



# GSPK Circuits Ltd – UK PCB Manufacturers

- ✓ Single-sided and double-sided PCBs
- ✓ Multilayer PCBs (4–20 layers)
- ✓ RF and microwave PCBs
- ✓ Heavy copper boards (up to 85 oz)
- ✓ Embedded copper PCBs
- ✓ IMS boards (copper/aluminium base)
- ✓ Copper coin PCBs
- ✓ Flex and flex-rigid PCBs
- ✓ Stencils

**GSPK Circuits Ltd is the largest privately owned UK manufacturer of printed circuit boards. We have been proudly serving the global electronics industry for over 60 years. Our long-standing experience and technical expertise enable us to deliver high-quality engineering and manufacturing processes you can rely on. While we are proud of our heritage, we're equally excited about the future.**

We operate using world-class operational management systems, allowing us to deliver on time, every time—with quality built into every step of the process.

Driven by customer demand, our agile and responsive manufacturing capabilities allow us to handle high-mix, low-to-medium volume requirements with some of the shortest lead times in the industry.

For rapid PCB prototyping, GSPK Circuits offers a comprehensive range of surface finishes including lead-free HASL, immersion silver, ENIG, and ENEPIG. We are the only UK circuit manufacturer with an in-house ENEPIG line, allowing us to control quality, shorten lead times, and crucially—eliminate the need to send boards to external subcontractors. This is a key advantage for customers in sensitive sectors such as defence, where full in-house control over manufacturing processes is essential.

We manufacture, test, and despatch conventional, double-sided plated through-hole, and multi-layer PCBs with speed and reliability—delivering to your schedule without compromising on performance.

As a specialist in application-specific PCBs, GSPK Circuits is the UK's leading manufacturer of heavy copper boards for power electronics. Our proprietary processes support the growing demand for high-current solutions. For effective thermal management, we offer copper coin technology and advanced DTE (Direct Thermal Exchange) techniques that bond copper directly to aluminium substrates. We also manufacture HDI, RF/microwave, IMS, flex and rigid-flex boards, and embedded component PCBs—all produced in our North Yorkshire facility.

Every project undergoes a full design-for-manufacture review to ensure the board is optimised for both performance and production. We're known for our practical, problem-solving mindset—working closely with customers to deliver tailored solutions for demanding applications.

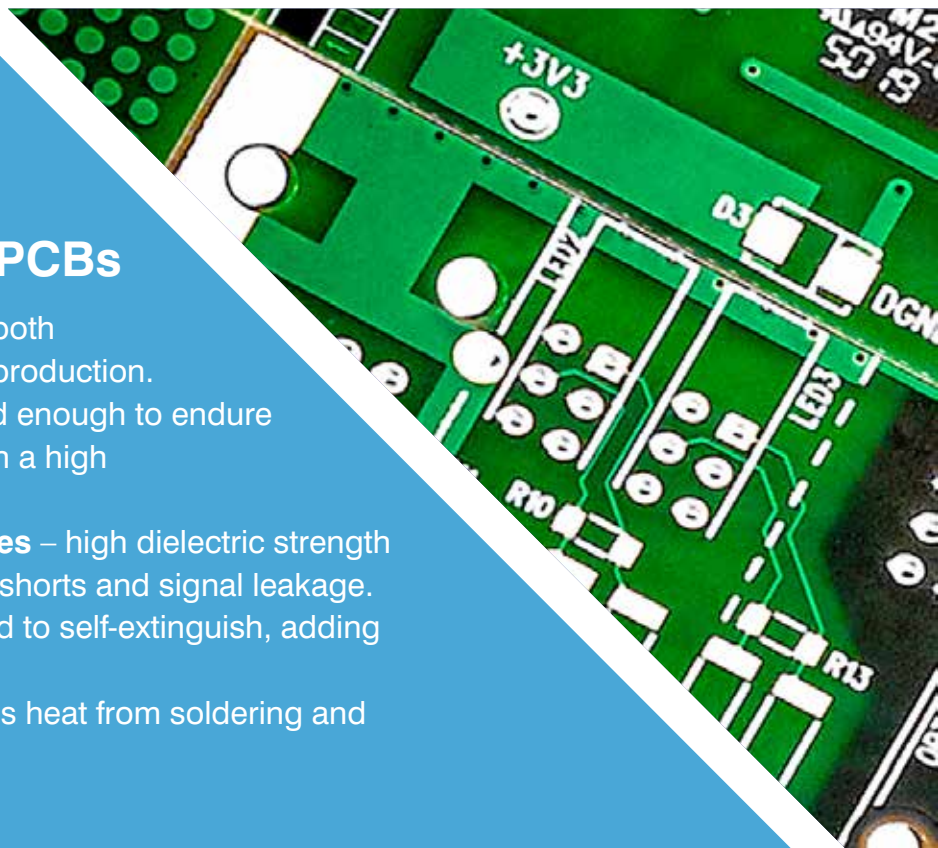
# Capabilities

|                            |                                                                                                                                                                         |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Board types</b>         | Single & Double Sided, Multi-Layer, Heavy Copper, IMS, Flex, Rigid-Flex, HDI, RF/Microwave, PCBs with DTE Pedestals and Copper Coins.                                   |
| <b>Maximum layer count</b> | <b>20</b>                                                                                                                                                               |
| Single Sided               | 1oz (35µm) - 30oz (1050µm)                                                                                                                                              |
| PTH                        | 1oz (35µm) - 30oz (1050µm)                                                                                                                                              |
| Multilayer (Outer layers)  | ½oz (18µm) - 30oz (1050µm)                                                                                                                                              |
| Multilayer (Inner Layers)  | ½oz (18µm) - 30oz (1050µm)                                                                                                                                              |
| <b>Metal Clad PCB</b>      | 1oz (35µm) - 15oz (525µm) (top copper layer)                                                                                                                            |
| <b>Heavy Copper</b>        | Max. 85oz, embedded copper on outers for planar level.                                                                                                                  |
| <b>Surface Finishes</b>    | Hot Air Solder Level, Immersion Gold (ENIG), ENEPIG, EPAG, Immersion Silver, Immersion Tin, Hard Gold & Gold Finger, OSP                                                |
| Maximum board thickness    | 6.00mm                                                                                                                                                                  |
| Maximum panel size         | 610mm x 1000mm                                                                                                                                                          |
| Minimum Track / Gap        | 0.075mm                                                                                                                                                                 |
| Hole Diameter (PTH)        | ±0.05mm                                                                                                                                                                 |
| Hole Diameter (Non-PTH)    | ±0.1mm                                                                                                                                                                  |
| <b>Solder Mask colours</b> | Various including Green, Blue, White, Black, Red                                                                                                                        |
| <b>Drilling</b>            | Minimum 0.15mm (mechanical), 0.075mm (laser)                                                                                                                            |
| <b>Approvals</b>           | <b>ISO 9001:2015</b><br><b>ISO 13485:2016</b><br><b>EN 9100:2018 (equivalent to AS9100D &amp; JISQ 9100:2016)</b><br><b>IATF 16949:2016</b><br><b>Joscar registered</b> |



## Key Benefits of FR4 PCBs

- ✓ **Cost-effective** – a staple for both prototypes and high-volume production.
- ✓ **Strong yet lightweight** – rigid enough to endure machining and assembly, with a high strength-to-weight ratio.
- ✓ **Excellent dielectric properties** – high dielectric strength and stable insulation prevent shorts and signal leakage.
- ✓ **Flame retardant** – engineered to self-extinguish, adding reliability and compliance.
- ✓ **Thermally stable** – withstands heat from soldering and operation at higher Tg levels.



# FR4 PCBs – The Heart of Reliable Electronics

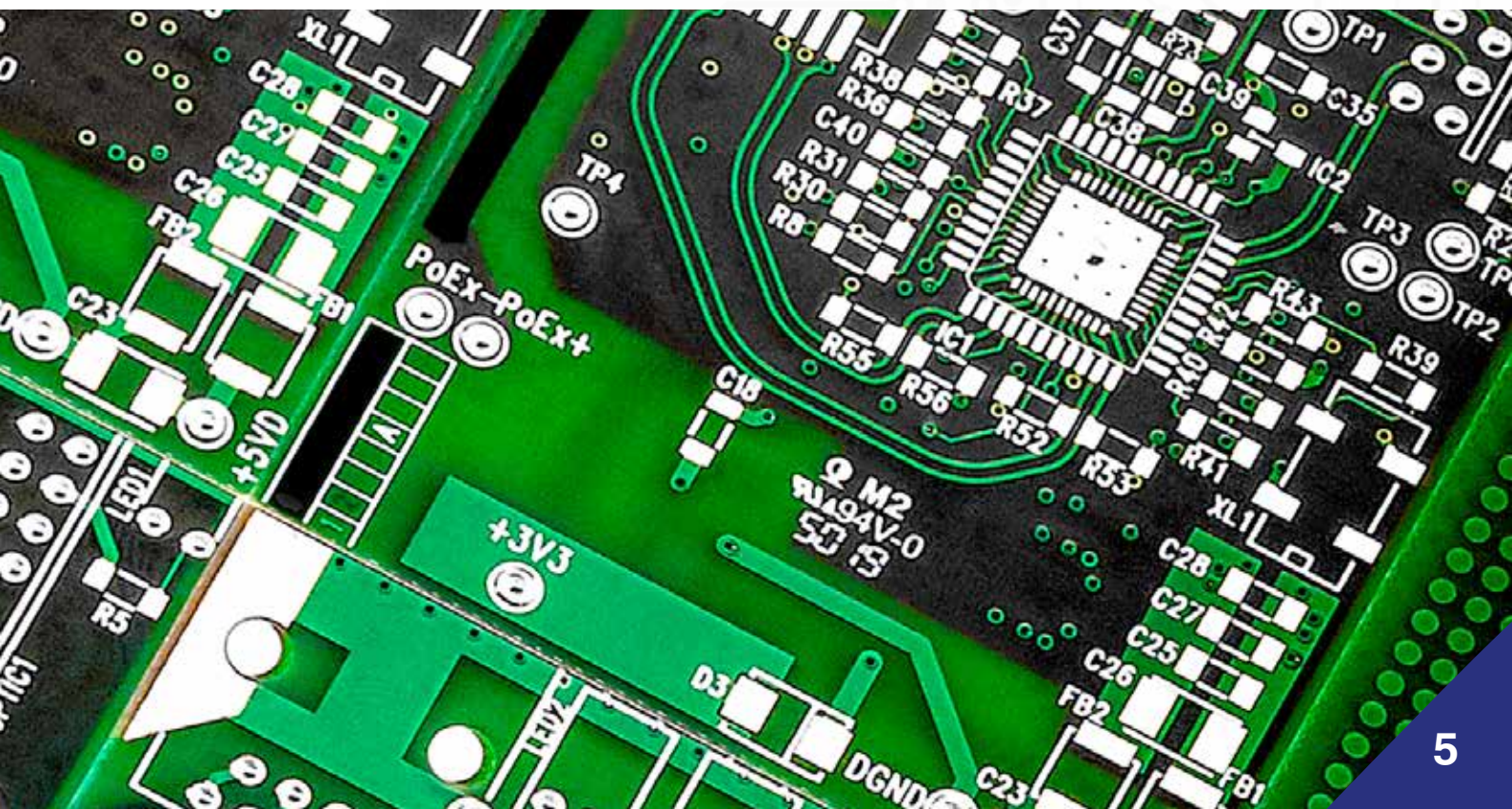
At GSPK, we began manufacturing single-sided PCBs back in 1964. Over the decades, we expanded into double-sided and multilayer fabrication. Such is the pace of modern electronics that approximately 30% of today's GSPK output involves technologies that didn't exist just three years ago. Despite this rapid evolution, traditional FR4 circuit boards—ranging from single - to eighteen-layer builds—remain the workhorse of our UK production facility, fulfilling the bulk of our clients' requirements.

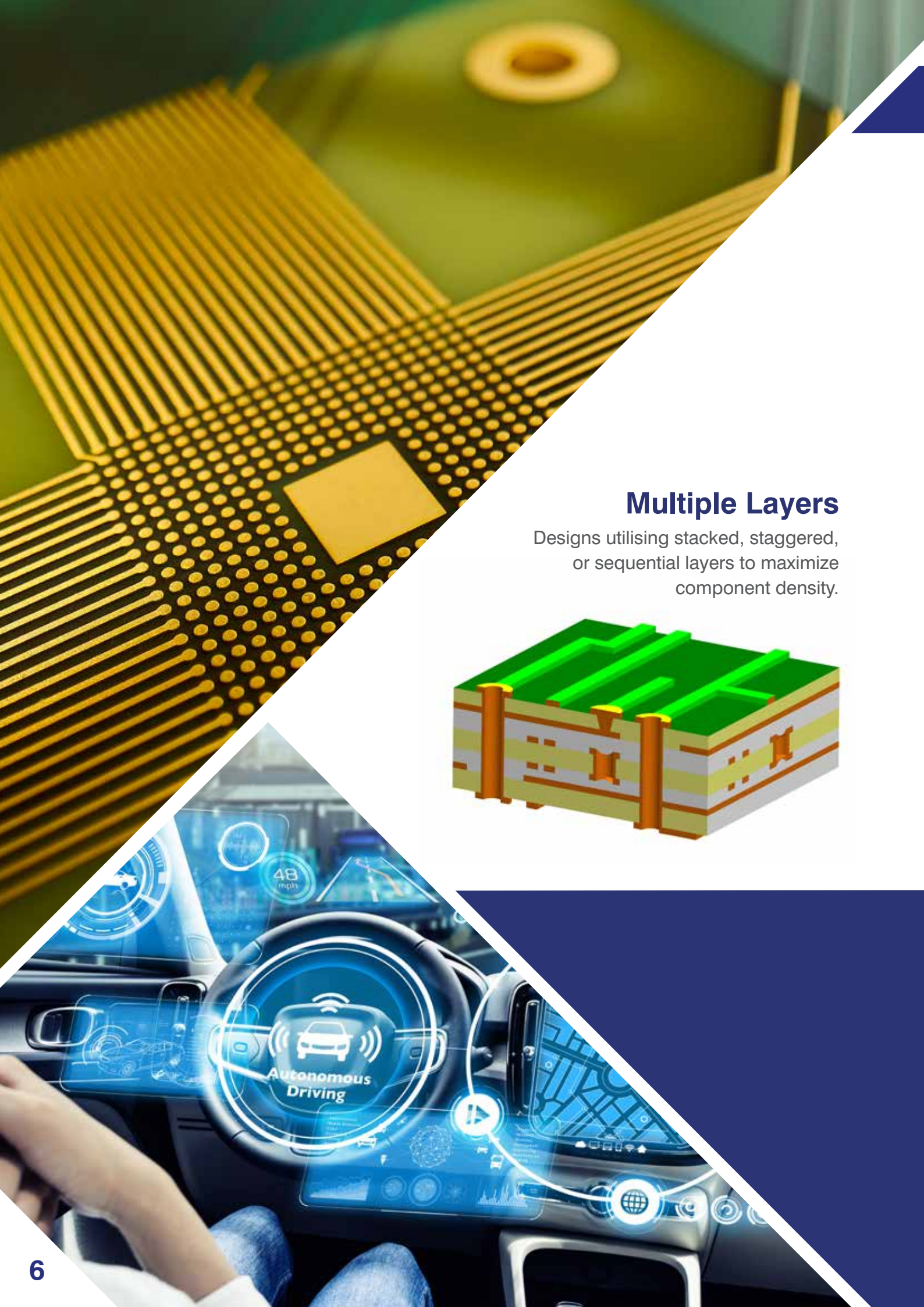
FR4, short for “Flame Retardant 4,” is a glass-reinforced epoxy laminate that meets modern standards and balances excellent electrical insulation, flame-resistant properties, and mechanical durability. Its typical glass transition temperature ( $T_g$ ) spans from 115 °C to over 180 °C, depending on the grade—ensuring stability across diverse operating conditions. Low moisture uptake (less than 0.1%) also makes FR4 ideal for humid or marine environments.

Standard FR4 typically has a  $T_g$  of 140–150 °C. We also stock high- $T_g$  variants rated up to 190 °C ( $T_g190$ )—ideal for assemblies demanding enhanced thermal endurance. We manufacture FR4 PCBs in single-sided, double-sided, and multilayer formats from 1 to 20 layers, with copper weights from ½ oz to heavy copper variants to offer flexibility for current-carrying needs. As standard, we offer board thicknesses ranging from 0.2 mm to 3.2 mm.

FR4 remains the go-to choice—whether for telecoms, medical devices, automotive systems, or routine industrial gadgets—thanks to its versatility, affordability, and dependable performance.

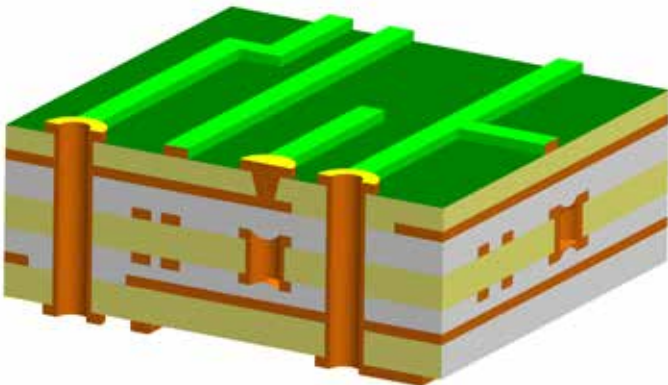
**At GSPK, our deep heritage in FR4 manufacturing ensures quality and innovation every step of the way.**





# Multiple Layers

Designs utilising stacked, staggered, or sequential layers to maximize component density.



# HDI and RF & Microwave

An HDI PCB (High-Density Interconnect PCB) stands out with significantly greater wiring density compared to traditional through-hole PCBs. As specified in IPC-6012, it is characterised by an average of at least 20 electrical connections per square centimetre on both sides of the board, enabling compact and complex designs.

HDI boards are commonly used to achieve smaller, lighter, more powerful and reliable electronic devices by utilising multiple layers, fine tracks and gaps, microvias, and blind and buried vias. With HDI a shorter signal path ensures power loss is less, and therefore its overall electrical performance is better which supports high-speed signals and improved signal integrity which is essential for many cutting-edge technology products.

***HDI PCBs (High-Density Interconnect Printed Circuit Board) should follow IPC2226, the standard for design such PCBs including features such as:***

- ✓ **Microvias:** Laser-drilled vias with a diameter typically less than 150 microns, enabling compact interconnections between layers.
- ✓ **Blind/Buried Vias:** Vias that connect specific layers without traversing the entire PCB, saving space and optimising design.
- ✓ **Thinner Lines and Spaces:** Enhanced density through fine conductor widths and spaces, often less than 100 microns.

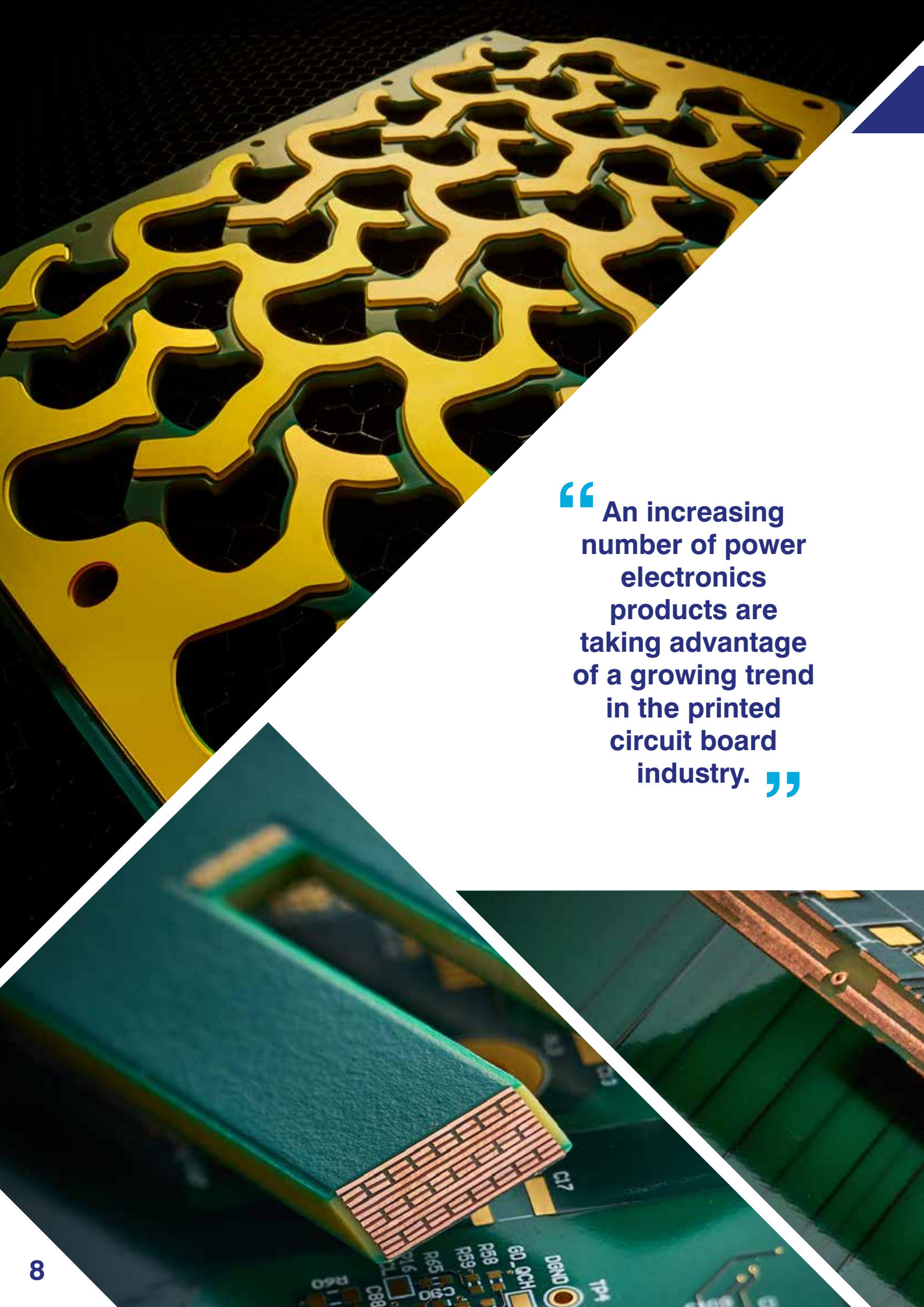
## RF & Microwave PCBs

PCBs used for RF (Radio Frequency) and microwave applications are specially designed to handle high-frequency signals, typically in the range of megahertz (MHz) to gigahertz (GHz). These PCBs must meet stringent requirements to ensure minimal signal loss, interference, and distortion at such high frequencies.

Specialist materials need to be used in manufacturing. FR4 is not suitable for high-frequency applications above 1 GHz due to its higher loss and variation in dielectric constant. At GSPK, manufacturing high-performance RF and microwave PCBs is one of our specialities.

With decades of experience, we are trusted by clients in aerospace, military, and telecommunications sectors for delivering precise and reliable solutions.

Our expertise ensures that each board meets the stringent requirements for high-frequency applications, providing exceptional signal integrity and durability in even the most demanding environments.



“ An increasing number of power electronics products are taking advantage of a growing trend in the printed circuit board industry. ”

# HEAVY COPPER PCBs

PCBs with 3oz or more of finished copper in the inner and/or outer layers are defined as Heavy Copper. Our manufacturing facilities allow Heavy Copper boards to be produced up to 18 layers.

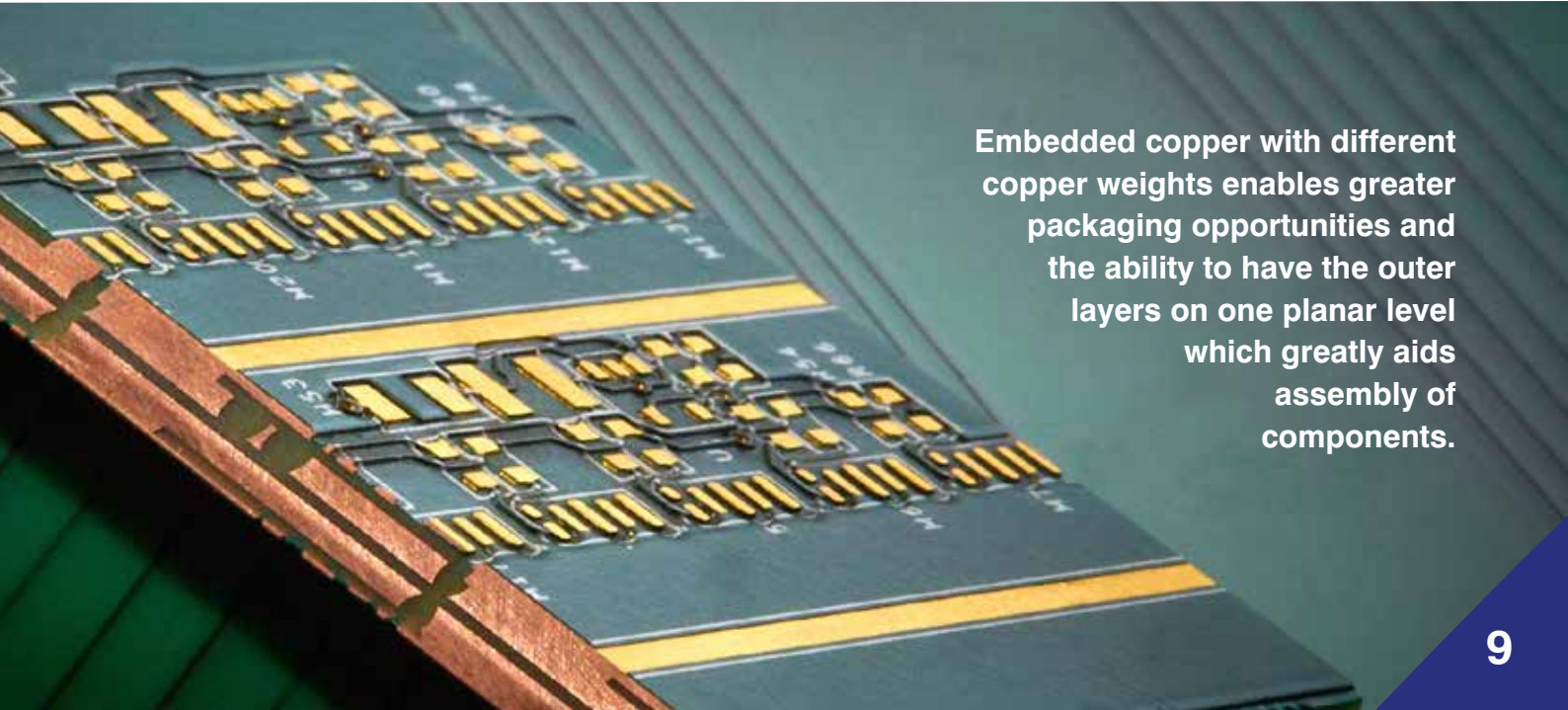
For Extreme Heavy Copper we have the capability for up to 85oz.

*Heavy Copper and Extreme Heavy Copper PCB's offer benefits such as:*

- ✓ Increased endurance to thermal strains.
- ✓ Higher current carrying capacity.
- ✓ Increased mechanical strength at connector sites and in PTH holes.
- ✓ Use of exotic materials to their full potential (i.e. high temperature) without circuit failure.
- ✓ Reduced product size by incorporating multiple copper weights on the same layer of circuitry.
- ✓ Heavy copper plated vias carry higher current through the board and help to transfer heat to an external heatsink.
- ✓ On-board heatsinks directly plated onto the board surface using up to 120-oz copper planes.
- ✓ On-board high-power-density planar transformers.

A new development at GSPK with Heavy Copper PCBs is we can embed part of a copper layer within the PCB core. This copper layer is often referred to as an “inner layer” or a “power plane,” and it is used to provide power and ground connections for the components on the board.

Part of the copper tracks are hidden within the board, much like the majority of an iceberg is hidden beneath the surface of the water. Embedded copper PCBs are used in a variety of electronic devices, particularly those that require high-speed or high-frequency signal processing. By providing a dedicated inner layer for power and ground connections, these PCBs can reduce electromagnetic interference (EMI) and improve signal integrity. They can also help reduce the overall size and weight of a device, since fewer external components are needed to provide power and ground connections.



Embedded copper with different copper weights enables greater packaging opportunities and the ability to have the outer layers on one planar level which greatly aids assembly of components.

# Copper Coins - Targeted Thermal Management

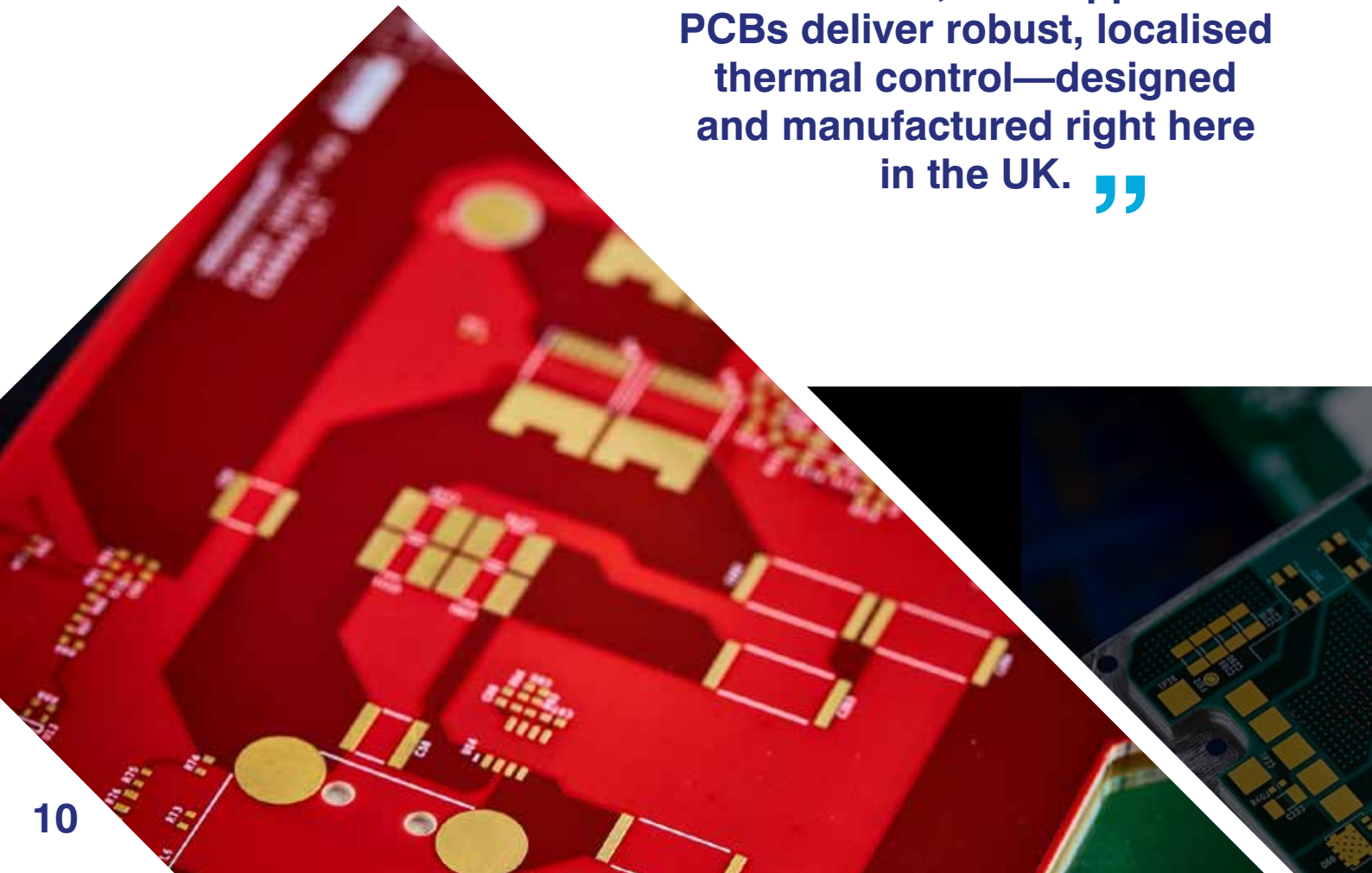
GSPK Circuits offers advanced Copper Coin technology to meet the demands of thermally challenging designs. This solution is ideal when specific components generate significant heat that must be quickly and efficiently dissipated.

Copper, with a thermal conductivity above 400 W/mK, is one of the most effective materials for heat transfer. A copper coin is a solid insert embedded directly into the PCB, typically positioned beneath heat-generating components. This creates a direct and highly efficient thermal path to a heatsink or chassis, reducing the reliance on thermal vias. **In fact, copper coins can offer around twice the cooling performance of a via array.**

At GSPK, we use electrical-grade C103 copper for its excellent conductivity and resistance to hydrogen embrittlement. Coins can be machined in various shapes and placed on the top, bottom, or through the entire PCB, with or without electrical connection.

Copper coin technology is suitable for single sided, double sided and multilayer boards and is particularly effective in designs where one or a small number of components generate the majority of heat. It also integrates well with other GSPK thermal management features, such as DTE pedestals, to create tailored solutions for high-power or high-reliability applications.

“ Whether you’re designing power modules, LED drivers or RF boards, our copper coin PCBs deliver robust, localised thermal control—designed and manufactured right here in the UK. ”



# IMS - Metal Clad Printed Circuit Boards

**GSPK Circuits is a leading UK manufacturer of high-performance IMS (Insulated Metal Substrate) - Printed Circuit Boards, also referred to as MPCBs (Metal Clad Printed Circuit Boards).**

Originally developed in the 1960s for high-power applications, this technology is now widely adopted in the LED industry and other thermally demanding environments where efficient heat dissipation is critical.

Unlike conventional FR4-based PCBs, IMS boards are engineered to transfer heat away from components far more effectively. The dielectric layer used in these boards typically has a thermal conductivity ranging from 1W/mK to 9W/mK — vastly superior to that of standard FR4 materials. This makes IMS the go-to solution for applications requiring reduced junction temperatures and reliable thermal management.

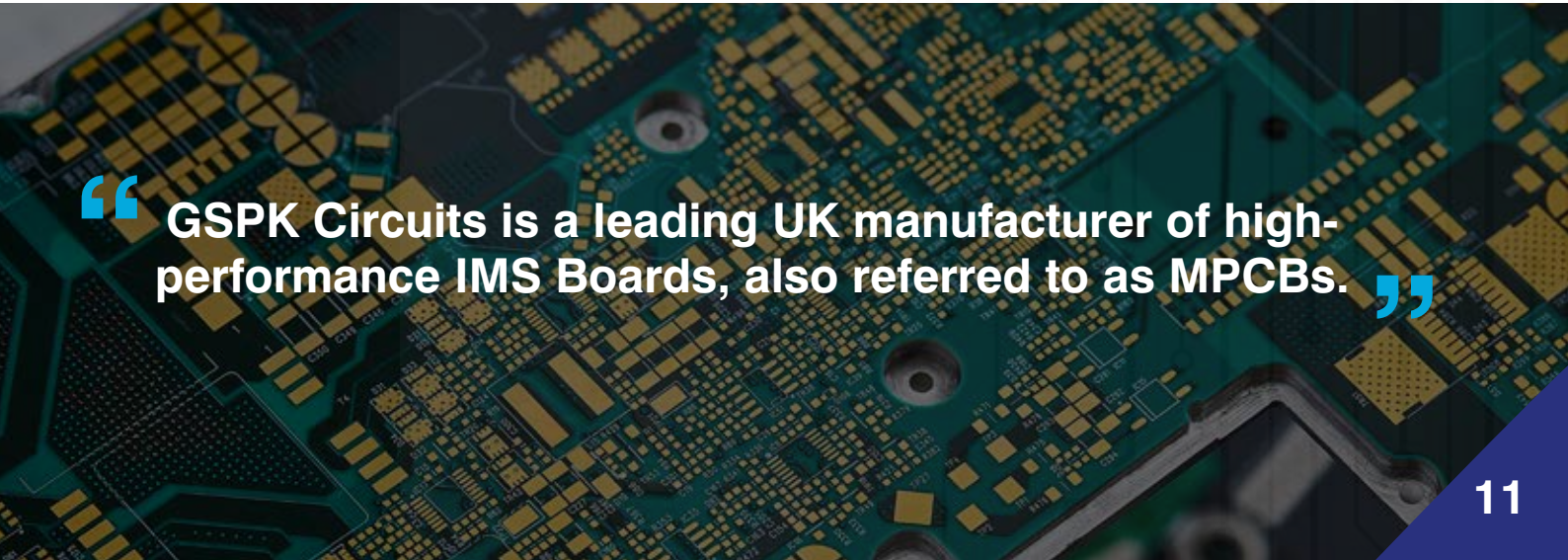
## **An IMS consists of three key layers:**

**Copper Foil** - Typically ranging from 1oz (35µm) to 4oz (140µm), although heavier copper is available on request. This layer forms the conductive circuit and is processed similarly to standard PCBs.

**Dielectric Layer** - This is the most crucial part of the construction. It electrically isolates the copper circuit from the metal base, while allowing rapid heat transfer. The performance of this layer defines the board's thermal efficiency. At GSPK, we use only premium dielectric materials to ensure optimal thermal conductivity and long-term reliability.

**Metal Base Layer** - Usually aluminium, although copper is used in specialist applications. The standard aluminium thickness ranges from 1.0mm to 3.2mm, with 1.6mm being the most common. Aluminium offers a good balance of thermal performance, mechanical stability, and low weight.

With over 60 years of PCB manufacturing expertise, GSPK is trusted by OEMs and electronics manufacturers who require reliable thermal solutions. Whether for LED lighting, automotive, power electronics or other high-power sectors, our IMS boards deliver consistent performance and quality.



**“GSPK Circuits is a leading UK manufacturer of high-performance IMS Boards, also referred to as MPCBs.”**



**“ At GSPK, Flex  
and Rigid-Flex  
technology is  
crafted for the  
most demanding  
applications. ”**

# Flex & Rigid-Flex PCBs

## Compact, lightweight solutions from GSPK

GSPK Circuits offers both Flex and Rigid-Flex PCBs for demanding applications where space, weight, and reliability are critical. These technologies provide mechanical flexibility without compromising electrical performance and are widely used in medical devices, aerospace, defence, and advanced consumer electronics.

## What are Flex and Rigid-Flex PCBs?

**Flex PCBs** (also called FPCs, Flexible Circuits, or Flex Circuits) are made from conductive copper layers laminated onto a flexible polyimide substrate. These circuits can be single-sided, double-sided or multilayered and can include rigid stiffeners to support component mounting.

**Rigid-Flex PCBs** combine one or more rigid PCB sections with flexible interconnects, creating a hybrid structure. These flex sections are often bent or folded into position during installation, allowing designers to reduce both board count and interconnect complexity.

This combination provides the structural strength of a rigid board with the adaptability of flex technology—ideal for compact, high-reliability assemblies.

## Tailored to Your Application

Whether your project requires a single flex layer or a complex multi-section rigid-flex design, GSPK has the experience and capability to deliver. We work closely with customers to provide optimal layout, stack-up, and material choices to ensure performance, reliability and manufacturability.

## Why Choose Flex and Rigid-Flex Technology?

These technologies offer numerous advantages, including:

- ✓ **Efficient use of space** – Flex circuits can fold, twist, or wrap into tight enclosures and 3D shapes, making them ideal where rigid boards simply won't fit.
- ✓ **Reduced weight** – Polyimide is substantially lighter than traditional substrates, and eliminating connectors further reduces the total weight.
- ✓ **Improved reliability** – By removing mechanical connectors and solder joints, failure points are reduced. Polyimide also enhances thermal and dimensional stability.
- ✓ **Lower assembly costs** – Fewer parts and simplified mechanical assembly can reduce manufacturing time and cost.
- ✓ **Dynamic Flex capability** – In applications like robotics, printers, or folding screens, flex circuits can endure repeated motion without fatigue.
- ✓ **Shock and vibration resistance** – Flex circuits absorb mechanical stress better than rigid PCBs, making them well-suited to high-vibration environments such as aerospace and automotive systems.

# Engineering

Once data is received it needs to be 'Engineered' – getting it ready for production. We have our own team of UK based Engineers and our group is resourced with a total of 18 PCB Engineers. Their primary function is to ensure data integrity and find the best possible design solutions available for you.

- ✓ DRC (debugging)
- ✓ CAD data validation
- ✓ Design For Manufacture advisory service
- ✓ Gerber manipulation (customisation of data)
- ✓ APQP and PPAP document provision
- ✓ FAIR document provision to release to AS 9102

## Surface finishes available

When producing a PCB, several factors are considered—layout, materials, laminates, inner layers, and the board's layer stack. Yet, the surface finish is often overlooked. While most engineers know that exposed copper will oxidise and affect soldering, many are unsure which finish to specify. Key considerations include storage time, end-use, assembly method, PCB design, and of course, cost. Below is a brief overview. Contact us for guidance on choosing the right finish for your application.

- |           |                    |
|-----------|--------------------|
| ✓ OSP     | ✓ EPAG             |
| ✓ HASL    | ✓ Immersion Silver |
| ✓ ENIG    | ✓ Immersion Tin    |
| ✓ ENEPIG* | ✓ Hard Gold        |

**\*GSPK is the only UK manufacturer with an in-house ENEPIG line, a strong example of GSPK's ongoing investment in advanced PCB capability.**

## Lead-times

As a leading UK PCB manufacturer, we deliver with speed and precision. To meet tight deadlines, we maintain a wide inventory of base materials and copper weights, allowing us to support diverse project needs quickly. Our experienced team works closely with you to ensure the right solution for your application.

## Testing

Every PCB we manufacture is electrically tested. We have Flying Probe Testers and AOI on site.

# Quality, Sustainability and Future Talent

At GSPK Circuits, quality is a mindset that drives everything we do. Our Business Management System is designed to ensure a safe, efficient, and environmentally responsible workplace, while consistently exceeding customer expectations.

## Our Commitment:

- ✓ To deliver high-quality products, on time and in full — today and into the future — while supporting our customers in achieving greater efficiency.
- ✓ To maintain certification to key international standards, including ISO 9001, ISO 13485, IATF 16949, and EN 9100, by following the robust policies and procedures set out in our Business Management System.



## Sustainability at GSPK Circuits

At GSPK Circuits, sustainability is built into how we operate. As a UK-based manufacturer of high-quality printed circuit boards, we recognise the environmental impact of our industry and are committed to reducing it wherever possible.

We are proud to have installed a solar farm at our manufacturing site, with the goal of generating 25% of the electricity needed to power our factory. It's one of the ways we're working towards a cleaner, more energy-efficient future.

Our sustainability policy is regularly reviewed and communicated to all staff, stakeholders, and supply chain partners. It reflects our commitment to continuous improvement and responsible practices across every level of our business.

We go beyond legal and regulatory requirements, expecting the same level of commitment from our suppliers and partners. From waste management to energy use, and from materials sourcing to ethical working practices, sustainability is a shared responsibility – and one we take seriously.

With over 60 years of manufacturing experience, we understand that long-term success means operating in a way that respects both people and planet. At GSPK Circuits, we're not just building PCBs – we're helping to build a more sustainable future.

## Investing in Future Talent

At GSPK Circuits, apprentices are here to make a difference. We actively recruit and train apprentices across the business, providing hands-on experience from day one. Their fresh ideas, energy, and commitment bring real value to our operations, and many have gone on to become permanent, integral members of the GSPK team. Supporting the next generation is a key part of how we grow, adapt, and lead in UK manufacturing.



**GSPK Circuits Ltd**  
Wetherby Road  
Boroughbridge  
North Yorkshire  
YO51 9UY  
United Kingdom

 **+44(0) 1423 798 740**  
 **[enquiries@gspkcircuits.ltd.uk](mailto:enquiries@gspkcircuits.ltd.uk)**  
 **[www.gspkcircuits.ltd.uk](http://www.gspkcircuits.ltd.uk)**

