Thermal Management Solutions

Oscar Yang
2010/12/14

POLYTRONICS
We make it better and safer

Polytronics Milestones

Polytronics Technologhy Corporation

- **1998 – Company founded**, ISO9001 certified
- 2000 – Accumulated break-even
- 2001 – Wickmann Group takes equity position and signs strategic alliance
- 2002 – Littelfuse acquires Wickmann: maintains equity and alliance
- **2003 – IPO on Taiwan OTC market**

  – TI Sensors & Controls (now Sensata Technology) signs JDA
- 2005 – China plant comes on-stream
- 2006 – Littelfuse signs five year OEM agreement

  – Sensata introduces 5HC motor control product using
- **2007 – DENKA signs JDA & PPA for the TCB development**
- 2008 – New building in SPIB construction complete and moving-in
- **2009 – Listed in Taiwan Stock Exchange**

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品质与环境系统认证

Polytronics Technologhy Corporation

- ISO-9001认证通过
- ISO-14001认证通过
- TL-9000认证通过
- TS-16949认证通过

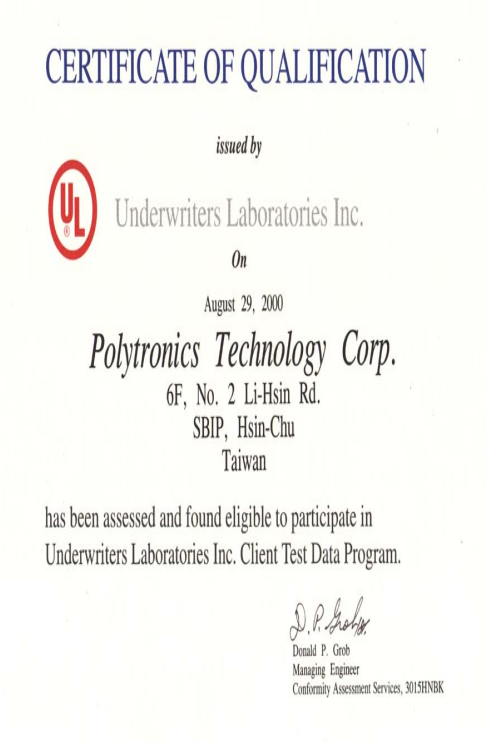
Polytronics Technology Corp
REGISTERED TO QS9000, TL9000,
ISO9001 (version 2000), and ISO 14001
CERTIFICATE NO. A8727 and A10971

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安规品质认证

Polytronics Technologhy Corporation

UL **TUV** **CSA**



CERTIFICATE OF QUALIFICATION

issued by

Underwriters Laboratories Inc.

On

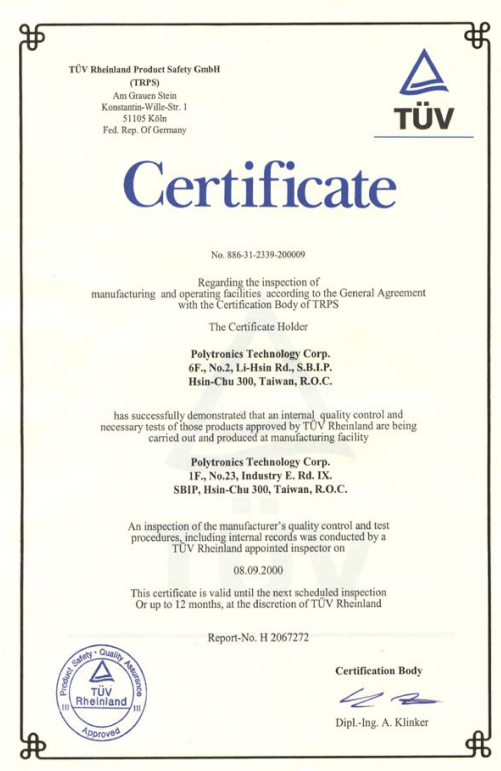
August 29, 2000

Polytronics Technology Corp.

6F, No. 2 Li-Hsin Rd.
SBIP, Hsin-Chu
Taiwan

has been assessed and found eligible to participate in Underwriters Laboratories Inc. Client Test Data Program.

Donald P. Grob
Managing Engineer
Conformity Assessment Services, 3015HNBK



TÜV Rheinland Product Safety GmbH
(TRPS)
Am Grauen Stein
Konstantin-Wille-Str. 1
51105 Köln
Fed. Rep. Of Germany

TÜV

Certificate

No. 886-31-2339-200009

Regarding the inspection of manufacturing and operating facilities according to the General Agreement with the Certification Body of TRPS

The Certificate Holder

Polytronics Technology Corp.
6F., No.2, Li-Hsin Rd., S.B.I.P.
Hsin-Chu 300, Taiwan, R.O.C.

has successfully demonstrated that an internal quality control and necessary tests of those products approved by TÜV Rheinland are being carried out and produced at manufacturing facility

Polytronics Technology Corp.
1F., No.23, Industry E. Rd. IX.
SBIP, Hsin-Chu 300, Taiwan, R.O.C.

An inspection of the manufacturer's quality control and test procedures, including internal records was conducted by a TÜV Rheinland appointed inspector on

08.09.2000

This certificate is valid until the next scheduled inspection Or up to 12 months, at the discretion of TÜV Rheinland

Report-No. H 2067272

Product Safety · Quality Assurance TÜV Rheinland Approved

Certification Body

Dipl.-Ing. A. Klinker



Underwriters Laboratories Inc.

CERTIFICATE OF COMPLIANCE

CERTIFICATE NUMBER: 270400 - E201431 Page 1 of 1
ISSUE DATE: April 27, 2000

Issued to: Polytronics Technology Corp. 6F, No. 2 Li-Hsin Rd. SBIP, Hsin-Chu, Taiwan

Report Reference: E201431

This is to Certify that representative samples of: Thermistor Type Devices (XGPU8) Models: SMD1210P020TS, -035TS, -050TS, -075TS, -110TS, and SMD1812P050TS/TG.

Have been investigated by Underwriters Laboratories Inc.® in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL1434, (First Edition) "Themistor-type Devices" CSA C22.2 No. 0 CSA TIL No. CA-3A

Additional Information: None

Only those products bearing the UL Recognized Component Marking for Canada should be considered as being covered by UL's Recognition and Follow-Up Service meeting the appropriate Canadian requirements.

The UL Recognized Component Marking for Canada consists of the UL Recognized Mark for Canada and the manufacturer's identification and catalog number, model number, or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory.

THE FINAL ACCEPTANCE OF THE COMPONENT IS DEPENDENT UPON ITS INSTALLATION AND USE IN COMPLETE EQUIPMENT SUBMITTED TO UNDERWRITERS LABORATORIES INC.

LOOK FOR THE UL RECOGNIZED COMPONENT MARKING ON THE PRODUCT

Engineer: Joe Antony, Underwriters Laboratories Inc. Review Engineer: Israel Savitzky, Underwriters Laboratories Inc.

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Customers & Partners _TCB

Polytronics Technologhy Corporation

- **Join-develops with DENKA.**
- **Qualified & Listed in Seoul Semiconductor QVL.**
- **FS MCPCB used in SONY Direct-lit LED BLU TV in 2004.**
- **LED BLU-**
  ship to AUO & Coretronic Groups, LG, Sharp & CMO Group are using PTTC's MCPCB., Samsung LCD approved.
- **LED Lighting-**
  ship to Foxsemicon, Aop, BrightLED, Coretronic Group & many China lighting companies.

SEOUL SEMICONDUCTOR

DENKA 電気化学工業株式会社

ecomaa LIGHTING

DELTA

SONY make.believe

Lextar 隆達電子

AUO

佰鴻工業股份有限公司 BRIGHT LED ELECTRONICS CORP.

LG

SHARP

fiti FOXSEMICON 沛鑫能源科技股份有限公司 foxsemicon integrated technology Inc.

Coretronic

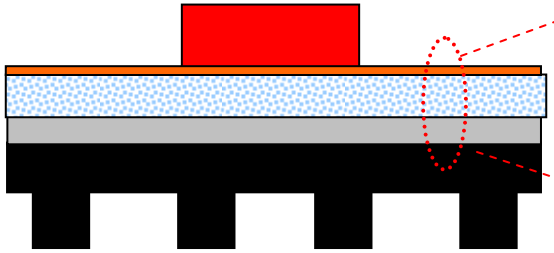
AOP Light up new era

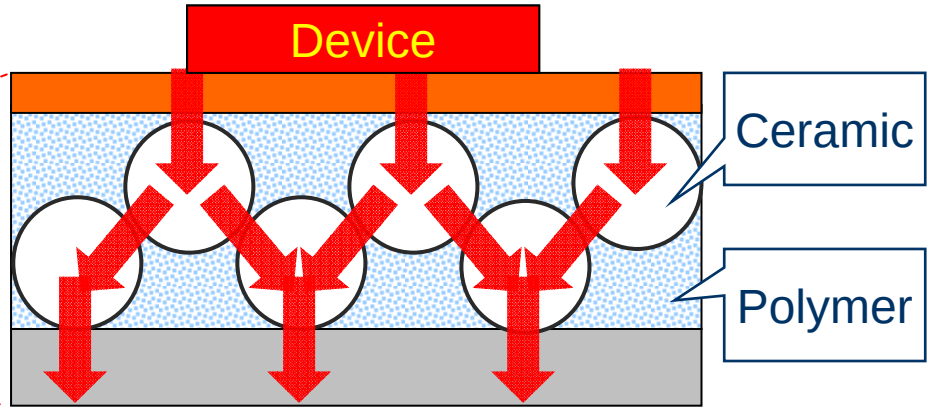
UNi 東貝光電

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Thermal Conductive Theory

- **Material**
  - Polymer
  - Ceramic filler





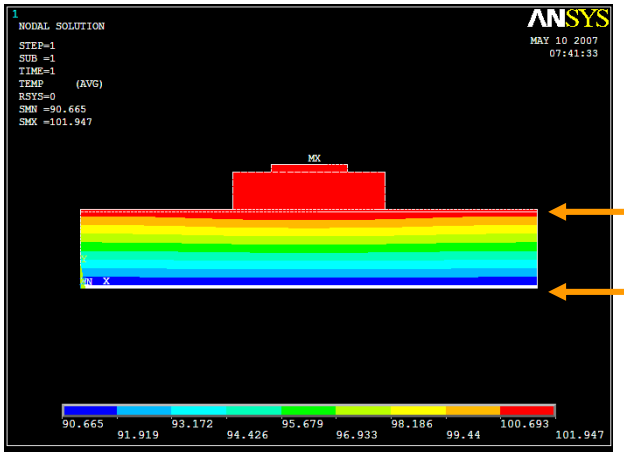
- **Simulation**

$$Q=\frac{-k(T2-T1)}{\Delta X}$$

Q=Heat flux

T=Temperature

k=Thermal Conductivity



T1

T2

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TCB Product Line

Polytronics Technologhy Corporation

Semifinished Product

Prepreg



Thin Core



Resin Coated Copper



Product

IMS
(General Product)



Multi-layer PCB
(Complicated circuit design)



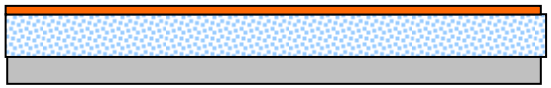
Metal Core
(Power Module)

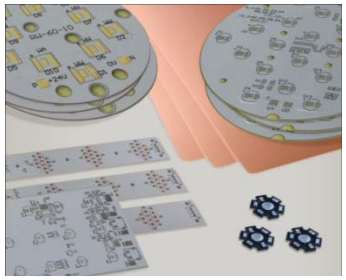


Foiled Substrate
(Material Saving)



MCPCB

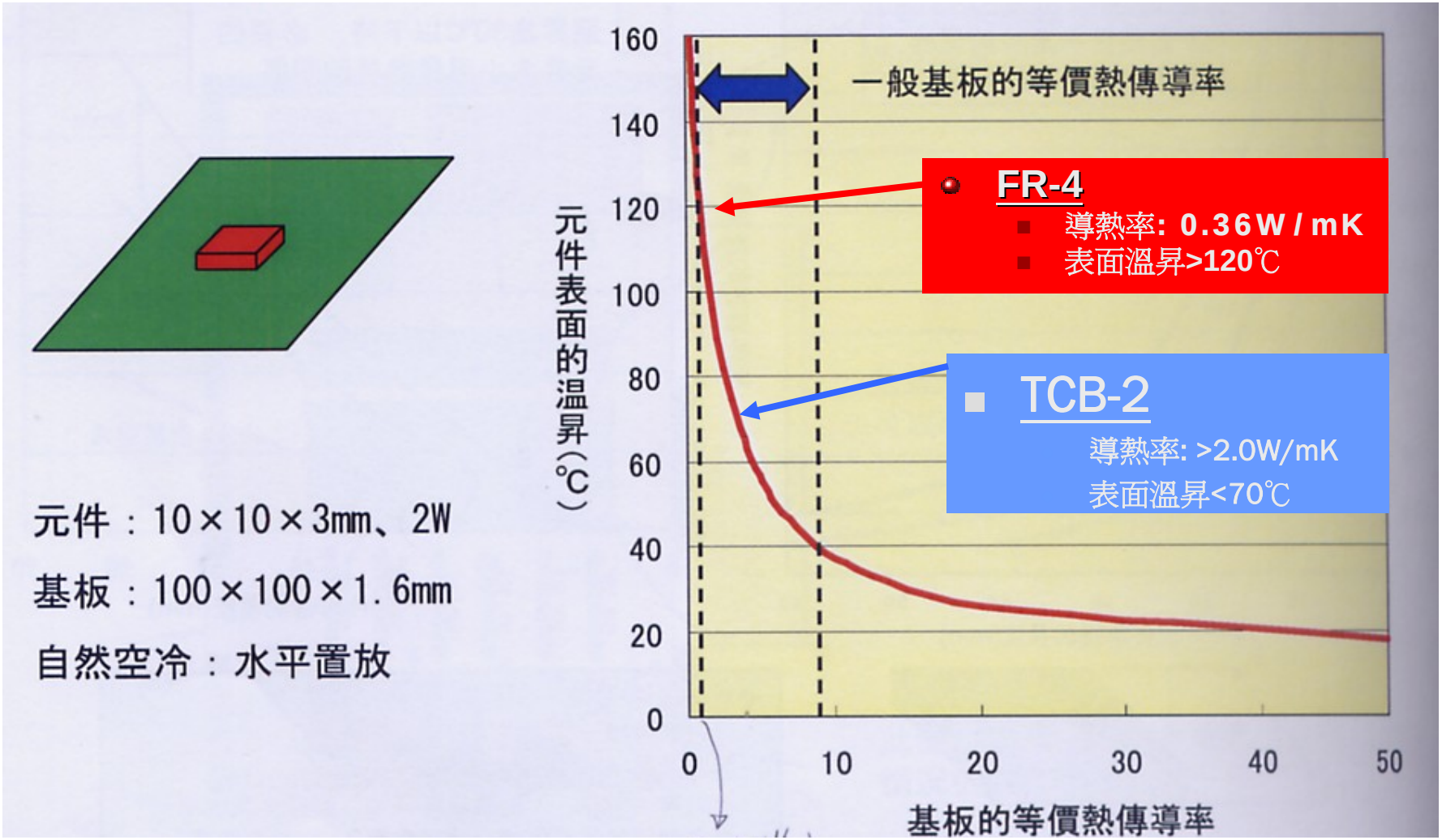




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Thermal Conductivity

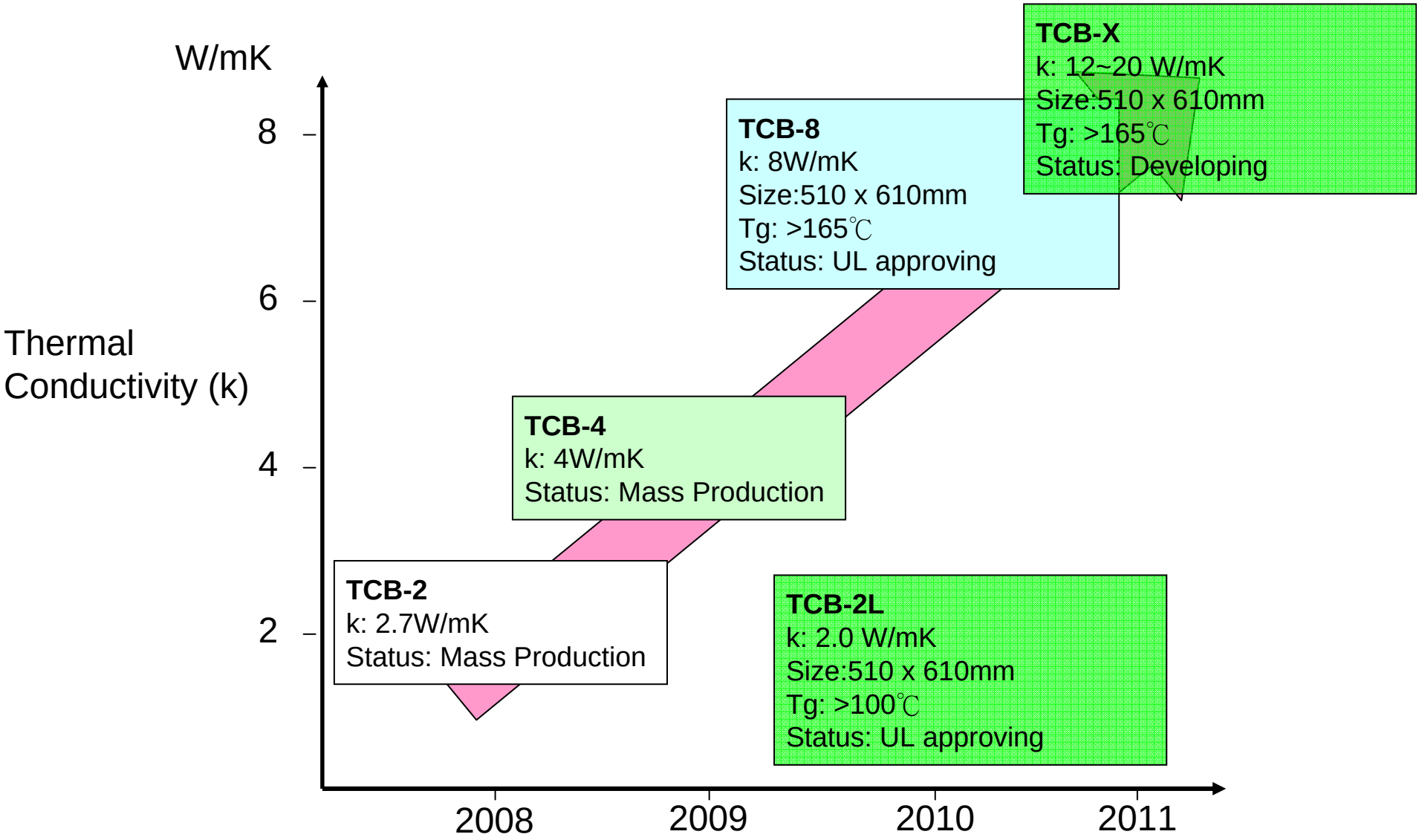
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TCB P/P Road Map

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Evaluate a Good TCB

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Thermal Conductive Board

Thermal Conductivity	Physical Property	Reliability
Lower device Temp.	Material Stability Dimension Stability	Outdoor Usage Certifications
●High Thermal Cond. ●2, 4,8 W/mK	●High Tg > 130°C ●Low CTE < 20ppm ●High Td > 350°C	●260°C 30min ●PCT Test ●Thermal Shock 1000hr ●85°C/85RH 1000hr ●UL 746E, SGS

- Remarks-
  - Base on IPC, JIS standards
  - Reliability testing under critical environment
  - Certification by UL & SGS

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Comparison Data(I)

Polytronics Technologhy Corporation

Comparison of 2W/mK products with international companies & local companies									
Sample	**TCB 2W**	**TCB 4W**	**A 2W**	**B 1.8W**	**D 2W**	**F 3W**	**G 2W**	**H 2W**	**I 2W**
K (W/mk)	**2.7**	**4.2**	**2.0**	**1.6**	**2.4**	**1.4**	**1.4**	**1.6**	**1.0**
Aging Test PCT, 48hr	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Fail**	**Pass**	**Fail**	**Fail**

Polytronics **International companies** **Local companies**

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Comparison Data(II)

Polytronics Technologhy Corporation

項目	PTTC TCB-2L	Berg. MP
導熱率TO-220	1.9W	1.8W
耐電壓	64	66
PCT/48hr耐電壓	63	55
260℃/30min耐電壓	63	62
剝離力	1.85	2.14
PCT/剝離力	1.49	1.87
260℃/30min剝離力	1.98	2.45
漂錫測試 260℃	>1hr	>1hr
漂錫測試 300℃	22min	29min
Tg	95	90

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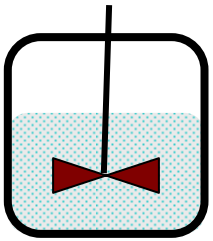
Manufacturing Process

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Pre-preg MFG Process

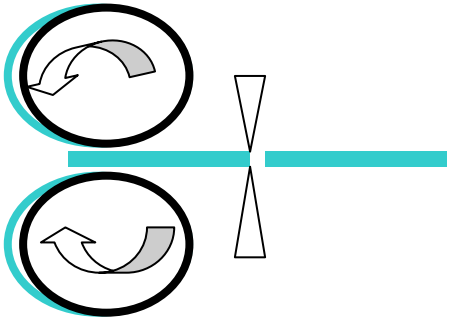
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- **Dry Process**
  (Polytronics Technology)



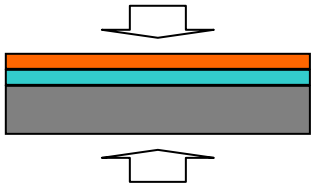
Mixing

- Polymer + Filler



Roll to Roll

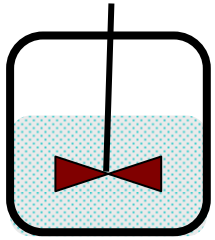
- Extrusion



Lamination

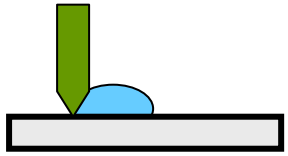
Process Flow

- **Wet Process**
  (Other Companies)



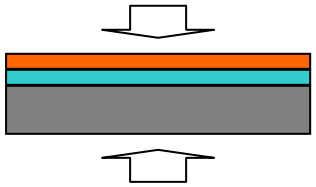
Mixing

- Polymer + Filler
- Solvent



Printing

- Screen or Slit
- Drying



Lamination

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Advantages of Dry Process P/P

- **Environment Concern**
  - Green product with non-solvent process
- **Flexible Product Line**
  - Economic process flow for different product manufactories
- **High Quality**
  - Well mixed materials with good thermal conductivity
  - None volatile material content
  - No fiber glass system causes low warpage problem

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TCB IP & Certification

- **IP**
  - Issued: TW I270187
  - Published: US 20070137835, US 20080057333, US 20080073623, TW 200812025, TW 200816235, CN 1997271, CN 101140915, CN 101161721
- **UL 746E**
  - UL File Number: E312082
- **SGS**
  - Test Report No.CE/2008/40704, CE/2008/81840

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Conclusion

- **Advantages of Polytronics TCB-**
  - Cost Advantage：
    - Excellent performance but less expensive than other companies.
    - High “Performance vs Price” Ratio
  - Completed Product Combination
  - High Thermal Conductivity
  - High Reliability
  - High Manufacturing Efficiency
  - Competitive Lead Time

Polytronics is your best choice for Thermal Management!

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