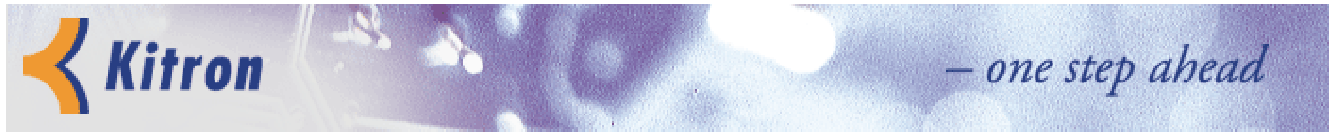


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Requirements and recommendations for manufacturing data

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General

Product related manufacturing data would typically include the following documentation:

- Master control sheet (List of documentation and revisions)
- Bill of material (BOM)
- Documentation for custom designed parts like mechanics, inductors, labels, printed circuit board etc.
- Assembly-drawings for boards, assembled units, cabling, labels etc.
- Schematics (Electrical diagrams, cabling etc.)
- Test specifications.
- Functional description.
- Software and firmware.
- Packing instructions.
- CAD data.

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All documents should state Part nr, drawing nr, date, revision, issued by etc. If you don't have a document control system yourself Kitrons system "Docusafe" will keep track of any documentation whether on paper or electronic data but consistency is important. ECO's (Engineering Change Orders) should be issued whenever a change to documentation or the product is introduced.

General requirements like RoHS must be stated at all levels of documentation where it is relevant, including but not limited to BOM, assembly drawing, PCB specification, drawings/specs for customer designed parts etc.

Avoid making overly large files in pdf or HPGL format.

Bill Of Material

The BOM should preferably be in Excel spreadsheet format, for quoting purposes at RFQ stage a list per part number is the fastest for Kitron to handle in our quoting system Quotesafe. For manufacturing purposes a list **per component** for import to the MRP system is necessary.

The BOM should contain the following information:

- Customers part number
- Customers article descriptions
- Quantities
- Circuit reference or designator (i.e. R201, U2 etc.)
- Approved manufacturers and manufacturers part nr where applicable.
- Package information, like QFP44, 0805

In order to assure correct pricing and conditions, and to avoid misunderstandings the following information should also be available:

- Information concerning design critical components or whether Kitron is free to decide.
- Customer approved vendors if applicable for ASIC's, mechanical parts etc.
- Information regarding specific agreements between customer and suppliers or manufacturers, particularly regarding agreed prices.
- Contact person at customer

Printed Circuit Board (PCB)

The following data should be included for purchase of the PCB.

- PCB specification
- Gerberdata, preferably RS274X format, 1 file for each physical layer, remember aperture list if gerber is in RS274D format.
- Gerber data for solder paste stencil. The stencil data should include board contour and fiducial marks as well as multipanel contour where applicable. Apertures shall be 1:1, no reduction.
- Drill data, preferably Exellon format.
- Mechanical drawing and drill drawing, preferably pdf, alternatively gerber or hppl. Remember to specify pressfit holes where applicable.
- Build up, if no build is present the board will be considered a "free build".
- "Readme" file containing relevant information about the data and each file.

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Other formats like ODB++ can be used but exercise care in which information is included and that the data is generated correctly. At the time of writing extended gerber/excellon is still the most universally accepted data format

The PCB specification should contain as much of the physical and other information possible not readily available from the CAD data, if the spec is missing time will be lost during the preproduction stage as well as an increased risk of the product not meeting expectations.

- Size
- Layercount
- Materials
- Nominal thickness/buildup
- Surface finish
- Copper thickness on inner and outer layers (Standard is 17,5um i/l and 35 o/l)
- Smallest track width and gap
- Quality requirements (Standard is IPC Class 2)
- Smallest hole size and corresponding pad diameter
- Hole count plated
- Hole count non plated
- Number of drills
- Blind/buried vias, if yes specify build or at least via spans
- Controlled impedance
- Markings, for instance UL requirement if mandatory
- RoHS requirement where applicable. (Missing requirement will be interpreted as RoHS not applicable)
- Special requirements, for instance colour of solder mask or legend.

Assembly

Assembly drawings including component placement for boards and exploded view of units, clearly illustrating all requirements for assembly like gluing, use of thread lock compound, leadforming, washers, raised components, labeling etc. The drawing should be in the form of a searchable pdf file. Where conformal coating is required it's advisable to specify on a separate drawing which areas that shall be free of coating. (To avoid cluttering up the assembly drawing)

PCB data and solder paste stencil as described previously.

Pick&place data for programming of SMD assembly machines.

The data format should be Excel spreadsheet or comma/semicolon separated ASCII.

The data must include:

- Circuit reference or designator (i.e. R201, U2 etc.)
- X position
- Y position
- Rotation (whole degrees)
- Side of board (top/bottom)
- Package information (QFP44, 0805 etc).

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The data shall be for a single board only. (Even if boards are delivered in multipanel)

Example (table/Excel shown):

REF. ID	X	Y	Q	T/B	Package type
R303	18875	14000	18000	Topp	1206
R300	17875	13000	9000	Bunn	0805
U10	2005	13900	27000	Topp	SOIC 16P
U14	19875	14000	18000	Bunn	SOIC 16P
C29	12675	13990	9000	Topp	CASE-A
FID1	10000	10000	00000	Top	FID

- The X/Y data shall be absolute positions with left side bottom corner as origin.
- All positions shall be center positions of the component.
- Components that are not mounted must be clearly marked as such.
- Both local and global fiducial marks must be included.

Test

To evaluate test feasibility and calculate a production test of the assembled product we will need the additional documentation.

- Schematics (searchable pdf)
- Functional description (word or searchable pdf.)
- Test specification (word or searchable pdf.)
- GenCAM or GenCAD data.

The CAD/CAM data should include component height info to ease programming of automatic inspection equipment; alternatively an IDF (Intermediate Data Format) file can be useful to evaluate the topography of the assembled board.

	Functional test	Boundary Scan	In Circuit Test	Format
Schematics	Mandatory	Mandatory	Mandatory	Searchable Adobe PDF (with text as text, not graphics)
Bill of material	If available	Mandatory	Mandatory	Clockwork if available, alternatively Excel spreadsheet
Assembly drawing	Mandatory	If available	If available	Searchable Adobe PDF (with text as text, not graphics)
Test specification	Mandatory			Searchable Adobe PDF (with text as text, not graphics)
Functional description	If available			Searchable Adobe PDF (with text as text, not graphics)
Complete CAD		If available	If available	GenCAM or GenCAD

In reality a more or less comprehensive development task in close cooperation with the customer is needed to facilitate functional testing of a product, often dedicated equipment as well as working reference units and bareboards is required.

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Mechanical parts

Information about current supplier(s), particularly product specific tooling.

Detail drawings including all dimensions in electronic form.

If available 2D detail drawings in DXF, DWG

Examples (drawings):

- Castings (existing suppliers)
- Machining,
- Printing (silk screen or similar)
- Assembly-drawings/exploded view

3D models in STEP/STP is preferred, alternatively IGES/IGS format.

Surface-treatment specification, including requirements for visual appearance

Other necessary information where applicable like parts lists, specifications for fasteners, raw materials, masking etc.

CAD data (recommended)

We highly recommend to submit complete CAD data for each product as work will progress more quickly, particularly for prototypes, and quality will be better as opportunities for mistakes will be reduced.

Kitron can view the following CAD formats

1. CamCAD *.ccz (evt *.cc) Direct import format for CAMCAD/visECAD
2. GenCAD *.cad Best format for automatic assembly and test
3. GenCAM *.gcm Standard format/IPC-2511
4. ODB++ *.tgz

5. If none of the abovementioned formats can be outputted, please submit a standard output from your CAD system like Cadif (*.paf), DDE (*.ipl) or similar.

OBSERVE: Data must be ASCII format, binary files is of no use to us.

Changes to this document

Date	Author	New Rev.	Short description
8/3-2007	GG	-	Draft, new document.