

ARE WE PLM YET?

A beginners introduction to product
lifecycle management for KiCad



01

INTRODUCTION

ABOUT ME

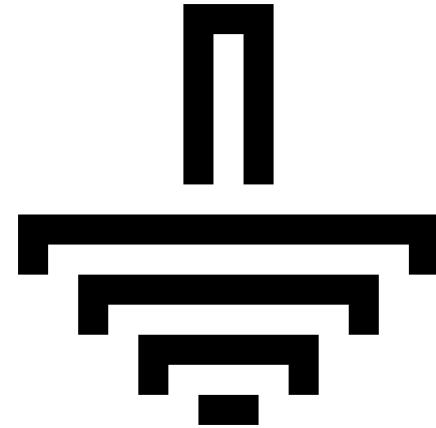


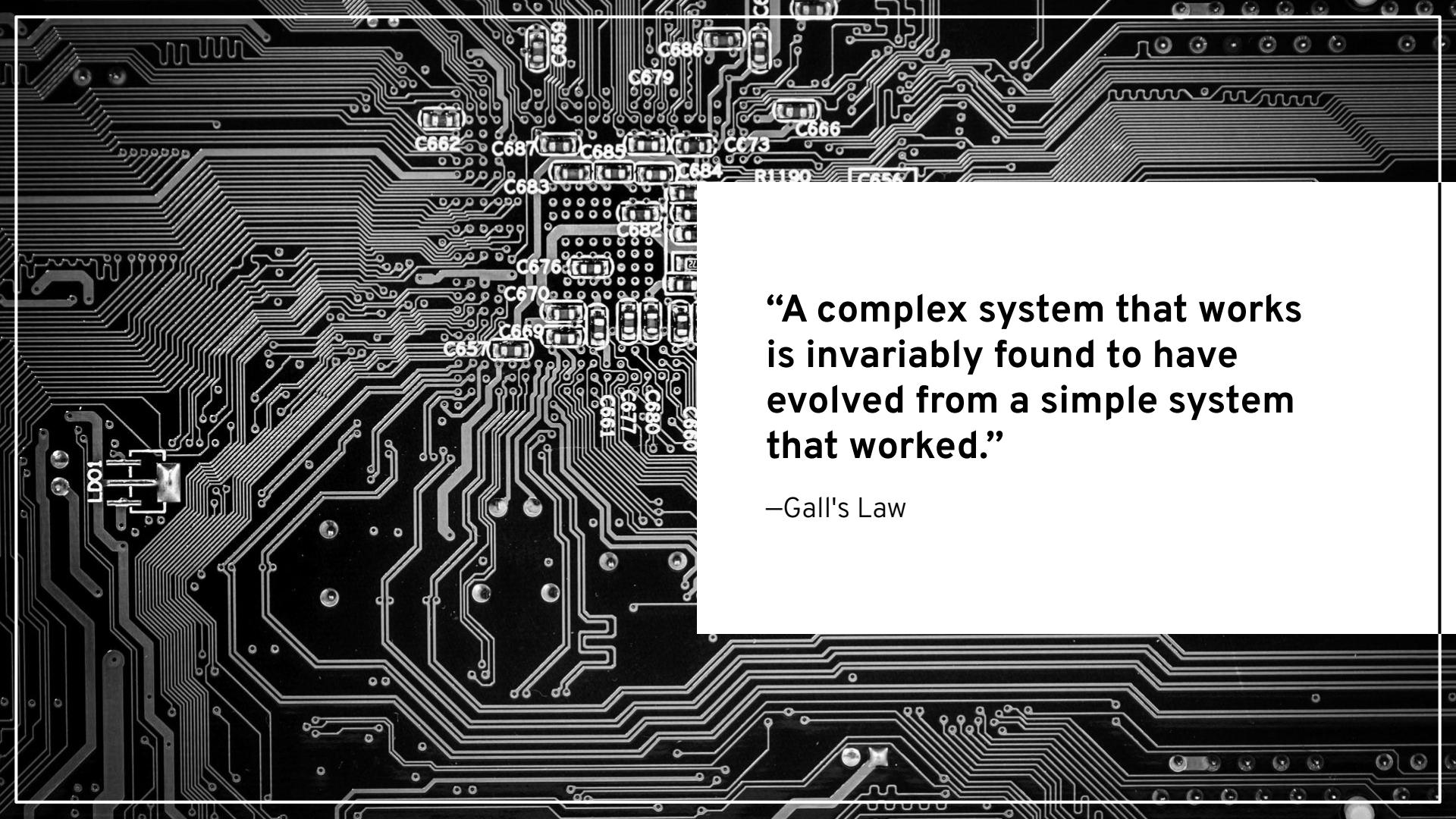
CHRIS WILSON

hardware design engineer
PM in PCBA manufacturing

**COMMON GROUND
ELECTRONICS**

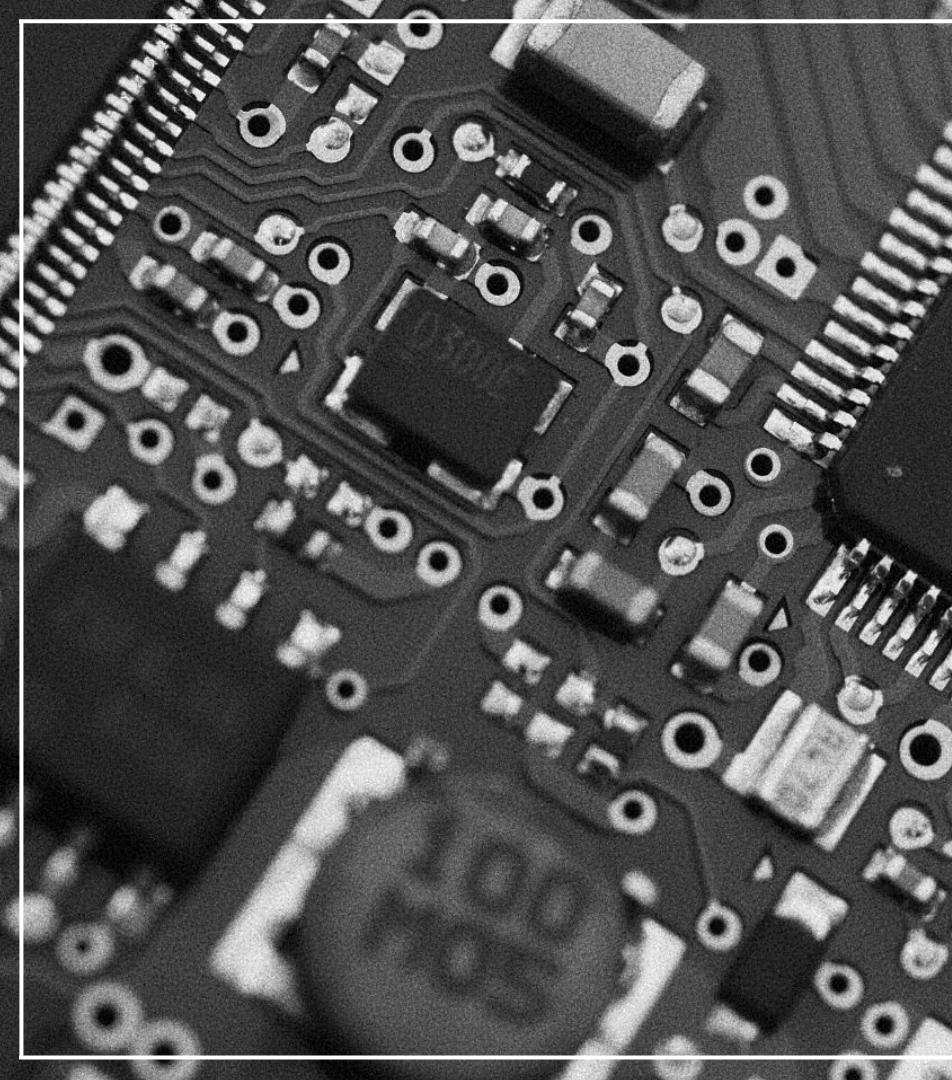
embedded systems
engineering services





**“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

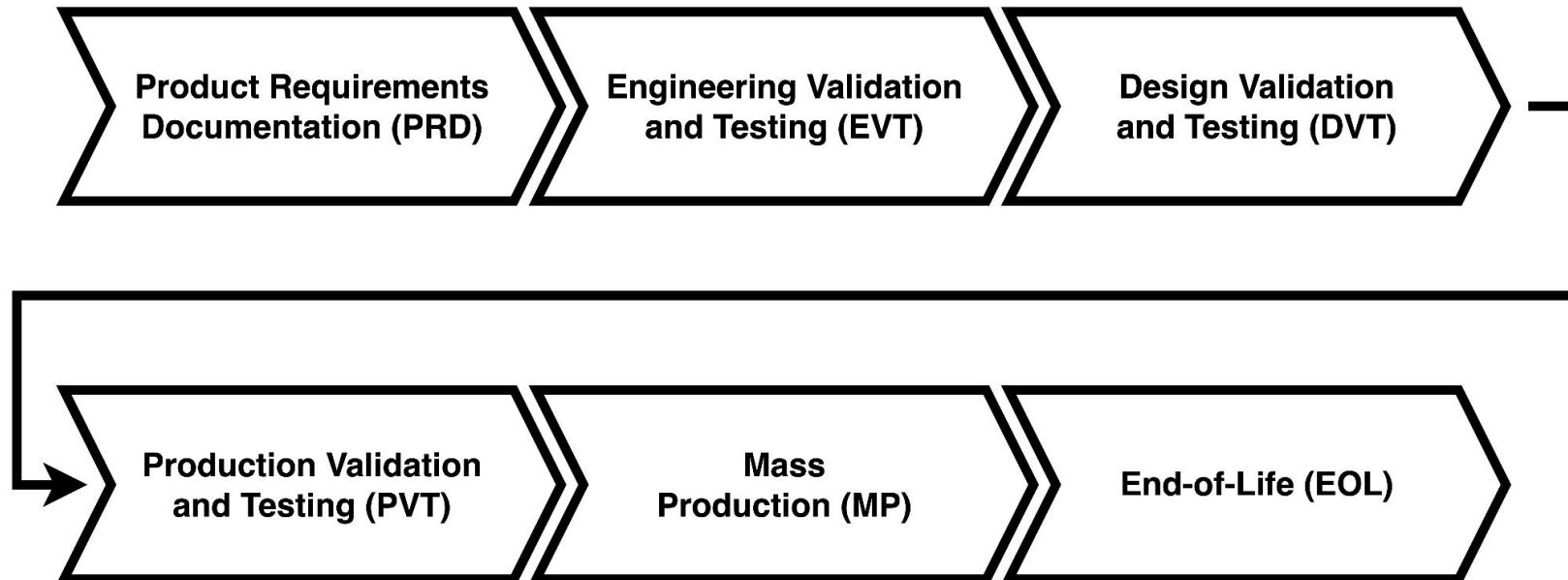
WHAT IS PLM?

A basic introduction to product
lifecycle management

WHAT IS PLM?

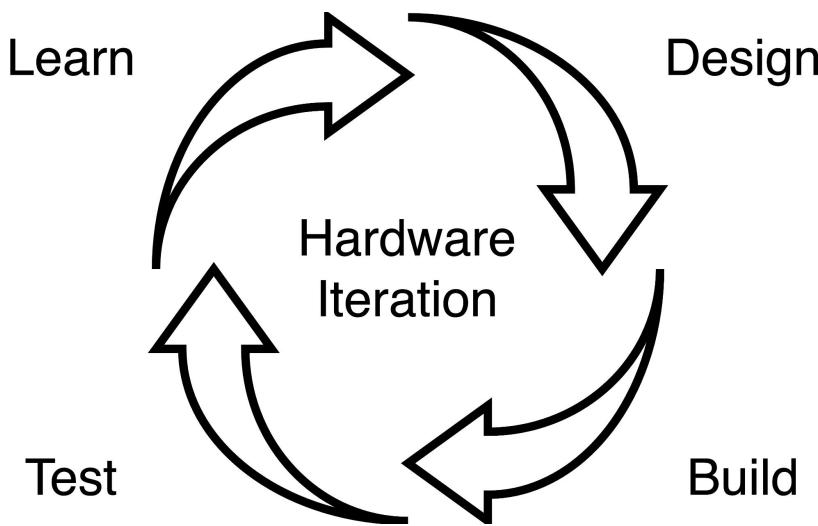
Product Lifecycle Management is a process that combines best practices and software tools to **centralize and structure product information** over the course of the product development lifecycle.

PRODUCT DEVELOPMENT LIFECYCLE



MULTIPLE HARDWARE ITERATIONS

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



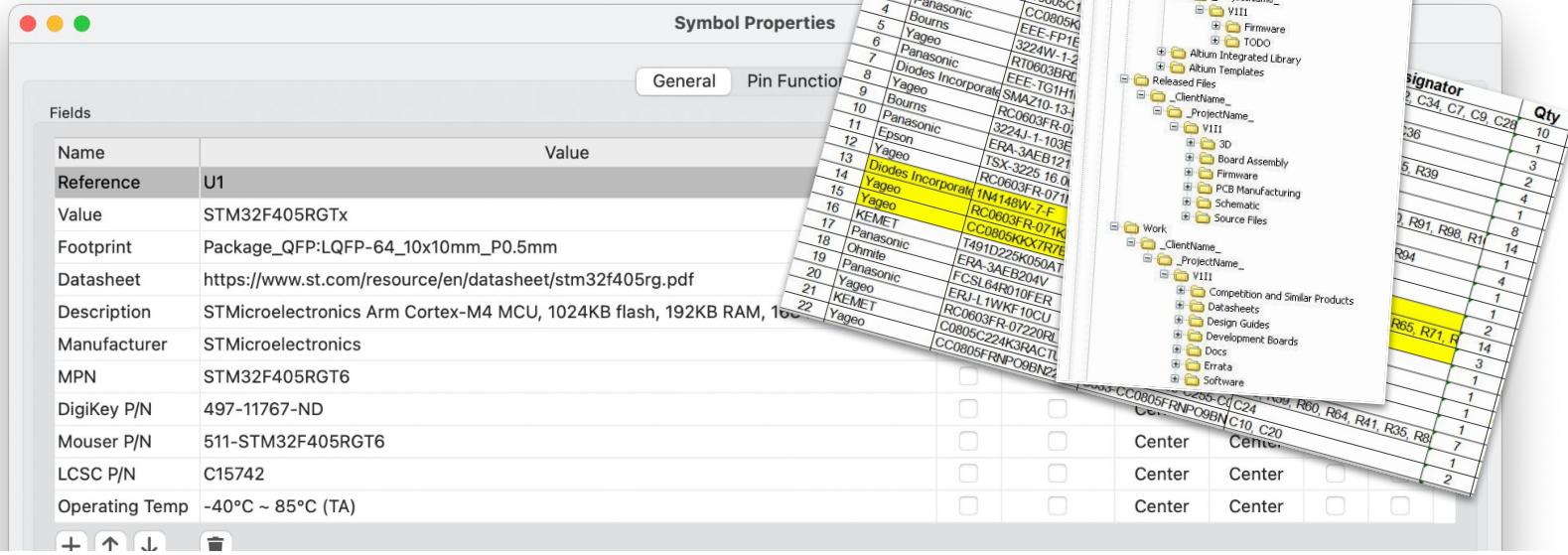
LOTS OF PRODUCT DATA TO MANAGE...

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...



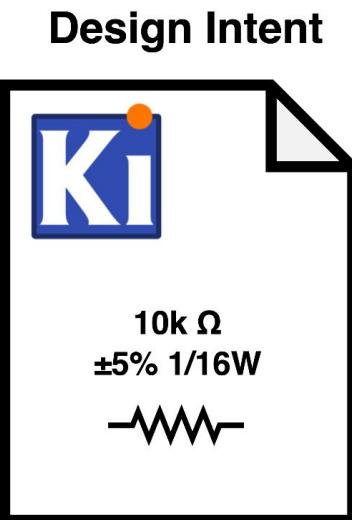
THIS IS NOT IDEAL

- 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!

Fields	
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 I...
Link1	https://www.mouser.com/en/products/detail/nxp-usa-inc/PCF85063BTL-1-118/402
Population	

DECOPLE DESIGN FROM MANUFACTURING

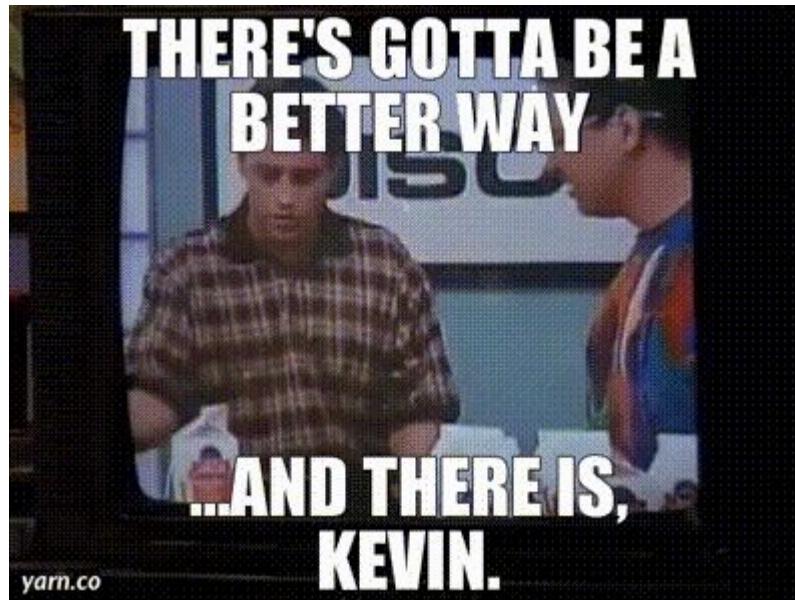
Ideally CAD should reflect **design intent**, not a snapshot of today's supply chain data.



Manufacturing Implementation

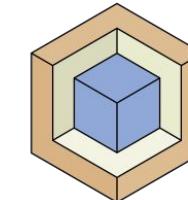
THERE'S GOTTA BE A BETTER WAY!

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



PLM SOFTWARE

People realized this and made...PLM software!

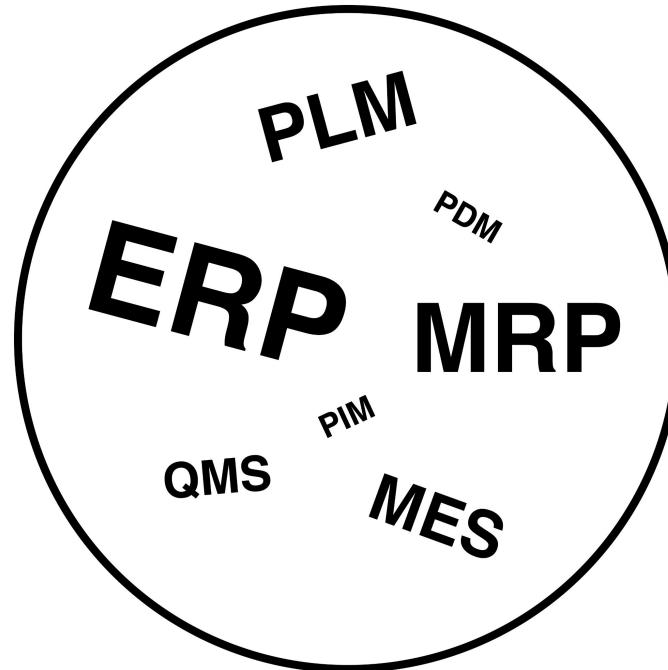


propel
openbom

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)

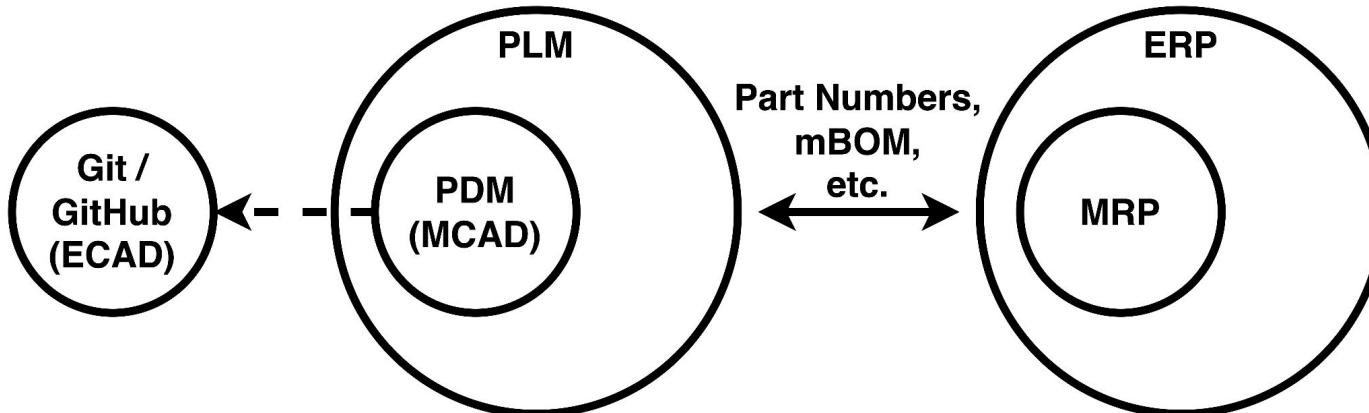
- Inventory, purchasing, scheduling, demand planning

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)

The screenshot shows the Aligni software interface for managing electronic components. On the left is a sidebar with navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main area displays a part record for "RC0603JR-07100RL".

Part Details:

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?	✗

Alternate Parts:

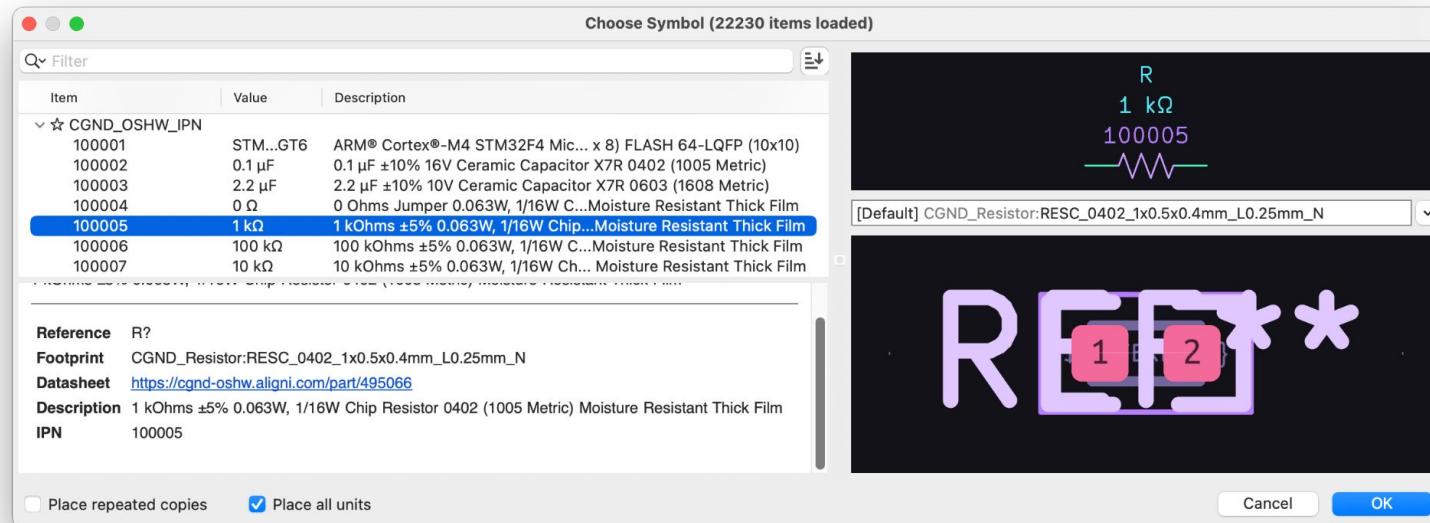
P/N	MANUFACTURER P/N	COMMENTS
100099	RC1608J101CS ROHS	Samsung Electro-Mechanics

Where Used:

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

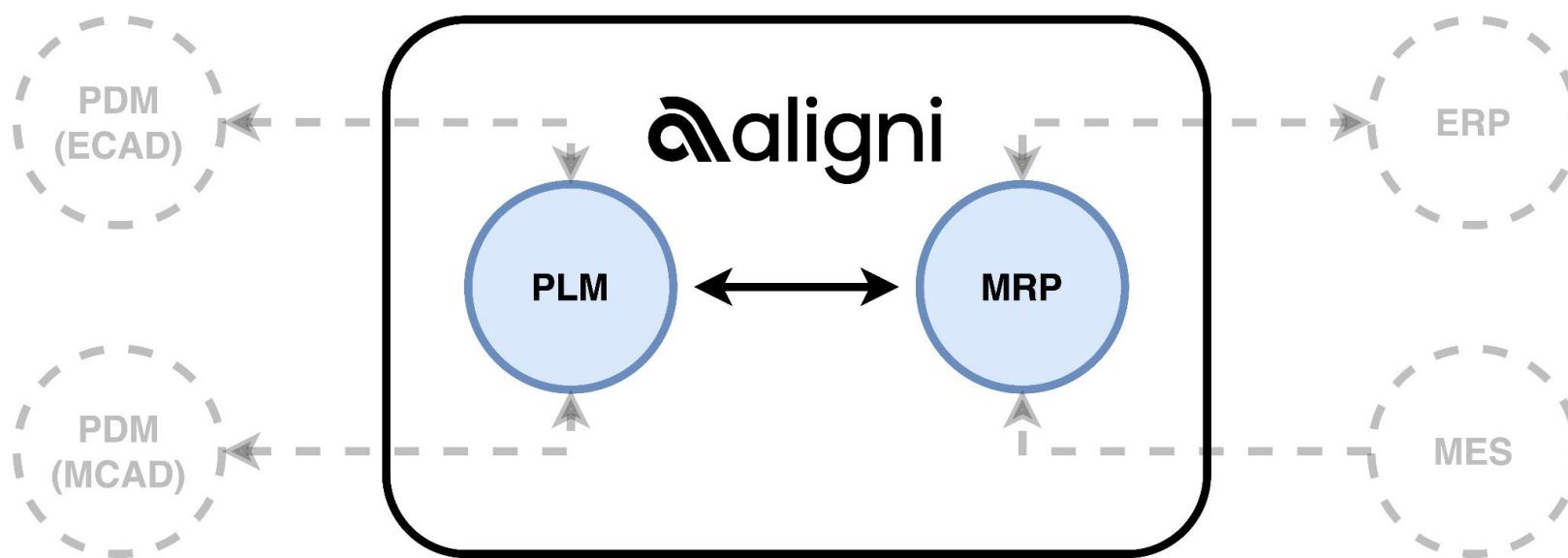
#	#	Qty	Reference	#	IPN	Value	Description	Datasheet	DNP
1	1	A1		100017	Raspberry Pi Pico	Raspberry Pi Pico, Microc	https://cgnd-oshw.aligni.net/100017		
2	1	D1		100089	Green	Green 570nm LED Indicati	https://cgnd-oshw.aligni.net/100089		
3	1	DOC1		100093	Pico SAO Host v2 Schematic	Raspberry Pi Pico SAO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

ALIGNI // INTRODUCTION

aligni

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 / 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 meet these criteria*

ALIGNI // SETUP // SIGN UP

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

The screenshot shows the Aligni website interface. At the top left, there is a green 'AL' icon and the word 'Guest'. To the right of the guest status are two blue buttons: 'Sign In' and 'Sign Up for Free'. A large red arrow points from the text above towards the 'Sign Up for Free' button. Below these buttons, the page title 'Public Organizations' is displayed. A sub-instruction 'Some great companies are doing their work on Aligni, and you can request to join them and help on some open source projects.' follows. The main content area features three organization cards. The first card, 'Opal Kelly SYZYGY', has a dark background with a blue 'Y' logo and the text 'SYZYGY'. It shows 2 Collaborators and 325 Parts, with a 'Visit' button. The second card, 'Circuit Dojo', has a light gray background with a white building icon. It shows 1 Collaborator and 358 Parts, also with a 'Visit' button. Below these cards are two more cards, partially visible, each featuring a building icon.

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 SYZYGY

COLLABORATORS 2 PARTS 325 Visit

Circuit Dojo

COLLABORATORS 1 PARTS 358 Visit

ALIGNI // SETUP // CREATE A NEW ORG

Create a new organization

The screenshot shows the Aligni platform interface. On the left, there is a dark sidebar with a user profile for "Chris Wilson". The main content area displays "Public Organizations" with two cards: "Opal Kelly SYZYGY" and "Circuit Dojo". A large red arrow points to a blue button labeled "Create New Organization" located in the top right corner of the page.

Chris Wilson

cgnd_chris • chris@cgnd.dev

Common Ground Electronics Open-Source Hardware

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 SYZYGY

COLLABORATORS 2 PARTS 325 Visit

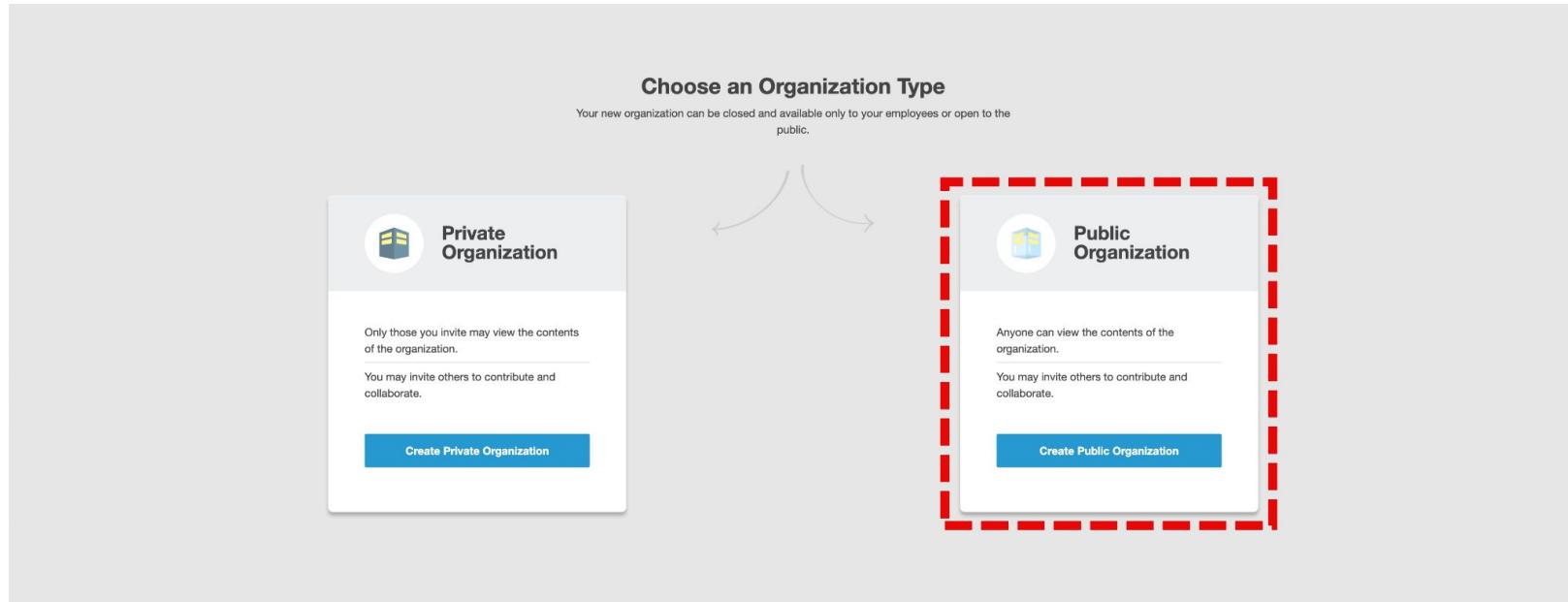
Circuit Dojo

COLLABORATORS 1 PARTS 358 Visit

Create New Organization

ALIGNI // SETUP // CREATE A NEW ORG

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



ALIGNI // DASHBOARD

Chris Wilson
Common Ground Electronics
Open-Source Hardware

Home Parts Supply Chain Inventory Quality Control Equipment Relationships Quotes Purchases

Chris Wilson
cgnd_chris • Common Ground Electronics Open-Source Hardware

Support Last login: 2025-05-10 (04:16 AM)

QuickSearch

Item Master

- Item Master Dashboard
- New Part
- Import New Items
- Bulk Item Update
- Compare Parts
- Part Collections
- Equipment Index
- Vaults Index

Planning

- Build Manager
- New Build
- Material Shortage Report (MSR)
- Safety Stock Manager (SSM)
- Safety Stock Assistant
- Demand Estimator

Inventory

- Inventory Dashboard
- Inventory Index and Search
- New Material Transfer
- Bulk Inventory Import
- Bulk Inventory Adjustments
- Quality Control Records

Supply Chain

Quoting Dashboard	Relationships Dashboard
Purchasing Dashboard	New Manufacturer
New Quote	New Vendor
New Purchase	New Contact
	New Customer

Change Management

- Change Management Dashboard
- New ECR
- New ECO

Reporting

- Purchasing Reporting
- Inventory Reporting
- Usage Reporting

System

- Account Settings
- Organization Settings

ALIGNI // ITEM MASTER

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

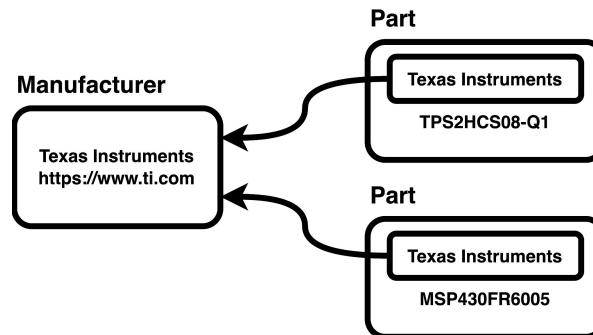
The screenshot shows the Aligni Item Master application interface. At the top, there's a header bar with the user profile 'Chris Wilson' and the company 'Common Ground Electronics Open-Source Hardware'. Below the header is a navigation bar with links for HOME, ENGINEER, SUPPLY CHAIN, INVENTORY, and QUALITY CONTROL. The main content area is divided into several cards:

- Item Master** card: Includes links for Item Master Dashboard, New Part, Import New Items, Bulk Item Update, Compare Parts, Part Collections, Equipment Index, and Vaults Index.
- Planning** card: Includes links for Build Manager, New Build, Material Shortage Report (MSR), Safety Stock Manager (SSM), Safety Stock Assistant, and Demand Estimator.
- Inventory** card: Includes links for Inventory Dashboard, Inventory Index and Search, New Material Transfer, Bulk Inventory Import, Bulk Inventory Adjustments, and Quality Control Records.
- Supply Chain** card: Includes links for Quoting Dashboard and Relationships Dashboard.

The left sidebar contains a vertical navigation menu with icons and labels for Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases.

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 attributes
- Backed by a “normalized relational database”



ALIGNI // PARTS

Chris Wilson
Common Ground Electronics
Open-Source Hardware

- Home
- Parts
- Supply Chain
- Inventory
- Quality Control
- Equipment
- Relationships
- Quotes
- Purchases

Collapse Sidebar



RC0603JR-07100RL

[Chip Resistors]
07100RL
YAGEO
100091
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

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 res resistor RC_L

Lifecycle Status Production

Aligni Part URL https://cgnd-oshw.aligni.com/part/567037

Datasheet URL https://www.yageo.com/upload/media/product/products/datasheet/rchip/PYU-RC_Group_51_RoHS_L_12.pdf

Tolerance - Lower Limit -5.0

Alternate Parts

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

Where Used

SHOW ONLY THIS REVISION USED IN ▾ V 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

ALIGNI // PARTS // REVISIONS

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

The screenshot shows the Aligni software interface for managing parts and revisions. On the left is a dark sidebar with a user profile (Chris Wilson, Common Ground Electronics, Open-Source Hardware) and navigation links: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main area displays a part record for item 100092. The top header includes the part number, manufacturer (Common Ground Electronics), and description ([Rigid Printed Circuit Boards] Raspberry Pi Pico SAO Host v2 PCB N/A). A status dropdown shows 'B ACTIVE'. To the right are two thumbnail images of the PCB. Below the header are buttons for 'New Revision' and 'Duplicate', and links for 'Print Label' and 'Delete'. A navigation bar below the header includes 'Details', 'Revisions' (which is selected and highlighted in blue), 'Inventory', 'Supply Chain', 'Quality', 'Demand (Product Matrix)', 'Attachments', 'Vaults', and 'History'. The 'Revisions' section shows a table titled 'Part Revisions' with 2 revisions total. The table has columns: STATUS, REVISION NAME, RELEASE DATE, RELEASED BY, and REVISION REASON. The first revision, 'B', is marked as 'ACTIVE' and was released on 2025-05-11 at 07:46 PM by 'cgnd_chris' with the reason 'See CHANEGLOG.md in the 2.0.1 design release for a list of changes.'. The second revision, 'A', is marked as 'RELEASED' and was released on 2025-05-09 at 08:40 AM by 'cgnd_chris' with the reason 'Initial release'. Buttons for 'COMPARE REVISIONS' and 'EXPORT CSV' are at the top right of the revision table.

Part Revisions 2 revisions total				
STATUS	REVISION NAME	RELEASE DATE	RELEASED BY	REVISION REASON
ACTIVE	B	2025-05-11 07:46 PM	cgnd_chris	See CHANEGLOG.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

ALIGNI // PARTS // INVENTORY

Warehouse location and stock count of this part

Chris Wilson
Common Ground Electronics
Open-Source Hardware

Home Parts Supply Chain Inventory Quality Control Equipment Relationships Quotes Purchases

RC0603JR-07100RL

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

A ACTIVE

New Revision Duplicate Add or Manage images. 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
1,000 each			Total On-Hand (1,000 available)

1 items collapsed. Click to expand.

Consumption Historical Consumption (each)

Safety Stock (each)

MANAGE SAFETY STOCK

Historical Consumption (each)

Manage Safety Stock

ALIGNI // PARTS // SUPPLY CHAIN

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

The screenshot displays the Aligni software interface, specifically the Supply Chain module. The top navigation bar includes links for Details, Revisions, Inventory, Supply Chain (selected), Quality, Demand (Product Matrix), Attachments, Vaults, and History.

Part Usage (Annual - Quarterly - Monthly): Shows consumption trends from 3Q21 to 3Q26. Legend: Consumed (yellow), Reserved (red), Allocated (green), Planned (light blue), Recurring (blue).

Purchase History: Displays historical purchase data with columns for Price (Price) and Quantity.

Vendor Part Numbers: A table mapping vendor part numbers to Aligni part numbers. Columns include VENDOR, PART NUMBER, BUY UNITS, and COMMENT.

VENDOR	PART NUMBER	BUY UNITS	COMMENT
DigiKey	311-100GTR-ND	each	Tape & Reel
DigiKey	311-100GRC1-ND	each	Cut Tape
DigiKey	311-100GRDKR-ND	each	Digi-Reel
Mouser	603-RC0603JR-07100RL	each	
Newark	26M6737	each	Cut Tape
Newark	23AC9119	each	Full Reel
LCSC	C110091	each	

Cost and Lead Time: A table showing cost and lead time details. Columns include VENDOR, PRICE, USE-AS PRICE, MIN / MULT, LEADTIME, INVENTORY, ENTERED, EXPIRES, NOTE, and OCTOPART.

VENDOR	PRICE	USE-AS PRICE	MIN / MULT	LEADTIME	INVENTORY	ENTERED	EXPIRES	NOTE	OCTOPART
Std. Cost / Lead Time	\$0.0031 / each	\$0.0031 / each	5,000 / 5,000	2 days	-	2025-04-30	-	Tape & Reel	

ALIGNI // PARTS // CREATING NEW PARTS

Some initial setup required before creating new parts

Chris Wilson
Chris Wilson
Open-Source Electronics
Open-Source Hardware

Home
Parts
Supply Chain
Inventory
Quality Control
Equipment
Relationships
Quotes
Purchases

Collapse Sidebar

Q Q

Create New Part

PART NUMBER Part number will be automatically generated.

MANUFACTURER YAGEO

MANUFACTURER P/N Use P/N as Manufacturer P/N

MANUFACTURER P/N RC0402LR-0710KL

TYPE Chip Resistors

MANUFACTURER FAMILY RC_L

DESCRIPTION 10 kOhms ±5% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric)

COMMENT Comment

VALUE 0

UNIT OF MEASURE each

* Unit of Measure may not be changed after the part has been created.

MANUFACTURED HERE? Manufactured Here

QUALITY CONTROL Quality Control Required

ATTRITION (%) Attrition (%)

DISPLAY VALUE 10 kΩ

KEYWORDS res resistor RC_L

LIFECYCLE STATUS Preliminary

DATASHEET URL <https://www.yageo.com/upload/media/product/productsearch/datasheet/RC0402LR-0710KL.pdf>

Must be defined before creating a new part

ALIGNI // SETUP // PART NUMBER SCHEME

Recommended internal part number scheme (100001):

The screenshot shows the Aligni software interface with the following details:

- Left Sidebar:** Chris Wilson, CG Organization Settings, Open-Source Hardware. Options include Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, Purchases, and GUEST ACCESS.
- Organization Settings:** CG Organization Settings, Common Ground Electronics Open-Source Hardware.
- Part Numbers Tab:** Selected tab under Organization Settings.
- Part Number Style:**
 - Manual: Examples: AX0300PC3-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: 0233-0000317, 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: 001-0000317, 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:** Max length = 7. This is the maximum length of the part number. If using an "autoincrement" style, the part number will be zero-filled to this length. A red callout box highlights this field with the text "Max length = 7".
- NEXT PART NUMBER:** Start with 100100. The next new part number will be assigned this number if you are using autoincrement part numbering. A red callout box highlights this field with the text "Start with 100....".
- DELIMITER:** Dash (-). This optional delimiter character will be added between the prefix and sequence number when generating new part numbers.

ALIGNI // SETUP // PART TYPES

Part Types associate parameters with groups of parts

The screenshot shows the Aligni software interface with a dark sidebar and a light main content area. The sidebar includes a user profile for 'Chris Wilson' and sections for Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The main content area is titled 'Settings' and 'Organization Settings'. It shows a list of 'Part Types' with columns for NAME, ATTRITION, NON-MATERIAL?, CATEGORY ONLY?, PART TYPES COUNT, and PARTS COUNT. A 'NEW PART TYPE' button is at the top right of the table.

NAME	ATTRITION	NON-MATERIAL?	CATEGORY ONLY?	PART TYPES COUNT	PARTS COUNT	Actions
_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	

ALIGNI // SETUP // CUSTOM PARAMETERS

Example: “KiCad Symbols” custom parameter

The screenshot shows the Aligni software interface with a dark sidebar on the left and a light blue header bar at the top.

Header: CG Chris Wilson, Common Ground Electronics Open-Source Hardware

Left Sidebar:

- Home
- Parts
- Supply Chain
- Inventory
- Quality Control
- Equipment
- Relationships
- Quotes
- Purchases

Header Bar:

CG Organization Settings Common Ground Electronics Open-Source Hardware

Organization Settings: Organization Settings > Custom Part Parameters > Edit Part Parameter

Edit Part Parameter Form:

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.

Buttons: Delete Part Parameter, Update Part Parameter

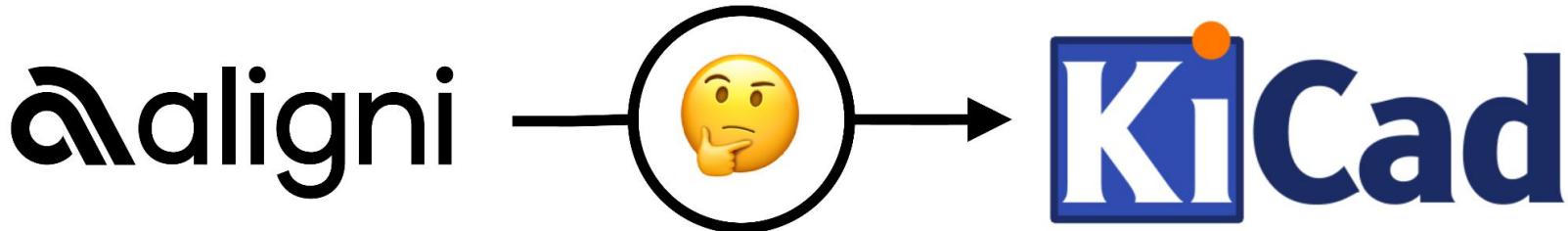
Associated Part Types:

- _default
- _test_part_type
- Card Edge Connectors
- Ceramic Capacitors
- Chip Resistors
- Crystals
- Ferrite Beads
- Flash Memory
- FPNAs

Buttons: Manage Part Types

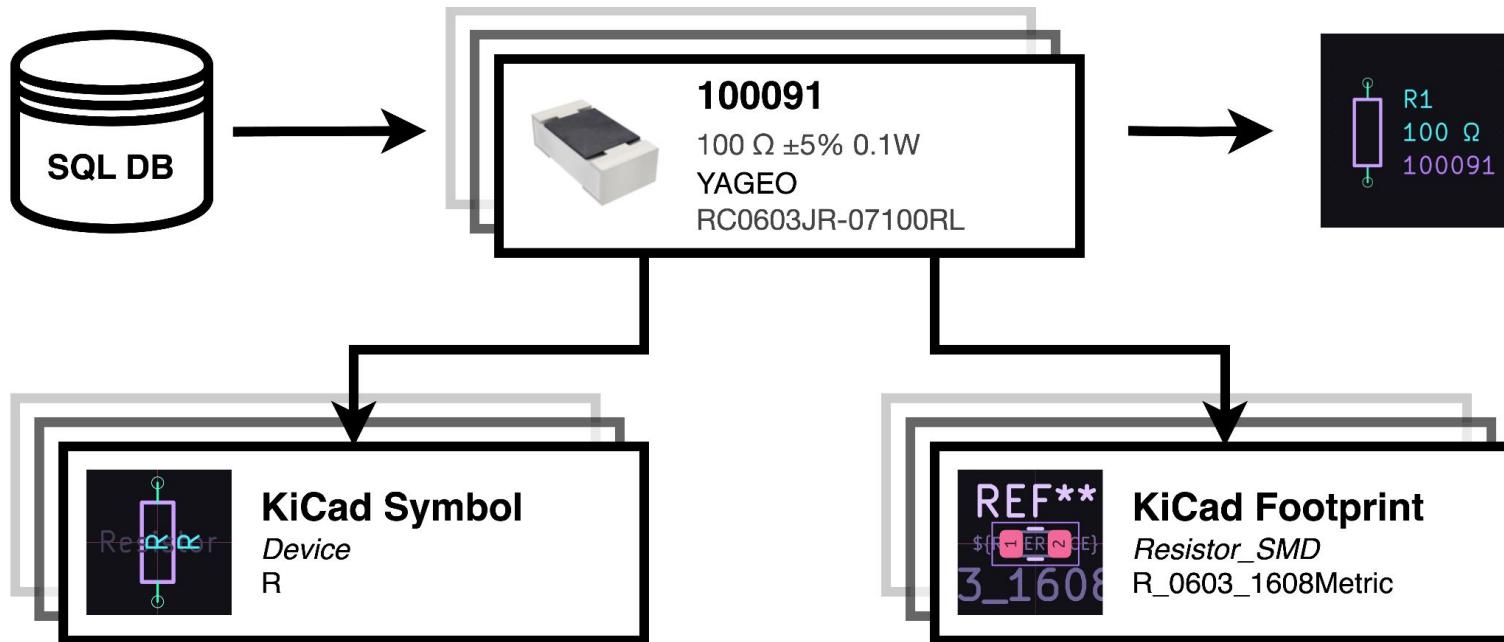
KICAD // DATABASE LIBRARY INTEGRATION

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



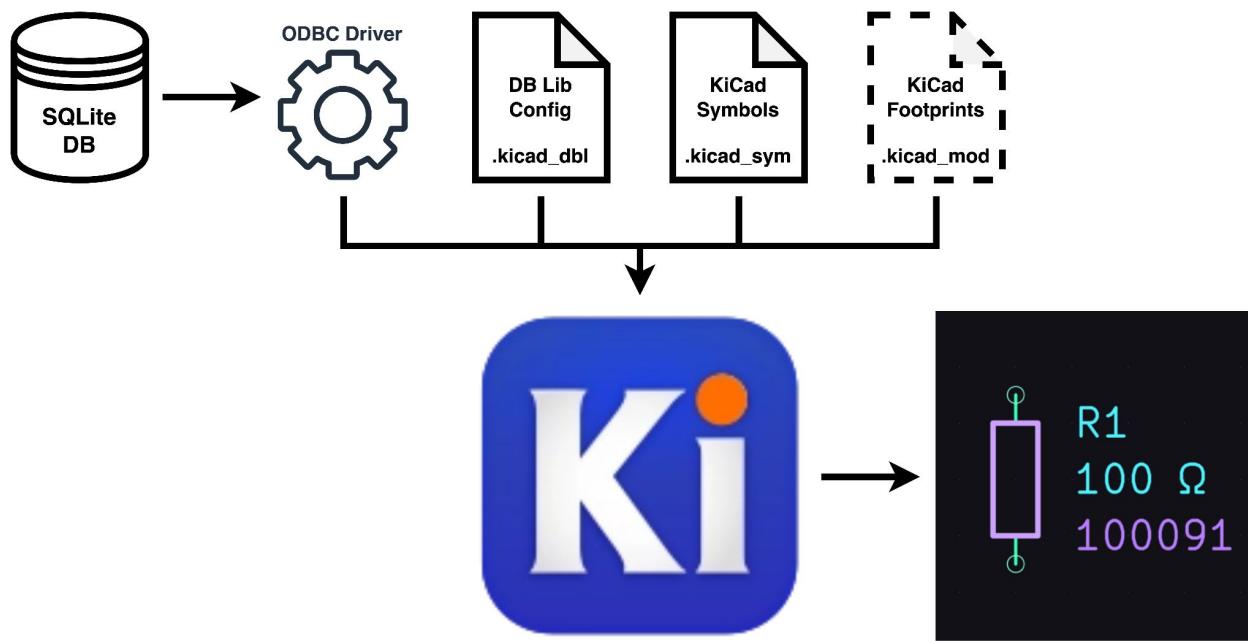
KICAD // DATABASE LIBRARY INTEGRATION

Database libraries are generated from SQL databases



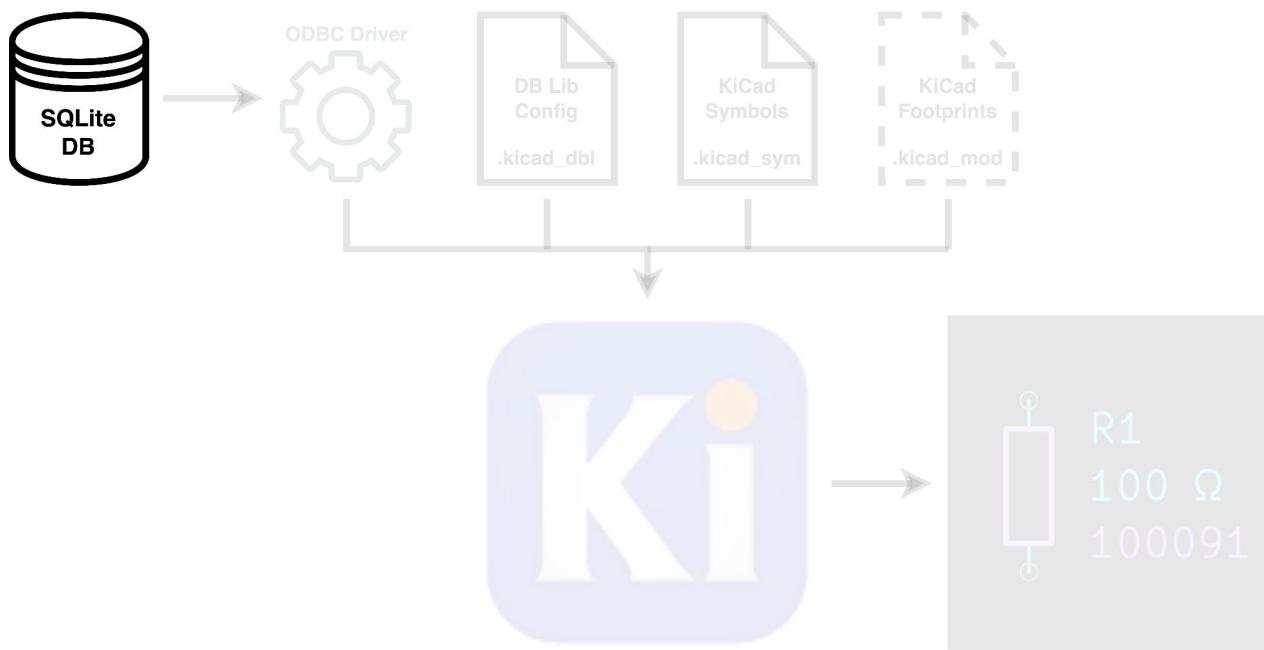
KICAD // DATABASE LIBRARY INTEGRATION

Database library inputs:



KICAD // DATABASE LIBRARY INTEGRATION

Where does the SQLite DB come from?



ALIGNI // REPLICATOR



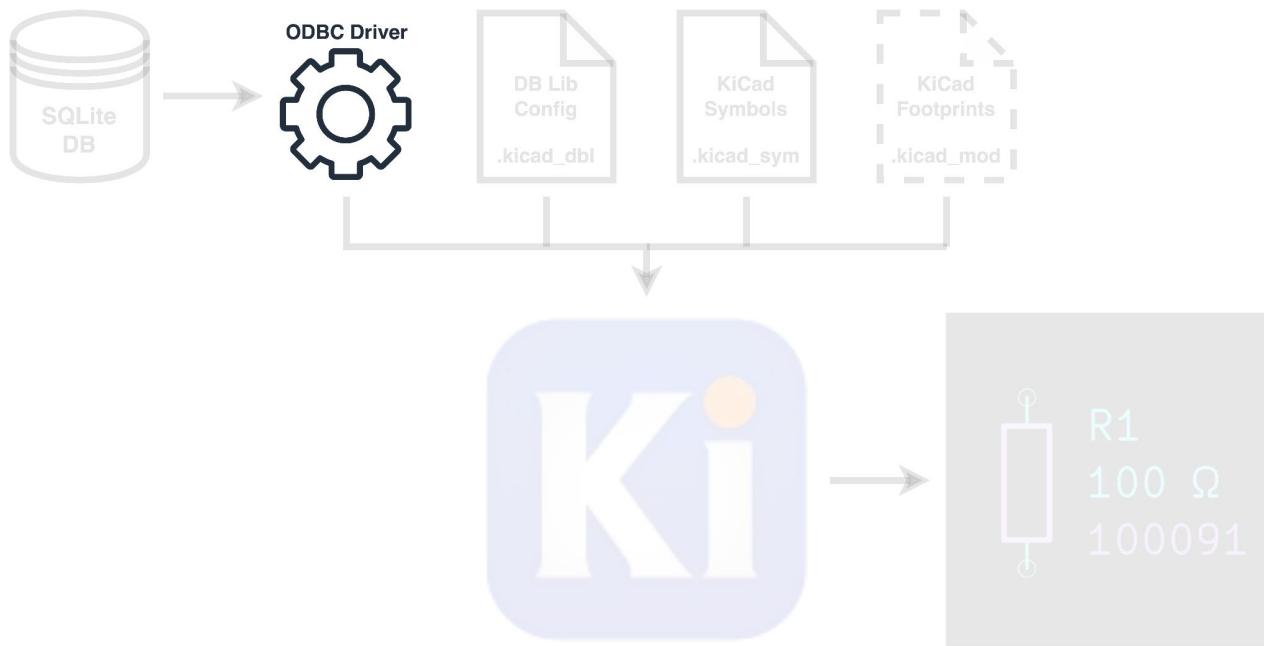
Aligni Replicator is a Windows application* that generates a **local SQLite database** with all the parts in your online Aligni account.

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

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

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

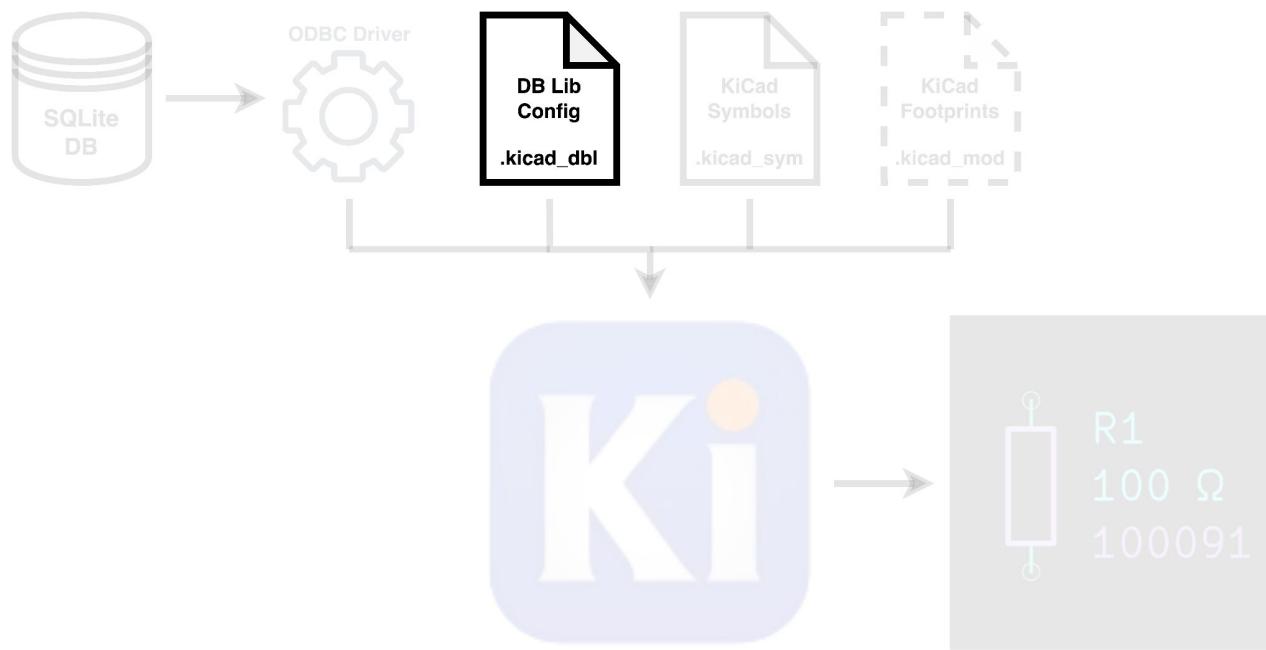
SQLite ODBC Driver

<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

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"  
  },  
}
```

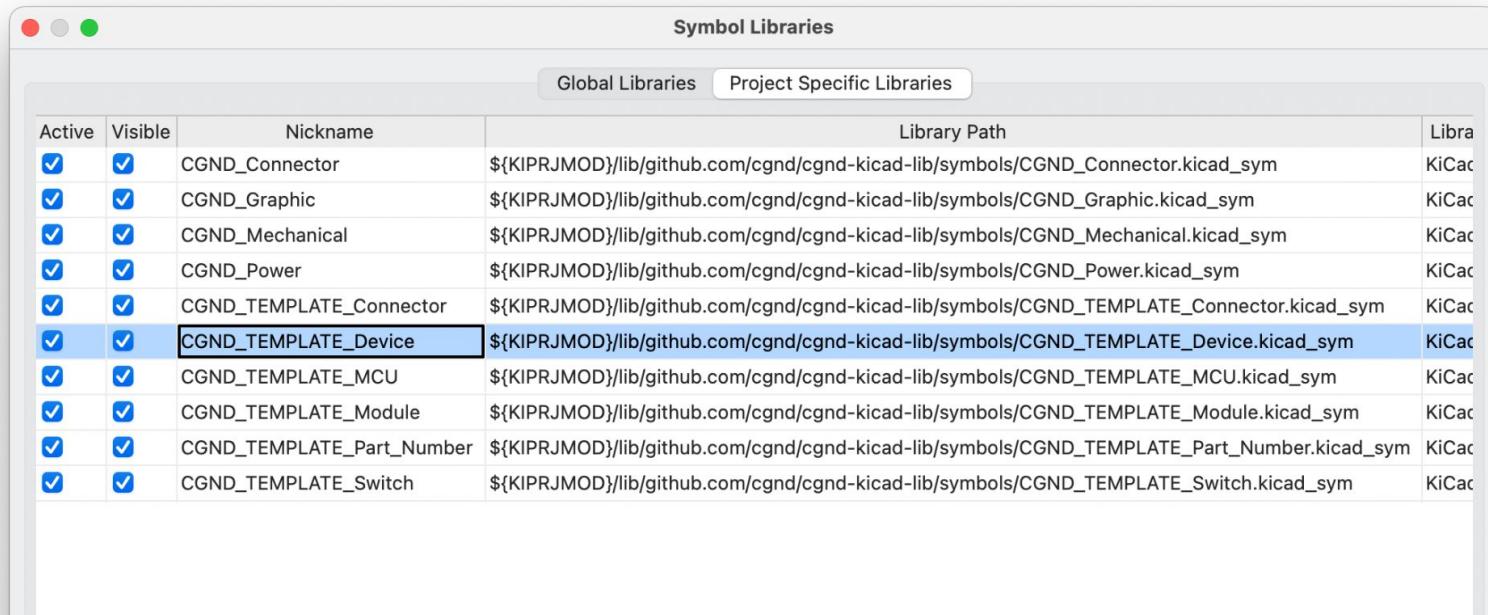
KICAD // DATABASE LIBRARY INTEGRATION



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

KICAD // DATABASE LIBRARY INTEGRATION

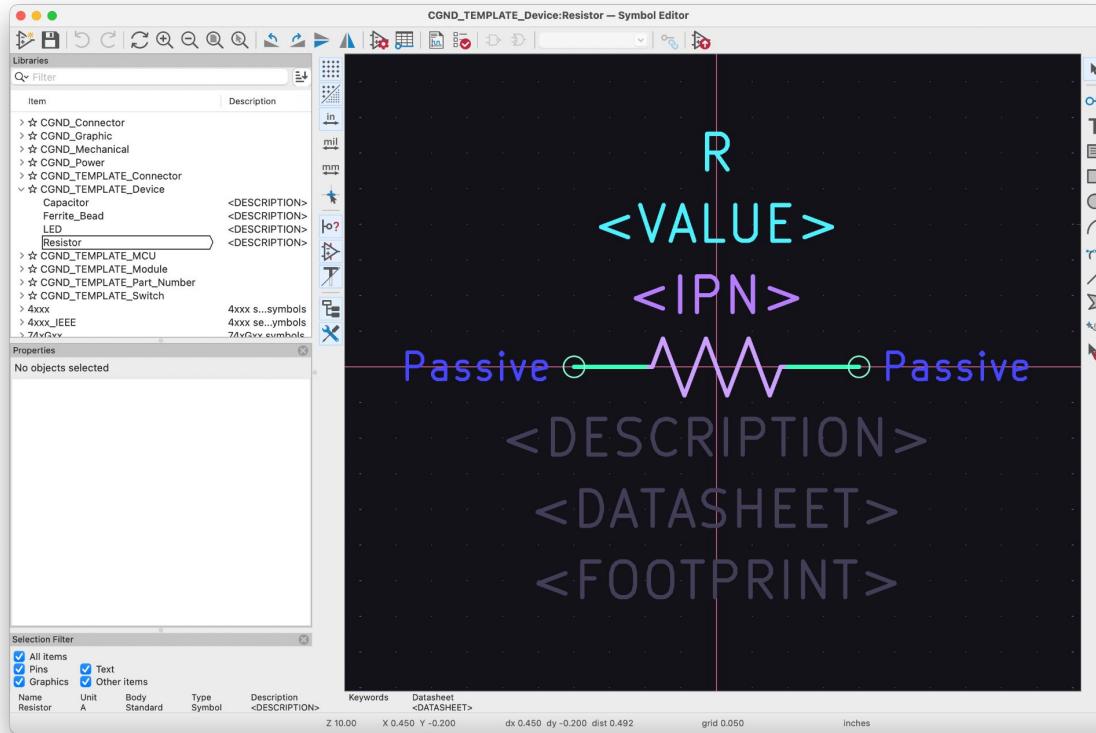
Referenced symbols must be defined in the library table



The screenshot shows the 'Symbol Libraries' dialog in Kicad. It has tabs for 'Global Libraries' and 'Project Specific Libraries', with 'Global Libraries' selected. The table lists symbols with columns for Active, Visible, Nickname, Library Path, and Library. The 'CGND_TEMPLATE_Device' row is highlighted with a blue border.

Active	Visible	Nickname	Library Path	Libra
✓	✓	CGND_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Connector.kicad_sym	KiCac
✓	✓	CGND_Graphic	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Graphic.kicad_sym	KiCac
✓	✓	CGND_Mechanical	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Mechanical.kicad_sym	KiCac
✓	✓	CGND_Power	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Power.kicad_sym	KiCac
✓	✓	CGND_TEMPLATE_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Connector.kicad_sym	KiCac
✓	✓	CGND_TEMPLATE_Device	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Device.kicad_sym	KiCac
✓	✓	CGND_TEMPLATE MCU	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE MCU.kicad_sym	KiCac
✓	✓	CGND_TEMPLATE_Module	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Module.kicad_sym	KiCac
✓	✓	CGND_TEMPLATE_Part_Number	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Part_Number.kicad_sym	KiCac
✓	✓	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	res 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

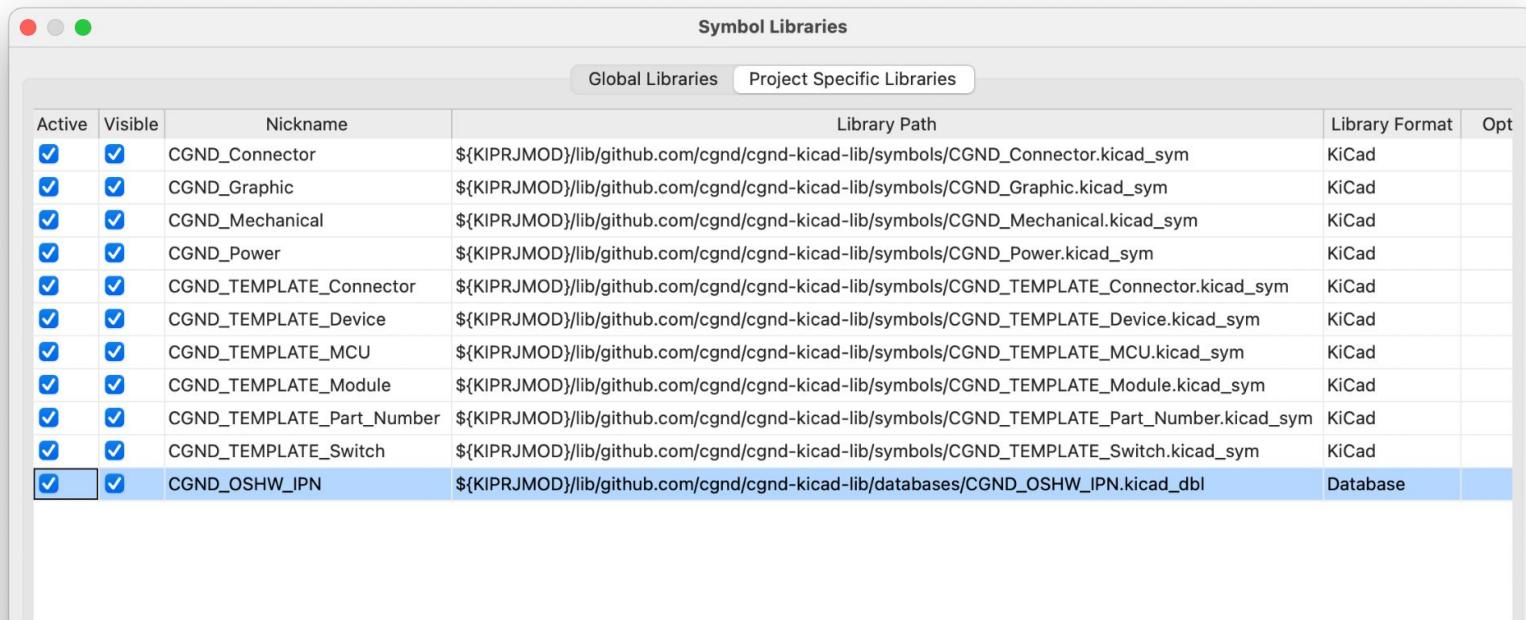
Map Aligni parameters to symbol properties



```
"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_db` config file to the symbol library table

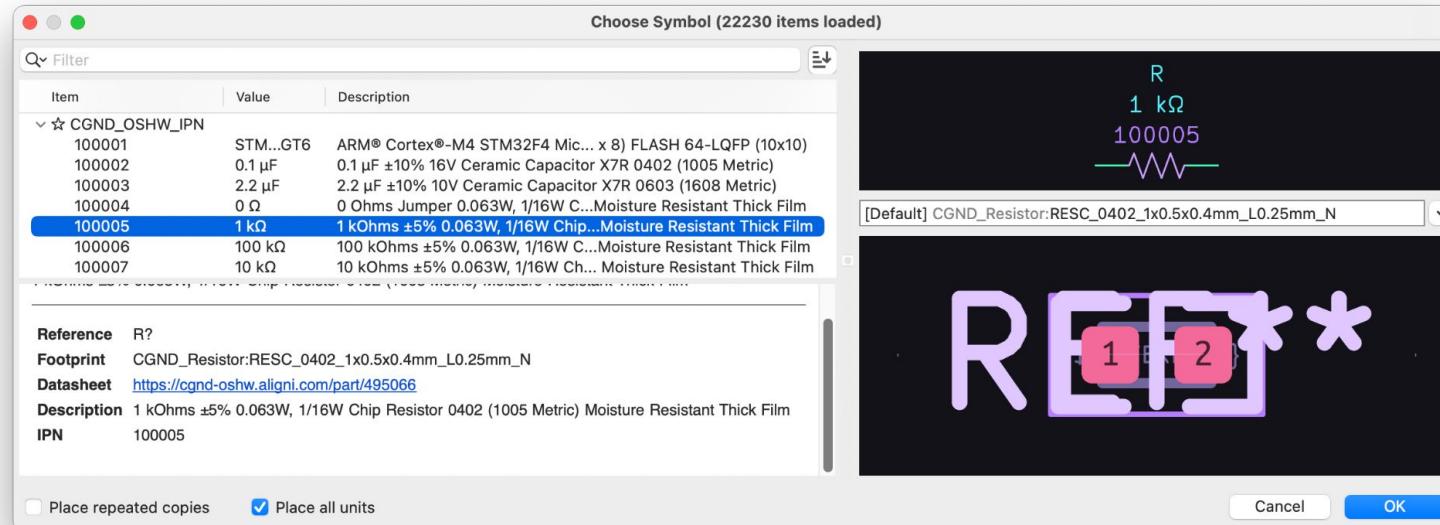


The screenshot shows the "Symbol Libraries" dialog in KiCad. The window title is "Symbol Libraries". There are two tabs at the top: "Global Libraries" (selected) and "Project Specific Libraries". The main area is a table with the following columns: Active, Visible, Nickname, Library Path, Library Format, and Opt. The table lists ten entries, all of which are currently active and visible. The last entry, "CGND_OSHW_IPN", has its "Library Format" set to "Database".

Active	Visible	Nickname	Library Path	Library Format	Opt
✓	✓	CGND_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Connector.kicad_sym	KiCad	
✓	✓	CGND_Graphic	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Graphic.kicad_sym	KiCad	
✓	✓	CGND_Mechanical	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Mechanical.kicad_sym	KiCad	
✓	✓	CGND_Power	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_Power.kicad_sym	KiCad	
✓	✓	CGND_TEMPLATE_Connector	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Connector.kicad_sym	KiCad	
✓	✓	CGND_TEMPLATE_Device	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Device.kicad_sym	KiCad	
✓	✓	CGND_TEMPLATE MCU	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE MCU.kicad_sym	KiCad	
✓	✓	CGND_TEMPLATE_Module	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Module.kicad_sym	KiCad	
✓	✓	CGND_TEMPLATE_Part_Number	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Part_Number.kicad_sym	KiCad	
✓	✓	CGND_TEMPLATE_Switch	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/symbols/CGND_TEMPLATE_Switch.kicad_sym	KiCad	
✓	✓	CGND_OSHW_IPN	\${KIPRJMOD}/lib/github.com/cgnd/cgnd-kicad-lib/databases/CGND_OSHW_IPN.kicad_db	Database	

KICAD // DATABASE LIBRARY INTEGRATION

Now we can place Aligni parts in a KiCad schematic!



KICAD // DATABASE LIBRARY INTEGRATION

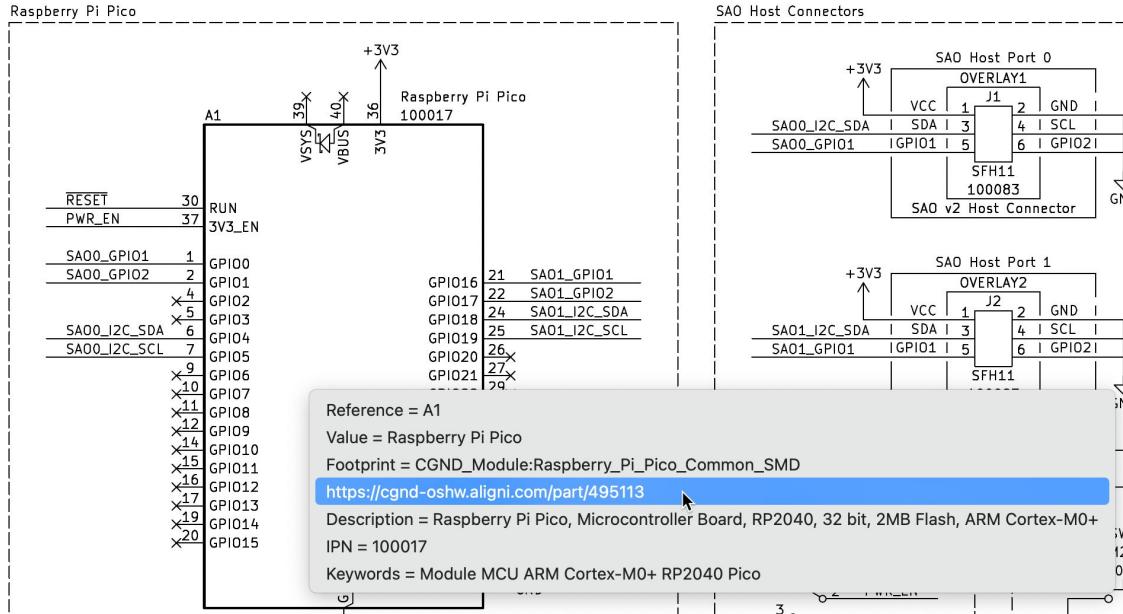
Parametric part search for library parts in Aligni

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



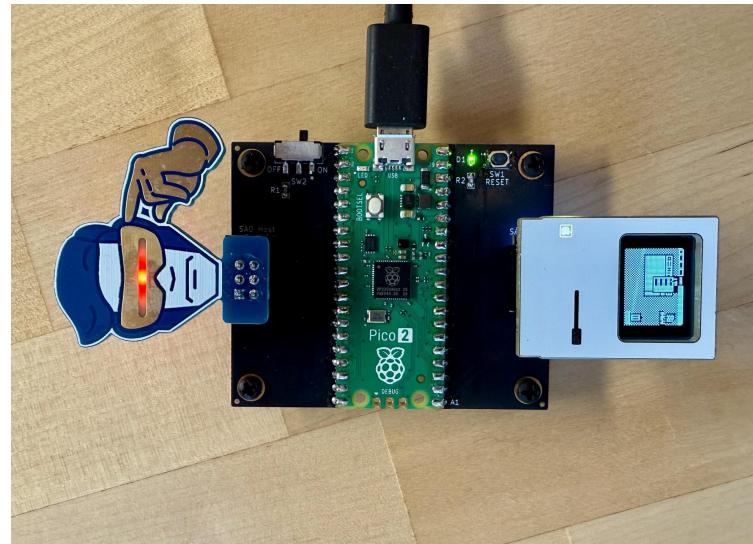
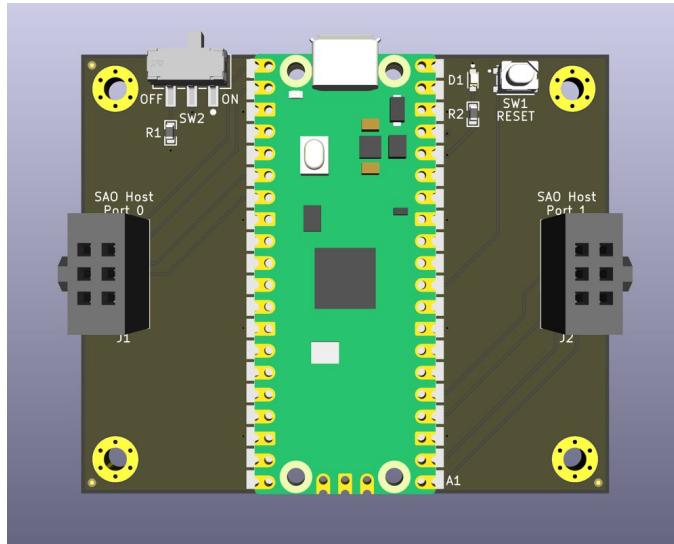
ALIGNI //

BOM IMPORT EXAMPLE



ALIGNI // BOM IMPORT EXAMPLE

Example assembly: Raspberry Pi Pico SAO Host board



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

ALIGNI // ASSEMBLY BOM IMPORT

Aligni import: map CSV columns to Aligni BOM columns

The screenshot shows the 'Step 2' screen of the Aligni Assembly BOM Import process. The screen is divided into three main sections: Step 1 (Choose a CSV file to import), Step 2 (Assign attributes to CSV columns, which is highlighted in blue), and Step 3 (Confirm part matches to the database). A green message bar at the top of Step 2 indicates that the CSV file has been loaded successfully and contains 8 columns. Below this, a table maps CSV columns to Aligni BOM columns:

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

At the bottom of the screen is a blue button labeled 'Match Parts & Move to Step 3'.

04

REVISIONS

How to use revisions in PLM

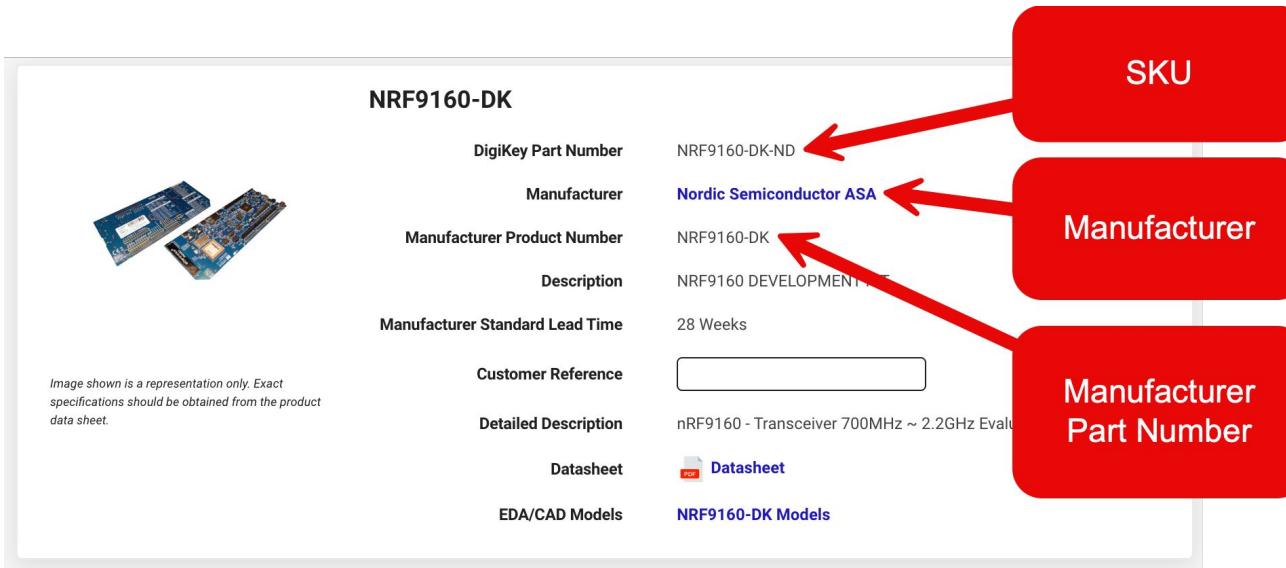
ALIGNI // PART REVISION BEST PRACTICES

- 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

How should revisions be used with PLM part numbers?

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

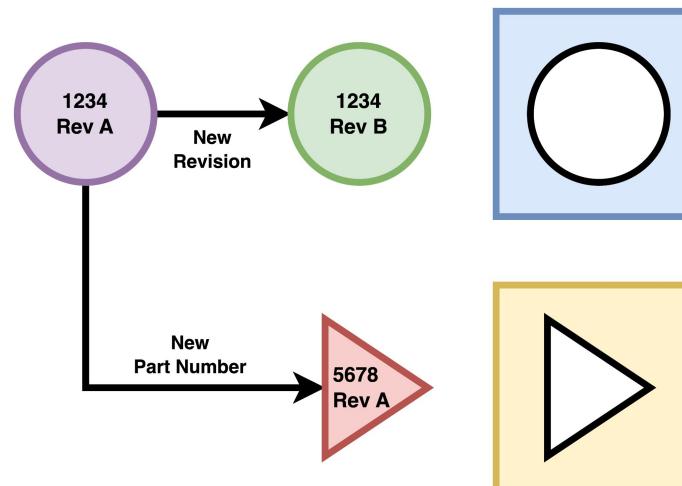
Use the "**Form, Fit, and Function**" (3F) rule:

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.

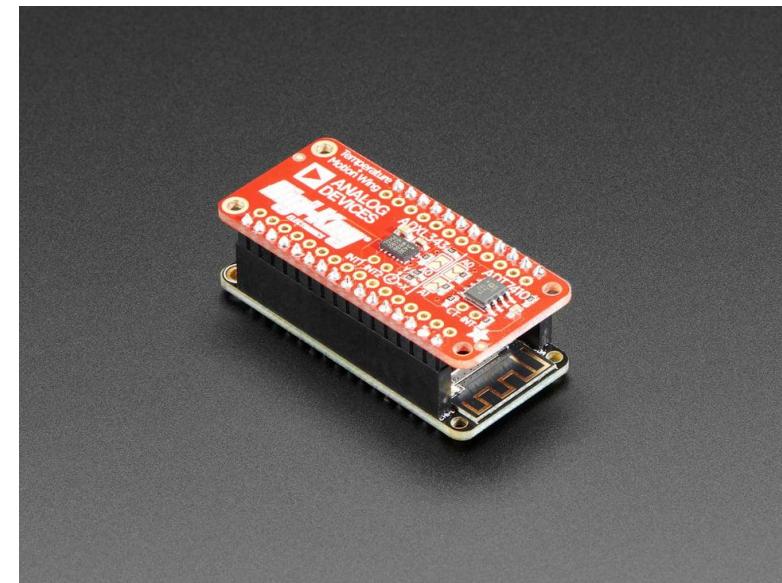
The screenshot shows a user interface for managing part revisions. On the left, a sidebar menu lists various categories: Home, Parts, Supply Chain, Inventory, Quality Control, Equipment, Relationships, Quotes, and Purchases. The 'Parts' item is currently selected. The main area displays a 'Release Revision' dialog. At the top of this dialog, there is a note: '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.' Below this, the 'Release Revision' section asks for a release name and brief description. A checked checkbox labeled 'Make active?' indicates that this revision will become the active revision for the item. The 'REVISION NAME' field contains the letter 'B'. The 'REVISION REASON' field contains the text 'There was a change to this part.' At the bottom of the dialog, the 'BOM Dispositions' section allows selecting whether to up-rev occurrences of the item on specific BOMs to the new revision or keep them as previous revisions. For the BOM entry 'TEST-100087', there are two options: 'Set all to Up-Rev' (selected) and 'Set all to Keep as Current Revision'. Below this, a 'BOM Disposition Confirmation' button is visible.

ALIGNI // PART REVISION BEST PRACTICES

This minimizes “churn” to assemblies when rev changes.

Example revision change:

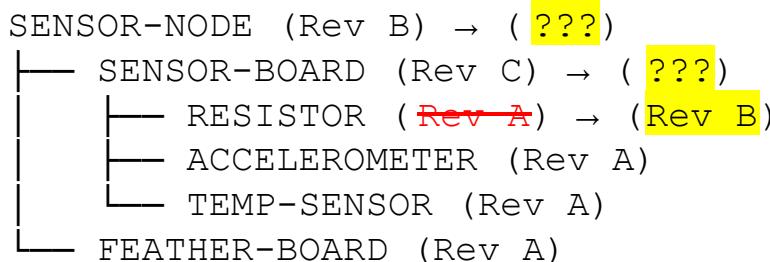
```
SENSOR-NODE (Rev B)
└── SENSOR-BOARD (Rev C)
    ├── RESISTOR (Rev A) → (Rev B)
    ├── ACCELEROMETER (Rev A)
    └── TEMP-SENSOR (Rev A)
└── FEATHER-BOARD (Rev A)
```



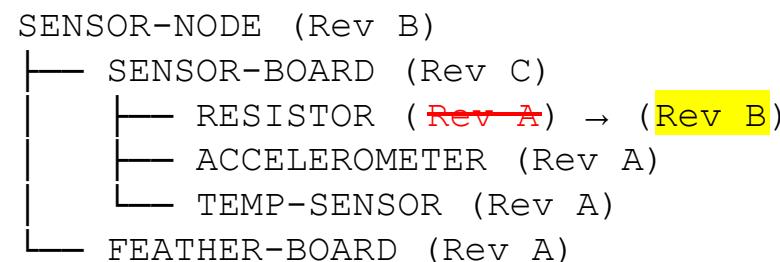
<https://www.adafruit.com/product/4147>

ALIGNI // PART REVISION BEST PRACTICES

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



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



*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.

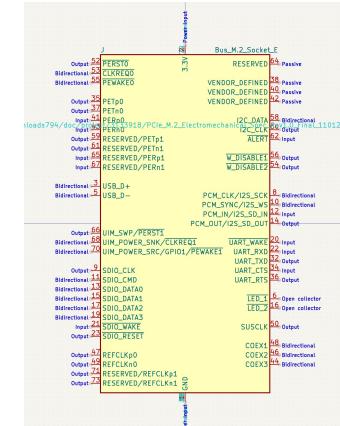
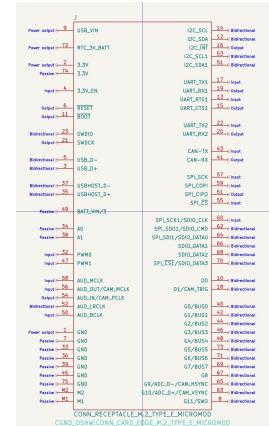
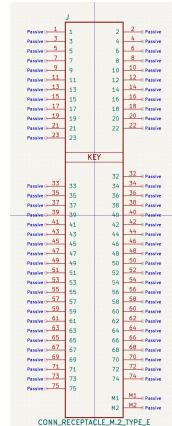
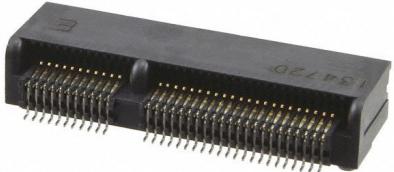
05

LIMITATIONS

Issues with the current integration

KICAD // ALTERNATE SYMBOLS

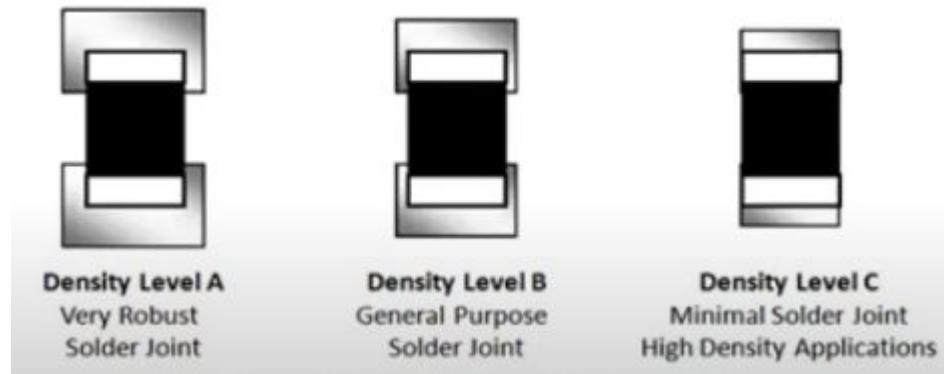
Currently no way to assign multiple symbols to a part:
Connector Generic MicroMod PCIe M.2



<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>

ALIGNI // USAGE LIMITATIONS

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	-
Warehouse	3	-
WooCommerce Integration	Unavailable	-
Xero Integration	Unavailable	-

ALIGNI // ALIGNI 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;
```

ALIGNI // 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>

07

RESOURCES

Additional resources

RESOURCES

- Aligni Public 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/SumanthKhalate/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>