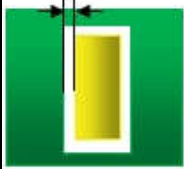
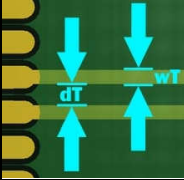
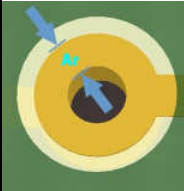


Gem Circuits Technical Capability FR4

Our technical capability below lists some of the more challenging limits that we may be able to manufacture, our standard specification on page 2 lists our recommendations to ensure cheaper prices, page 3-4 is for aluminium, page 5 is for CEM-1.

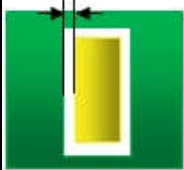
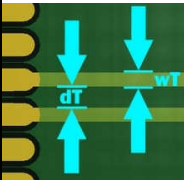
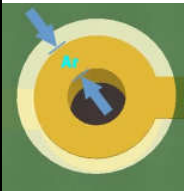
Feature	Capability
Maximum layers	16 layers
Base material	FR4 Tg140, Tg170, Tg180
Maximum board size	500mm x 800mm
Copper thickness	1oz, 2oz, 3oz, 4oz (more on request)
Board thickness	0.4mm - 3.2mm
Photoimageable solder mask	Green, black, white, blue, red, yellow, matt green, matt blue or matt black
Minimum soldermask clearance 	3 mil (0.076mm) mask to pad edge
Minimum silkscreen line width	4 mil (0.1mm)
CNC rout tolerance	± 0.1mm
Minimum track thickness (wT) 	* 4.0 mil (0.1mm) 1oz FR4 * 6.0 mil (0.15mm) 2oz FR4 * 8.0 mil (0.2mm) 3oz FR4
Minimum track clearance (dT)	* 4 mil (0.1mm)
Minimum hole size (via)	8 mil (0.2 mm)
Maximum thickness to hole ratio	8:1
Minimum annular ring 	5 mil (0.127 mm) hole to pad edge
Surface finish	HAL, lead-free HAL, Gold (1U",2U",3U"), OSP, Immersion Silver, Immersion Tin
Other masks/inks	Peelable mask Carbon ink
Impedance control	50-80Ω for single ended 85-110Ω for differential

* Minimum track values are for isolated cases and not all over.

Track clearance includes trace to trace, trace to pad, and pad to pad values.


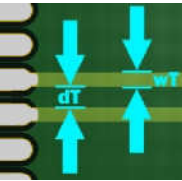

Gem Circuits Standard Specification FR4

Our standard specification lists some recommended values that ensure the best production yields, and therefore cheaper prices. Page 1 shows our more challenging limits for FR4, page 3-4 is for aluminium, page 5 is for CEM-1.

Feature	Capability
Recommended maximum layers	6 layers
Base material	FR4 Tg140
Recommended maximum board size	500mm x 600mm
Copper thickness	1oz, 2oz final copper weight
Recommended board thickness	0.4mm - 2.0mm
Photoimageable solder mask	Green, black, white, blue, red, yellow, matt black or matt green
Recommended minimum soldermask clearance 	3 mil (0.076mm) mask to pad edge
Recommended minimum silkscreen line width	5 mil (0.127mm)
CNC rout tolerance	± 0.2mm
Recommended minimum track thickness (wT) 	5 mil (0.127mm) 1oz FR4 8 mil (0.2mm) 2oz FR4
Recommended minimum track clearance (dT)	6 mil (0.15mm)
Recommended minimum hole size (via)	10 mil (0.25 mm)
Recommended maximum thickness to hole ratio	6:1
Recommended minimum annular ring 	6 mil (0.15 mm) hole to pad edge
Surface finish	HAL, lead-free HAL, Immersion Gold (1U" or 2U"), OSP
Impedance control	50Ω, 90Ω, 100Ω

Gem Circuits Technical Capability Aluminium

Our technical capability below lists some of the more challenging limits that we may be able to manufacture, our standard specification on page 4 lists our recommendations to ensure cheaper prices, page 1-2 is for FR4, page 5 is for CEM-1.


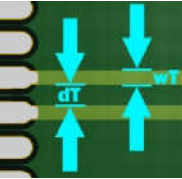

Feature	Capability
Maximum layers	1 (Single sided only)
Base material	Aluminium 1W/m.K or 2W/m.K
Maximum board size	500mm x 800mm
Copper thickness	1oz or 2oz
Board thickness (mm)	0.8mm - 2.4mm
Photoimageable solder mask	Green, black, white, blue, red, yellow, matt green, matt blue or matt black
Minimum soldermask clearance 	3 mil (0.076mm) mask to pad edge
Minimum silkscreen line width	4 mil (0.1mm)
CNC rout tolerance	± 0.2mm
Minimum track thickness (wT) 	* 6.0 mil (0.15mm) 1oz Aluminium * 8.0 mil (0.2mm) 2oz Aluminium
Minimum track clearance (dT)	* 6 mil (0.127mm)
Minimum hole size	32 mil (0.8 mm)
Minimum annular ring 	6 mil (0.15 mm) hole to pad edge
Surface finish	HAL, lead-free HAL, Gold (1U",2U",3U"), OSP, Immersion Silver, Immersion Tin

* Minimum track values are for isolated cases and not all over.

Track clearance includes trace to trace, trace to pad, and pad to pad values.

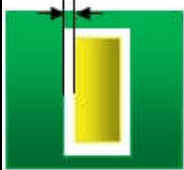
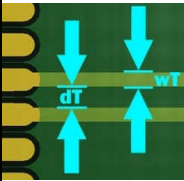
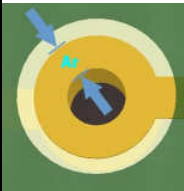
Gem Circuits Standard Specification Aluminium

Our standard specification lists some recommended values that ensure the best production yields, and therefore cheaper prices. Page 3 shows our more challenging limits for aluminium, page 1-2 is for FR4, page 5 is for CEM-1.

Feature	Capability
Maximum layers	1 (Single sided only)
Base material	Aluminium 1W/m.K
Recommended maximum board size	500mm x 600mm
Copper thickness	1oz
Board thickness (mm)	1.0mm - 2.0mm
Photoimageable solder mask	Green, black, white, blue, red, yellow, matt black or matt green
Recommended minimum soldermask clearance 	4 mil (0.1mm) mask to pad edge
Recommended minimum silkscreen line width	5 mil (0.127mm)
CNC rout tolerance	± 0.25mm
Recommended minimum track thickness (wT) 	8 mil (0.2mm)
Recommended minimum track clearance (dT)	7 mil (0.18mm)
Recommended minimum hole size	39 mil (1.0 mm)
Recommended minimum annular ring 	7 mil (0.18 mm) hole to pad edge
Surface finish	HAL, lead-free HAL, Immersion Gold (1U" or 2U"), OSP

Gem Circuits Standard Specification CEM-1

Our CEM-1 standard specification lists some recommended values that ensure the best production yields, and therefore cheaper prices. Page 1-2 is for FR4, page 3-4 is for aluminium.

Feature	Capability
Recommended maximum layers	1 (Single sided only)
Base material	CEM-1
Recommended maximum board size	500mm x 600mm
Copper thickness	1oz final copper weight
Recommended board thickness	1.6mm
Photoimageable solder mask	Green, black, white, blue, red, yellow, matt black or matt green
Recommended minimum soldermask clearance 	3 mil (0.076mm) mask to pad edge
Recommended minimum silkscreen line width	5 mil (0.127mm)
CNC rout tolerance	± 0.25mm
Recommended minimum track thickness (wT) 	6 mil (0.15mm) 1oz FR4
Recommended minimum track clearance (dT)	6 mil (0.15mm)
Recommended minimum hole size (via)	10 mil (0.25 mm)
Recommended maximum thickness to hole ratio	6:1
Recommended minimum annular ring 	6 mil (0.15 mm) hole to pad edge
Surface finish	HAL, lead-free HAL, Immersion Gold (1U" or 2U"), OSP