Design Rules Alumina 96% PCB (Al2O3 96%)

1. Definitions

1.1. Production solutions:

CERcuits offers two production solutions for Aluminum Oxide 96% (Al2O3 96%) circuits:

C-proto is our solution tailored for low-volume manufacturing batches, primarily produced in Belgium using our unique process. We recommend this solution for order sizes ranging from 1 to 10 panels per design.

A single C-proto manufacturing panel has a standard usable surface of 100x80mm.

C-production is designed for medium to high-volume manufacturing batches and will mostly be produced through one of our high-volume production partners. We recommend this solution for orders exceeding 10 manufacturing panels per design.

A single C-production manufacturing panel has a standard usable surface of 115x115mm.

1.2. Metalizations

Both manufacturing solutions can be supplied using two different methods of metallization:

Direct Plated Copper (DPC) utilizes copper as a conductor. After sputtering an interface and seed layer, copper is plated to the desired thickness. This manufacturing method closely resembles traditional printed circuit board production and supports plated-through holes, as well as similar solder masks and surface finishes such as ENIG & ENEPIG.

Thick Film technology typically employs silver or silver-palladium as a conductor, which is screen printed onto the substrate using a paste. The printed conductor is then dried and fired at high temperatures to form a robust bond. While this technology is well-suited for high-temperature applications exceeding 300°C, it does have limitations, including restricted possibilities for plated-through holes and surface finishes.

Both technologies can be assembled using soldering or wire bonding with the appropriate surface finish. For further details on surface finish selection, please feel free to contact us.

1.3. Classifications

Our design rules are classified into two categories:

Standard: Adhering to these specifications generally results in a smooth production process with reduced chances of failures or remakes. This approach leads to quicker turnaround times and lower costs.

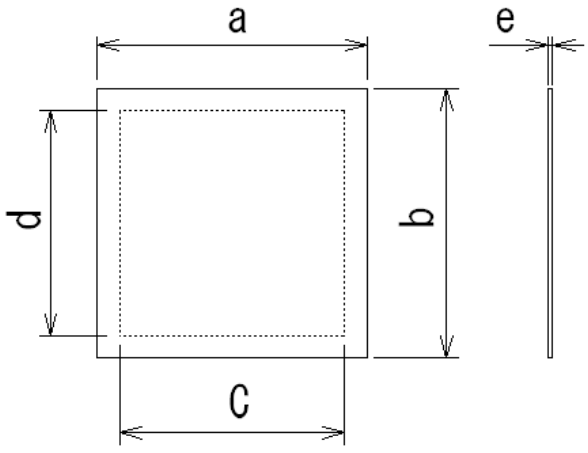
Special: These specifications push the boundaries of the production process and could potentially lead to challenges. While we can still likely fulfill these orders, additional engineering and/or production adjustments might be required for successful fabrication. Consequently, lead times and costs are higher in such cases. We also might ask for design/specification updates before or during manufacturing.

2. C-Proto

2.1. DPC

Note: C-Proto has no Tooling & Non recurring engineering costs

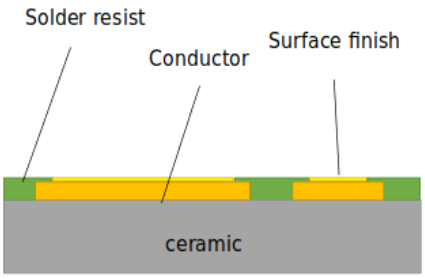
2.1.1. Dimensional specifications



Parameter	Standard	Special	Unit
Panel dimensions a & c	100	\	mm

Panel dimensions b & d	80	\	mm
Panel dimension e	0.38 | 0.5 | 0.635 | 0.76 | 1.0	0.25 | 1.5	mm
Min. dimension	5 x 5	1 x 1	mm

2.1.2. Metalization & finish

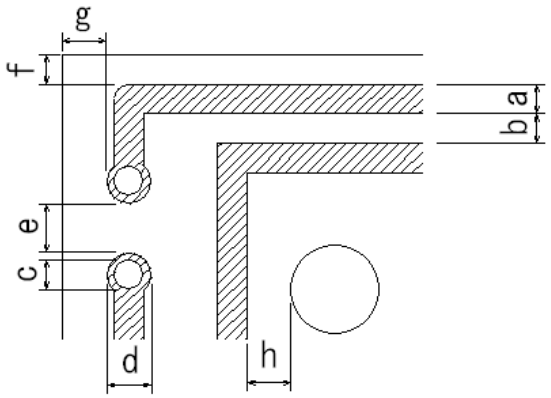


Parameter	Standard	Special	Unit
Conductor	Copper - Cu	\	
Conductor thickness	18 | 35 | 70	other thicknesses between 10um-105um	µm
Surface finish	None, Immersion Tin (Sn), ENIG, ENEPIG (see lookup table below)	Immersion Ag, EPIG, DIG, Hard gold (see lookup table below)	
Solder resist	Green, White, Black, High reflective white	UV-C reflective mask (>80% reflectance at 200-280nm)	
Solder resist minimum opening	0.15	0.08	mm
Solder resist minimum pad overlap	0.05	\	mm
Silk screen / legend	Engraving only	\	
Layers	single or double-sided	\	

Surface Finish lookup table

Copper thickness / line spacing	50um	75um	100 um	150um	200um-
18um	DIG, immersion Tin, immersion Ag	EPIG, DIG, Immersion Ag, Immersion Tin	EPIG, DIG, Immersion Ag, Immersion Tin, Hard gold	ENEPIG, ENIG, EPIG, DIG, Immersion Ag, Immersion Tin, Hard Gold	ENEPIG, ENIG, EPIG, DIG, Immersion Ag, Immersion Tin, Hard gold
35um	/	DIG, immersion Tin, immersion Ag			
70um and above	/	/	DIG, immersion Tin, Immersion Ag	DIG, Immersion Ag, Immersion Tin	

2.1.3. Spacing & vias



Parameter	Standard	Special	Unit
Min. line width (a)	0.15	0.05	mm
Min. line spacing (b)	0.15	0.05	mm
Line/pad to edge spacing (f)	0.2	0.05	mm
Line to hole/via spacing (h)	0.15	0.05	mm
Edge metalization	no	Yes	
Via specifications			
Min. via diameter (c)	0.3mm (thickness=<1mm)	0.15(thickness <0.38mm) - 0.2 (thickness <0.5mm)	mm

Min. via spacing	0.5	0.3	mm
Via/hole to edge spacing	3x Via diameter	1x Via diameter	mm
Through hole metallisation	Plated vias, plugged vias	copper filled vias (dia 0.15-0.3mm)	\
Filled via Size	\	0.15-0.3	mm
Annular ring specifications			
Min. annular ring diameter (d)	via diameter +0.4	via diameter +0.2	mm
Min. annular ring spacing (e)	0.2	0.1	mm
Annular ring to edge spacing (g)	0.2	0.05	mm

2.1.4. Tolerances

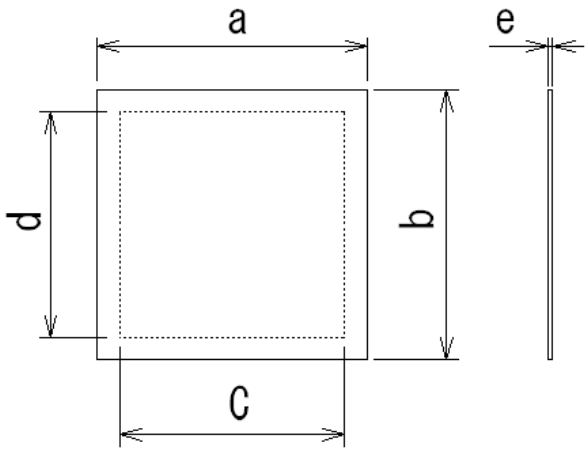
Parameter	Standard	Special	Unit
Dimensional tolerance	+/- 100	+/- 50	µm
Thickness tolerance	+/- 10	+/- 5	%
Hole tolerance	+/- 100	+/- 50	µm
Pad to hole/via tolerance	+/- 100	+/- 50	µm
Conductor thickness tolerance	+/- 6	\	µm
Line/Space width tolerance	+/- 50	+/- 30	µm

Surface roughness ceramic (Ra)	\	Ra <0.3	µm
Misalignment (only for double sided)	≤200	≤100	µm

2.2. Thick film

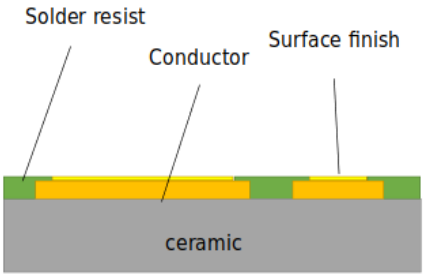
Note: C-Proto has no Tooling & Non recurring engineering costs

2.2.1. Dimensional specifications



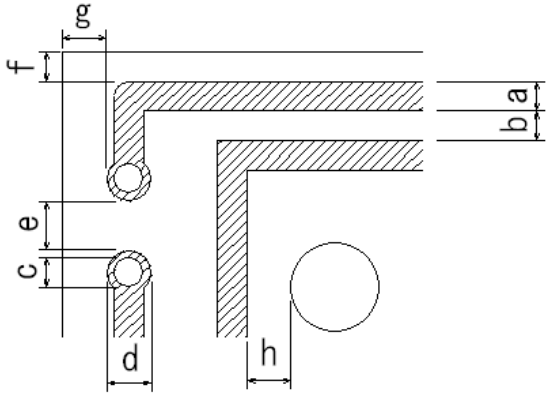
Parameter	Standard	Special	Unit
Panel dimensions a & c	100	\	mm
Panel dimensions b & d	80	\	mm
Panel dimension e	0.38 | 0.5 | 0.635 | 0.76 | 1.0	0.25 | 1.5 | 2.0	mm
Min. dimension	5 x 5	1 x 1	mm

2.2.2. Metalization & finish



Parameter	Standard	Special	Unit
Conductor	Silver - Ag, Silver-Palladium - AgPd (5% Pd)	Silver-Palladium - AgPd (10% Pd or other %)	
Conductor thickness	10-15	20-24, please enquire for other thicknesses	µm
Surface finish	none (Ag or AgPd)	Galvanic NiAu, Galvanic Au	
Solder resist	Blue dielectric (glass-based)	Green dielectric (glass-based)	
Solder resist minimum opening	0.2	0.1	mm
Solder resist minimum pad overlap	0.1	0.05	mm
Silk screen / legend	Engraving only	\	
Layers	single or double-sided	3 | 4 layers	

2.2.3. Spacing & vias



Parameter	Standard	Special	Unit
Min. line width (a)	0.2	0.1	mm
Min. line spacing (b)	0.15	0.1	mm
Line/pad to edge spacing (f)	0.15	0.1	mm
Line to hole/via spacing (h)	0.15	0.1	mm
Edge metalization / Castellated holes	no	yes	
Via specifications			
Via diameter (c)	0.2-0.4	>1mm plated vias only	mm
Min. via spacing	0.5	0.5	mm
Via/hole to edge spacing	3x Via diameter	1x Via diameter	mm
Through hole metallisation	Filled vias	Plated via	\
Filled via Size	0.2-0.4	\	mm
Annular ring specifications			
Min. annular ring diameter (d)	via diameter +0.4	via diameter +0.2	mm
Min. annular ring spacing (e)	0.2	0.1	mm
Annular ring to edge spacing (g)	0.2	0.1	mm

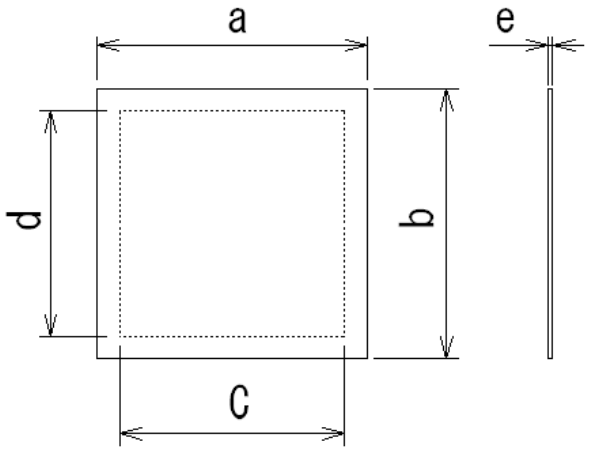
2.2.4. Tolerances

Parameter	Standard	Special	Unit
Dimensional tolerance	+/- 100	+/- 50	μm
Thickness tolerance	+/- 10	+/- 5	%
Hole tolerance	+/- 100	+/- 50	μm
Pad to hole/via tolerance	+/- 100	+/- 50	μm
Conductor thickness tolerance	+/-6	\	μm
Line/Space width tolerance	+/- 50	+/- 40	μm
Surface roughness ceramic (Ra)	\	Ra <0.4	μm
Misalignment (only for double-sided)	≤200	≤100	μm

3. C-Production

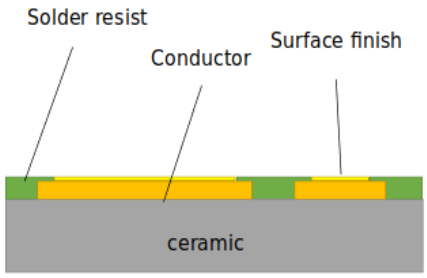
3.1. DPC

3.1.1. Dimensional specifications



Parameter	Standard	Special	Unit
Panel dimensions a & c	120	\	mm
Panel dimensions b & d	120	\	mm
Panel dimension e	0.25 | 0.38 | 0.5 | 0.635 | 0.76 | 1.0 | 1.5	2.0 | 3.0	mm
Minimum dimension	2x2	1x1	mm

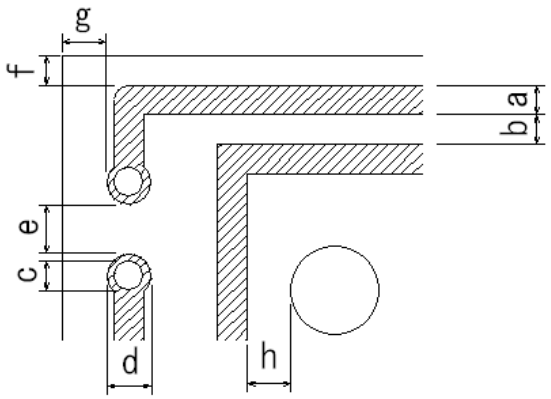
3.1.2. Metalization & finish



Parameter	Standard	Special	Unit
Conductor	Copper - Cu	\	
Conductor thickness	18 | 35 | 70	Other thickness between 10 - 300	µm
Surface finish	Imm. Ag, ENIG, ENEPIG	EPIG, Hard Gold, OSP	
Solder resist	Green, White, Blue, Black	other colors	
Solder resist minimum opening	0.2	0.08	mm
Solder resist minimum pad overlap	0.1	0.05	mm
Silk screen / legend	black, white	other colors	

Silk screen / legend size	W: 0.1 - H: 0.7	\	mm
Layers	single or double sided	\	

3.1.3. Spacing & vias



Parameter	Standard	Special	Unit
Min. line width (a)	0.15	0.08	mm
Min. line spacing (b)	0.15	0.08	mm
Line/pad to edge spacing (f)	0.2	0.1	mm
Line to hole/via spacing (h)	0.2	0.1	mm
Edge metalization / castellated holes	yes		
Via specifications			
Min. via diameter (c)	0.1 (aspect ratio 1:7)	0.06	mm
Min. via spacing	0.3	0.2	mm
Via/hole to edge spacing	3x Via diameter (c)	castellated holes possible	mm

Through hole metallisation	PTH, plugged vias	copper filled vias (dia 0.08-0.2mm)	\
Filled via Size	\	0.1-0.3	mm
Annular ring specifications			
Min. annular ring diameter (d)	0.2	0.1	mm
Min. annular ring spacing (e)	0.15	0.08	mm
Annular ring to edge spacing (g)	0.15	\	mm

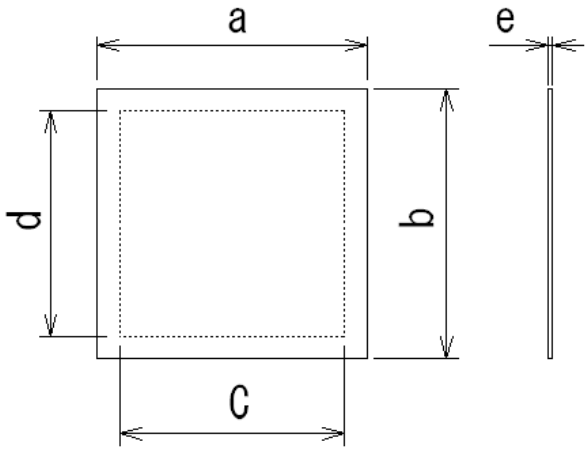
3.1.4. Tolerances

Parameter	Standard	Special	Unit
Dimensional tolerance	+/- 100	+/- 50	µm
Thickness tolerance	+/- 10	+/- 5	%
Hole tolerance	+/- 100	+/- 50	µm
Pad to hole/via tolerance	+/- 100	+/- 50	µm
Conductor thickness tolerance	+/- 6 (thickness 35um)	please enquire	µm
Line/Space width tolerance	+/- 20	\	µm
Surface roughness ceramic (Ra)	Ra≦0.3 Rz≤2	please enquire	µm
Misalignment (only for double sided)	≤100	≤50	µm

3.2. Thick film

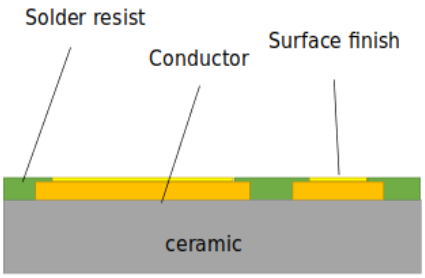
Note: NRE & tooling costs are required for screen manufacturing and process optimization

3.2.1. Dimensional specifications



Parameter	Standard	Special	Unit
Panel dimensions a & c	115	125	mm
Panel dimensions b & d	115	125	mm
Panel dimension e	0.38 | 0.5 | 0.635 | 0.76 | 1.0	0.25	mm
Min. dimension	5 x 5	1 x 1	mm

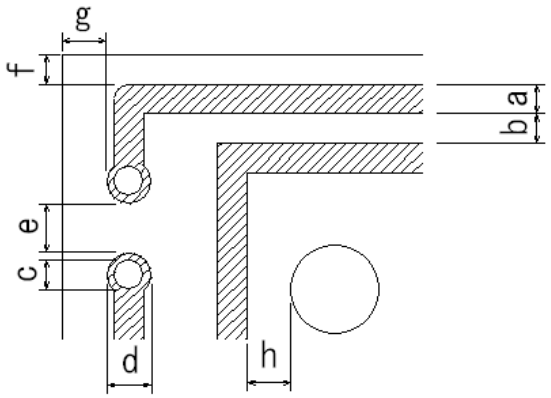
3.2.2. Metalization & finish



Parameter	Standard	Special	Unit
Conductor	Silver - Ag, Silver-Palladium - AgPd	Silver-Platinum	
Conductor thickness	10-20	20-40	µm

Surface finish	none	\	
Solder resist	White, Blue & Black (glass-based)	High reflective white	
Solder resist minimum opening	0.2	0.1	mm
Solder resist minimum pad overlap	0.1	0.1	mm
Silk screen / legend	Black, White	\	
Layers	single or double-sided	3 | 4 layers	

3.2.3. Spacing & vias



Parameter	Standard	Special	Unit
Min. line width (a)	0.2	0.1	mm
Min. line spacing (b)	0.2	0.1	mm
Line/pad to edge spacing (f)	0.15	0.1	mm
Line to hole/via spacing (h)	0.15	0.1	mm
Edge metalization / Castellated holes	no	yes	

Via specifications			
Via diameter (c)	0.12-0.3	>1mm plated vias only	mm
Min. via spacing	0.5	0.5	mm
Via/hole to edge spacing	3x Via diameter	1x Via diameter	mm
Through hole metallisation	Filled vias	Plated via	\
Filled via Size	0.12-0.3	\	mm
Annular ring specifications			
Min. annular ring diameter (d)	via diameter +0.4	via diameter +0.2	mm
Min. annular ring spacing (e)	0.2	0.15	mm
Annular ring to edge spacing (g)	0.2	0.15	mm

3.2.4. Tolerances

Parameter	Standard	Special	Unit
Dimensional tolerance	+/- 100	+/- 50	µm
Thickness tolerance	+/- 10	+/- 5	%
Hole tolerance	+/- 100	+/- 50	µm
Pad to hole/via tolerance	+/- 100	+/- 50	µm
Conductor thickness tolerance	+/-4 (10um thickness), +/-8 (20um thickness)	\	µm

Line/Space width tolerance	+/- 50	+/- 40	µm
Surface roughness ceramic (Ra)	\	Ra <0.5	µm
Misalignment (only for double-sided)	≤100	≤50	µm

