

# *Serving RF and Microwave Community with Thick Film Technology*

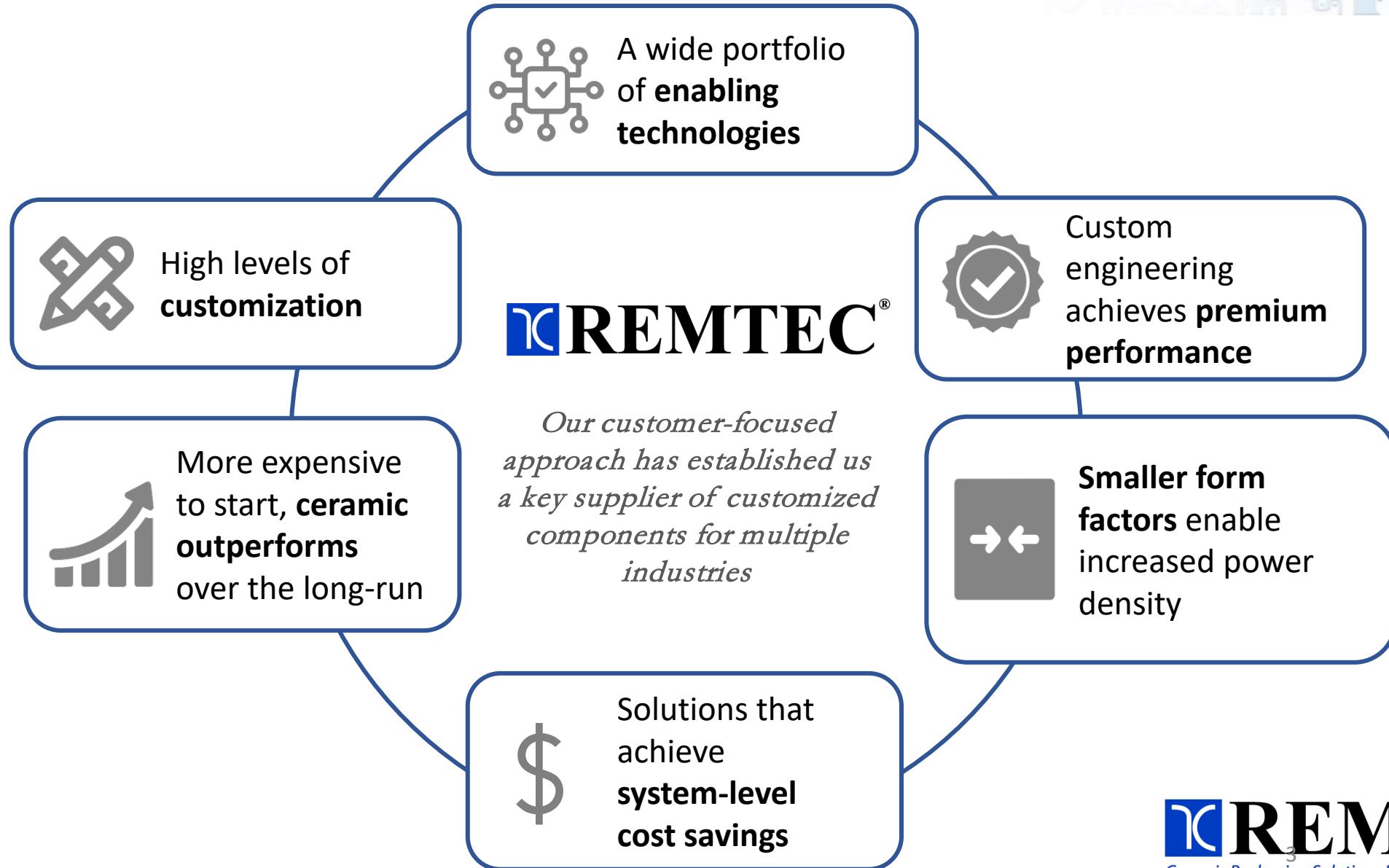


# *Remtec introduction*



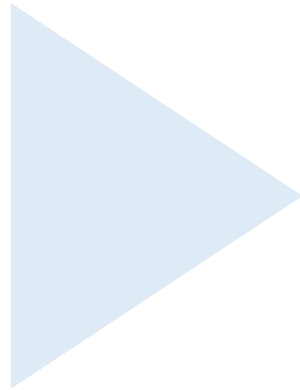
- A leading US based supplier since 1990 providing ceramic substrates and packaging solutions for high power and high circuit density.
- We fabricate electronic circuits and components using screen printing and firing techniques, known as thick film technology.
- Supplier of boards across various industries, including the RF and microwave space.
- Supplying ceramic substrates from low power, mixed signals to high power and high frequencies.
- We enable engineers to resolve difficult interconnect challenges at both the chip scale and circuit module level.

# Why customers value Remtec





# *Growing & expanding*



- ISO 9001:2015 Registered in 2005 & RoHS Compliance in 2006.
- ITAR Compliant and Registered with DDTC.
- MARKETS: RF& Microwaves, Power Electronics, Sensors, LED Lighting, Wireless Communications, 5G, Internet of Things, Industrial, Medical, Scientific, Automotive Electronics, Aerospace and Defense.

# *Why we are moving & expanding*

## Larger footprint for growth of capacity & capabilities

Transforming to high-tech manufacturer of electronic components, packaging and substrates:

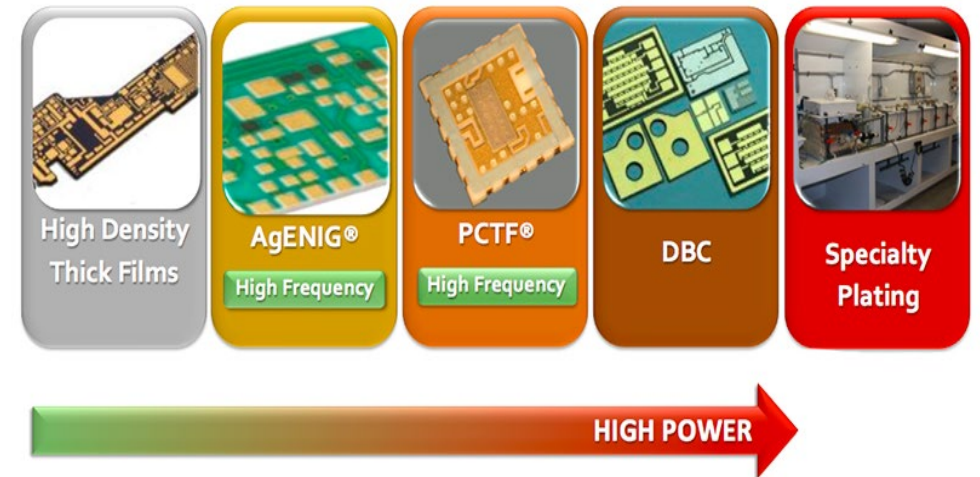
- **New high-tech process capabilities will enable ALL NEW offerings**
  - Additive Manufacturing, 3D printing, laser etching, fine line/ space etching
  - Develop raw materials to increase capability or solve industry problems
  - Partner with customers to “design to spec” vs. “build to print” = co-develop products
- **Lean facility will yield efficiencies and shorter lead times**
  - Lean transformation = improve product flow, reduce waste, increased capacity and throughput
  - More space for manufacturing, equipment, processes, testing, offices
- **Vertically integrate outsourced processes**
  - Significant cost reduction
  - Increased capacity and throughput, eliminate/ control bottlenecks

# *Remtec advantages*

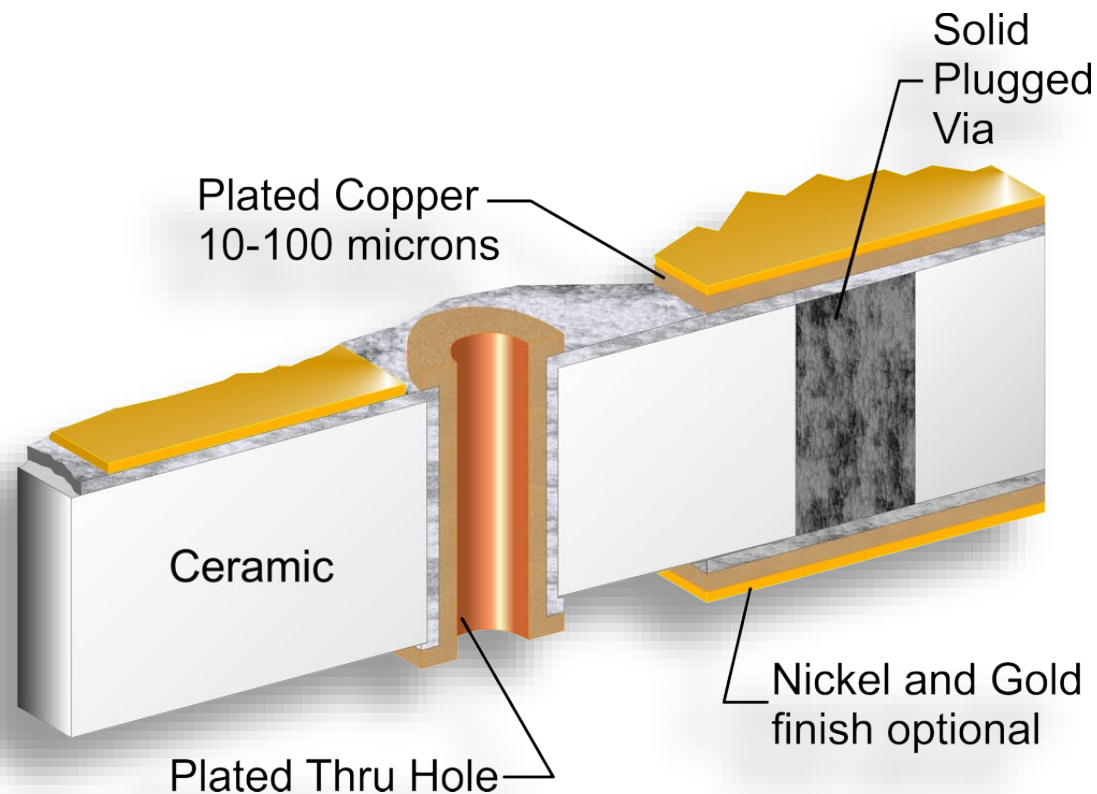
- **Cost-effective** — Remtec thick film technology offers a cost-effective alternative to thin film technology or ceramic substrate manufacturing.
- **Design flexibility** — Our screen-printing process allows for intricate designs and customization, enabling rapid prototyping and design iterations.
- **Integration** — Thick film technology enables the integration of various passive components (resistors, capacitors, inductors, couplers) and active devices (MMICs, transistors, diodes) onto a single substrate.
- **Temperature stability** — Thick film materials exhibit excellent thermal stability, making them suitable for high-temperature RF and microwave applications.
- **Scalability** — Remtec thick film technology is easily scalable for high-volume production.
- **Products over 30MHz to 40GHz**

# *Broad process base*

- Custom metallized boards with conductors and resistors
- Plated Copper on Thick Films (PCTF)
- High Definition Etchable Thick Film (HDTF)
- Silver Electroless Nickel Immersion Gold (AgENIG)
- Single and multilayer RF ceramic boards
- Leadless SMT Substrates
- Leadless Hermetic SMT Packages
- High Density Substrates
- Direct Bond Copper Substrates
- Ceramics, Beryllium Oxide (BeO), Aluminum Nitride (AlN), Barium Titanate



# Core business: PCTF® (Plated Copper on Thick Film)



**PCTF Ceramic Substrates Materials**

Ceramic	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Beryllia (BeO)	Aluminum Nitride (AlN)	Barium Titanate (BaTiO <sub>3</sub> )
Dielectric Constant	9.4	6.8	8.6	20-100
Thermal Conductivity	20-30	280	170	3.6
CTE	6.5	7.6	4.0	9.5

- Plated Cu with Ni & Au improves solderability leach resistance compared to Ag & Ni
- Provides SMT interconnect
- Leach resistance built in for manufacturing throughput and high reliability

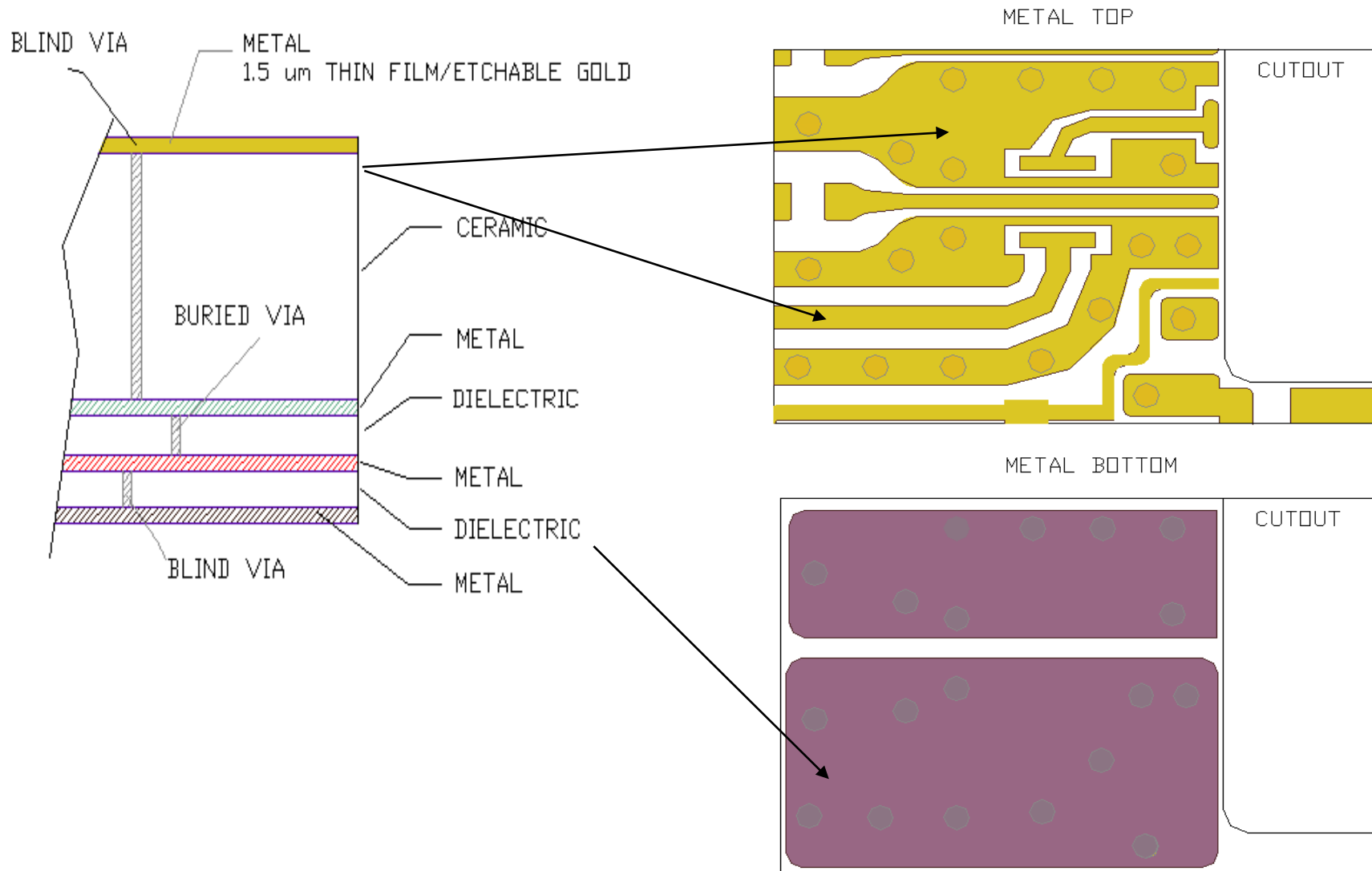
Solid fill vias:

- Provide hermetic interconnect
- Remtec PTV – Power Transfer Vias (thermal management)

**IDEAL FOR MULTIPLE RF & MICROWAVE APPLICATIONS**



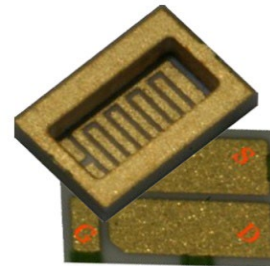
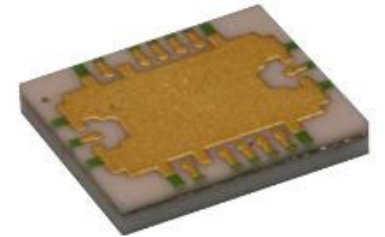
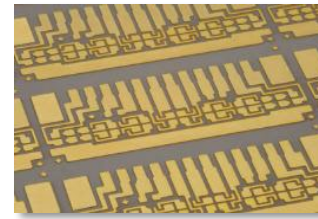
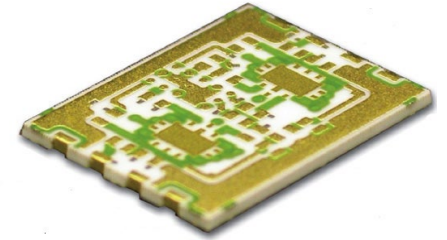
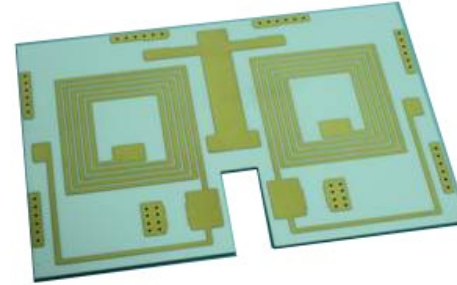
# Photo-etched gold Thick Films



High Density Integrated Solution combines microwave, power, and signal paths on one substrate. Resistors and inductors can be integrated.

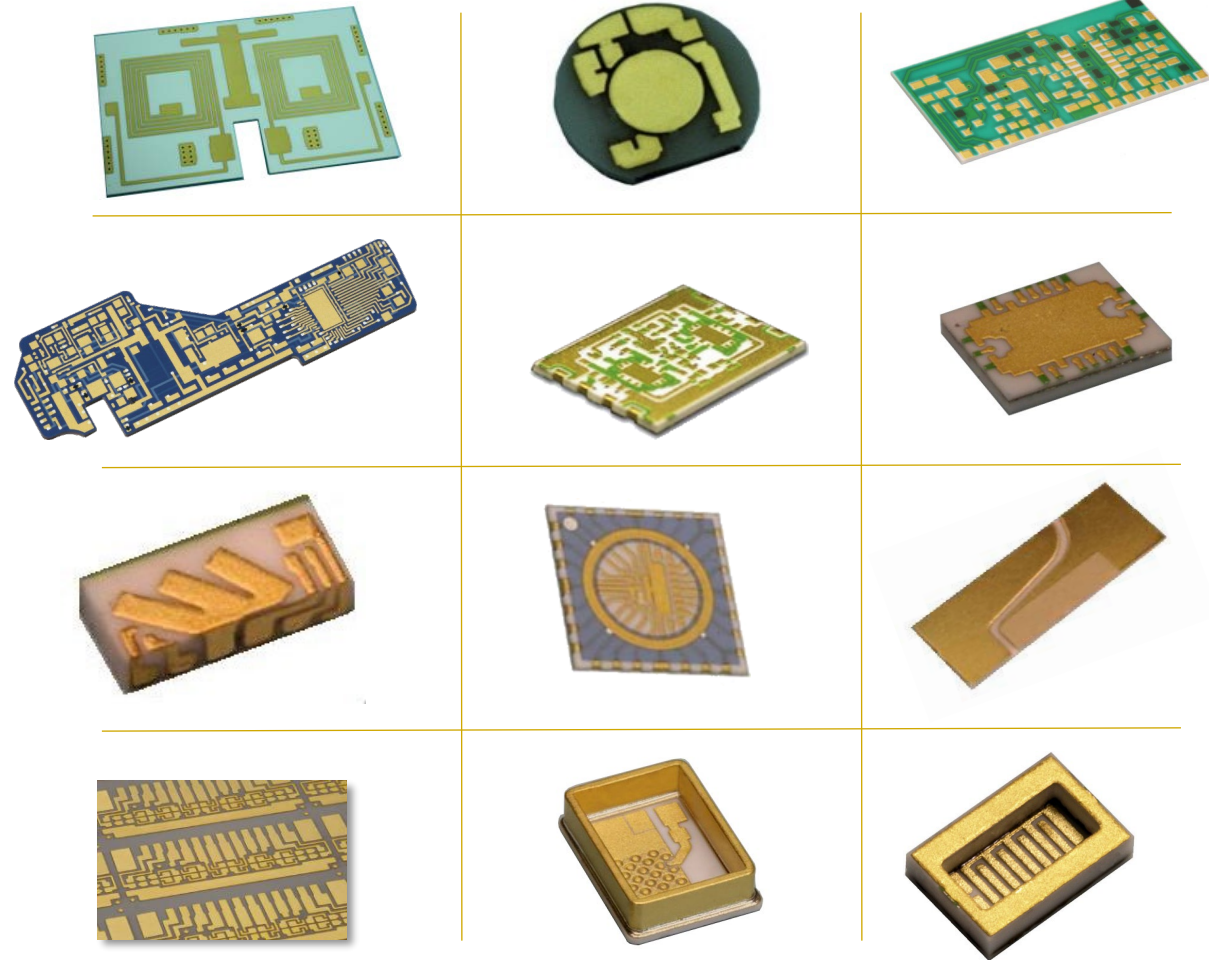
# Remtec process offerings

- **Leadless SMT packages with PCTF** for direct PC board mount (non-hermetic)
- **Hermetic leadless and leaded SMT packages with PCTF** for direct PC board mount
- **DBC substrates**



# Remtec products

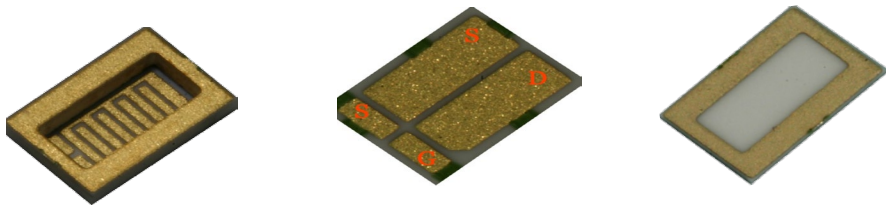
- Metalized Ceramic Substrates with *PCTF*
- Leadless SMT Packages with *PCTF*
- Vias – Solid Fill or Plated Through Hole
- Edge Wrap Castellations
- Printing on all sides & edges
- AgENIG® Thick Film Ceramic Substrates
- High Density Thick Film
- Micro Vias – .0045" diam.
- Etchable Thick Film Circuits
- Selective Plating Options
- AuSn Plating
- DBC



# Hermetic options

## Interposer

Interposer for GaN FET Transistor  
– CHIP SCALE

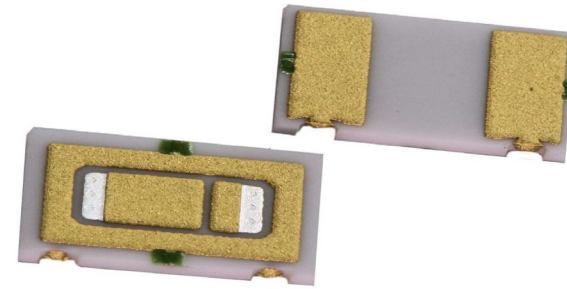


### EGaN FET

- BGA Construction and Hermetic Connections (VIAS)
- Ceramic with .002" Cu Plated
- Ceramic Frame
- Metallized glass top
- Flat ceramic Lid with Plated Gold Tin

## Substrate

For space application

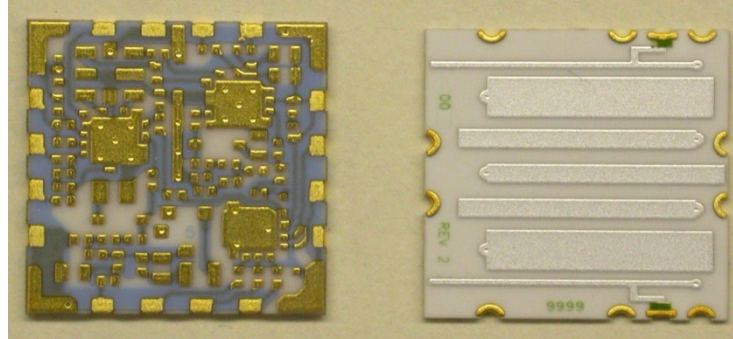


- .002" Plated Copper
- Hermetic Filled Vias
- SMT type with metallized edge wrap castellations
- Wire-bondable & solderable

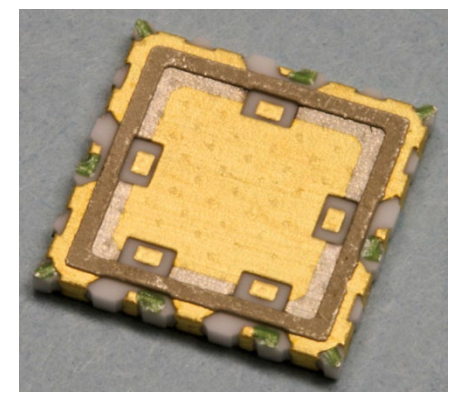
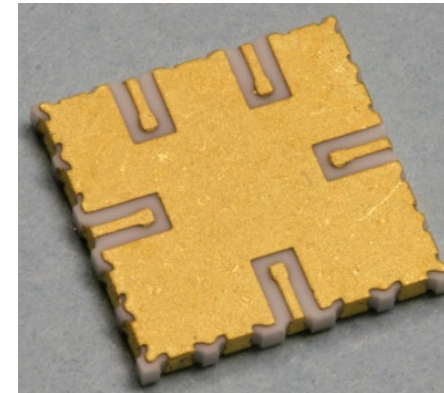
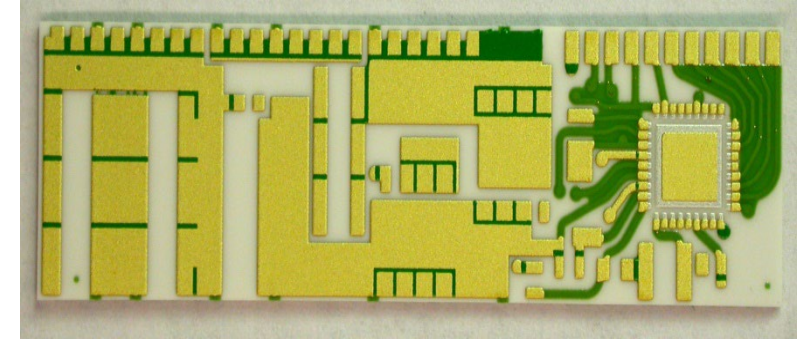


# *Amplifiers & IC substrates*

- Hermetic package
- Substrates with vias
- Metallized castellations for SMT
- Gold tin plating
- Leadless ceramic package

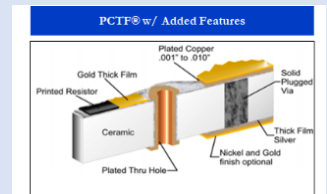


Power Amplifier



# Technical Performance Summary

<b>Material</b>	Ceramic dielectric relative permittivity range from 6 to 12
	Alumina (Al <sub>2</sub> O <sub>3</sub> ) 96% to 99.6%, Beryllium Oxide (BeO) and Aluminum Nitride (AlN)
<b>Layers</b>	Single or multiple layers up to 8 layers. Minimum thickness 10 mil
<b>Sublayer Structures</b>	Capacitors, resistors, inductors, filters, couplers, hybrids, interconnects, power combiners/dividers
<b>Line Widths</b>	6 mil typical, 4 mil minimum with our silk screen printing
<b>Minimum Spacing</b>	Minimum spacing between lines 4 mil
<b>Resistor Values</b>	5 Ohms to 10 MOhms*
<b>Lines &amp; interconnects</b>	Less than 5mOhm/Square – Gold, Silver, Palladium and Copper *
<b>Metallization Thickness</b>	3 to 15 microns *
<b>Interconnect lines and transmission lines</b>	≤1 mOhm *
<b>Via Holes</b>	5mil to 15 mils *
<b>PCTF (Plated Copper Thick Film) Layer Configuration</b>	Copper line resistance as low as 0.06 mOhms/sq, plated through holes and filled a resistance of 0.1mOhm, losses of less than 10mW@10A, thermal resistance of less than 1degC/W, and
<b>Frequency Range</b>	30MHz to 40 GHz
<b>Other Capability</b>	High density interconnects and fine lines *



\* Contact us for your specific needs and additional information

# *Why choose Remtec*

- Remtec thick film technology offers significant advantages in terms of cost, design flexibility, integration, temperature stability, and scalability.
- The RF and microwave community can benefit from the wide range of components and circuits that can be realized using thick film technology.
- Ongoing advancements at Remtec in thick film materials, processes, and applications continue to drive innovation.