

FIFO Delay Assembly Information

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Chapter 1

Ordering PCBs

Given a complete [KiCAD](#) PCB layout, how do you order the PCBs?

1.1 Exporting the PCB files from KiCAD

Circuit board manufacturers expect to receive a ZIP archive that contains both the *Gerber* files and *drill* files for a circuit board. The latest version of the files should exist at [/fifo-p3f/Gerber](#) on the [GitHub repository](#), but the files may be manually exported from KiCAD as follows. With the PCB layout editor open, select *File* → *Plot...* to open the window of Fig. 1.1. Choose an appropriate output directory and check that all of the correct layers needed for manufacture are selected, and then select *Generate Drill Files...* to open the window of Fig. 1.2. Now set the output directory to be the same as that for the Gerber files and select the *Generate Drill File* button. You may also want to generate a map file as a PDF to visually check that the holes are in reasonable places. Close the drill file window and select *Plot* in the Gerber file window to generate the Gerber files. You now should have a directory with several Gerber files for all of the layers and two drill files (corresponding to plated (PTH) and non-plated (NPTH) through-holes in the board). Create a ZIP archive from the directory of Gerber and drill files. You are now ready to send the files to a manufacturer.

1.2 Sending the files to a manufacturer

There are many prototyping PCB fabrication houses available,¹ but the one I have used previously is one of the largest, cheapest, and most popular: [JLCPCB](#). It is straightforward

¹To compare prices for given PCB feature sets, see [pcbshopper.com](#).

Plot format: Gerber Output directory: Gerber/

Included Layers

- ☒ F.Cu
- ☒ In1.Cu
- ☒ In2.Cu
- ☒ B.Cu
- ☐ F.Adhes
- ☐ B.Adhes
- ☐ F.Paste
- ☐ B.Paste
- ☒ F.SilkS
- ☒ B.SilkS
- ☒ F.Mask
- ☒ B.Mask
- ☐ Dwgs.User
- ☒ Cmts.User
- ☐ Eco1.User
- ☐ Eco2.User
- ☒ Edge.Cuts
- ☐ Marnin

General Options

- ☐ Plot border and title block
- ☒ Plot footprint values
- ☒ Plot footprint references
- ☐ Force plotting of invisible values / refs
- ☒ Exclude PCB edge layer from other layers
- ☒ Exclude pads from silkscreen
- ☐ Do not tent vias
- ☐ Use auxiliary axis as origin
- Drill marks: None
- Scaling: 1:1
- Plot mode: Filled
- Default line width: 0.1 mm
- ☐ Mirrored plot
- ☐ Negative plot
- ☒ Check zone fills before plotting

Gerber Options

- ☐ Use Protel filename extensions
- ☐ Generate Gerber job file
- ☐ Subtract soldermask from silkscreen
- Coordinate format: 4.6, unit mm
- ☐ Use extended X2 format
- ☐ Include netlist attributes

Output Messages

Show: ☐ All ☒ Errors ☒ Warnings ☒ Actions ☒ Infos

Run DRC... Generate Drill Files... Close Plot Save...

Figure 1.1: Exporting Gerber files.

Output folder:

Drill File Format

☒ Excellon

☐ Mirror Y axis

☐ Minimal header

☐ PTH and NPTH in single file

Oval Holes Drill Mode

☒ Use route command (recommended)

☐ Use alternate drill mode

☐ Gerber X2 (experimental)

Drill Origin

☒ Absolute

☐ Auxiliary axis

Drill Units

☒ Millimeters

☐ Inches

Zeros Format

☒ Decimal format

☐ Suppress leading zeros

☐ Suppress trailing zeros

☐ Keep zeros

Precision: 3:3

Hole Counts

Plated pads:	144
Non-plated pads:	3
Through vias:	130
Micro vias:	0
Buried vias:	0

Map File Format

☐ HPGL

☐ PostScript

☐ Gerber

☐ DXF

☐ SVG

☒ PDF

Messages

Figure 1.2: Exporting drill and map files.

to fill out the forms on these order websites, but be sure to check that their manufacturing tolerances are below what you request.² The turnaround time for these services varies, but is usually quite fast: about one week or less with DHL shipping.

²Our board is easily manufacturable by most fabrication houses.

Chapter 2

Ordering Parts

A complete DigiKey part list is available here. TODO.

Table 2.1: Digi-Key bill of materials. TODO: Update me.

Manufacturer Part Number	Digi-Key Part Number	Quantity	Unit Price
LM2940CT-5.0/NOPB	LM2940CT-5.0/NOPB-ND	1	1.53000
LM2776DBVR	296-43957-1-ND	1	1.02000
AD7840ARSZ	AD7840ARSZ-ND	1	33.39000
72V2105L10PFG	800-1511-ND	1	131.65000
LTC1740CG#PBF	LTC1740CG#PBF-ND	1	41.67000
SN74LVC2G157DCTR	296-13266-1-ND	3	0.48000
61C11-01-08-02	GH6102-ND	1	25.77000
3296W-1-102LF	3296W-102LF-ND	1	2.41000
PRPC002SAAN-RC	S1011EC-02-ND	2	0.08000
PJ-002A	CP-002A-ND	1	0.60000
151033RS03000	732-5013-ND	1	0.17000
931	1528-1169-ND	1	17.50000
A000062	1050-1049-ND	1	37.40000
5-1634503-1	A97581-ND	5	2.25000
TS12A12511DCNR	296-27523-1-ND	1	1.45000
LM4041DYM3-ADJ-TR	576-2573-1-ND	1	0.29000
TS53YL102MR10	TS53YL-1.0KCT-ND	2	1.87000
DMP3099L-7	DMP3099L-7DICT-ND	1	0.33000
SN74LVC1G04DBVR	296-11599-1-ND	1	0.32000
SN74LVC1G08DBVR	296-11601-1-ND	1	0.26000
08055C104KAT2A	478-1395-1-ND	20	0.08300
08053C105KAT2A	478-5030-1-ND	20	0.17600
CL21A106KAYNNNE	1276-2891-1-ND	20	0.19000
08055A102JAT2A	478-1328-1-ND	10	0.12600
RC0805FR-0749R9L	311-49.9CRCT-ND	3	0.10000
RC0805FR-0722RL	311-22.0CRCT-ND	2	0.10000
RC0805FR-07220RL	311-220CRCT-ND	1	0.10000
RC0805FR-075K1L	311-5.10KCRCT-ND	10	0.04000
RC0805FR-071K1L	311-1.10KCRCT-ND	2	0.10000
RC0805FR-073K9L	311-3.90KCRCT-ND	1	0.10000
RC0805FR-074K3L	311-4.30KCRCT-ND	1	0.10000
LM1117IDTX-3.3/NOPB	LM1117IDTX-3.3/NOPBCT-ND	1	1.44000
TLo82CDR	296-1284-1-ND	1	0.41000
OSTTC082162	ED2615-ND	1	1.72000
54102-S08-18	609-5600-ND	1	1.45000
PRPC003SAAN-RC	S1011EC-03-ND	1	0.12000
PRPC006SAAN-RC	S1011EC-06-ND	1	0.19000
LPPB042CFFN-RC	S9009E-04-ND	1	1.05000
RC0805JR-070RL	311-0.0ARCT-ND	10	0.03500