EMA Design Automation®

White Paper

Fundamentals of Component Data Management

Fundamentals of Component Data Management by Clive “Max” Maxfield

If you are not sure what Component Data Management (CDM) is, or why it is important as an electrical engineer, this article is for you.

Firstly, let’s define CDM in the context of designing and building printed circuit boards. Large or small, a circuit board is going to carry a number of components, which may include resistors, capacitors, inductors, and more. A high-level and highly simplified view of CDM is defined as a process by which we manage the components we wish to use on a PCB, all the way through the board’s development process. This begins with the original component selections made by the design engineers, and continues through the board layout to verification, component procurement, Design For Manufacture (DFM), and finally board population and assembly.

Why is CDM Important?

We should note that anyone designing a circuit board performs some form of component data management, even if, as an absolute worst case, all they have is a list of component names, numbers, package types, and suppliers jotted down on a piece of paper with an old pencil. Of course this would be the absolute “bottom of-the-barrel” situation, since it leaves so much room for error and makes it impossible to share the database within an engineering team. Quite apart from anything else, someone might lose the piece of paper, and then where would we be?

The next step up the “sophistication ladder” would be some form of machine-readable document (like a spreadsheet) that can be easily shared and accessed by all members of the board design and implementation team. However, this still leaves room for inevitable errors, such as one person making changes without communication, and thus the possibility of multiple copies or versions of the spreadsheet. This is probably “business as usual” in most situations.

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At the other end of the spectrum is a full-blown CDM system that permeates every aspect of the board’s design and development flow. This system would have access to any and all necessary component-related information, allow everyone who needs the information to have access to all appropriate component data, and ensure no one can make changes without informing everyone.

What are the Benefits of CDM?

Assuming you are in a position to implement a state-of-the-art component data management system, what benefits would be realized?

First, you would see increased efficiency and productivity across the entire board design and implementation flow. Part of this increased efficiency and productivity comes from eliminating the need for multiple people to repeatedly enter the same data. Similarly, it will eliminate people repeatedly completing the same tasks to fix component problems that should never have arisen in the first place.

Second, you will experience tremendous cost savings. Some of these savings come from the points already discussed. But we also see cost savings because it empowers the design engineers to locate and select low-cost versions of components.Similarly, the folks in procurement will have access to all relevant data with regards to cost and component availability.

In the cases where multiple boards are using similar components, (such as two versions of the same silicon chip from different manufacturers) the component data management system can help to ensure all boards use the same component. In turn, purchasing larger quantities gives added negotiating power to the folks in the procurement organization, all of which helps to cut costs and increase profitability.

Another benefit is the increased reliability of the final product. Using a modern CDM system ensures that everyone is working with the correct data. For example, if someone swaps out a component for another with a different tolerance, everyone will know about it. This means the verification group will be alerted, and will re-verify the board in the context of the new component tolerance. This ensures that the board will still work as planned, and there won't be any unfortunate failures when the board is finally deployed into the field. All of this serves to reduce the risks and chances of error associated with the project.

Last but certainly not least, the use of a modern CDM system will help to ensure that the board can be manufactured and assembled as planned without unexpectedly swapping out a component or re-spin the entire board, both of which impact costs and introduce delays. This results in reduced time to market and – more importantly – reduced time to profit.

The Ideal CDM Deployment

The ideal CDM deployment begins with a database. Ideally this will be located "in the cloud", that is, it will be a secure cloud server that will be accessible to all members of the circuit board development team, even if they work for different companies around the globe.

Next, we load the database with a selection of components along with any relevant parametric information associated with each component, such as the manufacturer's part number, the cost, tolerance values, operating temperature ranges, and so forth. This data essentially embraces any and all information the engineers might want to search for to determine the right component for the task at hand.

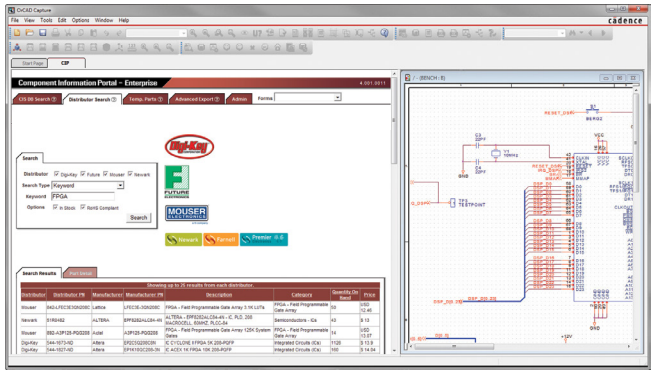
Any existing schematic symbols will then be imported into our database. Layout footprints will also be imported and associated with the appropriate schematic symbols. Similarly, we will need to import any analog or digital simulation models, RF simulation models, signal integrity models, and so on.

Personnel

Before we plunge deeper into the fray, this is probably the right time to introduce two very important people (or groups of people, in the case of large organizations)

First, we have someone who is known as the library manager. The library manager is in charge of making sure all of the various aspects of the components are in sync with each other; for example a layout footprint and its corresponding schematic symbol. Also, that the various attributes, parameters, simulation models, and such are all in sync.

Next we have the component engineer. The component engineer is in charge of evaluating the required component, and possibly selecting an alternative for one reason or another. The component engineer will also obtain all of the required data associated with the component, such as its layout footprint and simulation models, and work with the library manager to integrate the component into the database.



An example of OrCAD Component Information Portal (CIP)

Dynamic Component Data

At this stage it's important to note all of the component data loaded into our database may be classed as "static", relatively unchanging. Conceptually, we may visualize another level of dynamic component data riding above our static data.

This added level includes issues such as the current availability of the components; do we have enough on hand, and if not, are sufficient quantities available for purchase? What is the current pricing of the components? Are there cheaper alternatives? If a component is no longer available or is scheduled to be discontinued in the near future, what alternatives are available?

In many cases, this dynamic data comes from other sources, such as an enterprise-level PLM system, or from one or more distributer's databases. The important thing is that both the static and dynamic data associated with components is available, so the design engineers can select the most appropriate parts for the job, the procurement organization can start stocking up, and the manufacturing group can prepare to proceed.

An added aspect is the integration of the various design and management tools into the CDM system. For example, when the design engineers are looking for components, they should no longer be searching the schematic capture system's local database – instead, they should have access to all static and dynamic data associated with that component, allowing them to make the best possible selection.

Example Scenario

Now our component data management system is in place, let's consider some example usage scenarios. We start with the design engineers. As noted, when they are capturing their schematics, these professionals should have access to all static and dynamic information that will allow them to select the best components for the job at hand. Hopefully all of the components they require will already be in the database. In reality of course, things are rarely this simple. If an engineer fails to find an appropriate component, they will likely have to place a request for a new component and wait for it to become available in the database, causing the project to grind to a halt.

A better scenario is to allow the engineer to search the web for a suitable component, then automatically import the parametric data and schematic symbol associated with this component. Automatically importing the component negates the chance for hand-entered transcription errors. Such a part would be flagged in the database as not formally approved, but it would allow the design engineer to proceed in anticipation of the component engineer and library manager ratifying the component, or substituting an alternative, at some time in the future. When the schematics are handed over to the layout designers and verification engineers, the CDM system ensures each group has immediate access to the correct and up-to-date data they require.

Throughout the process, members of the procurement team are monitoring the situation to ensure all the desired components are available when required and to take full advantage of costs of scale if multiple design projects require common components.

A key point here is that the various users should not be inundated with data that is of no interest to them. Only information that is appropriate to each task should be made available by default.

If anyone makes changes regarding the components, for example, if a design engineer chooses an alternative component type, this information should be automatically communicated to all interested parties for them to consider and confirm.

Eventually the board will make its way to manufacturing and assembly. Unlike non-component data management scenarios, when using a modern CDM system, there should never be any problems at this stage. However, if it turns out the manufacturing organization decides it is necessary to swap out a component for an alternative with a slightly different tolerance, form factor, or other characteristic, then the CDM system will allow this decision to be communicated and negotiated throughout the entire organization. This will ensure an optimal decision, resulting in the highest quality board at the lowest possible cost, created in the timeliest manner.

Conclusion

Of course there are a variety of CDM solutions available. Our CDM solution has already been implemented by hundreds of customers throughout the world, and has many unique differentiators when compared with competitors. It provides access to a centralized database, allowing you to properly manage your component data, and comes complete with a 5,000 part starter library to eliminate the work associated with populating a database from scratch. Once implemented, you can search six major part distributors at once for parts that meet your exact requirements, then download the parametric data (including cost and quantity on-hand information) directly into the database. No manual entry required!

The OrCAD Component Information Portal™ (CIP) offers OrCAD® Capture CIS users a comprehensive 'off-the-shelf' component data management environment. CIP removes the barriers to implementing an effective component management process, allowing design teams to quickly and cost effectively realize the full benefits of a shared component database.

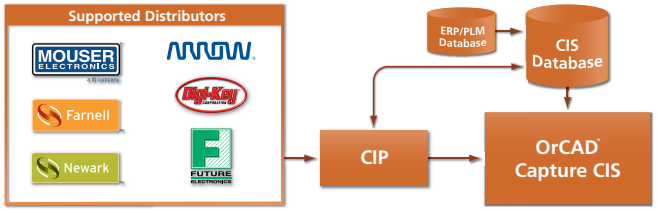


Diagram showing the different ways to access part information in OrCAD Component Information Portal (CIP)

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