ARE WE PLM YET?

A beginners introduction to product lifecycle management for KiCad

Teardown // 2025 // v1.0.2

01

INTRODUCTION

ABOUT ME

CHRIS WILSON

hardware design engineer
PM in PCBA manufacturing

COMMON GROUND ELECTRONICS

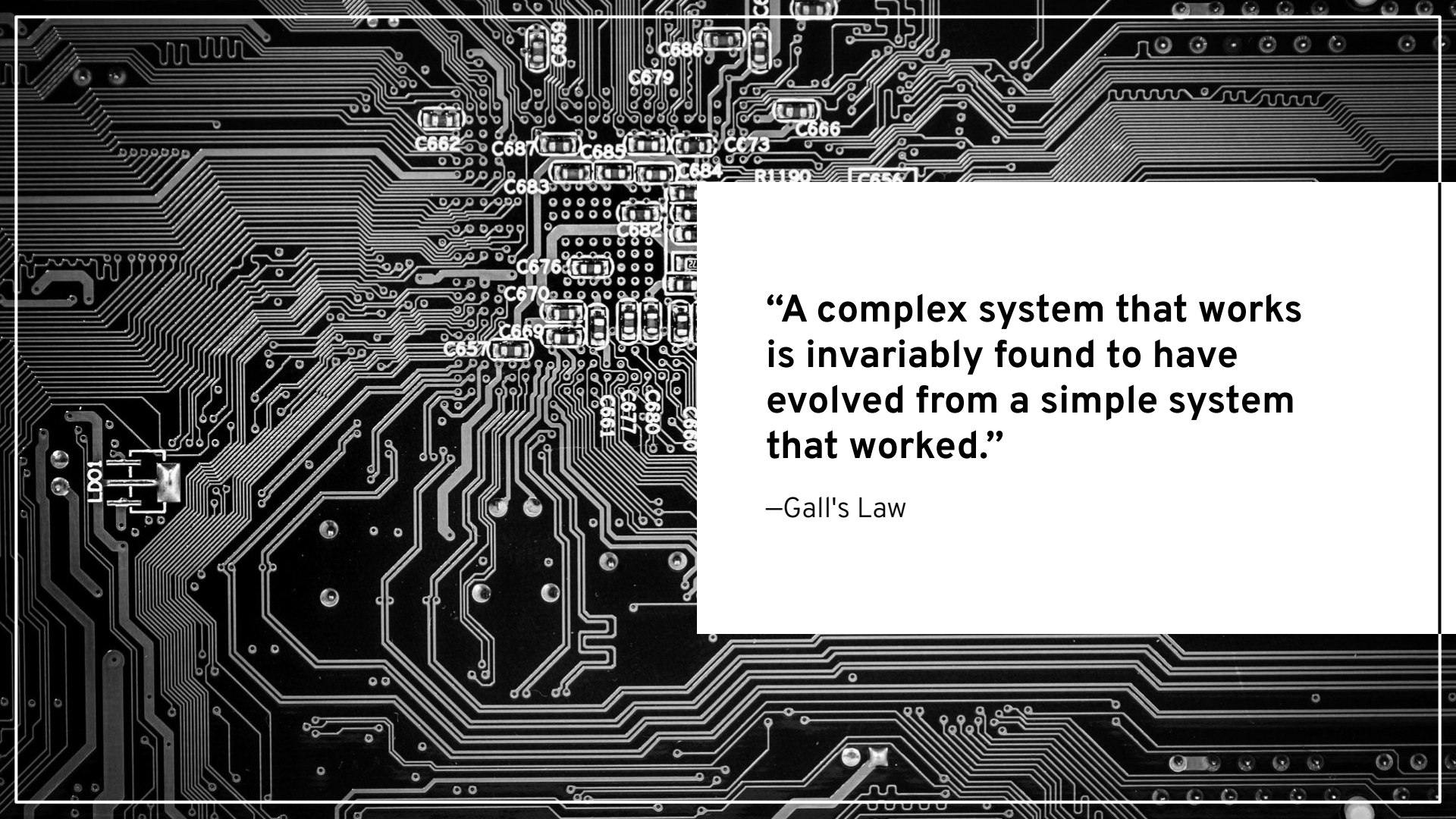
embedded systems
engineering services

LINK TO SLIDES & VIDEO

Feel free to ask questions and/or leave feedback in the comments section of this page.

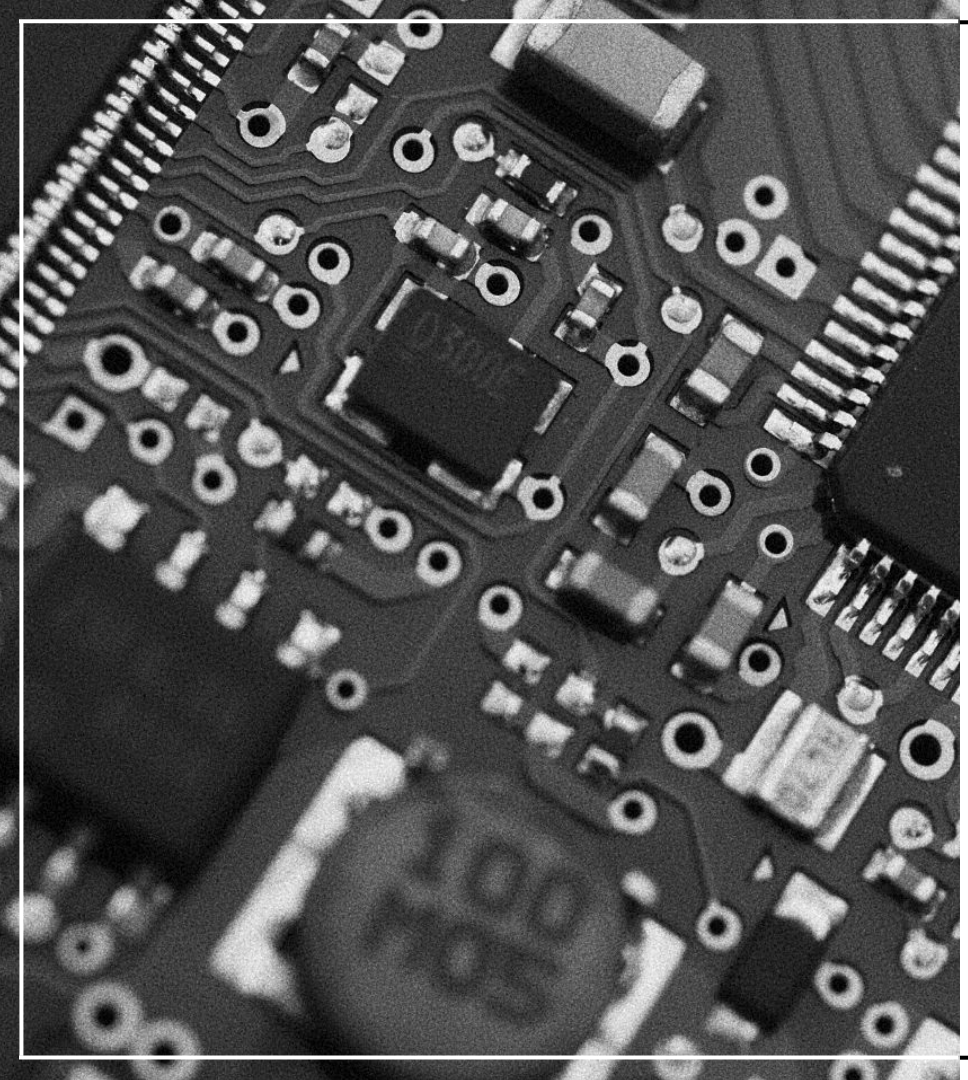
Email me: chris@cgnd.dev

https://cgnd.dev/posts/teardown-2025-talk-are-we-plm-yet/



“A complex system that works is invariably found to have evolved from a simple system that worked.”

—Gall's Law



A SIMPLE SYSTEM THAT WORKS

This talk is about my attempt at setting up a simple PLM workflow for KiCad that works for open-source designs.

GOALS (AND NON-GOALS) FOR THIS TALK

PLM can get pretty complex, we only have 50 min!

Goals

- Enough info to get started with PLM in a weekend
- Walk through PLM integration with KiCad + Aligni

Non-goals

- Cover every aspect of PLM
- Compare / contrast multiple PLM systems

02

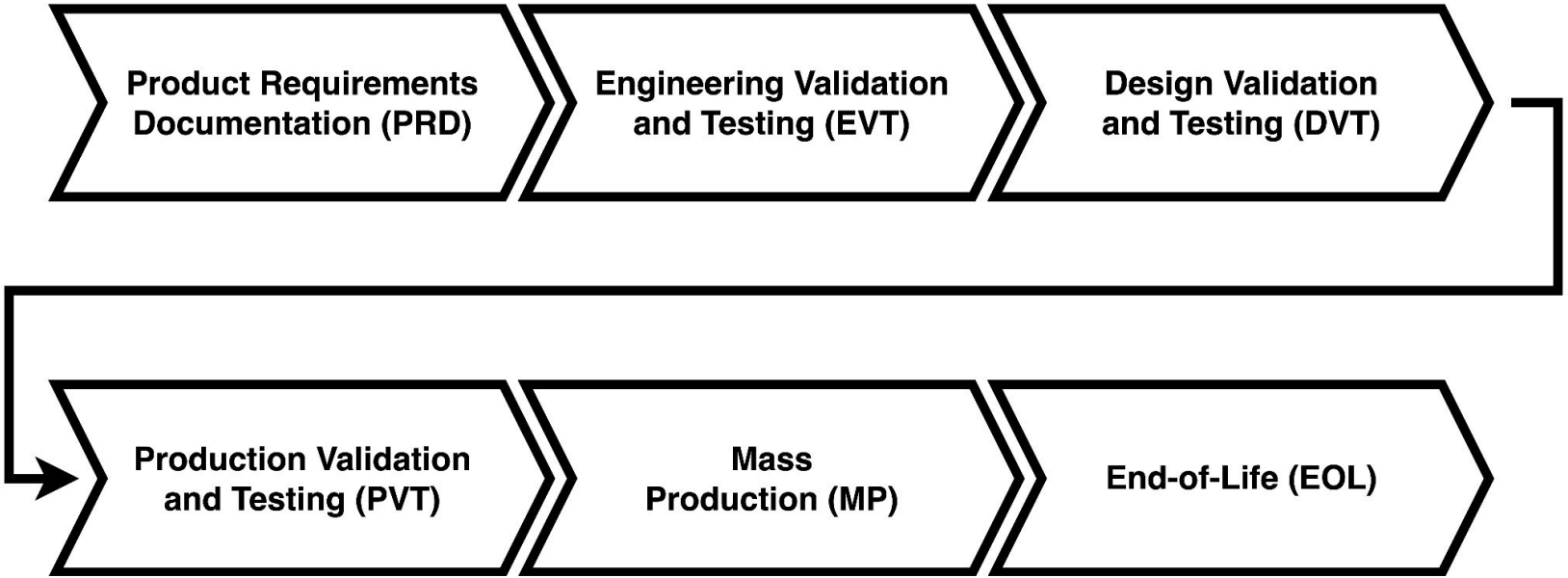
WHAT IS PLM?

A basic introduction to product lifecycle management

WHAT IS PLM?

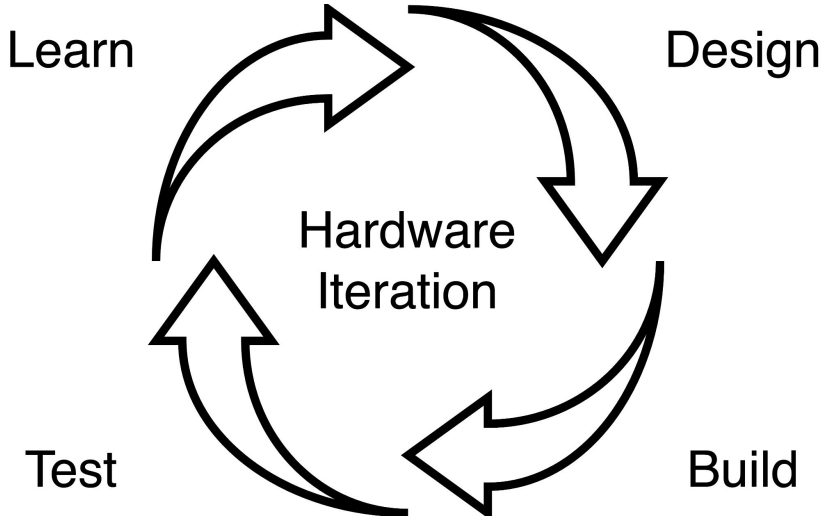
Product Lifecycle Management is a process that combines best practices and software tools to **centralize and structure product information** over the course of the product development lifecycle.

PRODUCT DEVELOPMENT LIFECYCLE



MULTIPLE HARDWARE ITERATIONS

Over the lifecycle of a product, the hardware design goes through multiple iterations.



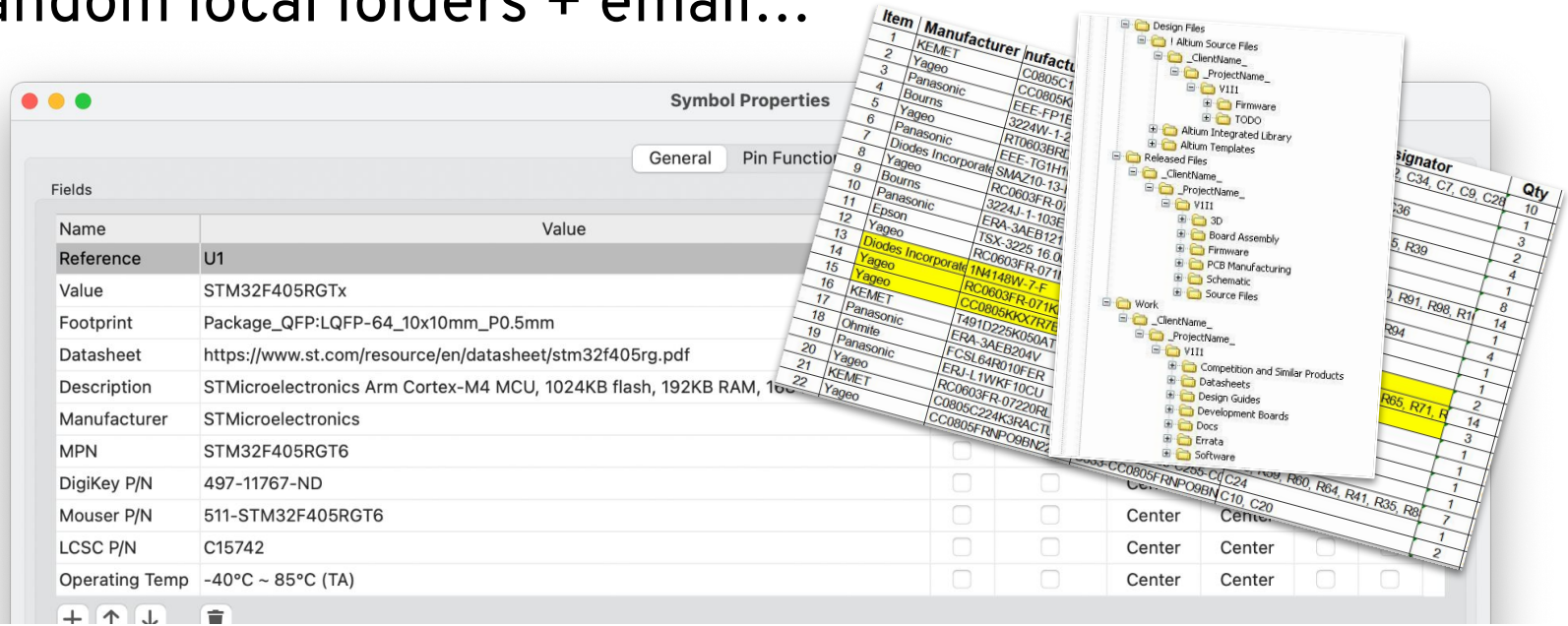
LOTS OF PRODUCT DATA TO MANAGE...

Each hardware iteration:

- Part numbers and revisions
- Parameters & specifications
- CAD files, drawings, manufacturing documentation
- Bill of Materials (BOM)
- Suppliers
- Regulatory compliance documentation
- etc...

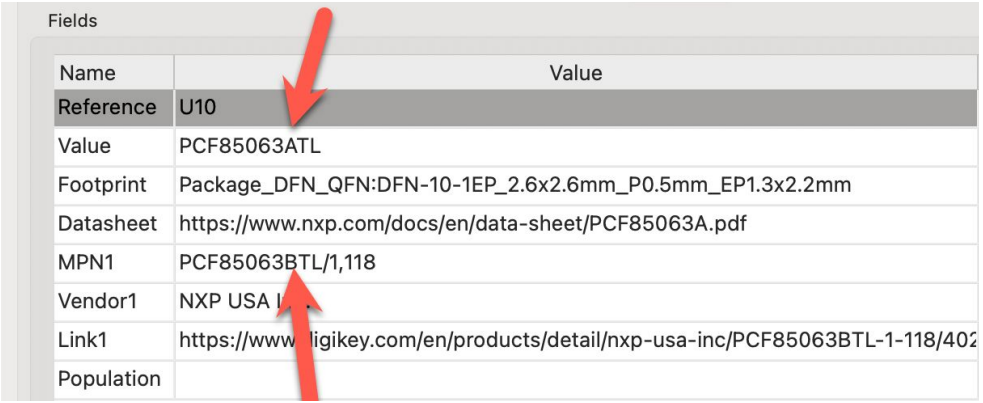
WHERE IS THIS DATA USUALLY STORED?

Sometimes in KiCad + spreadsheets + Google Drive + random local folders + email...



THIS IS NOT IDEAL

- Product data is siloed in KiCad
- Product data can become outdated
  - e.g. acquisitions (Fairchild → On Semi, etc)
- It's much easier to make mistakes with manual input!

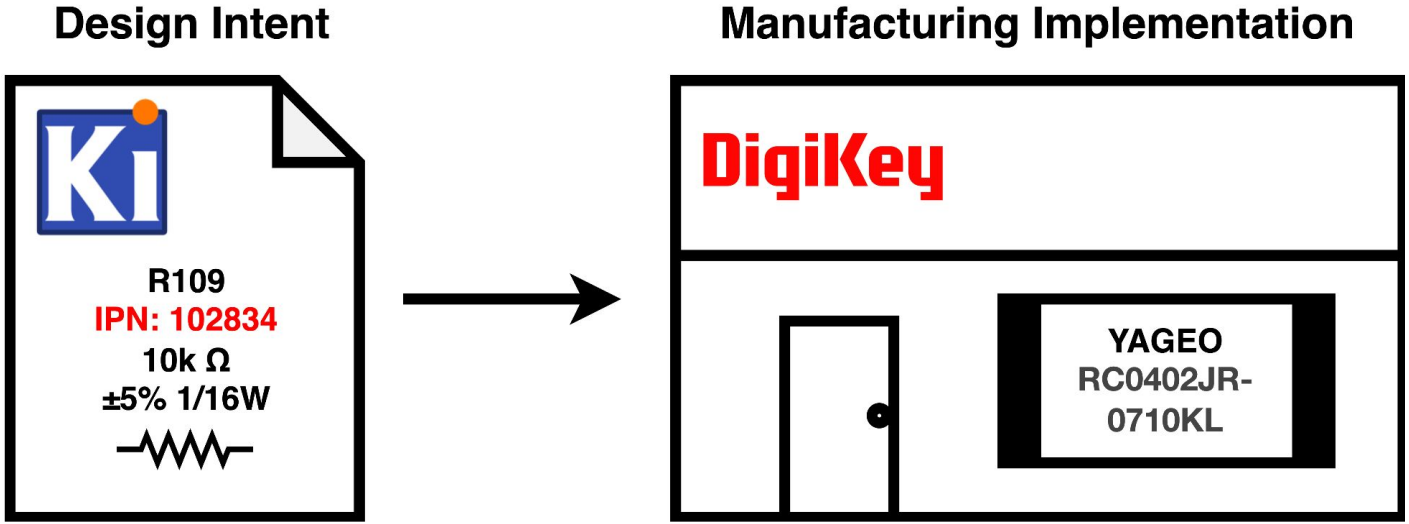


THERE'S GOTTA BE A BETTER WAY!

This darn data is so flingin' flangin' hard to manage!

DECOUPLE DESIGN FROM MANUFACTURING

Ideally CAD should reflect **design intent**, not a snapshot of today's supply chain data.



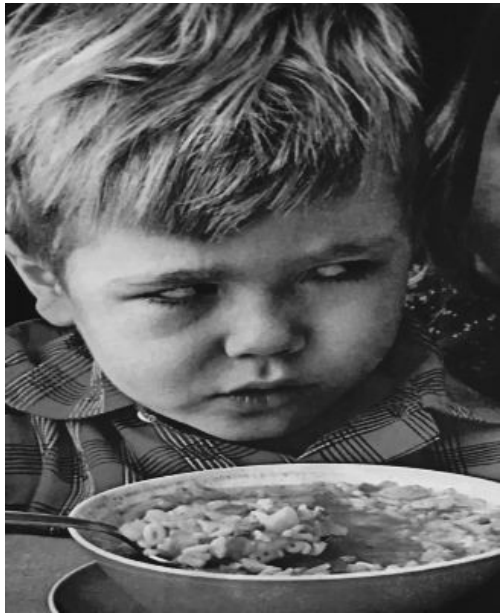
PLM SOFTWARE

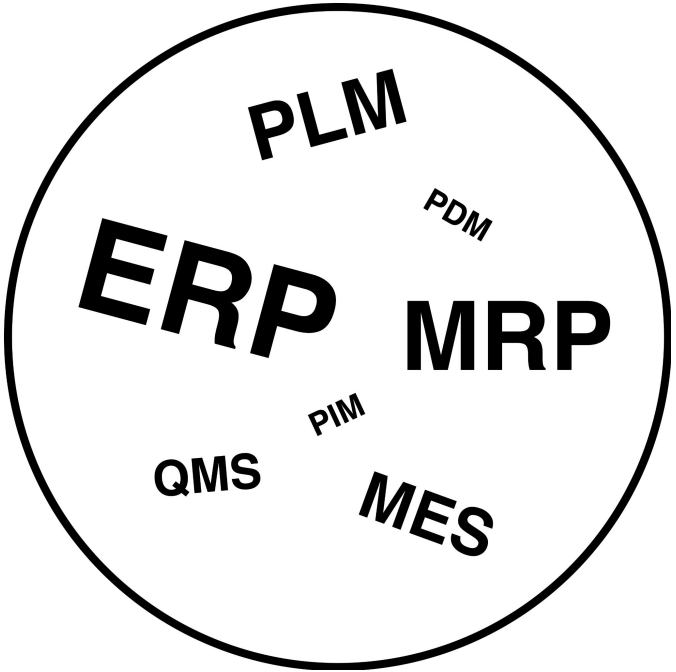
People realized this and made…PLM software!

WHAT DOES PLM SOFTWARE DO?

- Centralized “single source of truth” for product data
  - Part numbers, revisions, BOMs, documents, etc.
- Enables access to product data using role based access controls (internal teams & external vendors)
- Change management (ECR/ECO) and quality workflows
- Auditable change history
- Integrates with other systems (PDM ↔ CAD, MRP/ERP, MES, PIM, etc)

DECIPHERING THE “ALPHABET SOUP”





DECIPHERING THE “ALPHABET SOUP”

Product Data Management (PDM)

- Engineering tool to manage/version design files

Product Lifecycle Management (PLM)

- Central hub for product data, approvals, and lifecycle

Material Requirements Planning (MRP)

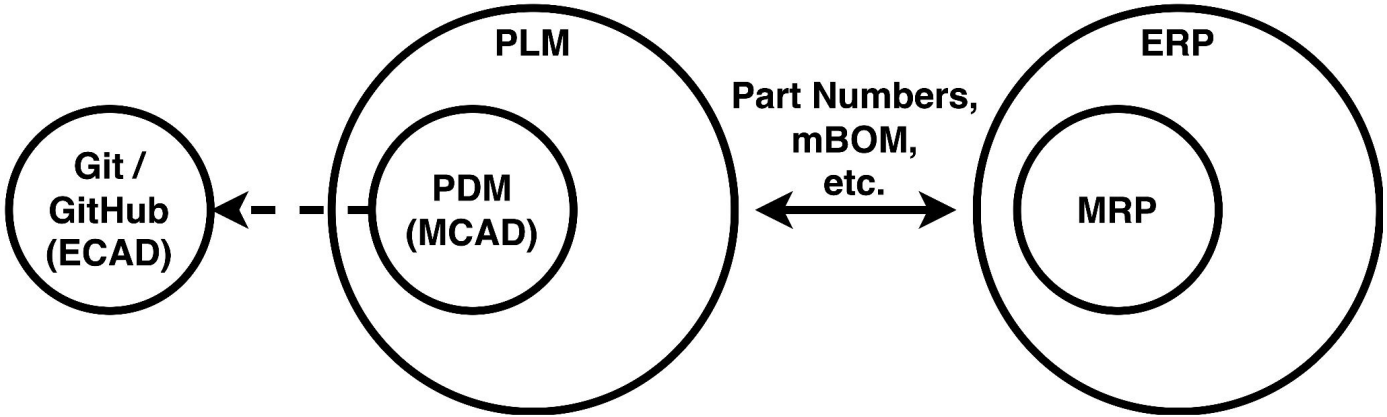
- Inventory, purchasing, scheduling, demand planning

Enterprise Resource Planning (ERP)

- Business and supply chain logic across departments

DECIPHERING THE "ALPHABET SOUP"

- PDM is typically a subset of PLM (MCAD)
  - More recently, ECAD tools using Git for PDM
- MRP is typically a "module" in a larger ERP system
- Product data flows from PLM to ERP (e.g. mBOM)



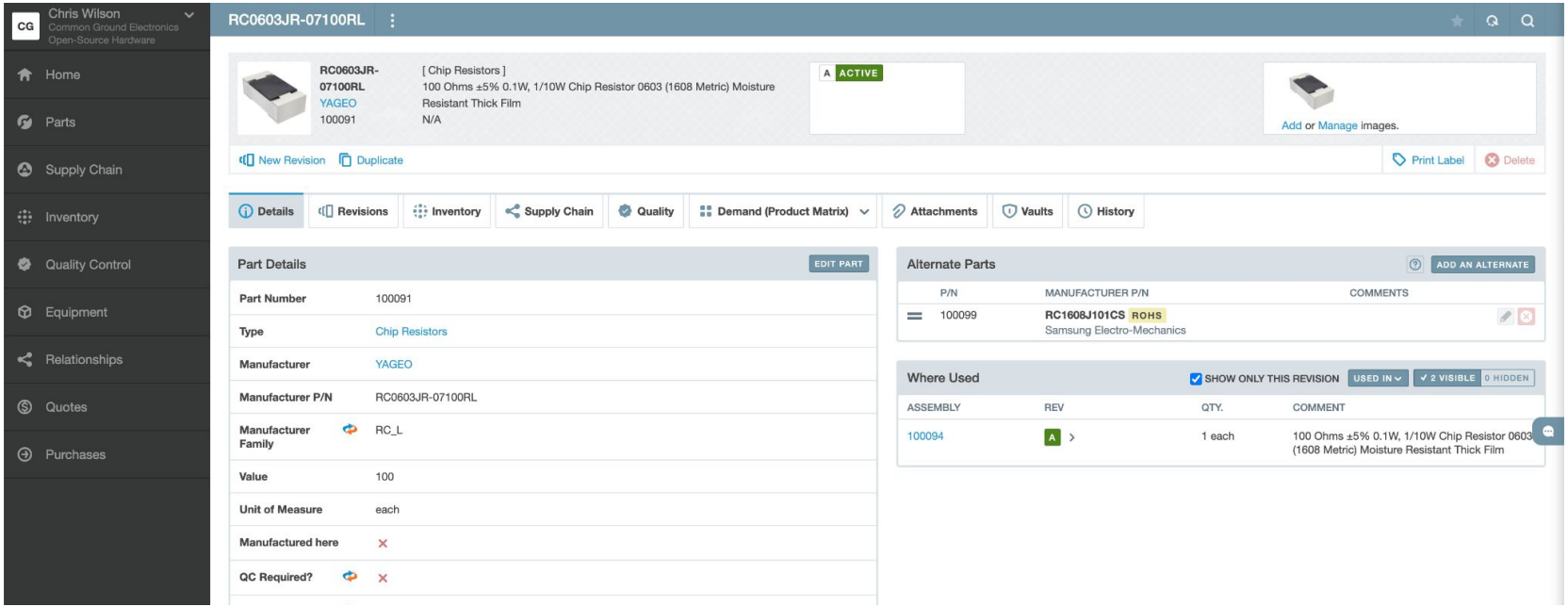
03

KICAD + ALIGNI

KiCad database library integration
with Aligni PLM

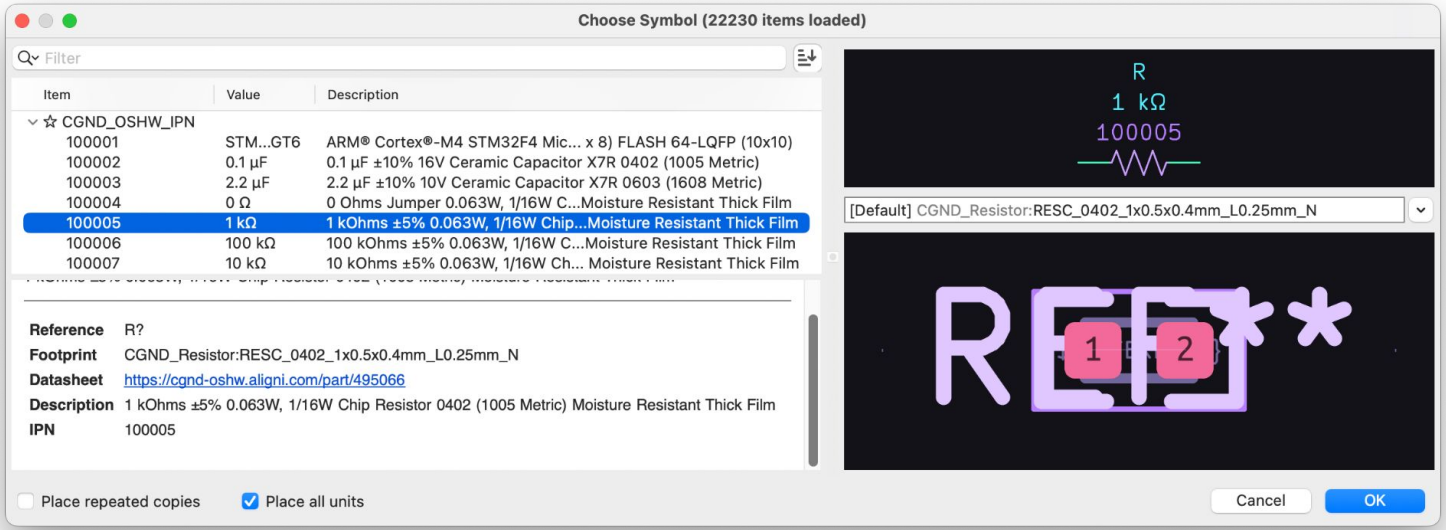
KICAD + ALIGNI // INTEGRATION GOALS

Part & supply chain data stored in Aligni (not KiCad)



KICAD + ALIGNI // INTEGRATION GOALS

Auto-generated library of fully-defined (“atomic”) parts



KICAD + ALIGNI // INTEGRATION GOALS

Import assembly BOM in Aligni directly from KiCad schematic BOM export

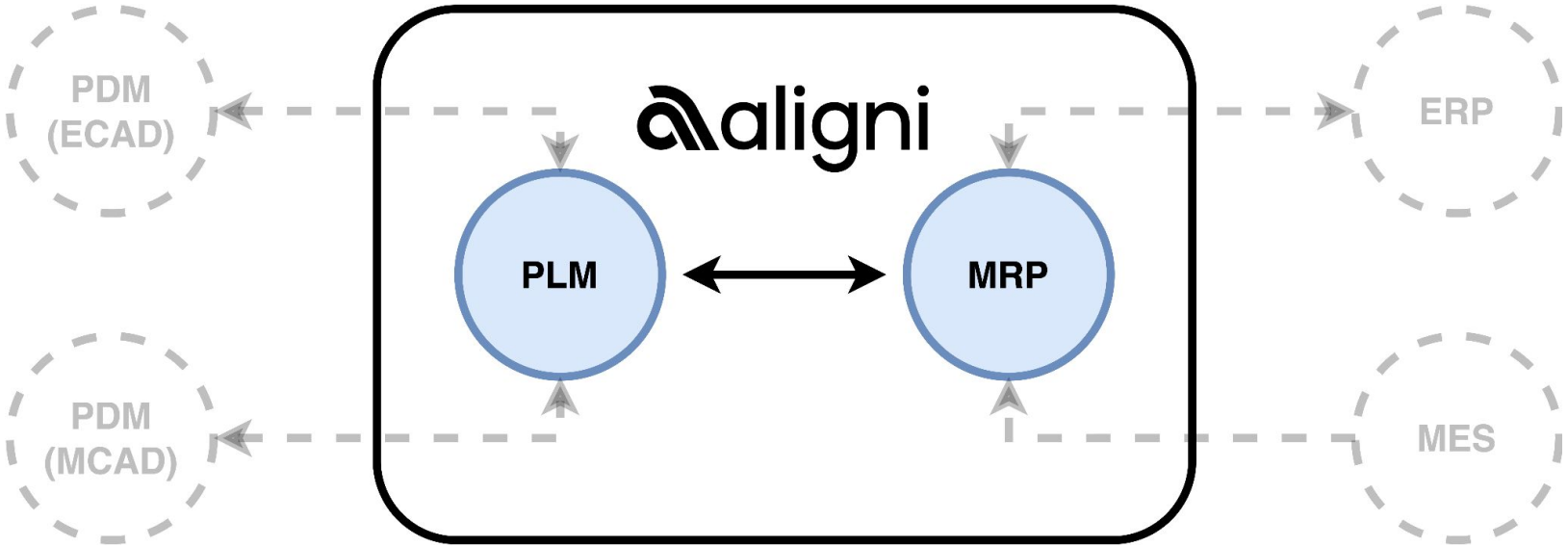
RPi_Pico_SAO_Host_v2_E...

#	#	Qty	Reference	#	IPN	Value	Description	Datasheet	DNP
	1	1	A1		100017	Raspberry Pi Pico	Raspberry Pi Pico, Microc	https://cgnd-oshw.aligr	
	2	1	D1		100089	Green	Green 570nm LED Indicati	https://cgnd-oshw.aligr	
	3	1	DOC1		100093	Pico SAO Host v2 Schematic	Raspberry Pi Pico SAO Ho	https://cgnd-oshw.aligr	
	4	2	J1,J2		100083	SFH11	6 Position Header Connec	https://cgnd-oshw.aligr	
	5	1	PCB1		100092	Pico SAO Host v2 PCB	Raspberry Pi Pico SAO Ho	https://cgnd-oshw.aligr	
	6	1	R1		100091	100 Ω	100 Ohms ±5% 0.1W, 1/1C	https://cgnd-oshw.aligr	
	7	1	R2		100090	560 Ω	560 Ohms ±5% 0.1W, 1/1C	https://cgnd-oshw.aligr	
	8	1	SW1		100069	PTS810SJM250SMTRLFS	Tactile Switch SPST-NO Tc	https://cgnd-oshw.aligr	
	9	1	SW2		100051	JS102011SAQN	Slide Switch SPDT Surfac	https://cgnd-oshw.aligr	

ALIGNI // INTRODUCTION

ALIGNI // PLM + MRP

Aligni combines PLM & MRP functionality



ALIGNI // PLM + MRP

- Part database (“Item Master”)
- Engineering change management (ECR/ECO)
- Quality control workflows
- Inventory management
- Planning & build management
- Supply chain management
  - Quoting / purchasing
  - Manufacturers / Vendors / Customers

ALIGNI // PLM + MRP

- **Part database (“Item Master”) ← this talk**
- Engineering change management (ECR/ECO)
- Quality control workflows
- Inventory management
- Planning & build management
- Supply chain management
  - Quoting / purchasing
  - Manufacturers / Vendors / Customers

ALIGNI // WHY ALIGNI?

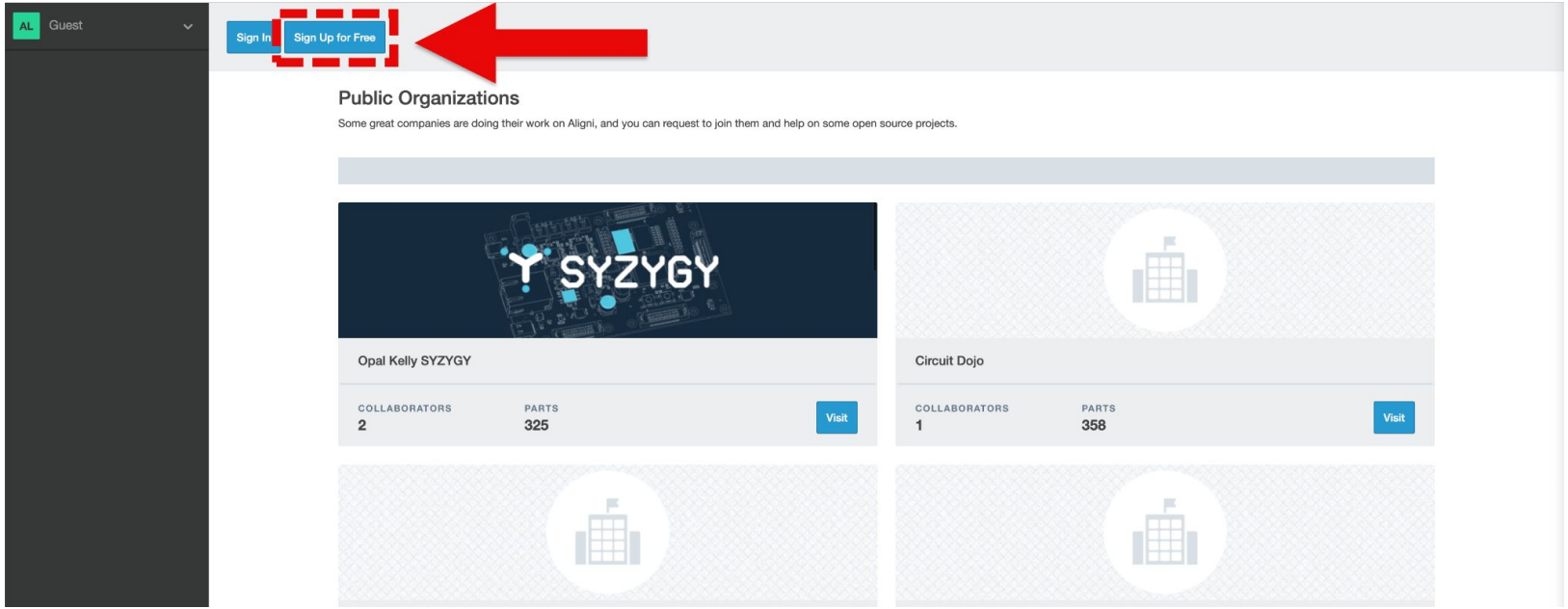
- Hosted solution with simple setup
- Support for KiCad database (or HTTP) libraries
- ECAD agnostic (e.g. supports Altium also)
- Free tier with no time limit
- Public access for open-source projects (Open Aligni)
- Automatically managed internal part numbers

Aligni was the only solution that met these criteria*

*In the last couple weeks, PartsBox added support for KiCad HTTP libraries

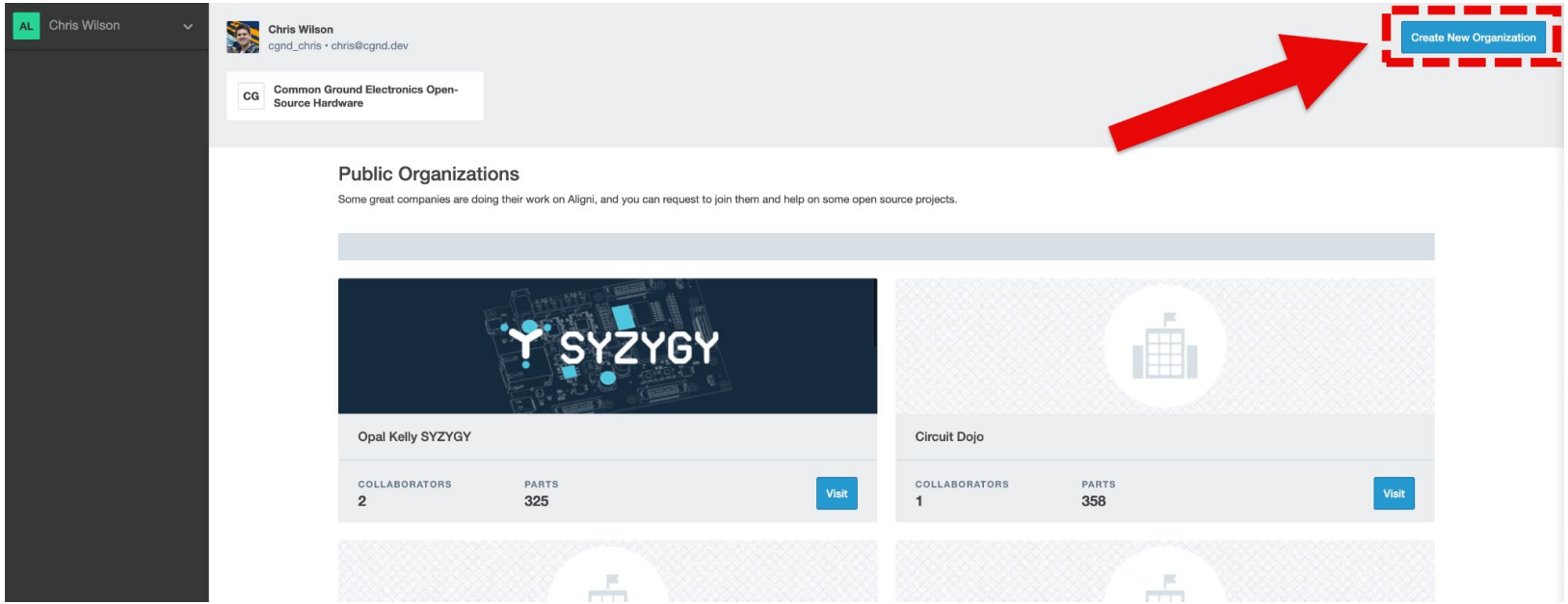
ALIGNI // SETUP // SIGN UP

Sign up for an account: https://app.aligni.com/catalog



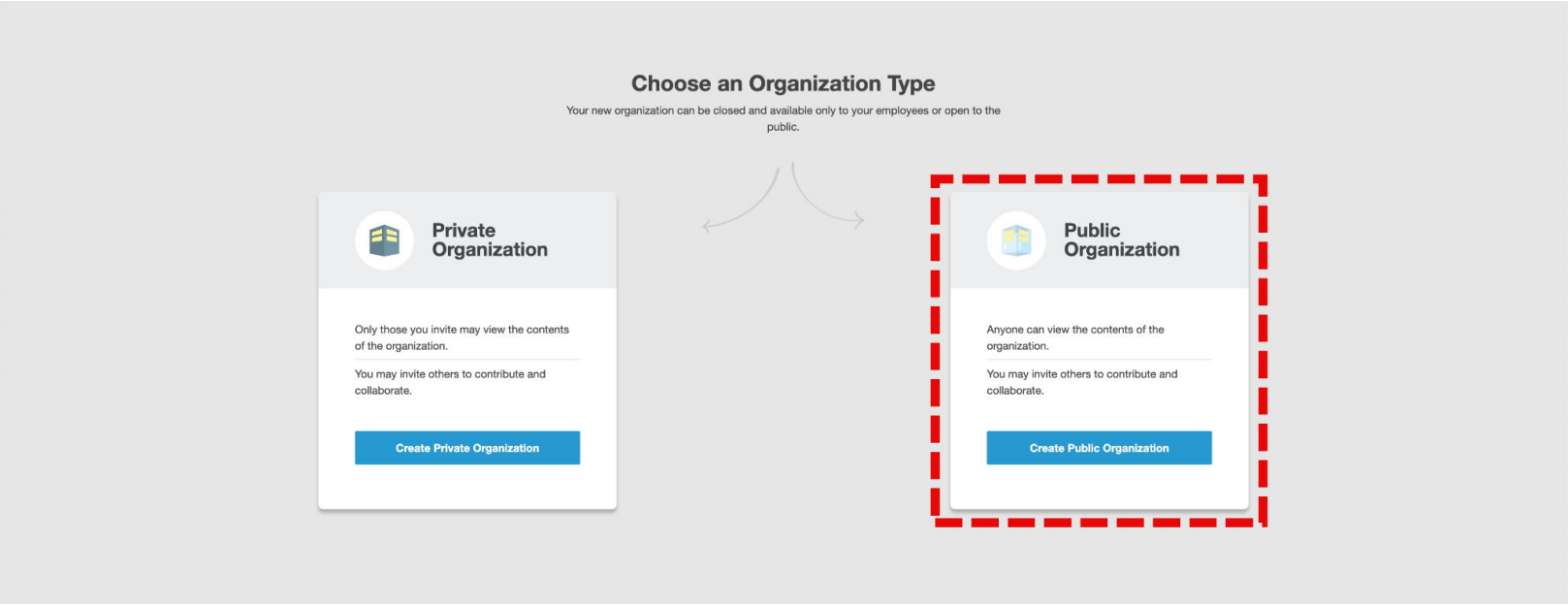
ALIGNI // SETUP // CREATE A NEW ORG

Create a new organization

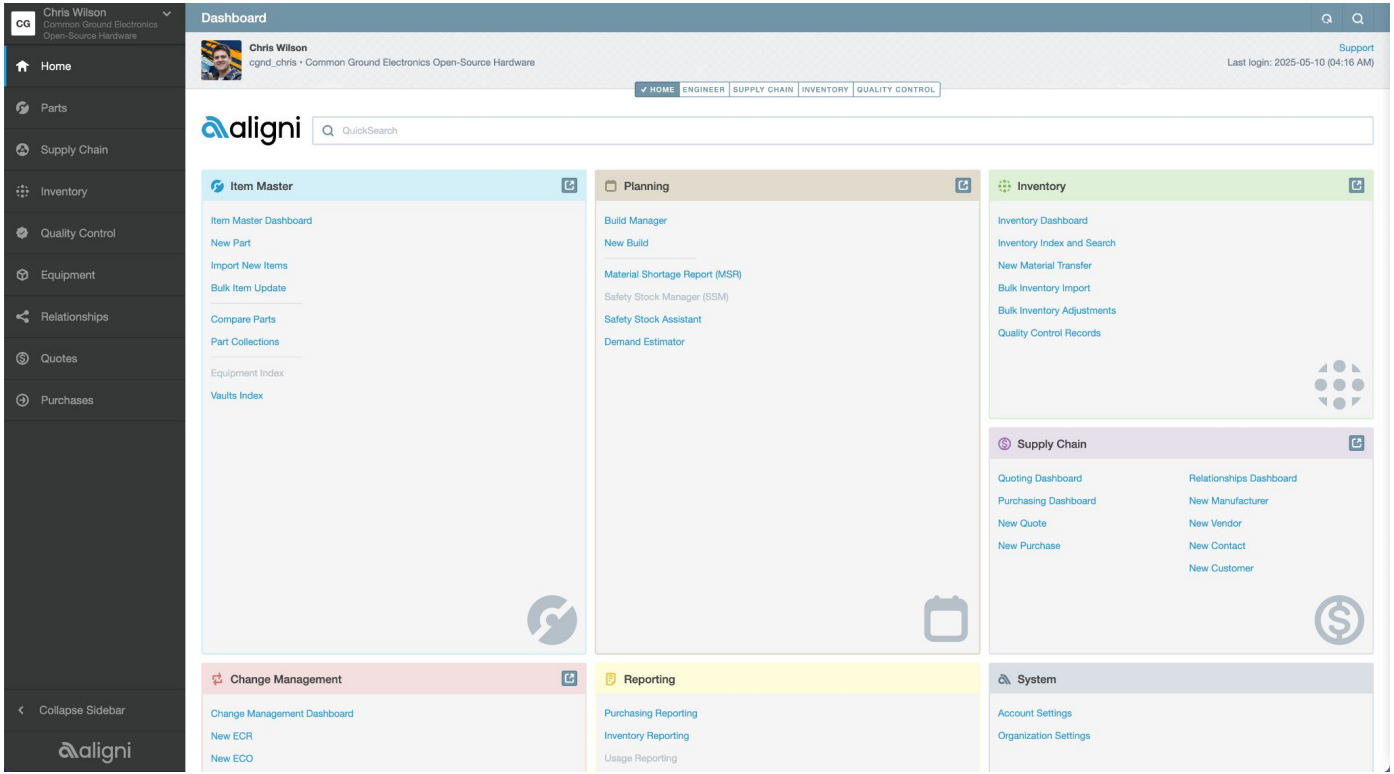


ALIGNI // SETUP // CREATE A NEW ORG

Choose “Public Organization” (free for open-source HW)

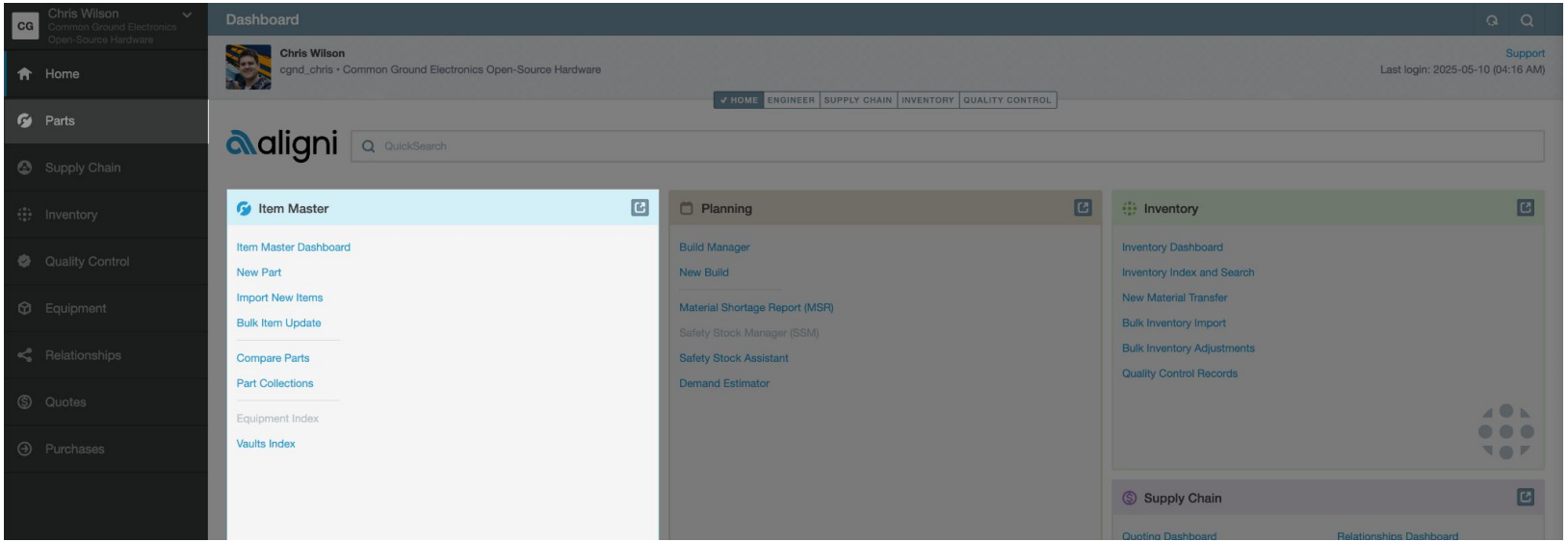


ALIGNI // DASHBOARD



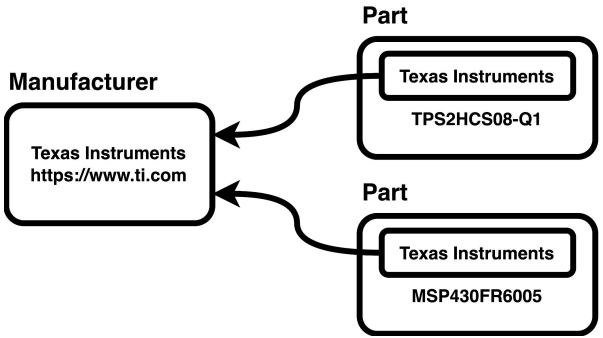
ALIGNI // ITEM MASTER

Focus of this talk is setting up the **Item Master** database as the source of part data for KiCad.

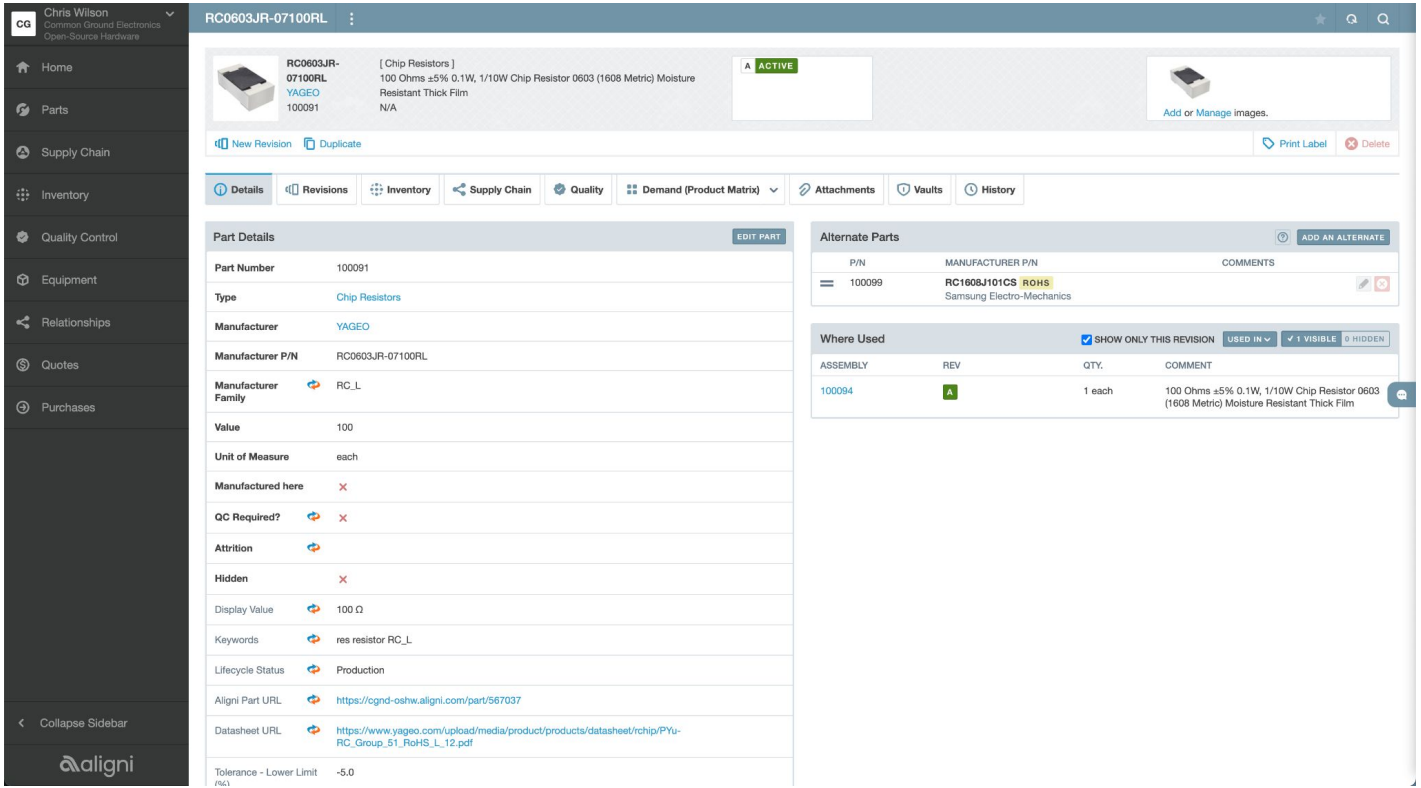


ALIGNI // ITEM MASTER

- "*Single source of truth*" central repository for part data that can be used in other systems
- Part numbers, descriptions, specifications, costs, suppliers, and other essential part attributes
- Backed by a "normalized relational database"

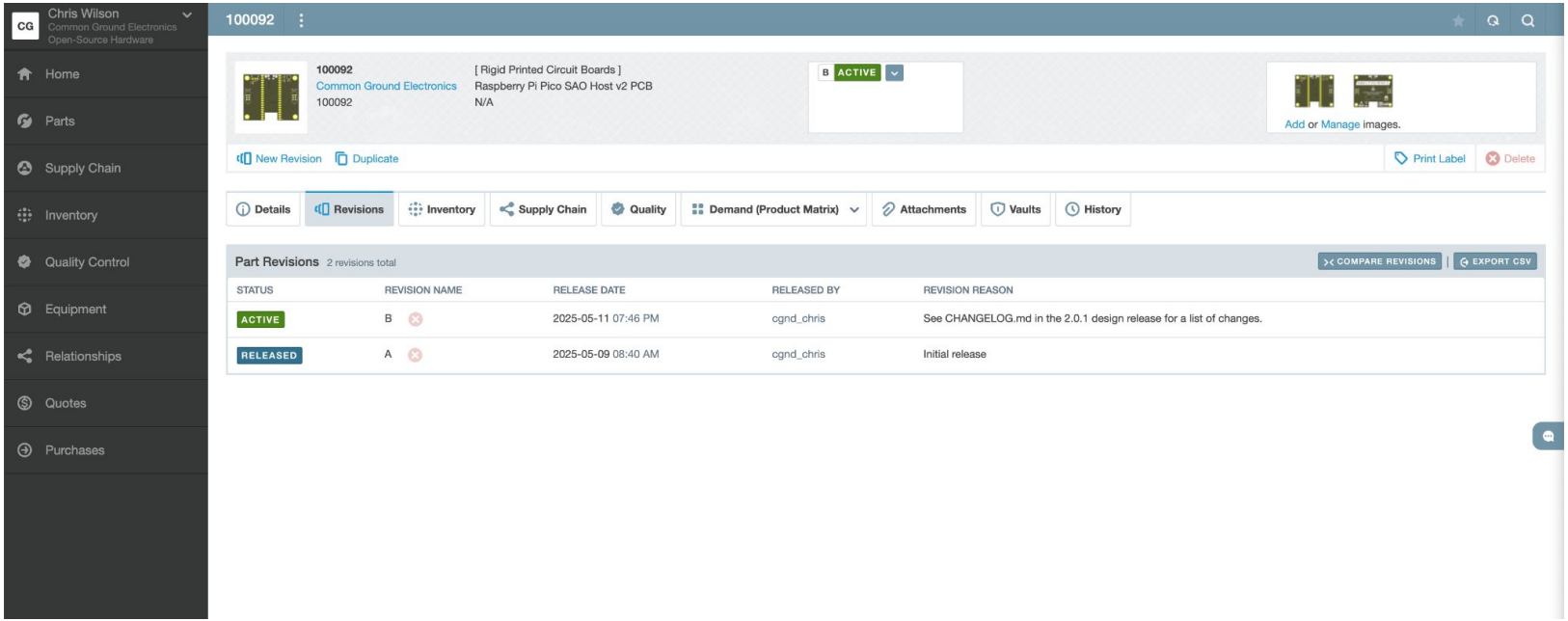


ALIGNI // PARTS



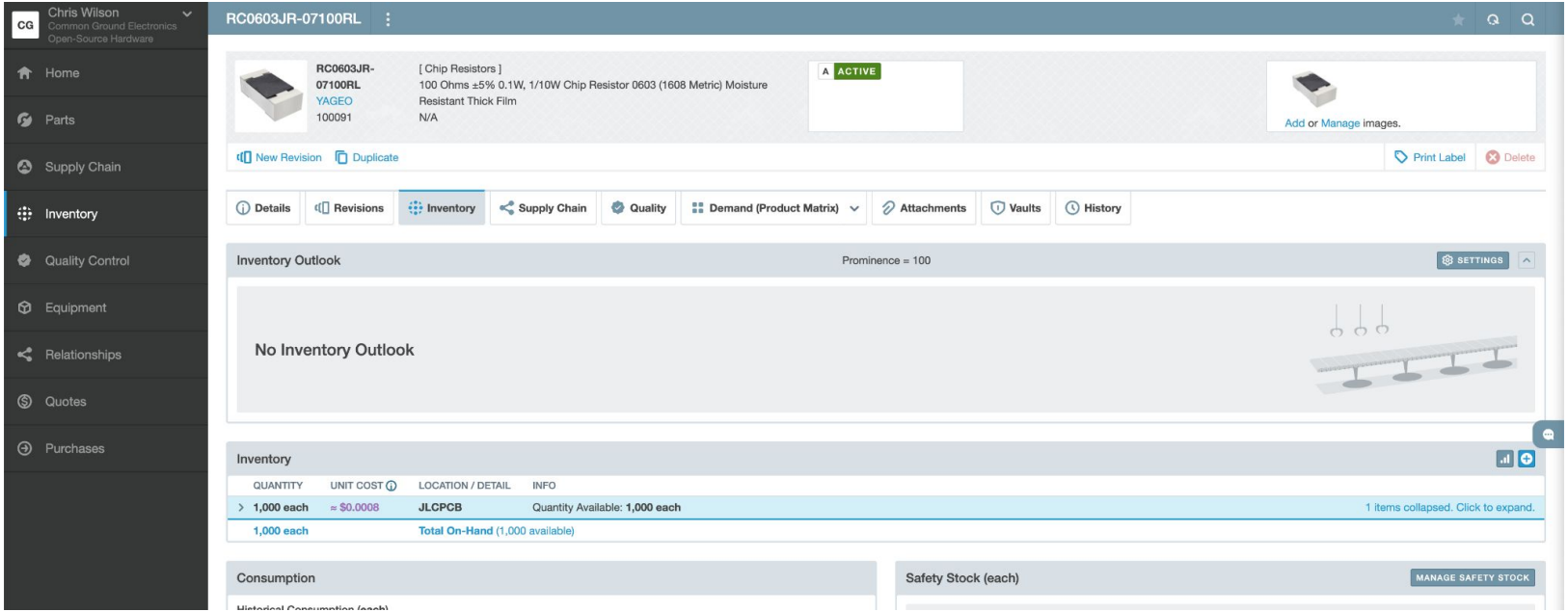
ALIGNI // PARTS // REVISIONS

Revisions: track changes to parts (more on this later)



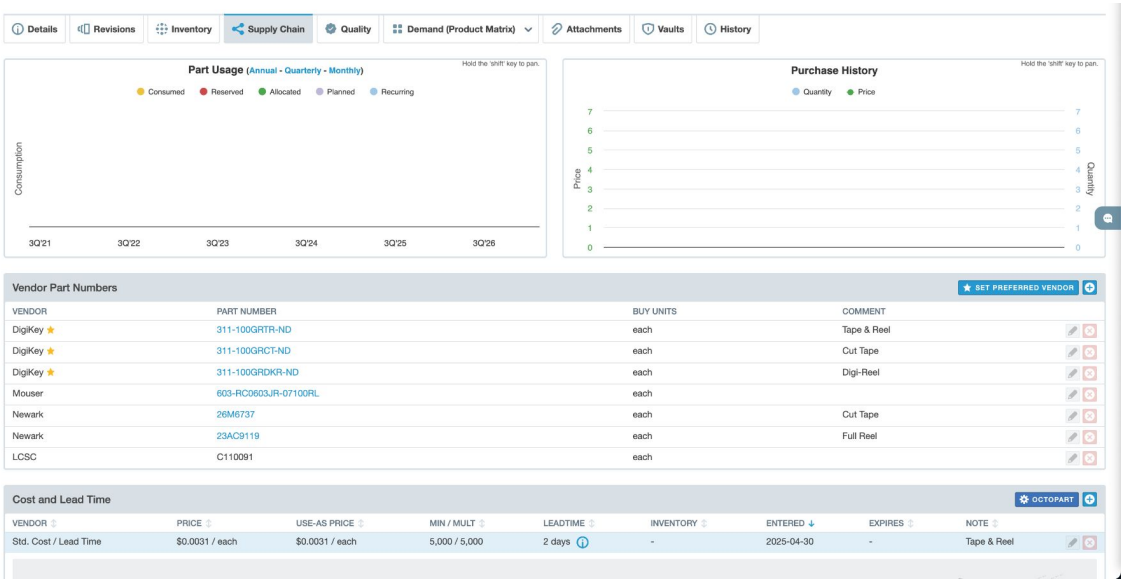
ALIGNI // PARTS // INVENTORY

Warehouse location and stock count of this part



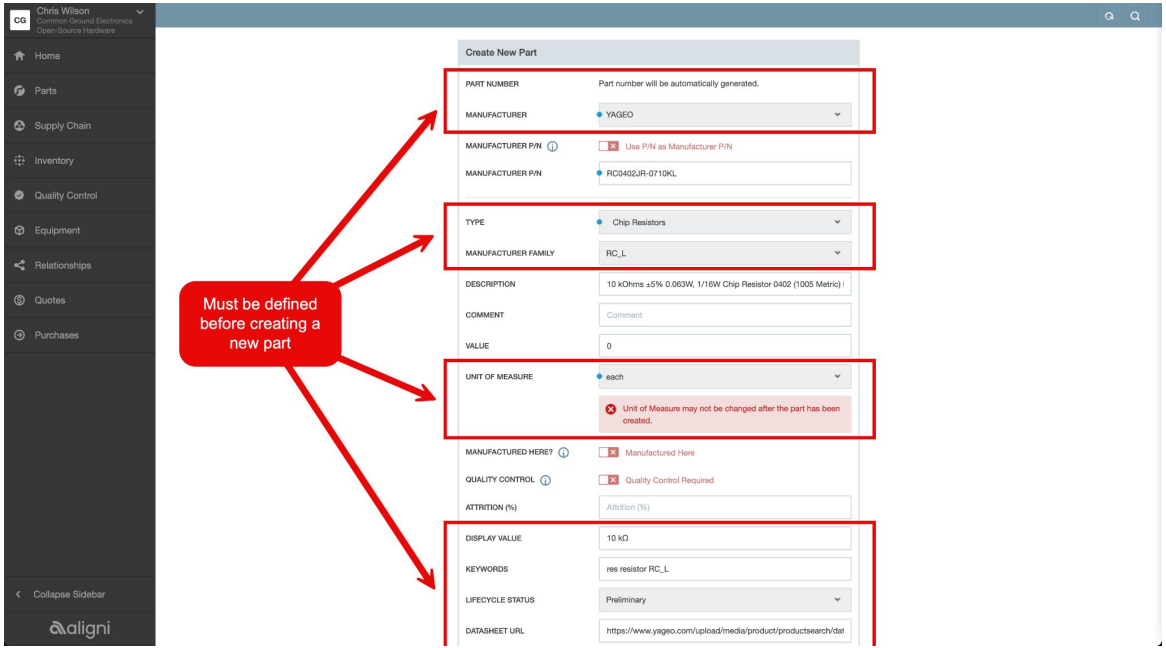
ALIGNI // PARTS // SUPPLY CHAIN

One-to-many relationship between the part in Aligni and supplier part number (SKU)



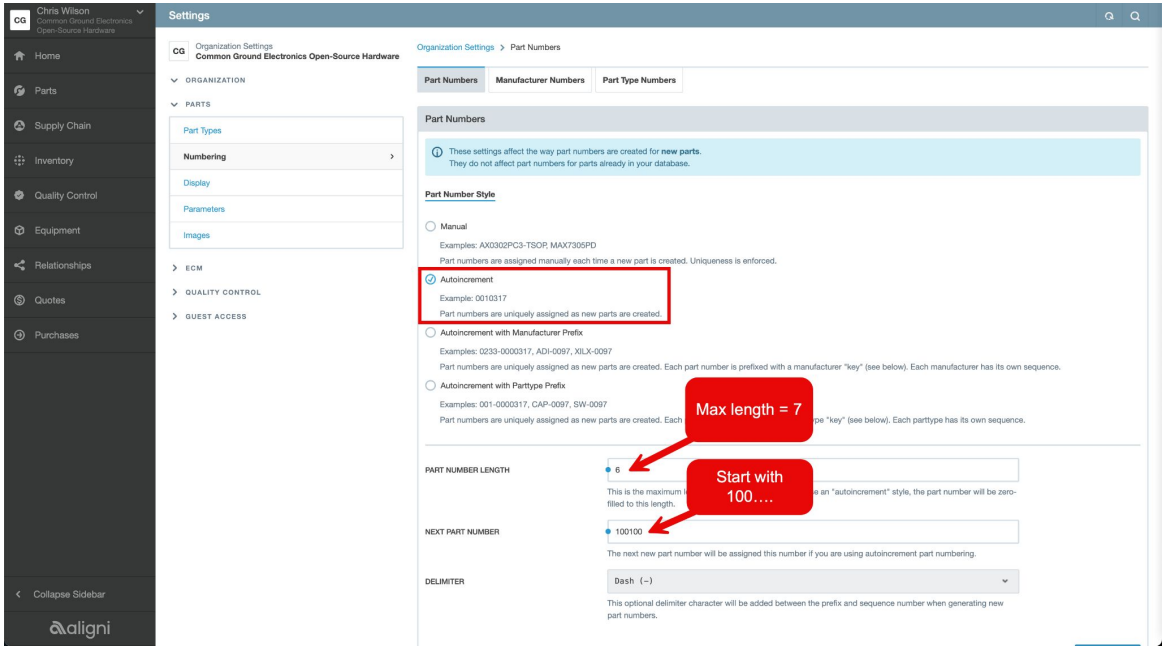
ALIGNI // PARTS // CREATING NEW PARTS

Some initial setup required before creating new parts



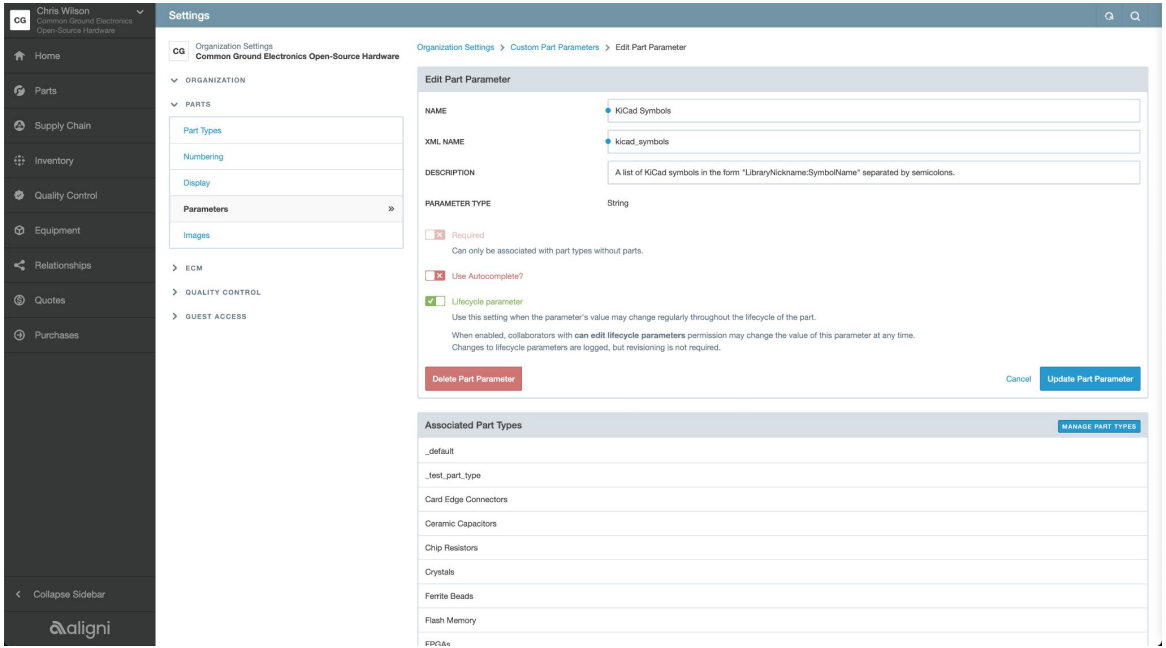
ALIGNI // SETUP // PART NUMBER SCHEME

Recommended: non-intelligent IPN scheme (`100001`)



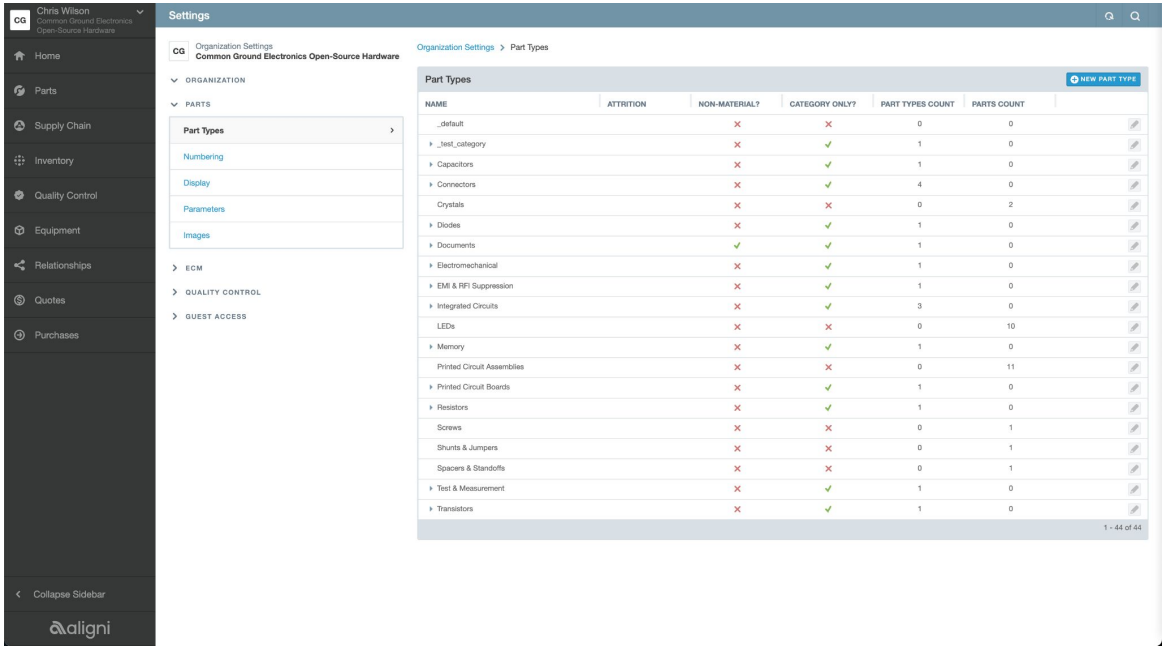
ALIGNI // SETUP // CUSTOM PARAMETERS

Example: “KiCad Symbols” custom parameter



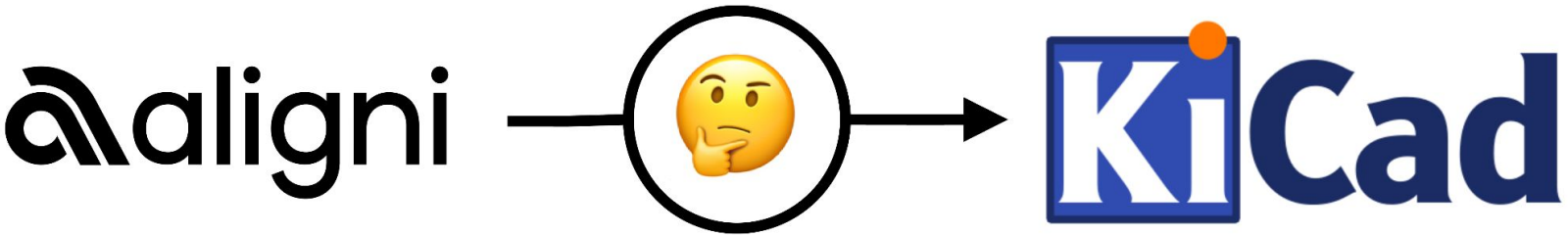
ALIGNI // SETUP // PART TYPES

Part Types associate parameters with groups of parts



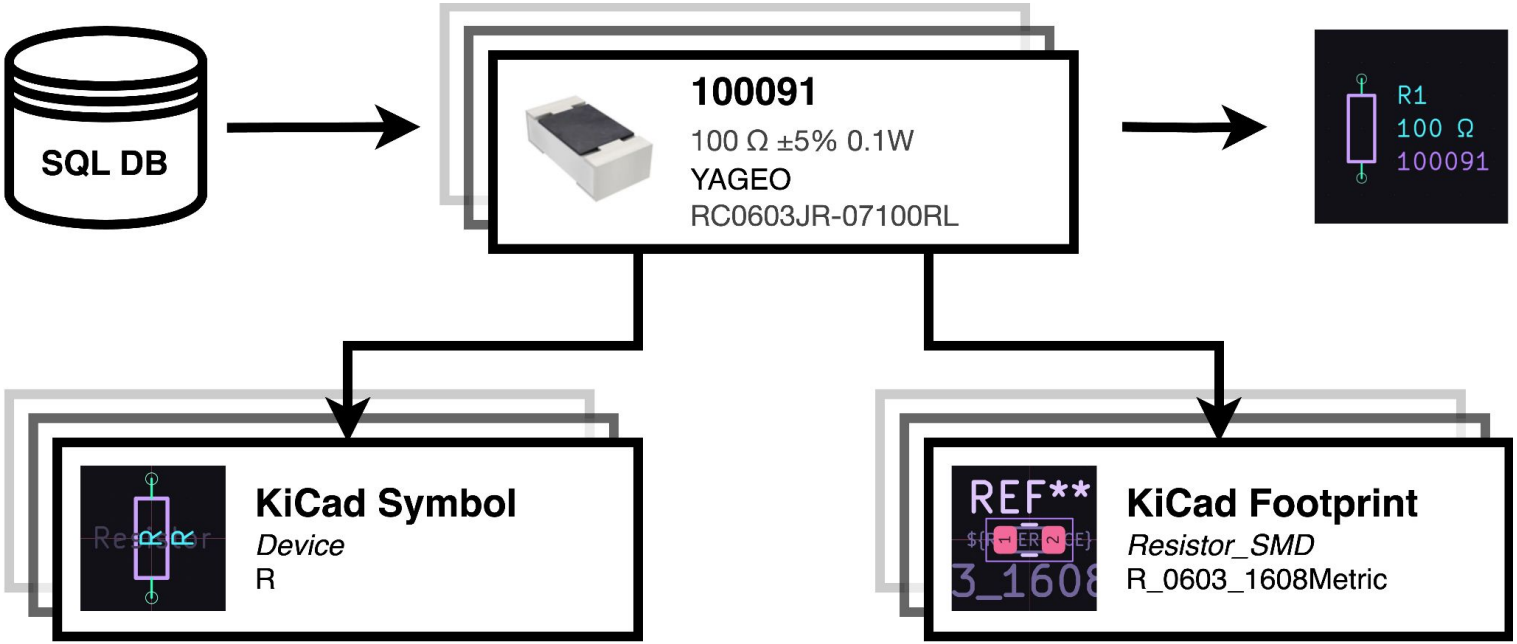
KICAD // DATABASE LIBRARY INTEGRATION

How to generate a KiCad library for all parts in Aligni?



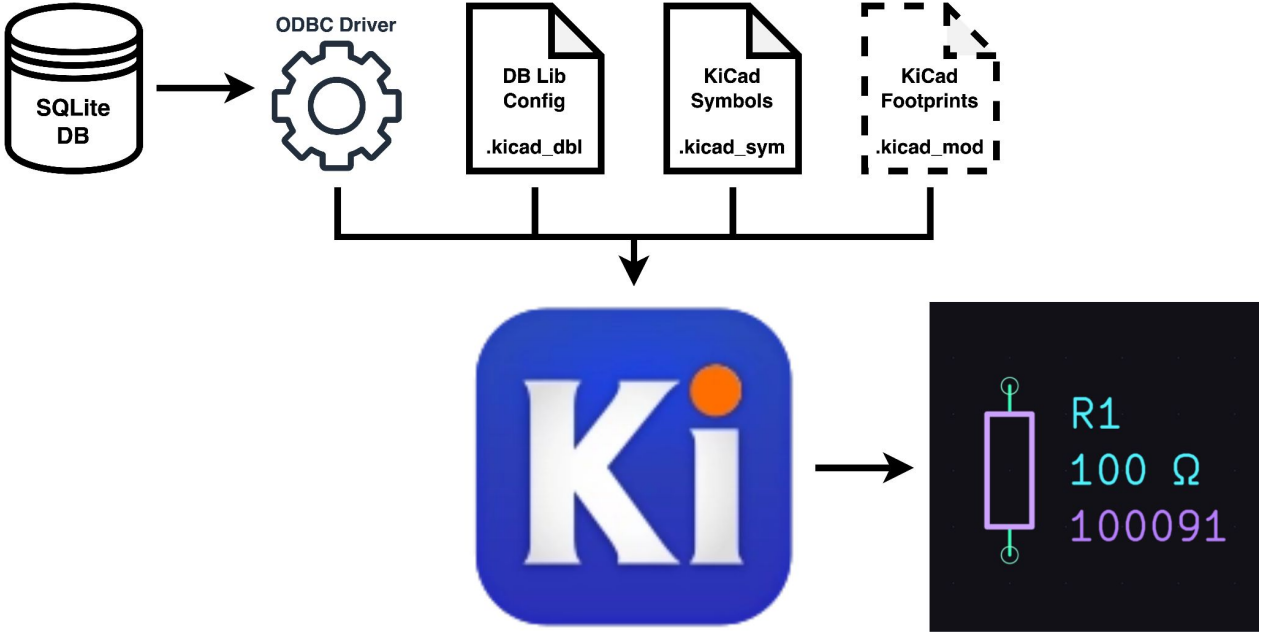
KICAD // DATABASE LIBRARY INTEGRATION

Database libraries are generated from SQL databases



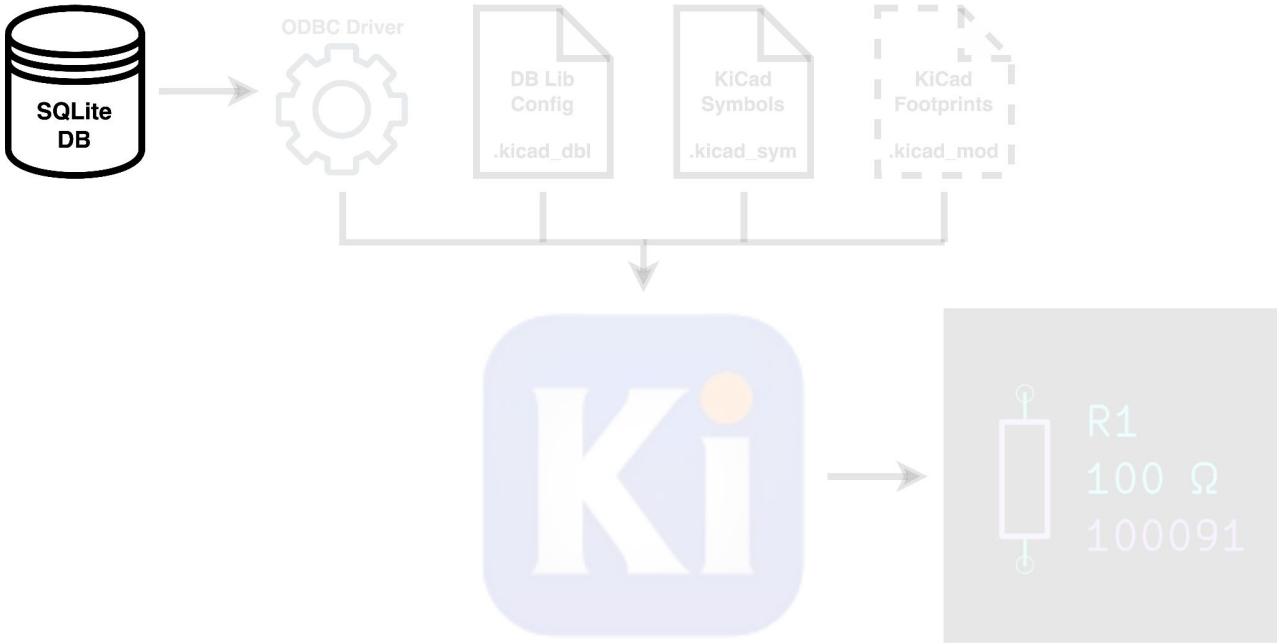
KICAD // DATABASE LIBRARY INTEGRATION

Database library inputs:



KICAD // DATABASE LIBRARY INTEGRATION

Where does the SQLite DB come from?



ALIGNI // REPLICATOR

Aligni Replicator is a Windows application* that generates a **local SQLite database** with all the parts in your online Aligni account.

*Replicator can be run in a VM but will not run in Wine.

https://docs.aligni.com/tools/replicator/

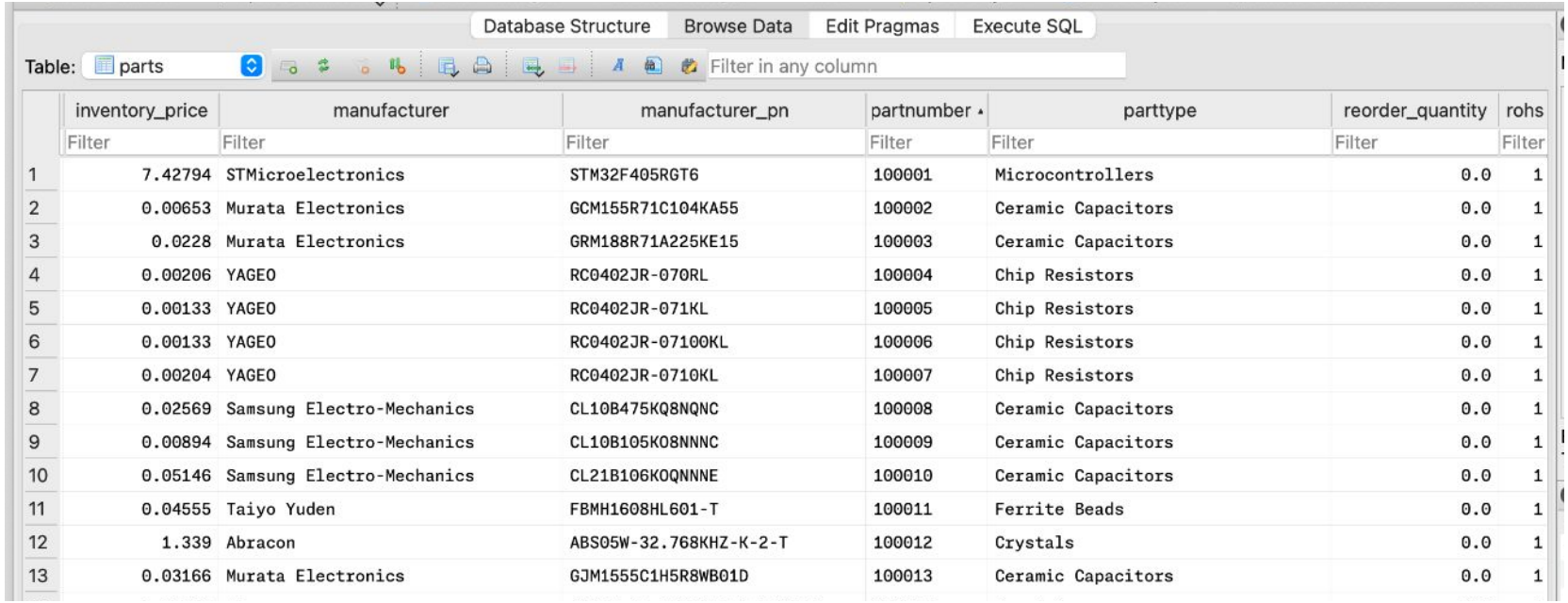
ALIGNI // REPLICATOR // DB SCHEMA

Database schema contains a `parts` table

Name	Type	Schema
Tables (1)		
parts		CREATE TABLE parts ('active' INT NULL, 'allow_fractional' INT NULL, 'comment' VARCHAR(4000), 'committed' INT
active	INT	"active" INT
allow_fractional	INT	"allow_fractional" INT
comment	VARCHAR(40...	"comment" VARCHAR(4000)
committed	INT	"committed" INT
created_on	DATETIME	"created_on" DATETIME
description	VARCHAR(40...	"description" VARCHAR(4000)
id	INT	"id" INT
inventory_price	FLOAT	"inventory_price" FLOAT
manufacturer	VARCHAR(40...	"manufacturer" VARCHAR(4000)
manufacturer_pn	VARCHAR(40...	"manufacturer_pn" VARCHAR(4000)
partnumber	VARCHAR(40...	"partnumber" VARCHAR(4000)
parttype	VARCHAR(40...	"parttype" VARCHAR(4000)
reorder_quantity	FLOAT	"reorder_quantity" FLOAT
rohs	INT	"rohs" INT
updated_on	DATETIME	"updated_on" DATETIME
value	FLOAT	"value" FLOAT
value_text	VARCHAR(40...	"value_text" VARCHAR(4000)

ALIGNI // REPLICATOR // “PARTS” TABLE DATA

`parts` table contains all parts from Aligni Item Master



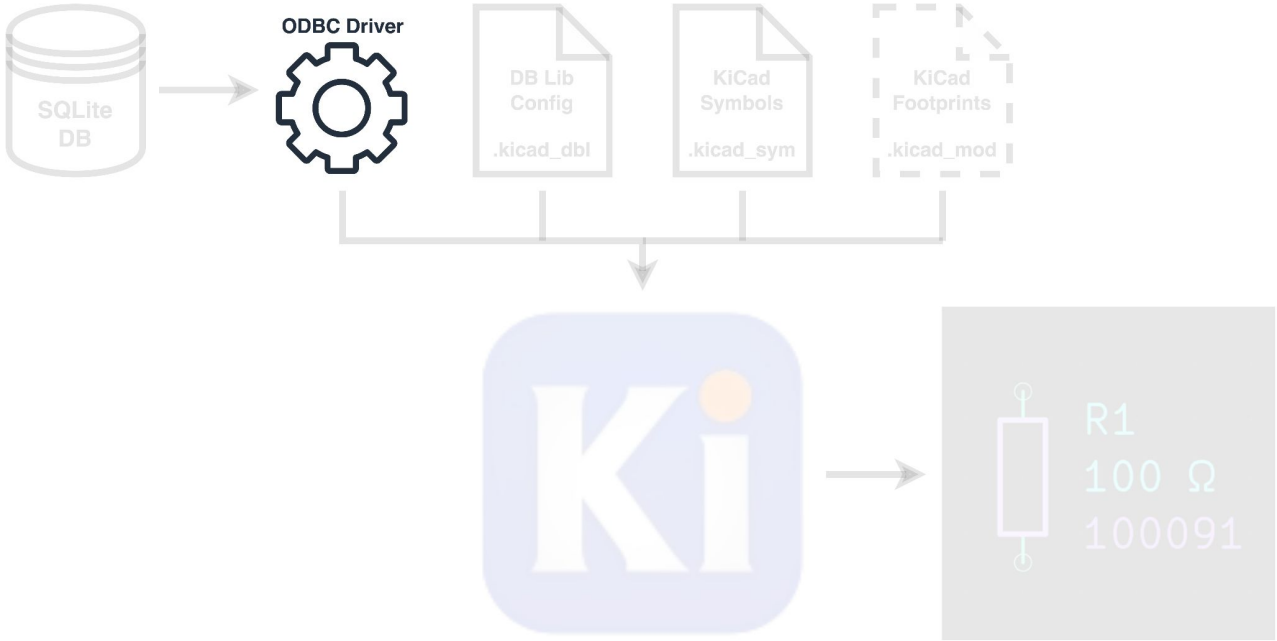
Database Structure | Browse Data | Edit Pragmas | Execute SQL

Table: parts — Filter in any column

	inventory_price	manufacturer	manufacturer_pn	partnumber	parttype	reorder_quantity	rohs
	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	7.42794	STMicroelectronics	STM32F405RGT6	100001	Microcontrollers	0.0	1
2	0.00653	Murata Electronics	GCM155R71C104KA55	100002	Ceramic Capacitors	0.0	1
3	0.0228	Murata Electronics	GRM188R71A225KE15	100003	Ceramic Capacitors	0.0	1
4	0.00206	YAGEO	RC0402JR-070RL	100004	Chip Resistors	0.0	1
5	0.00133	YAGEO	RC0402JR-071KL	100005	Chip Resistors	0.0	1
6	0.00133	YAGEO	RC0402JR-07100KL	100006	Chip Resistors	0.0	1
7	0.00204	YAGEO	RC0402JR-0710KL	100007	Chip Resistors	0.0	1
8	0.02569	Samsung Electro-Mechanics	CL10B475KQ8NQNC	100008	Ceramic Capacitors	0.0	1
9	0.00894	Samsung Electro-Mechanics	CL10B105KO8NNNC	100009	Ceramic Capacitors	0.0	1
10	0.05146	Samsung Electro-Mechanics	CL21B106KOQNNNE	100010	Ceramic Capacitors	0.0	1
11	0.04555	Taiyo Yuden	FBMH1608HL601-T	100011	Ferrite Beads	0.0	1
12	1.339	Abracon	ABS05W-32.768KHZ-K-2-T	100012	Crystals	0.0	1
13	0.03166	Murata Electronics	GJM1555C1H5R8WB01D	100013	Ceramic Capacitors	0.0	1

KICAD // DATABASE LIBRARY INTEGRATION

What's this ODBC driver thing?



KICAD // DATABASE LIBRARY INTEGRATION

ODBC (Open Database Connectivity)

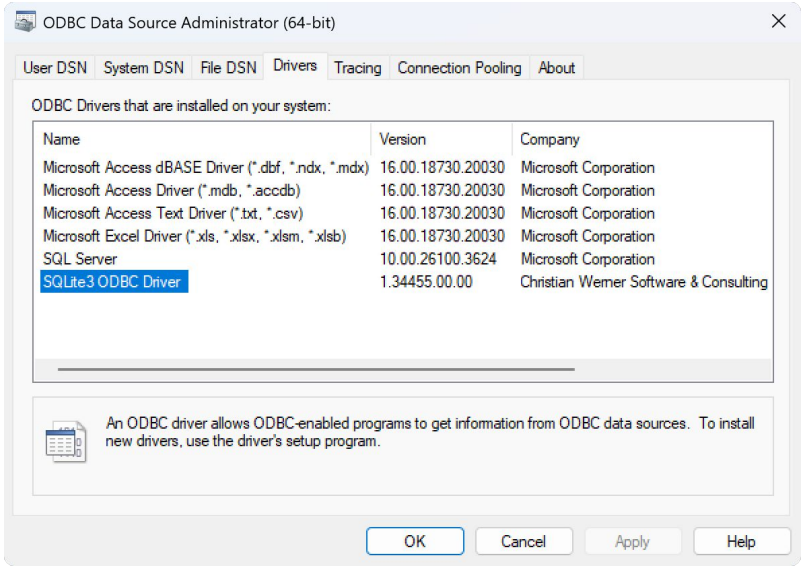
- Allows application to interact with different DBMS
- Industry-standard API

SQLite ODBC Driver
http://www.ch-werner.de/sqliteodbc/

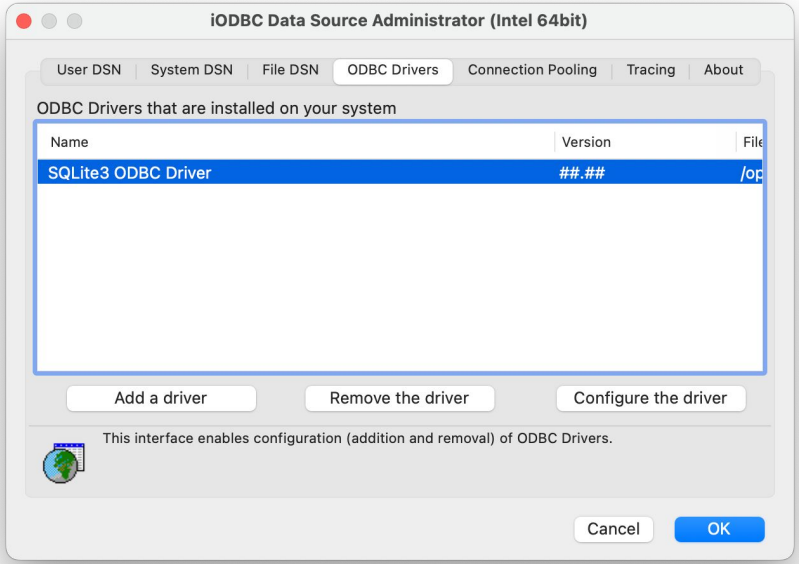
NOTE: On Windows, KiCad requires 64-bit ODBC driver, but Aligni Replicator requires 32-bit driver–install both!

KICAD // DATABASE LIBRARY INTEGRATION

Windows (64-bit)

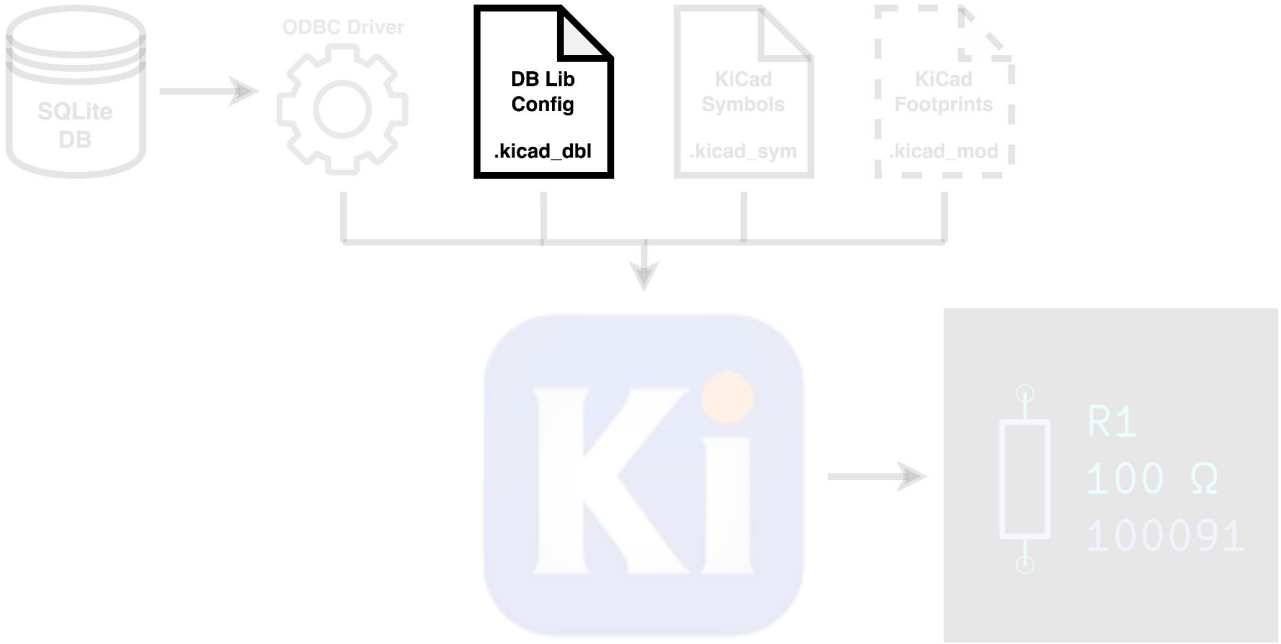


macOS



KiCad // Database Library Integration

Config file tells KiCad how to generate the DB library



KiCad // Database Library Integration

DB library configuration file (`*.kicad_dbl`)

- Maps tables/fields from DB to KiCad libraries/fields

Example library directory layout:

```
cgnd-kicad-lib/
├── 3dmodels/
├── databases/
│   └── CGND_OSHW_Aligni.sqlite ← Aligni SQLite Database
├── footprints/
└── symbols/
    └── CGND_OSHW_IPN.kicad_dbl ← KiCad DB library config file
```

KICAD // DATABASE LIBRARY INTEGRATION

Example: `CGND_OSHW_IPN.kicad_dbl`

```
{
  "meta": {
    "version": 1
  },
  "name": "Common Ground Electronics OSHW IPN Library",
  "description": "A KiCad database library containing internal part number symbols",
  "source": {
    "type": "odbc",
    "dsn": "",
    "username": "",
    "password": "",
    "timeout_seconds": 2,
    "connection_string": "Driver={SQLite3 ODBC Driver};Database=${CWD}/../databases/CGND_OSHW_Aligni.sqlite"
  },
```

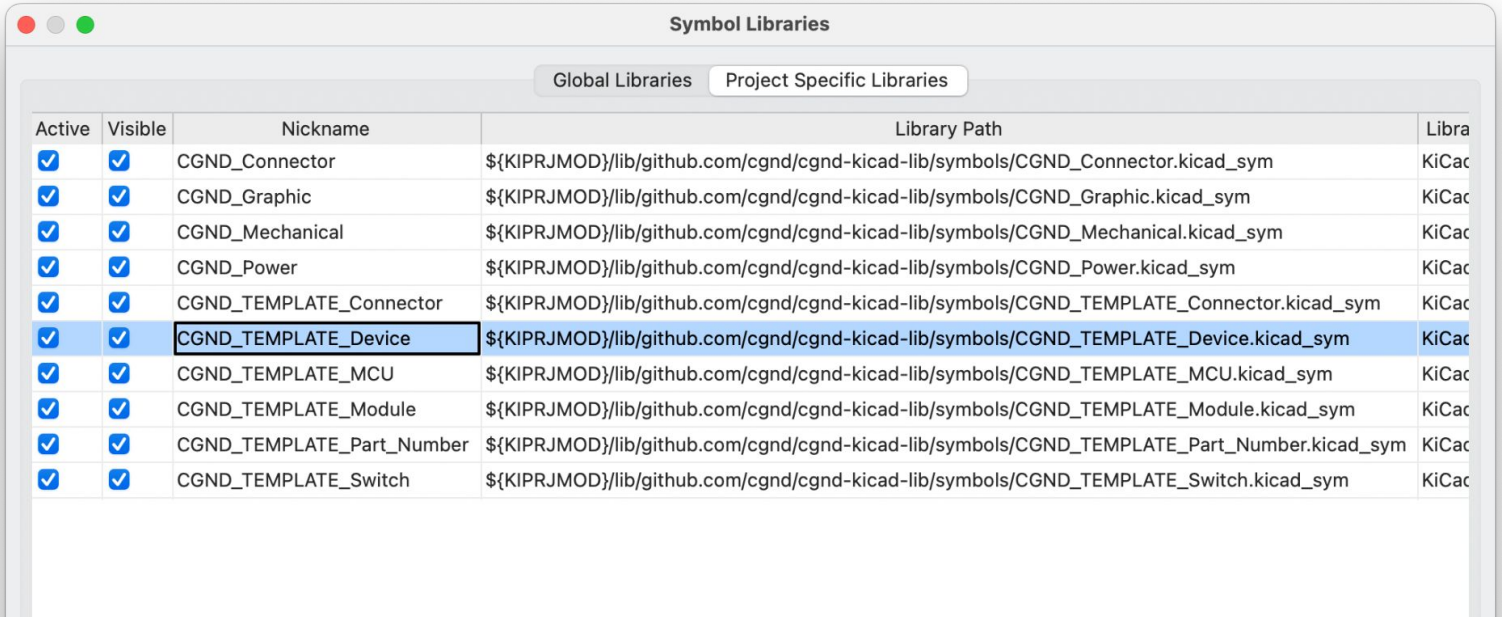
KICAD // DATABASE LIBRARY INTEGRATION

Map SQLite DB “`parts`” table to KiCad symbol library

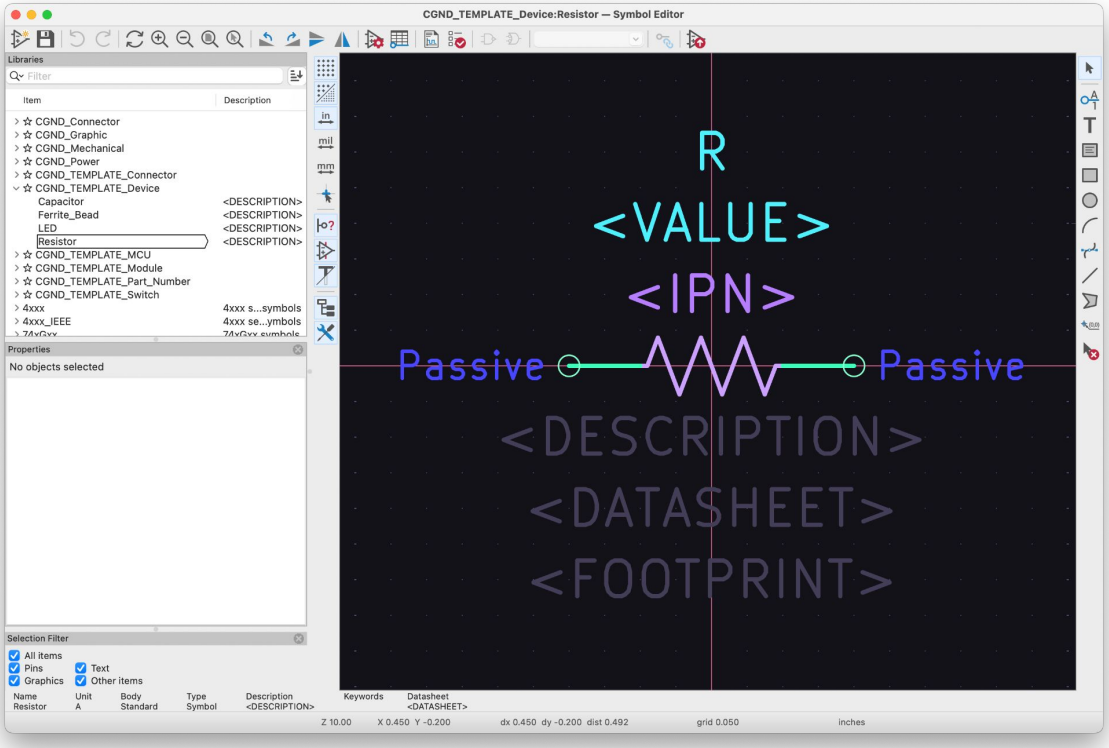
```
"libraries": [
  {
    "name": "",
    "table": "parts",
    "key": "partnumber",
    "symbols": "x_kicad_symbols",
    "footprints": "x_kicad_footprints",
    "fields": [
      ...
```

KICAD // DATABASE LIBRARY INTEGRATION

Referenced symbols must be defined in the library table



KICAD // DATABASE LIBRARY INTEGRATION



Fields/attributes populated from the Aligni DB.

No supply-chain details in the library symbol (only IPN and URL to Aligni part)

KICAD // DATABASE LIBRARY INTEGRATION

Map Aligni “Display Value” to symbol’s “Value” field

```
"fields": [
  {
    "column": "x_display_value",
    "name": "Value",
    "visible_on_add": false,
    "visible_in_chooser": false,
    "show_name": false,
    "inherit_properties": true
  },
```

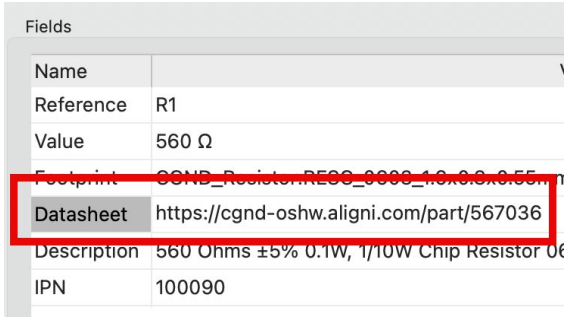
Fields

Name	
Reference	R1
Value	560 Ω
Footprint	CGND_Resistor:RESC_0603_1.6x0.8x0.55mm
Datasheet	https://cgnd-oshw.aligni.com/part/567036
Description	560 Ohms ±5% 0.1W, 1/10W Chip Resistor 06
IPN	100090

KICAD // DATABASE LIBRARY INTEGRATION

Map Aligni part URL to symbol's "Datasheet" field

```
{
  "column": "x_aligni_part_url",
  "name": "Datasheet",
  "visible_on_add": false,
  "visible_in_chooser": false,
  "show_name": false,
  "inherit_properties": true
},
```

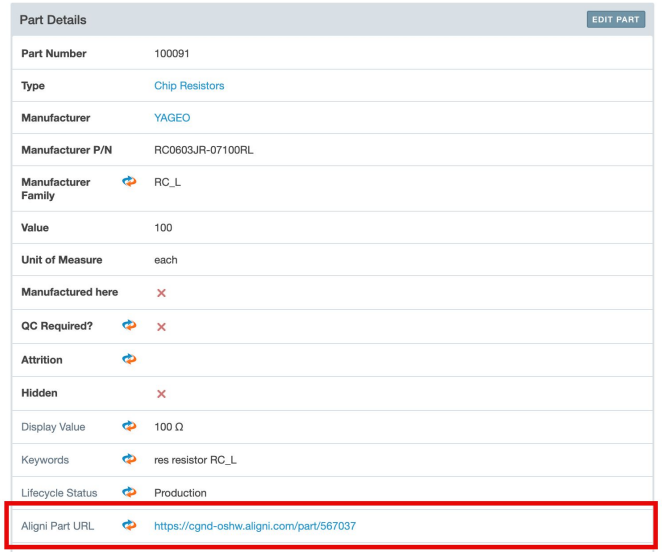


ALIGNI // REPLICATOR IS MISSING PART URL

How to get the `x aligni part url` column in the Aligni DB to map to the KiCad “Datasheet” field?

Simplest solution is to add a custom part parameter with the Aligni part URL.

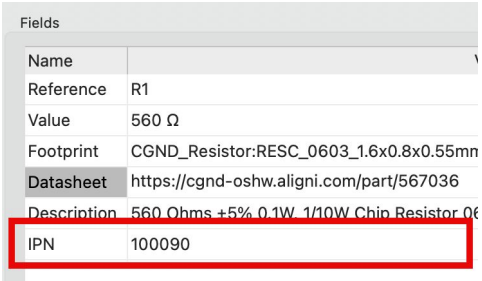
(See later slides for a SQL solution to add the URL)



KICAD // DATABASE LIBRARY INTEGRATION

Map Aligni part number to symbol's "IPN" field

```
{
  "column": "partnumber",
  "name": "IPN",
  "visible_on_add": true,
  "visible_in_chooser": true,
  "show_name": false,
  "inherit_properties": true
},
```



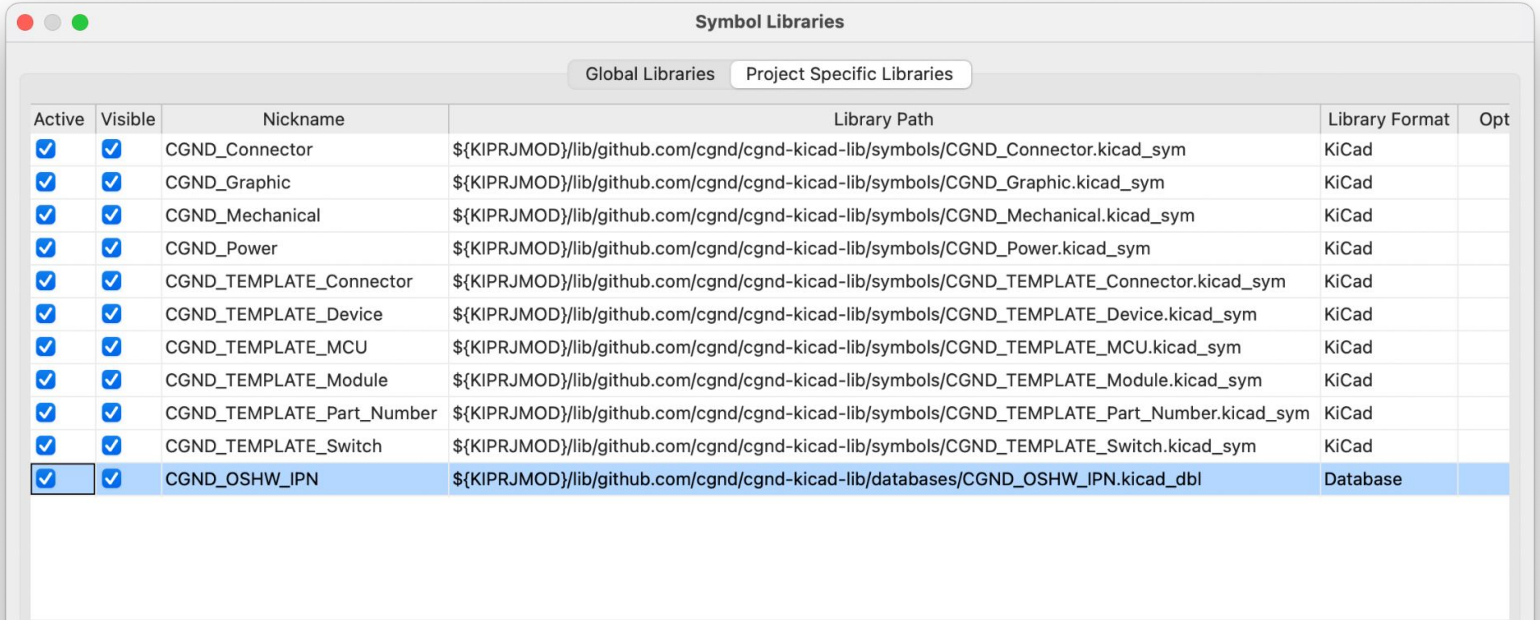
KICAD // DATABASE LIBRARY INTEGRATION

Map Aligni parameters to KiCad symbol properties

```
"properties": {
  "description": "description",
  "keywords": "x_keywords",
  "exclude_from_bom": "x_exclude_from_bom",
  "exclude_from_board": "x_exclude_from_board",
  "exclude_from_sim": "x_exclude_from_sim
}
```

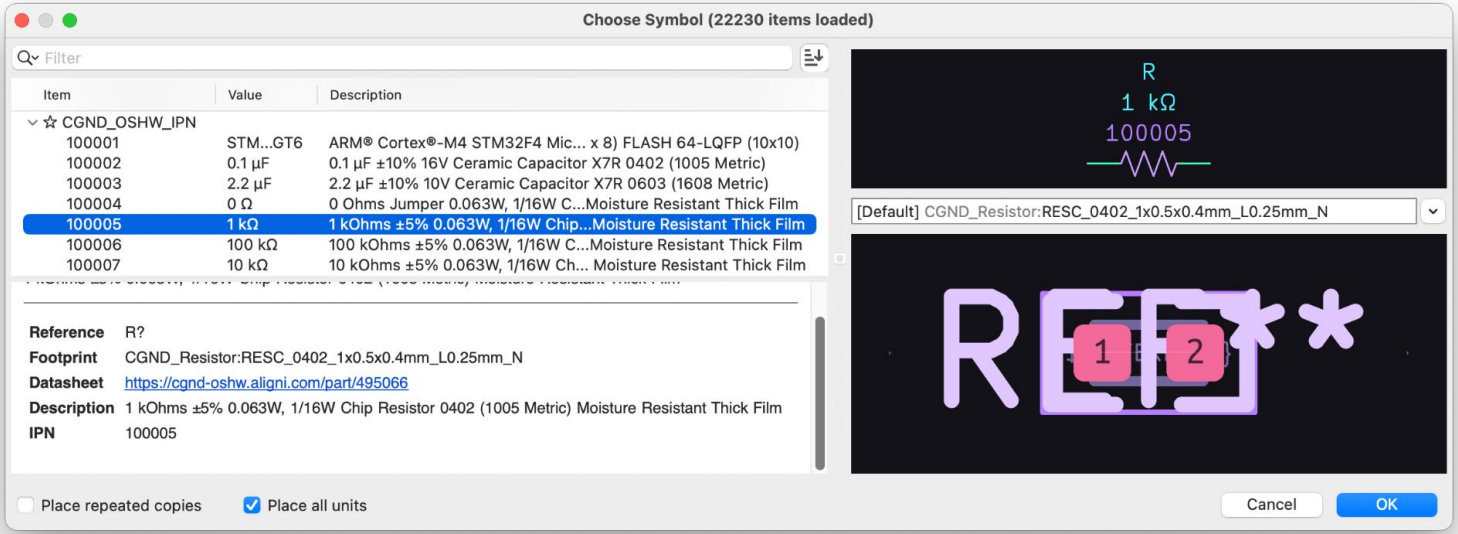
KICAD // DATABASE LIBRARY INTEGRATION

Add `*.kicad_dbl` config file to the symbol library table



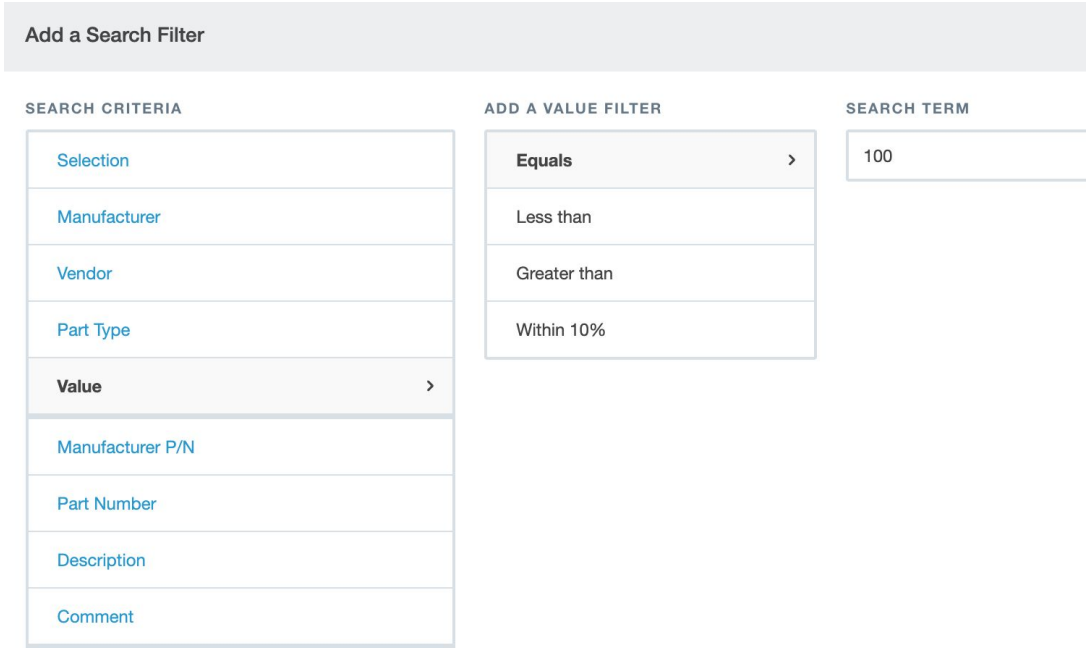
KICAD // DATABASE LIBRARY INTEGRATION

Now we can place Aligni parts in a KiCad schematic! 🎉



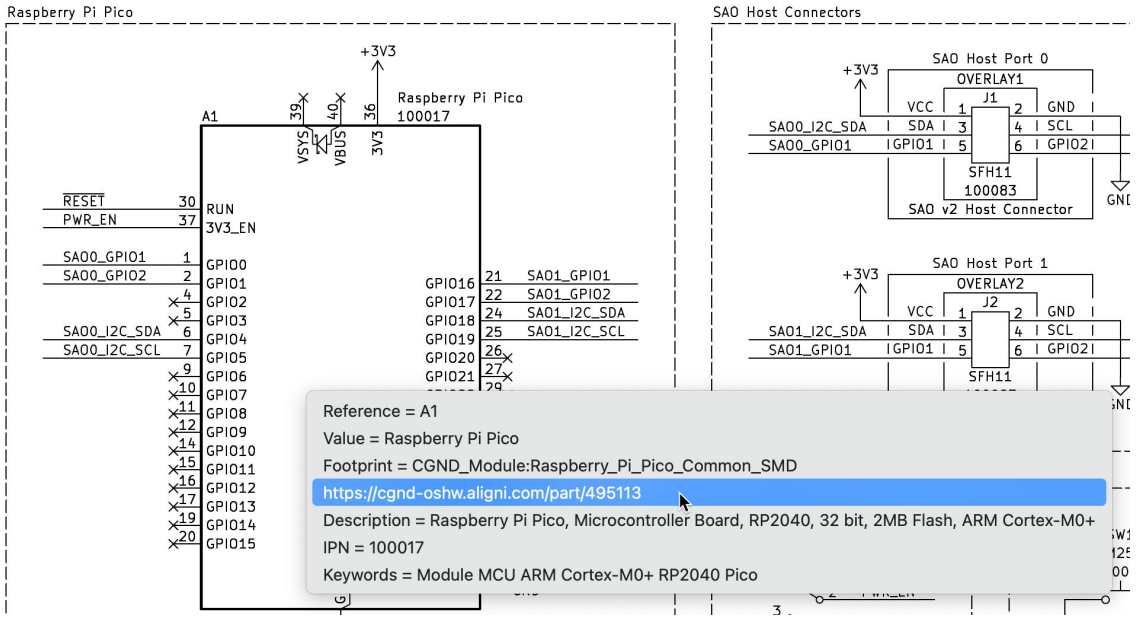
KICAD // DATABASE LIBRARY INTEGRATION

Parametric part search for library parts in Aligni



KICAD // DATABASE LIBRARY INTEGRATION

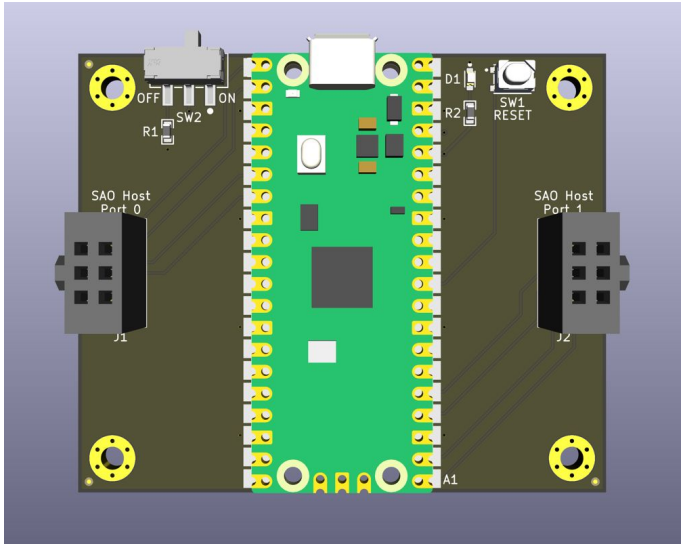
Links from schematic editor (“D”) & PDFs back to Aligni

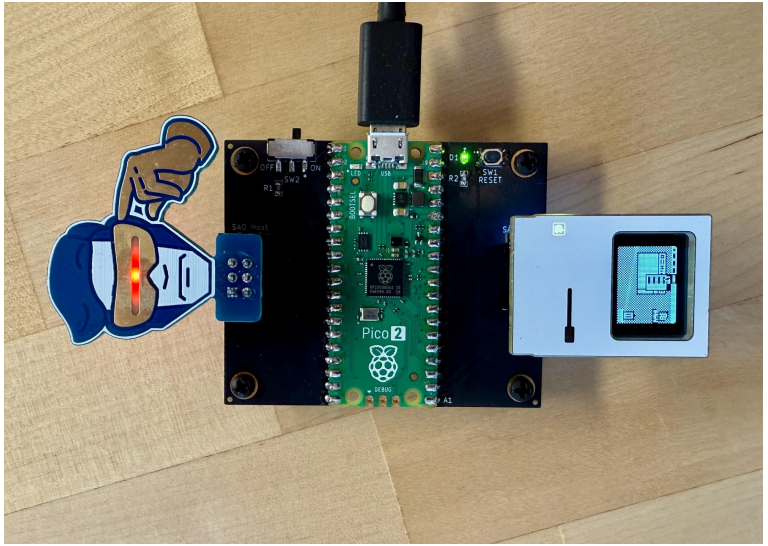



ALIGNI //
BOM IMPORT EXAMPLE
Solder
NinJa Pen
There is no cloud
Hacker.
DEFCON
BAY AREA

ALIGNI // BOM IMPORT EXAMPLE

Example assembly: Raspberry Pi Pico SAO Host board





https://github.com/cgnd/rpi-pico-sao-host

ALIGNI // ASSEMBLY BOM IMPORT

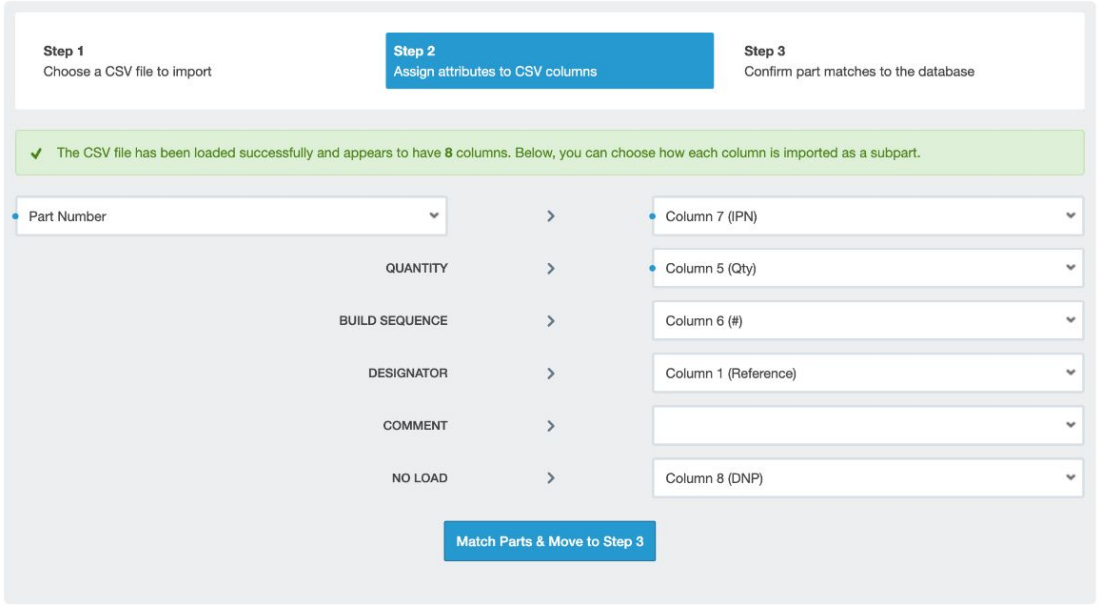
Export the KiCad schematic BOM as a CSV file

RPi_Pico_SAO_Host_v2_E...

# #	# Qty	Reference	# IPN	Value	Description	Datasheet	DNP
1	1	A1	100017	Raspberry Pi Pico	Raspberry Pi Pico, Microc	https://cgnd-oshw.aligı	
2	1	D1	100089	Green	Green 570nm LED Indicati	https://cgnd-oshw.aligı	
3	1	DOC1	100093	Pico SAO Host v2 Schematic	Raspberry Pi Pico SAO Ho	https://cgnd-oshw.aligı	
4	2	J1,J2	100083	SFH11	6 Position Header Connec	https://cgnd-oshw.aligı	
5	1	PCB1	100092	Pico SAO Host v2 PCB	Raspberry Pi Pico SAO Ho	https://cgnd-oshw.aligı	
6	1	R1	100091	100 Ω	100 Ohms ±5% 0.1W, 1/1C	https://cgnd-oshw.aligı	
7	1	R2	100090	560 Ω	560 Ohms ±5% 0.1W, 1/1C	https://cgnd-oshw.aligı	
8	1	SW1	100069	PTS810SJM250SMTRLFS	Tactile Switch SPST-NO Tc	https://cgnd-oshw.aligı	
9	1	SW2	100051	JS102011SAQN	Slide Switch SPDT Surfac	https://cgnd-oshw.aligı	

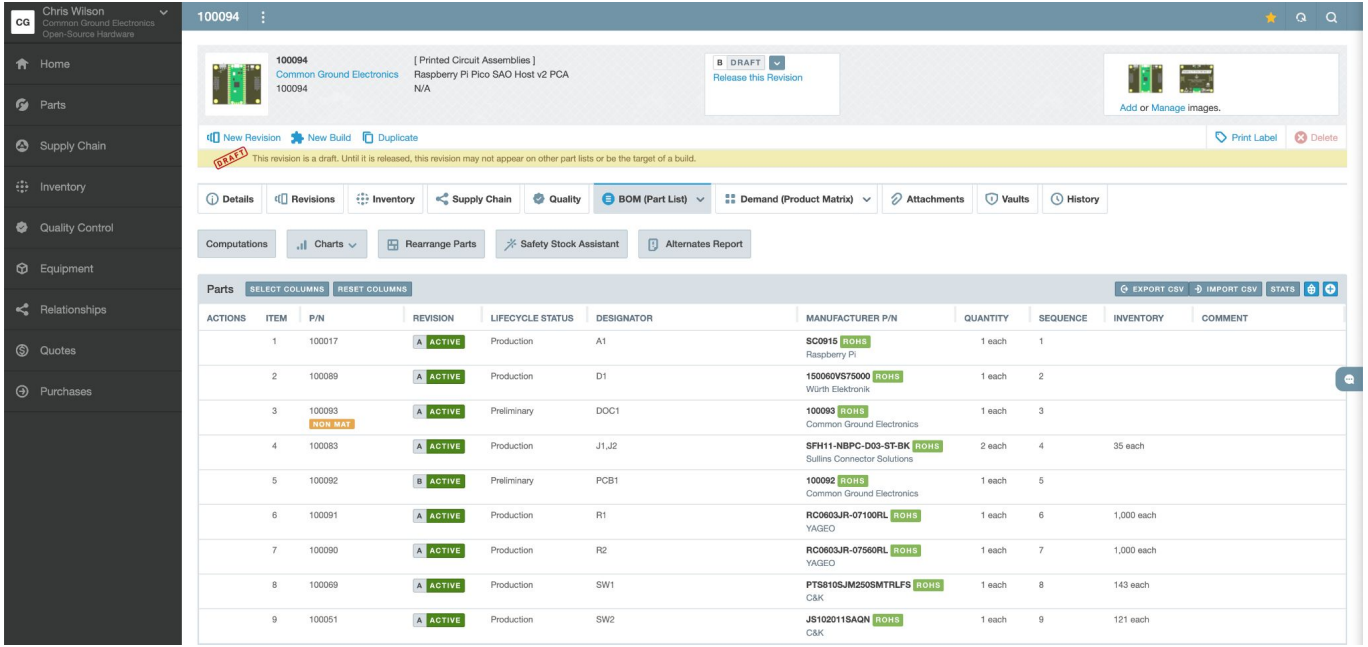
ALIGNI // ASSEMBLY BOM IMPORT

Aligni import: map CSV columns to Aligni BOM columns



ALIGNI // ASSEMBLY BOM IMPORT

Assembly BOM is populated based on parts from CSV



04

LIMITATIONS

Issues with this workflow

ALIGNI // REPLICATOR // “PARTS” TABLE

KiCad database libraries feature supports creating multiple libraries, one for each table in the database.

However, Aligni Replicator software only generates a database with a single `parts` table.

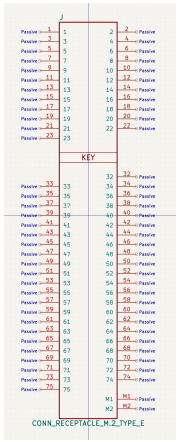
As a result, it’s only possible to generate a single KiCad library for all parts in the Aligni Item Master. It’s not possible to have separate libraries based on part type.

KICAD // ALTERNATE SYMBOLS

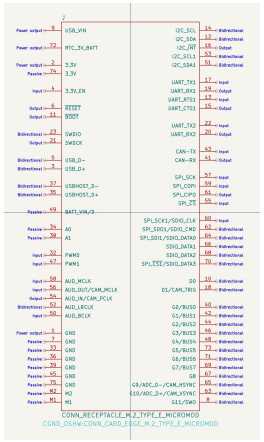
Currently no way to assign multiple symbols to a part:

Connector

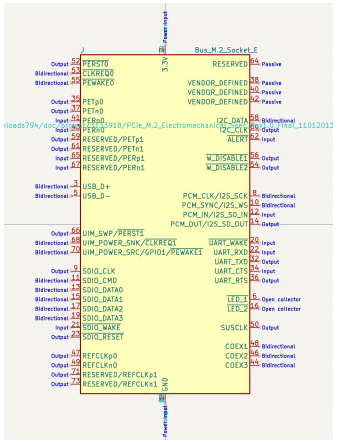
Generic



MicroMod



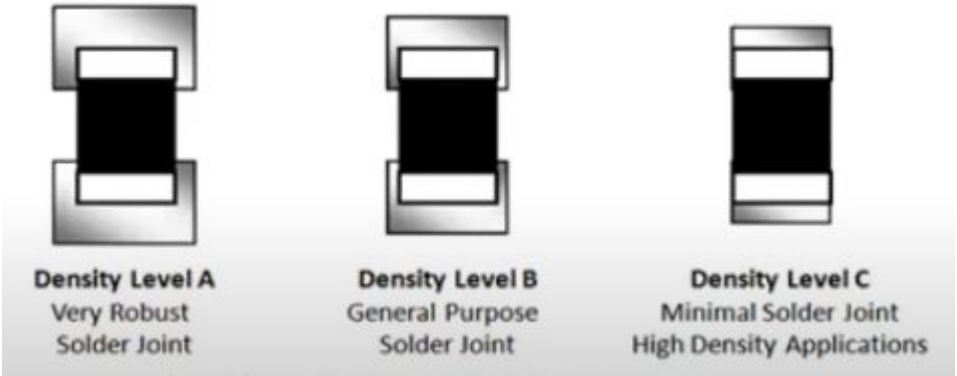
PCIe M.2



https://gitlab.com/kicad/code/kicad/-/issues/12380

KICAD // ALTERNATE FOOTPRINTS

Assigning multiple footprints to a part should be supported, but had some bugs when I tried it:



https://gitlab.com/kicad/code/kicad/-/issues/13587

ALIGNI // USAGE LIMITATIONS

Aligni free-tier usage limitations:

Usage		
	PUBLIC	ADD-ONS
Attachments	Unlimited	-
Builds	10	-
Collaborator Seats	0	0 / 5
Contacts	Unlimited	-
Customers	Unlimited	-
Demand Entries	Unavailable	-
ECO	5	-
ECR	5	-
Equipment	Unavailable	-
Inventory History	Unlimited	-
Inventory Sublocations	Unlimited	-
Inventory Units	Unlimited	-
Manufacturers	Unlimited	-
Material Transfers	Unlimited	-
Octopart Queries	100	-
Part Collections	Unlimited	-
Part Parameter Fields	Unlimited	-
Part Types	Unlimited	-
Parts	1000	-
Purchase Orders	Unlimited	-
Purchases	1	-
Quote Requests	1	-
Quote Responses	Unlimited	-
Quotes	Unlimited	-
UltraCart Integration	Unavailable	-
Units	Unlimited	-
Usage Reports	Unavailable	-
Vendors	Unlimited	-
Viewer Seats	Unavailable	-
Warehouses	3	-
WooCommerce Integration	Unavailable	-
Xero Integration	Unavailable	-

05

ADDITIONAL TIPS

Additional information that we
didn’t have time to cover in the talk

GIT // STORING SQLITE DATA IN A GIT REPO

- SQLite is a binary file format, not ideal for Git repos
- Hard to diff changes to a SQLite database (e.g. `sqldiff` won't show changes to internal metadata)

Solution:

- Use https://github.com/simonw/sqlite-diffable to dump the database schema/data to JSON format
- JSON representation is formatted to be "diffable"
- Check the JSON files into the Git repo instead of the SQLite database

ALIGNI // ADDING PART URL TO REPLICATOR DB

An `x_aligni_part_url` column can also be added to the Replicator database using SQL commands.

```sql
ALTER TABLE parts
ADD COLUMN x_aligni_part_url TEXT;

UPDATE parts
SET x_aligni_part_url = 'https://cgnd-oshw.aligni.com/part/' || id;
```

ALIGNI // ADDING PART URL TO REPLICATOR DB

This can be scripted in Python via `sqlite3` package:

```python
import sqlite3

conn = sqlite3.connect(db)
cursor = conn.cursor()
cursor.execute(f"""
    ALTER TABLE parts
    ADD COLUMN x_aligni_part_url TEXT
""")
cursor.execute(f"""
    UPDATE parts
    SET x_aligni_part_url = 'https://cgnd-oshw.aligni.com/part/' || id
""")
conn.commit()
conn.close()
```

06

REVISIONS

How to use revisions in PLM

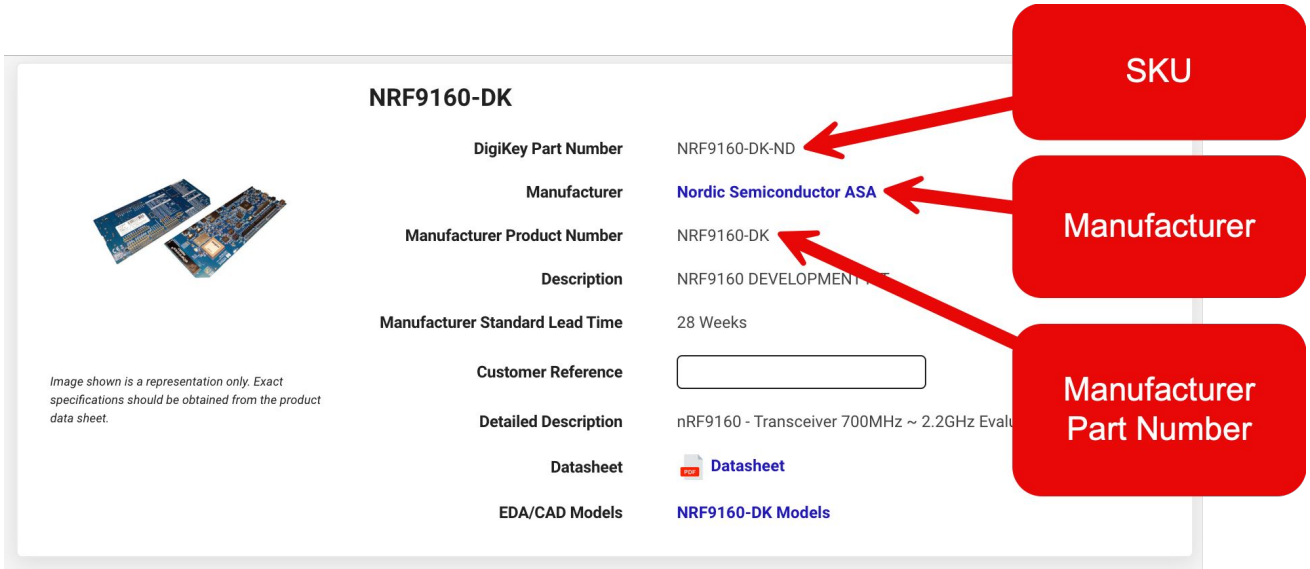
ALIGNI // PART REVISION BEST PRACTICES

- Parts in Aligni have “Revisions”
- Revisions allow tracking changes to a part over time
- **IMPORTANT:** many external systems (e.g. inventory management systems) **do NOT track part revisions**!
- Customers will typically buy from distributors using your **part number** only*

*Sometimes it’s possible to purchase a specific revision of a part when purchasing directly from the manufacturer

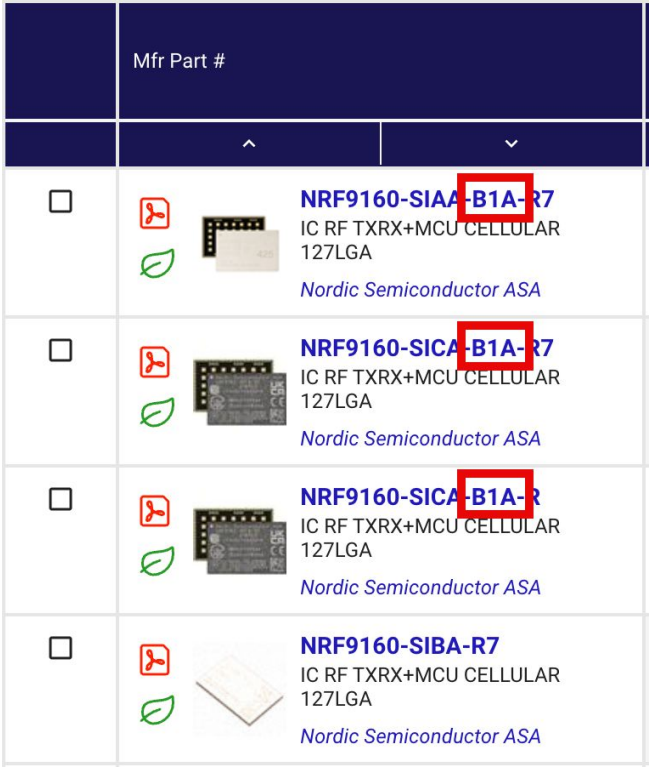
ALIGNI // PART REVISION BEST PRACTICES

- Example: DigiKey SKU = Manufacturer + MPN
- No way for customer to specify revision in order



ALIGNI // PART REVISION BEST PRACTICES

- If two revisions of a part need to be “binned” separately in inventory, they need to have different part numbers
- In this example, Nordic includes the die revision in the part number as a suffix



ALIGNI // PART REVISION BEST PRACTICES

How should revisions be used with part numbers in PLM?

Best Practice: different *revisions* of the same part number should be **interchangeable**.

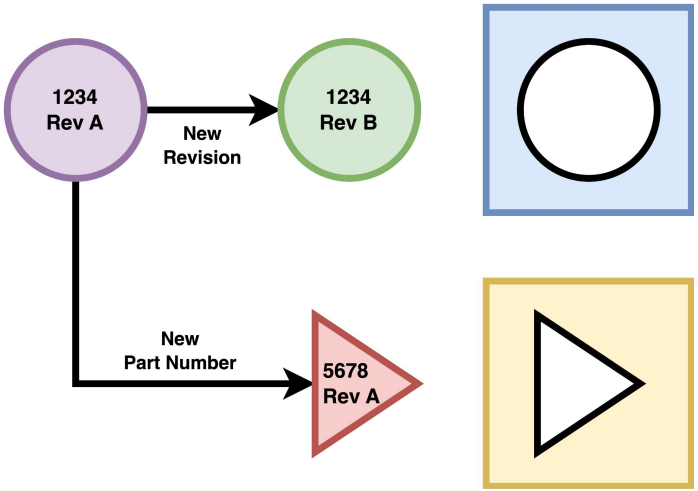
Use the "**Form, Fit, and Function**" (3F) rule:

> *If two parts have the same "form, fit, and function" (and sometimes "formulation") they can be substituted for one another.*

ALIGNI // PART REVISION BEST PRACTICES

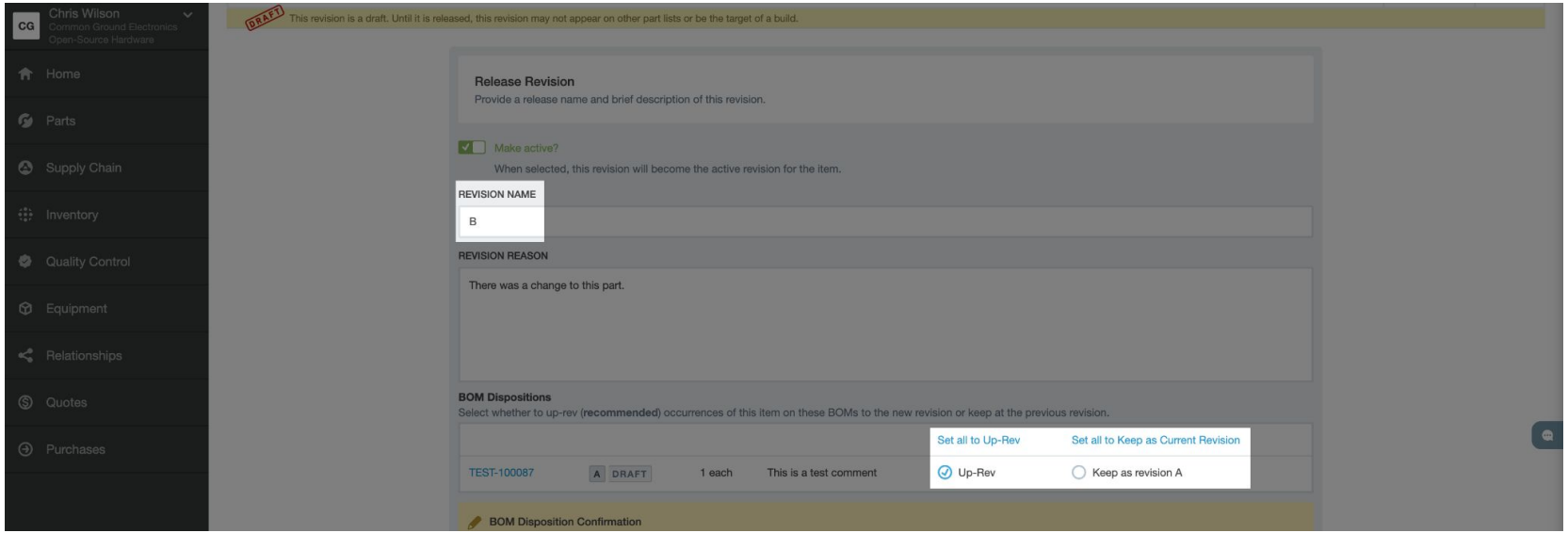
A general rule for dealing with changes to a part:

1. F/F/F **compatible** changes roll the **revision** of a part.
2. F/F/F **incompatible** changes **require a new part number**.



ALIGNI // PART REVISION BEST PRACTICES

Benefit: if revisions are following F/F/F methodology, PLM can “Up-Rev” all BOMs to latest part revision.

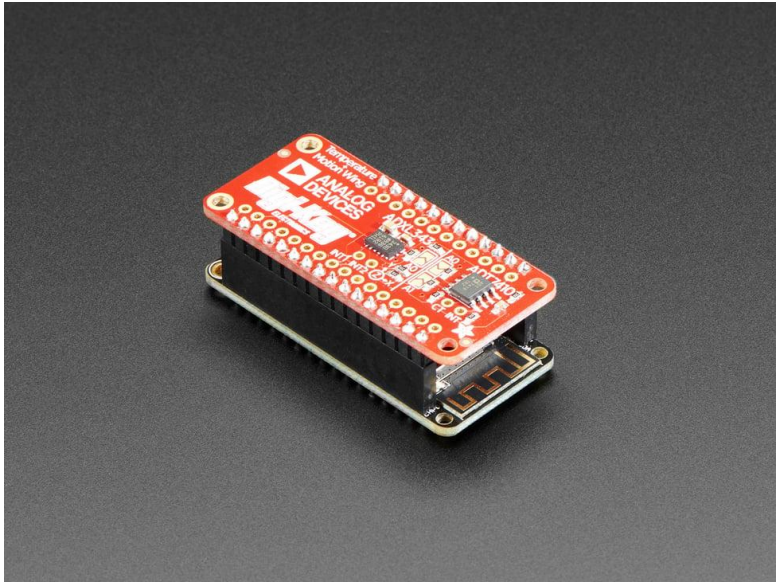


ALIGNI // PART REVISION BEST PRACTICES

This minimizes “churn” to assemblies when rev changes.

Example revision change:

```
SENSOR-NODE (Rev B)
├── SENSOR-BOARD (Rev C)
│   ├── RESISTOR (~~Rev A~~) → (Rev B)
│   ├── ACCELEROMETER (Rev A)
│   └── TEMP-SENSOR (Rev A)
└── FEATHER-BOARD (Rev A)
```



https://www.adafruit.com/product/4147

ALIGNI // PART REVISION BEST PRACTICES

❌ non-interchangeable: Triggers impact analysis for parent assemblies*

```
SENSOR-NODE (Rev B) → (???)
├── SENSOR-BOARD (Rev C) → (???)
│   ├── RESISTOR (~~Rev A~~) → (Rev B)
│   ├── ACCELEROMETER (Rev A)
│   └── TEMP-SENSOR (Rev A)
└── FEATHER-BOARD (Rev A)
```

✅ interchangeable: changes do not “roll up” the hierarchy

```
SENSOR-NODE (Rev B)
├── SENSOR-BOARD (Rev C)
│   ├── RESISTOR (~~Rev A~~) → (Rev B)
│   ├── ACCELEROMETER (Rev A)
│   └── TEMP-SENSOR (Rev A)
└── FEATHER-BOARD (Rev A)
```

*Repeat for *every* assembly BOM that uses the `RESISTOR` part...

Note: if you work in a highly regulated industry (medical, aerospace, etc), you most likely have a change management process that requires formally documenting all revision changes.

LINK TO SLIDES & VIDEO

Feel free to ask questions and/or leave feedback in the comments section of this page.

Email me: chris@cgnd.dev

https://cgnd.dev/posts/teardown-2025-talk-are-we-plm-yet/

THANKS!

Do you have any questions?

chris@cgnd.dev

https://cgnd.dev

07

RESOURCES

Links to additional resources

RESOURCES

- **Minimal KiCad+Aligni Example Project**
  https://github.com/cgnd/aligni-example-kicad-project
- **Aligni Pubic Organizations Page**
  https://app.aligni.com/catalog
- **Aligni Documentation (highly recommended)**
  https://docs.aligni.com/
- **KiCad Database Libraries Documentation**
  https://docs.kicad.org/9.0/en/eeschema/eeschema.html#database-libraries

SQLITE ODBC DRIVER EXAMPLES

- **macOS**
  https://cdwilson.dev/articles/kicad-database-libraries-on-macos/
- **Windows**
  https://github.com/SumantKhalate/KiCad-libdb
- **Linux**
  https://datawookie.dev/blog/2015/09/setting-up-odbc-for-sqlite-on-ubuntu/

PLM RESOURCES

- **Part numbering system design**
  https://www.buyplm.com/plm-good-practice/part-numbering-system-software.aspx
- **Form/Fit/Function guide in Aligni**
  https://docs.aligni.com/guides/form-fit-function/
- **Part interchangeability best practices**
  https://www.buyplm.com/plm-good-practice/form-fit-function-interchangeable-parts.aspx

ALTERNATIVES TO CHECK OUT

Alternatives people mentioned but I haven't tried yet:

- https://partsbox.com/
- https://inventree.org/
- https://durolabs.co/
- https://github.com/git-plm/gitplm
- https://binner.io/

G2 PLM Reviews

- https://www.g2.com/categories/product-lifecycle-management-plm