



西門子Simcenter MicReD測 試設備介紹

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Outline



- ✧ 易富迪科技熱特性量測實驗室
- ✧ Siemens and MicReD
- ✧ Simcenter MicReD量測設備介紹
- ✧ Worldwide & China and Taiwan Customers

易富迪科技熱特性量測實驗室



熱特性量測實驗室

- 成立：2019 年1 月
- 地點：新北市板橋區
(捷運江子翠站步行7分鐘)
- 服務：半導體元件熱阻量測服務
功率循環(壽命)量測服務
硬體DEMO及教育訓練

易富迪科技熱特性量測實驗室



全台唯一獨立量測實驗室



提供給客戶的服務:

1. 完整的Demo及教育訓練
2. 客戶產品熱特性的Benchmark
3. 代測服務
4. 資深工程師和客戶面對面的技術探討

量測可得到之結果 (Follow JEDEC 51-1 電性量測法)

1. 元件的 R_{thjc} 、 R_{thjb} 、 R_{thja} 熱阻值
2. 元件的 ΔT_j (junction to ambient) 溫度變化
3. Z_{th} (Thermal Impedance)
4. Structure Function 結構函數
5. Pulse Thermal Impedance
6. SOA (Safety Operation Area)
7. 利用JEDEC JESD 51-14量測後可分析:
 - a. 元件封裝層各層熱阻比較
 - b. 製程良率檢驗
 - c. 製程變異性比較 (更改封裝材料後熱阻的差異)

1. LED
2. Logic IC
3. Diode
4. MOSFET (discrete or module)
5. IGBT (discrete or module)
6. 除上述較常見的元件外，能通電並有電壓差變化的元件皆能量測

西門子受訓認證



Siemens & MicReD



- Hungarian company, spun out of Budapest University of Technology
Department of Electron Devices



- Still maintain strong links with BUTE:
 - innovation in products
 - research behind development



Siemens and MicReD

Siemens & MicReD



1997
Company
founded

2001
Thermal test chip
design won award

2005
SEMI-THERM top 2 papers;
and acquired by Flomerics

2007
Members of the EU
NANOPACK project

2008
Merging with Mentor Corporation
Mentor MicReD Product Development

**Mentor
Graphics®**

...ter first developed

Excellence Silver



5

7

2016
Mentor Corporation
merging with
Siemens Business

Mentor®
A Siemens Business

MicReD

Simcenter MicReD量測設備介紹

Simcenter MicReD 相關量測設備



T3Ster
暫態熱阻量測儀



T3Ster Booster
增壓穩壓系統



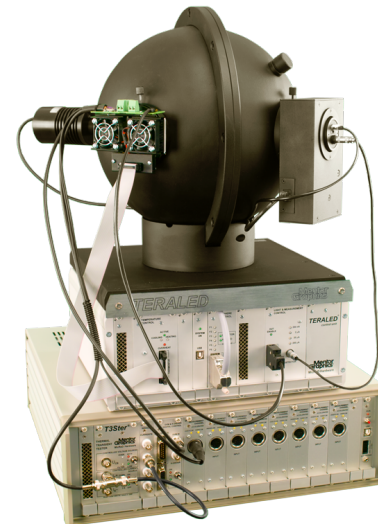
T3Ster SI
暫態熱阻量測儀



Power Tester
功率循環信賴性測試



DynTIM
材料導熱係數
量測設備



TeraLED
LED光熱耦合量
測積分球



T3Ster S
簡易型暫態熱阻量測儀

T3Ster暫態熱阻量測系統



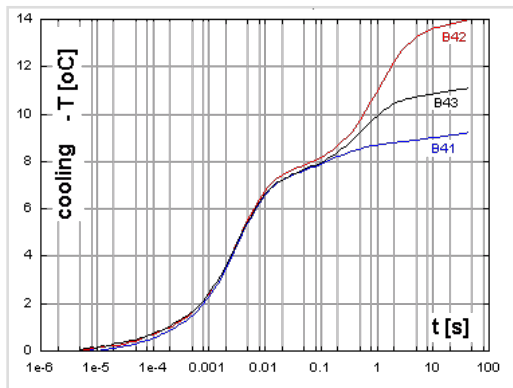
電性量測法(Electrical test method, ETM)



- 利用半導體元件本身順向電壓(forward voltage)隨溫度規律變化之特性。
- **量測電壓變化**後可準確計算出溫度差。
- **真正求得元件之接面溫度(Junction temperature)變化。**
- 穩態量測 (steady state)和 **暫態量測** (transient State)。
- 精確(0.01°C)且即時(1μs)的量測



符合國際JEDEC 量測規範



- 量測原理採**JESD51-1**規範之電性量測法
- 透過 JEDEC **JESD 51-14**規範之異質熱介質暫態量測法 (Transient Dual Interface Method, TDIM) ，測得封裝整體或分層熱阻Rthjc 。
- 透過 JEDEC **JESD 51-2a**規範之靜止空氣自然對流穩態量測法，測得封裝整體熱阻Rthja 。

T3Ster所搭配之Booster系列



∞ 增壓穩壓測試系統(Booster)

- 高電流增壓穩壓測試系統
- 高電壓增壓穩壓測試系統

∞ 提供多組電源輸出頻道，可同時量測

- 高電流與高電壓系統皆具有相關機型
- 雙輸出之單一頻道亦可獨立控制
- 電訊號暫態反應 < 10 μ s
- 可並聯多部Booster，功率可達千瓦等級。



Booster 增壓穩壓系統	高電流 (Diode, IGBT, etc.)		高電壓 (LED, etc.)
輸出頻道數量	單輸出	雙輸出	雙輸出
電流/電壓規格	200A/7V 240A/11V	38A/40V 50A/30V	10A/150V 10A/280V

相關量測小配件



其他配件與客製化產品



熱電耦放大器
(J, K, T type)



VCB generator
Rdson generator
(for MIL-STD 750E)

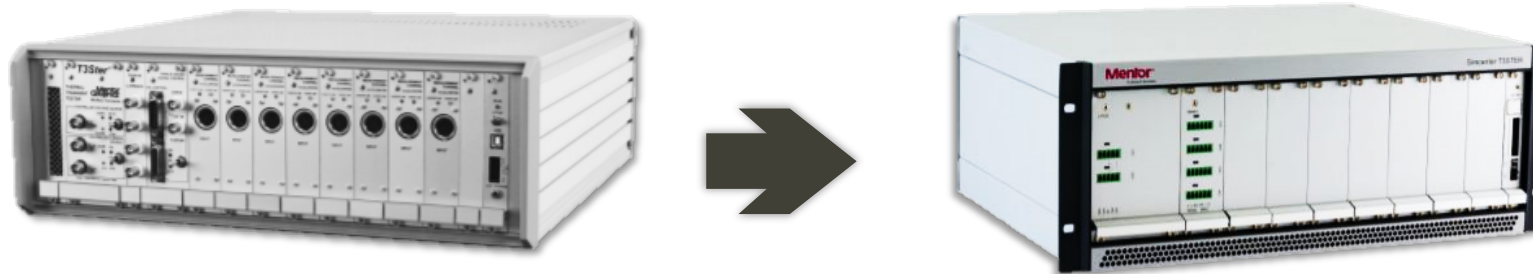


LED串聯器
可串聯4顆LED量測
使用2台可串聯8顆



可擴充訊號通道
(Channel for T3Ster)

T3Ster SI 暫態熱阻量測設備

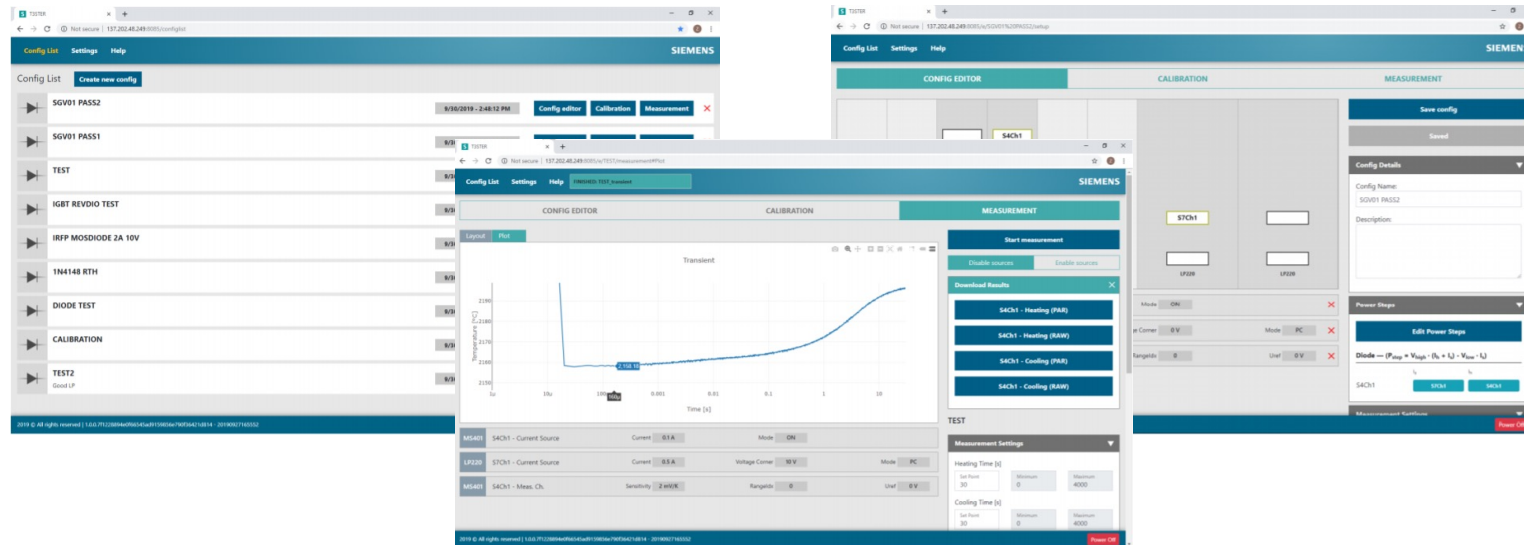


New T3STER version
with completely redesigned
system architecture & control software

Key benefits

- Improved usability
- Simple integration
- Flexible configuration & High throughput

T3Ster SI 暫態熱阻量測設備



☞ **Supported browser: Chrome**

User can control the system from anywhere with appropriate network connection

☞ **Redesigned user interface**

- provides simple to use interface, for basic users,
- but provides high flexibility for experienced users

T3Ster SI 暫態熱阻量測設備



- ✎ A single T3STER SI frame can host up to **10 Plug in Units (PIU)**
 - The actual number of heating and measurement channels can be adjusted to the customer needs and budget.
 - Up to **5 heating current outputs**
 - Up to **40 measurement channels**

T3Ster SI 暫態熱阻量測設備



TH800 HW 模組

- 專為T3Ster SI設計的全新PIU
- 此模組可同時偵測8個發熱源溫度
- 可與溫度傳感器及熱敏電阻相容(PT100, NTC, PTC)



≈ 8 x



T3Ster SI 所搭配之Booster系列



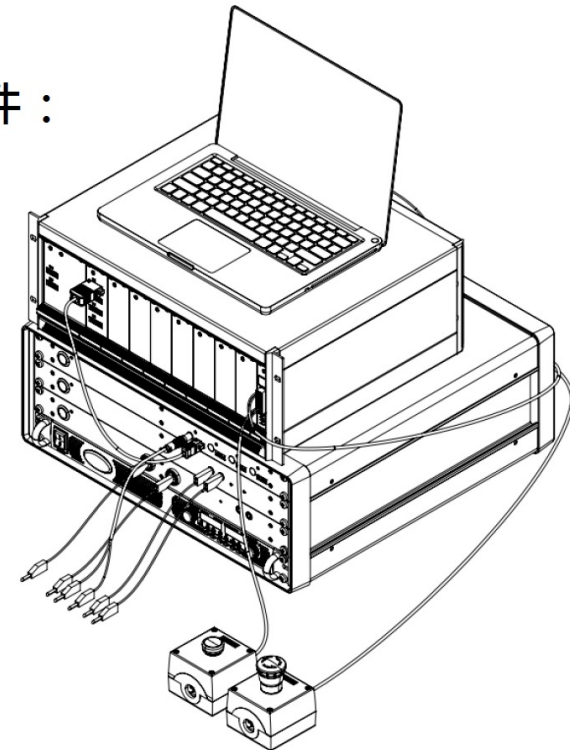
∞ T3Ster SI因應安全問題

- 無法支援Classic產品：HV Booster 150V & 280V
- 在單獨使用T3Ster SI主系統時，高壓的二極體(LED)最大可量測電壓為80V。

∞ 發展全新大電壓Booster (HXM)

可在T3Ster SI 系統上安全操作並量測大電壓元件：

- 模組結構組成 (PSU, OS, CG, DIV)
- 兩種硬體版本
 - Simcenter Micred Power Booster 10A/150V
 - Simcenter Micred Power Booster 5A/300V
- 新增與T3Ster SI相容的安全功能設計
- 支援T3STER SI control SW 2021.2 或更高版本



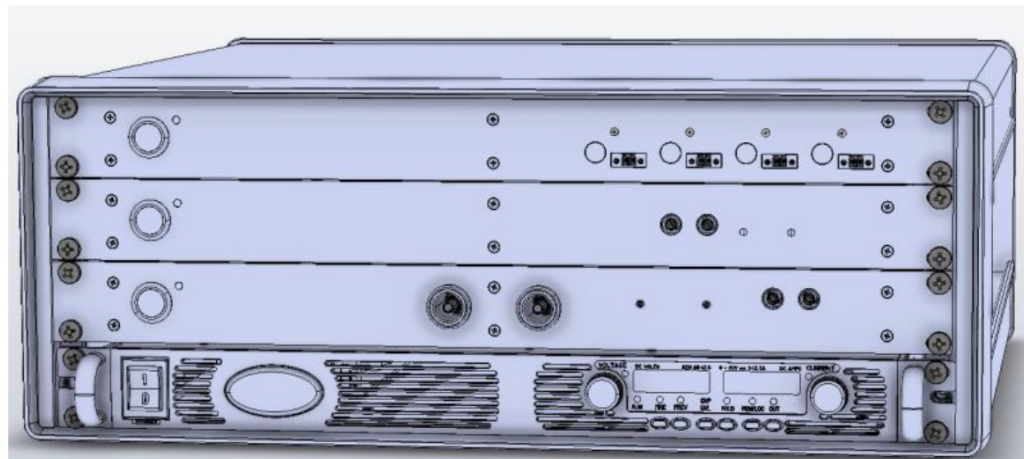
T3Ster SI 所搭配之Booster系列



全新大電壓Booster系統模組組成

- 四個模組(PSU, OS, CG, DIV)尺寸皆為 19" 1U規格
- 系統採用 4U 機架包覆，可於桌面應用，亦可由客戶組裝到標準 19" 機櫃
- 系統已包含加熱電流源 PSU (TDK)，無需額外訂購 PSU。

DIV
CG
OS
PSU



**T3STER SI 專用的大電壓Booster
無法適用於傳統的T3Ster**

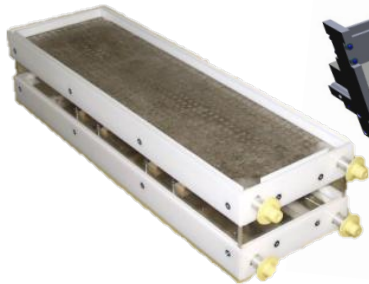
符合JEDEC規範之溫控平台系列



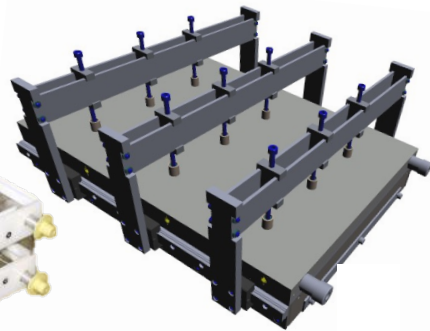
∞ Rthjc(JESD 51-14)



製冷晶片恆溫控制模組
0-90°C(5-10min), 解熱8W



550*160*110mm



300*400*60mm

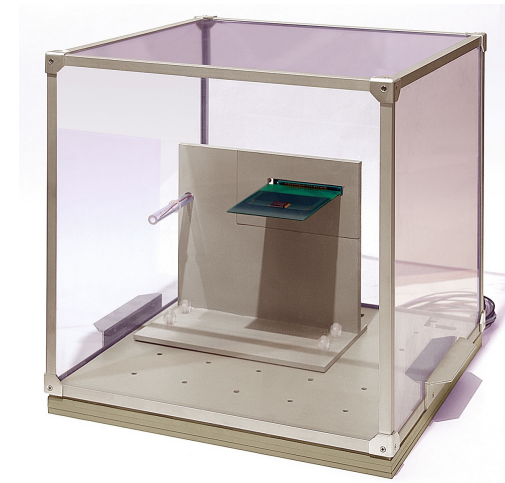


水冷式恆溫控制模組

冷板+Julabo冰水機

針對大型及大功率元件

∞ Rthja(JESD 51-2a)



自然對流箱

(still-air chamber)

依照JEDEC規範製成

Power Tester 系列



- ☞ Automotive and transportation
- ☞ Power generation and conversion
- ☞ Thermal testing and power cycling (reliability)



2011 Ecotec 1.4L I-4 VVT (LUU) at
2011 Voltree Drive Unit 4ET50 (MR)
for Chevrolet Volt.



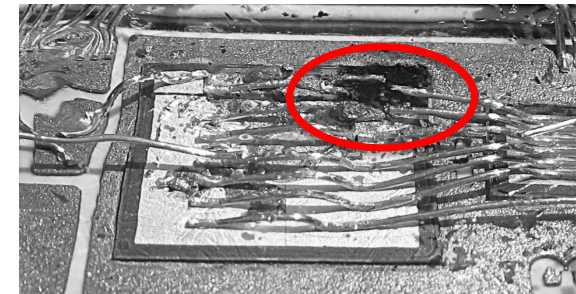
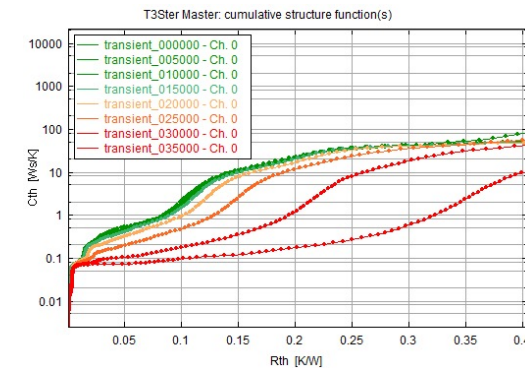
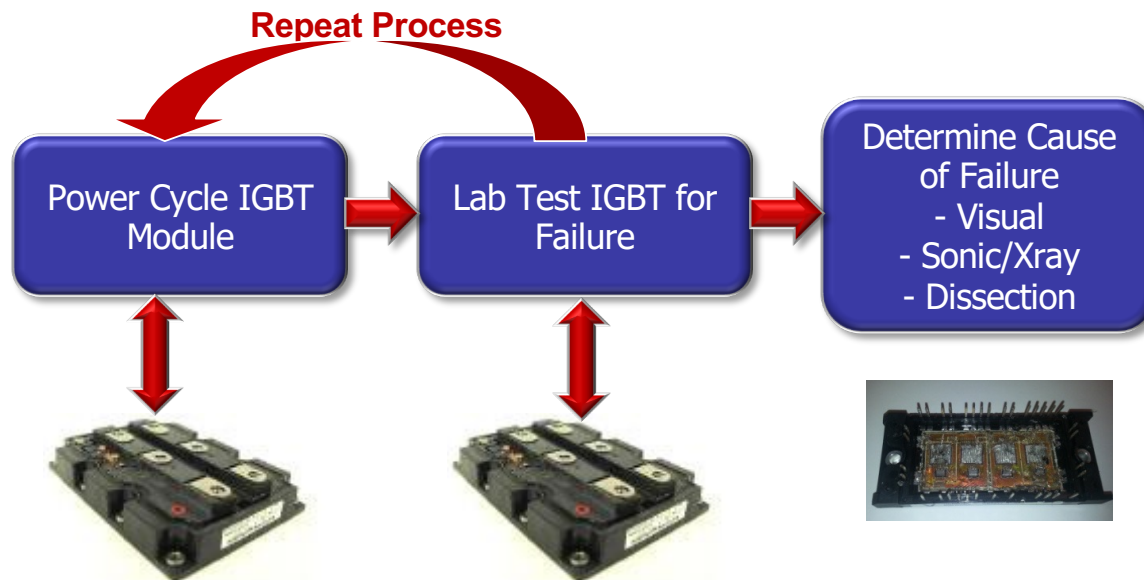
Power Tester 系列



- Traditional Process:
 - Run set number of power cycles
 - Take to lab and test for failure
 - Repeat power cycling/lab testing cycle until failure
 - Take to lab and determine reason for failure

■ Issues:

- Repetitive cycle/lab test process = long times
- No “real time” indication of failure in progress – only post mortem
- Failure cause requires lab analysis – typically internal to package



Power Tester 系列



New Launches

- ☞ PWT 1500A 12C 8V
- ☞ PWT 1800A 12C 12V
- ☞ PWT 3600A 12C 6V
- ☞ PWT 600A 16C 48V
- ☞ PWT 2400A 16C 12V
- ☞ PWT 600A 16C 18V
- ☞ Customers request optimization

Power Tester 系列-1500A,1800A,3600A



POWERTESTER 1500A, 1800A, 3600A

- 3 heating channels, 12 (3x4) meas. channels
- Has coldplate, hydraulics and closed cavity
- 3 standard versions

- ✓ 1500A 3C 8V - can go to 12C by SW
- ✓ 1800A 12C 12V
- ✓ 3600A 12C 6V

Power Tester 系列-2400A



POWERTESTER 2400A

- 4 heating channels, 16 (4x4) measurement channels
- No coldplate, hydraulics or closed cavity
- ✓ 1 standard version
—2400A 16C 12V

Power Tester 系列-600A



POWERTESTER 600A

- 1 heating source, dual output, 16 (2x8) meas. channels
- No coldplate, hydraulics or closed cavity
- 1 standard version

✓ 600A 18V 16C

Dyn-TIM 材料導熱係數測試



- ✧ High precision measurement environment for T3Ster to perform TIM conductivity tests
- ✧ Aimed at the test of compressible materials such as greases, pastes, soft pads, phase change materials
- ✧ Fully automated testing process



Dyn-TIM 材料導熱係數測試



- ✧ T3Ster is the best tool in the market to measure TIM performance in-situ, in the application environment
- ✧ Still it may not be enough to measure the **material properties** of TIM-s alone
 - We need to separate the TIM from the rest of the application



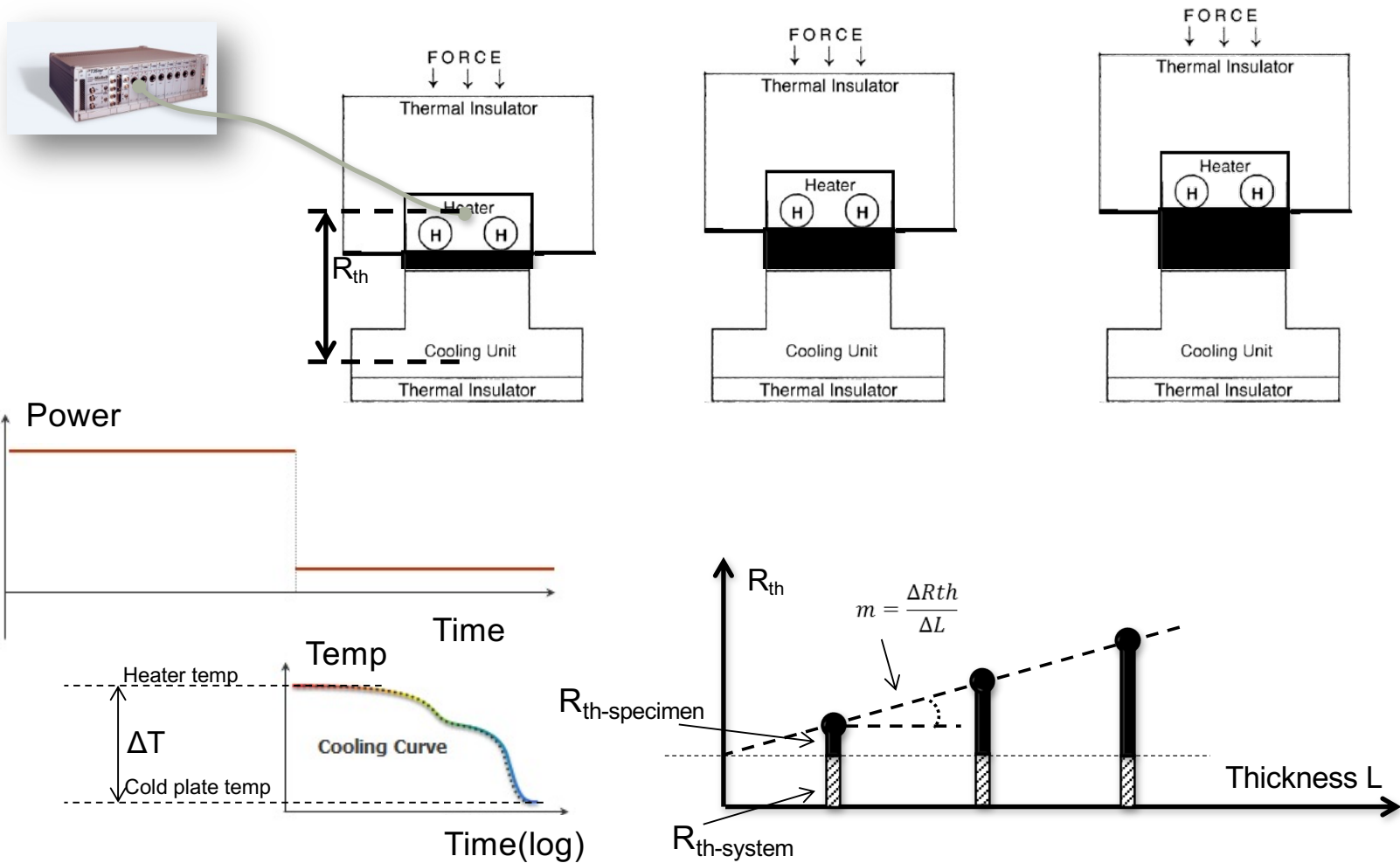
- ✧ DynTIM is a stable test environment capable of changing important variable : **The TIM's thickness**
- ✧ Making thermal tests at different TIM thickness allows us to calculate the materials' thermal conductivity accurately
 - The effect of the environment stays constant, only the TIM's changes

Dyn-TIM 材料導熱係數測試

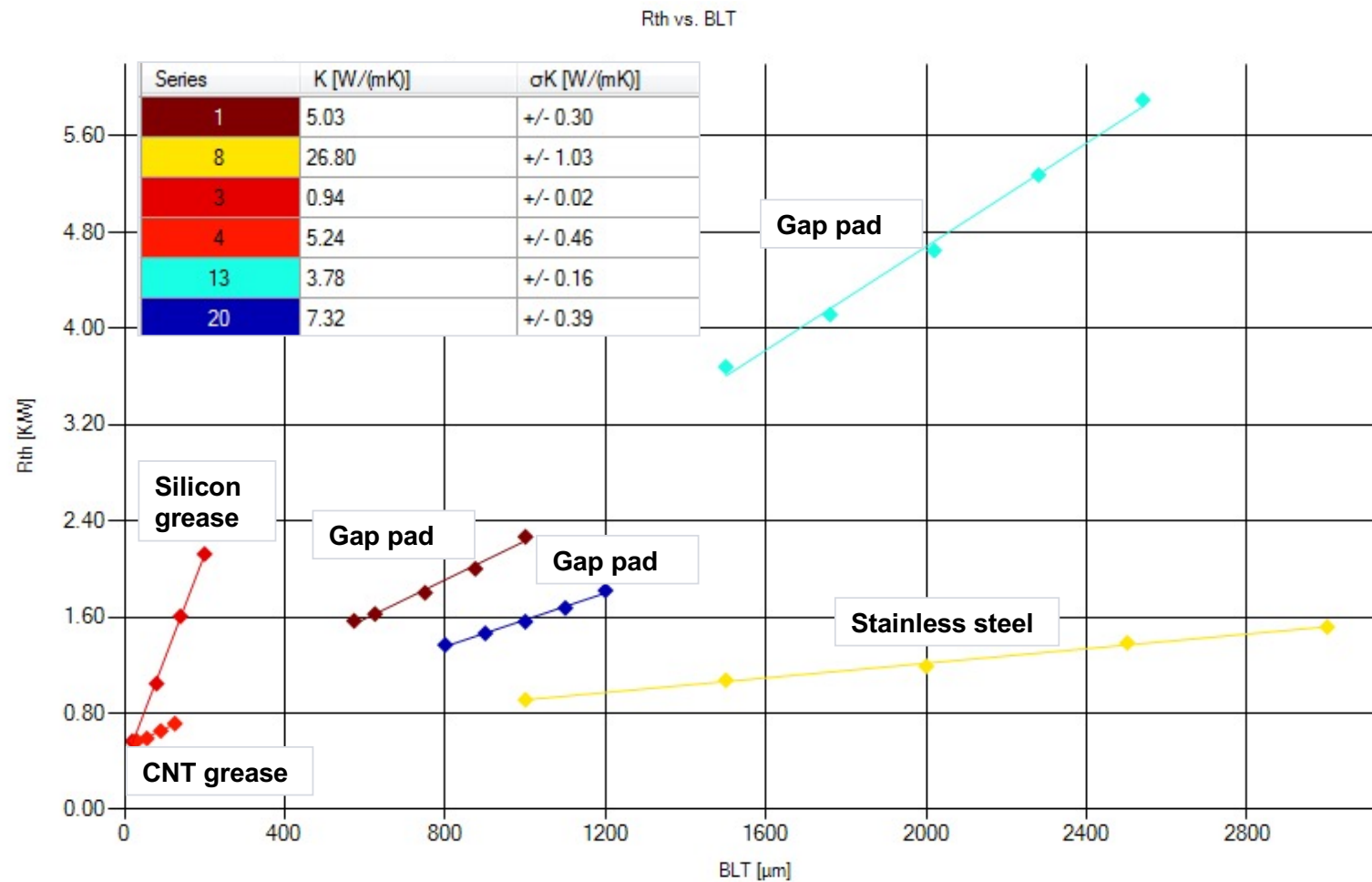


Feature	Value	Note
Sample size and shape	12.8 mm diameter, circular grips	
Sample thermal resistance range	0.01 K/W – 5 K/W	For highest measurement accuracy
Measurement grip materials	Bottom: Nickel plated copper, Top: Copper	
Cold-plate temperature range	5-90 °C	Set by external fluid thermostat
Sample thickness range	0-70 mm	Measurement above 5mm thickness not recommended
Sample thickness setting resolution	1 µm	
Sample thickness setting accuracy	1 µm for Type I materials 5 µm for Type II materials	Thickness measurement of Type III materials is better than 10 µm
Temperature measurement resolution	0.01 °C	
Relative accuracy of derived heat conductivity	Typically better than 5%	For Type I materials
Pressure range	1060 kPa - 3600 kPa	Measurement of Type I materials is carried out at 0 pressure
Pressure reading accuracy	80 kPa	
Measurement modes	ASTM TYPE I materials : Bondline thickness control ASTM Type II materials: Bondline thickness control + pressure limit ASTM Type III materials: Constant pressure mode	Bondline thickness values set by the user in case of Type III materials
Data output	Raw data export: XML, CSV Report generation: HTML, Export conductivity value as a FloTHERM assembly	Raw measurement data can also be processed using T3Ster Master
Dimensions	(LxHxW)= 590mm*570mm*260mm	
Weight	40 kg	
Supply voltage	100-230 VAC 50/60 Hz	
Additional hardware requirements	T3Ster unit Liquid circulator unit, min. 10 l/min, min. 10 W cooling capacity (Third party) PC running Windows XP/Windows 7 OS (Third party)	Thermostated circulator unit required for tests carried out at different than ambient temperatures Tubing not included, for assembly instructions see quick connection guide For the list of recommended third-party elements, please contact your official Mentor Graphics partner

Dyn-TIM 材料導熱係數測試



Dyn-TIM 材料導熱係數測試

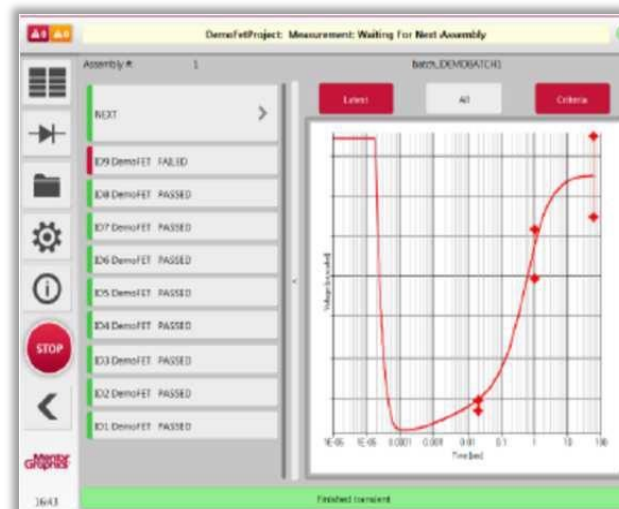
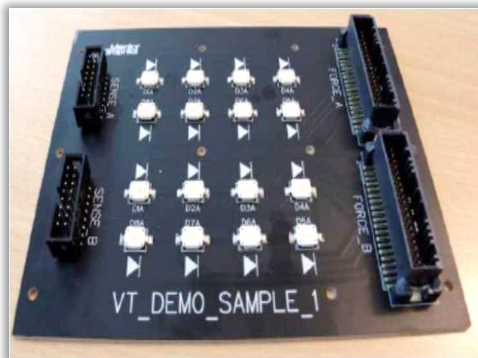
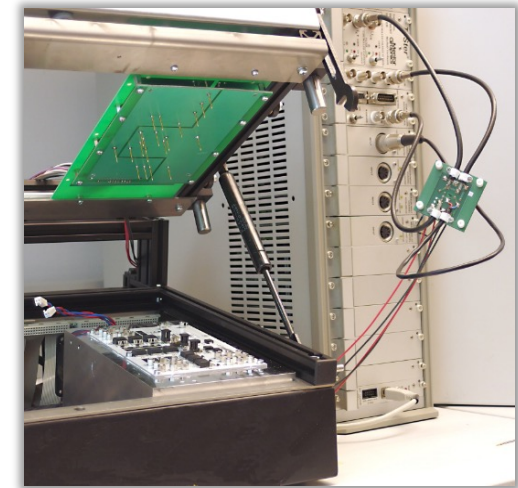


Simcenter Thermal Quality Tester

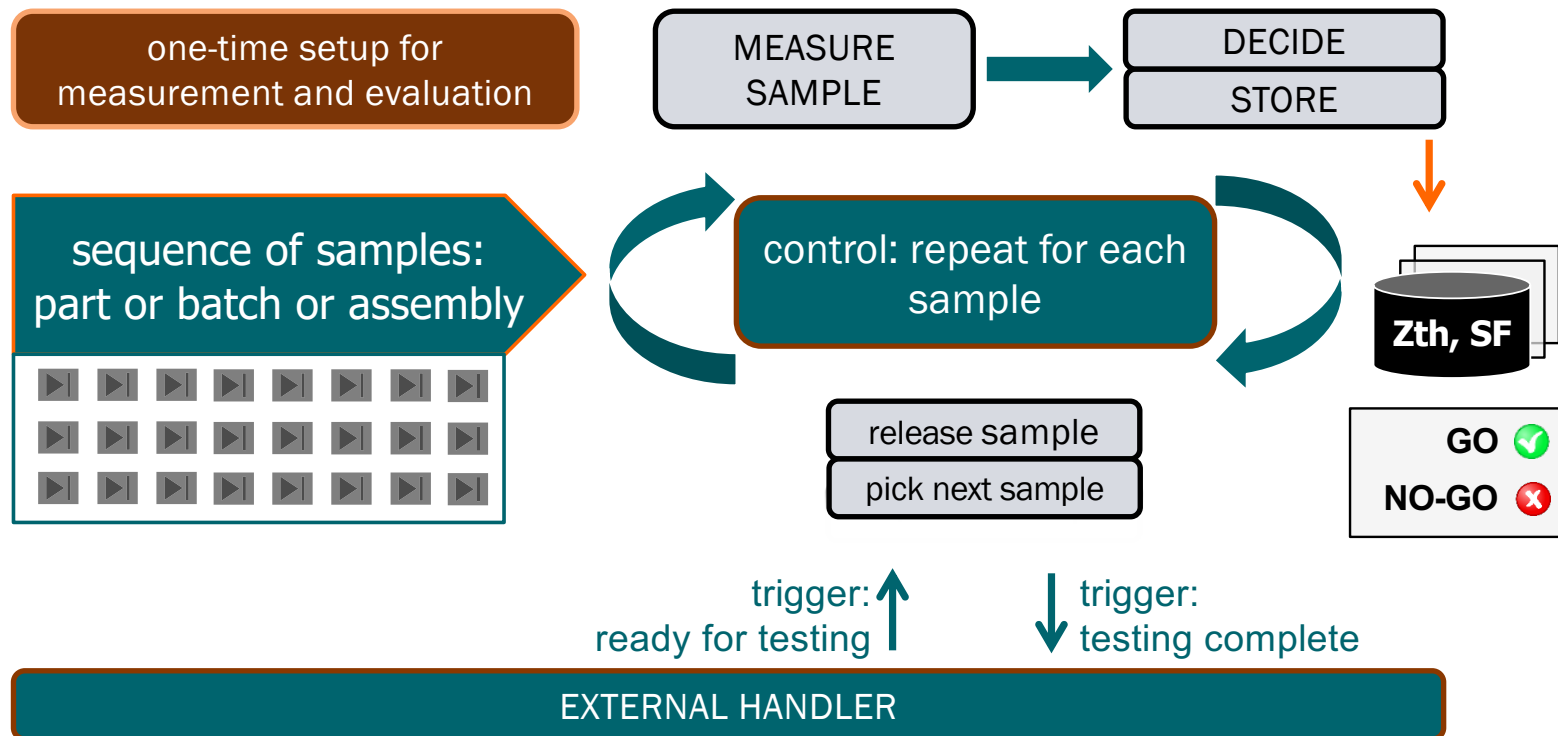


Thermal Quality Tester

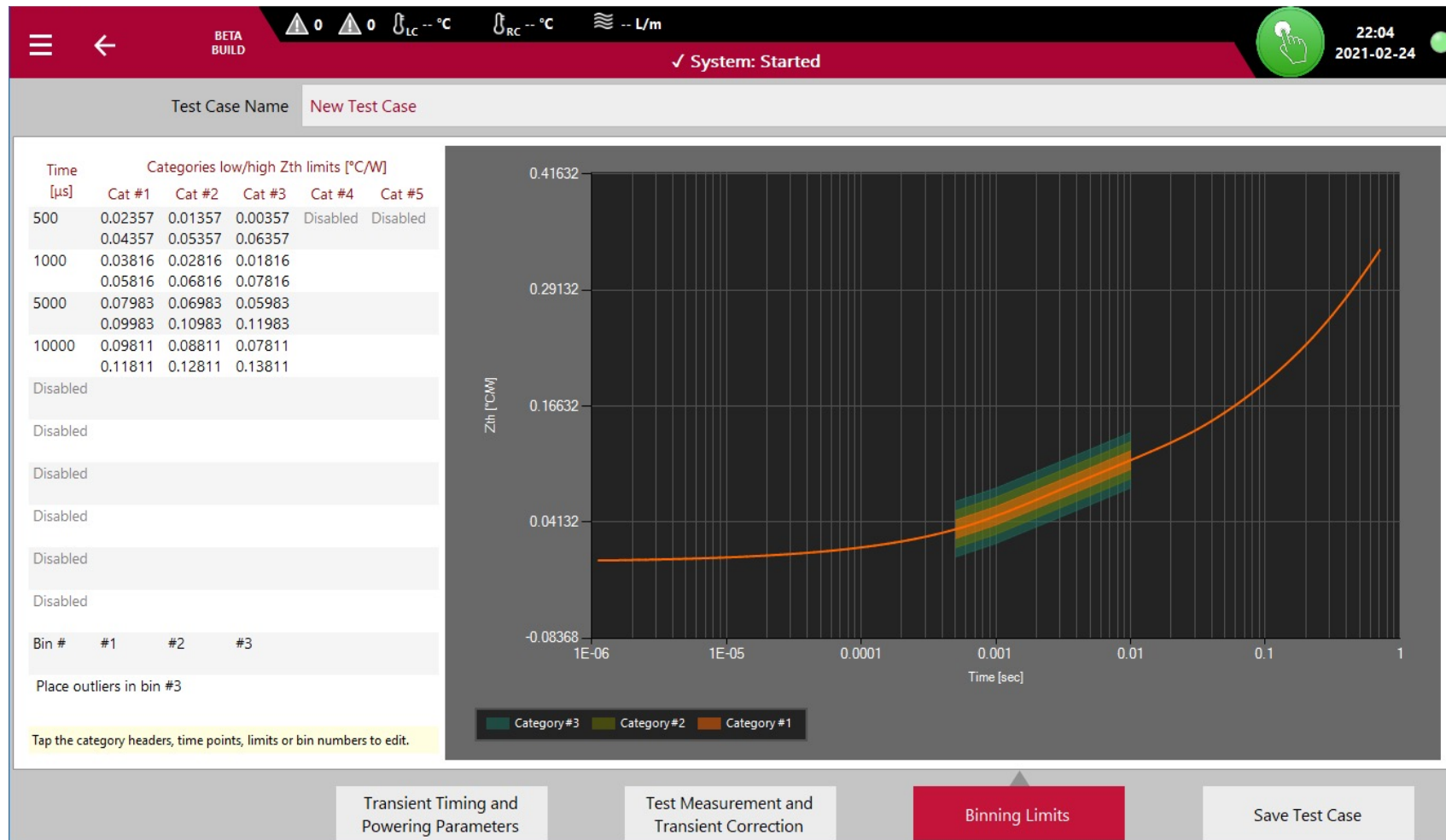
- 針對客戶需求之客製化軟體、測試板及設備
- 接近全自動化的測試
- 一次性收集大量元件量測數據
- 人性化的觸碰面板及操作介面
- 可進行批次量測，兼具生產設備之能力
- 可自動判定量測元件優劣
- 協助線上改善其品質和良率



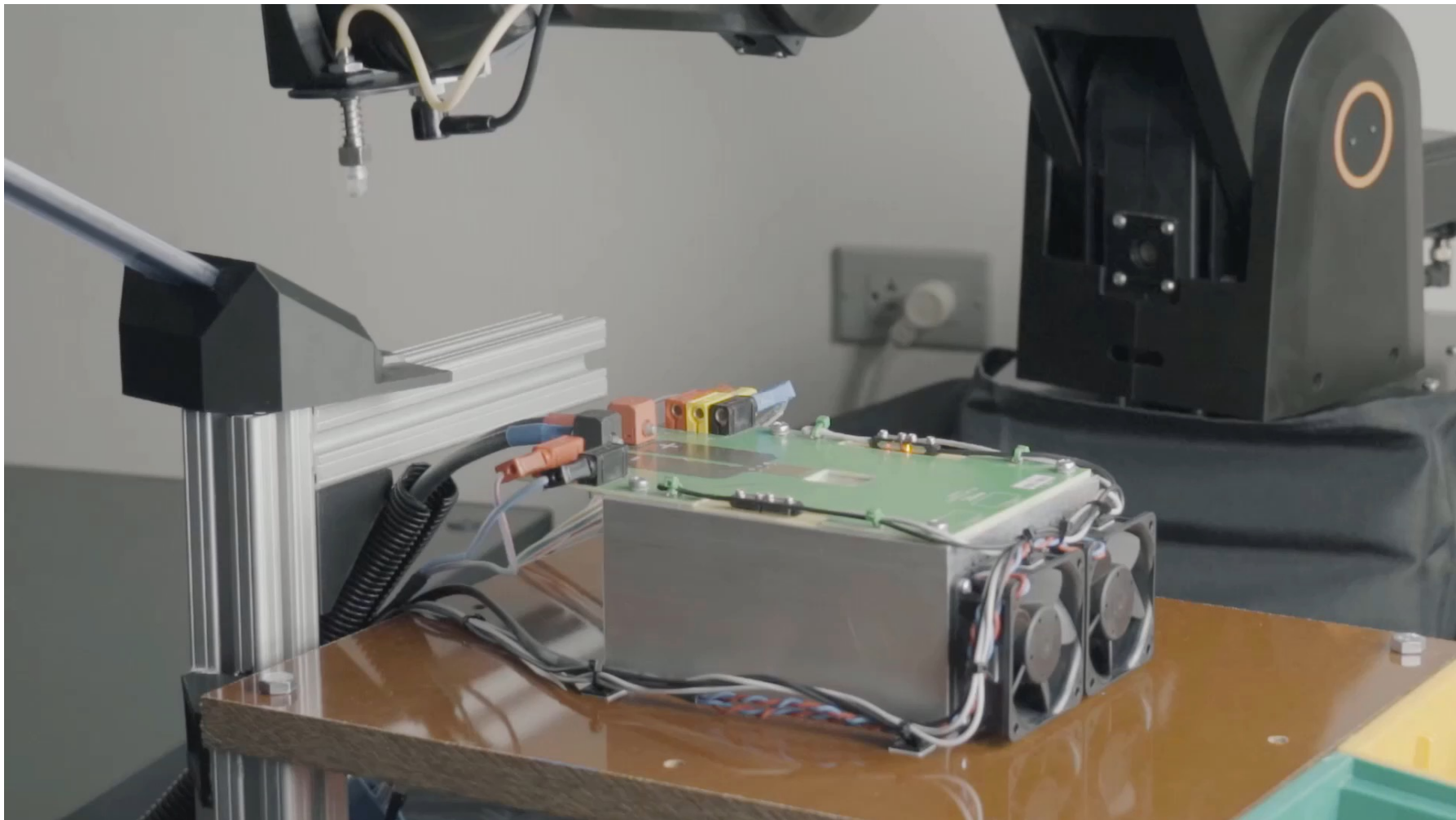
Simcenter Thermal Quality Tester



Simcenter Thermal Quality Tester



Simcenter Thermal Quality Tester



Worldwide & China and Taiwan Customers

Worldwide Customers



Infineon headquarters, Munich
Infineon, Regensburg



LUMILEDS
LIGHT FROM SILICON VALLEY



IBM Research, Zurich



OSRAM



NOKIA



Philips Research
Philips Semiconductors
Philips Lighting



TOYOTA

DENSO



三菱重工

NXP

China Customers



上汽集团
SAIC MOTOR



University of
Nottingham
UK | CHINA | MALAYSIA

宁波分校



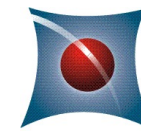
SITRI 上海微技术工业研究院
Shanghai Industrial Technology Research Institute



Taiwan Customers



∞ 台積電、台積固態照明、日月光、大中積體電路、億光、艾笛森、
工研院電光所*2、工研院綠能所、隆達、光寶、尼克森微電子、英
特明、中興大學、群創



國立中興大學
National Chung Hsing University

EVERLIGHT

LITEON®

Lextar

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LASTER TECH GROUP



工業技術研究院
Industrial Technology
Research Institute



AOT

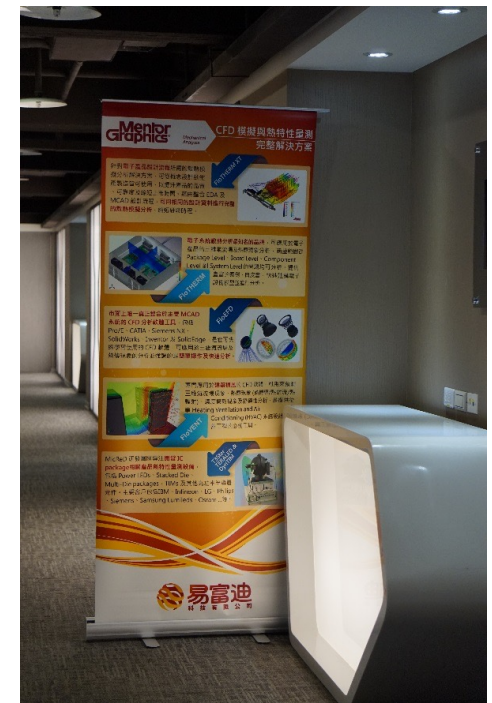
Taiwan Customers



EFD所能提供之服務



- 每月電子報發送，提供案例分享，課程訊息及產品訊息。
- 保固期間若有軟體版本更新時，免費升級至最新版本。
- 保固期間不限人次之免費軟體基礎教育訓練。
- 不限時數、次數之電話熱線服務。
- 不限次數之E-mail 24小時回覆服務。
- 免費參加本公司所主辦之所有付費活動。



聯絡我們



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