2

Innovative Products and Services

Recommended Primary Stakeholders for This Section:

☐ Suppliers ■ Customers ☐ Employees ■ Investors ☐ Government ■ Media ■ General Public

2.1 R&D and Innovation

GRI 3-3 416-2 417-1 417-2 TC-SC-000.A TC-SC-000.B TC-SC-410a.1

Material Topics **Innovative Product Management – Sustainable Product Innovation and Incomplete Intellectual Property Management**

Innovative Products and Services

To maintain industry competitiveness and promote sustainable development, TSC continues to focus on innovative product research and development. Its R&D expenditures have increased year by year, reaching NT$126.066 million in 2024, accounting for 3% of net revenue—exceeding 3% for two consecutive years. At the same time, TSC aims to minimize the environmental impact of its business operations by establishing environmental specifications for all products and controlling hazardous substances. This includes compliance with the EU RoHS Directive and REACH Regulation, while progressively incorporating green product concepts into both the design and production stages.

Policy and Commitment

- Monitor regulatory trends related to materials to ensure 100% compliance with applicable laws and regulations.
- Provide energy-efficient product solutions to reduce the environmental impact of manufacturing and packaging.
- Maintain a comprehensive intellectual property (IP) management framework to protect R&D outcomes.
- Manage IP risks to prevent rights infringement and safeguard proprietary assets.
- Collaborate with professional firms for high-quality applications and global strategic IP protection.
- Conduct IP training to enhance awareness and practical skills among R&D and technical personnel.

Management Approach and Evaluation Mechanism

- Establish and maintain the TSC Environmental Compliance database to manage hazardous substances in accordance with EU RoHS, REACH, and other regulations.
- Have the quality management system regularly verified by third parties, including IATF 16949 and ISO 9001.
- Invest in R&D and process optimization to enhance product efficiency, reliability, and energy performance.
- Assign the Legal Department to oversee IP management, including system planning, rights protection, and coordination with external firms.
- Maintain a patent database and conduct regular reviews to assess patent value and maintenance strategies.

Action Plans and Performance

- **Develop multiple innovative products, including MOSFETs, Automotive Low-Power Voltage Regulator ICs, and ESD protection devices, with ongoing validation and mass production.**
- **Achieve 99% full material disclosure by weight for 10,064 products.**
- **In 2024, conduct one patent training session for the R&D team, with 23 participants, in collaboration with external firms.**

2.1.1 Products and Services

Note: Data is current as of February 2025.

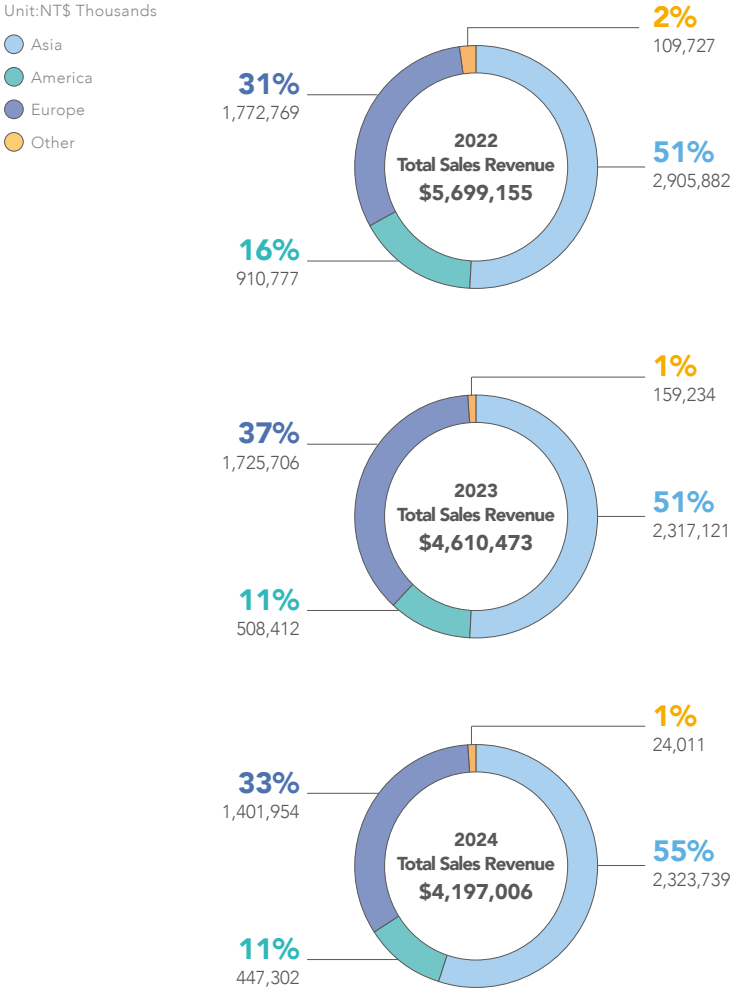
TSC is primarily engaged in the manufacturing of Rectifiers, Transistors and LED Drivers, Assembly, Testing, and After-sales Service. Its product portfolio includes rectifiers, protection diodes, MOSFETs (metal–oxide–semiconductor field-effect transistors), bipolar junction transistors, ultra-low-power voltage regulators, ESD protection diodes, high-voltage low-loss rectifiers, fast recovery rectifiers, LED drivers, sensors, and wide-bandgap devices. These products are mainly applied in three key sectors: automotive electronics, the industrial market (including charging stations, power tools, and pneumatic equipment), and consumer electronics. In line with the market trend toward lighter, thinner, and smaller products, TSC has in recent years actively pursued the development of compact, energy-efficient, and integrated solutions.

Vertical integration is one of TSC's core competitive advantages, enabling us to provide end-to-end services covering R&D, design, production, assembly, testing, and sales. This integrated approach streamlines manufacturing and reduces communication errors.

Approximately 70% of product output is produced in-house, with the remaining 30% outsourced or externally procured. The annual output of core rectifier products reaches 4,779,684 Kpcs. TSC has actively advanced transformation initiatives and adjusted sales strategies, with the automotive and industrial markets contributing around 70% of total revenue by the end of 2024. In terms of regional sales distribution, Asia accounted for 55%, Europe and the Americas combined for 44%, and other regions for 1%.

Sales Performance and Proportion by Major Regional Markets

Unit:NT$ Thousands



Diversified Strategic Approach

To provide customers with more comprehensive product solutions, TSC has continuously improved its technological innovation and R&D capabilities. It has also formulated short-, medium-, and long-term product development strategies to meet customer needs and market trends.

Strategic Goals

	Short-term	Mid-term	Long-term
Product Development	• Gain deep insight into market demands and accelerate product launches, such as developing advanced MOSFETs, wide-bandgap semiconductors, and high-efficiency rectifiers for automotive applications. • Leverage existing technologies and platforms to create new product variants that address diverse customer needs. • Optimize the product portfolio in line with customer requirements and market trends. • Identify new application scenarios to extend existing products into emerging markets and sectors.	• Enhance R&D on safety and reliability to improve product quality and market trust. • Deepen customer collaboration to deliver customized products and services, increasing market share. • Build a new product ecosystem. • Advance sustainable development and green manufacturing. • Expand into new markets and applications to broaden product use and market size.	• Strengthen research and practice on product life-cycle management to achieve long-term sustainable development. • Promote green design and green manufacturing of products to achieve environmental protection and sustainable development goals. • Develop cloud-based products and services to achieve the sharing and collaboration of smart and digital products. • Promote product circular economy and resource utilization, achieve product recycling and waste reduction, and achieve sustainable development goals.
Technological Advancement	• Introduce new talents and technologies to enhance R&D and manufacturing capabilities. • Accelerate product smartification and digitization to enhance product added value and market competitiveness. • Strengthen the R&D and manufacturing procedures of products to improve efficiency and product quality. • Strengthen cooperation with suppliers to improve supply chain efficiency and reliability.	• Introduce new materials and technologies to improve product performance and power consumption ratio. • Promote product design and testing automation to improve product development efficiency and product quality. • Promote smart manufacturing and industrial internet to enhance production efficiency and product quality. • Strengthen corporate innovation culture and R&D capabilities, enhance innovation vitality and competitiveness of the business. • Promote green manufacturing and strengthen green technology R&D.	• Promote the application of cutting-edge technologies such as artificial intelligence and machine learning to enhance the intelligence and autonomy level of products. • Continue to advance technology R&D to maintain a technological competitive advantage. • Promote comprehensive corporate digital transition to enhance corporate intelligence and digitization level. • Promote deep collaboration and innovation with industry chain partners, jointly advancing industrial development.

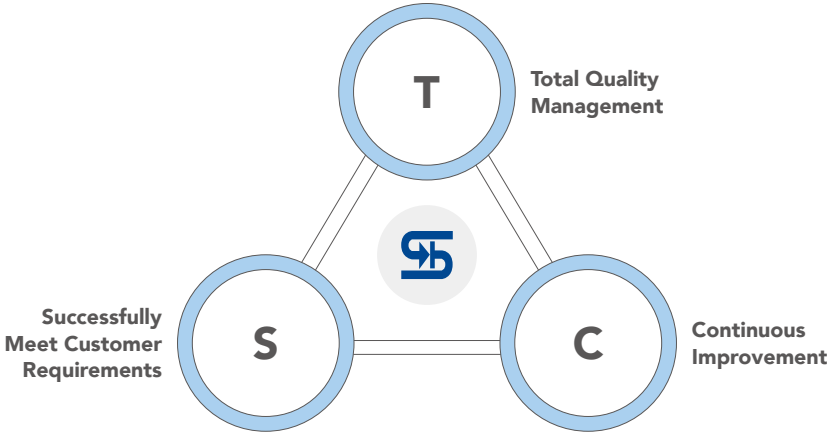
Diverse Product Portfolio

AEC-Q Qualified

Discrete	• Rectifier • Protection Diode • MOSFETS • Small Signal Product • General Purpose and Low VCE(sat) Transistor
Power Management Sensor Wide Bandgap	• Amplifier & Comparator • Voltage Regulator • LED Driver • Voltage Reference • Magnetic Sensor • Wide Bandgap

Product Development Execution Process

TSC VISION



Building a Diversified, Differentiated, and Competitive Product Profolio

Starting in 2024, we accelerated product development by restructuring R&D resources, creating dedicated teams for core and new products, and assigning exclusive teams to each goal. Leveraging in-house chip design and automated assembly, TSC invests in Schottky rectifiers, Fast Recovery Diodes (FRED), Transient Voltage Suppressors (TVS), MOSFETs, ESD protection devices, and low dropout/low-power automotive regulators.

We are developing next-generation Trench Schottky Rectifiers, FREDs, Super Junction MOSFETs, and Shielded Gate Technology (SGT) MOSFETs to reduce conduction and switching losses, addressing demand for eco-friendly, energy-saving applications. These are applied in automotive electronics, industrial, telecommunications, and energy sectors. ESD protection R&D focuses on compliance with in-vehicle communication and Ethernet standards.

In third-generation semiconductors, we launched SiC Schottky diodes and are developing SiC MOSFETs. We are also producing low-power, high-output automotive power supplies, with some models developed in-house. Products are progressively passing automotive qualification, to strengthen quality and customer trust.

- **Developing Sustainable Products**

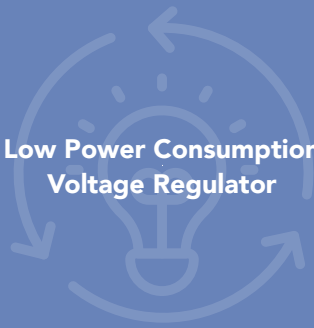
With the rise of 5G and electric vehicles, demand has grown for products that can withstand high temperatures and pressure, deliver high power, and consume less energy. Silicon carbide (SiC) semiconductors, with superior high-voltage performance, power handling, and thermal dissipation, are increasingly used in EVs, charging stations, and 5G technologies. In recent years, TSC has advanced R&D to enhance product performance and reliability, enabling delivery of higher-spec products. In 2024, we launched an ISO 14067 Product Carbon Footprint project, focusing first on assembled products, with carbon hotspot analysis expected by the end of 2025.

Sustainable Product Case Study

Silicon Carbide Schottky Diode

High-performance power semiconductor devices offer several advantages over traditional silicon Schottky diodes:

- Excellent thermal resistance and high voltage tolerance
- Low reverse recovery time, reducing switching losses and improving efficiency
- Compact size and lightweight, ideal for space-constrained applications or devices
- Long lifespan, reducing maintenance and replacement costs



Low Power Consumption Voltage Regulator

A high-stability voltage regulation component suitable for portable and battery-powered devices, featuring:

- Extended battery life and reduced heat generation, ideal for small electronic devices
- Simplified thermal management and circuit design
- Enhanced energy efficiency and environmental performance
- Compact size and high reliability, supporting long-term stable operation

High Voltage Low Loss Rectifier

A rectifier designed for high-voltage environments with minimal energy loss:

- High conversion efficiency with low power dissipation
- Strong voltage tolerance and wide applicability
- Compact design without the need for large heat sinks
- Extended lifespan and reduced operational and maintenance costs

Intellectual Property Protection

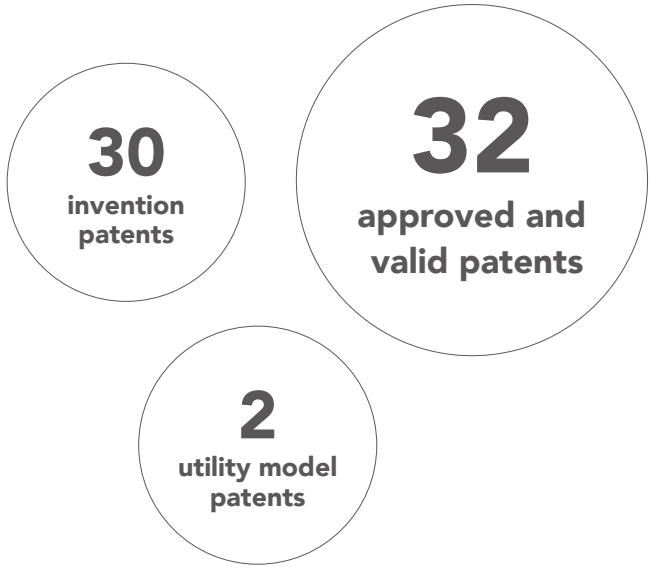
Intellectual Property (IP) is a key intangible asset reflecting TSC's investment in technology development and long-term growth. The Company has established the Intellectual Property Management Measures to guide the management and protection of IP rights across the group. To strengthen the value of R&D outcomes and promote patent cultivation, TSC regularly engages external firms to deliver IP and patent training for internal R&D and technical teams.

In response to evolving industry structures and rapid technological advancements, TSC has redefined its intellectual property strategy—shifting focus toward core technology development and the retention of high-value patents. A comprehensive review of group patents is conducted to optimize the portfolio, with priority given to filing new invention patents that demonstrate originality and innovation. TSC also collaborates with a U.S.-based technology firm to co-develop advanced technologies, emphasizing quality over quantity. As of now, **TSC holds 32 approved and valid patents** (including 30 invention and 2 utility model patents), with 4 additional applications pending.

To reinforce TSC's commitment to intellectual property (IP) deployment, the Legal Department—together with senior management—has launched several initiatives to strengthen internal IP management. These include regular training and industry-specific courses for R&D and technical teams, as well as the planning of new internal systems, such as the implementation of trade secret protection measures.

In Q1 2024, TSC invited an international IP law firm to deliver a training session titled "Essential Patent Knowledge for R&D Personnel" to enhance employees' understanding of patent protection. These efforts aim to safeguard core technologies and improve the quality of patent applications.

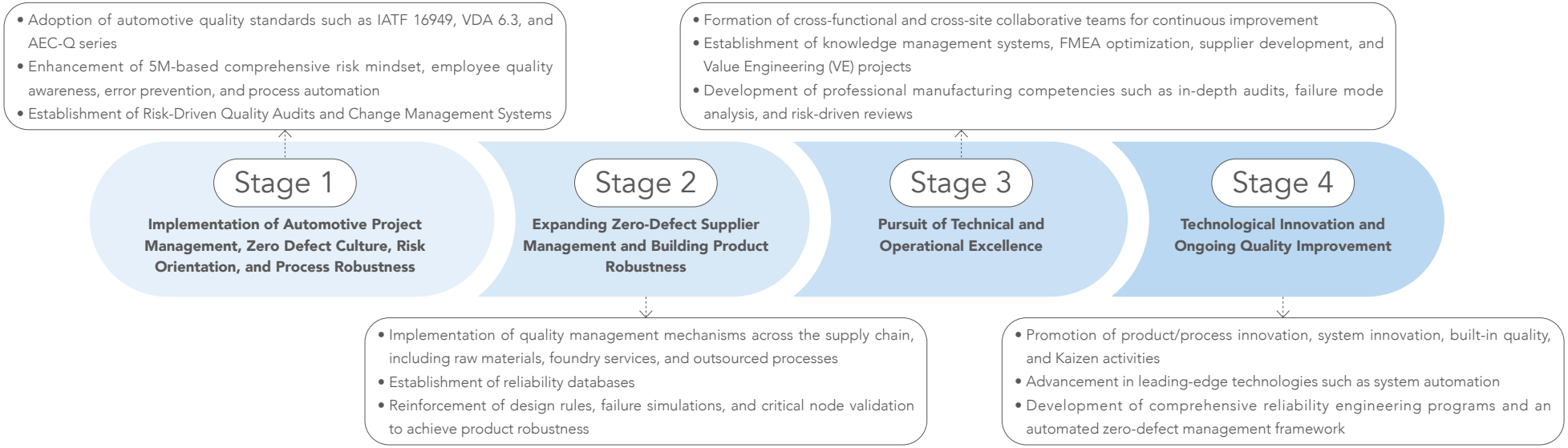
To foster innovation and enhance product quality and competitiveness, TSC has established a range of incentive programs to encourage employee participation in research, invention, and IP protection. These include proposal rewards, patent grant bonuses, infringement reporting incentives, rejection compensation, licensing rewards, and annual recognition. Through these measures, TSC promotes a culture of innovation while safeguarding its intellectual property.



Quality Excellence Roadmap

To ensure product quality and process reliability, TSC launched the "Quality Excellence Roadmap" in 2017. Aligned with automotive quality standards, the roadmap introduces a Zero Defect Strategy, risk-based management, and process robustness in phased implementation.

By integrating advanced technologies and promoting cross-functional collaboration, TSC continuously strengthens its quality management capabilities. The Company upholds global certifications such as IATF 16949 and ISO 9001, reinforcing its commitment to continuous improvement, defect prevention, and delivering high-quality products to the global automotive market.



Through this long-term roadmap, TSC is systematically aligning its management capabilities with automotive electronic quality standards, reinforcing an end-to-end quality management system from design to mass production, and fully realizing its commitment to quality and a zero-defect culture.

Reliability Analysis

Since 2000, we have strengthened our management through VDA6.3 process audits and IATF 16949. By integrating our existing quality management system, we assist in internal diagnosis and optimization, refine our zero-defect goals, and enhance competitiveness in the automotive supply chain. Additionally, in response to the continuous improvement of the international automotive industry, we have fully implemented Structural Planning Analysis Functional Analysis Failure Analysis Risk Analysis Optimization Documentation the latest version of AIAG-VDA FMEA (Failure Mode and Effect Analysis) in 2020 to optimize costs for products and manufacturing procedures.

AIAG-VDA FMEA

Automotive Supplier Audit

To ensure product quality in the automotive supply chain, TSC classifies its automotive suppliers into four categories and conducts regular audits based on VDA 6.3 and ISO 9001 standards. Audit formats include on-site, online, and documentation reviews. In 2024, TSC audited nine automotive suppliers, with no major non-conformities identified—demonstrating solid supplier quality performance.

If non-conformities arise, suppliers must submit and implement corrective action plans within a specified timeframe. TSC conducts follow-up reviews to verify improvements. For systemic issues, the Quality Assurance and Procurement teams support root cause analysis and provide technical guidance. Repeated non-compliance may lead to re-audits or adjustments in cooperation strategy.

Raw Material Management

TSC provides integrated semiconductor services from wafer fabrication to assembly and testing. The frontend process involves chemicals, etchants, and silicon wafers, while back-end operations use materials such as lead frames and carrier tapes. To reduce resource waste, TSC continually optimizes production processes. Raw material suppliers are selected based on strict standards and follow each plant's procurement procedures to ensure compliance with regulatory and quality requirements.

Total Amount of Production Material Consumption Used

Unit: Kg

	2022		2023		2024	
	Weight	Percentage	Weight	Percentage	Weight	Percentage
Total renewable materials used	194,610	5%	158,453	6%	150,072	5%
Total non-renewable materials used	3,713,706	95%	2,418,640	94%	2,961,346	95%
Total Materials Used	3,908,316	100%	2,577,093	100%	3,111,419	100%

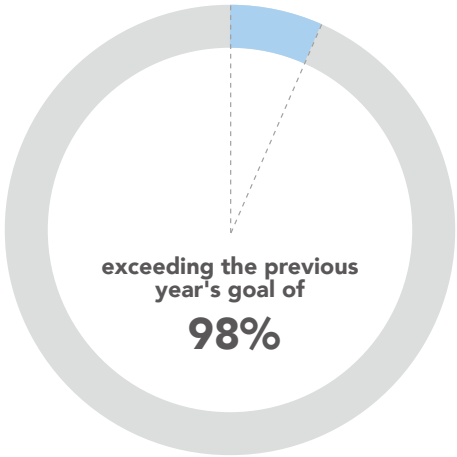
Note:
1. The data includes all manufacturing sites.

Chemical Substance Control and Disclosure

TSC uses various chemical substances in its production processes, posing potential risks to human health and the environment. As international regulations and customer expectations on chemical control rise, TSC recognizes the importance of transparent chemical management throughout R&D, design, and manufacturing.

To support this, TSC has established a Materials Composition Declaration (MCD) system on its official website, allowing customers and stakeholders to access product composition data via a self-service portal. In 2024, TSC completed full material disclosure for 10,064 products, achieving a 99% disclosure rate by weight, surpassing the 98% target.

Moving forward, TSC will continue expanding its material database and analyzing high-risk substances to strengthen its commitment to producing environmentally friendly products.



Hazardous Substances Management

TSC considers hazardous substance management essential to sustainable operations and customer trust. We strictly comply with international regulations, including EU RoHS and REACH, and have established the TSC Environmental Compliance database to manage such substances. We also disclose hazardous substances in response to customer needs, supporting customers in expanding the green product market.

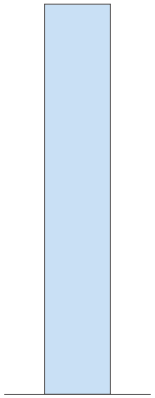
A full list of applicable environmental regulations is available on our website under Environmental Regulatory Compliance. In 2024, certain products contained declarable substances under IEC 62474, in accordance with the EU RoHs and REACH regulations, which still permit the use of specific substances for which no alternatives currently exist. TSC continues to monitor regulations and explore safer substitutes. Suppliers are also required to comply, and documentation is reviewed annually.

TSC ensures product safety through ISO 9001 and IATF 16949 systems, incorporating PDCA reviews and customer-specific requirements into development and production. In 2024, all products and packaging met regulatory and customer requirements, with zero violations, no safety-related incidents, and no labeling non-compliance.

Laws or Directives
EU Restriction of Hazardous Substances Directive (RoHS)[*1]
EU Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Safe Drinking Water and Toxic Enforcement Act
End-of-Life Vehicles Directive (ELV)
Persistent Organic Pollutants (POPs)
U.S. Environmental Protection Agency – Toxic Substances Control Act (TSCA)
EDEC J-STD-609 Lead-Free Marking Standard
China Volatile Organic Compounds (VOCs) Regulation

Compliance Rate of TSC Products

100%



Note:

1. This refers to the instruction for restricting the use of certain hazardous substances in electronic and electrical equipment (Restriction of Hazardous Substances).

Management of Raw Materials and Packaging Materials

Each site tailors its packaging based on production plans, product types, customer needs, and environmental regulations. TSC prioritizes recyclable materials such as reusable cartons, plastic packaging, and cushioning. At the Yilan Site, reels and plastic boxes are recovered and reused in partnership with suppliers. The Shandong Site has reduced carton usage, keeping packaging waste below 1 kg per $10,000 RMB of production value. In 2024, the site also eliminated heat-shrink plastic film to further cut plastic use at the source.

Total Packaging Material Usage

Unit: Kilograms

	2022		2023		2024	
	Weight	Percentage	Weight	Percentage	Weight	Percentage
Total renewable materials used	154,915	23%	112,337	23%	114,588	23%
Total non-renewable materials used	530,463	77%	369,046	77%	391,520	77%
Total Materials Used	685,378	100%	481,384	100%	506,108	100%

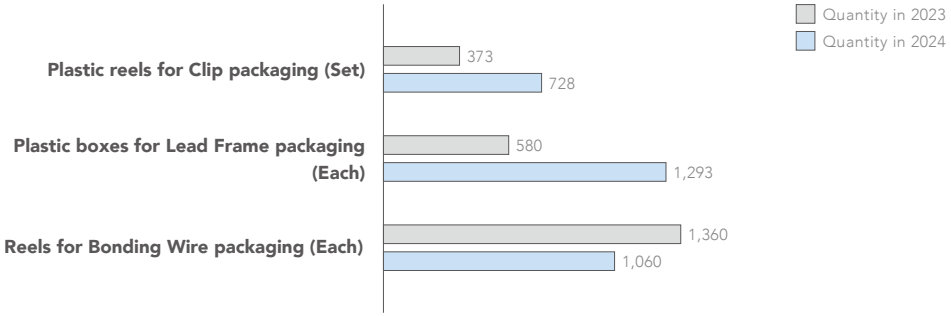
Note:
1. The data includes all manufacturing sites.

Value Chain Collaboration

Although TSC selects most of its packaging materials based on customer requirements, such as using anti-static plastic packaging materials for isolation of static electricity and content protection, which are difficult to replace with other materials, TSC is also dedicated to promoting value chain collaboration and finding appropriate vendors for recycling. In 2024, TSC continued to advance circular resource utilization. At the Yilan Site, 1,060 assembly reels used for bonding wire were recycled through cooperation with original suppliers. The number of plastic packaging boxes for lead frames significantly increased from 580 units in 2023 to **1,293** units in 2024. Similarly, recycled plastic reels for clip packaging grew from 373 to **728** units, a **95%** year-over-year increase. These achievements demonstrate TSC's effective resource management and material reuse practices.

Looking ahead, TSC will continue to inventory recyclable materials and assess their potential for reuse to further strengthen the efficiency of circular resource utilization.

Statistics of Recycled and Reused Packaging Materials



2.2 Customer Relationship Management GRI 3-3

Foundational Topic Customer Relationship Management

Policy and Commitment

- Operate multiple global logistics locations and service strategies to deliver reliable, comprehensive solutions that meet customer needs.
- Maintain organizational flexibility to provide customized, high-quality services in response to special customer requirements.
- Ensure customer satisfaction and service quality through effective two-way communication channels.
- Remain committed to earning and maintaining customer trust by responding promptly to all service demands.

Management Approach and Evaluation Mechanism

- Implement customer relationship management in accordance with internal procedures to maintain partnerships, monitor performance, and drive continuous improvement.
- Establish satisfaction indicators and regularly review service performance through annual survey analysis and scorecard management.
- Provide customer education and training to enhance product and service understanding.
- Offer dedicated sales and customer service contact windows for efficient communication and support.

Action Plans and Performance

- **Conduct annual customer satisfaction surveys to identify improvement areas; the 2024 score reached 4.7.**
- **Analyze survey feedback to determine key satisfaction drivers and prioritize enhancement actions.**
- **Establish a global Field Application Engineer (FAE) team to provide real-time technical support and co-develop market demand with customers.**
- **Host seminars and training sessions to ensure timely two-way communication and issue resolution.**
- **Implement a distributor management system to monitor sales data, capture market trends, and refine market strategies.**

2.2.1 Customer Satisfaction Improvement

TSC is committed to building customer trust through effective relationship management and high service quality. Smooth two-way communication is key to sustaining satisfaction and loyalty.

We provide clear product information and inquiry systems on our website, supported by Sales and Field Application Engineers who regularly hold product application briefings in collaboration with agents. Website content and interface are continuously optimized to enhance user experience.

TSC maintains active communication through customer visits, satisfaction surveys, and a formal grievance channel. We incorporate customer feedback to improve products and services, driving customer retention and business performance.

In recent years, we have deepened cooperation during the design-in stage, aligning our product development with customer needs and further strengthening long-term strategic partnerships.

Customer Grievance Channel

To protect customer rights, TSC provides multiple grievance channels. Customers may submit feedback through regional sales teams. Upon receiving a grievance, the Sales Division contacts the customer within 48 hours to assess the issue—whether related to quality, delivery, or service. The case is then handled in accordance with internal customer service procedures. The FAE/AE and Quality Assurance teams investigate the root cause and propose solutions to minimize losses for both parties.

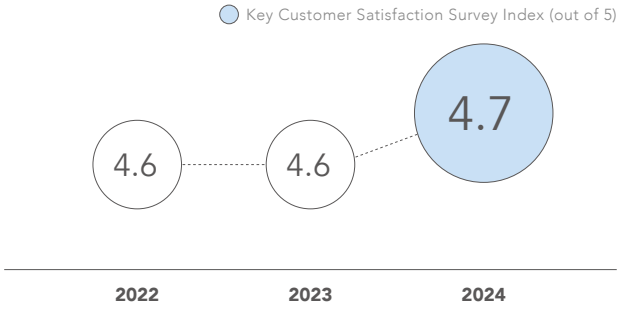
Customer Grievance Process and Improvement Actions

Customer Grievance	After receiving the complaint, take immediate follow-up disposal within 48 hours
Emergency containment measures/ Cause analysis	A failure analysis is conducted to identify the root cause of the complaint, including potential human errors, equipment malfunctions, or communication gaps.
Implement standardization of strategy	Improvement measures are proposed within 5 to 7 days upon receipt of the sample.
Develop countermeasures	Submit a report on failure analysis improvement and standardize improvement measures

Customer Satisfaction Survey

TSC adopts a dual approach—annual satisfaction surveys and customer scorecards—to evaluate customer satisfaction. Each year, an online survey is distributed to key customers contributing over 70% of the previous year's revenue, covering four areas: Customer Service & Sales Support, Delivery, Product Quality, and Customer Experience & Partnership. For customers using scorecards, TSC uses their evaluations instead of issuing separate surveys. Over the past three years, average satisfaction has remained above 4.5 (out of 5). In 2024, all customer scorecards met required benchmarks. TSC will continue enhancing service quality with customer satisfaction as a core focus.

Customer Satisfaction



Strengthening Partnerships and Enhancing Market Coverage

Starting in 2024, TSC implemented a distributor management system to monitor product sales performance and market trends through a structured and data-driven approach. This initiative supports the formulation of more precise market strategies and enhances operational efficiency. At the same time, the visualization of data allows TSC to track inventory levels effectively, ensuring smooth product circulation and minimizing the risks of overstocking or shortages, thereby reducing supply chain vulnerabilities.