Quality Manual

1-QUAL-00001 Rev. D

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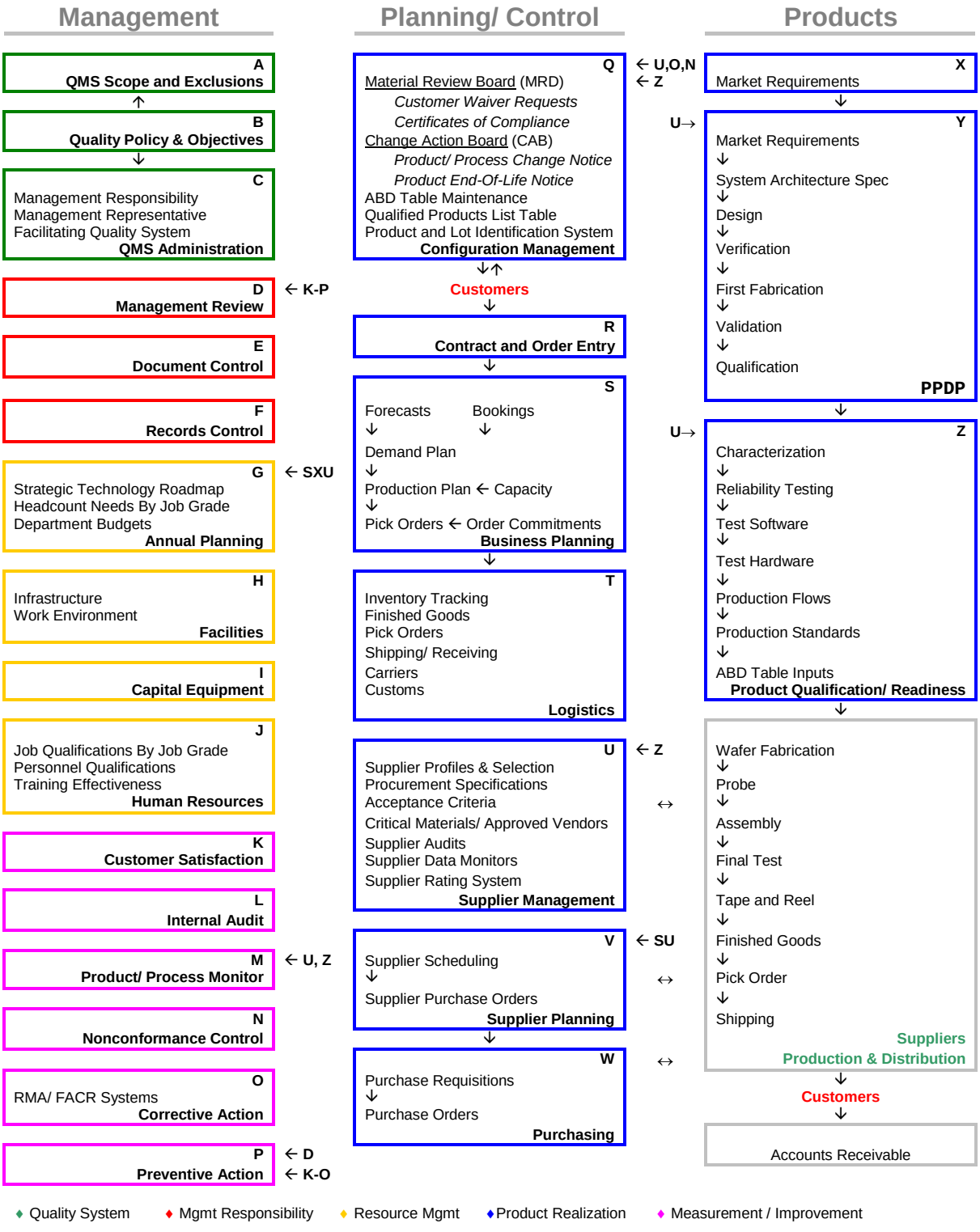
Table of Contents For Quality Manual

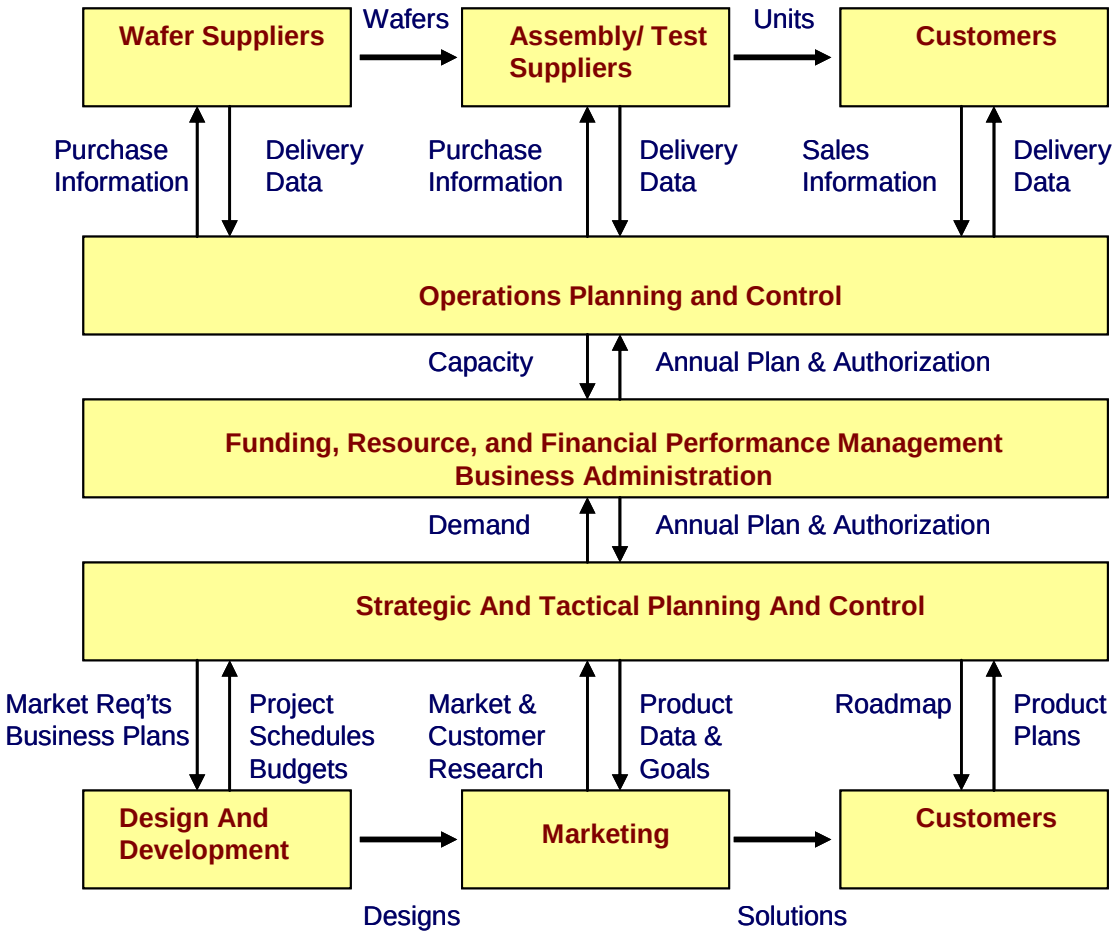
Sequence/ Interactions of Quality Management System Processes



QMS Organization Chart

Supplier Interaction		Quality System Activities		Customer Interaction
		Business Units		
		Marketing	⇔	Market Requirements
		Strategic Planning		Contracts
		Applications Engineering	⇔	Product Support
		Publications		
		Engineering	⇔	Product Specification
		Program Management		Product Validation
		Integrated Circuits Dev		
		Software Development		
		Firmware Development		
		Printed Wiring Board Dev		
		Product/Test Engineering		
Wafer Technology	⇔	Technology Engineering		
Mask Fabrication		Computer Aided Design		
		Operations		
		Business Planning		
		Inside Sales	⇔	Purchase Orders
		Demand Planning		Return Requests
		Production Planning	⇔	Order Commitments
		Inventory Tracking		
Distribution Centers	⇔	Logistics	⇔	Shipments
		Configuration Data		
Wafer Fabrication	⇔	**Manufacturing Operations**		
Assembly		Supplier Planning		
Tape and Reel		- Wafer Fabrication		
External Testing		- Assembly/ Test		
Supplier Contracts		Assembly Engineering		
		Test Operations		
		Quality	⇔	Voice of The Customer
QMS Registration	⇔	Quality System Admin		
		Customer Service	⇔	Failure Analysis
		Quality Engineering	⇔	Questionnaires
Reliability Testing	⇔	Reliability Engineering	⇔	Product Qualification
Burn-In		Central Document Control		
FA Services	⇔	**Device Physics Lab**		
		Information Technology (ERP)		
		Facilities		
		Administration		
		Sales	⇔	Sales
Temporary Help	⇔	**Human Resources**		
PWB Suppliers	⇔	**Finance**		
		Legal		
Supplier Orders	⇔	**Purchasing**		

Product Planning and Delivery



Scope and Exclusions

Scope

The Cirrus Logic quality management system applies to the design and development of integrated circuits and related systems, and to the supply of integrated circuits through subcontracted manufacturing, test and delivery. 4.2.2 a

Cirrus Logic Management intends that the business objectives, strategies, tactics, and processes used to realize this scope always satisfy applicable customer, regulatory, and statutory requirements.

Applicable location

Cirrus Logic, Inc.
2901 Via Fortuna
Austin, Texas 78746

www.cirrus.com

Exclusions

The Cirrus Logic quality management system excludes two requirements of ISO 9001:2000 section 7:

a) Implementation of post-delivery activities: Cirrus Logic products do not require post-delivery servicing. 7.5.1 f

   Software update and release after the delivery of integrated circuits is classified as initial delivery of a new release rather than as a post delivery activity.

b) Customer property: At no time is customer property used by or under the control of Cirrus Logic. 7.5.4

These exclusions do not affect ability or responsibility to provide product that meets applicable customer or regulatory requirements.

Quality Policy and Management Objectives

Quality

Quality is the degree to which customer requirements for Cirrus products and services are identified and satisfied.

Quality Policy

Management's policy for quality: — 4.2.1 a, 5.1 b, 5.3 a-c

Satisfy customers first.
Provide competitive solutions for customers.
Comply with customer and regulatory requirements.
Improve continuously.

Quality Objectives

Cirrus measures and continually improves the degree to which customer requirements and the quality policy are satisfied. — 4,2,1 a, 5.3 b, c, 5.4.1, 7.1a

Management establishes goals for product conformity and process effectiveness to accomplish these ends. These include goals for the business processes described in this manual.

Product conformity is measured by tracking final test yields. [NOTE: Yields and yield standards (goals) are strictly proprietary.]

Process effectiveness is measured by comparing actual results to expected results, or by resulting product conformity.

Typically, many metrics may be established for a given product or process. Any metric which meets the criteria in this section may be used as audit evidence for established quality objectives.

Quality System Scorecards

Quality scorecards are self-audit forms established to record business process compliance and quality objectives. Scorecards communicate quality policy and indicate effectiveness of the quality system. 5.3 c-e

Eight scorecards are used to cover the processes in the quality system:

- Quality system implementation
- Leadership and management review
- Resource management
- Design and development implementation
- Manufacturing readiness
- Supplier management
- Production planning and control
- Document and record control

Administration

Planning	Top management is responsible for ensuring that the requirements of this chapter are implemented and administered.	5.4.2 a
Delegation	The management representative for quality may delegate administrative duties (but not responsibility) of the quality system to the Quality Department. Each business process in this manual is assigned to a specific department(s) for administration. Managers may designate process owners to facilitate. Executive management retains authority to ensure establishment and ownership of the processes in this manual.	5.5.1
Administration Requirements	Management Representative, acting for top management shall: - Document the quality policy and explain how management sets quality performance objectives for products and the business processes - Identify the business processes used to identify and meet customer, regulatory, and statutory requirements. - Define the sequence and interactions that allow quality manual processes to function as a system. Designated Facilitators shall: - Document the procedures needed to operate and control each business process effectively - Monitor, measure, and analyze the processes to ensure achievement of planned results and continual improvement - Assess and provide the resources and information needed to operate, monitor and control each business process - Make the procedures comply with ISO9001:2000 - Specify controls for outsourced manufacturing processes - Plan and implement needed changes - Maintain integrity of the quality system	4.1 a 4.2.2 b 4.1 c 4.2.2 c 4.1 b 4.1 d 4.1 4.1 e 4.1 f 4.1 5.4.2 a, b 5.3 a-e

Documentation Requirements

Document a quality manual that defines scope, exclusions, and procedures for the quality management system, and interaction between the quality system processes. 4.2.1 a-d

Document Cirrus quality policy and quality objectives in the quality manual.

Document the business processes used to identify and meet customer, regulatory, and statutory requirements in the quality manual. Include any processes needed to fulfill the quality policy, meet the quality objectives, meet customer requirements, and implement the requirements of ISO9001:2000.

Six procedures are specifically required by ISO9001:2000. Document these as business processes in the quality manual. They are:

1) Document Control process
2) Records Control process
3) Internal Audit process
4) Nonconformance Control process
5) Corrective Action process
6) Preventive Action process

The quality manual is designated as tier 1 (policy level) of the quality management system documentation.

Designate cross-functional process flow descriptions as tier 2. Work instructions are tier 3.

Documents that relate to specific product, manufacturing processes, forms, software, customers, suppliers, records, and so forth, are designated tier 4.

Record Requirements

Ensure that records specifically required by ISO9001:2000 are required by the appropriate quality manual chapters. 4.2.1 e

These include:

1) Evidence of conformity to requirements (4.2.4)
    a. For product (at development and production)
    b. For quality system processes
2) Evidence of effective quality system operation (4.2.4)
3) Management reviews (5.6.1)
4) Personnel education, training, skills, experience (6.2.2e)
5) Product realization planning (7.1d) (see 6 thru)
6) Review of customer-specified requirements (7.2.2)
7) Product design requirements (7.3.2)
8) Review of design results versus requirements (7.3.4)
9) Design and development verification (7.3.5)
10) Design and development validation (7.3.6)
11) Design and development changes (7.3.7)
12) Supplier evaluation, selection, performance (7.4.1)
13) Validation of non-verifiable production processes (7.5.2)
14) Validity of measurement on uncalibrated equipment (7.6)
15) Internal audit results (8.2.2)
16) Authorized release of nonconforming product (8.2.4)
17) Nonconforming product and subsequent actions (8.3)
18) Corrective actions
19) Preventive actions

Commitment Requirements

The Management Representative shall provide auditable evidence of top management commitment to develop, implement, and continually improve the quality system, as follows: 5.1

5.1 a-e

1. Organization-wide communication of the importance of customer, statutory, and regulatory requirements.
2. quality policy and quality manual
3. quality objectives and results
4. management reviews
5. resource needs and availability

Customer Focus Requirement	The Management Representative shall provide auditable evidence that business processes for order entry, contract administration, and product development include procedures for determining customer requirements and converting them into work instructions with a view toward enhancing customer satisfaction.	5.2
Quality Policy Requirements	The Management Representative shall provide auditable evidence that the quality policy is communicated and understood within the organization and that it is reviewed annually for continued suitability. In establishing and reviewing the quality policy, ensure that: 1. it is appropriate to the purposes of Cirrus Logic 2. it includes a commitment to comply with quality system requirements and to continually improve quality system effectiveness 3. quality objectives consistent with achieving the goals of the quality policy are established and reviewed	5.3 a-e
Responsibility and Authority	Responsibilities for the quality system are assigned functionally in the QMS Organizational Chart. These apply regardless of the departmental organization of the company. The quality manual is used to communicate these responsibilities. Authority for review and approval follows normal departmental hierarchy. Signature authority defined and used by management for financial approval applies (i.e same sign-off as in the purchase order system). For specific business processes, such as design and development programs (PPDP chapter), responsibility and authority are specified within the process. A department(s) is assigned as process owner for each process in the quality manual. The owning department(s) maintains the process documentation, and is accountable for implementation, operation, control, effectiveness, and corrections.	5.5.1

Requirement For Management Representative

Cirrus Logic Senior Vice President of Operations functions as the executive Management Representative for Quality. 5.5.2

This manager has overall responsibility, authority, and accountability for the quality system.

Duties include ensuring that:

- quality system processes are appropriately documented, implemented, and operated
- performance and opportunities for improvement are reported to top management
- awareness of customer requirements is promoted throughout the organization.

The Quality Department supports the Management Representative in carrying out these duties.

Internal Communication Requirement

Top management ensures that communication takes place regarding the effectiveness of the quality system in top level reviews, such as quality system management reviews, operations reviews, quarterly business reviews, and product development reviews. 5.5.3

Top management ensures that appropriate internal communication processes are established within the quality system business processes.

Process # Management Review

Function Review and improve effectiveness of the quality system in meeting customer requirements.

Facilitator Management Representative for Quality

Input Documented reports of:
- quality objectives and metrics
- results of audits
- customer feedback
- process performance
- product conformity
- status of corrective and preventive actions
- follow-up actions from previous reviews
- changes affecting the quality system
- recommendations for improvement

Output Documented decisions and actions related to:
- improving effectiveness of the quality system
- improving product in relation to requirements
- resource needs

Procedure

Quality schedules, prepares and presents review materials on behalf of the Management Representative. 5.6.1 5.6.2 5.6.3

Quality schedules management reviews of the quality system just prior to scheduled (annual) audits visits from the certifying ISO9001:2000 registrar.

Quality consolidates the required inputs from review materials previously presented to management at quarterly business reviews, operations reviews, development project reviews, and/or interim quality system reviews (if any).

Top management assesses continuing suitability, adequacy, effectiveness, and needed improvements for specific quality system processes, the quality policy, the quality manual, and/or quality objectives.

Top management assigns actions as needed. Actions are followed up at subsequent reviews.

Process # Document Control

Function Document control and engineering change control.

Facilitator Quality Department

Local Document and Records Control Centers

Applications Engineering – data sheets
CAD – CLI system, product configuration and IC design
Central Document Control – general quality system documents
Contract Administration - customer contracts and specifications
Finance - annual plan, resources
Human Resources – training, human resources
Information Technology - database systems and contents
IT/ Test Applications - production test programs
Program Management – PPDP templates
PWB group – demo boards, evaluation boards
PWB Layout -production test hardware
Design Engineering – software/firmware
Sales - order entry

Input controlled documents, files, data bases, and revisions of these

Output review, approval, maintenance and revision control

Procedure

Application 4.2.3

This procedure applies to the maintenance of controlled documents. These are the documents, electronic files, and databases used to control configuration and conformance for products or processes.

Examples include policies, procedures, work instructions, forms, specifications, software, firmware, test programs, product layout, schematics, and PPDP templates.

Revision control of these items is the means for reviewing and approving configurations (versions) of the items they define.

Document Control Centers

Local document control centers maintain specific document types (rather than having all departments use a centralized document control activity).

Relevant department managers assign an administrator over each document control center. Administrators document control procedures for their centers within the on-line “Records Matrix” template.

Documentation Tiers

In this section the word “documents” refers to controlled procedures, specifications, templates, work instructions, data files, and data bases.

The quality manual and other management policy statements are designated tier 1 documents. They take precedence over lower tier documents.

Cross-functional flow charts and top level procedures are designated tier 2. These relate interface, roles, responsibilities and communication. Tier 2 documents take precedence over lower tier documents.

Process work instructions and documents that apply to multiple products, suppliers, or customers are designated tier 3.

Documents that apply to a specific product, material, supplier, or customer are designated tier 4. Forms and records are designated tier 4.

Records Matrix

The Records Matrix is an on-line template for implementing the requirements of ISO 9001:2000 clauses 4.2.3 and 4.2.4.

Document center administrators use the template to create the tier 2 document control and records control procedures for their centers.

The tier 2 procedures in the Records Matrix are used to audit document and records control centers. (The audit standard.)

Typically, tier 3 work instructions and tier 4 forms for document and records control centers are not needed. But they may be created and used at the local administrator’s discretion.

Authorizing Local Document Control Centers

Department managers that have the option of using the Central Document Control center (operated by the Quality department) should do so.

Where use of the Central Document Control activity would result in duplicate file storage locations, difficulty arises in keeping the Document Control copy current with the original copy. Department managers should opt to operate the original storage location as a local document control center in this case.

The Quality Department reviews and endorses this decision through the act of approving procedures in the Records Matrix.

Records Matrix Template 4.2.3 a-g

The Quality Department maintains the Records Matrix system and templates. They are used to create separate procedures for document control and records control.

The Records Matrix template requires that procedures be created to define methods to meet the following requirements:

Template 1: Required for document control only:
- document approval before intended use
- periodic review, update, and re-approval
- identifying changes and revision status
- availability of relevant versions at points of use
- identity and distribution of documents of external origin
- identify and prevent use of obsolete documents

Template 2: Required for document control and records control:
– identification (of items and revisions)
– storage 4.2.4
– protection (e.g. backup)
– retrieval and master listing
– retention time
– disposition
– document types maintained
– administering department
– legibility assurance
– identifying tier 3 work instructions (if any)

Process # Records Control

Function Maintenance of quality system records.

Facilitator Quality Department

Centers Applications Engineering – data sheets
CAD – CLI system, product configuration and IC design
Central Document Control – general quality system documents
Contract Administration - customer contracts and specifications
Finance - annual plan, resources
Human Resources – training, human resources
Information Technology - database systems and contents
IT/ Test Applications - production test programs
Program Management – PPDP templates
PWB group – demo boards, evaluation boards
PWB Layout -production test hardware
Design Engineering – software/firmware
Sales - order entry

Input records, files, and data relevant to products and quality system process results

Output maintenance and retrieval

Procedure Application

This procedure applies to the maintenance of quality system records. These are the documents, electronic files, and data used to record minutes, decisions, actions, transactions and results.

For example, forms are controlled documents but filled out forms are records. Some data such as sales orders on SAP may serve simultaneously as records and as controlling documents.

Records may be amended (corrected or added to) but may not be revised. In other words, the original entry should be preserved.

Records Control Centers

Records control centers are usually synonymous with local document control centers. However, records must be maintained separately from controlled documents, using separate procedures.

Local records control centers maintain specific record types (rather than having all departments use a centralized records control activity).

Relevant department managers assign an administrator over each records control center. Administrators document control procedures for their centers within the on-line “Records Matrix” template.

Documentation Tiers

Records are designated tier 4.

Records Matrix

See and apply the *Records Matrix* section in the Document Control procedure.

Authorizing Local Records Control Centers

See and apply the *Authorizing Local Document Control Centers* section in the Document Control procedure.

Records Matrix Template 4.2.4

See and apply the *Records Matrix Template* section in the Document Control procedure.

Process # Annual Planning

Function Assess what business activities and resources are needed to determine and meet customer requirements.

Facilitator Finance

Input strategic plans, revenue and cash flow plans, technical roadmaps, quality system processes

Output budgeted business activities

Procedure

Top Management aligns strategic objectives and technical roadmaps to market direction, and determines what business activities are needed to realize these. 6.1 a-b

Quality management activities needed to determine and meet customer requirements are included. Basically, these are the processes described in the quality manual. Capability to continually measure and improve these processes is included.

Finance facilitates an annual budgeting process to determine what resources are needed to implement and operate the necessary business activities.

Department heads submit department budgets to the annual budgeting process.

Resource budgeting includes determination of the positions and job grades needed to perform quality system processes.

Top management supervises the adjustment and finalization of these budgets. The annual plan budgets are adjusted as needed throughout the fiscal year in response to changing customer and business conditions.

Department managers use budgets and personnel assignments to provide evidence of resource planning and implementation. Headcount variance is not considered an audit issue if quality system processes are staffed, operating, and effective.

Financial tracking of department budget variance is not audited for ISO 9001:2000 purposes.

Process # Capital Equipment Planning

Function Assess and provide the equipment needed to operate business and quality system activities.

Facilitator Finance

Input annual planning process

Output determination of equipment needs
budgets and evidence for provision of those needs

Procedure Equipment 6.3 a-c

Capital equipment is equipment with property value in excess of limits designated by Finance. The designation is in accordance with generally accepted accounting practices.

Managers identify equipment needed to carry out their departmental business processes.

Managers create capital equipment purchase requisitions and submit them for financial approval through the purchase order system. Purchase requisitions include or refer to procurement specifications for the equipment.

The executive management team reviews and approves the capital equipment purchase requisitions.

Executive management approves equipment purchases based on needed market strategy, timing, capability, and effect of depreciation in planned financial performance. Assessment of alternatives is part of this decision process.

Once approved, the originating department and/or purchasing group orders the equipment, and accepts it upon delivery. Acceptance is based on compliance with purchase orders and procurement specifications.

Executive management approves requests to remove depreciated and/or inactive equipment from equipment inventory through its regular capital equipment review. Disposition is by sale, storage, or scrapping.

Supplier management activities assess capital equipment needed at external supplier locations and ensure its provision through vendor profile and supplier audit procedures. On occasion Cirrus Logic will direct and assist suppliers in the procurement of capital equipment. See the Supplier Management procedure.

Work Environment 6.4

Work environment for manufacturing processes and equipment is specified and controlled by suppliers. Cirrus confirms these controls through supplier profile surveys and supplier audits. [See the Supplier Management process.]

Process **Facilities, Communication, Data Processing**

Function Assess and provide the facilities and work environment needed to operate business and quality system activities.

Facilitator Facilities, Information Technology

Input annual planning process

Output determination of facility and work environment needs
budgets and evidence for provision of those needs

Procedure Facilities and Communication 6.3 a-c

Top Management aligns strategic objectives and technical roadmaps to market direction, and determines what business processes are needed to realize these.

Facilities budgets the buildings, utilities, equipment, related services, and maintenance needed to operate essential business activities. Related services include transportation.

Information Technology budgets the communication and data processing equipment and services needed to operate business processes.

Facilities and IT groups arrange purchases and subcontracting to meet the above needs.

Facilities and IT groups set the acceptance criteria and accept the procured items.

The activities above are performed within the scope of the annual budget plan, as adjusted.

Infrastructure and work environment needs for manufacturing are determined by the suppliers. Adequacy is verified through the Supplier Management process.

Work Environment 6.4

Facilities group determines workspace standards and supports other groups by providing furniture, assigned workspace, and necessary utilities for individuals.

Process ## Human Resources and Training

Function Apply appropriate education, training, skills, and experience to work affecting product quality. 6.2.1

Facilitator Human Resources

Input quality objective metrics, job requirements, new technologies, techniques, and customer or market requirements

Output ensure quality-affecting tasks are performed by personnel who have the needed qualifications

Procedure Determine Needs 6.2.2 a

Department Managers specify job positions in department budgets and the annual plan.

Needed competencies are specified by assigning an appropriate job grade to each position.

Each job grade has defined competencies based on appropriate education, training, skills, and experience needed for the job type and level of responsibility.

Human Resources group provides these generic definitions. They are derived from competitive industry standards.

Department managers define position-specific requirements in addition to the generic competencies (i.e. job descriptions).

Employee training is needed to stay current with new technologies, techniques, or requirements.

For example, design training seminars occur throughout the year. Sales personnel are trained in new product characteristics. Human Resources group conducts benefits, supervisory, and management seminars.

Take Actions to Satisfy Needs 6.2.2 b

Managers hire, promote, and transfer personnel in accordance with the positions approved in department budgets. Executive

management requires justification before approving deviations.

Human Resources group verifies an individual's qualifications against the generic job grade and position-specific job description when they are hired, promoted, or transferred into a position.

In addition, managers re-evaluate the needs of the position and the match with individual qualifications during annual performance reviews. This is the venue for determining if an individual needs development or training, and planning that action.

Department managers determine when training sessions are needed and take action to initiate them.

Evaluate Effectiveness of the Actions 6.2.2 c

Performance review scoring is used to evaluate effectiveness in meeting competency requirements for job grades.

This information is reported statistically for management review by the Human Resources group. H.R. includes related data such as statistics on timeliness of reviews. These data provide evidence that the review process is implemented and effective.

Top management responds with broad-based direction or actions to improve overall scores as needed.

Effectiveness of individual development and/or training is evaluated and reported by the manager in the individual's performance review. These are not available for auditing. However, the results contribute to the statistical scoring described above.

Effectiveness of group training may be evaluated through post-training surveys or other methods that provide feedback to the trainer.

This practice is encouraged but not mandatory as there are generally other quality objective metrics that will indicate whether the training has had an effect. For example, meeting sales goals for a new product can be used to indicate whether new product training was effective.

Awareness of Contribution 6.2.2 d

Managers are encouraged to ensure their employees remain aware of the contribution their work makes toward satisfying customer and business objectives and requirements.

The primary means for doing this is the “all-hands meeting” conducted by the executive staff to review achievements versus objectives at the end of each fiscal quarter.

Secondarily, awareness of individual contribution is emphasized in performance reviews and during promotion of the quality policy.

Maintain Records 6.2.2 e

Human Resources group maintains appropriate records to indicate whether individuals fulfill the education, training, skills, and experience qualifications required for their assigned job grades.

Design and Development

Process **Marketing Requirements/ Business Plan**

Function Determine requirements and objectives for products.

Input As applicable:
customer specifications and contracts
market research and analysis
Cirrus strategic roadmap
analysis of competing products
supplier technologies and tolerances

Output As applicable: 7.2.1 a-d
product requirements specified by the customer 7.3.2 a-d
product requirements necessary for intended use
functional and performance requirements
information derived from previous similar designs
requirements necessary to meet industry standards
applicable statutory and regulatory requirements
requirements determined by the organization
manufacturability requirements and goals

Procedure Marketing personnel in each business unit prepare a marketing requirements document (MRD) and business plan (BP) for each product development project. 7.1 a, 7.1 d, 7.2.2, 7.2.3

The purpose of the MRD/BP is to document product requirements and objectives and provide a baseline for subsequent project progress and design reviews.

A template for the MRD/BP is provided in the Product Development process (PPDP).

Within the framework of the PPDP, the MRD/BP is reviewed and approved prior to the organization's commitment to design and supply the product.

The PPDP defines approval authority and provides for subsequent revision of the MRD/BP as the development project progresses. Each revision is reviewed, approved, and communicated to the design team.

Records of MRD/BP reviews and resulting actions are

maintained within the development project records by the program manager.

Typically, Cirrus Logic designs and develops build-to-stock catalog products, and no customer specifications or development contracts apply. Instead, the MRD/BP serves in lieu of customer specifications and represents Cirrus' determination of the product features and requirements that best serve the targeted customers. MRD/BP review and approval serves to confirm the determination.

Cirrus design teams may confer with selected customers in determining product objectives and requirements. [These communications typically do not result in contracted design commitments or specifications.]

In the event contracted arrangements are made, Cirrus design team is accountable to the customer to demonstrate that customer-specified requirements are satisfied. Verification, validation, and review activities for this purpose are included in the PPDP framework.

The PPDP provides for subsequent customer communication arrangements as part of the program plan. Chiefly, these are oriented toward launching the product in the marketplace.

NOTE: In some projects, design innovation rather than market assessment and MRD/BP will define the product features, functionality, and/or performance. These should not conflict with MRD/BP (i.e. revise the MRD/BP or revise the design). Such items should be documented in product specifications as "requirements" by project end.

Design and Development

Process **Product Development Process**

Function Plan and manage product development projects so as to meet MRD/BP requirements and objectives.

Facilitator Business Unit General Managers – PPDP framework
Business Unit Program Managers – each development project
Development Teams – design, verification, validation activities

Input Marketing Requirements Document/ Business Plan
(See outputs of)

Output Program Plans/Schedules
System Architecture Specifications
Product Designs
Design Verification and Validation
Design Failure Mode and Effect Analysis (automotive)
Design and Program Reviews (Results vs. Requirements)

Procedure Design and Development Planning — 7.1 a-d, 7.3.1 a-c

Cirrus business units maintain and use a common project management template to plan and manage product development. The template is called the Platform Product Development Process, or PPDP.

This creates a common language, culture, and set of expectations for designers, and facilitates communication between design and management.

Some variation is allowed in how the different business units apply the PPDP to accommodate the different types of products developed.

The PPDP specifies separate development flows for marketing, system design, hardware design, integrated circuit design, and firmware/software design.

Each project uses only the development flows that are applicable. For instance, many integrated circuits do not require software development.

The flows are synchronized to product life cycle phases. In this way development is staged to define and coordinate interfaces, communication, and responsibilities.

The PPDP defines required development activities, milestones, and deliverables at appropriate stages in each development flow.

Program managers ensure that PPDP-required activities, milestones, deliverables, and approval authority are applied in each project plan. Project plans are updated at phase exit milestones, minimally.

Required activities include determination of requirements, design steps, reviews, verification, and validation.

Minimal deliverables include defined requirements, specifications, designs, manuals, analysis, decisions, resourcing, schedules, budgets, and records that products meet requirements. The PPDP provides numerous templates and checklists for deliverables.

Milestones include phase exit reviews, approvals, releases, and starts or completions of development activities.

Design and Development Inputs 7.3.2 a-d

Design and development inputs are determined and documented through the Marketing Requirements/ Business Plan process.

Design and Development Outputs 7.3.3 a-d

The person(s) who presents PPDP deliverables for approval and release is responsible for presenting these in a format that compares results to requirements.

Authorized reviewers approve deliverables on the basis of these comparisons.

For product release, products should be shown to meet specified requirements, to be ready for purchasing and manufacturing, and to have complete data sheets and acceptance criteria.

The Product Qualification and Readiness process describes how these requirements are satisfied for integrated circuits.

Design and Development Verification

Verification is defined as confirmation through test or examination that an item meets its design inputs.

The PPDP requires a product verification plan for each development flow (system, integrated circuits, hardware, firmware/software, but not the marketing flow).

Consequently each project plan should include verification plans and verification for the items being developed.

Verification results should be retained in the project records in a format that compares results to specifications.

Design and Development Validation

Validation is defined as confirmation through test or examination that an item works in its intended application.

The PPDP requires a product validation plan for each development flow (system, integrated circuits, hardware, firmware/software, but not the marketing flow).

[One plan may suffice for all of these flows if the items should be integrated to perform the validation testing.]

Consequently each project plan should include validation plans and validation for the items being developed.

Validation should occur prior to releasing the product for customer use in end products.

Validation results should be retained in the project records in a format that compares results to expected performance.

Design and Development Review

The PPDP requires reviews for each development flow to evaluate whether designs meet requirements at each life cycle stage and to identify any problems and necessary actions.

Consequently each project plan should include design reviews and product qualification reviews for the items being developed.

Gate exit reviews ensure that requirements for each life cycle phase are satisfied or disposed before releasing the design to the next phase.

Project reviews are conducted to confirm schedules, budgets, and/or completion of milestones.

Reviews should compare results to planned requirements. The PPDP provides standard review checklists to facilitate checking applicable requirements.

The PPDP specifies required participants and approval authority for the various reviews. This ensures participation by appropriate functions concerned with the stage(s) being reviewed.

Review summaries and actions should be retained in the project records in a format that compares results to expected performance.

Design and Development Change Control

Engineering change control for designed items shall be implemented in a way that satisfies the requirements of the Document Control process.

Formal engineering change control begins at the point that integrated circuits are released to the mask shop, and at alpha release for software. [Both occur at the end of Phase 2 in the PPDP.]

Change review and approval shall include evaluation of the effect of the change on manufacturing and the customer.

Design changes are verified, validated, reviewed, and approved in accordance with applicable PPDP requirements for original design.

Design and Development

Process **Product Qualification and Readiness**

Function Qualify products, release to production, and sustain.

Facilitator Product/test Engineering

Input Industry standards for integrated circuit qualification
Product verification and validation results

Output New or Revised Product Release
characterization data vs. data sheet limits
qualification (reliability) test results
test programs
test conditions and limits
test hardware designs
production test flows
yield and cost standards
QPL Release Reviews and Records

Sustaining [See Process and Product Monitor process]
process monitoring and trends
nonconformance disposition, causes, and trends
failure analysis reports

Procedure The product qualification procedure is called the QPL process, which stands for *qualified products list*. QPL is the back end of the PPDP process.

QPL's job is to concurrently qualify manufacturing readiness, product reliability, manufacturing processes, and facilities for Cirrus and the customer.

Product/Test Engineering is responsible for seven QPL deliverables for each new or revised product:

7.3.1
7.3.2
7.3.3
7.3.4
7.3.5
7.3.6
7.3.7
7.5.2
8.2.3
8.2.4

- characterization data vs. data sheet limits
- qualification (reliability) test results
- test programs
- test conditions and limits
- test hardware
- production test flows
- yield and cost standards

Review and approval of the above items is a condition for releasing products to production. QPL, Characterization, and Release-To-Production procedures are maintained at the tier 3 work instruction level. These documents specify requirements and acceptance criteria for product release.

The PPDP template requires that QPL plans be created, approved, and implemented for each new or revised product.

QPL forms are maintained to document QPL review records, decisions, and actions.

QPL reviews have the same rank and importance as design reviews in that they verify and authorize new and revised products for release to production. The PPDP template synchronizes QPL reviews with product life cycle phases.

Product/Test Engineering is also responsible for product monitoring, nonconformance disposition, and failure analysis of returns for datasheet compliance problems after release to production. [See Process and Product Monitor process, and Nonconformance process.]

Product Characterization and Qualification

Characterization and qualification testing are the means for verifying product conformance to data sheet and reliability specifications. Characterization also qualifies test programs, test conditions and limits, and test equipment capability.

Product qualification is the means for validating supplier technologies, processes, and facilities.

Production Test Programs 7.5.1 7.5.2 7.6

Test programs, conditions, and parametric limits, including yield limits, provide the standards of acceptance for electrical testing. These items are verified against product data sheet specifications for function and performance. This is the means for ensuring that manufacturing testing correlates to product data sheets.

Needed measurements are verified for compatibility with equipment capability during the Hardware Advisory Group process review, where test equipment and test hardware

requirements are determined for new designs. At this point provisions for specified but un-testable requirements are decided. They may be guaranteed by design simulation or characterization correlated to testable parameters.

Qualified test programs are maintained and distributed to production test facilities by the Information Technology activity. This group is responsible for meeting document and records control requirements.

Production Test Hardware

7.5.1
7.5.2
7.6

Test fixtures are referred to as test hardware. These fixtures provide an interface between electrical measurement equipment and each specific product type.

Test hardware is developed by Product/Test Engineering or by subcontracted suppliers. Product/Test Engineers qualify the initial hardware, using production setup and correlation procedures.

Test suppliers maintain test hardware, including procuring and qualifying additional copies, and records of qualification for use.

Test setups, including test hardware, are qualified for each use.

Printed Circuit Board Layout activity maintains documentation for test hardware, including records of Product/Test Engineering review and approval.

Where test hardware is developed and provided by external suppliers, design documentation and approval records are maintained by the hardware supplier.

Production Flows

Production flows document the sequence of manufacturing steps for specific product types. They provide the quality plan for controlling product fabrication, work instructions, and records for each production lot.

Suppliers maintain and follow production flows for wafer fabrication and assembly activities, including test and measurement steps. This is verified through the Supplier Management process.

Product/Test Engineering specifies production flows for testing finished wafers and units. Production flows specify the procedures, test programs, and test hardware needed to perform each manufacturing step. These flows are communicated to test suppliers by the *Test Operations* group.

Yield and Cost Standards

Product/Test Engineering develops cost and performance standards necessary for production control planning.

These standards are compared to theoretical results for continuous improvement purposes.

Production Planning Processes

Process **Configuration, Information, Traceability**

Function Identify products to provide change control and traceability.

Facilitator CAD Group – CLI number database and product data
Marketing – FE and BE Product Marketing numbers on SAP
Information Technology – SAP and CAMSTAR systems
Business Planning – SAP/CAMSTAR production configuration
Quality – QPL, CAB, and MRB processes

Input Product versions and production options.

Output Documentation tracing production lots to the version of product, tools, technologies, firmware, software, and facilities used.

Procedure Product Identification 7.5.3

CLI numbers identify engineering drawings and electronic data for integrated circuits. A new CLI number is assigned for each version.

Front End and Back End Product Marketing numbers identify the integrated product types for marketing and sales purposes. FE numbers refer to the product in wafer or die form. BE number refers to the packaged units and includes characters to indicate information related to the package type. The revision letter ties the Product Marketing number to a specific CLI number.

Product Marketing numbers and CLI numbers are associated in the SAP (business and finance) database with unique numbers for sales orders, invoices, delivery numbers, and return authorization numbers.

Product Marketing numbers and CLI numbers are associated with production lot numbers, location, and test status in the CAMSTAR (inventory tracking) database.

The CLI number and Product Marketing number systems comply with the Document Control process.

Procedures are maintained at the tier 3 work instruction level by

the Quality department to explain the coded characters embedded in Product Marketing numbers.

Product Configuration

The electronic data that documents integrated circuits is maintained by the CAD group and identified by CLI number. This data includes such things as floor plan, layout, schematic, and pattern generation layers, that define the product configuration. Each CLI number lists the applicable electronic file versions in the data base. CAD maintains the relevant files.

Each version of the same product receives a unique CLI number. Version control begins at the pattern generation release milestone in the PPDP, with the proviso that prior verification and reviews should be repeated if subsequent changes are made in the circuit design.

Results of design rule checks, simulation, modeling and so forth should reference the applicable CLI version.

CLI data base should document the applicable technologies, layout rules, sizing, CAD tools, simulation models, et al, used with each CLI version, as well as listing the product configuration files.

Production Lot Identification and Traceability

Front end lot numbers are assigned in CAMSTAR to each wafer lot by Supplier Planning group. The Cirrus FE lot numbers are traceable to the supplier wafer lot numbers, FE Product Marketing number, and wafer purchase requisition number between the CAMSTAR and SAP databases.

FE lot numbers are converted to back end lot numbers in CAMSTAR at the time wafers are sent to assembly suppliers for dicing and assembly. BE lot numbers are traceable to assembly and test purchase requisition numbers between the CAMSTAR and SAP databases. Ultimately, BE lot numbers are traceable to customer purchase orders in SAP.

Package marking codes are uniquely associated in CAMSTAR with root BE lot numbers. (BE lots may be split into numerous sub lots, each identified by the root number and a dash number.)

Package mark codes identify the wafer fab, assembly site, and assembly date code.

Procedures are maintained at the tier 3 work instruction level to explain the package mark and lot identification code formats.

Production Configuration Control

The *Assembly Build Data* (ABD) table assigns assembly work orders, build sheets, mount and bond diagrams, and labeling instructions to specific Product Marketing numbers. It is maintained on SAP by Business Planning. The inputs are provided and authorized by Product/Test and Assembly Engineering. Supplier planning groups then use this table to specify assembly instructions for suppliers.

The *Critical Materials List* lists qualified suppliers for materials and services used to manufacture and test products. This information is maintained as a tier 3 document by Manufacturing Operations group and is entered into the SAP system by Purchasing. SAP prevents use of non-approved suppliers for purchase orders and purchase requisitions.

The Change Action Board (CAB) approves applications for *Process Change Notice* (PCN), and *End-Of-Life* (EOF) notice. The Quality department facilitates CAB meetings, procedures, forms, and records. Sales group is responsible for customer notification.

The Material Requirements Board (MRB) reviews and approves applications for movement or end use of nonconforming product, for *Customer Waiver* requests, and for *Certificates of Compliance*. The Quality department facilitates MRB meetings, procedures, forms, and records

Quality group maintains the *Qualified Products List* (QPL), including product qualification procedures and records. Supplier Planning and Logistics groups use this status to restrict the total quantity of units shipped based on level of product qualification.

Product/test Engineers define *Production Flow* requirements for test and inspection operations. Flows list the sequence of testing and inspection activities. They designate test programs, hardware, acceptance criteria, procedures, and/or special instructions for each step. Test Operations provides these

instructions to test suppliers.

Data and Information Systems

Information Technology group maintains the data base systems and data storage used by the other departments for product configuration and production traceability. Data in these systems functions either as records or as specifications. As such the systems and data are subject to the requirements of the Document Control and Records Control processes.

Production Planning Processes

Process # Contract and Order Entry Administration

Function Accept customer purchase orders and provide commitments for fulfilling them. Convert orders into internal instructions.

Facilitator Marketing – Quotation Pricing Standards
Sales – Order Entry
Contract Administration – Contract Review

Input Customer purchase orders, contracts, specifications

Output agreed contract exceptions
backlog in SAP
original commitment dates
conversion of customer requirements to internal instructions

Procedure Contract Administration Process 7.2.2 7.2.3

Methods for identification of requirements related to products:

Delivery/Handling	Technical	Technical
All Products	Build-To-Stock	Customer-Specific
Purchase Orders	Cirrus Data Sheets	Customer Contracts or Specifications

Methods for review of requirements related to products:

Delivery/Handling	Technical	Technical
All Products	Build-To-Stock	Customer-Specific
Order Entry Process	Not Reviewed. (No deviations to data sheets allowed)	Contract Administration Process

As a rule, Cirrus supplies build-to-stock products, also known as commercial-off-the-shelf (COTS). For these products the customer purchase orders, Cirrus terms and conditions, and Cirrus data sheets suffice to specify the product requirements.

This arrangement allows customer-specified labels, packing, and shipping instructions, within limits.

For deviations to this arrangement the Contract Administration

office facilitates the review of customer contracts and specifications by relevant functions within the organization.

The contract administrator conducts or arranges direct communication with affected customers to identify and resolve product information, contract or specification related enquiries, determination of ability to meet agreed requirements, and changes.

Once contract or customer specifications are reviewed and exceptions resolved, customer purchase orders citing the agreed requirements may be accepted.

Product/Test Engineering is responsible to implement technology-based customer-specific processing or testing requirements through the Product Qualification and Readiness process.

The Finance maintains reviewed and approved contracts and customer specifications in compliance with the Records Control process.

Customer Requirements Related To Product Development

Refer to the Marketing Requirements/ Business Plan process.

Order Entry Process

The Sales organization authorizes and trains personnel to enter customer purchase order requirements into SAP. Subsequent change orders are handled identically to original purchase orders.

Marketing originates quotation standards. Sales uses these to respond to requests for quotations prior to receiving purchase orders. Sales group maintains records of the quotation standards and quotations.

Order entry personnel determine customer requirements directly from purchase orders. The entered data is reviewed against the purchase order prior to submitting. The purchase order is initialed and dated to record the review.

Original purchase orders and change orders are maintained as

records in accordance with the Records Control process at all locations where order entry occurs. The Sales group manager responsible for the Order Entry process conducts training and, when possible, visits Sales offices to verify conformance to the Order Entry process and records maintenance. However, the SAP system provides the primary record of purchase orders, commitments, and performance.

Data entry includes requested product types, versions, quantities, delivery dates, carriers, and billing and delivery locations.

Customer-specified handling and labeling requirements, if any, are entered in a SAP table called customer master data.

Customer purchase orders and change orders are treated as contracts.

Purchase order data is entered into SAP backlog. The Business Planning process generates production control plans and actions to fulfill the purchase orders.

Business Planning generates commitment dates to fulfill backlog after analyzing ability to deliver. The commitment dates are communicated to the Sales organization and ultimately to customers to signify acceptance of the orders.

Returned Material Authorization

Customer requests to return product are processed in SAP as Returned Material Authorization (RMA) requests. The personnel who are authorized to enter purchase orders also enter returned materials requests.

RMA requests provide for documentation of customer complaints as well as review and approval of the requests before returns are authorized. A return authorization (RE) number is communicated to the customer. The number is used for inventory tracking in SAP when the goods are received. Refer to the Corrective Action process.

Production Planning Processes

Process # Business Planning

Function Translate demand into production plan. Deliver customer orders.

Facilitator Business Planning

Input Demand forecasts, customer order backlog, WIP, finished goods inventory, supplier capability and capacity, QPL status

Output Demand plan, build plan schedules, pick orders

Procedure

The demand plan consolidates orders and forecasts into shipments needed to satisfy customers and business goals. Marketing and Sales activities are responsible for demand forecasts. 7.1 a-b 7.5.1 f

Marketing and operations personnel meet at least quarterly to compare and adjust demand and demand response plans as goods are shipped against customer orders. Adjustments to demand and response plans occur as needed throughout the fiscal quarter.

Results are converted to supplier plans and purchase requisitions. [See Supplier Planning process.]

Demand plans and response plans are transitional documents and not subject to records control. Performance is measured by on-time delivery against customer orders, and by quarterly business performance against forecasts.

Business Planning also schedules customer shipments, based on the backlog of customer purchase orders. Assignment of the shipment commit date constitutes official acceptance of a customer purchase order.

Business planning generates pick orders to fill customer purchase orders from finished goods at the time orders should be shipped. These orders authorize shipments to customers.

Production Planning Processes

Process # Supplier Planning

Function Authorize suppliers to manufacture, test, inspect, and deliver Cirrus products.

Facilitator Supplier Planning

Input Build plan from Business Planning Process

Output Supplier purchase order releases
Supplier deliveries

Procedure

Supplier Planning groups schedule and order production and testing services in response to the production control plans generated by the Business Planning process. 7.1 a-b 7.4.1 7.4.2 7.5.1 f 7.5.3

Purchase requisitions are released against large purchase orders in the SAP system. In this way suppliers carry out production control plans. [SAP data comprises the records.]

Purchase requisitions contain or reference the Product Marketing number and technical and delivery requirements for products. A procurement specification or contract is listed on each purchase requisition. [See Supplier Management process.]

The SAP system automates the process of supplier selection by allowing only authorized suppliers for each service being purchased.

Supplier response is ensured by scheduling work and by tracking capacities, work-in-progress and deliveries.

Supplier planning activities exist for wafer orders, assembly orders, and test/inspection orders.

Production Planning Processes

Process # Logistics

Function Direct inventory tracking, movement, storage, labeling, packing, shipping, and receiving services.

Management customs, carriers, and distribution suppliers.

Ensure proper handling and preservation of inventory in storage and transit.

Facilitator Logistics

Input
pick orders
labeling, packing, shipping instructions
returned material authorization

Output
inventory identification and tracking records
inventory storage and preservation
shipments
satisfaction of customs requirements
returned material receipt and disposition

Procedure

Logistics group manages outsourced finished goods, shipping, and receiving activities as a Supplier Management group. 7.1 a-b 7.5.1 f 7.5.3 7.5.5

Logistics ensures that procedures exist and are followed for product handling, packaging, storage, preservation, receiving and delivery of products, their constituent parts, and materials. [See procurement specifications in Supplier Management process.]

Preservation procedures include methods for ESD protection, moisture protection, safe handling, and monitoring shelf life to prevent shipment of product with expired shelf life without customer waiver or Cirrus re-qualification. Preservation requirements apply through delivery to intended destinations.

Logistics also manages the lot identification, tracking, and status system (CAMSTAR). [See the Configuration Management process.]

Logistics group follows the Supplier Management process to select, qualify, and manage outsourced storage, distribution, and

shipping/receiving services.

Logistics group manages the process for ensuring compliance with customs regulations required for international trade, with oversight from the Legal department.

Logistics manages the methodology and processes for implementing customer-specific packaging, labeling, and bar code instructions originated by the Order Entry process.

Logistics manages the receipt and disposition of returned products with direction from Quality and Product/Test Engineering. Returned products are identified as such and segregated from other goods until and unless re-qualified for sale and delivery. Quality group provides the authority and instructions for qualifying products returned through stock rotation agreements with distributors (to ensure that said product meets all specified requirements).

Manufacturing

Process # Purchasing

Function Submit purchase order releases to manufacturing suppliers.

Facilitator Purchasing

Input Purchase requisitions from Supplier Planning process

Output Placement of purchase orders with suppliers.

Procedure The SAP system includes automated workflow for review and approval of purchase requisitions. 7.4.1 7.4.2

Purchasing activity oversees the purchasing activity in the SAP system. Purchasing communicates purchase orders to suppliers. Purchasing also performs vendor selection and buying for items and services not directly relevant to product conformance.

The Critical Materials system identifies part numbers, relevant specifications, and approved suppliers for items and services that affect product conformance. SAP is configured so that this information appears correctly on purchase orders. The system only allows selection of suppliers on the approved list.

Purchasing enters the critical materials data into SAP, but does not originate it. [See Supplier Management process.]

Purchasing accepts purchase requisitions for critical materials from the Supplier Planning and processes them in SAP.

Other purchasing requirements for critical materials are met through the Supplier Planning process, including requirements for purchasing information, controls, verification of the adequacy of purchase requirements before submitting the order, and verification of purchased product, and records.

Purchase requisition and purchase order records are maintained within the SAP system.

Manufacturing

Process # Supplier Management

Function Ensure conformance of purchased goods and services.

Facilitator Fabrication Technology group – wafer fabrication, mask
Assembly Engineering – assembly, piece parts, tape and reel, et al
Test Operations – probe, final test and inspection
Reliability Engineering - burn-in and reliability testing
Logistics – Distribution, shipping and receiving

Input Product and technology requirements

Output Conforming product

Procedure

Cirrus integrated circuit products are subject to the Supplier Management process since production and test is outsourced. 7.1 a-d 7.4.1 7.4.2

Supplier Management groups manage the technical aspects for purchasing production and test services. 7.4.3

Supplier Management groups:

a) ensure purchased items and services conform to specified purchase requirements,
b) evaluate and select suppliers,
c) specify purchasing requirements
d) ensure verification of purchased items

Generic templates for meeting these criteria are maintained at the tier 2 flow-chart level. Supplier Management groups follow these procedures.

Product evaluation boards and demonstration boards are exempt from Supplier Management audits because they are not incorporated into end products. Test hardware is similarly exempt because it gets re-qualified with each use. [See the Product Qualification and Readiness process.]

Critical Materials System

Materials, services, and outsourced processes that directly affect product quality are classified as critical materials.

Assembly Engineering facilitates and maintains critical materials lists for Supplier Management groups. The data allows (only) approved materials, services, and suppliers to be referenced on purchase requisitions in the SAP system.

Purchasing Data

Procurement specifications or their contractual equivalent are created to define the technical requirements for suppliers. The generic template for procurement specifications are defined in a tier 2 procedure.

In addition, tier 4 documents may be needed. For example, Assembly Engineering provides build sheets, mount and bond diagrams, assembly work orders, and marking diagrams as well as procurement specifications.

Technology baseline information is required by procurement specifications, as needed to ensure process control. Cirrus Supplier Management groups review and authorize supplier technologies, procedures, and controls for use on Cirrus products.

Baseline includes identification of supplier technologies, processes, and/or procedures sufficient to establish process change control and notification from the supplier. This applies to technologies that affect physical configuration or performance of products.

The critical materials/purchase order system ensures that procurement specifications are referenced on SAP purchase orders.

For automotive products, suppliers are required to maintain process control plans and process FMEAs.

Supplier Selection and Qualification

Supplier selection and qualification is based on technology, vendor profiles, certification, supplier audits, monitoring of supplier-provided data, delivery performance, acceptance results, and results of process and product qualification.

Supplier scorecards are maintained to summarize this information for management review, supplier comparison, corrective action, and continual improvement.

Verification of Purchased Items

Outsourced product processing is verified and accepted through subsequent incoming acceptance and intermediate and final testing in the manufacturing flow. This is a verification of the product against the product data sheet. [See the Product Qualification and Readiness process.]

Process Controls

Cirrus Supplier Management Groups ensure that suppliers implement process controls in compliance with ISO 9001:2000 paragraphs…

7.5.1 control of production and service provision
7.5.2 validation of processes for production and service provision
7.5.3 identification and traceability
7.5.4 customer property
7.5.5 preservation of product
7.6 control of monitoring and measuring devices
8 measurement, analysis, and improvement

7.5.1
7.5.2
7.5.3
7.5.4
7.5.5
7.6
8

Supplier Management groups require this compliance in procurement specifications.

Supplier management groups monitor and enforce this compliance through supplier profiles, supplier audits, and monitoring data required by procurement specifications.

Validation of Processes

Suppliers processes and locations are not fully qualified as approved vendors until QPL qualification of product occurs. [See product Qualification and Readiness.]

Process # Customer Satisfaction

Function Monitor and employ customer perception to improve products and services.

Facilitator Quality Department

Input Customer-originated information concerning:

- customer report cards
- awards
- complaints
- quality returns
- customer satisfaction surveys
- market analysis
- delivery performance

Output improvement actions concerning:

- product conformity to specifications
- conformity of quality system to ISO9001:2000
- effectiveness of the quality management system in meeting customer requirements

Procedure

Collect and document the relevant input (where available) and summarize for management review, as follows: 8.2.1

Categorize incidents as applying to one of the following areas: product, development, fabrication, detection, delivery, application, qualification, supplier, or quality system.

Classify each incident as compliment or complaint.

Rank and determine which issues to improve (for example, a risk priority number based on frequency, ability to detect, and impact may be assigned to each complaint).

Assign action items, and obtain commitments to correct or improve from the assignees. Follow up until the action is complete and effect is verified.

Summarize the findings and present for management review at least annually.

Process # Internal Audit

Function Assess the conformity and effectiveness of the quality management system processes.

Effectiveness relates to meeting customer requirements.

Facilitator Quality Department

Input
- ISO 9001:2000 requirements
- product specifications
- Quality Manual
- specified customer requirements, if accepted
- internal audit findings and observations
- supplier profiles, audit findings, and observations

Output Actions to correct or improve conformity or performance of products, services, or processes.

Internal audit records
Management review summaries and presentations

Procedure Internal audits are scheduled annually so as to assess each quality system process against the ISO9001:2000 standard at least once every eighteen months. 8.2.2

Executive management is the primary client of the internal audit. Department managers are clients of the results for their audited activities.

The order of importance for internal audits is:

a) verify that quality system processes defined in the quality manual are in use
b) verify that they conform to the requirements of the quality manual
c) assess effectiveness of quality system processes in satisfying customer requirements
d) assess the regular maintenance of the quality system processes and procedures
e) verify that the quality manual processes meet ISO 9001:2000 requirements

The Quality Department maintains audit schedules for each calendar year and conducts internal audits using qualified internal and/or subcontracted auditors.

Select auditors and conduct audits so as to ensure objectivity and impartiality. Auditors do not audit their own work.

Adjust scope, method, and criteria for each internal audit to take the following into consideration:

a) coverage of each quality system process in the prescribed eighteen month cycle
b) coverage of each quality system-relevant department in the prescribed eighteen month cycle
c) target agenda for the upcoming registrar audit
d) customer feedback
e) results of previous audits, corrective and preventive actions
f) direction of management reviews

Managers of audited departments are responsible for taking appropriate actions within an agreed time frame. Managers report action follow-up to the Quality Department.

The Quality Department is responsible for follow-up to verify the action is implemented and effective. Verification results are part of the internal audit record.

The Quality department is responsible to summarize internal audit results and present them for management review.

Internal audit records are originated by the Quality Department and maintained in central Document Control.

Supplier audits are conducted by the responsible supplier management organizations in conformance to the Supplier Management Process in this quality manual.

Written procedures and work instructions for internal auditing are maintained at the tier two and tier three levels. These are followed to adjust the scope, criteria, and methods to be used for each internal audit.

Process # Product and Process Monitor

Function Monitor conformity of products and services.
Monitor effectiveness of processes.

Facilitator Quality System Processes – Relevant Facilitators
Manufacturing Processes – Relevant Supplier Mgmt Groups
Products – Product/Test Engineering

Input product test and inspections data, manufacturing data, delivery data, quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions, management review

Output Production Flows
Test and Inspection Steps
Acceptance Criteria
Data Analysis
Quality Objectives and Metrics.
Continual Improvement actions.

Procedure

Processes In the Quality Manual — 8.2.3, 8.2.4

The facilitator(s) for each quality manual process is responsible to define and maintain a quality objective(s) and metric(s) suitable to monitor the effectiveness of the process in achieving planned results. Planned results should be related to meeting customer requirements. — 8.4, 8.5.1

Facilitators use the quality objective(s) results to indicate when the process needs corrective, preventive, or continual improvement action, and take action when indicated.

Make quality objectives and metrics available for internal audits and management review.

Production and Delivery Process Monitoring At Suppliers

Supplier management groups authorize production and product handling flows used by suppliers for Cirrus products. [See Supplier Management process.]

Supplier Management procurement specifications should ensure that suppliers:

a) define and implement production flows containing test and/or inspection steps for process and product conformity
b) define, implement, and monitor acceptance criteria for the test and inspection steps
c) monitor and analyze the resulting data for needed corrective, preventive, and continual improvement actions
d) specify data that should be reported and/or available to Cirrus
e) process conformity includes conformity to ISO9001:2000.

Supplier management groups ensure that suppliers maintain or provide lot records indicating conformity with acceptance criteria at all in-process and final test operations.

Supplier management groups ensure that yield limits are used to indicate conformity with acceptance criteria for electrical and mechanical tests and inspections.

Supplier management groups ensure that supplier procedures require lot records to indicate the person authorizing release of product from the manufacturing step when yield limits are met.

Supplier management groups ensure that supplier procedures require that production lots be put on hold for engineering disposition if yield limits are not met.

Customer waivers are required to ship any product that does not meet data sheet requirements. This does not apply to units that pass data sheet requirements in a lot that fails yield limits, if engineering disposition indicates such units are reliable.

Final Test Operation

The purpose of final test is to verify that each unit of each product type meets the specified data sheet.

Product/Test Engineering and Assembly Engineering define and authorize the production flows and related items used at Final Test (test programs, test hardware, test conditions, test limits, lot acceptance criteria). These are provided to test subcontractors by the Test Operations group.

Test Operations is responsible to ensure that the suppliers implement and use the authorized items for final test.

Process Effectiveness Monitoring at Cirrus

Each supplier management department is responsible to monitor product conformity and/or delivery performance as the method for measuring process effectiveness.

Each supplier management group maintains supplier scorecards for active suppliers. Scorecards serve as the quality objectives and metrics for supplier management. [See Supplier Management process.]

Supplier management groups use the scorecards to indicate needed corrective, preventive, or continual improvement actions and to take action when indicated.

Supplier management groups make scorecards available for internal audits and management review.

Product Conformity Monitoring At Cirrus

Product/Test Engineering reports electrical yield variance (from standards) for internal audits and management review. Yield variance serves as the top quality objective metric for product conformity.

Product/Test Engineering also reports nonconformance trends for internal audits and management review. Nonconformance trends should indicate the frequency of lots that get put on hold for failing yield limits, and the Pareto of reasons for putting these lots on hold.

Product/Test Engineering uses product yield variance and nonconformance trends to indicate when fabrication, test, and inspection processes need corrective, preventive or continual improvement action. Take action as indicated.

Process # Nonconformance Control

Function Detection, handling and disposition of nonconforming product.

Prevention of unauthorized movement, processing, or delivery of nonconforming product.

Facilitator Foundry Engineering – Wafer Processing Criteria
Product/Test Engineering – Electrical and Functional Criteria
Assembly Engineering – Mechanical Criteria
Supplier Management Groups – Implementation

Input Production Flows
Test and Inspection Steps
Acceptance Criteria

Output Identification and disposition of nonconforming product

Procedure Supplier management groups authorize supplier technologies and production flows for use on Cirrus products. Production flows are verified to have adequate test/inspection steps, acceptance criteria, and nonconformance controls. [See Supplier Management process.] 8.3

Yield limits are the primary nonconformance control for Cirrus Products. They are used as lot acceptance criteria during test/inspection steps during final test operations.

Units that fail final production tests and inspections are classified as nonconforming yield drop-out. Such units are identified and segregated from untested and passing products. Cirrus procurement procedures shall require this, and Test Supplier procedures shall define the methods.

Failing units are disposition by the supplier scrap process with permission from Cirrus planning group.

Production Lots that fail yield limits are classified as nonconforming product until disposed. Such lots are identified and segregated from untested and passing product. Cirrus procurement procedures shall require this, and Test Supplier procedures shall define the methods.

After detection of a failing lot, the test setup is then verified. If the test setup is found to function correctly the lot is placed on hold for engineering notification and disposition.

Cirrus Product/Test Engineering or Assembly Engineering is responsible to determine the cause and disposition.

The options for engineering disposition are:

a) correct and qualify the test/inspect setup and repeat the test
b) confirm the reliability of passing units and move/ship the low-yielding lot
c) screen the product to eliminate a specific nonconformity from the population of units; then move/ship the passing units
d) confirm reliability and obtain customer waiver for the nonconformance
e) scrap the lot or otherwise prevent its movement and use

Where customer waiver is to be used, a Material Review Board must first review and approve the engineering disposition.

When necessary, sample units from failing production lots are provided to Product/Test Engineering for failure analysis.

Process # Corrective Action

Function Eliminate the causes of nonconformities.

Facilitator Quality Department

Input Any information source regarding product or process conformity, or process effectiveness.

Especially customer complaints, returned material, failure analysis, audits, process monitors, product monitors, nonconformance control, management reviews, material review boards, change action board, and supplier scorecards.

Output Problem description, effect ranking, team identification, containment action, root cause analysis, corrective action plan, implementation, and verification of effect (8D process)

or replacement of errant material, process, or technology

Procedure Corrective action applies to revising or replacing processes so that they will produce conforming products or services. 8.5.2

Correction and segregation of nonconforming product (process results) is called *containment*. Containment and corrective action should never be confused with each other.

Action intended to correct a process so as to eliminate or reduce the cause of nonconformities may be classified as a corrective action and used for audit evidence.

Information streams that regularly result in corrective action include audits, management reviews, change action board (CAB), material review board (MRB), returned material authorization (RMA) system, and failure analysis (FACR) system. In general, the Quality Department administers, assigns, reviews, and records these.

Supplier Management groups originate, review, and administer corrective actions needed from suppliers.

Facilitators of processes in this quality manual are responsible to originate, review, and administer corrective actions needed to correct effectiveness and conformity of their respective

processes. Effectiveness should be assessed through quality objectives and their metrics.

The Quality Department provides guidance to all other groups concerning corrective and preventive action and continual improvement of the quality system.

Reviewing Nonconformities and Customer Complaints

Review process effectiveness and conformity at least annually to determine if corrective action is needed.

Customer complaint based information should be reviewed when received. This includes RMA and FACR requests.

Determination of need shall be based on assessment of the effect on achievement of customer and business requirements, and shall be documented as a quality record.

Determining Causes of Nonconformities

The person or team assigned to implement corrective action is responsible to determine root cause.

Root cause analysis may require failure analysis of products. Cirrus Logic operates a Device Physics Laboratory to support failure analysis.

FACR reports are used to report failure analysis and root cause findings to customers.

Evaluating The Need For Action

The person or team assigned to implement corrective action is responsible to assess effect and opportunity to improve.

One effective method, where nonconforming product is involved, is to assign a score for frequency, effect, and ability to detect the nonconformity.

The Quality department, through oversight of corrective and preventive action systems and of customer interests, has authority to intervene and require action.

Management may direct that action be taken as a result of management review.

Determining And Implement Needed Actions

A corrective action plan should be documented as a sequence of steps to be taken.

The assigned individual or team is responsible for creating, recording, implementing, and evaluating the action plan.

Reviewing Corrective Actions Taken

The corrective action plan should include steps for evaluating the effects of the action, once taken, in eliminating the nonconformity.

The assigned individual or team is responsible for reviewing and recording the effect of the actions taken. The assignee(s) must determine if the actions were effective.

Records of Results of Actions Taken

The assigned individual or team is responsible for recording problem description, effect ranking, team identification, containment action, root cause analysis, corrective action plan, implementation, and verification of effect.

Such records must be maintained in an authorized records center compliant with the requirements of the Records Control process.

The web-based CAPA system meets these criteria and may be used to record any corrective action.

Management Review

The Quality department reports corrective action summaries for Management Review.

Process # Preventive Action

Function Eliminate the causes of potential nonconformities to prevent their occurrence. Reduce dependence on detection to deliver conforming product.

Facilitator Development Program managers – for Design and Development Supplier Management groups – for production processes

Input Any information source regarding product or process conformity, or process effectiveness - especially design inputs, reviews, verification, validation, technology specifications, process limits, simulation results, process and product monitors, customer feedback.

Output Problem description, effect ranking, team identification, root cause analysis, preventive action plan, implementation, and verification of effect (8D process) - or replacement of errant process, or technology

Procedure Preventive action applies to designing products and processes so as to enhance manufacturability and product conformance. 8.5.3

Design project teams are responsible for administering preventive action to products under development. Program managers ensure this is part of the project agenda.

Supplier Management groups are responsible for ensuring that suppliers administer acceptable preventive action programs for manufacturing processes.

<u>Determine Potential Nonconformities And Their Causes</u>

Any formal problem solving or analysis approach may be used to identify potential nonconformities and determine the need for preventive action.

Design FMEA should be used for automotive product design of build-to-stock products to the extent possible. [For customer-specified designs FMEA may be a mandatory part of the contract.] Process control charts and Process FMEA should exist for supplier manufacturing processes supporting automotive products.

Another acceptable method is to apply the corrective action for one product to similar products that are not (yet) experiencing nonconformities.

Regardless of the approach used, records should be generated that compare potential nonconformities with their root causes.

Evaluate The Need For Action To Prevent Nonconformity

Preventive action is needed when potential nonconformity frequency is high, ability to detect is low, and effect is strong. Together, these factors define risk for the nonconformity.

The responsible design team or supplier management department makes this evaluation and records it. (Alternately, Supplier Management reviews and authorizes preventive action by the supplier.)

Determine and Implement Needed Action

Once the risk for preventive action is known and a decision for preventive is made, an individual or team is assigned to define and implement the preventive action.

From this point forward, preventive action for processes is administered in exactly the same way as corrective action. [See Corrective Action process.]

For products under development, preventive action is documented as a design requirement. [See Product Development process.]

Record and Review Results

For Product Development: Preventive action decisions are recorded in approved Marketing Requirements Documents (MRD) and architecture specifications (SAS) for projects.

Subsequent design and development work is verified against MRD and SAS during reviews. [See Product Development]

For Product Fabrication: See Corrective Action process.