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**GEOMETRIC
SOLUTIONS**

Design for PCB assembly/test

Verifying the assembly/test of PCB designs earlier in the design cycle

Benefits

- Ensure electronics assembly/test across multiple facilities
- Facilitate early identification and correction of assembly/test issues
- Shorten pre-production inspection and analysis
- Improve reliability with less manual or custom processing
- Eliminate late stage design rework
- Reduce manufacturing scrap

Business challenges

- Enable “design anywhere, build anywhere”
- Accelerate time to volume production
- Lower manufacturing costs
- Improve product quality and reliability

Summary

Teamcenter® software provides a design-for-assembly/test solution that enables your electronic design teams to analyze and verify a printed circuit board layout's conformance to your company's assembly/test rules. You can use the solution to establish libraries with customizable rules and parameters that reflect the specific capabilities of each facility. By executing the design-for-assembly/test solution early in the design process, teams can significantly reduce costly design rework and accelerate manufacturing's transition to volume production.

Verifying PCB assembly/test during design

The printed circuit board (PCB) assembly/test process has a dramatic effect on product cost, reliability and time-to-market. To lower costs and speed time-to-market, PCB manufacturing facilities employ specialized equipment that automates each step. Manufacturing engineers continuously monitor and tune these processes to ensure that

they achieve the consistency and quality needed to maintain product reliability. Applying this knowledge early in the physical layout process is a key component in the rapid transition to cost effective volume production.

Adherence to assembly/test rules during the creation of a PCB design is critical to passing pre-production manufacturing tests and designing reliable and manufacturable products at the lowest possible cost. PCB designs that do not match a facility's capabilities require modifications to the process and manual interventions that necessitate more production time, lower product reliability and increase manufacturing costs. By using the knowledge and insight of suppliers and manufacturing engineers, your product teams can configure a set of assembly/test rules that promote high-volume manufacturing.

Teamcenter's design-for-assembly/test solution enables your product teams to establish a library that captures these rules and then enables team members to use these rules to analyze and verify PCB design. By enabling you to execute design-for-assembly/test practices early in the design phase, Teamcenter provides PCB designers with the information they need to quickly identify and correct assembly/test issues prior to release. This early detection eliminates problems that would otherwise slow a design's transition to volume production or necessitate rework late in the product delivery schedule.

Design for PCB assembly/test

Features

- PCB assembly/test rule analysis and verification
- Templates for rules selection and definition
- Fiducial, component, test point and board rules
- User-configurable parameters
- Graphical display of rules and violations
- ECAD viewer for navigation
- Multiple measurement utilities

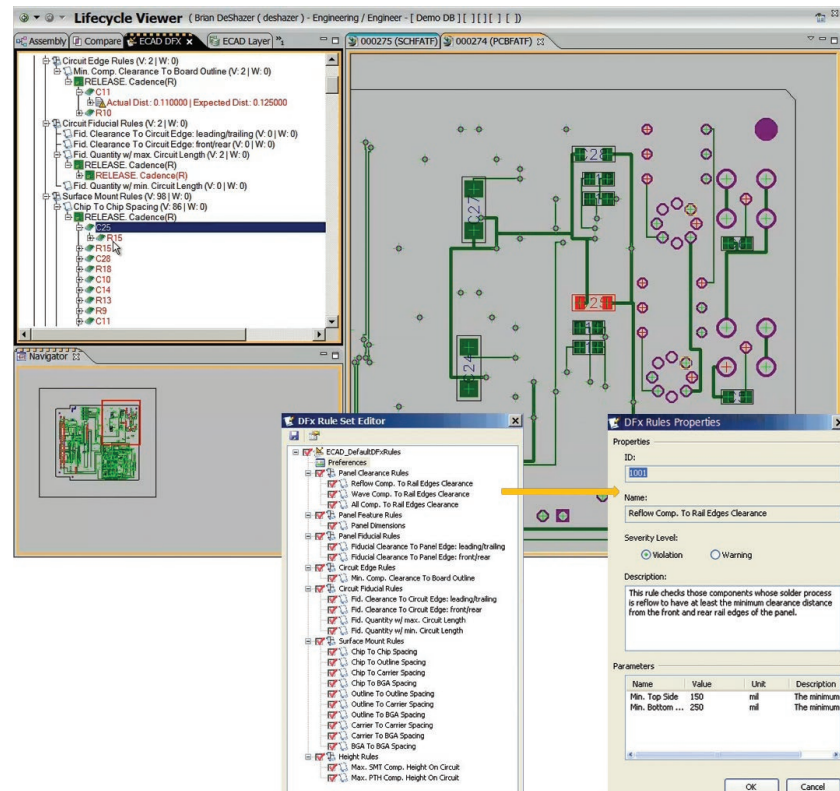
Quickly identifying and investigating assembly/test issues

To aid team members in interpreting the results of the analysis, Teamcenter provides detailed reports that clearly identify potential issues as warnings or violations. This segmentation aids PCB designers in understanding whether an issue requires special attention by the manufacturing engineer during pre-production, warrants a change to the assembly/test process or requires the design to be reworked.

PCB designers can quickly identify and highlight each object affected by the violation using Teamcenter's ECAD viewer and its powerful navigation features. Objects not conforming to a rule are highlighted in one display, while individual rules and the analysis results are displayed in another.

Selecting either a rule or an object in one window automatically highlights the entity in the other. To assist designers in distinguishing warnings from violations, Teamcenter provides user-configurable color assignments.

To further accelerate the process, Teamcenter enables design teams to organize results and investigate in greater detail those factors that triggered these issues. For designs that generate lots of issues, designers can collapse and expand information, select individual items or clear content. To investigate why an object failed and provide the insight needed to correct the problem, Teamcenter enables designers to probe the rule's threshold values against the actual measured value.



Reducing scrap and late stage rework

The late discovery of manufacturing issues often presents product teams with problems that delay product introduction schedules because of the need for design rework. These problems also can increase product cost and scrap rates as modifications are made to the production process. Teamcenter helps product teams avoid these problems by facilitating early detection and correction of manufacturing issues.

Due to the complexity of today's PCB designs, even small changes – such as moving components, inserting test points, or placing additional fiducials to improve manufacturability – can become time consuming and difficult. By executing Teamcenter's design-for-assembly/test solution early and using its related insights, PCB designers can correct potential issues before time consuming rework is required.

Utilizing a host of configurable rules, Teamcenter flags non-conformance issues that relate to panel dimensions and clearances, fiducial quantity and clearance, circuit edge clearance, component-to-component clearance, height of placed components or test point placement and clearance. Early identification of these issues reduces the scrap generated by pre-production engineers in instances when they try to modify the process to suit the design. Early execution also enables design teams to quickly identify and correct potential

issues before they negatively impact schedule, cost or product quality.

Facilitating the design anywhere, build anywhere model

Whether you leverage your own assembly/test facilities or engage the services of a contract manufacturer, Teamcenter provides the flexibility of tailoring facility rules to meet your specific needs. By utilizing more than 50 pre-defined manufacturing rules with editable parameters, design teams are able to establish a library of assembly/test rule files that mirror the capabilities of each individual facility. As suppliers are added to your value chain or facilities are updated, product teams can easily modify the contents of the existing library to reflect these new capabilities.

Since each facility supports a different set of assembly/test processes, product teams can define the severity of non-conformance issues. For example, the number of fiducials used for a given circuit length may warrant a warning for one facility process, but result in a violation for another. A "warning" notification typically alerts the PCB designer to less than optimal situations that require communications to the manufacturing engineer prior to release. "Violation" level notifications usually require extra or manual processing that add costs or lower product quality.

In addition to different processes, each facility has equipment that operates within different sets of clearance tolerances. For example, the clearance between components or test points will vary depending on the types of components being placed. User-editable parameters enable product teams to establish unique clearances based on component types that use body limits, pad extents or composite representations. You can use Teamcenter to establish appropriate machine and probe tolerance parameters that, in turn, ensure that the machine operates at optimal performance. This increases throughput while reducing scrap from damaged components.

By integrating the varied manufacturing processes and constraints during design, product manufacturers can easily and successfully implement and support the design anywhere, build anywhere model prevalent in today's electronics industry.

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