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Management Guide to Bill of Materials

MANAGEMENT GUIDE TO BILL OF MATERIALS

In the past, many PCB designers were confined to tools that dictated when the Bill of Materials could be produced. But we know from years of experience that the Bill of Materials, or BOM, can change throughout the design process. We believe the decision should be up to you, which is why we strive to offer tools that embrace flexible and agile options for PCB designers and other professionals involved in the decision process.

Join us as we discuss a variety of topics to help you with Bill of Materials management, including:

- Bill of materials in supply chain management: Part inventory control
- Bill of Materials Inventory Management and the Benefits of an Online Parts Request System
- The Benefits of Having an Automated Bill of Materials in Project Management
- Why You Should Include Mechanical Parts in Your Bill of Materials Template

BILL OF MATERIALS IN SUPPLY CHAIN MANAGEMENT: PART INVENTORY CONTROL

Sending information to other departments and personnel is a regular part of the PCB design process. For purchasing, their part of this process starts when engineering sends them a bill of materials (BOM) for a new design. At this point in the design cycle, the BOM is a preliminary document and it is constantly changing as parts are added, updated, or eliminated during the design cycle. The problem for purchasing is that this constantly changing BOM data impacts their ability to effectively research parts for pricing and availability.

For a moment, put yourself into the shoes of the purchasing staff. They often aren't part of the design team, so they don't know all the details about what engineering is trying to accomplish or what the plan is to get there. They typically aren't part of manufacturing either, and yet the assembly line expects purchasing perfection so that the correct parts are available when they want them. This leaves purchasing staff being stuck between a rock and a hard place trying to balance the requirements of both engineering and manufacturing. They often get blamed for things that are beyond their control. There are ways to make the part inventory component of the bill of materials to streamline part inventory control.

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Manually created BOM's require continual updates to stay current with the design

THE PROBLEMS WITH A MANUALLY CREATED PRELIMINARY BOM

When a PCB design is being engineered, all of its parts will eventually have to be ordered for assembly. Traditionally a parts list is developed into a preliminary BOM and this is sent to purchasing for them to begin their research. Although this does give purchasing a place to start, it can also cause a lot of problems down the line as well. This is how a manually created BOM impacts purchasing with respect to the engineering and manufacturing departments.

Engineering: In engineering, the PCB design is constantly changing, which requires the BOM to be updated accordingly. As a result, new copies of the preliminary BOM are being sent to purchasing. If a new copy is delayed or doesn't make its way to the right people, then purchasing will end up working from outdated data. Any parts that have already been researched and have preliminary quotes may have changed or even been eliminated without purchasing's knowledge.

Manufacturing: On the other side of the spectrum, manufacturing may have their own part changes. Once again, if those changes aren't tracked in a timely manner with updated preliminary BOM's, purchasing may be researching and quoting parts that are no longer required for the design.

For these reasons, part purchasing orders are usually deferred until the final BOM is ready and sent around. In a manual process, this final BOM is usually not available until the end of the design cycle along with the complete fabrication and assembly documentation packages. With a BOM that is manually created and distributed at the end of the design cycle, there may be difficulties with getting the best pricing on parts or in getting the parts delivered in time for assembly.

Here is where automated BOM management tools can be a real asset.

Solutions for your inventory control problems

BOM MANAGEMENT TOOLS WILL HELP PART INVENTORY PROBLEMS

BOM management tools will help your purchasing department manage the supply chain more efficiently. By having real-time access to the BOM, purchasing can respond to part requests for the design when they happen without any confusion.

As the BOM evolves, purchasing agents will have accurate part information so that they can research preliminary price quotes. In addition, purchasing will have immediate knowledge of any parts that are changed or eliminated from the BOM. This saves time researching parts that are no longer being used in the design.

BOM management tools will also free up the purchasing department from having to wait for a final BOM to be sent to them. As soon as the BOM is flagged in their system as being ready, those orders can be placed. Since the ordering information has already been researched, updated, and prepped in the system, orders can be made without needing to create another set of documents.

BOM management tools position your purchasing department correctly within the product development flow. For easy to use BOM software, check out Altium's BOM management tools. It will take help reduce errors and time due to an older manually created BOM process, and help your product get to market sooner.

Would you like more information on bill of materials management solutions? Talk to an expert at Altium.

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BILL OF MATERIALS INVENTORY MANAGEMENT AND THE BENEFITS OF AN ONLINE PARTS REQUEST SYSTEM

I once asked a family member to borrow some money to use as a down payment. His response included a counter-proposal that I didn't understand, so I let it pass. Unfortunately, by not understanding his answer to my request, I missed out on an even better opportunity than what I had initially asked for.

That exchange has stayed in my mind as an example of how important clear communication is. In our world of PCB design the need for clear communication is essential, especially when requesting new parts for a design. Yet these requests can get garbled, delayed or even lost when the part request documentation fails to be distributed properly. Engineers can also requests parts that are not available or are from suppliers that are not on the approved vendor list. All of these problems can result in costly redesigns and slow down manufacturing. Fortunately, there are bill of materials inventory management tools available that can help you solve part request problems.

THE TRADITIONAL METHOD OF SUBMITTING A NEW PART REQUEST

Parts have been requested by design teams for as long as printed circuit boards have been designed. As a PCB design is developed, parts are added to the schematic and connected together to complete the circuitry. If the design requires a new part that has not been used before, the following steps are usually taken:

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1. The engineering team researches part vendors to find the part that they need.

2. Once the part is found, engineering submits a new part request in the form of a spreadsheet, E-mail, or a paper document to the purchasing and CAD departments.

3. Purchasing researches the part for cost and availability and assign a company part number to it.

4. The CAD department uses part data gathered by engineering to develop preliminary library parts for schematic and layout.

5. Upon confirmation of availability, the approved part request is sent back to engineering.

6. Library parts, schematics, and layout are all updated with the approved part information.

There are many steps in this process, any one of which can cause problems with the part request.

Problems with the traditional part request system

Problems associated with the traditional part request system

There are a number of problems that can arise with the traditional method of requesting parts. Two of the worst of these problems are requesting new parts from unapproved vendors, and requesting parts that are unavailable for purchase.

In order to find the exact part that they need, engineering may look at part suppliers that are not qualified as an approved vendor for the company. Even though the requested part is the perfect solution for the design, the part vendor itself may not be acceptable for business reasons that are not obvious to engineering. Also, a new part may be offered by an approved vendor, but it may not be available for use yet, or it may not be available in the quantities required to support your manufacturing needs.

Qualifying a new vendor or finding a substitute to replace unavailable parts takes time. The design may have progressed to the point

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where a redesign to accommodate a new replacement part will seriously impact the design schedule.

Another problem that can occur is a failure in the distribution of the part request documentation. This can happen because:

1)   Part requests on paper can get accidentally lost or destroyed. We used to laugh at the old excuse of "the dog ate my homework", but the reality of missing paperwork is just not that funny.

2)   Documentation personnel that are absent from the office can cause delays in the creation or delivery of part requests.

3)   Incorrectly addressed documents or Emails can cause a part request to end up in the wrong location.

4)   Part request files can get lost due to network or hardware mismanagement.

Anyone of these issues can derail a traditional part request system. This causes the CAD department to be late in finalizing the part, which adds delays to finishing the design in engineering. All of these delays can continue to snowball downhill until finally the manufacturing department is affected causing the product delivery date to slip.

Part requests using a bill of material inventory management system

Making part requests through a bill of materials inventory management system

The problems in a traditional parts request system are no longer an issue with the part request functions of a bill of materials inventory management system.

Engineering and purchasing part research is tied together: Your engineers will be able to work together with your purchasing agents to immediately start a new vendor qualification process. Additionally, your engineering will have real-time access to approved vendor and parts lists to know which vendors are qualified and which parts are available for use.

Distribution of part requests is all contained within the bill of materials inventory management system: The aggravation from delayed

or lost part request documentation will no longer be a problem in your design cycle. All personnel will have access to the part requests through the inventory management system. This will allow them to work as soon as a part request is filed instead of waiting for documentation to be distributed.

Part data is immediately available to all personnel: Your engineering, CAD, and manufacturing departments will all have real-time access to all part request data sheets. This will allow all personnel to work with confirmed vendor part data eliminating the need for temporary or "preliminary" parts that require updating later on.

There are a lot of problems that can arise from using the traditional method of requesting new parts for a PCB design. Engineering may not know that the parts that they are requesting are not available for purchase, or that the part supplier may not be accepted as an approved company vendor. Then, the part requests themselves may get delayed or lost depending on how they are distributed to different departments. All of these problems can be resolved by using the online parts request functions of a bill of materials inventory management system.

Bill of materials inventory management tools can help improve interdepartmental communication during the design cycle. By taking the problems out of the traditional method of requesting new parts, your design team members can focus on design rather than managing documentation. Altium Designer's BOM management tools can help you with this. Find out more information by talking to an expert at Altium.

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THE BENEFITS OF HAVING AN AUTOMATED BILL OF MATERIALS IN PROJECT MANAGEMENT
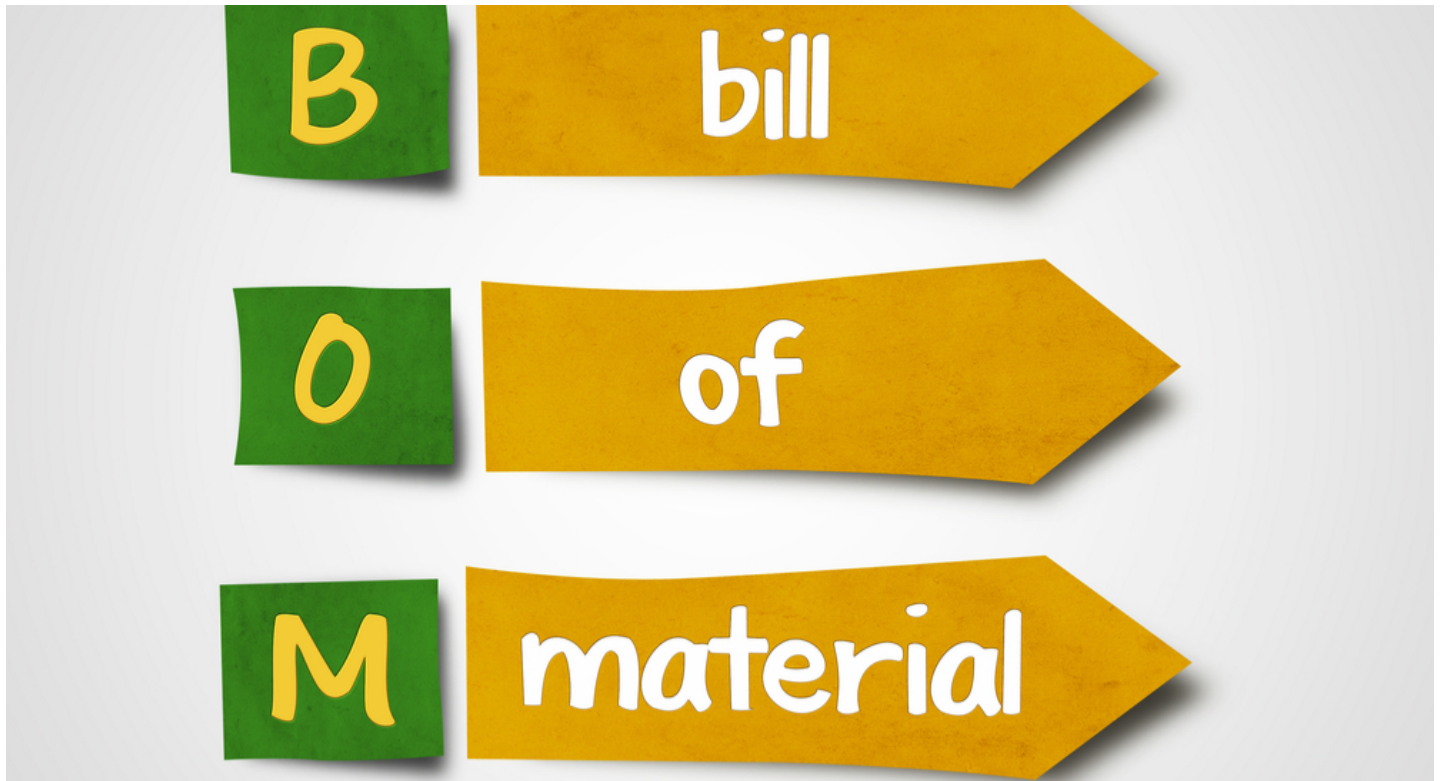
I have some friends who founded a startup company to create and market a brilliant new product. Their product quickly became a success, but all their hard work was constantly undermined by communication issues between departments. It wasn't long until the engineers found their creative hands tied, purchasing was buried under an avalanche of unreliable documentation, and the product build in manufacturing was slowed to a crawl from incorrect and missing data. Without product in the pipeline, sales fell off and the company floundered.

So just what problem in interdepartmental communication led to this disaster? It was all due to simple miss-management of part control in the bill of materials.

## THE LIFE CYCLE OF A BILL OF MATERIALS (BOM)

Your company's departments need clear communication to effectively manage a product's parts. When this process is working, the engineering, procurement, and manufacturing of a product moves along smoothly. In general, this is how it works:

1. Engineering creates a bill of materials for the different aspects of the design.

2. The purchasing department will take the engineering BOM's and determines which parts are available for purchase based on costs and availability.

3. Manufacturing uses the BOM to build and test the product completing the cycle.

There is a lot of back and forth between the departments during the design phase. The engineers may decide to substitute different parts from what they originally specified based on feedback from purchasing. Meanwhile manufacturing will be analyzing the design to make sure that the requested parts are suitable for their processes and send their results back to engineering for more changes.
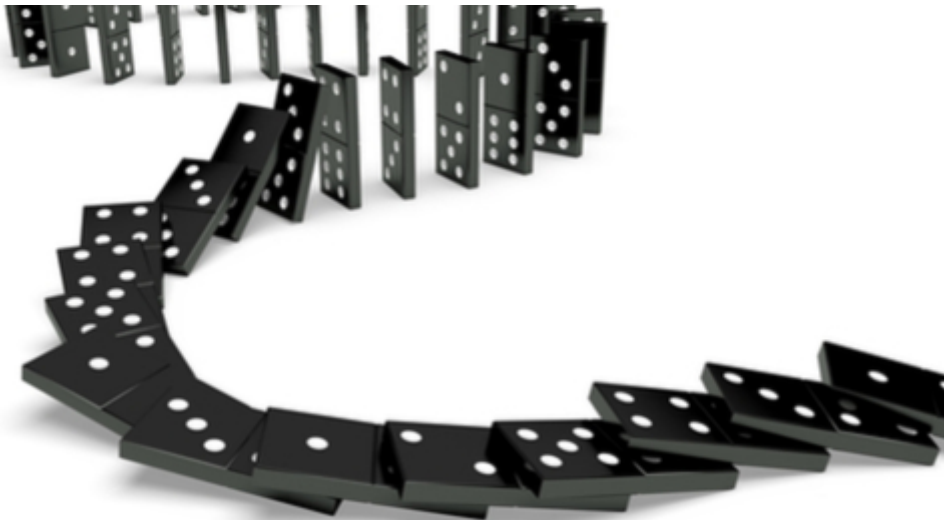
A BOM problem can affect each successive step in the process like a string of dominoes going down

MANUALLY BOM MANAGEMENT

Each step in managing the BOM process affects the next step. If there are problems in one area, those problems will impact the next step. If left uncorrected, the whole process can go down like a string of dominoes

Engineers who don't have current part information won't be able to make informed decisions on what parts to use. If purchasing doesn't get accurate information from engineering, they can't give reliable responses back to engineering or adequately prepare manufacturing for what will be coming. Manufacturing will be the last domino in line to go down as product lines are slowed or shut down due to incorrect or missing BOM information.

BOM management tools can help you to improve production

HOW AUTOMATED BOM MANAGEMENT TOOLS CAN HELP YOU

Exercising control over the bill of materials, however, can guard against these problems and help keep the dominoes of your product production upright and in place. Using a central database to manage your bill of materials will also help in the following ways:

Immediate part inventory access: Engineers can have real-time access to company part inventories to see what is on hand and what they will need to research and order. By eliminating the need to send a spreadsheet to purchasing and waiting for them to create a BOM, the engineer can continue the product design cycle without unnecessary interruption.

BOM creation as a living document: Creating, changing, and updating the bill of materials can be a continual process as the product is being designed instead of being put together at the end of the design cycle. This gives complete revision control to the engineer while also providing the ability to track changes. It also eliminates the errors that can come from having a second party create a BOM from an engineering spreadsheet.

Part requests: Purchasing will receive real-time engineering part requests from the BOM database instead of having to wait for individual spreadsheets to be distributed. Not only does this process reduce the possibility of errors, but it saves time too.

BOM management tools allow for efficient communication between departments: By working together in the BOM database, engineering, purchasing, and manufacturing will have immediate responses to part requests and part changes. This reduces the back and forth time in the design cycle that used to be required when manually changing the BOM.

Part inventory control: With BOM management tools, purchasing can begin the part ordering process while the design is still in engineering without having to wait for a manually created BOM from an engineering spreadsheet. This allows part ordering to already be in the queue, and part inventories stocked and ready when the board is manufactured.

No delay in manufacturing: With BOM management tools at their disposal, manufacturing is able to prepare in advance for unique part assembly requirements. This reduces the prep time that manufacturing takes in getting ready to start a run.

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Controlling your bill of materials using BOM management tools can reduce errors and shave precious time off your design cycle. This will ultimately save your company time and money making your product delivery a success. For easy to use BOM software, check out Altium's BOM management tool. It is easy to download and will make your life a whole lot easier once you get started with it.

Want more info on bill of materials management solutions? Talk to an expert at Altium.

WHY YOU SHOULD INCLUDE MECHANICAL PARTS IN YOUR BILL OF MATERIALS TEMPLATE

Have you ever put together a project where there weren't enough parts to finish the job? I have, and I know how frustrating it is to have to wait for the missing parts to be replaced. Meanwhile, that partially completed bookshelf or bicycle just sits there mocking you. You can't use the bookshelf, and nothing in life hurts worse than the scolding face of an 8-year-old who can't ride their new bike.

This problem can also happen during the manufacturing of printed circuit boards. PCB CAD systems will usually collect all the electrical component information for resistors, caps, IC's, etc., and promote it to the bill of materials. The problem is with the non-electrical parts which are sometimes missing. These missing parts could include items such as heat sinks and shields, or mounting hardware and manufacturing stickers. The reason that these parts end up missing is because they were never part of the CAD database in the first place, and someone forgot to add them manually.

It is important that you make sure that the bill of materials is complete. The best way to do this is to include the mechanical part information in the design so that it is automatically promoted to the final BOM. Before we talk about the best ways to do that though, here are some of the parts that commonly slip through the cracks.

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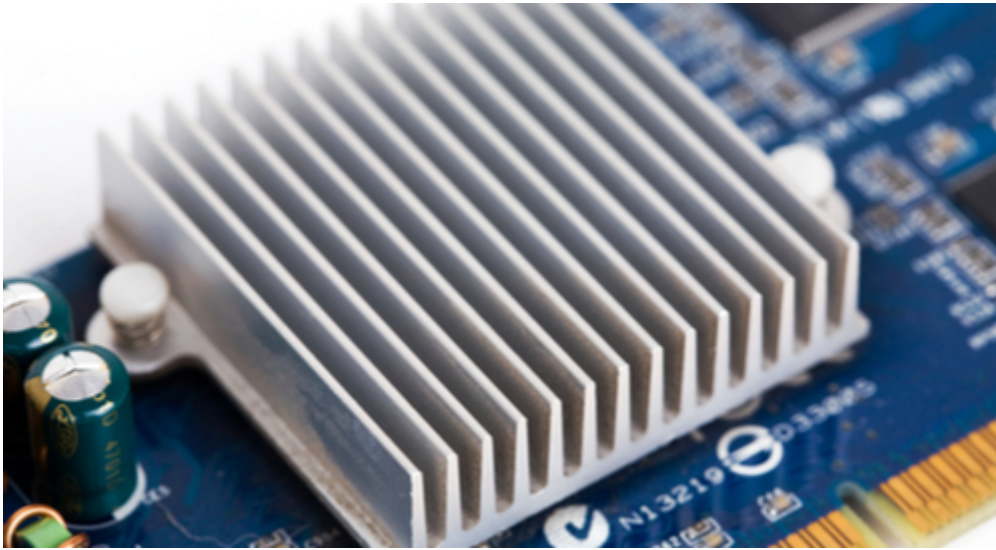
Heat sinks like these will need to be accounted for on the PCB

MECHANICAL PARTS THAT ARE OFTEN MISSING FROM A PCB BOM

Because mechanical parts do not have an electrical connection to the circuit board, they are often not included on the schematic. This can cause them to be forgotten on the final bill of materials. These parts can include the following:

Individual heat sinks: Parts that run hot, such as transistors and power field-effect transistors (FETs), will often need to be cooled with a heat sink. In some cases, the transistor will be bolted to the PCB in order to use the metal of the board as a heat sink. In other cases, the transistor will be physically attached to the heat sink part. In either case, the bolt and/or the heat sink will need a part number and a unique reference designator for the BOM.

Large area heat sinks: Often an area of the board will require more cooling than what the individual heat sinks may provide and a larger stand-alone heat sink will be used. These stand-alone heat sinks will also need part numbers and reference designators.

Shielding: Your PCB design may also need shields for blocking EMR and EMI. Shields like this, and their associated mounting hardware, will also need to be accounted for in the BOM.

Mounting hardware: Your PCB will likely have other mounting hardware associated with it that will have to be accounted for. This hardware may include brackets, metal spacers, or card cage extractors. You may also have connectors, lights, and switches in your design that are usually attached with nuts and bolts, clips or other mounting hardware. These will need to be accounted for in the bill of materials as well.

Labels: Another PCB item that often gets overlooked in the BOM is any manufacturing labels or stickers. A printed circuit board is often designed with part names and numbers, serial numbers, and other identification markings created in etch or silkscreen. However, there may be bar code labels or other manufacturing stickers that have to be manually attached during board assembly.

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PROBLEMS WITH MANUALLY ADDING MECHANICAL PART INFORMATION TO THE BOM

As you can see, the list of mechanical parts that don't make it onto the BOM is substantial and will impact the timeline of the final product. A common reason why they are excluded is that they might not be in the CAD database need to be appended to the BOM. This is a manual process, so care must be taken to ensure that the correct part numbers, their reference designators, and quantities are reported. Once the bill of materials is correctly updated with this information the boards can be built.

In theory this makes sense, but in reality this manual method is prone to error. It is also time consuming since it requires diligent verification to make sure that the final BOM matches the actual design. Last minute design changes that are not updated to the BOM can result in inaccuracies that eventually cause problems in manufacturing.

Your circuit board will have mechanical parts attached to it as this board does

ADDING MECHANICAL PART NUMBERS TO YOUR DESIGN

We've talked about what kinds of parts are often missing from a PCB BOM, and what can cause these problems. The good news that you can avoid these problems by adding the mechanical part information directly to your design. This way your mechanical parts will be automatically promoted to the bill of materials template instead of having to be manually appended.

Some PCB CAD systems will allow you to enter mechanical part numbers with reference designators and quantities as an attribute to the layout. Other systems will allow you to add this information directly to the PCB footprints in layout.

The best method is to add non-electrical part information as a mechanical part directly to the schematic. This way each of these parts will have their correct part number, and a unique reference designator. Since they are controlled by the schematic, they are

easier to work with and to account for.

The correct representation of mechanical part information in the PCB BOM is an important part of your PCB design. As we've seen though, getting the correct information into your bill of materials template can be problematic. Fortunately though there are mechanisms in place within our CAD tools that will allow us to this without error of manually appended BOMs.

Altium's design tools can help you to accurately work with your mechanical parts. They also offer BOM management tools that give you better control of the content and quality of your PCB BOMs. If this level of quality and control sounds helpful to you, then Altium's BOM tools might be the answer that you are looking for. If so, find out more information by talking to an expert at Altium.

ADDITIONAL RESOURCES

Thank you for reading our guide on Management Guide to Bill of Materials. To read more Altium resources, visit the Altium resource center here or join the discussion at the bottom of each original blog post:

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