



TEAMCENTER

**Semiconductor
Lifecycle
Management —
Usage**

Teamcenter 2412

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1. Semiconductor Lifecycle Management overview


What is Teamcenter Semiconductor Lifecycle Management?

As the challenges facing the semiconductor industry increase in complexity, so does the design of the semiconductor devices that address them. Using Teamcenter Semiconductor Lifecycle Management software, you can track the complete product lifecycle and manage all metadata in a unified environment. Using a preconfigured semiconductor design and manufacturing BOM, you can streamline processes, workflows, and collaboration between designers and manufacturers to ensure data quality and compliance.

The solution focuses on the following three key aspects of the silicon lifecycle from design to manufacturing:

- New Product Introduction (NPI) manages the product delivery and spans the entire process from requirements capture to final product delivery.
- IC Design focuses on managing the Integrated Circuit (IC) design process and artifacts.
- IC Manufacturing focuses on the IC front-end and back-end manufacturing planning to enable foundry and back-end operations.

Where do I go from here?

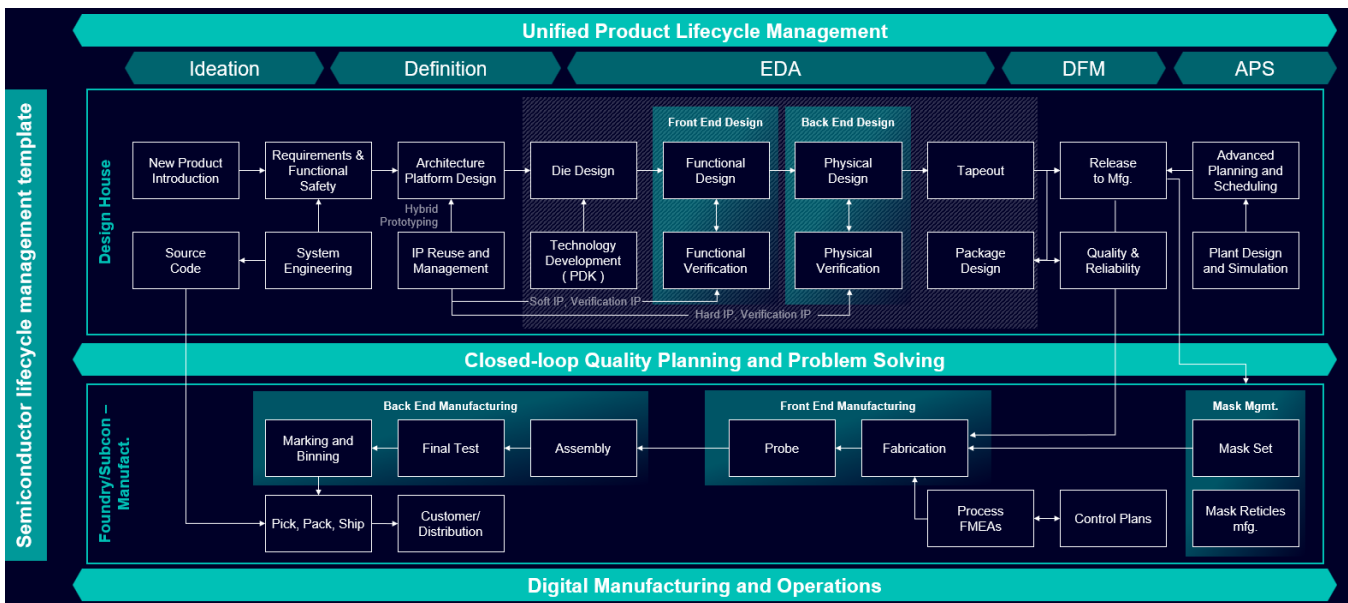
 Business User	
What are workspaces?	A workspace is a home page configured for a specific role. Workspaces simplify the user interface, making it easier for a user to complete various tasks.
What NPI metrics and dashboards are available?	To view the available metrics and dashboards for NPI, see NPI metrics and dashboards .
What functional safety evaluation tools are available?	Semiconductor Lifecycle Management allows users to perform HARA and FMEDA analyses, synchronize FMEA data with FMEDA, and generate a safety analysis report .
How does the tapeout process get completed?	The tapeout process involves approval of the tapeout checklists, including answers to checklist questions and verification of those answers.

How do I create a new die design?	To create a die design and associate it with a Wafer Process Technology (WPT), see Author die design .
How is the back-end manufacturing process completed in Semiconductor Lifecycle Management?	The back-end manufacturing process starts with the creation of concept MPNs .
How does reliability testing work in Teamcenter?	Reliability testing involves assessing the stability and performance of semiconductor devices over time.

Business process

Overall process flow

The Semiconductor Lifecycle Management solution is a unified platform for edge-to-edge semiconductor design and manufacturing. The following graphic illustrates the overall process flow:



The solution includes a master data model that holds both logical and physical business objects and manages the information flow between the design, supply chain, and manufacturing teams.

More specifically, the solution:

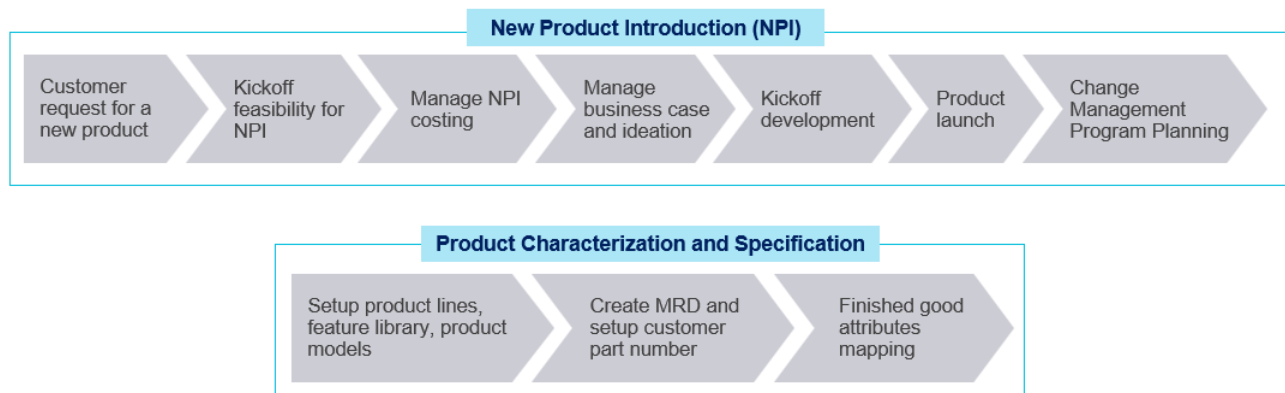
- Manages all semiconductor design and manufacturing data and artifacts, including RTLs, netlists, GDSII files, IPs, crystals, wafers, die designs, process technologies, mask information, probe setups, die kits, package kits, assembly items, test items, and binned items.
- Manages the Bill of Information, or Super BOM, including site-specific and common BOMs, site effectivities, alternates, substitutes, substance compliances, and conflict mineral tests.

- Manages fabrication, probe, assembly, and test process technology, including mapping information between process nodes and manufacturing locations.
- Allows complete traceability from design artifacts to the finished product for all revisions and product maturity levels.

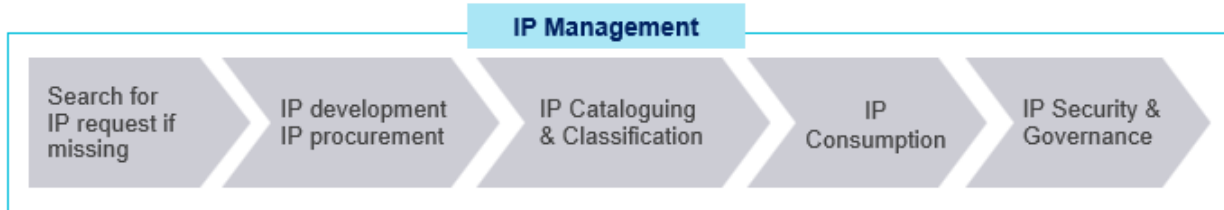
Semiconductor lifecycle feature bundles

Key modules of the solution include:

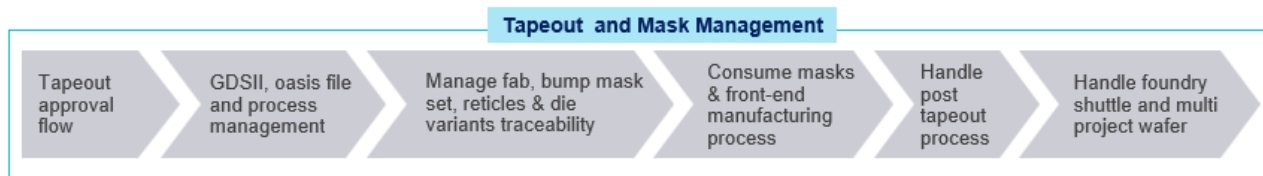
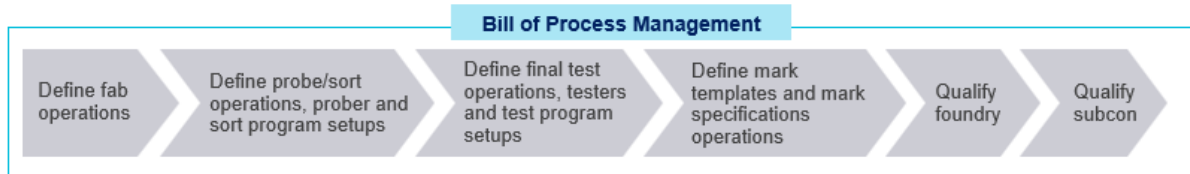
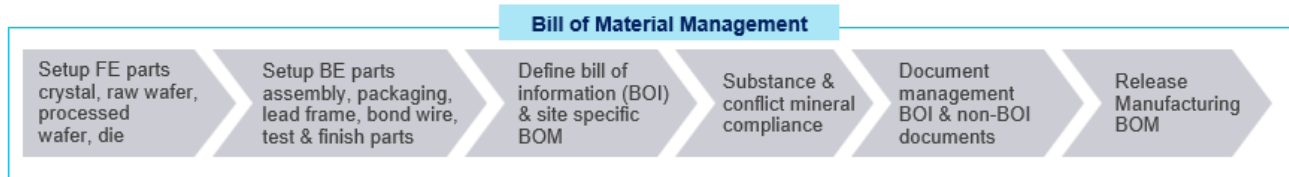
- NPI
 - New Product Introduction (NPI)
 - Product characterization and specification



- IC Design
 - Chip design, development, and verification
 - IP management (including integration with Perforce Methodics IPLM software)
 - Technology development
 - PDK management



- IC Manufacturing
 - Bill of Material (BOM) management
 - Bill of Process (BOP) management
 - Tapeout and mask management



Add-on functionality

Additional modules of the solution include:

- Functional Safety
 - Hazard Analysis and Risk Assessment (HARA)
 - Failure Modes, Effects, and Diagnostic Analysis (FMEDA)



- Reliability test planning



Workspaces

A workspace is a home page configured for a specific role. It is the page that is initially displayed when a user logs in. Each workspace shows contextual data based on the user's role and scope of work. For example, when creating a new item, a designer sees a list of design item types, whereas an assembly engineer sees only the types of items that pertain to users in manufacturing roles. This simplified user interface helps users perform their tasks efficiently.

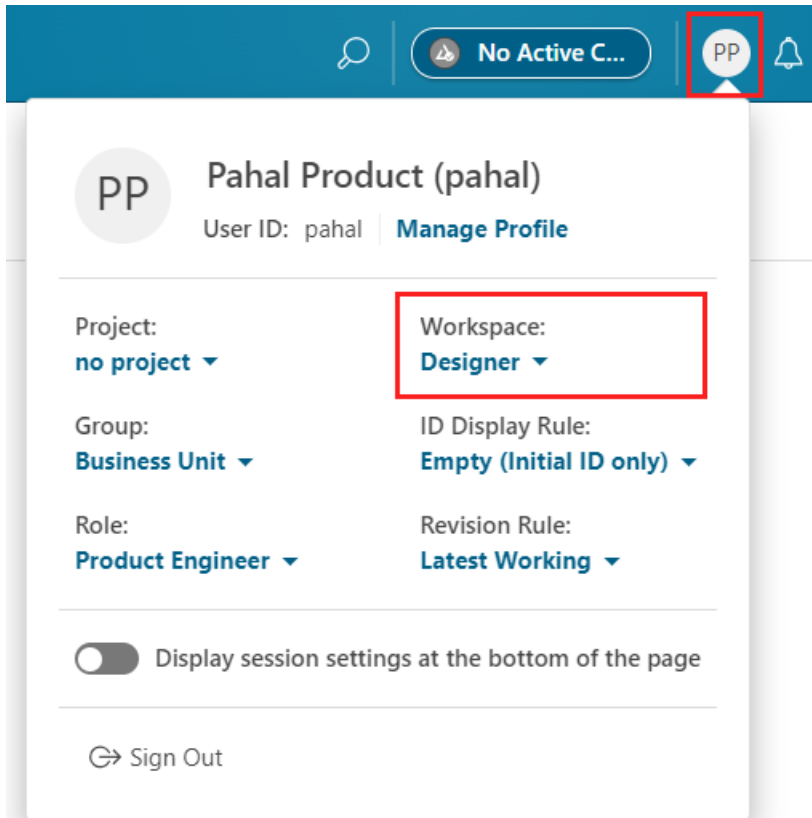
In the Semiconductor Lifecycle Management solution, there are three workspaces available, **Program Manager**, **Designer**, and **Manufacturer**. Each workspace is defined for a specific set of roles typically involved in each phase of the Semiconductor workflow process.

Note:

The following table shows the default options, but the mapping between various roles and workspaces is configurable based on your business needs.

Program Manager	Designer	Manufacturer
<ul style="list-style-type: none"> • Project Manager 	<ul style="list-style-type: none"> • IP/ITAR Admin 	<ul style="list-style-type: none"> • Package Engineer
<ul style="list-style-type: none"> • Program Manager 	<ul style="list-style-type: none"> • Technology Development Engineer 	<ul style="list-style-type: none"> • Material Analyst
<ul style="list-style-type: none"> • Project Sponsor 	<ul style="list-style-type: none"> • Technology Development Manager 	<ul style="list-style-type: none"> • Fabrication Engineer
	<ul style="list-style-type: none"> • Product Engineer 	<ul style="list-style-type: none"> • Probe Engineer
	<ul style="list-style-type: none"> • Mask Engineer 	<ul style="list-style-type: none"> • Mask Engineer
		<ul style="list-style-type: none"> • Assembly Engineer
		<ul style="list-style-type: none"> • Test Engineer
		<ul style="list-style-type: none"> • Product Engineer

Change workspaces from the **Profile**.



Semiconductor Foundation

Foundation includes a master data model that holds both logical and physical business objects and manages the information flow between the design, supply chain, and manufacturing teams.

More specifically, Foundation:

- Manages all semiconductor design and manufacturing data and artifacts, including RTLs, netlists, GDSII files, IPs, crystals, wafers, die designs, process technologies, mask information, probe setups, die kits, package kits, assembly items, test items, and binned items.
- Manages the Bill of Information (Super BOM), including site-specific and common BOMs, site effectivities, alternates, substitutes, substance compliances, and conflict mineral tests.

Document management

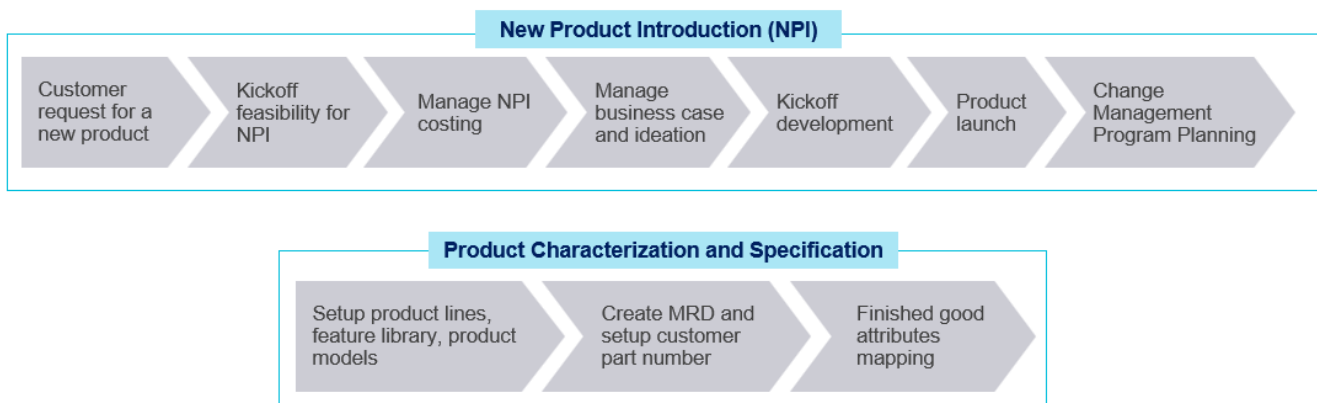
When creating a controlled document, there are two types of documents. Bill of Information (BOI) documents refer to documents that complete the BOM and BOP. Non-BOI documents refer to quality and standards documents. Both BOI and Non-BOI documents are controlled documents and have preconfigured document subtypes with metadata to characterize them. Consolidating the controlled documents at the enterprise level helps standardize and streamline product development and corporate processes. Standard document management capabilities include revision control and workflow management for managing the maturity of a document.

2. Use Semiconductor Lifecycle Management

New Product Introduction

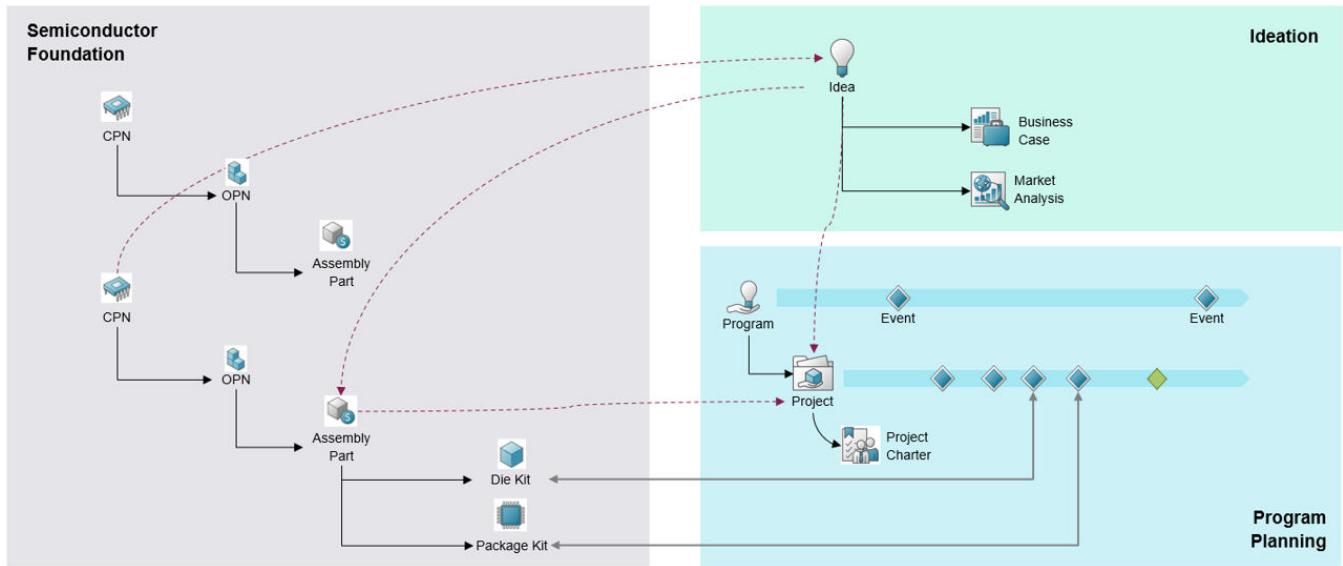
About New Product Introduction

New Product Introduction (NPI) provides an end-to-end, fully integrated project management solution that accelerates time to value.



It offers workflows based on industry best practices and leverages predefined project templates selected automatically based on the characteristics of the new idea. The solution connects projects to integrated portfolio planning to ensure that adequate resources such as time, money, and staff are allocated to meet project targets.

The following graphic illustrates the overall process flow for NPI:

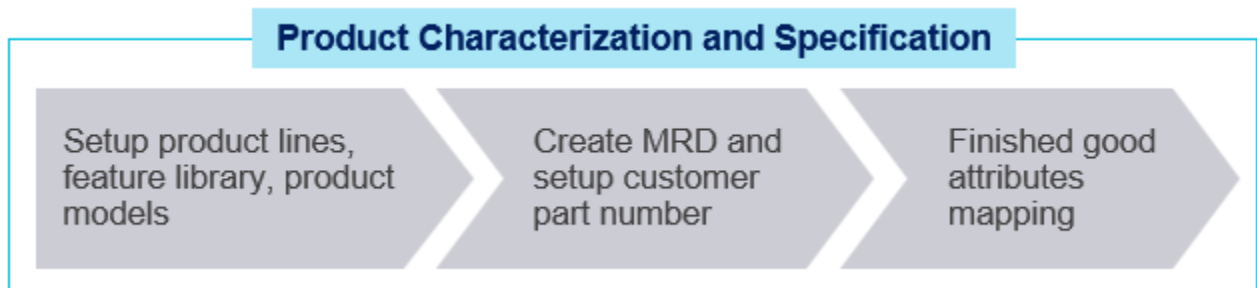


The NPI process starts when a new idea is logged in Teamcenter. The idea could be about introducing a new product or making an improvement to an existing one. The idea then undergoes feasibility studies, including documentation of the business case and market analysis. Once the idea is approved, it is converted into a project so it can be implemented. In the example from the previous image, the idea has an impact on the assembly part, for example, size reduction. For this, a new die kit and a new package kit need to be generated to realize the size reduction.

There are a few project templates readily available when creating a new project from an idea. These include checklists, lists of deliverables, and charters. The best template gets selected by default based on the idea characteristics.

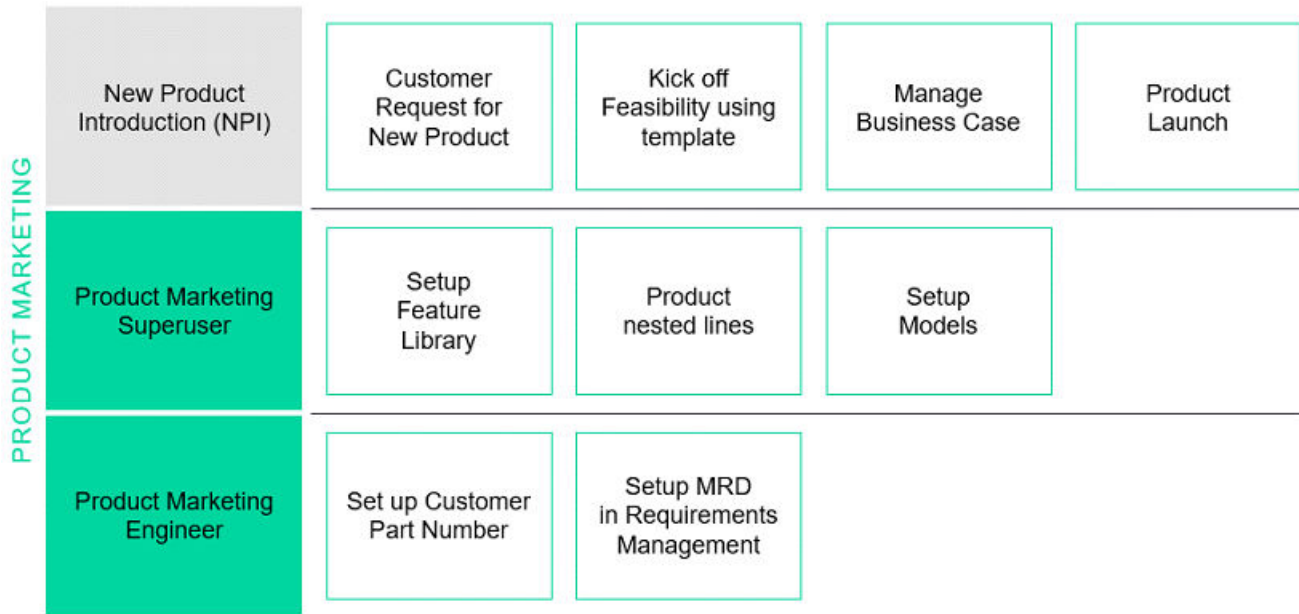
Product characterization and requirements

Teamcenter Semiconductor Lifecycle Management enhances business performance by integrating product requirements, development, material sourcing, and global resource utilization.

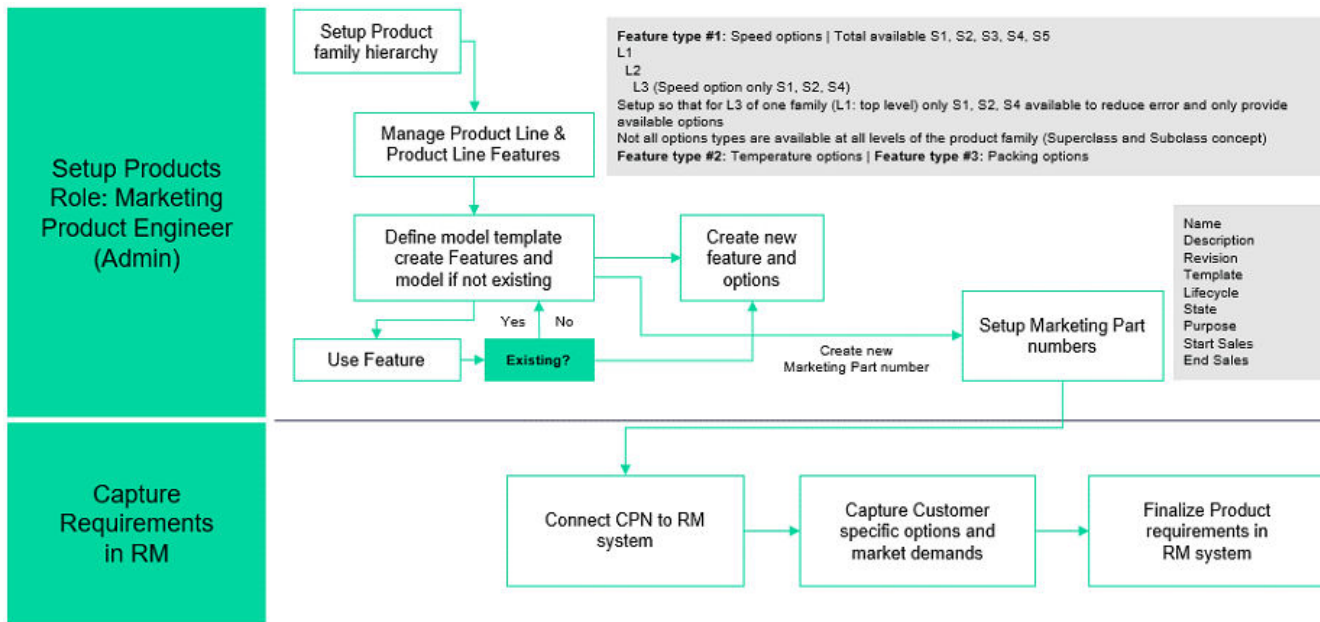


Process flow

The following graphic details the typical process flow:



The product marketing administrator sets up the feature library or, if it already exists, adds new features to the base feature library. The objective is to use the master library and create models with a subset of features and domain values.



Idea capture

Capture an idea and review it for the feasibility phase.

Create an idea

1. Log in as a product engineer.

Note:

Users in any role can create an idea, provided they have NPI licenses.

2. On the global header, click your profile icon, and ensure that the workspace is set to **Program Manager**.
3. From the home page, click **CREATE IN FOLDER**.
4. Select **Idea** from the **Type** list.
5. Enter a **Name**, **Description**, **Source**, and other relevant information as needed.
6. Click **Add**.

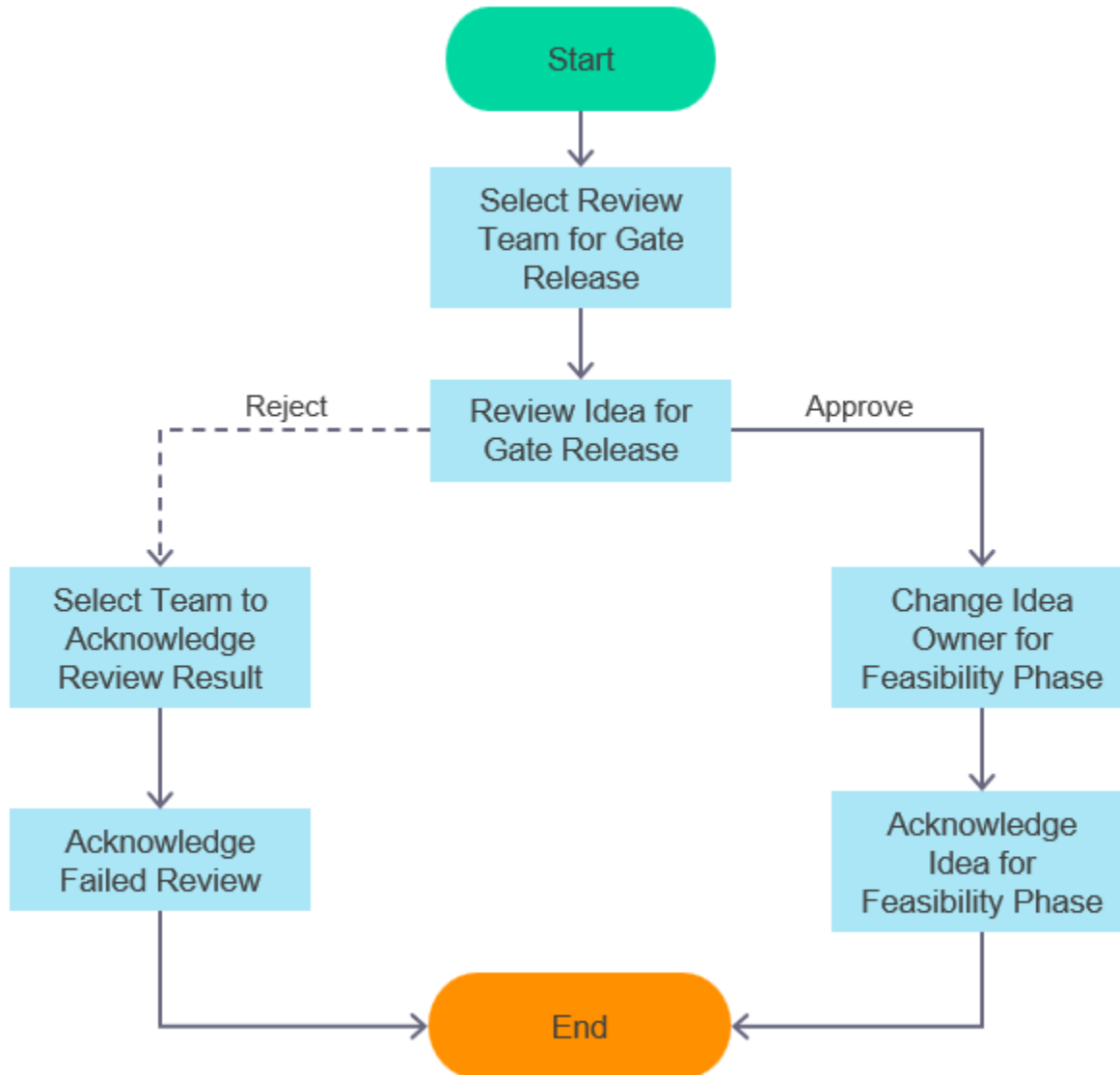
Associate data to an idea

1. With the new idea open, select **Marketing Briefs**.
2. Click **Add to** ⊕ to associate requirement specifications and other documents to the idea.

Submit a new idea to workflow

1. With the new idea open, choose **More Commands** ⋮ > **Manage** ⚙ > **Submit to Workflow** 📄.
2. Ensure that **Template** is set to **Idea Gate Release Process** and enter a **Name** and **Description**.
3. Click **Submit**.

Upcoming workflow tasks






In the **Idea Gate Release Process**, the idea goes through the following workflow steps:

1. **Review Idea for Gate Release:** This task goes to the program manager's team inbox, and the idea is reviewed. Once this is done, the task is completed by clicking **Approve**.
2. **Change Idea Owner for Feasibility Phase:** This task goes to the inbox of the workflow requestor, and the requestor assigns a reviewer. Once this is done, the task is completed by clicking **Complete**.
3. **Acknowledge Idea for Feasibility Phase:** This task goes to the assigned reviewer's inbox, and the reviewer opens the idea to confirm the following:

- The idea's **Maturity** is set to **Feasibility**.
- Additional sections, such as **Business Case**, **Marketing Analysis**, and **Score** are displayed.

Tip:

To more easily access the idea when needed, choose **More Commands ...** > **Manage**  > **Pin to Home**  or **Add to Favorites** .








Once this is done, the task is completed by clicking **Acknowledge**.



Ownership of the **Idea** is transferred to the reviewer after the reviewer acknowledges the task for feasibility.

Idea feasibility

The feasibility phase consists of idea business case development, market analysis, and scoring. The idea is reviewed for the realization phase.

Set up the idea

1. Log in as a product engineer.
2. Open the idea and choose **More Commands ...** > **Edit**  > **Start Edit** .
3. Enter the following information:
 - **Design Type: Digital**
 - **Subcategory: Complex Derivative**
 - The **Category** is set automatically.
4. From the **Score** section, click **Add**  to add the **Idea Score**. Enter a **Score Category** and a **Value** to the idea score table.
5. Choose **More Commands ...** > **Edit**  > **Save Edits**  to save the changes.
6. From the **Business Case** section, click **Add to**  to add a business case to the idea. Enter a **Name**, **Description**, and other information to the business case.
7. Open the **Business Case** and add technical and financial goals under the **Goals and Objectives** section.
8. Open the idea and click **Add to**  under the **Market Analysis** section to add market analysis to the idea.

9. Select one or more ideas, and choose **More Commands ... > Manage**  **> Submit to Workflow** .
10. Select the **Idea Gate Release Process** workflow and click **Submit**.

Program Manager approval

1. Log in as the program manager.
2. Go to the **Team** inbox, open the **Check for Completeness Review** task, and complete the necessary approvals.

Project Sponsor approval




1. Log in as the project sponsor.
2. Go to the **Team** inbox and complete the necessary approvals.

After the project sponsor approves the idea for the realization phase, it goes to the project manager's inbox for project creation.

Idea realization/project feasibility

Create a project based on project templates and assign the project to a program.

Create a project

1. Log in as a project manager.
2. Go to the **Team** inbox, and select the **Create Project** task.
3. Select one or more ideas from the targets and choose **More Commands ... > New**  **> Initiate Plan** .
4. Click **Add**  to select a project template.

The system searches and filters project templates based on the idea's design type and subcategory properties. The user selects and adds the appropriate template.

The project creation panel allows the user to select an existing program under which to create the new project. If no program is selected, then the system creates a project under the default program.

5. Enter a **Name** and other pertinent information.

6. Click **Create** to create the project.

The newly created project brings all the necessary information from the project template such as events, checklists, and questions, and adjusts the dates based on the new start date.

7. Click **Layout Choice**  > **Top Bottom** .



8. Ensure the project properties are propagated from the project templates.

9. Choose **References** and locate the idea listed in the **Project Requests** section.

10. From the project's **Overview** page, enter the following information:

- **Priority**
- **Complexity**
- **Innovation Type**
- **Is Strategic**

11. Associate the project to the specific program. A project can be reassigned to a different program if necessary.


- a. Choose **More Commands**  > **New**  > **Reassign Parent Plan** and search for the appropriate program.
- b. Select the program and click **Reassign**.



The project gets reassigned to the selected program.

12. Go back to the inbox and complete the **Create Project** workflow task.

Create a project charter

During the planning phase, create and associate a project charter to the project. Then transfer ownership to the project sponsor.

1. Log in as a project manager.
2. Open the project.
3. Choose **Charter** and click **Add to** .
4. Enter a **Name**, **Description**, and other information as needed.

5. Click **Add**.
6. Open the new project charter and add it to the **Favorites** folder.
7. Choose **Targets** and enter the following information:
 - **Revenue Plan** section properties
 - **Project Costs** section properties
 - **Project Tracking** section properties
8. Transfer ownership of the project charter to the project sponsor by choosing **More Commands ... > Manage**  **> Change Owner** .




Project planning



During the project planning phase, the project is updated with resources, risks, and deliverables. Then the project charter is reviewed for approval.

Note:

Schedule Manager must be installed to create schedules.


Update the project

1. Log in as a project manager.
2. Open the project plan.
3. Choose **Layout Choice**  **> Top Bottom** .
4. Choose **Events** and open the **Prototype** event.
5. From the event, choose **Deliverables**.
6. If the event/phase deliverable is not yet created, click **Add to**  above the **Deliverables** table to create a deliverable of type **Program Deliverable** and then enter the following information:
 - **Name**
 - **Description** – enter a value of **Digital**.
7. Select the **Schedule Required** check box.

8. Click **Add**.
9. Repeat the previous steps to add deliverables for other events if needed.
10. Generate the schedule for the prototype event.
 - a. From the **Deliverables** table, select the **Prototype Phase Deliverable**.
 - b. Choose **More Commands ... > Manage**  **> Generate Schedules**  and enter the following information:
 - Click **Start Date**.
 - Set a **Reference Date** as a starting date of the current phase.
 - c. Click **Generate Schedules** to see the generated schedule.

Note:



The schedule is generated based on the schedule template defined by the attribute map (**STAM**) and the schedule template value map (**STVM**).

11. Open the **Prototype** event and choose **Schedules**.
12. Open the schedule and choose **Tasks**.
13. Select a task and assign the project manager as the responsible user.
If needed, repeat the previous steps to generate schedules for all phases.
14. From the event, choose **Attachments** and create deliverables such as a **Customer Part** or **Orderable Part** by clicking **Add to** .







These are the deliverables for the project.

The project manager should ensure that all planning for a project is complete in terms of phase deliverables, schedule, task assignments, and resource loading.

Approve and baseline project charter

1. Log in as a project sponsor.
2. Open the project charter and choose **More Commands ... > New**  **> Create Revision Baseline** .
3. Enter a description and click **Create**.

A project charter baseline is created.

4. Choose **History**, locate the baseline, and open it. Then add it to the **Favorites** folder.
5. Update the project charter properties as needed. Choose **More Commands ... > Edit**  **> Start Edit**  and add information. Then choose **More Commands ... > Edit**  **> Save Edits**  to save the changes.
6. Compare the current project charter with the project charter baseline by going to the **Favorites** folder, selecting the project charter and project charter baseline, and selecting **Compare**.
7. Validate the various properties in the compare window.
8. Release the project charter by first selecting the project charter and choosing **More Commands ... > Manage**  **> Submit to Workflow** .
9. Select the **TCM Release Process** template and click **Submit**.



The project charter is released.

Tip:

Before completing the plan phase, the project charter must be released.

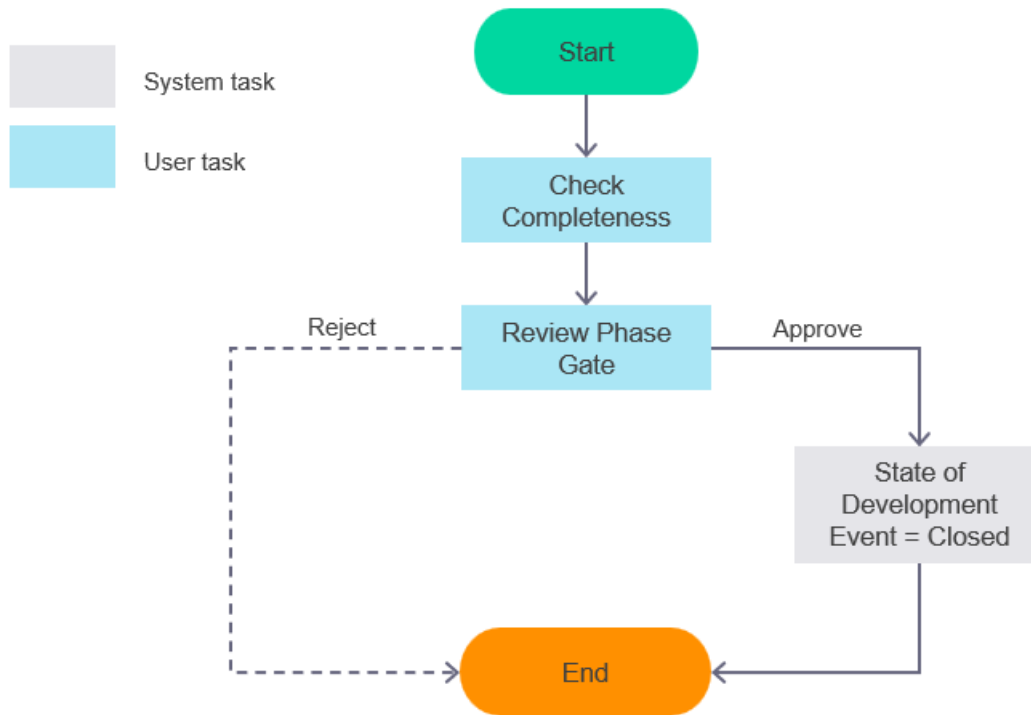
Initiate plan phase gate review

Initiate the **Phase Gate Review** process so the project can advance to the next phase.

1. Log in as the project manager.
2. Submit the plan phase for gate review:
 - a. Open the project timeline and select the **Development** event.
 - b. Choose **More Commands ... > Manage**  **> Submit to Workflow** .
 - c. Ensure that the **Phase Gate Review** template is selected and click **Submit**.

On start, the workflow checks to see that the project has values for **Innovation Type**, **Complexity**, **Target Start**, **Target End**, **Category**, **Subcategory**, and **Design Type**. It also checks whether or not the project has a **Project Charter** associated with a released state.

Upcoming workflow tasks



In the **Phase Gate Review** process, the project goes through the following workflow steps:

1. **Check Completeness:** This task goes to the project manager's inbox, and the project manager completes the following activities:
 - Ensures that all the deliverables are complete for the current phase.
 - Follows up with the responsible owner for pending checklist items.
2. **Review Phase Gate:** This task goes to the inbox of the workflow requestor, and the requestor assigns a reviewer. Once this is done, the task is completed by clicking **Complete**. The assigned reviewer then approves or rejects the current phase completeness based on the following conditions:
 - Approve – if all the deliverables are complete and no pending actions are left for the current phase.
 - Reject – if anything is pending as per the defined checklist for the phase.
3. **Acknowledge Idea for Feasibility Phase:** This task goes to the assigned reviewer's inbox, and the reviewer opens the idea to confirm the following:
 - The idea's **Maturity** is set to **Feasibility**.

- Additional sections, such as **Business Case**, **Marketing Analysis**, and **Score** are displayed.

Once this is done, the task is completed by clicking **Acknowledge**.

Ownership of the **Idea** is transferred to the reviewer after the reviewer acknowledges the task for feasibility.

Once the reviewer approves the task, the **Development Event State** is set to **Closed**.

Project implementation

During the project implementation phase, the project manager updates the project and resource plans and adds potential risks.

Update the project

1. Log in as the project manager.
2. The project manager updates the project plan and the resource plan as needed.
3. The activity owner works on the activity and delivers the assigned task.
4. At the end of the development phase, the development phase gate review occurs.

The tapeout checklist is run during the **Development Phase Gate Review**.

Manage risks





1. Log in as the project manager.
2. Open the project and select **Risks**.
3. Click **Add to** ⊕ in the **Project Risks** section.
4. Enter information for the following properties:
 - **Name**
 - **Description**
 - **State**
 - **Risk Strategy**
 - **Impact**

- **Probability**
 - **Target Date**
5. Ensure that the risk is added to the **Project Risks** section.
 6. Open the risk and update the **Risk Strategy**, **Response Strategy**, and **Response Description** as needed.

Tapeout process





This topic covers the approval process for tapeout checklists, including answers to checklist questions and verification of those answers.

Approve tapeout checklist questions

1. Log in as the project manager.
2. Search for the project, open the **Prototype** event, and choose **Checklists**.
3. Open the checklist, and select one or more checklist questions.
4. Choose **More Commands ...** > **Manage**  > **Assign Resource** .
5. Repeat this step to assign responsible users to all the questions in the checklist.
6. Select the **Checklist** and choose **More Commands ...** > **Manage**  > **Submit to Workflow** .
7. Select **Checklist Questions Process** from the template list and click **Submit**.





The checklist question goes to the assigned responsible user.

Answer checklist questions

1. Log in as the user assigned to the questions.
2. Go to the **Inbox** and select the **Answer Question** task.
3. Choose **Attachments** and open the **Checklist Question**.
4. Choose **More Commands ...** > **Edit**  > **Start Edit** .
5. Select a value for the **Answer** box and add comments as necessary.
6. Choose **More Commands ...** > **Edit**  > **Save Edits** .

7. Go to the **Inbox**, select the **Answer Question** task, and click **Complete**.

Verify answers to checklist questions

1. Log in as the project manager.
2. Go to the **Inbox** and select the **Verify Answers to Checklist Questions** task.
3. From the **Targets** section, open the checklist question.
4. Choose **More Commands ...** > **Edit**  > **Start Edit** .
5. Update the **State** and **Closed Date** properties.
6. Choose **More Commands ...** > **Edit**  > **Save Edits** .
7. Go to the **Inbox**, select the **Verify Answers to Checklist Questions** task, and click **Complete**.
8. Set the **Checklist State** to **Closed** as an approval.
9. Post the tapeout approval.

The GDSII is released.

NPI metrics and dashboards

Note:

This functionality is only available with Teamcenter Reporting & Analysis installed.

The following dashboards and metrics allow users to easily track progress, gain insight, and recognize risks:

- **Ideation Effectivity Metric:** This dashboard shows how many ideas move from idea to project planning and through the rest of the project phases. It also gives a view of how ideas are distributed across various maturity phases of an NPI project based on selected criteria, such as timeframe.
- **Investment by Innovation Type:** This dashboard shows how company investments are deployed. The report gives an idea of innovation and breakthrough projects versus continuous improvement projects. The different categories are **Technology Risk**, **Breakthrough**, **Replacement**, and **Market Risk**.
- **NPI Cycle Time:** This dashboard calculates the average cycle time of the selected projects, as well as cycle time by phase.



- **NPI Project Labor Report:** This dashboard calculates the total money spent for labor, looking at target spent versus actual spent, based on selected criteria such as date range, business unit, and innovation type for all active projects by various categories.
- **NPI Revenue – Target vs Forecast:** This dashboard shows the sum of the product revenue of target versus forecast revenue by project innovation type for selected projects.
- **On Time Delivery (OTD) report for Sample Plan:** This dashboard measures delivery to the committed sample plan dates. For a given month, the metric measures how many projects were sampled the first time on time per the total number of projects due for sampling on the month.
- **Top N Project Dashboard:** Default and recommended top 10 projects with the highest net present. The list also includes projects which are strategic and selected by executive management.
- **Development Passes, Mask set Ratio, Days late to Prototype complete:** This dashboard displays the tabbed report for the average development passes, mask set ratio, and days late to prototype completion against the plan for a selected set of projects based on time, business unit.
- **Risk Management section:** includes a **Risk Statement** in addition to the **Impact Score, Probability, Mitigation Plan,** and **Contingency Plan.**



Run an NPI report

1. Log in as the project manager.
2. Click the **Reports** tile and go to the **Analytics** page. The following semiconductor reports and metrics are available:

- **Ideation Effectivity Metric**

- **Top N Project Dashboard**
 - **Investment by Innovation Type**
 - **NPI Cycle Time**
 - **NPI Project Labor Report**
 - **NPI Revenue – Target vs Forecast**
 - **On Time Delivery (OTD) for Sample plan**
 - **Research and Development Metrics**
 - **Development Pass**
 - **Maskset Ratio**
 - **Days Late to Prototype Complete**
3. Select the specific report from the list and choose **More Commands ... > New  > Generate Report **.
 4. Provide the appropriate information and click **Generate Now**.

Based on the user input, the system generates the report. The project manager analyzes the data based on the initial input and further updates.

Functional Safety

HARA process

About the Hazard Analysis and Risk Assessment process

Functional safety standards are defined to ensure the reliability of built-in safety mechanisms. The Hazard Analysis and Risk Assessment (HARA) is a crucial process in ensuring functional safety, particularly in the automotive industry. The basis of the HARA is to identify all the potential hazards and categorize them according to their severity, probability, and controllability.

Semiconductor Lifecycle Management provides the foundational elements, such as functions, malfunctions, hazards, and harms, needed to perform HARA analyses as defined by the ISO26262 standard. Digital thread capabilities in Teamcenter help manage the end-to-end HARA process. The system calculates an Automotive Safety Integrity Level (ASIL) value based on the given input criteria, and then it generates a report for a given assembly revision depicting ASIL scores, safety groups, severity, controllability, and exposure criteria. This new functionality improves traceability from requirements to design to functional safety analyses.

Create a function

A function identifies an intended action or the value of a device, and it can be reused for multiple CPNs.

1. Log in as a product engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Designer**.
3. To add a function, find an existing CPN or assembly part, or create a new one.
4. Open the appropriate CPN or assembly part, and choose **HARA Analysis**.
5. From the **Functionality** section, click **Add** ⊕.
6. Select **Function** from the **Type** list, enter a **Name** and other relevant information as needed, and click **Add**.

Add a malfunction to a function

A malfunction identifies a failure or unintended behavior of a system that could result in harm.

1. Select the function item in the **Functionality** table, and from the **Malfunctions** table, click **Add** ⊕.
2. Enter a name and other relevant information, and then click **Add**.

Create a HARA analysis

Before an analysis can be performed, a **HARA Analysis** item must be created. This item is used to define the possible hazardous events.

1. Log in as a safety engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Designer**.
3. Find and open the appropriate CPN that requires analysis, and choose **HARA Analysis**.
4. Ensure that no items are selected in the **Functionality** and **Malfunctions** tables.
5. In the **HARA** section, click **Add** ⊕.
6. Enter a **Name** and click **Add**.

Add a hazardous event to the HARA analysis

A hazardous event identifies a specific operating situation that can occur and cause a hazard. For example, if a car's lights go out while driving in the dark, that would be a hazardous event.

1. Open the new **HARA Analysis**, and in the **Hazardous Event** section, click **Add** ⊕ > **Hazardous Event**.
2. Enter a **Name** and **Description**.
3. In the **Functionality** section, select a **Function** and **Malfunction**.
4. In the **Hazard** section, click **Add** ⊕ to add a new or existing hazard.
5. In the **Hazard** pane, create a new hazard from the **New** section or add an existing hazard from **Palette** or **Search**.
6. Click **Add**.
7. Select an existing **Potential Effect** from the list, or create a new potential effect by clicking **Add** ⊕.
8. In the **Harm** section, click **Add** ⊕ to add a new or existing harm.
9. In the **Harm** pane, create a new harm from the **New** section or add an existing hazard from **Palette** or **Search**.
10. Select a **Severity** from the list.
11. Click **Add** ⊕ in the **Harm** pane.
12. Click **Add**.

The new hazardous event is added to the table.

13. Double-click the **Severity Comment** cell and enter a descriptive comment as necessary.
14. Double-click each of the following cells, and select the appropriate value or enter a comment as necessary:
 - **Exposure**
 - **Exposure Comment**
 - **Controllability**
 - **Controllability Comment**

Once the **Severity**, **Exposure**, and **Controllability** are set, the system calculates the **ASIL** value for the hazardous event.

Add a safety goal to the hazardous event

Safety goals are the top-level safety requirements for each device. They are used to formulate the functional safety requirements needed to avoid any unreasonable risk for each hazardous event.

1. From the **Hazardous Event** section, select the hazardous event and click **Add** ⊕ > **Safety Goal**.
2. Create a new safety goal from the **New** section or add an existing safety goal from **Palette** or **Search**.
3. Click **Add**.

The **Safety Goals Summary** table is updated with the new safety goal. The system automatically propagates the highest ASIL value amongst all hazardous events with that safety goal and displays the value in the **ASIL (Safety Goal)** column.

4. In the **Hazardous Event** table, open the malfunction by clicking the link in the **Malfunction** column.


The system automatically propagates the hazardous event's safety goal to the malfunction.

5. With the malfunction open, from the **Safety Goal** table, open the safety goal.
6. From the **Safe State** table, click **Add** ⊕.
7. Create a new safe state from the **New** section or add an existing safe state from **Palette** or **Search**.
8. Click **Add**.

The **Safe State** table is updated. The system automatically propagates the safety goal's ASIL value to the new safe state.



Duplicate a hazardous event

The **Duplicate** option copies an existing hazardous event and helps you update any properties as necessary. This option can save time if you have several hazardous events with many of the same property values.

1. From the **Hazardous Event** section, select a hazardous event and click **Duplicate** .
2. Make changes to the selections as necessary and click **Duplicate**.

Send HARA analysis for approval



Once the HARA analysis has been completed, it can be sent out for approval.

1. Open the **HARA Analysis** and choose **More Commands ... > Manage**  **> Submit to Workflow** .
2. Select **Hara Analysis Release Process** for the **Template** and click **Submit**.

The HARA analysis is sent through an approval process. Once approved, it is released and can no longer be updated. In addition, all related objects, including hazardous events, hazards, hazardous situations, harms, safety goals, and safe states are released and are no longer modifiable.

Generate a HARA Analysis report

Once the HARA analysis is completed, a report can be generated.

1. Open the **HARA Analysis** and ensure that nothing is selected in the tables.
2. Choose **More Commands ... > New**  **> Generate Report** .
3. Select **HARA Report** from the list of report types and click **Generate**.

FMEDA process

About the Failure Modes, Effects, and Diagnostic Analysis process

Functional safety standards are defined to ensure the reliability of built-in safety mechanisms. The Failure Modes, Effects, and Diagnostic Analysis (FMEDA) process is an assessment method used to guarantee functional safety. The basis of the FMEDA is to examine potential failure modes within a system to determine how these failures may affect the safety performance.

Semiconductor Lifecycle Management provides the foundational elements, such as failure modes, safety mechanisms, safety goals, and FMEDA analysis objects, needed to perform FMEDA analyses as defined by the ISO26262 standard. Digital thread capabilities in Teamcenter can help manage the end-to-end FMEDA process. The system calculates various failure rates based on the individual block-level or component-level failure rates and the failure mode values input by the user. Each of the system components is then scrutinized to assess its capability to prevent a potential violation of a safety goal. This assessment is accomplished by designing specific system-level safety mechanisms for both single-point and multi-point failures. This functionality extends traceability from requirements to design to functional safety analyses.

Create a system model structure


A system model structure is created to accurately represent a planned product. These reusable digital models can be used in later development stages, such as simulation and product validation.

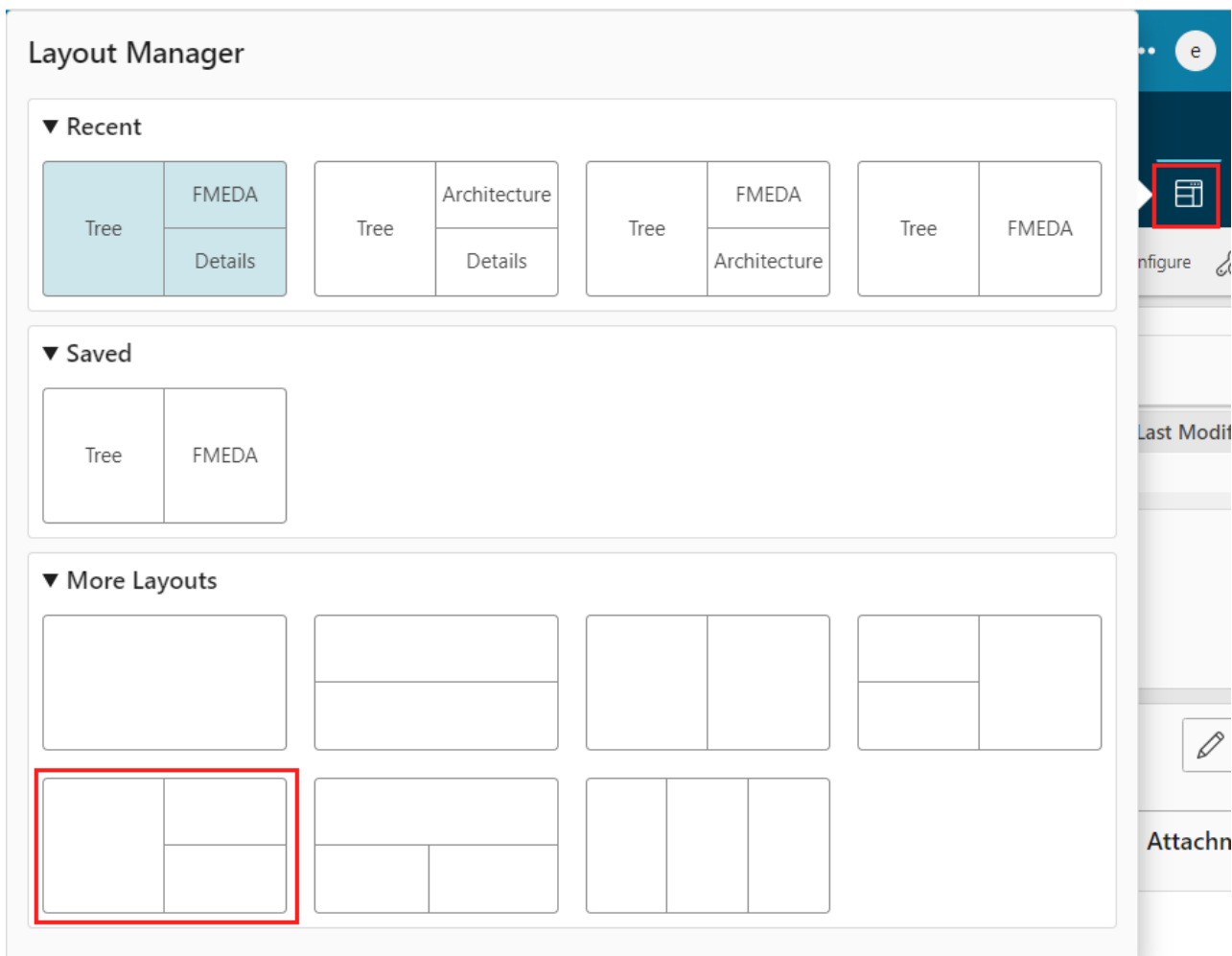
Create a system model

1. From the **Home** page, click the **Explorer** tile.
2. Select the folder in which you want the new system model to be created.
3. Choose **More Commands** **...** > **New** ***** > **Add** **⊕**.
4. Select **System Model** for the **Type**, enter a **Name**, **Description**, and other relevant details, and click **Add**.

Create a system block

This block represents the system-level block in the structure.

1. Open the system model and choose **Content**.
2. Choose **Layout Manager** , and select the three-pane layout as shown in the following image.



3. Choose **FMEDA** in the upper right pane, and choose **Details** in the lower right pane.
4. Select the system model and click **Add** ⊕ > **Child**.
5. Select **System Block** for the **Type**.
6. Enter additional details such as a **Name** and a **Description**.
7. For **Failure Rate Defined As**, choose **System** from the list.
8. Click **Add**.

Create a component block

A component block defines the structural elements of the system. It can be a leaf-level block with failure modes defined on it, or it can have allocated blocks as children which have failure modes defined on them.

1. Select the new system block and click **Add** ⊕ > **Child**.
2. Select **System Block** for the **Type**.
3. Enter additional details such as a **Name** and a **Description**.
4. For **Failure Rate Defined As**, choose **Component** from the list.
5. Click **Add**.



Create allocated blocks

An allocated block deals with the assignment of behaviors or other elements to structural components. These blocks represent leaf level blocks that have failure modes defined on them.

1. Select the new component block and click **Add** ⊕ > **Child**.
2. Select **System Block** for the **Type**.
3. Enter additional details such as a **Name** and a **Description**.
4. For **Failure Rate Defined As**, choose **Allocated** from the list.
5. Click **Add**.



Add a failure rate to a component block

The failure rate of a component block is set by the user.

1. Select the component block and choose **FMEDA Input** in the **Details** pane.
2. Click **Edit** .
3. Enter a value for **Failure Rate DB** and click **Save** .


Add area to allocated blocks

The area of an allocated block is entered by the user.

1. Select an allocated block and choose **FMEDA Input** in the **Details** pane.
2. Click **Edit** .
3. Enter a value for **Area** and click **Save** .

Add failure modes to allocated blocks

Leaf-level blocks have failure modes defined on them.

1. Select an allocated block and choose **FMEDA Input** in the **Details** pane.
2. From the **Failure Modes** table, click **Add** .
3. Enter a **Name**, **Description**, and **Failure Mode Ratio**.
4. Click **Add**.
5. Add additional failure modes as necessary, ensuring that the failure mode ratio total is 100.

If the failure mode ratio doesn't total 100, you will receive an error.

Create FMEDA

Once the system model for the IC has failure modes defined for each of the blocks, an FMEDA can be created. The FMEDA is used to analyze the design of the IC and determine if the failure data of its components is within the limits defined by the ISO26262 standard to be considered for detailed design.

1. With the system model open, within **FMEDA**, click **Create FMEDA** .

Tip:

Hold the mouse over the **Create FMEDA**  button to view a list of checks that the system makes before allowing FMEDA creation.

2. Enter a **Name** and **Description**.
3. In the **Safety Goal** section, click **Add** ⊕.
4. Select a safety goal from **Palette** or **Search**. Click **Add**.
5. Add additional safety goals as necessary.
6. Ensure **Open on create** is selected and click **Create**.

A new FMEDA analysis object is created for the system model. All BOM configuration rules such as revision rules, variant conditions, and effectivities are considered by the system during an analysis creation.

7. For each component with one or more failure mode defined, select **Yes** or **No** for the **Failure mode that has the potential to violate the safety goal in absence of safety mechanism?** column.
8. For the components with **Yes** selected, double-click within the corresponding **Safety Mechanism for SPF** cell, click **Add** ⊕, and select an existing safety mechanism for a single-point failure.

Note:

New safety mechanisms cannot be created from the **Analysis** table. They must be created using **More Commands** ... > **New** ✨ > **Add** ⊕. Then, select **Safety Mechanism** for the **Type** and enter a value for **Coverage**. Once created, the safety mechanisms will appear in this list.

The system performs calculations based on the values entered and updates the **Results** section.


9. Select **Yes** or **No** for the **Failure mode that may lead to the violation of safety goals in combination with an independent failure of another component?** column.
10. For the components with **Yes** selected, double-click within the corresponding **Safety Mechanism for MPF** cell, click **Add** ⊕, and select an existing safety mechanism for a multi-point failure.

The system performs calculations based on the values entered and updates the **Result** section.

Update FMEDA after system model changes

An FMEDA analysis becomes outdated when any change is applied to the relevant system model. For example, structure changes like the addition or removal of a block, changes to a block's properties such

as the failure rate or area, and changes to the failure modes and ratios all necessitate an update to the existing FMEDA analysis.

1. With the system model open, within **FMEDA**, select the appropriate FMEDA and click **Update FMEDA** .


The selected FMEDA begins updating, and the system notifies the user when the update is complete.

2. Open the FMEDA.

All changes made to the system model are reflected in the updated FMEDA.

Update FMEDA after structure context changes

When an FMEDA analysis is created, all BOM configuration rules are considered. The FMEDA becomes outdated with any change to the BOM configuration. As a result, the FMEDA must be updated.

1. With the system model open, make the necessary changes to the BOM configuration, such as changing the revision rule, date effectivity, or unit effectivity.
2. Within **FMEDA**, select the appropriate FMEDA, and click **Update FMEDA** .


The selected FMEDA begins updating, and the system notifies the user when the update is complete.

3. Open the FMEDA.

All BOM configuration changes are reflected in the updated FMEDA.

Synchronize with FMEA


The failure elements in an FMEA structure can be used as a reference to create failure modes with the same names. These failure modes can then be used in an FMEDA analysis.

1. Open and expand an existing system model.
2. Select an allocated block and choose **FMEDA Input** in the **Details** pane.
3. To use an existing FMEA failure mode as a reference for a new FMEDA failure mode, click **Add from FMEA**  from the **Failure Modes** table.

The resulting list shows the existing FMEAs for this system model structure and their representative failure elements.



4. Select a failure element and click **Add**.

A new failure mode is created and linked to the representative FMEA failure element that was selected in the **Add from FMEA** panel. The failure mode can now be used in an FMEDA analysis.

5. To view the linked failure element, right-click the new failure mode in the **Failure Modes** table, and then choose **Existing Trace Link** .

Send FMEDA for approval



Once the FMEDA analysis has been completed, it can be sent out for approval.

1. Open the **FMEDA** and choose **More Commands ...** > **Manage**  > **Submit to Workflow** .
2. Select **FMEDA Analysis Release Process** for the **Template** and click **Submit**.

The FMEDA analysis is sent through an approval process. Once approved, it is released and can no longer be changed. In addition, all related FMEDA elements and failure modes are released and are no longer modifiable.

Generate an FMEDA Analysis report


You can generate a report containing an FMEDA's analysis values.

1. Open the **FMEDA** and choose **More Commands ...** > **New**  > **Generate Report** .
2. Select **FMEDA Report**.
3. Select a language for **Report Display Locale**, enter a file name, and click **Generate**.

An HTML file is generated containing the FMEDA's properties, its analysis table values, and the calculated results values.


Generate a Safety Analysis report

A functional safety analysis report provides a comprehensive evaluation of safety aspects. After HARA and FMEDA analyses have been completed, a safety analysis report can be generated for a given part.

1. With the system model open, within **Details**, click **Overview**.
2. In the **Related Part** section, click **Add** .
3. Select the part for which you want to generate the safety analysis report from **Palette** or **Search**. Click **Add**.

The selected part is added to the **Related Part** table.

4. Open the related part.

5. Choose **More Commands ... > New ✨ > Generate Report** .
6. Select **FuSa Safety Analysis Report** from the list of report types and click **Generate**.

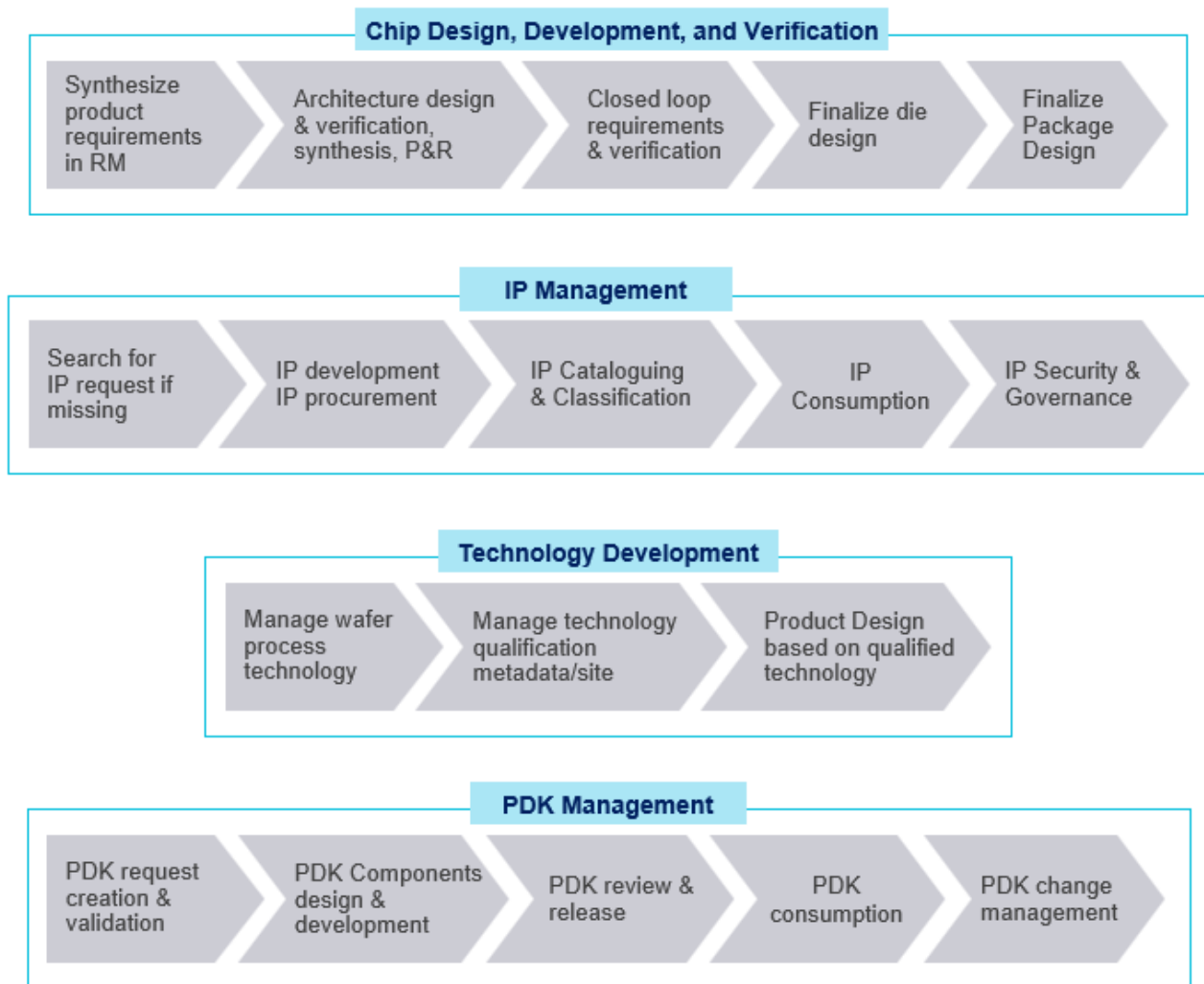
The report is generated and related to the part.

7. Click **Attachments** and open the report from the **Files** table.

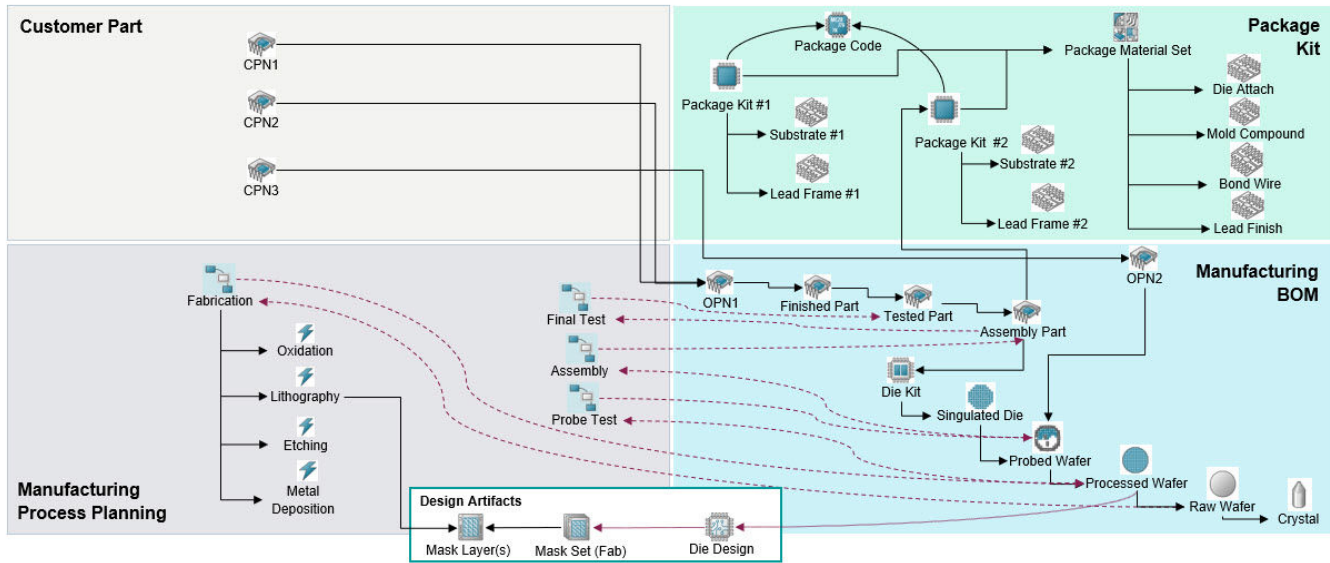
This report can be downloaded and manually updated with additional information as necessary.

IC Design

About IC Design



The following graphics illustrates the overall process flow for IC design:



The Die Design Object (DDO) is the central object that holds all the digital design artifacts for the entire project. Typically, it is created using EDA tools, and a golden copy of the design is imported into Teamcenter as an RTL, Netlist, or GDSII file.

The DDO lists all the intellectual properties associated with the die design. The central IP management repository holds the enterprise-wide intellectual property and ensures proper governance in terms of who can create an IP, who can consume an IP, and the traceability of an IP to an NPI project and requirements, as well as how the IP is going to get procured from an external organization. All these processes and orchestration are handled by a corporate IP repository and the associated process framework.

Semi companies typically maintain a list of wafer process technology (WPT), its attributes, and qualification information in a standalone database. When a new die is conceived, it typically gets associated to a wafer process technology. Various characteristics are considered in the qualification process, such as the wafer size, for example, 14 or 22 nm, the number of poly layers, the maximum and minimum numbers of metal layers, and the number of mask layers.

The mask set, which is generated from the GDSII file, is also associated with the DDO and maintained in Teamcenter.

The screenshot illustrates the relationship between different design artifacts in Teamcenter. The main window shows the 'Properties' for 'DD-111001' (SoC Die Design). A blue arrow points to a pop-up window for 'WPT-111001/A1;1-WPT-22nm', which shows its own 'Properties' and a 'Site Qualification' table. Another blue arrow points to a 'Mask Set' pop-up window, which shows a tree view of 'Mask Layer1' through 'Mask Layer5' and its 'Properties'.

Chip design, development, and verification

The DDO is the central business object which holds all the design artifacts. Note that the DDO is an abstraction at the design or logical level, whereas the singulated die is the physical realization of the logical DDO.



Author die design

1. Log in as a product engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Designer**.

3. From the home page, click **CREATE IN FOLDER**.
4. Select **Die Design** as the type.
5. Enter information for the **Name**, **Description**, and **Maturity** properties.
6. Select a **Wafer Process Technology**. This property specifies which process technology the die design belongs to.
7. Click **Add**.

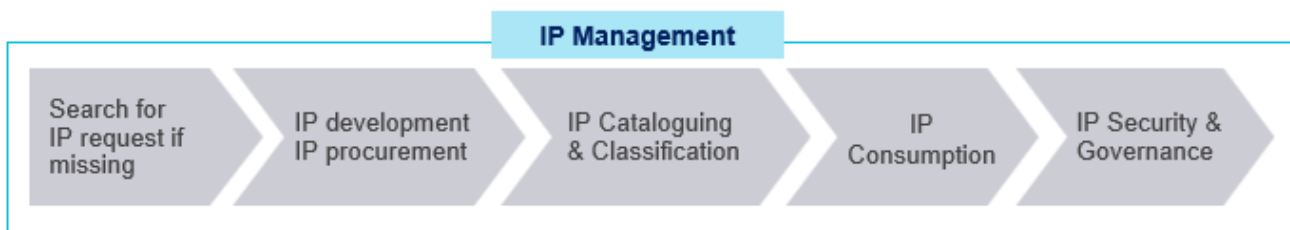
The die design is created.

8. Choose **Overview** and add other properties as needed.

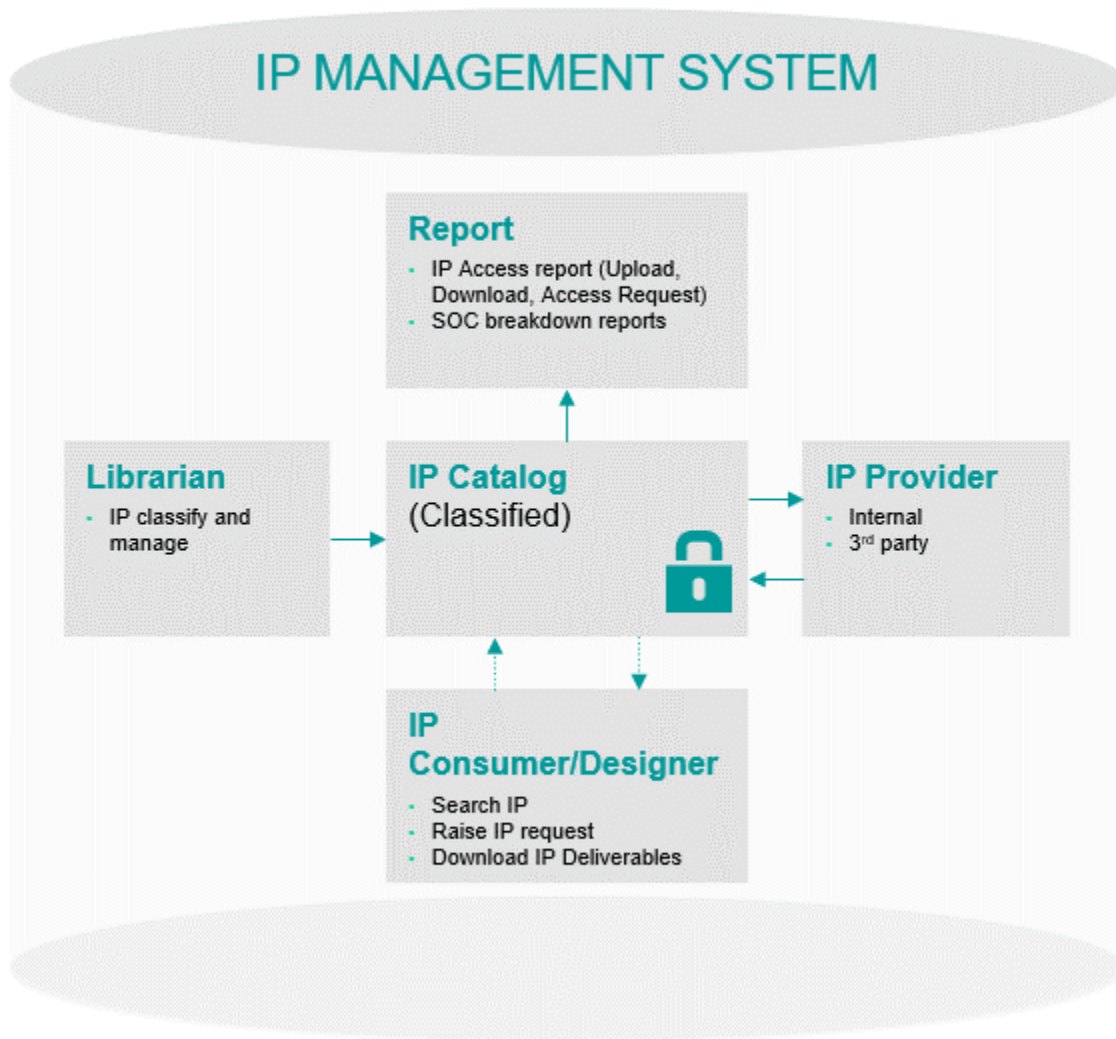
IP reuse and management

About IP management

IP consists of the fundamental building blocks that are essential to achieve the design process. IP blocks can be insourced or can be purchased from other IP providers.

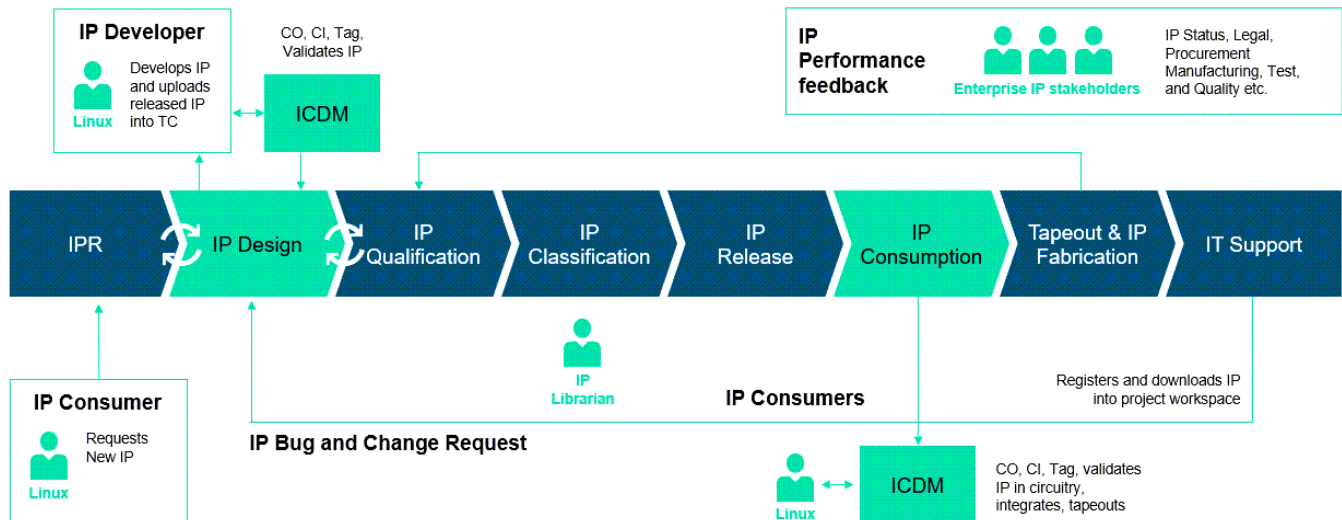


The central IP management repository holds the enterprise-wide intellectual property and ensures proper governance in terms of access rights. Based on the activity that is performed on the IP, the traceability and requirements of the IP is maintained with the NPI project. The IP management process and orchestration are handled by a corporate IP repository and the associated process framework.



When working on a new design, an NPI design engineer consults the IP library for the IP that is needed.

- If the IP is available in the library, the design engineer can request access from the IP librarian. The IP librarian then follows the IP request process to ensure governance and traceability.
- If the IP is not readily available in the library, then the librarian procures one based on the requestor's specification of the IP requirements.



The overall IP lifecycle management flow starts with the IP request and ends when the request is fulfilled. Multiple mechanisms are in place to ensure that the organization has a trusted centralized IP repository. The IP repository is the source of truth that can be harmonized across all NPI projects.

ITAR data management

As part of the International Traffics Arms Regulation (ITAR) certification, every semiconductor company must ensure that all their products marked as ITAR have complied with the ITAR regulations during the design and manufacturing process. Also, only ITAR-certified personnel can view or modify product records classified as ITAR within the United States.

Typically, companies use standalone homegrown systems, spreadsheets, and paper records to ensure that they are maintaining compliance. These records can get compromised at times, leading to serious penalties. The IP module helps companies manage ITAR information in a digitized format. It helps to earmark products as ITAR-classified data using license information. Only selected company personnel who are ITAR certified can access those records; anybody else, including IT professionals, is forbidden to either search for or use any of the ITAR-classified information. Violations can lead to a huge penalty for the company, including criminal punishment and imprisonment, so companies must be diligent in protecting their ITAR information.

Associate IP license to the IP data set

The IP librarian searches for an IP and associates an IP license to the dataset.





1. Log in as the IP administrator.
2. Select **IPs** as the search category, type ***** in the search box, and click **Search**.

Note:

Create a new IP and **.zip** data set if no IP is available.

Search results can be further filtered based on the properties.

The system shows all available IPs.

3. Open the appropriate IP and choose **Attachments**.
4. Select the **.zip** dataset and choose **More Commands ... > Manage**  **> Attach licenses** .
5. Click **Attach License**  and select the appropriate license from the list. The user listed in the selected license has restricted access.
6. Click  and then click **Attach**.

Request access for an existing IP

Search and navigate IP

1. Log in as a product engineer.
2. Open an existing IP to which a license is attached.
3. Choose **Attachments**. It has a list of content and an IP summary file.

The license restricts access to certain items related to the IP. You must place an **IP** access request to get the restricted **IP** content.

4. Select the IP and submit it to the **Request for IP Access** workflow.

Provide access to an existing IP

The IP librarian grants access to restricted IP content for the requester.

Note:

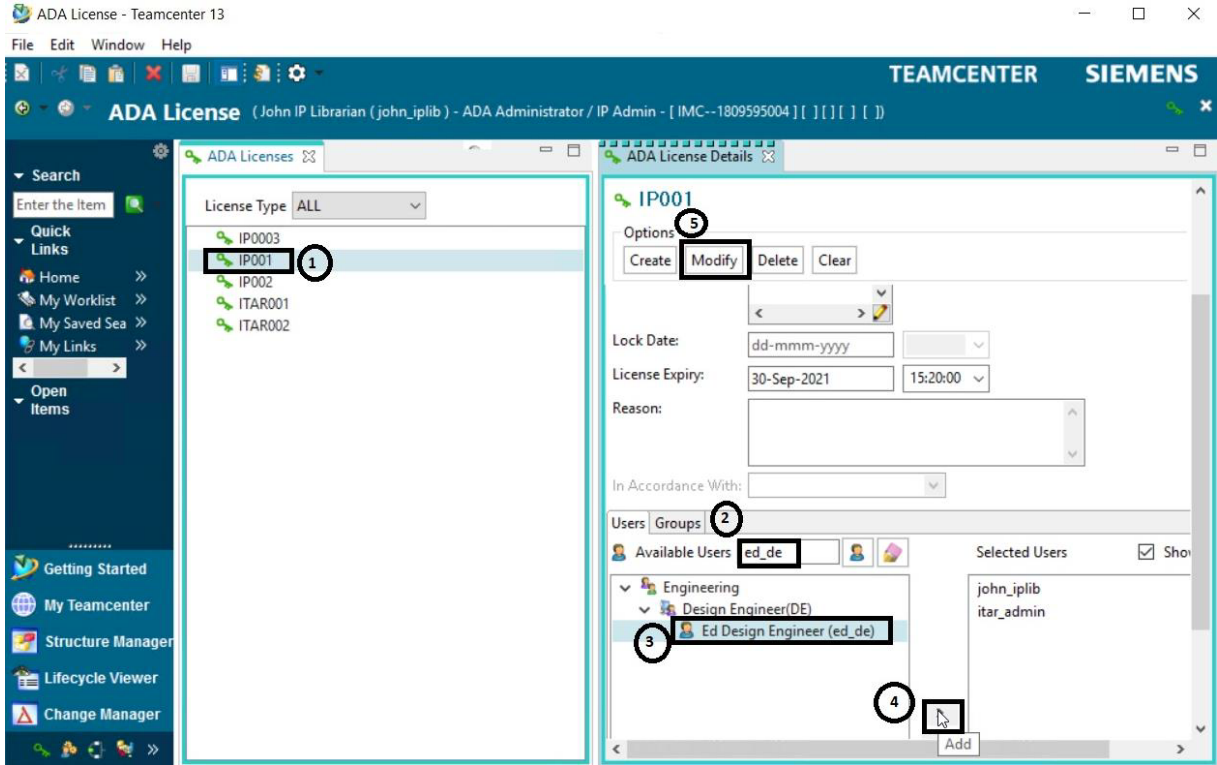
This can be performed in the Teamcenter rich client.

1. Log into the Teamcenter rich client as an IP administrator.
2. Go to the team inbox and follow the task instructions to grant IP access to the requester.

Example of a task instruction: **Attach IP License to IP artifact. If license is already attached to IP artifact, then update the IP license.**

3. If the IP license is attached to the IP dataset, then modify the attached IP license to add the requested user or group.

- Search for the IP and go to its **.zip dataset**.
- Find the IP license attached to the **.zip dataset**.
- Go to the **ADA License** and modify the license to add the requested user for access.



- If the IP license is not attached to the IP dataset, then add a new license with the appropriate user or group and attach the license to the IP dataset.

- Complete the task from the inbox.

The system notifies the requester that IP access has been granted. The requester can now view the **.zip** dataset along with the IP. The requester can also download the IP content.

Note:

In case of an external IP, the librarian seeks approval from the IP vendor before granting IP access to the requester.




Request a new IP

If a product engineer cannot find an appropriate IP in the IP library, the engineer can request a new IP.


- Log in as a product engineer.

2. On the global header, click your profile icon, and ensure that the workspace is set to **Designer**.
3. From the home page, click **CREATE IN FOLDER**.
4. Select **Controlled Document** as the type.
5. Select **BOI** as the category and **IP Specification** as the subcategory.
6. In the **File Attachments** section, click **Choose File** and select the appropriate IP specification document file.
7. Click **Add**.



The controlled document is created and opened.

8. From the **Overview** of the new controlled document, choose **More Commands ... > Manage**  **> Submit to Workflow** .
9. Select **Request for New IP** for the **Template** and click **Submit**.
10. Log in as an IP Admin.
11. Go to the **Team** inbox and check the IP Request for completeness.
 - a. Select the **IP Request** task, and from the **Targets** section, open the attached document.
 - b. Choose **Participants**, and in the **Approver** section, click **Add** .
 - c. Select a product engineer and click **Add**.
 - d. Signoff the task as **Complete**.
12. Log in as a product engineer.
13. Navigate to the **Inbox**, select the **Review IP Request** task, review the request, and approve it.
14. Log in as a project sponsor.
15. Navigate to the **Team** inbox and select the **IP Request Approval** task.

The user can select a particular option according to the provided information.
16. Click **External-3PIP**.
17. Log in as an IP admin.

18. Navigate to the **Team** inbox and select the **Procure and Create IP Object** task.
19. From the **Targets** section, click **Add to**  to create a new IP object.
20. Enter a **Name** and other relevant information such as selecting **Internal or External**. Then click **Add**.
21. Open the newly created IP object, choose **Attachments**, and add any required artifacts.

The user can add a .zip dataset and attach a license to that dataset.



22. Choose **Classification** and click **Add**. Use the **Search** box to find and select the appropriate item. Finally, provide the necessary information and click **Classify**.
23. Log into the rich client as an IP admin, open the **ADS Licenses** application, and select the attached license. Specify a product engineer user and click **Modify**.
24. Log in as a product engineer.
25. Search for an IP object that has been created. Open it and choose **More Commands ... > New**  **> Create Change** .
26. Select **Issue Report** as the **Type**, provide the required information, and click **Create and Submit**.





Define Bill of IP for a die design

A product engineer can create a representative IP from a die design and associate it with an IP.

Note:

Type the name and library name without spaces if you plan to use Methodics for IP development.

1. Log in as a product engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Designer**.
3. From the home page, click **CREATE IN FOLDER**.
4. Choose **IP Object** as the type.
5. Enter information for the **Name**, **Description**, and other required properties.
6. Click **Add** to create the IP.
7. With the new IP open, choose **More Commands ... > Edit**  **> Start Edit** .

8. Update **Internal or External** and **Library Name** as needed, and then choose **More Commands ...** > **Edit**  > **Save Edits** .
9. Click **Add to**  in the **Intellectual Property Specifications** section to associate the die design to the IP.
10. Click **Search** and search for the die design to add.
11. Select the appropriate die design and click **Add**.
12. Create a **Bill of IP** for the representative IP.
 - a. From the open IP, choose **Content**.
 - b. Use **Add**  > **Child** to search for and add an existing IP as a child to the IP. Search for and add more children IPs as needed.
 - c. Create and add one new IP as a child IP under the representative IP.
 - d. Populate the IP properties as needed. Ensure that the **Library Name** property is populated for the new IP.
13. Mark the representative IP as **Precise**.



Internal IP development

Export Bill of IP from Teamcenter to Methodics

Once the Bill of IP for a die design is authored, it can be transferred from Teamcenter to Methodics. New IPs can then be developed using the Methodics workspace and IP development capabilities. Once a new IP is released, the updated Bill of IP can be transferred back to Teamcenter.

Note:

The Bill of IP can contain both existing and new IPs.

1. Log in as a product engineer.
2. Initiate the **Export IP to Methodics** workflow on a representative IP object:
 - a. Select a representative IP Object revision and choose **More Commands ...** > **Manage**  > **Submit to Workflow** .
 - b. Select the **Export IP to Methodics** workflow and click **Submit**.

3. The task goes to the **workflow requestor** user to select a reviewer to review the Bill of IP. After assigning a reviewer, complete the task.
4. The task goes to the specified reviewer who approves or rejects the Bill of IP. When the reviewer approves the task, the requestor receives notification after a successful export.

Develop new IP in Methodics

A Bill of IP can have existing IPs and new IPs. The Bill of IP is first transferred from Teamcenter to **Methodics**, and then a new IP is created using the **Methodics** workspace and IP development capabilities. Once a new IP is released, the updated Bill of IP is transferred back to Teamcenter.

1. Log into Methodics with the user name **admin** and password **admin**.
2. Search for and open an IP.
3. From the **Resources** section, select the IP and click **Go to IPV Page**.

The **0.TRUNK** version of the new IP opens.

4. Perform the following steps to create a new version of the IP.
 - a. Click **Edit IPV**.
 - b. In the **IP Details** section, select **Perforce** for the **DM Type**.
 - c. In the **IPV Details** section, type the repository path. For example: **//mdx_test/tutorial/new_IP_for_RepIP**.
 - d. Click **Save**.

The **1.TRUNK** version for the new IP is created.

5. Release the new version of the IP. Click **Edit Aliases** from **1.TRUNK** to release this version of the IP.
6. Go to the IP by clicking the link in the breadcrumb. From the **Parents** section, click the IP in the right pane.

The **0.TRUNK** version of the IP opens.

7. Perform the following steps to create a new version of the IP:
 - a. Click **Edit IPV**.
 - b. From the **Resources** section, select the new version of the new IP (**1.TRUNK**).

- c. Click **Save**.



The **1.TRUNK** version of the IP is created.

8. Release the new version of the IP by clicking **Edit Aliases** from **1.TRUNK**.

This version of the IP is released.

Import IP from Methodics to Teamcenter

Import the updated version of the new IP into Teamcenter.

1. Log in as a product engineer.
2. Search for and open the latest revision of an IP.
3. Choose **More Commands ... > Manage**  **> Submit to Workflow** .
4. Select the **Import IP from Methodics** workflow to import the updated IP version into Teamcenter and click **Submit**.

The process owner receives a notification after successful importation.

5. Click the link from the notification email.

Tip:

Search for and open the new revision of the IP in Teamcenter if the email notification was not received.

6. Verify the following information about the new revision of the IP:
 - The **Data Management Version Info** property contains a value.
 - In the **Bill of IP**, the new revision of the IP, which was newly created for development, contains the **Data Management Version Info** property with a value.

Update die design

Associate a GDSII file to the die design.

1. Log in as a product engineer.
2. Search for a die design and open it.

- Choose **Attachments** and associate **RTL**, **netlist**, and **GDSII** files as needed.

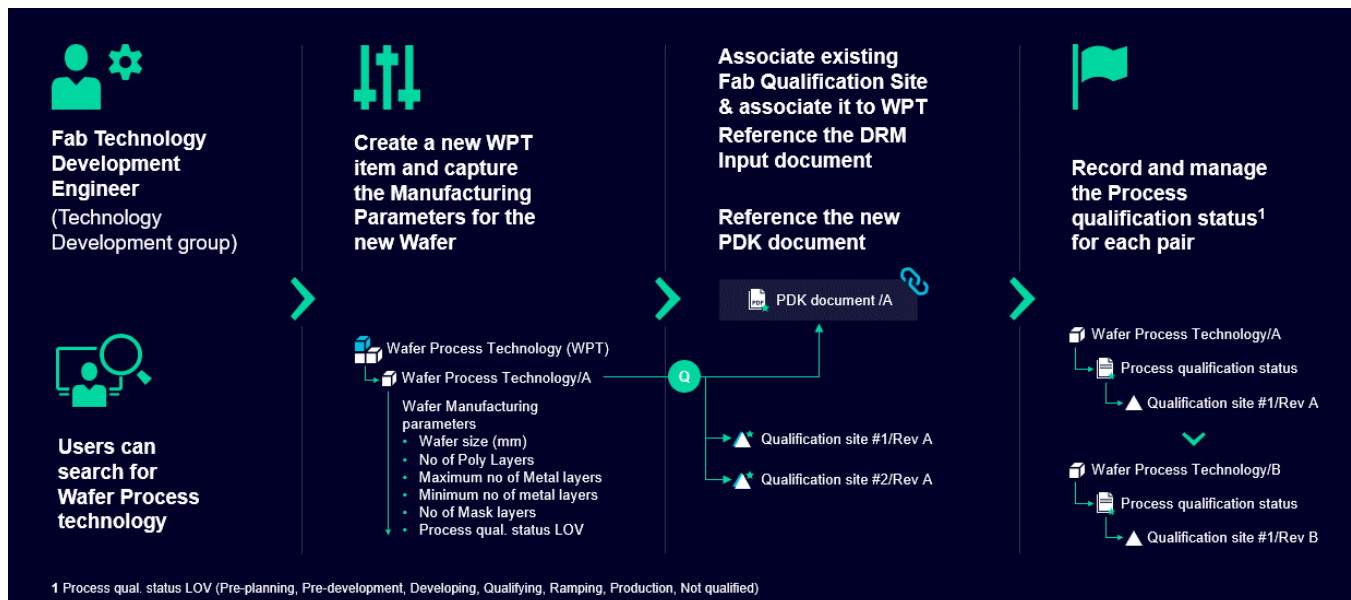
Technology development

About technology development

Technology development drives differentiation for your products with better management of increasingly sophisticated products and processes.



Typically, semiconductor companies maintain a list of WPTs, their attributes, and qualification information in a standalone database. When a new DDO is created, it gets associated to a WPT.




Create Wafer Process Technology

Create WPT




- Log in as a technology development engineer.
- From the home page, click **CREATE IN FOLDER**.

3. Select **Wafer Process Technology** from the **Type** list.
4. Enter information for the **Name**, **Description**, **Maturity**, and **Geometry** properties.
5. Click **Add**.

Associate a fabrication site to the WPT

1. Create a new **Plant (Fabrication Site)** if it does not already exist.
2. Create and associate a **Fabrication Qualification** to the WPT by opening the WPT, choosing **Overview**, and clicking **Add**  in the **Site Qualification** section.

The **Add** panel opens with **Fabrication Qualification** selected as the type.

3. Enter information for the **Name**, **Description**, and other relevant properties.
4. Click **Add**.
5. Choose **Attachments**, and in the **Documents** section, associate the qualification document of this **Fabrication Site** to the WPT.
6. From the fabrication qualification's **Overview**, update the **Maturity** value to show the qualification status. Also, enter information for the following properties:
 - **Wafer Size**
 - **Number of Poly Layers**
 - **Minimum Number of Metal Layers**
 - **Total Number of Mask Layers**
7. Initiate the **WPT** approval process. Select the WPT and choose **More Commands**  > **Manage**  > **Submit to Workflow** .
8. Ensure the **Review and Release Process** workflow is selected and click **Submit**.
9. Go to the **Inbox**, assign reviewers for the WPT approval process, and complete the **select signoff team** task.

Approve Wafer Process Technology

1. Log in as a reviewer.
2. Go to the **Inbox**, select the **Review Target** task, and follow instructions to review the WPT.

3. After completing the review, update the review task and specify whether you **Approve** or **Reject** the WPT.

If approved, the WPT is released.

Process Design Kit management

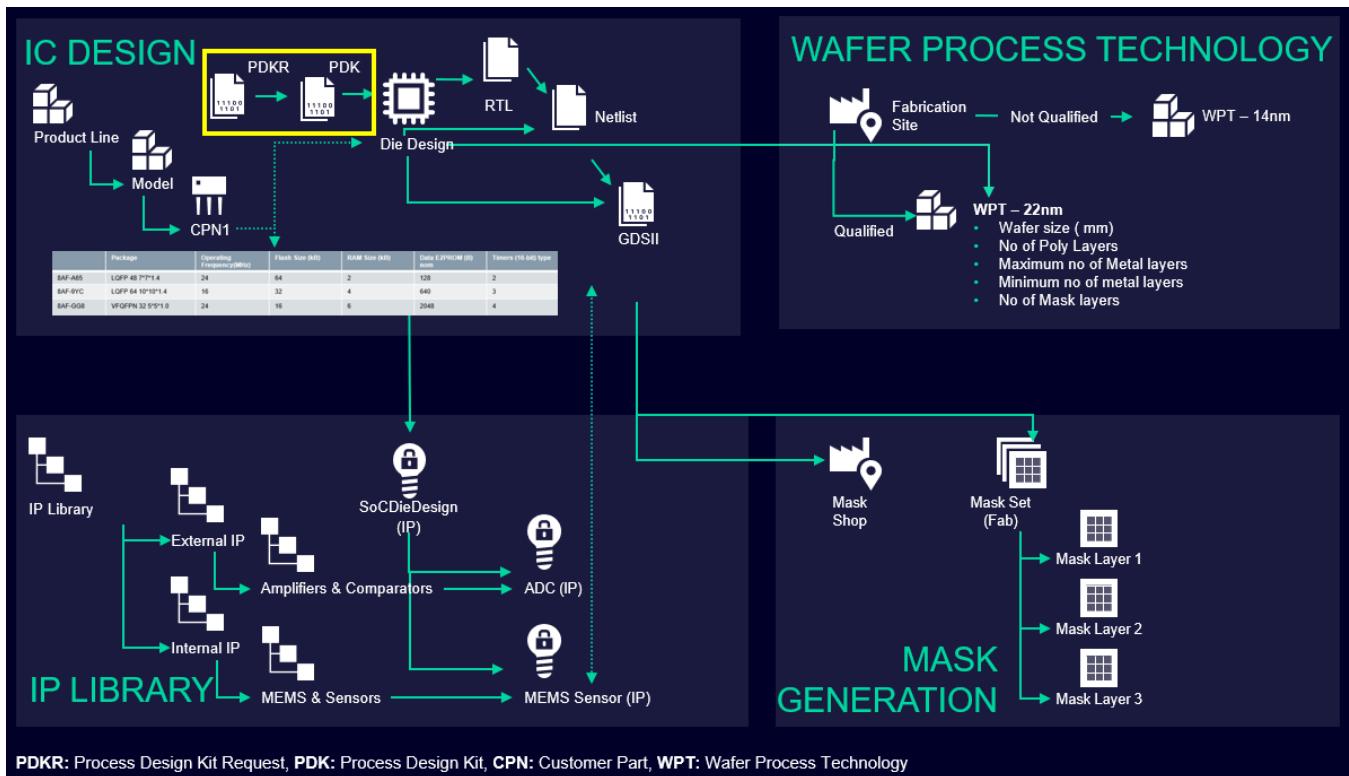
About Process Design Kit management



A Process Design Kit (PDK) is a set of files used in the semiconductor industry to model a fabrication process for designing integrated circuits. PDKs are often specific to a foundry and may be subject to non-disclosure agreements. These kits are essential tools for semiconductor designers, as they contain the necessary information to design and verify the functionality of ICs within a specific semiconductor manufacturing process.

Key components of PDKs include the following:

- Technology files
- Device models
- Design rules
- Parameter extraction tools
- Simulation models libraries



Create a PDK request

PDK development starts with a PDK request, where a business justification is supplied for the new PDK development.

This task should be completed by a user in the **Product Engineer** role using the **Author** workspace.

1. From the **Home** page, click the **Explorer** tile.
2. Select the folder in which you want the new PDK request to be created and click **Add** ⊕.
3. Select **Process Design Kit Request** for the **Type**, enter a **Name**, **PDK Justification**, **PDK Requested By**, and other relevant details.
4. Click **Add**.

Submit the PDK request for review

After creating a PDK request, it is submitted to a workflow for approval.

This task should be completed by a user in the **Product Engineer** role using the **Author** workspace.

1. Select the new PDK request and choose **More Commands ...** > **Manage** ⚙ > **Submit to Workflow** 📄.

2. Select **Request for New PDK** for the **Template** and click **Submit**.

The PDK request is sent to **Team** inbox of the PDK administrators.

Check the PDK request for completeness

Members of the **Technology Development** group in the **PDK Admin** role receive a **Check PDK Request for Completeness** task in their **Team** inboxes.

1. As a user in the **PDK Admin** role, navigate to the **Team** inbox.
2. Open the **Check PDK Request for Completeness** task.
3. Follow the task instructions in the **Action** section.
4. After verifying the justification for the PDK, add comments if needed, and click **Complete**.

The PDK request goes back to the PDK requestor to assign reviewers.

Assign reviewers to the PDK request

The PDK requestor receives a task to assign reviewers to the PDK request.

This task should be completed by a user in the **Product Engineer** role using the **Author** workspace.

1. Navigate to the **My Tasks** inbox.
2. Open the **select-signoff-team** task.
3. Assign reviewers in the **Tech Development Manager** role to assess the PDK request and determine approval.
4. After selecting reviewers, add comments if needed, and click **Complete**.

The PDK request moves to the assigned reviewers.

Review the PDK request

Users assigned as reviewers for the PDK request receive a **perform-signoffs** task.

This task should be completed by a user in the **Tech Development Manager** role using the **Author** workspace.

1. Navigate to the **My Tasks** inbox, and select the **perform-signoffs** task.

2. Follow the task instructions in the **Action** section.
3. Enter review comments as necessary and click **Approve**.

The PDK request moves to the PDK development subprocess.

Create and update a PDK revision

Now that the PDK request has been approved, a new PDK revision can be created.

This task should be completed by a user in the **Tech Development Manager** role using the **Author** workspace.

1. Navigate to the **My Tasks** inbox, and select the **Create/Update PDK Revision** task.
2. Review the task instructions in the **Action** section.
3. To create a PDK revision, choose **Attachments**.
4. In the **Targets** section, click **Add** ⊕.
5. Select **Process Design Kit** for the **Type**, enter a **Name**, **Supported Technology**, **External PDK Identifier**, and other relevant details.
6. Click **Add**.
7. From the **All Targets** table, open the new PDK revision.
8. Choose **More Commands** ⋮ > **Edit** ✎ > **Start Edit** ✎.
9. In the **PDK Components** section, click **Add** ⊕.
10. Enter values in the **PDK Components** table as needed.

Tip:

Use the slider to view all the columns.

11. Add, remove, and duplicate additional components as needed.
12. Once all necessary components are added, choose **More Commands** ⋮ > **Edit** ✎ > **Save Edits** 📄.
13. From the inbox, select the task, add comments if needed, and click **Complete**.

The PDK revision goes back to the PDK revision creator to assign reviewers.

Assign reviewers to the PDK revision

The creator of the PDK revision receives a task to assign reviewers.

This task should be completed by a user in the **Tech Development Manager** role using the **Author** workspace.

1. Navigate to the **My Tasks** inbox.
2. Open the **select-signoff-team for PDK Review** task.
3. Assign reviewers to assess the PDK revision and determine approval.
4. After selecting reviewers, add comments if needed, and click **Complete**.

The PDK revision moves to the assigned reviewers.

Review the PDK revision

Users assigned as reviewers for the PDK revision receive a **perform-PDK Review signoffs** task.

1. As a reviewer, navigate to the **My Tasks** inbox, and select the **perform-PDK Review signoffs** task.
2. Follow the task instructions in the **Action** section.
3. After verifying the PDK and its components, enter review comments as necessary, and click **Approve**.

This completes the PDK request and PDK revision workflows.

Add PDK revision to die design

As part of the die design process, the die designer wants to utilize the latest version of a PDK in the design.

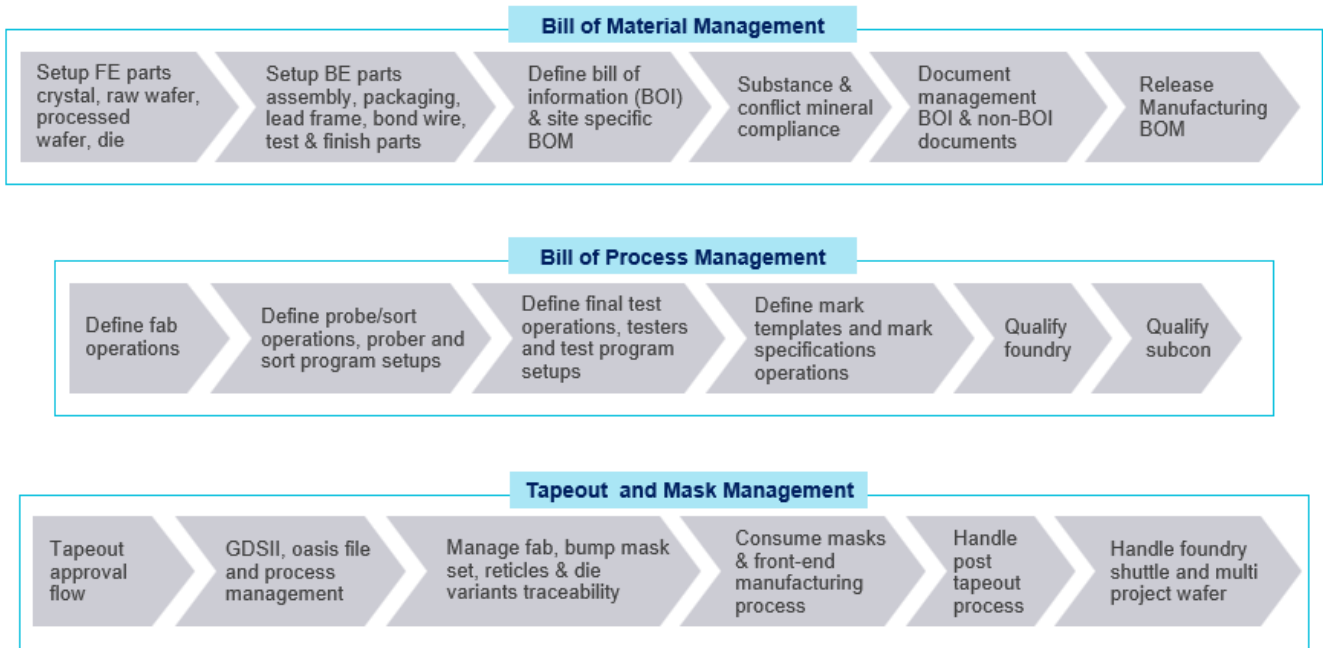
This task should be completed by a user in the **Product Engineer** role using the **Author** workspace.

1. Search for and open an existing die design.
2. In the **Process Design Kits** section, click **Add** ⊕.
3. Search and add the PDKs created and released previously.
4. Click **Add**.

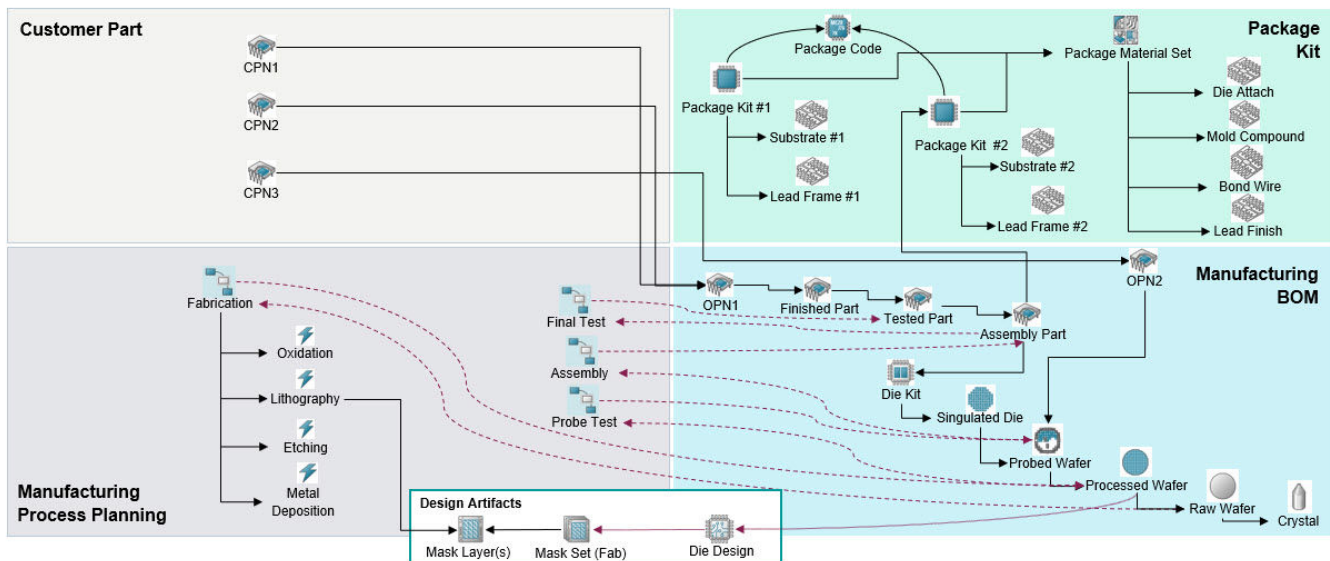
The PDK revision is now associated with the die design.

IC Manufacturing

About IC Manufacturing



The IC manufacturing business objects, manufacturing operations, and data flow are shown in the following graphic:



The silicon crystal is diced into a raw wafer which is then processed by going through the fabrication process: oxidation, lithography using the mask layers generated from the die design GDSII file, etching, and metal deposition. The resulting processed wafer is probed, and then singulated. The good dies are assembled using the correct package kit and package material before the final test and consumption in the electronic module.

IC in PCBA assembly

The Semiconductor Lifecycle Management solution allows for multi-domain design management and its traceability from different CAD design tools to the centralized PLM system. You can create and maintain a harmonized component library in the centralized PLM system, a common bill of material that clearly illustrates the mechanical portion as well as the electronic BOM, the different components of the PCB board, and any software that is part of the final product. The system also helps in handshaking the data between the PCB design and the mechanical CAD design

For example, imagine that an IC component is missing from the PCB design. In this case, the end PCB manufacturer also happens to do the IC design, so the system requests a new part. The librarian makes it available in the PCB design library and component library. Then, the PCB design engineer selects the IC component and places it into the board. Finally, after the data exchange between the mechanical CAD and the electrical CAD, it ends up in the PLM system as complete BOM data with all the design artifacts. The component library can be used for other projects and support multiple design tools that are typically present in a company. This creates one central component library database for the entire enterprise.

If a part is not available in the library, the PCB design engineer requests a new part and associates other documents that help to clarify the part request process. The component in the library is further classified with additional metadata for use in searching and cataloging.

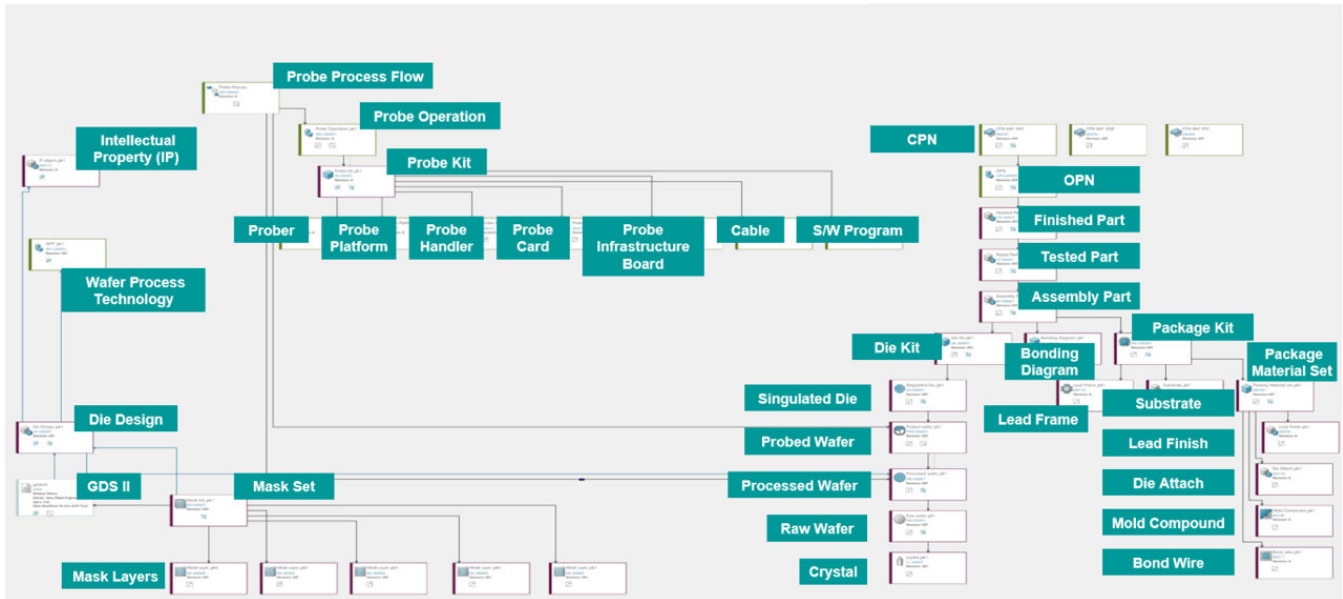
The solution supports additional PCB design collaboration in terms of initiating an ECAD-MCAD collaboration process review of the ECAD changes and exporting the final design into Teamcenter. From a traceability standpoint, once the entire BOM for the PCB assembly is expanded, it includes that IC component and can be expanded further all the way to the crystal level, as well as the IP designs that go into creating that IC object. This is a very powerful mechanism to show the traceability from the component to the final end system. Once the design is finalized between the MCAD and the PCB design, it remains in Teamcenter.

Module traceability

Typically, semiconductor companies struggle building traceability from design to manufacturing. The systems are fragmented, standalone, point, digitized systems, and they often don't associate with each other. In this way, there is failure to achieve the desired state of digitalization.

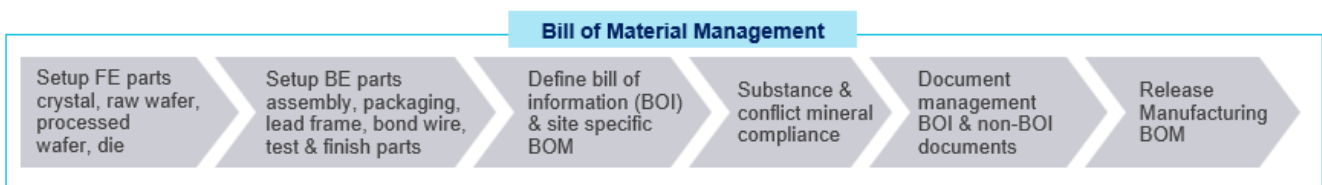
To solve the traceability problem, a digital thread connects everything from requirements to the final finished product via bills of material or the different part types from both engineering and manufacturing. The bill of process, the recipe which stays as a layer on top of the bill of material, and any associated items, such as the intellectual properties used to build the tapeout operations and the checklist that is used to do a tapeout process flow, are also connected. Having the digital thread in place enables traceability of the product from revision to revision, including how it was conceived and

how it was built for a specific revision. This helps in rapid root cause analysis and allows for continuous improvement in both design and manufacturing.



Bill of material management

Semiconductor companies need to manage complex information and collaborate across multiple, globally distributed sites and data silos. The key to success is BOM Management. This module allows for the creation of frontend and backend parts and the population of their attributes. Then the associations are checked to ensure that they are correctly marked and that the lifecycles are properly populated. At the end, the product types from crystal to the final finished product are connected, ensuring traceability at all levels.



The semiconductor industry uses a unique inverted BOM structure. The different part types that make up the BOM — from crystal to raw wafer to processed wafer to probed wafer to singulated die, assembly item, die kit, package kit, tested part, and finished part — are illustrated in the following graphic:

CPN-8AF-A65 >

Revision: Global (Latest Working) | Date: Today | Units: None | Variant: No Variant Rule | Expansion: No Rule

Tree | Add | Edit Structure | Find | Filter | Configure | Expand | Excel Roun... | Edit | ...

Element	ID	Revision	Revision Name
CPN-8AF-A65	AP-111025	001	CPN-8AF-A65
OPN_8AF-A65	AP-111029	001	OPN_8AF-A65
Finished Part	AP-111001	001	Finished Part
Tested Part	AP-111002	001	Tested Part
Assembly Part	AP-111003	001	Assembly Part
4-Lead Chip Scale Package Kit	PKG-111016	A1	4-Lead Chip Scale Package Kit
Substrate	111223	A	Substrate
Lead Frame	111221	A	Lead Frame
Package Material Set	111259	A1	Package Material Set
Lead Finish	111262	A	Lead Finish
Bond Wire	111263	A	Bond Wire
Die Attach	111266	A	Die Attach
Mold Compound	111268	A	Mold Compound
Die Kit	DK-111003	001	Die Kit
Singulated Die 1	SD-111001	001	Singulated Die 1
Probed Wafer	WF-111001	001	Probed Wafer
Processed Wafer	WF-111003	001	Processed Wafer
Raw Wafer	WF-111002	A1	Raw Wafer
Crystal	CL-111001	A1	Crystal
Singulated Die 2	SD-111008	001	Singulated Die 2

CPN-8AF-A65

Overview | Marking | Partners | Classification

▼ Properties

ID: AP-111025
Revision: 001
Name: CPN-8AF-A65
Description: CPN-8AF-A65
Type: Assembly Part Revision
State: Customer
Maturity: Prototype
Packing Materials:
Make/Buy: Make

► More Properties

▼ Package Code

Table | Selection Mode | Select All

Name	ID
C04-06051	111311

▼ Site Qualification

Table | Selection Mode | Select All

Name	ID
------	----

Packaging

In addition to standard packaging types, advanced packaging types such as interposers, interconnects, die bridges, and die spacers are available. When the **Package Type** property on assembly parts, package kits, and die kits is set to **3DIC**, the addition of standard package items is not allowed by the system.

Element	ID	Object Type
Assembly Part	033484	Assembly Part
Die Kit	033488	Die Kit
Die Spacer	033496	Die Spacer
Die Bridge	033500	Die Bridge
Singulated Die	033502	Singulated Die
Interconnect - Ball	033506	Interconnect
Interconnect - Bump	033510	Interconnect
Interconnect - Microbump	033514	Interconnect
Package Kit	033492	Package Kit
Package Material Set	033518	Package Material Set
Assy Mat - Die Attach	033520	Assembly Material
Assy Mat - Bond Wire	033522	Assembly Material
Assy Kit - Substrate	033526	Assembly Kit
Assy Mat - Substrate	033536	Assembly Material
Assy Kit - Interposer	033534	Assembly Kit
Assy Mat - Interposer	033538	Assembly Material
Interposer Assembly	033542	Interposer Assembly
Interconnect - Ball	033550	Interconnect
Assy Mat - Pkg Mech Comp	033552	Assembly Material

Assembly Part					
Owner: Pahal Product (pahal) Last Modified Date: 08					
Overview HARA Analysis Partners Classification					
▼ Properties					
ID:	033484				
Revision:	A				
Name:	Assembly Part				
Description:					
Type:	Assembly Part Revision				
Package Type:	3DIC				
State:	Assembled				
Maturity:	Concept				
Is Lead Free:					
Is RoHS Compliant:					
Make/Buy:	Buy				
► More Properties					
▼ Bonding Diagram					
<input type="checkbox"/> Table <input checked="" type="checkbox"/> Selection Mode <input checked="" type="checkbox"/> Select All					
<table border="1"> <thead> <tr> <th>Name</th> <th>ID</th> </tr> </thead> <tbody> <tr> <td colspan="2"> </td> </tr> </tbody> </table>		Name	ID		
Name	ID				
▼ Site Qualification					
<input type="checkbox"/> Table <input checked="" type="checkbox"/> Selection Mode <input checked="" type="checkbox"/> Select All					

Change process

When a part from the bill of material needs to change, a change process is applied. For example, if the copper wire in a package kit needs to be replaced with gold wire, the change process would include a redlining activity which acts as a markup for the reviewers to see what the change looks like before it is implemented. The reviewers can accept or reject the change. If the change is approved, the implementer can implement it either instantaneously or after the effectivity date is reached.

Substance and conflict mineral compliance management

Whenever BOM parts are created, it is important to track the substances and material compositions of those parts so they can be evaluated against compliance standards at the part and end-product levels. This module allows for tracking of the materials used to compose the BOM and their compliance to different international standards, such as ROHS, REACH, and Green, including testing for any conflict mineral. For example, gold cannot be procured from certain countries. The vendor provides substances and composition information to the semiconductor company, and the compliance module calculates the composition at different rollup levels in the BOM hierarchy, as well as compliance to different international standards.

000161-Bond Wire Vendor Part
 Owner: Angela Material Analyst (angela_ma) | Date Modified: 19-Feb-2021 | Release Status: | Type: Vendor Part

Overview | Partner Contracts | Composition | Compliance | Queries | Smelters | Changes | Attachments | Where Used | Workflow

PROPERTIES

ID: 000161
 Vendor Part Name: Bond Wire Vendor Part
 Description: Desc
 Type: Vendor Part
 Measured Mass: 1.39
 Materials Unit of Measure: Grams
 Vendor: 000145-Vendor

REVISIONS

Selection Mode | Select All

Object	Current Revision	Release Status	Date Modified	Last Modifying User	Checked-Out
000161/A:1-Bond Wire V...	A		19-Feb-2021	Angela Material Analyst [...]	

VENDOR LOCATION

Table

Name	Description	DUNS Number	City	State / Province	Country
------	-------------	-------------	------	------------------	---------

LATEST COMPLIANCE RESULTS

Table | Selection Mode | Select All

Name Of The Regul...	Status	Substance Complian...
RoHS EU:0508	<input checked="" type="checkbox"/> PASS	26-Feb-2021
RoHS China:1407	<input checked="" type="checkbox"/> PASS	19-Feb-2021

COMMERCIAL PARTS

Table | Selection Mode | Select All

ID	Name	Description
111219	Bond Wire	Compliant Bond Wire Co...

Maintain RoHS compliance results to keep compliant bond wires up to date.

You can control the composition of the compliant bond wire for substance compliance.

111278-Bond Wire Vendor Part

Overview Partners Materials Composition Smelters Changes Attachments Where Used Workflow

Owner: Madhav Material (madhav) Date Modified: 15-Mar-2021 Release Status: Type: Vendor Part

Show Bill of Materials Show Bill of Substances

Material	Mass (Grams)	Cumulative %	Substance	CAS	Mass (Grams)	% of Material
111289/A;1-Wire Bond Copper palladium coated (CuPdAu)	1.39	100				
			Copper (Cu)	7440-50-8	1.3608	97.8992
			Gold	7440-57-5	0.0013	0.0935
			Palladium	7440-05-3	0.0279	2.0071

Package design

Standard packaging

Create a package material set

1. Log in as a package engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Manufacturer**.
3. From the home page, click **CREATE IN FOLDER**.
4. Select **Package Material Set** from the **Type** list.
5. Enter information for the **Name** and **Description**.
6. Click **Add**.
7. Open the **Package Material Set** and choose **Content**.
8. Click **Add** ⊕ > **Child**.

The **Add Child** panel appears.

Tip:

Click **Pin Panel** 📌 to keep the **Add** panel open when adding multiple children.

9. Search for and add the **Die Attach** assembly material to the **Package Material Set**. If **Die Attach** does not exist, create a new one.

10. Search for and add the **Bond Wire** assembly material to the **Package Material Set**. If **Bond Wire** does not exist, create a new one.
11. Search for and add the **Mold Compound** assembly material to the **Package Material Set**. If **Mold Compound** does not exist, create a new one.
12. Search for and add the **Lead Finish** assembly material to the **Package Material Set**. If **Lead Finish** does not exist, create a new one.

Create a package kit

1. Log in as a package engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Manufacturer**.
3. From the home page, click **CREATE IN FOLDER**.
4. Select **Package Kit** from the **Type** list, fill in the required fields, and click **Add**.
5. Create a new assembly site if it does not already exist.
6. With the package kit open, click **Add** ⊕ in the **Site Qualification** section to create and associate a qualification.
7. Enter information for the **Name** and **Description** properties, and then click **Add**.
8. Choose **Attachments** and associate the qualification document of this assembly site to the package kit in the **Documents** section.
9. Open the qualification, and from the **Overview**, update the **Maturity** value to show the qualification status.
10. Create a **Package Code** if it does not already exist.
11. Associate the package kit to the appropriate package code by opening the package code and clicking **Add to** ⊕ in the **Package Kit** section.
12. Click **Search** and search for the package kit.
13. Select the newly created **Package Kit**, and click **Add** to add the **Package Kit** to the package code.
14. Open the **Package Kit** and choose **Content**.
15. Search for and add the following assembly materials to the **Package Kit**. If the assembly material does not already exist, create a new one.

- **Lead Frame**
- **Substrate**
- **Package Material Set**

3DIC packaging

Create a 3DIC assembly part

Before creating an advanced packaging structure, a package engineer must create the top-level 3DIC assembly part.

1. From the **Explorer**, select a folder in which to create the new 3DIC assembly part, and choose **More Commands** \dots > **New** \star > **Add** \oplus .
2. Select **Assembly Part** from the **Type** list, enter a **Name**, and select **3DIC** for the **Package Type**.
3. Click **Add**.

The assembly part is created in the selected folder.

Create a 3DIC package kit

As a package engineer, start building the packaging structure by adding a new 3DIC package kit to the assembly part.

1. Open the **Assembly Part** and choose **Content**.
2. With the **Assembly Part** selected, choose **Add** \oplus > **Child**.
3. Select **Package Kit** from the **Type** list and enter a **Name**.

The **Package Type** is automatically set to the **3DIC** type because the parent assembly part is of type **3DIC**.

4. Click **Add**.

The **Package Kit** is created and added to the packaging structure under the parent assembly part.

Create a 3DIC assembly kit and add material

As a package engineer, continue building the packaging structure by adding a new 3DIC assembly kit to the package kit.

1. From **Content**, select the **Package Kit** and choose **Add** \oplus > **Child**.

2. Select **Assembly Kit** from the **Type** list, enter a **Name**, and select an **Assembly Kit Type**.

Available **Assembly Kit Types** include **Substrate**, **Lead Frame**, and **Interposer**.

3. Click **Add**.

The **Assembly Kit** is created and added to the packaging structure under the package kit.

4. Select the new **Assembly Kit** and choose **Add** ⊕ > **Child**.

5. Select **Assembly Material** from the **Type** list and enter a **Name**.

The **Assembly Material Type** is automatically selected based on the **Assembly Kit Type**.

6. Click **Add**.

The **Assembly Material** is created and added to the packaging structure under the parent assembly kit.

7. Add additional assembly kits and materials as needed.

Create a 3DIC package material set and add material

As a package engineer, continue building the packaging structure by adding a new 3DIC package material set to the package kit.

1. From **Content**, select the **Package Kit** and choose **Add** ⊕ > **Child**.

2. Select **Package Material Set** from the **Type** list, enter a **Name**, and click **Add**.

The **Package Material Set** is created and added to the packaging structure under the package kit.

3. From **Content**, select the new **Package Material Set** and choose **Add** ⊕ > **Child**.

4. Select **Assembly Material** from the **Type** list, enter a **Name**, and select an **Assembly Material Type**.

Available **Assembly Material Types** include **Bond Wire**, **Die Attach**, **Lead Frame**, **Mold Compound**, **Substrate**, **Lead Finish**, **Interposer**, and **Package Mechanical Component**.

5. Click **Add**.



The **Assembly Material** is created and added to the packaging structure under the parent assembly kit.

6. Add additional assembly materials as needed.

Update classification properties

If your administrator has activated automatic classification, the **Classification** section will be populated with relevant properties.

As a package engineer, you can update these classification properties.


1. In the package structure, select the new **Assembly Material** and click **Classification**.
2. In the **Properties** section, click **Edit Properties** .
3. Add information to the available property boxes. For example, you may enter a wire material and diameter for a bond wire assembly material.
4. Click **Save** .

The classification properties are updated and the changes are reflected in the **Overview**.

5. Update the classification properties of the other package structure items as needed.

Create a 3DIC die kit


As a design engineer, start building the die structure by adding a new 3DIC die kit to the assembly part.

1. Open the **Assembly Part** and choose **Content**.
2. With the **Assembly Part** selected, choose **Add**  **> Child**.
3. Select **Die Kit** from the **Type** list and enter a **Name**.

The **Package Type** is automatically set to the **3DIC** type because the parent assembly part is of type **3DIC**.

4. Click **Add**.

The **Die Kit** is created and added under the parent assembly part.

5. Select the new **Die Kit** and choose **Add**  **> Child**.
6. Select **Singulated Die** from the **Type** list and enter a **Name**.
7. Click **Add**.

The **Singulated Die** is created and added under the die kit.

8. Update the **Quantity** in the content structure table for each line item as necessary.

9. Continue building the die kit structure by adding items, such as additional die kits, singulated dies, die spacers, and die bridges.

Create additional 3DIC items in package kit

As a package engineer, continue building the packaging structure by adding an interposer assembly to the package kit and an interconnect to a die kit.

1. From **Content**, select the **Package Kit** and choose **Add** ⊕ > **Child**.
2. Select **Interposer Assembly** from the **Type** list, enter a **Name**, and click **Add**.

The **Interposer Assembly** is created and added to the packaging structure under the package kit. This assembly can contain its own sub-package structure and die kit with dies. It can be reused, purchased, and sold as a standalone package.

3. Build the interposer assembly structure by creating new items from the **New** section or by adding existing items from **Palette** or **Search** in the **Add Child** panel.
4. From **Content**, select a **Die Kit** and choose **Add** ⊕ > **Child**.
5. Select **Interconnect** from the **Type** list, enter a **Name**, and select an **Interconnection Type**.

Available **Interconnection Types** include **Ball**, **Bump**, and **Microbump**.

6. Click **Add**.

The **Interconnect** is created and added to the structure under the selected die kit.

7. Update the **Quantity** in the content structure table for each line item as necessary.
8. Add additional interconnects as needed.

Add relevant files

As a package engineer, add relevant files as attachments to the corresponding 3DIC items.

1. In the package structure, select a **Die Kit** and click **Attachments**.
2. In the **Files** section, click **Add** ⊕.
3. Drag and drop or browse to the appropriate file. For example, you may want to attach a **DXF** to the die kit.
4. Click **Add**.

The file is listed in the **Files** section.

5. Attach relevant files to the other 3DIC items in the structure as needed.

Import a structure from Excel




Packaging structures can be created manually, or they can be defined in an Excel file and imported.

1. Prepare the Excel file for importing a structure.
2. Import a structure from Excel.
3. Verify that the structure imported correctly.

Check for substance and conflict mineral compliance




The following tests can be performed if Teamcenter Substance Compliance is set up.

Run compliance check for material against regulation



1. Log in as a material analyst.
2. Search for and open the desired vendor part.
3. Choose **More Commands**  > **Manage**  > **Compliance Check** .
4. Select a regulation from the list and click **Check**.
5. Click **Refresh** after the compliance check finishes.

Compliance results appear in the **Compliance Results** section under **Compliance**.

Run compliance check for BOM



1. Log in as a material analyst.
2. Search for and open a **Package Kit** for compliance checking of the BOM.
3. Choose **More Commands**  > **Manage**  > **Compliance Check** .
4. Select **REACH Candidate EU0117** for the **Regulation** and click **Check**.
5. Click **Refresh** after the compliance check finishes.

Compliance results appear in the **COMPLIANCE RESULTS** section under **Compliance**.

6. Select the **Package Kit** again and choose **More Commands ... > Manage**  **> Compliance Check** .
7. Select **Conflict Minerals US 1405** for the **Regulation** and click **Check**.
8. Click **Refresh** after the compliance check finishes.

Compliance results appear in the **COMPLIANCE RESULTS** section under **Compliance**.

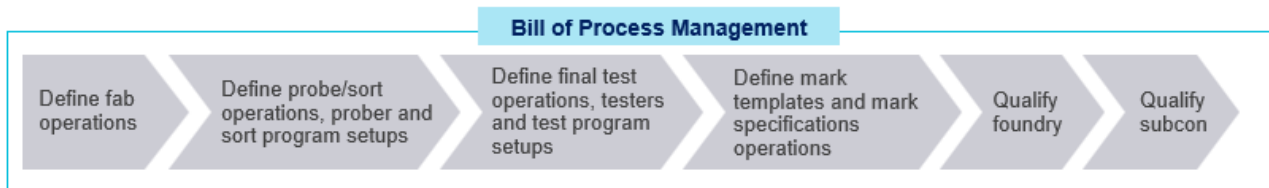
Failed compliance check

1. If a compliance check fails, under **Compliance**, select the row for the failed regulation, for example **Conflict Minerals US:1405**.
2. Choose **More Commands ... > Manage**  **> Apply Exemption** .
3. Select the material **Gold** from the **Substance/Substance** category. Select the conflicting minerals and click **plus (+)**. Then click **Apply**.

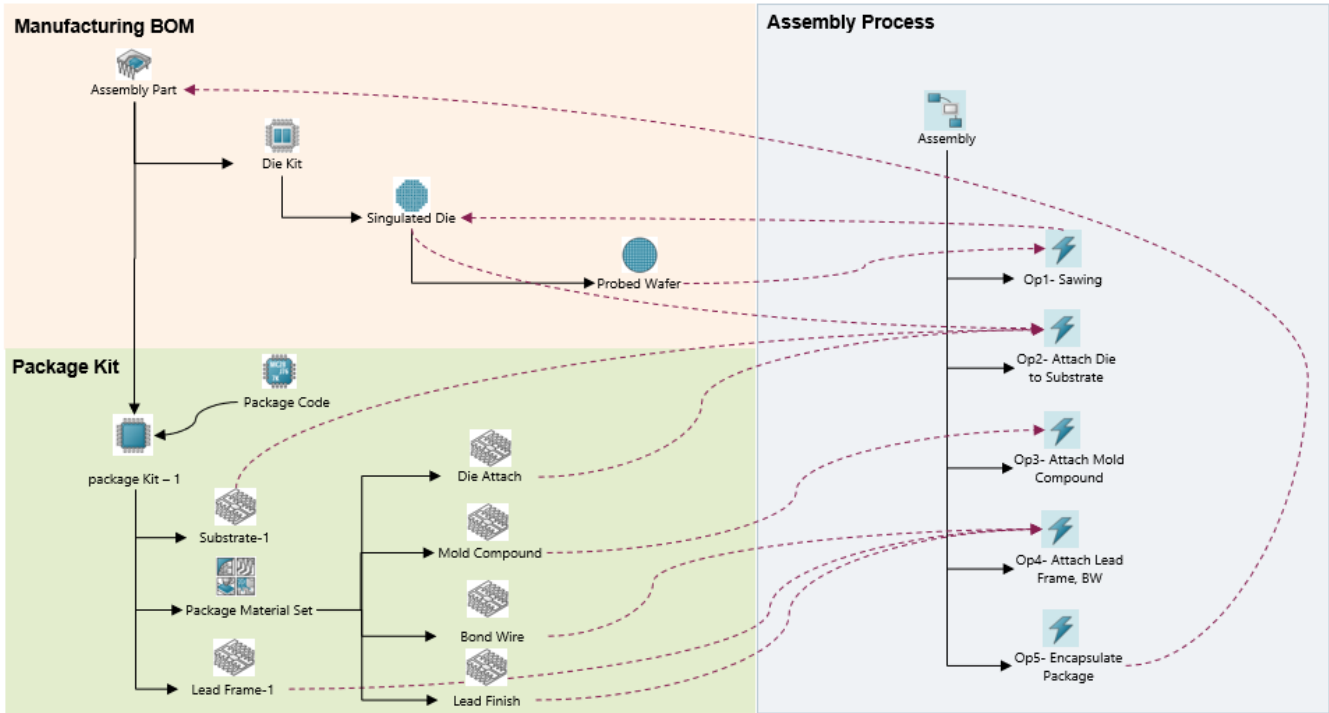
The regulation status changes to **PASS**.

Bill of process management

The bill of process management module helps manage the IC manufacturing process flow.



Using Teamcenter Manufacturing Process Planner (Easy Plan), the system directs the manufacturing team step by step throughout this process. The following graphic illustrates an example of the assembly process:



Process Planning | WP Back-end manufacturing | Finished Part | Back end BOP | Time Unit: second

Show Consumption and Impact State

Product | Latest Working | Plant BOP | Latest Working | Plant | Latest Working

Target Assemblies	Resources	Background Parts
Object		
AP-111001/001;1-Finished Part		
AP-111002/001;1-Tested Part		
AP-111003/001;1-Assembly Part		
PKG-111016/A1;1-4-Lead Chip Scale Package Kit		
DK-111003/001;1-Die Kit		

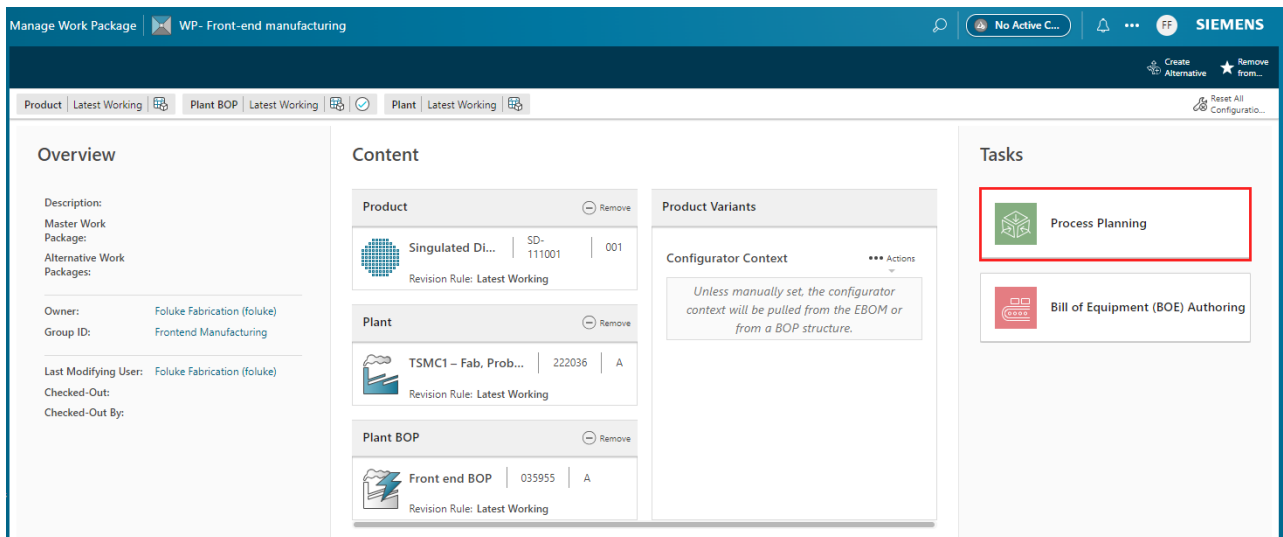
Process
036303/A;1-Back end BOP
036324/A;1-Assembly area
036325/A;1-Assembly station
036327/A;1-Sawing
036329/A;1-Attach die to substrate
036332/A;1-Attach mold compound
036333/A;1-Attach Lead Frame, BW to Su...
036335/A;1-Encapsulate Package
036384/A;1-Test area

Parts (2)	Resources	Work Area	Summary	Files	Documents
Object			Occurrence Type		Occurrei
WF-111001/001;1-Probed Wafer			MEConsumed		
SD-111001/001;1-Singulated Die 1			METarget		

Front-end manufacturing

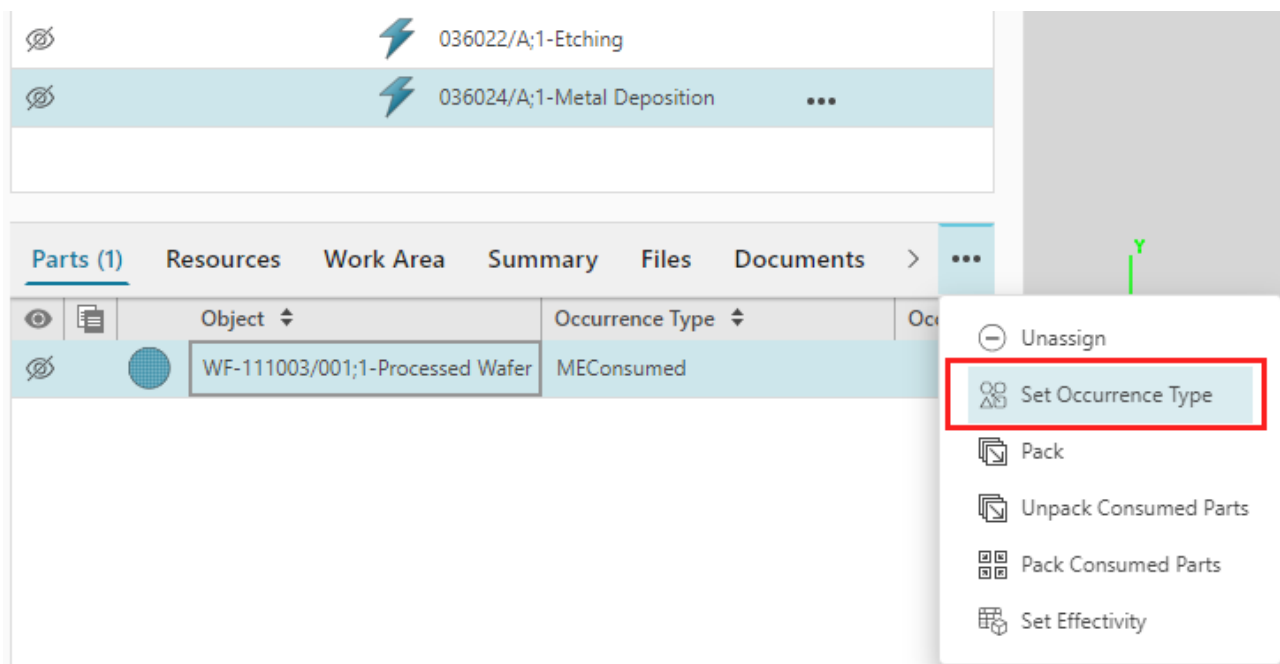
Fabrication

1. Log in as a fabrication engineer.
2. Click the **NEW WORK PACKAGE** tile.
3. Select **MECollaborationContext** for the **Type**.
4. For the **Name**, type **WP- Front-end manufacturing** and click **Create**.
5. In the newly created work package, add an existing singulated die as the **Product**.
6. Add a plant that has bills of resources of mask sets and probe kits that can be used as resources in the manufacturing processes, for example, TSMC1 — Fab, Probe.
7. Create a new plant BOP named **Front end BOP**.
8. Click **Process Planning**.



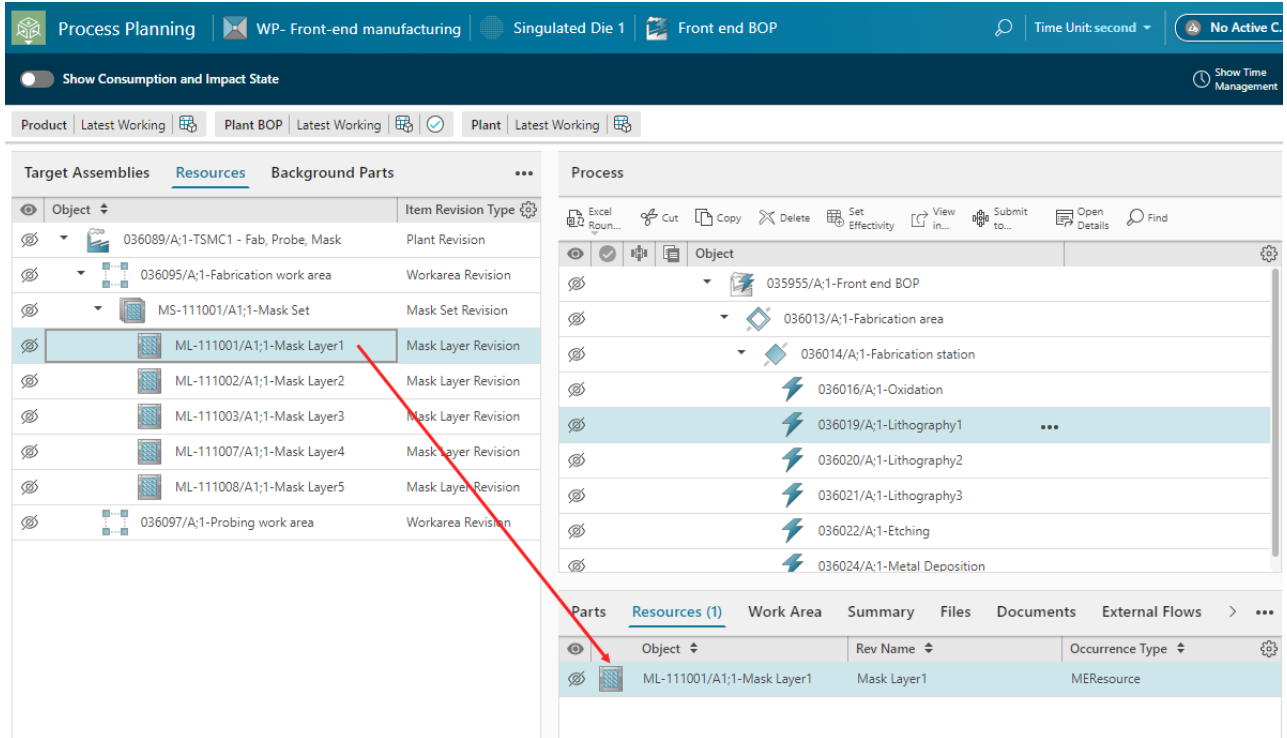
9. Select **Front end BOP** and click **Create** ⊕.
10. Select **Process Area** as the **Type**, enter **Fabrication area** for the **Name** and click **Create**.
11. Select **Fabrication area** and click **Create** ⊕.
12. Select **Process Station** as the **Type**, enter **Fabrication station** for the **Name**, and click **Create**.
13. Select **Fabrication station** and choose **Create** ⊕ > **Create Operation** ⊕.

14. Create the following operations using **Create & Add More**:
 - Oxidation
 - Lithography1
 - Lithography2
 - Lithography3
 - Etching
 - Metal Deposition
15. Select the first operation in the **Process**.
16. Expand the **Singulated Die** in **Target Assemblies**. Drag and drop the **Raw wafer** to add it as a part for the first operation. Validate that the **Occurrence Type** is **MEConsumed**.
17. Drag and drop the **Processed wafer** to add it as a part for the last operation.
18. Select the **Processed wafer** from the **Parts** table, click **...**, and choose **Set Occurrence Type**.



19. Change the occurrence type to **METarget**.
20. Choose **Resources** in the left panel, click **...**, and choose **Add Work Area**. Select a plant with a bill of resources.

21. In the **Process** panel, select an operation, and choose **Resources** below.
22. Set **Mask Layers** as the resource for the operations by dragging and dropping the **Mask Layers** from the plant to the **Resources** in the **Process** panel.



Probe

Create and classify resources

1. Log in as a probe engineer.
2. Create an **Equipment** item.
3. Choose **Classification**, search for and select the appropriate class, and click **Classify**.
4. Create additional **Equipment**, **Resources**, or **Factory Tools** as required.

Create and classify probe kit

1. Log in as a probe engineer.
2. Create a **Test Kit** with a **Kit Type** of **Probe**.
3. Open the test kit, choose **Content**, add the equipment item created in the previous task as a child.

4. Add additional **Equipment**, **Resources**, and **Factory Tools** as needed.

Create probe process flow

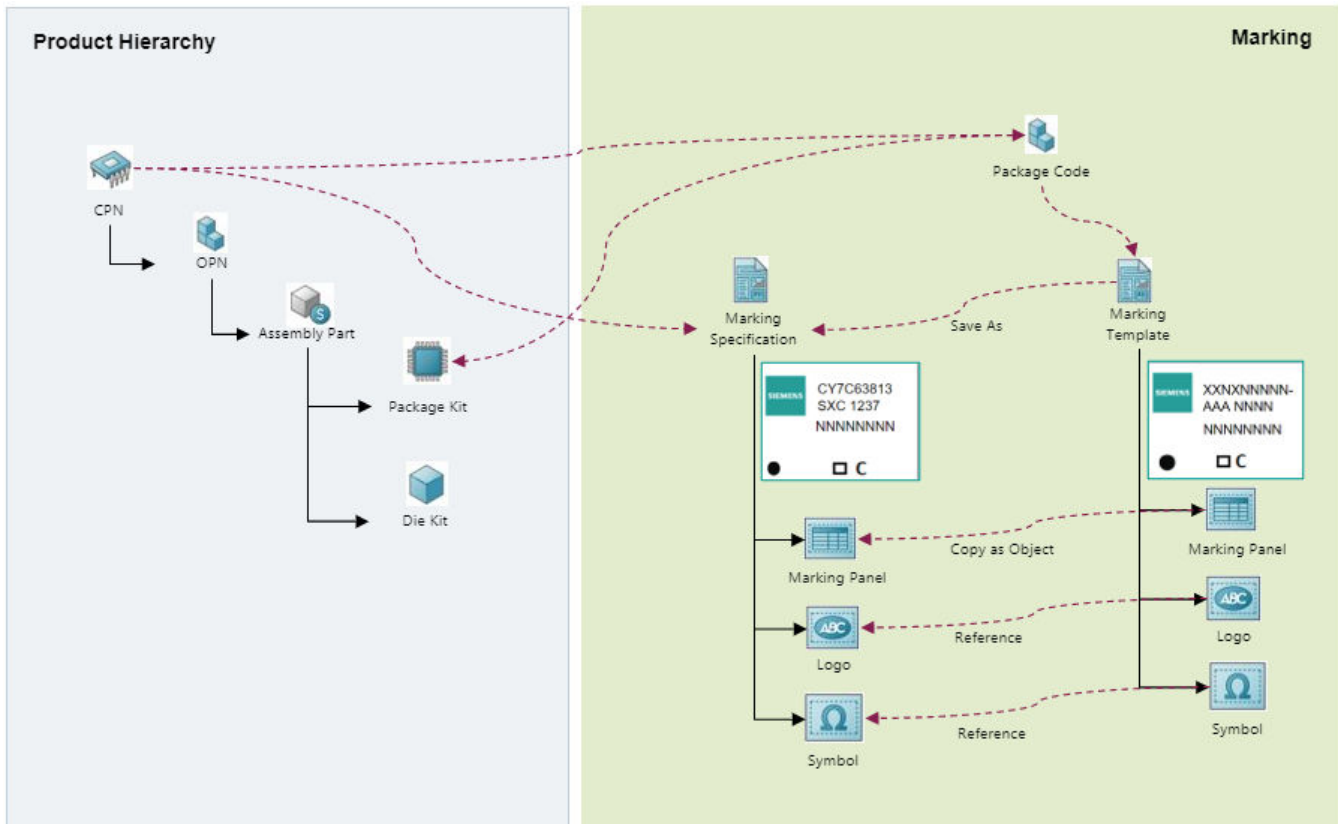
1. Log in as a probe engineer.
2. Search for the existing work package named **WP – Front end manufacturing**.
3. Click **Process Planning**.
4. Select **Front end BOP** in the **Process** and click **Create** ⊕.
5. Select **Process Area** as the **Type** and enter **Probe area** for the **Name**.
6. Select **Probe area** in the **Process** and click **Create** ⊕.
7. Select **Process Station** as the **Type** and enter **Probing station** for the **Name**.
8. Select **Probing station** in the **Process**, click **Create** ⊕ > **Create Operation** ⊕.
9. Enter **Probe Operation** for the **Name** and click **Create**.
10. Select the **Probe Operation** in the **Process**.
11. Expand the **Singulated Die** in the **Target Assemblies**.
12. Drag and drop the **Processed wafer** to add it as a consumed part for the **Probe Operation**. Validate that the **Occurrence Type** is **MEConsumed**.
13. Drag and drop the **Probed wafer** to add it as the target part for the **Probe Operation**.
14. Select the **Probed wafer** from the **Parts** table, click **...**, and choose **Set Occurrence Type**. Set the **Occurrence Type** to **METarget**.
15. In the **Process**, select the **Probe Operation**, and choose **Resources**.
16. Set the **Probe kit** as the resource for the operation by dragging and dropping it to the **Resources** table in the **Process**.

IC marking

Once an IC chip is manufactured, it needs to be marked with information such as the chip ID, the maker of the chip, where the first pin comes from, the lot code, and the expiration date. For companies managing thousands of chips, ensuring that there is an integrated database with a single version of all the marking templates and specifications is a challenge. Many times, marking data is created in Excel spreadsheets and then sent to the OSAT. In this case, the marking data is typically not associated with

the bill of material or bill of process data. Therefore, the OSAT must convert the PDF, Excel, and other formats into a format that the machine can understand. This method can lead to a loss of data during translation or an inaccurate mapping from a marking specification to a product.


The IC marking module simplifies the overall design and execution process of marking data. The system creates unique marking templates at the package code level which shows the signature of the marking for the package family. Using the marking template, a marking specification is then created for each part number. This ensures data integrity is maintained as defined by the marking template guidelines and minimizes errors in creating marking specifications.







Back-end Manufacturing

Define concept MPNs


1. Define the BOM connection by first opening the **OPN** and choosing **Content**.
2. Search for and add a **Finished Part**.
3. Search for and add a **Tested Part** to the **Finished Part** that was just added.
4. Search for and add an **Assembly Part** to the **Tested Part** that was just added.

5. Search for and add a **Die Kit** and one or more **Package Kits** to the **Assembly Part**.
6. Search for and add a **Singulated Die** to the **Die Kit** that was just added.
7. Search for and add a **Probed Wafer** to the **Singulated Die** that was just added.
8. Search for and add a **Processed Wafer** to the **Probed Wafer** that was just added.
9. Search for and add a **Raw Wafer** to the **Processed Wafer** that was just added.
10. Search for and add a **Crystal**.
11. Create a **Bonding Diagram** if none already exists.
12. Go to the assembly part's **Overview**.
13. Click **Add to**  in the **Bonding Diagram** section.
14. Click **Search**, and then find and select the desired bonding diagram from the list.
15. Click **Add** to add the bonding diagram to the assembly part.

Associate OPN to CPN

1. Log in as a product marketing engineer.
2. Search for and open a CPN, and then choose **Content**.
3. Search for and add an OPN under the CPN.
4. Select the CPN and choose **More Commands ...** > **Edit**  > **Start Edit** .
5. Update the **Packing Materials** property with appropriate packing materials.
6. Choose **More Commands ...** > **Edit**  > **Save Edits** .

Associate package code to CPN

1. Search for and open the desired CPN. Choose **Overview** and check if the **Package Code** section is populated.
2. If the **Package Code** section is empty, then complete the following steps:
 - a. Click **Find**  to find an object in context of the structure.

- b. Choose **Package Kit** from the **Keyword** list to find the package kit used in the CPN hierarchy.
- c. Provide input for the search and click **Find**.

The search results show all the package kits used in the CPN.

- d. Select any package kit.

The **Overview** page of the package kit includes a **Package Code** section.

3. Copy the package code, go to the CPN **Overview** page, and add it in the **Package Code** section using **Add** ⊕ and pasting from the clipboard.

Assembly

1. Log in as an assembly engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Manufacturer**.
3. From the home page, click **NEW WORK PACKAGE**.
4. Select **MECollaborationContext** for the **Type**.
5. Enter **WP Back-end manufacturing** for the **Name** and click **Create**.
6. In the new work package, add an existing finished part as the **Product**.
7. Add a plant that has bills of resources of tests kits that can be used as resources in the back-end processes, for example, **TSMC2 – Assembly, Test**.
8. Create a new plant BOP named **Back end BOP**.
9. Click **Process Planning**.
10. Select **Back end BOP** in the **Process** and click **Create** ⊕.
11. Select **Process Area** as the **Type**, enter **Assembly area** for the **Name**, and click **Create**.
12. Select **Assembly area** in the **Process** and click **Create** ⊕.
13. Select **Process Station** as the **Type**, enter **Assembly station** for the **Name**, and click **Create**.
14. Select **Assembly station** in the **Process** and choose **Create** ⊕ > **Create Operation** ⊕.
15. Create the following operations using **Create & Add More**:

- Sawing
 - Attach die to substrate
 - Attach mold compound
 - Attach Lead Frame, BW to Substrate and Die
 - Encapsulate Package
16. Set the **Probed Wafer** as the consumed part and the **Singulated Die** as the target part for the **Sawing** operation.
 17. Set the **Singulated Die** as the consumed part for the **Attach die to substrate** operation.
 18. Search for and add **Substrate** and **Die Attach** as consumed parts for the **Attach die to substrate** operation.
 19. Search for and add **Mold Compound** as the consumed part for the **Attach mold compound** operation.
 20. Search for and add **Lead Frame, Bond Wire,** and **Lead Finish** as consumed parts for the **Attach Lead Frame, BW to Substrate and Die** operation.
 21. Set the **Assembly Part** as the target part for the **Encapsulate Package** operation.

Final test

1. Log in as a test engineer.
2. Search for and open the existing work package named **WP- Back end manufacturing**.
3. Click **Process Planning**.
4. Select **Back end BOP** in the **Process** and click **Create** ⊕.
5. Select **Process Area** as the **Type**, enter **Test area** for the **Name**, and click **Create**.
6. Select **Test area** in the **Process** and click **Create** ⊕.
7. Select **Process Station** as the **Type**, enter **Testing station** for the **Name**, and click **Create**.
8. Select **Testing station** and click **Create** ⊕ > **Create Operation** ⊕.
9. Enter **Test Operation** for the **Name** and click **Create**.




10. Set **Assembly Part** as the consumed part and **Tested Part** as the target part for the operation.
11. Set **Test Kit** as the resource for the **Test Operation** from the plant under **Resources**.

Marking

Create a marking specification

Note:

Ensure that a package code is associated to the CPN. If not, follow the procedures in **Associate package code to CPN**. Also, verify that the CPN has the **Marking template** property set based on the associated package code.

1. Log in as a product marketing engineer.
2. Search for and *select* but do not open the appropriate CPN. Choose **Marking** and locate the **Marking Template** section.
3. Select the marking template and choose **More Commands** **...** > **New**  > **Save As** .
4. Click **New**.
5. Enter a **Name** and **Description** as needed.
6. For the **Design Type**, select **Specification**.
7. Click **Save** to create the marking specification
8. Copy the newly created specification, and return to the CPN.
9. From the CPN's **Marking** page, paste the new specification into the **Marking Specification** section.
10. Only complete this step if the solution sample template and Adobe Illustrator are set up.
 - a. From the marking specification's **Overview**, select **Part number line1** in the **DIGITAL ASSET** section.
 - b. Click **Edit**  > **Edit Panel Content** and fill in the **Value** property, for example, **CY7C63813-**.
 - c. Repeat the previous steps to update another line. An example of second line value is **SXC1237**.
 - d. Select **Part number line1** again and verify the preview section shows the updated value. Then select **Part number line2** to verify the updated value.

11. Only complete this step if the solution sample template and Adobe Illustrator are set up.
 - a. Refresh the marking specification by first opening Adobe Illustrator and searching for the marking specification from embedded Teamcenter.
 - b. Select the marking specification and click **Open > Send to Illustrator** to open the specification in Adobe Illustrator.
 - c. Check that the **Line1** and **Line2** content is refreshed in the specification as it was updated by the marking engineer.
 - d. Click **Save** to save the updated specification into Teamcenter.
 - e. From Teamcenter, choose **Attachments**, and check that the Adobe Illustrator (.ai) and PDF files are associated with the marking specification.
 - f. Choose **Overview**, and check that the marking specification preview appears there.
12. Submit the marking specification to the **Marking Design approval process**, and choose a reviewer to review the marking specification and its content.

Review and approve the marking specification

Review the marking specification content. Log into Teamcenter as a reviewer, and complete the marking specification approval task.

After approval, the marking specification and its content is released. The .ai and .pdf dataset is also released.

Packing/Shipping

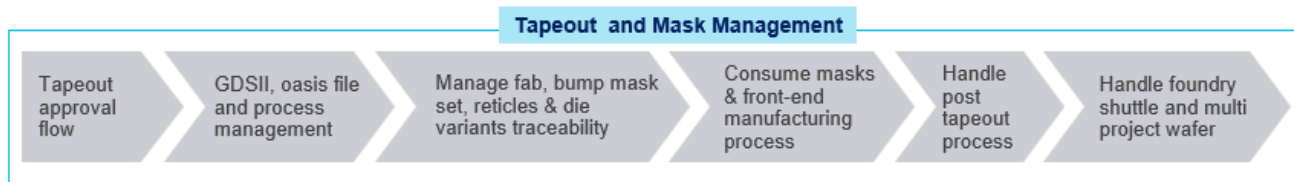
1. Log in as a package engineer.
2. Click the **NEW WORK PACKAGE** tile.
3. Select **MCollaborationContext** for the **Type**.
4. Enter **WP Packing** for the **Name** and click **Create**.
5. In the new work package, add an existing CPN part as the **Product**.
6. Create a new plant or add an existing one.
7. Create a new plant BOP named **Packing BOP**.
8. Click **Process Planning**.

9. Select **Packing BOP** in the **Process** and click **Create** ⊕.
10. Select **Process Area** as the **Type**, enter **Packing area** for the **Name**, and click **Create**.
11. Select **Packing area** in the **Process** and click **Create** ⊕.
12. Select **Process Station** as the **Type**, enter **Packing station** for the **Name**, and click **Create**.
13. Select **Packing station** in the **Process** and click **Create** ⊕ > **Create Operation** ⊕.
14. Enter **Packing operation** for the **Name** and click **Create**.
15. Set **Finished Part** as the consumed part and **OPN** as the target part for the operation.

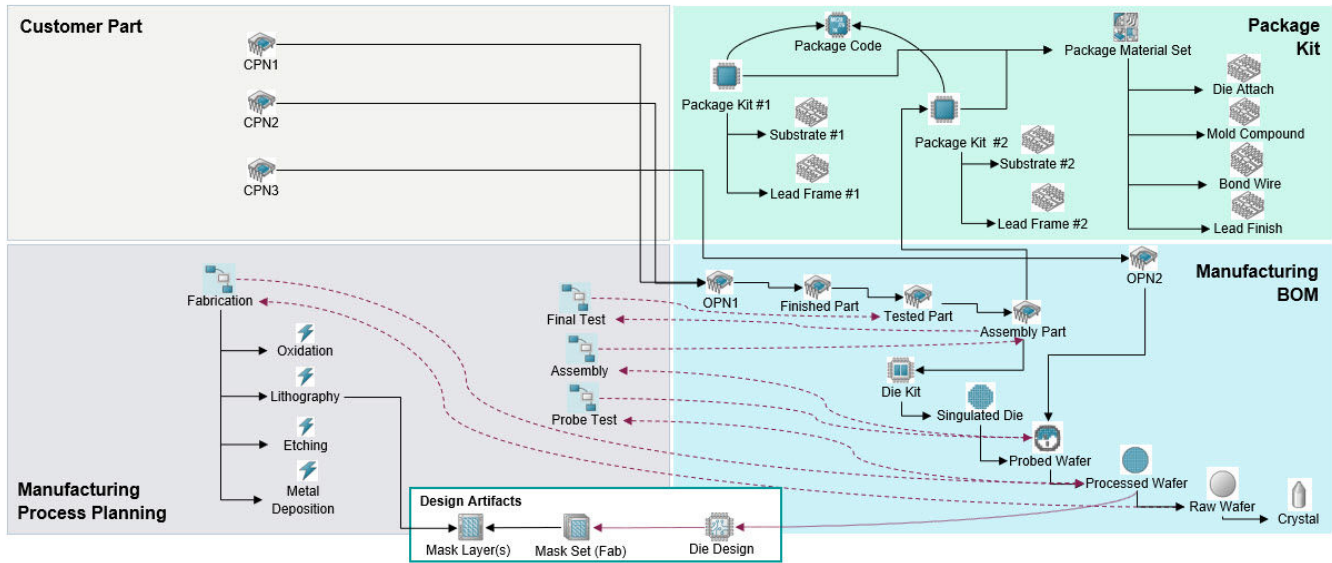
Mask generation

Tapeout and mask management

Tapeout and mask management prevents costly configuration errors and reduces risk by introducing access control and tapeout approval flow.



The following graphic illustrates the tapeout process flow. The GDSII files are used to generate the different mask sets and mask layers.



The WPT and mask set information are linked to and can be accessed from the DDO.

The screenshot shows a software interface with several panels:

- Overview Panel (Left):** Shows properties for 'DD-111001' (SoC Die Design, Revision A1, Maturity: Production).
- Properties Panel (Top Right):** Shows properties for 'WPT-111001/A1;1-WPT-22nm' (Wafer Process Technology Revision, Maturity: Production).
- Site Qualification Table (Middle Right):**

Name	ID	Type	Maturity	Site Qual
Qualification for WPT-22nm	222039	Fabrication Qualification...	Production	222036/...
- Mask Set Panel (Bottom Right):** Shows properties for 'MS-111001' (Mask Set, Revision A1, Maturity: Production) and a list of mask layers: Mask Layer1, Mask Layer2, Mask Layer3, Mask Layer4, Mask Layer5.

Blue arrows indicate the navigation path from the main DDO to the WPT and then to the Mask Set.

Create mask set

1. Log in as a mask engineer.
2. On the global header, click your profile icon, and ensure that the workspace is set to **Designer**.
3. From the home page, click **CREATE IN FOLDER**.
4. Select **Mask Set** from the **Type** list.
5. Enter information for the **Name**, **Description**, and **Maturity** properties.
6. Click **Add**.

The new **Mask Set** is created.

7. Open the mask set, and from the **Overview**, add additional information into the property boxes, such as **Mask Set Type**.

Associate mask set to die design

1. Log in as a product engineer.
2. Search for a die design and open it.
3. Click **Add to** ⊕ above the **Mask Set** table.
4. Click **Search**, search for the desired mask set, and select it.
5. Click **Add**.


The mask set is added to the **Mask Set** table.



Create mask layers

1. Log in as a mask engineer.
2. Open a mask set and choose **Content**.
3. Click **Add** ⊕ > **Child**.

The **Add Child** panel appears.

Tip:

Click **Pin Panel**  to keep the **Add** panel open when creating multiple layers.

4. Enter information for the following properties as appropriate:
 - **Name**
 - **Description**
 - **Maturity**
5. Click **Add**.
6. Repeat the previous steps to create and add multiple mask layers to the mask set.
7. Select the mask set and choose **More Commands ...** > **Manage**  > **Submit to Workflow** .
8. Select **Mask Set Release Process** as the template and then click **Submit**.
 This step initiates the **Mask Set Release Process**.
9. Go to the **Inbox** and select reviewers for the mask set approval.
10. Click **Complete**.

The mask set now goes to the selected reviewers for approval.

Mask set and mask layers review

1. Log in as a reviewer.
2. Go to the **Inbox** and select the **perform-signoffs** task.
3. Follow the task instructions.
4. Select **Approve** or **Reject** as appropriate and signoff on the task.

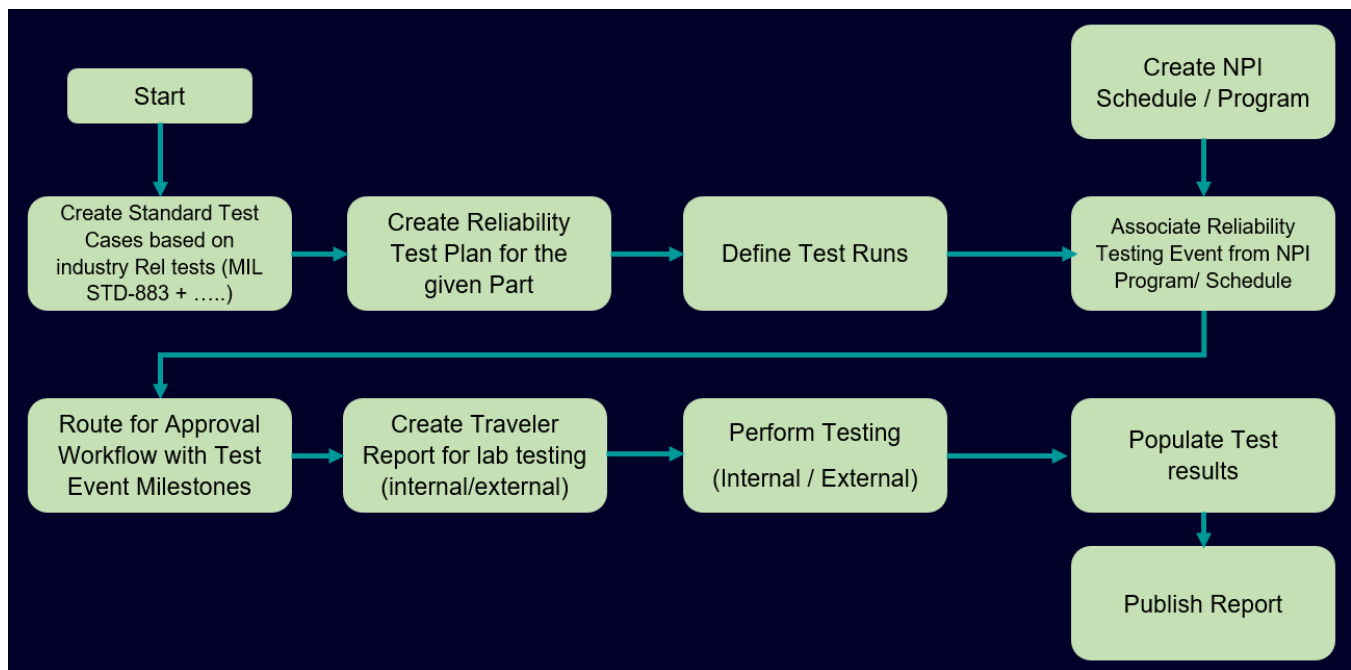
If approved, then the mask set is released.

Reliability testing

About reliability testing



Reliability testing in the context of semiconductors involves assessing the stability and performance of semiconductor devices over time, particularly under various stress conditions. The goal is to ensure that the semiconductor components can consistently meet specified performance criteria throughout their expected lifespan. This is accomplished by streamlining New Product Introduction scheduling with visibility into reliability testing schedules, managing reliability test findings, and sharing the traveler report with the testing teams.



The following are some examples of the various types of testing:

- Temperature Testing
 - High and low temperature tests simulate real-world conditions.
 - Evaluate performance under heat stress and cold environments.
- Voltage and Stress Testing



- Assess semiconductor robustness under different voltage levels.
- Identify issues related to overvoltage or undervoltage conditions.
- Humidity and Moisture Testing
 - Expose devices to high humidity or moisture levels.
 - Evaluate resistance to environmental conditions.
- Thermal Cycling
 - Subject devices to repeated temperature changes.
 - Evaluate ability to withstand thermal stress without degradation.
- Mechanical Stress Testing
 - Apply vibration or mechanical shock.
 - Assess durability and resistance to physical damage.
- Simulated Aging Testing
 - Simulate aging process over an accelerated timeframe.
 - Predict device performance over an extended period.
- Bias Temperature Instability (BTI) Testing
 - Assess impact of bias and temperature on device reliability.
 - Examine how these factors affect device performance over time.
- Burn-In Testing
 - Testing for extended period/cycles under stressful conditions.
 - Assess reliability under severe working conditions.

Create and release a parameter definition

A parameter definition is what is being measured in a test case. The parameters used in a test case are based on the parameter definition. For example, temperature is a parameter definition, and a test case

can have parameters of temperature after one hour, temperature after two hours, and temperature after three hours.

This task should be completed by a user in the **Reliability Manager** role.

1. From the **Explorer**, select a folder in which to create the new parameter definition and click **Add**.
2. Select **Parameter Definition** for the **Type** and enter a **Name**.
3. Select **Reliability** for the **Application** and **Double** for the **Data Type**.
4. Click **Add**.
5. Select the new parameter definition and choose **More Commands ...** > **Manage**  > **Submit to Workflow** .
6. Select the **TCM Release Process** template and click **Submit**.


Build a test case library

Although a new test case can be created at the time it is being added to a qualification plan, it is useful to have a library of test cases already defined. These existing test cases can be reused by being added to multiple qualification plans as needed.

The following tasks should be completed by a user in the **Reliability Manager** role.

Create a test case


A test case is a set of actions performed on a system to determine if it functions correctly over time.

1. From the **Explorer** page, select a folder in which to create the new test case and click **Add** .
2. Select **Test Case** for the **Type**, enter a **Name**, select a **Test Type** from the list, and enter the relevant **Compliance Standards**.
3. Click **Add**.

Add test case details





Details such as a test case's purpose, steps, and conditions must be defined.

1. Open the new test case.
2. Choose **Documentation**, click **Edit** , and enter details for the test case.

- When finished, click **Save Edits** .

Define test case parameters

Variables can be captured as parameters that can then be used in multiple executions of the same test case.

- From the **Details** sticky tab, choose **Parameters**.
- Above the **Parameters** table, choose **Table Settings**  > **Arrange** .
- Click **Column Arrangements**  and select **Reliability** to display the columns relevant to reliability testing in the table.
- To add a parameter, click **Add**  above the parameter table.
- Enter a **Name**, select **Reliability** for the **Application**, and select a **Parameter Definition**.
- Continue entering details for the **Goal**, **Min**, **Max**, **Lot Size**, and **Sample Size**.
- Click **Add**.

Note:

Create one parameter for each readout point.

A single test case has been created and defined with procedure details and parameters. Continue creating test cases in this way to build your test case library.


Add a test qualification plan

A test qualification plan is used to group test cases that are run to determine if a CPN meets or exceeds the reliability and quality requirements of its intended application.

The following tasks should be completed by a user in the **Reliability Manager** role.


Create a CPN (assembly part)

Find and open an existing CPN to add a test qualification plan to it. If the CPN doesn't exist, create a new one using the following steps:


- From the **Explorer** page, select a folder in which to create the new CPN and click **Add** .
- Select **Assembly Part** for the **Type**, enter a **Name**, **State**, and other necessary information.

3. Click **Add**.

Create a qualification plan for the CPN

1. Select the new CPN.
2. From the **Overview**, in the **Test Qualification Plan** section, click **Add** .
3. Select **Test Qualification Plan** for the **Type**, enter a **Name**, **Market Type**, **Test Location**, and other necessary information.
4. Click **Add**.

Add test cases to the qualification plan




1. Open the new test qualification plan from the **Test Qualification Plan** table.
2. From the **Structure**, click **Add**  **> Child**.
3. Click **Palette** and add test cases that have been created as part of the test case library.

Note:

If the required test case is not found in the test case library, a new test case specific to the qualification plan can be created from the **New** tab of the **Add Child** panel.

4. Click **Add**.

Submit qualification plan for review

1. Select the test qualification plan and choose **More Commands**  **> Manage**  **> Submit to Workflow** .
2. Select **Reliability Plan Review Process** for the **Template** and click **Submit**.
3. Click **Workflow** and complete the task.

Next, the test qualification plan goes to the **Team** inbox for review. Anyone in the **Reliability Manager** role can review and approve the plan.

Generate Reliability Travelers report

The area of an allocated block is entered by the user.

This task should be completed by a user in the **Reliability Manager** role.

1. Open the qualification plan and choose **More Commands ...** > **New** ✨ > **Generate Report** 📄.
2. Select the **Reliability Traveler Report** and click **Generate**.
3. From the **Details** sticky tab, choose **Reports**.

Create a test package

A **Test** package is used to record test results.

This task should be completed by a user in the **Reliability Manager** role.

1. Open the test qualification plan.
2. In the structure, select the reliability test plan in the top row and choose **More Commands ...** > **New** ✨ > **Create Test** 📄.
3. Select **Test** for the **Type**.
4. Enter a **Name**, select an **Inclusion Rule (TestCaseCoverage)** from the list, and click **Create**.

Note:

If the **Test** doesn't open automatically, you can open it from the **Test Results**.

Import test results





Test results can be manually entered directly in Teamcenter or imported from an Excel file containing the data.

This task should be completed by a user in the **Reliability Manager** role.

1. Open the **Test** package.
2. Above the **Parameters** table, choose **Table Settings** ⚙️ > **Arrange** 📄.
3. Click **Column Arrangements** 📄 and select **Reliability** to display the columns relevant to reliability testing in the table.
4. To manually input the data, in the **Parameters** table, double-click a cell to enter a value.

Example:

Enter a value for the **Measurement** column, and the result of either **Pass** or **Fail** is automatically determined using the **Goal**, **Min**, and **Max** values.



5. To enter a measurement result using Excel, select the relevant parameters and click **Excel Round-trip**  > **Export To Excel** .
6. Ensure that the **Parameter_template** is selected and click **Export**.
7. In the exported Excel file, create a new sheet for each parameter, and enter the corresponding data.
8. Use a hyperlink to link each sheet to the result sheet.
9. Save the Excel file.
10. In Teamcenter, from the **Parameters** table, click **Excel Round-trip**  > **Import From Excel** .
11. Navigate to the Excel file containing the results and click **Import**.

The results are calculated using the imported values.

Generate Reliability Test Execution Report

The area of an allocated block is entered by the user.

This task should be completed by a user in the **Reliability Manager** role.

1. Select the **Test** package and choose **More Commands ...** > **New**  > **Generate Report** .
2. Select **Reliability Test Execution Report** and click **Generate**.

Relate reliability execution schedule to overall NPI









1. Find and open an existing NPI program or create a new one, adding projects, events, and deliverables as needed.

This task should be completed by a user in the **Reliability Manager** role.

Note:

More detailed information about program, projects, events and schedules can be found in the *Program Planning* documentation.

2. From the **Home** page, click **Schedules**.

3. Choose **More Commands**  > **New**  > **Create Schedule** .
4. Enter a **Name** or other necessary information and click **Add**.
5. Copy the new schedule to the clipboard.
6. Open the program once again, and click **Layout Choice**  > **Top Bottom**  to display the bottom pane.
7. Choose **Schedules**.
8. Click **Add Schedule** .
9. From the **Palette**, select the schedule from the **Clipboard** section and click **Add**.
10. Click **Schedule Milestones**  > **Show** to display milestones from the reliability schedule on the NPI program timeline.
11. Click **Dependency**  to show event dependencies.
12. Create a dependency between the reliability testing schedule milestone and the NPI program event by dragging the milestone to the event.

With this dependency, the system won't allow the reliability schedule execution to go beyond the overall program events.