



**MICROCHIP OVERVIEW,  
QUALITY SYSTEMS AND  
CUSTOMER INTERFACE SYSTEMS  
HANDBOOK**



**MICROCHIP**



QUALITY MANAGEMENT SYSTEM  
CERTIFIED BY DNV  
**==ISO/TS 16949:2002==**

Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELoq® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

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# INTRODUCTION

Microchip Technology Incorporated, a leading supplier of field programmable PIC® 8-bit and 16-bit RISC microcontrollers (MCUs), analog semiconductors and related memory products, offers complete embedded control solutions that combine time-to-market advantages with high performance and increased functionality.

The purpose of this handbook is to provide you with an introduction to Microchip Technology Inc., a general overview of our quality system and internal operations, and a brief description of the interface systems designed to ensure total customer satisfaction and excellence in customer service.

At the center of Microchip's Core Business Culture are its Mission, Guiding Values and Aggregate System Model providing constancy of purpose while allowing the flexibility to be creative and innovative to meet customer needs.

Our Aggregate System Model defines the interrelationship of all our business systems and resources to achieve our mission and strategic goals. The model is designed so that our company culture, systems, practices, policies and employees work in union to achieve Microchip's performance potential.

### **MISSION STATEMENT**

Our Mission Statement defines our business and our direction for success.

"Microchip Technology Incorporated is a leading supplier of field-programmable embedded control solutions by providing RISC microcontrollers and related nonvolatile memory products. In order to contribute to the ongoing success of customers, shareholders and employees, our mission is to focus resources on high-value, high-quality products and to continuously improve all aspects of our business, providing a competitive return on investment."

### **GUIDING VALUES**

Our Guiding Values provide the core principles that define our culture and the way we do business. They provide the framework for all decision making whether it is regarding the quality of our product or service, the way we treat our customers, suppliers and employees, to the way we determine our business strategies.

- Quality Comes First
- Customers Are Our Focus
- Continuous Improvement is Essential
- Employees Are Our Greatest Strength
- Products and Technology Are Our Foundation
- Total Cycle Times Are Optimized
- Safety Is Never Compromised
- Profits And Growth Provide for Everything We Do
- Communication Is Vital
- Suppliers, Representatives and Distributors Are Our Partners
- Professional Ethics Are Practiced

### **QUALITY CULTURE**

At Microchip, every organization, business unit and individual owns quality of their outputs, whether it is product, software, process, or services.

### **QUALITY POLICY**

In order to meet or exceed customer expectations at a reduced cost, we encourage our employees to support continuous improvement, anticipate problems and implement root cause solutions.

## PROCESS AND PRODUCT OVERVIEW

Since its inception, Microchip Technology has directed its resources on delivering innovative semiconductor products to the global embedded control marketplace. To do this, we have focused our technology, engineering, manufacturing and marketing resources on three synergistic product lines: microcontrollers (MCUs), analog semiconductors and high-endurance nonvolatile memory products. Microchip's expanding product portfolio is aimed at delivering a more comprehensive array of high-value embedded control solutions to a growing base of customers.

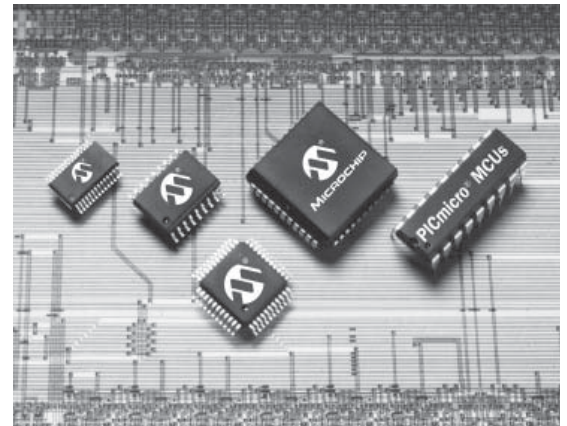
### PROCESS TECHNOLOGY

Microchip's wafer fabrication processes have been developed with reliability and manufacturability as their primary goals. All products manufactured at Microchip make use of a common N-well CMOS process to which modules are modified to create the specific functions required by the product (EEPROM, MCU, logic, Enhanced FLASH, analog and EPROM). The baseline N-well CMOS process is released on mature manufacturing lines that supports 1.2, 0.9, 0.7, 0.5 and 0.4 micron technologies. All devices utilize a proprietary passivation suitable for a wide variety of package types. Microchip manufactures 8-inch wafers.

Microchip's research and development activities include exploring new process technologies and products that have industry leadership potential. Particular emphasis is placed on products that can be put to work in high-performance, broad-based markets. Equipment is continually updated to bring the most sophisticated process, computer-aided design (CAD) and testing (CAT) tools on-line. Cycle times for new technology development are continuously reduced by using in-house mask generation, a high-speed pilot line within the manufacturing facility and continuously improving methodologies.

### PRODUCTS

By pushing the design and process dimensions of our sub-micron, double-level metal manufacturing process, Microchip has achieved world-class yields which are unmatched by our competition. (Please refer to [www.microchip.com](http://www.microchip.com) for detailed product information).



### 8-Bit Microcontrollers

With a broad product portfolio, Microchip can provide solutions for the entire range of 8-bit microcontrollers. The PIC<sup>®</sup> microcontroller solution features a powerful architecture, appropriate integration of both analog and digital peripherals and flexible memory technologies, that include Flash, EEPROM, OTP and ROM. Microchip's proprietary PIC<sup>®</sup> microcontrollers have quickly become a worldwide standard that provides low-risk product development and faster time-to-market with seamless program size expansion, standard pin schemes and code compatibility.

### Serial EEPROM Nonvolatile Memory

Microchip's advancements in nonvolatile memory products are revolutionizing the industry. Small-footprint, low-voltage, high-density product enhancements give customers enormous performance advantages in their application designs. Microchip has pioneered the industry leading Smart Serial<sup>™</sup> family, which has set the standard for embedded control memory solutions. Design tools, including the industry-first Total Endurance<sup>™</sup> Disk, provide easy-to-use systems for product development.



### Secure Data Products

Microchip offers 8-bit PIC microcontrollers that provide remote control/secure entry solutions via

Microchip's revolutionary KEELoq® technology. The patented KEELoq code hopping technology, a worldwide standard, provides a simple highly secure solution for authentication, remote keyless entry (RKE), passive keyless entry (PKE) or other remote control solutions. Microchip is expanding its KEELoq product family to include programmable encoders and decoders.



### **Analog and Interface Products**

Microchip offers a product line of stand-alone analog and interface products. This product line complements our existing PIC MCU products and offers our customers a more flexible system solution. Additionally, many of these stand-alone devices support functionality that may not currently be available on PIC MCUs.

### **Digital Signal Controllers**

Microchip's family of dsPIC® DSC Digital Signal Controllers combines the many features and capabilities of a 16-bit microcontroller with the high performance capabilities of a Digital Signal Processor (DSP).

The dsPIC DSC product family offers a broad development tool suite of hardware and software to ease the effort of the designer, high performance Harvard dual-bus architecture and proliferation of integrated peripherals to monitor and control all aspects of the embedded control product.

### **Development Systems**

Microchip offers a comprehensive set



of easy-to-learn application development tools, including the industry-leading MPLAB® Integrated Development Environment. The tools are designed to allow quick and easy programming of PIC MCUs for specific applications. The development tools also provide a software migration path for customers moving from entry-level to real-time emulation by providing a common assembly language.

**Literature Order Information:** Information on Microchip's products can be obtained by contacting your local Microchip sales office or by visiting our web site at [www.microchip.com](http://www.microchip.com).



# MICROCHIP CORPORATE OVERVIEW



Chandler, Arizona: Company headquarters near Phoenix, Arizona; executive offices and R&D occupy this 242,000 square-foot multi-building facility.



Tempe, Arizona: Microchip's 170,000 square-foot wafer fabrication facility supports current manufacturing capacity.



Gresham, Oregon: With more than 200,000 square-foot of clean room space, this is Microchip's most technically advanced manufacturing facility.



Bangkok, Thailand: Microchip's 140,000 square-foot manufacturing facility houses the technology and assembly/test equipment for high speed testing and packaging.

## GLOBAL NETWORK OF FACILITIES AND SALES OFFICES

Microchip is a global competitor providing local services to the world's technology centers. The Company's design and technology advancement facilities and wafer fabrication sites are located in Arizona and Oregon. Microchip's Bangkok, Thailand, facility serves as the foundation of Microchip's extensive assembly and test capability. The use of multiple fabrication, assembly and test sites located worldwide ensures Microchip's ability to meet the increased production requirements of a fast growing customer base.

Our manufacturing facilities are located in:

- Tempe, Arizona and Gresham, Oregon (Wafer Fabrication)
- Chandler, Arizona (Wafer Test)
- Bangkok, Thailand (Assembly & Test)

The Company sells its products to a broad spectrum of embedded control markets, including consumer electronics, automotive, office automation, communications and industrial control. Microchip supports its global customer base from direct sales and engineering offices in Asia, Europe, and the Americas. The Company also franchises distributors and a network of technical manufacturer's representatives serving the global market worldwide.

## DIVISION STRUCTURE AND INTERFACES

At Microchip, the progressive culture is a consciously designed working environment in which all organizations understand and practice a common set of values to achieve the company goals of quality and technological advancement. The relatively flat organizational structure provides a flexible framework for multiple disciplines to work together and provide customers with high quality results that are consistent with their technical and business needs.



# MICROCHIP CORPORATE OVERVIEW

Within Microchip, each organization has clearly defined responsibilities to the business operations and the established Quality System. The principal responsibilities and interfaces are worldwide sales and marketing, product divisions, purchasing and material control, manufacturing and quality systems.

## ***Worldwide Sales and Marketing***

Worldwide Sales and Marketing have the authority and responsibility for promoting the sales of Microchip products in the global marketplace and within the Corporate guidelines. These functions have primary responsibility to ensure that all customer requirements and requests are reviewed with the product division groups and can be met as required by contract.

## ***Product Divisions***

The Product Divisions have the authority and responsibility to design silicon devices for Microchip based on the design specifications and technology requirements. They also have the responsibility to review performance to specifications, ensure testability and other quality-related requirements are met, and to initiate resolution of deficiencies found during all phases of design, qualification and manufacturing.

## ***Purchasing and Material***

The Purchasing and Materials Groups have the authority and responsibility for making final determination of supply sources within corporate quality and cost expectations, as well as providing internal material services to manufacturing and support organizations. These groups also have the responsibility for coordinating the review of change orders on purchased materials and initiating communication of corrective actions to suppliers on quality-related issues.

## ***Manufacturing***

Manufacturing has the authority and responsibility for all manufacturing operations and process development activities in support of new and existing products. Manufacturing Departments utilize statistical techniques for monitoring the quality of all fabrication, assembly and test facilities. Employees apply a well-documented corrective and preventive action system to provide continuous improvement throughout all operations.

## ***Quality Systems***

Quality Systems has the authority and responsibility for conducting device qualifications, tracking ongoing reliability performance, performing failure analysis, overseeing corporate quality system maintenance programs and customer satisfaction activities.

## OPERATIONS



Microchip has received quality awards from several Fortune 100 customers. Awards include the Ford Q1 award, United Technology Q-Plus, Bosch Automotive Division Preferred Supplier Award, and the Delco CDF-AEC A100/QS9000 Certification from Det Norske Veritas (DNV).

Microchip delivers fast turnaround and consistent quality through total control over all phases of production. Research and development, design, mask making, wafer fabrication, final test and quality assurance testing are conducted at facilities wholly owned and operated by Microchip. Subcontract assembly facilities are utilized throughout Asia to provide appropriate capacity for meeting customer needs. Approved subcontract facilities have been qualified through rigorous stress testing and by successfully passing a site Quality System audit. Our comprehensive design process along with our integrated approach to manufacturing has resulted in high and consistent yields, positioning Microchip as a quality leader in its global markets. Microchip's commitment to continuously improve operations provides customers with excellent pricing, quality, reliability and on-time delivery.

The following sections provide an overview of the Microchip Quality System, the new product and technology introduction processes, the product qualification methodology, on-going reliability monitors and a top-level flow of manufacturing operations and in-process controls.

### THE MICROCHIP QUALITY SYSTEM

#### Quality System Makeup

Microchip's Quality System is based on the elements and criteria specified by ISO/TS-16949:2002. The specified controls apply to all stages of design and manufacturing.

Management's stated public commitment to the quality of Microchip's products is expressed in terms of the Quality Policy:

In order to meet or exceed customer expectation at a reduced cost, we encourage our employees to support continuous improvement, anticipate problems and implement root cause solutions.

The Microchip Quality Manual documents the Quality System used for the company's design and manufacturing activities. It defines Microchip's overall policy and the responsibilities toward each of the quality system elements. For each element, Microchip maintains documented procedures to ensure adherence to the established controls. Microchip periodically conducts Management Reviews and internal audits of the quality system to ensure the system's continuing suitability.

The purpose of this section is to provide an overview of a few key elements and controls contained within the total Quality System. (Refer to the Microchip Corporate Quality Manual for a complete description of the Microchip Quality System and controls across all elements).

#### Document and Data Control

Activities affecting quality are defined by documented procedures. These documents include criteria for ensuring all necessary product and process control activities have been completed and that requirements have been satisfied. All documents are reviewed and approved for accuracy and are maintained under revision control. The Quality System documentation structure can be represented by four levels of information, as depicted in Figure 2.

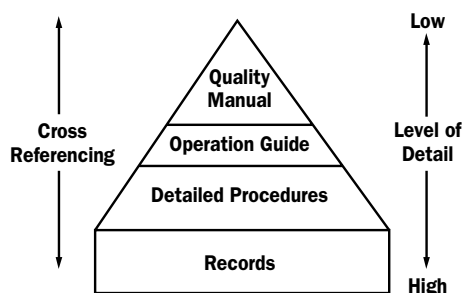


Figure 2: Quality System Document Structure

## Contract Review

The contract review process ensures a common understanding of the quality requirements between Microchip and the customer. All customer contractual requirements are reviewed to ensure:

- The scope of the contract is clearly defined.
- Requirements are adequately documented.
- The capability to fulfill the contract exists.
- Any differences between customer requirements and Microchip's capabilities are identified and resolved.

Microchip employs the Non-Standard Customer Action Request (NSCAR) procedure to process special customer requests – those outside of the Microchip data book specification and/or unique to a specific customer. See 'Contract Specification and Review' in Figure 8.

## Product Identification and Traceability

Product identification and traceability of material within the manufacturing operation is important to ensure correct lot processing, proper material control and to support problem solving efforts during all stages of production and delivery. Microchip's traceability system has been designed to provide forward and backward traceability data based on the information contained within the part marking scheme.

Parts are physically marked with a code YYWWNNN, where:

YY signifies the year (calendar)  
WW signifies work week (calendar)  
NNN is a unique alphanumeric trace code,

That is fully traceable to:

- Wafer lot number and location
- Assembly lot number and location
- Test lot number and location
- Associated logs and records

Note: Where package size does not allow for the full seven-digit code marking, abbreviated formats have been defined to support traceability requirements.

## Corrective/Preventive Actions

Microchip establishes and maintains procedures for corrective and preventive actions to assure requests for action are assigned, root cause solutions are implemented and measures are taken to prevent problem occurrence and problem reoccurrence. The procedures are based on the 8-D approach to effective problem solving. The scope of corrective/preventive action is applicable to all processes affecting quality, including customer complaints. The effectiveness and closure of these actions are internally tracked. The status of the corrective/preventive action system is examined during Management Reviews to assure effective problem resolution.

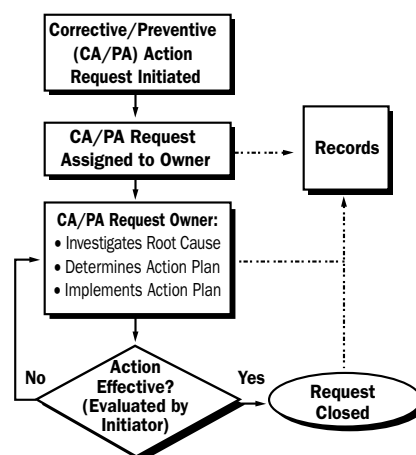


Figure 3: Site Corrective/Preventive Action Process

## **Qualification of Employees**

Microchip's corporate training philosophy addresses both the technical and human side of doing business. As part of the employee development process, managers and supervisors identify the quality-related responsibilities for each employee, define the employee's training needs and ensure that the employee completes all necessary training to perform his or her job. For manufacturing employees, a formal Manufacturing Operation Certification System is maintained to specify the requirements and operations to which employees must be formally certified. Similarly, all other personnel's training activities and qualifications are formally documented and maintained.

Microchip's Employee Development Organization offers a wide range of courses which focus on developing the skills necessary for employees to perform their jobs well. Programs have been created in support of Microchip's Strategic Vision and Guiding Values. Programs have been defined to support the training needs of Production Specialists, Engineers and Technicians, Managers and Teams, Project Managers, and Administrative and Support Personnel. Courses are offered on technical subjects, manufacturing operations, leadership, project management, problem solving, decision making, statistics, quality improvement, teaming and business practices. In addition, employees routinely attend external seminars, universities and distance learning programs to enhance their technical and management expertise.

## **Statistical Techniques & Defect Prevention**

Microchip employs various statistical techniques to characterize, control and reduce variability of production processes. To do this, engineering and manufacturing establish minimum process requirements including:

- Design analysis and elimination of potential problems and failure mechanisms.
- A reference standard for the process, based on process qualification and capability studies.
- Statistical tools to provide real-time process analysis and feedback.

- Statistical tools (e.g., Design of Experiments, Pareto Analysis, Trend Charts, Probability Plots, Reliability Analysis Techniques) to identify top problems, assignable cause and direct improvement actions through internal corrective and preventive action systems.

Specific applications of these techniques are:

- Engineering's application of continuous improvement is based on FMEA Methodology (CIPP) used during product development, verification, validation and enhancement activities.
- In-line process control using process control charts and parametric electrical testing to monitor performance and alert operators of abnormal conditions.
- Off-line analysis of designed experiments (DOE), defect density data, yield and parametric electrical test data.
- The establishment of acceptance limits and monitoring of final test and outgoing quality levels.
- Device reliability predictions based on ongoing reliability monitor results.

Microchip emphasizes that the effective implementation of these statistical techniques is dependent upon the existence and adequate application of all other basic elements of the total quality system.

## **Internal Audits**

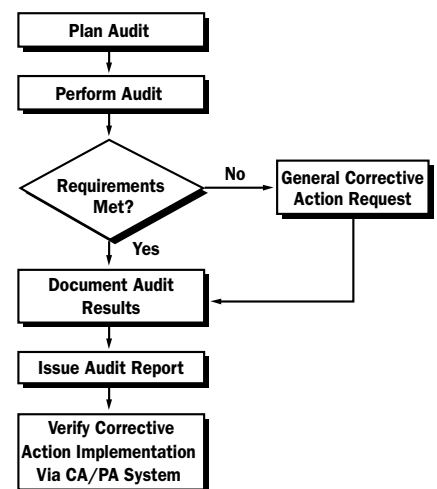


Figure 4: Internal Audit Flow

Evaluating conformance to the Microchip Quality System is accomplished through internal audits. Documented procedures have been established for planning and performing these audits.

Internal audits are scheduled on the basis of status, importance of activity and system coverage. These audits are conducted by persons independent of those having direct responsibility for the activity being audited. Results of the audit are recorded in a formal audit report. The auditee is responsible for correcting any non-conformity discovered during the audit. Follow-up activities are performed to verify implementation and effectiveness. Audit results are included during Management Review. Management review is a process by which top management reviews the health of the entire quality system by reviewing metrics related to product performance, process performance, internal audits, corrective/preventive action, customer satisfaction, etc.

## New Products and Technology Introduction

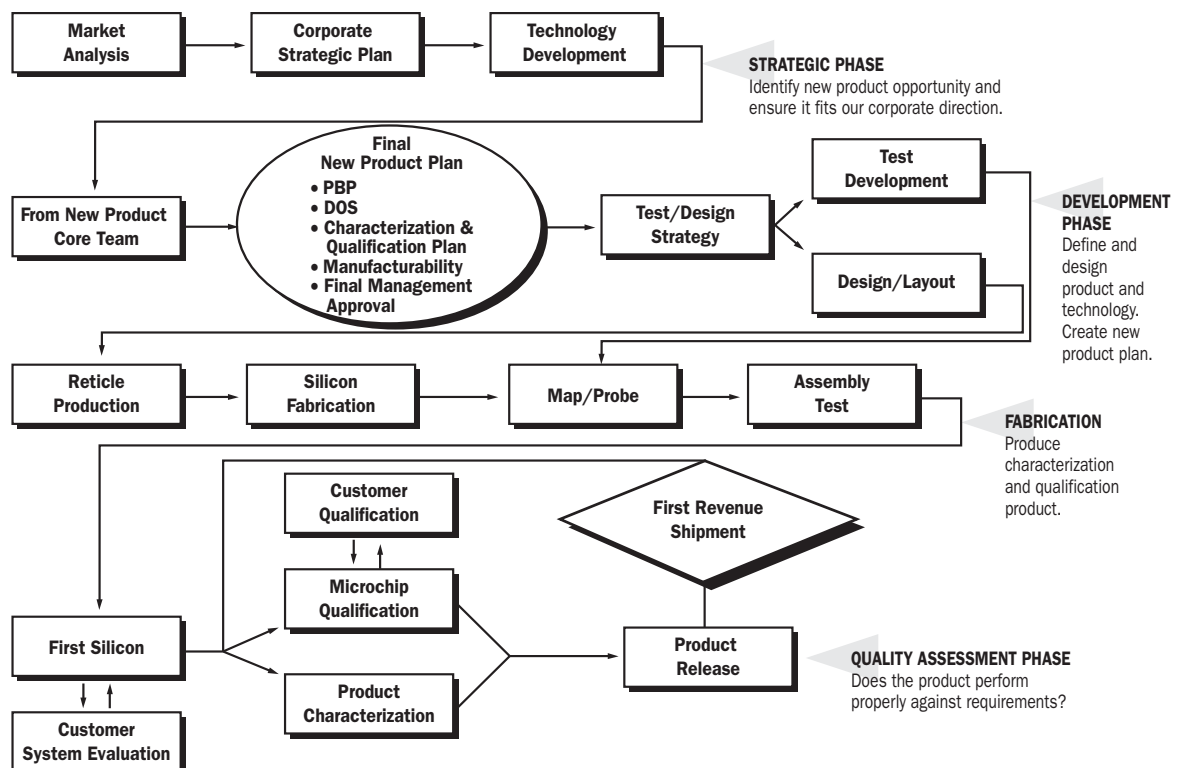
New product and process development planning utilize the Advance Product Quality Planning methodology. Product Planning is

driven by the Product Divisions who have responsibility to ensure that required design controls are established and implemented. Since the essential aspects of a product, such as performance and reliability, are established during the design phases, Microchip maintains documented procedures to control and verify that product designs meet or exceed specified requirements. In this way, deficient designs, which can be a major contributor to quality problems, are avoided.

New product ideas originate from the customer, field engineering or the product divisions. Marketing analysis and technical feasibility reviews are performed for those ideas that fit the Company's strategic direction. Once a decision has been made to proceed with a new product concept, a New Product Development Team is established to formalize the design and implementation plan.

The control and documentation of critical design stages includes planning, review/verification of input requirements, confirmation of design output, design verification and design validation. The new product development process is depicted in Figure 5.

Figure 5: New Product Development





Design planning is the process by which design plans are established and used by the cross-functional teams to track critical project milestones. These teams are composed of design personnel and a designated cross-functional Product Development Team consisting of members from areas including quality, test, marketing, applications and manufacturing.

Design Objective Specifications (DOS) document the product design inputs. Review sessions are conducted throughout the design process to ensure that the DOS, as well as designs, continue to meet all requirements.

The design validation process commences with Manufacturing Review. This process outlines tasks necessary for product development. These tasks include the establishment of characterization plans, test plans, qualification plans, process description, product schedules, validation plans, verification to quality conformance requirements, process steps, test procedures, and review of the compatibility of the design to production processes. Product/process development outputs also include:

- Designation of special characteristics
- Development of FMEAs
- Establishment of actions to reduce potential failure modes with higher risk priority numbers
- Development of control plans to identify critical process steps and their associated control specifications

Final reviews of simulation data, as well as device performance data, are conducted to determine if the product meets the requirements of the product specification. The reviews are held by the cross-functional Product Development Team before the product is released for first silicon manufacturing. After “first silicon,” design validation is performed to ensure that product conforms to defined user needs and/or requirements. The intent of this process is to ensure that products meet specified requirements and that all quality related activities are identified, planned for and implemented. The resulting product plan is documented through the Product Specification Index (PSI).

### Manufacturing Process

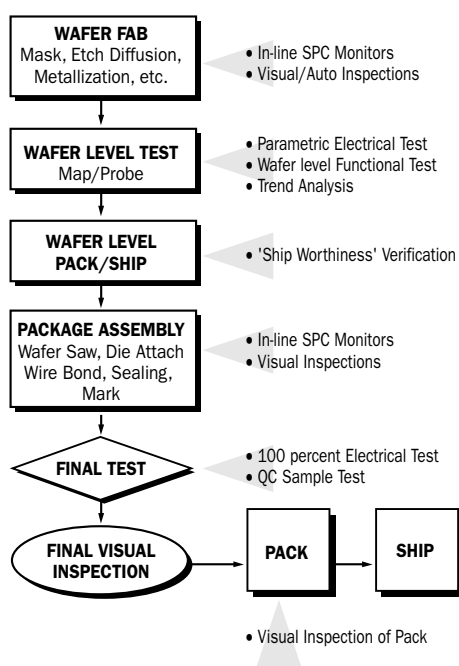
Once the product design and process have been successfully validated, the product is formally released to production. The generic wafer fabrication, assembly and test flow is illustrated in Figure 6. Specifications are maintained (and are under revision control) for all fabrication, assembly and test operations.

The wafer fabrication process consists of several sub-processes. The general process is as follows: A layer of oxide is grown on the surface of a silicon wafer. Because the oxide can be removed by etching, it provides a tool for placing patterns (mask) onto the wafer and selectively introducing the dopants required by the specific device. After oxidation, a photo resist chemical is dispensed on the wafer. The wafer is aligned with the mask and exposed to ultra-violet light to produce a pattern on the wafer. The wafer is ‘etched’ to leave specific areas of exposed silicon for implantation of dopants to a prescribed concentration and profiles. Dopants are further diffused into the wafer by placing the wafers in furnaces where heat is applied. A deposition process is used to deposit a thin film of specific material over the wafer for the purpose of isolation, planarization, providing a conductive layer, or adding a protective layer. The sub-process cycle is repeated several times, depending on the device under fabrication. The final fabrication operation involves putting a protective seal over the circuit by depositing a thin coating of material over the entire wafer surface. The completed wafers are sent to Map and Probe for wafer level testing (failed die are identified). After test, the wafers are packed and sent for package assembly and test.

During assembly, individual good and bad die are separated. Once the package type has been determined, the die is attached to an appropriate carrier (e.g., leadframe paddle for plastic packages). The device is then processed through wire bond, where thin wires of gold or aluminum are used to connect the die bonding pads to the package leads. Packages are then sealed with a lid or molding compound and marked with the part number and other product identifiers. The packages are processed through electrical test, quality control sample test and

Figure 6: General Wafer Fabrication, Assembly and Test Flow

final visual inspection to verify functional and visual/mechanical performance. SPC monitors, tests and inspections are utilized throughout the manufacturing process to ensure process control and product performance requirements have been met. A reliability monitor system is used to verify product and process design stability over time.



## Qualification System

Microchip's qualification process is directed at ensuring that new products are evaluated, characterized and qualified per specified requirements. The process provides a statistical basis to determine and validate the levels of expected quality and reliability. As inputs to the process come from several functions of the organization, the qualification process is conducted in a cross-functional team environment. The team operates using a fully documented qualification process which sets forth guidelines for standard qualifications, monitoring and sampling procedures. A set of baseline specifications is maintained that states which changes require re-qualification. These process changes can only be made after successful demonstration of reliability performance. This procedure results in a reliable field performance, while enabling the smooth phase-in of improved designs and product capability.

Listed below are the types of qualification tests typically performed to confirm product performance to design objectives. Also provided is a brief description of test purpose and method/conditions. Detailed testing procedures and acceptance criteria are documented in Microchip's worldwide quality conformance specification.

Die Tests	Test Purpose	Method/Condition
Dynamic Life Test	To demonstrate the reliability of devices subjected to the specified conditions over extended periods of time.	MIL-STD-883, method 1005. Devices are exercised at the maximum data sheet operating voltage. Two temperature/duration combinations are used. Devices subjected to 125 °C are functionally tested at 168 hours (infant) and 1008 hours (long term). Devices subjected to 150 °C are functionally tested at 96 hours (infant) and 408 hours (long term). Sample: 600(0) for new processes and products, 200(0) for any process change on an existing process.
ESD	To categorize the electrostatic discharge sensitivity for micro-circuits.	MIL-STD-883, notice 8, method 3015 for HBM. EIA/JESD22-A115-A waveform with MIL-STD-883, method 3015 combinations for MM. Corporate Guidelines are 2000V-HBM and 200V-MM. Sample: 12-HBM, 12-MM (3 per voltage level).
Endurance Cycle (EEPROM/FLASH)	All EEPROM/Flash memory designs require a sufficient number of endurance cycles in page, type, block or bulk mode to meet device requirements.	MIL-STD-883, method 1033. Cycling at 85 °C, devices subjected to 100K page/byte cycles or 100K page/block/bulk cycles depending upon the device endurance specification. Sample: 231(0).
Latch-Up Test	To categorize the latch-up susceptibility for all micro-circuits.	QCI-30521. Corporate Guidelines of greater than 200mA (+ and -) at 25 °C and 100mA (+ and -) at the highest rated operating temperature.
Retention Bake	To examine the possible loss of data in programmed device.	MIL-STD-883, method 1033. Two temperature/duration combinations are used. Devices subjected to 150 °C are tested at 168 hours and 1008 hours. Devices subjected to 175 °C are tested at 96 hours and 504 hours. Sample: 200(0).



## OPERATIONS

Package Tests	Test Purpose	Method/Condition
Bond Strength	To ensure that lead bonded devices meet established lead bond strength limits and to ensure that no bond degradation occurs during the sealing process.	MIL-STD-883, method 2011, C or D. Devices are subjected to simulated seal cycle using a heater plate and preseal units are pulled (2 grams for Aluminum and 3 grams for gold – 0.001” diameter wire). Sample: 15(0).
Coplanarity	To verify the coplanarity of leads.	QCI-33003. Lead > 4mils out of common plane is considered fail. Sample: 30(0).
Endpoint Electrical	To determine device functionality.	Devices are tested to electrical test specifications.
HAST	To determine the effects of high temperature and high humidity on package.	JESD22-A110. Devices tested are subjected to 130 °C, 85% RH, and maximum data sheet operating voltage. After 96 hours the devices are functionally tested at 25 °C and hot temperature. Sample: 77(0).
Operating Life (DLT)	To demonstrate the reliability of devices subjected to specified conditions over an extended time period.	MIL-STD-883, method 1005. Devices are exercised at the maximum data sheet operating voltage. Conditions are 150 °C for 408 hours with full functional test at -40 °C, 25 °C and 125 °C after 408 hours. Sample: 600(0).
Physical Dimensions	To verify that the external physical dimensions of the device conform to drawing dimensions.	JESD22-B100. Dimensions verified for body, lead length, space between leads, etc. Sample: 2(0).
Pressure Cooker	To sample electrically good packages which have been molded and moisture impregnated at the same time.	JESD22-A102. Devices placed in pressure cooker and exposed to conditions of 121.5 °C, 15PSIG pressure 100% RH for 96 hours – functionally test at 25 °C. Sample: 77(0).
Lead Finish	To determine the integrity of all primary and undercoat lead finish.	MIL-STD-883, method 2025. A bend stress is applied to randomly selected leads from each device. Sample: 15(0).
Lead Integrity	To check the resistance of the leads to metal fatigue.	JESD22-B105, condition A/C. Devices are subjected to 3 bend stress cycles, followed with a visual inspection. Sample: 45 leads from a min. of 5 devices.
Solderability	To evaluate the solderability of terminations that are joined by soldering.	JESD22-B102. Specimens are immersed in flux and dipped in a 245 °C, ±5 °C molten solder bath. Sample: 22(0).
Temperature Cycle	To determine the resistance of a part exposure at extremes of high and low temperatures and to the effect of alternate exposures to these extremes.	JESD22-A104 condition C. Devices are subjected to 500 thermal cycles alternating between -65 °C and +150 °C. Sample: 77(0).
Visual	To perform a visual inspection of the device for visual/mechanical criteria.	PI-91081B. Devices are inspected for defects or damage to case, leads or seals, or illegible markings. Sample: 22(0).

**Note:** Older devices may have been qualified under different conditions/criteria relevant at the time of qualification.

## Ongoing Reliability

Once qualified, Microchip employs a reliability monitor system to verify that the level of quality and reliability demonstrated during the qualification of product is being maintained over time.

Listed below are the types of monitor tests typically performed to confirm continued product performance attributes. These are accelerated tests that evaluate performance well beyond the typical application conditions. The test methods and conditions are equivalent to those performed during qualification.

Occasionally tests are combined to create sequential tests (commonly used reliability tests executed one after another using the same devices). Microchip performs sequential testing to simulate the interaction of worst case environmental condition experienced in field applications. Surface-mount devices are preconditioned (bake, moisture soak, convection reflow) prior to the package tests to accurately emulate the assembly process performed by customers. As a result, Microchip's reliability monitor data provides a clear indication of expected field reliability.

Test	Test Method and Condition	Conditions	Minimum Sample Size	Sample/ Testing Frequency
Lead Integrity	JB105, condition A/C		45 leads from a minimum of 5 devices	Weekly
Lead Finish	MIL 2003		45 leads from a minimum of 5 devices	Weekly
Temperature Cycle Electrical Test	JESD22-A014 PDC – S12/14/16	-65 °C to 150 °C, 100 cycles 25 °C	77	Weekly
Solderability	JESD22-B102	245 °C solder	120 leads or 5 parts	Weekly
HAST  Electrical Test	JESD22-A110  PDC – S12/14/16	130 °C/85% RH, maximum data sheet operating voltage for 96 hours 25 °C	77	Weekly
Pressure Cooker  Electrical Test	JESD22-A102  PDC – S12/14/16	121.5 °C, 15 PSIG pressure 100% RH for 96 hours 25 °C	77	Weekly
Dynamic Life Test	MIL-STD-883, method 1005	150 °C for 408 hours. Devices are exercised at the maximum data sheet operating voltage.	Depends upon hardware	Weekly
Endurance Cycle	MIL-STD-883, method 1033	100K cycles at 85 °C	Depends upon hardware	Weekly
Retention Bake	MIL-STD-883, method 1033	175 °C for 504 hours	100	Weekly

### ***Reliability Data – High Temperature Dynamic Life Test (DLT)***

Microchip's products provide competitive leadership in reliability with demonstrated performance of less than 100 FITs (Failures-in-Time) operating life for most products. High temperature DLT (150 °C) accelerates random failure modes which would occur in user applications. In addition to an elevated temperature, voltage bias and functional signals are used to exercise the device in a manner similar to user systems. The actual failure rate experienced could be considerably less than that calculated if lower device temperatures occur in the application board.

Detailed Microchip product reliability reports are published quarterly and are available through Microchip's web site.

### ***Reliability Data – High Temperature Data Retention Bake (RET)***

Microchip's products provide competitive leadership in reliability with demonstrated performance of less than 100 FITs (Failures-in-Time) operating life for most products. In data retention bake, devices are subjected to 175 °C bake. This bake accelerates charge loss in the memory cell, and 96 hours at 175 °C is equivalent to greater than 250 years in the field at 55 °C. The actual failure rate experienced could be considerably less than that calculated if lower device temperatures occur in the application board.

Detailed Microchip product reliability reports are published quarterly and are available through Microchip's web site.

### ***Total Endurance™ Software***

Endurance is the measure of the number of times an EEPROM can be erased and rewritten. Since differing criteria are often used by suppliers when determining EEPROM endurance, it is important that the specific conditions of the study used in this determination be well understood. Unfortunately, the conditions used rarely fit the application being used by the customer. As a result, the actual EEPROM endurance performance in the application may not meet the data book specification or the customer's requirements. The task of determining the true "in application" endurance prior to implementation becomes guesswork.

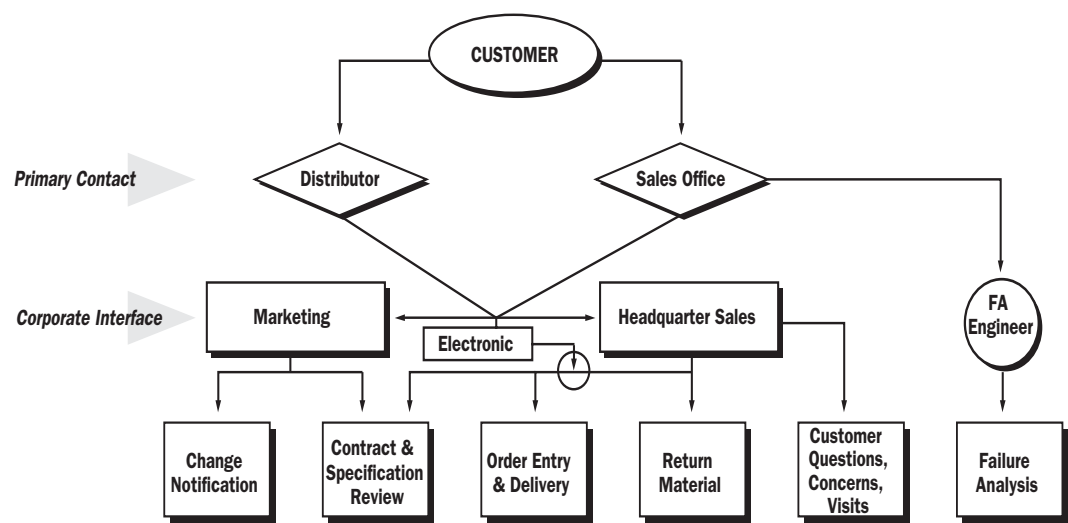
Microchip has developed a way to eliminate this guesswork. Through an extensive examination of technology, application and environmental conditions, Microchip has developed a software model capable of accurately predicting EEPROM endurance. This Windows® based endurance prediction tool, called Total Endurance™ software, allows the user of the software to perform a "what if" analysis of their application and fine tune their design to achieve established reliability requirements. Trade-offs can be examined for several variables. These variables include: device type, voltage, temperature, cycling mode, data pattern, number of bytes/cycles, erase/write cycles per day, application life and PPM. These variables have been chosen because they can be directly modified by the customer. The model uses these inputs to generate numerical and graphical outputs of the endurance characteristics for the conditions provided.

The model itself was developed from the results of a comprehensive  $2^{7-4}$  factorial experiment conducted by a cross-functional team of Microchip engineers. A comparison of model data to endurance data taken from reliability monitors of Microchip's EEPROM products showed a good fit between curves.

The Total Endurance™ software is available from local sales representatives, distributors and the Microchip web site.

# CUSTOMER INTERFACE STRUCTURE

Figure 7: Customer Interface System



## System Overview

Microchip uses a combination of direct sales and distributors to market our products worldwide. The direct sales force is divided into three geographic regions: Americas, Europe and Asia/Pacific. The efforts of the direct sales force are supported by a network of national and regional distributors.

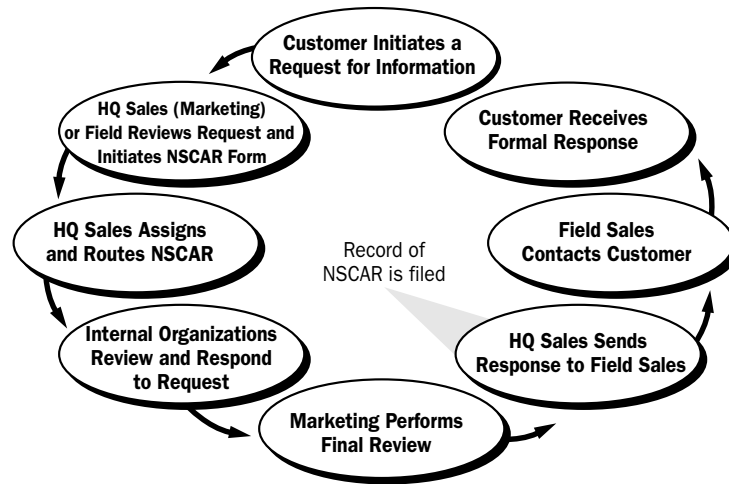
To provide consistent support to our customers, both direct sales and distributors have access to Microchip's corporate interfaces, Marketing and Headquarter Sales. This structure simplifies the communication with the customer and encourages a strong working relationship between our customers and our sales support. Our sales support also has an electronic link to customer specific data, providing them with the capability to quickly respond to customers needs.

## Order Entry and Delivery

Customers who are interested in placing orders should contact their local Microchip sales office, sales representative or distributor. Orders can be placed by telephone, Fax, EDI or via customer-provided purchasing documentation. Once the order has been received, confirmed and scheduled, the sales contact will mail the customer an acknowledgment of the order, including the Standard Terms that apply to the order. If the customer requires any changes to the order, they should notify their local sales representative or distributor to initiate the change request.

## CUSTOMER INTERFACE STRUCTURE

Figure 8: NSCAR Process



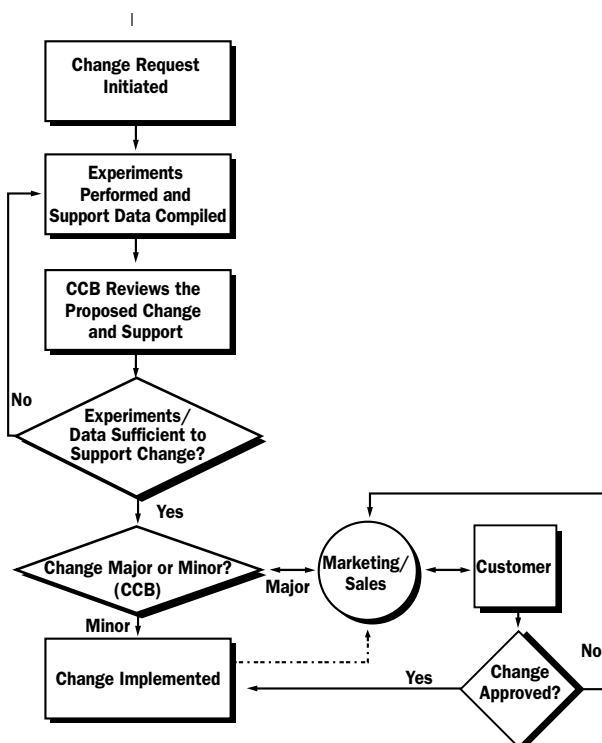
### ***Contract and Specification Review***

The NSCAR (Non-Standard Customer Action Request) system is used to address special customer requests for information. Specification reviews (product and process), business surveys, supplier surveys, self-assessments, device samples and product/process information are examples of requests that are serviced through the NSCAR system. The NSCAR system is Microchip's process to ensure all customer requests for information are accurately completed in a timely manner.

From the customer standpoint, the NSCAR process is very simple. The customer provides a request to the primary customer contact (Distributor or Sales Office) and Microchip does the rest. The Distributor or Sales Office forwards the request to the Microchip Headquarters Sales Department who logs in the request for tracking. Headquarters Sales forwards the request to one of four departments depending on the request: Quality Systems, Automotive Product Group, Legal, or Marketing. Upon completion of the request, the response and completed NSCAR form are reviewed by Marketing and returned to Headquarters Sales. Headquarters Sales returns the completed request to the Distributor or Sales Office and files a copy in Document Control for future reference. The Distributor or Sales Office will return the completed request to the customer.

# CUSTOMER INTERFACE STRUCTURE

Figure 9: Change Notification System



## Change Notification

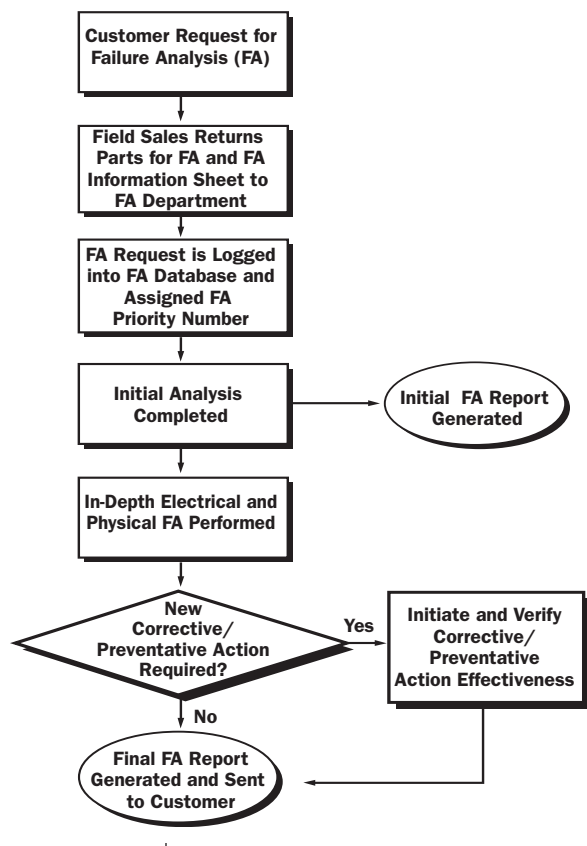
Microchip's Change Notification system is designed to ensure the changes that potentially effect yield, reliability, customer delivery, and form, fit or function of the parts are thoroughly reviewed and communicated to all appropriate parties. The Change Control Board (CCB), which is composed of representatives throughout our business, is the controlling body of the Change Notification system. The CCB provides consistency and a multi-disciplined approach in determining the effect the change will have on the product.

Customer notification services are available through our web site to help our customers stay up to date on Microchip's products. Customers who subscribe through the web site, will receive an E-mail whenever a change is being made to the product family or development. Customers can subscribe for change notification by following the instructions specified on our web site at [www.microchip.com](http://www.microchip.com), under the category, Support/Customer Change Notification.

## Failure Analysis (FA)

For product which needs to be returned for Failure Analysis, customers should contact their local sales office or Microchip representative to initiate the request. The sales contact gathers the necessary information, completes the F/A Information Form and forwards all appropriate data and product to the Failure Analysis Department in Chandler, Arizona. Upon receipt of the product and F/A Information Form, a Failure Analysis Tracking Number is assigned, an initial evaluation is performed and the initial response is forwarded to the customer via the person identified on the F/A Information Form. To facilitate the accurate assessment of the problem, the Failure Analysis Engineers work closely with the customer and Field Technical Application Engineers. Once the cause of the fail is identified, a corrective action is initiated, if needed, and the final report is written.

Figure 10: Failure Analysis Process



## CUSTOMER INTERFACE STRUCTURE

### ***Return Material***

Microchip strives to ship products that exceed customers' quality expectations. But in the event that a return is necessary, Microchip employs a 'Return Material Authorization' (RMA) procedure to efficiently handle customer returns. A customer who wishes to return material should contact their local Microchip sales representative or distributor. Once the RMA request has been received and approved, an acknowledgment of the RMA authorization will be sent. The Microchip sales representative or distributor will contact the customer with instructions on how to process the returns. Any credit and/or replacement parts, based on part lead times and urgency of request, will be issued upon receipt.

### ***Development Systems Returns***

It is not uncommon for customers to experience unintended damage to development tools during their development cycle. To ensure timely support to customers during their product development activities, Microchip has established a Service Authorization Request (SAR) Procedure to handle rapid replacement of defective development systems. The procedure provides customers with a replacement unit typically within 24-48 hours of request receipt. To initiate an SAR, customers should notify their local Microchip Field Applications Engineer.



## CUSTOMER INTERFACE STRUCTURE

### **TECHNICAL SUPPORT**

Microchip employs a variety of strategies to enable our customers to research information, seek assistance, comment and voice improvement ideas. To provide the highest quality of customer service, Microchip offers both on-line and direct technical assistance support personnel services.

#### **• World Wide Web Site**

The web site allows customers access to the current information and help related to Microchip products. In order to ensure service responsiveness, the Microchip Systems team monitors the site and posts the latest technical information, application notes, errata sheets, bug reports, software tool updates, and provides technical help and embedded systems insights. Through the web site, users may download files of the latest development tools software, data sheets, application notes, user guides, articles and sample programs and technical support information (with frequently asked questions and on-line discussion groups). A variety of Microchip specific business information is also available, including listings of Microchip sales offices, distributors and factory representatives.

The Microchip web site is available by using an Internet browser to connect to:

[www.microchip.com](http://www.microchip.com)

#### **• Systems Information and Upgrade Hot Lines**

In addition to the web site, Microchip maintains a Systems Information and Upgrade Hotline. This service provides users with a listing of the latest versions of all of Microchip's development systems software products. The line also provides information on how customers can receive any currently available upgrade kits.

## CUSTOMER INTERFACE STRUCTURE

### ***Technical Assistance Support Personnel***

Microchip employs a highly trained staff of Field Application Engineers (FAE), Corporate Application Engineers (CAE) and technical consultants. Many of the distributors and regional technical support locations are listed on the Web Site Sales Information page.

To provide customers with most efficient technical support, questions should be first directed to the customer's local Microchip distributor. Most of Microchip distributor offices have FAEs certified on Microchip's products.

Additional technical help is available through the sales representative, the local Microchip sales office, the regional Microchip FAE or Corporate Applications Engineering.

### ***Technical Support***

Web site: [support.microchip.com](http://support.microchip.com)

For a complete listing of worldwide sales and support service centers, please refer to the back cover of this handbook, or to our web site under 'Contact Us'.

## CUSTOMER SATISFACTION

“Customers are our Focus” and “Continuous Improvement is Essential” are integral parts of Microchip’s Customer Satisfaction Strategy. Our strategy involves a systematic approach to understanding areas of dissatisfaction for our customers, providing the direction and support to address the concerns, taking action to correct the problems, and communicating the results internally as well as externally.

Our customers provide us with data regarding their satisfaction or dissatisfaction with Microchip’s products and service in a variety of ways. Customer satisfaction surveys, supplier report cards and returned material (FA and RMA) provide Microchip with valuable information regarding the level of customer satisfaction. All this data is used to help generate a clear picture of the key areas we need to focus on to increase our customers level of satisfaction. The Customer Satisfaction Council, which is composed of vice presidents, directors and managers, review all the customer related data and set direction based on the data. The selected improvement initiatives are communicated to the affected organizations and teams are formed to develop and implement solutions based on the direction and data. To close the loop, the results are communicated to the Customer Satisfaction Council, Executive Management, Microchip employees and our customers.

Results of last year’s survey showed Silicon Quality, Reliability, Overall Products and Value ranked within the top ten (highest percentage of “Delighted” scores) of all categories surveyed. Past initiatives have resulted in measurable improvements for Development Tools (Quality, Value and Selection), Failure Analysis (Responsiveness and Effectiveness) and Customer Education (technical seminars offered on Microchip products and applications).

In addition to driving focused improvement efforts, the customer satisfaction survey data is used as a tool for measuring year to year trends in our overall satisfaction levels (products and services). Microchip also monitors its competitive performance (e.g., repurchase loyalty, brand awareness and approved vendor status) through the review of third-party U.S. market research studies.

Microchip’s broad product line and continuing technological advancements provide customers with reliable, cost-effective solutions that support our customer’s design and application challenges. To maintain our leadership position, the Company is committed to continuous improvement and innovation.

To obtain more information about our full product line or for answers to specific technical or business questions, please call your local Microchip sales and service location.



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## WORLDWIDE SALES & SERVICE

### U.S. AND CANADA

Atlanta	678-957-9614
Boston	774-760-0087
Chicago	630-285-0071
Dallas	972-818-7423
Detroit	248-538-2250
Kokomo	765-864-8360
Los Angeles	949-462-9523
Santa Clara	408-961-6444
Toronto	905-673-0699

### EUROPE

Austria-Weis	43-7242-2244-39
Denmark	45-4450-2828
France-Paris	33-1-69-53-63-20
Germany-Munich	49-89-627-144 0
Italy-Milan	39-0331-742611
Netherlands	31-416-690399
Spain-Madrid	34-91-708-08-90
United Kingdom	44-118-921-5869

### ASIA/PACIFIC

Australia-Sydney	61-2-9868-6733
China-Beijing	86-10-8528-2100
China-Chendgu	86-28-8665-5511
China-Fuzhou	86-591-8750-3506
China-Hong Kong	852-2401-1200
China-Qingdao	86-532-8502-7355
China-Shanghai	86-21-5407-5533
China-Shenyang	86-24-2334-2829
China-Shenzhen	86-755-8203-2660
China-Shunde	86-757-2839-5507
China-Wuhan	86-27-5980-5300
China-Xian	86-29-8833-7250
India-Bangalore	91-80-4182-8400
India-New Delhi	91-11-4160-8631
India-Pune	91-20-2566-1512
Japan-Yokohama	81-45-471-6166
Korea-Gumi	82-54-473-4301
Korea-Seoul	82-2-554-7200
Malaysia-Penang	604-646-8870
Philippines-Manila	632-634-9065
Singapore	65-6334-8870
Taiwan-Hsin chu	886-3-572-9526
Taiwan-Kaohsiung	886-7-536-4818
Taiwan-Taipei	886-2-2500-6610
Thailand-Bangkok	66-2-694-1351

### Customer Notification System

Register on our web site  
([www.microchip.com/cn](http://www.microchip.com/cn))  
to receive the most current  
information on our products.



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(480) 792-7200 • Fax (480) 792-7277

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