Industry Leader in Providing both the products and services that are critically important to its customer's success

PCB Manufacturing in Thailand

Ready to Meet New Opportunities'

Tracy Watt – KCE VP Technology

PCB Industry Summit
THPCA & TPCA

My PCB Background

40 years in PCB manufacturing Industry

- CANADA 1982 – 1989 : NORTEL Captive PCB Manufacturer
  - Digital Telecommunications
- AMERICA 1989 – 2001 : HADCO PCB Manufacturer
  - Internet Infrastructure
- THAILAND 2001 – 2023 : KCE PCB Manufacturer
  - Automotive, Industrial, Telecom

PCB Manufacturers in Thailand (Start 1983 – 2009)

2022 Thailand Rigid PCB production revenue > 1.6 B USD

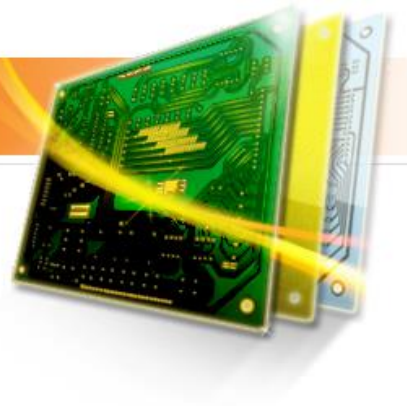
PCB Manufacturer	Location in Thailand	Year Start Thai Production	Nationality	2022 Thai Revenue (MUSD)	New Factory Investment (MUSD)
KCE	Lat Krabang, Ayuthaya	1983	Thailand	500	250+
E & E (Kingboard)	Ayuthaya	1987	China (1972)	80	
Draco (Chinpoon)	Pathumtani	1989	Taiwan (1979)	90	
Kyoden	Chonburi	1996	Japan (1983)	115	100
Mektec	Bangpa-in	1995	Taiwan/Japan	FPC	
Apex	Samut Sakhon	2001	Taiwan (2009 HC)	515	
CMK	Prachinburi	2006	Japan (1961)	220	200
APCB	Bangpa-in	2009	Taiwan (1981)	100	

Recent New PCB Factory Announcements

Total Rigid PCB Revenue in Thailand could grow to over 3B usd by 2025

PCB Manufacturer	Location in Thailand	Announcement	Nationality	Target opening	Investment (MUSD)
WUS	Ayuthaya	2022	China	2025	280+
Dynamic	Prachinburi	2022	Taiwan	Q4 - 2024	300
AoshiKan PC	Ayuthaya	2022	China	2024	150+
Jove	Rayong	2022	China	2024	70+
Compeq	Samut Prakarn	2023	Taiwan	Q4 - 2024	42
Starteam	Prachinburi	2022	Germany	2024	
Sihui Fuji	Rayong	2022	China	2024	75+
CEE (Eagle Electronic)	Ayuthaya	2022	China	2025	82

Advantages of PCB Manufacturing in Thailand

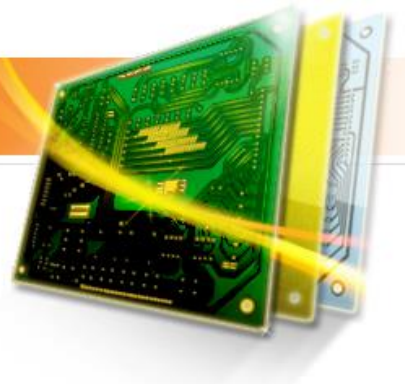


- ✓ Readily Available Resources (Water, Power)
- ✓ Excellent Transportation Infrastructure (Air, Land, Sea, Rail)
- ✓ Well Educated and Highly Skilled Labor Force
- ✓ Cost Competitive
- ✓ National Broadband Digital Network
- ✓ Supportive Government Policies (License, Permits, Incentives)
- ✓ Attractive Low Cost of Living and High Standard of Living

Market is Driving Innovative Technologies

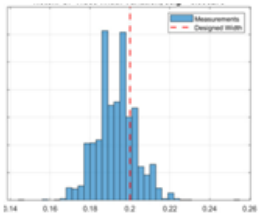
Market \ Application	HDI microVia	Circuit Density	Layer Count	Special Materials	Flexible Circuit	Heavy Copper
Automotive						
Autonomous	Type III	75 - 150 uM	6 - 12 layer	Low Loss	SemiFlex	N/A
Connected	Type III	40 - 100 uM	8 - 16 Layer	Low Loss	N/A	N/A
Electrification	Type III	150 - 400 uM	4 - 8 Layer	High Thermal	N/A	3 - 6 oz/sqft
Industrial						
Robotics / Automation	Type III	75 - 100 uM	4 - 10 Layer		N/A	N/A
Power Supply	N/A	150 - 250 uM	4- 10 Layer	High Thermal	N/A	3 - 6 oz/sqfft
Telecom						
5G , IOT	Type III	75 - 100 uM	6 - 30 Layer	Low Df/ Dk	Flex	N/A
Cloud, Datacenter	Type III	75 - 150 uM	12 - 30 Layer	Low Dk	N/A	N/A
Medical						
Health Monitor	Type III	50 - 100 uM	4 - 8 Layer	Low Df/ Dk	Rigid Flex	N/A
Consumer						
Wearable	ALIV	50 - 100 uM	6 - 8 Layer	Low Df / Dk	Rigid Flex	N/A

Circuit Density Development Timeline



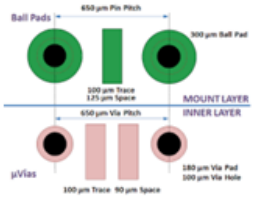
L/S = 200 / 200 um

BGA pitch : 1.27 mm
PTH



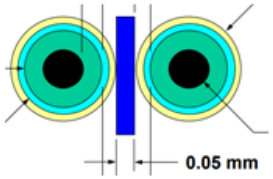
L/S = 100 / 100 um

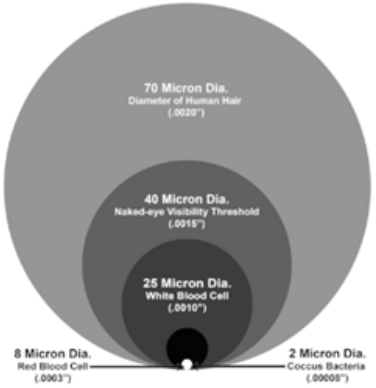
BGA pitch : 0.65 mm
PTH or HDI uvia



L/S = 50 / 50 um

BGA pitch : 0.40 mm
HDI / LDI / mSAP

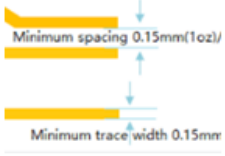




1990's | 2004 | 2010 | 2016 | 2022 | 2024

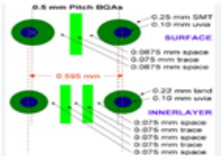
L/S = 150 / 150 um

BGA pitch : 1.00 mm
PTH



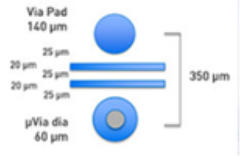
L/S = 75 / 75 um

BGA pitch : 0.50 mm
HDI uvia

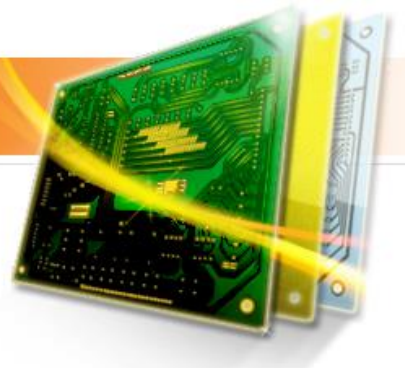


L/S = 20 / 25 um

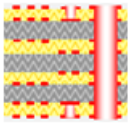
BGA pitch < 0.4 mm
HDI / LDI / mSAP



HDI Development Timeline



2005 — *HDI Type I*
1 level uvia



2011 — *HDI Type II*
1 level uvia + Buried via

2012 — *HDI Type III*
2 level uvia staggered + Buried via

2013 — *HDI Type III*
2 level Cu fill Stacked uvia + Buried via

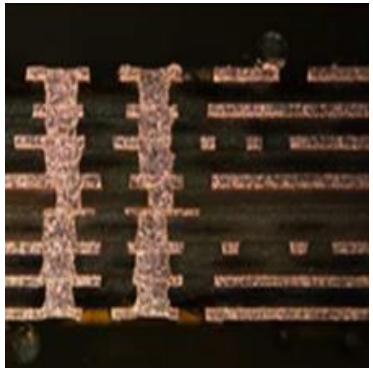
2019 — *HDI Type III*
3 level Cu fill Stacked uvias

2023 — *HDI (ELIC)*
All layers uvia

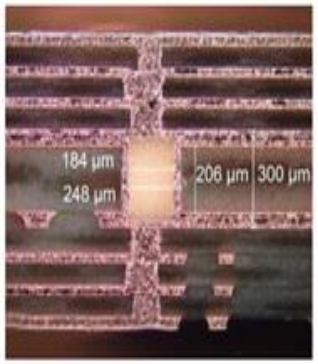
New Process / Equipment Development

- Circuitry : Phototool Imaging >>> Laser Direct Imaging (LDI)
- Metallization : Vertical Electroless Cu >>> Horizontal Conductive Polymer
- Drilling : Mechanical >>> Laser
- Plating : Hoist Flight Bar >>> Vertical Conveyor Plating (VCP)
- Plating : Subtractive >>> Semi Additive (mSAP)
- Electrical Test : 2-wire >>> 4-wire Kelvin Bridge
- Inspection : Human Operator >>> Automated Optical / Visual
- Transport : Manual >>> Robotics / Conveyors
- System : Manufacturing RP >>> Enterprise Resource Planning (ERP)

New Interconnect Technologies



ELIV (coreless)



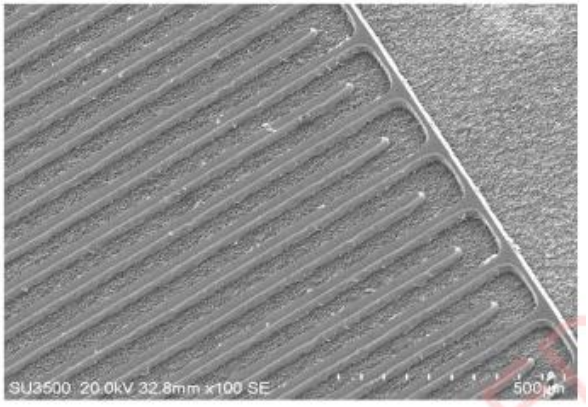
ELIV (center core)

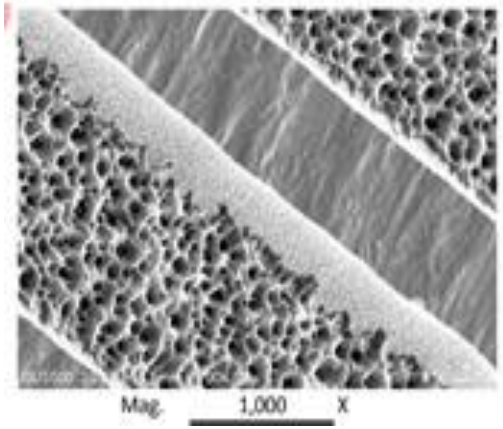
HDI 3-8-3

HDI 4-4-4

6-6 Seq. Lam

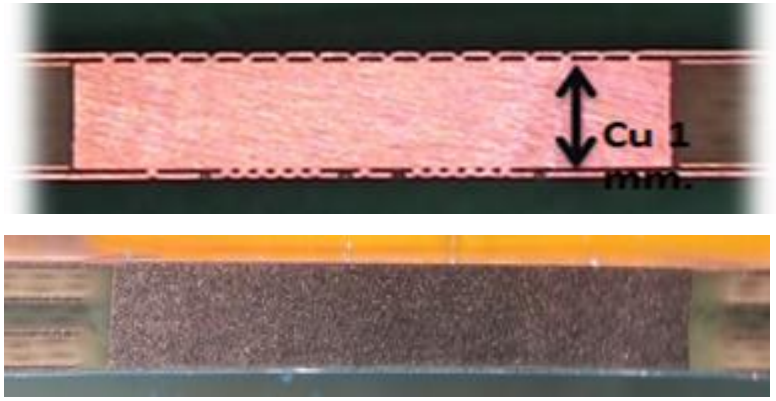
SEM Result : 40/40



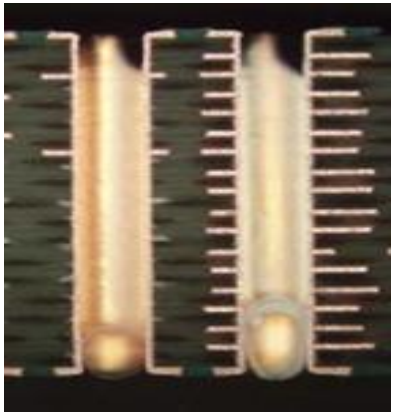


40 / 40 micron line width / spacing

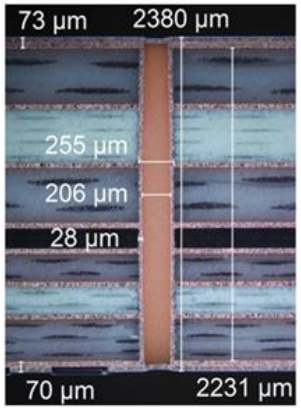
New Product Offerings



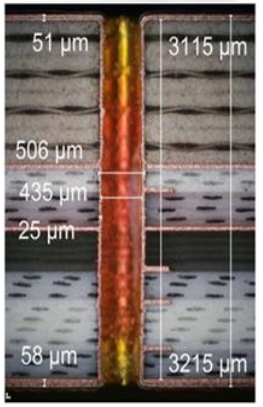
Copper Insert / Coin



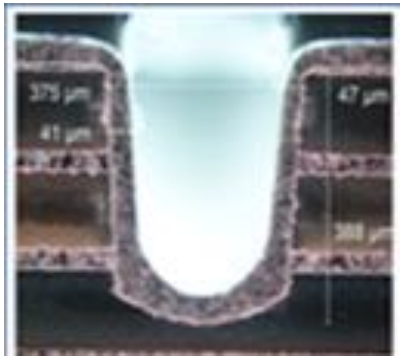
18 Layers



VIPPO

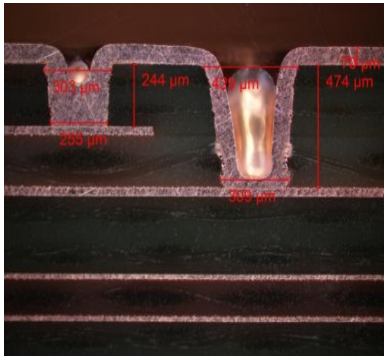


Hybrid

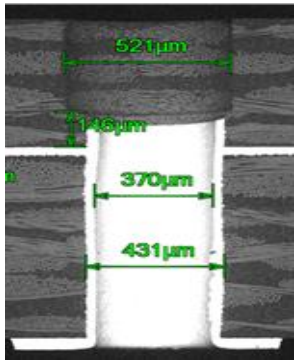


Depth Drill Plated

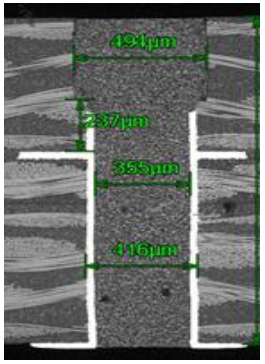
Depth Routed plated



Skipped Laser via plated

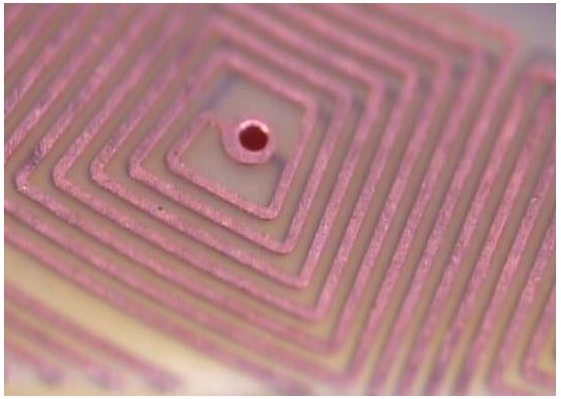


BackDrill

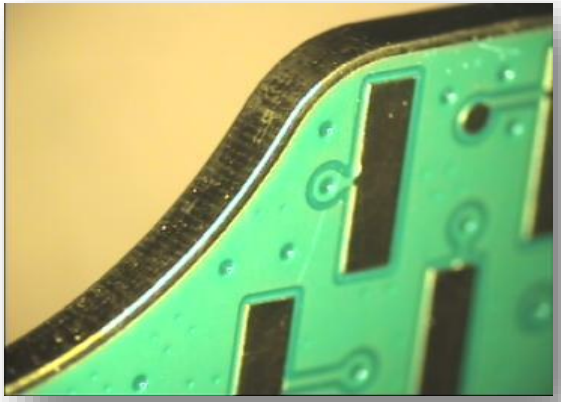


Backdrill Filled

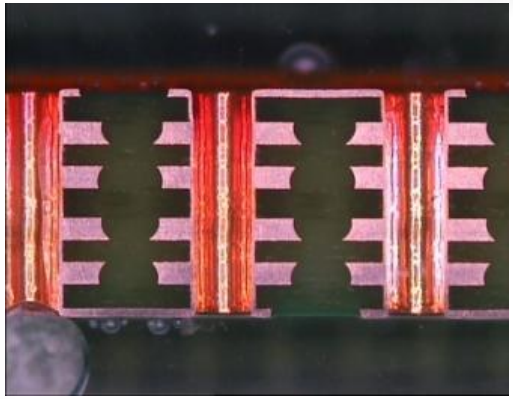
New Product Offerings



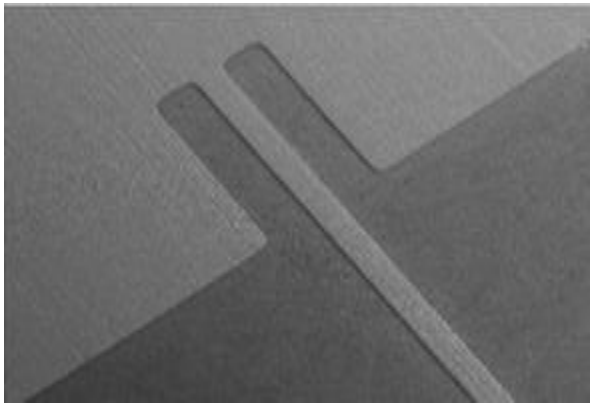
Inductance Coil



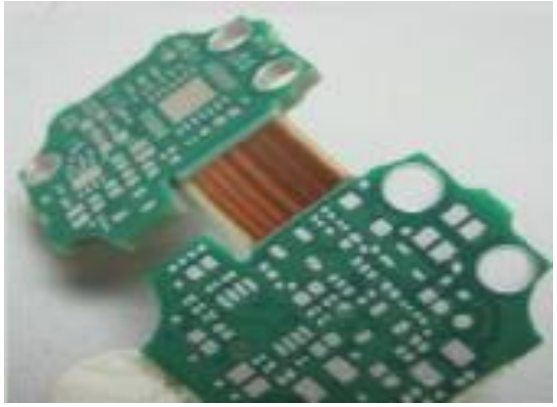
Edge Plating



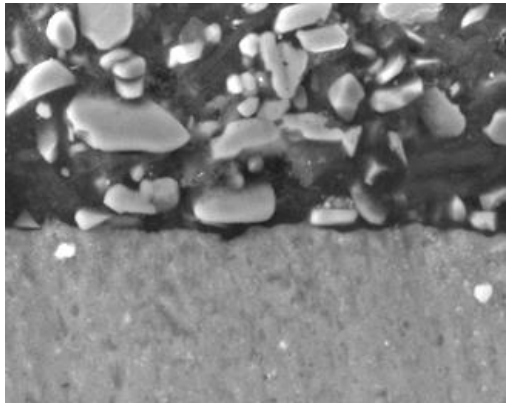
Heavy Copper



RF Radar Antenna

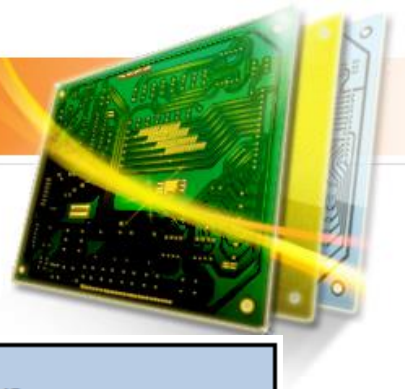


Semi-Flex



Insulated Metal Substrate

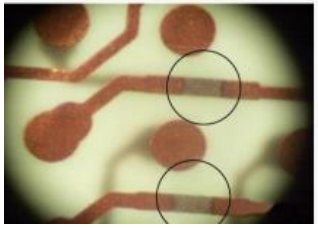
Short Term Capability Development



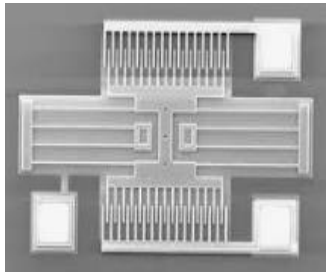
Technology Driver	Influence on PCB Design	Enabling Technology	Development Roadmap			
			2020	2022 / 2023	2024 / 2025	2026
Interconnect Complexity	Circuit Density	mSAP & LDI Vacuum Etching	75 um	50 um	35 um	20 um
Increasing Bandwidth / Datarate	Maximum Layer Count	Advanced Registration System	14 Layer	18 Layer	24 Layer	30 Layer
Component Pitch Package Size	HDI Microvia	Laser Drill Copper Fill Plating	HDI Type III	4 Level Stacked	ELIV	SLP / SIP Substrate Like
High Speed High Frequency Signal Integrity	Low Df / low DK	Plasma Desmear, High Temp Lamination	Modified Epoxies	Hydrocarbon Ceramic	Ceramic PTFE	Liquid Crystal Polymer
High Current High Voltage Thermal Dissipation	Heavy Copper	Heat Sink Attach Metal Core Copper Insert	4 oz/sqft	6 oz/sqft	12 oz/sqft copper inserts	Thermal Conductive Resins

Future Development Plans

Embedded Resistance

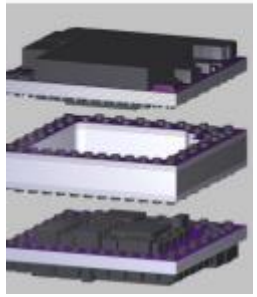


Micro Electro Mech



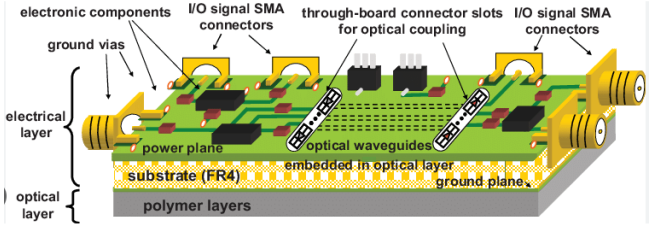
FUTURE PRODUCT	ENABLING TECHNOLOGY	PRODUCT APPLICATION
RIGID FLEX	POLYIMIDE HYBRID, COVERLAYER ADHESIVE REGISTRATION SYSTEM	MOLDED, SHAPED ELECTRONICS
PRINTED FLEXIBLE CIRCUITS	3D PRINTING	BIOMETRICS, CAPACITIVE CONTROL, WIRLESS SENSORS
INTEGRATED PASSIVE COMPONENTS	THIN FILM RESISTIVE INKS, CAPACITIVE PLANES	HIGH SPEED & HIGH DENSITY COMPUTING
EMBEDDED ACTIVE COMPONENTS	DIE ATTACH ADHESIVE, CAVITY ABLATION	HIGH SPEED & HIGH DENSITY COMPUTING
ELECTRO OPTICAL WAVE GUIDE	ION INTEGRATION WITHIN THIN GLASS SHEETS	HIGHER BANDWIDTH DATA TRANSMISSION
MEMS TECHNOLOGY	ELECTRO MECHANICAL INTEGRATION	GYROSCOPE, ACCELEROMETER, STABILITY CONTROL, AIRBAG ACTIVATION
SYSTEM on a CHIP	SEMI_ADDITIVE PROCESSING HDI TYPE III STACKED INTERCONNECTS	HIGH INTEGRATION SMART DEVICES

Interposer

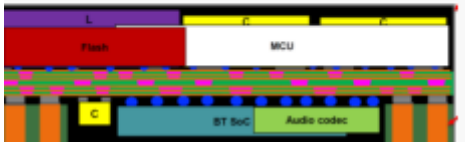


Embedded Components

Electro Optical Waveguide



System in Package (SiP)



Final Comments

PCB Industry in Thailand is Constantly Changing

- New Locations and Expansions
- New and Improved Capabilities
- New Processing Methods
- New Advanced Materials
- New Equipment
- New Product Requirements

Thailand PCB Industry will continue to Prosper and Grow
By continuing to

Expand, Invest, Improve and Evolve


KCE
GROUP
THANK YOU
Khop Khun Krop