# CHAPTER 1 - QUALITY ASSURANCE FOR SEMICONDUCTOR DEVICES

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# 1.1 Approach toward Quality Assurance

## 1.1.1 Basic Policies

The Sony Group is not content simply to improve product and service quality, and is instead deploying company-wide activities to realize the world's top management quality in order to provide the highest level of satisfaction in all aspects to our customers. As a member of the Sony Group, the Semiconductor Network Company is charged with the development, design, manufacture and sale of semiconductor products.

Within the Sony Semiconductor Network Company as well, all divisions, related departments and factories hold the basic policies of "the customer first" and "providing top level quality" with the aim of realizing the "No. 1 customer satisfaction in the world". To achieve this, the Semiconductor Network Company constantly strives to improve the quality of its semiconductor products through activities such as maintaining and improving ISO 9000 Series and QS-9000 quality systems, improving work process performance through Six Sigma activities, and improving product quality through various scientific approaches.

## 1.1.2 ISO 9000 Series and QS-9000

### 1.1.2.1 Construction of a Quality System Based on the ISO 9000 Series

As semiconductor product structures become increasingly complex, customer expectations toward quality are becoming even stricter. Customer requirements are generally incorporated into Specifications, but even with perfect Technical Specifications, if the systems of the organization supplying the product contain defects, then the Specifications alone cannot be considered capable of continuously satisfying customer requirements.

The Sony Semiconductor Network Company has promoted the successive acquisition of ISO 9000 Series certification since fiscal 1993. The ISO 9000 Series is an international standard concerning quality assurance and quality control systems, and currently all divisions and factories have acquired either ISO 9001 or ISO 9002 certification.

The following control is carried out through "process management", which is the basic concept for the ISO 9000 Series.

- Work structures (work flow) through which products flow
- Quality of products flowing through these structures (work flow)

This control makes it possible to create and supply products with stable quality to customers, thereby meeting customer demands and firmly establishing trust in Sony Semiconductor products.

The Sony Semiconductor Network Company's quality system document system was constructed based on ISO 9000 Series requirements. This system and our basic approach toward maintaining and improving quality systems are described below.

**(1) Quality document system diagram (Fig. 1-1)**

The quality system is stratified and compiled into documents with quality manuals at the top supported by regulations, rules, procedures and detailed work standards, etc.

**(2) Quality system maintenance and improvement (Fig. 1-2)**

Employees are trained and keep records of duties carried out according to prescribed methods based on the latest documents to ensure that the constructed quality system is implemented in the prescribed manner.

The quality system is periodically checked and evaluated though systematic internal quality audits and audits by ISO certification agencies to provide opportunities for improvement.


Fig. 1-1 Quality Document System

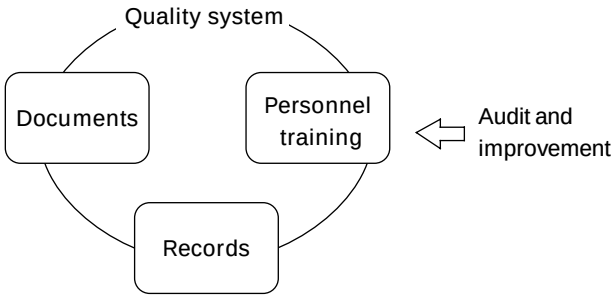



Fig. 1-2 Quality System Maintenance and Improvement

As shown above, the Sony Semiconductor Network Company works to continuously improve processes and performance by reliably implementing and periodically reviewing the constructed quality system.

#### 1.1.2.2 Deployment to QS-9000 Certification Activities

The Sony Semiconductor Network Company is conducting activities with the aim of acquiring QS-9000 certification during fiscal 2000 in order to further increase the effectiveness of the quality system constructed with the ISO 9000 Series.

QS-9000 is the standard required of primary suppliers by America's "Big Three" automotive manufacturers (General Motors, Ford and Chrysler), and this certification must be acquired to supply parts to the Big Three. QS-9000 is based on the ISO 9000 Series, and more clearly delineates the concept of working for both the customer's and one's own benefit to ensure customer satisfaction by carrying out constant improvements which focus on preventing defects in the supply chain and reducing "variance" and "waste". QS-9000's effectiveness is acknowledged and its adoption has begun to spread rapidly to automotive manufacturers other than the Big Three mainly in North America and Europe.

The Sony Semiconductor Network Company is working to improve customer satisfaction and realize the No. 1 customer satisfaction in the world by incorporating and implementing the concepts in this standard.

### 1.1.3 Six Sigma

**Six Sigma activities**

The Sony Group is working to improve product and service quality and to continue providing the highest level of satisfaction to our customers. Using the Voice of Customers (VOC) as a starting point, we have systematized conventional QC and TQC activities in a more scientific and logical manner, and are introducing and deploying reconstructed Sony Six Sigma activities on a company-wide basis in order to realize the highest management quality at the 6 $\sigma$ level.

Within the Sony Semiconductor Network Company as well, all divisions, related departments and factories have introduced and are working to actively utilize Six Sigma activities in an organized manner. We are continuing our efforts to improve the quality of our semiconductor products with the targets of "providing top-level quality and solutions" and "achieving the No. 1 customer satisfaction in the world".

**Sony Semiconductor Network Company - Sony Six Sigma basic policy and activity guidelines**

**Aim:**

Sony Six Sigma aims to hold the "maximization of customer satisfaction and creation of customer values" as a shared value, to establish Win-Win relationships with customers, and to make a culture of learning take root in order to further improve management quality.

**Basic policy:**

Sony Six Sigma will be positioned as a shared management tool, and efforts will be made to firmly establish a culture of learning and to scientifically and rationally achieve Customer Satisfaction through the in-depth application of this culture.

**Activity guidelines:**

(1) Correctly understanding the Voice of Customers (VOC), setting important themes to be resolved as Critical to Quality (CTQ), appropriately breaking down these CTQ, deploying and reliably executing specific projects in an organized manner, following up in an organized and vigorous manner to achieve targets, and reducing all Costs of Poor Quality (COPQ) in corporate management activities.

(2) Solving Critical to Quality (CTQ) with the Six Sigma Approach (D-MAIC).
- D-MAIC = Define - Measurement - Analysis - Improvement - Control
- D = Define (Correctly recognizing VOC, extracting CTQ and setting themes = projects)
- M = Measurement (Understanding themes)
- A = Analysis (Analyzing themes)
- I = Improvement (Improving themes)
- C = Control (Constructing systems to ensure that improvement effects take root)

(3) Reliably carrying out quality planning, design review, and confirming design validity. Producing and supplying high quality products by reliably executing work according to the quality system.

(4) Working to "Look realistically at real objects in real situations" in all aspects, analyzing data using scientific methods, performing appropriate statistical processing to allow correct judgment of the obtained data, and then using this data to make swift improvements.

## 1.1.4 Scientific Approach

In order to build in stable quality in the semiconductor device design and manufacturing processes, the Sony Semiconductor Network Company takes a scientific approach and uses various statistical techniques in each process.

In addition, we have introduced Six Sigma to our training curriculum and are working for widespread understanding of these concepts in order to achieve effective improvements.

As examples, the Statistical Process Control (SPC) performed mainly in the manufacturing process and the Failure Mode and Effects Analysis (FMEA) performed in the design and manufacturing processes are described below.

### 1.1.4.1 Statistical Process Control (SPC)

The manufacturing process is controlled using check sheets, graphs, control diagrams and other control tools. In particular, control diagrams are an effective means for continuously monitoring changes in process quality for each process, and make it possible to take proper action when trouble occurs.

Control diagrams set control limits (average $\pm 3\sigma$) indicating the range of normally occurring data based on the variance $\sigma$ of process data over a certain range, and enter measurement data onto record charts.

When an abnormal factor enters the process variance, the data exceeds the control limit lines, so control

charts are effective for quickly detecting process changes. In addition to detecting when the data exceeds the control limit lines, process changes such as rising and falling data trends can also be detected.

The use of control diagrams and other statistical techniques helps to quantitatively understand and analyze variance which affects quality, and is useful in improving quality.

Specifically, first the important control items are determined based on the characteristics items demanded by customers, items affecting device quality and reliability, and items which correlate with defect mechanisms, etc.

Capability measures (Cp, Cpk) are calculated for each process based on these items, and process improvements are then carried out for items with low process capability measures levels to achieve higher level values and realize stable quality.



**Process capability measures**

The process stability with respect to the standards for that process can be obtained from the process data over a certain period and the standard values. These are called process capability measures (Cp, Cpk), and are obtained by the following formulas.

$$Cp = \frac{\text{(Standard upper limit - Standard lower limit)}}{6\sigma}$$

(Process capability measures in consideration of data (average value) bias toward the standard center)

$$Cpk = \frac{|\text{Standard limit closest to the average value - average value}|}{3\sigma}$$

The Semiconductor Network Company works to improve process variance by periodically understanding these process capability measures.

### 1.1.4.2 Failure Mode and Effects Analysis (FMEA)

Failure Mode and Effects Analysis (FMEA) consists of confirming and evaluating the risks posed by the failure modes which are latent in devices or processes.

Confirming these risks makes it possible to systematically discover what is necessary to eliminate or reduce decisive trouble and achieve an optimum design.

Table 1-1 shows a simplified example of FMEA applied with the purpose of improving quality in a wafer manufacturing process.

In this example, two modes are given as failure modes.

First, a number representing the seriousness of the problem is assigned to the Seriousness column. Next, a number representing the probability of occurrence, that is to say the degree of possibility of that problem occurring, is assigned to the Frequency column. Then, a number representing the degree of possibility of a detection miss is assigned to the Detection level column.

The result of multiplying of these three numbers is entered to the Priority column, and this number can be used to rank the risk of each problem in order from high to low.

The conclusion reached in this example is that measuring the positioning accuracy is the most important matter which should be investigated.

The next step in FMEA is to brainstorm as to the possible causes of these problems and formulate action plans for foolproofing or eliminating the problems.

Then, improvements are carried out based on the formulated action plans.

Table 1-1 FMEA Example

| Product or Process | Potential Failure Mode | Potential Effect(s) of Failure | Severity | Potential Cause(s) | Occurrence | Current Design Controls | Detection | Risk Priority Number (RPN) | Recommended Actions - Important Items | Countermeasures and Plans |
|---|---|---|---|---|---|---|---|---|---|---|
| 1PC process | Withstand voltage defect | Isolation deterioration | 4 | High channel density | 2 | Channel density control | 3 | 24 | 4 | Increase the EQC frequency of the injector. |
| | | | | | | | | | | Introduce an annealing activation rate control process. |
| | | | | Small gate-drain interval | 4 | Positioning accuracy measurement | 3 | 48 | 1 | Increase the number of measurement points and strengthen the screening. |
| | | | | | | | | | | Adjust the stepper. |
| | | | | | | | | | | Review the positioning method and mark structure. |
| | | | | Short circuit caused by particles | 1 | Particle control | 3 | 12 | 5 | Review the equipment dust control method. |
| | | | | | | | | | | Reduce floor dust. |
| | Large wiring resistance | Insertion loss deterioration | 3 | Thin wiring metal thickness | 3 | Thickness measurement | 5 | 45 | 2 | Introduce thickness measurement using a dummy wafer. |
| | | | | Narrow wiring width | 3 | Line width measurement | 4 | 36 | 3 | Introduce TEG for line width measurement. |
| | | | | | | | | | | Review the stepper exposure conditions. |
| | | | | | | | | | | Introduction of dye-containing photoresist. |
| | .... | .... | ... | .... | ... | .... | ... | ... | .... | .... |

### 1.1.5 Approach toward Quality Certification

As shown in Fig. 1-3, the reliability of prototypes is evaluated mainly through accelerated life tests, and the quality is certified in order assure the quality of semiconductor products.

With recent trends toward small-lot production of multiple items such as ASIC, it is not feasible to perform all evaluations for each individual product.

The approach adopted by the Sony Semiconductor Network Company is to divide semiconductor product reliability into the three areas of wafer process technology, circuit technology and packaging technology, and to evaluate each individually.

Regarding wafer process technology, basic reliability is evaluated for each major technology such as the 0.5 µm or 0.35 µm generations, and the process is certified. This assures the basic reliability of each semiconductor product manufactured using that wafer process technology.

The circuit technology of each individual product is checked from the viewpoint of reliability as to whether new or special circuits are used or whether special operating conditions are required, etc. Then the differences from the basic technology are clarified and only the reliability evaluation which is thought to be necessary is added.

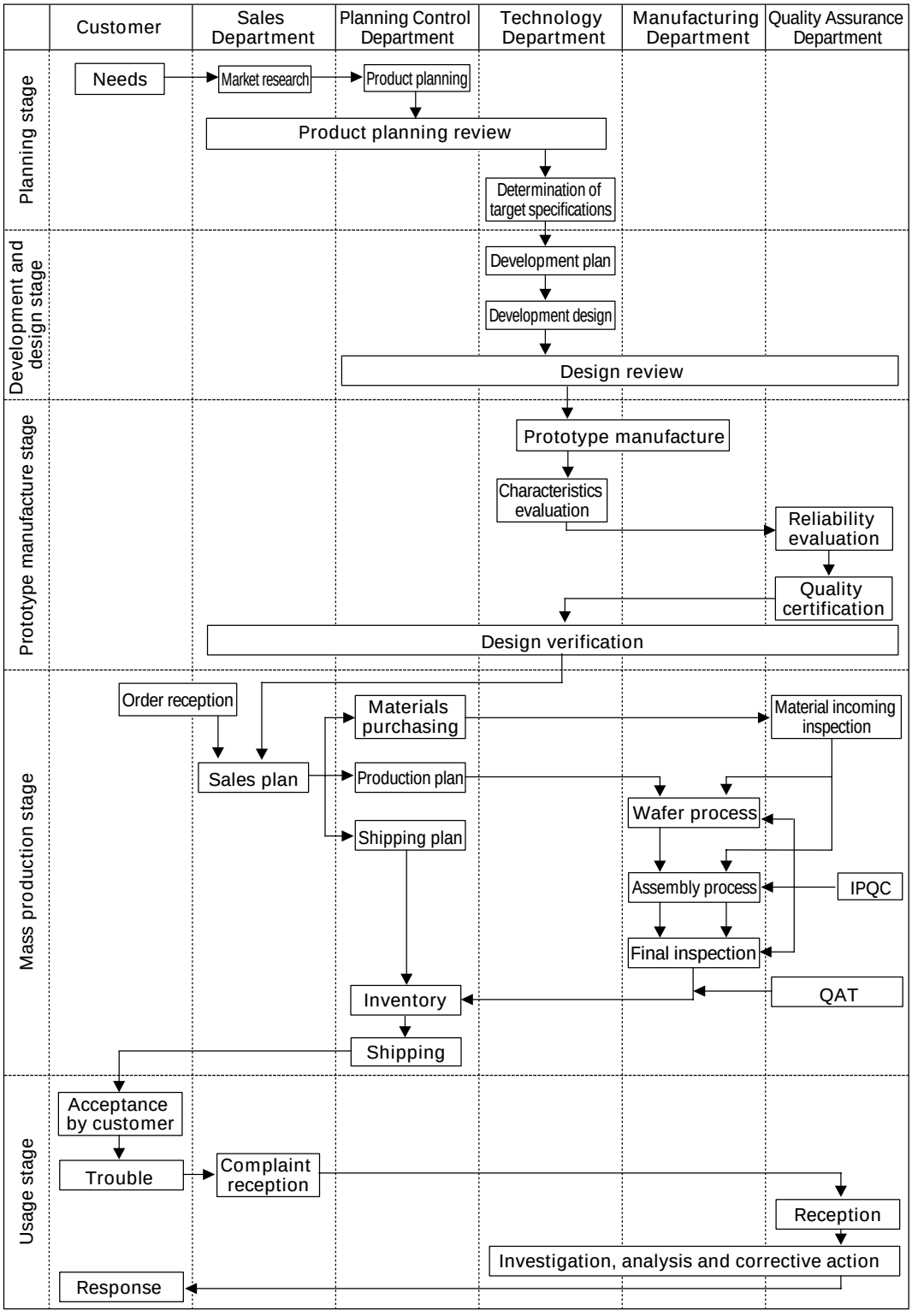
For packaging technology as well, in contrast to general plastic packages such as conventional LQFP and QFP, when developing and manufacturing packages with new structures such as CSP (Chip Size (Scale) Package), the basic reliability is evaluated and the package is certified. This assures the basic reliability of each semiconductor product manufactured using that packaging technology.

In this manner, quality certification of Sony semiconductor products is based on the certification of basic technologies such as process certification and package certification.

## 1.2 Quality Assurance System for Semiconductor Devices

To ensure quality and reliability and to supply products which meet customer needs in a timely manner, all Sony Semiconductor Network Company departments carry out activities based on a consistent quality assurance system from the product planning stage through development, design, manufacture of prototypes, evaluation, mass production, shipping, market and service.

Fig. 1-3 shows the Sony Semiconductor Network Company's quality assurance system.




IPQC : In Process Quality Control QAT : Quality Assurance Test

Fig. 1-3 Quality Assurance System Diagram

## 1.2.1 Quality Assurance in the Development Stage

### 1.2.1.1 Product Planning

Before starting product planning, it is essential to carry out market research activities to ascertain the intended applications and the product quality and reliability demanded by each customer, and also to understand technical trends in the general marketplace, basic specifications, delivery periods, prices, quality, reliability and other demands on products.

Information on demanded quality and reliability acquired through the above activities and various data obtained in-house from accumulated quality and reliability results and fundamental research on reliability technology are used to set target quality and reliability levels which are appropriate for product applications and operating environments and to formulate development plans.

This information is then compiled into product plans, and design specifications are drawn up based on these product plans and summarized as input for design.

### 1.2.1.2 Product Development and Design

Product design is an extremely important process for ensuring high reliability in semiconductor devices, and it is necessary to build in both quality and reliability.

Product design should incorporate reliability in all aspects based on design specifications which have been thoroughly investigated in the planning stage. For example, circuit and layout designs should have sufficient design leeway to tolerate variance in the manufacturing process.

Product design work proceeds according to the design specifications. These design specifications include design inputs (applicable laws and regulations, customer demands, in-house standards) to ensure that appropriate requirements are selected. Product design passes through the stages of logic/circuit design, layout design, mask design, prototype manufacture and evaluation before reaching completion. In addition, reliability evaluation to assure quality and reliability levels, design review and design verification are carried out at strategic points throughout this process to confirm that the design input requirements are satisfied.

Design review consists of reviewing design results with the aim of improving design quality. Design verification checks that products meet needs and customer requirements using input documents (design specifications), output documents (evaluation data), related reports and other materials. In addition, production drawings and preparations are checked, products are approved as mass production types, and procedures for starting mass production are initiated.

### 1.2.1.3 Design Review

The product design results and observance of the design specifications used as these inputs are checked as the design review. Design review may also be carried out partway through the design work and these results fed back to the design to improve design quality.

Design review consists of checking whether the design standards which are the rules to be followed during circuit design, layout design and assembly are being observed, and thorough investigation of design data by technical experts. Observance of design standards is checked using various simulation tools during circuit and layout design, and the design results are automatically and manually verified against the design standards to check whether there are any design errors, design standard violations or problems with product performance.

In addition, experts from related departments review designs from various angles using checklists which include design standards, cases of past trouble, etc. These design reviews aim to avoid trouble after prototype manufacture and mass production, and build the target performance, quality and reliability into products in line with demands.

## 1.2.2 Quality Assurance in the Mass Production Stage

### 1.2.2.1 Process Quality Control in Manufacturing

In order to supply the high quality and high reliability products demanded by customers, related departments perform capacity verification with respect to production, shipping and material purchasing plans which have been created based on the latest sales plan, and then operations shift to the production stage.

Based on the concept of building in quality in the manufacturing process, the manufacturing conditions (process conditions, facility conditions, manufacturing environment conditions, workmanship criteria, etc.) which have been determined according to the various drawings presented from the Development and Design Departments are prescribed in the work standards, and standard upper and lower limit control is performed as In Process Quality Control (IPQC). Then, SPC control (see 1.1.4) is carried out for important control items which have a significant effect on quality, and efforts are made to stabilize quality and to discover and prevent trouble. (Fig. 1-4)

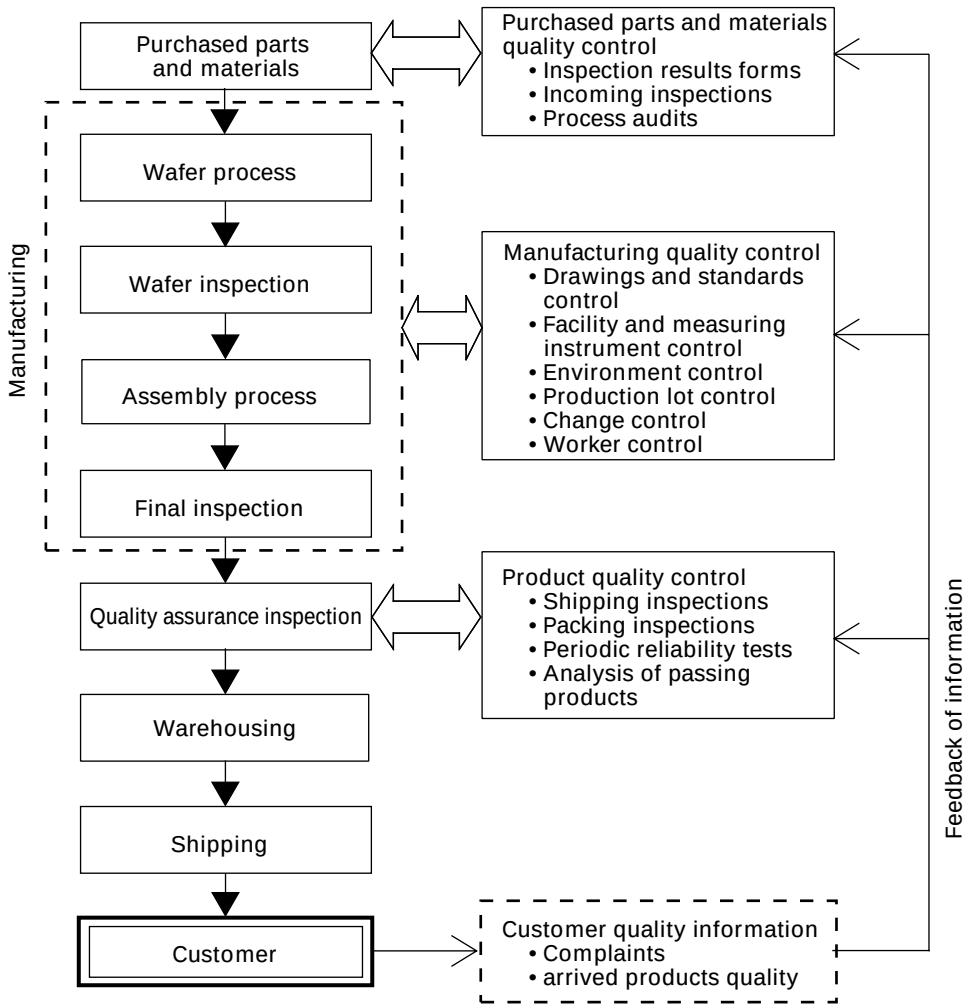



Fig. 1-4 Quality Control Flow in the Mass Production Stage

All necessary information concerning quality, from materials and parts purchasing to quality control, manufacturing process control, inspections, warehousing and quality conditions at the customer's place, is controlled by a data collection system and used to make swift quality improvements. When trouble occurs in the manufacturing process, a trouble report is issued, the Technology Department in charge investigates the matter, and action is taken to correct the problem and prevent recurrence. (Fig. 1-5)

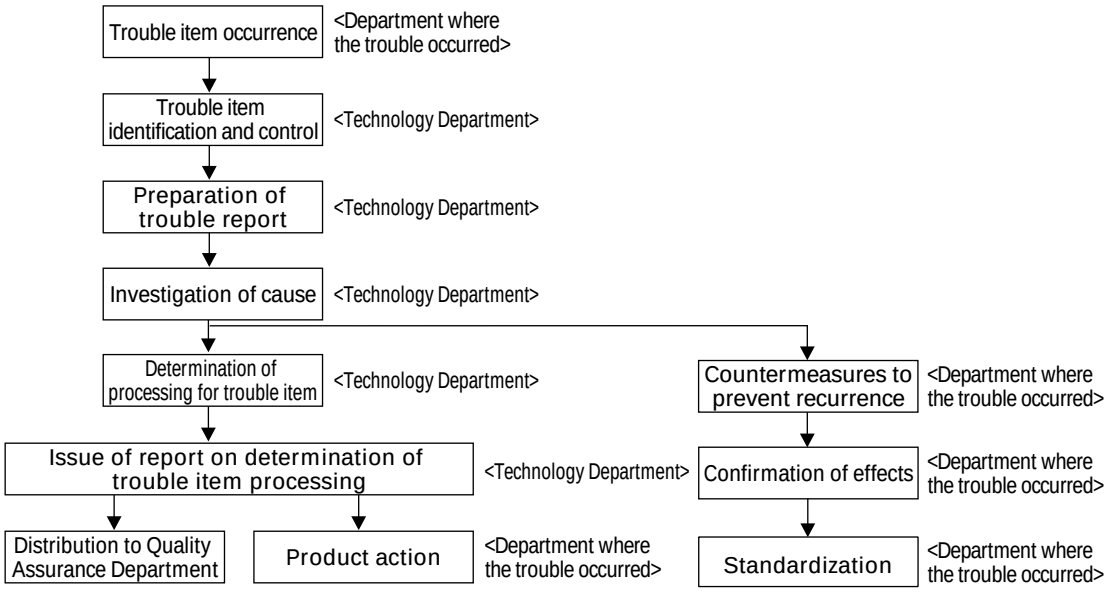



Fig. 1-5 Trouble Item Occurrence and Corrective Action

In this manner, a final inspection is carried out to check whether manufactured products satisfy product specifications and customer demands, and only passing products are shipped to customers.

### 1.2.2.2 Process Quality Control for Outsourced Items

Even when outsourcing part of the manufacturing process, quality assurance activities are promoted based on the same approach for both in-house production lines and outsourced production lines. These activities include product quality, process control, quality improvement activities and measures when trouble occurs, and efforts are made to maintain and improve product quality and to prevent the occurrence of trouble. (Fig. 1-6)

- **Certification of product quality**

Outsourced production items undergo the same quality and reliability evaluations as in-house production items as "quality certification" to make sure there are no problems.

- **Line audits**

Line audits are conducted by specialists when starting outsourced production to make sure there are no problems, and production starts after this "line certification".

- **Measures when trouble occurs**

When trouble occurs in outsourced production processes, product and corrective actions are carried out according to the decisions of related in-house departments based on information provided from the outsourcing supplier.

- **Periodic quality meetings**

Periodic quality meetings are held with outsourcing suppliers, and quality improvement activities are promoted. These activities include extracting themes such as trend control for process control items and inspection passing rates, and correction and prevention of problems.

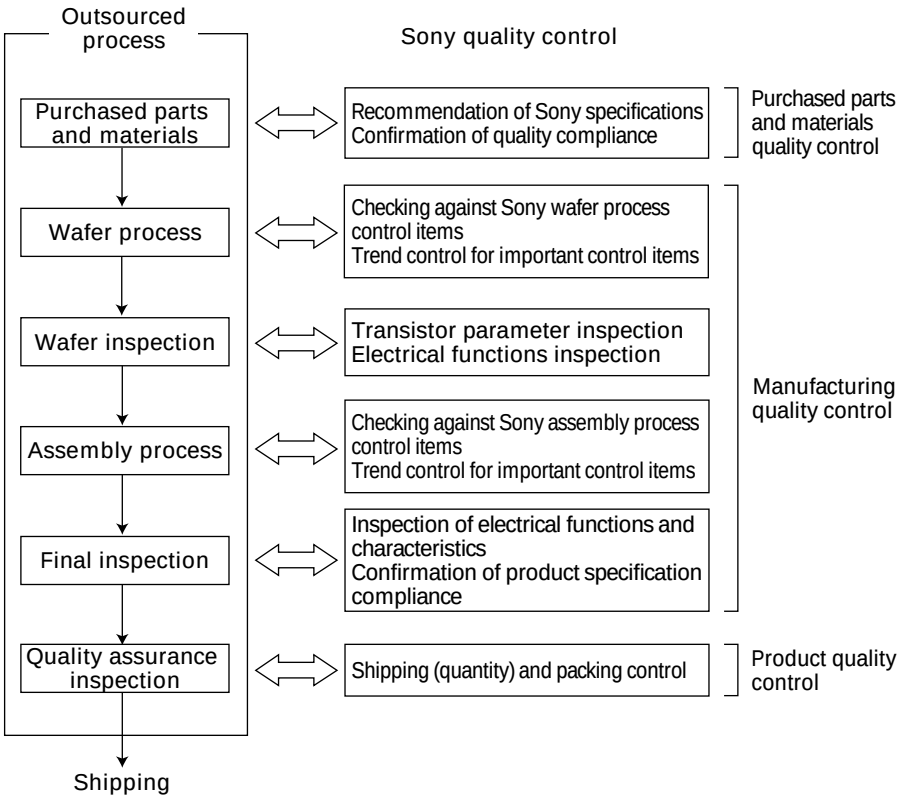



Fig. 1-6 Process Quality Control Flow for Outsourced Items

## 1.2.3 Quality Assurance for Materials and Parts

As semiconductor devices move toward higher performance and higher density, design demands on materials and parts are also becoming higher level.

On the other hand, it hardly needs mentioning that materials and parts quality is important for assuring the quality of semiconductor devices.

The Sony Group system includes supplier and manufacturer evaluation and registration, certification inspections and evaluation of materials and parts, and overall evaluation as semiconductor devices, etc. Within this system, Sony promotes activities to assure materials and parts quality, and purchases materials and parts which meet high level design demands. These procedures are shown in Fig. 1-7.

Specific activity contents are as follows.

- Selection of manufacturers based on demanded materials and parts specifications.
  Manufacturers are selected mainly by the Development and Purchasing Departments according to materials and parts functions and performance.
- Evaluation and registration of suppliers
  “Management”, “technology”, “quality”, “price” and “delivery period” are evaluated and registered mainly by the Purchasing and Quality Assurance Departments, and this information is shared by the Sony Group.
- Review and certification of manufacturers (factories)
  “Quality systems” and “process quality control” are reviewed and certified mainly by the Purchasing, Quality Assurance and Development Departments, and this information is shared by the Semiconductor Group.
- Certification inspection and evaluation of materials and parts
  Lead frames and other mechanical parts are certified by inspecting the appearance and measuring the dimensions.
- Evaluation and certification of quality and reliability as semiconductor devices
  Items for which evaluation in material and part units is difficult are certified by overall evaluation as completed semiconductor devices.
- Registration and control of materials and parts purchasing data sheets
  These sheets are prepared by the Development Department, then individual numbers are assigned to each material and part and this data is registered and controlled by the Purchasing Department.
- Materials and parts incoming inspections
  These inspections are performed by the Purchasing Department (Quality Assurance Department) based on the purchasing data sheets.
- Materials and parts inventory and control
  This is performed by the Purchasing Department (Quality Assurance Department) based on the purchasing data sheets.
- Ensuring materials and parts lot traceability for semiconductor devices
  This is controlled by the Manufacturing Department as quality records within process control.
- Materials and parts change control
  Materials and parts changes are received by the Purchasing Department and verified by the Development and Quality Assurance Departments. Steps are taken to ensure traceability when making changes.

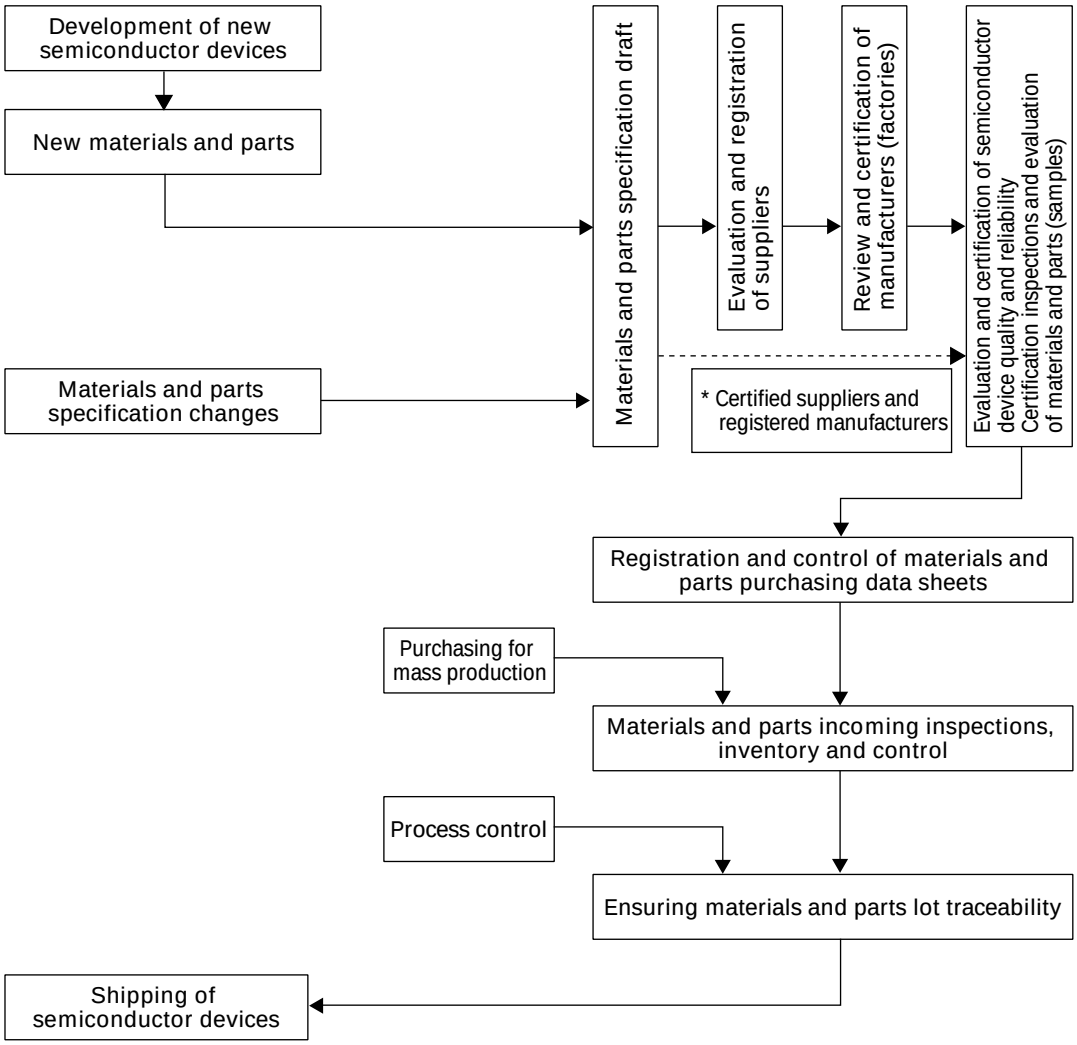



Fig. 1-7 Flow from Materials and Parts Development to Shipping

## 1.2.4 Facility and Measuring Instrument Control and Environment Control

During the course of semiconductor production, product performance and quality are assured and improved by having measuring instruments constantly operating in the normal condition and within the required accuracy.

Measuring instrument accuracy is controlled by establishing a preventative maintenance system. Incoming inspections are carried out when instruments are purchased and periodic inspections are carried out during use to check accuracy, calibrate instruments, and prevent malfunctions and drops in accuracy. Fig. 1-8 shows the quality control system for measuring equipment.

The environment has a significant effect on semiconductor device quality and reliability. Therefore, control items, control methods and control standards for temperature, humidity, dust and other items are set according to the manufacturing process and micro-machining level, and the environment is maintained and controlled by monitoring systems, etc. In addition, quality is also maintained and controlled by monitoring the specific resistance, purity and other characteristics of the deionized water, gases and chemicals used in manufacturing lines.

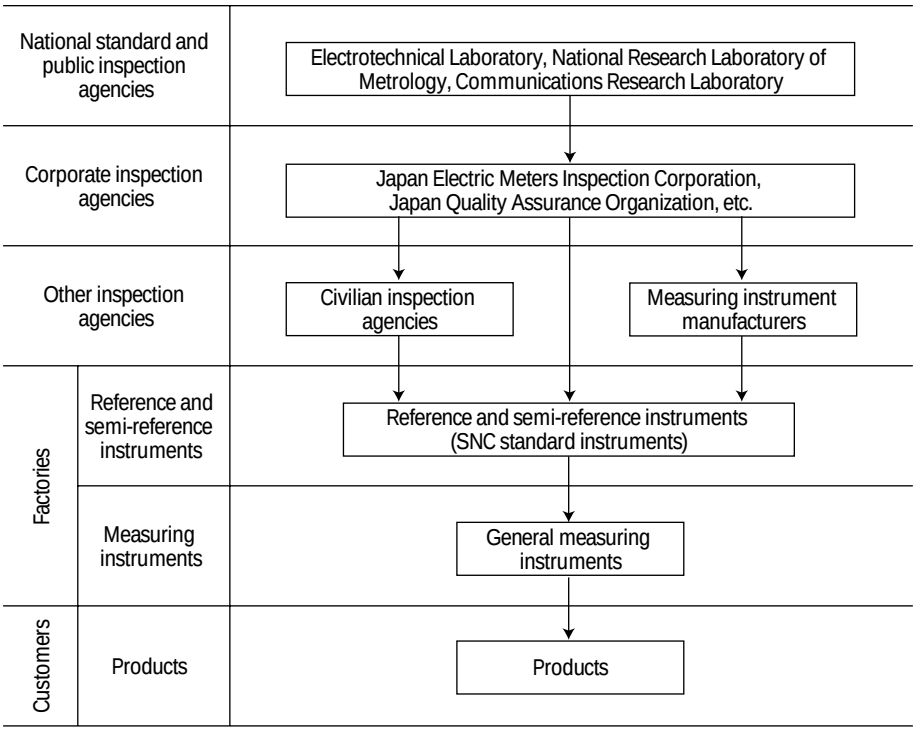



Fig. 1-8 Traceability of Measuring Instruments

## 1.2.5 Change Control

Changes are made to products or manufacturing process in order to improve semiconductor product functions, quality and reliability and also to improve productivity.

The feasibility of these changes is judged using sufficient data indicating that the change will not produce any negative effects.

When a change is planned, all related departments review the change. The necessary and ideal evaluation of items thought to have a technical effect is planned, and these effects are confirmed by manufacturing prototypes, etc.

In the case of changes which alter the product itself or changes to the manufacturing process which have a significant effect on the product, these results are conveyed in advance to customers to confirm that there is no effect at the customer.

After these judgments are received, if the change is acceptable, instructions are issued and initial control of floating data is performed as necessary for the final check.

This change system is shown in Fig. 1-9.

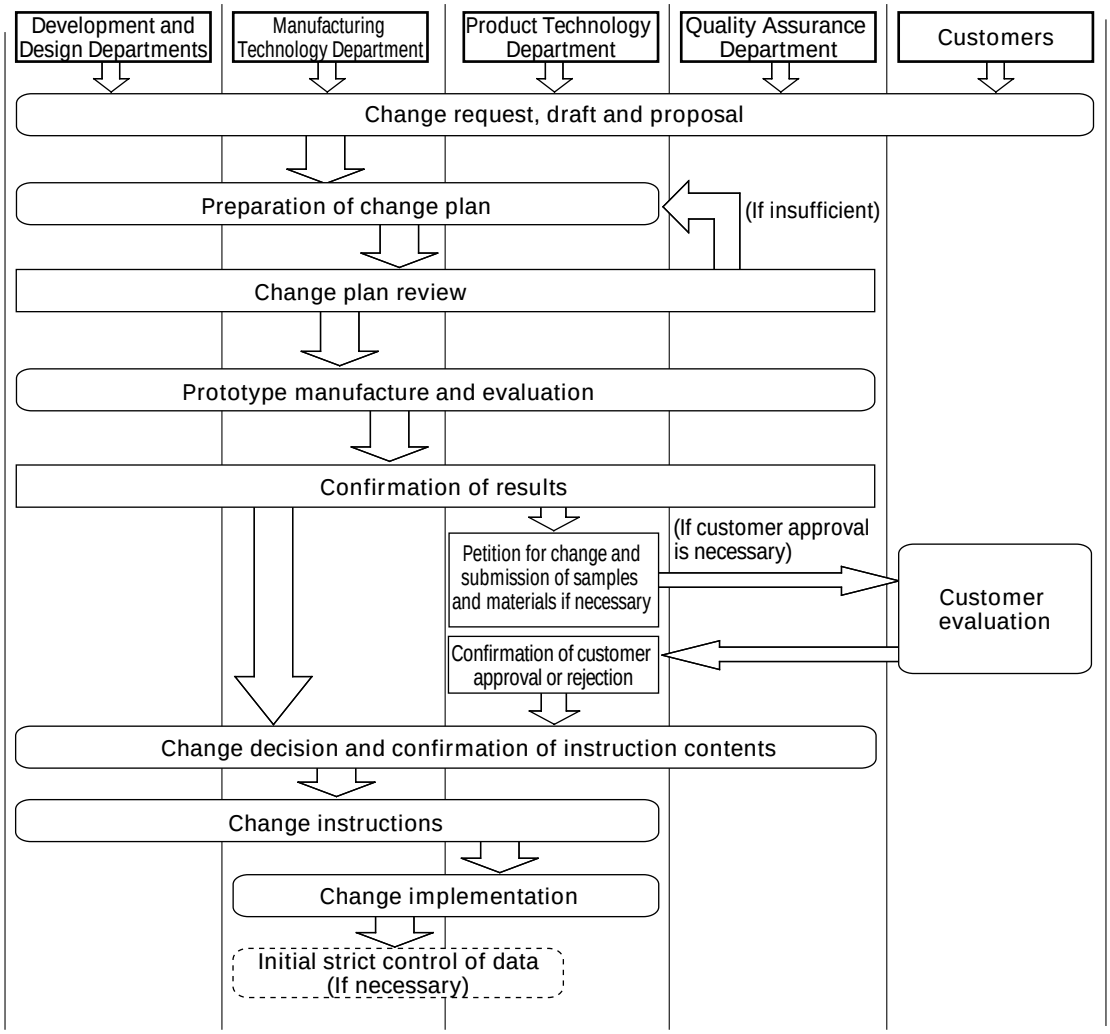



Fig. 1-9 Change System

# 1.3 Product Shipping Quality Assurance

Checks are carried out to ensure that the quality control established in the development and manufacturing stages is being reliably executed. Then, shipping inspections are carried out to confirm the quality assurance of each lot and periodic reliability tests are conducted in process and package units in order to ensure the quality and reliability of shipped products.

## 1.3.1 Quality Assurance Test (QAT)

Table 1-2 shows an example quality assurance inspection. The tested items are electrical characteristics, mechanical characteristics, thermal environment, reliability and long-term reliability.

Table 1-2 Example Quality Assurance Inspection

| | Shipping inspection (Gp-A) | Mechanical strength test (Gp-B) | Periodic reliability test/other (Gp-C) | Long-term reliability test (Gp-D) |
|---|---|---|---|---|
| Frequency | Visual check: Lead bending, marking defects, chipping, voids, control defects<br>Characteristics: DC and AC characteristics<br>Packing: [Every lot] | Solderability<br>S-Pd PPF products: each package category<br>Solder plated products: each outsourcing supplier<br>Soldering heat resistance [Once per month] | Representative types for sampling are determined each month from the wafer process family and the package family.<br>Electrostatic strength test [Once per month] | One type from among the Gp-C tested items each month<br>[Once per month] |
| Conditions | Visual check: IC visual inspection<br>Judgment: AQL0.065 (0-1/200)<br>Characteristics: FC standard<br>Judgment: AQL0.065 (0-1/200)<br>Packing: IC packing standard | Solderability:<br>Sn/Pb : 230°C for 3 s<br>Sn/Ag/Cu: 245°C for 3 s<br>Judgment: Visual<br>Soldering heat resistance: IR reflow<br>Sony recommended temperature profile (Peak 260°C$_{max}$)<br>Judgment: Visual, FC | HTB: 85°C to 125°C<br>Test time max. 1008 h<br>THB: 85°C, 85% RH<br>Test time max. 1008 h<br>TC: -65°C to +150°C<br>Test time max. 100 cycles<br>PCT: 121...C, 100% RH (unsaturated), 2.03 × $10^5$ Pa<br>Test time max. 236 h<br>Electrostatic strength test: Machine model only | Same conditions as Gp-C<br>HTB time: 5000 h<br>THB time: 5000 h<br>TC time: 500 cycles<br>PCT time: 500 h |
| Quantity | Visual check: 200 pcs/lot<br>Characteristics: 200 pcs/lot<br>Packing: Entire lot | Solderability<br>Soldering heat resistance: 96 pcs/lot | HTB 22 pcs, THB 22 pcs, TC 22 pcs, PCT 22 pcs/lot<br>Electrostatic strength test | Continued from Gp-C: 1 lot per month |

AQL: According to MIL-STD-105E/JIS Z9015
Sampling standard: According to MIL-S-19500 Sampling Inspection Table
(See Appendix Table A-5.)

S-Pd PPF: Sony specification palladium Pre-Plated lead Frame

### 1.3.1.1 Shipping Inspection

After the final inspection, sampling inspections are performed for each lot and a lot judgment is made to confirm that the electrical specifications, appearance and packing condition of shipped products satisfy the specifications demanded by customers.

### 1.3.1.2 Periodic Reliability Tests

Tests are carried out in process and package units to confirm that the reliability levels of shipped semiconductor products satisfy the levels demanded by customers.

## 1.3.2 Handling Customer Complaints

When a customer experiences trouble, these complaints pass through Sony's sales company and are received by the Quality Assurance Department.

Investigation and analysis of complaint items and feedback of these results are both a duty and a service to customers, and at the same time provide valuable information for improving product quality.

Results of investigations of complaint items and the contents of countermeasures are reported to customers in document form and efforts are made to obtain understanding. However, in some cases customers may be visited to report these results directly.

Fig. 1-10 shows an outline of the customer complaint handling flow.

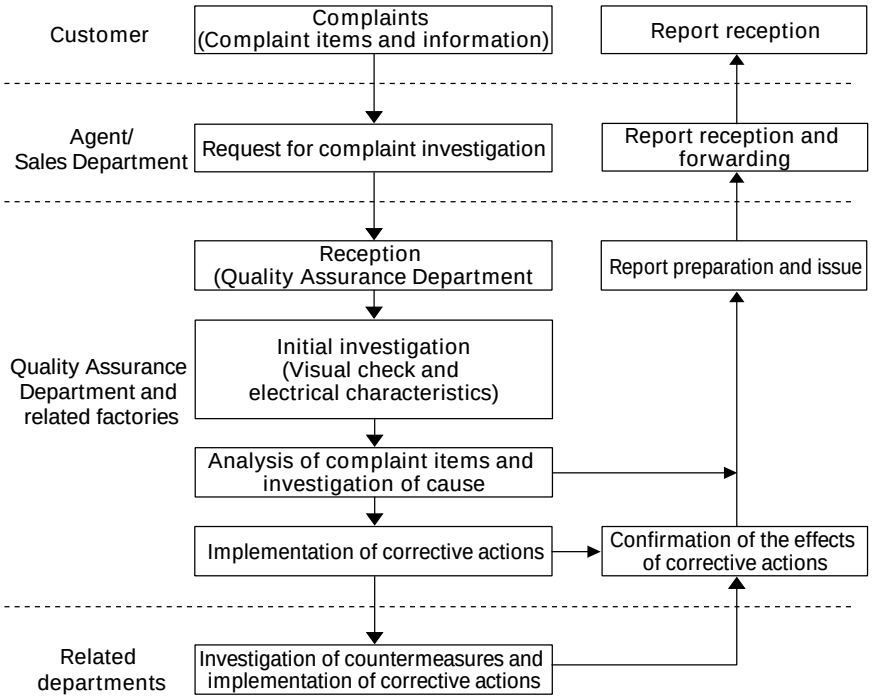



Fig. 1-10 Customer Complaints Handling Flow

### 1.3.2.1 Complaints Information

Complaints processing requires accurate information concerning the conditions under which the trouble occurred, and the more the information can be obtained from the customer, the easier the investigation and analysis can proceed. Therefore, when requesting investigation of complaint items, customers are requested to present detailed information on the trouble contents, the process in which the trouble occurred, the electrical, mechanical and thermal stress application history, lot dependency, occurrence rate, surrounding circuit conditions, applications, etc.

Particularly with lead bending and packing trouble (incorrect items or mixing of different types), detailed information at the time of occurrence is required.

#### 1.3.2.2 Return of Complaint Samples

Complaint items should be returned as much as possible in the condition in which the trouble occurred.

When returning samples, appropriate measures should be taken to avoid external stress (electrical, thermal and mechanical) so that the effects of stress during handling and transport do not change the trouble conditions.

#### 1.3.2.3 Return of Analyzed Samples

Items judged as acceptable or for which the complaint symptoms cannot be reproduced as a result of analysis by the Sony Semiconductor Network Company are returned to the customer for reconfirmation. If customers can reproduce the complaint symptoms, investigation should be requested again together with detailed information.

### 1.3.3 Corrective Action

After determining the cause from the complaint item investigation and analysis results, countermeasures are implemented and corrective action is also taken as necessary for the quality systems in each stage to prevent recurrence as shown in the example below.

(1) Evaluation and verification systems in the development and design stage
(2) Quality and reliability evaluation systems
(3) Control system for drawings, specifications and other data transferred from development and design to production
(4) Process internal quality control, trouble processing and facility control systems in the production stage

Taking corrective action for quality systems prevents the same kind of trouble from occurring in products other than the complaint item.

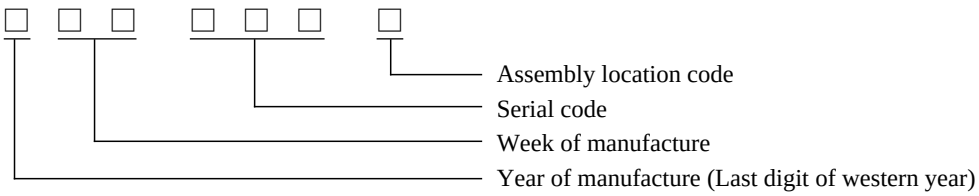
### 1.3.4 Product Identification and Traceability

Manufacturing history identification is controlled by assigning production lot numbers to allow tracing of the manufacturing history. Lot numbers are comprised of seven digits representing the year and week of manufacture, a serial code and a code indicating the assembly location. For small package items, this lot number is divided or omitted, and the full name is indicated on the shipping label.

(For details, see the item on Sony product name indications.)

#### 1.3.4.1 Product Lot Indication (Traceability)

Full lot number indication




Divided indication

□ □ □ Year and week of manufacture
□ □ □ □ Serial code and assembly location code

#### 1.3.4.2 Product Name Indication

Semiconductor devices are identified by naming and marking each product according to the Sony product name regulations for each category.

In principle the full name should be indicated, but since discrete devices have small packages, this indication is omitted in many cases.

# 1.4 Product Liability (PL) Act



## 1.4.1 Purpose of Activities

Sony carries out product liability (PL) activities under the name “Safety and Peace of Mind” activities.

Customer expectations toward safety and peace of mind are “to provide safe products and work together with customers to establish an environment in which products can be used with peace of mind”, and Sony’s mission is to realize customer satisfaction.

To fulfill this mission, Sony has prescribed the following basic guideline and policy for promoting safety and peace of mind, and the Sony Semiconductor Network Company has further established its own basic policy based on these.

**Basic guideline**

Sony will work to supply safe products and “make Sony the world reference” in the field of safe use by customers.

**Basic policy**

Sony recognizes that one of its most important management requirements is to conduct business activities aimed at realizing a “society where peopple can live safely and with peace of mind,” and will work to prevent accidents in all corporate activities. Furthermore, in the unfortunate event that accidents do occur, Sony will handle these incidents in a fair and swift manner.

**Basic policy of the Sony Semiconductor Network Company**

The Sony Semiconductor Network Company recognizes that one of its most important management requirements is to conduct business activities aimed at realizing a “society where people can live safely and with peace of mind,” and will “work through set customers which are direct customers to prevent accidents at the final customer.” Furthermore, in the unfortunate event that accidents do occur, the Sony Semiconductor Network Company will handle these incidents in a fair and swift manner.

## 1.4.2 Management Structure for Promoting Safety and Peace of Mind

The Sony Semiconductor Network Company promotes safety and peace of mind from the following starting points of PS, CS and PL.

**(1) Product Safety (PS)**

Supplying safe products

**(2) Customer Satisfaction (CS)**

Realizing safe use

**(3) Product Liability (PL)**

Fair and swift redress

## 1.4.3 Activities for Promoting Safety and Peace of Mind

### (1) PS

The possibility of semiconductor products being the direct cause of death, injury or damage to property is extremely rare. However, semiconductor product quality or reliability failure in set products which use semiconductor products may trigger accidents in the final market.

The Sony Semiconductor Network Company feels that improving the quality and reliability of semiconductor products is the most important item for preventing PL accidents in set products, and works constantly to improve quality and reliability.

### (2) CS

Product data sheets, catalogs, user manuals and other materials contain clearly marked notes on operation in order to prevent PL accidents resulting from improper use by customers such as use at voltages exceeding the absolute maximum rating.

### (3) PL

In the event that quality or reliability failure of a semiconductor product causes a set product PL accident in the final market, efforts are made to respond swiftly to clarify the cause and prevent the damage from spreading.

We have established an emergency contact network in the event of a safety and peace of mind accident, and created an organization which allows responses on a 24-hour basis in order to effect this swift response.

## 1.4.4 Systems for Promoting Safety and Peace of Mind

The Sony Semiconductor Network Company has appointed Product Liability Authorized Reviewers (PLAR) as the final persons in charge of promoting safety and peace of mind in order to realize PS, CS and PL. In addition, systems for promoting safety and peace of mind have also been established, and implementation of action plans is monitored and corrective action taken.