

Design for Assembly Software Overview

Introduction

The virtual assembly service is aimed at using an engineer's Bill of Materials (purchasing information), the external or surface gerbers (top and/or bottom as needed), and a CAD export/report that contains the component placement information. These items are imported into a proprietary software program called BOM Builder, which is functionally a virtual pick-and-place machine. Having this data allows for part-to-placement verifications and helps ensure there are no existing errors or missing items (refdes or locations) in the files/data.

ABOUT THE SOFTWARE

BOM Builder is a software tool used to prepare electronic component data for automated assembly.

Originally, it was a way to use a Bill of Materials as a starting point for defining the placement information for every component ... thus the name BOM Builder. Since then, it has grown to become a virtual pick-n-place software for BOM verification and automated assembly BOM Builder imports a "Parts List" from a spread sheet Bill Of Material (BOM and allows easy association of that data to physical packages and their X/Y placement on a PCB surface. Several additional data items are collected and merged with this list:

- Similar parts are merged into Line Items in preparation for Pick and Place setup.
- STUFF and NO STUFF status is provided to support construction of Product Variations.
- X,Y Rotations and Side (Top or Bottom) status (XYRS Information) for Pick and Place.
- Indicators for Through Hole, Machine and Hand-Placed Components.
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With a parts list and all the component placement data available, the next questions are "Is all of the data correct?" and "Does the data match the PCB as designed in lay out?" The DFA software is very unique in that it presents all this data as a completed assembly image. Using a custom Gerber Reader and package graphic libraries, BOM Builder shows the resulting data as a final board image. This image allows the "Form and Fit" of the various components to be checked BEFORE an actual bare PCB is fabricated.

INPUT DATA OVERVIEW

BOM Builder automatically groups and sorts components into line-items based on either manufacturer's (mfgs) part numbers (or reference designators). As line items are formed from the input "Parts List" (BOMs), it is very common that errors are detected. Many BOMs are constructed by hand using Excel or other spreadsheet programs. Such BOMs often have several errors and data inconsistencies.

BOM Builder includes logic that detects many of these input errors, provides a listing of them, and allows an operator to quickly identify and correct the errors.

Clearly defining the components that will NOT be placed is almost as important as defining which components are machine-placed or hand-loaded. The DNI (do not install) components are important during receiving parts and inventory through the process to final inspection including all non-stuffed components in the BOM. Marking them as "Not Stuffed" (using a separate column) is very useful to a production process. Final inspection must verify that no required parts are missing.

The number of line items in a project directly affects assembly machine set-up as each component type requires a separate machine feeding location. Purchasing departments also require a list of required components in line item format. The number of BOM line items directly affects the effort required to purchase material and the effort of kitting components for the assembly process. Set-up costs dominate low-volume assembly costs and line-item counts are the key contributors. Good engineering practices will always attempt to reduce the line item counts. Also, when items are not grouped properly, then inventory efforts are also hampered.

The concept of X, Y, Rotation and Side data being used for assembly is easily visualized. The need for Stuffed, Machine and Hand assembly data is not as obvious until the entire assembly process is considered. A kit of components must be sorted such that the various types of components arrive at the proper workstations. None of the through hole parts are required at the pick-and-place machine. Since some SMT parts cannot be machine-placed, they must be hand-placed BEFORE sending the partially placed boards to the solder reflow process.

Through hole part mounting is accomplished AFTER both top and bottom SMT (Machine and Hand) at yet another workstation. The cost for Hand and Through Hole assembly is much higher than SMT machine assembly and these counts are very important when computing assembly cost.

ASSEMBLY VIEW

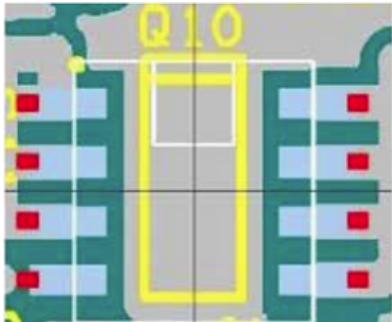
BOM Builder shows how the components will fit on the surface of the final PCB. A very important function of the assembly view is to identify how component leads fit on the copper pads and show the related solder paste (from the stencil or paste gerber file). The ability to automate the collection of assembly data from schematics, PCB designs, CAD tools or spreadsheets and to combine this data with a library of component models is unique.

COMMONLY DETECTED ERRORS

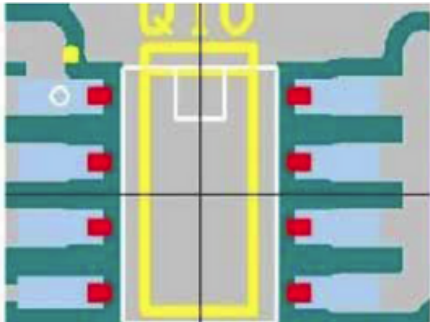
Over 90% of design projects unknowingly are submitted with errors. The electronic assembly image sent back to customers based on actual data files helps catch and correct these errors prior to beginning the assembly process. Key factors the tool evaluates include:

- BOM to XYRS/Pick n Place to Gerber comparison
- 100% part verification on ICs
- Part Verification
- Identify incorrect parts on footprints
- Identify incorrect footprints for parts
- Missing, unclear or incorrect polarity markers
- Description verification (BOM vs. Manufacture description)
- Paste verification
- Part spacing verification

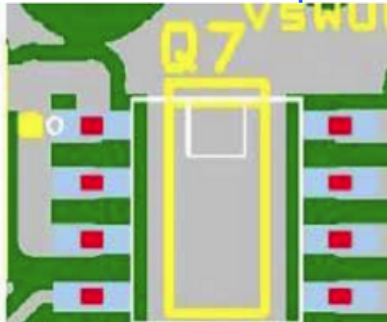
Poor Solder Joint in the Toe



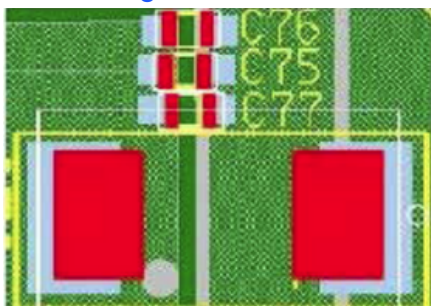
Poor Solder Joint in the Heel



Correct Part for Footprint



Conflicting Parts



Spacing Violations



ROLE OF THE ENGINEER

Engineering customers simply upload their files and we automatically puts each project through the following process:

- First a PDF image is created from actual manufacturing data.
- Next, engineering team reviews every design to verify part fit and rotation.
- Customers are notified if errors are found and allowed to confirm final designs.
- The design check is done while parts are being procured.

This free process prevents delays and costly rework, ultimately reducing assembly time by a full week, on average.