

KATHREIN Automotive	KAG CS EE N2000	Page 1 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

Edition	Date	Author	Reason of change
3.1	2018-12-17	Thole	Update after review
3.0	2018-11-20	Thiemann	Transfer into Company Standard / new Template
2.4	2018-11-07	Thole	Update after review /New format
2.3	2016-08-27	Thole	Update after review
2.2	2015-08-27	Thole	Update after review with KAH/KARO
2.1	2015-06-30	Thole	Update Panel
2.2	2015-01-17	Thole	Update with KARO
1.2	2014-03-28	Thole	Review from Hang Ping
1.0	2013-11-07	Thole	Complete update
0.5	2013-07-10	Thole	RoHS requirement added
0.3	2011-9-30	Thole	Lead free HASL added
0.3	2009-10-29	Kuehne	2 nd Draft/ adaption of wording reg. standard thickness
0.1	2001-10-15	Kuehne	First Draft

Specific abbreviations		
KAG	➔	KATHREIN Automotive Groupe
CS	➔	Company Standard
IATF	➔	International Automotive Task Force
PCB	➔	Printed Circuit Board
PPAP	➔	Production Part Approval Process
AE	➔	American English
BE	➔	British English
IPC	➔	IPC – Association Connecting Electronics Industries
IMDS	➔	International Material Data System
RoHs	➔	Restriction of Hazardous Substances Directive
HASL	➔	Hot Air Solder Leveling
DIN	➔	German Institute for Standardization (Deutsche Industrie Norm)
ISO	➔	International Organization for Standardization

KATHREIN Automotive	KAG CS EE N2000	Page 2 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

Content

1. Scope	3
2. General specifications	3
3. Area of Application.....	3
3.1. Quality management system	3
4. Condition	3
4.1. Base Material	3
4.2. Material Thickness	4
4.3. Layout	5
4.4. Surface	6
4.4.1. PCB Surface selection guideline:	6
4.5. Copper thickness.....	6
4.6. Solder Resist.....	6
4.7. Solderability	7
4.8. Storage.....	7
5. Panel Design	8
5.1. Panel Size	8
5.2. Frame Routing.....	8
5.3. Breakaways Width	8
6. Panel Characterization	8
6.1. 2-D data matrix code ECC200	8
6.2. Laser Label	8
7. Schematic outline of PCB-Panel	9
8. Delivery and Packaging	9
9. References.....	9

KATHREIN Automotive	KAG CS EE N2000	Page 3 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

1. Scope

All norms and standards are valid in the version of the first creation date, if nothing else is defined in written form with KAG.

2. General specifications

- This standard describes the general Specifications of PCB's for the **KAG supplier** for purchased parts which are designed by KAG.
- This standard must be a part of the inquiry drawing and has to be verified by the supplier in the PPAP.

Possible deviations to the content of this norm from supplier side, has to be confirmed in written form by KAG.

3. Area of Application

PCB's delivered to KAG must fulfil multiple boundary conditions in order to be process able in all processes described below. This specification defines the general requirements that are mandatory, if there is nothing different requested in the PCB documents (drawing, PCB profile).

The specific PCB documents always overrule this specification.

3.1. Quality management system

The supplier must provide evidence that he is certified to series of standards DIN EN ISO 9001 resp. IATF 16949.

The pcb's must fulfil IPC-A 600 class 3.

4. Condition

4.1. Base Material

General: PCB materials must be listed UL 94-V0. Is a special UL-identification required, this must be mentioned and described in the production documents.

Used Base Material: FR4 (Standard), for special cases different material can be defined in the PCB documents (drawing, PCB profile ...).

Released base materials are specified in the PCB documents that are submitted together with the layout data. The Base material must meet RoHs Compliance 2011/65/EU and IPC-4101.

KATHREIN Automotive	KAG CS EE N2000	Page 4 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

If nothing different is specified in the PCB data that are submitted with the layout. The released FR4 base materials are:

Released Material	Manufacturer
Duraver-E-Cu 104	Isola
MC-100-EX	Panasonic
UV-Block FR4-86	Nan Ya
NP-140TL	Nan Ya
S1141	Shengyi

4.2. Material Thickness

The material thickness is fixed on the PCB drawing and PCB-Specification
The thickness tolerance should be according IPC4101. Preferred class is L.
Defined is the thickness of the base material with 18µm base copper.

This value can be measured by x-ray or cut of the PCB.

Nom. Thickness	Class K	Class L	Class M
0,8	+ -0,165	+ -0,100	+ -0,075
1	+ -0,165	+ -0,100	+ -0,075
1,2	+ -0,19	+ -0,130	+ -0,075
1,5	+ -0,19	+ -0,130	+ -0,075
1,6	+ -0,19	+ -0,130	+ -0,075

KATHREIN Automotive	KAG CS EE N2000	Page 5 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

The standard thickness is: 1.60 ± 0.13 mm for two layer PCB's.

For two layer PCB's also $1.0 \text{ mm} \pm 0.10$ mm is a standard thickness.

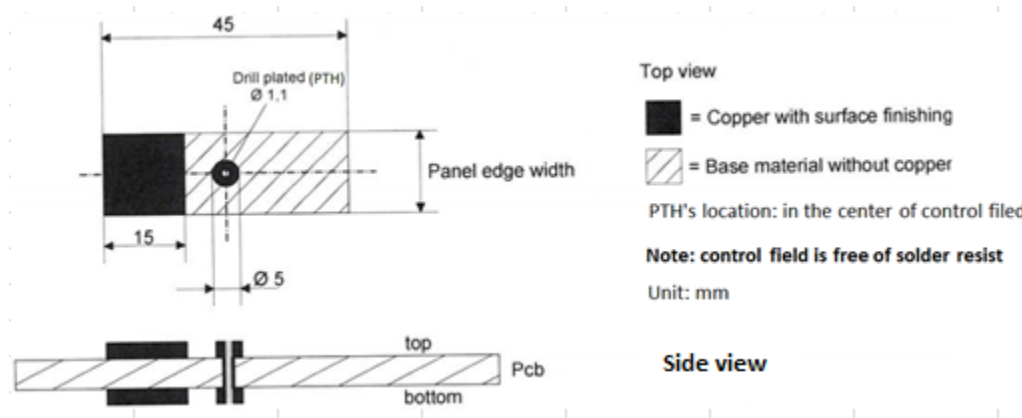
For 4 layer Multilayer (ML) PCB the standard thickness is $1,55 \pm 0,13$ mm with the following layer construction.

4 Layer STD Build 1.55mm 0.062"

copper - 1	18µm	1/2oz
Prepreg 7628	180µm	7mil
Prepreg 7628	180µm	7mil
copper - 2	35µm	1oz
Core		
	710µm	27.95mil
copper - 3	35µm	1oz
Prepreg 7628	180µm	7mil
Prepreg 7628	180µm	7mil
copper - 4	18µm	1/2oz

Layer construction for Multilayer pcb's is defined in the mechanical drawing.

The base material thickness of the PCB can be measured on the control field on the panel.



All general tolerances for pcb's are defined on the pcb-drawing. Common is the use of tolerance spec. "Feinleiter 3".

4.3. Layout

Even balanced copper distribution on top and bottom side, and on outer layer and inner layer (ML) required, target: even area distribution, Cu shares on top and bottom ~1:1

Even distribution of grids or dummy pads on open spaces, solid copper stripes or screen on the panel frames (also on ML inner layer)

(important for the avoidance of uncontrolled warpage, and necessary for the achievement of an even thickness distribution while plating and application of the solder resist)

KATHREIN Automotive	KAG CS EE N2000	Page 6 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

With application of ImmSn surface, a rotating solder resist clearance of 0.15 – 0.20mm around the via eye-let for hole size > 0.45 mm or a complete closing (plugging) of the via is necessary for hole size ≤ 0.45mm.

4.4. Surface

1-/2 sided without PTH:	lead free HASL (preferred) , ImmSn, OSP, ImmNi/Au
2-sided PCB / Multilayer:	lead free HASL (preferred) , ImmSn, OSP, ImmNi/Au
HDI-PCB:	ImmSn , ImmNi/Au
Surface for covered solder joints:	ImmSn , OSP, lead free HASL
Surface for heat seal:	ImmNi/Au

4.4.1. PCB Surface selection guideline:

- Standard HAL Lead-free
- Chem Tin required in case of
 - Ultra-Fine pitch Components
 - 0201
 - 0402 in mix with fine pitch
- OSP: Special release possible in case of
 - Single side SMT
 - No PTH Soldering
 - No soldering process on back side
 - High volume (short storage time)
- ImmNi/Au: Special release possible

Surface treatment must meet RoHs Compliance.

4.5. Copper thickness

Need to follow standard minimum IPC-6012 (Class 3).

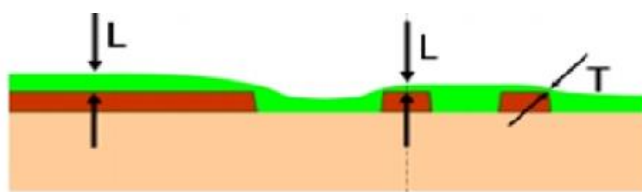
Higher requirements can be defined on PCB profile and need to be followed.

4.6. Solder Resist

Standard: photo image able green free of air bubble, qualified for reflow soldering and multiple soldering.

Solder resist must be useable for 2D laser marking.

Thickness requirement for Solder Resist is as below:



Thickness in L area: 10um~35um

Thickness in T area: ≥ 7um

KATHREIN Automotive	KAG CS EE N2000	Page 7 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

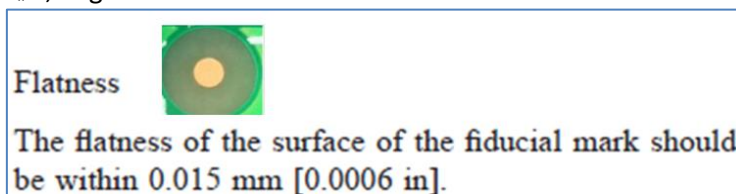
4.7. Solderability

The solder ability must follow the IPC and J-STD standard.

For lead free HASL surface, Sn thickness requires 2um~30um;

For Immersion Sn surface, Sn thickness requires $\geq 0.8\mu\text{m}$.

For Fiducial Mark, there is also flatness requirement. Refer to 《IPC-SM-782A-Surface-Mount-Design---L》, Page 24.



4.8. Storage

Storage conditions: DIN EN 60721-3-3, class 3K2 is recommended.

Storage shelf life is recommended as below:

Maximum storage times (shelf life)

Reference: day of delivery

	Hot Air Levelling HASL (leaded or lead-free)	OSP Organic Surface Preservation (Entek, Gliccoat...)	Immersion Ni/Au (ENIG)	Immersion Sn (iSn)	Bondable surfaces (reductive or plated Au)
<u>single-sided PCB's</u> <u>double-sided PCB's</u> (PTH / STH)	12 months	6 months	6 months	6 months	6 months
<u>Multilayer / HDI- PCB's</u>	6 months	6 months	6 months	6 months	6 months
<u>Flex-/ Rigid-Flex- PCB's</u>	6 months	6 months	6 months	6 months	6 months

KATHREIN Automotive	KAG CS EE N2000	Page 8 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

5. Panel Design

The panel is defined in panel design specification

5.1. Panel Size

Panel width standard: **185.0mm ± 0.3mm**, 160.0mm ± 0.3mm

Panel length: **>157.5 ± 0.3mm to <300± 0.3mm ***

(*based on best material utilization at PCB supplier and requirements for production and cost effective packaging at PCBA-supplier)

5.2. Frame Routing

Slot width **min. 1.5 ± 0.2mm (Typ. 1.6 ± 0.2 mm)**

Different frame routing (e.g. acc. to specification of PCBA-supplier) must be agreed with KAG.

5.3. Breakaways Width

- A) According the PCB-drawing for Bridge points.
- B) Other breakaways:
 - Base material thickness >1.36mm (standard thickness with standard tolerance):
bridge width = **1.5 ± 0.1mm**
 - Base material thickness < 1.36mm:
bridge width = **2.0 ± 0.1mm**
 - Base material FR1 (1.6mm):
bridge width = **min. 2.0mm**

6. Panel Characterization

6.1. 2-D data matrix code ECC200

Dimension 6.0 x 6.0 mm (4.0 x 4.0mm plus quiet zone 1.0 x 1.0mm), clearance 2 mm around, copper covered with solder resist, component-free and **free of markings** (see schematically drawing panel)
For multiple panel boards, 2D data matrix code required on each single PCB on top or bottom side at a suitable position. If position is not given and specified in CAD data, it should be mutually agreed with KAG.

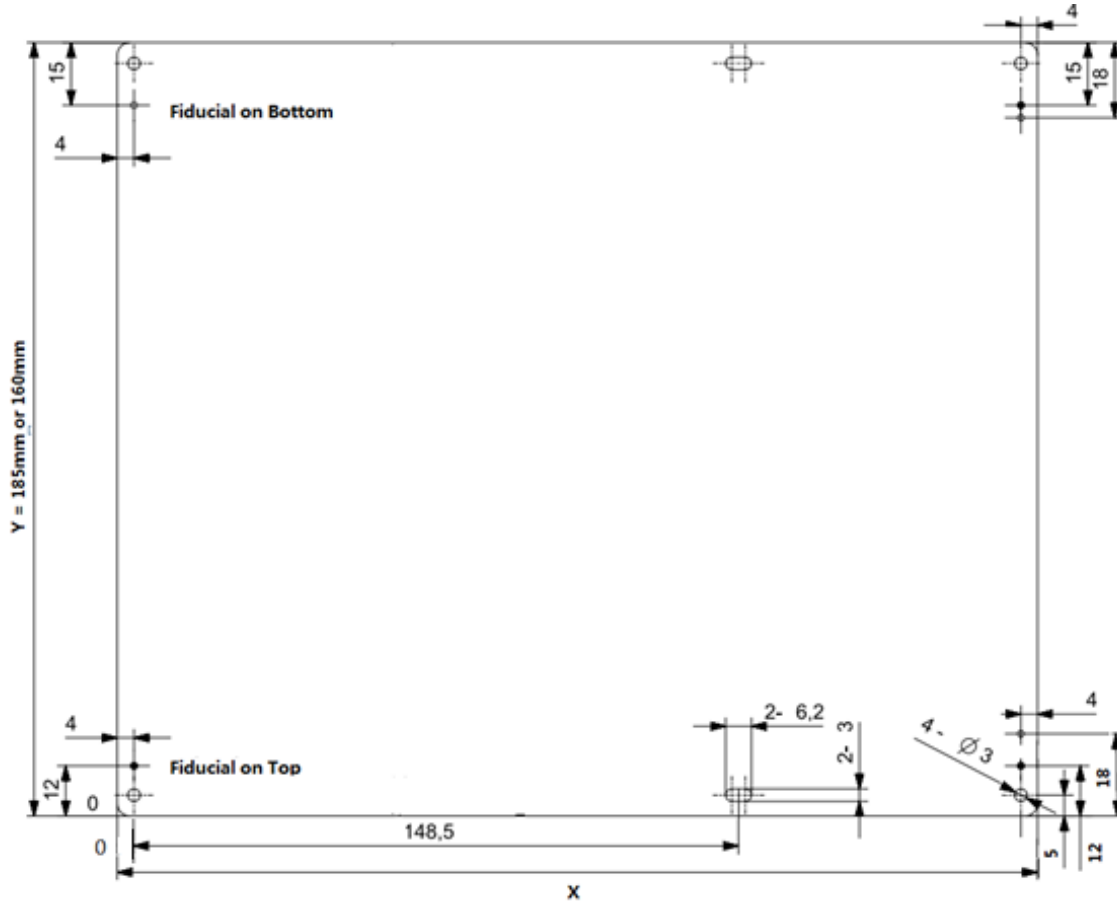
6.2. Laser Label

At KAG a laser label will be printed on the panel. Therefore a 6x6mm area with clearance of 2 mm around, component-free and **free of markings** is foreseen.

The position of this area is at y=92.5mm on right or left panel frame.

KATHREIN Automotive	KAG CS EE N2000	Page 9 of 9-	
		Prepared by: Thiemann	Approved by: Thole
KAG_N2000	<u>PCB Specification</u>	Edition: 3.1	Date: 2018-12-17

7. Schematic outline of PCB-Panel



Details see KAG Panel design guideline.

8. Delivery and Packaging

The PCBs must be packaged so that they can suffer no physical damage, and in such a way that the characteristics described in the specification cannot be changed.

For details e.g. identification of packaging, units of packaging, kind of packaging, the packaging specification of the responsible logistic department is valid.

9. References

Actual IPC Standards available at <http://shop.ipc.org>