



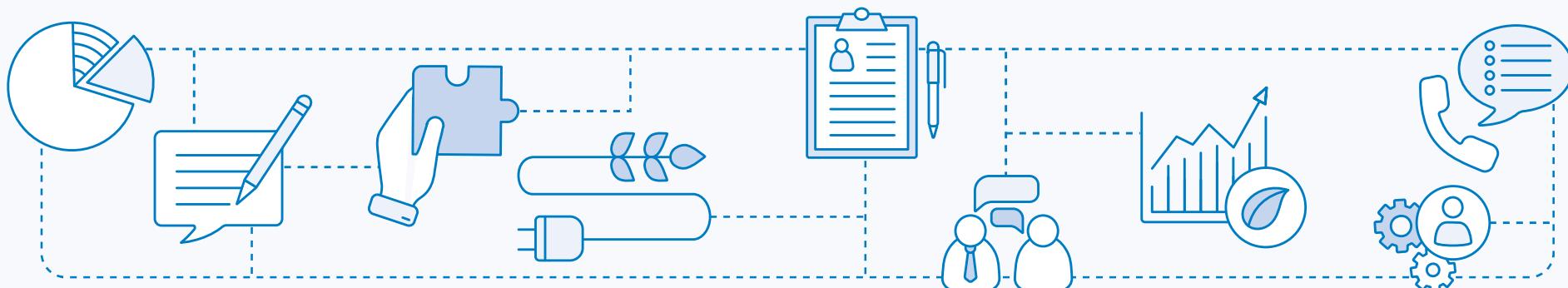
## Innovation R&D and Green Product Manufacturing 4

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# Key Results and Strategies

Strategic Approach	Commitment	KPI	2023 Goals and Performance
R&D and Innovation	<p>To become a world-leading provider of customized IC solutions employing advanced technologies, while consistently identifying significant growth opportunities in target markets and addressing sustainability concerns. Collaborating with world-class customers and partners to collectively achieve sustainable objectives.</p>	<ul style="list-style-type: none"> <li>Year-on-year increase in the number of patent applications.</li> </ul>	<ul style="list-style-type: none"> <li>Over the past two years, approximately NT\$1.5 billion was invested in research and development.</li> <li>The allowance rate for patents across different countries was as high as 99%.</li> <li>In the past three years, the total number of patents across different countries reached 168.</li> <li>The HBM3 IP, recognized for its outstanding development technology and specifications, was awarded the prestigious 2023 EE Awards Asia Gold Selection Award for Best IP of the Year.</li> </ul>
Quality and Customer Relationship Management	<p>By adhering to the PDCA cycle of quality management, we ensure the effective implementation of our quality management system, continuously improving corporate performance, and striving towards becoming a world-leading provider of IP and ASIC solutions.</p> <p>In our strategies for customer relations and communication, we utilize various forms of two-way communication to establish seamless collaborative relationships.</p>	<ul style="list-style-type: none"> <li>ISO quality management system certification</li> <li>Maintain a record of zero penalties</li> <li>Customer satisfaction rate over 90%.</li> </ul>	<ul style="list-style-type: none"> <li>Sustained ISO 9001 management system certification.</li> <li>Maintained IECQ QC 080000 management system certification, verified by an impartial third-party organization.</li> <li>Attained international recognition from renowned customer Sony for green product certification, becoming a Sony supplier partner.</li> <li>In 2023, GUC products had no significant penalties for violations of relevant regulations in supply and usage, and experienced no complaints or returns due to hazardous substances.</li> <li>Achieved a 97% customer satisfaction rate in 2023.</li> </ul>



## 4.1 Creative Future, Sustainable Innovation

Since its establishment in January 1998, GUC has faced the challenges and opportunities brought about by the rapid changes in technology and the shifting landscape of the supply chain. With the increasing complexity of advanced process application chip design, GUC has remained vigilant. The objective of GUC is to become a world-leading provider of customized IC solutions utilizing advanced technologies, encompassing leading IP, design and packaging solutions. The Company aims to consistently identify significant growth opportunities in target markets and address sustainability concerns, collaborating with world-class customers and partners to achieve sustainable goals.

With the development of technologies such as Cloud computing, Artificial Intelligence (AI), Augmented Reality/Virtual Reality (AR/VR), Automotive electronics, and 5G

communication, coupled with the exponential growth in data generated by the Internet of Things (IoT), data centers and communication infrastructure are required to provide immense data transmission and computer processing. High-Performance Computing (HPC), combining high-density computing units with high-capacity memory units, significantly reduces the time required for processing massive amounts of data. To assist customers in developing real-time, efficient, and reliable high-performance data processing chips, GUC not only continues to advance its forward-looking technologies down to 5/4/3/2nm but also relentlessly pursues innovation. In 2023, the Company remains committed to providing the most competitive 2.5D/3D solutions, offering small-chip architectures such as CoWoS and InFO to meet market demands.



GUC offers related silicon intellectual property and advanced packaging solutions for the CoWoS and InFO small-chip architectures



GUC integrates TSMC's most advanced processes with advanced packaging technologies to provide comprehensive solutions



### **G** High Performance Computing (HPC)

HPC integrates high-density computing units with large-bandwidth, high-capacity memory units, significantly reducing computation time for processing massive data. In recent years, governments have collaborated with the technology industry, academia, and the healthcare system to monitor the COVID-19 pandemic. They have utilized HPC and structured drug design systems to simulate the behavior of viral proteins, understand the virus's genetics and variations, and develop effective drug compounds to curb the spread of the coronavirus.

As the post-pandemic era sees a flourishing global application of big data, the utilization of data centers has diversified. This includes cloud servers, high-performance computing units, AI/ML, ChatGPT, and autonomous driving, etc. These novel applications will significantly alter people's work and lifestyle. To assist customers in developing real-time, efficient, and reliable high-performance data processing chips, GUC not only continues to 5/4/3/2nm advanced technologies but has also closely collaborated with semiconductor foundries since 2018. They have developed advanced process design platforms and 2.5D/3D advanced packaging technologies, providing leading-

### **G** 5G Communication

The fifth-generation mobile communication (5G) technology offers advantages such as high bandwidth, high density, and low latency. It provides faster and higher-capacity millimeter-wave communication networks (mmWave) and diverse application services for low-power and energy-efficient smart Internet of Things (IoT) devices (sub-5G). By enabling society to enter the era of ubiquitous connectivity, 5G communication will lead to the flourishing development of various innovative applications:

**Smart Cities:** Through 5G integration, managing various facilities in cities such as buildings, energy, transportation, and air pollution can enhance energy efficiency, contributing to national energy conservation and carbon reduction goals.

**Smart Living:** The application of 5G technology breaks spatial limitations, covering areas such as healthcare, education, culture, entertainment consumption, and smart homes, thereby enhancing social welfare and making life more convenient.

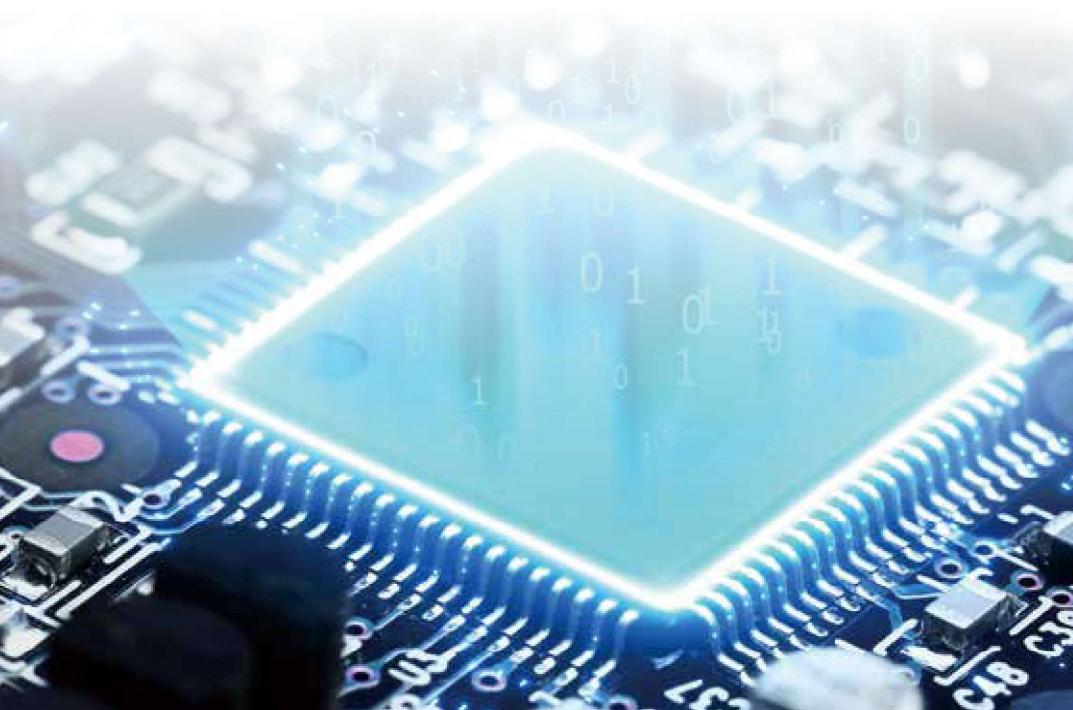
GUC has been committed to the development of 5G technology. This includes providing solutions for SerDes and high-speed ADC/DAC IP. Customer products in the sub-6G frequency band have successfully entered the commercial stage, indirectly driving the popularization and commercialization of 5G technology. Since 2020, GUC has been offering solutions that support both sub-6G and mmWave communication frequency bands, assisting customers in finalizing designs. In 2021, these solutions underwent verification by multiple telecommunications operators, enhancing the quality of existing 5G communication services and making mobile communication life faster and more convenient.

security, healthy oceans, clean air, biodiversity conservation, weather, and disaster resilience. It helps human society cope with environmental changes, reduce natural disaster risks, provide food and water security, protect natural resources and biodiversity, and enhance the well-being of all humanity.

GUC meets the demand in the artificial intelligence market by assisting customers in developing advanced AI ASIC chips. From product concept to specification, development, verification, manufacturing, production, and final product stages, customers can flexibly choose to utilize our services at any semiconductor design phase. To meet the high-performance requirements of AI chips, GUC offers system-level IP solutions, aligning with the increasing trend of AI applications. In parallel with promoting energy efficiency and carbon reduction, GUC provides ultra-low-power design service solutions, significantly reducing the power consumption of AI SoC chips to meet the ultra-low-power requirements of edge computing.

## 4.1.2 Innovation Achievements

GUC's small chip architecture using CoWoS and InFO have become mainstream in infrastructure products, and the GUC R&D team, working closely with key partners, has extensive experience in the development of HBM and GLink IP and the mass production of CoWoS products. To support our customers in gaining a head start in 2.5D/3D advanced packaging while helping them maintain their market leadership, GUC continued to firmly demonstrate our long-term commitment to provide the most competitive 2.5D total solutions, including the industry's first silicon certified HBM3 PHY and controller, GLink 2.5D and 3D small chip interfaces, electrical and thermal simulation, package design, DFT and production testing, CoWoS and InFO fabrication expertise, and more.



## 2023 Technology and Development Success and Innovation Achievements

1. GUC combined with TSMC's InFO/CoWoS packaging technology to migrate to the third generation 5nm chip interconnect IP "GLink 2.3" to 3nm, which can provide customers with a complete multi-chip interconnect solution.
2. In the first quarter of 2023, GUC successfully taped out the 3nm HBM3 8.6G (PHY & Controller) IP, supporting TSMC's CoWoS-S and CoWoS-R packaging.
3. Leveraging TSMC's 3DFabric chip stacking technology, GUC and its customers completed the first-ever 7nm + 7nm WoW (wafer on wafer) 3D verification chip design and tape-out in March 2023.
4. In the third quarter of 2023, GUC successfully completed the design specification for a 6nm high-performance computing client.
5. In November 2023, GUC led the industry by tape out HBM3 (PHY & Controller) IP with DRAM manufacturers' 12Hi HBM3 and HBM3E memory.
6. Combining TSMC's CoWoS-R packaging technology, GUC introduced the UCle/32G 3nm chip interconnect IP GUCle 1.0, providing customers with a complete multi-chip interconnect solution compliant with the UCle interoperability standard.
7. GUC successfully developed a 5nm long-distance communication optical communication chip for customers, integrating 56G high-speed SerDes. Simultaneously, they completed the design and tape-out for the next-generation 3nm chip.
8. Utilizing TSMC's advanced process, GUC integrated AI/HPC chips designed by customers for large-scale cloud data centers with 2.5D CoWoS packaging technology.
9. Leading the industry, GUC began 3nm development, completing the design flow development for the enhanced N3P version in the fourth quarter of 2023. Additionally, they completed the tape out for HBM3, GLink, and UCle IP in January and November 2023, meeting customer product design requirements.
10. GUC successfully cooperated with 5nm AI clients, designing AI chips for large-scale cloud data centers with 2.5D InFO packaging technology. Furthermore, they completed the tape out for GUCs' GLink chip interconnect IP in the fourth quarter of 2023.
11. GUC provides leading industry spec-in services, assisting 5nm data center-grade AI chip clients and 16nm automotive chip clients in chip design in 2023.

## 4.2 Continued Investment in Innovative Research and Development

In addition to the development of advanced processes such as 5/4/3/2nm, ultra-high speed interface chip interconnect IP GUCle, GLink, GLink 3D, HBM2 / 2E / 3Controller and PHY, and high speed ADC/DAC, our Company continues with developing key components such as Power Management Solution, Clock Generator, etc. to interface to higher-end processes. We have also established an R&D team to develop our own memory IP (TCAM, SFIAM), custom standard cells, diverse libraries and our own IP to provide customers with more complete solutions.

To meet future growth demands, our Company will continue to invest in research and development resources to optimize the design process for 5/4/3/2nm technologies. Additionally, we will continue to develop ultra-high-speed interface chip interconnect IP GUCle, GLink, GLink 3D, HBM PHY & Controller, High-speed ADC, and TCAM. We estimate that approximately NT\$1.5 billion will be allocated to research and development expenses over the next two years.



## 4.3 Performance of Innovation R&D

### Wafer Products ASIC Design Services

GUC's primary business is to provide Application-Specific Integrated Circuit (ASIC) design services to meet the market demand for complete wafer design, fabrication, packaging, and testing services.

**ASIC and wafer products:** We provide customers with complete services from design to wafer fabrication, packaging and testing.

- **NRE (Non-Recurring Engineering):** NRE provides the circuit design components database and various IP required for product design, and the circuit diagram for the photomask set, and commissions the foundry to produce the photomask, wafers, cutting, and packaging. Our engineers do the product testing and then deliver the samples to the customer for trial production.
- **MPW (Multiple-Project Wafer):** We provide low-cost and time-efficient wafer validation services by integrating different customers' designs and sharing the manufacturing cost of the same set of photomasks and the same batch of wafers (Engineer Run), so that design engineers can achieve low-cost and fast validation with advanced process technology before mass production. This allows the design engineers to use advanced process technology to achieve low-cost and rapid pilot production verification before mass production.
- **Intellectual Property (IP):** An IC design that has been designed and validated to be reusable and have specific functions. With the advancement of IC manufacturing technology, multi-functional chips and even SoCs have become the mainstream of IC design, and Reusable IP can reduce customers' investment in design duplication and design resources.

GUC introduced a high-capacity emulator to speed up SoC hardware development and verification (over 700 times faster than workstation emulation) and to enable early software/firmware development and verification, reducing time-to-market.

## Provide Advanced Custom ICs (Advanced ASIC Services)

The supply chain of the semiconductor industry can be divided into four major groups, including design, manufacturing, packaging, and testing, depending on the upstream, midstream, and downstream. GUC provides upstream IC design services. The design flow of a chip is not only about hardware design, but also requires the assistance of design software and high automation integration to design high efficiency low power consumption chips in the smallest nanometer size. In response to the rapid changes in the semiconductor industry and the ever-changing needs of our customers, our Advanced ASIC Services framework provides customers with the flexibility to choose to enter the semiconductor design chain at any stage from "product concept, specification, development, verification, production, to final product".

Advanced ASIC Services consists of four cores:

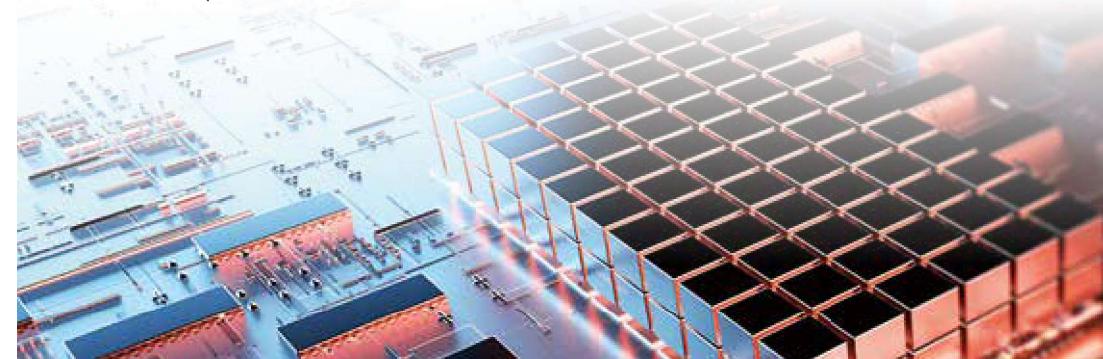
1. IP Solution: Help customers reduce design time cost and SoC development risk to meet their customized IC needs.
2. Chip Implementation: We work closely with TSMC and have a high level of information mastery in advanced manufacturing processes. We are able to establish early knowledge of advanced process technologies, shorten the time for customers to enter advanced manufacturing processes, and help customers to quickly enter mass production, improve yields, and strengthen market competitiveness.
3. ASIC Manufacturing: GUC provides professional and high quality manufacturing services to customers by partnering with world-class foundries, package and test houses, and other support suppliers to minimize barriers to entry and technical risks, shorten time-to-market and time-to-volume, and ensure high quality, high yield, and on-time delivery, allowing our customers to accurately invest their valuable resources in their core competencies.
4. Advanced Packaging Technology: GUC lays out advanced process design platform solutions and advanced packaging technologies in collaboration with TSMC. GUC completes the design and verification of CoWoS, InFO, and 3DIC, meeting the demands for high performance, low latency, and low power consumption. GUC continues to develop IP such as HBM, GLink, and UCle on advanced packaging platforms.

## AI Artificial Intelligence Technology Applied to IP Design and Design Service

In recent years, the rapid development of artificial intelligence (AI) has become an indispensable technical tool for enterprise research and development. Proper utilization of AI can enhance efficiency and reduce resource waste. GUC's IP design team has prioritized the adoption of AI technology for Monte Carlo simulations. This approach saves computational resources and shortens simulation time, allowing for the allocation of limited resources to more design projects.

In 2020, GUC introduced an Engineering Change Orders (ECO) tool with machine learning technology, enabling a 15-30% reduction in schedule for leakage optimization in design services. Furthermore, in 2022, the integration of AI-based automated layout and routing technology was successfully achieved and applied to multiple projects in the advanced process design. This not only saves manual effort and increases speed but also results in a 2-8% improvement in power efficiency. We will continue to collaborate with advanced Electronic Design Automation(EDA) companies to introduce AI-related EDA technologies, strengthen design processes, enhance efficiency, and apply them to customer chip projects to achieve higher performance and lower power consumption.

In addition to adopting AI-related technologies from EDA companies, GUC continues its annual collaboration with universities to establish AI and machine learning techniques in the EDA design process. We aim to integrate these technologies into the design service process in the future to enhance design quality, efficiency, and optimization, and apply them to customer products.



## 4.4 Patents and Silicon Intellectual Property

GUC provides comprehensive ASIC (Application-Specific Integrated Circuit) design services, offering design and production services for customers' end-use application products. In terms of ASIC design services, these include: SoC spec-in design & verification, chip implementation methodology, low-power solutions, design for testability, flagship SoC design solutions, etc. Regarding ASIC production services, these encompass advanced packaging technologies, testing, product engineering, quality and reliability, supply chain management, etc. Additionally, GUC possesses the capability to develop silicon intellectual property (IP) independently, acting as an IP provider. To this end, the Company is dedicated to innovating and developing various competitive silicon IP, including: High Bandwidth Memory (HBM) IP, Die-to-Die (GLink-2.5D/3D) IP, Mixed-Signal Front-End IP, Embedded Memory IP, and others.

In order to ensure the protection of innovative research and development outcomes, GUC submits patent applications for competitive technical solutions generated during the ASIC design and production service stages. Additionally, the Company actively pursues patent layouts for its proprietary silicon intellectual property (IP). Through the protection of patents, the Company can safeguard the maximum benefits and competitive advantages brought by its R&D achievements, while providing customers with enhanced security for

ASIC products. Recognizing the significance of patent rights, the Company has been offering engineers courses on intellectual property rights annually since 2016, in order to strengthening awareness of patent rights and promoting momentum for patent proposals. GUC has accumulated a total of 168 patents worldwide in the past three years, also actively submitting patents in technical fields such as CoWoS, HBM, G-Link, etc., to maintain our leading position and competitive edge.

### Patent Numbers in Various Countries for GUC in the Past 3 Years

Patents Granted from 2021 to 2023

Countries	Number of Patents
Taiwan	64
United States	51
China	48
Japan	5



## Intellectual Property Rights Management

To encourage invention and innovation, maintain competitive advantage, and protect research and development achievements, GUC established the "Intellectual Property Management Regulations" in 2016 and initiated intellectual property related management plans since 2000. The Company also formulated the "Patent Proposal Application Procedure" as a guideline for patent application, maintenance, utilization, and incentive related matters. To ensure careful evaluation of patent proposals, an internal patent review mechanism, the "Patent Committee," was established. The committee comprises senior executives from relevant departments within the Company and distinguished professors from the IC design field, serving as external consultants. Through internal deliberation and feedback from the committee, the technical content of invention proposals is refined, effectively ensuring patent quality and increasing the likelihood of patent allowance. In the past three years, the Company has filed a total of 171 patent applications worldwide, with 66 applications completing examination. Among these, 65 patents were granted, 1 was abandoned, and the rest are pending examination, demonstrating an impressive patent allowance rate of 99% (65/66=99%). Moreover, for patent proposals not suitable for public disclosure yet possessing technical value, the Patent Committee may decide to protect them as trade secrets to prevent the leakage of proprietary technology.

In addition, to effectively enhance management efficiency, GUC introduced the "Patent Management Information System" in 2015 as a platform for managing patent proposals, applications, maintenance, bonus distribution, technical classification, and product applications. With the assistance of this information system, the protection level of confidential patent information can be enhanced, while the efficiency of personnel can be improved, and the occurrence of human errors in patent application affairs can be reduced.

Furthermore, GUC conducts regular patent inventory operations to review the application status of patents and their relevance to related products, serving

as an assessment of patent value. Meanwhile, to strengthen R&D personnel's awareness of patent rights and respect for them, and to avoid inadvertently infringing on patents with research and development results, the Company mandates that new R&D personnel must take basic patent courses. In addition to basic patent courses, the Company regularly invites patent industry lecturers to provide R&D personnel with practical courses on intellectual property, including patent search, infringement verification, and design around. As of 2023, a total of 223 individuals have attended these advanced courses.

To maintain its leadership position in the industry, GUC adopts a strategy that combines key operational development objectives with intellectual property protection. Specifically targeting certain developed silicon intellectual properties (IP), such as CoWoS, HBM, and G-Link, patent engineers, along with relevant R&D personnel, regularly review the research, design processes, and outcomes. They evaluate the feasibility of patent applications and actively pursue patent applications for cases with valuable patent layouts, continuously monitoring the progress of related proposals. In the past two years, GUC has systematically pursued patent layouts for specific silicon intellectual properties (IP). This not only strengthens the Company's competitive advantage in specific areas but also implements "IP project/IC product potentization" to achieve the goal of "patent protection of IP projects/IC products." Regarding the management of patent right and silicon intellectual property (IP), the patent technology inventory operation also serves as a basis for evaluating the value of the Company's patent right.

To ensure that senior management fully understands the execution of the Company's intellectual property management plan, the legal affairs supervisor reports on this matter to the Board of Directors at least once a year.

## 4.5 Green Product Design Services

During the chip fabrication process, GUC generates energy consumption data for the chips and provides energy consumption models. This enables design engineers to conduct more energy optimization in the chip design process, effectively controlling the overall energy consumption of the chips. Additionally, we are committed to providing customers with the best power consumption solutions in packaging design.

### Silicon Intellectual Property (IP)

GUC continues to develop advanced process technologies such as 5/4/3/2nm, in addition to silicon intellectual properties (IP) including ultra-high-speed interface chip interconnect IP GUCle, GLink, GLink 3D, HBM2E/3 Controller and PHY, and high-speed ADC/DAC, our Company continues with develop key components such as Power Management Solution, Clock Generator, etc. to interface to higher-end processes. We have also established an R&D team to develop our own memory IP (TCAM, SRAM), custom standard cells, and a rich portfolio of library and our own IP to provide customers with more complete solutions.

### High Bandwidth Memory (HBM3) IP

GUC has developed the latest 3nm product for the new generation of 8.4~8.6G High Bandwidth Memory (HBM3), leveraging process advancements and the efforts of its R&D team. Compared to the 5nm technology, it is expected that the speed of the latest product will increase to 8.6Gbps, with a reduction in power consumption of approximately 16.4%. This advancement not only assists in developing more powerful features but also conserves energy. This IP is scheduled to complete silicon validation in the first quarter of 2024. GUC's HBM3 IP, distinguished by its outstanding development technology and specifications, was honored with the Best IP of the Year award at the 2023 EE Awards Asia.



### Ultra-High-Speed Interface Chip Interconnection IP GLink 2.5D

GUC successfully integrated TSMC's InFO packaging technology to validate the first generation 7 nm Glink 1.0 ultra-high speed interface chip interconnection (IP) in 2020. The second generation 5 nm GLink 2.0 IP was validated in Q3 2021. With an 85.7% increase in beachfront efficiency and only a 20% increase in power consumption, it enables customers to significantly reduce energy consumption with the same Beachfront efficiency requirements. In the same year, GLink 2.3, a 5 nm chip interconnection IP, was finalized and then silicon proven in Q3 2022. The test results showed a 92.3% improvement in beachfront efficiency at the same power consumption level, resulting in mass inquiries and usage among several different customers. In 2023, the GLink 2.3LL IP is being advanced to 3 nm, with testing and validation expected to be completed by 2024, anticipating further reduction in power consumption at the same transmission speed. GUC's GLink-2.5D product was awarded "The Annual Innovation Product Award" at the 2022 International Integrated Circuit Exhibition and Symposium (IIC) for its outstanding development technology and forward-looking specifications.

### Universal Chip Interconnect IP UCle

The UCle 1.0 was launched at March 2022 with the aim of standardizing the chip-to-chip interface for both standard and advanced packaging, fostering collaboration in the multi-chip integration ecosystem. GUC has made thorough preparations for this medium to long-term trend, leveraging its experience and expertise in GLink-2.5D to develop the next-generation GUCle, the highest specification of UCle (32Gbps per channel). The design proposal was finalized in the fourth quarter of 2023. Compared to GLink-2.5D, it is expected to significantly increase the Beachfront efficiency by more than double.

## Low Power TCAM Entity Silicon Smart IP

GUC is committed to expanding the support range of its 5 nm TCAM. The original design could read, write, and search up to 512 data entries, with each entry consisting of 160 bits. Now, it has been upgraded to support up to 1,024 data entries, with each entry widened to 240 bits. This enhancement not only improves efficiency for customers but also eliminates the engineering hassle of integrating multiple small TCAM blocks.

Moreover, the Company has completed the silicon verification for this design version and has progressed to 4 nm (N4P) technology in 2023, completing the TCAM IP compiler design. These series of updates and upgrades will provide customers with more robust and flexible TCAM options, helping them address evolving application demands.

## GLink-3D Chip Stacking Interface IP

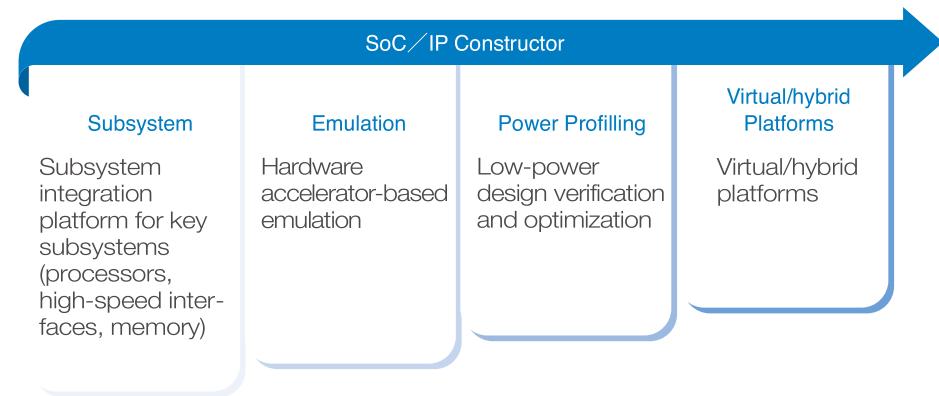
2.5D and 3D packaging are two advanced packaging technologies aimed at increasing transistor density. In April 2023, GUC obtained SoIC packaged chips produced in collaboration with TSMC, and has been continuously verifying the performance of GLink-3D 1.0 in TSMC's testing laboratories. Currently, samples of the chips are operational in various process corners, with data being measured and collected for various electrical characteristics. The verification report is expected to be completed by 2024. GLink-3D 1.0 was recognized with the EE Awards Asia Golden Selection Award for Best IP in 2022, injecting significant momentum into GUC's technical prowess and innovation capability.

Building on this success, GUC will continue to advance GLink-3D 2.0, further enhancing data bandwidth and reducing power consumption. The Company plans to introduce a 2GHz low-latency solution, presenting a stronger technological advantage in the market.

## Single-chip (SoC)

As technology enters the era of Internet, wireless communication, smartphones, Internet of Things, automotive electronics, and high-performance computing with artificial intelligence, system-on-chip (SoC) that integrates more functions has become the mainstream trend in IC design. However, the complexity of highly integrated designs and the design timeline, cost, and specifications resulting from advanced manufacturing processes are inevitable challenges.

To help customers achieve their market goals, SoC RD continues to refine design integration and validation techniques to shorten project execution time and achieve optimal power/performance/boost solutions.



Since 2021, SoC RD has completed the 16 nm Automotive and 12 nm 5G Networking chips, along with 7 nm Metaverse chip in 2022. By 2023, we will further complete the 5 nm Datacenter AI chip and a 16 nm automotive chip in test production versions. Simultaneously, we have actively collaborated with suppliers to conduct test consulting for automotive chips. These achievements underscore the SoC RD department's diverse design capabilities across different domains.

Over the years, the Company's SoC RD department has leveraged its increased R&D capacity and industry-leading design integration verification process. According to the results of the project, it can effectively shorten lead time by 30-50%. In addition, performing critical debugging tasks at the early stage of design integration, save 30-50% of the resources for extensive functional simulation and verification debugging at the later stage, and optimize the chip specifications according to the process evolution. This includes 20-30% performance improvement, 15-20% power reduction, and 20-30% chip area reduction.

In the future, SoC RD will continue to work on advanced design integration and verification technologies based on this green design concept to optimize the resources required for system-on-a-chip and contribute to the advanced semiconductor field.

## Design Services

GUC has continuously improved its advanced design technology processes, completing the N3E v1.1 and N3P v0.9 design processes in 2023. These advancements assist customers in swiftly adopting more advanced and efficient processes. Under the same design verification conditions, the overall design process achieves optimal energy consumption and performance. Compared to N5, it can further reduce power consumption by 28.1% and 29.56%. We will continue to develop the N3P 1.0 and future 2 nm design processes to assist our Company in using lower-power processes, enhancing competitiveness, and applying them to customer projects. We will continue to assist customers in advancing towards greener products.

Process - Component	N5 – H210	N3E v1.1 – M143	N3P v0.9 – M143
Power (uW/MHz)	27.40	19.70	19.30
Power Reduction Ratio (Compared to N5-H210)		28.10%	29.56%

## 4.6 Product Quality and Competitiveness

GUC encourages all employees to provide customers with high quality design services, silicon intellectual property, and competitive products in the spirit of innovation and continuous improvement, and is committed to listening to our customers and building a trustworthy and mutually beneficial partnership with them. Through the spirit of PDCA quality management, we ensure the effective execution of our quality management system, continuously improve our corporate performance, and strive to become the world's leading IP and ASIC supplier.

GUC is committed to providing outstanding ASIC IC design services. Our quality and reliability organization continuously improves the ISO quality management system, maintaining ISO 9001 certification annually to identify opportunities for comprehensive quality management improvements to ensure customer satisfaction. Additionally, we have obtained the internationally renowned Sony Green Product Certification, becoming a partner supplier to Sony.

GUC is deeply committed to green products, starting from the implementation of green design. Through continuous technological innovation, we meet our customers' strict requirements for hazardous substances, striving to reduce and regulate the use of harmful substances. We maintain IECQ QC 080000 management system certification annually, verified by third-party impartial organizations, to ensure the effectiveness of green product management. Our relentless efforts have been fairly evaluated and certified, with the latest certificate valid until August 2025. GUC's green ICs comply with the requirements of the EU RoHS Directive and the EU REACH regulation, ensuring the non-use of restricted substances. In response to specific customer requests, GUC conducted

265 compliance surveys commissioned by customers in 2023, including international regulations such as IPC 1752 and chem SHERPA material declaration statements, and provided survey results to customers. Furthermore, to ensure that the production process of green ICs complies with regulatory requirements, we conduct quarterly business reviews (QBR) with seven designated suppliers. We have added HSF (hazardous substances free) compliance item and regularly evaluate the execution results each quarter.

GUC obtained ISO 13485 certification for medical device quality management system in 2017 in response to SDG 3 "Ensure healthy lives and promote well-being for all at all ages." This certification ensures that the Company has effective mechanisms for designing medical chips. Each year, third-party verification is conducted to ensure compliance, and the certification was renewed in 2023, assisting in the launch of products in the medical device market that comply with regulations and market requirements.



ISO 9001 Certificate



IECQ QC 080000 Certificate



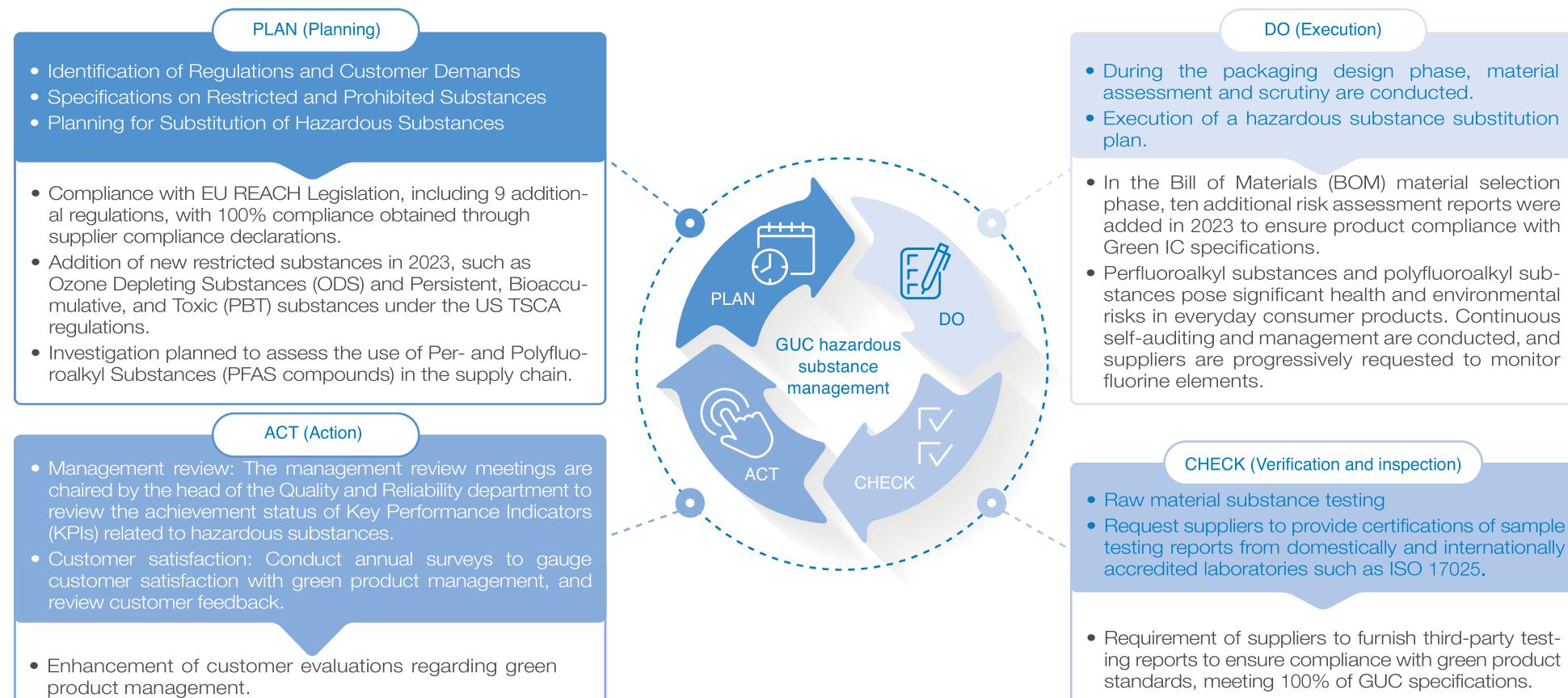
GUC Sony Green partner



ISO 13485 Certificate

## Green Product Management Model and Practices

GUC has implemented a PDCA management process for green substance management to address regulatory risks. By surveying suppliers, we propose improvements and work with members of our supply chain to reduce the use of hazardous substances. These efforts are aimed at improving the competitiveness of GUC's products in advance of international regulatory trends. In order to ensure compliance of the green IC production process with regulatory requirements, we conduct Quarterly Business Review (QBR)



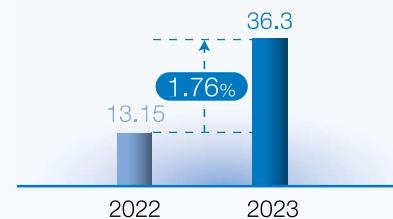
## 4.7 Management and Practices of Hazardous Substances

1. Green IC Design:GUC is committed to follows green procurement procedures to select materials that fully comply with international regulations, including RoHS, EU Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (EU REACH) and customer requirements on restricted hazardous substances. In 2023, there were additions and revisions to Ozone Depleting Substances (ODS), as well as Persistent, Bioaccumulative, and Toxic (PBT) substances under the United States' TSCA. To ensure materials compliance of HSF(hazardous substances free) property and active efforts to seek alternative green materials.
2. Green Material Selection:During the Bill of Materials (BOM) material selection phase, GUC actively conducts risk assessments. In 2023, ten additional risk assessment summary reports were added to ensure product compliance with green IC specifications. Simultaneously, material restrictions are established to exclude hazardous substances, aiming to mitigate potential environmental impacts throughout all stages of production, such as global warming and ozone layer depletion.
3. Green IC Manufacturing:GUC strengthens its hazardous substance management mechanisms by requiring suppliers to monitor hazardous substances in raw materials. Simultaneously, suppliers are required to provide third-party testing reports to ensure compliance with the spirit of green products and international regulations. In 2023, a total of 265 customer-commissioned investigations were conducted, all of which fully complied with the customers' requirements.

### Ink to Laser Marking

GUC is committed to reducing environmental impacts at every stage of the product lifecycle through sustainable thinking. GUC ICs have changed to Laser marking from Ink process. We make strong efforts for reducing environmental impacts associated with our product lifecycle. This change not only saves resources such as ink volume, wiping cloths, ink heads, acetone, but also reduces oven energy consumption.

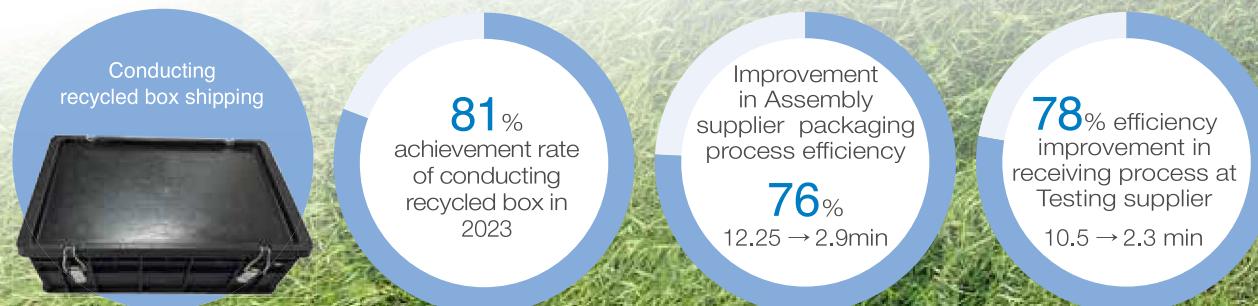
The energy-saving benefits resulted in a reduction of 36.3 tCO<sub>2</sub>e/year in greenhouse gas emissions in 2023, compared to 13.15 tCO<sub>2</sub>e/year in 2022, representing a growth of 1.76%. Simultaneously, it reduces environmental pollution and energy consumption. Through such practices, we not only ensure a green and low-carbon supply chains but also safeguard the environment on which we depend for survival.



4. Green IC Packaging: GUC complies with current international trends in non-toxic green regulations for packaging materials, as stipulated by the Packaging Directive (94/62/EC):

- Lead (Pb), hazardous substance in electronic product processes, is both reproductively toxic and carcinogenic, may damage to human body. Since 2018, GUC has fully implemented lead-free bumps, achieving a 100% lead-free bump target in 2022, aligning with international regulatory trends.
- Green production imposes restrictions on harmful substances in packaging materials. In 2023, France Packaging Mineral Oil Act 2020-105 was added, regulating mineral oil substances in ink packaging materials. Mineral oil saturated hydrocarbons (MOSH) and mineral oil aromatic hydrocarbons (MOAH) have been proven to be carcinogenic and bio-accumulative. To comply with international regulatory trends and safeguard customer health, we rigorously assess and monitor the compliance of 14 suppliers. Currently, following GUC's guidance in 2023, five more suppliers are compliant, and we also take the initiative to help other suppliers to improve their capabilities.
- Recycled, environmentally-friendly boxes: Considering the environmental impact of packaging material disposal, GUC adopts recycled environmentally-friendly boxes to replace single-use cardboard boxes, thereby reducing waste (Reduce), reusing conductive boxes in the factory (Reuse), and promoting recycling (Recycle) to minimize environmental impact. Additionally, simplification of packaging procedures from packaging plants to testing facilities enhances packaging and unpacking efficiency, including saving on inner box packaging procedures, reducing operational time waste. In 2023, the adoption rate of recyclable conductive boxes reached 81%.

5. Waste Management and Recycling: In 2023, GUC commissioned authorized suppliers for waste disposal, adhering to waste clearance regulations for sorting and processing. Special categorization and management were implemented for gold wire products, which were subsequently recycled and reused by the suppliers.



## 4.8 Customer Service and Satisfaction

In terms of customer relationship and communication planning, GUC aims to establish a seamless cooperative relationship through regular and irregular meetings and visits, as well as quarterly and monthly performance reviews or audits, in order to achieve consistent and cooperative results in the short-, medium- and long-term development goals and social responsibility planning of both parties. To serve our customers nearby, we have set up customer service offices in six regions, including Taiwan (our headquarters), China, Japan, Korea, the United States, and Europe, and set up a dedicated service window to provide support to both sides on planning and implementing policies related to environmental management, social responsibility, hazardous substance control, conflict minerals, and ISO 9001 compliance. We not only accept third-party verification to provide necessary and sufficient information immediately to meet the needs of downstream customers and public authorities, but also cooperate with our customers' CSR programs to implement the necessary activities, investigations, confirmations, audits, and related data collection.

In order to confirm customer satisfaction with GUC's service quality, GUC conducts customer satisfaction surveys in the first quarter of each year or at the completion of a project. GUC's customer satisfaction team not only tracks the specific responses from customers, but also identifies the problems through precise data analysis and reports them to the senior management as a guideline for the medium- and long-term operation plan.

The customer satisfaction survey for the past five years to 2023 has received a response rate of above 80%, and those who are "satisfied" with GUC have exceeded 90% for the past five years, with a rate of 97% in 2023. This shows that GUC continues to improve its customer service performance to achieve customer satisfaction despite the evolution of technology and increasing business competition. In the 2023 customer satisfaction survey, a total of 20 customers left compliments such as 'immediate response', 'proactive in dealing with problems', 'reliable supply chain protection system', 'professional technical team', and 'reliable technology and service', which is the greatest encouragement to GUC.

For customer complaints, we have established a "Customer Complaint Management Procedure", which requires the relevant departments to reply to customers within 24 hours after receiving a customer complaint and provide a preliminary analysis report within 5 working days. We achieved an on-time response rate of 90% in 2023.

### Customer Satisfaction Survey Statistics

Year	2021	2022	2023
Average Customer Satisfaction	94%	95%	97%



## GUC Customer Complaint Handling Process

