# MTSI Product Development Tasks

Micro Technology Services, Inc. has used these steps in thousands of designs ranging from simple PCB layouts to multimillion dollar seismic systems, the world’s largest camera, thermal and fused night vision, torpedoes, video projectors, space systems, and consumer products.

## Product Definition

Product Definition sets the direction for the whole development program. In this phase, a cross functional team including New Product Planning, Marketing, Applications, and Engineering works together to understand customer needs, market positioning, and technical limits.

The team's goal is to produce an approved Product Brief. This document captures product goals, target specifications, competitive context, and key assumptions. Without a solid Product Brief, later design and engineering decisions have no stable foundation. That makes this phase critical to program success.

## Design Specification

The Design Specification takes the high-level Product Brief and turns it into a detailed technical document. This document guides all later design and validation work.

It defines mechanical form factors, electrical performance, software interfaces, and operational requirements in enough detail for all engineering teams to work in parallel. A formal review meeting is held with representatives from Applications, Marketing, Design, Mechanical, Software, Product, and Test Engineering to check completeness and alignment before approval.

The approved specification becomes the baseline for the product. Any scope changes after this point must go through a controlled change process to protect schedule and cost.

## Hardware Design

Hardware Design covers schematic capture, part selection, signal integrity analysis, and design for test planning. Together, these activities turn the approved specification into a detailed electronic design ready for prototyping.

The phase begins with a design review focused on timing closure, technical risk, and resource needs. Key activities include power budget analysis, interface definition, worst case timing and loading analysis, and thermal assessment.

The phase ends when all prototype documentation schematics, netlists, and supporting analyses are complete and ready for fabrication.

## Fabrication/Debug

The Prototype phase builds a fast, reworkable physical version of the design before committing to PCB tooling. This allows early functional and timing checks at lower cost and risk.

Technicians build a breadboard assembly from the approved schematics. The design team then debugs it directly to fix logic errors, timing violations, and integration issues. This phase is a valuable chance to confirm critical interfaces and catch design flaws that are cheap to fix now but costly after PCB fabrication.

The phase is complete when full functionality is confirmed and all key timing paths are verified against the specification.

## Data Sheet Draft

The first Data Sheet Draft creates technical description of the product. It covers key electrical characteristics, pin descriptions, functional block diagrams, and application information in a format suitable for customer review.

This early draft, produced without final illustrations, gives the Applications group the content they need to begin developing application notes, customer presentations, and preliminary user guidance. It also helps expose specification gaps or inconsistencies early before they become field issues.

The draft is complete when it has been formally given to the Applications group for technical review.

## Operations Manual Draft

The Operations Manual Draft provides the user level documentation needed to configure, run, and troubleshoot the product. Like the data sheet, this early draft is produced without final illustrations and is sent to the publication team so editing, formatting, and illustration work can run in parallel with final hardware development.

The manual should cover installation, operating modes, interface descriptions, performance specifications, and diagnostic guidance. Submitting it early also gives technical writers and applications engineers a chance to find areas where the design or user interface could be simplified before production release.

### PCB Design and Layout

PCB Design and Layout convert the verified schematic into a manufacturable printed circuit board. Electrical engineering and PCB layout teams work closely together to meet signal integrity, power distribution, thermal, and mechanical requirements at the same time.

Layout work includes part placement, controlled impedance routing, power and ground plane definition, differential pair matching, test point placement, and design rule check (DRC) compliance. Fabrication and assembly design rules such as minimum trace widths, via structures, solder mask requirements, and panelization constraints must all be met to ensure a high yield manufacturing process.

The phase is complete when a fully verified check print confirming netlist correctness and physical compliance has been delivered and approved.

## Purchase Prototype PCB

This phase converts the verified layout data into a physical board by placing an order with a qualified PCB fabrication vendor. The purchase order includes a complete fabrication package: Gerber files, drill data, impedance specifications, laminate and layer stack details, and any special process notes such as controlled depth drilling or surface finish requirements.

Vendor selection should consider prototype turn time, technology capability, and quality history. Defects in early builds can significantly delay the debug schedule. The phase is complete when the prototype PCBs are physically received and inspected for dimensional and workmanship compliance before being released to assembly.

## Fabrication/Debug Prototype PCB

The Prototype PCB Fabrication and Debug phase is the first time the design runs on production intent circuit boards. This makes it a key risk reduction milestone for the program.

The process starts with controlled assembly of the first board including part placement, soldering, and incoming inspection followed by systematic power up, functional testing, and debug under engineering supervision. Findings from this phase directly drive any needed schematic or layout corrections, part substitutions, or firmware updates before the design is declared stable.

The phase is complete when at least one board has been fully assembled, powered up, and evaluated to confirm the design is fundamentally sound and ready for pilot production.

## Fabrication/Test Pilot Units

The Pilot Unit build is a small volume production run of at least five units. It confirms both the design and the manufacturing process under near production conditions.

Unlike the first prototype build, pilot units are assembled using production intent processes, tooling, and procedures. This gives an early read on assembly yield, test coverage, and any workmanship sensitive design features. Each unit is evaluated to confirm specification compliance and unit to unit consistency.

Results from the pilot build feed directly into production documentation refinement, test program development, and any final engineering changes needed before full production release.

## Production Documentation

Production Documentation is the formal set of controlled engineering documents that defines everything needed for repeatable, high-quality manufacturing. The package includes fabrication drawings, assembly drawings, parts lists, and operation manuals. All documents must be reviewed, approved, and placed under document control before production can begin.

The accuracy and completeness of this package directly affect manufacturing yield, procurement efficiency, and the ability to produce a consistent product throughout its lifecycle. Documentation approval is a mandatory gate for Engineering Release. Any later changes must go through the formal Engineering Change Notice (ECN) system to keep traceability and production integrity.

## Parts List

The finalized Parts List is a structured, controlled document that lists every part needed to build the product. It is the authoritative source for procurement, production planning, and inventory management.

Each entry follows the company standards and includes shipping, packaging, and procurement information such as approved vendor lists, manufacturer part numbers, lead times, and minimum order quantities needed for both prototype and production builds. A correct parts list is essential for avoiding supply chain disruptions, managing cost, and ensuring substitutions are properly qualified and documented.

Submitting the finalized parts list kicks off the procurement activities needed to support the production schedule.

## Order Long Lead Parts

Ordering long lead components early prevents them from delaying production. A cross functional review involving the Production Planner, Raw Materials Controller, Buying Agent, and optionally the Design Engineer and Product Engineering Manager names all components with extended delivery times. These typically include active ICs, custom magnetics, specialty connectors, or sole sourced devices.

The review confirms quantities and specifications before orders are placed. Ordering early reduces the risk of schedule delays due to part availability and provides time to qualify alternate sources if a preferred vendor cannot meet requirements.

The phase is complete when purchase orders have been placed for all long-leaded items.

## Order Production Parts

Ordering Production Parts ensures all components needed for the planned production volume are on order in time to support the build schedule. Unlike long lead part ordering, which targets elevated risk items, this activity covers the full bill of materials. It must account for vendor lead times, minimum order quantities, scrap allowances, and safety stock requirements.

Purchasing, Production Planning, and Product Engineering must work together to confirm that part numbers, approved vendors, and quantities match the released production documentation.

The phase is complete when purchase orders are confirmed for all production required materials.

## Approved Artwork

Artwork Approval is a formal check of PCB artwork the photo tool data files used to fabricate the board for both electrical correctness and mechanical accuracy.

This review confirms that the artwork matches the approved layout, that all layer-to-layer registration requirements are met, that controlled impedance features are correctly dimensioned, and that mechanical features such as board outline, mounting holes, and connector keep outs conform to the mechanical specification. Errors found during artwork review are far cheaper to fix than those found after fabrication, making this a high value quality gate.

The phase is complete when the artwork has been verified with no errors.

## Approved Film

Film Approval is the physical inspection and sign off photographic films or equivalent fabrication media used in PCB production. This covers both prototype and production tooling sets.

The Product Engineer reviews each film layer for dimensional accuracy, feature quality, and conformance to the approved artwork data. The review checks for pinholes, scratches, or processing artifacts that could create defects in finished boards. For production film, this step also confirms that the tooling set is complete, properly labeled, and suitable for long term storage and repeat use.

Approval by the Product Engineer formally releases the film package for fabrication and is documented in the product's manufacturing record.

## Characterization

Characterization is a systematic engineering evaluation that confirms the product's performance across its full specified operating range. It provides objective evidence that the design meets all requirements in the approved specification.

Testing covers electrical performance, timing margins, power consumption, temperature and voltage margin analysis, and any product specific functional tests needed to confirm specification compliance. The process stresses the product beyond nominal conditions to find margin, reveals sensitivity, and ensures robust performance in customer hands.

The phase ends with a formal characterization report that documents test methods, results, and any deviations or observations relevant to production testing or customer application guidance.

## Test Equipment Design/Fabrication

This phase develops all hardware, software, and procedural tools needed to evaluate the product efficiently in a production environment. This includes functional test fixtures, bed of nails assemblies, automated test scripts, calibration procedures, and test coverage documentation.

The test coverage documentation clearly shows which product functions and parameters are verified at each test stage and which, if any, are not covered by production test. Developing test equipment in parallel with product design rather than after engineering release is essential to avoid it becoming a gate to production start.

The phase is complete when the test system has been fully documented, confirmed against known good units, and formally released to the production test floor.

## Project Reviews

Project Reviews are formal, scheduled cross functional checkpoints held at key milestones throughout the development program. Their purpose is to assess readiness to go ahead, surface risks, and ensure alignment across all contributing teams.

The four primary reviews Definition Review, Design Specification Review, Prototype Design Review, and Final Design Review each have defined entry and exit criteria. These criteria ensure the team has objectively confirmed readiness before committing to the next phase. Reviews provide management visibility into technical progress, schedule status, and open risk items.

Decisions made in project reviews are documented and tracked to closure as binding program commitments.

## Engineering Release

Engineering Release is the formal milestone at which the design is declared complete and handed in from engineering to manufacturing and operations.

Release requires four specific exit criteria to all be met: production documentation is fully approved, final film has been signed off, characterization has been completed and reported, and pilot units have been successfully evaluated. This multi criteria gate ensures manufacturing has documentation, tooling, test equipment, and a validated design to build product consistently and to specification from the first production lot.

Engineering Release also sets up the baseline configuration from which all future engineering changes must be formally managed.

## Build Preproduction Boards

Engineering and Production assemble and test five units built to full production documentation. It is the final validation step before committing to full production quantities.

These units are built using released production documentation, production qualified components, and the production test system. Any workmanship, process, or design issues found during this process must be resolved through formal Product Change Notices (PCNs) or Engineering Change Notices (ECNs) before production is authorized. The preproduction build gives the manufacturing team firsthand experience with the product and surfaces assembly process challenges while volume is still low and changes are manageable.

The phase is complete when all five units have been assembled, evaluated, and confirmed against specification.

## Build Production Boards

Build Production Boards is the final phase of the development program the transition from engineering and pilot activities to full rate manufacturing.

The production lot is built entirely from documentation, using production qualified components, approved assembly processes, and the validated production test system. Manufacturing assumes full ownership of quality and throughput. First article inspection, statistical process control, and yield monitoring confirm that the manufacturing process is stable and capable of consistently producing the correct product.

This phase and the program are formally complete when the first production lot has been fully assembled, evaluated, and placed into finished goods inventory, ready for customer shipment.

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