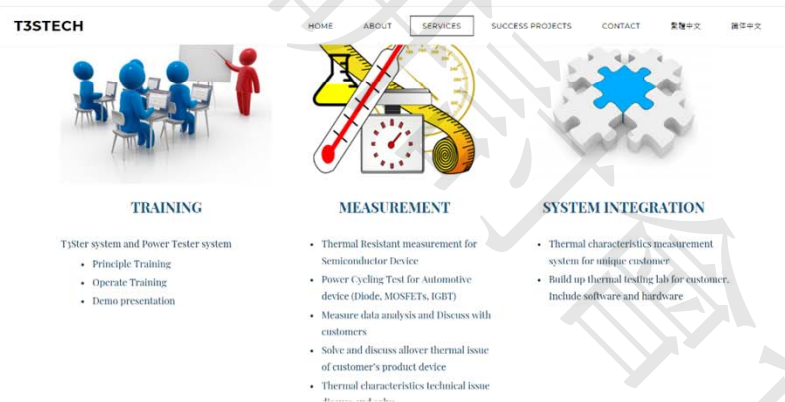
- 崔思特科技 熱特性量測實驗室 (T3Stech Corporation)
- 成立於 2019.1
- 地點: 新北市 板橋區
- **半導體電子元件之功率循環 / 熱阻測試 / 熱模擬 / 技術支援**



- 實驗室網頁
- Website: www.t3stech.com



T3Stech Equipment



T3Stech Service



Successful case share for IGBT measure

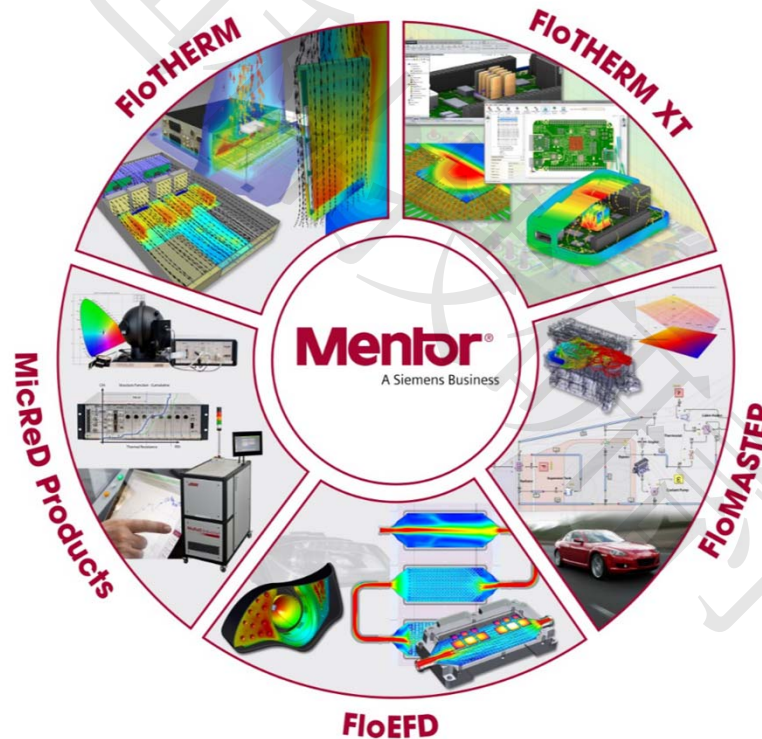
Thermal Lab. – Products Training Certification



Thermal Lab. — 西門子Simcenter MAD 產品 技術諮詢/解析

SIEMENS

Ingenuity for life



Hardware:

T3Ster System
Power Tester Series
Dyn-TIM
TeraLED

Software:

FloTHERM
FloEFD

- FloTHERM XT
- FloVENT

Thermal Lab.

- Technical Service item as bellow:

1. Demo MAD products to customers for HW / SW by Webex meeting
2. Benchmark measurement and simulation.
3. Data analysis and report to customers
4. Solve any problem of HW/ SW from customer requests.
5. Make SI system belongs to some unique customers which depends on their request from MicReD products.
6. install HW or SW on customer site
7. after installing, do detail training on customer site
8. Technical issue support for HW/SW.

Thermal Lab. — 量測及模擬的委託

➤ Hardware:

- T3Ster
- Booster x2 → 240A /11V, 150V /10A
- Still-Air Chamber
- Julabo Chiller (~450W)
- Thermostat (~8W)
- MicReD Cooling Plate 30X40

➤ Software:

- FloTHERM
- FloEFD
- FloTHERM XT
- FloVENT

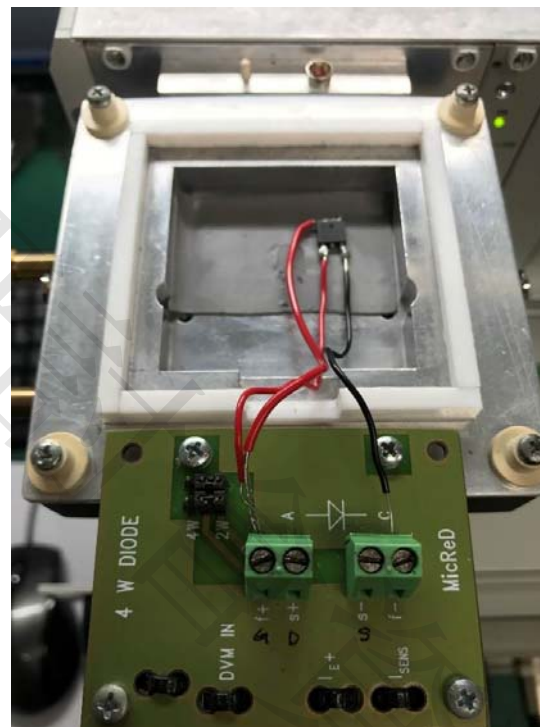
➤ Measure/Simulation Support item

- Rth measurement
- Reliability cycling test
- Customer benchmark measurement
- Data analysis and technical issue support
- SI (System Integration) system arrangement
- Software simulation analysis(include technical issue support)



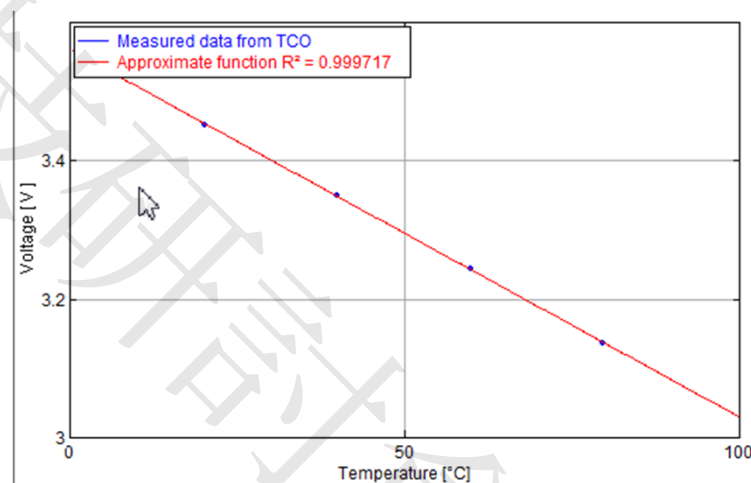
➤ 量測案例分享

量測案例 1 - MOSFET單體熱阻量測



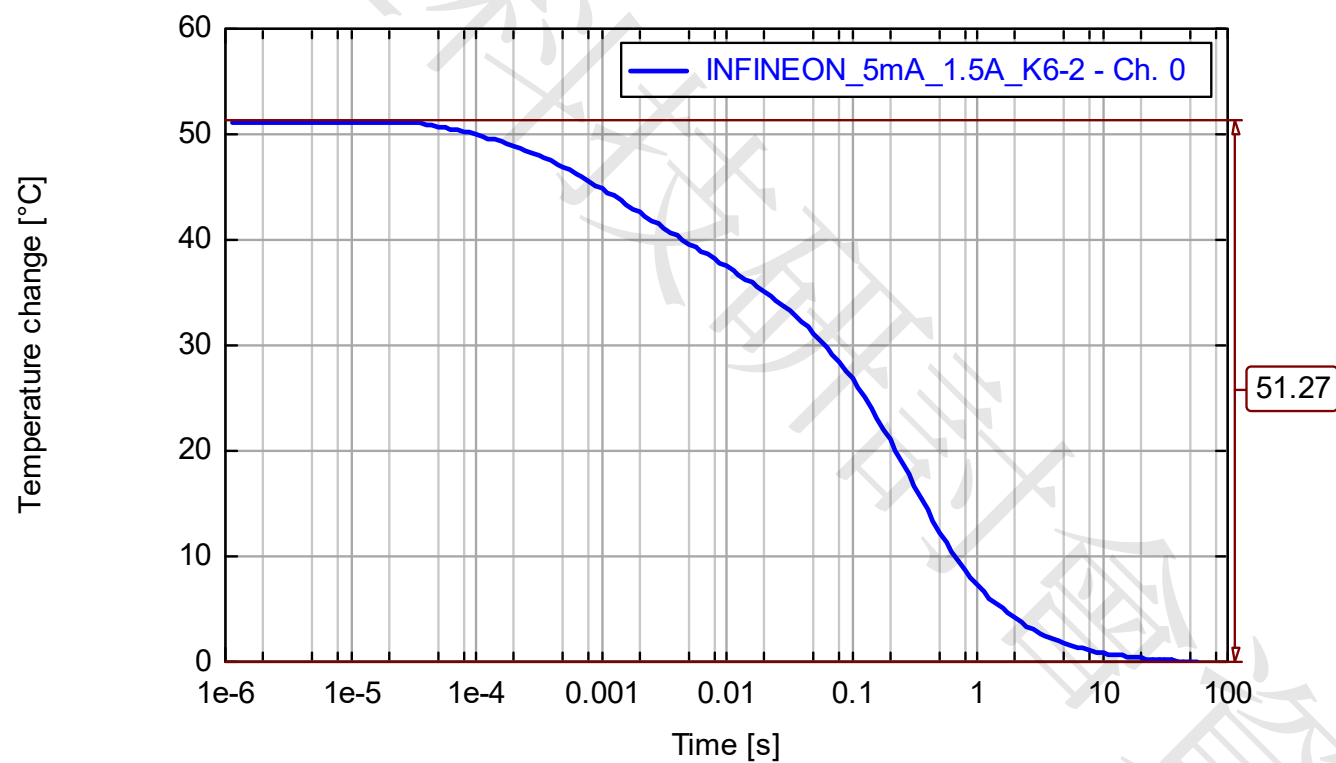
量測案例 1 - MOSFET單體熱阻量測

DUT	Infineon 80R1K4P7	
Item	T (°C)	Vf (V)
T1	20.11	3.451936
T2	39.99	3.350276
T3	59.89	3.244832
T4	79.71	3.135554
R ²	0.9997	
Sensitivity (mV/K)	-5.307	



量測案例 1 - MOSFET單體熱阻量測

T3Ster Master: Smoothed response



量測案例 1 - MOSFET單體熱阻量測

T3Ster Master: structure function(s)

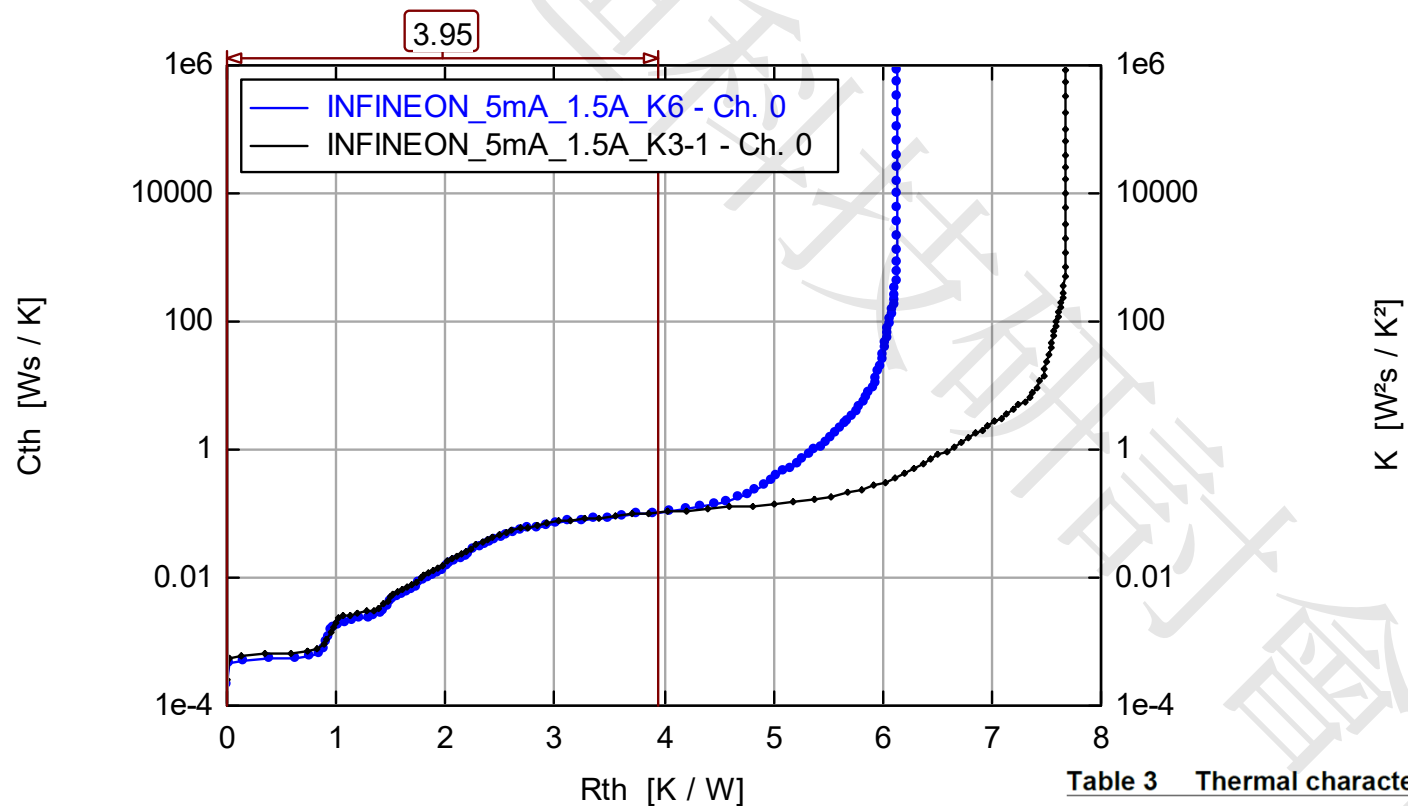


Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	M
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	3.9	$^{\circ}C/W$	-

量測案例 2 - 不同測試條件下的熱阻變化

1. Different Environment Temp. (60c and 80c)

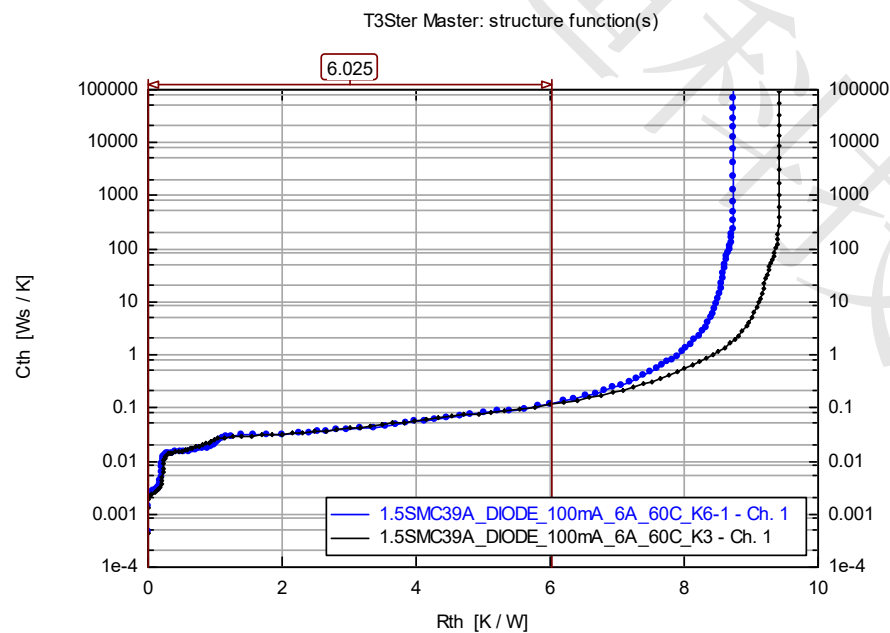
- DUT put on **Cooling Plate** (溫控冷板) and measurement
- Measurement Parameter and I-V Characteristic as bellow:

Set Parameter	1.5SMC39A
Im	100mA
Id	6A
Ambient Temp.	60 °C and 80 °C

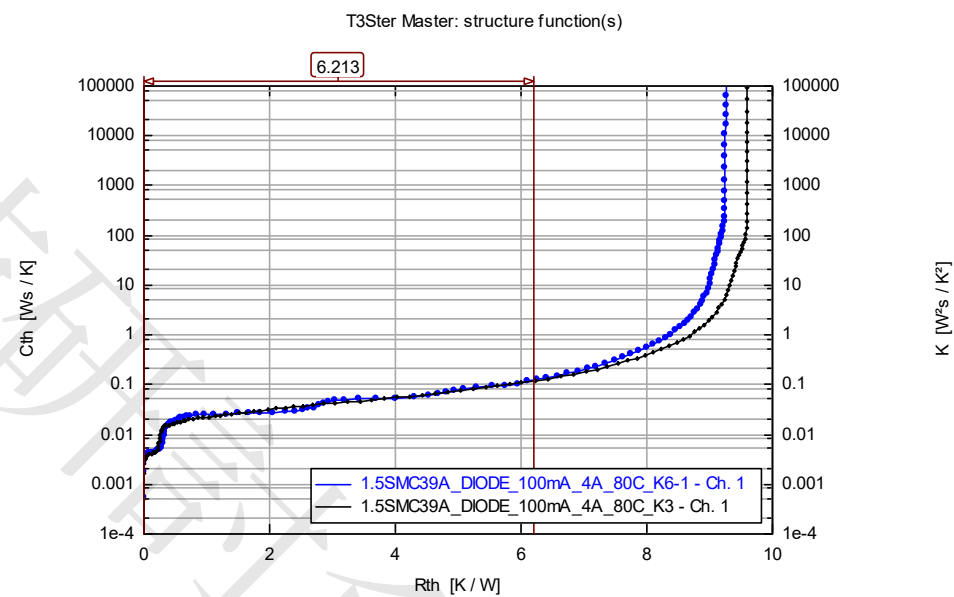
* Remark: Im is measurement current and Id is driven current.



量測案例 2 - 不同測試條件下的熱阻變化



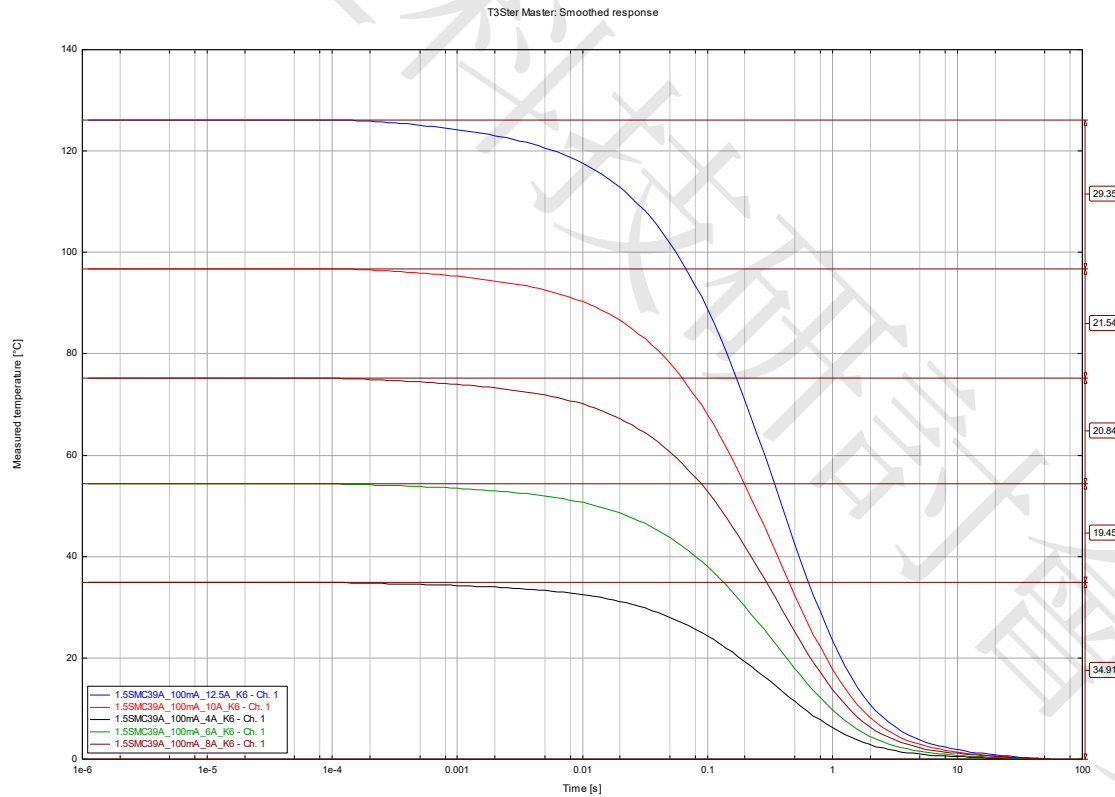
60度



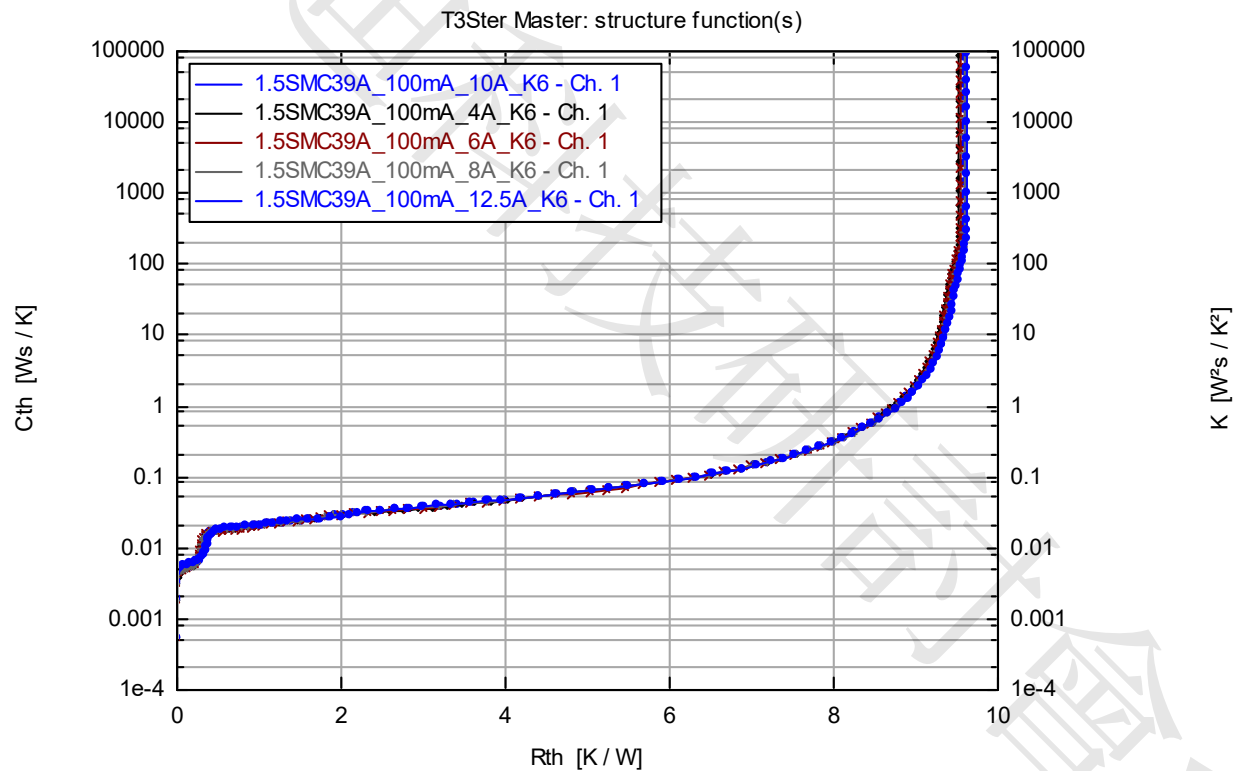
80度

量測案例 2 - 不同測試條件下的熱阻變化

2. Different ΔT_j ----60,80,100,120,150



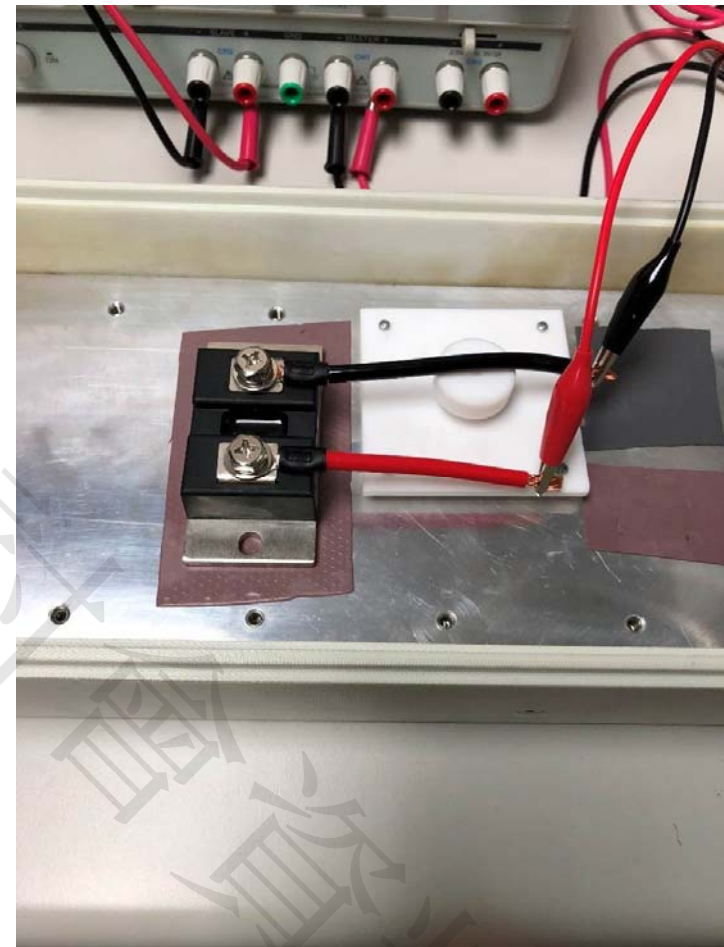
量測案例 2 - 不同測試條件下的熱阻變化



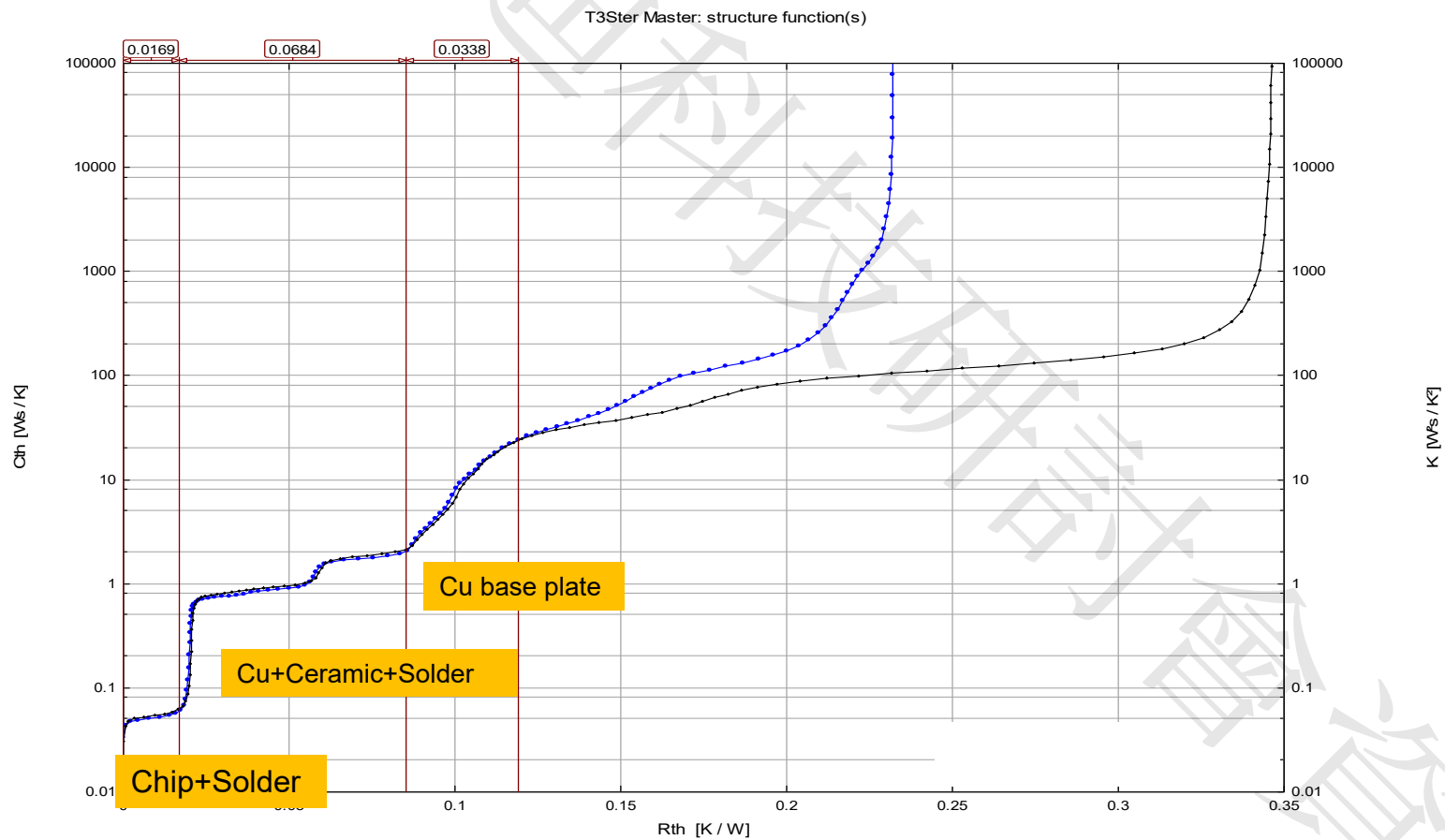
量測案例 3 - 不同模組的熱阻量測優劣比較

T3Ster Parameter	Two Diode Module
I_m	100 mA
I_d	50A
Ambient Temp.	25 °C

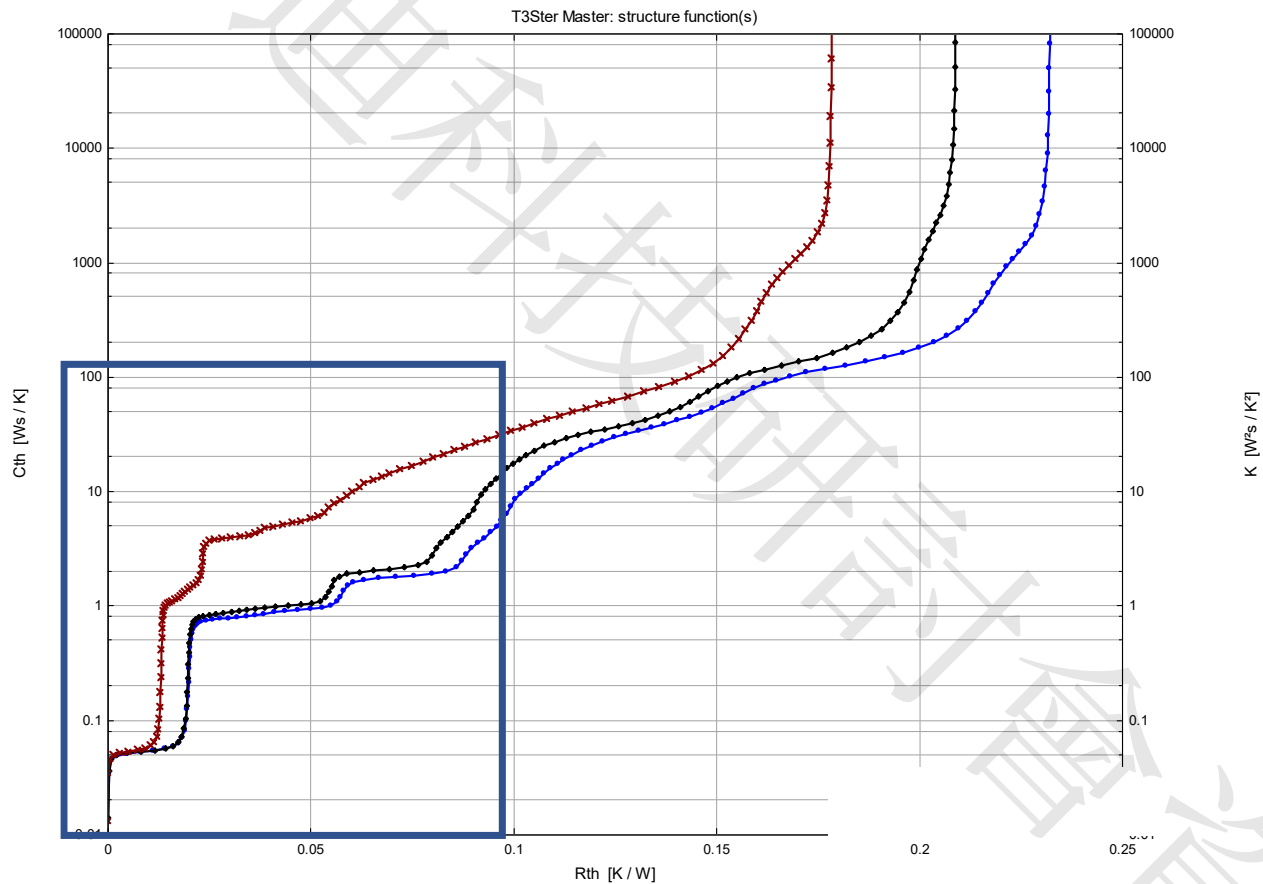
* Remark: I_m is measurement current and I_d is driven current.



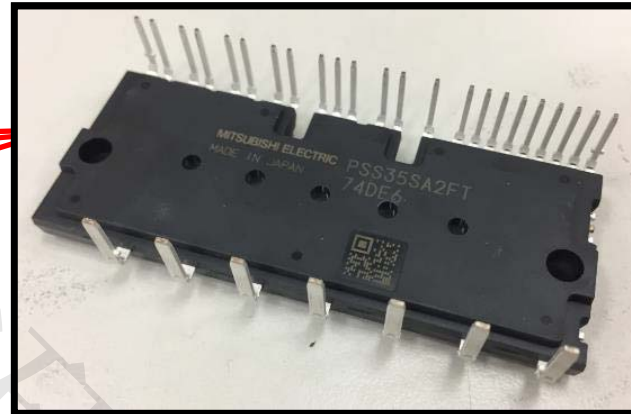
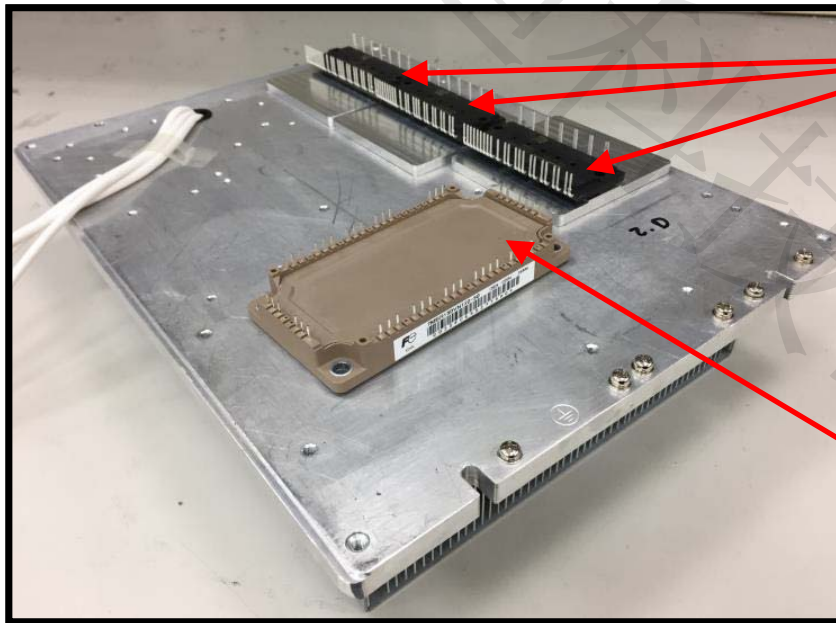
量測案例 3 - 不同模組的熱阻量測優劣比較



量測案例 3 - 不同模組的熱阻量測優劣比較

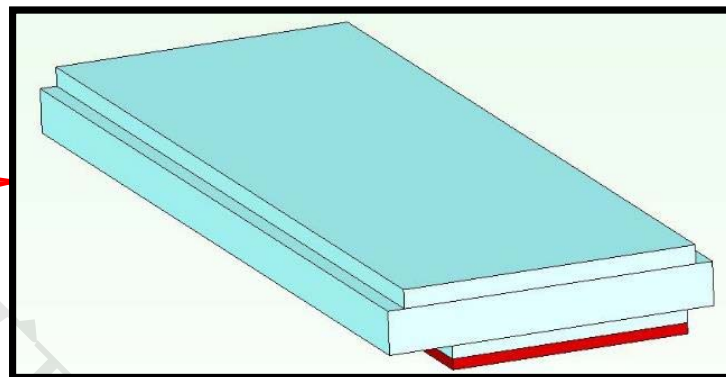
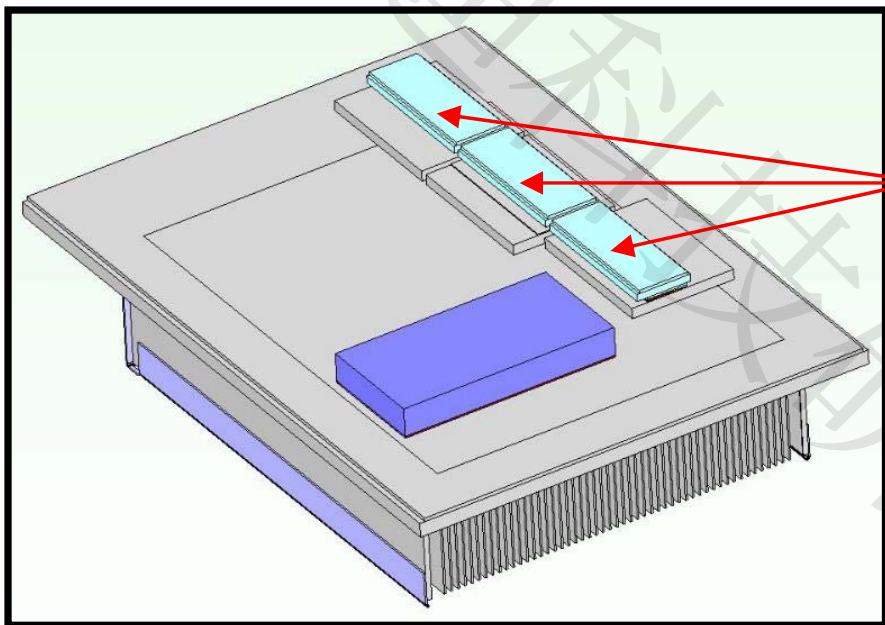


量測案例 4 – T3Ster 和FloTHERM的校正應用



1. 功率開關元件，常使用於驅動電機的變頻器與驅動器。
2. 高電流驅動產生大量積熱。
3. 四軸一體設計造成散熱問題

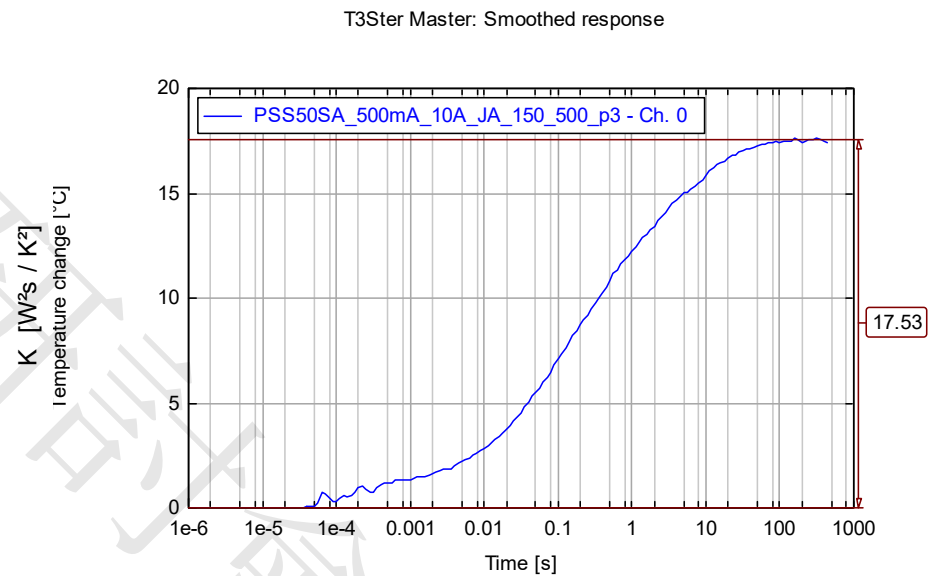
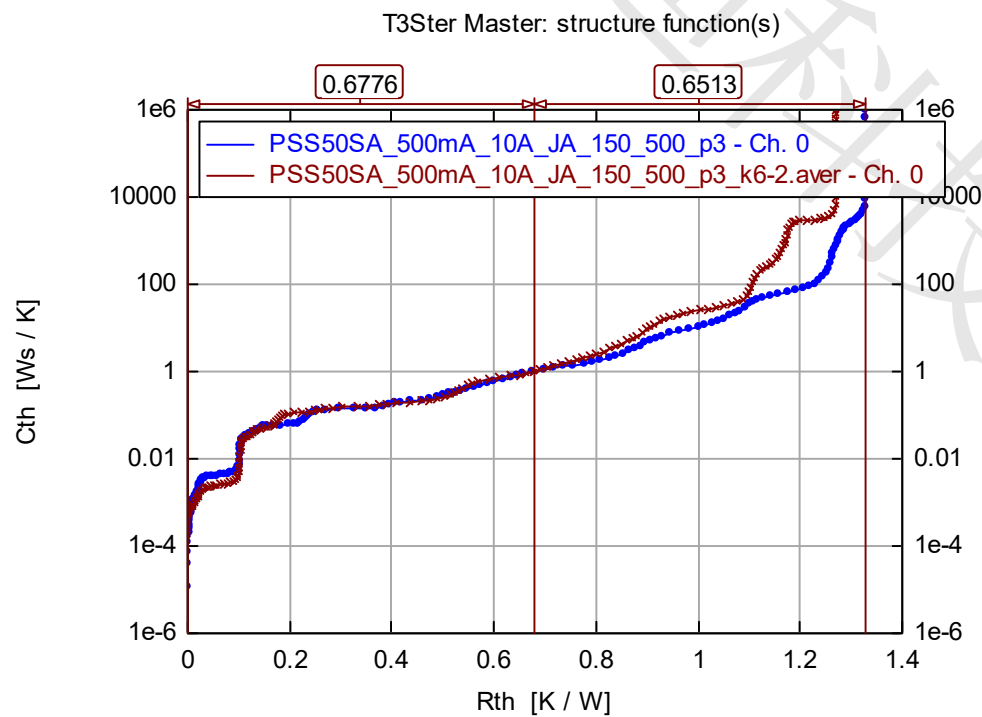
量測案例 4 - T3Ster 和FloTHERM的校正應用



1. 僅量測 IGBT 模組外觀尺寸，並使用 Cuboid 建構 3D 模型
2. 整個 IGBT 模組均設定相同材質參數
3. 底部加入 Cuboid，並設定均勻發熱

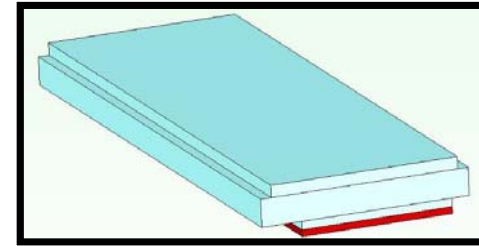
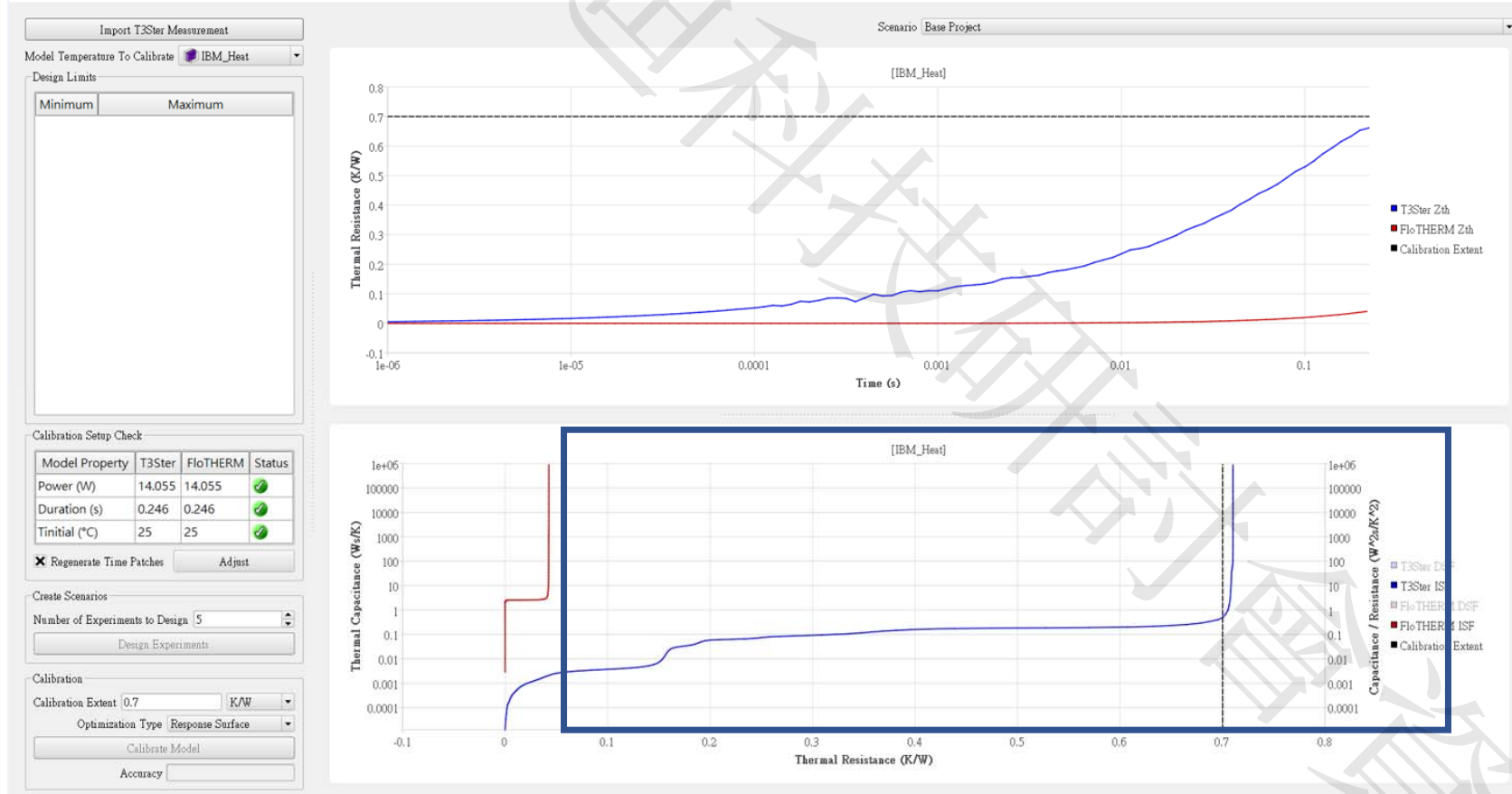


量測案例 4- T3Ster 和FloTHERM的校正應用

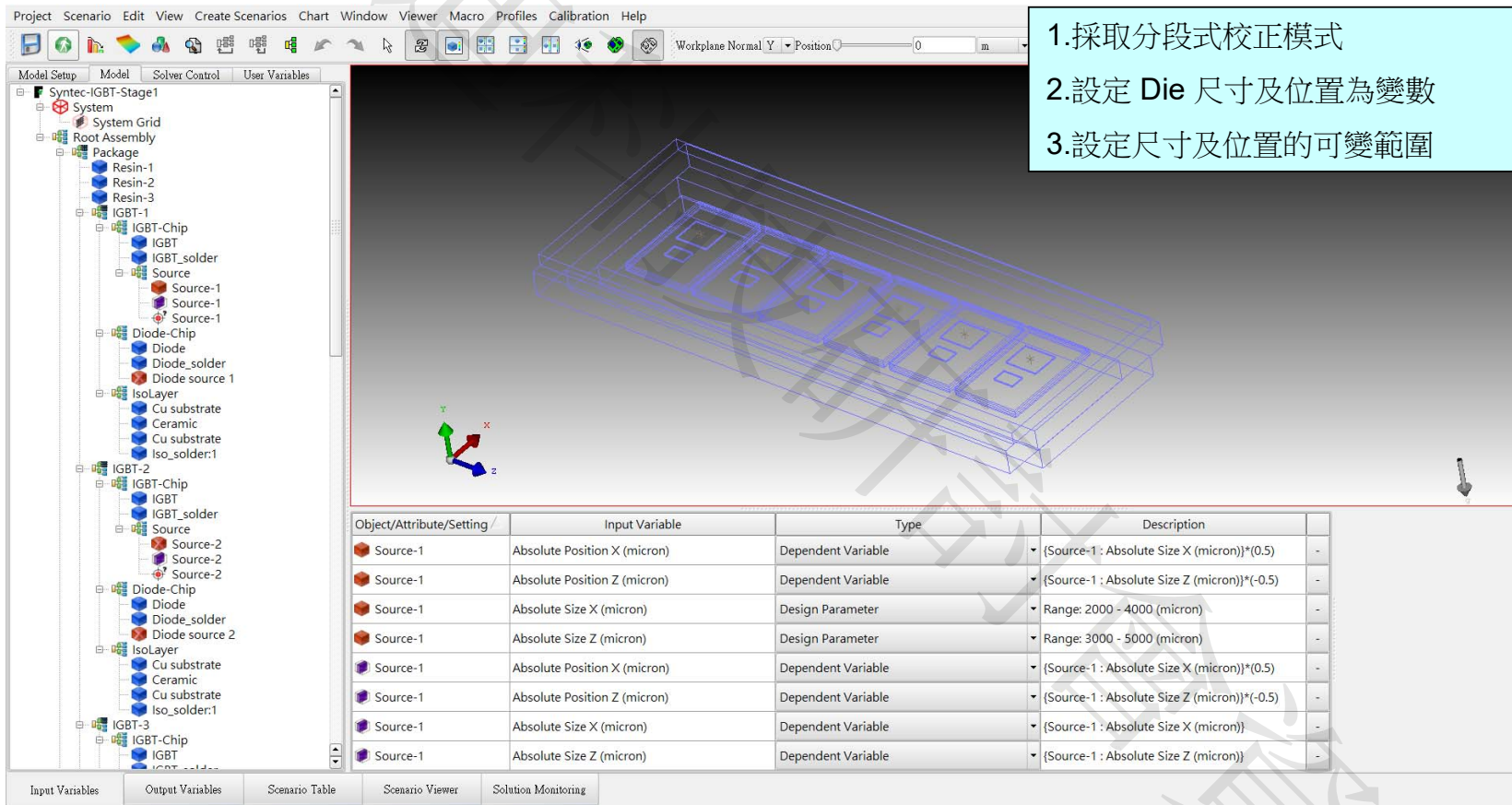


量測案例 4 - T3Ster 和FloTHERM的校正應用

PSS50SA_500mA_10A_JA_150_500_p1_0_final_Ch0.floccalibration - Detailed Model Calibration



量測案例 4 - T3Ster 和FloTHERM的校正應用



The screenshot displays the T3Ster software interface. On the left is a hierarchical tree view of the model components, including 'Syntec-IGBT-Stage1', 'System Grid', 'Root Assembly', 'Package', and three IGBT-Chip assemblies (IGBT-1, IGBT-2, IGBT-3). The central area shows a 3D wireframe model of the power module. On the right, a table lists the input variables used for calibration.

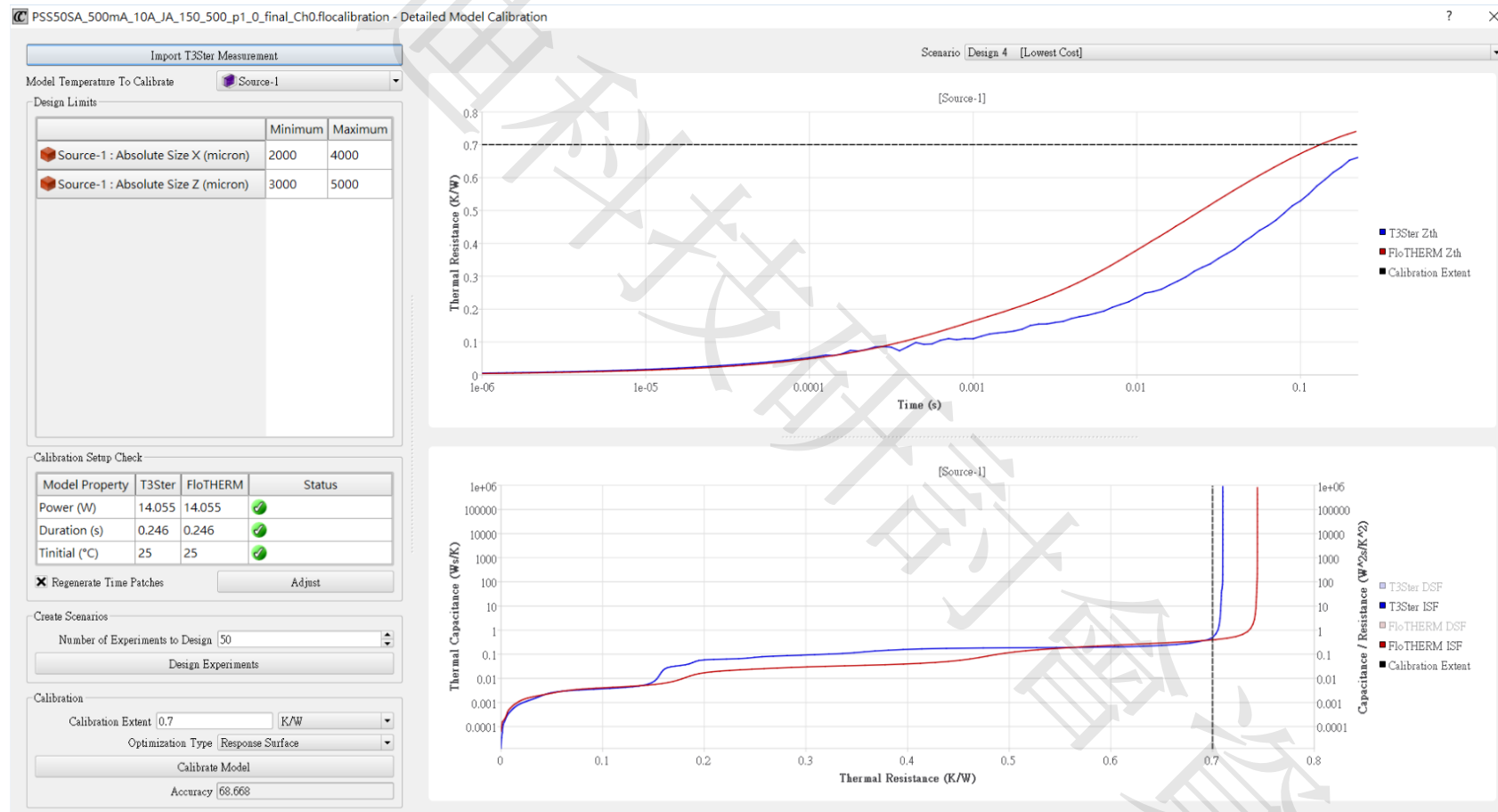
Object/Attribute/Setting /	Input Variable	Type	Description	
Source-1	Absolute Position X (micron)	Dependent Variable	{Source-1 : Absolute Size X (micron)}*(-0.5)	-
Source-1	Absolute Position Z (micron)	Dependent Variable	{Source-1 : Absolute Size Z (micron)}*(-0.5)	-
Source-1	Absolute Size X (micron)	Design Parameter	Range: 2000 - 4000 (micron)	-
Source-1	Absolute Size Z (micron)	Design Parameter	Range: 3000 - 5000 (micron)	-
Source-1	Absolute Position X (micron)	Dependent Variable	{Source-1 : Absolute Size X (micron)}*(-0.5)	-
Source-1	Absolute Position Z (micron)	Dependent Variable	{Source-1 : Absolute Size Z (micron)}*(-0.5)	-
Source-1	Absolute Size X (micron)	Dependent Variable	{Source-1 : Absolute Size X (micron)}	-
Source-1	Absolute Size Z (micron)	Dependent Variable	{Source-1 : Absolute Size Z (micron)}	-

1.採取分段式校正模式

2.設定 Die 尺寸及位置為變數

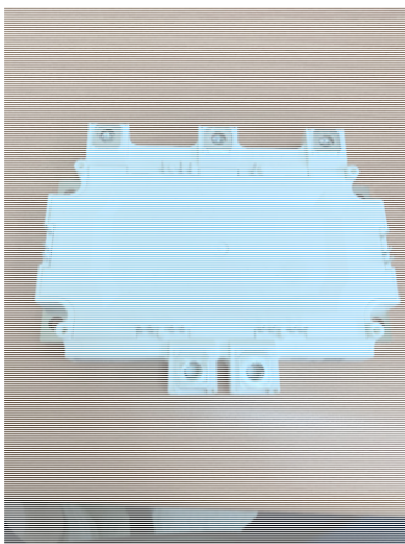
3.設定尺寸及位置的可變範圍

量測案例 4 - T3Ster 和FloTHERM的校正應用

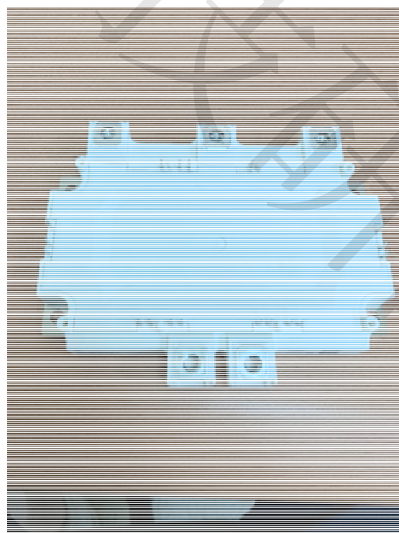


量測案例 5—功率循環及熱阻量測比較

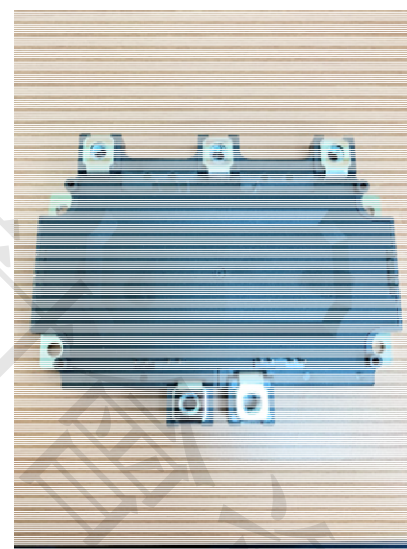
- 3個不同的 IGBT 模組的參數及熱特性比較。
- 提供相同的測試條件於3個模組進行測試。
- 提供比較的模組為: Infineon和STARPOWER



Infineon-
FS400R07A1E3-00010



Infineon-
FS400R07A1E3-00226



STARPOWER-
GD400FFX65P3S

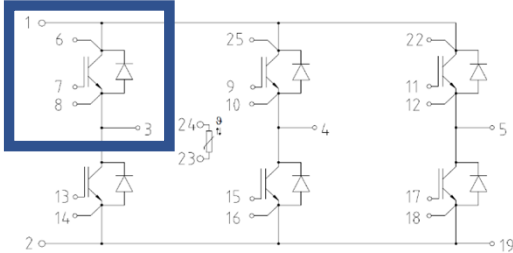
量測條件定義-3個模組皆相同

- 環境溫度: 25°C
- 功率迴圈測試施加功率: 約500W @ 320A
- 測試條件: 固定電流 320A
- 總迴圈次數: 2000 cycles
- 每 200 cycles 測試量測一次熱阻 @ 200A
- Pulse on /off 時間: 3 秒 / 3 秒

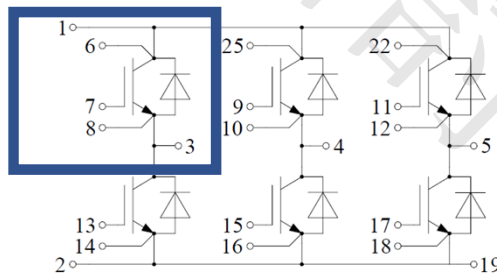


FS400R07A1E3
HybridPACK™ 1 Module

7 Circuit diagram



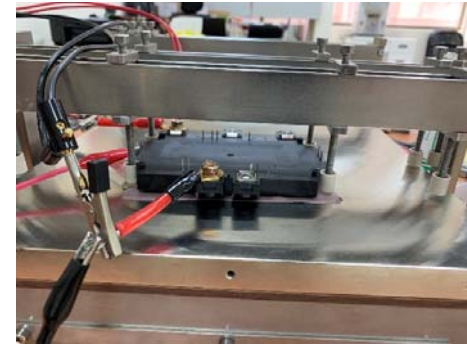
Circuit Schematic



3顆模組中所量測的IGBT



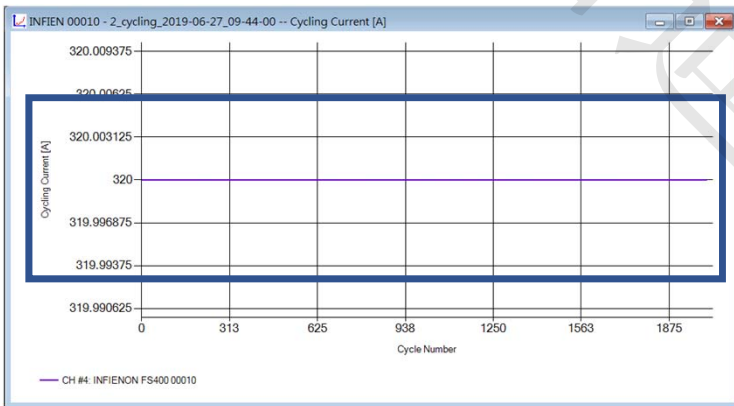
Infineon-
FS400R07A1E3-00010



STARPOWER-
GD400FFX65P3S

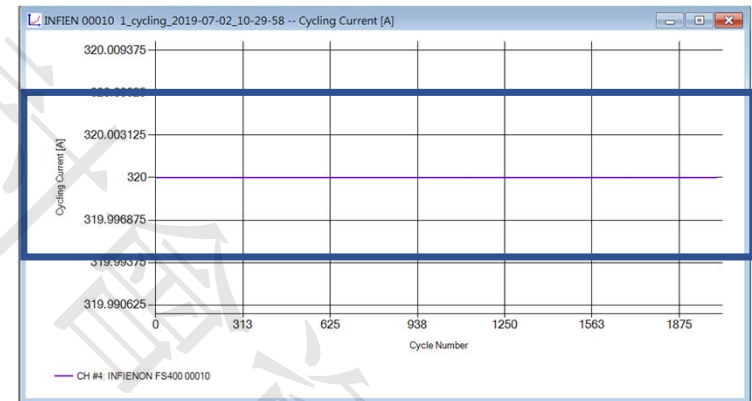
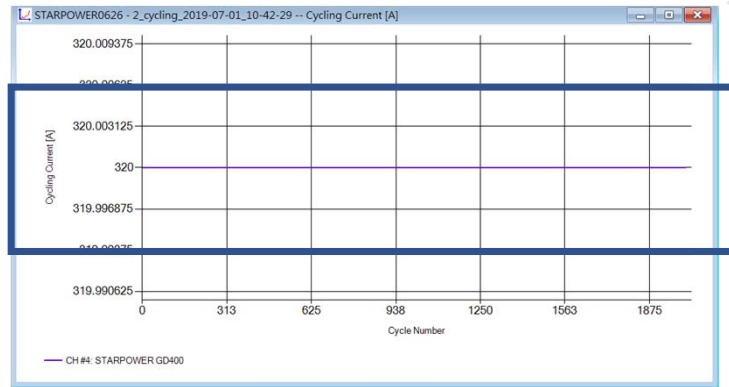
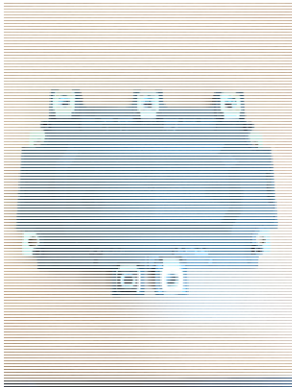
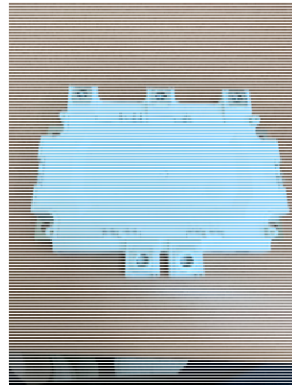


Power Tester 量測結果 – current output@320A



Infineon-
FS400R07A1E3-00010

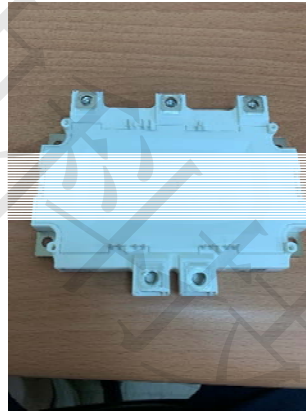
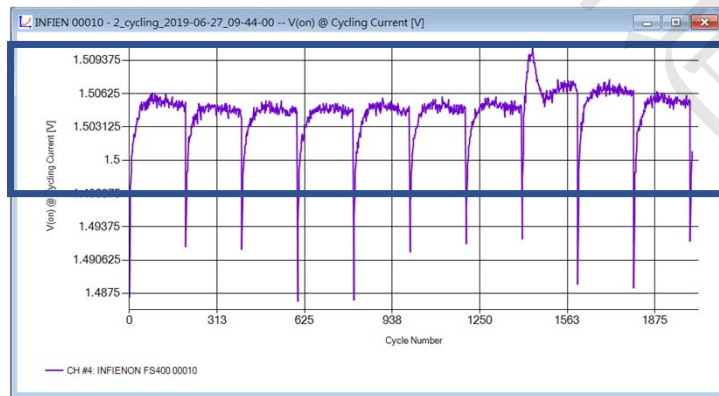
Infineon-
FS400R07A1E3-00226



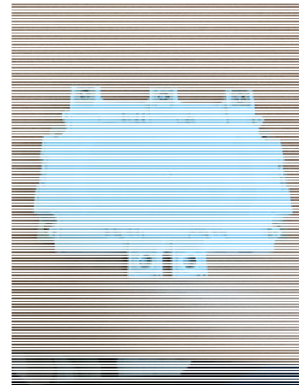
STARPOWER-
GD400FFX65P3S

首先可以確認設備輸出給2個模組的電流是相同且穩定的

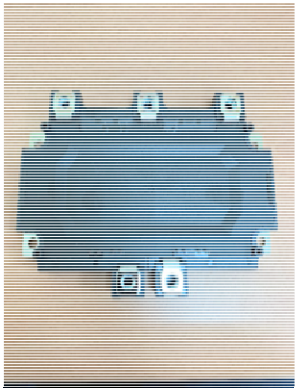
Power Tester 量測結果 – Von (320A 下的電壓)



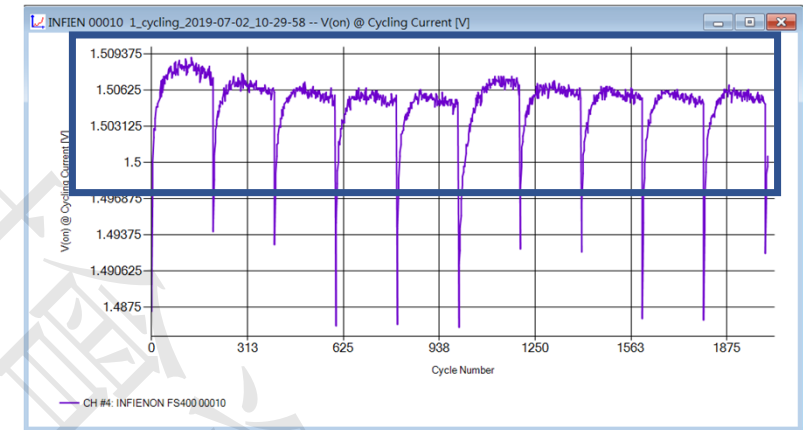
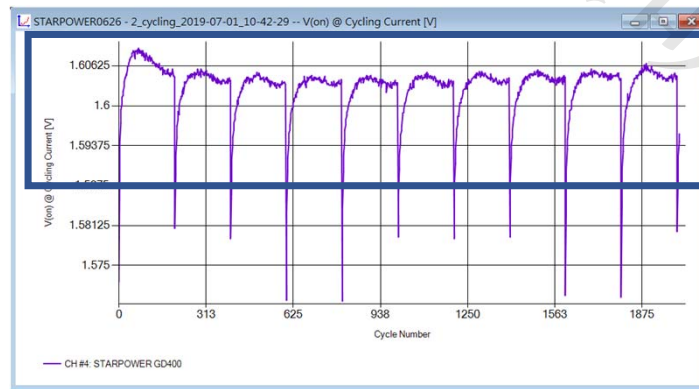
Infineon-
FS400R07A1E3-00010
About 1.5V



Infineon-
FS400R07A1E3-00226
About 1.5V



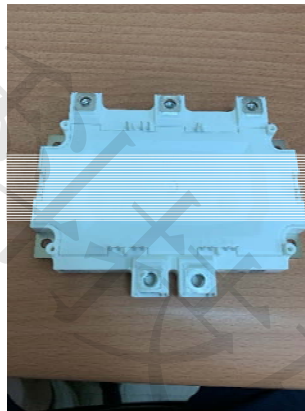
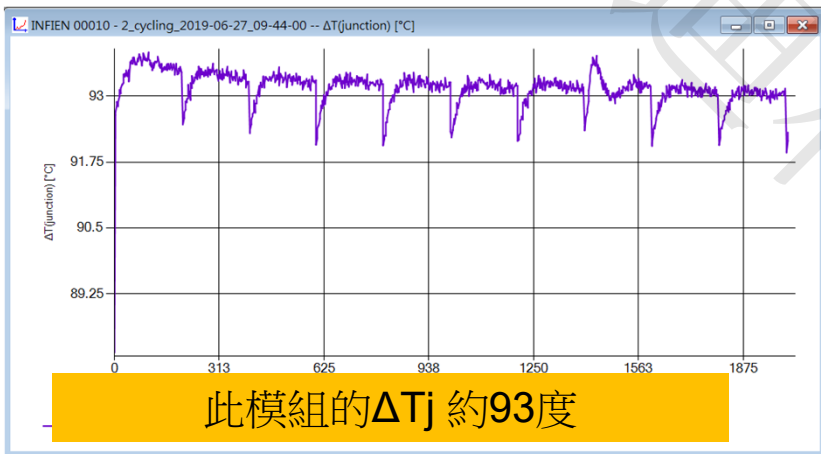
STARPOWER-
GD400FFX65P3S
About 1.6V



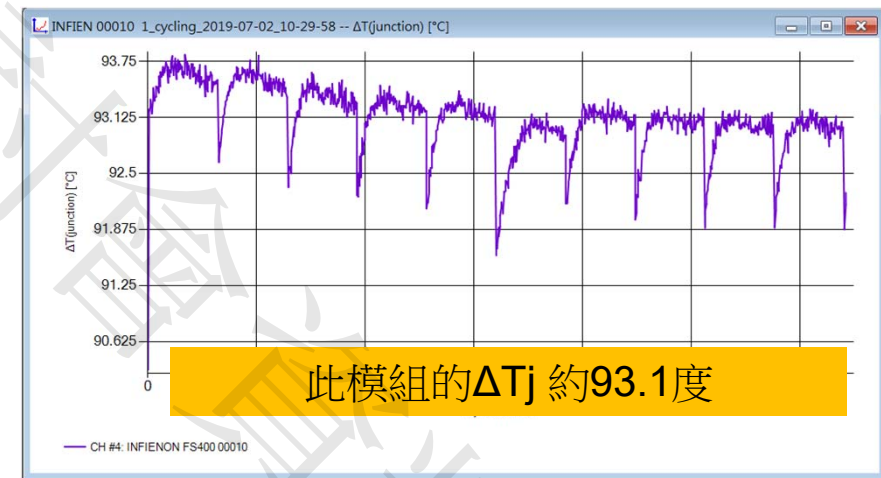
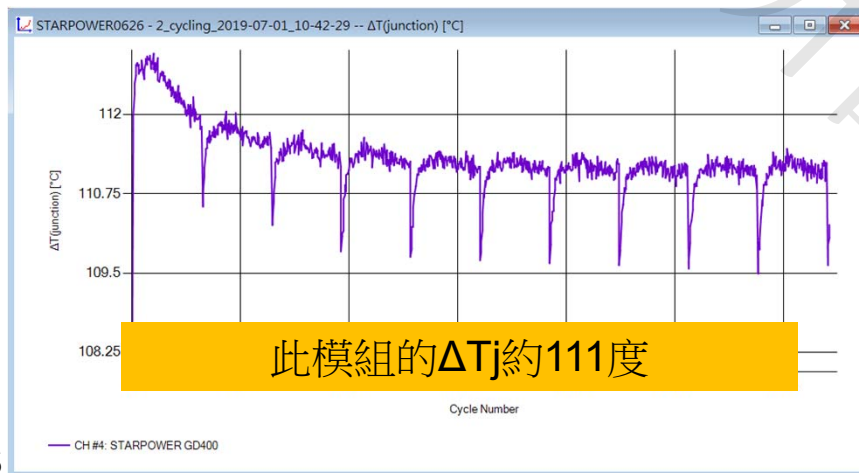
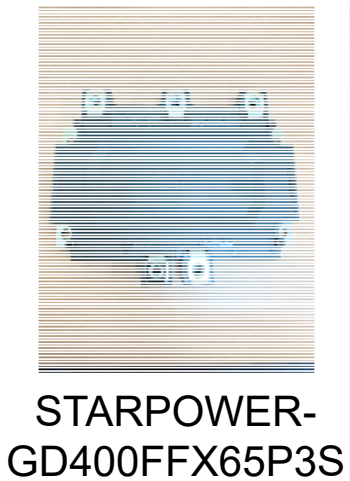
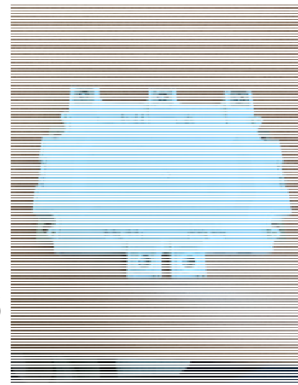
由3個模組Von的穩定表現可以確認 wire bond在經過2000 cycle之後並無異常

Power Tester 量測結果 - ΔT_j 溫度監控

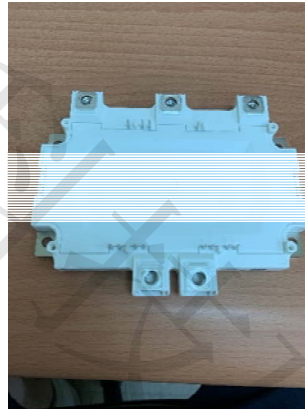
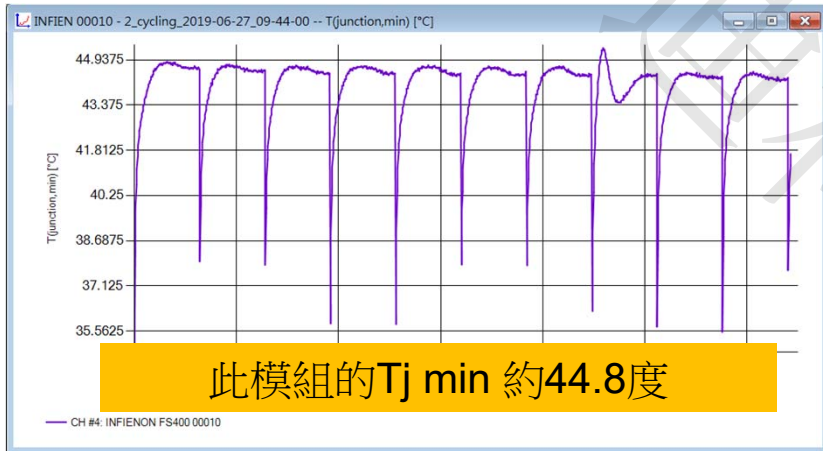
Infineon-
FS400R07A1E3-00010



Infineon-
FS400R07A1E3-00226

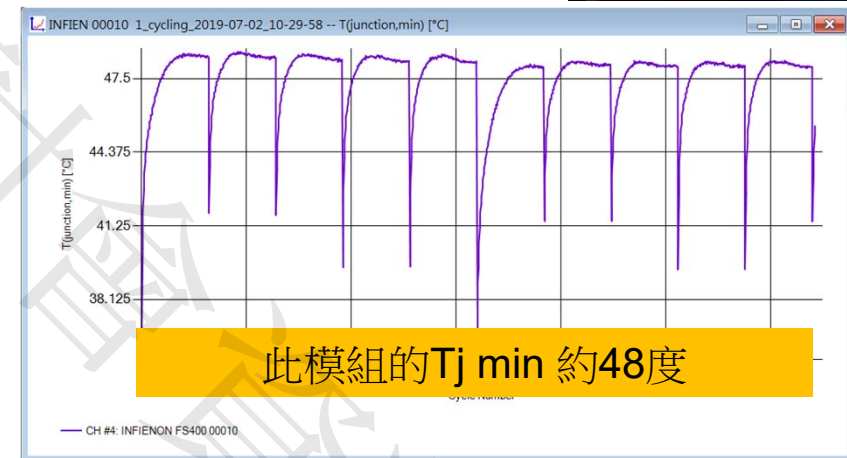
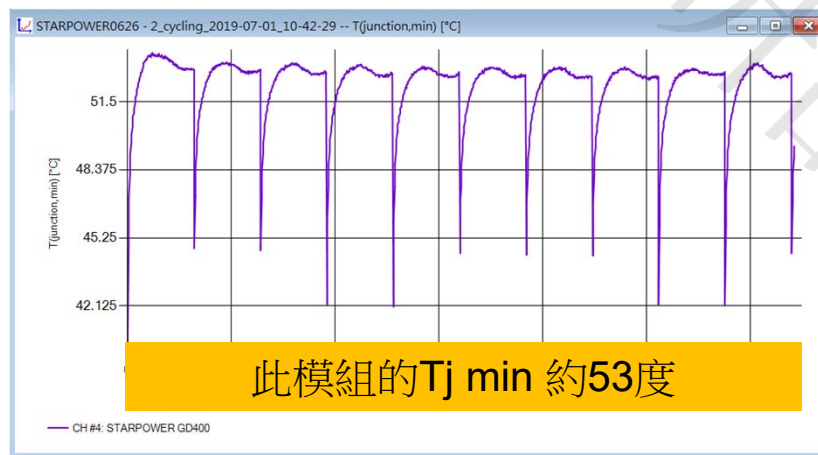
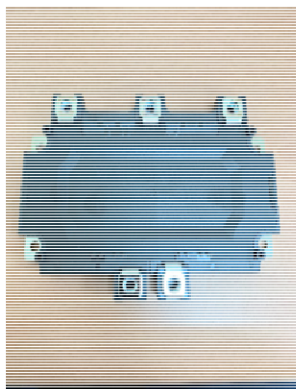
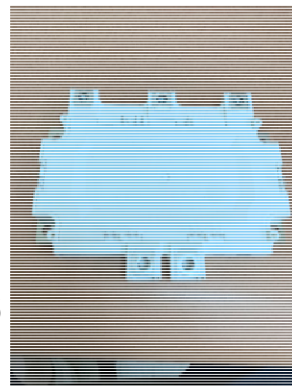


Power Tester 量測結果 - T_j 最小值

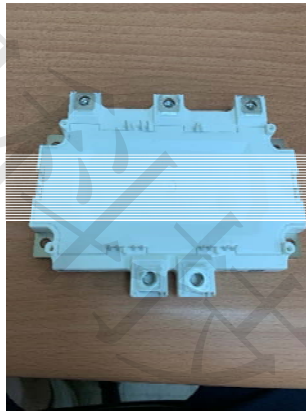
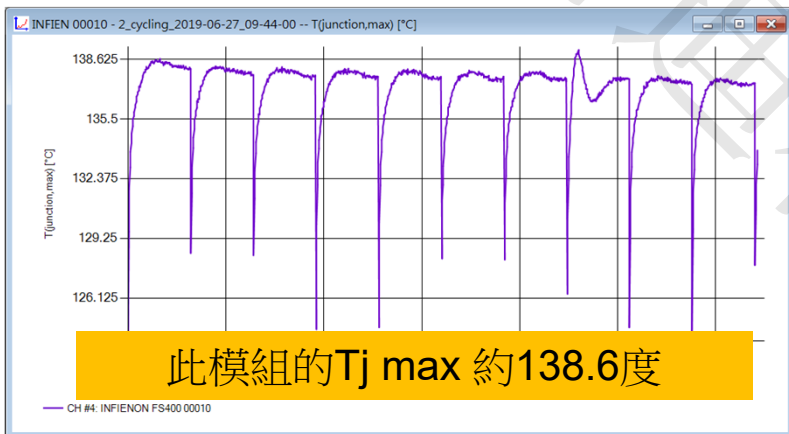


Infineon-
FS400R07A1E3-00010

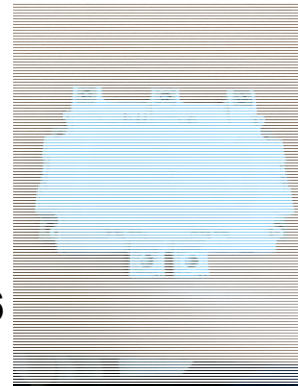
Infineon-
FS400R07A1E3-00226



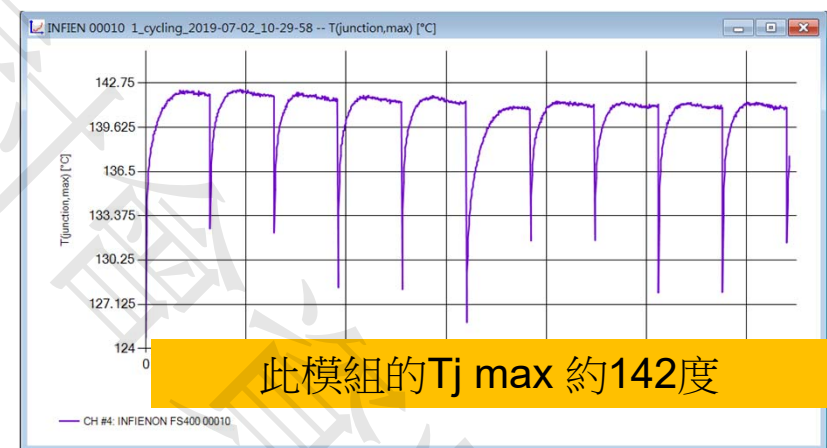
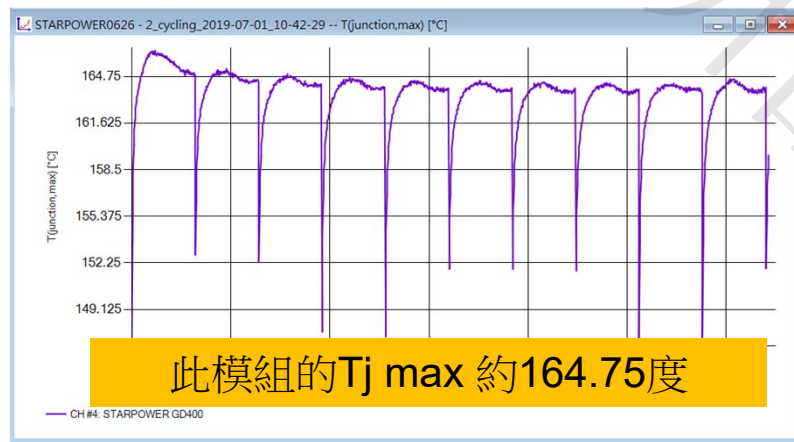
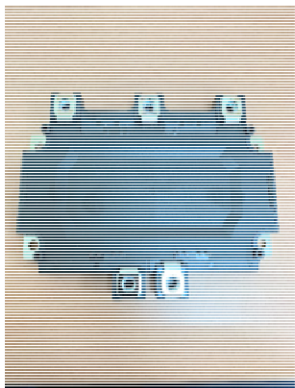
Power Tester 量測結果 - T_j 最大值



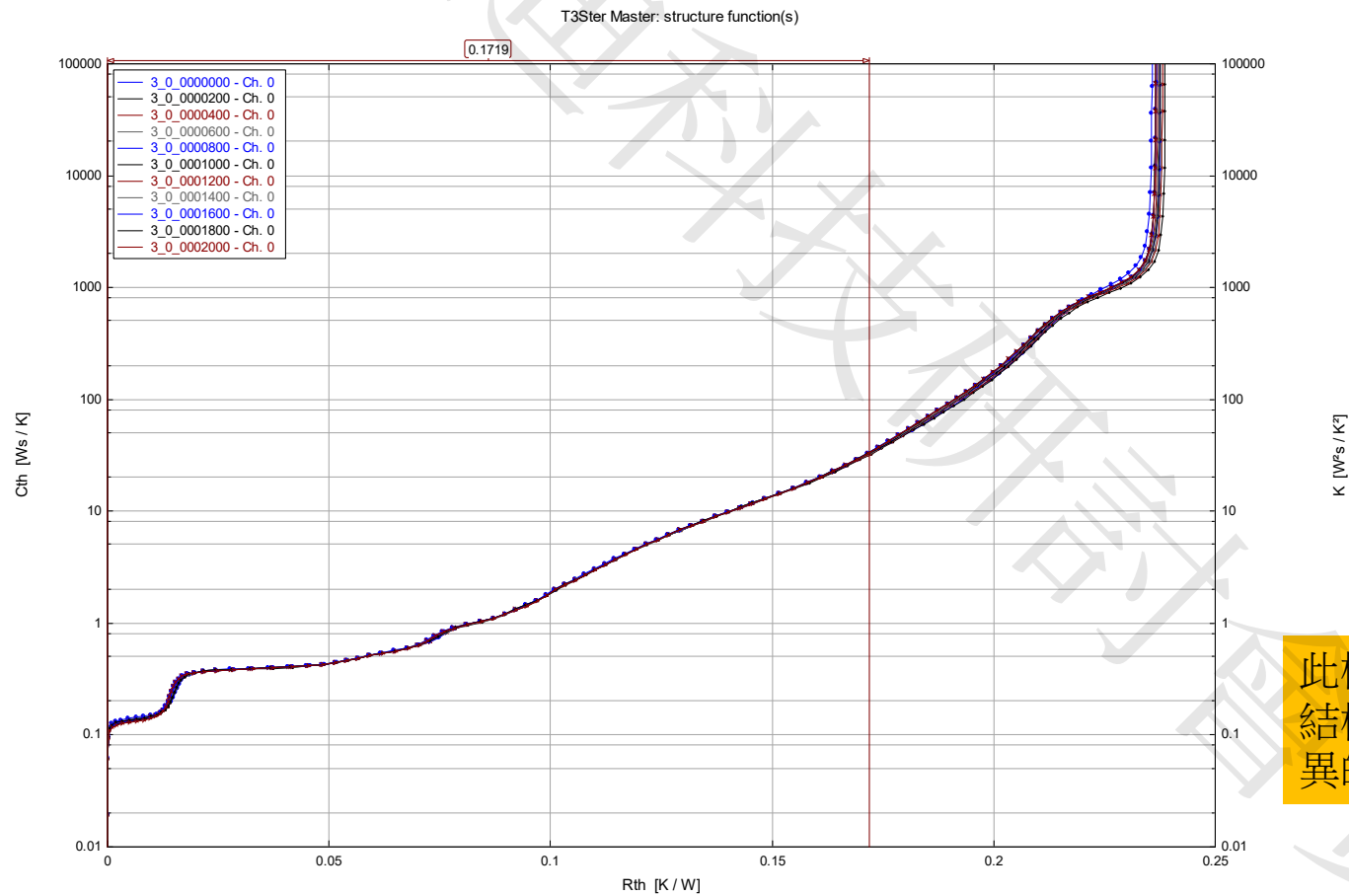
Infineon-
FS400R07A1E3-00010



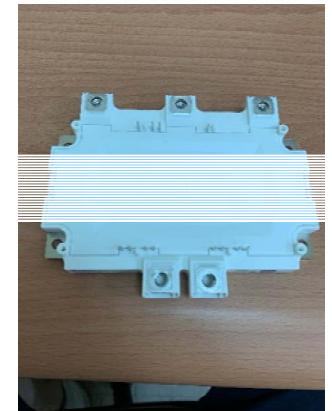
Infineon-
FS400R07A1E3-00226



Power Tester 量測結果 - 結構函數熱阻 @0.171 k/w



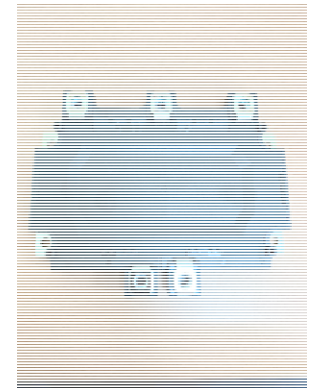
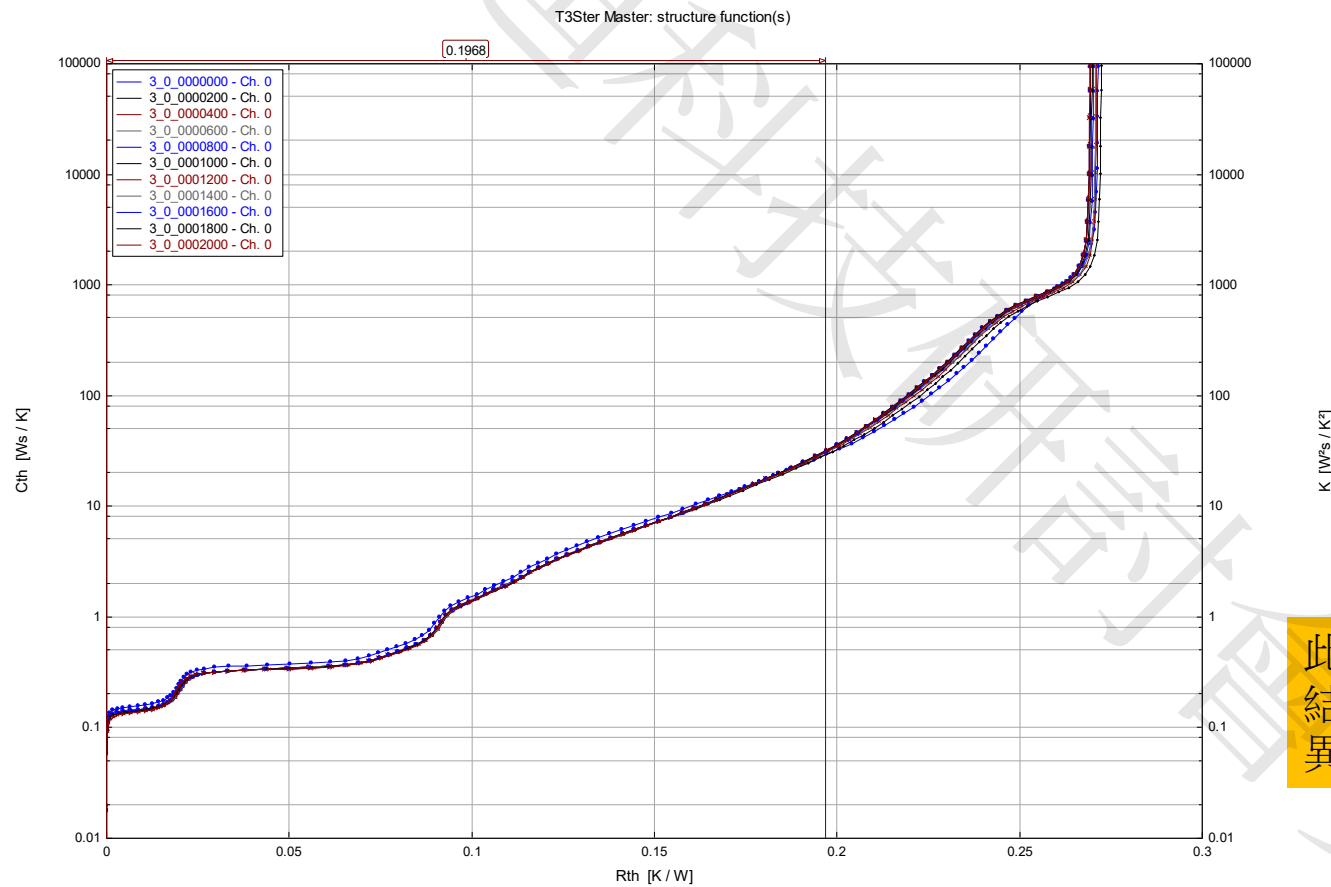
Infineon-
FS400R07A1E3-00010



此模組在run了2000 cycle之後，由結構函數來看熱阻式完全沒有差異的，表示結構層並無損壞

Power Tester 量測結果 - 結構函數熱阻 @0.197 k/w

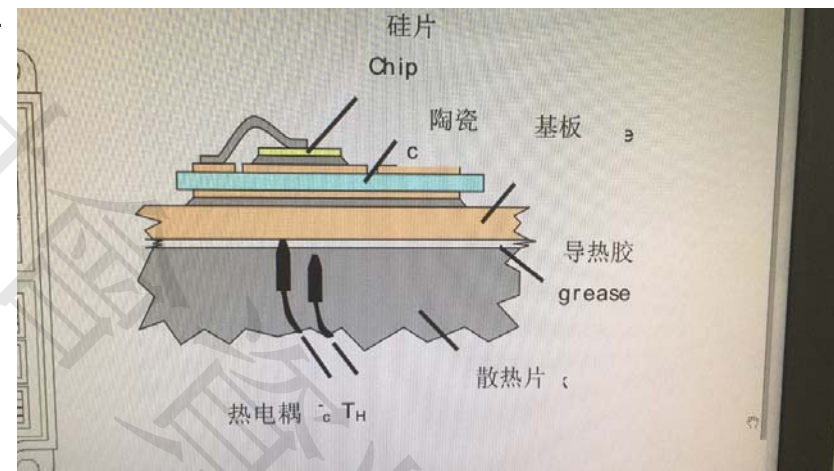
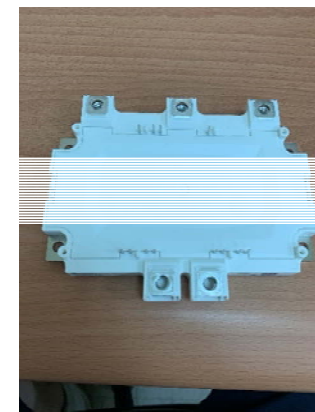
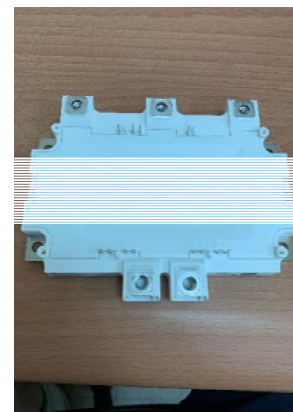
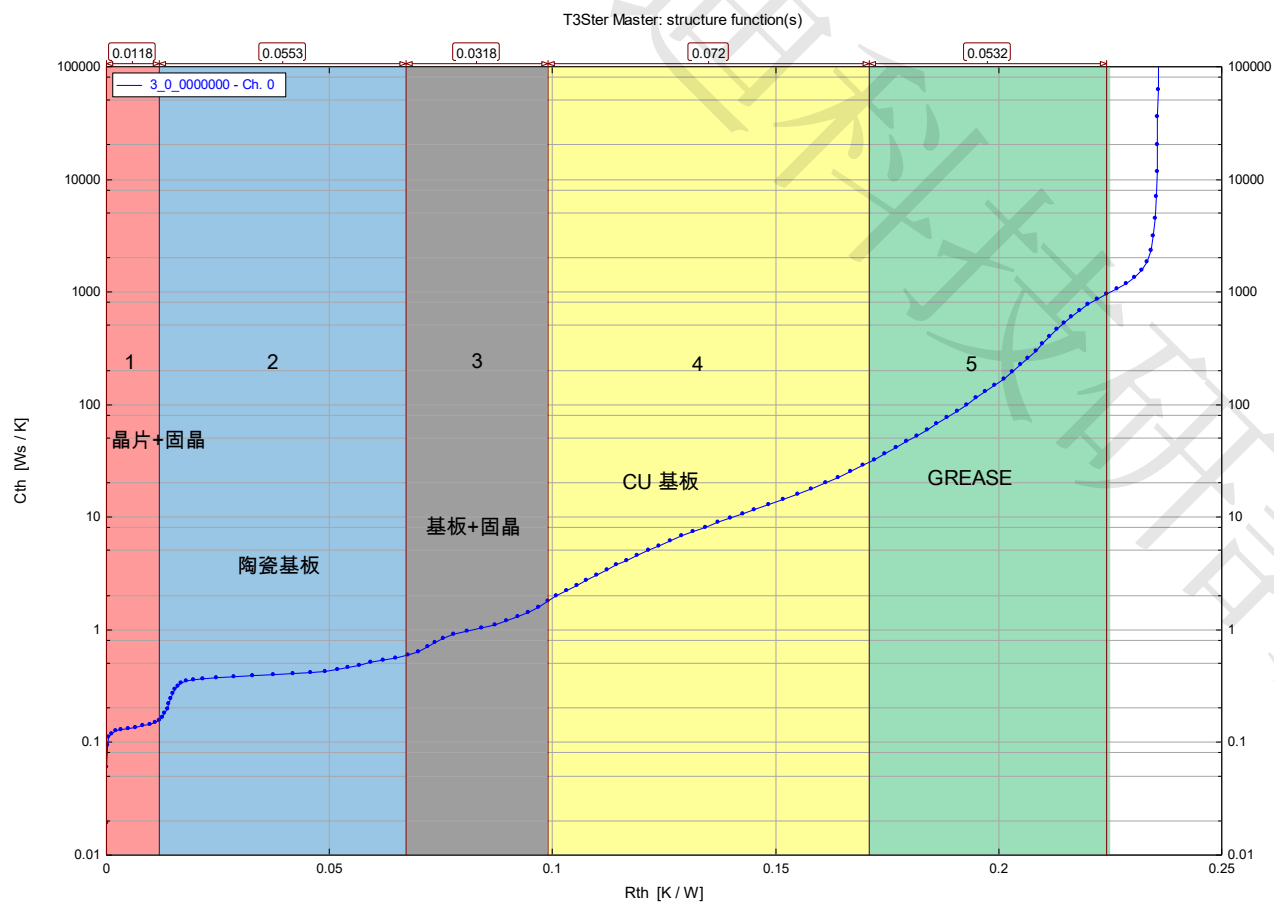
STARPOWER-
GD400FFX65P3S



此模組在run了2000 cycle之後，由結構函數來看熱阻式完全沒有差異的，表示結構層並無損壞

Power Tester 量測結果 - 約略分層確認

Infineon- FS400R07A1E3-00010 Infineon- FS400R07A1E3-00226



- TRAINING
- MEASUREMENT
- SYSTEM INTEGRATION

➤ 聯絡我們:

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