

Right first time in practice

Wim De Greve

Eurocircuits n.v.

19-04-2023 – D&E event

**D&E
EVENT**



Het ontwerpen van
innovatieve elektronica

Woensdag 19 april 2023
1931 Congrescentrum 's-Hertogenbosch

Right first time - Goal

- The first prototype
 - Meets the specifications
 - Is in time
 - Is within budget
 - Can be produced in series within the proposed budget



Keep on dreaming...



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congrescentrum 's-Hertogenbosch

Real life

- The specifications are not complete/clear when the planning and budget are made
- Specifications change during the development cycle
- Planning/deadlines are based on incorrect assumptions
- Interpretations of “When will it be finished?”
 - Management
 - Development engineer



Best practices (1)

- Get organized
 - Specifications
 - Planning
- Solve the issues before they become a problem

**PROBLEM
SOLVED** ✓

Typical scenario

- Engineer orders the prototype(s)
 - Initial deadline is already passed

**DEADLINE
*EXTENDED***

Typical scenario

- Problems are detected by the manufacturer
 - Component issues
 - Component cannot be identified from the BOM data
 - Components are not available (with a short delivery term)
 - Component footprints do not match the board layout
 - Position information is not clear
 - Component rotation is not clear



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Typical scenario

- Problems are detected by the manufacturer
 - PCB data is not complete
 - Outline is missing
 - Drill data is missing
 - Mixed formats, units
 - Multiple datasets



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Typical scenario

- Problems are detected by the manufacturer
 - PCB data does not match the board specifications
 - Trackwidth
 - Isolation
 - Annular ring
 - ...



Typical scenario

- Problems are detected by the manufacturer
 - The design cannot be produced
 - Thick copper with fine tracks
 - Plating issues
 - Unsupported Blind/Buried via definitions
 - ...



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Typical scenario

- Result
 - Best case
 - Communication between designer and manufacturer
 - Ping-pong
 - Delivery date shifts while the communication goes on
 - Worst case
 - Back to the drawing table
 - Prototype order cancelled



Typical scenario

- Why do you ask so many questions?
 - Some manufacturers “solve” problems without asking questions or notification
 - Working prototype supplied
 - The issues are not solved in the design data
 - They will turn up again in the next production run



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Is there a better scenario?



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Best practices (2)

- Early involvement
 - At the start of the design
 - Communicate with your manufacturer
 - Use the available tools to check your design decisions
- Virtual production
 - During the design
 - Submit your data for verification before ordering



Best practices (2) – Early involvement

- Component selection
 - Use the available web sites to check
 - Component specifications
 - Availability
 - Price
 - Use reliable component libraries
 - Do not use denser technology than needed
 - Available board surface
 - Higher price
 - More difficult to produce/repair



Best practices (2) – Early involvement

- Determine technical board specifications
 - Avoid conflicting specifications
 - Select a proven buildup
 - Define blind/buried vias
 - Check price implications
 - Know your CAD system



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Best practices (2) – Virtual production

- Virtual PCB production
 - Upload board data as soon as a version is available
 - Check if correctly read in
 - Check for conflicts



Best practices (2) – Virtual production

- Virtual assembly production
 - Upload board and assembly data as soon as a version is available
 - Component matching
 - Availability/pricing
 - Footprint matching
 - Manufacturing checks



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Best practices (2)

- Pre-order components
 - Make sure the components are available for assembly in time



**Nice theory, but how
does it work in practice?**



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch



























Practice – Component selection

- Before layout design
- Upload BOM file



Practice – Component selection

- Check component identification

 DM3D-SF ↗ SPN: HR1941CT-ND Connector  Find alternatives	Suggest		10 (8 + 2) Position Card Connector Secure Digital - microSD™ Surface Mount, Right Angle Gold	On Demand Type SMD	U7 ↗	Assembler ↗ Hirose Electric Co Ltd	Qty per PCB 1 Order qty 1	 <input type="checkbox"/>	  
 10103594-0001LF ↗ SPN: 609-4050-1-ND Connectors, Interconnects  Find alternatives	Suggest		USB - micro B USB 2.0 Receptacle Connector 5 Position Surface Mount, Right Angle; Through...	On Demand Type MIXED	"P2, P4" ↗	Assembler ↗ Amphenol	Qty per PCB 2 Order qty 2	 <input type="checkbox"/>	  
 Unidentified  Search Part		 Part image not available		Type ↗	P3 ↗	Assembler ↗	Qty per PCB 1 Order qty 0	Unidentified <input type="checkbox"/>	  
 Unidentified  Search Part				Type ↗	P6 ↗	Assembler ↗	Qty per PCB 1	Unidentified <input type="checkbox"/>	  

EURO
CIRCUITS

D&E
EVENT
Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Practice – Component selection

- Find alternatives

Search Part(s)







BoM data

MPN:	SPN:	Manufacturer:	Supplier:	Your selection:
-	-	-	-	MPN:
Description:	Package:	URL:	Value:	Category:
-	Pin_Header_Straight_1x03	-	CONN_01X03	-
Ref des	Comment	Unassigned		
P3	-	55		

All categories ▾ Pin_Header_Straight_1x03 CONN_01X03

Showing 20 part(s) of total 220 part(s) - Scroll to load more.

Generic 22 eC-Stock 3 Reserved Stock 0 On Demand 220

MPN	Image	Description
 087-1-003 ↗ Header TH MPE Garray		Pin headers 2.54 mm, 1X03, straight
 087-1-003-0-S-XS0-1260 ↗ Header TH MPE Garray		Pin headers 2.54 mm, 1X03, straight
 GT25-32DP-2.2H ↗ Connector SMD Hirose Electric Co Ltd		CONN PIN HEADER PCB SMD R/A

EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Practice – Component selection

- Find alternatives

Alternates for RC0402FR-071ML

BoM data				Your selection
MPN: -	SPN: 311-1.00MLRCT-ND	Manufacturer -	Supplier: -	MPN: RC0402FR-071ML
Description: -	Package: R_0402	URL: -	Value: 1M	Category: Resistors
Ref des R23	Comment -	Unassigned 35	Unassigned 0.0049	
Unassigned 0.0049				

Showing 2 part(s) of total 2 part(s)

Alternatives 2

MPN	Image	Description
CRG0402F1M0 Resistors SMD TE Connectivity		1M Ohm ±1% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
GPR04021M Resistors SMD Unknown		0402, Res 1.0M0hm, 50V, 1.0%, 62.5mW

EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica


Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Practice – PCB specifications

- Before layout design
 - Check specifications without board data required
-

No Data Available Yet?

Click Here

 PCB Calculator

EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

Practice – PCB specifications

- Immediate price + alternatives

PCB proto service

PCB quantity PCB(s)

Lead time

Board surface / Order surface **0.80 dm² / 0.80 dm²**

Est. shipment date **20-04-2023**

Prices	Net
Single PCB	€ 52.67
Total boards	€ 52.67
VAT	€ 11.06
Total Gross	€ 63.73


Alternatives		PCB quantity			Expand
		1	2	5	
Working Days	2 WD	Net € 130.55	Net € 88.59	Net € 48.46	
		€ 130.55	€ 177.18	€ 242.30	
3 WD	Net	Net	Net		
		€ 52.67	€ 38.77	€ 20.63	
		€ 52.67	€ 77.54	€ 103.15	

Practice – PCB specifications

- Conflict reporting

Outer layer copper foil ⓘ


12 μm (end +/-30 μm) 18 μm (end +/-35 μm) 70 μm (end +/-95 μm) More Options▾

 The selected outer layer copper foil (70 μm (end +/-95 μm)) requires a minimum outer layer trackwidth of 0.200 mm. The current value for outer layer trackwidth is 0.150 mm. Press accept to adapt the outer layer trackwidth setting to the required value.

Accept

Outer layer trackwidth (OL-TW) ⓘ

0.100 mm 0.125 mm 0.150 mm 0.175 mm More Options▾


 The selected outer layer copper foil (70 μm (end +/-95 μm)) requires a minimum outer layer trackwidth of 0.200 mm. The current value for outer layer trackwidth is 0.150 mm. Press accept to adapt the outer layer trackwidth setting to the required value.


Accept

Practice – PCB specifications

- Price increasing options

PCB Definition ▾

Top soldermask ⓘ Green Black White None  More Options ▾

Bottom soldermask ⓘ Green Black White None  More Options ▾

Practice – PCB specifications

- Buildup and Blind/Buried via selection

The screenshot shows the 'Buildup Editor' window with the following settings:

- Material:**
 - Number of layers: 6
 - Board thickness: 1.55 mm
 - Reversed buildup:
 - Base material: FR-4 Improve
 - Blind/Buried via runs: 2
 - Extra press cycles: 1
 - Special buildup:
 - Defined impedance:
- Available buildups:**

Core thickness	Outer layer copper foil	Inner layer copper	
0.360 mm	12 µm (end 30 µm)	12 µm	
0.360 mm	12 µm (end 30 µm)	18 µm	
0.360 mm	18 µm (end 35 µm)	18 µm	
0.360 mm	18 µm (end 35 µm)	35 µm	
0.360 mm	35 µm (end 60 µm)	35 µm	
0.360 mm	35 µm (end 60 µm)	70 µm	
0.360 mm	70 µm (end 95 µm)	70 µm	
0.200 mm	12 µm (end 30 µm)	12 µm	
0.200 mm	12 µm (end 30 µm)	18 µm	
0.200 mm	18 µm (end 35 µm)	18 µm	
0.200 mm	18 µm (end 35 µm)	35 µm	

Buildup:

- Top legend
- Top soldermask
- Top copper
- Prepreg - PR2116 - 0.12mm
- Prepreg - PR2116 - 0.12mm
- Inner copper 1
- Core - FR4-Improved - 0.36mm
- Inner copper 2
- Prepreg - PR2116 - 0.12mm
- Prepreg - PR2116 - 0.12mm
- Inner copper 3
- Core - FR4-Improved - 0.36mm
- Inner copper 4
- Prepreg - PR2116 - 0.12mm
- Prepreg - PR2116 - 0.12mm
- Bottom copper
- Bottom soldermask
- Plated drill
- Non Plated Through Hole (NPTH)
- Blind/buried via (Inner 1 - Inner 2)
- Blind/buried via (Inner 1 - Inner 4)**

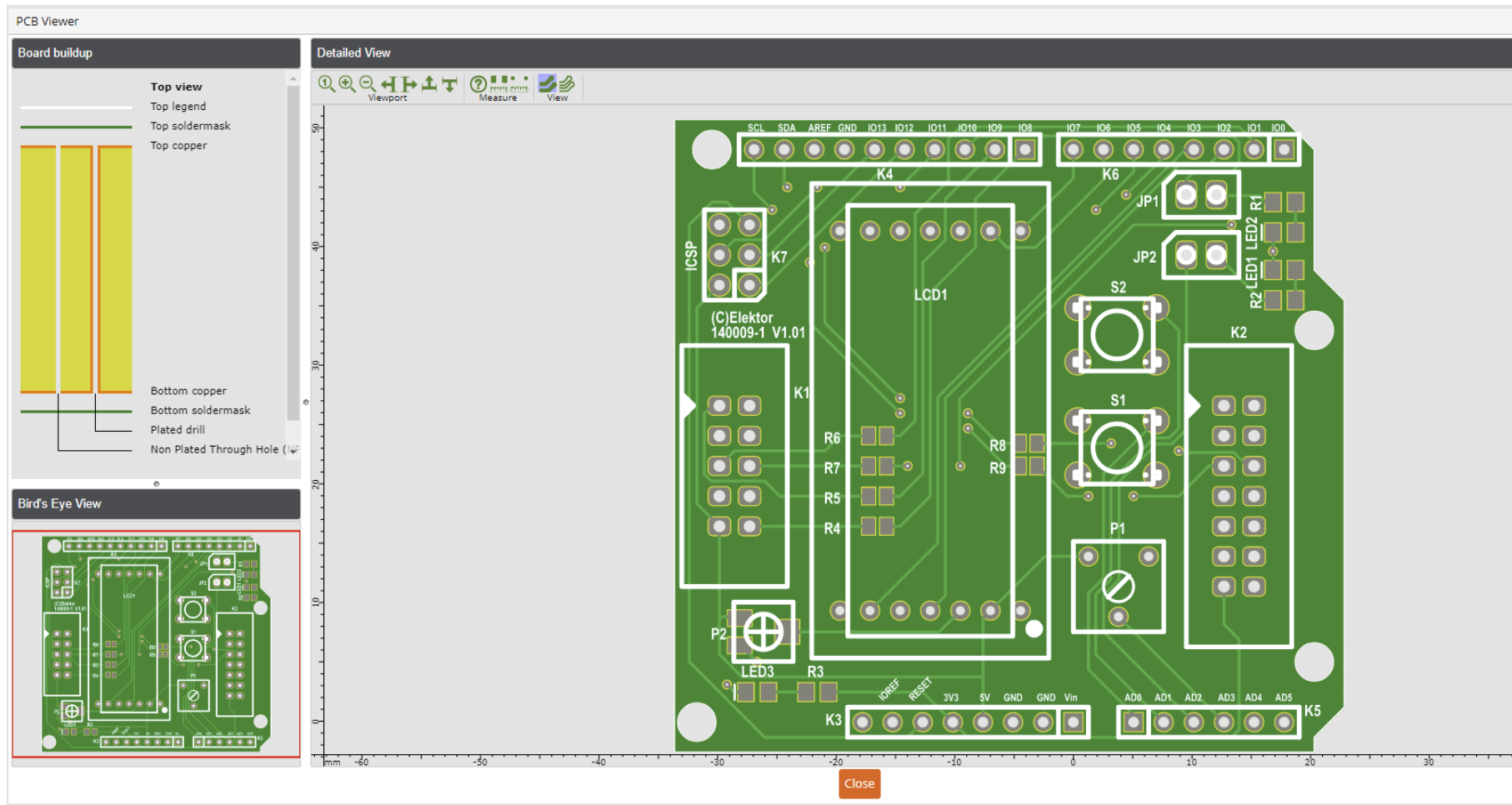
Practice – Virtual PCB production

- Can be done with intermediate versions of the board design
- Upload board data



Practice – Virtual PCB production

- PCB Viewer - Check PCB images



Practice – Virtual PCB production

- Buildup Editor – Check/correct import + layer assignment

The screenshot displays the Buildup Editor software interface, which is used for configuring PCB production parameters. The interface is divided into several panels:

- Material:** Contains settings for the PCB material, including:
 - Number of layers: 2
 - Board thickness: 1.55 mm
 - Base material: FR-4 Improved
 - Defined impedance:
 - Top soldermask: Green
 - Bottom soldermask: Green
 - Top legend: White
 - Bottom legend: None
 - Peelable mask: No
 - Carbon contacts: No
 - Via filling/Hole plugging: No
 - Top heatsink paste: No
 - Bottom heatsink paste: No
- Available buildups:** A table listing different material configurations based on core thickness, outer layer copper foil, and inner layer copper foil.
- Buildup:** Shows a cross-sectional diagram of the PCB layers with labels for Top view, Top legend, Top soldermask, Top copper, Core, Bottom copper, Bottom soldermask, Plated drill, Non Plated Through Hole (NPTH), and Bottom view.
- Imported Layers:** A table listing imported layers and their functions:

File name	Function
Detected Unplated drills/slots	Drill/Slot Editor
Detected Plated drills/slots	Drill/Slot Editor
Detected Outline	Outline/Milling Editor
Detected Milling	Outline/Milling Editor
140009_arduino_course_GBL	Bottom copper
140009_arduino_course_GBS	Bottom soldermask
140009_arduino_course_GTL	Top copper
140009_arduino_course_GTO	Top legend
140009_arduino_course_GTS	Top soldermask
140009_arduino_course_TXT	Drill/Slot
- Layer image:** A 2D top-down view of the PCB layout, showing various components, pads, and holes. The image includes a coordinate system and a toolbar with icons for Viewport, Measure, View, Undo/Redo, and Version.

At the bottom of the interface, there are buttons for "Cancel" and "Apply", and a "Contact support" link.

The logo for EURO CIRCUITS is displayed in a green box. Below it, the D&E EVENT logo is shown, along with the text "Het ontwerpen van innovatieve elektronica".

Practice – Virtual PCB production


- Compare measured values against target values

Technology Classification

Outer layer trackwidth (OL-TW) ⓘ

0.150 mm 0.175 mm 0.200 mm 0.250 mm More Options ▾

Measured: 0.130 mm


 The measured value for Outer layer trackwidth (OL-TW) does not match the required value. Please accept or ignore the measured value.

Accept Ignore PCB Checker

Outer layer isolation distance (OL-TT-TP-PP) ⓘ

0.150 mm 0.175 mm 0.200 mm 0.250 mm More Options ▾

Measured: 0.137 mm

 The measured value for Outer layer isolation distance (OL-TT-TP-PP) does not match the required value. Please accept or ignore the measured value.

Accept Ignore PCB Checker

Practice – Virtual PCB production

- PCB Checker – Find DRC violations

The screenshot displays the PCB Checker software interface, which is divided into several panels:

- DRC - DFM information:** This panel contains two tabs: "DRC information" and "DFM information". The "DRC information" tab is active, showing a table of DRC violations. The table has columns for "Layer", "Required", "Measured", and "Count".
- Board buildup:** This panel shows a cross-sectional view of the PCB layers. The layers are labeled: "Top view", "Top legend", "Top soldermask", "Top copper", "Bottom copper", "Bottom soldermask", "Plated drill", and "Non Plated Through Hole". The total material thickness is indicated as 1.59 mm.
- Detailed View:** This panel shows a magnified view of a PCB track. The track is highlighted in orange, and a red box in the "Bird's Eye View" panel below it indicates the location of the track on the board.
- Fault view:** This panel shows the current issue: "Outer layer trackwidth (OL-TW) - Top copper". It displays a small image of the track and the measured trackwidth (0.130 mm) compared to the required trackwidth (0.150 mm).
- Related order details:** This panel shows the order details for the trackwidth, including a dropdown menu for the required trackwidth (0.150 mm) and the measured trackwidth (0.130 mm).

At the bottom of the interface, there are "Cancel" and "Apply" buttons, and a "Contact support" button.

The logo for EURO CIRCUITS is displayed in white text on a green background. Below it, the text "D&E EVENT" is shown in white on a dark blue background. The text "Het ontwerpen van innovatieve elektronica" is written in white below the event name. At the bottom, the date "Woensdag 19 april 2023" and the location "1931 Congressentrum 's-Hertogenbosch" are listed in white text on a blue background.

Practice – Virtual Assembly

- Can be done with intermediate versions of the board design
- Upload board and assembly data

Upload PCB data Upload BOM data Upload CPL data Confirm Analysis Confirm Parameters

Upload BOM data

Drop your BOM here

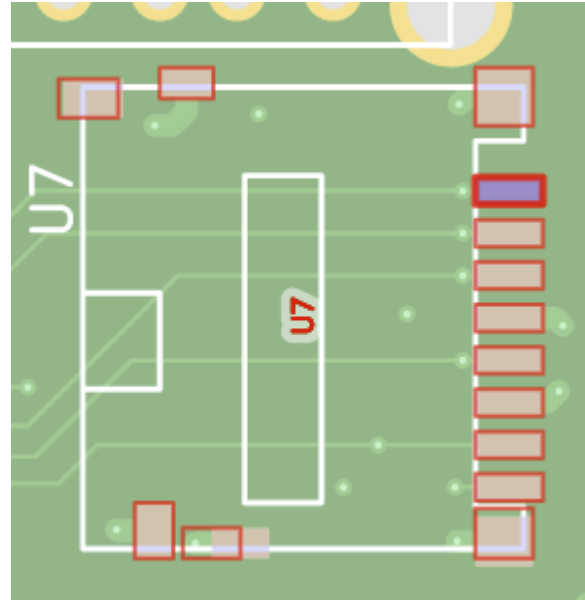
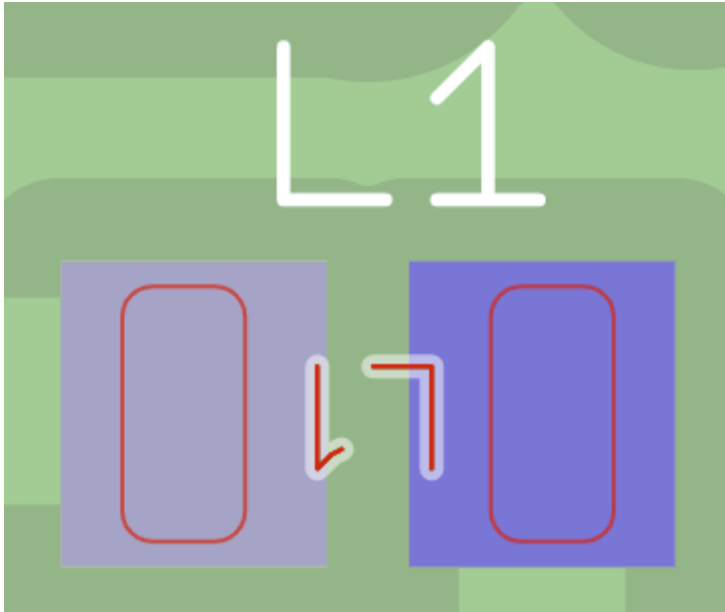
Browse

Supported formats: csv, xls, xlsx, ods, txt and xlsx

[Skip assembly data](#) [Upload CPL data](#)

Practice – Virtual Assembly

- CPL Editor – Check component footprints



Practice – Virtual Assembly

- CPL Editor – Check manufacturing issues

The screenshot displays the Assembly Editor software interface. The main window shows a detailed view of a PCB layout with various components labeled (C28, C30, C29, Q1, R18, C19, C26, C35). A red box highlights a specific area where components C29 and Q1 are overlapping. On the left side, there is a 'Issues' panel with a table listing manufacturing issues and their counts. Below the table is a 'Fault view' section showing a detailed view of the 'Overlapping components - Top' issue, with 'Component 1 :P1' and 'Component 2 :R5' highlighted.

Layer	Values
Top	9
Footprints do not match the paste pads	
Top	1
Pin 1 does not match	
Top	2
Components close to or outside outline	
Top	5
Components with mechanical pins	
Top	2
Drilled SMD pad	
Top	9
Bottom	11
Small pitch	
Top	1
Overlapping components	
Top	4

Current issue: Overlapping components - Top

Component 1 :P1

Component 2 :R5

Cancel Apply

Contact support

EURO CIRCUITS

D&E EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

**Right first time is maybe
more than just a dream**



EURO
CIRCUITS

D&E
EVENT

Het ontwerpen van innovatieve elektronica

Woensdag 19 april 2023
1931 Congressentrum 's-Hertogenbosch

www.eurocircuits.com
euro@eurocircuits.com

