Explanation of the late President Kanjiro Okada’s motto—
Quality speaks for itself – no matter where you go

In 1966, Fujitsu began a companywide movement to ensure high levels of quality and reliability. During its preparation, then-president Kanjiro Okada stated that “Suppressing costs and meeting deadlines is important, but these are meaningless if the quality is not good. Quality precedes everything.” This statement summarizes Fujitsu’s unwavering commitment to quality.

Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality and Reliability</td>
<td>3</td>
</tr>
<tr>
<td>Quality Policy and Quality Assurance System</td>
<td>4</td>
</tr>
<tr>
<td>Quality Assurance Program</td>
<td>6</td>
</tr>
<tr>
<td>Collaboration with Suppliers</td>
<td>12</td>
</tr>
<tr>
<td>Customer Support for Quality</td>
<td>14</td>
</tr>
<tr>
<td>Quality Management System</td>
<td>16</td>
</tr>
<tr>
<td>Environment Management System</td>
<td>17</td>
</tr>
<tr>
<td>LSI Products</td>
<td>18</td>
</tr>
<tr>
<td>Company Overview</td>
<td>19</td>
</tr>
</tbody>
</table>
Quality and Reliability

Fujitsu Semiconductor LSIs are used in a variety of fields and play an important role in our customers’ products. Fujitsu Semiconductor places the highest priority on product quality and reliability, and we are known for high-quality and reliability globally. We aim to improve quality and reliability even further in terms of people, process, and product.

Fujitsu Semiconductor’s employees expend every effort to achieve success by setting extremely high standards for quality and reliability. This is a result of our internal training program. This training program ensures that every employee is fully aware of the importance of achieving high-quality in the final product.

Maintaining the quality management process for all aspects of our business from product planning to the follow-up provided for the customers is the key point in providing high-quality products in a stable manner. Fujitsu Semiconductor is able to achieve this goal by implementing thorough checks at each stage of the quality management process, and being vigilant in maintaining strict control standards.

Fujitsu Semiconductor’s many, diverse, and rich experiences enable us to develop products that meet a variety of customer needs. We seek to contribute to diverse segments of society by providing highly reliable products created from highly reliable semiconductor devices.

Reliability Scheme

- Customer Satisfaction
  - Consider the best quality with our customers
  - Make the best quality with our suppliers
- Process
  - Quality Management Process Supporting High-Quality
- Product
  - High-Quality products
- People
  - Employees trained to raise the awareness of contribution to High-Quality
Quality Policy and Quality Assurance System

■ Quality Policy

“We enhance the reputation of our customers and the reliability of social infrastructure.” in the FUJITSU Way

The quality policy of Fujitsu Semiconductor is described in the “Corporate Values” of the FUJITSU Way which defines the philosophy and policy of the Fujitsu Group for all companies in the group.

* Details of the FUJITSU Way can be viewed in our downloadable catalog on the Fujitsu Group Philosophy and Policy (FUJITSU Way) page. URL:http://www.fujitsu.com/global/about/philosophy/

■ Quality Assurance System

The Quality Assurance department controls every stage from planning of new product, design, mass-production, to managing customer complaints to supply highly reliable semiconductor products and services to customers. Our Quality Assurance department functions as the overall center for assuring quality and reliability, and has strong relationships not only with our internal engineering departments but also with the QA dept. at our suppliers.
Our company conducts evaluations and examinations of semiconductor devices according to our quality assurance program at every stage from market research and planning to design prototype development and mass production.

Creating quality starts from the planning stage for semiconductor devices. We conduct market research to ascertain and analyze customer requirements, incorporate these into product planning and then apply that to quality.

Continuing from the product-planning stage, we incorporate consistent quality in all stages of design, prototype development and mass production.

○ Quality Assurance Flowchart
## Design Reviews

From the time that market research, product planning and development planning are completed until mass production begins, we conduct design reviews at each step of the development stage. The design review in our Quality Assurance Program is composed of five steps from DR0 to DR4.

### Design Review System

<table>
<thead>
<tr>
<th>Design Review</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Planning Review (DR0)</td>
<td>The Development Planning Review evaluates the processes, circuits, materials and equipment to be used for the new product. It also establishes a schedule for DR1, DR2 and DR3.</td>
</tr>
<tr>
<td>Technical Review (DR1)</td>
<td>The results of DR0 determine the basic design for the product characteristics and reliability. Pilot circuits are produced for evaluation, and the basic technology is established. The Technical Review examines this basic design to verify that the development technology is appropriate.</td>
</tr>
<tr>
<td>Product Review (DR2)</td>
<td>Characteristics, functions and reliability of pilot products are verified at this stage. Conditions and specifications for pilot mass production are determined, and other steps are taken to prepare for mass production.</td>
</tr>
<tr>
<td>Mass Production Review (DR3)</td>
<td>Before mass production, product evaluations and Mass Production Approval Tests are conducted on the pre-mass production products. The Mass Production Review confirms the findings of the Mass Production Approval Tests including the specifications and equipment allocations required for mass production, and makes the final decision to begin mass production.</td>
</tr>
<tr>
<td>Mass Production Stability Review (DR4)</td>
<td>Review to confirm stability and long-term reliability of production after starting mass production. Implemented three months after shipping or approximately 30 lots after starting mass production.</td>
</tr>
</tbody>
</table>

### FMEA (Failure Mode and Effects Analysis)

FMEA has been incorporated into our product designs to evaluate the three items including the degree of effect, the degree of occurrence and the degree of detection of failures that can occur and their causes. A risk index (degree of importance) is formed by combining the values recorded for above three items. Countermeasures are undertaken starting with items having high numerical values. Implementing FMEA allows us to confirm that countermeasures are being implemented for predicted failures, and is useful in making corrections and taking steps for prevention.

### Sample of FMEA Sheet

![Sample of FMEA Sheet](image-url)
Reliability Tests

Process Qualification Test
To ensure the reliability of newly developed technologies, we conduct process qualification using TEGs (Test Element Groups)* for all fundamental failure modes.

* TEG (Test Element Group): A group of elements used to evaluate and identify failure modes.

Process Qualification Test Items

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Factor</th>
<th>Main Acceleration Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromigration</td>
<td>Wiring materials, structure, current density</td>
<td>Current density, temperature</td>
</tr>
<tr>
<td>Stress Migration</td>
<td>Wiring materials, structure</td>
<td>Temperature, stress</td>
</tr>
<tr>
<td>Hot Carrier Injection</td>
<td>Transistor structure, distribution of impurities</td>
<td>Electric field</td>
</tr>
<tr>
<td>Gate Oxide Integrity</td>
<td>Structure, oxide film characteristics</td>
<td>Electric field, temperature</td>
</tr>
<tr>
<td>Negative Bias Temperature Instability</td>
<td>Transistor structure, oxide film characteristics</td>
<td>Electric field, temperature</td>
</tr>
</tbody>
</table>
Mass Production Approval Tests

These tests are conducted for mass production approval and include technical factors that affect a product's reliability. The tests also consider new technological factors or newly combined technological factors. We use TEG or representative products that relate to actual products by using grouping method of our products.

<table>
<thead>
<tr>
<th>Test Item Conditions</th>
<th>JEDEC Standard Number</th>
<th>Purpose of Test</th>
<th>New Process Technology Launch</th>
<th>New Assembly Package Technology Launch</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature Operating Life Test*</td>
<td>HTOL</td>
<td>125°C</td>
<td>JESD22-A108</td>
<td>Evaluates device durability when operated for long periods under high-temperature environments.</td>
</tr>
<tr>
<td>Temperature Humidity Bias Life Test*</td>
<td>THB</td>
<td>85°C 85%RH</td>
<td>JESD22-A101</td>
<td>Evaluates device durability when operated for long periods in a high-temperature, high-humidity atmosphere.</td>
</tr>
<tr>
<td>Temperature Cycling Test*</td>
<td>TC</td>
<td>-65°C up to 150°C</td>
<td>JESD22-A104</td>
<td>Evaluates device durability in repeated high and low temperature situations.</td>
</tr>
<tr>
<td>Highly Accelerated Stress Test</td>
<td>HAST</td>
<td>130°C 85%RH</td>
<td>JESD22-A110</td>
<td>Evaluates durability when device is stored in a bias-charged state in a high-temperature, high-humidity atmosphere.</td>
</tr>
<tr>
<td>Unbiased HAST</td>
<td>UHAST</td>
<td>130°C 85%RH</td>
<td>JESD22-A118</td>
<td>Evaluates durability when device is stored in a high-temperature, high-humidity atmosphere.</td>
</tr>
<tr>
<td>Low Temperature Operating Life Test</td>
<td>LTOL</td>
<td>-55°C</td>
<td>JESD22-A108</td>
<td>Evaluates device durability when operated for long periods under low-temperature environments.</td>
</tr>
<tr>
<td>High Temperature Storage Life Test</td>
<td>HTSL</td>
<td>150°C</td>
<td>JESD22-A103</td>
<td>Evaluates device durability when stored for long periods under high-temperature environments.</td>
</tr>
<tr>
<td>Endurance Test</td>
<td>Operation ambient temperature</td>
<td>-</td>
<td>JESD22-A106</td>
<td>Evaluates durability in repeated writing of data.</td>
</tr>
<tr>
<td>Thermal Shock Test</td>
<td>TS</td>
<td>0°C up to 100°C</td>
<td>JESD22-A106</td>
<td>Evaluates durability in sudden heat changes.</td>
</tr>
<tr>
<td>Early Life Failure Rate Test</td>
<td>ELFR</td>
<td>125°C</td>
<td>JESD74</td>
<td>Evaluates initial reliability of device use.</td>
</tr>
<tr>
<td>Electrostatic Discharge Sensitivity Test (Human Body Model)</td>
<td>HBM</td>
<td>-</td>
<td>JS-001</td>
<td>Evaluates device durability when static electricity discharges are received by human body model.</td>
</tr>
<tr>
<td>Electrostatic Discharge Sensitivity Test (Charged Device Model)</td>
<td>CDM</td>
<td>-</td>
<td>JS-002</td>
<td>Evaluates device durability when static electricity discharges are received by a device.</td>
</tr>
<tr>
<td>IC Latch-Up Resistance Test</td>
<td>LU</td>
<td>-</td>
<td>JESD78</td>
<td>Evaluates device resistance to latch-up.</td>
</tr>
<tr>
<td>Thermal Characterization</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Evaluates electrical characteristics under low, room, and high temperatures.</td>
</tr>
</tbody>
</table>

* For Surface mount type package, implements tests by adding thermal stress envisioning surface mounting before test. ○: Implemented, △: Optional, -: Not implemented
### Design Change, Process Change

When Design change and/or Process Change are proposed internally, a primary review meeting organized by the QA department and other relevant departments is held to study the changes. In order to confirm that there are no differences in quality and reliability to our existing products, evaluation and qualification tests are performed if needed. The manager of QA department finally approves the changes before the application.

We notify our customers of changes in advance when we judge the changes could affect the products and/or process of customers from the viewpoint of quality, reliability, electrical characteristics, device dimensions, external appearance, and ease-of-use.

#### Flowchart of Design Change and Process Change

- **Proposal of Change**
  - Proposal
    - Design change
    - Process change

- **Primary Review**
  - Review
    - OK
      - Design change
      - Study of necessary evaluation
      - Check if the change affects customers’ product and process
      - Review if the notification to the customers is necessary

- **Notification to Customers**
  - Necessary
    - Notification to Customers
  - Not necessary
    - Review
      - OK
        - Review and decide if the change is ok based on the results of evaluation
      - NG
        - Abort Change

- **Decision Review**
  - NG
  - Review
    - OK
      - Initial Control of Ramp-up Period if needed
### Traceability

Fujitsu Semiconductor controls manufacturing logs of all devices from the wafer process to assembling, testing, and shipping so that we can trace the manufacturing history when any problem occurs in the market or manufacturing process of a customer.

Manufacturing history of each device can be identified by the marking on each device package.

### Marking Example

![Marking Example Diagram]

### Customized Quality Programs to Meet Diverse Customer Requirements

Fujitsu Semiconductor has the customized quality assurance programs which can provide higher quality and higher reliability products to meet diverse customer requirements. These optional programs are optimized to automotive applications or similar high-quality requirement applications in some cases.

These products can usually be identified by a specific parts number such as "GS grading."

Following table shows the example of our specific quality assurance programs.

Please contact us for more details of such customized quality programs.

### Special Quality Assurance Support Example

<table>
<thead>
<tr>
<th>Items of Requirement</th>
<th>Content of Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability Evaluation (Qualification) Level</td>
<td>Support of AEC-Q100 compliance</td>
</tr>
<tr>
<td>Information on Our Quality Control</td>
<td>Request of PPAP contents supply (FMEA, control plan, MSA, and others)</td>
</tr>
<tr>
<td>Requirements of Our Suppliers</td>
<td>Requirement of obtaining IATF16949 certification</td>
</tr>
<tr>
<td>Other Requirements</td>
<td>Request of quality targeted Low FIT rate, low ppm, optional screening</td>
</tr>
</tbody>
</table>
Fujitsu Semiconductor, a design and development company of electronics devices has a strong relationship with suppliers such as wafer manufacturers and package assembly makers. We collaborate to improve our products in terms of quality, engineering, price, stable supply and CSR* in order to satisfy our customers.

* CSR: Corporate Social Responsibility

**Collaboration Through 5 Important Factors**
**Selecting and Certifying of Suppliers**

For manufacturing of high-quality products, the suppliers to which we outsource wafer manufacturing, and packaging for our products are very important. Therefore, we carefully decide and certify the suppliers.

First stage is the selection stage. At this stage, we decide candidates for supplier through three steps, candidate selection, a capital investigation, and a technical investigation.

After selecting the candidate, we shift to the second stage, certification stage. At this stage, we can begin to certify the candidate through four-steps, a prototype technology evaluation, a reliability evaluation, conclusion of purchasing specification (including an agreement on Quality Assurance), and finally an audit, for certification.

If the candidate is approved by the audit, we certify the company as a supplier.

**Supplier Management at Mass Production**

Fujitsu Semiconductor outsources manufacturing of our products to certified suppliers. In controlling mass production at this stage, we conduct continuous monitoring, measurements, and analysis of the supplier through monthly reports, quality meetings, complaint support and abnormal control activities. Furthermore, we evaluate and rate our suppliers quality based on the results of their performance. And also we conduct periodic audits, special audits, and give them feedback.

---

*1 SPR: Supplier Performance Review
*2 QBR: Quarterly Business Review
Fujitsu Semiconductor has continued to supply detailed support for product quality to ensure a stable supply of high-quality products. An example is failure analysis. If any failure by our products occurs at the customer side after shipping, we investigate the failed device to find the root cause. Then we implement countermeasures against the cause, and take corrective action to prevent the same failure recurring. The failure analysis report to the customer includes the above status, the cause of failure, countermeasure, and corrective action etc. We provide feedback internally to improve quality and reliability of products. In addition, Fujitsu Semiconductor responds to customer requests such as providing of quality and reliability data, and cooperating with factory audits.

Customer Support for Quality

Customer Quality Support Diagram
Fujitsu Semiconductor carefully analyzes all products returned from customers as failures. After an initial check on external appearance and electrical characteristics, we investigate the cause of the failure. When we specify the root cause, we implement countermeasures against the cause, and take corrective action to prevent the same failure from recurring.

Fujitsu Semiconductor provides feedback on the failure analysis information to not only our internal engineering Dept. but also suppliers to improve the quality and reliability of the final product.
Fujitsu Semiconductor acquired the certification of ISO9001, which is the international standard of Quality Management System (QMS).

### ISO9001: Certification

<table>
<thead>
<tr>
<th>Company Name and Location</th>
<th>ISO Standard Number</th>
<th>Date of Certification</th>
<th>Date of Expiration</th>
<th>Certificate Registration Number</th>
<th>Certification Body</th>
</tr>
</thead>
</table>

*1: Date updated  
*2: Initial date of certification

### ISO9001 Certificate
Fujitsu Semiconductor regards the “environment” as an important keyword in corporate activities. Therefore our company promotes environment activities based on the Fujitsu Group environment activities plan, and our environment policy.

Environmental Policy

With our customers, we contribute to the protection of a rich global environment, using state-of-the-art technology to provide semiconductor devices with superior environmental characteristics.

Operational Principles

By applying the following principles, we work to prevent pollution of the global environment and reduce the environmental burden of our products throughout their lifecycles, including development, procurement, manufacture, sales, usage, and disposal:

- We develop products with outstanding environmental characteristics.
- We promote proper management of chemical substances contained in products, packaging materials, etc.
- We promote measures to counteract global warming, effective utilization of water and resources, and proper management of wastes.
- We promote proper management of chemical substances to prevent pollution of the global environment.
- We conform to environmental regulations around the world and keep our promises to customers.
- We promote activities to make environmental and social contributions, and to preserve biodiversity.
- We effectively and continually improve our environmental management system, and work hard to improve our environmental performance.

ISO14001 Certification

Fujitsu Semiconductor Group acquired the certification of ISO14001 which is the international standard of Environment Management System (EMS) as a member of the Fujitsu group. Environmental issues require global support, so our company takes environmental problems as a serious issue to be handled by business management.

ISO14001 certification for the Fujitsu Semiconductor Group

<table>
<thead>
<tr>
<th>Company Name and Location</th>
<th>Date of Certification</th>
<th>Date of Expiration</th>
<th>Registration Number</th>
<th>Regulatory Authority</th>
</tr>
</thead>
</table>

*Date updated
Reliability and Experiences: High-Quality, Highly Reliable Memory

Having been recognized for their high-quality and reliability, Fujitsu Semiconductor’s memory products have been offered for nearly 50 years.

Matured memory manufacturer

Fujitsu Limited has offered a continuous stream of memory products for more than 47 years since 1969. Today Fujitsu Semiconductor Limited offers products based on Ferroelectric Random Access Memory (FRAM), a type of high-quality, high-reliability non-volatile memory.

Development of FRAM began in 1995, and Fujitsu has a track record of more than 18 years of mass production. Fujitsu has previously received inquiries from customers in 45 countries all over the world regarding a diverse range of more than 200 types of applications.

FRAM has been employed for smart cards and RFID tags (Radio Frequency IDentification tags, i.e., electronic tags) in the customer applications, and also for power meters, automation machinery, medical RFID tags in the industrial applications.

Outstanding features

FRAM has the characteristics of both non-volatility and random access like SRAM. Its features include: no need for battery backup to retain data, as well as high-speed writing, a high number of read/write cycles, and low power consumption compared to existing non-volatile memory. Due to these advantages, FRAM is used in applications requiring continuous rewriting of data, real-time recording of three-dimensional information, and robust protection of data.

Proof of High Technology

Since 1999, Fujitsu has providing FRAM devices in production. Continuous mass production and stable supply of FRAM are evidence of Fujitsu Semiconductor’s advanced technological skills.

Initially FRAM using ferroelectric technology could not be mass produced because ferroelectric deteriorated through conventional semiconductor processes. Fujitsu identified the cause of the deterioration and adopted a countermeasure to the manufacturing process, which led to us being the first company to successfully mass produce FRAM.

The development of mass production technology for FRAM products and their contributions to society were honored in prizes recent years.

Fujitsu continues stable supply of high-quality FRAM backed by our technological strength.

The above description is an excerpt from the Fujitsu Semiconductor Group Profile. For details, please refer to the Corporate Profile Catalog available on our website. (http://www.fujitsu.com/jp/group/fsl/en/about/profile/index.html).
Corporate Profile

Company name: FJITSU SEMICONDUCTOR LIMITED
Location of head office: Shin-Yokohama Chuo Building, 2-100-45, Shin-Yokohama, Kohoku-Ku, Yokohama, Kanagawa Prefecture, Japan
Capital: Yen 60 Billion
Date of establishment: March 21, 2008
Business description: Businesses related to system memories, wafer foundry, and sales
Shareholders: Fujitsu Limited, 100% shareholder
Representatives: Kagemasa Magaribuchi
President and Representative Director

Office

Shin-Yokohama TECH Office
Shin-Yokohama TECH Building 3-9-18, Shin-Yokohama, Kohoku-Ku, Yokohama, Kanagawa Prefecture, Japan
FUJITSU SEMICONDUCTOR LIMITED
Shin-Yokohama Chuo Building, 2-100-45,
Shin-Yokohama, Kohoku-Ku, Yokohama, Kanagawa, Japan

Inquiries: