METALLIZED SUBSTRATES, PACKAGES AND COMPONENTS WITH PCTF® TECHNOLGY

Remtec has developed and commercialized an enabling packaging technology by combining standard Thick and Thin Films with copper plating, advanced materials and proprietary manufacturing processes. The Company's core PCTF® technology addresses a broad array of power applications across a large number of various industries.

Remtec Inc. has developed and commercialized a proprietary process for manufacturing cost effective metallized ceramic substrates, chip carriers, packages and specialty components based on PCTF® metallization –Plated Copper on Thick (Thin) Films. PCTF® technology provides an enabling solution oftentimes not achievable with either conventional thin or thick films or co-fired ceramics. This cost effective technology is extremely versatile. In addition to its basic copper plated metallization (25 / 125 µm thick), there are added value features such as plated through holes, solid plugged metal vias, castellations and integrated, wide range thick film resistors and multilayers.

Current Carrying Capacity

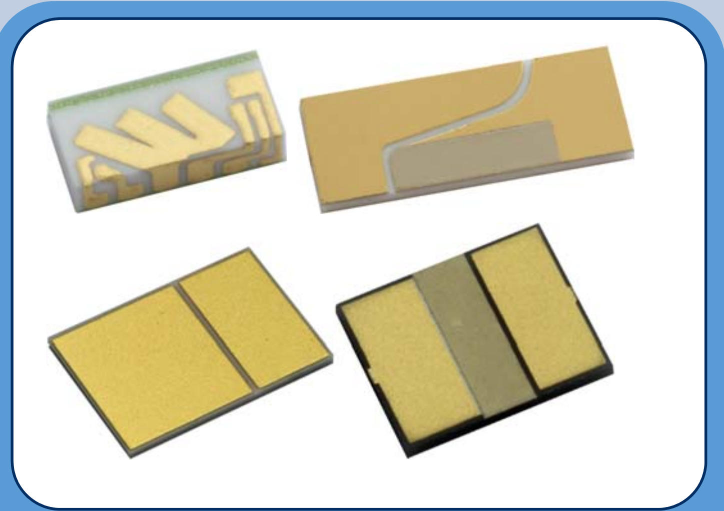
Using plated copper metallization from 25 µm to 125 µm thick, on a thermally conductive ceramics combined with **copper plated thru holes and plugged vias** with **low dc resistance ≤ 1mΩ** allows high current capacity in excess of 50 Amps as well as excellent heat spreading and low thermal resistance.

Thermal management improvement

Plated copper metallization on Alumina, AlN and BeO as thin as .010", with thermal vias **(K≥250 W/°CxM)**, plated through holes and plated-up heat spreaders provides low thermal resistance (**Øjc)** of below **1°C/W**, and serves as a thermal management solution.

Innovative ceramic Packages

A combination of solid metal, thermal vias (k ≥ 200 W/(Mx^{O}C) with low dc resistance of 1mΩ that are hermetic to (10^{-8} atm cc/s) and wraparounds for SMT attach allows design and fabrication of leadless hermetic packages, flip chip carriers and interposers.



Laser Diode, Photo Diode and LED Submounts on alumina, AlN and BeO with PCTF metallization (25-75 µm thick copper), Ni-Au finish and selective gold tin plating.

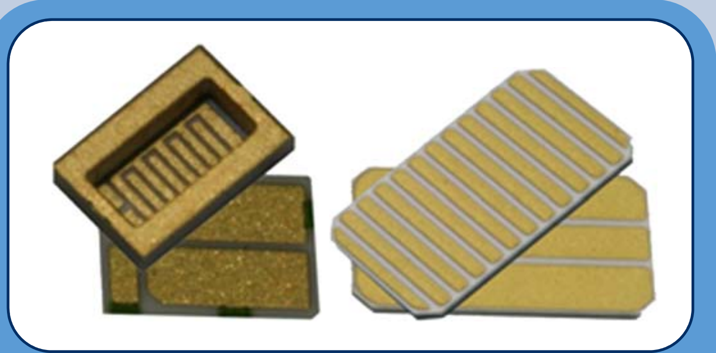
Leadless SMT Substrates / Packages on alumina, AlN, BeO and Barium Titanate with PCTF metallization (25-50 µm thick copper), solid metal plugged vias and castellations, printed thick film resistors, Ni-Au finish and selective gold tin plating for RF Power Amplifiers, LNAs, attenuators and filters.

Increasing circuit density in a miniaturized package
Using Remtec's PCTF® technology, designers can combine fine lines **(50** µm**)** and thick copper plated "wires". In addition, conductor multi-layer patterns (up to five layers), small size printed thick film resistors (≤250 µm) and inductors contribute to maximum performance in a miniaturized package.

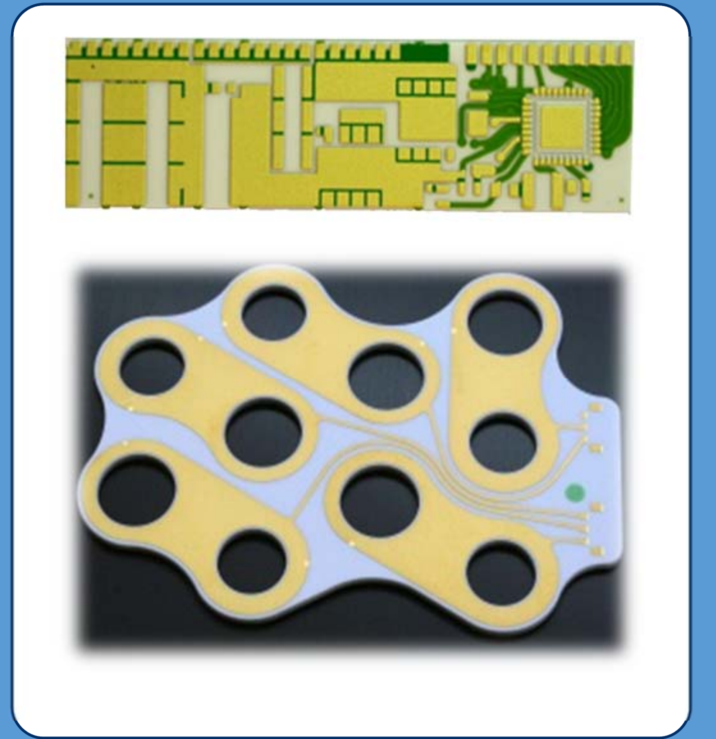
PCTF ® circuitry operates at a wide frequency range
Remtec's metalized ceramic substrates have been successfully field-tested to frequencies up to **mm range** with low losses, often replacing costly thin film circuits without sacrificing performance. PCTF technology incorporates etched fine lines, transmission lines, RF resistors, and efficient signal and ground connections.

PCTF ® circuitry assures high assembly yield
Tin, Nickel, and Gold (electrolytic & electroless) finish over bare copper allows for excellent soldering, wire bonding (aluminum and gold) and eutectic die attach. Remtec's metalized substrates, chip carriers and packages are compatible with advanced electronic assembly techniques. Our substrates withstand multiple soldering operations**,** assure excellent solderability, exhibit no solder leaching and are suitable for various interconnect techniques: SMT, gold and aluminum wire bond, epoxy die-bond, flip chip attachment and high temperature die-attach.

PCTF ® Reliability
Remtec's metalized ceramic substrates (fully-assembled) withstand thermal cycling from -65°C to 150°C (more than 1000 cycles) and other MIL-STD-883C testing without the loss of adhesion as well as via integrity and hermeticity. In addition, Remtec's substrates have qualified for space (Class H & K), military and biomedical applications.



Ceramic Interposers and hermetic SMT packages with PCTF metallization (25-50 µm thick copper) and solid metal plugged vias.

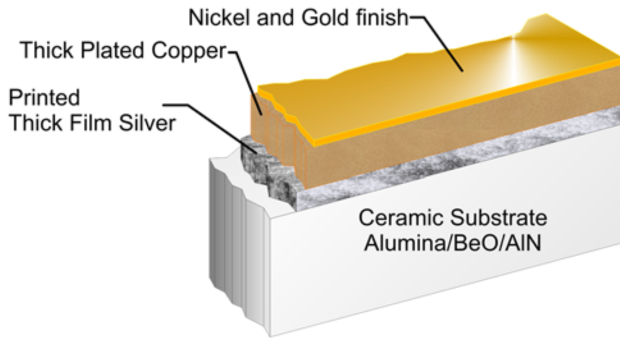


PCTF® Ceramics metallized with 25-75 µm copper, solid metal plugged vias, Ni-Au finish for DC power electronics.

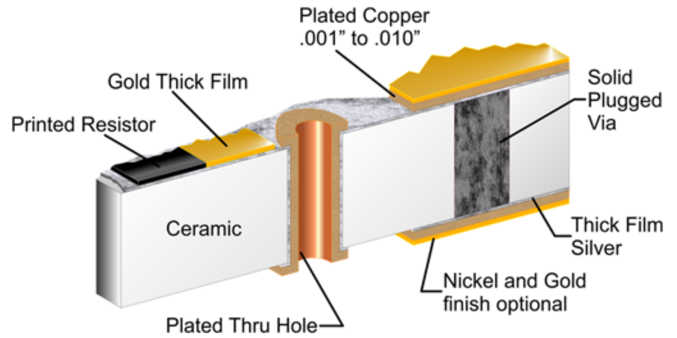
Remtec services a broad range of industries from telecommunications to power supplies, optoelectronics, microwave circuitry, laser instrumentation systems and medical electronics, covering military, industrial and commercial industries. Typical applications include RF power amplifiers and LNA's, optical switches, laser and photo diode submounts, LEDs, sensors, filters, high-density DC/DC converters, driver circuits, thermoelectric coolers, power hybrids, power modules, interposers, flip chip carriers and other power assemblies.

The sales and applications engineering team at Remtec is staffed to provide a diverse customer base with rapid response, short lead time and problem solving support. Remtec, a RoHS compliant, ISO 9001:2008 certified and ITAR compliant company, supplies multilayer substrates in low, medium and high volumes for military, avionics, space and industrial applications.

PCTF® LAYER BY LAYER CONFIGURATION



Typical PCTF Configuration



Basic PCTF Circuit with added Features

PLATED COPPER LINE RESISTANCE

Line Thickness	Resistivity
.001" (25 micron)	0.65 m ohms/sq
.005" (127 micron)	0.14 m ohms/sq
.010" (254 micron)	0.06 m ohms/sq

PLATED THROUGH HOLE RESISTANCE

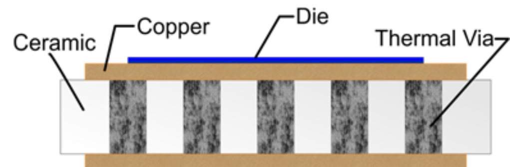
Ceramic Thickness	Hole Diameter	Resistance (m ohms)
.015" (381 micron)	.008" (203 micron)	0.39
.025" (635 micron)	.010" (254 micron)	0.52
.040" (1016 micron)	.012" (305 micron)	0.70

PCTF®: Plugged Via DC Resistance

- Array of 4 vias (.010" diameter in .020" ceramic)
- Total Resistance: 0.1mΩ (10^{-4}Ω)
- @ 10 amp I^2R losses ~10mW

PCTF®: Low Thermal Resistance Package

- 30 Vias with k ≥ 200 W/Mx^{O}C in 0.5 mm alumina ceramic under 3x3 mm die that dissipates 10W, each via has thermal resistance of ~30°C/W.
- Enables cost effective, low thermal resistance package: less than 1^{O}C/W (~10°C temperature rise)



CERAMIC PACKAGING SOLUTIONS
FOR OPTIMUM PERFORMANCE

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