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| GENUS innovation limited |
| Design Procedure |
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| **Genus** |
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| This procedure details the activities involved in designing the product against a set of requirements given by the customer. |

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# Overview

This procedure details the activities involved in designing the product against a set of requirements given by the customer.

# Objective

To arrive at the most appropriate and optimal solution for subsequent implementation to fulfill a given set of requirements and give the development team a detailed guidance of the architecture of the product.

# Scope

This procedure applies to all Development Projects.

# Inputs

* Functional Specifications
* Change Requests

# Entry Criteria/Triggers

* Intimation of the Approved Project Plan to Design Team
* The practitioners have undergone QMS trainings with focus on performing their processes.

# Tasks

| **Sr.No** | **Task** | **Owner/Role** |
| --- | --- | --- |
|  | **Prepare Design** |  |
|  | Understand requirements and prepare “Design Documents”. Use “Hardware Design Template” (TMPL\_HDWDSN), “Firmware Design Template” (TMPL\_FRWDSN ) and “Mechanical Design Template” (TMPL\_MCHDSN). Discuss the design parameters within the Design team for seeking their inputs. This might generally be done in the form of a Design Meeting, involving all relevant technical team members.  The selection of the design elements is a tailorable option. The project must consider adding and/or eliminating some of the below based on the project requirements, after due approvals are received from the PEG. For details, refer “Tailoring Guidelines”(GDLN\_TAILOR). | Individual Design Teams corresponding to each functional area |
|  | Split each major functional area into modules. (Refer guidelines below.) Perform the Detailed functional decomposition of the module with respect to requirements into submodules. Arrive at detailed definitions of functionality for the same.  Design each of the product components using appropriate techniques. (Refer guidelines below.)  Identify and specify the components (circuits, functions, conceptual sketches etc.) used for implementation of the identified modules. Assign Unique identifier to each Module. |  |
|  | Identify and specify design considerations and constraints (Refer guidelines below), if any. |  |
|  | Identify and specify external interfaces and internal dependenices (Refer guidelines below) if any. |  |
|  | Specify each functional areas implementation environment (Refer guidelines below) as mentioned in the Functional Specification and agreed at the time of sign off. |  |
|  | Refer “Master Lists of Libraries”. Use “Firmware Master Library” (MSTL\_FRWLIB), “Hardware Master Library” (MSTL\_HDWLIB) and “Mechanical Master Library” (MSTL\_MCHLIB) for reuse analysis. Consider whether the module under consideration can be implemented afresh, reused from a similar/same implementation in an earlier project, or procured off-the-shelf. The key considerations must be ease of implementation, cost, licensing, schedule constraints or any other relevant factors. |  |
|  | Identify, evaluate and select alternative solutions for important design decisions. Use best practices to resolve the same. For e.g. DAR, Refer “Decision Analysis and Resolution Procedure” (PRCD\_DARPRC). The rationale and plan for the DAR must be specified in the DAR plan section of the Project Plan. Use “DAR Template” (TMPL\_DARGEN) for the same. | Individual Design Teams corresponding to each functional area |
|  | Update “Requirement Traceability Table” (TMPL\_REQTRT) for traceability between requirements and detailed product decomposition.  This might generally be done in the form of a Design Meeting, involving all relevant technical team members. | Design Team/s |
|  | Identify Interfaces, Describe the Interfaces in detail and specify their types using “Inerface Control and Integration Design Document” (TMPL\_INTDSN).  This might generally be done in the form of a Design Meeting, involving all relevant technical team members. | Design Team/s |
|  | Determine intergration sequence, list of modules to be integrated, integration method, intergration environment and integration criteria using “Inerface Control and Integration Design Document” (TMPL\_INTDSN). Also refer “Design Implementation and Module Integration procedure” (PRCD\_IMPINT).  This might generally be done in the form of a Design Meeting, involving all relevant technical team members. | Design Team/s |
|  | Start to develop Product support documentation and User Manual. | Design Team/s |
|  | Develop Integration Test Cases using “Integration Test Case” Template (TMPL\_INTCAS).   * Test conditions. * Intended environment and the tools required.   Interfaces required for testing. | Design Team/s |
|  | Update “Requirement Traceability Table” (TMPL\_REQTRT) for traceability between requirements and integration test cases.  This might generally be done in the form of a Design Meeting, involving all relevant technical team members. | Design Team/s |
|  | Review Design documents, Interface Control and Integration Design Document, Product support documents and User Manual. Use “Checklist for Hardware Design Review” (CHKL\_HDWRVW), “Checklist for Firmware Design Review” (CHKL\_CODRVW), “Checklist for Mechanical Design Review” (CHKL\_MCHRVW). | Reviewer |
|  | Log the findings in “Review and Testing Defects Log”. | Reviewer |
|  | Close the identified defects. | Design Team/s |
|  | Approve the Design documents. | Project Manager |
|  | Baseline the Design documents. | Design Team/s |
|  | **Allocation of Tasks for Implementation** |  |
|  | Allocate the respective tasks to the individual technical members for development.  Inform the technical members about their responsibilities.  The Project Manager subsequently updates the Project Plan. | Design Team/s, Project Manager |

\* Improvements/Suggestions are solicited on “Process Improvement Proposals Database”.  
\*For details on the Roles and Responsibilities of the practitioners, Refer "Roles and Responsibility" document in the QMS.

# Verification

* Peer Review of Design Outputs.
* Review of the process and its work products by PPQA members.
* Review of the process and its work products by Senior Management.

# Guidelines

## For Firmware:

* Determine and specify individual modules using architectural flow diagram, flowcharts, algorithms.
* Select suitable Data types and scopes for variables.
* Determine data flow between modules which may include decision making logics.
* Consider reentrancy, worst case and best case timings, side effects and processor loading for desiging ISRs.
* Use Error handling and correction techniques for e.g. CRC, LRC, checksum in communication modules.
* Determine development environment for e.g. IDE, Compiler, Configuration management tools, Emulators & Simulators, Verification tools, Programmers etc.
* Determine the internal dependencies on other peripheral modules and external dependencies on hardware design.
* Below are selection guidelines for MCU :



## For Hardware:

* Split modules using functional block diagrams and concept diagrams.
* Design each of the product components using appropriate techniques, which may include
  + Design on Paper
  + Pspice/Multisim Simulation
* Choose components with considerations of proper rating, package, market availability, longetivity etc.
* Identify internal dependencies using:
  + Another Modules Design
  + Firmware Design
  + Mechanical Design
* Identify external dependencies using:
  + Another Modules Design
  + Firmware Design
  + Mechanical Design
  + User interfaces
* Identify and specify development environment.
* Make schematic and BOM using “Schematic Tempelate” (TMPL\_SCHMTC) and “BOM Template” (TMPL\_PRDBOM)
* Perform failure mode analysis on each step for each product component during design.
* Below are selection guidelines of some critical components :





## For Mechanical:

* Modules can split by functional block diagram and concept diagram.
* Design each of the product components using appropriate techniques, which may include
  + Design on Paper
  + Module Prototyping
* Choose components/methods with considerations of proper rating, market availability and manufacturibility
* Internal dependencies can be identify by :
  + Another Modules Design
  + Hardware Design
* External interfaces can be identify by :
  + Another Modules Design
  + Hardware Design
  + User interfaces
* Identify and specify the implementation environment.
* Made mechanical drawings and BOM using “Mechanical Drawing Tempelate” (TMPL\_MCHDRG) and “BOM Template” (TMPL\_PRDBOM)
* Faliure mode analysis on each steps for each product components during design.
* Below are selection guidelines of critical components :



## Technical Data Package (TDP):

TDP is the complete design documentation for a product or product component and the additional information needed to support its effective use. TDP is maintained throughout the life of the product. It includes:

* Requirement Documents (Customer requirements, Functional specifications, Requirement Traceability Table)
* Planning Data (Project Plan, Risk Plan, Estimates, Schedule etc.)
* Design Documents
* Source Codes, Schematics, BOMs, Mechanical drawings, PCB layouts
* Test Cases, Test Plans
* Metrics Reports

## Configuration :

* Refer "Configuration Management and Release Procedure" (PRCD\_CONFIG) for Access Rights, location of work products, naming convention and types of controls.

# Applicable Measurements

* Number of defects identified in Design.

# Exit Criteria/Outputs

* Approved and Baselined Design (Firmware Design, Hardware Design, Mechanical Design, Interface Control and Integration Design Document, Schematic, BOM, Drawings, Conceptual sketches, Integration Test Cases)
* Updated Requirement Traceability Table.
* Identified resources assigned for Functional Modules.