



# TCLAD

Thermal Management Solutions

## New Gen IMS Materials for Power Electronics

**Stuttgart, Germany**  
**Dec 3-5, 2024**

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# TCLAD Technologies

a Global Company

**TCLAD is Born from Bergquist and Polytronics**

**Turnover \$50M**

**Business Units**

TCLAD Technologies – Taiwan, TCLAD In – USA, TCLAD Europe GmbH

**Manufacturing Locations:**

Prescott WI USA, Hsinchu Science Park Taiwan, Kunshan China

**Distribution Locations:**

Prescott WI USA, Kirchheimbolanden Germany, Hsinchu Taiwan, Kunshan China, Hong Kong



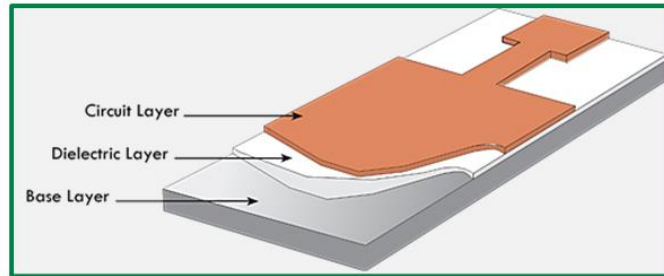
# Product Portfolio



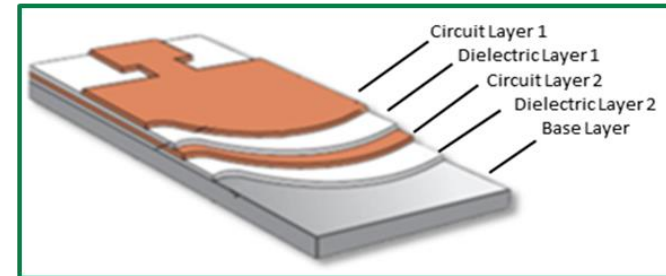
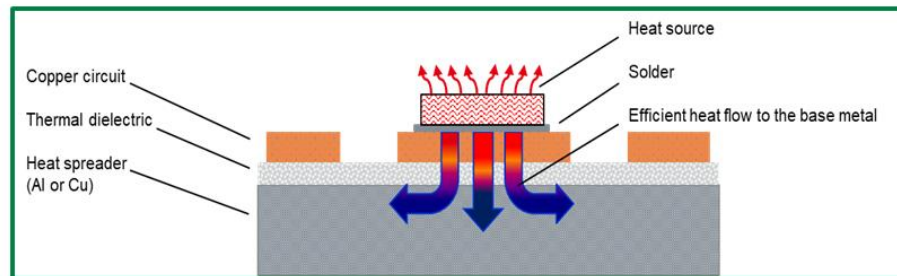
- ❖ IMS (Insulated Metal Substrate)
- ❖ MCPCB (Metal Clad PCB)
- ❖ TIM (Thermal Interface Material)
- ❖ ICE (Immersion Cooling Fluid)
- ❖ SMTB (Surface Mount Thermal Bridge)
- ❖ OCP (Over Current Protection)

# I.M.S. Product Highlight

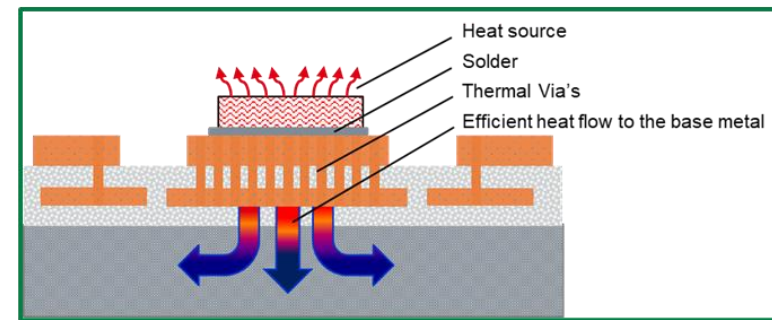
## IMS Structure 1 and 2 layers



- Aluminum base → 0,5 mm to 5 mm thick, standard
- Copper base → 0,5 mm to 3 mm thick, standard
- Dielectric types: 50  $\mu\text{m}$  to 228  $\mu\text{m}$  thick
- Copper foil → 18  $\mu\text{m}$  to 500  $\mu\text{m}$  (0,5oz to 14oz) and thicker



- Provides more circuit routing area
- Layer 2 can be a heat spreader
- Thermal via's used to reduce thermal impedance
- Electrical via's for L1 to L2 interconnects
- Layer 2 can be used as a shield layer to reduce EMI issues

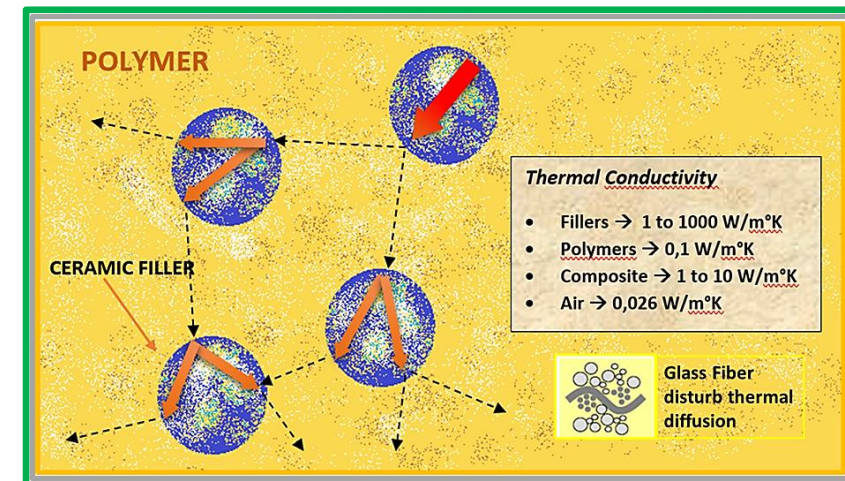
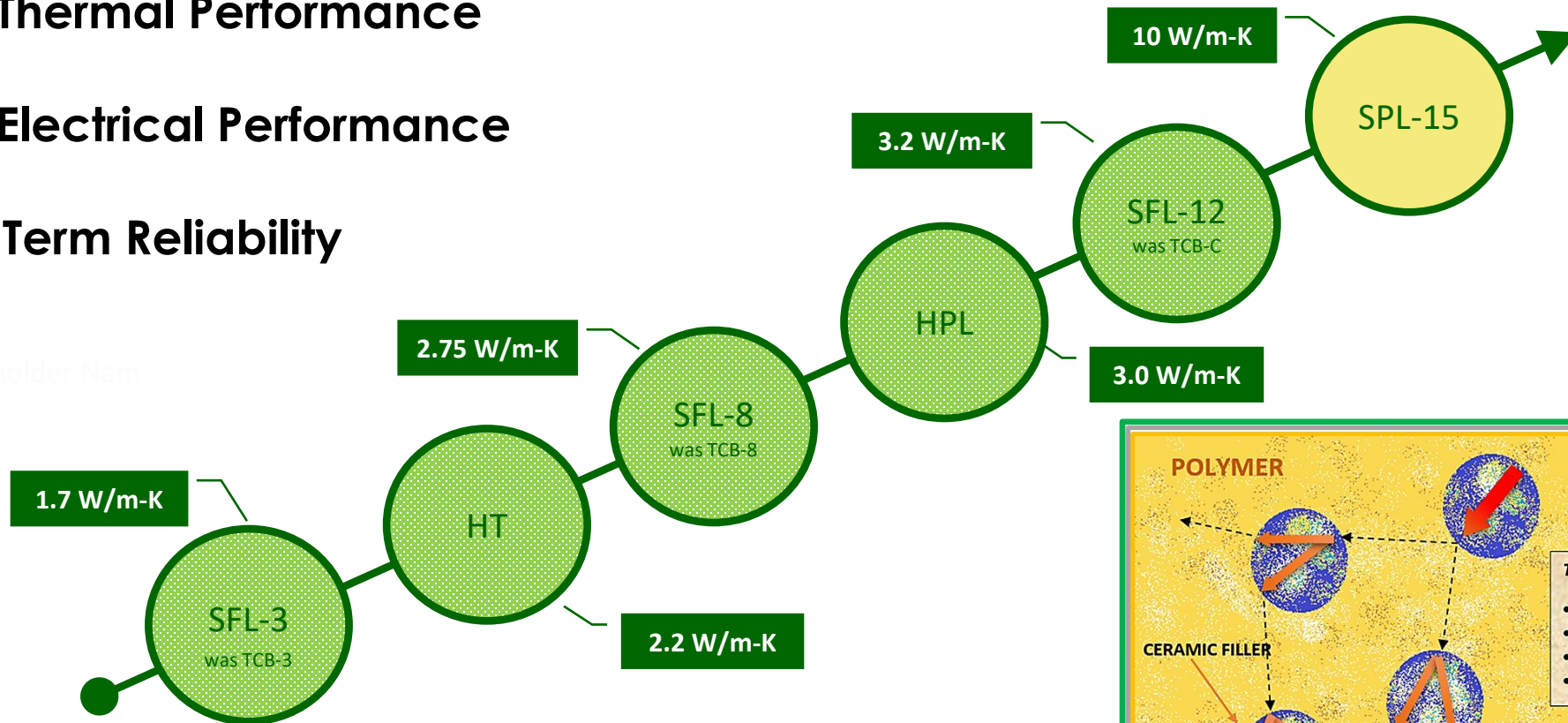


# I.M.S. Product Highlight

## Our Most Popular IMS Materials

- ✓ High Thermal Performance
- ✓ High Electrical Performance
- ✓ Long Term Reliability

Stakeholder Name

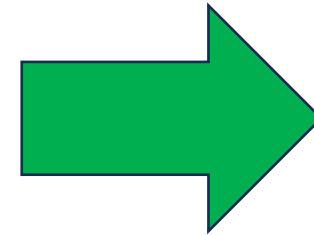


# I.M.S. Product Highlight



## Power Electronics Challenges

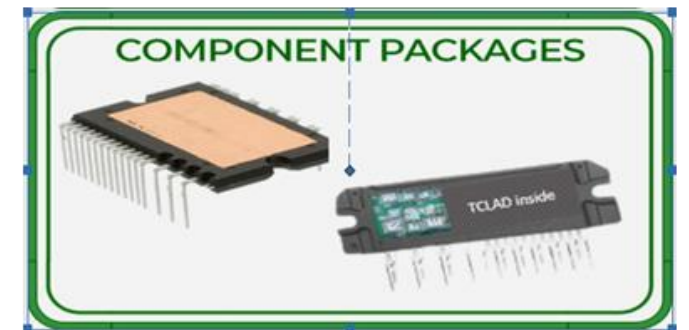
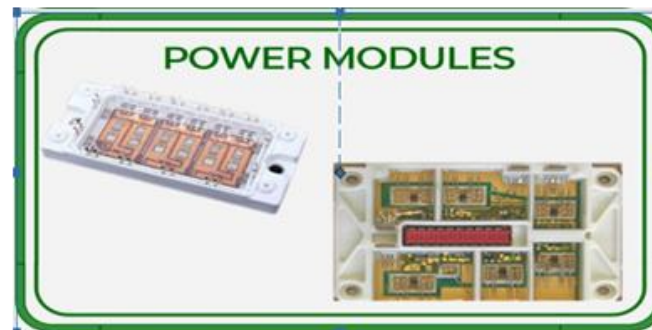
- ✓ **THERMAL** →
  - HIGH POWER MANAGEMENT (thousands Watt)
  - POWER DENSITY MANAGEMENT (W/cm<sup>2</sup>)
  - 3D HEAT SPREADING FEATURE, NO HOT SPOTS
  - FAST REACTION TO HEAT PEAKS
  - STABLE THERMAL PARAMETERS vs AGING
- ✓ **ELECTRICAL** →
  - HIGH OPERATING AND TEST VOLTAGE
  - TWO OR MORE LAYERS
  - HIGH CURRENT CARRYING FEATURE
  - STABLE ELECTRICAL PARAMETERS vs AGING
  - STABLE ELECTRICAL PARAMETERS vs TEMPERATURE
- ✓ **MECHANICAL** →
  - FLEXIBLE FORM FACTORS
  - FLATNESS & WARPAGE CONTROL
  - MECHANICAL STABILITY
  - SOLDER JOINT RELIABILITY



# I.M.S. Product Highlight

## I.M.S. Power Applications

Applications	AC/DC	DC/DC	Inverter	OBC	EV DC/DC	Motor Control	IPM
System	✓	✓	✓	✓	✓	✓	
Module	✓	✓	✓		✓	✓	✓
Component Package					✓		✓

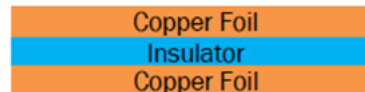
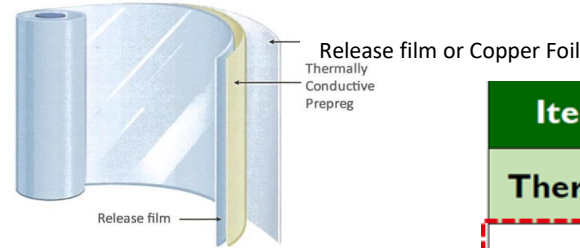


# I.M.S. Product Highlight

## New Gen IMS Dielectric: SPL-15



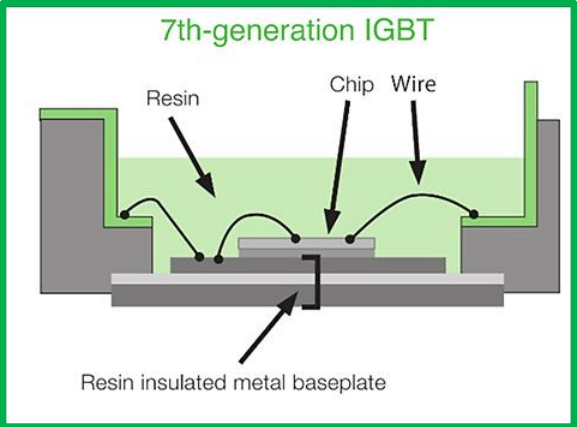
- ✓ Higher Thermal Conductivity
- ✓ High Tg (200°C operating)
- ✓ Improved Reliability
- ✓ Greater Design Flexibility compared to DBC
- ✓ Cost Effectiveness
- ✓ Available in 4 forms, IMS panel, Thin Core, RCC, and Prepreg laminating film
- ✓ Higher Tg allows modulus to be low at max operating temperature, thus allowing for better mechanical reliability



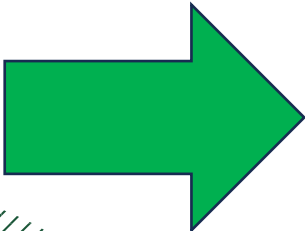
Item	Thickness	Unit	Value	Method
Thermal Properties				
Product Thermal Conductivity		W/m-K	15	TO-220
Dielectric Thermal Conductivity		W/m-K	10	ASTM D5470
Thermal Resistance	100µm (4mil)	°C-in²/W	<0.015	ASTM D5470
Electrical Properties				
Breakdown Voltage	80µm (3.2mil)		3	
	100µm (4mil)	KVAC	4	ASTM D149
	150µm (6mil)		6	
Mechanical Properties				
Peel Strength @ 25°C		Kg/cm	>1.0	IPC TM-650 2.4.8
Glass Transition (Tg)		°C	270	IPC TM-650 2.4.25
Agency Ratings & Durability				
UL Maximum Operating Temperature (MOT)		°C	TBD expect 200C	UL 746
UL Flammability		-	TBD expect V-0	UL 94

# I.M.S. Product Highlight

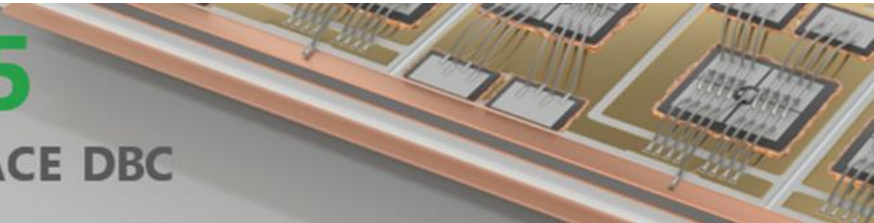
## New Gen I.M.S. vs DBC



Characteristic	IMS	DBC Al <sub>2</sub> O <sub>3</sub>	DBC AlN
Electrical Strength	Good	Excellent	Excellent
Thermal Performance	Good/Excellent	Good	Excellent
Robustness	Excellent	OK	OK
Form Factor Flexibility	Excellent	Poor	Poor
Multilayer Capability	Excellent	N/A	N/A
Copper Thickness	Excellent	Good	Good
Flatness in thermal cycle	Excellent	OK	OK
Cost	Good	Good	Poor



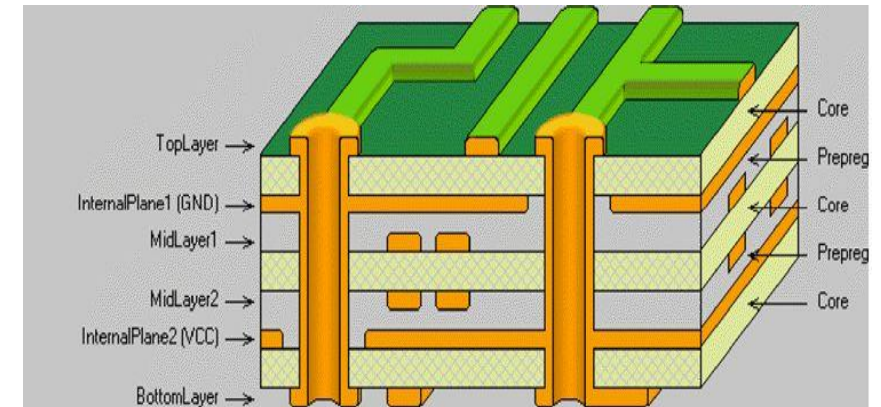
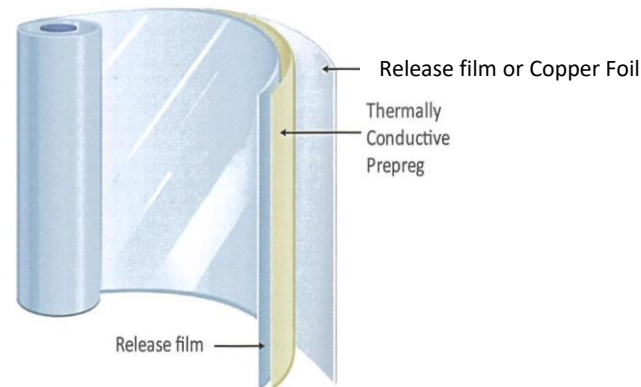
**TCLAD SPL-15**  
 VIABLE SOLUTION TO REPLACE DBC



## Board Level Solutions

### Thermal Clad SFLG dielectrics with glass for multilayer PCB applications

- ✓ Embedded fiberglass allows for processing / handling thin core material
- ✓ Available with SFL-8 and SFL-12 dielectrics
- ✓ Available as thin core, rolls, and sheets
- ✓ Good thermal & mechanical performance
- ✓ Easy to handle
- ✓ Processing similar to FR-4
- ✓ Cost competitive



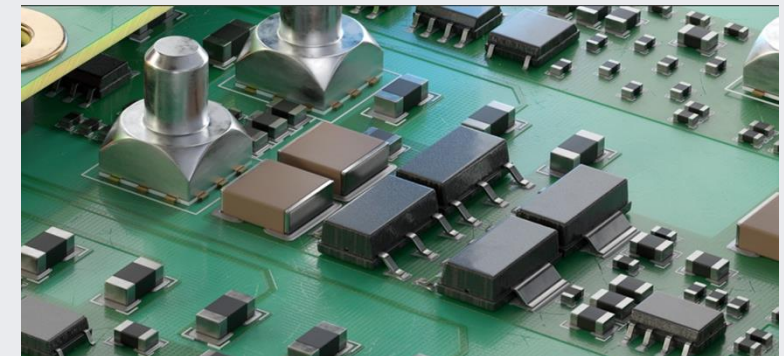
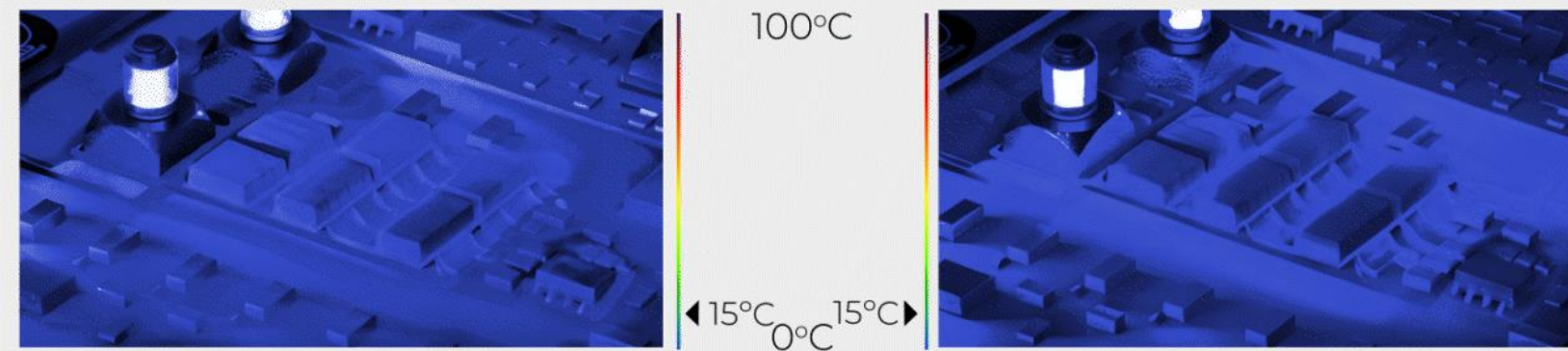
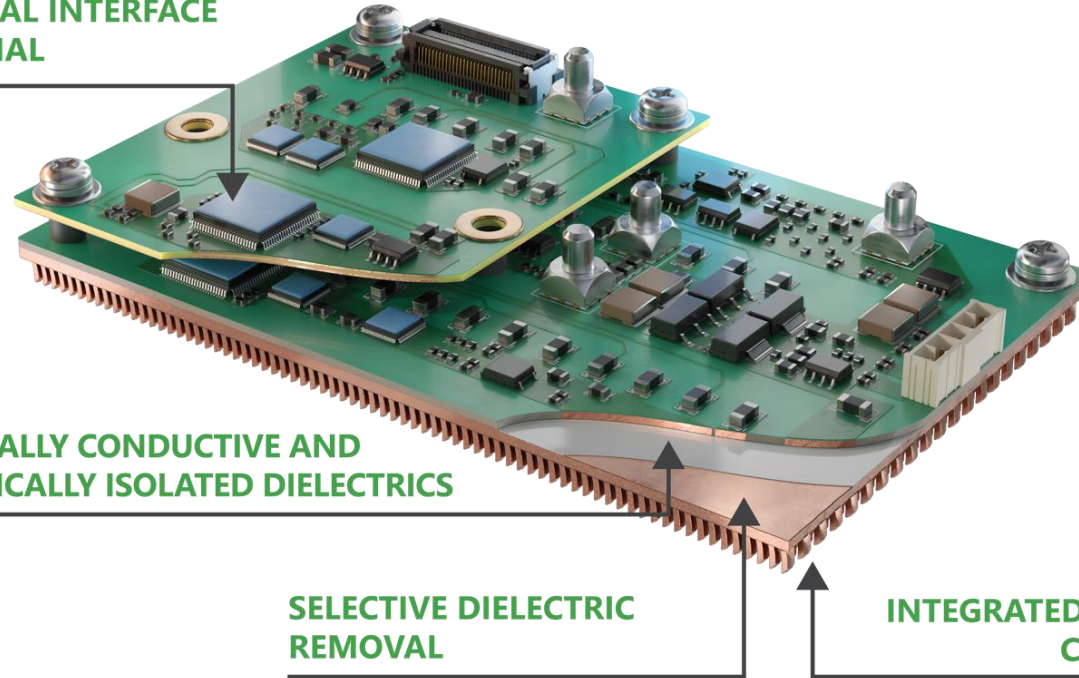
# With TCLAD You See the Difference

THERMAL INTERFACE  
MATERIAL

THERMALLY CONDUCTIVE AND  
ELECTRICALLY ISOLATED DIELECTRICS

SELECTIVE DIELECTRIC  
REMOVAL

INTEGRATED ACTIVE  
COOLING



**Thank You**

**TAKING HEAT OUT, IT'S WHAT WE DO**