

ARE WE PLM YET?

A beginners introduction to product
lifecycle management for KiCad





01

INTRODUCTION

ABOUT ME

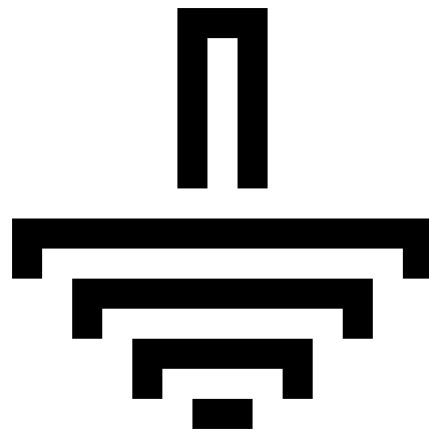


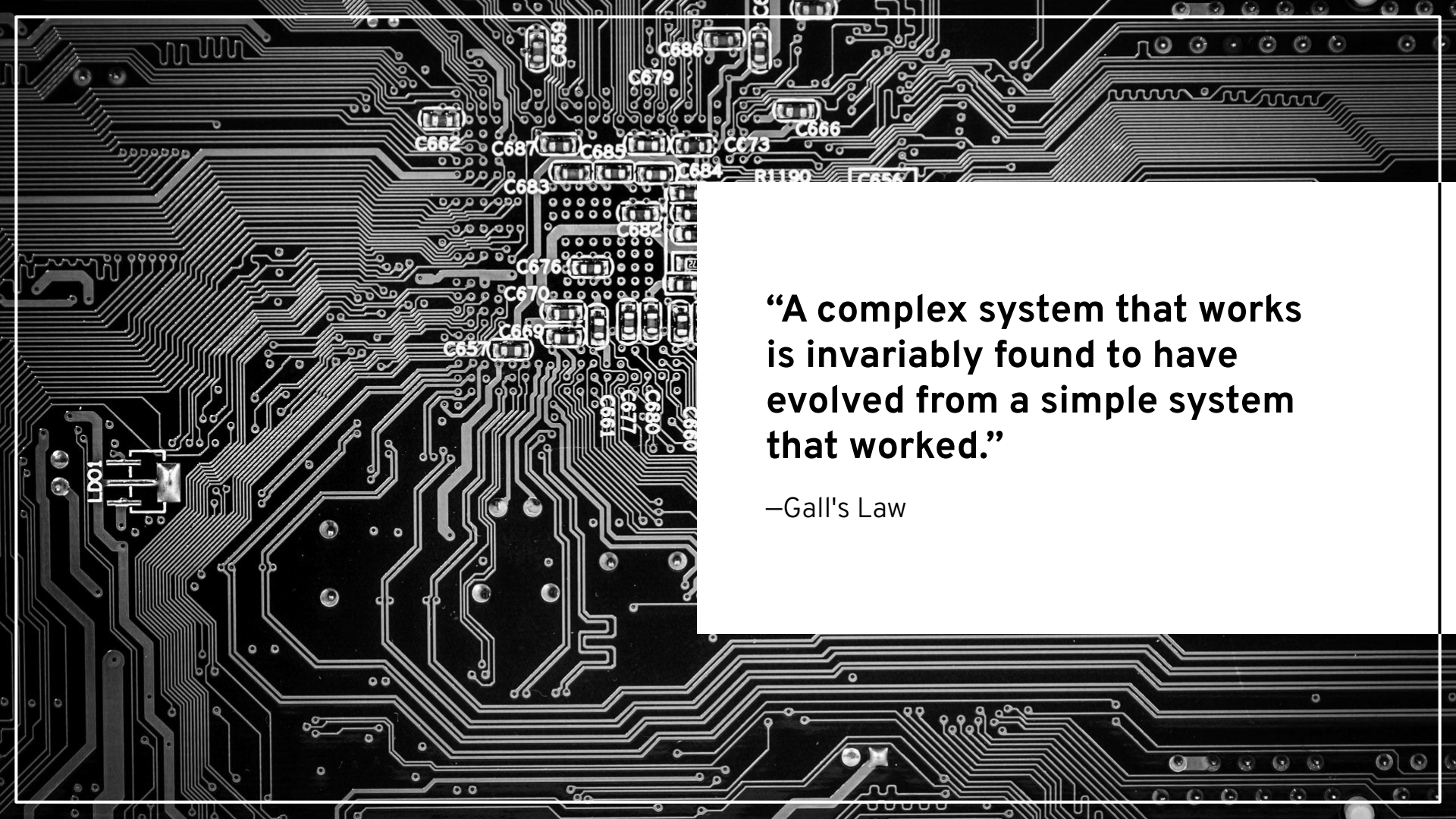
CHRIS WILSON

hardware design engineer
PM in PCBA manufacturing

**COMMON GROUND
ELECTRONICS**

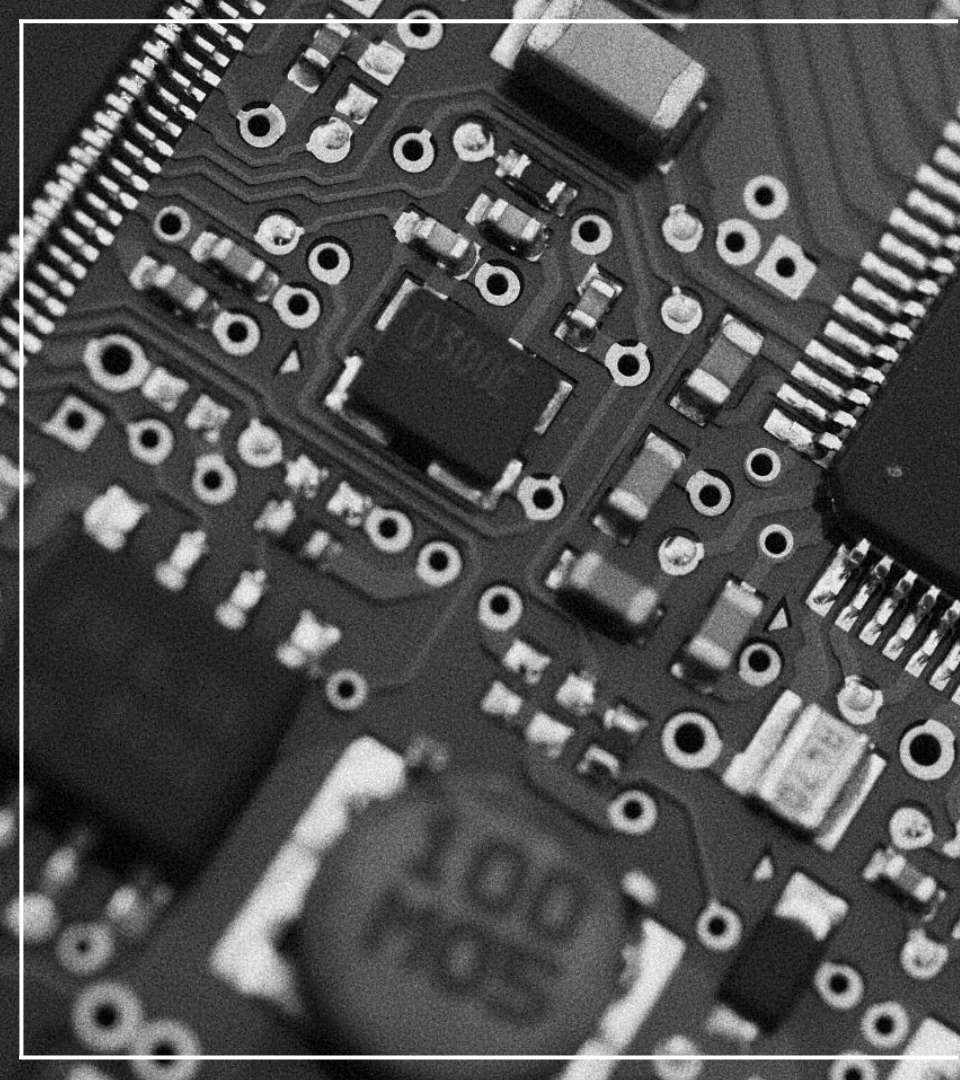
embedded systems
engineering services





**“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 40 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

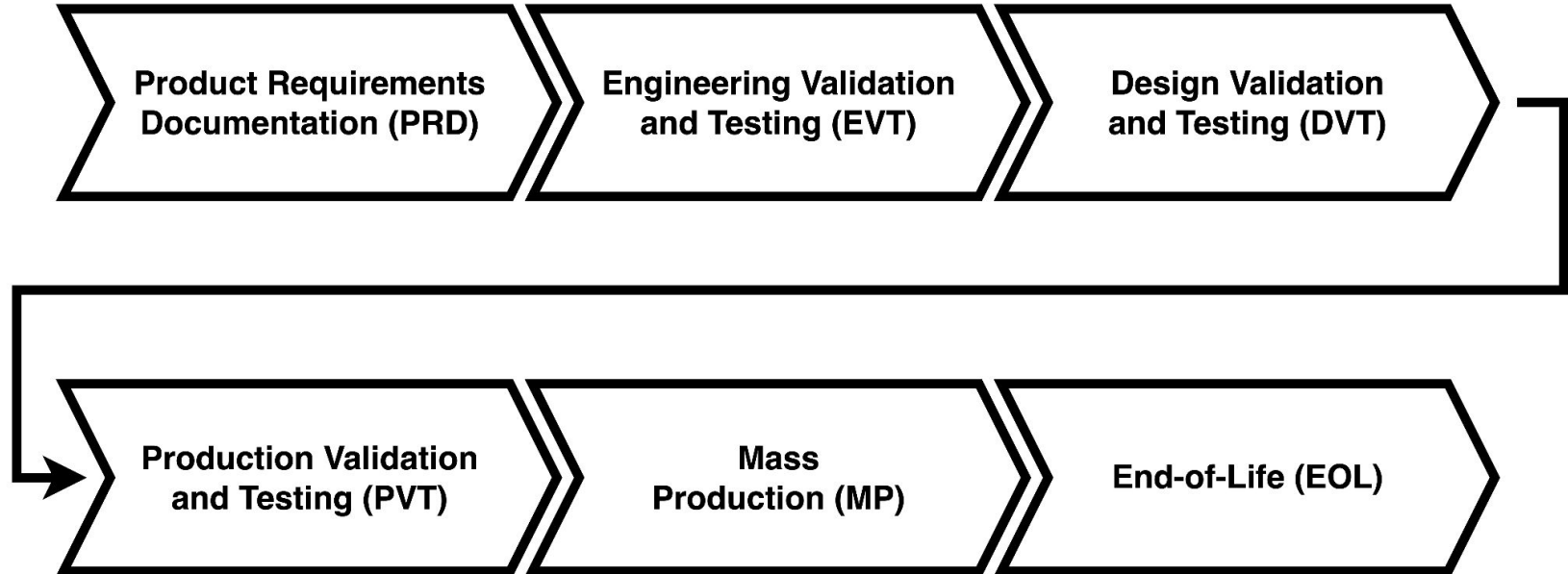
WHAT IS PLM?

A basic introduction to product
lifecycle management

WHAT IS PLM?

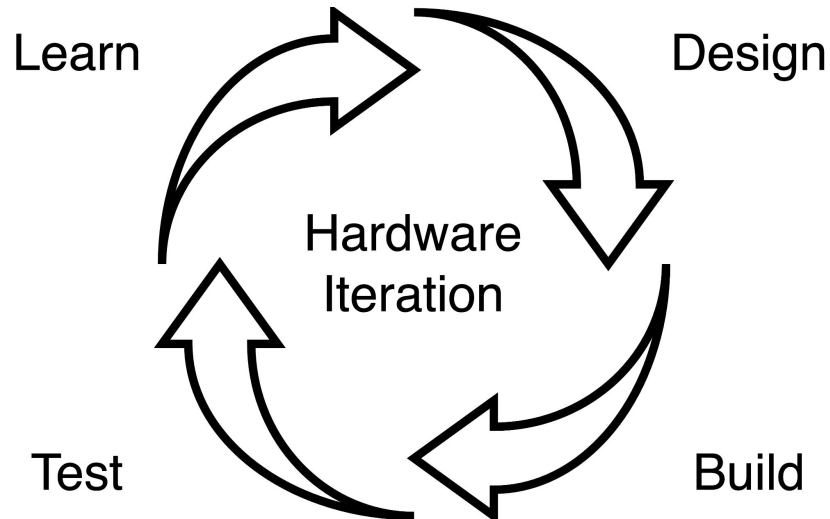
Product Lifecycle Management is a process that combines best practices and software tools to **centralize and structure product information** over the course of the product development lifecycle.

PRODUCT DEVELOPMENT LIFECYCLE



MULTIPLE HARDWARE ITERATIONS

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



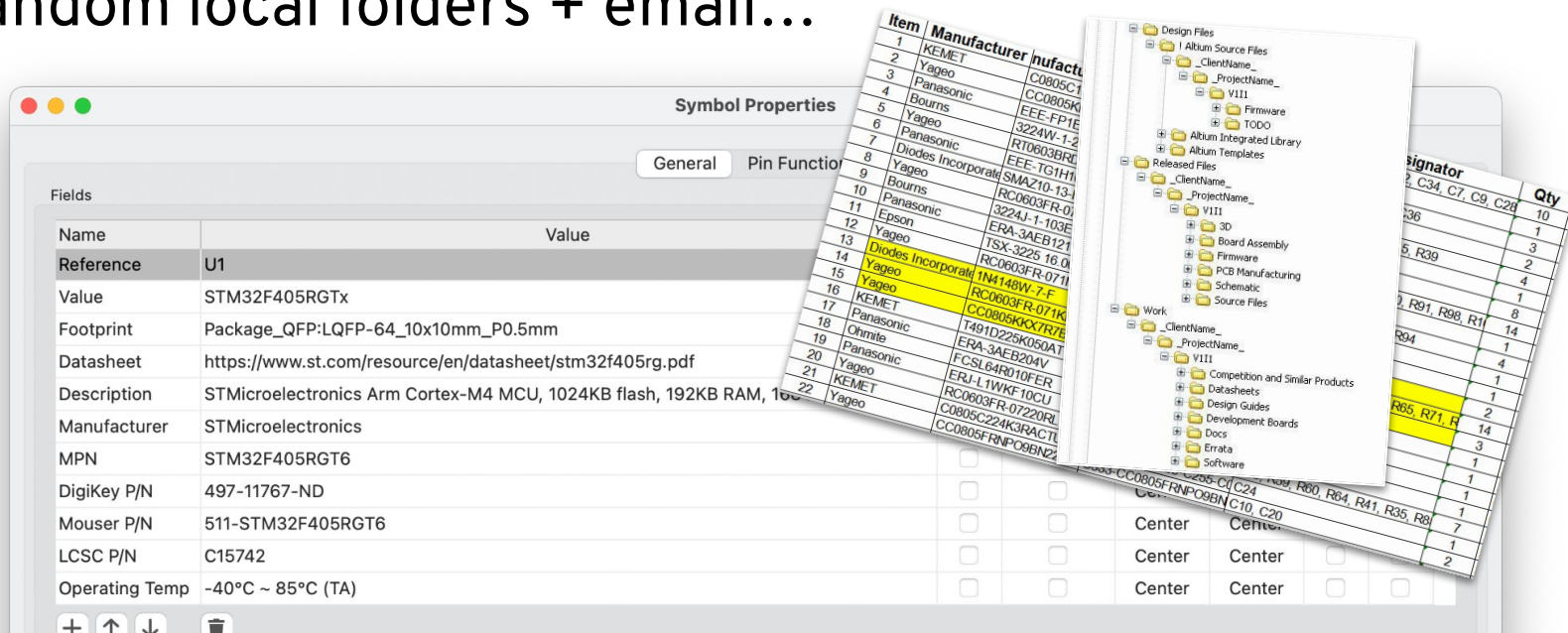
LOTS OF PRODUCT DATA TO MANAGE...

Each hardware iteration:

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

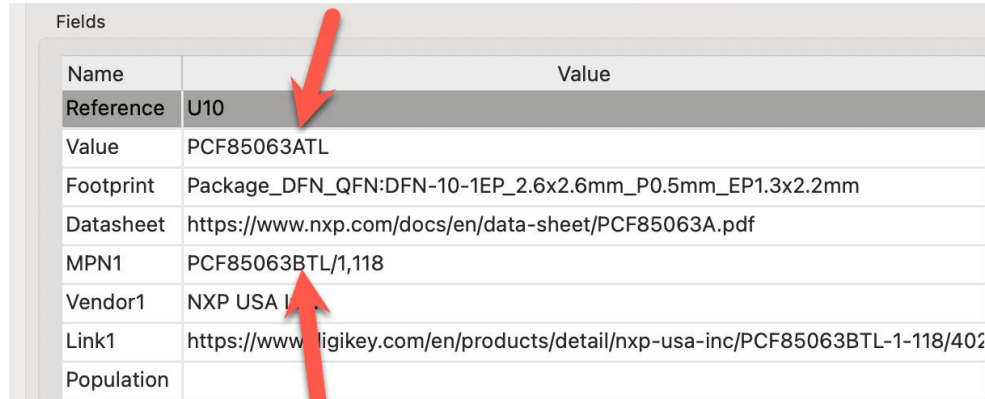
WHERE IS THIS DATA USUALLY STORED?

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!



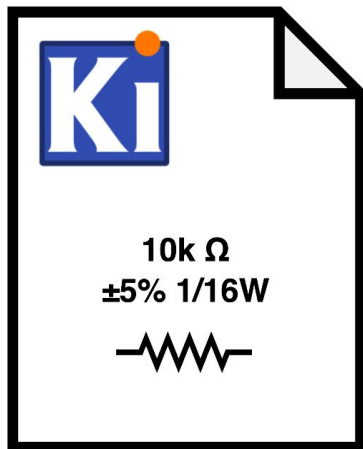
The image shows a screenshot of a 'Fields' table in KiCad. The table has two columns: 'Name' and 'Value'. The 'Reference' field is highlighted with a red arrow pointing to its value 'U10'. The 'Vendor1' field is also highlighted with a red arrow pointing to its value 'NXP USA INC'. The table contains the following data:

Name	Value
Reference	U10
Value	PCF85063ATL
Footprint	Package_DFN_QFN:DFN-10-1EP_2.6x2.6mm_P0.5mm_EP1.3x2.2mm
Datasheet	https://www.nxp.com/docs/en/data-sheet/PCF85063A.pdf
MPN1	PCF85063BTL/1,118
Vendor1	NXP USA INC
Link1	https://www.digikey.com/en/products/detail/nxp-usa-inc/PCF85063BTL-1-118/402
Population	

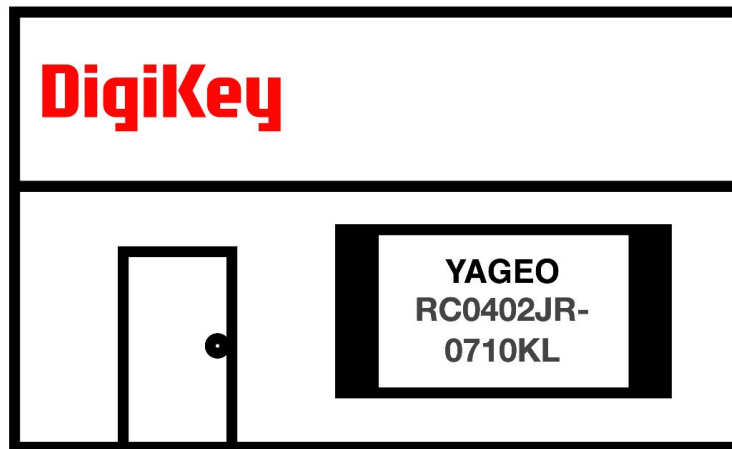
DECOUPLE DESIGN FROM MANUFACTURING

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

Design Intent



Manufacturing Implementation



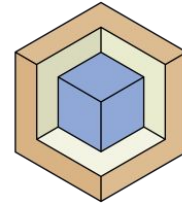
THERE'S GOTTA BE A BETTER WAY!

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



PLM SOFTWARE

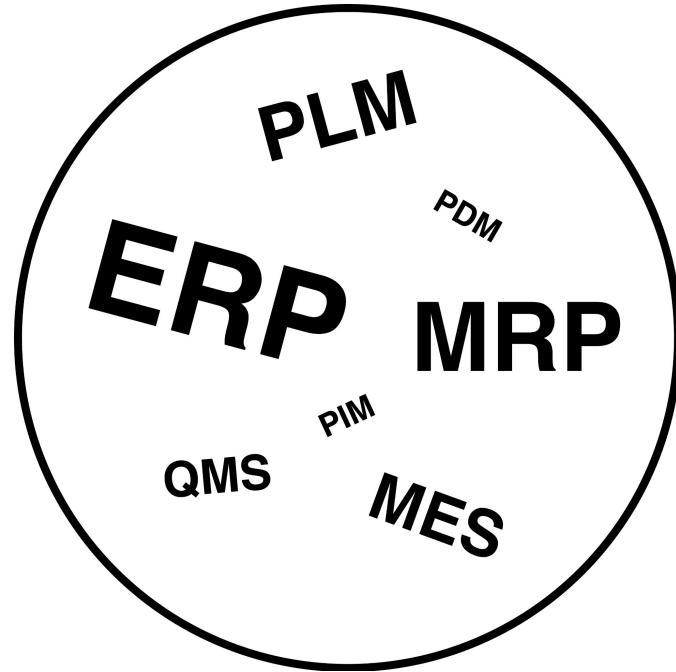
People realized this and made...PLM software!



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)

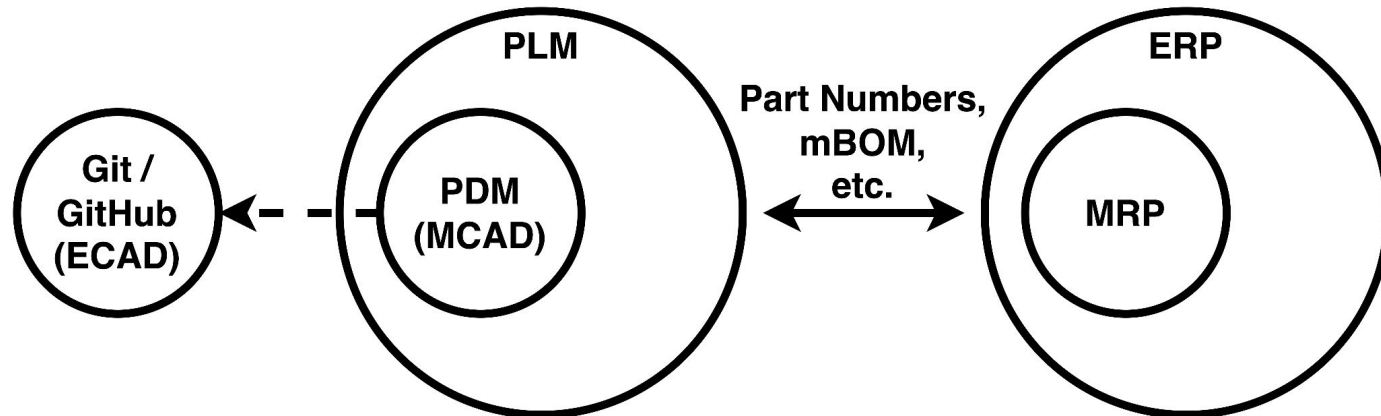
- Inventory, purchasing, scheduling, demand planning

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)

Chris Wilson
Common Ground Electronics
Open-Source Hardware

Home

Parts

Supply Chain

Inventory

Quality Control


Equipment

Relationships

Quotes

Purchases

RC0603JR-07100RL




RC0603JR-07100RL

YAGEO

100091

[Chip Resistors]
100 Ohms ±5% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film
N/A

A ACTIVE



Add or Manage images.

New Revision

Duplicate

Print Label

Delete

Details

Revisions

Inventory

Supply Chain

Quality

Demand (Product Matrix)

Attachments

Vaults

History

Part Details

EDIT PART

Part Number	100091
Type	Chip Resistors
Manufacturer	YAGEO
Manufacturer P/N	RC0603JR-07100RL
Manufacturer Family	RC_L
Value	100
Unit of Measure	each
Manufactured here	X
QC Required?	X

Alternate Parts

ADD AN ALTERNATE

P/N	MANUFACTURER P/N	COMMENTS
100099	RC1608J101CS ROHS	Samsung Electro-Mechanics

Where Used

SHOW ONLY THIS REVISION

USED IN

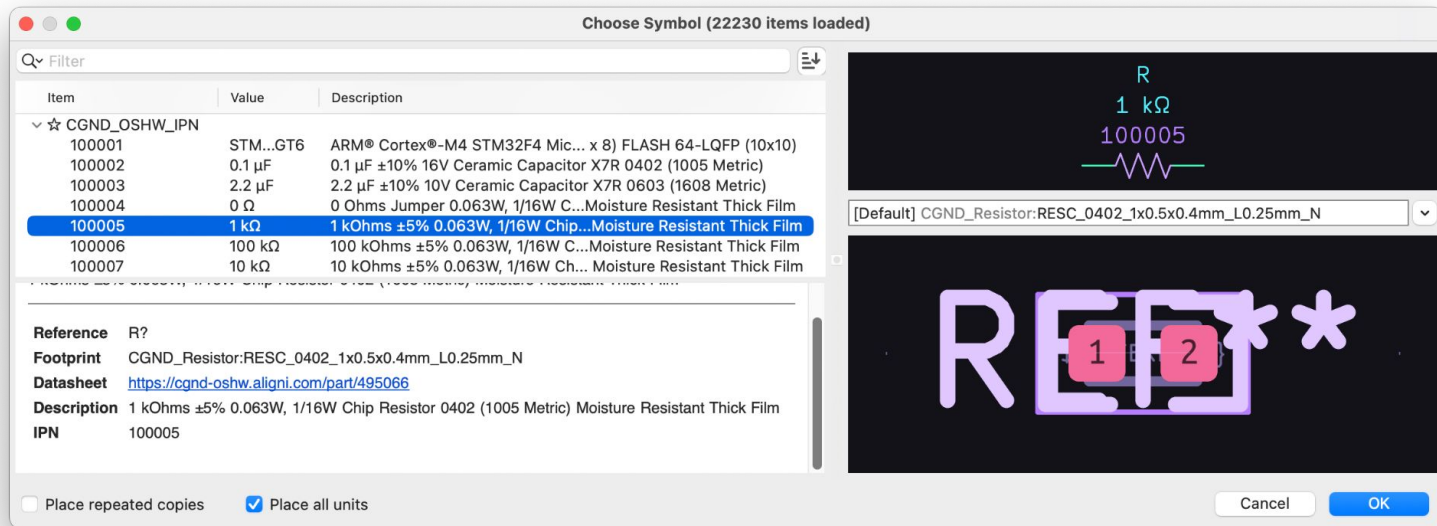
2 VISIBLE

0 HIDDEN

ASSEMBLY	REV	QTY.	COMMENT
100094	A >	1 each	100 Ohms ±5% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film


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

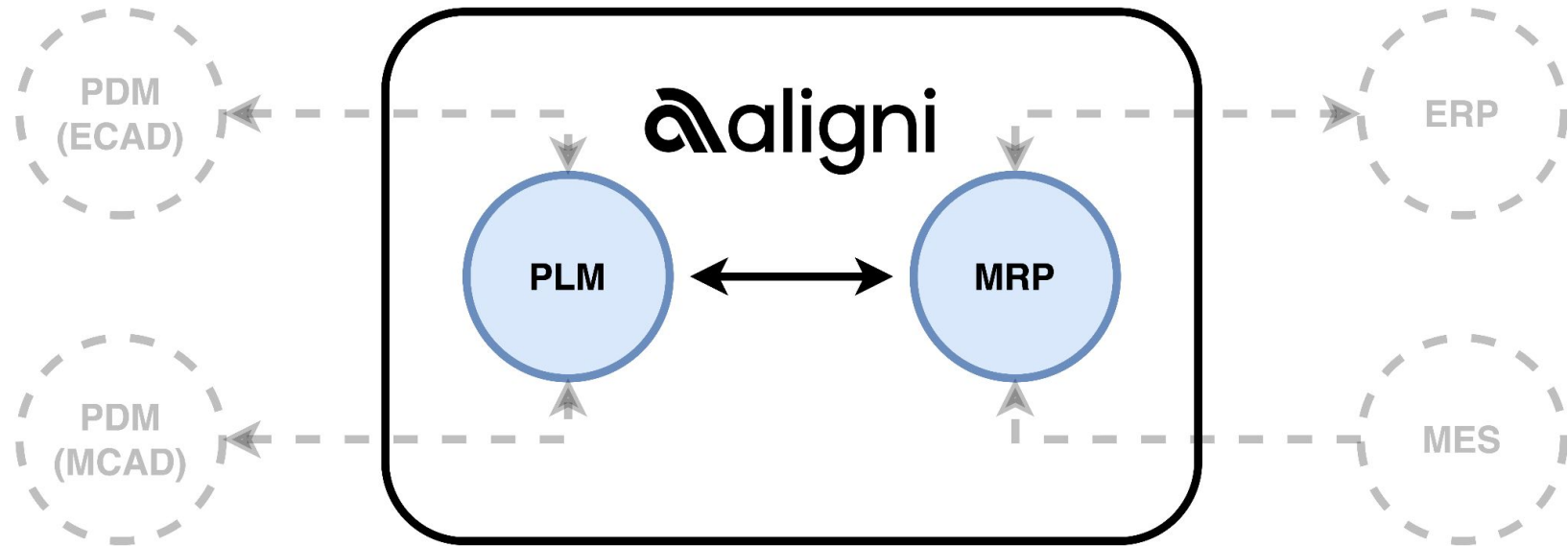
ALIGN // INTRODUCTION

The logo for 'align' features a stylized lowercase 'a' on the left, composed of a thick black curve and a white negative space. This is followed by the word 'align' in a bold, lowercase, sans-serif typeface. The entire logo is rendered in black on a white background.

align

ALIGNI // PLM + MRP

Aligni combines PLM & MRP functionality



ALIGN // 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

ALIGN // 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

ALIGN // WHY ALIGN?

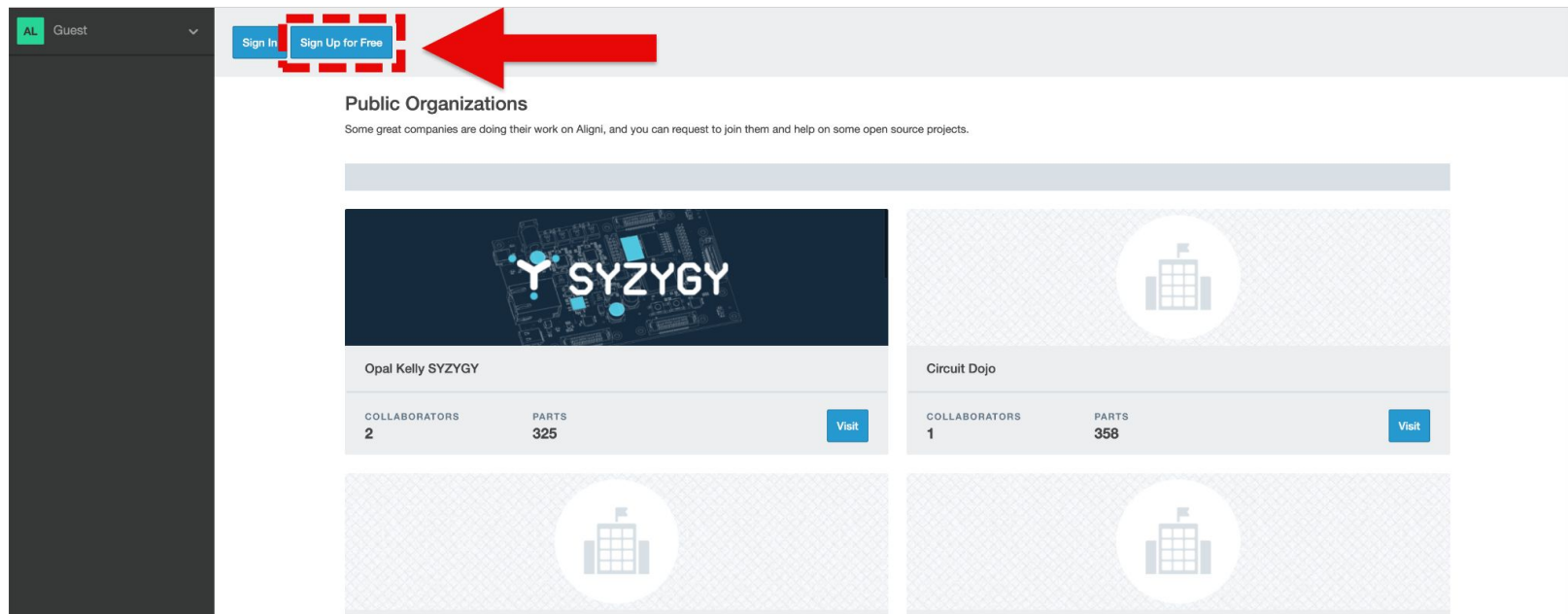
- Hosted solution with simple setup / no development
- Support for KiCad database (or HTTP) libraries
- ECAD agnostic (e.g. supports Altium also)
- Free tier with no time limit
- Public access for open-source projects (Open Aligni)
- Automatically managed internal part numbers

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>




The screenshot displays the Aligni app interface. On the left is a dark sidebar with a green 'AL' logo and the text 'Guest'. The main header is light gray and contains two buttons: 'Sign In' and 'Sign Up for Free'. The 'Sign Up for Free' button is highlighted with a red dashed border, and a large red arrow points to it from the right. Below the header, the section is titled 'Public Organizations' with the subtitle 'Some great companies are doing their work on Aligni, and you can request to join them and help on some open source projects.' The main content area features a grid of organization cards. The first card is for 'Opal Kelly SYZGY', which includes a header image with the SYZGY logo, the name 'Opal Kelly SYZGY', and statistics: 'COLLABORATORS 2' and 'PARTS 325'. A blue 'Visit' button is in the bottom right corner. The second card is for 'Circuit Dojo', featuring a building icon, the name 'Circuit Dojo', and statistics: 'COLLABORATORS 1' and 'PARTS 358', also with a blue 'Visit' button. Two more placeholder cards with building icons are visible at the bottom.

AL Guest

Sign In Sign Up for Free


Public Organizations

Some great companies are doing their work on Aligni, and you can request to join them and help on some open source projects.




Opal Kelly SYZGY


COLLABORATORS	PARTS	Visit
2	325	



Circuit Dojo

COLLABORATORS	PARTS	Visit
1	358	





ALIGN // SETUP // **CREATE A NEW ORG**

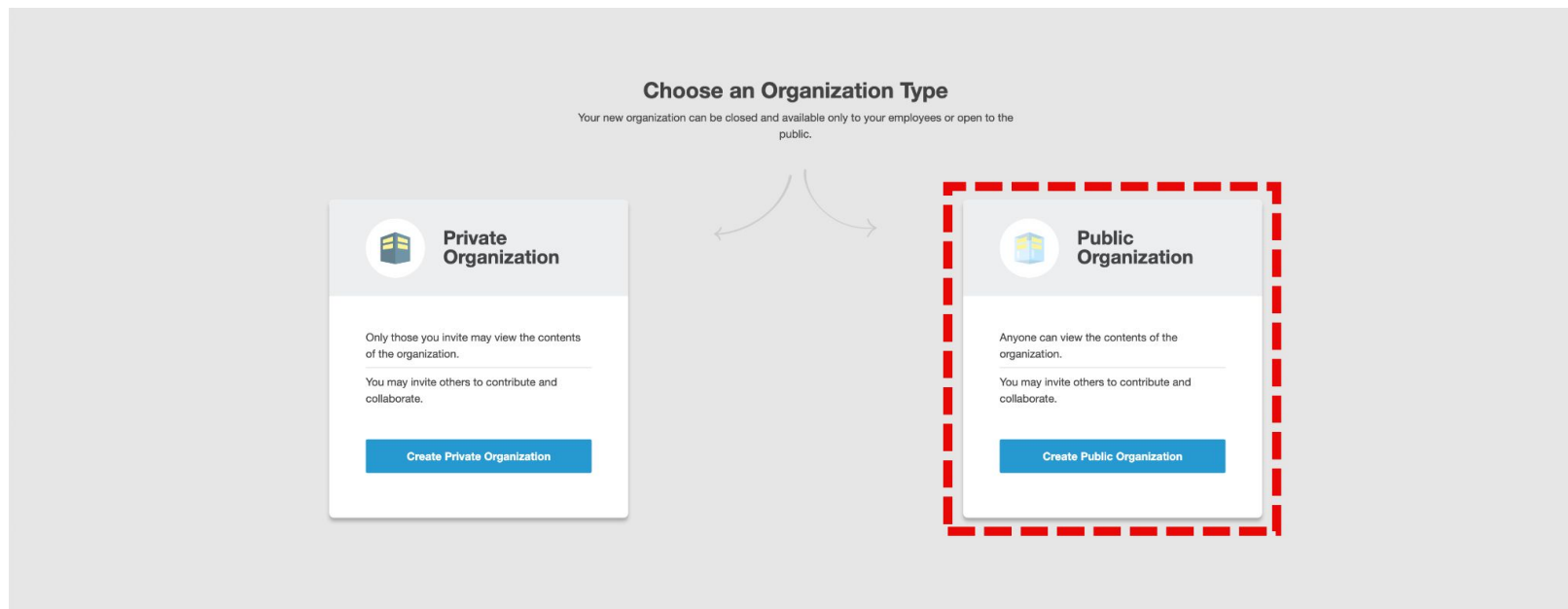
Create a new organization

The screenshot displays the Align user interface. On the left is a dark sidebar with the user's name 'Chris Wilson' and a dropdown arrow. The main header area shows the user's profile 'Chris Wilson' with email 'cgnd_chris - chris@cgnd.dev' and a badge for 'Common Ground Electronics Open-Source Hardware'. In the top right corner, a blue button labeled 'Create New Organization' is enclosed in a red dashed rectangular box, with a large red arrow pointing towards it from the left. Below the header, the section 'Public Organizations' is visible, with a subtext: 'Some great companies are doing their work on Align, and you can request to join them and help on some open source projects.' The main content area features two organization cards. The first card for 'Opal Kelly SYZGY' has a dark blue header with a circuit board image and the SYZGY logo. It lists '2 COLLABORATORS' and '325 PARTS' with a 'Visit' button. The second card for 'Circuit Dojo' has a light gray header with a building icon, listing '1 COLLABORATORS' and '358 PARTS' with a 'Visit' button. The bottom of the screen shows the start of two more organization cards.

Organization	Collaborators	Parts	Action
Opal Kelly SYZGY	2	325	Visit
Circuit Dojo	1	358	Visit

ALIGN // SETUP // **CREATE A NEW ORG**

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



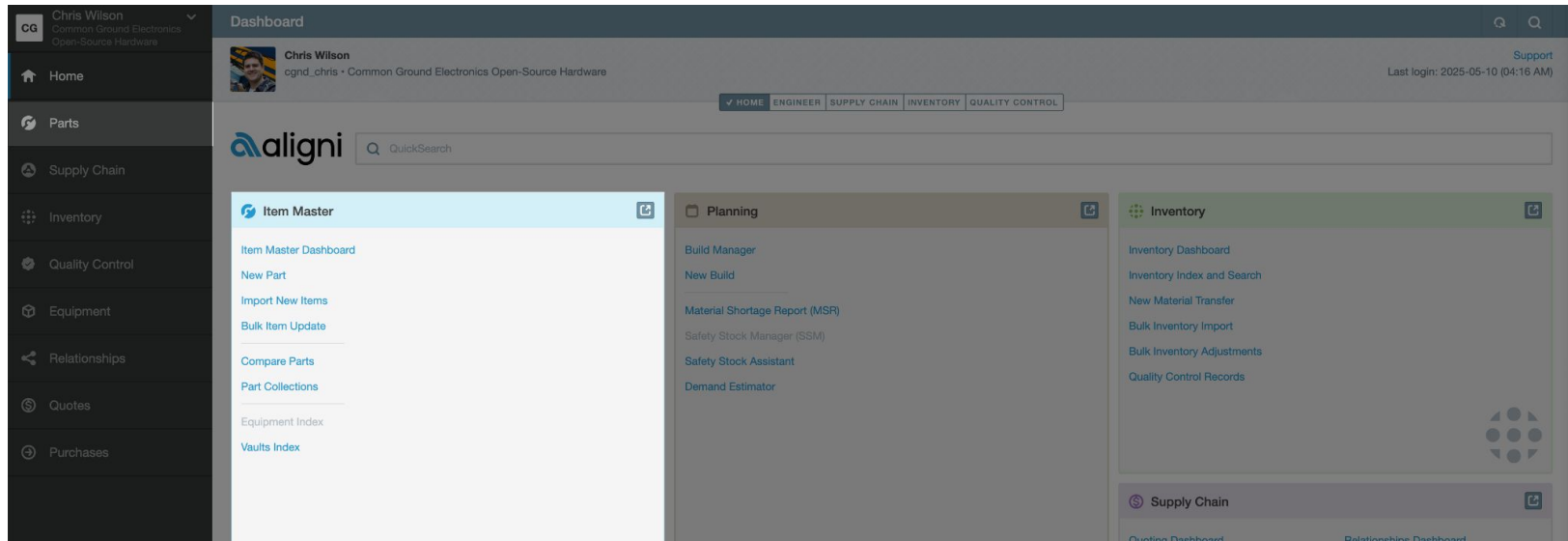
ALIGN // DASHBOARD

The screenshot displays the ALIGN Dashboard interface. On the left is a dark sidebar with navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. At the bottom of the sidebar is the ALIGN logo and a 'Collapse Sidebar' button. The main dashboard area has a header with the user's name 'Chris Wilson', company 'Common Ground Electronics Open-Source Hardware', and a 'Support' link. Below the header is a navigation bar with tabs: HOME, ENGINEER, SUPPLY CHAIN, INVENTORY, and QUALITY CONTROL. The dashboard is divided into several modules:

- Item Master** (light blue header):
 - Item Master Dashboard
 - New Part
 - Import New Items
 - Bulk Item Update
 - Compare Parts
 - Part Collections
 - Equipment Index
 - Vaults Index
- Planning** (light brown header):
 - Build Manager
 - New Build
 - Material Shortage Report (MSR)
 - Safety Stock Manager (SSM)
 - Safety Stock Assistant
 - Demand Estimator
- Inventory** (light green header):
 - Inventory Dashboard
 - Inventory Index and Search
 - New Material Transfer
 - Bulk Inventory Import
 - Bulk Inventory Adjustments
 - Quality Control Records
- Supply Chain** (light purple header):
 - Quoting Dashboard
 - Purchasing Dashboard
 - New Quote
 - New Purchase
 - Relationships Dashboard
 - New Manufacturer
 - New Vendor
 - New Contact
 - New Customer
- Change Management** (light pink header):
 - Change Management Dashboard
 - New ECR
 - New ECO
- Reporting** (light yellow header):
 - Purchasing Reporting
 - Inventory Reporting
 - Usage Reporting
- System** (light blue header):
 - Account Settings
 - Organization Settings

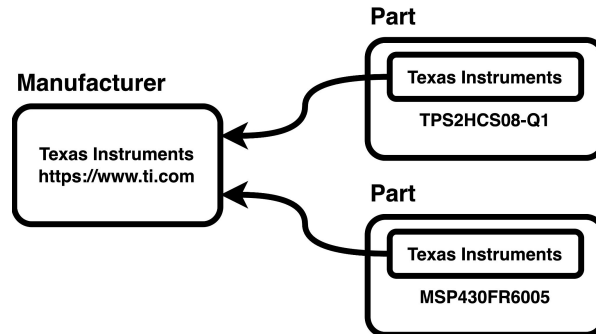
ALIGN // ITEM MASTER

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



ALIGN // 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 attributes
- Backed by a “normalized relational database”



ALIGN // PARTS

cg

Chris Wilson
Common Ground Electronics
Open-Source Hardware

Home

Parts

Supply Chain

Inventory

Quality Control

Equipment

Relationships


Quotes

Purchases

Collapse Sidebar

align


RC0603JR-07100RL



RC0603JR-07100RL
YAGEO
100091

[Chip Resistors]
100 Ohms ±5% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film
N/A

A ACTIVE



Add or Manage images.

New Revision

Duplicate

Print Label

Delete

Details

Revisions

Inventory

Supply Chain

Quality

Demand (Product Matrix)

Attachments

Vaults

History

Part Details

EDIT PART

Part Number	100091
Type	Chip Resistors
Manufacturer	YAGEO
Manufacturer P/N	RC0603JR-07100RL
Manufacturer Family	RC_L
Value	100
Unit of Measure	each
Manufactured here	X
QC Required?	X
Attrition	
Hidden	X
Display Value	100 Ω
Keywords	res resistor RC_L
Lifecycle Status	Production
Align Part URL	https://cgnd-oshw.aligni.com/part/567037
Datasheet URL	https://www.yageo.com/upload/media/product/products/datasheet/rcchip/PYu-RC_Group_51_RoHS_L_12.pdf
Tolerance - Lower Limit	-5.0

Alternate Parts

ADD AN ALTERNATE

P/N	MANUFACTURER P/N	COMMENTS
100099	RC1608J101CS ROHS Samsung Electro-Mechanics	

Where Used

SHOW ONLY THIS REVISION

USED IN

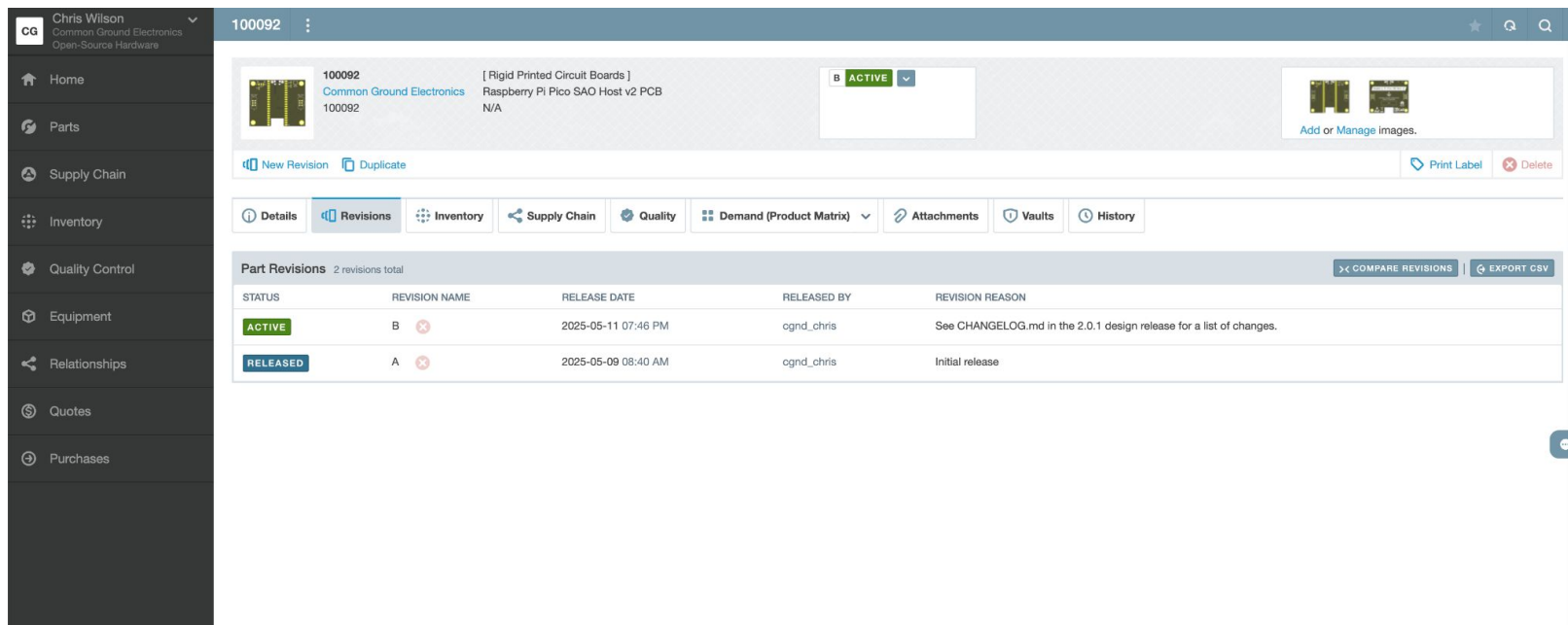
1 VISIBLE

0 HIDDEN

ASSEMBLY	REV	QTY.	COMMENT
100094	A	1 each	100 Ohms ±5% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film

ALIGN // PARTS // REVISIONS

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



The screenshot displays the ALIGN software interface for managing parts and revisions. The left sidebar contains navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main content area shows the details for part 100092, which is a Raspberry Pi Pico SAO Host v2 PCB. The 'Revisions' tab is active, showing a table of two revisions: Revision B (ACTIVE) and Revision A (RELEASED). The table includes columns for STATUS, REVISION NAME, RELEASE DATE, RELEASED BY, and REVISION REASON. The 'ACTIVE' status is highlighted in green, and the 'RELEASED' status is highlighted in blue. The revision reason for Revision B is 'See CHANGELOG.md in the 2.0.1 design release for a list of changes.' and for Revision A is 'Initial release'.

CG Chris Wilson
Common Ground Electronics
Open-Source Hardware

100092 [Rigid Printed Circuit Boards]
Common Ground Electronics Raspberry Pi Pico SAO Host v2 PCB
100092 N/A

B ACTIVE

Add or Manage images.

New Revision Duplicate

Print Label Delete

Details Revisions Inventory Supply Chain Quality Demand (Product Matrix) Attachments Vaults History

Part Revisions 2 revisions total >< COMPARE REVISIONS < EXPORT CSV

STATUS	REVISION NAME	RELEASE DATE	RELEASED BY	REVISION REASON
ACTIVE	B	2025-05-11 07:46 PM	cgnd_chris	See CHANGELOG.md in the 2.0.1 design release for a list of changes.
RELEASED	A	2025-05-09 08:40 AM	cgnd_chris	Initial release

ALIGN // PARTS // INVENTORY

Warehouse location and stock count of this part

CG

Chris Wilson
Common Ground Electronics
Open-Source Hardware

Home

Parts

Supply Chain

Inventory

Quality Control


Equipment

Relationships

Quotes

Purchases

RC0603JR-07100RL



RC0603JR-07100RL

YAGEO

100091


[Chip Resistors]

100 Ohms ±5% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film

N/A

A

ACTIVE



Add or Manage images.

New Revision

Duplicate

Print Label

Delete

Details

Revisions

Inventory

Supply Chain

Quality

Demand (Product Matrix)

Attachments

Vaults

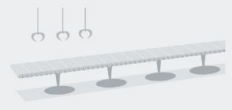
History

Inventory Outlook

Prominence = 100

SETTINGS

No Inventory Outlook



Inventory

Quantity

Unit Cost

Location / Detail

Info

> 1,000 each

≈ \$0.0008

JLPCB

Quantity Available: 1,000 each

1 items collapsed. Click to expand.

1,000 each

Total On-Hand (1,000 available)

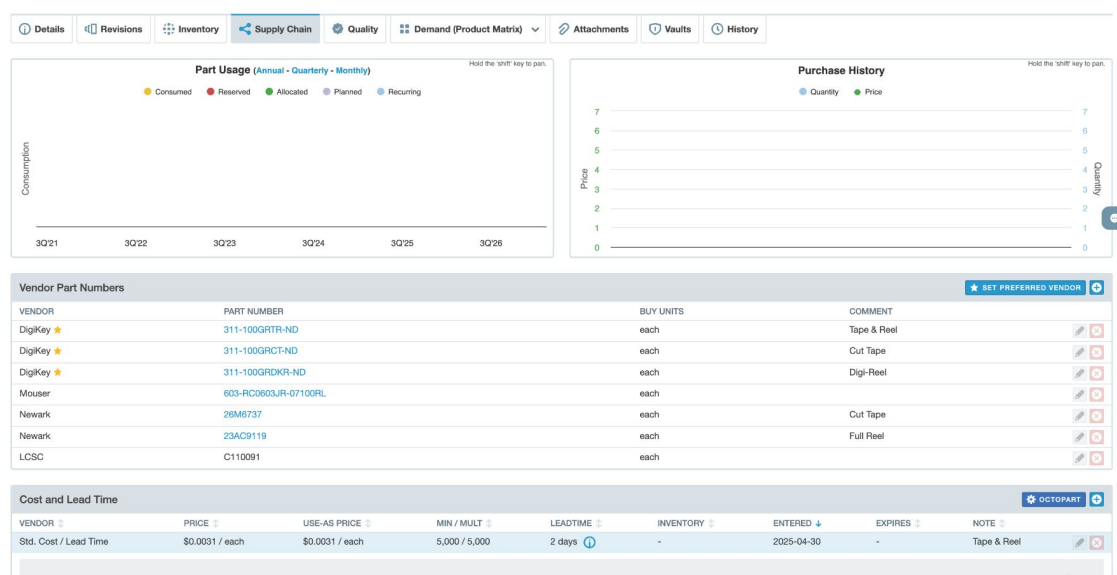
Consumption

Safety Stock (each)

MANAGE SAFETY STOCK

ALIGNI // PARTS // SUPPLY CHAIN

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



ALIGN // PARTS // CREATING NEW PARTS

Some initial setup required before creating new parts

The screenshot shows the 'Create New Part' form in the ALIGN software. The form is divided into several sections, each with a red border. A red callout box with the text 'Must be defined before creating a new part' has four arrows pointing to the following fields:

- PART NUMBER:** Part number will be automatically generated.
- MANUFACTURER:** YAGEO
- TYPE:** Chip Resistors
- UNIT OF MEASURE:** each
- KEYWORDS:** res resistor RC_L

Other fields visible in the form include:

- MANUFACTURER P/N:** RC0402JR-0710KL
- DESCRIPTION:** 10 kOhms $\pm 5\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric)
- COMMENT:**
- VALUE:** 0
- MANUFACTURED HERE?** ☒ Manufactured Here
- QUALITY CONTROL:** ☒ Quality Control Required
- ATTRITION (%):**
- DISPLAY VALUE:** 10 k Ω
- LIFECYCLE STATUS:** Preliminary
- DATASHEET URL:** <https://www.yageo.com/upload/media/product/productsearch/dst>

ALIGN // SETUP // PART NUMBER SCHEME

Recommended internal part number scheme (100001):

The screenshot shows the 'Settings' page for 'Chris Wilson' (Common Ground Electronics Open-Source Hardware). The left sidebar contains navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main content area is titled 'Settings' and includes a sidebar for 'ORGANIZATION' and 'PARTS'. The 'PARTS' sidebar has links for 'Part Types', 'Numbering', 'Display', 'Parameters', and 'Images'. The 'Numbering' link is selected, leading to the 'Part Numbers' configuration page. This page has three tabs: 'Part Numbers', 'Manufacturer Numbers', and 'Part Type Numbers'. The 'Part Numbers' tab is active. It contains a 'Part Number Style' section with three options: 'Manual', 'Autoincrement', and 'Autoincrement with Manufacturer Prefix'. The 'Autoincrement' option is selected and highlighted with a red box. Below this, the 'PART NUMBER LENGTH' field is set to 7, highlighted with a red box and a red callout that says 'Max length = 7'. The 'NEXT PART NUMBER' field is set to 100100, highlighted with a red box and a red callout that says 'Start with 100....'. The 'DELIMITER' field is set to a dash character (-). The page also includes a 'Collapse Sidebar' button at the bottom left and an 'aligni' logo.

Chris Wilson
Common Ground Electronics
Open-Source Hardware

Settings

Organization Settings
Common Ground Electronics Open-Source Hardware

Organization Settings > Part Numbers

Part Numbers Manufacturer Numbers Part Type Numbers

Part Numbers

These settings affect the way part numbers are created for new parts.
They do not affect part numbers for parts already in your database.

Part Number Style

☐ Manual
Examples: AX0302PC3-TSOP, MAX7305PD
Part numbers are assigned manually each time a new part is created. Uniqueness is enforced.

☒ Autoincrement
Example: 0010317
Part numbers are uniquely assigned as new parts are created.

☐ Autoincrement with Manufacturer Prefix
Examples: 0233-000317, ADI-0097, XILX-0097
Part numbers are uniquely assigned as new parts are created. Each part number is prefixed with a manufacturer "key" (see below). Each manufacturer has its own sequence.

☐ Autoincrement with Parttype Prefix
Examples: 001-000317, CAP-0097, SW-0097
Part numbers are uniquely assigned as new parts are created. Each part number is prefixed with a parttype "key" (see below). Each parttype has its own sequence.

PART NUMBER LENGTH

7

This is the maximum length of the part number. If the part number is not filled to this length, it will be padded with zeros. If the part number is an "autoincrement" style, the part number will be zero-filled to this length.

NEXT PART NUMBER

100100

The next new part number will be assigned this number if you are using autoincrement part numbering.

DELIMITER

Dash (-)

This optional delimiter character will be added between the prefix and sequence number when generating new part numbers.

Max length = 7

Start with 100....

aligni

ALIGNI // SETUP // PART TYPES

Part Types associate parameters with groups of parts

The screenshot displays the ALIGNI web application interface. On the left is a dark sidebar with navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main content area is titled 'Settings' and shows 'Organization Settings' for 'Common Ground Electronics Open-Source Hardware'. Under the 'PARTS' section, the 'Part Types' sub-section is active, displaying a table of part types and their associated parameters.

NAME	ATTRITION	NON-MATERIAL?	CATEGORY ONLY?	PART TYPES COUNT	PARTS COUNT
..default	✗	✗	✗	0	0
..test_category	✗	✓	✓	1	0
Capacitors	✗	✓	✓	1	0
Connectors	✗	✓	✓	4	0
Crystals	✗	✗	✗	0	2
Diodes	✗	✓	✓	1	0
Documents	✓	✓	✓	1	0
Electromechanical	✗	✓	✓	1	0
EMI & RFI Suppression	✗	✓	✓	1	0
Integrated Circuits	✗	✓	✓	3	0
LEDs	✗	✗	✗	0	10
Memory	✗	✓	✓	1	0
Printed Circuit Assemblies	✗	✗	✗	0	11
Printed Circuit Boards	✗	✓	✓	1	0
Resistors	✗	✓	✓	1	0
Screws	✗	✗	✗	0	1
Shunts & Jumpers	✗	✗	✗	0	1
Spacers & Standoffs	✗	✗	✗	0	1
Test & Measurement	✗	✓	✓	1	0
Transistors	✗	✓	✓	1	0

1 - 44 of 44

ALIGN // SETUP // CUSTOM PARAMETERS

Example: “KiCad Symbols” custom parameter

The screenshot displays the ALIGN web application interface. On the left is a dark sidebar with navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main content area is titled 'Settings' and shows the 'Edit Part Parameter' configuration for the 'KiCad Symbols' parameter. The configuration includes fields for NAME, XML NAME, and DESCRIPTION, and a section for PARAMETER TYPE with options for Required, Use Autocomplete?, and Lifecycle parameter. Below this is a table of Associated Part Types.

Settings

Organization Settings
Common Ground Electronics Open-Source Hardware

Organization Settings > Custom Part Parameters > Edit Part Parameter

Edit Part Parameter

NAME: KiCad Symbols

XML NAME: kicad_symbols

DESCRIPTION: A list of KiCad symbols in the form "LibraryNickname:SymbolName" separated by semicolons.

PARAMETER TYPE: String

☐ Required
Can only be associated with part types without parts.

☐ Use Autocomplete?

☒ Lifecycle parameter
Use this setting when the parameter's value may change regularly throughout the lifecycle of the part.
When enabled, collaborators with can edit lifecycle parameters permission may change the value of this parameter at any time.
Changes to lifecycle parameters are logged, but revisioning is not required.

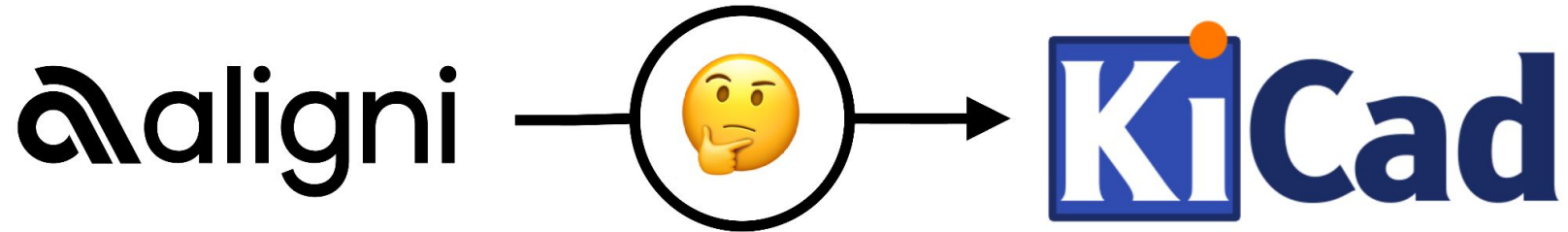
Delete Part Parameter Cancel Update Part Parameter

Associated Part Types [MANAGE PART TYPES](#)

._default
._test_part_type
Card Edge Connectors
Ceramic Capacitors
Chip Resistors
Crystals
Ferrite Beads
Flash Memory
FRGAs

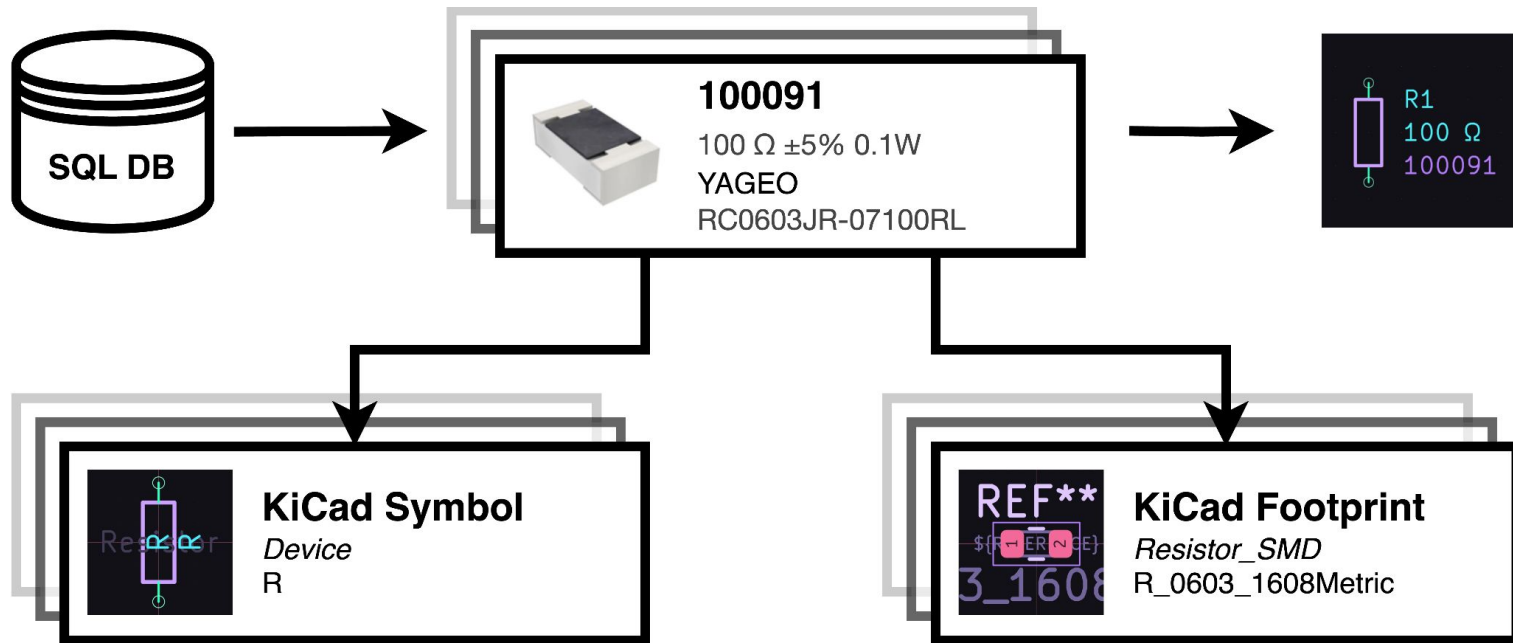
KICAD // DATABASE LIBRARY INTEGRATION

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



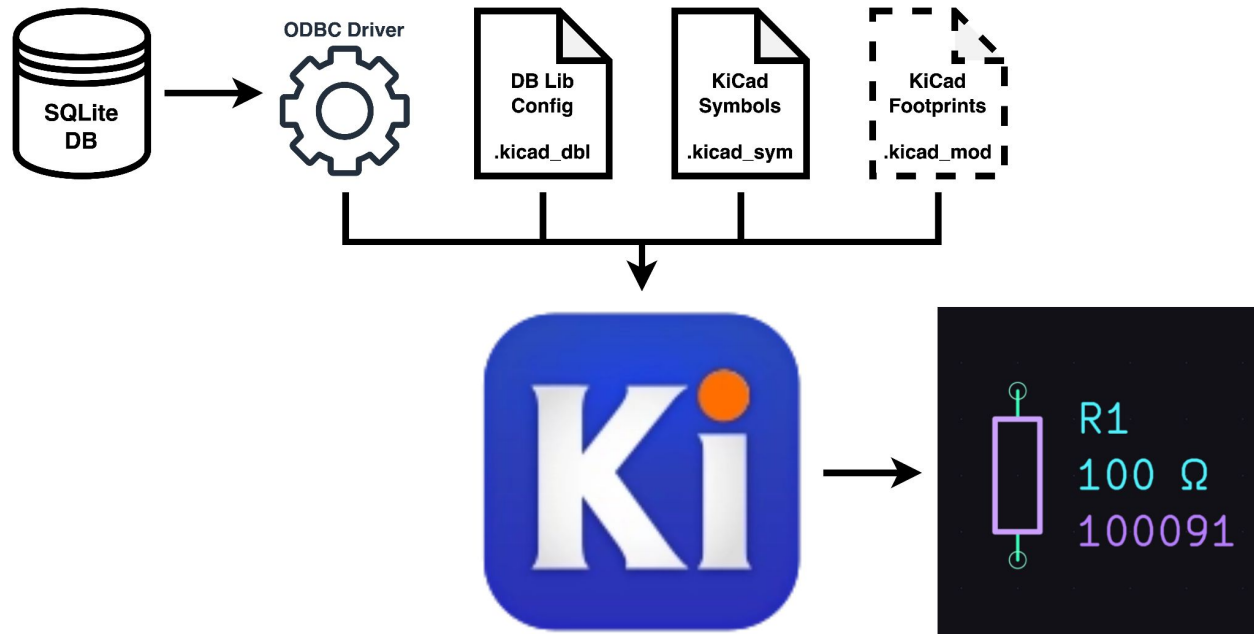
KICAD // DATABASE LIBRARY INTEGRATION

Database libraries are generated from SQL databases



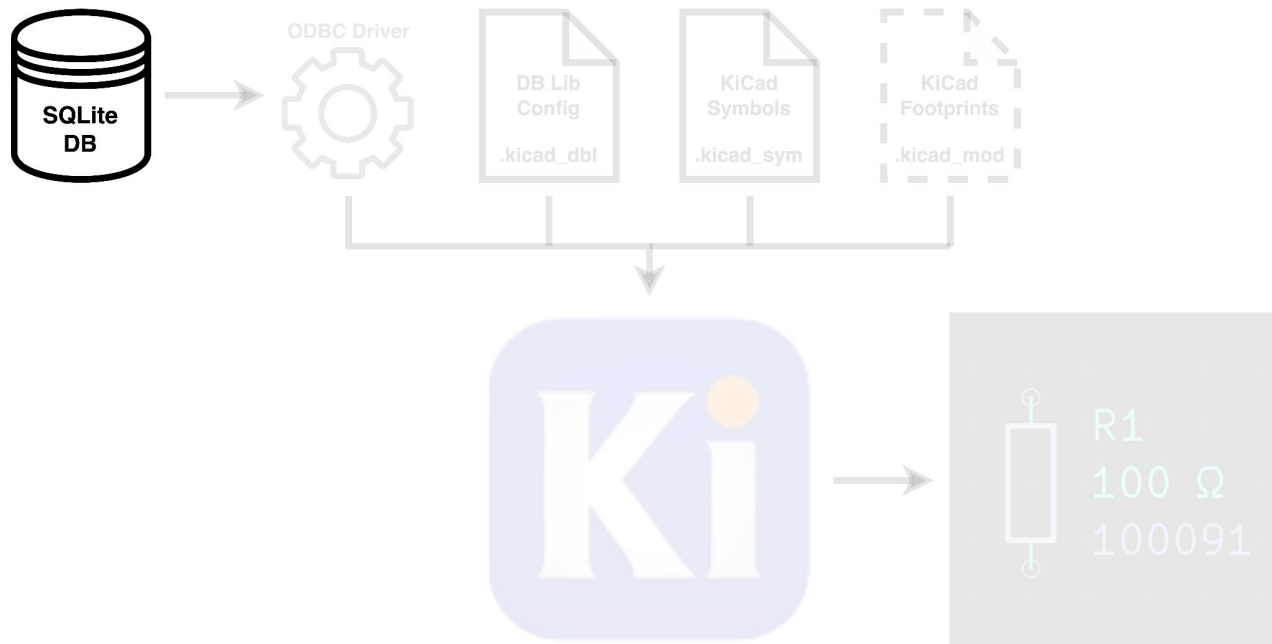
KICAD // DATABASE LIBRARY INTEGRATION

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/>

ALIGN // 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)

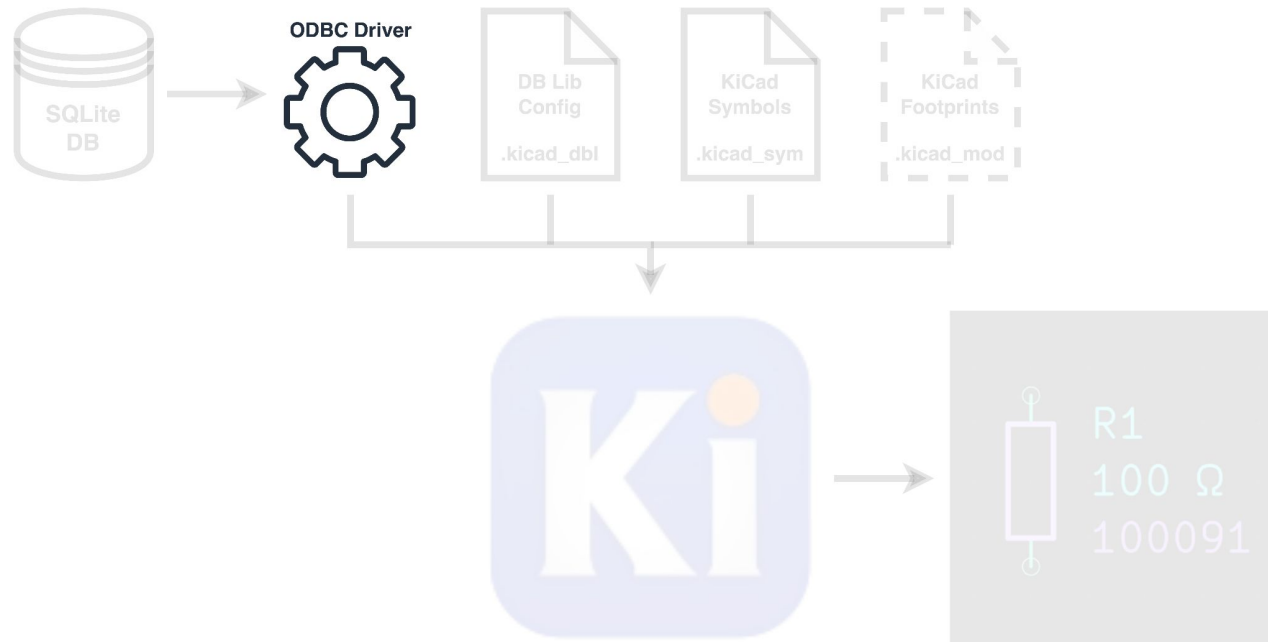
ALIGN // REPLICATOR // DB DATA

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	CL10B105K08NNNC	100009	Ceramic Capacitors	0.0	1
10	0.05146	Samsung Electro-Mechanics	CL21B106K0QNNNE	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

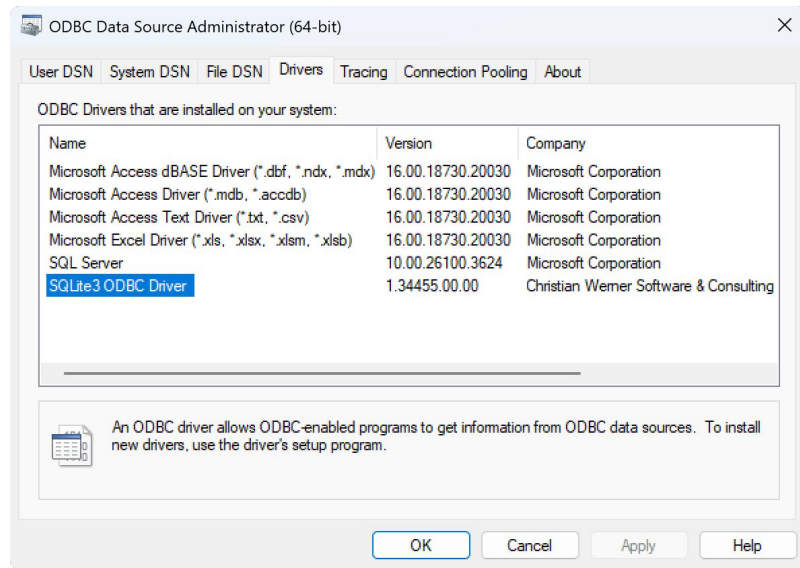
SQLite ODBC Driver

<http://www.ch-werner.de/sqliteodbc/>

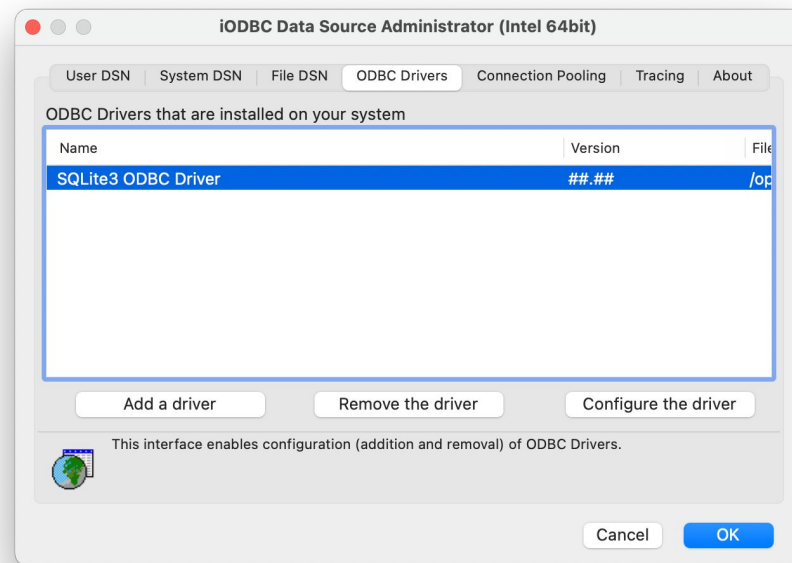
NOTE: On Windows, KiCad requires 64-bit ODBC driver, but Aligni Replicator requires 32-bit driver—install both!

KICAD // DATABASE LIBRARY INTEGRATION

Windows (64-bit)

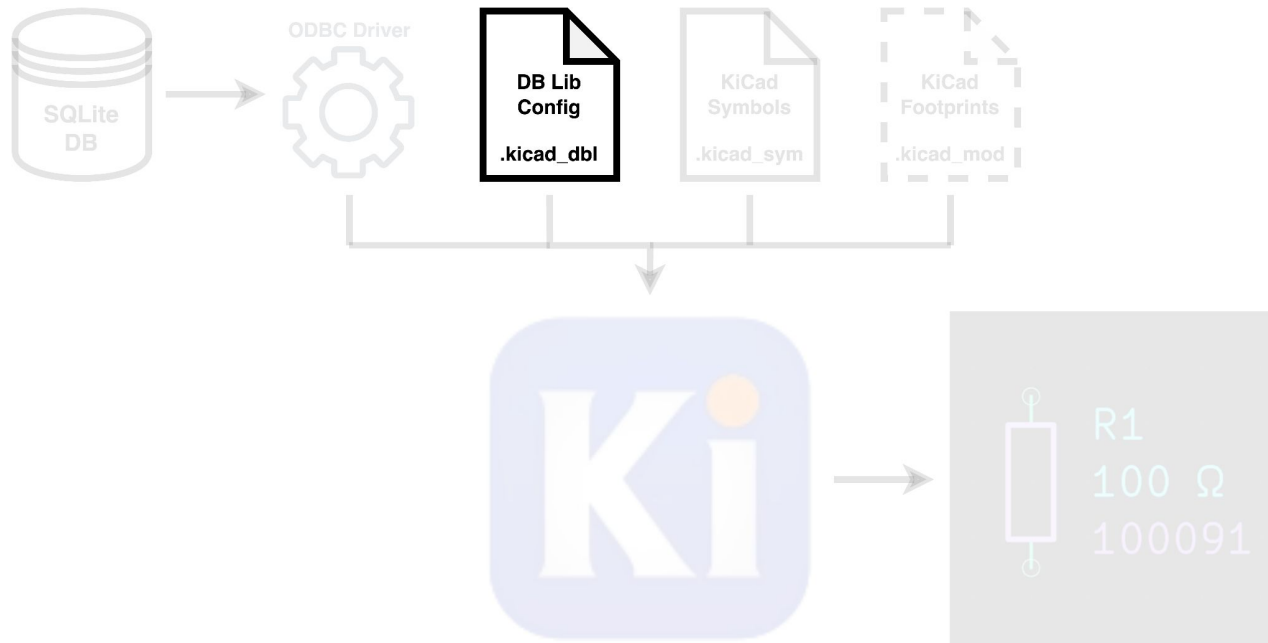


macOS



KICAD // DATABASE LIBRARY INTEGRATION

Config file tells KiCad how to generate the DB library



KICAD // DATABASE LIBRARY INTEGRATION

Example: CGND_OSHW_IPN.kicad_dbl

- Database library configuration file
- Maps tables/fields from DB to KiCad symbols/fields

```
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

```
{
  "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"
  },
}
```

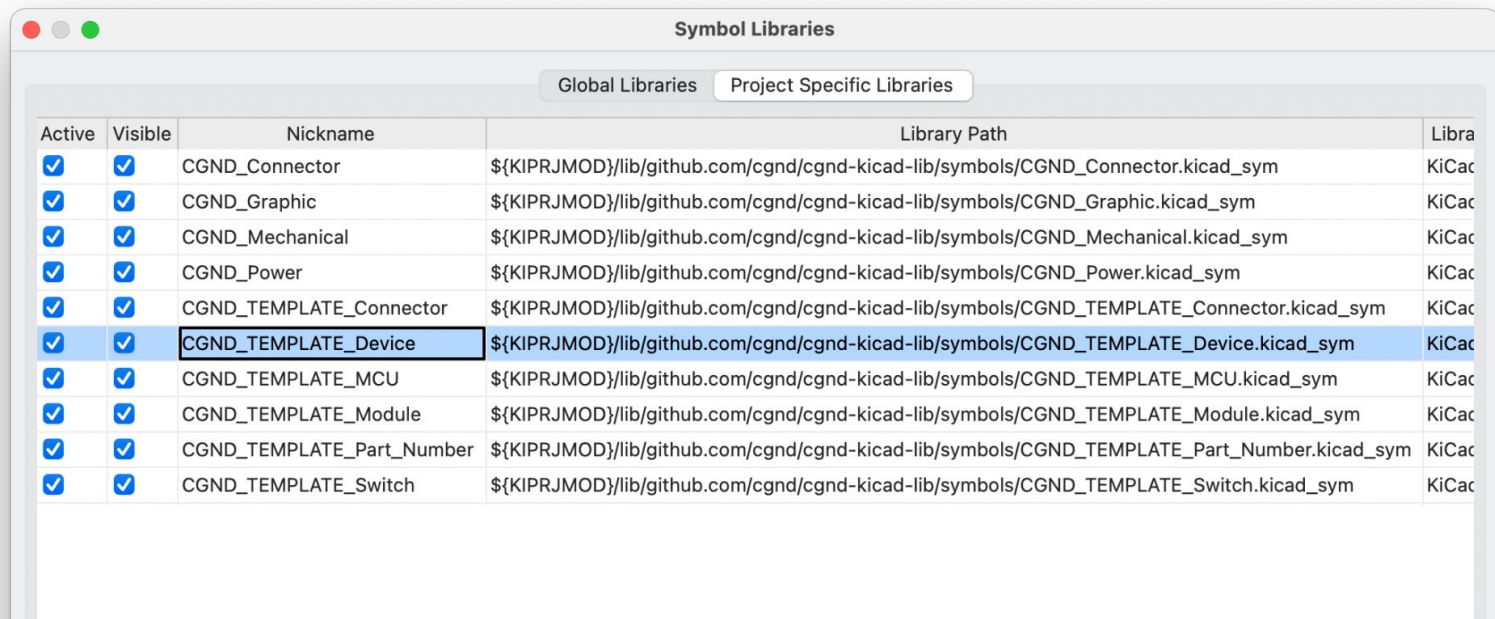
KICAD // DATABASE LIBRARY INTEGRATION



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

KICAD // DATABASE LIBRARY INTEGRATION

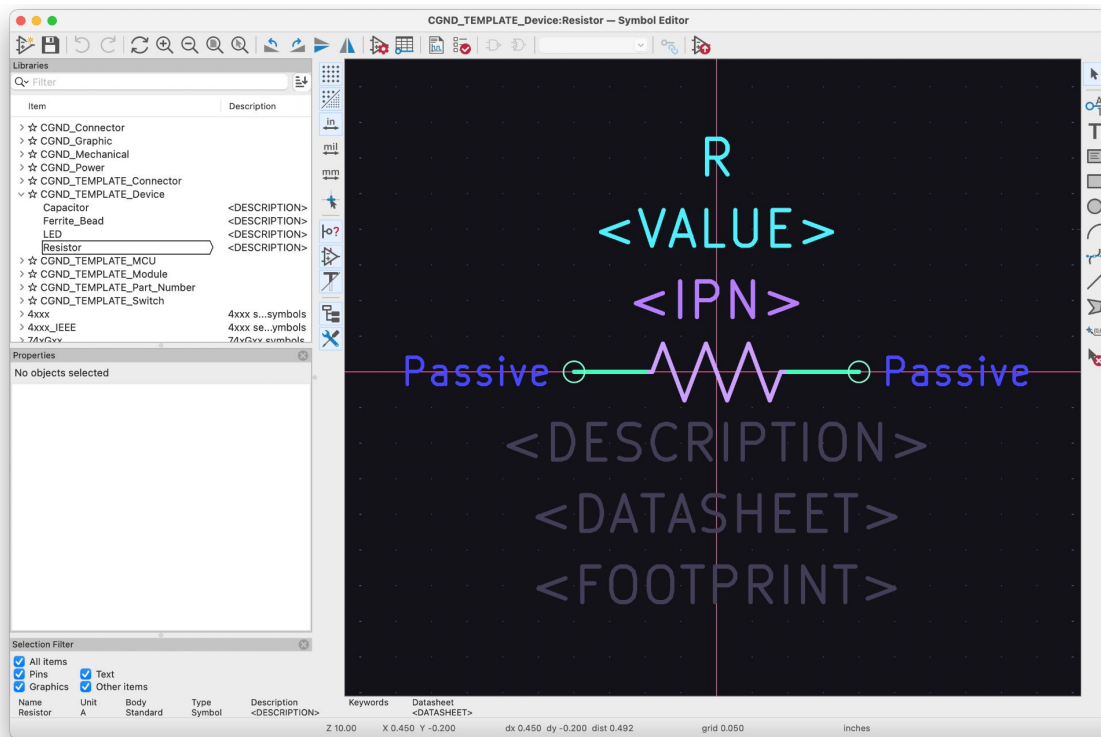
Referenced symbols must be defined in the library table



The screenshot shows the 'Symbol Libraries' dialog box in KICAD. It has two tabs: 'Global Libraries' and 'Project Specific Libraries'. The 'Project Specific Libraries' tab is selected. Below the tabs is a table with five columns: 'Active', 'Visible', 'Nickname', 'Library Path', and 'Libra'. The table lists several symbol libraries, with 'CGND_TEMPLATE_Device' highlighted in blue. The 'Active' and 'Visible' columns for all listed libraries have blue checkmarks.

Active	Visible	Nickname	Library Path	Libra
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Connector.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Graphic	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Graphic.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Mechanical	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Mechanical.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Power	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Power.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Connector.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Device	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Device.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_MCU	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_MCU.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Module	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Module.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Part_Number	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Part_Number.kicad_sym	KiCac
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Switch	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Switch.kicad_sym	KiCac

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  
  },  
]
```


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?

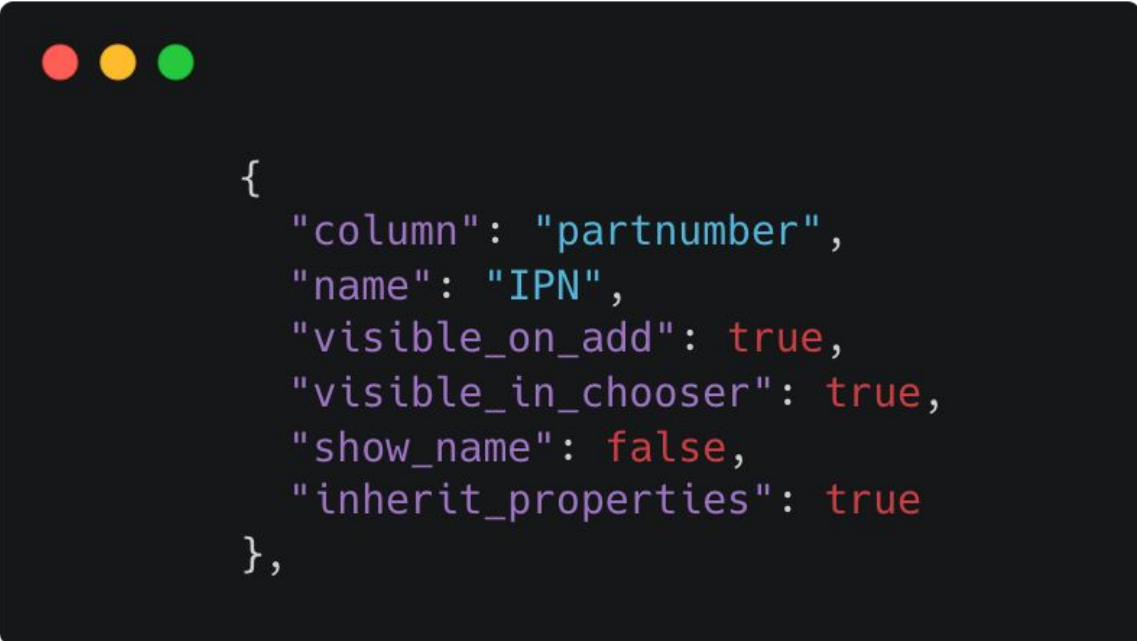
Simplest solution is to add a custom part parameter with the Aligni part URL.

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

Part Details		EDIT PART
Part Number	100091	
Type	Chip Resistors	
Manufacturer	YAGEO	
Manufacturer P/N	RC0603JR-07100RL	
Manufacturer Family	RC_L	
Value	100	
Unit of Measure	each	
Manufactured here	✗	
QC Required?	✗	
Attrition		
Hidden	✗	
Display Value	100 Ω	
Keywords	resistor RC_L	
Lifecycle Status	Production	
Aligni Part URL	https://cgnd-oshw.aligni.com/part/567037	

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

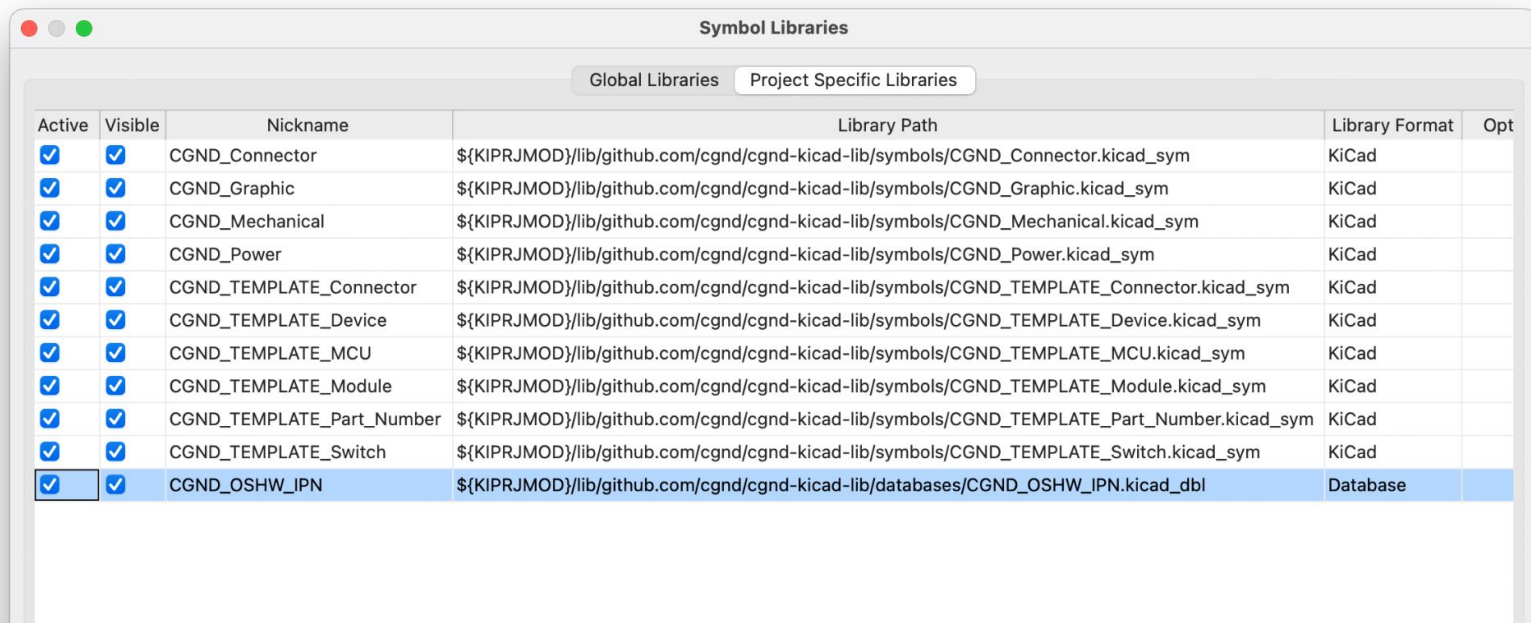
Map Aligni parameters to symbol properties



```
"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

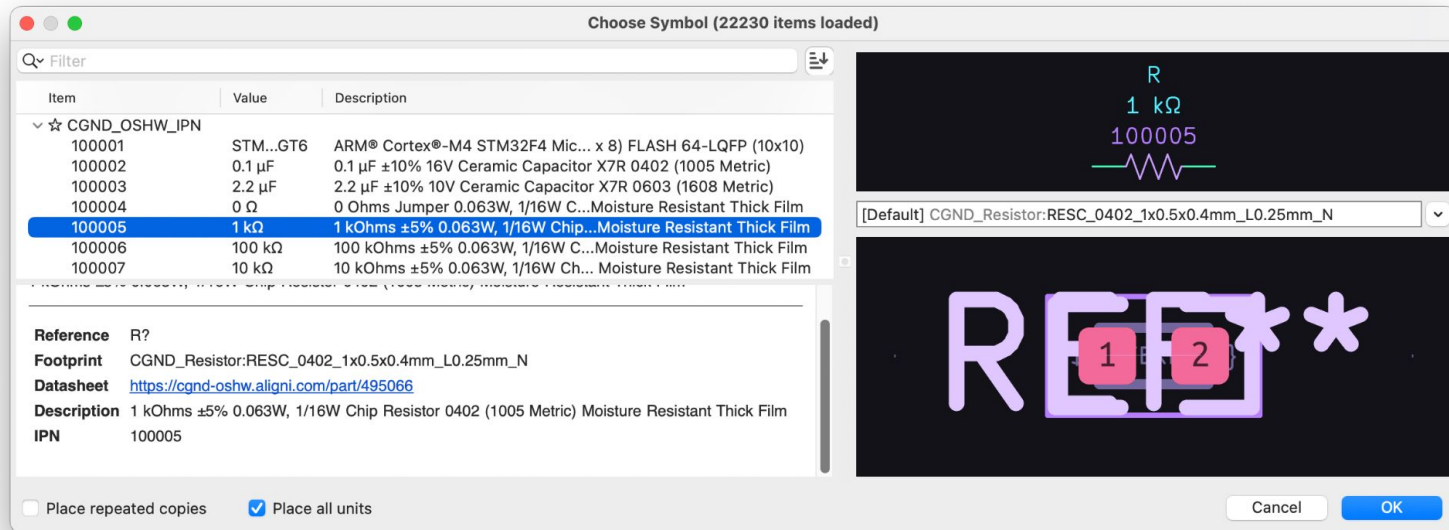
Add `*.kicad_dbl` config file to the symbol library table



Global Libraries					
Project Specific Libraries					
Active	Visible	Nickname	Library Path	Library Format	Opt
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Connector.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Graphic	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Graphic.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Mechanical	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Mechanical.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_Power	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Power.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Connector.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Device	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Device.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_MCU	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_MCU.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Module	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Module.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Part_Number	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Part_Number.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_TEMPLATE_Switch	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Switch.kicad_sym	KiCad	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CGND_OSHW_IPN	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/databases/CGND_OSHW_IPN.kicad_dbl	Database	

KICAD // DATABASE LIBRARY INTEGRATION

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



KICAD // DATABASE LIBRARY INTEGRATION

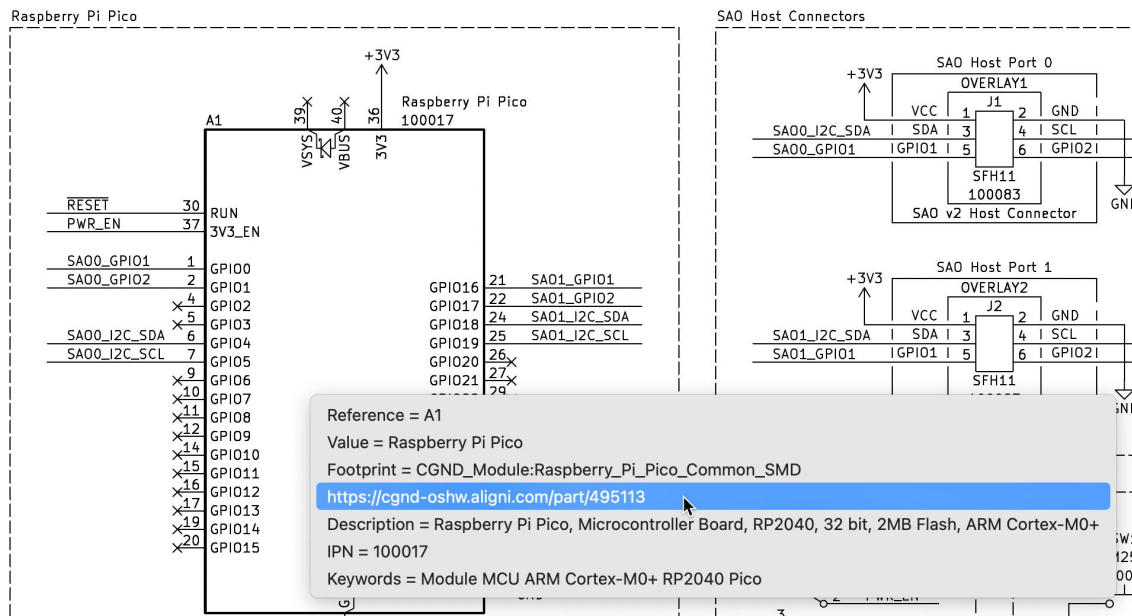
Parametric part search for library parts in Aligni

Add a Search Filter

SEARCH CRITERIA	ADD A VALUE FILTER	SEARCH TERM
Selection	Equals >	100
Manufacturer	Less than	
Vendor	Greater than	
Part Type	Within 10%	
Value >		
Manufacturer P/N		
Part Number		
Description		
Comment		

KICAD // DATABASE LIBRARY INTEGRATION

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

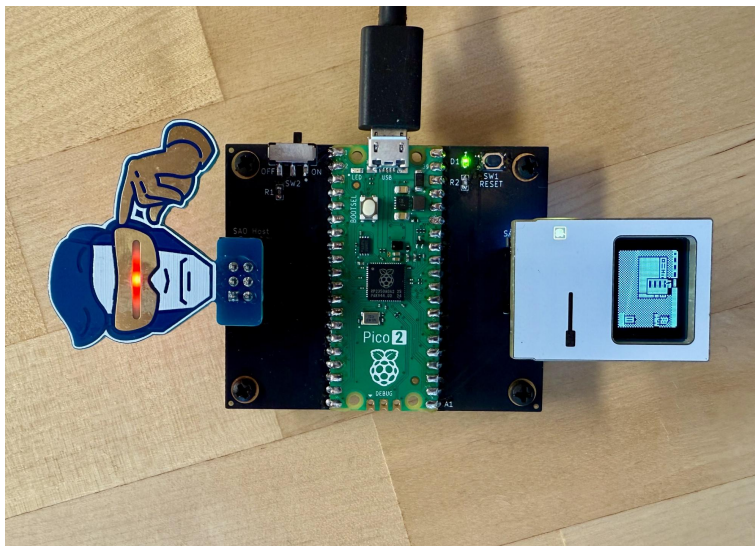
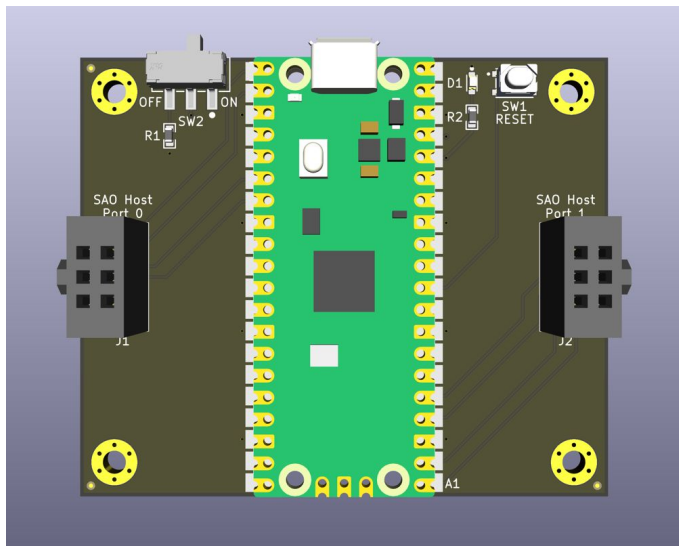


ALIGN // BOM IMPORT EXAMPLE



ALIGN // BOM IMPORT EXAMPLE


Example assembly: Raspberry Pi Pico SAO Host board



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

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

ALIGN // ASSEMBLY BOM IMPORT

Aligni import: map CSV columns to Aligni BOM columns

Step 1
Choose a CSV file to import

Step 2
Assign attributes to CSV columns

Step 3
Confirm part matches to the database

✓ The CSV file has been loaded successfully and appears to have 8 columns. Below, you can choose how each column is imported as a subpart.

• Part Number	>	• Column 7 (IPN)
QUANTITY	>	• Column 5 (Qty)
BUILD SEQUENCE	>	Column 6 (#)
DESIGNATOR	>	Column 1 (Reference)
COMMENT	>	
NO LOAD	>	Column 8 (DNP)

Match Parts & Move to Step 3

ALIGN // ASSEMBLY BOM IMPORT

Assembly BOM is populated based on parts from CSV

The screenshot displays the ALIGN software interface for managing Assembly BOMs. The sidebar on the left contains navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The top header shows the user 'Chris Wilson' and a search bar. The main content area is titled '100094' and displays a BOM for 'Raspberry Pi Pico SAO Host v2 PCA'. The BOM is currently in 'DRAFT' status. Below the header, there are tabs for 'Details', 'Revisions', 'Inventory', 'Supply Chain', 'Quality', 'BOM (Part List)', 'Demand (Product Matrix)', 'Attachments', 'Vaults', and 'History'. The 'BOM (Part List)' tab is active, showing a table of parts. The table has columns for 'ACTIONS', 'ITEM', 'P/N', 'REVISION', 'LIFECYCLE STATUS', 'DESIGNATOR', 'MANUFACTURER P/N', 'QUANTITY', 'SEQUENCE', 'INVENTORY', and 'COMMENT'. The table lists 9 parts, each with a revision status (ACTIVE) and a lifecycle status (Production or Preliminary). The parts are sourced from various manufacturers, including Common Ground Electronics, Würth Elektronik, Sullins Connector Solutions, YAGEO, and C&K.

ACTIONS	ITEM	P/N	REVISION	LIFECYCLE STATUS	DESIGNATOR	MANUFACTURER P/N	QUANTITY	SEQUENCE	INVENTORY	COMMENT
	1	100017	A ACTIVE	Production	A1	SC0915 ROHS Raspberry Pi	1 each	1		
	2	100089	A ACTIVE	Production	D1	150060V575000 ROHS Würth Elektronik	1 each	2		
	3	100093	A ACTIVE NON MAT	Preliminary	DOC1	100093 ROHS Common Ground Electronics	1 each	3		
	4	100083	A ACTIVE	Production	J1,J2	SFH11-NBPC-D03-ST-BK ROHS Sullins Connector Solutions	2 each	4	35 each	
	5	100092	B ACTIVE	Preliminary	PCB1	100092 ROHS Common Ground Electronics	1 each	5		
	6	100091	A ACTIVE	Production	R1	RC0603JR-07100RL ROHS YAGEO	1 each	6	1,000 each	
	7	100090	A ACTIVE	Production	R2	RC0603JR-07560RL ROHS YAGEO	1 each	7	1,000 each	
	8	100069	A ACTIVE	Production	SW1	PT5810SJM250SMTLFLS ROHS C&K	1 each	8	143 each	
	9	100051	A ACTIVE	Production	SW2	JS102011SAGN ROHS C&K	1 each	9	121 each	

The slide features a minimalist design with two large black rectangles. One rectangle is positioned on the left side, spanning the middle vertical section. The other rectangle is on the right side, positioned higher and overlapping the '04' text. The background is white with a thin black border.

04

REVISIONS

How to use revisions in PLM

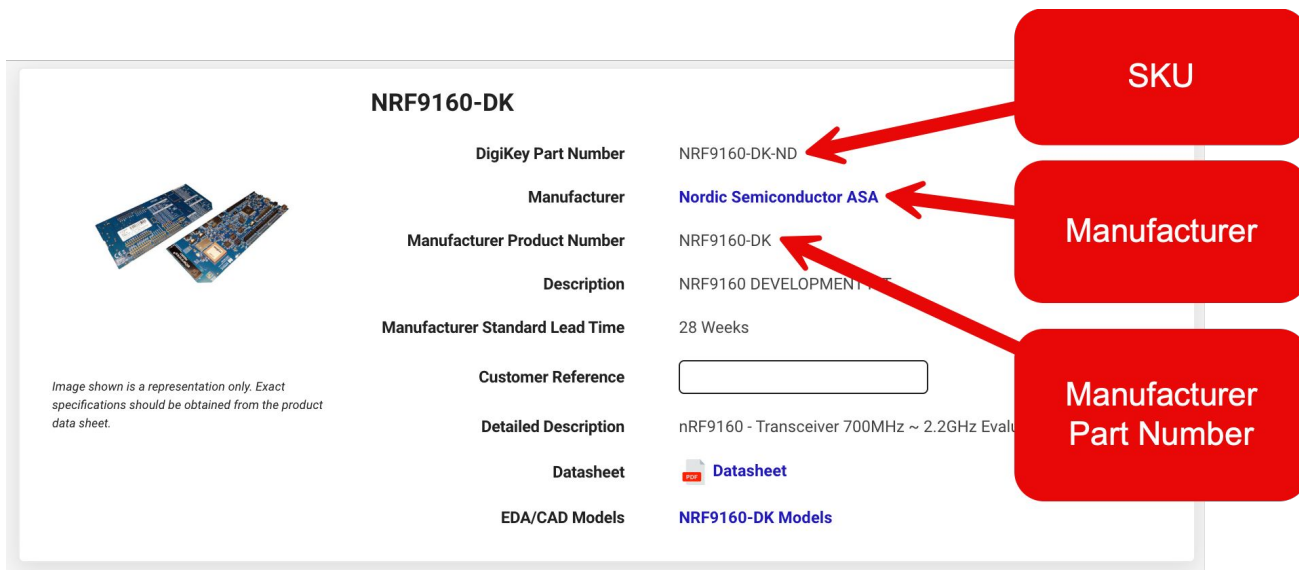
ALIGN // PART REVISION BEST PRACTICES

- 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

ALIGN // PART REVISION BEST PRACTICES

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



The screenshot shows a DigiKey product page for the NRF9160-DK. On the left is an image of the development kit. To its right is a table of specifications. On the far right, three red rounded rectangles are stacked vertically, labeled 'SKU', 'Manufacturer', and 'Manufacturer Part Number'. Red arrows point from these labels to specific parts of the product information: 'SKU' points to the DigiKey Part Number, 'Manufacturer' points to the Manufacturer name, and 'Manufacturer Part Number' points to the Manufacturer Product Number.


NRF9160-DK	
DigiKey Part Number	NRF9160-DK-ND
Manufacturer	Nordic Semiconductor ASA
Manufacturer Product Number	NRF9160-DK
Description	NRF9160 DEVELOPMENT KIT
Manufacturer Standard Lead Time	28 Weeks
Customer Reference	<input type="text"/>
Detailed Description	nRF9160 - Transceiver 700MHz ~ 2.2GHz Eval
Datasheet	 Datasheet
EDA/CAD Models	NRF9160-DK Models

Image shown is a representation only. Exact specifications should be obtained from the product data sheet.








SKU

Manufacturer

Manufacturer Part Number

ALIGN // 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

	Mfr Part #	
	^	v
<input type="checkbox"/>	 	NRF9160-SIAA-B1A-R7 IC RF TXRX+MCU CELLULAR 127LGA <i>Nordic Semiconductor ASA</i>
<input type="checkbox"/>	 	NRF9160-SICA-B1A-R7 IC RF TXRX+MCU CELLULAR 127LGA <i>Nordic Semiconductor ASA</i>
<input type="checkbox"/>	 	NRF9160-SICA-B1A-R IC RF TXRX+MCU CELLULAR 127LGA <i>Nordic Semiconductor ASA</i>
<input type="checkbox"/>	 	NRF9160-SIBA-R7 IC RF TXRX+MCU CELLULAR 127LGA <i>Nordic Semiconductor ASA</i>

ALIGN // 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**.

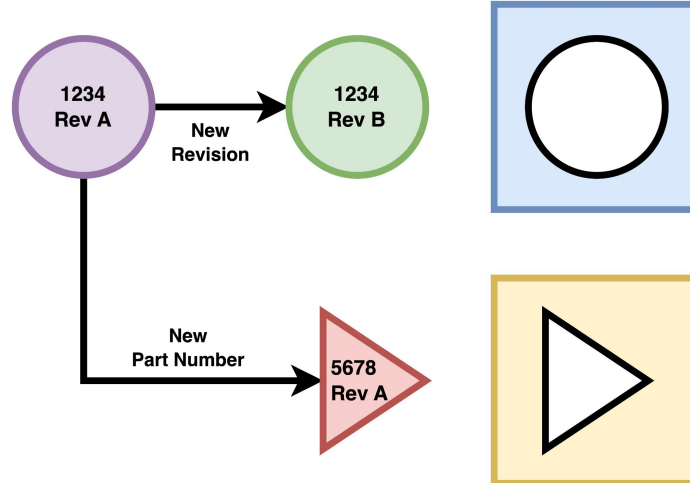
Use the "**Form, Fit, and Function**" (3F) rule:

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

ALIGN // 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**.



ALIGN // PART REVISION BEST PRACTICES

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

The screenshot shows the 'Release Revision' form in a PLM system. A red 'DRAFT' stamp is in the top left. A warning banner at the top states: 'This revision is a draft. Until it is released, this revision may not appear on other part lists or be the target of a build.' The left sidebar contains navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main form area includes:

- Release Revision**: A section for providing a release name and brief description.
- Make active?**: A checkbox that is currently checked. A note below it says: 'When selected, this revision will become the active revision for the item.'
- REVISION NAME**: A text field containing the letter 'B'.
- REVISION REASON**: A text area containing the text 'There was a change to this part.'
- BOM Dispositions**: A section with the instruction 'Select whether to up-rev (recommended) occurrences of this item on these BOMs to the new revision or keep at the previous revision.' Below this is a table with one row for 'TEST-100087'.

Part Number	Disposition	Quantity	Comments	Action
TEST-100087	A DRAFT	1 each	This is a test comment	<div>Set all to Up-RevSet all to Keep as Current Revision</div> <div><input checked="" type="radio"/> Up-Rev <input type="radio"/> Keep as revision A</div>

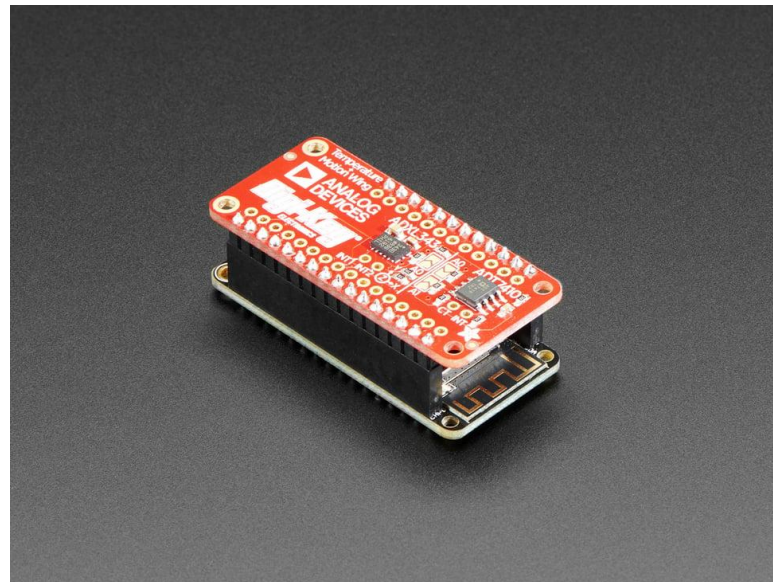
At the bottom of the form is a 'BOM Disposition Confirmation' section.

ALIGN // 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>

ALIGN // 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.



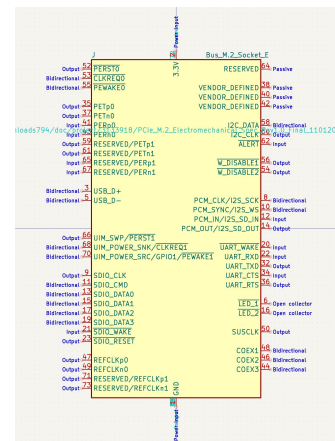
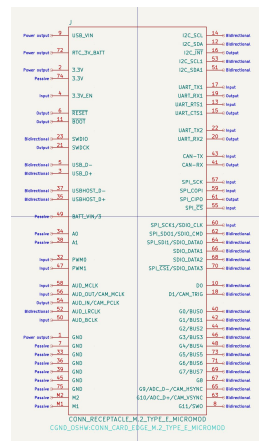
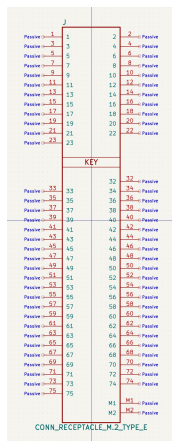
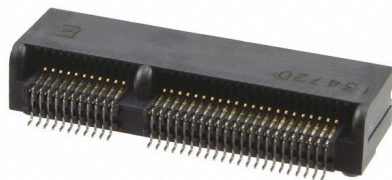
05

LIMITATIONS

Issues with this workflow

KICAD // ALTERNATE SYMBOLS

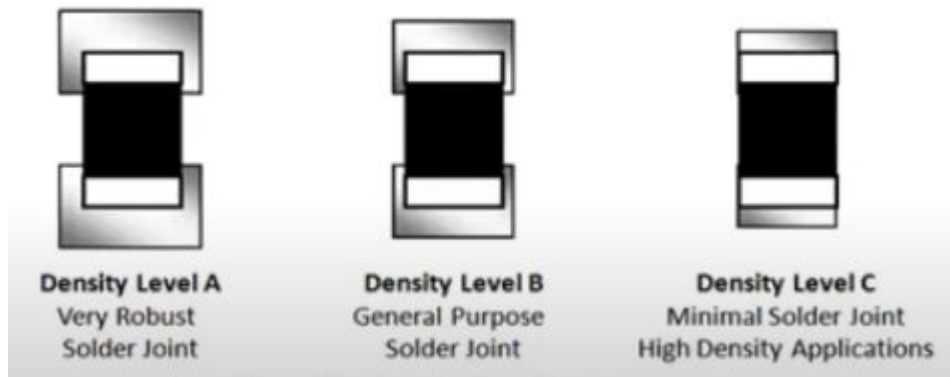
Currently no way to assign multiple symbols to a part:
Connector Generic MicroMod PCIe M.2



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

KICAD // ALTERNATE FOOTPRINTS

Assigning multiple footprints to a part should be supported, but it wasn't working when I tried it:



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

ALIGN // USAGE LIMITATIONS

Free-tier usage limitations:

Usage		
	PUBLIC	ADD-ONS
Attachments	Unlimited	-
Buils	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	-

ALIGN // ALIGN DB ONLY HAS “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.



06

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
- Hard to diff changes to a SQLite database (e.g. `sqldiff` won't show changes to internal metadata)
- 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 representation 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.



```
ALTER TABLE parts
ADD COLUMN x_aligni_part_url TEXT;

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

ALIGN // ADDING PART URL TO REPLICATOR DB

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

```
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()
```

THANKS

Do you have any questions?

`chris@cgnd.dev`

`https://cgnd.dev`

The slide features a minimalist design with two large, solid black rectangles. One rectangle is positioned on the left side, spanning the middle vertical section. The other is on the right side, spanning the top horizontal section. These rectangles intersect, creating a cross-like shape that divides the slide into four quadrants.

07

RESOURCES

Additional resources

RESOURCES

- **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>