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Atmel Corporation
Quality & Reliability Handbook
1999

Rev. 1281A–03/99

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Section 6

Letter from the President and CEO of Atmel Corporation

As we enter the new millennium, semiconductors have become so pervasive that they touch almost every aspect of our lives. Their application ranges from telephones, television, and radios to computers, video games, wireless phones, consumer electronics, and the highly sophisticated electronics in the automotive, medical electronics, aerospace, and military applications. Cost, functionality, and miniaturization are fueling this growth.

This has given rise to a major trend towards the integration of different functions on a single chip to provide customers with a complete product solution. These system-level "solutions" not only include the IC but the software, as well as related support and service. Customers also expect these system-level solutions to be highly cost competitive. This requires a broad set of core semiconductor technologies and close cooperative partnerships with customers.

In addition, customers and end-users want these solutions to be defect-free and highly reliable. For example, today's consumers expect the same level of reliability from their computers or cell phones that they have come to expect from their television sets and radios which rarely breakdown.

Atmel management believes that the attributes of a successful semiconductor company under this emerging environment of the new millennium are:

- Develop and provide complete system-level solutions with a broad set of technologies
- Meet time to market requirements of major customers
- Be cost competitive
- Forge partnerships with major customers
- Broad emphasis on continuous improvement to develop and supply defect-free products and services

As a company with a unique set of memory, logic, analog, and high frequency technologies, Atmel has set its strategy to provide System Level Integration (SLI) solutions to our customers through the integration of these technologies and functions on a single chip. We believe that these solutions provided in a timely manner with the highest levels of quality and reliability, combined with outstanding service, will enable us to forge strong, long-lasting, and mutually rewarding partnerships with our customers.

This handbook describes our system of continuous improvement, our newly enhanced and robust Quality Business System, as well as the related infrastructure to ensure that we continue to meet and exceed our customers' expectations as we enter the new millennium.

George Perlegos

President and Chief Executive Officer

Section 1

Quality Policy and General Information

1.1 Atmel Corporate Quality Policy

Service, Quality, Innovation

think... ATMEL

Corporate Quality Policy

Atmel will provide a Competitive Advantage to its Customers through Timely, Innovative, Defect-Free Products and Outstanding Service Driven by a Culture of Systematic Continuous Improvement.

George Perlegos
President and Chief Executive Officer

B. Jeffrey Katz
Vice President of Marketing

Gust Perlegos
Executive Vice President and General Manager

Ken Kwong
Vice President of North American Sales

Tsung-Ching Wu
Executive Vice President of Technology

Bernard Pruniaux
Chief Executive Officer, Atmel ES2

Ralph Bohannon
Senior Vice President of Manufacturing

Mike Ross
Vice President and General Counsel

John Bryant
Vice President of Flash Marketing

Saleem Shaikh
Vice President of Quality and Reliability

Donald Colvin
Vice President and Chief Financial Officer

Steve Schumann
Vice President and General Manager, Nonvolatile Memories

Tony Giaudo
Vice President and General Manager, Custom ASICs

Mikes Sisois
Vice President of Planning and Information Systems

Dr. Hank Heinricht
Chief Executive Officer, Atmel TEMIC

Graham Turner
Vice President of European Operations

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Senior Vice President and General Manager,
Asia/Japan Operations

Toshiki Wada
Vice President of Atmel Japan

James Hu
Vice President of Process Development

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1.2 Company Background

Atmel is a worldwide leader in the design, manufacturing and marketing of advanced semiconductors and system-level integration solutions.

Atmel Corporation, founded in 1984, is a worldwide leader in the design, manufacturing and marketing of advanced semiconductors, including advanced logic, nonvolatile memory, mixed signal and RF (radio frequency) integrated circuits. Atmel is also a preeminent provider of system-level integration solutions, enabling its customers to lead the markets they serve with electronic products that are smaller, smarter, less expensive and more versatile than ever before.

Atmel is a multi-national company with worldwide revenues balanced between North America, Europe and Asia, and significant development and manufacturing operations in each region. Headquartered in San Jose, California, Atmel operates fabrication facilities in the United States and Europe, including an 8-inch, class one, 0.25-micron capable wafer fabrication plant in Rousset, France.

Atmel chips are manufactured using the most advanced wafer processes, including Bi-CMOS, CMOS and Silicon Germanium (SiGe) technologies. In fact, Atmel is one of the first manufacturers to offer SiGe, a new technology that cost-effectively addresses the manufacturing requirements of the RF and high-frequency wireless communications markets.

Atmel manufactures and ships over 4 million integrated circuits (ICs) per day — more than 1 billion ICs per year — for use in a wide range of communications, computer and consumer applications. Here are just a few examples of how Atmel's advanced ICs are enhancing the electronic products used by individuals and families every day…

■ A Single-Chip IC that's more than Fun and Games

Video gamers can enjoy playing their favorite Sony Playstation® applications anytime or anywhere thanks to Atmel's high-performance single-chip IC inside Sony's new PocketStation™ personal digital assistant (PDA). Atmel's ability to combine an ARM microprocessor core, a large Flash memory and analog interfaces on one ultra-low power chip is taking fun and games to a whole new level.

■ Making Smart Cards Smarter™

Atmel is providing the brains for leading-edge "smart card" applications like pay TV, banking, health cards, social security records and Internet shopping. Atmel's smart card ICs combine dense nonvolatile memory with a flexible microcontroller and a powerful encryption "engine" for unmatched flexibility, security and computing power.

■ An Advanced Chip that's "All in the Wrist"

Like something out of the world of Dick Tracy, Atmel designs and manufactures the powerful sound/storage chip inside the "Easy Rec," an innovative wristwatch voice recorder from Casio. Atmel's unusual combination of analog processing and Flash memory delivers the goods in a super low-power, low-voltage solution fit for high-tech detectives, and others.

■ New Uses for Proven Technologies

Atmel is extending its core technologies to address totally new electronic applications. As an IC supplier for the first commercially available V-Chip parental TV monitoring system, for example, Atmel is leveraging our Flash memory franchise and microcontroller expertise to meet the growing needs of a changing world.

And that's just for starters. Atmel also designs, manufactures and markets advanced ICs for the automotive, instrumentation, military and industrial control markets, delivering quality, innovation and value to every market served.

Atmel's world-class portfolio of advanced logic, nonvolatile memory, mixed signal and RF semiconductors is the foundation for the Company's ability to serve the needs of these rapidly evolving markets. At the same time, Atmel's system-level integration initiative is combining more functions on fewer chips, enabling customers to achieve greater cost and power efficiencies, smaller circuit boards and, ultimately, sleeker end-user devices like lighter mobile phones, leaner computer peripherals and more capable electronic appliances.

In addition, Atmel is one of the elite few companies capable of integrating dense nonvolatile memory (NVM), logic and analog functions on a single chip. Atmel streamlines the integration of these functions to achieve high quality, fast time-to-market and low unit prices for its customers.

1.2.1 World Headquarters: San Jose, California, USA

Atmel is headquartered in San Jose, California and has 9 North American and 15 international sales offices. Atmel employs 6,000 people worldwide and markets its products through a global network of Company sales offices, registered sales representatives and electronic component distributors.

Section 2

Overview of Continuous Quality Improvement

2.1 Atmel's Quest for Continuous Improvement

2001 and Beyond
- World Class Excellence
- Total Quality Culture

1999-2000
- QS-9000
- New Product Time to Market
- Customer Satisfaction Surveys
- Quality Councils
- Advanced Quality Planning
- Deployment of Enhanced Q and R Database and Tools

1997-1998
- Customer Satisfaction Program
- Six Sigma Program
- Standardization Across Corporation
- 10X Improvement Program
- Enhanced Quality Business System

1995-1996
- Zero Defects Initiative
- Quality Tools Training
- Product Development Methodology

1994
- ISO-9001 Certification
- Statistical Process Control in Manufacturing
- Team-Driven Problem Solving

Before 1993
- Mil-Std-883
- DESC Certified

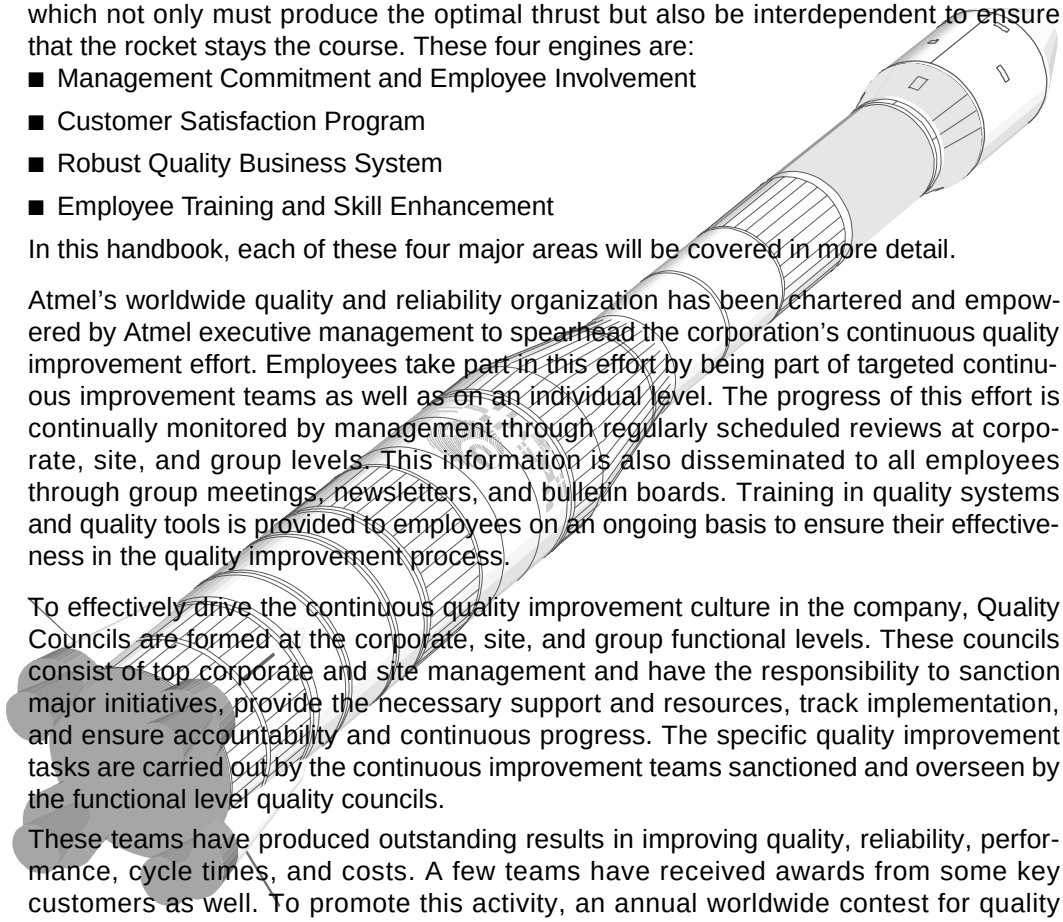
Atmel's philosophy of continuous improvement ensures that our customers receive products with not only the highest levels of quality and reliability, but that every group within the company operates with the same customer expectations in mind. This customer focus is achieved by employee involvement at all levels. To keep employees updated on the latest requirements and standards, training in quality systems, quality tools, and customer requirements are conducted on an ongoing basis.

2.2 Continuous Improvement Thrust

The analogy of Atmel's Quest or Continuous Improvement is a rocket with four engines which not only must produce the optimal thrust but also be interdependent to ensure that the rocket stays the course. These four engines are:

- Management Commitment and Employee Involvement
- Customer Satisfaction Program
- Robust Quality Business System
- Employee Training and Skill Enhancement

In this handbook, each of these four major areas will be covered in more detail.



2.2.1 Management and Employee Involvement

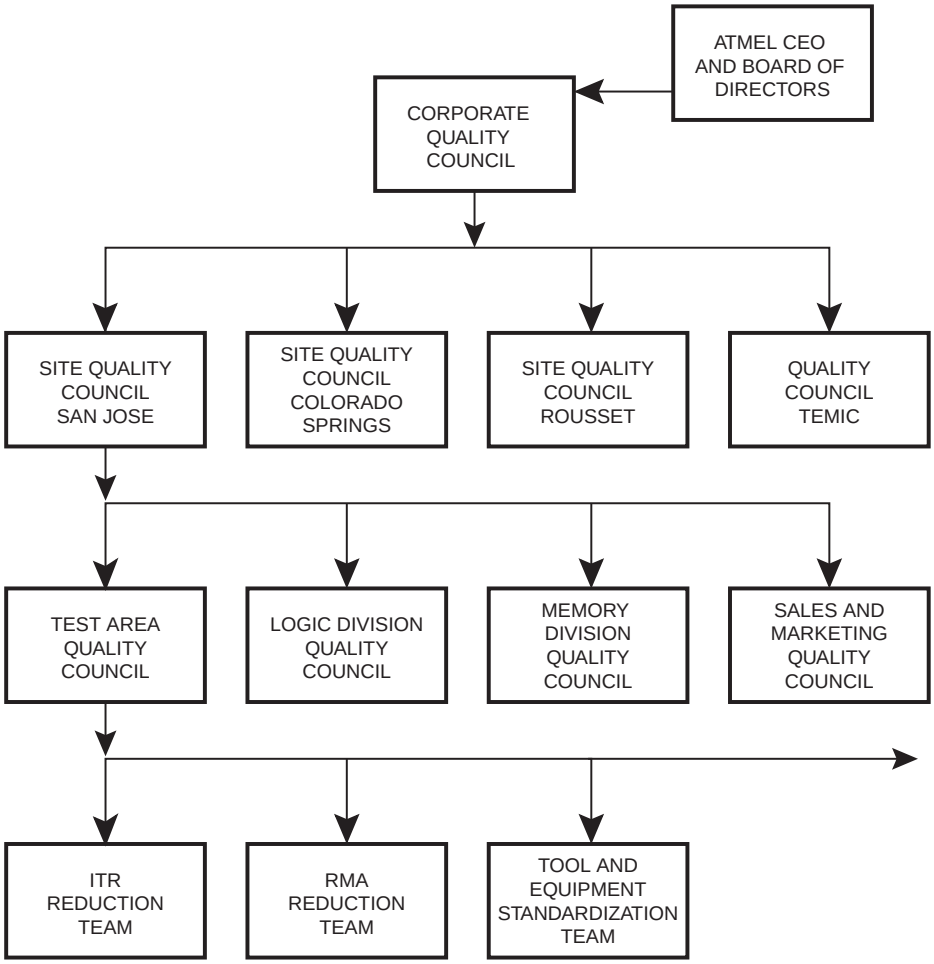
Atmel's worldwide quality and reliability organization has been chartered and empowered by Atmel executive management to spearhead the corporation's continuous quality improvement effort. Employees take part in this effort by being part of targeted continuous improvement teams as well as on an individual level. The progress of this effort is continually monitored by management through regularly scheduled reviews at corporate, site, and group levels. This information is also disseminated to all employees through group meetings, newsletters, and bulletin boards. Training in quality systems and quality tools is provided to employees on an ongoing basis to ensure their effectiveness in the quality improvement process.

2.2.2 Quality Council Structure

To effectively drive the continuous quality improvement culture in the company, Quality Councils are formed at the corporate, site, and group functional levels. These councils consist of top corporate and site management and have the responsibility to sanction major initiatives, provide the necessary support and resources, track implementation, and ensure accountability and continuous progress. The specific quality improvement tasks are carried out by the continuous improvement teams sanctioned and overseen by the functional level quality councils.

These teams have produced outstanding results in improving quality, reliability, performance, cycle times, and costs. A few teams have received awards from some key customers as well. To promote this activity, an annual worldwide contest for quality improvement teams from various sites and functional areas is being kicked off in 1999. The overall structure is illustrated on the next page.

Figure 2-1. Quality Council Structure



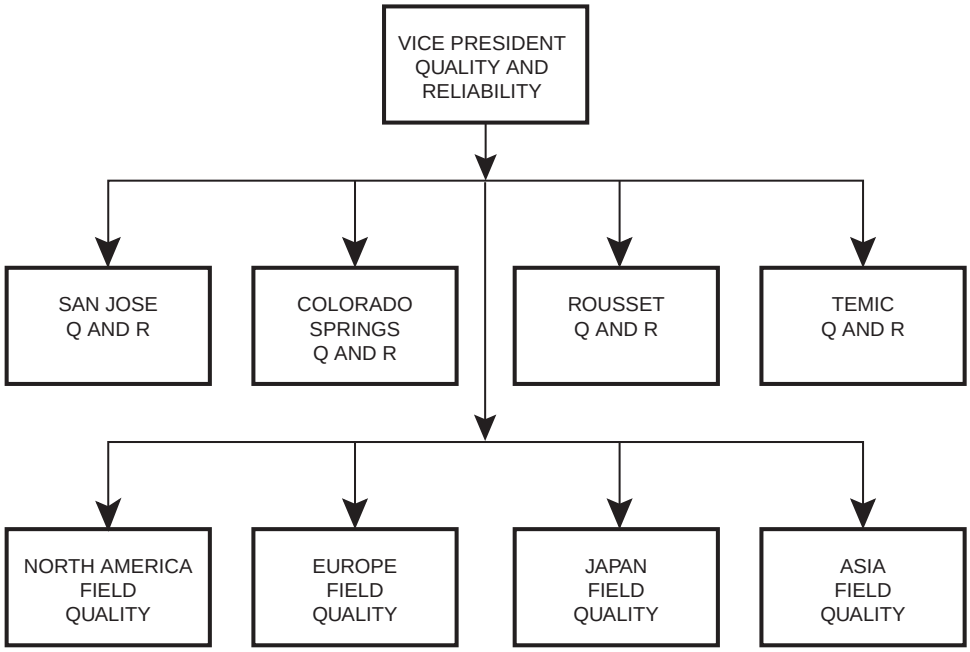
2.2.3 Worldwide Quality and Reliability Organization

Atmel's Worldwide Quality and Reliability Organization acts as the executive arm of the quality councils at the corporate and site levels. It is responsible for ensuring that Atmel has the most competitive systems, processes, and programs in place to drive the strategic quality improvement goals. It maintains and reports all internal and external quality and reliability data. As the customer advocate, it also has the overall responsibility for Atmel's Customer Satisfaction Program including scorecard and customer survey management.

The Worldwide Quality and Reliability Team meets periodically to develop major goals, initiatives, and programs based on internal and external data. These are then reviewed by the councils and approved by executive management.

This process creates a common understanding and ensures alignment on key goals and initiatives across Atmel. Once set, these goals and initiatives are closely monitored by the worldwide quality and reliability team with progress reported at all levels of the organization. In addition, intranet, bulletin boards, and newsletters are used to broadly disseminate the progress.

Figure 2-2. Worldwide Quality and Reliability Structure



2.2.4 External Certifications

Certification to external standards like ISO-9000 for our design and manufacturing processes is one example of how Atmel strives to meet the needs of its customers worldwide. Atmel design and manufacturing sites as well as our major subcontractors are certified to ISO-9000 standards (including Temic Semiconductor which was acquired in early 1998). Each site goes through third party recertification audits periodically. Like any other global organization, Atmel recognizes the importance of consistency across all sites. Therefore, Atmel is now using the same auditors in North America and Europe.

In 1997, Atmel launched a major effort to further enhance our Quality Systems to meet the emerging quality standards in the US and Europe as well as our toughest customer requirements. As a result, several enhancements were made to the quality system.

In 1998, Atmel executive management decided to adopt the much tougher QS-9000 standard across the corporation to further streamline and enhance our quality system, and establish compliance to the automotive market requirements. Now, QS-9000 has become a major strategic quality improvement goal for Atmel. An aggressive plan is already in place to achieve certification to QS-9000 by mid-2000.

Temic and Rousset sites in France and Germany are also registered to pursue the European Quality Award, which is roughly equivalent to the US Malcolm Baldridge Quality Award.

2.3 Strategic Quality and Reliability Goals and Initiatives

2.3.1 Strategic Goals

1. **Be a top tier supplier to major global customers.**
   This goal is the cornerstone of Atmel's success. Atmel aims to become a preferred supplier of our major customers and win customer loyalty. Our customer satisfaction program is focused towards achieving this goal.
2. **Achieve 6 sigma or better process control in manufacturing.**
   Atmel believes that our manufacturing processes must be properly characterized and controlled to ensure delivery of consistent products to our customers. This goal is aimed at achieving very tight control on the manufacturing processes in our wafer fabs and subcontractor assembly areas.
3. **Achieve 10X improvement in customer quality.**
   The ultimate measure of the quality and reliability of our products is the experience of our customers. Atmel is striving to reduce the customer reported and internally monitored quality and reliability metrics by 10X. These include such items as customer line fallout, outgoing product quality, service errors, product reliability and customer reported issues.
4. **Achieve first pass success on new products.**
   While the six sigma goal is aimed at improvements in manufacturing, this goal is geared towards improving the development processes. By reducing rework in the design and development processes, Atmel can excel in meeting our customers' time to market needs for their new products.
5. **Achieve QS-9000 Certification.**
   Atmel received ISO-9001 certification as a corporation in 1994. Now, we have decided to pursue QS-9000 certification. This will not only enhance our internal systems, but also allow us to meet emerging customer needs and actively participate in the global automotive market.

2.3.2 Continuous Improvement Initiatives

Atmel has numerous continuous improvement initiatives at all levels of the organization. These initiatives support all or some of the strategic goals and have well defined start and finish dates. The initiatives listed below are broad corporate level initiatives for 1999-2000 with multi-site cross functional implementation teams.

1. Statistical/Maverick Lot Control
2. Wafer Level Reliability
3. Closed Loop Corrective Action
4. New Product and Technology Development and Introduction Process - Failure Modes and Effects Analysis (FMEA), Design for Manufacturability (DFM), and Advanced Product Quality Planning (APQP)

Section 3

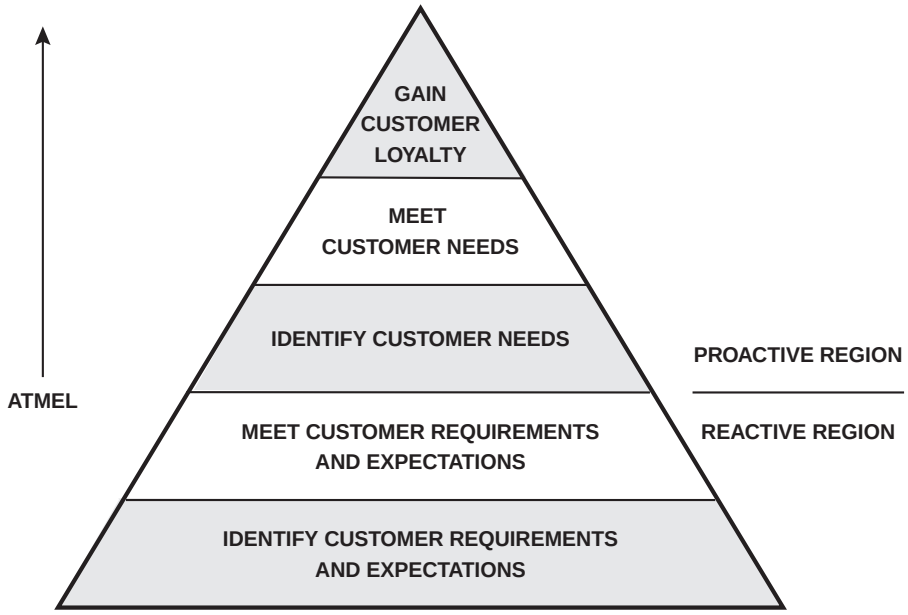
Customer Satisfaction Program

3.1 Atmel's Strategy to Achieve Customer Satisfaction

Since its inception, Atmel has prided itself on providing outstanding service to its customers. Customer service teams have been in existence in all areas of the company from wafer fabs through final test and shipment. Atmel has received outstanding service awards from many of its major customers throughout its history.

In 1997, Atmel broadened this effort to a well-defined Customer Satisfaction Program with the objective to achieve preferred supplier status at its top global customers without diminishing its focus on serving all of its customers. Many of these top global customers impose the most stringent requirements in the industry. Any improvements made to achieve a preferred supplier status at a particular customer are applied across all sites to benefit Atmel's entire customer base.

A model of our customer satisfaction program is provided below.



As this model indicates, it is no longer sufficient to just identify and meet the requirements and expectations of the customers to win their loyalty. In addition, as the industry moves towards system level solutions, proactive engagement with the customers to further identify their needs becomes inoperative.

3.2 Executive Champions and Customer Satisfaction Teams

Atmel assigns cross functional teams for all major customers. Typically, these teams include the account manager, marketing manager/director from the leading Atmel business unit, sales manager, and a quality champion from the Q and R organization. To ensure that the team gets priority and resources, it is supported by an Executive Champion.

The overall objective of each customer satisfaction team is to proactively engage with their assigned customer and achieve the preferred supplier status for Atmel. Atmel believes that by meeting the needs of our customers, we will achieve their loyalty and provide a mutually positive business impact. Teams set specific annual goals to meet the overall objective. This proactive approach requires frequent communication and formal feedback from customers.

Based on customer inputs, the teams develop an action plan with short-term and long-term tasks to meet customer needs. However, each team has the flexibility to use whatever process and methods are most desirable to their assigned customer.

3.3 Customer Scorecards and Surveys

Atmel relies heavily on formal feedback from our customers to identify opportunities for continuous improvement. This feedback is usually received through periodic scorecards from key customers which provide useful information about our performance in areas most important to the customer. Usually the criteria includes delivery, cost, and quality performance. This process has resulted in several continuous improvement initiatives at Atmel.

The business divisions at our Temic subsidiary have also conducted customer surveys to receive additional valuable information beyond the scorecards. Surveys can help in the mutual understanding and exchange of information about product and technology roadmaps and help align Atmel with our customers' immediate and future needs. The customer survey process is being expanded to all of Atmel in 1999.

3.4 Field Quality Organization

Atmel has appointed Field Quality Support personnel in all major global regions. These include North America, Europe, Japan, and Asia to ensure timely support to our customers worldwide. These field quality managers act as our customers' first point of contact and are responsible for tracking and following up all issues to closure. They are also responsible for facilitating communication through customer meetings covering quality, reliability, and service.

3.5 Customer Specification Review Process

Atmel has a formal review for all customer documents and specifications to determine technical, delivery, and legal requirements. This review is coordinated by customer service and quality assurance. The review process usually takes about two weeks. Response may be prepared by many groups including product and design engineering, manufacturing, customer service, legal, and quality. Any exceptions to the customer requirements must be negotiated with and approved by the customer before an order can be processed. Atmel prefers to use its standard products and flows to minimize cost. However, to meet unique customer requirements, a special lot traveler (SL) system is used.

3.6 Customer Service – Returned Material and Failure Analysis Process

Atmel strives to supply defect-free product with the highest levels of quality and reliability. Occasionally, our products may not work to the customers expectations in their systems. Investigation and analysis of such product is handled by our Returned Material Authorization (RMA) and Failure Analysis (FA) system. Atmel field sales and field applications groups work closely with the customer to determine the root cause of failures at the customer site. However, if further analysis is required, the parts to be analyzed are returned through the appropriate field quality organization to the corresponding Atmel

site. Atmel places a very high priority on providing quick initial feedback to our customers (within 48 hours after the parts are returned). A final report identifying containment, root cause, and corrective action is provided within fifteen days.

To minimize transit time on failure analysis reports, Atmel relies heavily on electronic mail to communicate internally and with customers. We have also standardized the format of the final response to the Eight Discipline Approach to Problem Solving (8D), which emphasizes a team approach and outlines results in a more comprehensive and structural manner. We ask our customers to provide the maximum amount of information on any product returned for analysis in order to facilitate the fastest response and closure.

Any material returned for credit or replacement must be handled through the appropriate Atmel sales office or sales representative using our RMA system. Standard forms are used to ensure completeness of information and quick response.

3.7 Customer Data Transfer and Notification Systems

Atmel produces monthly product quality reports and quarterly reliability monitor and process control reports. These reports are made available to all sales offices for distribution to customers. Atmel also has a system to produce special reports for customers with specific needs which are not met by the standard reports.

Atmel relies heavily on continuous improvement to enhance our products. In our fast moving technology, Atmel must also stay competitive in costs. These factors result in changes to our products after they are released for mass production. Atmel has a comprehensive system to manage such changes including inventory management and customer notification when required. Customers are notified through a Process Change Notice (PCN) before a major change is implemented. Customer approval is required before shipment of a changed product.

Section 4

Quality Business System

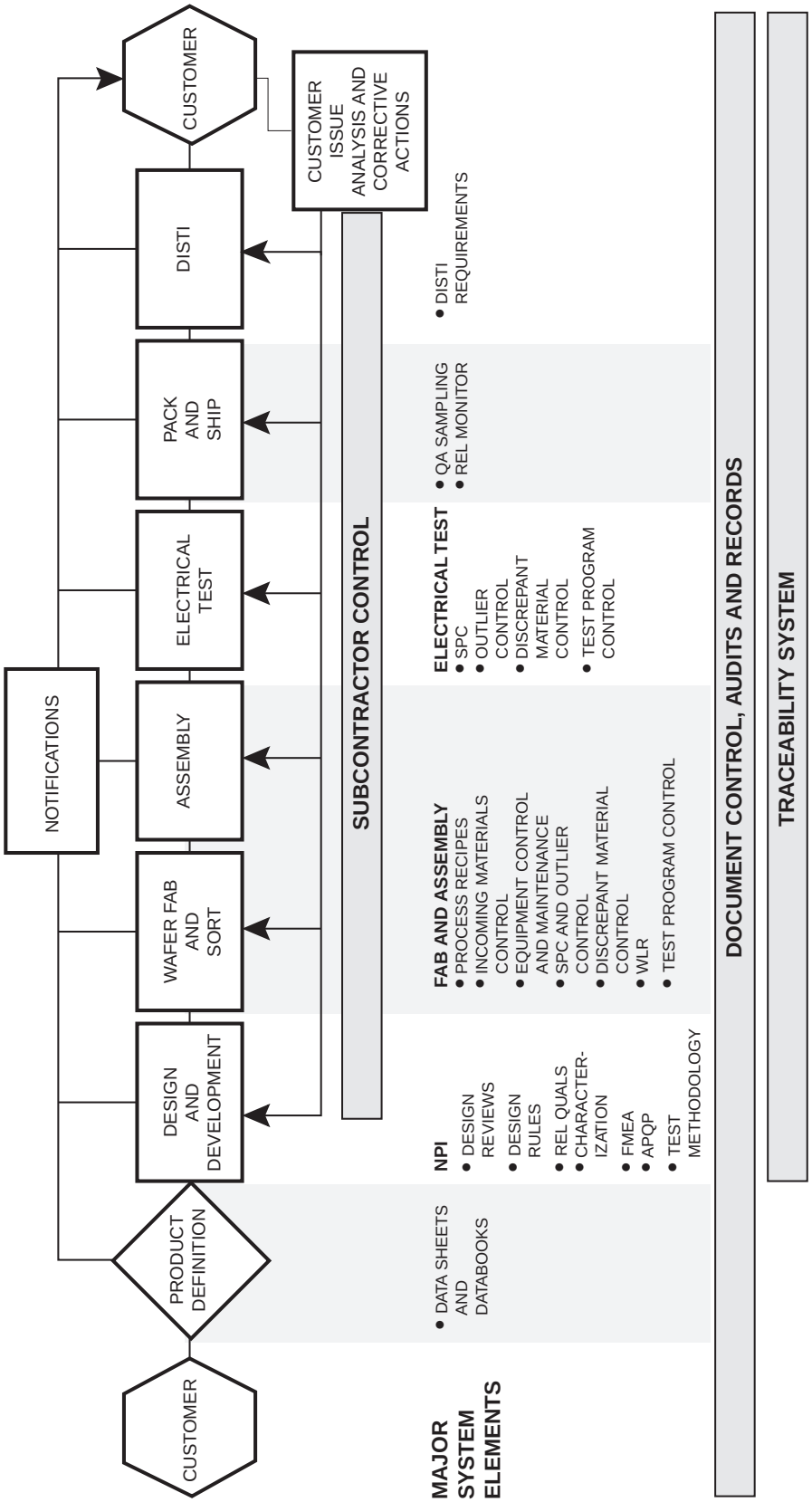
4.1 Quality Business System Model

Atmel's core business is to design, develop, manufacture, and deliver various IC products based on its memory, logic, and analog technologies. These products range from commodity memory devices such as Serial EEPROMs, Flash PEROMs, and Microcontrollers to system-level solutions requiring custom ASICs. For these system level solutions, customer interaction is required during the product definition stage to the time the product goes into high volume production and obsolescence.

The entire process to define, develop, manufacture, and deliver products starts and ends with the customer. At each of these steps, Atmel has clearly defined corporate systems and procedures to guarantee that our products meet or exceed customer requirements. All design and manufacturing groups must comply to the corporate level systems and requirements to assure consistency of our products regardless of the original design and manufacturing site.

The system which integrates our business needs with a robust quality system is called the Atmel Quality Business System Model, illustrated on the following page.

Figure 4-1. The Atmel Quality Business System Model



All major corporate level systems and procedures are identified in this model. This model is used as a baseline to ensure corporate level standardization and to identify opportunities for improvements, as well as for training and communication.

Major elements of the system are:

- Product Definition and Data Sheets
- New Product Introduction System
- New Technology Introduction Methodology
- Reliability Qualification and Monitor Methodology
- Product Characterization and Test Methodology
- Product and Technology Transfer Methodology
- Statistical Process Control System
- Incoming Material Control System
- Equipment Control, Calibration, and Maintenance
- Product Quality Monitoring System
- Product Traceability System
- Subcontractor Selection, Monitor, and Control System
- Supplier Selection, Monitor and Control System
- Distributor Interface System
- Customer Specification Review System
- Customer Notification System
- Customer Failure Analysis and Returned Material System
- Document Control System
- Audit and Review System
- Training Methodology

A complete description of the Atmel Quality System is provided in the Corporate Quality Manual (CPQ-1000). However, some of the more important elements are described below.

4.2 Statistical Process Control

Atmel has implemented a comprehensive Statistical Process Control (SPC) system in all of our manufacturing areas including wafer fabs. We also require all major subcontractors to meet this requirement. Atmel is continuously pursuing tighter control over its processes. Achieving Six Sigma control (a measure of tight process control) over our manufacturing processes is a strategic continuous improvement goal. The performance of each critical process parameter is continuously monitored by each manufacturing site. Corrective actions are taken if a parameter falls out of control.

In addition, a system to identify and minimize Maverick or abnormal lots is also being implemented in all wafer fabs, assembly, and test areas. This assures shipment of consistent product to our customers at all times. SPC data can be provided to our customers if requested.

4.3 Product Traceability System

All Atmel product is traceable to the source wafer fab lot number. This traceability is provided by the bottom side data code which signifies the data of assembly and provides the fab source and lot number. Product traceability information is also provided on the outer and inner package boxes, as well as on the tube, tray and tape and reel shipments.

4.4 Supplier Selection, Monitor and Control

All direct materials directly used in the manufacture of Atmel products must be procured from approved and certified suppliers. Suppliers are evaluated by a team consisting of representatives from procurement, engineering and quality groups. Decisions to approve or certify a supplier are based on team's evaluation of the supplier's systems and controls and their ability to meet all of Atmel requirements.

Verification of the procured material may occur in the form of acceptance inspection by Atmel, acceptance inspection by the supplier or review of process and other relevant data. Periodic supplier audits are performed to assure continued conformance to Atmel requirements.

A supplier may be removed from the approved list if they consistently fail to meet Atmel requirements.

4.5 Distributor Interface System

Atmel distributors are in the unique position of being our customers and sub contractors. A significant portion of Atmel's product requires additional processing to accommodate our customers applications. This processing may include programming a customer pattern, repackaging, and shipment to unique and specific requirements. This additional handling can affect the product quality and reliability when received by the customer. Consequently, Atmel maintains a program to educate and audit the distributors to ensure that processing and handling procedures conform to Atmel's rigid internal requirements.

4.6 Document Control System

Atmel utilizes a hierarchical document control system. All documents are driven by the Corporate Quality Manual (CPQ-1000) which is in conformance with ISO-9000 and QS-9000 quality standards. The next level in this hierarchy are the corporate level documents. The third level includes site documents which are driven by the corporate level specifications.

Within each site, a local hierarchical structure may exist to facilitate communication, training, and utilization of these documents. Local documents are usually classified according to the corresponding functional area. The corporate level quality system documents are classified as CPQ-2xxx (a level below CPQ-1000). This system gives the desired level of control at the corporate level without sacrificing site level flexibility and control.

Changes to any of the documents can be initiated by anybody in the company. However, all changes must be evaluated and approved by all functions affected at the appropriate level.

4.7 Audit and Review System

Atmel maintains a system of internal and external audits to ensure compliance with our specifications. The main purpose of these audits is to determine opportunities for improvement in quality systems, operating procedures, and training in order to make the system more robust. These audits are augmented by the semi-annual ISO-9000 quality system audits which are conducted by third-party auditors on contract with Atmel. All issues and improvement opportunities are reviewed and followed up with appropriate corrective actions.

A cross reference of Atmel system to ISO-9000 and QS-9000 elements is provided on the following pages.

Table 4-1. ISO-9000 and QS-9000 Elements

Quality Business System	System Elements	QS-9000 / ISO 9001
Customer	Customer Spec Review	Contract Review (3) Control of Customer-supplied Product (7) Quality Systems (2) Management (1)
Product Definition	Data Sheet	Contract Review (3) Design Control (4)
Design and Development	Data Sheet New Product Definition New Product Introduction Methodology Design Reviews Design Rules Rel Qualifications Characterization Test Methodology Documentation and Records Management Change Determination, Notification and Response	Design Control (4) Control of Quality Records (16) Document and Data Control (5)
Wafer Fab and Sort	Process Recipes Incoming Materials/ Supplier Control Equipment Control & Maintenance SPC (12) and Outlier Control Discrepant Material Control Wafer Level Reliability Test Program Control Traceability System Document Control Reliability Qualification Policy Change Determination, Notification & Response Reliability Monitoring Procedure Sub Contractor Selection, Monitor & Control Corrective Action and Response System Audit and Assessment	Quality Systems (2) Purchasing (6) Inspection and Testing (10) Inspection and Testing (10) Inspection and Test status (12) Training (9 &18) Statistical Techniques (20) Control of Inspection, Measuring, and Test Equipment (11) Process Control (9) Control of Nonconforming Product (13) Product Identification and Traceability (8) Control of Quality Records (16) Document and Data Control (5) Design Control (4) Design Control (4) Corrective and Preventive Action (14) Internal Quality Audits (17)

Table 4-1. ISO-9000 and QS-9000 Elements (Continued)

Quality Business System	System Elements	QS-9000 / ISO 9001
Assembly	Sub Contractor Selection, Monitor & Control	Purchasing (6)
	Audit and assessment process	Internal Quality Audits (17)
	Incoming Materials/Supplier Control	Purchasing (6)
		Inspection and Testing (10)
		Inspection and Testing (10)
		Inspection and Test status (12)
		Training (9 & 18)
		Statistical Techniques (20)
	Equipment Control & Maintenance	Control of Inspection, Measuring, and Test Equipment (11)
	SPC	Process Control (9)
	Outlier Control	
	Discrepant Material Control	Control of Nonconforming Product (13)
	Traceability System	Product Identification & Traceability (8)
	Document Control	Control of Quality Records (16)
		Document and Data Control (5)
	Reliability Qualification Policy	Design Control (4)
	Change Determination, Notification & Response	
	Reliability Monitoring Procedure	Design Control (4)
	Corrective Action and Response System	Corrective and Preventive Action (14)
Electrical Test	Process Recipes	
	Test Program Control	Quality Systems (2)
		Inspection and Testing (10)
		Inspection and Test status (12)
		Training (9 & 18)
	SPC	Statistical Techniques (20)
	Equipment Control & Maintenance	Process Control (9)
		Control of Inspection, Measuring, and Test Equipment (11)
	Traceability System	Product Identification & Traceability (8)
	Discrepant Material Control	Control of Nonconforming Product (13)
	Outlier Control	
	Document Control and Records Management	Control of Quality Records (16)
		Document and Data Control (5)
	Subcontractor Control	
	Qualification Policy	Design Control (4)
	Change Determination, Notification & Response	Design Control (4)
	Reliability Monitoring Procedure	Quality Systems (2)
	Audit and Assessment System	Internal Quality Audits (6)
	Corrective Action and Response System	Corrective and Preventive Action (14)

Table 4-1. ISO-9000 and QS-9000 Elements (Continued)

Quality Business System	System Elements	QS-9000 / ISO 9001
Pack and Ship	QA Sampling	
	Subcontractor Selection, Monitor & Control	Statistical Techniques (20) Purchasing (6)
		Design Control (4)
		Handling, Storage, Packaging, Preservation, and Delivery (15)
		Inspection and Testing (10)
		Inspection and Test status (12)
		Corrective and Preventive Action (14)
	Equipment Control & Maintenance	Training (9 & 18)
		Control of Inspection, Measuring, and Test Equipment (11)
	Traceability System	Product Identification & Traceability (8)
	Discrepant Material Control	Control of Nonconforming Product (13)
	Process Recipes	Quality Systems (2)
	Document Control and Records Management	Control of Quality Records (16) Document and Data Control (5)
	Change Determination, Notification & Response	
Distribution	Distribution Requirements	Certification to ISO 9002
	Sub Contractor Selection, Monitor & Control	Purchasing (6)
Customer	Failure Analysis and Return Material Authorization	Corrective and Preventive Action (14)
	Change Determination, Notification and Response	Design Control (4)
	Reliability Monitoring	Control of Quality Records (16)
	Document Control and Customer Spec Review	Document and Data Control (5)
	Corrective Action and Response System	Corrective and Preventive Action (14) Quality System (1)

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CERTIFICATE OF REGISTRATION

ISO 9000

ATMEL Corporation

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San Jose, CA 95131

Underwriters Laboratories Inc.® (UL) issues this certificate to the Firm named above, after assessing the Firm's quality system and finding it in compliance with

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EN ISO 9001:1994; BS EN ISO 9001:1994; ANSI/ASQC Q9001:1994

for the following scope of registration

3674 (US) : Semiconductors and Related Devices

The design, manufacture and test of monolithic and multichip integrated circuits. Registration also covers activities at the Colorado Springs, Colorado and Columbia, Maryland facilities of ATMEL Corporation.

This quality system registration is included in UL's Directory of Registered Firms and applies to the provision of goods and/or services as specified in the scope of registration from the address(es) shown above. By issuance of this certificate the firm represents that it will maintain its registration in accordance with the applicable requirements. This certificate is not transferable and remains the property of Underwriters Laboratories Inc.®.

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S. Joe Bhatia
Vice President
Follow-Up Services

UL REGISTERED FIRM

Section 5

New Product Development and Introduction

5.1 Overview

In order to meet our customer and market needs, it is imperative that Atmel develop and introduce new products in a timely manner with minimal design rework while meeting quality and reliability goals. To achieve this goal, Atmel uses a comprehensive product development and new product introduction methodology (NPI). This methodology defines development stages, milestones, and deliverables in the development process. This ensures consistency across the design, development, and product business groups located worldwide. It also serves to guarantee participation in the development process by all stakeholders at the earliest possible opportunity. In addition, most major business divisions have developed specific checklists suitable for their specific business needs.

Figure 5-1. AT45D041 SPI DataFlash®

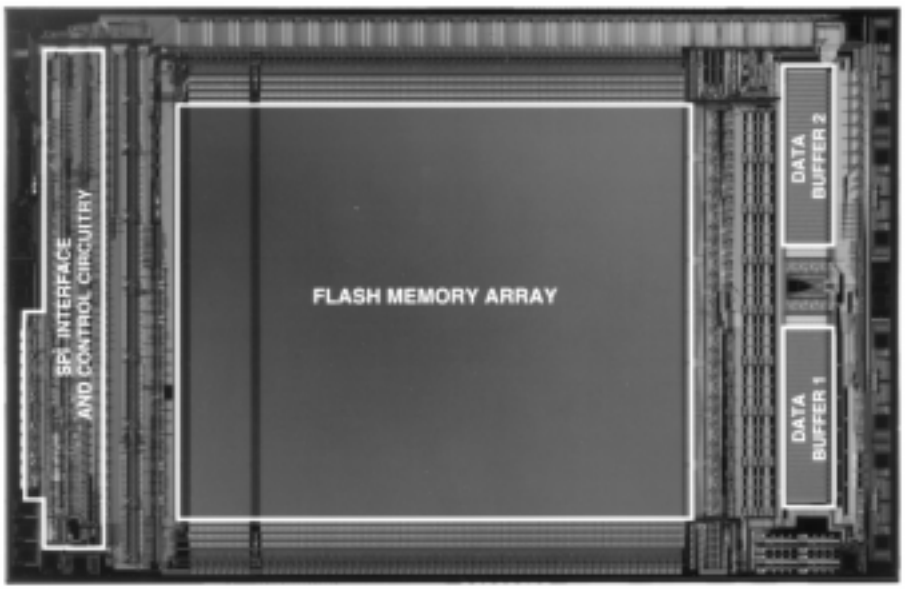
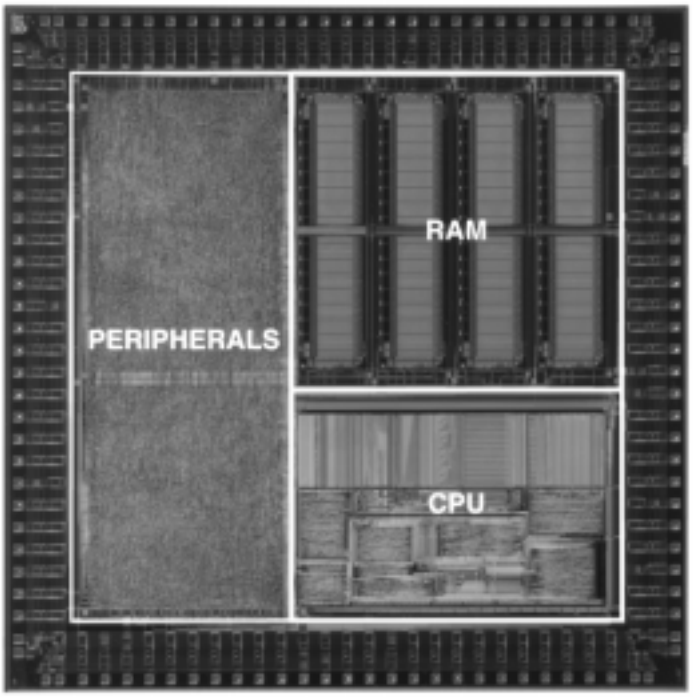
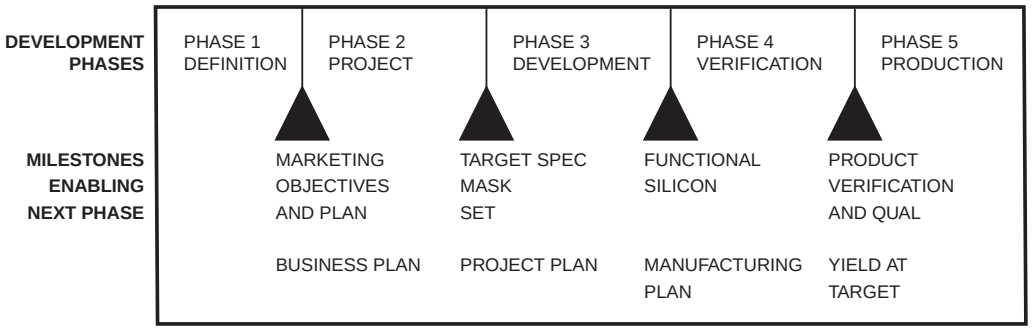


Figure 5-2. AT91M40400 16/32-bit MCU



5.2 Product Development Phases

Figure 5-3. Product Development Phases



5.2.1 Phase 1, Definition

A team comprised of marketing, design, and management is formed to define a new product using market research, customer surveys, and competitive analysis data as well as internal strategic plans. This team determines project feasibility and make a recommendation to executive management which must decide if the project should be funded.

5.2.2 Phase 2, Project Planning

If the project receives approval, a broader cross functional team is formed to develop a detailed project plan under the leadership of the marketing group. This team is responsible for advanced product quality planning to ensure that customer needs will be met by the new product. Team involvement also addresses any potential barriers to a successful and timely completion of the project. This phase is complete when the business plan is finalized.

5.2.3 Phase 3, Design and Development

Process design and development groups work collaboratively to assure manufacturable designs. In some cases, a new technology or modification to an existing technology may be needed to produce the new product. Periodic design reviews conducted by the design groups ensure that the project stays on track. This phase is completed with the mask set tape and a preliminary data sheet.

5.2.4 Phase 4, Verification and Qualification

In this phase, functional silicon is used to verify, characterize, and qualify the product. Product manufacturability is also assessed in this phase to ensure a fast production ramp. A characterization report, product reliability qualification report, and other performance data including any application notes and data sheet addendums are available at the end of this phase.

5.2.5 Phase 5, Production Ramp Up

The manufacturing and support groups take over the responsibility to ramp the product to high volume production. This requires close monitoring of line yields, manufacturing cycle times, and other potential manufacturing issues for prevention and timely resolution. Marketing and business planning groups determine the demand and loading of the manufacturing areas. Final data sheets are released in this phase.

Proper documentation in both paper form and electronic media is maintained for each product development project. Some of these include schematic files and net lists, design rules, tape-out databases, characterization data, and reliability qualification reports. These documents are maintained for a minimum of five years.

Section 6

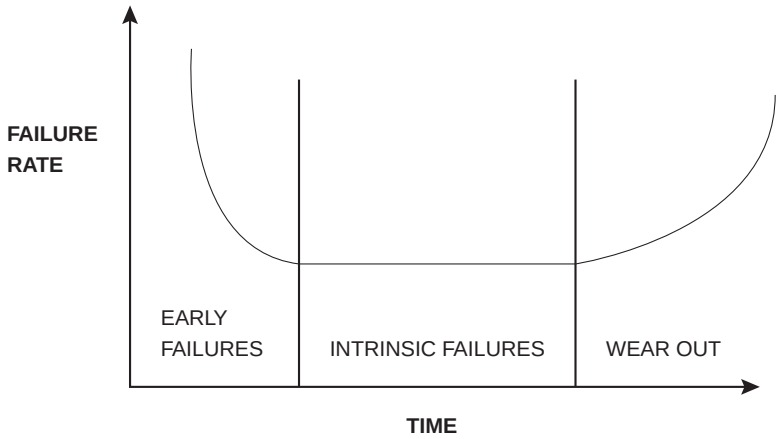
Reliability Qualification and Monitoring

6.1 Overview and Philosophy

Reliability may be defined as the ability of a product to perform under stated conditions for a specified period of time. Generally, reliability levels are expressed as the probability that a part will fail to function after a specified interval of time. The same part will have different probabilities of failure under different use conditions. For example, a part which may last for thirty years in a desktop computer in an air-conditioned office building may last for only ten years in a car engine which experiences temperature and humidity extremes.

In the electronics industry, this failure rate over time exhibits certain characteristics which are commonly referred to as the “Bathtub Curve”. It has three regions as depicted below (Early Failure Rate, Intrinsic Failure Rate, Wear Out Failure Rate).

Figure 6-1. Bathtub Curve



The bathtub curve behavior depends on the reliability of the die, wafer fabrication process, package, and assembly process. It also depends on the customer’s board/system manufacturing processes. All of these factors interact to determine the final reliability performance. A complete and comprehensive understanding of these contributing factors will enable a manufacturer to minimize potential reliability failures.

Products can operate in a system for up to thirty years without wearing out. Therefore, any tests designed to accurately evaluate reliability utilize accelerated use conditions. This acceleration is achieved by conducting tests at extreme temperatures and operat-

ing voltages which serve to shorten the overall test times to more manageable levels. Even with accelerated conditions, these tests can take several months to complete.

Another recent complexity in reliability evaluation is due to the high costs associated with large die sizes and high pin count packages.

Long cycle times and high qualification costs have resulted in the emergence of techniques to evaluate reliability in wafer form where even higher temperatures and voltages can be applied for greater acceleration. These techniques are referred to as Wafer Level Reliability (WLR).

Atmel supplies the most reliable product to our customers by developing highly reliable technologies and design rules in our wafer fab areas. Further reliability enhancements are made by using packages and assembly subcontractors with proven reliability and by qualifying these processes as well as products in packaged and finished forms before release to high volume production. Atmel's Reliability Methodology consists of early evaluation and short-loop monitoring of its technologies using WLR, end-of-line reliability qualification of new products and technologies using a battery of stress tests, and monitoring the reliability of production released products by periodically repeating these stress tests on an ongoing basis on a representative group of products. These three programs are referred to as Wafer Level Reliability (WLR), Reliability Qualification Methodology, and Reliability Monitor Program.

6.2 Wafer Level Reliability

WLR involves the reliability evaluation of new technologies during development and an ongoing monitor of these technologies on wafers which provide the earliest possible feedback. Special test structures have been developed for various technologies to evaluate the fundamental reliability of design rules and technologies. Wafer Level Reliability test structures are designed to ensure reliability of thin oxides, metallization and dielectric structures, and the basic transistor ruggedness. Structures are designed for the following tests:

- Gate Oxide Integrity (GOI)
- Time Dependent Dielectric Breakdown (TDDB)
- Gate Oxide Charge Retention (Qbd)
- Hot Carrier Injection (HCI)
- Metal and Plug Step Coverage
- Metal Electromigration (EM)
- Ionic Contamination
- Interlayer Dielectric Integrity
- Transistor Latch Up
- Transistor Performance and Ruggedness
- Process Induced Charging

All structures on new technologies are used to evaluate the robustness and reliability. Most structures are used to monitor reliability and process performance on an ongoing basis. These structures are also used to perform the initial assessment of major improvement changes.

6.3 Reliability Qualification Methodology

Wafer Level Reliability Tests, though very comprehensive and useful, have not achieved universal acceptance to replace reliability tests performed on the finished product due to the lesser known interactions between the die, package, and assembly processes. For this reason, Atmel maintains a very stringent reliability qualification methodology for new products, technologies, and packages on finished product. These reliability tests are designed to accelerate potential failure mechanisms due to process technology, pack-

age and die interaction, and worst-case environmental conditions. Each test and its purpose is briefly described below.

6.3.1 Data Retention Bake (DRB)

This test is used to measure a device's ability to retain a charge for extended periods of time without applying voltage bias. Stressing at high temperatures (150°C for plastic packages) accelerates any discharge causing the memory state to change.

6.3.2 Electrostatic Discharge (ESD)

This test is conducted in order to evaluate a device's sensitivity to ESD charges. Both Human Body (HBM) and Charge Device (CDM) models are used to replicate the handling environment.

6.3.3 Endurance Test (END)

This test is performed in order to evaluate a device's ability to be programmed, erased, and verified repeatedly for a pre-determined number of cycles. This test is used for products that are used in applications requiring multiple programming and erase cycles.

6.3.4 Highly Accelerated Stress Test (HAST)

The purpose of this test is to evaluate a plastic packaged component's ability to withstand harsh environmental conditions with extreme temperature and humidity levels. The parts are stressed to high temperature (130°C) and relative humidity (85%RH) conditions in a biased state to achieve maximum acceleration.

6.3.5 High Temperature Operating Life Test (HTOL)

The purpose of this test is to accelerate thermally activated failure mechanisms through the use of high temperatures (typically between 125°C and 150°C), increased voltage (commonly 30% above nominal), and dynamic bias conditions. Readouts at various time points are taken to determine the Early Failure Rate (EFR) and Intrinsic Failure Rate (IFR). EFR is expressed in defective parts per million (DPPM) and IFR is expressed in Failures in Time (FITs).

6.3.6 Latch Up (LU)

The purpose of this test is to evaluate a device's susceptibility to Latch Up at high current and voltage conditions.

6.3.7 Steam Pressure Pot (SPP)

This test is used to evaluate a plastic packaged component's ability to withstand severe conditions of pressure (15 psig), temperature (121°C), and humidity (100%RH).

6.3.8 Temperature Cycle (TC)

This test is used to measure a product's sensitivity to stresses due to differences in thermal expansion and contraction characteristics of the packaged components (die and mold compound, wire bond, die attach, etc.) by repeated alternating temperature dwells between high (typically 150°C) and low (typically –65°C) temperature extremes.

6.4 Reliability Modeling

The models used to predict the expected field performance are described below.

6.4.1 Thermal Acceleration

$$TAF = e^{\frac{e_a}{k} \times \left[\frac{1}{T_f + (P_f \times \theta_{JAf})} - \frac{1}{T_s + (P_s \times \theta_{JAs})}\right]}$$

where,

- TAF= Thermal Acceleration Factor
- e_a = Activation Energy (eV)
- k = Boltzman's Constant (8.617 x 10-5 eV/°K)
- T = Temperature (°K)
- f = Field Conditions
- s = Stress Conditions
- P = Power Dissipation (W)
- θ_{JA} = Thermal Resistance Coefficient - Junction to Ambient (°C/W)

6.4.2 Voltage Acceleration

Voltage acceleration is only used for failure mechanisms which are known to be accelerated by Voltage (i.e., gate oxide defects, charge gain, etc.). The Voltage Acceleration model is:

$$VAF = e^{Z \times [V_s - V_n]}$$

where,

VAF= Voltage Acceleration Factor
V_s = Stress Voltage (V)
V_n = Nominal Voltage (V)
Z = Voltage Acceleration Constant

6.4.3 Overall Acceleration

The overall acceleration factor (AF) is computed as the product of the thermal and Voltage acceleration factors. In cases where Voltage acceleration is inapplicable, a default value of 1.0 is assigned.

$$AF = TAF \times VAF$$

6.5 Failure Rate

$$\lambda = \frac{\chi^2\left(1 - \frac{\alpha}{100}, 2n + 2\right) \times 10^9}{2 \times AF \times DH}$$

where,

λ = Failure Rate (FITS)
χ^2 = Failure Estimate
α = Confidence Level (60% or 90%)
n = Number of Failures
DH = Device Hours

6.6 Example Calculation

HTOL (High Temperature Operating Life) testing at 125°C for 1,000 hours on a particular device results in 1 failure (charge gain) out of a sample size of 500 units. The corresponding activation energy for charge gain is known to be 0.5 eV (Voltage Acceleration constant = 1.0). The power dissipation for the device is identical under field and stress conditions (.15W). The junction temperature rise for the package is 20°C/W. The stress and nominal Voltage levels are 6.5 V and 5.0 V respectively. The field operating temperature is known to be 55°C.

The thermal and Voltage acceleration factors are computed as follows:

$$TAF = e^{\frac{0.5}{8.617 \times 10^{-5}} \times \left[\frac{1}{328 + (0.15 \times 20)} - \frac{1}{398 + (0.15 \times 20)}\right]}$$

$$VAF = e^{1.0 \times [6.5 - 5.0]} = 4.5$$

Therefore,

$$AF = 21.3 \times 4.5 = 95.9$$

The failure rate in FITS (with 60% confidence) is calculated as:

$$\lambda = \frac{4.04 \times 10^9}{2 \times (95.9) \times (1{,}000) \times (500)} = 42 \text{ FITS}$$

Table 6-1. Chi-square Failure Estimate Reference

Number of Failures	Chi-square (60% Conf.)	Chi-square (90% Conf.)
0	1.83	4.61
1	4.04	7.78
2	6.21	10.64
3	8.35	13.36
4	10.47	15.99
5	12.58	18.55
6	14.69	21.06
7	16.78	23.54
8	18.87	25.99
9	20.95	28.41

Figure 6-2. Cross Section of a Typical Source-drain Array

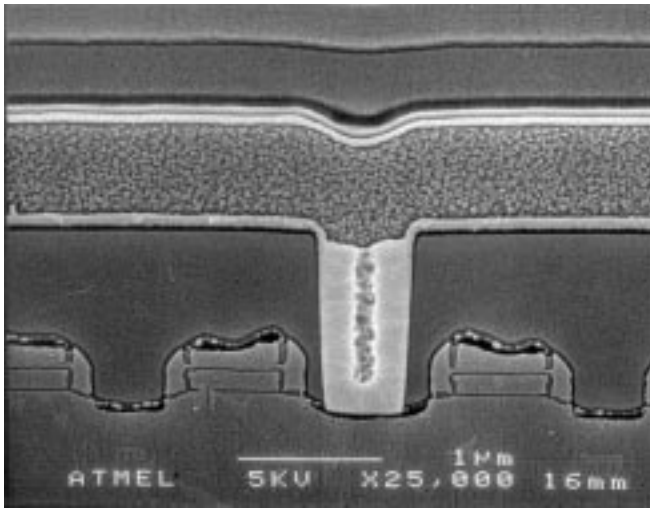


Figure 6-3. Cross Section Showing Multi-level Metal Structure with Plugs

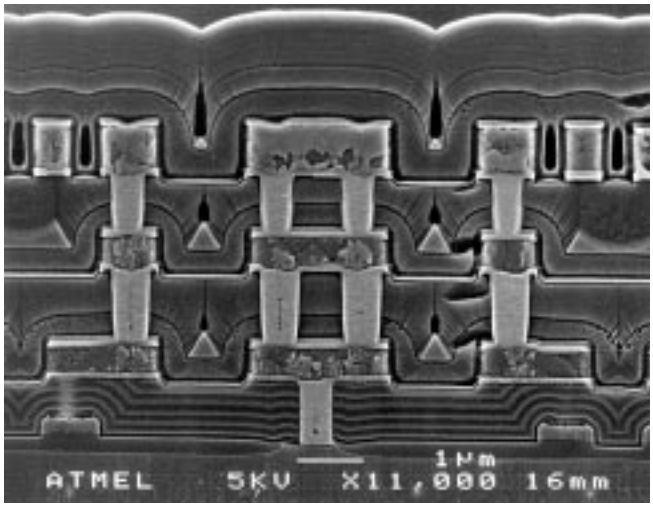
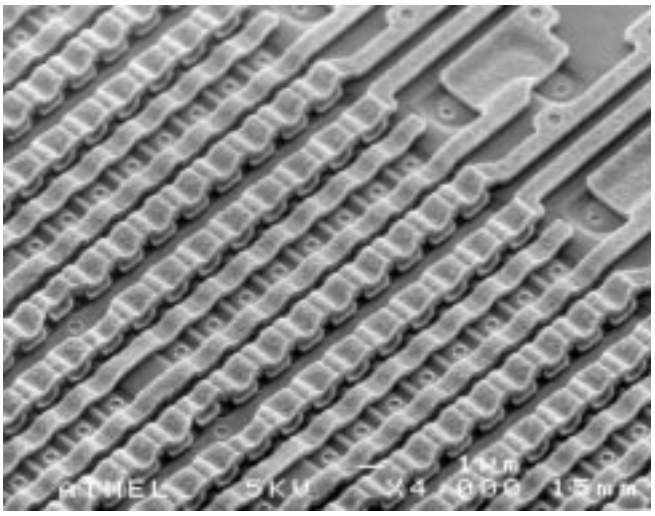


Figure 6-4. Top View Showing Planarized Metal Structures



6.7 Reliability Monitor Program

Each quarter, Atmel's reliability group subjects a set of representative products to the stress tests previously used for reliability qualification to ensure that the products, process and packages have not degraded over time. These products are selected using a criteria which includes volume, complexity, fab area, assembly source, and specific customer requirements. This data is accumulated over several quarters to determine trends in reliability of fab technologies, design rules, and assembly processes. Additionally, this data is used to identify continuous improvement opportunities and appropriate corrective actions. Quarterly reliability monitor reports are provided to customers when requested.

6.8 Failure Analysis and Corrective Action

In order to continuously improve reliability, it is imperative to understand the root cause of failures and prevent their recurrence. A systematic approach is necessary to ensure that the more prevalent failures are eliminated first. Atmel has a policy to analyze every reliability failure to determine its root cause. Sources of failures include customer returns and internal reliability evaluations. At the end of each quarter, a summary and Pareto distribution of all failure modes and mechanisms is used to determine the top three mechanisms requiring immediate attention. This has helped Atmel focus its resources on eliminating several failure mechanisms in recent years.

6.9 Reliability Targets

Results of the reliability monitor and qualification programs are used to determine the average failure rates for each technology and each major product family. Specific targets are set for technologies based on customer requirements and maturity level. Slightly higher failure rates may be tolerated on newer technologies.

Section 7

Subcontractor Monitor and Control

7.1 Overview

Almost all large corporations rely on subcontractors to provide services which are specialized. This reduces any exposure to the changes in the business climate and eliminates the need to invest heavily in plant and equipment. Downside risk of unit costs, capacity, and cycle times can be minimized by entering into strategic partnerships with subcontractors and by implementing a clearly defined system of checks and balances.

Atmel made a strategic decision to utilize subcontractors for assembly. In addition, we may subcontract segments of the development processes such as software needed for a certain product family or product testing.

7.2 Categories

We must ensure that services provided by our subcontractors meet both internal and external requirements. Consequently, we have implemented a comprehensive system to select, monitor, and control our subcontractors. This system relies on a cross-functional team, which typically consists of representatives from the relevant engineering, procurement, quality, reliability, and manufacturing groups. The subcontractor will be classified into one of the following categories based on specific criteria, (Quality, Reliability, Service, etc.).

7.2.1 Unapproved

These subcontractors are usually newly engaged for a short-term business need or in a situation where sufficient time is not available for classification into a higher category. This is a temporary classification.

7.2.2 Limited Business

In this category, the subcontractor is undergoing a qualification concurrent to providing Atmel a service. A paper review of subcontractor systems, controls, and capabilities is generally sufficient to receive this classification. This is also a temporary classification but can last until a “Qualified” classification is achieved.

7.2.3 Qualified

The majority of Atmel subcontractors fall into this category. These subcontractors have gone through an Atmel or equivalent audit to assess their system, technology, capacity, and other capabilities and have received formal approval.

7.2.4 Strategic

A few subcontractors have a strategic relationship with Atmel due to their unique technology, partnership relationship, or other factors. These subcontractors have a technology roadmaps which fits Atmel and our customer requirements. They also provide a superior level of products and services.

7.2.5 Disqualified

This status is given to subcontractors who exhibit repetitive problems and fail to meet internal and customer requirements. Customers in this category are unable to continue business with Atmel.

Each group using a subcontractor defines its requirements for cost, cycle time, and delivery. Subcontractors must also meet Atmel's Corporate Quality and Reliability requirements which include:

- Monthly or Quarterly SPC reports
- Process Change Notification for all changes
- Process Change Approval on all major changes
- Yield and In-line Monitor data
- Annual Facility Audits
- ISO-9000 or Equivalent Certification (moving towards QS-9000 in year 2000)
- Quality and Reliability Monitor Programs
- FA System that Meets Atmel Requirements
- Dedicated Quality Contact

As this program evolves, we will develop a system for recognizing our outstanding subcontractors on an annual basis.

Section 8

Quality Assurance and Monitoring

Through Statistical Process Control (SPC), In-line Quality Control (QC), and other statistical techniques, Atmel is able to achieve a high level of control over the quality of product in our manufacturing processes. Atmel's Outgoing Quality Assurance monitor program is geared towards assuring ourselves and our customers that the product being shipped is of the highest quality. Any failures detected at the outgoing quality test require the identification of the root cause and its subsequent prevention. This results in continuous improvement of product quality levels to achieve our ultimate goal of providing our customers with products that are free of electrical, mechanical, visual, or administrative defects. This end of line program can be broken down into three areas: In-line Quality Control, Quality Assurance Inspection, and Shipping Quality Inspection.

8.1 In-Line Quality Control

This is established by performing 100% re-inspection on previously tested devices immediately prior to package coplanarity verification. This testing is only conducted on devices which have been recently introduced or have experienced a higher than normal lot rejection rate during Quality Assurance Inspection. The primary purpose of this testing is to ensure that the device has completed its pre-determined allotment of electrical screens (parametric, functionality, etc.).

8.2 Quality Assurance Inspection

This inspection is conducted at the end of the line and is the predominant vehicle used to guarantee defect-free product. Each lot undergoes three inspections (electrical, visual/mechanical, and administrative). A failure that is identified during any of the inspections triggers 100% rescreening of the entire lot. The results from the rescreen are used to identify and implement corrective actions.

First, a random sample of devices is electrically tested. The sample size depends on the lot size and the product/package type quality classification (audit, reduced, normal, or tightened). The quality classification is based on the most recent quality inspection results (lot rejection rate and DPPM level) for the product/package type. Typically, newer products fall into the tightened category (large sample sizes, up to 500 units per lot) and mature products fall into either the reduced or audit plans (small sample sizes, as low as eight units per lot). This statistically powerful program is the most suitable way to maximize the likelihood of finding a failure by focusing resources on the products that have the highest probability of containing a defect and driving continuous improvement.

Second, a random sample of devices is inspected for visual and mechanical defects. The sample size is dependent upon the package type being inspected. The criteria includes coplanarity, lead pitch, incorrect mark, poor mark, and other package anomalies.

Third, the associated paperwork (lot traveler) is inspected by Quality Assurance Inspectors to verify that each step in the product flow was completed satisfactorily. Each unit is accounted for during this inspection.

8.3 Shipping Quality Inspection

Final quality inspection occurs after parts have been matched with a customer purchase order. Quality Assurance Inspectors verify that the part marking and quantity correspond with the information contained on the order form. Also, they will check to make sure any special instructions (dry pack, tape and reel, date code restrictions, etc.) are adhered to prior to shipment.

Outgoing quality levels are monitored on an ongoing basis for all product families to assure a rapid pace of continuous improvement. Our overall goal is to improve product quality levels at the rate of fifty percent each year.

Section 9

Quality Tools and Training

9.1 Purpose and Impact

Achieving our strategic objectives as a corporation requires that we not only focus on continuous improvement of systems, equipment, and processes but most importantly on continuously improving the knowledge base of our employees. Atmel puts a significant emphasis on the training and re-training of our personnel at all levels of the organization to maintain a culture of total quality and to ensure that we stay competitive in our marketplace. Employee training is classified as both internal and external.

9.2 Internal Training

Internal training consists of training in customer satisfaction, quality systems, and quality tools used in the development and manufacturing of our products. Internal training is provided by subject matter experts who may be Atmel employees or external contractors. This training is targeted towards all employees; some material is mandatory. Contents and the level of detail vary with the target audience. For example, company executives may receive an overview lasting eight hours while training courses for the engineering groups may take more than 40 hours. Operators will receive the same number of hours of training as engineers, but the content is much simpler and more directly applicable to their specific job functions.

Supervisory and management training is also provided to the appropriate personnel. Training material is customized by each site to suit their specific needs. Some of the courses that have been offered include:

- Atmel Quality System
- Customer Satisfaction Program
- Reliability Qualification Methodology
- Subcontractor Program
- SPC Tools
- Design of Experiments
- Project Management
- Team Building
- Problem Solving Methodology

9.3 External Training

External training for career enhancement or to learn new skills necessary for performing a job function is usually very specific to each employee. Typically, this type of training requires a discussion between the employee and supervisor to determine the specific needs resulting in a mutually agreed upon plan. This may involve attending classes at a

local university or technical school or attending specially arranged seminars as well as industry consortia meetings.

9.4 Training Records

Employee training records are maintained by the Human Resource group or their designee at each site. All employees are expected to immediately start the use of the skills learned from internal and external training to achieve the maximum mutual benefit.

Section 10

Major Initiatives in 1999 and 2000

As part of our Quest for Continuous Improvement, Atmel defines a set of corporate and site initiatives. This ensures that we are always improving our products, services, and technology. The following initiatives have been launched in 1999.

10.1 New Product Introduction Methodology Enhancement

The purpose of this initiative is to enhance our existing methodology. More rigorous characterization, test methodology, and FMEA will be part of this improvement.

10.2 Abnormal Lot Control Program

The purpose of this program is to automatically flag and control lots that fall outside the normal statistical distribution. New information systems and tools are being evaluated to implement this program.

10.3 Wafer Level Reliability Program

We plan to enhance the WLR program to add high density analog and mixed signal technologies to our current WLR program and make better use of test structures in new technology development.

10.4 Closed Loop Corrective Action System

Enhancements in our corrective action system are planned to ensure proper escalation and resolution of cross-site and subcontractor issues.

Section 11

Summary and Conclusions

Atmel management wants to achieve a culture of Total Quality where each individual understands the impact of their job function on the end product and customer. This culture requires that proper training and skills be provided to employees along with a robust quality system to support its business. These coupled with a strong management focus and review process ensure that Atmel will stay focused on its quest for continuous improvement. Our quality policy to supply defect free, innovative products and outstanding service highlighted by our quality logo reflect Atmel's philosophy where our customers always come first!