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PCB-Investigator
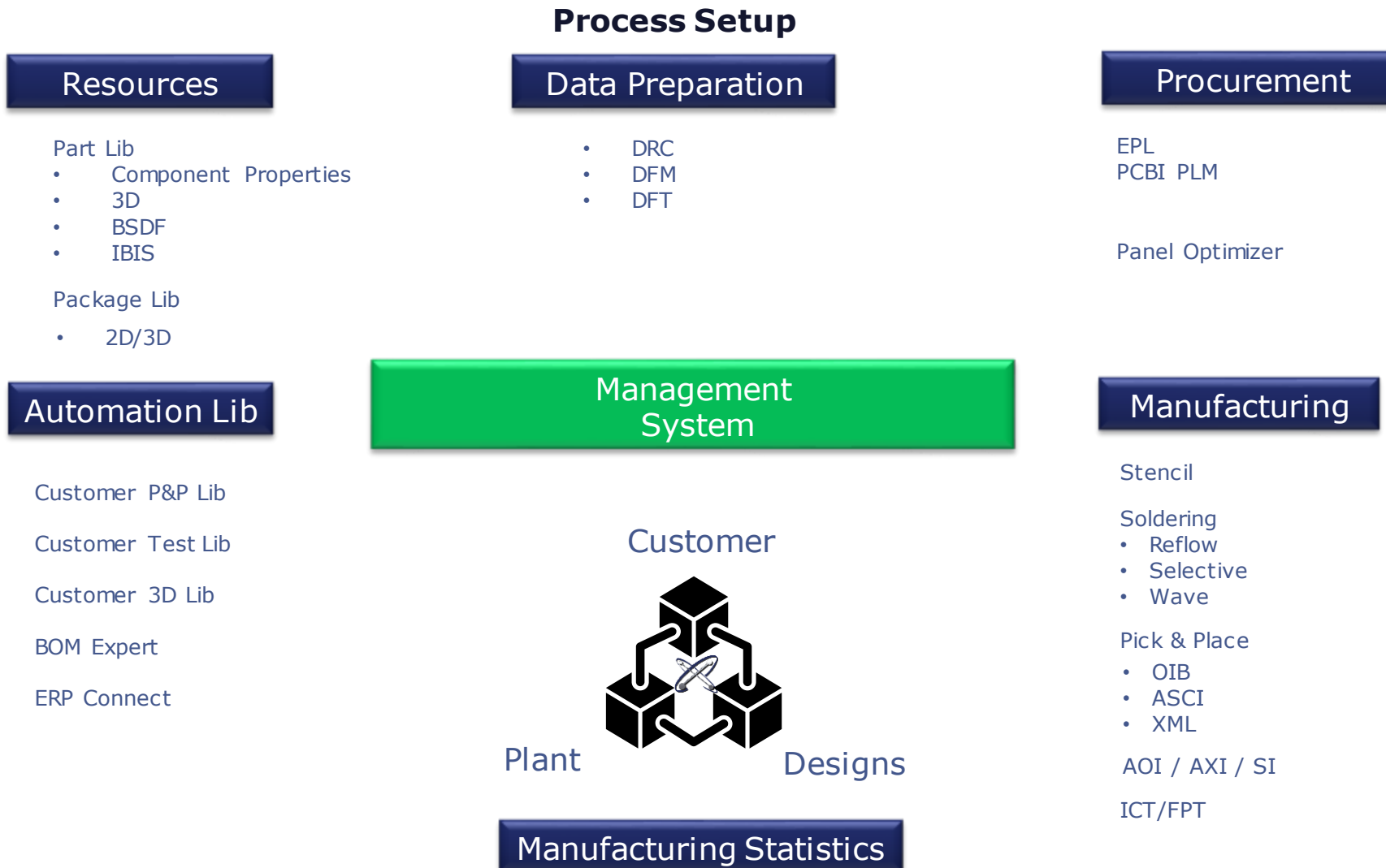
EMS

01/2023

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Industry 4.0

Process Setup

Resources

Part Lib
- Component Properties
- 3D
- BSDF
- IBIS

Package Lib
- 2D/3D

Data Preparation

- DRC
- DFM
- DFT

Procurement

EPL
PCBI PLM

Panel Optimizer

Automation Lib

Customer P&P Lib

Customer Test Lib

Customer 3D Lib

BOM Expert

ERP Connect

Management System

Customer

Plant   Designs

Manufacturing

Stencil

Soldering
- Reflow
- Selective
- Wave

Pick & Place
- OIB
- ASCI
- XML

AOI / AXI / SI

ICT/FPT

Manufacturing Statistics

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PCBI Production Control

Data preparation typically involves various steps to prepare data for use in a specific context. This can include normalizing layer names, neutralizing component centers and angles, creating panels, inserting markers, inserting holes, completing attributes, linking SAP BOMs (Bill of Materials), creating variations, and creating a test point concept. It may also involve linking parts to a library. All of these steps serve to prepare the data for further use and ensure that it is suitable for the intended goal.

- **Material procurement:** The procurement of materials needed for PCB assembly, such as printed circuit boards, electronic components and tools.
- **Manufacturing planning:** The creation of manufacturing plans and schedules to ensure that production is done efficiently and within the scheduled time.
- **Resource management:** Managing resources such as workstations, machines, and tools to ensure they are used effectively.
- **Quality Control:** Performing quality controls during production to ensure that all products meet quality standards.
- **Document Management:** Managing documents such as drawings, specifications, and logs to ensure that all relevant information is available.

Overall, the production control functions in PCB assembly include the control and monitoring of processes to ensure that production runs smoothly, and quality standards are met.
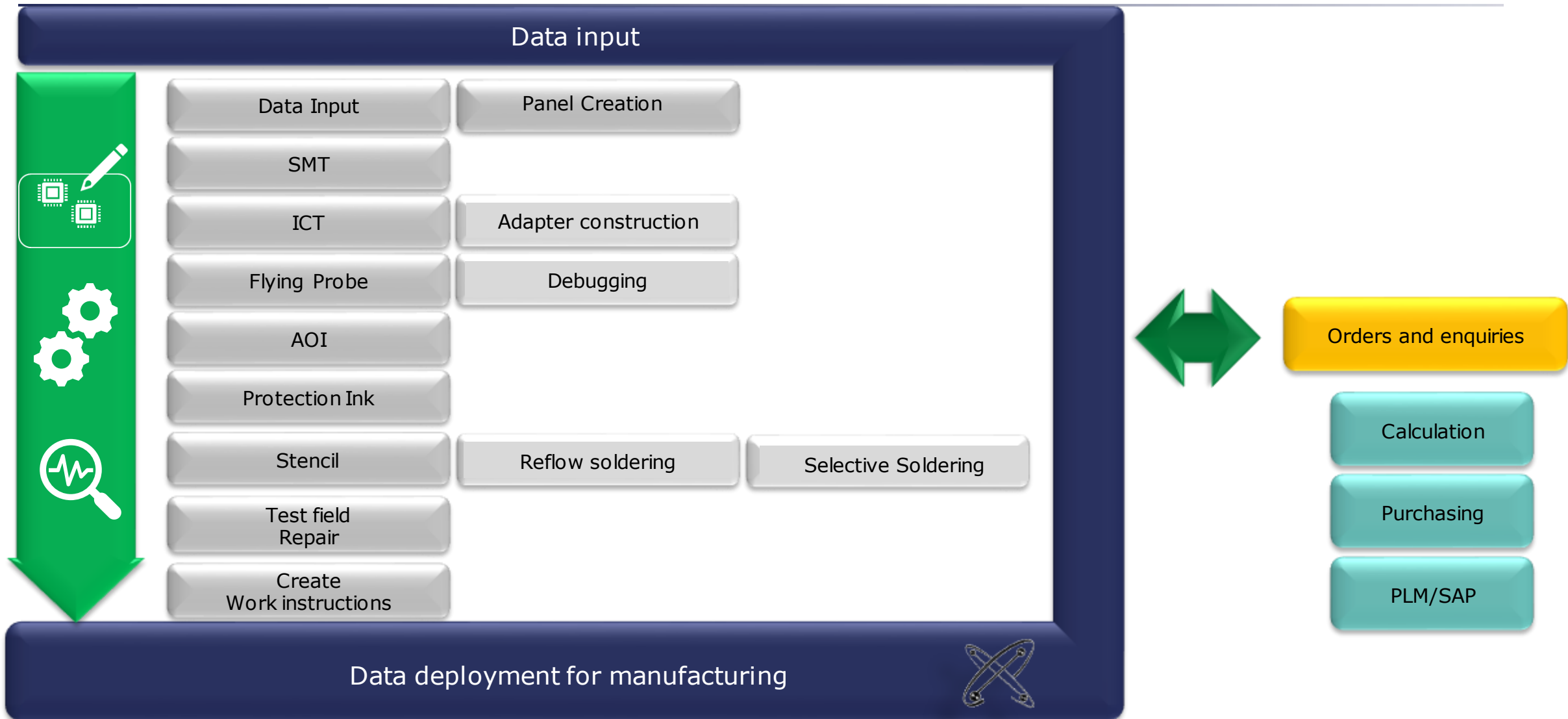
EMS Data Flow
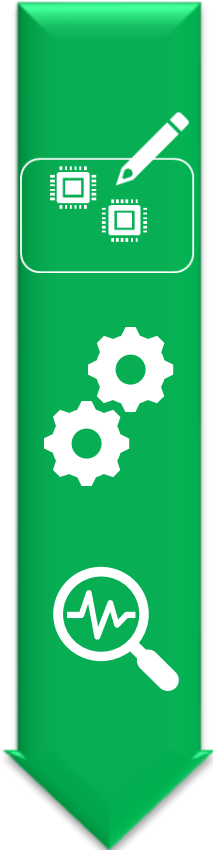
The flow of data in an EMS company typically includes all data collected throughout the lifecycle of a product, from development to manufacturing and sales. These include, in particular, the following points:

- **Development data:** Data collected during the development of a product, such as drawings, specifications and prototypes.
- **Manufacturing data:** Data collected during the manufacture of a product, such as process parameters, quality control data, and bills of materials.
- **Sales data:** Data collected during the distribution of a product, such as customer orders, deliveries and returns.
- **Customer Data:** Data collected from customers, such as contact information, orders, and feedback.
- **Financial data:** Data related to the company's finances, such as invoices, payments and costs.

Data flow in an EMS company includes all data collected during the lifecycle of a product, from development to manufacturing and sales. This data is used to control and monitor the development, manufacture and distribution of products.

EMS Data Flow

Data input

Data Input	Panel Creation
SMT	
ICT	Adapter construction
Flying Probe	Debugging
AOI	
Protection Ink	
Stencil	Reflow soldering
Test field Repair	
Create Work instructions	

Selective Soldering

Orders and enquiries

Calculation

Purchasing

PLM/SAP

Data deployment for manufacturing

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Tasks Data Preparation

Creating a Digital Twin

Data preparation

- Layer names normalize
- Neutralize component center and angle
- Panel creation
- Insert markers
- Inserting holes
- Complete Attributes
- Link SAP BOM
- Create variants
- Create a test point concept
- Linking parts to library

Automating processes with rules can offer many benefits, especially in the area of data preparation. Some possible benefits include:

Time saving: Automated processes complete tasks faster than humans, especially when they are repetitive tasks.

Improved accuracy: Rules ensure that tasks are always performed in the same way, which can lead to higher accuracy.

Reduce human error: Automated processes eliminate human error that can be caused by human error such as fatigue, distraction, and other factors.

Cost savings: Automation can help reduce costs by reducing the amount of human labor required.

Improved efficiency: Automated processes can help improve the efficiency of businesses by ensuring tasks are completed faster and more accurately.

Overall, automating processes with rules offers many benefits that can help improve the efficiency and accuracy of data preparation processes.

Tasks Data Preparation

Creating a
Digital Twin

Data preparation

- Layer names normalize
- Neutralize component center and angle
- Panel creation
- Insert markers
- Inserting holes
- Complete Attributes
- Link SAP BOM
- Create variants
- Create a test point concept
- Linking parts to library

Plausibility

Review

DFM

DRC
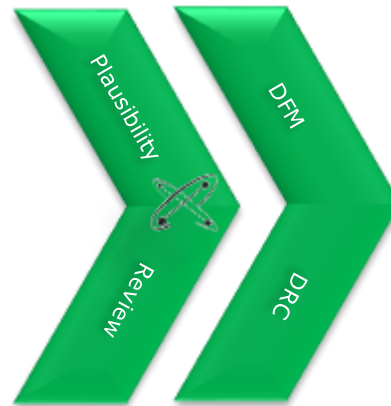
The processed data is retrieved by the individual departments if necessary

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Collaboration

Manage data with PCBI PLM

Concurrent processing of manufacturing data.

Additional data for production is stored in XML format and is virtually displayed within the ODB++ data set. This allows for visualizations and analyses to be performed based on both the original data and the extended data from the XML.
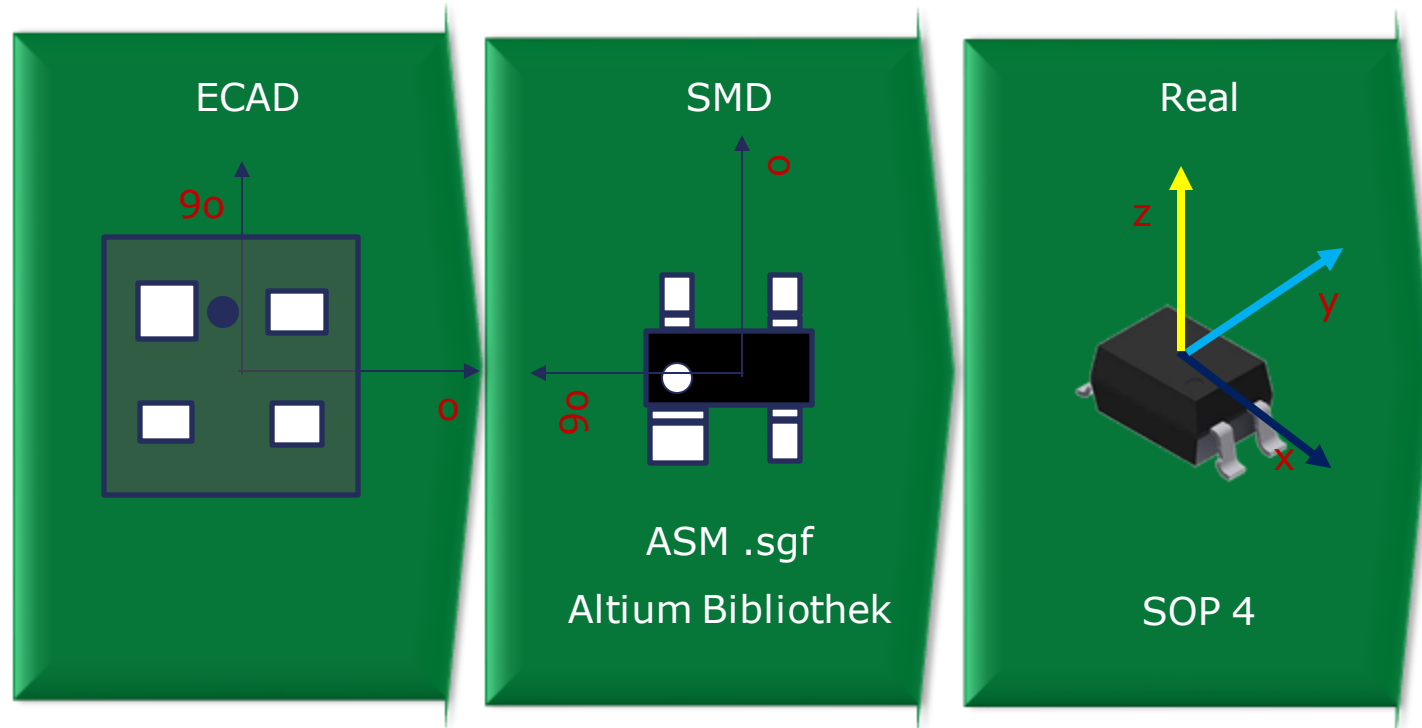

ECAD Daten

ODB++   IPC2581   GenCAD

ODB++

Panel

Linked

SMT Pick & Place

Fixture ICT

Flying Probe

AOI 2D

AOI 3D

AOI X

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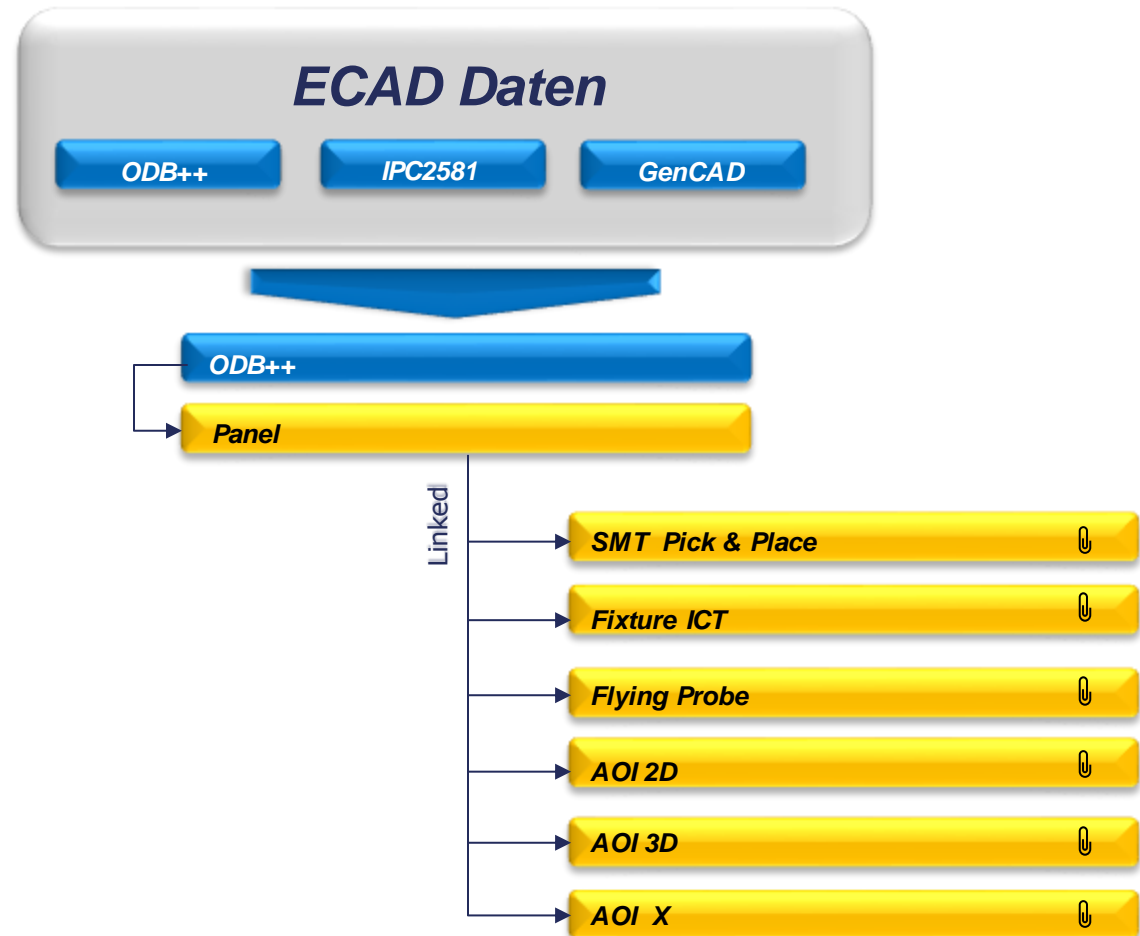
Use the existing part definition

Part dimensions
Part Pin to Land Pad
Component Height
Part Angle

Benefits

ECAD

SMD

Real
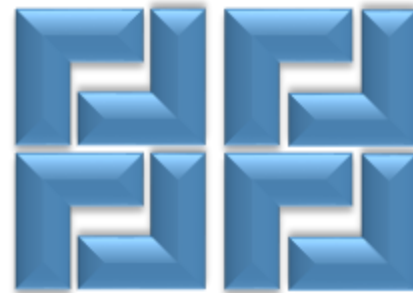
ASM .sgf

Altium Bibliothek

SOP 4

Component Position Analysis

SMD Pick-up position and rotation

ICT Adapter Needle access

Flying Probe Needle access

Distances Cracking Milling

AOI Program Creation

Analysis

Panel Creation

Templates

Automatic Nesting

Desired size

Mixed Panel

Desired number of repeats

The optimal utilization of a PCB (printed circuit board) supplier's resources will depend on a number of factors, including the capacity of the supplier's manufacturing equipment and labor force, the demand for PCBs, the lead times for orders, the supplier's production schedule and backlog, and the supplier's inventory levels. To maximize utilization, the supplier may need to carefully manage these factors and make adjustments as needed to ensure that they are using their resources as efficiently as possible.

One way to analyze the utilization of a PCB supplier's resources is to calculate their utilization rate, which is the percentage of time that their equipment and labor are being used to produce PCBs. This can be done by measuring the actual time that the supplier's equipment and labor are being used to produce PCBs and comparing it to the total available time. If the utilization rate is low, it may be possible to increase production by improving the efficiency of the manufacturing process or by increasing the number of orders that the supplier is able to fulfill.

Other factors that can impact the utilization of a PCB supplier's resources include the complexity of the PCBs being produced, the availability of raw materials, and the supplier's ability to meet customer demand in a timely manner. By analyzing these and other factors, the supplier can identify opportunities to improve utilization and increase their efficiency.
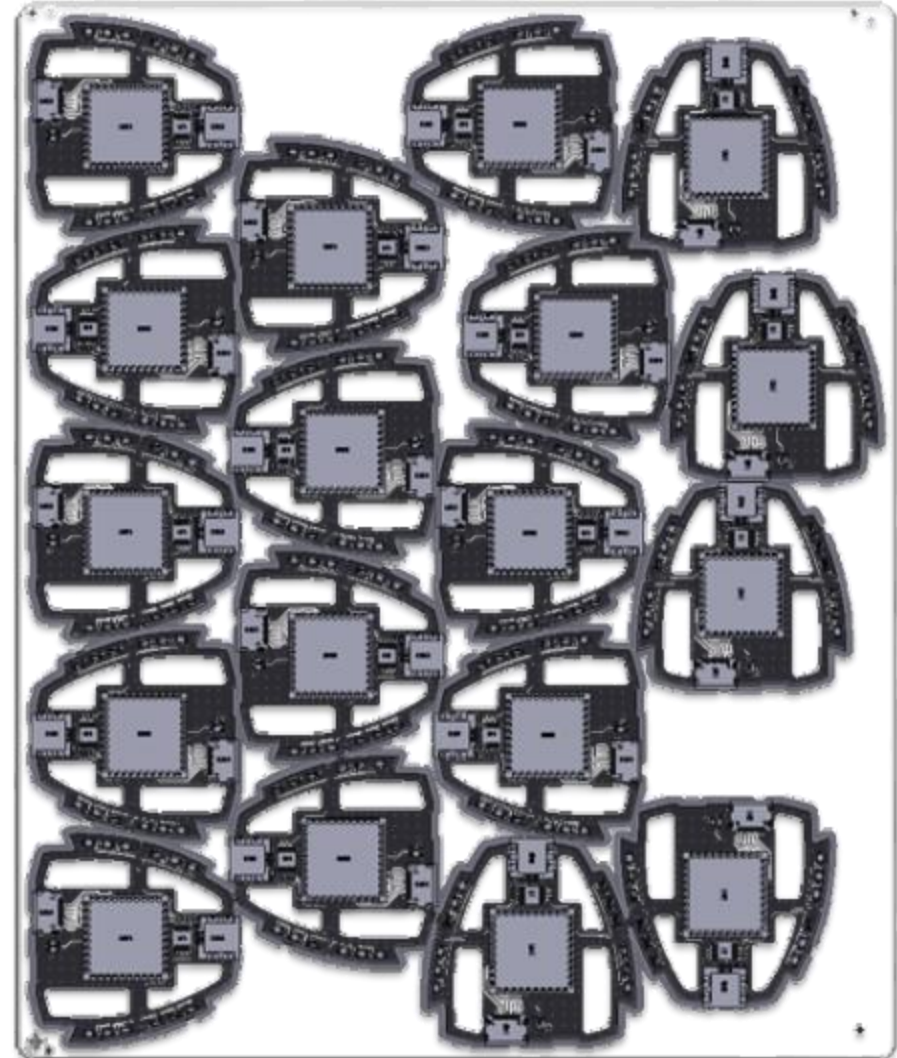
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Panel Creation

Advanced penalization with PCB-Investigator

Multiple methods for creating panels are integrated

- Panel Size
- Step & Repeat
- Nesting of Boards
- Predefined Templates
- Customer adjustments

Generated data

- Panel
- Fiducial
- Tooling holes
- Milling paths
- Separation bars

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One Tool for all data preparations

There are several benefits to preparing PCB data in one tool:

1. No data breach: By using a single tool to prepare PCB data, there is less risk of data being lost or compromised due to transferring it between multiple tools or systems.

2. All layers available: When using a single tool to prepare PCB data, it is easier to ensure that all layers of the PCB design are properly accounted for and included in the final data set.

3. Easy measurement: With all of the PCB data in one place, it is easier to make measurements and perform analyses on the design.

4. Analyses applicable: By having all of the PCB data in one tool, it is easier to apply various analyses to the design to assess its performance and identify any potential issues.

5. ECAD values available: When using a single tool to prepare PCB data, it is easier to access and incorporate any necessary ECAD (electronic computer-aided design) values into the design.
Overall, preparing PCB data in a single tool can help to streamline the design process and ensure that the data is accurate and complete.

Drawing creation in ODB++

Profile as 0 Line

PCB contour is managed as 0 line

Drawing
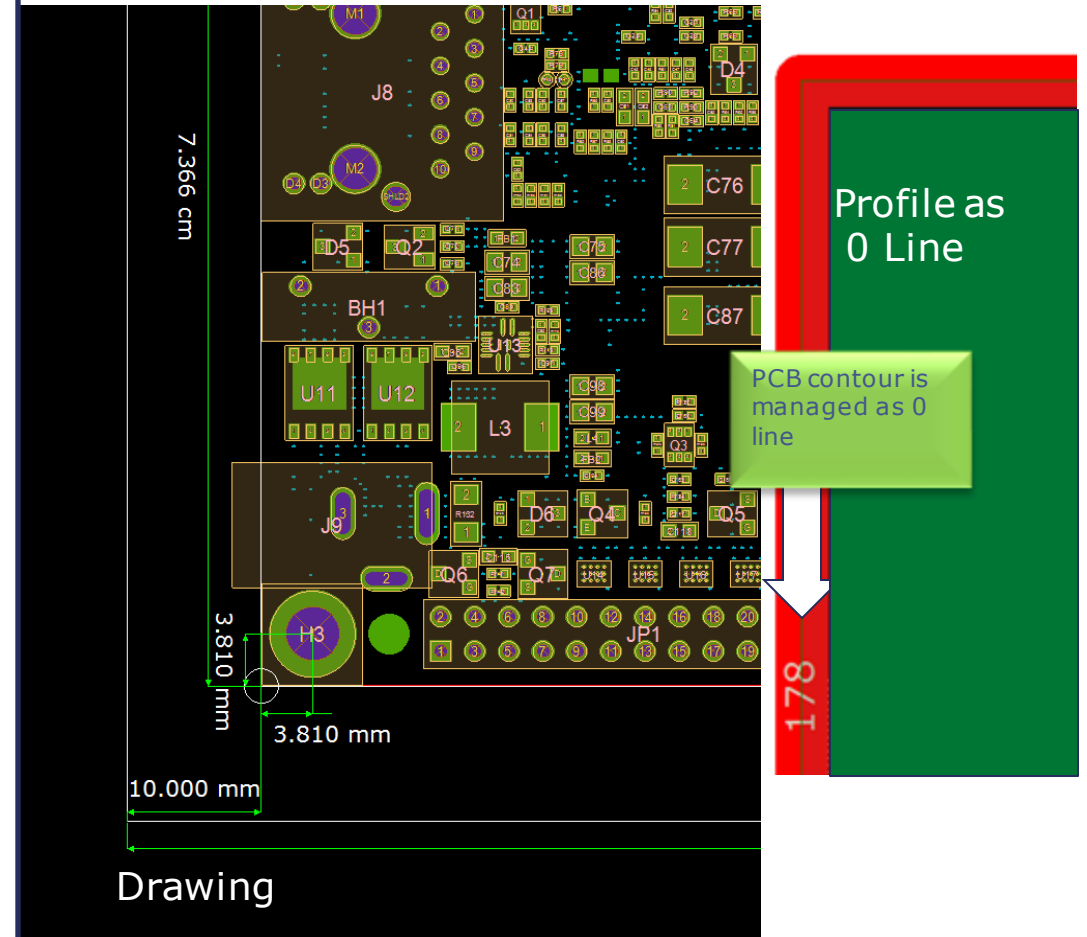
Machine Exports with PCB-Investigator

Benefits of using one tool include:

• Decreasing training effort by only needing to train employees on one software package

• Easier representation of employee skills and experience as there is less need to track expertise in multiple software packages

• More opportunity for automation as there is less complexity and fewer potential points of failure

• Fewer installation packages and software maintenance required on each machine

• Standardization of data processing to improve efficiency and consistency

• Easier process of continuous improvement as there is less complexity to manage.
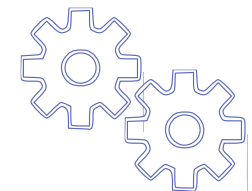
Global Library for Components

Standard Attribute Bauteile

- PartName
- ApprovedPartNames
- Manufacturer
- PartDescription
- Type
- Package
- CompType
- Length
- Width
- Height
- Diameter
- PinCount
- Pitch
- PlacementAngle
- MountType
- Populated
- Weight
- Volume
- 3DModelLocation
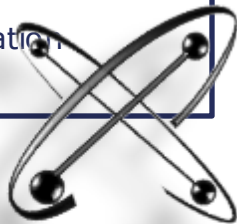
There are several processes in PCB design and manufacturing that can benefit from the use of a library:

1.Adapter construction/test program creation: A library can be used to store standard adapter construction and test programs, which can save time and effort when creating these programs for new PCB designs.

2.Flying Probe: A library of standard flying probe test patterns can be used to quickly and easily test new PCB designs, rather than having to create a new test pattern for each design.

3.Stencils creation: A library of standard stencil designs can be used to create stencils for new PCB designs, which can save time and effort in the stencil creation process.

4.AOI Exports: A library of standard AOI (automatic optical inspection) export files can be used to quickly and easily generate AOI exports for new PCB designs, rather than having to create a new export file for each design.

5.Manufacturing instructions: A library of standard manufacturing instructions can be used to create manufacturing instructions for new PCB designs, which can save time and effort in the instruction creation process.

6.SMT Placement Program creation: A library of standard SMT (surface mount technology) placement programs can be used to create placement programs for new PCB designs, which can save time and effort in the program creation process.

Global library of templates

Standard templates with attributes

- Placement Marker
- Mounting holes
- Slots
- Separation bars
- Ritz Symbol
- Border
- ICT Adapter

Standard templates with attributes can be used in PCB design to help ensure that certain features or elements are consistently included in the design. Some examples of standard templates with attributes that might be used in a PCB design include:

Placement Marker: A placement marker is a feature that is used to identify the location and orientation of a PCB on a manufacturing line. It may include attributes such as size, shape, and color.

Mounting holes: Mounting holes are used to secure a PCB to a substrate or enclosure. They may include attributes such as size, shape, and location.

Slots: Slots can be used for various purposes in a PCB design, such as allowing for movement or providing clearance for components. They may include attributes such as size, shape, and location.

Separation bars: Separation bars can be used to divide a PCB into distinct sections or to provide electrical isolation between different parts of the circuit. They may include attributes such as size, shape, and location.

Border: A border is a frame or outline that surrounds the edge of a PCB. It may include attributes such as size, shape, and color.

ICT Adapter: An ICT (in-circuit test) adapter is a device that is used to connect a PCB to an ICT tester. It may include attributes such as size, shape, and connector type.

Symbol Abkürzung	Erklärung	Norm / Referenz
—	Geradheit	DIN EN ISO 1101
▱	Ebenheit	DIN EN ISO 1101
○	Rundheit (Kreisform)	DIN EN ISO 1101
⌀	Zylindrizität (Zylinderform)	DIN EN ISO 1101
⌒	Profil einer beliebigen Linie, Linienprofil	DIN EN ISO 1101 DIN EN ISO 1660
⌓	Profil einer beliebigen Fläche, Flächenprofil	DIN EN ISO 1101
//	Parallelität	DIN EN ISO 1101
⊥	Rechtwinkligkeit	DIN EN ISO 1101
∠	Neigung	DIN EN ISO 1101
⊕	Position, Lage	DIN EN ISO 1101
≡	Symmetrie	DIN EN ISO 1101
◎	Konzentrizität (für Mittelpunkte), Koaxialität (für Achsen)	DIN EN ISO 1101
↗	Rundlauf (Kreisförmige Lauftoleranz „radial") Planlauf (Kreisförmige Lauftoleranz „axial")	DIN EN ISO 1101
⫽	Gesamtlauf, Gesamtrundlauf, Gesamtplanlauf	DIN EN ISO 1101
	Rundum (Profil), Konturlinien der Querschnitte, Oberfläche von geschlossenen Geometrieelementen	DIN EN ISO 1101
	Vollflächig (Profil), alle Geometrieelemente eines Werkstückes bei einfacher Geometrie	E DIN EN ISO 1101:2015
▱ 0,15	Toleranzindikator, Kennzeichnung des tolerierten Geometrieelementes ohne Bezugsangabe	DIN EN ISO 1101
⊥ 0,15 B	Toleranzindikator, Kennzeichnung des tolerierten Geometrieelementes mit Bezugsangabe	DIN EN ISO 1101 DIN EN ISO 5459

Import ASM CAD library

**Reading the ASM GF data of the pick & place systems with PCB-Investigator**
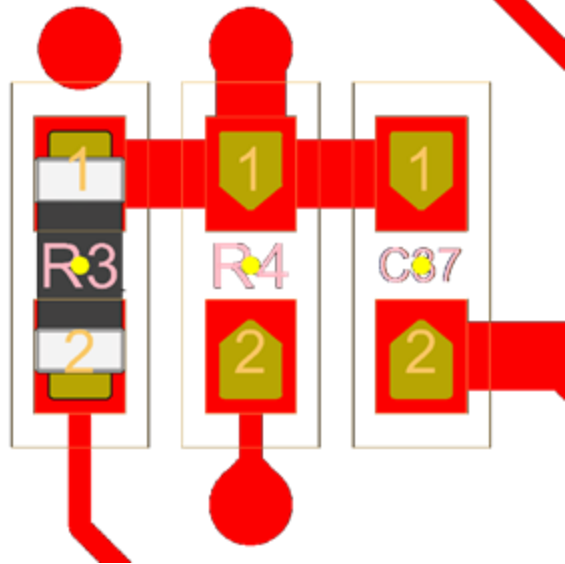
- Uniform component view on the assembly line and in the CAM for preparation
- Improved modeling of 2.5D views
- Applicable for all analyses

```
GF
{
    KOMMENTAR '0603'
    ICOS DATEN
    {
        LAENGE 1500
        BREITE 700
        HOEHE 1000
        AUSSEN_LAENGE 1500
        AUSSEN_BREITE 700
        AUSSEN_HOEHE 1000
        AUSSEN_HOEHE_TOLERANZ 75
        TOLERANZ ( 500,350,75 )
        LAGE TOLERANZ ( 500,500,1933 )
        TEILUNG FEHLER GRENZE 100
        REIHEN VERSATZ 375
        QUALITAETS GRENZE 0
        SPEZIFIKATIONEN <
            UNREGELMAESSIGE GEHAEUSEFORM

        >
    BEINCHEN MODELL LISTE
    {
        MODELL 1
        {
            ART -1
            LAENGE 300
            BREITE 700
            TOLERANZ ( 75,75 )
            KONTRAST -1
            AUFSETZ DATEN
            {
                LAENGE 300
                BREITE 700
                KONTRAST -1
            }
            GRUPPEN LISTE
            {
                (
                    WINKEL 18000
                    BEINCHEN ANZAHL 1
                    MITTELPUNKT (X 600   Y 0 , 0)
                    GRUPPEN TEILUNG 1
                )
                (
                    WINKEL 0
                    BEINCHEN ANZAHL 1
                    MITTELPUNKT (X -600   Y 0 , 0)
                    GRUPPEN TEILUNG 1
                )
            }
        }
    }
}
```

Body Size

Pin Size

**Center Pin Pad**

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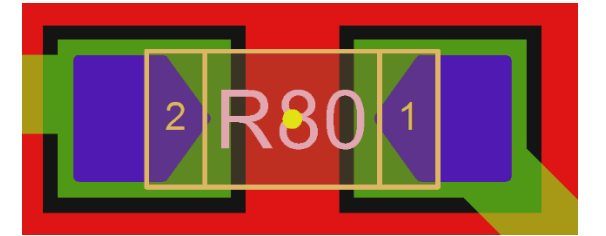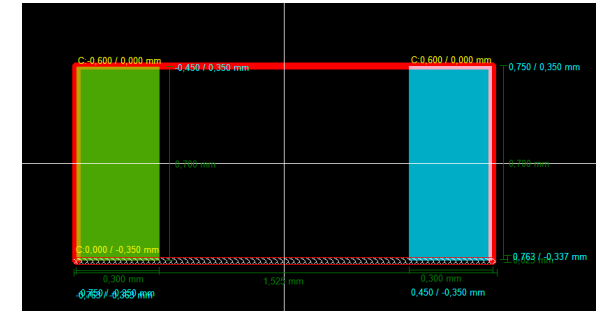
Test field / Repair

A viewer license for production facilities can be advantageous because it allows employees to view and access certain types of data or software without the need for a full license. Some potential benefits of a viewer license in a production environment include:

1.**Fully automatable:** Viewer licenses can be fully automated, allowing employees to access the data or software they need without the need for manual intervention.

2.**Individually adaptable** to the task: Viewer licenses can be customized to meet the specific needs of individual employees, allowing them to access only the data or software they need to perform their tasks.

3.**Easy connection to systems**: Viewer licenses can be easily connected to other systems, such as manufacturing equipment or databases, allowing employees to access and use the data or software as needed.

Overall, a viewer license can be a useful tool for production facilities as it allows employees to access and use certain types of data or software without the need for a full license, which can save time and resources.
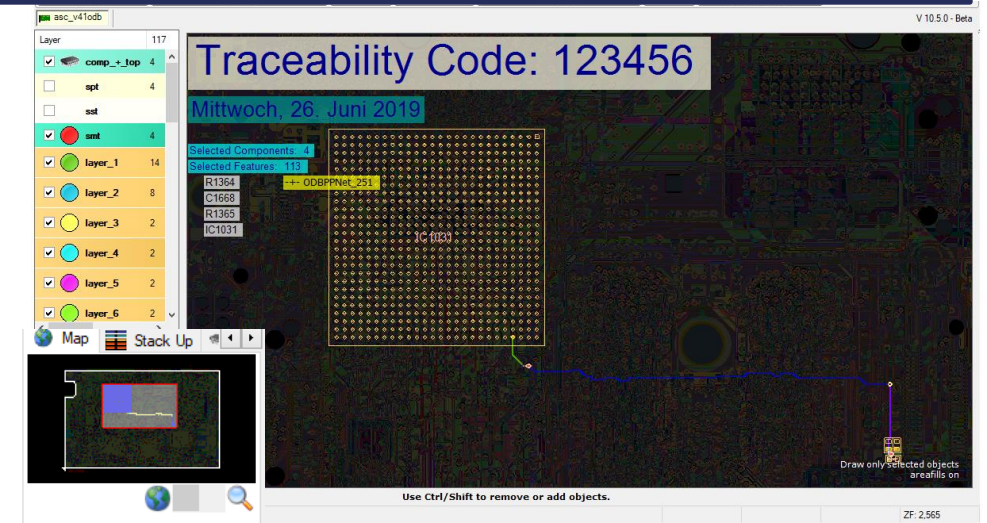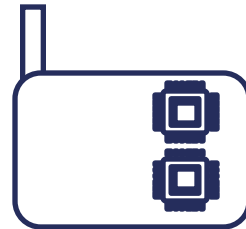
Fixture / Fixtureless

Hardware

- Needle grid
- Needle type
- Sleeves type
- Tooling holes
- Management of additional electronics
- Creation of wiring plan
- Add test system channels to networks
- Reference slides creation
- Milling plates generation

STEP Export
IDF Export
GenCAD
3D Druck Daten

Im Test
Seica
Takaya
Spea
I3070
Generic

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Fixture / Fixtureless

A needle grid is a pattern of needles that is used in various manufacturing processes, such as pick and place or testing. The needle type refers to the specific type of needle that is used in the grid, which can vary based on the application and the materials being worked with.
Sleeves type refers to the type of sleeves that are used in conjunction with the needles in the grid. These sleeves may be used to protect the needles, to provide a surface for the needles to grip, or for other purposes.

Tooling holes are openings in a surface that are used to hold or position tools or other objects during manufacturing. They may be used to hold fixtures, jigs, or other types of tooling.

Management of additional electronics refers to the process of managing and integrating additional electronic components or systems into a PCB design or manufacturing process. This may involve designing new circuits or modifying existing ones to accommodate the additional electronics.
Creation of a wiring plan refers to the process of creating a detailed diagram or plan that shows how the various electrical components of a PCB or other device are interconnected.

Adding test system channels to networks refers to the process of integrating test systems or equipment into a network of devices. This may involve configuring the test systems to communicate with other devices on the network and establishing protocols for transferring data and other information.

Reference slides creation refers to the process of creating slides or other reference materials that can be used to help guide the manufacturing process. These slides may include diagrams, instructions, or other types of information that are relevant to the manufacturing process.
Milling plates generation refers to the process of creating milling plates, which are used to guide a milling tool in the production of PCBs or other devices. Milling plates may be created using computer-aided design (CAD) software or other tools.

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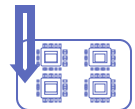
Stencils Creatiobn

IPC-7351

Generic Requirements for
Surface Mount Design and
Land Pattern Standard

IPC-7525A

Stencil Design Guidelines

- Paste Modeling with Real Views
- Determining Flying Probe Access optimally
- Tombstone optimization in pastes
- Calculation pastes consumption
- Analysis Pad TriggerIng Behavior
- Soldering joint konus at SMD
-
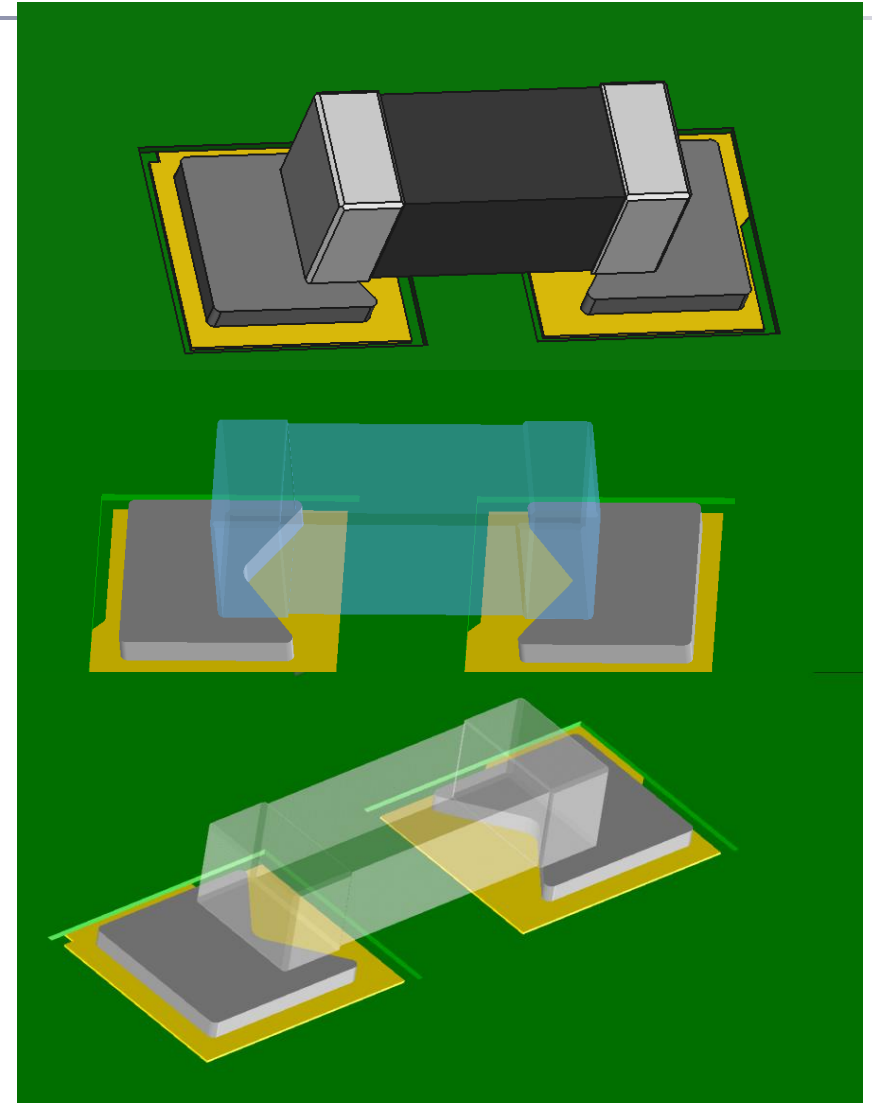
Stencils Creation

Paste modeling with real views refers to the process of creating a virtual model of a PCB design that includes the paste that will be used to create the actual PCB. This model can be used to visualize the paste deposition and understand how it will flow and behave during the manufacturing process.

Determining flying probe access optimally refers to the process of identifying the best locations on a PCB for a flying probe to access in order to test the circuit. This may involve considering factors such as the layout of the PCB, the size and shape of the probe, and the type of test being performed.

Tombstone optimization in pastes refers to the process of optimizing the paste deposition process to minimize the formation of tombstones, which are vertical defects that can occur when soldering SMT (surface mount technology) components. Tombstones can be caused by various factors, including inadequate paste coverage or improper drying of the paste.

Calculating paste consumption refers to the process of determining the amount of paste that will be needed to manufacture a PCB. This may involve considering factors such as the size and complexity of the PCB, the type of paste being used, and the efficiency of the paste deposition process.

Analysis pad triggering behavior refers to the process of analyzing the behavior of pads on a PCB during manufacturing, including how they respond to various stimuli such as heat, pressure, and electrical current. This analysis can help to identify potential issues with the pads and suggest ways to improve their performance.

Soldering joint konus at SMD refers to the process of soldering a konus, which is a type of connector, to an SMD (surface mount device) on a PCB. This may involve using a soldering iron or other soldering tool to apply heat and create a secure joint between the konus and the SMD.

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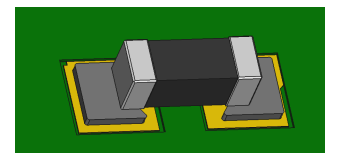
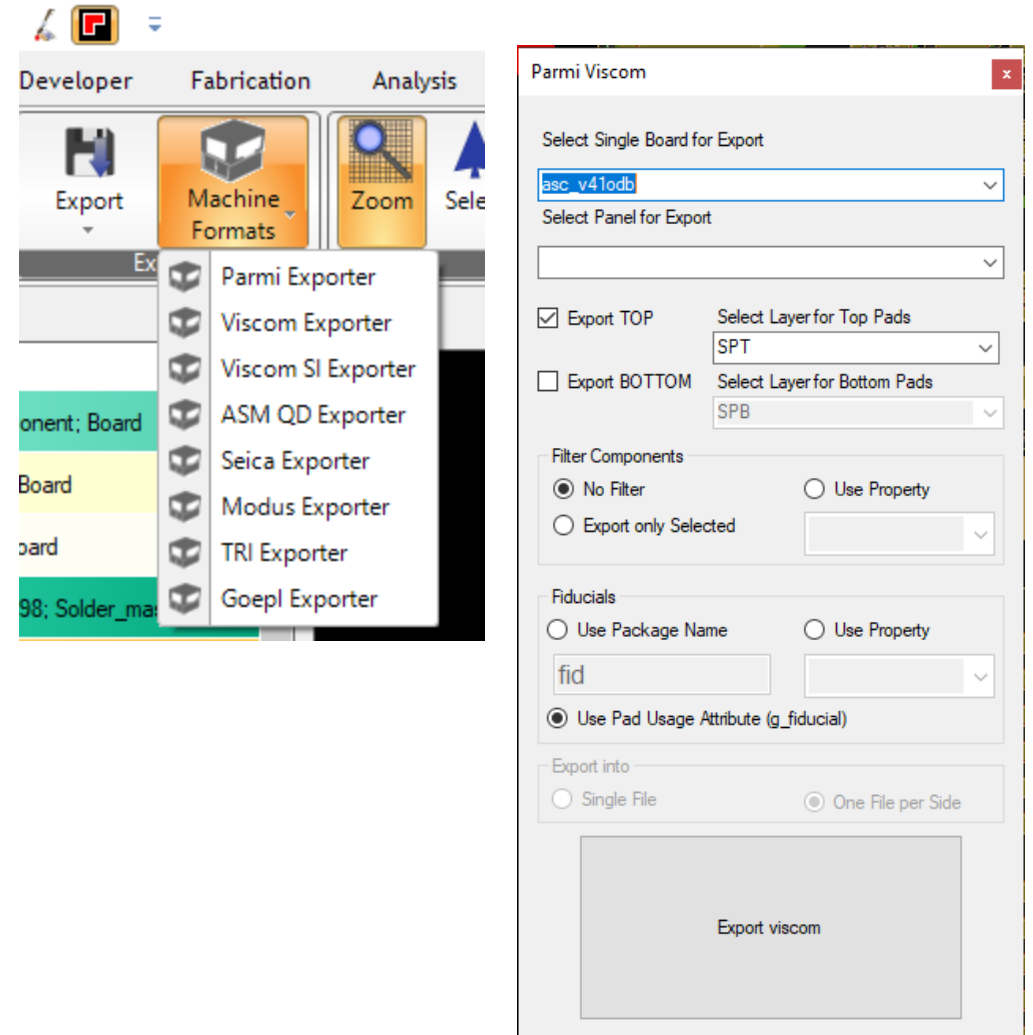# Stencils / Fixture / Fixtureless

Example of a "Digital Twin"

140µm
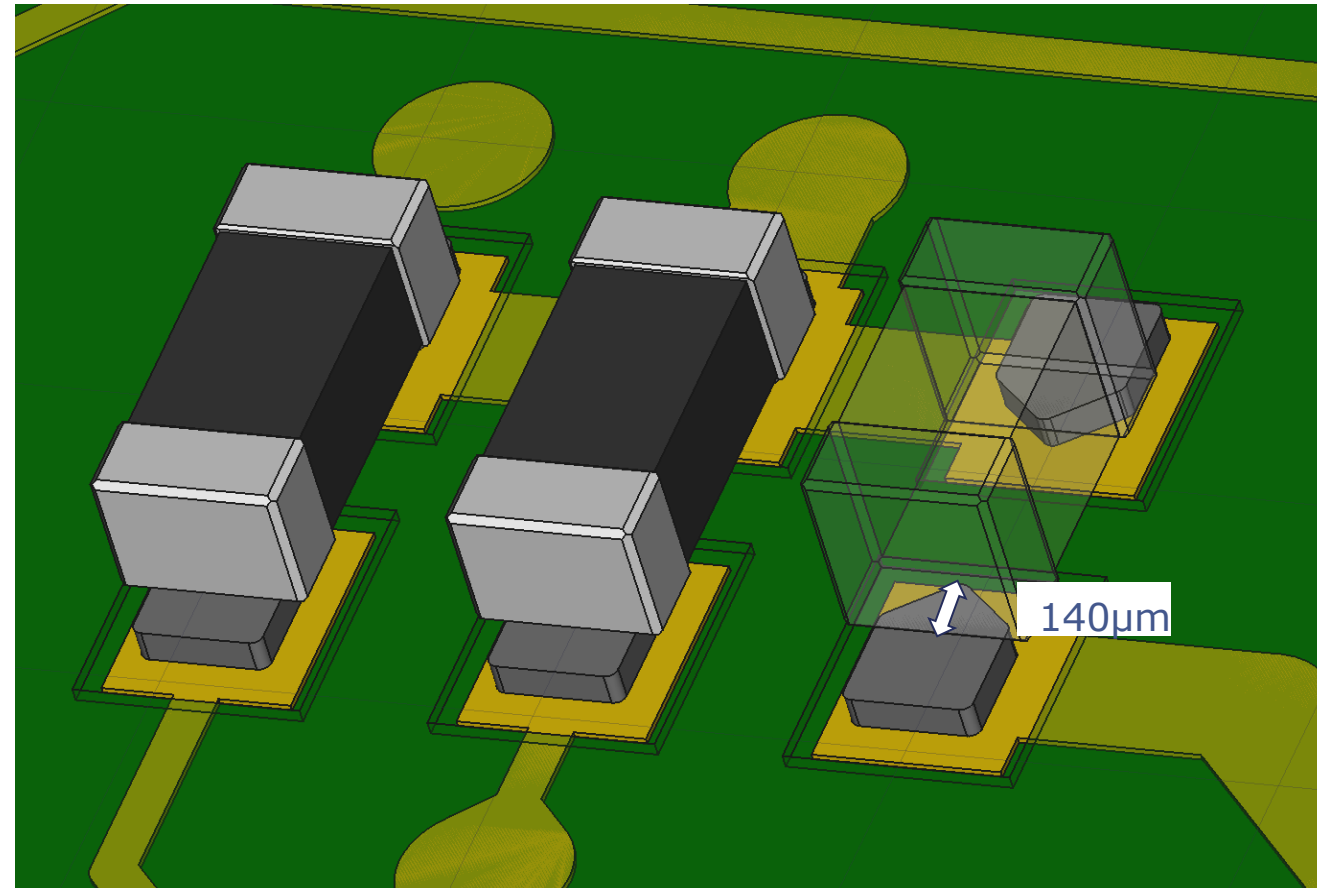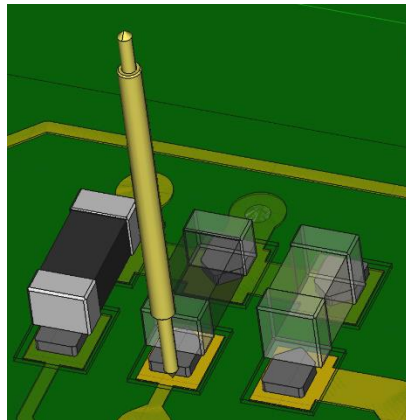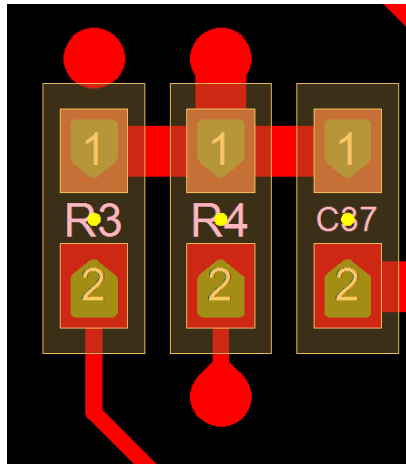
AOI / Tester / SMT

Machine formats

- Parmi
- Viscom SI
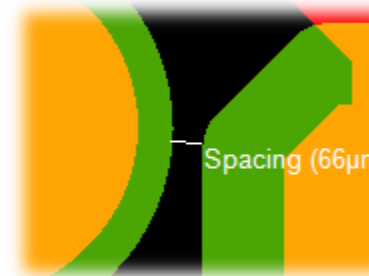- Viscom XML
- Göpel
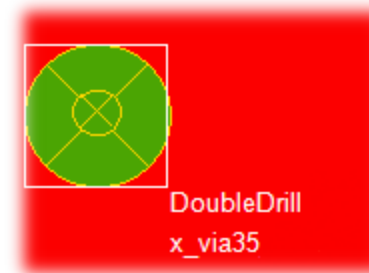- Modus
- Tri
- Seica
- ASM QD

DFM / DRC

Within a few seconds, the complete design is checked for its producibility

Standard analyses with preset of rules

- Pasten
- Masken
- Kupfer
- Bohrungen
- Tombstone
- Bauteilabstand
- Stecker

DoubleDrill
x_via35

Spacing (58μm)

Spacing (66μm)

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DFM / DRC

Standard analyses with preset rules are pre-defined sets of analysis procedures that are used to evaluate certain aspects of a PCB design or manufacturing process. Some examples of standard analyses that might include a preset of rules include:
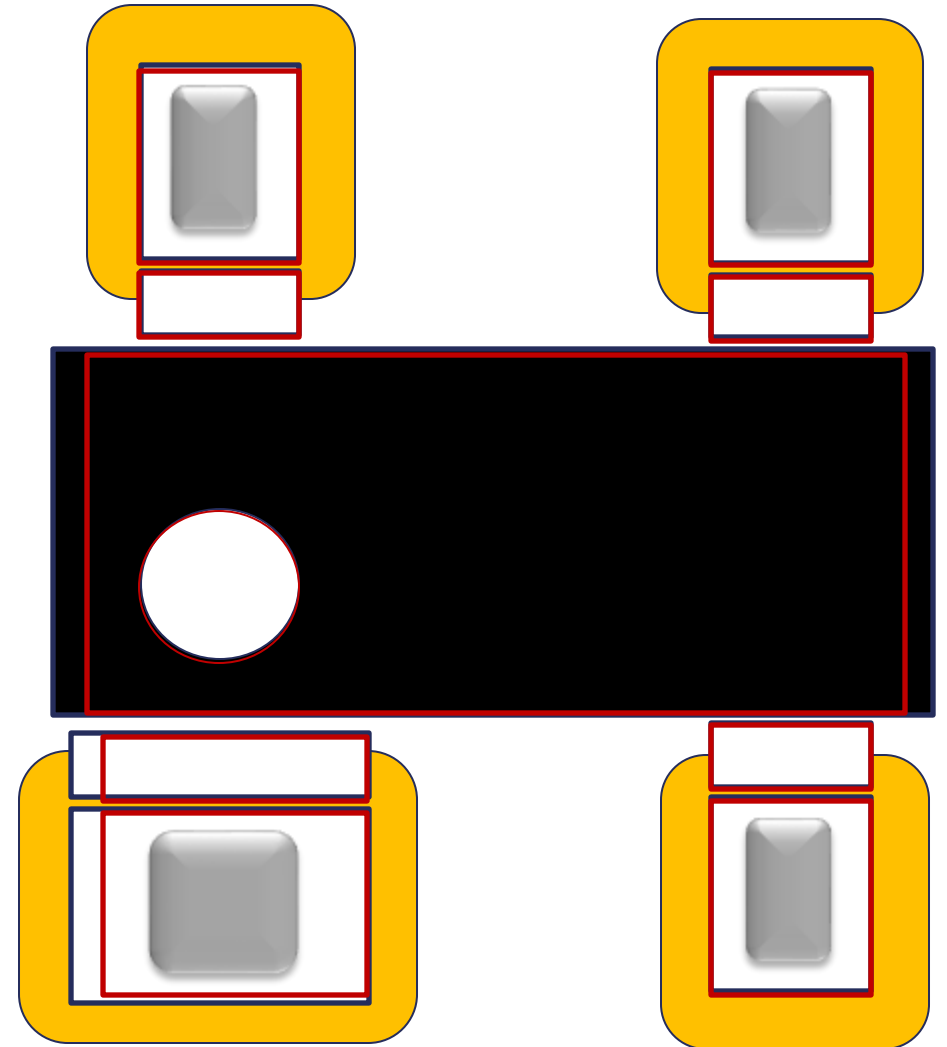
1. Paste: A paste analysis may include rules for evaluating the quality and consistency of paste deposition, as well as rules for identifying issues such as inadequate coverage or contamination.

2. Mask: A mask analysis may include rules for evaluating the quality and accuracy of the mask that is used to create the PCB, including rules for identifying defects or errors in the mask.

3. Copper: A copper analysis may include rules for evaluating the quality and consistency of the copper traces on a PCB, as well as rules for identifying defects or issues with the copper.

4. Holes: A holes analysis may include rules for evaluating the quality and accuracy of the holes in a PCB, including rules for identifying issues such as misalignment or irregular shapes.

5.Tombstone: A tombstone analysis may include rules for evaluating the occurrence and severity of tombstones on a PCB, as well as rules for identifying the root causes of tombstones and suggesting ways to mitigate them.

6. Component spacing: A component spacing analysis may include rules for evaluating the spacing between components on a PCB, including rules for identifying issues such as overcrowding or insufficient clearance.

7. Connector: A connector analysis may include rules for evaluating the quality and reliability of connectors on a PCB, including rules for identifying issues such as poor fit or insufficient contact.
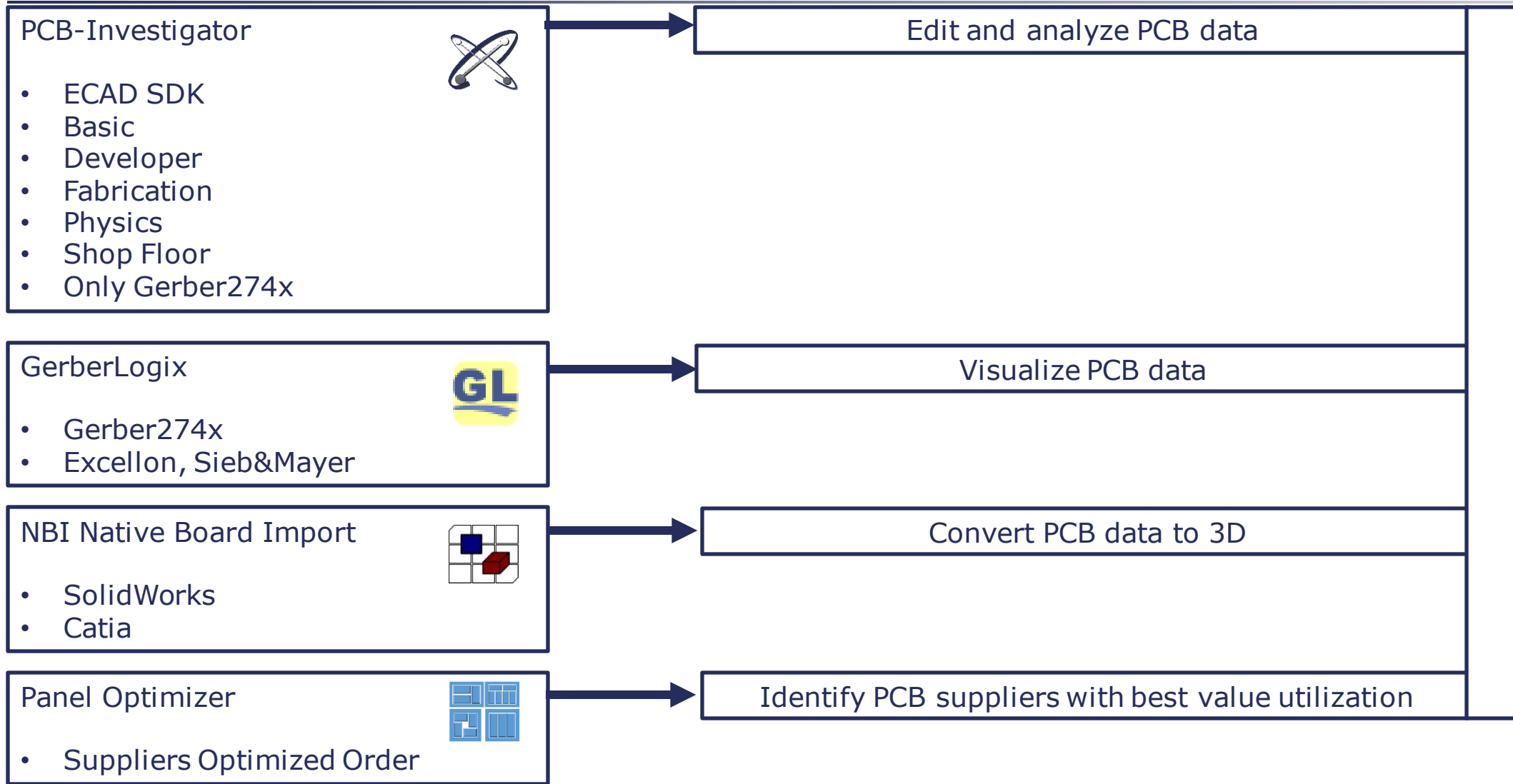
Component Tolerances

The feature of superimposing approved components onto a PCB design can be useful for verifying that the components meet certain requirements or standards. This feature may allow users to view the components in relation to other parts of the PCB design, such as the traces or other components, to ensure that they are properly positioned and sized.

The min max display of component body size and min max display of part pin sizes are features that can be used to evaluate the size and dimensions of components and their pins. These features may allow users to view the minimum and maximum sizes for these elements, which can be useful for ensuring that the components and pins meet certain specifications or requirements.

These features may be particularly useful for verifying that components and pins are within acceptable tolerances, as well as for identifying any potential issues with the size or dimensions of these elements. They may also be useful for ensuring that components and pins are properly aligned and positioned within the PCB design.

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Software Portfolio

PCB-Investigator

- ECAD SDK
- Basic
- Developer
- Fabrication
- Physics
- Shop Floor
- Only Gerber274x

Edit and analyze PCB data

GerberLogix

- Gerber274x
- Excellon, Sieb&Mayer

Visualize PCB data

NBI Native Board Import

- SolidWorks
- Catia

Convert PCB data to 3D

Panel Optimizer

- Suppliers Optimized Order

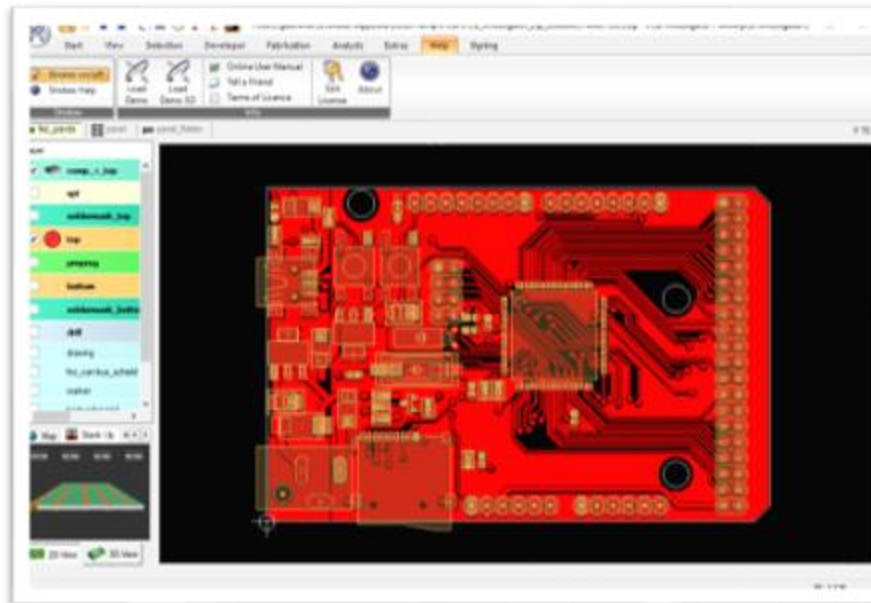Identify PCB suppliers with best value utilization

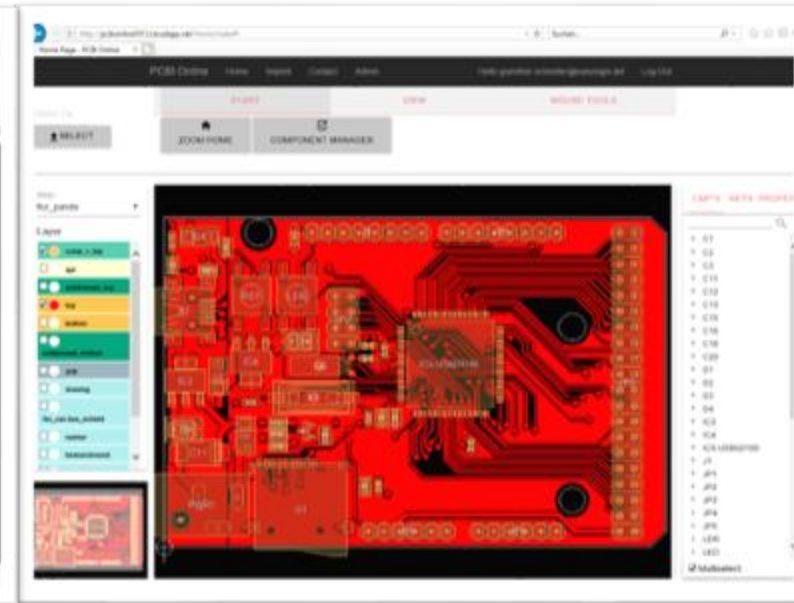# PCBI 365 PLM / Desktop and Web

Desktop and Online available

- ## CAM for PCB-Data
  - ODB++, IPC2581, Gerber274X , DXF, Excellon, Sieb & Meyer ...

PCBI 365 helps you connect your dispersed teams, partners, and suppliers

Desktop   Browser

easyLogix.de

PCBI 365 PLM / Desktop and Web

The web version of PCB Investigator can be accessed from any device with a web browser and an internet connection, making it convenient for users who need to access the tool from multiple locations or devices. The desktop version of PCB Investigator can be installed on a single machine and is typically used by users who need to access the tool locally or who do not have access to a web browser.

Both versions of PCB Investigator provide similar features and capabilities, including tools for viewing and reviewing PCB designs, generating reports, and performing analyses. The choice between the web and desktop versions may depend on the user's specific needs and preferences, as well as the resources and infrastructure that are available to them.

Desktop

Browser

Extensions

Request Customized Functions

Get in touch,

info@easylogix.de

Guenther Schindler

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Useful Links:

PCB-Investigator
www.pcb-investigator.com

PCBi-Physics
www.PCBi-Physics.com

Native Board Import (3D Interface to CATIA, SiemensNX, SolidWorks, SolidEdge)
www.sts-development.biz

GerberLogix
www.gerberLogix.com

Online Gerber Viewer
www.Gerber-Viewer.com

Software Development, CAD Converter, data connection
www.easyLogix.de