LibrePCB

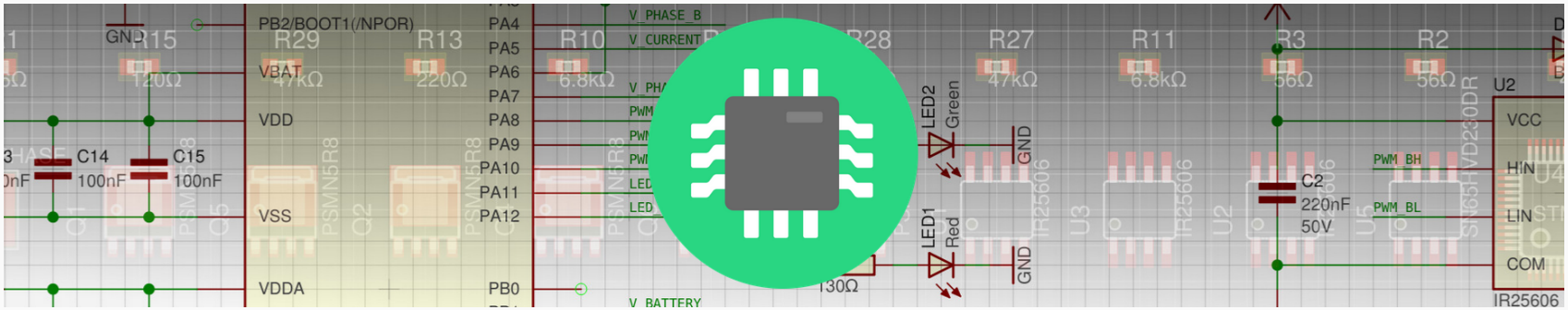
A new, powerful and intuitive EDA tool for everyone

Danilo Bargen, Raphael Nestler

June 15, 2019

CoSin 2019

Goals For Today



Goals

- Intro to LibrePCB
- Library Concepts
- Install LibrePCB
- Create a LED PCB

Getting Started

`https://download.librepcb.org/nightly_builds/master/`

Linux

librepcb-nightly-linux-x86_64.AppImage

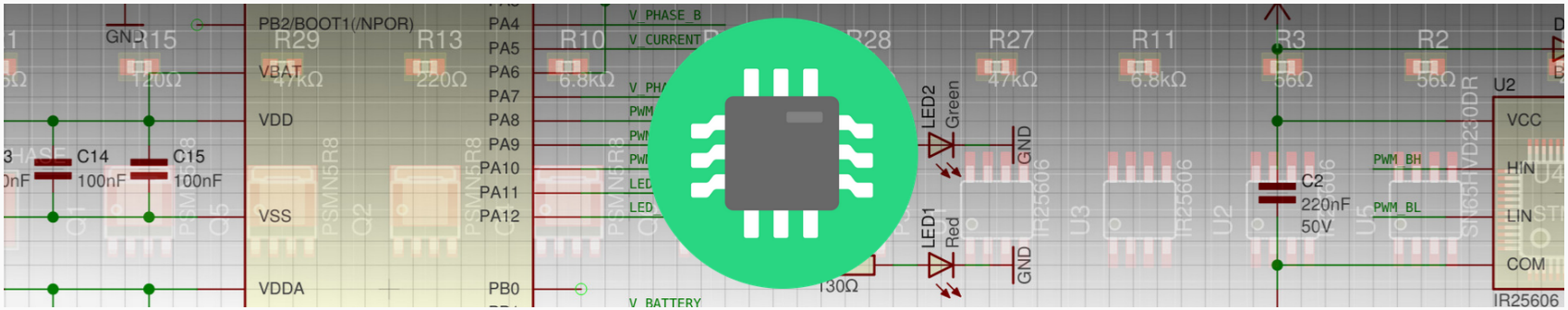
macOS

librepcb-nightly-mac-x86_64.dmg

Windows

librepcb-installer-nightly-windows-x86.exe

About LibrePCB



Free/OpenSource EDA Suite

- Multiplatform
- Written from scratch in C++11/Qt5
- Development started in 2013, first stable release in late 2018
- Website: `https://librepcb.org/`
- GitHub: `https://github.com/LibrePCB/LibrePCB`

Motivation

Frustration about existing EDA tools

- Library system
- File format
- Usability

Library Management

Problem

- Different library types (e.g. *.lib, *.pretty, *.3dshapes)
- Tools do not (completely) handle library management
  - No integrated tool to install and update libraries
  - No dependency management
  - Complicated project library management

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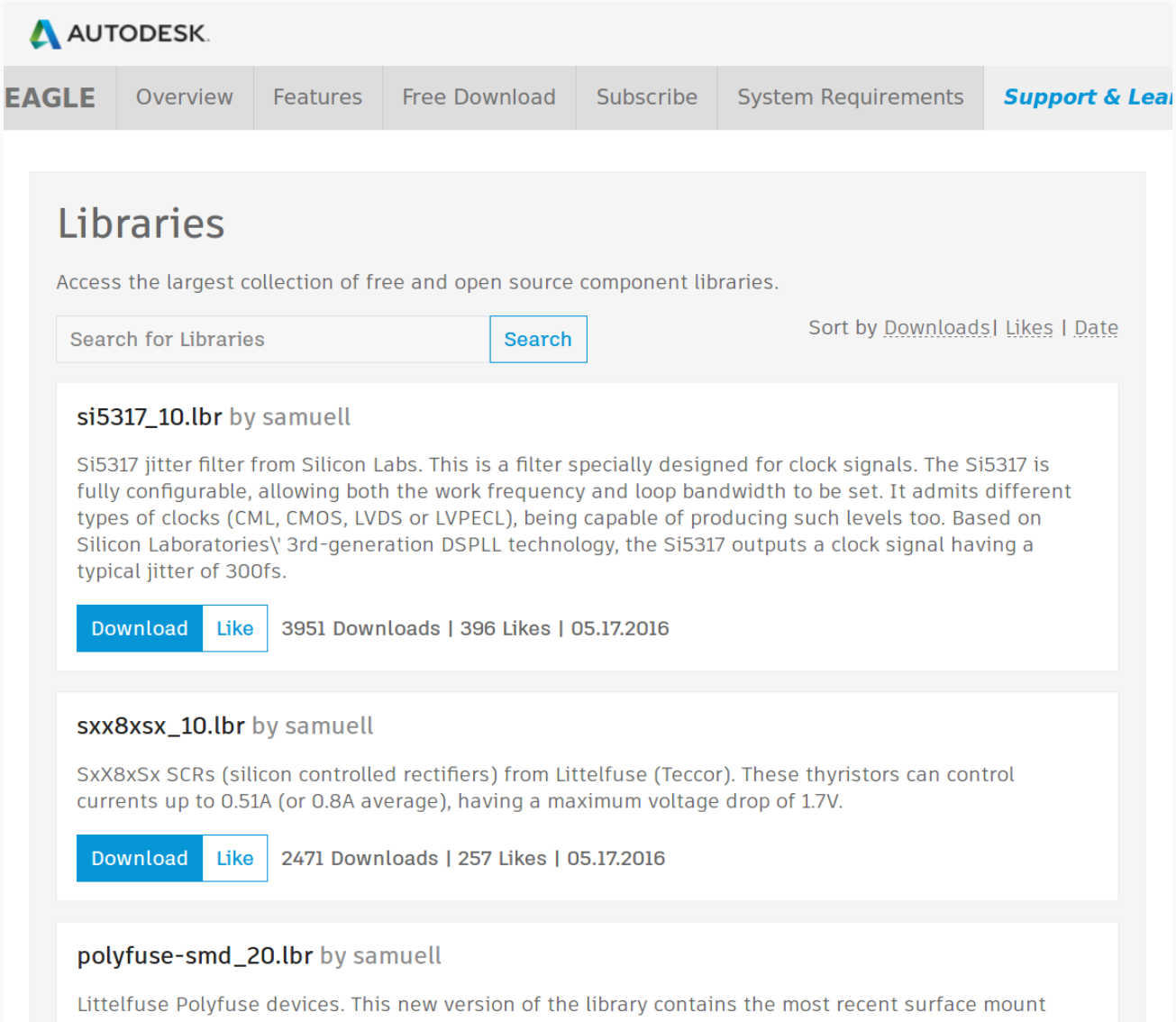
Result

- It's up to the user to manage his libraries (which is a pain)

Library Management



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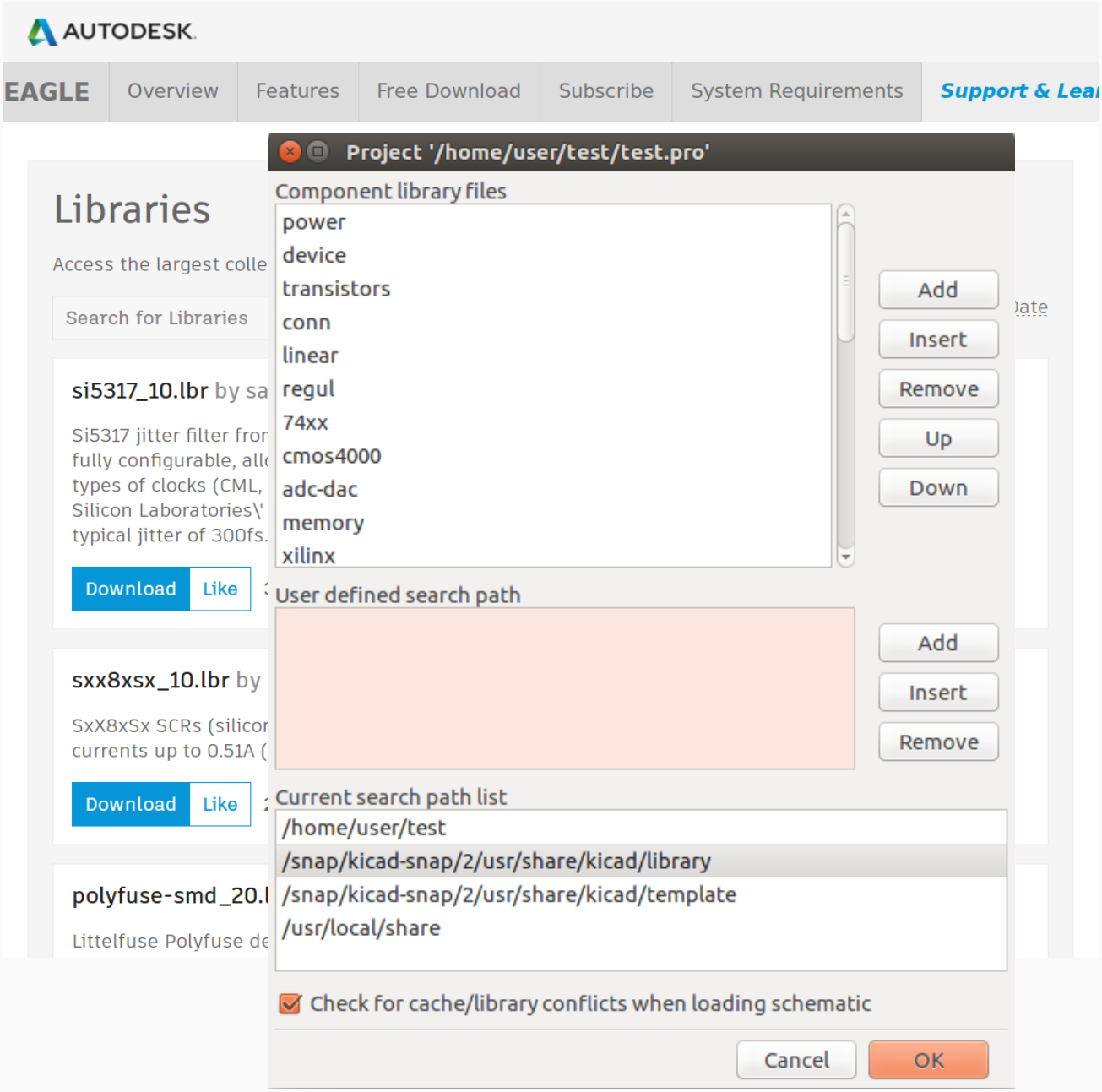

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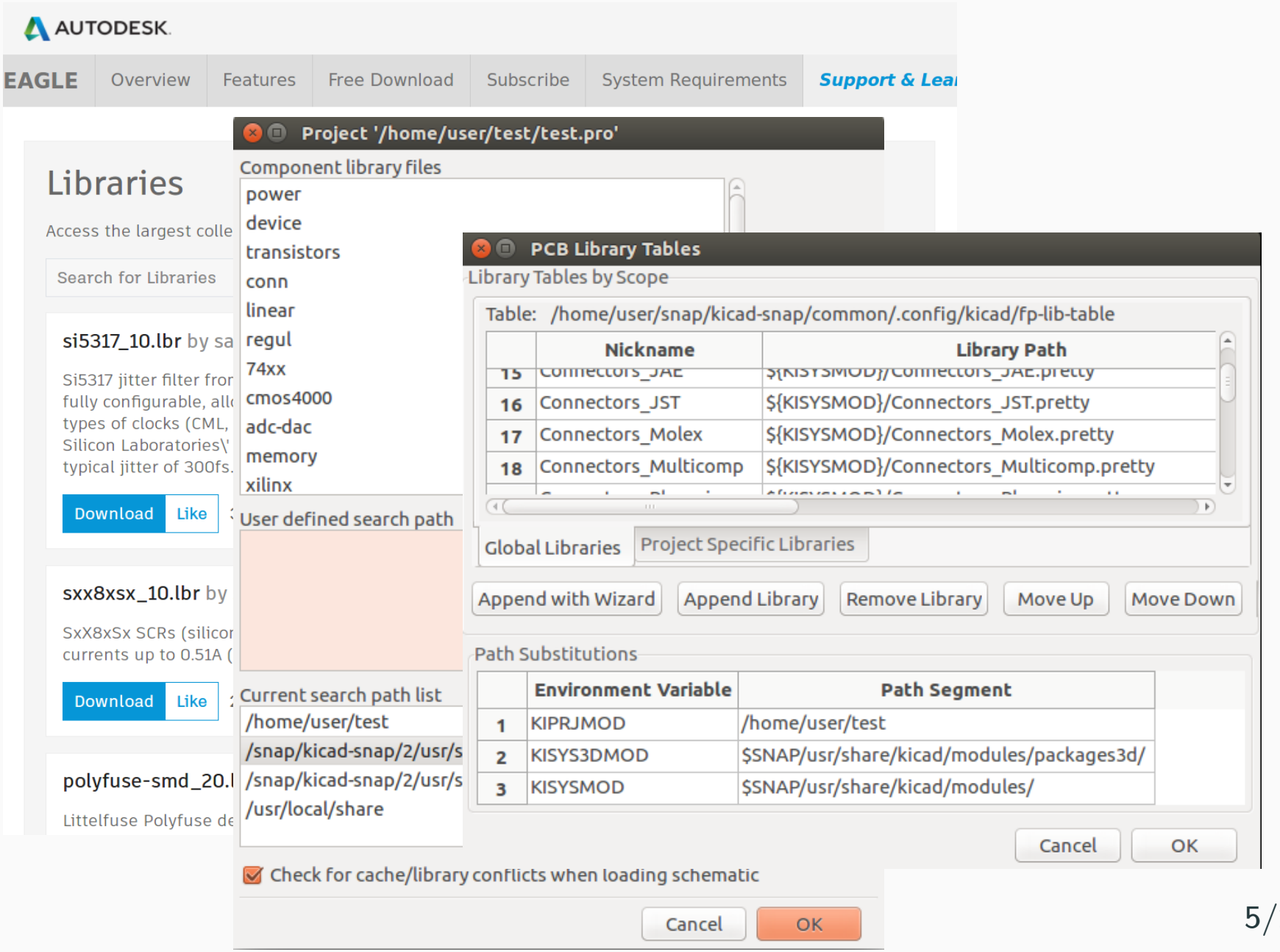

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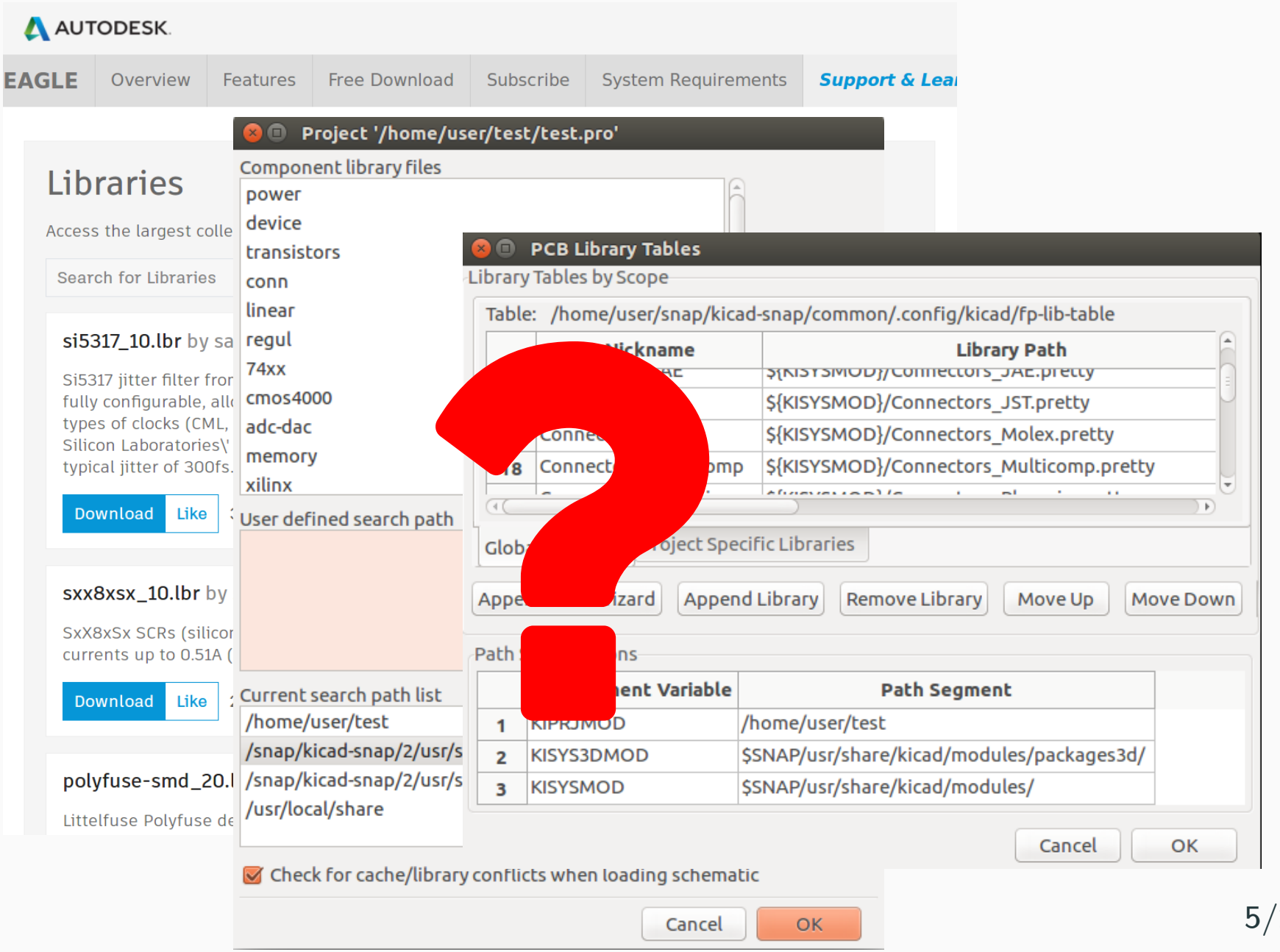
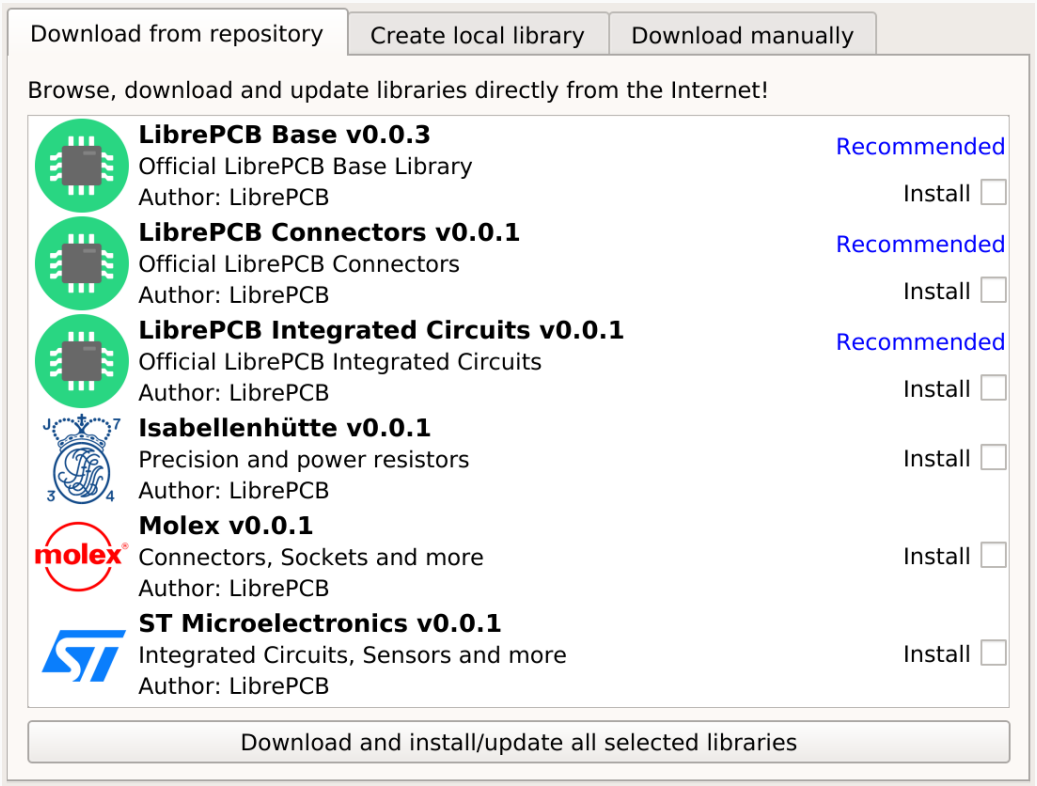


Library Management

Solution

- Integrated library manager with dependency management
- Libraries can contain any entity type (symbols, footprint, ...)
- The application handles basically **everything** for you



Library References

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- Everything is referenced by name
- References across libraries not possible in some tools

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- Name conflicts because they are not unique
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- Many duplicates accross different libraries

Solution

- Every entity is identified by a random UUID
- References always by UUID, never by name
- Entities can be referenced across different libraries

Library References

```
(librepcb_symbol
 (uuid f0061936-5169-49c9-bfa5-4efc8108cd1c)
 (name "Connector 1x4")
 ...
 (pin 169d6728-7108-4600-aa48-765711db01bc (name "1")
  (pos -20.32 40.64) (rot 0.0) (length 5.08)
 )
 (pin 1c49822e-fd83-452a-a7a6-f4ae1357a0c7 (name "2")
  (pos 20.32 -40.64) (rot 180.0) (length 5.08)
 )
 (pin 208bd2b9-ed07-4df5-b5ab-a89fb03378d5 (name "3")
  (pos 20.32 -38.1) (rot 180.0) (length 5.08)
 )
 (pin 2684075c-566e-43fb-b025-17cf43badaf4 (name "4")
  (pos 20.32 -12.7) (rot 180.0) (length 5.08)
 )
)
```

Symbol Variants

Problem

- Impossible to have different symbols for the same component
  e.g. Resistor:

Symbol Variants

Problem

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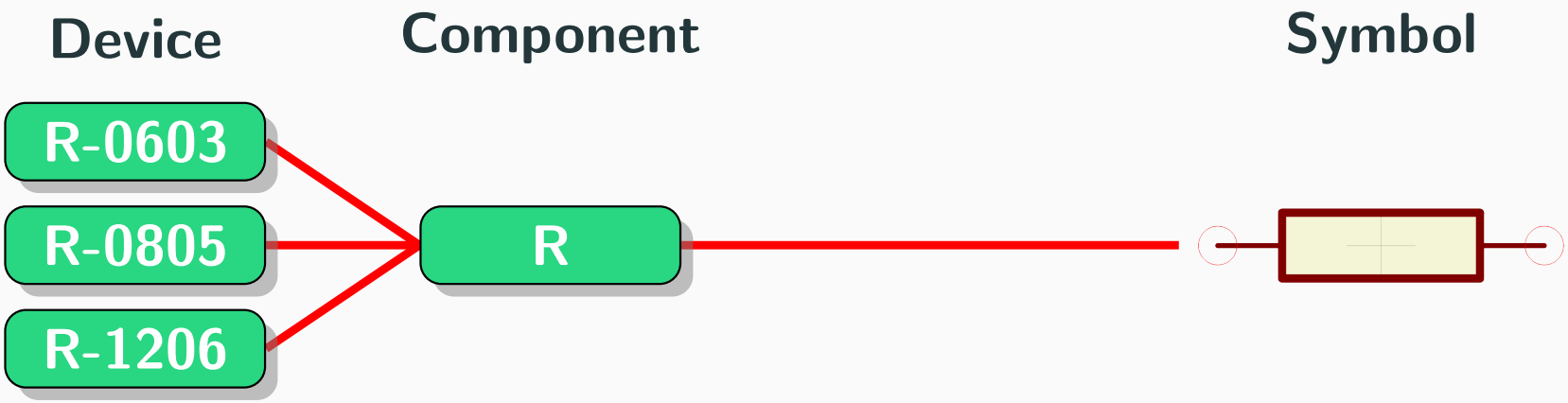
  e.g. Resistor:

Result

- Duplicate components (same functionality, different symbol)

Symbol Variants



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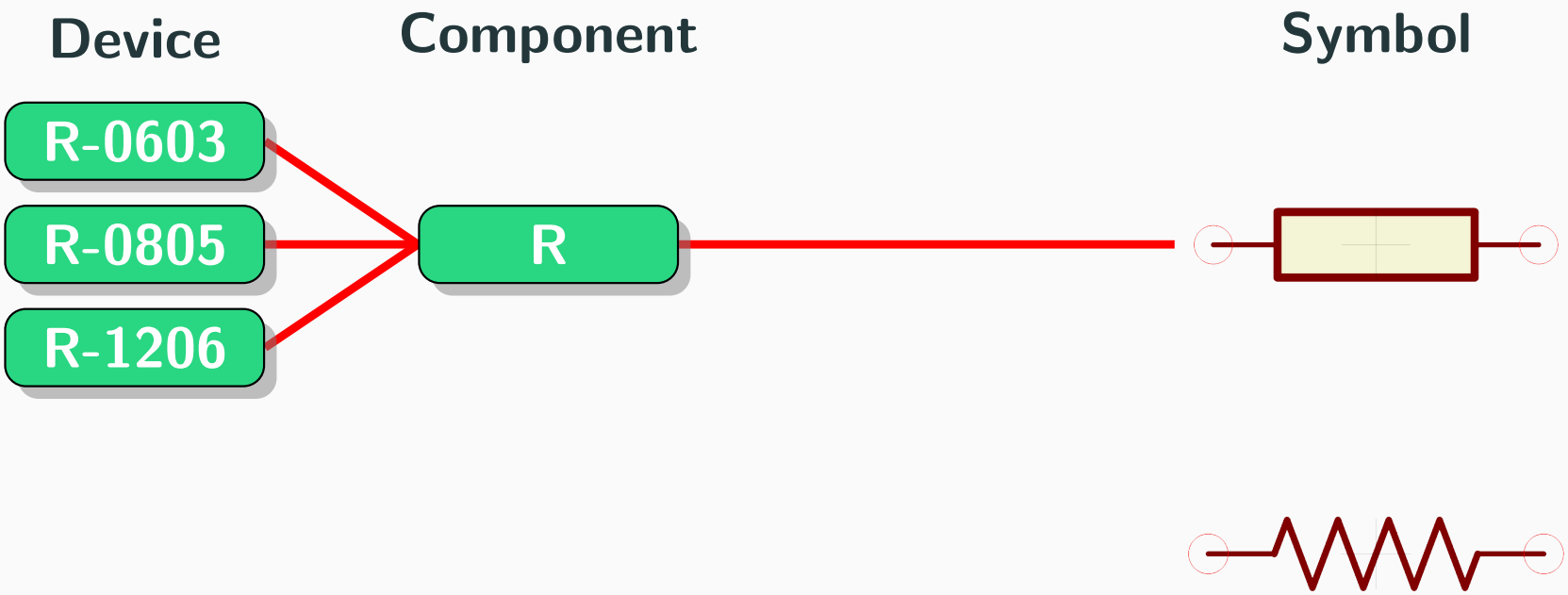

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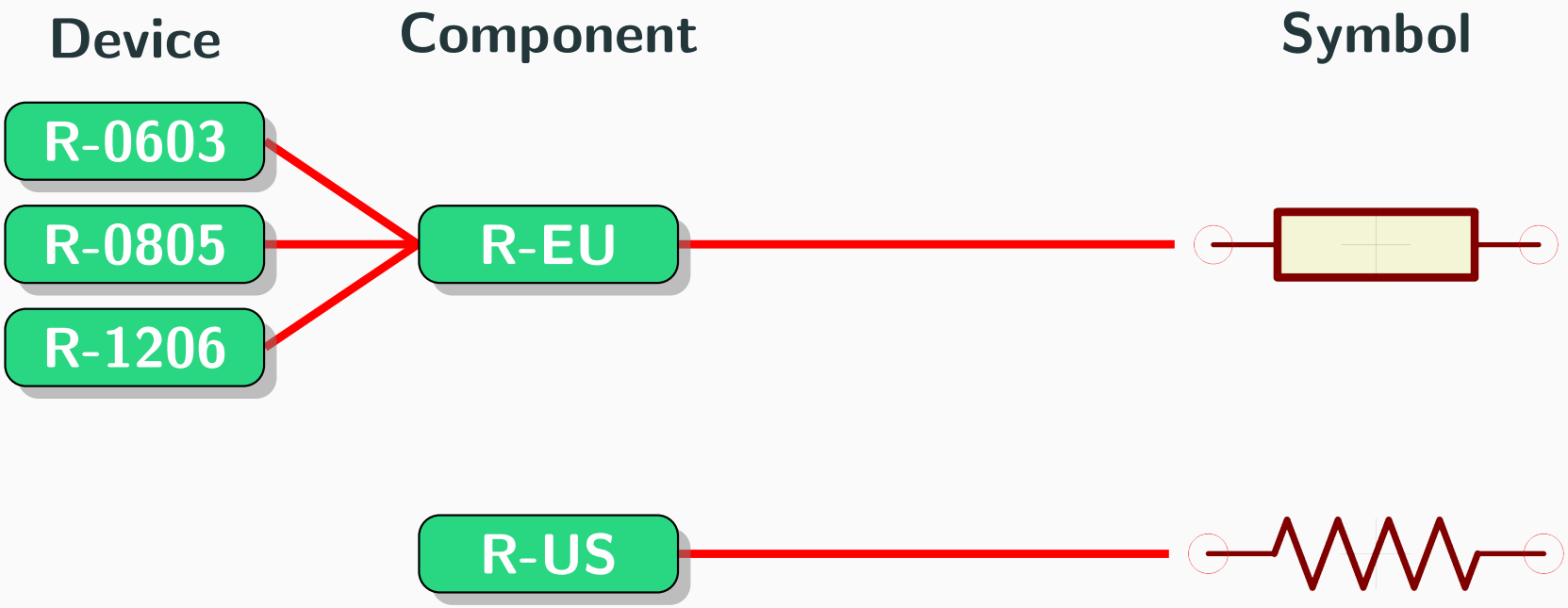

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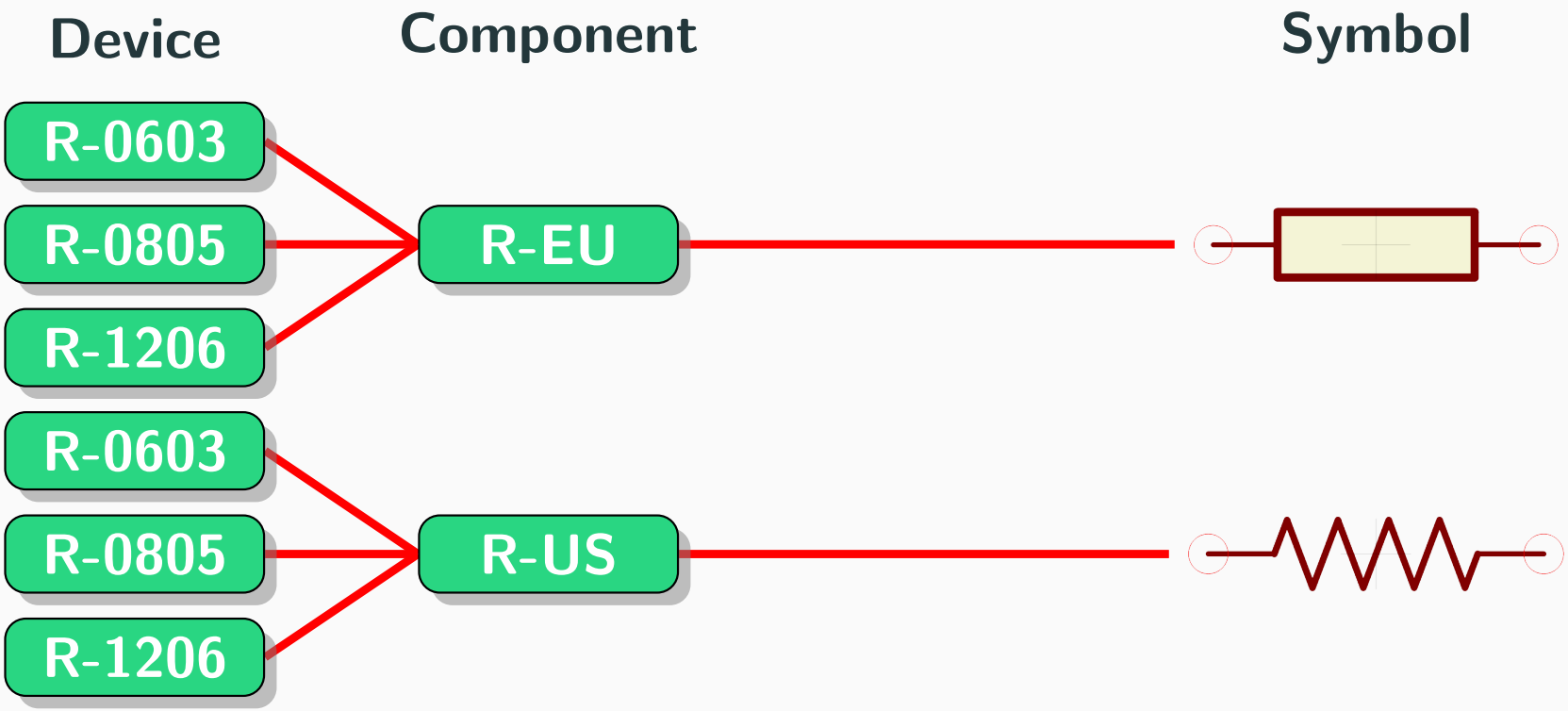

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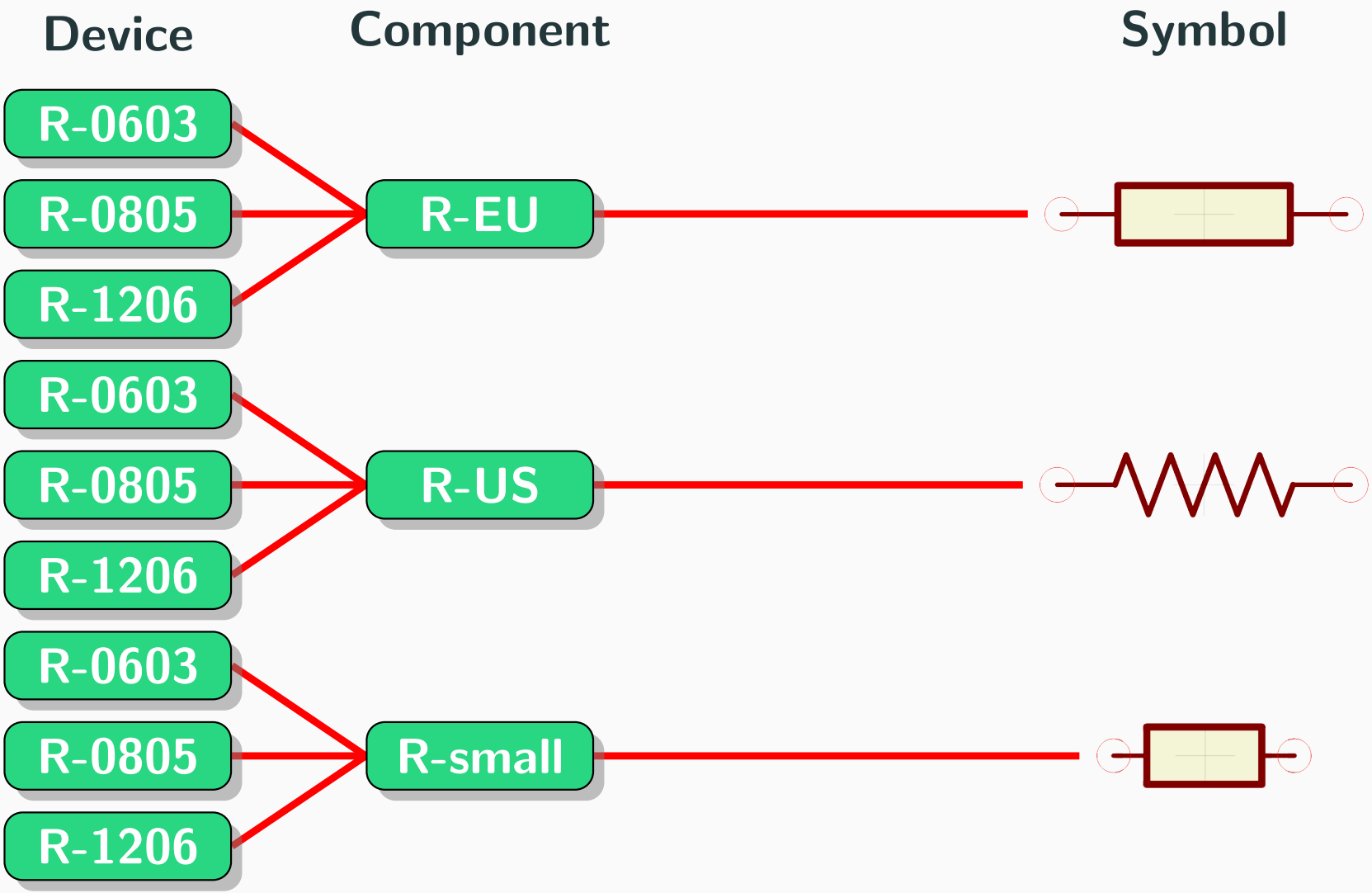

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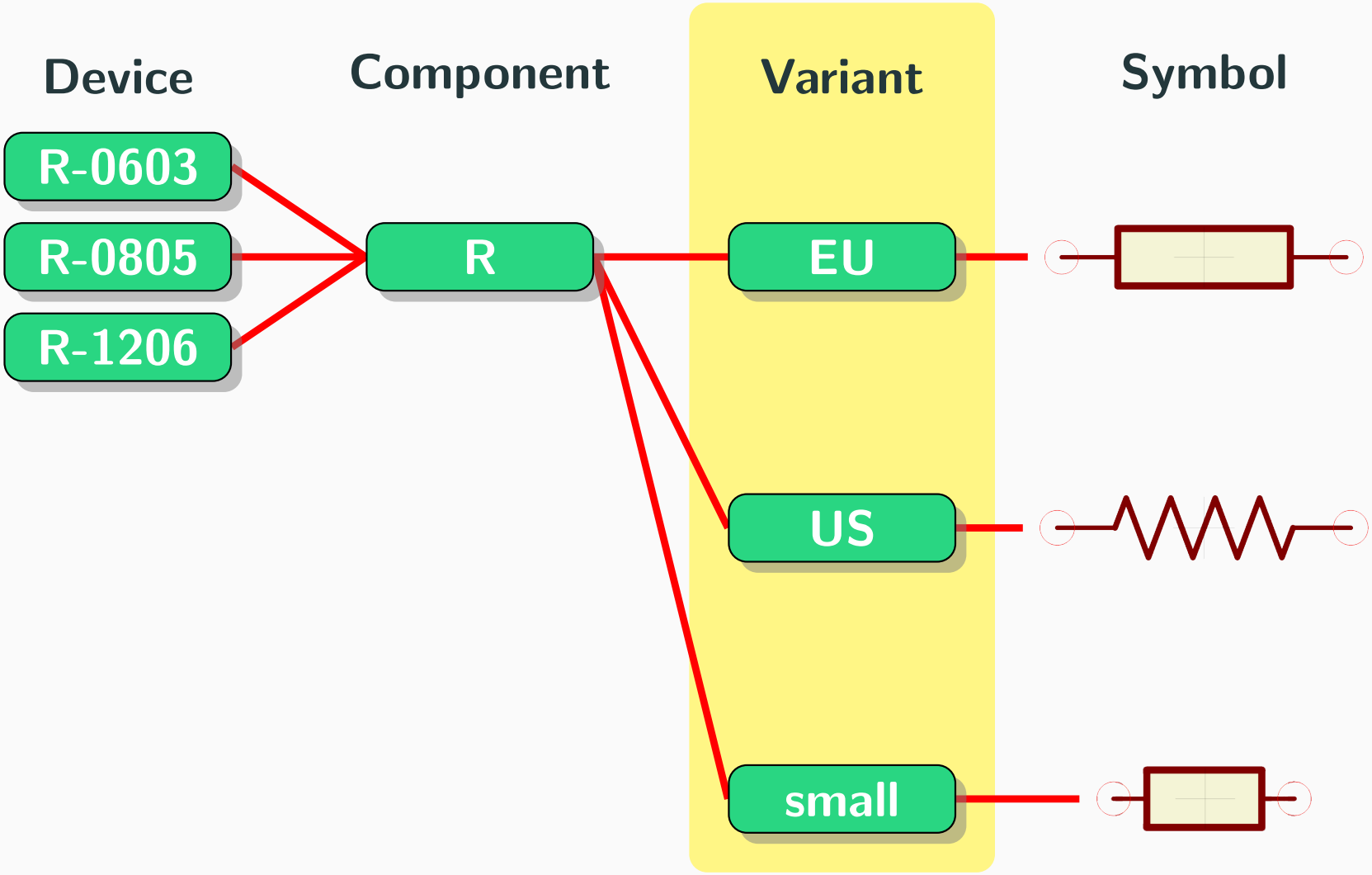
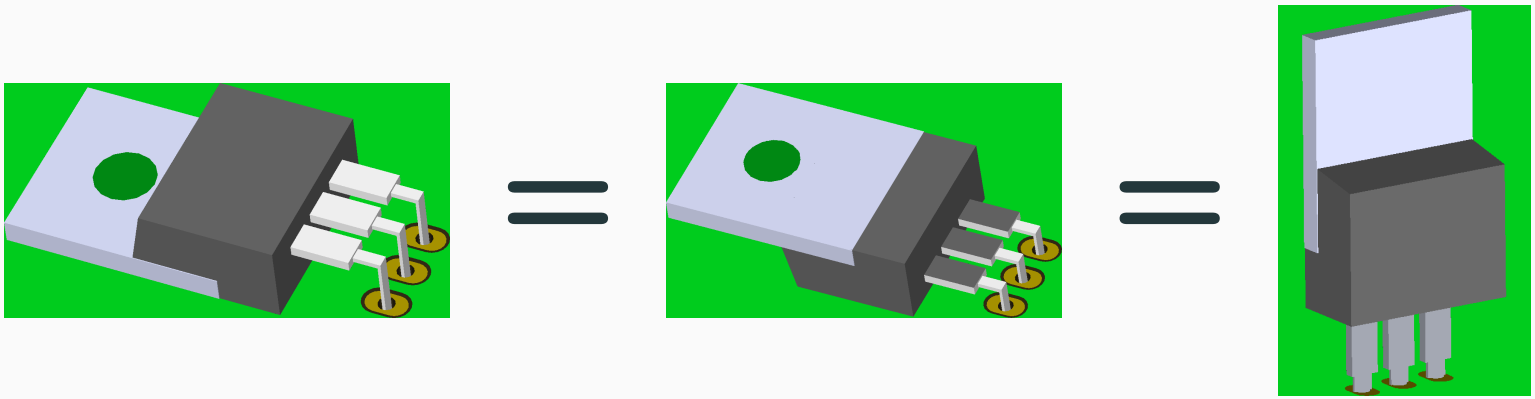


Footprint Variants

Problem

- Libraries do not provide an abstraction layer for **packages**



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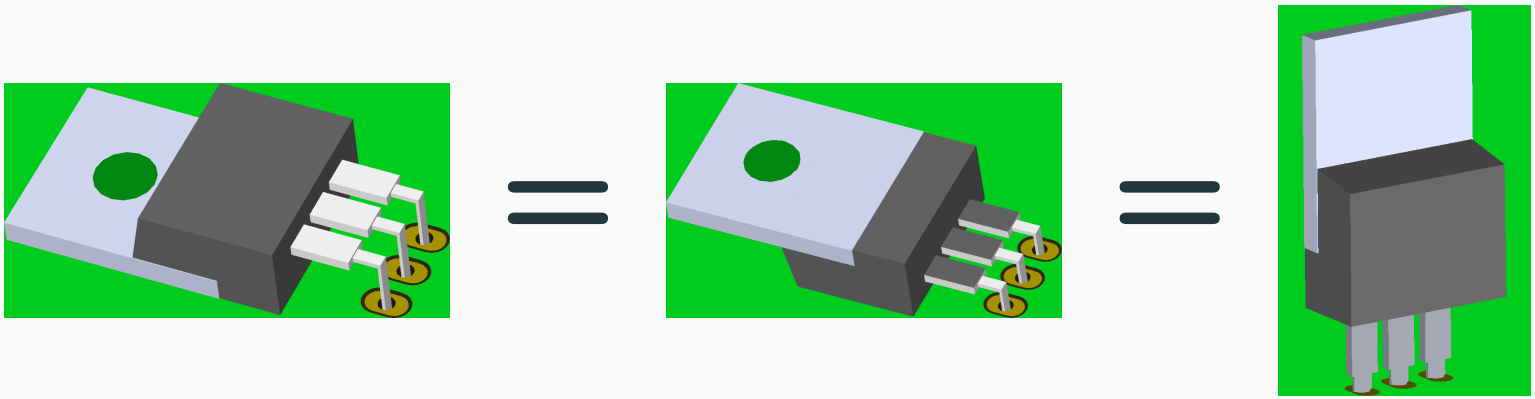
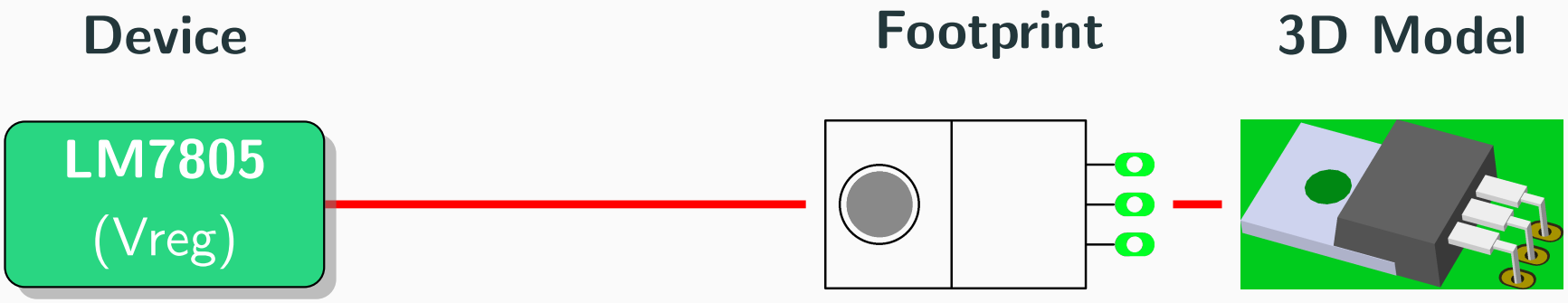


Result

- Devices need to know every footprint variant of their package

Footprint Variants



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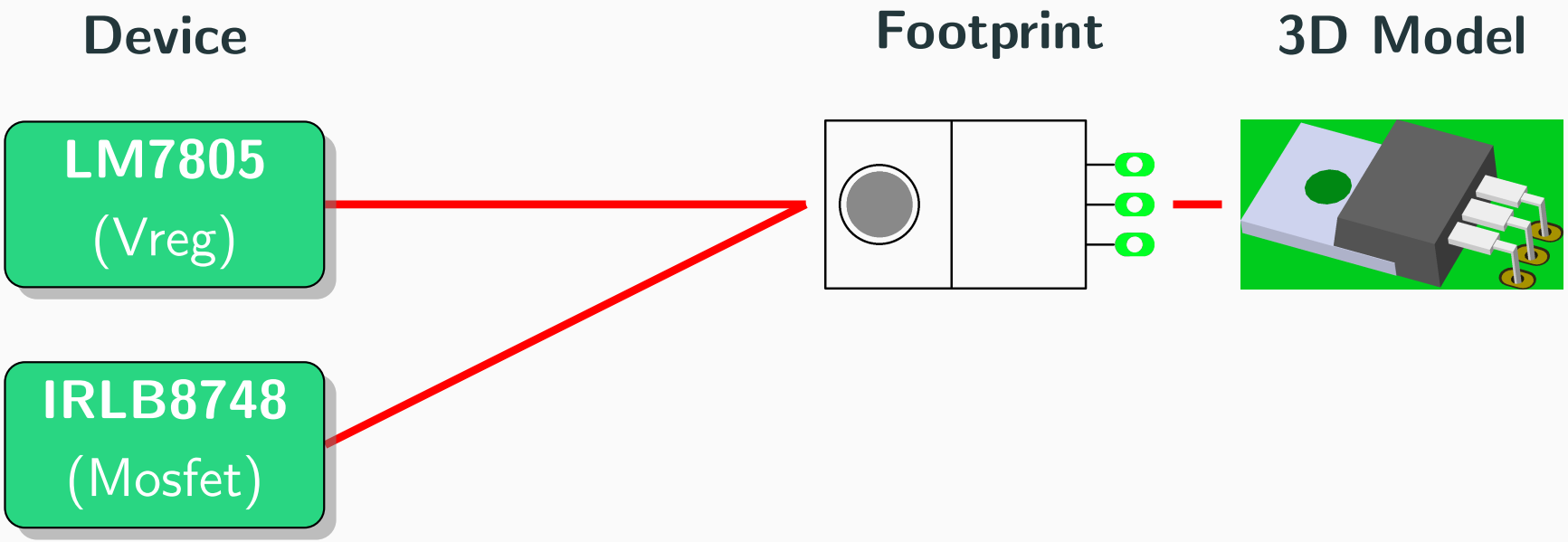

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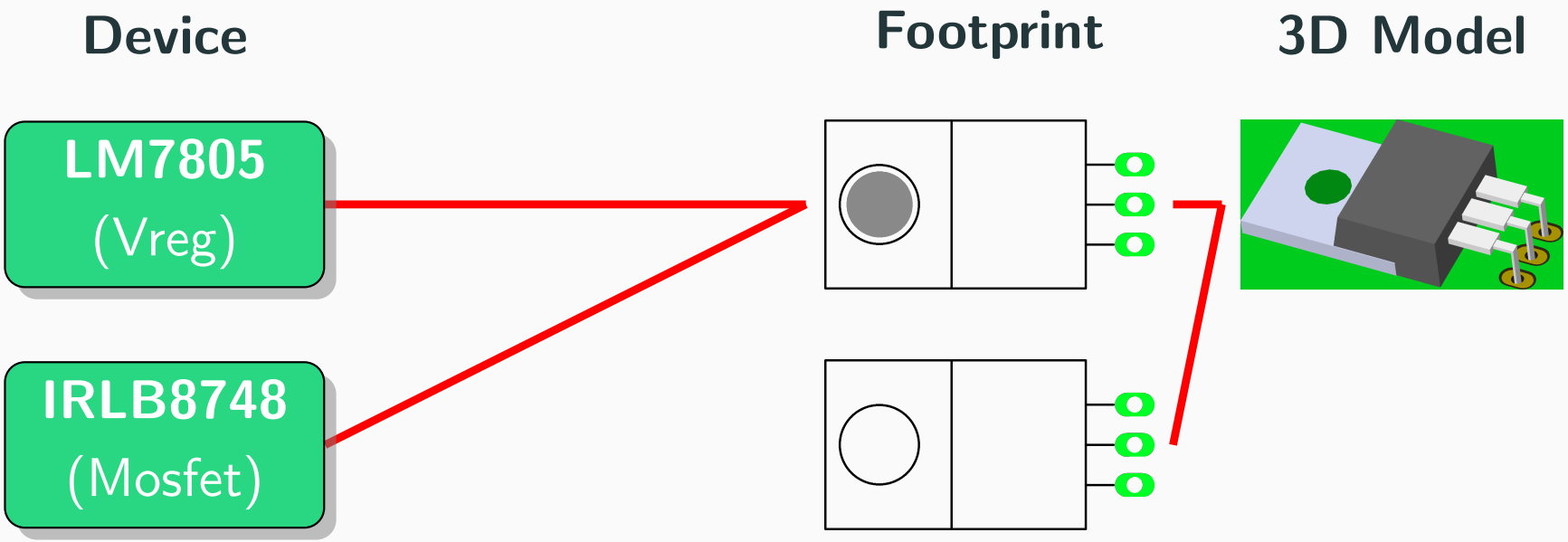

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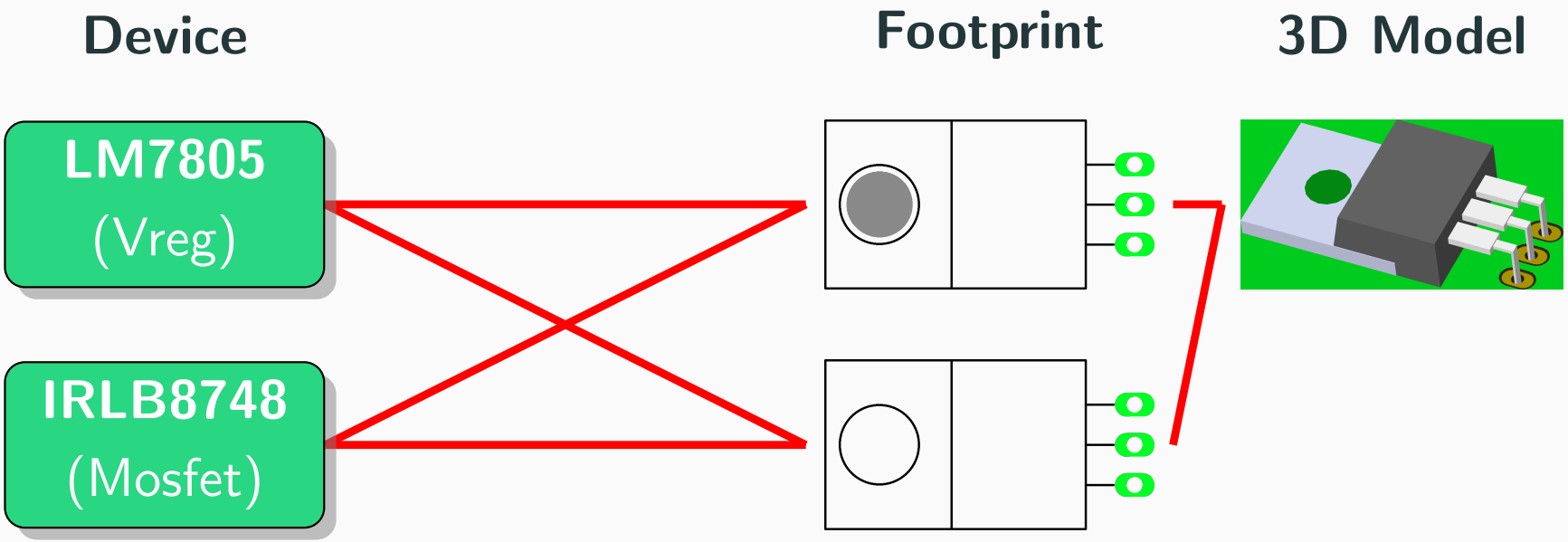

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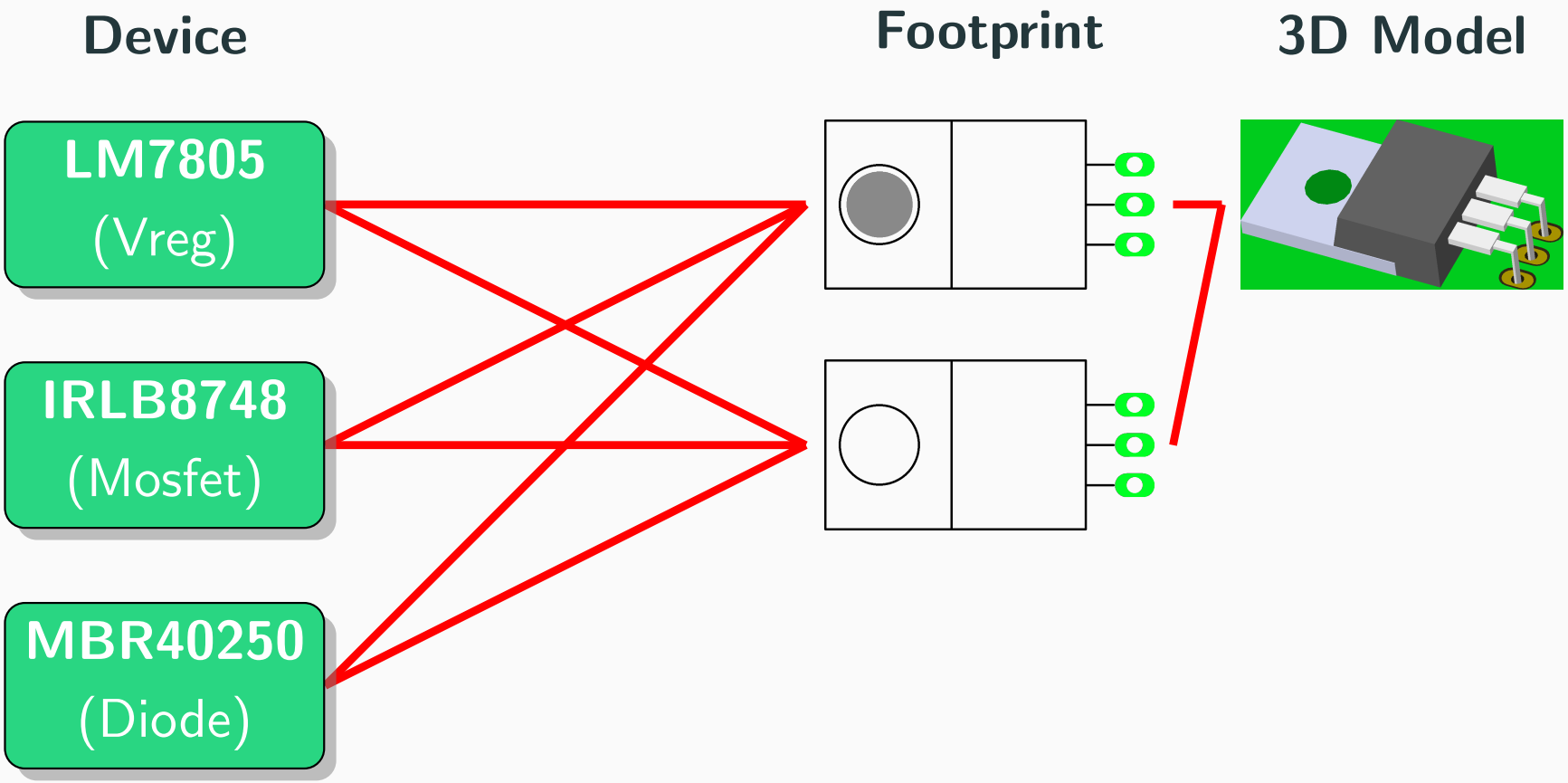

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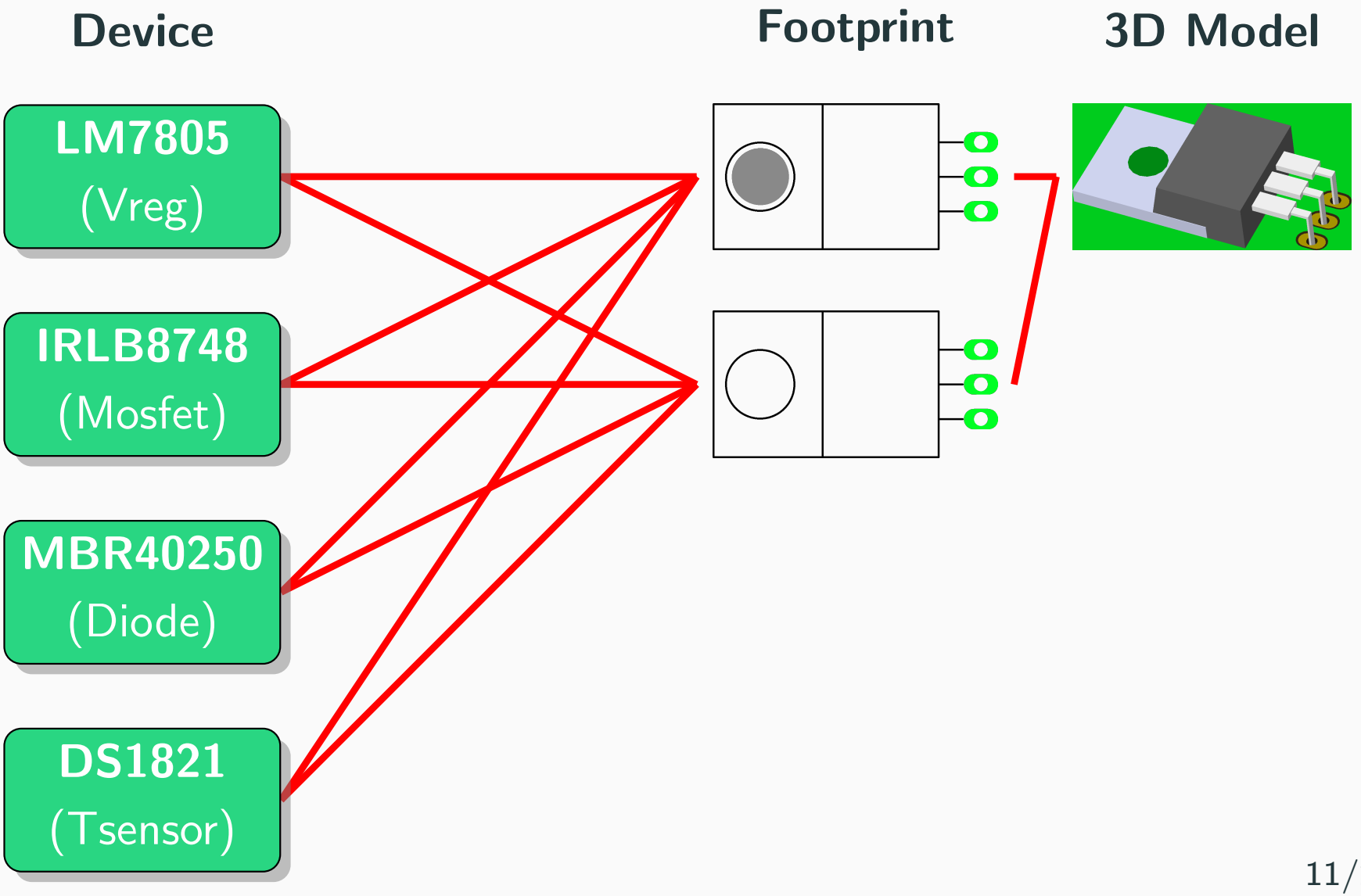

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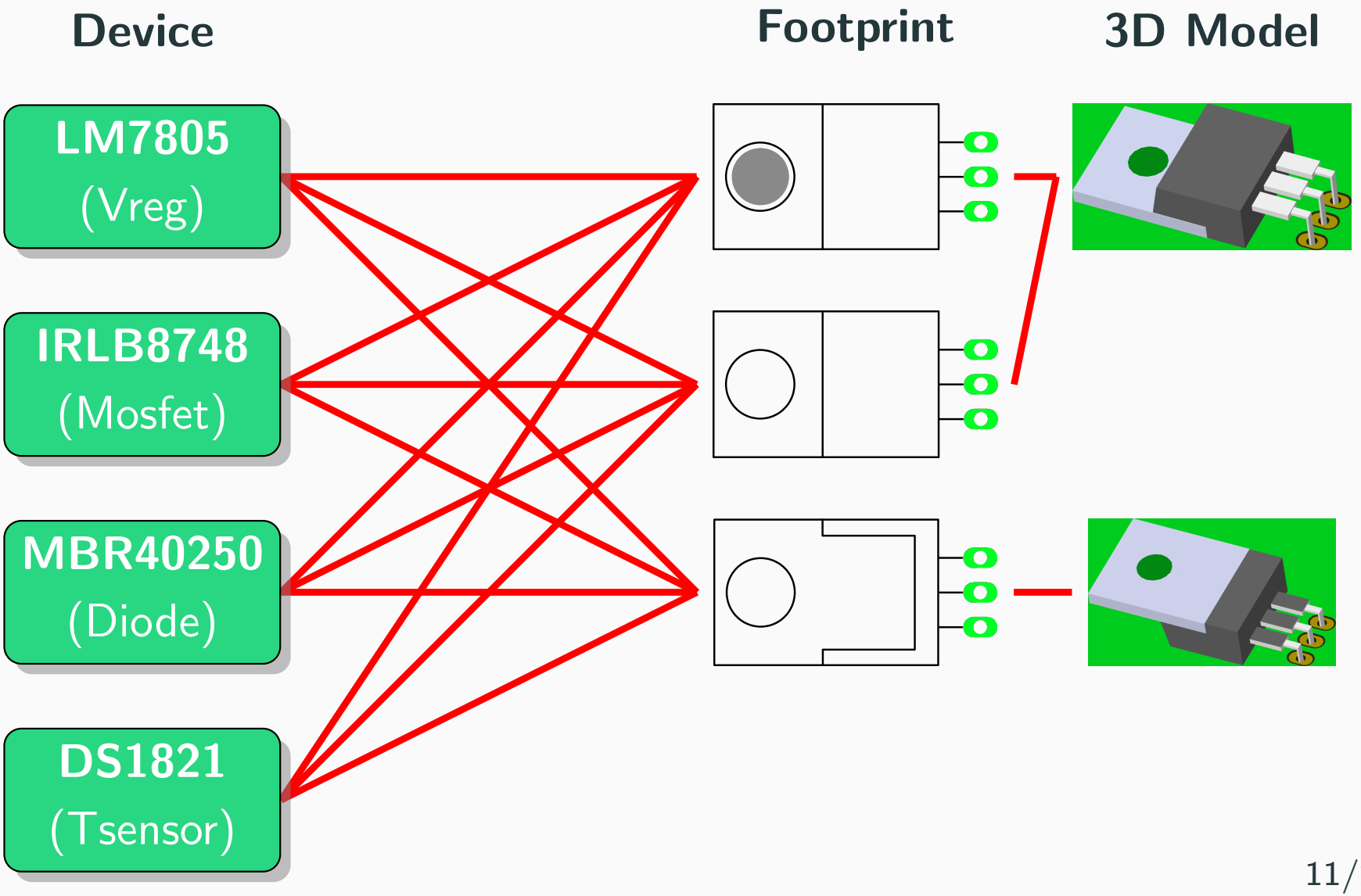

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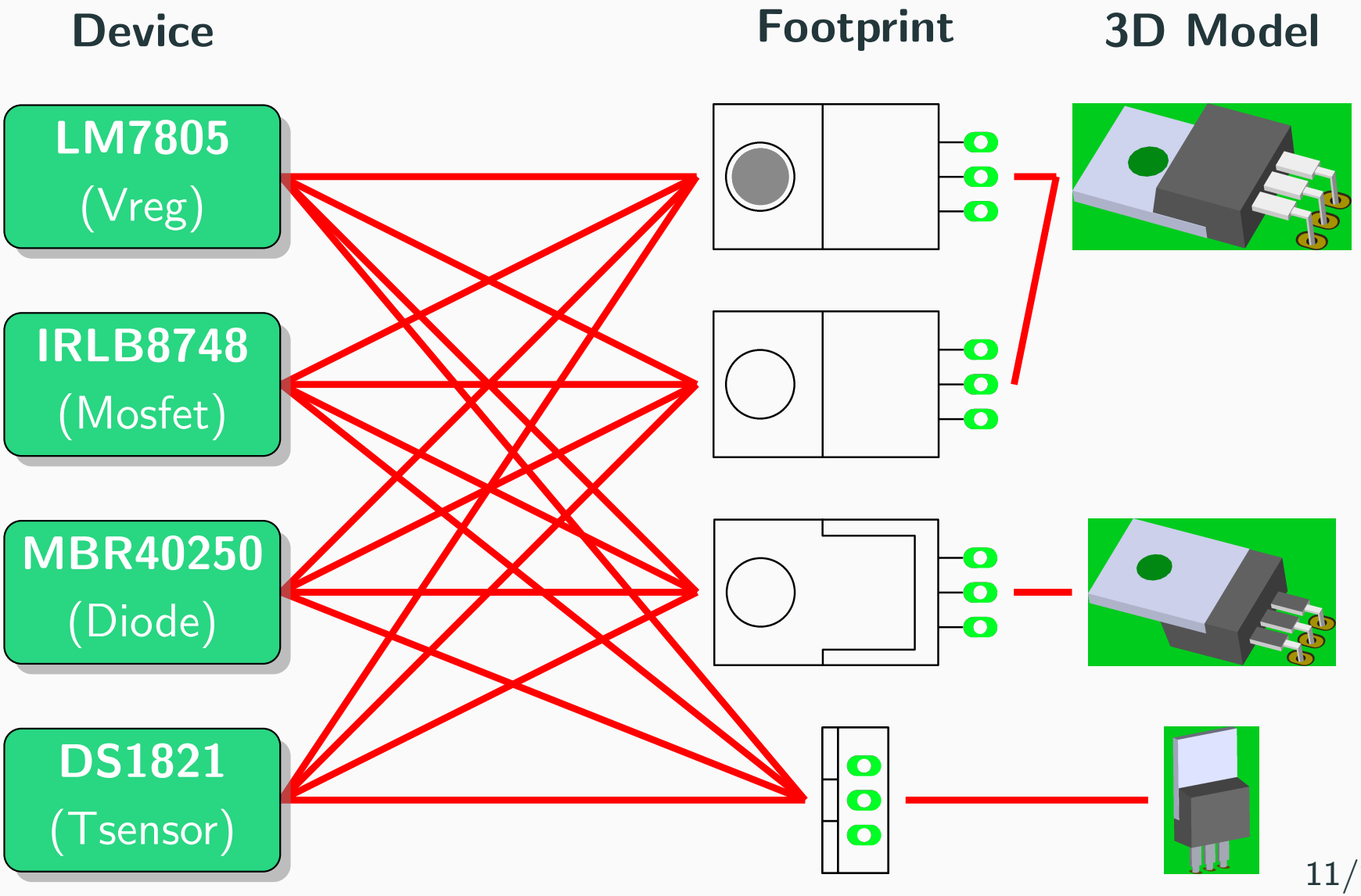

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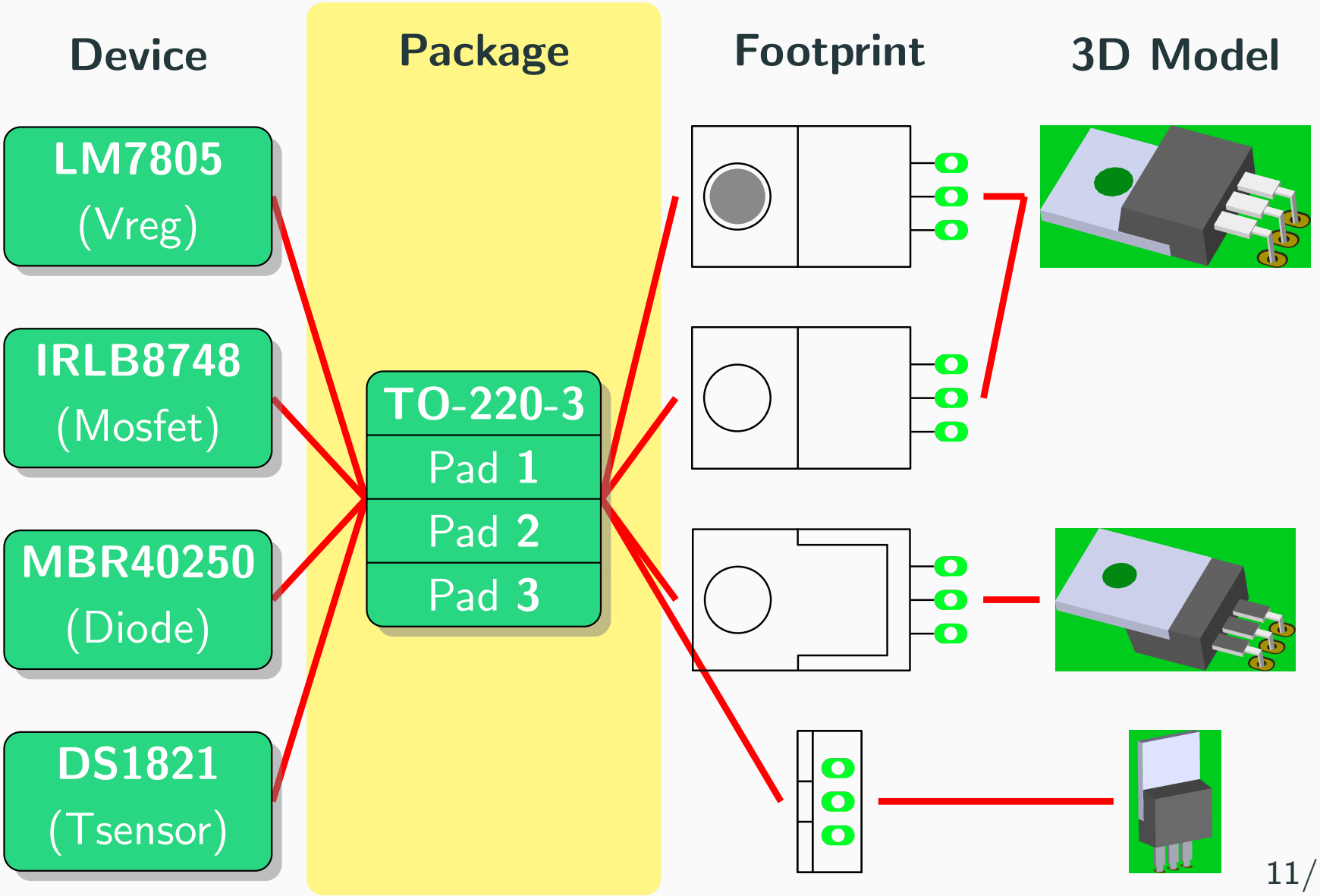

Library Browser

Problem

- Entities are organized by their containing library
- No way to assign categories and/or keywords to library entities

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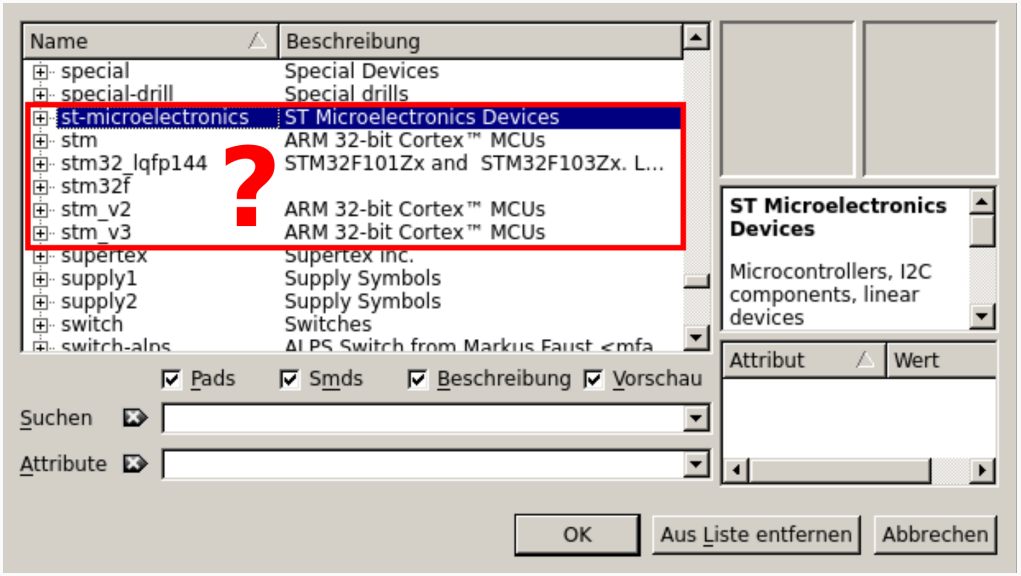
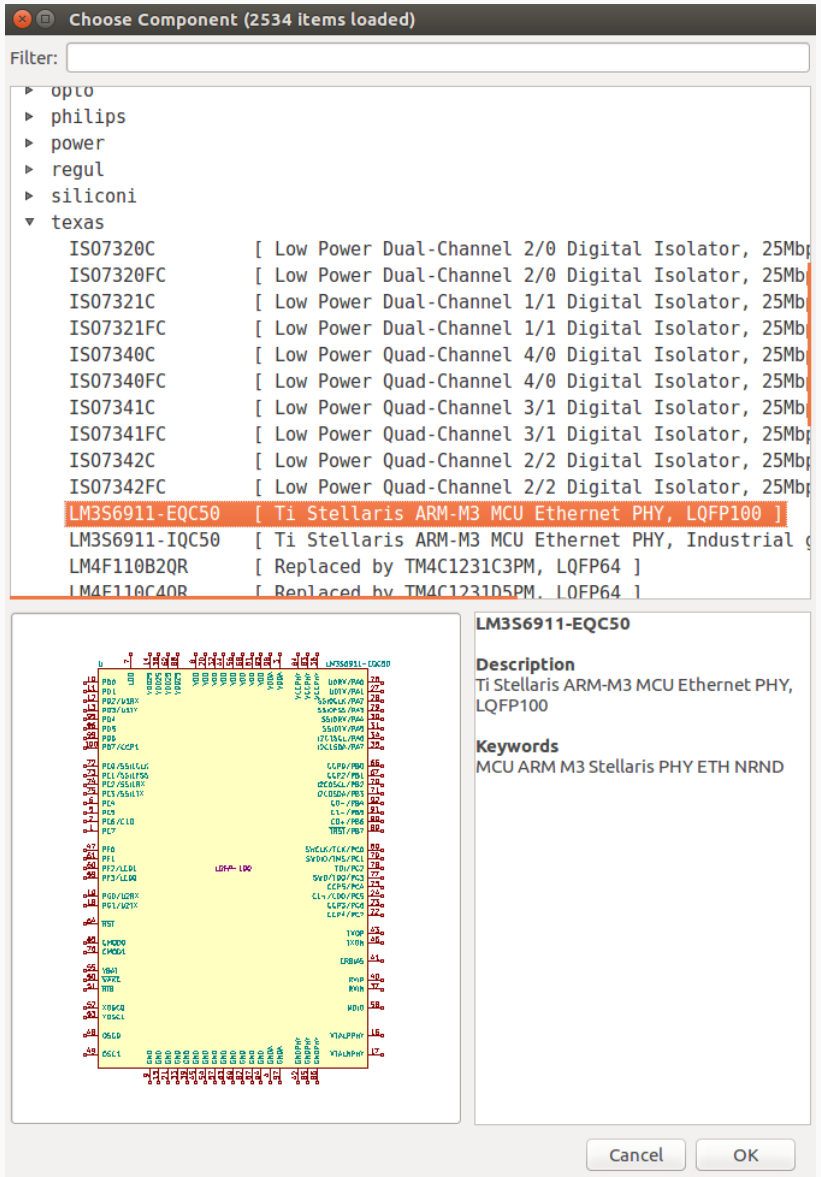
Result

- Users need to carry about (absolutely irrelevant) library names
- Entities are very hard to find in the library browser

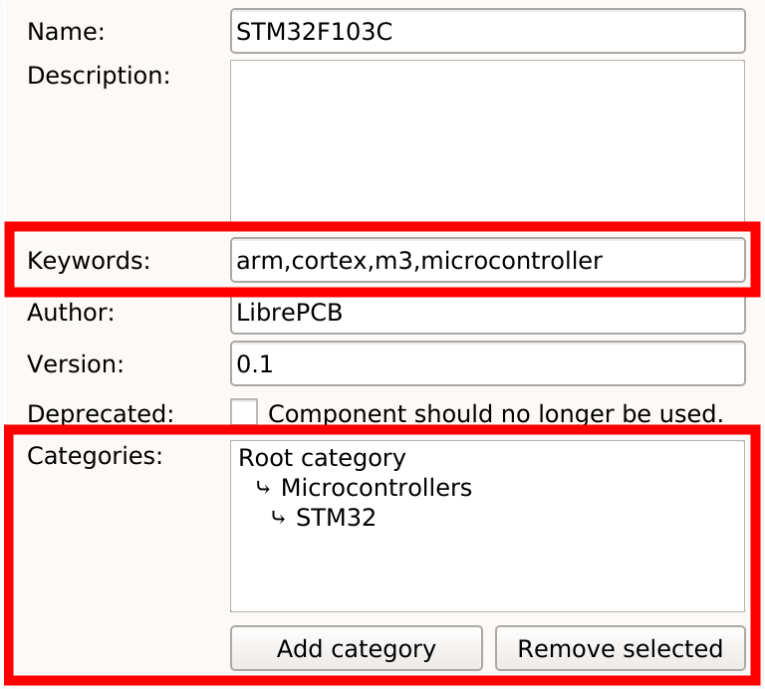
Library Browser





Solution

- Libraries can contain **categories**
- Entities can be assigned to these categories
- Entities can have keywords



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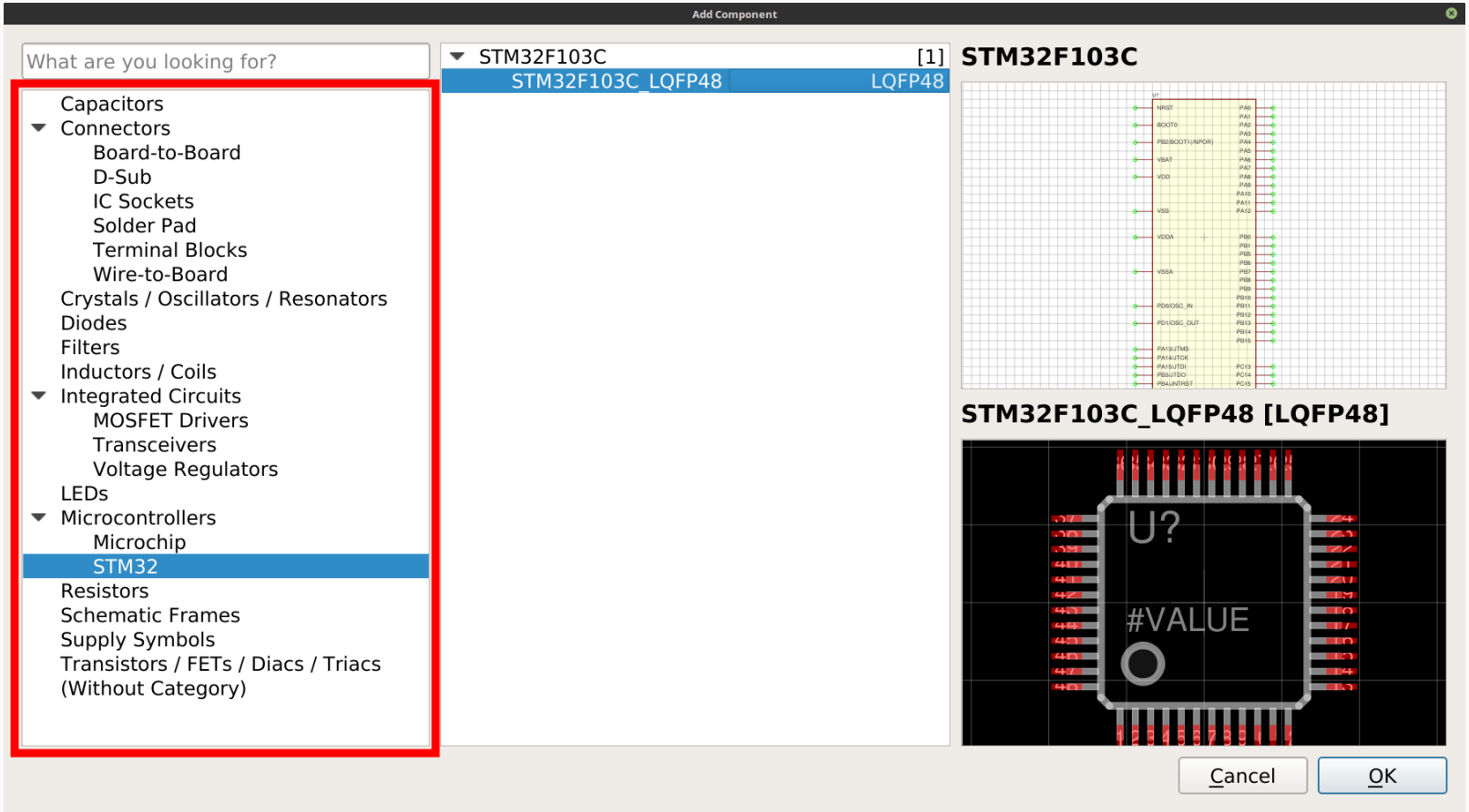

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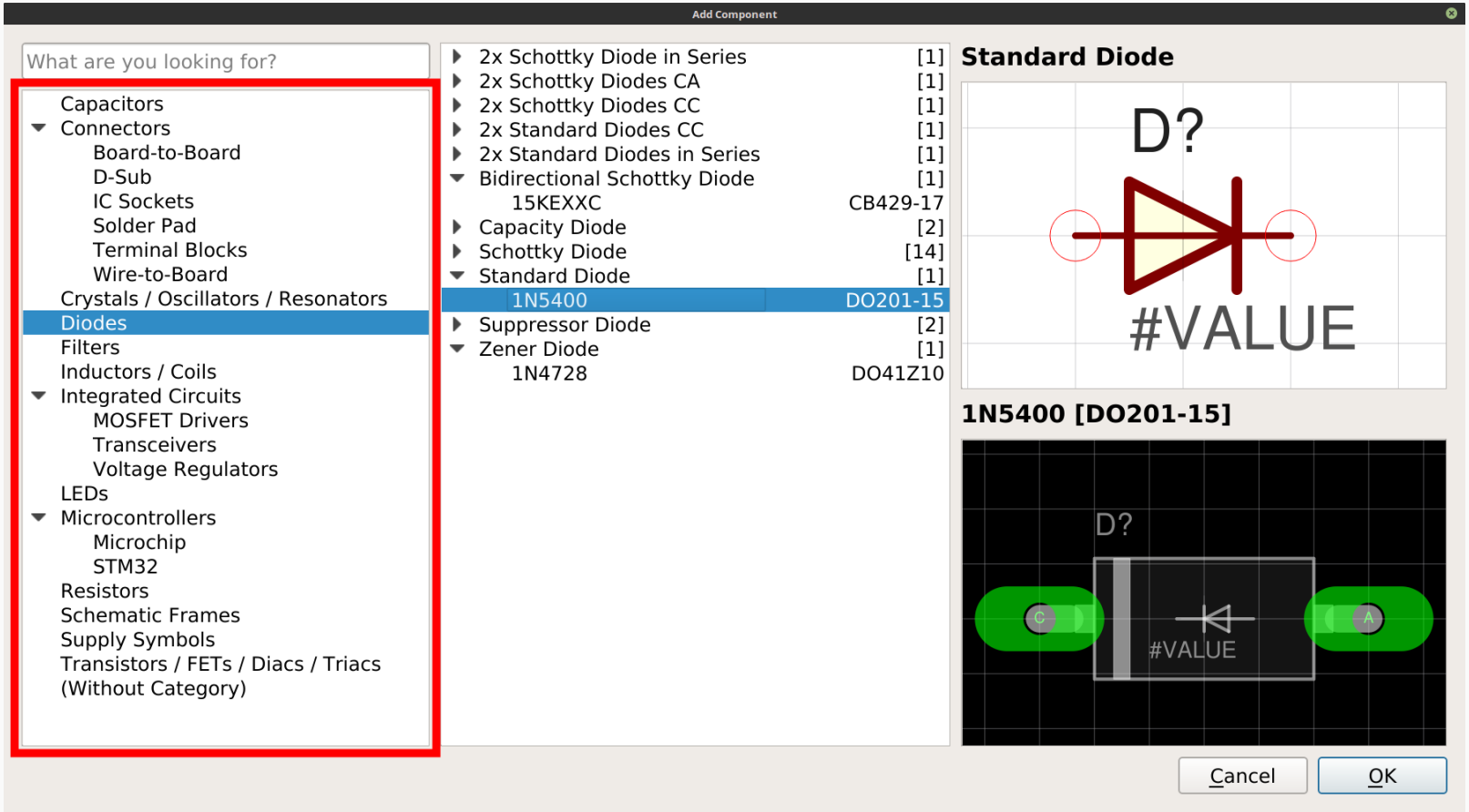

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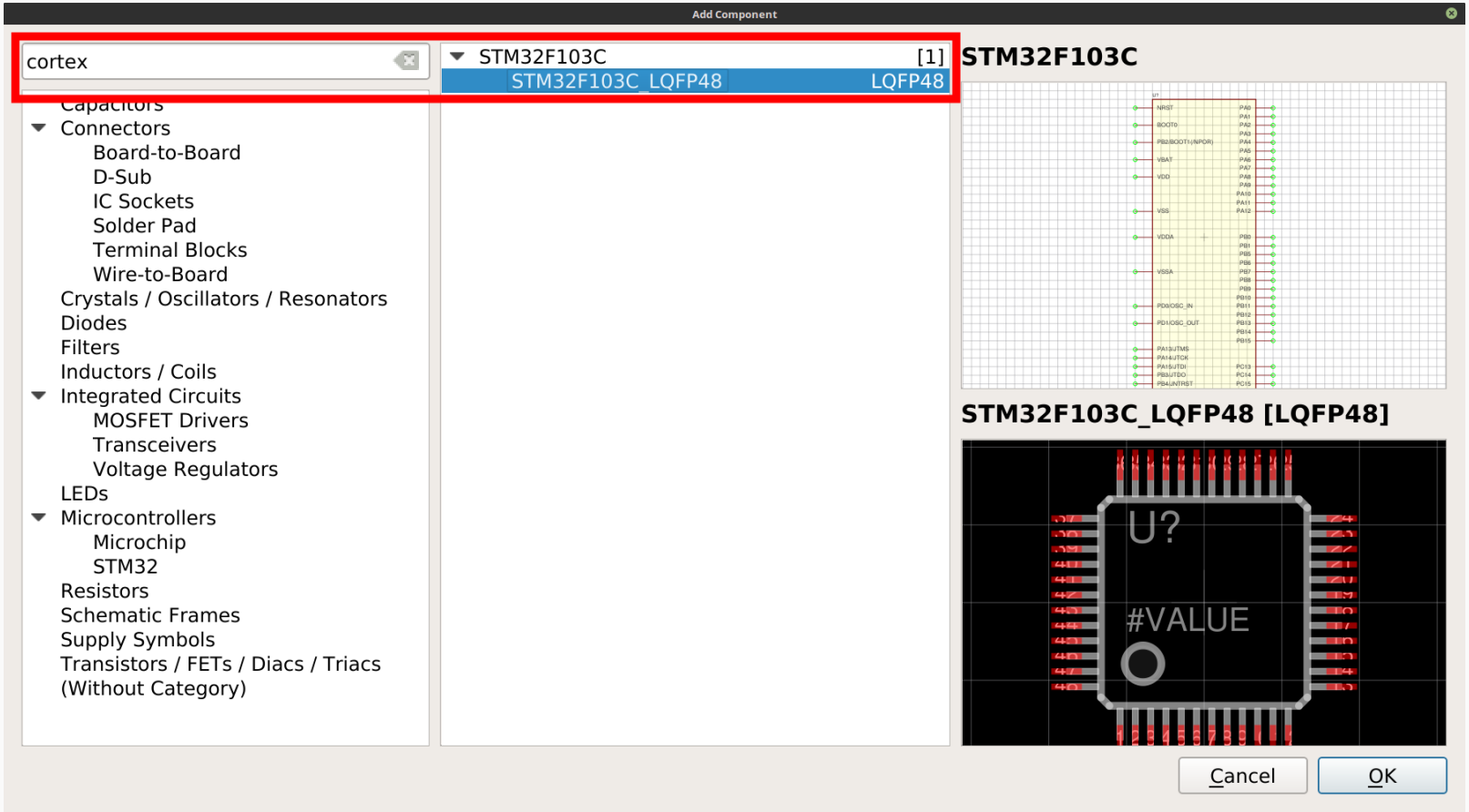

Footprint Assignment

Problem

- Schematics contain ”exact parts” (footprint known)

Footprint Assignment

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- Schematics contain "exact parts" (footprint known)

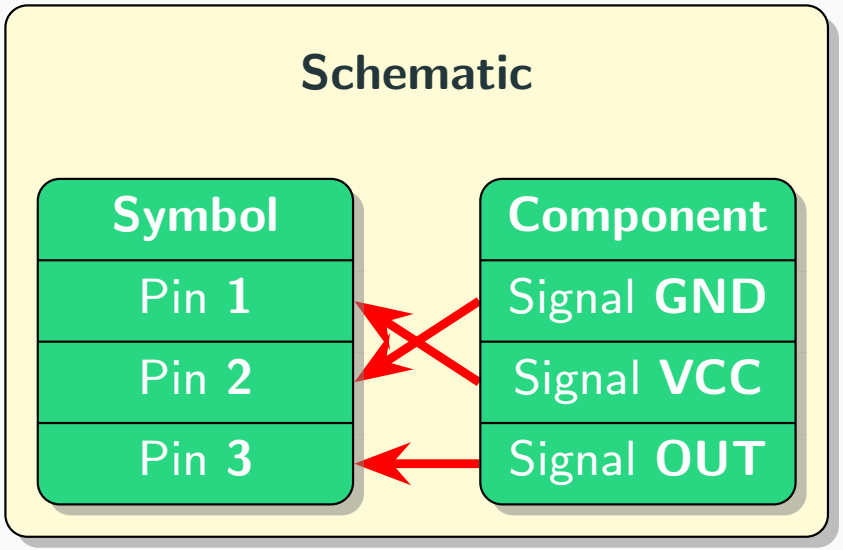
Result

- Wasting time for choosing (irrelevant) footprints in schematics
- Changing footprints afterwards requires to adjust schematics

Footprint Assignment

Solution

- Schematics contain "components" (footprint unknown)



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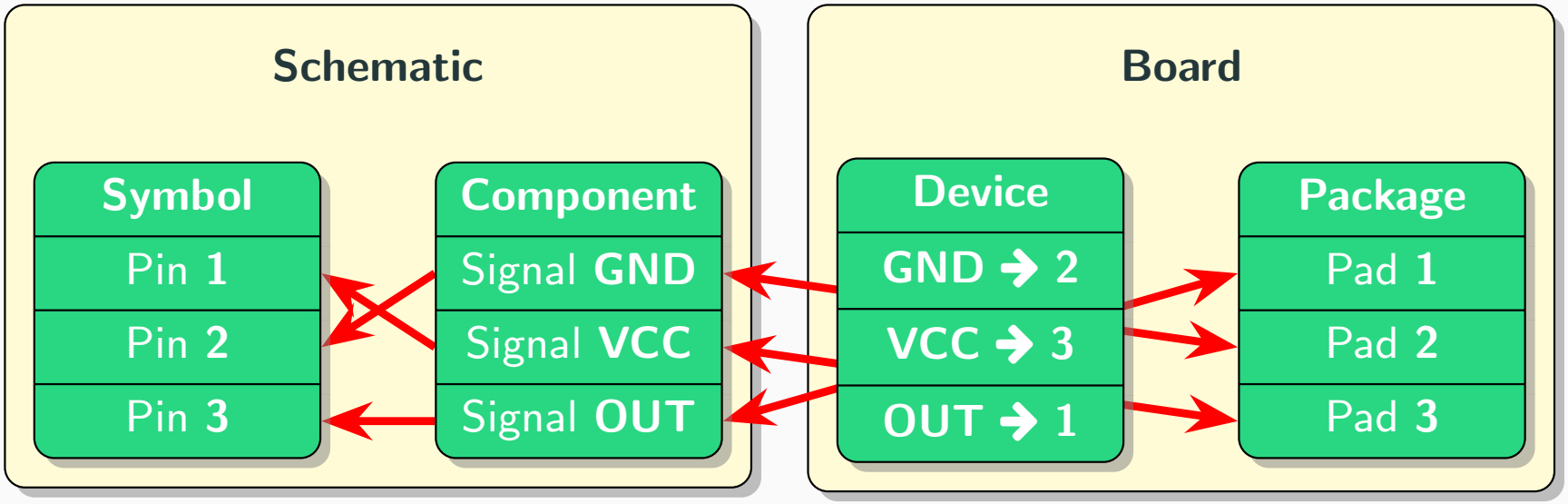
- Boards contain "devices" (assign package to component)



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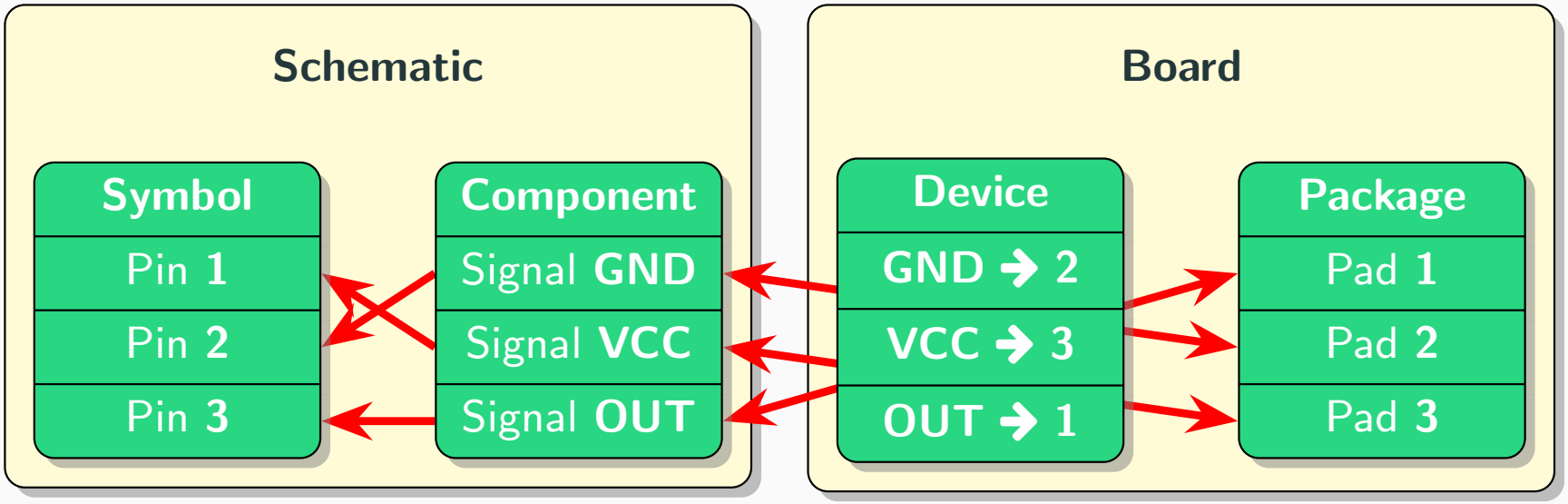

➔ Schematics can be drawn without worrying about footprints

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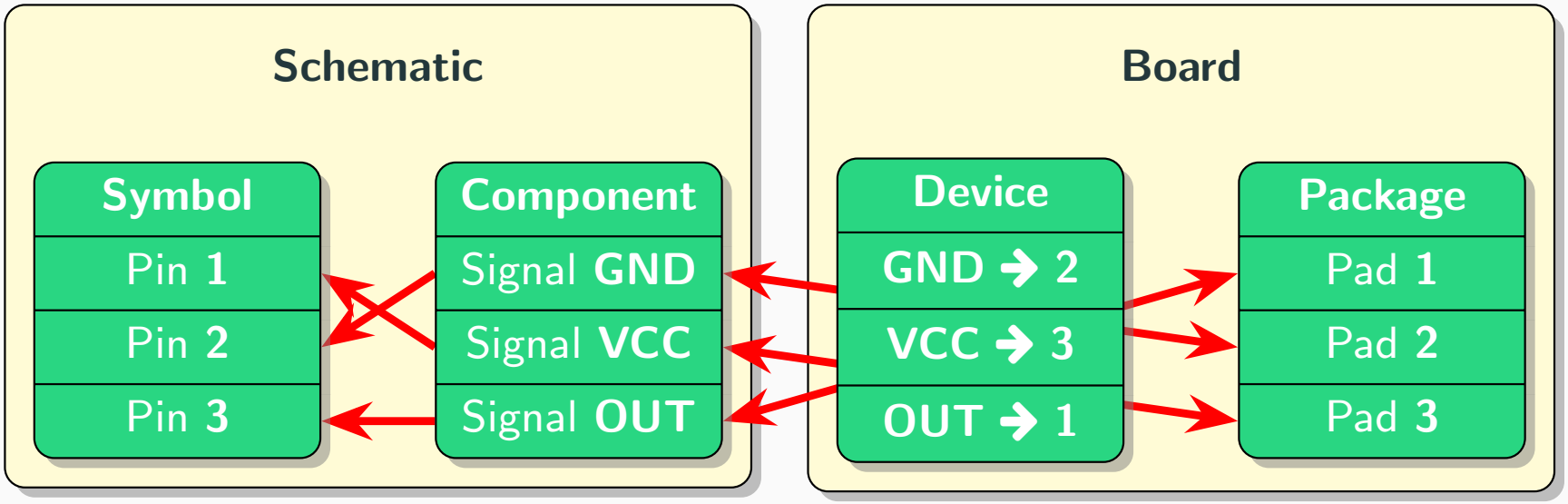

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➔ Footprints can easily be changed in boards

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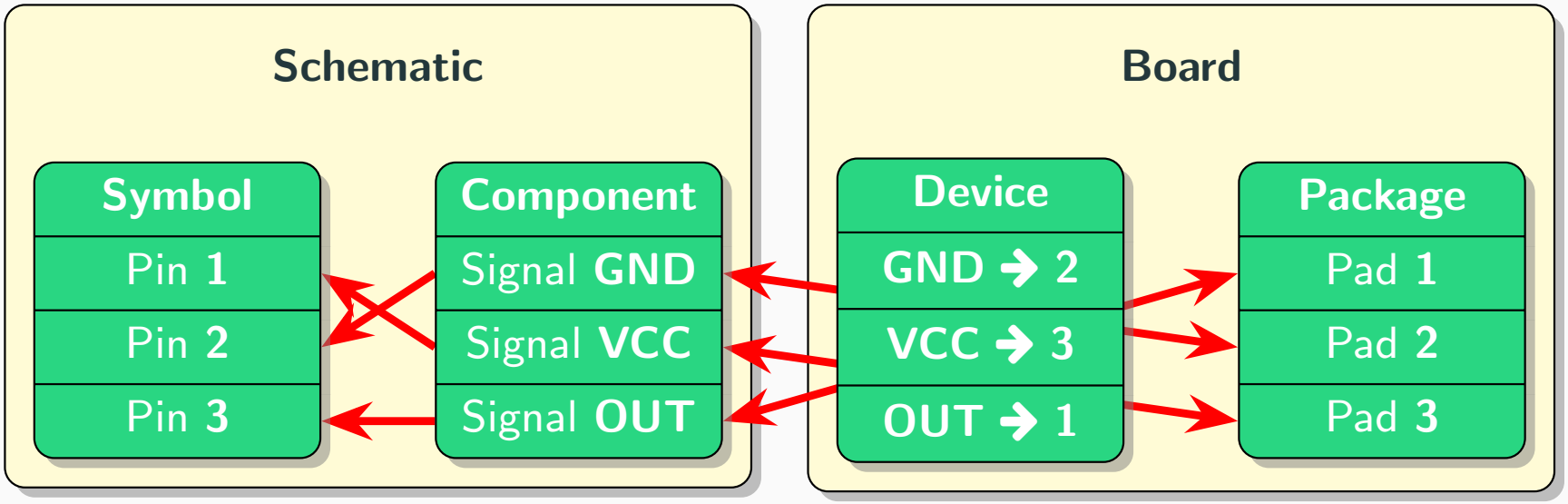

➔ Schematics can be drawn without worrying about footprints

➔ Footprints can easily be changed in boards

➔ Pin-to-pad mapping stored in library

Version Control Systems

Problem

- Important and unimportant data mixed
- Unclear which files to version control

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Result

- Local changes even if nothing modified
- Very large and opaque diffs/commits
- Merging is basically impossible

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- Unclear which files to version control

Result

- Local changes even if nothing modified
- Very large and opaque diffs/commits
- Merging is basically impossible

Solution

- Many small files for higher granularity
- Unimportant data strictly separated
- Automatic creation of `.gitignore`

```
MyProject
├── .gitignore
├── boards
│   └── default.lp
├── core
│   ├── circuit.lp
│   ├── erc.lp
│   └── settings.lp
├── output
│   └── ...
├── schematics
│   ├── power.lp
│   └── logic.lp
└── user
    └── ...
```

Version Control Systems

```
--- a/test.kicad_pcb
+++ b/test.kicad_pcb
@@ -3,7 +3,7 @@
   (general
     (no_connects 0)
-    (area 41.834999 87.554999 233.755001 153.745001)
+    (area 20.171999 28.969758 233.755001 157.374234)
     (drawings 4)
@@ -21,7 +21,7 @@
     (36 B.SilkS user)
-    (37 F.SilkS user)
+    (37 F.SilkS user hide)
     (38 B.Mask user hide)
@@ -62,7 +62,7 @@
     (aux_axis_origin 0 0)
-    (visible_elements FFFC4601)
+    (visible_elements FFFC4609)
     (pcbplotparams
```

KiCad 4.0.2+dfsg1-stable: zoom around, hide "F.SilkS", show "Through Via"

Problem

- Files are **not really** human readable

Version Control Systems

Problem

- Files are **not really** human readable

Result

- Diffs are very hard to understand
- Limited use of version control systems

Version Control Systems

Problem

- Files are **not really** human readable

Result

- Diffs are very hard to understand
- Limited use of version control systems

Solution

- Don't just consider text-based file formats as human readable!
- Control every tiny detail of the generated files
- Consider opaque parts of files as bugs and fix them

Project Status

Library Management		
Library Editor		
Schematic Editor		(except missing copy&paste)
Board Editor		(no DRC, some inconveniences)
Export (e.g. Gerber)		
Available Libraries		
File Format		Stable

Contributors welcome!

https://github.com/LibrePCB/LibrePCB/blob/master/CONTRIBUTING.md

IRC: #librepcb on Freenode

- **Participate in issues**
- **Open pull requests**
- **Improve documentation**
- **Donate (Patreon or Bitcoin)**

Getting Started

`https://download.librepcb.org/nightly_builds/master/`

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librepcb-nightly-linux-x86_64.AppImage

macOS

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Windows

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Libraries

Install the following libs:

- LibrePCB Base
- LibrePCB Connectors

Goals

To do:

- Create a PCB for the LED challenge in the tent outside
- Create missing library elements:
- Create a PCB
- If you want, manufacture it with the PCB mill

Library Elements

We need the following library elements:

- Connector for 12V wires, 1.6mm diameter holes ($\rightarrow$ We need a new Package and Device)
- SMD 1206 resistor ($\rightarrow$ From the standard lib)
- THT LED 5mm ($\rightarrow$ We need a new Package and Device) `https://katalog.we-online.de/led/datasheet/151053BS04500.pdf`
- Optional: Toggle button (no datasheet, ask Tony)

Thank you!

http://librepcb.org