JOINT STATEMENT OF THE 27th MEETING OF THE WORLD SEMICONDUCTOR COUNCIL (WSC)

May 25, 2023
Seoul, Korea

The world's leading semiconductor industry associations – consisting of the Semiconductor Industry Associations in China, Chinese Taipei, Europe, Japan, Korea, and the United States – held the 27th meeting of the World Semiconductor Council (WSC) today in Seoul, Korea.

The meeting was chaired by Noh Jung Kwak, CEO of SK Hynix and Chair of the host delegation, the Semiconductor Industry Association in Korea, and included delegations from the Semiconductor Industry Associations in China, Chinese Taipei, Europe, Japan, and the United States. The delegations were chaired, respectively, by Haijun Zhao of Semiconductor Manufacturing International Corporation (SIA in China), Cliff Hou of TSMC (SIA in Chinese Taipei), Takashi Miyamori of Toshiba Elec. Dev. & Storage Corp. (SIA in Japan), and Matt Johnson of Silicon Labs (SIA in the U.S.).

The WSC meets annually to bring together industry leaders to address issues of global concern to the semiconductor industry. The WSC's mandate is to encourage cooperation to promote fair competition, open trade, protection of intellectual property, technological advancement, investment liberalization, market development, and sound environmental, health and safety practices. The WSC also supports expanding the global market for information technology products and services.

Established under the "Agreement Establishing a New World Semiconductor Council" signed on June 10, 1999, and amended on May 19, 2005, the WSC has the goal of promoting cooperative global semiconductor industry activities in order to facilitate the healthy growth of the industry from a long-term global perspective. This Agreement states, "the increasing globalisation of the semiconductor industry raises important issues that must be addressed effectively through international cooperation within the world semiconductor industry", and that "the WSC activities . . . shall be guided by principle of fairness, respect for market principles, and consistency with

WTO rules and with the laws of the respective countries or regions of each Member. The WSC recognizes that it is important to ensure that markets will be open without discrimination. The competitiveness of companies and their products should be the principal determinant of industrial success and international trade."

The WSC seeks policies and regulatory frameworks that fuel innovation, propel business, and drive international competition and avoid any actions that distort markets and disrupt trade. Antitrust counsel was present throughout the meeting. During the meeting, the below reports were given and discussed, and related actions were approved.

I. Semiconductor Market Data

The WSC reviewed the semiconductor market report covering global market size, market growth, and other key industry trends. According to WSTS data, in 2022, the global semiconductor market totaled US$574.1 billion in revenue, up year-over-year by 3.2 percent.

Logic was the largest semiconductor category by sales at $176.6 billion (30.8% of 2022 total market revenue). Memory ($129.8 billion) and analog ICs ($89 billion) rounded out the top three product categories in terms of total sales.

China, other Asia-Pacific markets and the Americas constituted the top three markets in 2022, collectively accounting for $472.1 billion in total revenue. Annual sales increased in most regions, with particularly strong year-on-year increases in the Americas (+16.2%), Europe (+12.8%), and Japan (+10.3%). Sales by end application were led by communications (30.0% of total revenue) and computer (26.2% of total revenue), with the automotive market demonstrating significant year-on-year growth of 13.5%.

While long-term growth drivers exist (AI, 5G/6G, High Performance Computing, IoT, etc.), uncertainty due to global economic headwinds and the cyclical nature of the market may affect future growth in the semiconductor sector. Maintaining free and open markets globally for semiconductor products is therefore more important than ever.

II. Cooperative Approaches in Protecting the Global Environment

The WSC is firmly committed to sound and positive environmental policies and practices. The members of the WSC are proactively working together to make further progress in this area.

1) New 2030 Voluntary Agreement on PFC Emmission Reductions

The World Semiconductor Council (WSC) has a decades-long track-record of voluntary Perfluorinated compound (PFC) emissions reductions. Today, the WSC announces the adoption of a new, third voluntary PFC emissions reduction goal for 2030.

The elements of the 2030 goal include the following:

- The WSC commits to achieving a PFC[1] emissions reduction rate of 85% by 2030, with the baseline being 81% in 2021, by continuously implementing best practices for new semiconductor fabs and expansions to existing fabs. The WSC will continuously review and update best practices. The WSC will conduct a mid-point review of the goal in 2026 with the intent of tracking progress towards the goal.
- PFC emissions will be reported pursuant to the IPCC 2019 methodology (Tier 2c, AR5), and all guidelines documented within IPCC 2019 refinement.[2]
- While PFCs are a continued focus of the WSC, the WSC has a goal of expanding its efforts to broader GHG emissions reductions. At the midpoint review, the WSC will set a broader greenhouse gas (GHG) emissions reduction goal, collecting, and reviewing use and emissions data on N_2O, Heat Transfer Fluids (HTF) and Scope 2 GHG emissions.

The WSC will publish industry-wide progress on the 2030 goal on an annual basis. This external reporting will provide aggregated results of the absolute PFC consumption and emissions[3] as well as the emission reduction trend. These figures represent the combined emissions for the six WSC regional associations, in their own regions and in the "Rest of World" fabs.

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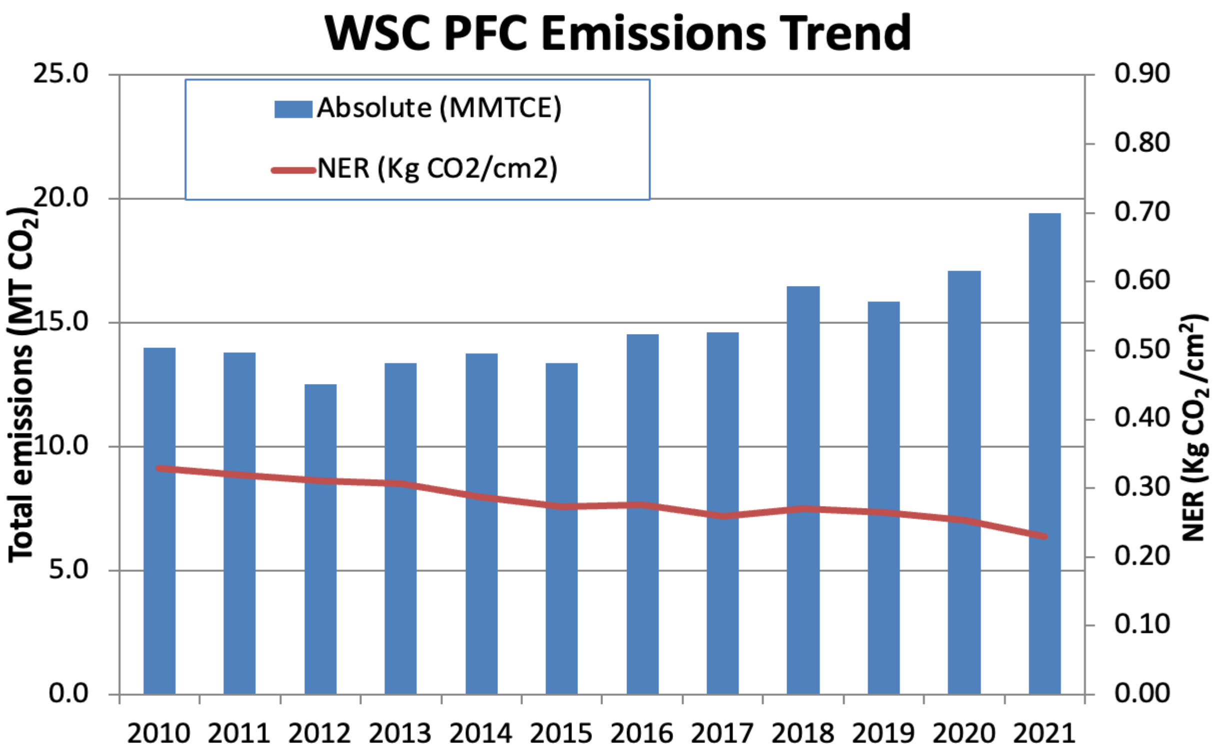
[1] PFC is currently defined as process HFCs, PFCs, SF_6 and NF_3.

[2] This shall include but is not limited to: CF_4 emission factor due to combustion at point of use abatement (if point of use abatement system is not certified), carbon byproducts for NF_3 cleans of carbon containing precursors, tracking abatement uptime, certifying point of use abatement.

[3] Consumption and emissions will be reported as CO_2 equivalents.



(2) Safety and Health

The WSC is focused on a sound proactive approach to safety and health (S&H) policies and practices, including the provision of a workplace environment that is safe and healthy for all employees.

Collecting S&H data is a typical tool which semiconductor companies use to review and manage their activities and in order to identify learnings for continuous improvement of safety and health practices. Additionally, the WSC is sharing S&H semiconductor best practices in expert settings, to advance industry practices as a whole.

Five associations have contributed to S&H aggregated data at the WSC. The 2022 results will be published at the JSTC/GAMS meeting in October 2023.

(3) Chemical Management

The global semiconductor industry uses per- and polyfluoroalkyl substances (PFAS) in numerous applications in semiconductor manufacturing, manufacturing equipment and support facilities due to the unique properties of these chemicals, and residual amounts remain in finished semiconductor products. (Chemicals incorporated into physical products, such as manufacturing equipment and support facilities, and finished semiconductor products are referred to as "articles" in chemicals regulation.) Many of these uses are essential to the production process and equipment for fabricating semiconductors, and alternatives are currently unavailable. The WSC recognizes, however, that there is increasing concerns regarding the environmental and health impacts of PFAS, and as a result Governments/Authorities around the world are considering restrictions on the continued use of these substances.

Ongoing production and innovation in the semiconductor industry will require the continued use of PFAS for the foreseeable future. In order to maintain advancements in semiconductor technology while also addressing important environmental and health needs, the WSC urges Governments and Authorities to increase support for research in identifying alternatives to PFAS that have improved environmental attributes while also satisfying the rigorous functional and performance demands of semiconductor industry. In addition, **the WSC calls on Governments/Authorities to increase support for research in areas such as detection and treatment technologies at very low levels of concentration.**

The global semiconductor industry relies on a complex, highly integrated global supply chain to supply the specialized chemicals, gases, and equipment needed in the process of fabricating semiconductors, and many of these chemical inputs and equipment include PFAS. As Governments/Authorities consider regulations on PFAS throughout the economy, **the WSC calls on Governments/Authorities to avoid disruption to the global semiconductor and industrial supply chains by allowing the continued use of PFAS in crucial semiconductor applications and manufacturing process as well as cross-border movement of these chemicals and articles, which may include PFAS.**

III. Semiconductors: Enabling Carbon Emissions Reduction

Semiconductors enable the transition towards a decarbonized global economy and help fight climate change by reducing society's environmental footprint. Over the past few decades, the semiconductor industry has been a leader in decreasing its climate "footprint" through voluntary greenhouse gas (GHG) emissions reduction targets in its operations, as described above in II.1 regarding PFC emissions. The industry has also increased its climate "handprint," enabling other sectors of the economy to reduce their carbon emissions and environmental impact. Further, the deployment of semiconductor-enabled technologies has empowered energy efficiency improvements, accelerated renewable energy, minimized emissions and waste, and revolutionized the way the economy functions in the digital age.

Expert assessments indicate that semiconductor-enabled digital technologies can reduce greenhouse gas emissions by 15 percent, which is almost one-third of the 50 percent reduction required by 2030.[4] By making products and services "smarter," improving their efficiency, and assisting in the generation and distribution of clean energy, these digital technologies can further improve the greenhouse gas footprint across all sectors of the economy.

The WSC is committed to continue pursuing technology innovations that fight climate change, advance energy efficiency, and foster sustainability. The WSC encourages GAMS to promote policies that drive adoption of semiconductor-enabled technologies as a means of improving energy efficiency and reducing GHG emissions, including recommendations set out in the United Nations Sustainable Development Goals (SDGs), which provide a roadmap to 2030 for global prosperity through action on important social and environmental issues.[5] The WSC believes semiconductor-enabled technology will continue to play a key role in realizing the SDGs by elevating governments, businesses, civil society, and other organizations to achieve a better and more sustainable environmental future for all by 2030. Semiconductors enable the transition towards a decarbonized global economy and help fight climate change by reducing society's environmental footprint."

The WSC presents the White Paper on "Semiconductors Enabling Carbon Emissions Reduction" that identifies several critical economic sectors in which semiconductor-enabled technology will enhance energy efficiency, reduce carbon

[4] See e.g., World Economic Forum, "Digital technology can cut global emissions by 15%. Here's how" (2019) (https://www.weforum.org/agenda/2019/01/why-digitalization-is-the-key-to-exponential-climate-action/).

[5] UN Sustainable Development Goals (https://sdgs.un.org/goals). Among many, the UN Sustainable Development Goals (SDGs) include such efforts as affordable, reliable, and sustainable energy (Goal 7); sustainable economic growth (Goal 8); resilient infrastructure and sustainable industrialization (Goal 9); inclusive and sustainable cities (Goal 11); sustainable consumption and production (Goal 12); and urgent climate action (Goal 13). The SDGs were adopted in 2015 and are built off of the UN Millennium Goals. The 2008 WSC Joint Statement endorsed Target 8F of the Millennium Goals, which aimed to expand "the benefits of new technologies, especially information and communications."(http://www.semiconductorcouncil.org/wp-content/uploads/2016/07/08WSC-Joint-Statement-Final.pdf)

emissions, and help transition toward a more sustainable future: Smart Buildings, Electric Vehicles, Data Centers, and Connectivity. (*See* **Annex 1**.) The WSC will continue to update this White Paper to include additional key sectors as more data and reports become available.

IV. Effective Protection of Intellectual Property

Abusive Patent Litigation, Patent Quality and IP Litigation Statistics

The WSC recognizes that abusive patent litigation seriously undermines innovation by redirecting resources to unnecessary litigation expenses and makes it more difficult for companies to bring legitimate products to market. **The WSC encourages GAMS to support the *WSC Best Practices to Combat Abusive Patent Litigation*.**

The quality of patents is crucial to the continued growth and innovation of the semiconductor industry, and is an important element in curbing abusive patent litigation. In recognition of the importance of improving patent quality, the WSC has been working with WIPO and the patent offices of GAMS members to encourage the collection and dissemination of standardized statistical metrics bearing on patent examination quality. The WSC commends WIPO for its efforts to collect and publish meaningful metrics bearing on patent quality across jurisdictions and encourages WIPO to continue and expand this effort.

An important issue for WSC stakeholders concerns IP-related litigation. The WSC believes that improved visibility into international IP litigation would lead to a better understanding of this important area, and potentially to ideas for improvements aimed at benefiting innovation, reducing costs and obstacles, and better protecting IP worldwide. The WSC will continue to explore ways to improve IP litigation data available to stakeholders.

V. Fighting the Proliferation of Semiconductor Counterfeiting

Counterfeit semiconductor products create serious risks to the safety and health of the public as well as to critical national infrastructure and can have a significant economic impact for semiconductor rights holders. Semiconductors are the "brains" inside critically important electronic systems, including healthcare and medical equipment, electric power grids, communications systems, automotive systems, and aviation systems. The WSC's Anti-Counterfeiting Task Force promotes anti-counterfeiting activities, including training and information sharing with law enforcement authorities, awareness raising, and encouraging purchases from authorized sources.

Counterfeiting threatens the innovation-driven economy that underpins prosperous societies and industry sectors like semiconductor manufacturing. The WSC supports proactive industry and law enforcement activities to remove trademark infringing and counterfeit semiconductors from being offered for sale on online platforms. To promote further awareness of online challenges and mitigation practices, the WSC has produced a paper on Counterfeit Semiconductors and the Online Environment. The coincidence of the online economy and globalization has allowed criminal networks to expand the scope of their operations, free ride on intellectual property, sell counterfeit goods directly worldwide with virtually no barriers to entry, low costs of set-up, and fewer risks of being caught. There are indications that counterfeiters are now more active and have also shifted from large well-known B2B & B2C platforms to lesser known online platforms.

WSC members remain committed to increasing awareness of risks caused by counterfeits to the infrastructure, public health and safety. As part of WSC awareness-raising, the WSC will support the World Anti-Counterfeiting Day on June 9, 2023 which highlights the problems and risks caused by counterfeits. (See **Annex 2**.) Moreover, WSC members engage with national enforcement authorities to allow customs officers to better identify counterfeit semiconductors.

The WSC has shared examples of anti-counterfeiting capacity building measures and practices that could be employed across the semiconductor industry and has circulated widely the WSC's White Paper "Winning the Battle against Counterfeit Semiconductor Products," available on the WSC website.

The WSC appreciates the GAMS' commitment to fighting semiconductor counterfeiting. The WSC looks forward to continued coordination in stopping counterfeits and will continue to cooperate with GAMS customs and enforcement authorities across all regions of the WSC in these efforts.

The WSC recommends that GAMS members continue to implement appropriate domestic, bilateral, and multilateral IP enforcement countermeasures to deal with counterfeit semiconductors. The WSC supports GAMS coordination with their customs and law enforcement authorities to facilitate a further strengthening of IP enforcement activities at global, regional, and national levels through closer cooperation with the industry.

VI. Encryption Certification & Licensing Regulations

With the use of encryption having become ubiquitous in commercial ICT applications, most electronic products contain semiconductors with cryptographic capabilities. The WSC reiterates the importance of the *WSC Encryption Principles*, endorsed by GAMS, as they make clear that commercial encryption should not be regulated except in narrow and justifiable circumstances. Generally, there should be no regulation of cryptographic capabilities in widely available products used in the domestic commercial market because mandating or favoring specific encryption technologies will reduce, not increase, security.

Based on the *WSC Encryption Principles*, encryption regulations should not be used for the purposes of limiting market access for foreign products. The WSC Encryption Principles underscore the importance of market access, transparency, adoption of international standards, non-discriminatory and open procedures, and rules for commercial encryption. Compliance with the WSC Encryption Principles will help keep markets open and free from unnecessary regulation and discrimination, promote innovation, enable the dissemination of leading-edge security solutions, and thus allow the digital economy to flourish.

The WSC supports the decision by GAMS to organize an Encryption workshop in 2023. As requested by GAMS in 2022, the WSC performed a *2023 Self-Assessment Survey* of existing and draft regulatory practices, as well as issues related to commercial encryption, in relation to the WSC Encryption Principles. The WSC presents a proposed agenda for the GAMS Encryption workshop of October 2023 for GAMS consideration (see **Annex 3**).

The WSC encourages GAMS to continue the dialogue, making use of the results of the *2022* and *2023 WSC Self-Assessment Survey* to complete the review, analysis

and assessment of relevant policies and measures by the 2023 GAMS Encryption Workshop and GAMS meeting with a view to the full implementation of the WSC Encryption Principles.

The WSC further agrees with the GAMS Chair's Summary that non-discriminatory access to relevant standardization bodies is of utmost importance. Access by non-domestic semiconductor companies to the TC260 Working Group 3 on Cryptography and receiving reliable information on the application procedure and all relevant criteria for membership of working groups on cryptography is to be clarified, with the aim to resolve the issue of access.

VII. Customs and Tariffs

Information Technology Agreement (ITA)

The ITA and its Expansion (hereinafter "the Agreement") have greatly accelerated trade in semiconductors and semiconductor-enabled technologies. The Agreement has generated a very significant increase in the value of global semiconductor-related trade, making semiconductors one of the most globally traded products today.

The large deployment of semiconductor-enabled technologies has had a profound impact on society and the economy. It has spurred productivity and made significant contributions toward solving global societal challenges like healthcare, climate change, secure connectivity, education, and more.

Ever faster technological innovation has continued in the semiconductor industry since the 2015 ITA-Expansion Agreement was signed. As a result, there currently are semiconductor products, manufacturing equipment, and materials which fall outside the scope of the Agreement. The rapid technological development leading to new products and emerging technologies has meant that products that were not on the market or not identified in international customs classifications at the time the Agreement was signed are now on the market but are not covered by the Agreement today. These products include a myriad of indispensable components of devices which are critical, for example, telecommunication, remote healthcare, connectivity and transport infrastructure.

The WSC strongly supports a further ambitious tariff-elimination initiative to significantly expand product coverage of the Agreement, which has been one of the World Trade Organization (WTO)'s most successful trade deals.

Given the unique role semiconductors and semiconductor-enabled technologies play in advancing solutions to global challenges, the WSC calls on Governments and Authorities to initiate a new round of negotiations to further expand the ITA to include semiconductor-related products not previously covered.

WTO Moratorium on Customs Duties on Electronic Transmissions

The WSC applauds the decision by WTO members at 12th Ministerial Conference (MC12), to renew the Moratorium on Customs Duties on Electronic Transmissions until the next Ministerial conference.

The WSC would like to highlight that the long-standing WTO agreement to not impose customs duties on electronic transmissions has greatly contributed to the growth and development of the digital economy. Continuation of the Moratorium is also critical to the post COVID-19 recovery. The cross-border exchange of knowledge, technical know-how, and scientific and commercial information across transnational IT networks, as well as access to digital tools and global market opportunities have helped sustain economies, expand education, and raise global living standards.

Continuation of the Moratorium is also important to supply chain resilience, including semiconductors. Semiconductor manufacturers rely on the constant flow of research, design, and process data and software to enable their production flows and supply chains for critical products.

The WSC urges the GAMS to support extending the Moratorium at MC13, and work towards a WTO agreement that permanently protects electronic transmission from protectionist customs duties and procedures. The WSC is glad to present to GAMS a White Paper detailing the importance of duty-free electronic transmissions for the semiconductor industry (see Annex 4, "Maintaining A Free And Open Market: The Importance of the WTO E-Commerce Moratorium to the Semiconductor Industry").

HS Classification for semiconductors

The WSC recalls that the Harmonized System (HS) plays a fundamental role in ensuring a globally harmonised and consistent customs classification for all traded goods including semiconductors. It also creates the basis for a level playing field in international business.

The WSC highlights that it is crucial that the HS nomenclature stays up-to-date with technology developments in semiconductors and facilitates trade through reduction of unnecessary complexity and administrative burden. It is therefore important that new and innovative semiconductor products are integrated into the HS through its regular review cycles.

The WSC has agreed on a proposal to amend HS heading 8534 by "Smart printed circuit board" (or Smart PCBs). These products are obtained by embedding one or more semiconductor components (i.e. discrete active or passive elements or electronic integrated circuits, bare or encapsulated) or other non-semiconductor-based components into "printed circuits" as referred to in Note 8.a) to Chapter 85.

The WSC calls on GAMS to support the WSC proposal to include "Smart printed circuit board" (or Smart PCBs) in the HS by amending HS heading 8534 (Annex 5) The WSC calls on GAMS to cooperate with its customs services to achieve the implementation of this amendment to HS heading 8534 within the HS2027 review.

Semiconductor-based transducers

The WSC applauds the work by World Customs Organization (WCO) to ensure the entry into force on January 1, 2022, of the HS Explanatory Notes (HSEN) for HS heading 8541 covering semiconductor-based transducers.

The WSC has noticed that some of the language in the HSEN contain elements which may raise questions regarding what is covered under semiconductor-based transducers. In order to ensure clarity and avoid future potential disputes, the WSC has developed a proposal to amend the HSEN. The proposal can be found in **Annex 6**.

The WSC reiterates its call to GAMS to work with their Customs agencies to ensure that the WSC proposal to amend the HSEN for semiconductor-based

transducers is swiftly endorsed by the WCO contracting parties so that it will be adopted without delays.

VIII. Regional Support Programs

Given the vital role of the semiconductor industry to all regions' economic growth and innovation, combined with the immense technological challenges and rising costs facing our industry, the WSC encourages market-based regional support which fosters semiconductor industry progress, avoids market and trade distortions, and is fully consistent with the GAMS Regional Support Guidelines and Best Practices and WTO rules.

The WSC welcomes GAMS' support for full implementation of the Regional Support Guidelines and Best Practices, developed by the WSC and adopted by the GAMS in 2017. These Guidelines reflect the shared view that regional support in the semiconductor sector should be transparent, non-discriminatory, and non-trade distorting; that actions by governments/authorities should be guided by market-based principles; and that the competitiveness of companies and their products, not the intervention of governments and authorities, should be the principal drivers of innovation, industrial success and international trade.

The WSC welcomes the GAMS' ongoing commitment to increasing transparency through the regular sharing of information and analysis and assessment of subsidies and other forms of regional support. Such transparency and assessment are vital to promoting consistency with the principles of the Guidelines and WTO rules, and avoiding non-market-based support that can lead to excess capacity that is not commercially justified, create unfair competitive conditions, hinder innovation, and undermine the efficiency of global value chains.

This information exchange has had some notable success in filling the gaps caused by shortfalls in the WTO's subsidy notification process. Since 2017, a total of 42 semiconductor-related programs have been covered over two phases of information exchange (Phase 1 and Phase 2). In reviewing the achievements and challenges from these first two Phases, the WSC recognizes that these exchanges provide important transparency, opportunities for dialogue, and improved understanding of each region's regional support programs, and a valuable forum for addressing concerns about excess capacity and market distortions. However, the WSC notes that there is a need for additional process improvements to ensure the timely, equitable, and reciprocal sharing of information by all regions before beginning a new “Phase 3” information exchange.

The WSC presents the new process document as the basis to move forward with a Phase 3 Information Exchange, with an additional 2 programs per region.

The WSC notes that five programs from Phase 1 and 2 have been identified by GAMS for further study and alignment and requests the JSTC to continue the process of information exchange to ensure comprehensive responses on both the Phase 1 and 2 programs to fully achieve the goals set out in the Regional Support Guidelines and Best Practices.

The WSC continues to pursue work on the best practices for government/authority transfers (grants, loans, loan guarantees, equity investments), including developing a best practice paper for such transfers.

The WSC requests GAMS to complete the analysis and assessment of these regional support programs, including outstanding Q&As for Phase 1 and 2, as well as the newly nominated Phase 3 programs, with respect to consistency with the Regional Support Guidelines and Best Practices at an 8th Workshop on Regional Support at the 2023 GAMS Meeting. The WSC presents to GAMS a proposal for the workshop agenda, and requests that GAMS members work to finalize an agenda and invite appropriate officials in their regions to participate in this workshop (See **Annex 7**). The WSC also requests GAMS to continue and review the process of regular exchanges in support of full implementation of the Regional Support Guidelines and Best Practices, and continue the discussion of best practices for government/authority transfers at the GAMS level.

The WSC welcomes the October 2022 GAMS agreement to work together to maintain the effectiveness of existing WTO disciplines, as well as to reform the WTO to help it meet new challenges.

IX. Global Supply Chain

The WSC appreciates the complexity, value and importance of the global supply chain to the semiconductor industry. In response to the invitation by GAMS to continue cooperative efforts to examine ways and means to increase resilience, security and transparency of the global supply chain, with the aim to help mitigate shortages of semiconductors, the WSC presented an initial report of semiconductor global supply chain.

The WSC invites GAMS to acknowledge the complexity of the semiconductor global supply chain, and the fact that it would be virtually impossible for any single region to replicate all of the elements of the current global supply chain. To this end, the WSC is committed to deepen its understanding of the global supply chain, including all the elements, and the interactions among them, with the aim to preserve the healthy functioning of the global supply chain.

X. Approval of Joint Statement and Approval of Recommendations to GAMS

The results of today's meeting will be submitted by representatives of WSC members to their respective governments/authorities for consideration at the annual meeting of WSC representatives with the Governments/Authorities Meeting on Semiconductors (GAMS) to be held in October 2023 in the U.S.

XI. Next Meeting

The next meeting of the WSC will be hosted by the Semiconductor Industry Association in Japan in June 2024.

XII. Key Documents and WSC Website:

All key documents related to the WSC can be found on the WSC website, located at: http://www.semiconductorcouncil.org. Information on WSC member associations can be found on the following websites:

Semiconductor Industry Association in China:
http://www.csia.net.cn

Semiconductor Industry Association in Chinese Taipei:
http://www.tsia.org.tw

Semiconductor Industry Association in Europe:
http://www.eusemiconductors.eu

Semiconductor Industry Association in Japan:
http://semicon.jeita.or.jp/en/

Semiconductor Industry Association in Korea:
http://www.ksia.or.kr

Semiconductor Industry Association in the US:
http://www.semiconductors.org

Annexes:

Annex 1: White Paper on "Semiconductors Enabling Carbon Emissions Reduction"

Annex 2: WSC Supports World Anti-Counterfeiting Day

Annex 3: Proposed Agenda for the 2023 GAMS Workshop on Encryption

Annex 4: WSC White Paper: "Maintaining a Free and Open Market: The Importance of the WTO E-Commerce Moratorium to the Semiconductor Industry"

Annex 5: WSC proposal to include "Smart printed circuit board" (or Smart PCBs) in the HS by amending HS heading 8534

Annex 6: WSC proposal to amend the HS Explanatory Notes on Semiconductor-Based Transducers

Annex 7: Proposed Agenda for the 2023 GAMS Workshop on Regional Support

Annex 1

Semiconductors Enabling Carbon Emissions Reductions
WSC White Paper

About the WSC

The World Semiconductor Council (WSC) is an international forum that brings together industry leaders to address issues of global concern to the semiconductor industry. Comprised of the semiconductor industry associations (SIAs) of the United States, Korea, Japan, Europe, China and Chinese Taipei, the goal of the WSC is to promote international cooperation in the semiconductor sector in order to facilitate the healthy growth of the industry from a long-term, global perspective. It also supports expanding the global market for information technology products and services and promoting fair competition, technological advancement, and sound environmental, health and safety practices.

Introduction

As the world faces the daunting challenge of addressing global climate change, semiconductor technology offers promising solutions for a myriad of industries and sectors. Semiconductor-enabled industries are critical in helping the global economy increase energy efficiency and clean energy production, as well as reducing emissions from various sectors such as transportation, manufacturing, buildings, energy, and agriculture. According to the World Economic Forum, semiconductor-enabled technologies can reduce greenhouse gas emissions by up to 15%, almost one-third of the reduction needed by 2030.[6]

In addition to providing efficiency and emissions reduction solutions for other economic sectors, the semiconductor industry itself has made great strides in minimizing its environmental footprint. This WSC white paper focuses on the semiconductor industry's "handprint," the industry's potential to reduce emissions through enabling other sectors to transition to a more sustainable future. By making products and services "smarter" and improving their efficiency, semiconductor technology can improve the greenhouse gas footprint of all sectors across the economy by facilitating the deployment of renewable energy infrastructure, enabling the responsive and efficient use of electricity, and promoting green mobility. For every unit of emissions generated by the semiconductor industry on a Scope 1-2 basis, it has helped avoid 5 times more emissions for end-customers.[7] The World Economic Forum notes that scaling up digitalization in high-emissions industries can reduce greenhouse gas emissions by up to 20% by 2050, offering a significant contribution to achieving a net-zero trajectory.[8]

Large-scale emitters of GHGs, including agriculture, transportation and logistics, industrials, buildings, and infrastructure sectors, are seeking “smart” solutions to become more efficient and sustainable. This white paper identifies several critical economic sectors in which semiconductor-enabled

[6] https://www.weforum.org/agenda/2019/01/why-digitalization-is-the-key-to-exponential-climate-action/.

[7] https://www.gsam.com/content/gsam/us/en/institutions/market-insights/gsam-connect/2022/Green_Capex_Capturing_the_Opportunities.html.

[8] https://www.weforum.org/agenda/2022/05/how-digital-solutions-can-reduce-global-emissions.

technology will enhance energy efficiency, reduce carbon emissions, and help transition toward a more sustainable future: Smart Buildings, Electric Vehicles, Data Centers, and Connectivity.

Smart Buildings

The United Nations Environment Programme has found that the building and construction sector accounts for over 34% of global energy demand and 37% of energy and process-related carbon emissions.[9] Accelerating urbanization in the developing world will magnify the demand for construction materials, with global steel and cement production set to grow by up to 50% and 23% respectively by 2050.[10] Therefore, reducing carbon emissions in this sector is essential to achieving net zero emissions by 2050. Indeed, a study by the American Council on Energy Efficient Economy (ACEEE) shows that "smart devices" could dramatically reduce energy consumption in commercial buildings: between 30-50% in otherwise inefficient buildings.[11]

Digitalization offers numerous possibilities to reduce energy consumption in smart homes and smart buildings. For example, semiconductor-enabled technologies enable the buildings to stop cooling or heating and use natural air ventilation depending on the weather conditions. Smart buildings use advanced metering and building controls, as well as sensors at each desk to optimize energy use. Technological solutions not only promote sustainability, but they can improve security, increase comfort, and generate substantial savings for homeowners and businesses. These solutions are mainly driven by semiconductors and intelligent semiconductor systems – with power management integrated circuits (ICs), microcontrollers, and security ICs communicating between the real and digital world.[12]

Sensors enable connected devices to understand their surroundings and adjust accordingly. For example, rather than using pre-set timers for heating, ventilation, and air conditioning (HVAC) systems, sensors equipped with AI-processing functionality can detect how many people are present in a structure and for how long.[13] This data can be used to precisely warm, cool, and ventilate the building. Lighting can comprise up to 40% of the energy used in commercial premises. Light-emitting diodes (LEDs), a semiconductor device, use 75% less energy than halogens.[14] They also emit less heat and can last up to 10 times longer.

Buildings that incorporate and integrate these smart technologies together can significantly minimize their carbon emissions. A study found that grid-interactive efficient buildings (GEBs), which use smart controls to blend energy efficiency, energy storage, renewable energy, and load flexibility technologies, can reduce energy costs by up to 20%.[15] The Powerhouse Brattørkaia in Norway has demonstrated that digitalization can even enable buildings to become energy positive across their entire lifecycles. Not only is the building extremely energy efficient – incorporating occupant adaptive

[9] https://www.unep.org/news-and-stories/press-release/co2-emissions-buildings-and-construction-hit-new-high-leaving-sector.

[10] https://www.unep.org/news-and-stories/press-release/co2-emissions-buildings-and-construction-hit-new-high-leaving-sector.

[11] https://www.aceee.org/sites/default/files/publications/researchreports/a1701.pdf.

[12] https://www.infineon.com/cms/en/about-infineon/energy-efficiency-technologies/smart-home-and-building/.

[13] https://news.microsoft.com/source/features/digital-transformation/climate-change-demands-intelligent-buildings-smarter/.

[14] https://www.energy.gov.au/business/energy-management-business/3-implement-energy-savings.

[15] https://rmi.org/insight/value-potential-for-grid-interactive-efficient-buildings-in-the-gsa-portfolio-a-cost-benefit-analysis.

HVAC and lighting systems – 3,000m² of solar panels and a natural refrigerant heat pump allow it to generate 500,000 kWh of renewable energy per year.[16]

Electric Vehicles

According to the International Energy Agency, transportation has the highest reliance on fossil fuels of any sectors and is responsible for 37% of direct global emissions.[17] Consequently, the transition from internal-combustion engine (ICE) models to electric vehicles (EVs) is one of the most important steps towards decarbonizing the sector. EVs are surging in popularity globally and could account for 18% of total car sales by the end of 2023.[18] Ambitious government programs to incentivize electric car sales coupled with pledges by major auto manufacturers to phase out ICE vehicles could even lift EV market share above 50% by 2030 in some regions.

Increasing the number of EVs on the road will require producing a lot more automotive semiconductors. A KPMG report finds that the "average fully electric cars will have twice as much semiconductor content as ICE (internal combustion engine) cars", because of the increased use of all kinds of semiconductors, and sensor technology.[19] Modern cars contain well over 1,000 semiconductor chips, which control essential safety features like air bags and automated braking, calibrate fuel injection, and run infotainment systems.[20] The average semiconductor content of an EV could be 2 to 3 times higher than that of a conventional ICE model. Within the powertrain of an EV, semiconductors are used in the charger, inverter, DC/DC converter, battery, central processor, and motor.

The development of semiconductors used in power electronics devices is paving the way for wider EV adoption. Replacing silicon chips with wide-bandgap semiconductors made from silicon carbide and gallium nitride can mitigate many of the concerns that consumers have about the convenience, performance, and affordability of EVs. Silicon carbide devices deliver greater efficiency, extending the range covered on a single charge and reducing the overall cost of the powertrain. Silicon carbide devices can also operate at far higher voltages than silicon-based devices, delivering faster charging times.[21]

Semiconductors also play a crucial role in the development of charging infrastructure for electric vehicles, facilitating the efficient transfer of power from the grid to the vehicle's battery and enabling the integration of renewable energy sources. The Electric Power Research Institute (EPRI) and Natural Resources Defense Council (NRDC) estimated that if plug-in electric vehicles are widely adopted by 2050, the electricity and transportation sector combined could achieve a 48% reduction between 2015 and 2050.[22] A study by Carnegie Mellon University found that the combined impact of an

[16] https://www.archdaily.com/924325/powerhouse-brattorkaia-snohetta.

[17] https://www.iea.org/topics/transport.

[18] https://www.iea.org/reports/global-ev-outlook-2023/executive-summary.

[19] https://myscma.com/wp-content/uploads/2020/03/kpmg-automotive-semiconductors-new-ice-age.pdf

[20] https://www.fierceelectronics.com/sensors/auto-chips-seen-biggest-revenue-producer-23-kpmg-survey.

[21] https://blog.st.com/how-semiconductor-technology-is-accelerating-electric-vehicle-growth/.

[22] https://www.nrdc.org/media/2015/150917.

emissions-free power grid and the widespread adoption of EVs (from 67% to 84%) would result in a 90% in emissions from light-duty vehicles.[23]

Data Centers

Data centers, facilities used to house networked computer servers, which store, process, and distribute data between connected devices, are the backbone of the digital economy. As the number of internet users has more than doubled since 2010 and internet traffic has spiked 20-fold, data centers and data transmission networks demand increasing amounts of energy (approximately 1% of the global electricity demand).[24] However, total emissions from data centers have grown only modestly during that same period, thanks to energy efficiency gains enabled by semiconductors.

Most of the energy demand within data centers comes from powering and cooling the server racks. Cooling equipment ensures the safety and reliability of the servers, preventing malfunctions and downtime. As the operators of data centers seek to enhance their sustainability, they are implementing new technologies to improve power usage effectiveness (PUE). PUE represents the ratio of the total amount of energy used by a computer data center facility to the energy delivered to the computing equipment.

Some hyperscalers have employed AI systems to improve their data center PUE. These cloud-based systems can analyze data drawn from thousands of sensors within the cooling system to predict how potential actions will affect future energy consumption and then identify and implement actions which will minimize energy consumption. One report from Ernst & Young estimates that pragmatic usage of AI can enable companies to save up to 40% of the power spent on data center cooling.[25] Another tool that enables carbon footprint reduction within data centers is machine learning (ML). Supervised ML has proven effective in solving complex constraint-based carbon reduction problems that involve hundreds of potential variables and factors that impact emissions like workload distribution and space utilization.[26]

Connectivity

Connectivity technologies enable devices to communicate with each other and transfer data. Subsequent generations of the semiconductors that are used in connectivity technologies have been designed to become more energy efficient.

Ethernet technology refers to the protocol, port, cable, and computer chip needed to plug a device into a local area network (LAN) for rapid data transmission via coaxial or fiber optic cables. Energy-Efficient Ethernet (EEE) is a set of enhancements to Ethernet physical layer variants that reduces power consumption during periods of low data activity.[27] In Fast Ethernet and faster links, constant and significant energy is used by the physical layer as transmitters are active regardless of whether data is being sent. If they could be put into sleep mode when no data is being sent, that energy could be saved. Power consumption can thus be reduced by 50% or more, while retaining full compatibility

[23] https://iopscience.iop.org/article/10.1088/1748-9326/ab7c89.

[24] https://www.iea.org/reports/data-centres-and-data-transmission-networks.

[25] https://www.ey.com/en_in/technology/how-ai-and-automation-make-data-centers-greener-and-more-sustainable.

[26] https://venturebeat.com/data-infrastructure/data-center-ops-how-ai-and-ml-are-boosting-efficiency-and-resilience/.

[27] https://www.versitron.com/whitepaper/overview-of-energy-efficient-ethernet.

with existing equipment. Most Ethernet switches and network interface cards (NICs) today are made with EEE enhancements that reduce carbon emissions.

The Universal Serial Bus (USB) standard is used to connect computers with external devices, enhancing interoperability and popularizing the "plug and play model." USB technology has evolved to reach greater speeds and higher transfer rates along with more efficient power usage. Since USB2 was introduced in 2000, USB power consumption has declined by 95%. The maximum transfer rate has also increased dramatically: USB 2.0 (480Mbps), USB 3.2 (5GBps), USB 4 (40Gbs).[28]

Bluetooth is an open wireless technology standard that uses radio frequency to share data over a short distance. Introduced by the Bluetooth Special interest Group in 2010, Bluetooth Low Energy (BLE) is a technology protocol independent of Bluetooth Classic which consumes considerably less power while maintaining a similar communication range.[29] BLE is aimed particularly at IoT applications in the health, sport, and fitness sectors. For example, increasingly popular fitness tracking devices communicate with smartphone apps using BLE. BLE-enabled contact tracing was a powerful tool to prevent the spread of the coronavirus during the pandemic. Compared to the 1W reference value for Bluetooth Classic, BLE offers 0.01W - 0.5W power consumption. This means that as more IoT devices come online, the use of BLE has greatly reduced their energy demand.

Conclusion

As this paper has demonstrated, many applications of semiconductor technology in carbon-intensive sectors have the potential to make significant contributions towards driving solutions to climate change. However, this will hinge on mitigating risks to the global semiconductor supply chain and ensuring continued innovation in efficiency. Global governments can accelerate this transformation by implementing policies that encourage the adoption and deployment of semiconductor-enabled solutions and achieve climate goals in a flexible, market-based manner.

[28] https://www.k2e.com/articles/evolution-of-usb/.

[29] https://www.bluetooth.com/wp-content/uploads/2022/05/The-Bluetooth-LE-Primer-V1.1.0.pdf?__hstc=44473531.dcde15fb1474e5a4a55b4d6fdeaf88ac.1682541900527.1682541900527.1682541900527.1&__hssc=44473531.1.1682541900527&__hsfp=4062740069&hsCtaTracking=8e3cb9ce-2e7b-471a-b5cc-2343a4915b6a%7C090f705a-f0df-4f4b-8a54-c8f97c73eb69.

Annex 2

9th June 2023

FOR IMMEDIATE RELEASE

WSC supports World Anti-Counterfeiting Day

On 9 June 2023, the EU's Intellectual Property Office and Global Anti-Counterfeiting Group are celebrating the 25th edition of the World Anti-Counterfeiting Day (WACD). The World Semiconductor Council (WSC) strongly supports the WACD and believes it is a great initiative to highlight the anti-counterfeit measures being taken across industries. In recent years, the overall semiconductor shortage has shown that counterfeiters are now more active and have shifted trademark infringing online offerings of semiconductors to less well-known online platforms.

In 2012, the WSC has established an Anti-Counterfeiting Task Force amongst the semiconductor industry associations of China, Chinese Taipei, Europe, Japan, Korea, and the United States, with the aim of promoting activities to fight counterfeiting, incl. training, awareness raising, and encouraging purchases from authorised sources. The WSC works closely with governments and authorities on policies and regulations, and encourages domestic, bilateral, and multilateral countermeasures and enforcement activities. Such enhanced anti-counterfeiting cooperation activities at the industry level alongside government agencies, customs and law enforcement agencies is instrumental to identify and stop parties involved in manufacturing or trafficking in counterfeit goods. The World Anti-Counterfeiting Day enables the organisation of various events focusing on problems of counterfeiting & piracy under the umbrella of an international outreach campaign.

According to the Organisation for Economic Co-operation and Development (OECD), international trade in counterfeit goods represented up to 2.5% of world trade, or up to USD 464 billion[30] in 2019. In view of these staggering numbers, the WSC is convinced of the importance of an initiative such as the World Anti-Counterfeiting Day, especially as counterfeit products are expected to circulate rapidly to meet current high demand and believes it to be a great way of highlighting the common cause of fighting counterfeiting – industry sectors alongside well-informed customers, and national enforcement authorities.

[30] Source: Organisation for Economic Co-operation and Development (OECD)–European Union Intellectual Property Office (EU IPO) (2021), *Illicit Trade, Global Trade in Fakes A WORRYING THREAT*

About WSC

The World Semiconductor Council is a cooperative body of the world's leading semiconductor industry associations – consisting of the Semiconductor Industry Associations in China, Chinese Taipei, Europe, Japan, Korea and the United States – that meets annually to address issues of global concern to the semiconductor industry. The WSC also meets annually with the governments and authorities of the six regions to convey industry recommendations. The WSC is dedicated to the principle that markets should be open and competitive and works to encourage policies and regulations that fuel innovation, propel business and drive international competition in order to maintain a thriving global semiconductor industry.

More information on the WSC is available at http://www.semiconductorcouncil.org

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Annex 3

2023 GAMS Encryption Workshop

WSC Agenda Proposal

October 2023, Phoenix

09:30-09:35	Welcome and Introduction	GAMS Chair (US)
09:35-9:45	Report from WSC: Encryption Principles and 2022 WSC Self-Assessment Survey on Encryption	Chair of the WSC Encryption Task Force
9:45-12:15	Continuation of the ongoing GAMS review of draft and existing policies and measures, with a view to the full implementation of the *WSC Encryption Principles* - Analysis and assessment by GAMS against the WSC Encryption Principles	GAMS delegates WSC Representatives
12:15-12:30	Break	
12:30-13:00	Conclusion	GAMS Chair

Annex 4

MAINTAINING A FREE AND OPEN MARKET: The Importance of the WTO E-Commerce Moratorium to the Semiconductor Industry

Since the 1998 Geneva Ministerial Conference, the World Trade Organization (WTO) Members have upheld a moratorium against customs duties, or tariffs, on electronic transmission that has been extended every two years at each WTO Ministerial. This agreement, known as the WTO Moratorium on Customs Duties on Electronic Transmissions ("E-commerce Moratorium" or "the Moratorium") has facilitated the tremendous growth in global e-commerce and digital trade that has provided immense benefits to developed and developing countries, large and small businesses, and individuals alike. Like all major economies, India has seen major economic benefits from the e-commerce moratorium and resulting digital boom, because of its particular strengths in cross-border business services; software and semiconductor design, entertainment (e.g. Bollywood films and music, and consumer electronics) that depend on duty-free electronic transmissions to access global markets. The Moratorium has particularly benefited India's millions of small and medium enterprises (SMEs), which often lack the ability to establish or access overseas bricks-and-mortar retail establishments, and therefore depend on the Internet to reach hundreds of millions of foreign customers. On the export front, an UNCTAD 2018 report indicated that in India exported $89 billion in ICT-enabled services, with the majority (63%) in computer services, as well as management and administration services and engineering and R&D. As part of this trend, a growing number of smaller Indian firms are leveraging e-commerce markets to sell Indian music, books and other items to the Indian diaspora abroad, particularly as Indian entertainment products have achieved greater sway with global audiences. The UNCTAD study concluded that 'digital delivery' is of particular value to smaller Indian companies.

The recent COVID-19 pandemic has underscored the importance of maintaining and developing a global digital marketplace, which has only become more pronounced as the world moved online during COVID-19, enabling remote healthcare, remote working and interacting. This high-level of connectivity of global digital flows has also been fundamental to pandemic response, allowing researchers to help "track and trace" the development of the pandemic, learning more about the virus and accelerating the search for a vaccine. Indeed, the pace of digitalization and growing reliance on connectivity will become ever more important in our societies.

However, continued renewal of the WTO moratorium is at risk, as several WTO Members have opposed its renewal. Non-renewal of the Moratorium would represent a major setback, both for the global semiconductor industry and the global economy. Indian computer scientists provides semiconductor design and development services to most of the world's leading chip companies, but this work needs to be integrated into global design teams to facilitate integrated, round-the-clock worldwide design work.

Because of its world-class educational institutions, India has built up a large, high-skilled, and comparatively low-cost technology work force. As a result, Indian business services companies have established themselves as global leaders in providing advanced software, computer, management and administration, engineering, and research and development services. However, given increasing restrictions on immigration, this Indian work force needs the Moratorium in order to continue to access global markets. This industry already faces major protectionist pressures because of its demonstrated ability to provide high-quality, world class services at a low cost. If India's trading partners put tariffs on electronic transmissions, foreign companies will go elsewhere, leaving a large, under-utilized Indian technology work force.

For the semiconductor industry, if the moratorium on customs duties were to expire, electronic transmissions such as semiconductor design, development, and manufacturing data could potentially face tariffs across the globe, increasing costs for companies and consumers and further straining the semiconductor supply chain.

The compliance burden of completing customs paperwork for every single cross-border electronic transmission would be crushing for any business, let alone a small-business or start-up, and would undermine global e-commerce and global R&D networks that have spurred economic growth, technological innovation, and societal advancement[31]. This would be particularly disruptive to the semiconductor supply chain, which relies on the seamless and unimpeded flow of semiconductor research, designs, software, chemical formulations, manufacturing information, and other data which can -and typically do – cross multiple borders on a daily basis.

With a globally integrated supply chain, the collapse of the Moratorium would not only damage India's semiconductor design industry and workforce, but also the global ICT industry that it serves. In May 2022, the World Semiconductor Council (WSC), alongside nearly 80 additional industry and technology groups, signed onto global industry statement urging WTO members to renew the Moratorium to support supply chain resilience during a time of unprecedented digital transformation.

With all of this at stake, the WSC urges all WTO Members to support extending the Moratorium at MC -3, and work towards a WTO agreement that permanently protects electronic transmission from protectionist customs duties and procedures.

<u>The Importance of Duty-Free Electronic Transmissions for the Semiconductor Industry</u>

The duty-free movement of electronic transmissions within and across borders underpins the digital economy and has facilitated technological innovation and growth. The core of the digital economy consists of an intricate network of electronic supply chain models involving data centers, the IoT ecosystem, and evolving telecom infrastructure (soon to be enhanced with 5G technologies). The semiconductor industry is known for generating massive amounts of data every day. This data can come from a variety of sources, including the manufacturing process itself, quality control measurements, and test data from finished products.

According to a report by McKinsey & Company, a single semiconductor fab can generate up to several petabytes of data per day[32]. This data can include information about the chemical composition of materials used in the manufacturing process, measurements of the physical characteristics of individual chips, and data from sensors that monitor the manufacturing equipment. Importantly, most of the data crosses the border on a daily basis. For example, the data generated by sensors and other monitoring equipment is sent to companies' different production sites every day, and is used to optimize production processes, identify, and address quality issues more quickly, and improve yield rates. The amount of data generated by the semiconductor industry has also been increasing rapidly due to the growing complexity of manufacturing processes, the use of advanced sensors and analytics, and the proliferation of internet of things (IoT) devices.

As the industry continues to grow and develop, it is likely that the amount of data generated will only continue to increase. This data will be used for a variety of purposes, including improving the efficiency of the manufacturing process, identifying defects in individual chips, and optimizing the performance of finished products.

Therefore, the WTO e-commerce moratorium helps to ensure that there are no barriers to the cross-border transfer of digital data and information, which is critical for the semiconductor industry to conduct research, collaborate with partners, and distribute products globally. If customs duties were imposed on electronic transmissions, it could increase the cost of doing business and make it more difficult for semiconductor companies operating in countries that oppose the Moratorium to compete on a global scale.

Below includes the specifics of why the Moratorium is important for the semiconductor industry:

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[31] https://itif.org/publications/2023/05/08/transforming-global-trade-and-development-with-digital-technologies/

[32] https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/semiconductors/pdfs/mosc_1_revised.ashx

Chip design activities happen all around the world. In 2021, the world's leading semiconductor companies employed approximately 187,000 semiconductor design engineers. Of that number, about 20% are based in India. Tariffs on chip design transmissions risk global supply chains and could cause companies to conduct design in jurisdictions that do not have such limitations. For countries like India to continue to attract semiconductor foreign investment and cultivate a resilient ICT supply chain and work force, the continued seamless movement of R&D, design, engineering and manufacturing data without customs restrictions is essential.

R&D and Innovation

The semiconductor industry has long benefited from basic research and development occurring at research centers and universities across the globe. As semiconductors incorporate more features, and thus integrating more functionality, the more complex the device design will be. Companies and their R&D organizations have assembled into global networks of engineering and verification teams to handle new architecture and process steps – spanning from device design teams, semiconductor equipment makers, and finally device fabricator. The semiconductor industry is a highly innovative industry, with companies constantly developing new technologies and products. This often requires round-the clock collaboration between companies, universities, and research institutions across different countries and regions, as global teams work in various markets to bring new innovations to market. The free flow of data is critical to facilitating this collaboration, as it enables researchers and developers to share information, insights, and expertise across borders. Under this international R&D structure, semiconductor designs, design tools, engineering skills, research methodologies, and other data associated with component development is transferred from location-to-location, crossing multiple international borders along the way. Tariffs on these electronic transmissions would threaten this collaboration that has helped to generate new innovations and technologies that fuel the advancement of our industry.

Supply Chain Management

The semiconductor industry relies on a globalized supply chain to source raw materials, manufacture products, and distribute them to customers. The manufacturing of semiconductors involves a complex and highly specialized process that requires the coordination of multiple suppliers and partners. The free flow of data across borders is critical to manage this supply chain, as it enables companies to track the movement of goods, optimize production processes, and monitor quality control. Without the free flow of data, it would be much harder for semiconductor companies to manage their supply chains and ensure the efficient production and delivery of products.

Semiconductor Design & Integration

During the semiconductor design, manufacturing, and test processes, a tremendous amount of data is generated, collected, and electronically transmitted through information warehouses used by many disparate engineering teams during the manufacturing flow. The microprocessor design flow, for example, involves several hundred engineering phases which are highly dependent on technology transfers. From the instructions that process the digital data to control the operation of the electronic system (the "Logic"), to the design of the various power, clock planning and computing blocks, to the completion of the integrated circuit's architectural layout- each step in the design flow involves transactions between engineering teams located all around the world.

Illustrative example of the "Design Flow" for microprocessors

If governments were to begin levying customs duties on electronic transmissions, semiconductor R&D activities involving designs, computing blocks, circuit layouts, software, etc. could be severely impacted – even if that technical information were to be transferred intra-company. Tariffs on chip design transmissions also risk with global supply chains and could cause companies to conduct design in jurisdictions that do not have such limitations. Countries aiming to advance their semiconductor design sector will be most successful when they are duty free.

Of 187,000 semiconductor design engineers employed by leading semiconductor companies, about 20% are based in India. Tariffs on chip design transmissions risk global supply chains and would cause companies to shift cutting-edge design work to jurisdictions that do not have tariffs. It would also induce foreign countries to put up protectionist tariff barriers to Indian chip design, which offers a low cost but highly competitive, alternative to domestic design, particularly since skilled software and chip design engineers are in short supply. For countries like India to continue to attract semiconductor foreign investment and cultivate a resilient ICT supply chain and work force, the continued seamless movement of R&D, design, engineering and manufacturing data without customs restrictions is essential.

Global Race to Attract Semiconductor Investment

As countries around the world are announcing incentives policies to attract investment in semiconductors, it is important that these countries continue to uphold the Moratorium at MC13. This will send a strong signal that India remains committed to an investment friendly and world-class ecosystem for advanced semiconductor production by maintaining certainty and predictability for semiconductor companies, suppliers, partners, and customers. This will create even more opportunities for India to continue to expand its existing role within the global semiconductor value chain, from research and development to design and manufacturing.

Annex 5

- HS 2027 Review -

Proposed amendments to HS Chapter Notes and Explanatory Notes for heading 85.34

Seoul, 25 May 2023

Chapter 85 – Legal Notes

8. For the purposes of heading 85.34

a) "printed circuits" are circuits obtained by forming on an insulating base, by any printing process (for example, embossing, plating up, etching) or by the " film circuit " technique, conductor elements, contacts or other printed components (for example, inductances, resistors, capacitors**, transducers**) alone or interconnected according to a pre-established pattern, other than elements which can produce, rectify, modulate, or amplify an electrical signal (for example, semiconductor elements)

~~***The expression "printed circuits" does not cover circuits combined with elements other than those obtained during the printing process, nor does it cover individual, discrete resistors, capacitors or inductances. Printed circuits may, however, be fitted with non printed connecting elements.***~~

b) ***"Smart printed circuits (smart PCBs)" are obtained by embedding one or more semiconductor components (i.e. discrete active or passive elements or electronic integrated circuits, bare or encapsulated) or other non-semiconductor-based components into "printed circuits" referred to in Note 8.a) to Chapter 85. Smart PCBs might be able (but not limited) to produce, rectify, modulate or amplify an electrical signal or to perform logical functions (for example by means of integrated circuits).***

Printed circuits ***and smart printed circuits*** may, however, be fitted with non-printed connecting elements.

Thin or thick film circuits comprising passive and active elements obtained during the same technological process are to be classified in heading 85.42.

HS Explanatory Notes for Heading 85.34 Printed circuits

In accordance with Note 6 to this Chapter, this heading covers the circuits which are made by forming on an insulating base, by any printing process (conventional printing or embossing, plating up, etching, etc.), conductor elements (wiring), contacts or other printed components such as inductances, resistors, capacitors, ***transducers*** (" passive " elements).

In smart PCBs semiconductor or other non-semiconductor-based components are embedded into the built-up layers of a typical printed circuit board. This allows building

highly compact electronic systems. Components are embedded either in a single or into multiple layers of the PCBs build-up with an two or three-dimensional interconnection architecture.

Depending on the available components (semiconductor or other non semiconductor based chips or components) and their respective connectors, different methods can be applied for the embedding. The highest degree in miniaturization and performance is achieved by embedding of bare dies (semiconductor chips without package). On the other hand, packaged components, as commercially available, could also be embedded into the built-up layers of the printed circuit board. In this manner, highly compact and robust systems with a two or three dimensional interconnection architecture could be created.

Some basic or " blank " circuits may comprise only printed conductor elements generally consisting of thin uniform strips or wafers with, if appropriate, connectors or contact devices. Others combine several of the above elements according to a pre-established pattern.

The insulating base material is generally flat but may also be in the shape of a cylinder, a truncated cone, etc. The circuit may be printed on one or both sides (double circuits). Several printed circuits may be assembled in multiple layers and interconnected (multiple circuits)~~.~~ ***or have embedded components, (i.e., Smart PCBs).***

The heading also covers thin or thick film circuits consisting solely of passive elements.

Thin film circuits are formed by the deposition on glass or ceramic plates of specific patterns of metallic and dielectric film, by vacuum evaporation, cathode sputtering or chemical methods. The patterns may be formed by deposition through masks or by deposition of a continuous sheet with subsequent selective etching.

Thick film circuits are formed by screen printing onto ceramic plates of similar patterns, using pastes (or inks) containing mixtures of powdered glass, ceramics and metals with suitable solvents. The plates are then furnace fired.

Printed circuits may be provided with holes or fitted with non printed connecting elements either for mounting mechanical elements or for the connection of electrical components not obtained during the printing process. Film circuits are generally supplied in metallic, ceramic or plastic capsules which are fitted with connecting leads or terminals.

Individual passive components such as inductances, capacitors, resistors ***or transducers*** obtained by any printing process are not regarded as printed circuits of this heading but are classifiable in their own appropriate headings (e.g., heading 85.04, 85.16, 85.32, 85.33 or 85.41).

Circuits on which mechanical elements or electrical components have been mounted or connected are not regarded as printed circuits within the meaning of this heading. They generally fall to be classified in accordance with Note 2 to Section XVI or Note 2 to Chapter 90, as the case may be.

Annex 6

WSC Proposed Amendments to the Harmonised System's (HS) Explanatory Notes for Semiconductor-based Transducers, HS Heading 85.41

Legenda: ***bold italics*****=** suggested amendment

~~***bold italics strikethrough***~~**=** deletions

ARTICLE 16 PROCEDURE

AMENDMENTS TO THE EXPLANATORY NOTES – HS 2022

Heading 85.41.

Page 85.41-1. Part (A).

Delete and substitute :

"**(A) SEMICONDUCTOR DEVICES (FOR EXAMPLE DIODES, TRANSISTORS, SEMICONDUCTOR BASED TRANSDUCERS)**

These are defined in Note 12 (a) (i) to this Chapter.

The operation of the devices of this group is based on the electronic properties of certain "semiconductor" materials ***(which are relevant for e.g. diodes and transistors)*** or, for the purpose of semiconductor-based transducers, on their semiconductor properties including physical (e.g., mechanical***, thermal, optical***) and chemical properties.

The main characteristics of ***these "semiconductor"*** materials is that at room temperature their resistivity lies in the range between that of conductors (metals) and that of insulators. They consist, for instance, of certain ores (e.g., crystal galena), tetravalent chemical elements (germanium, silicon, etc.) or combinations of chemical elements (e.g., trivalent and pentavalent elements, such as gallium arsenide, indium antimonide).

Semiconductor materials consisting of a tetravalent chemical element are generally monocrystalline. They are not used in their pure state but after very light doping (in a proportion expressed in parts per million) with a specific "impurity" (dopant).

For a tetravalent element, the "impurity" may be a pentavalent chemical element (phosphorus, arsenic, antimony, etc.) or a trivalent element (boron, aluminium, gallium, indium, etc.). The former produce n-type semiconductors with excess electrons (negatively charged); the latter produce p-type semiconductors with electron deficiency, that is to say that holes (positively charged) predominate.

Semiconductor materials combining tri- and pentavalent chemical elements are also doped.

In the semiconductor materials consisting of ores, the impurities contained naturally in the ore act as dopants.

The semiconductor devices of this group generally comprise one or more "**junctions**", between p-type and n-type semiconductor materials.

They include:

(I) **Diodes** which are two-terminal devices with a single p n junction; they allow current to pass in one direction (forward) but offer a very high resistance in the other (reverse). They are used for detection, rectification, switching, etc.

The main types of diodes are signal diodes, power rectifier diodes, voltage regulator diodes, voltage reference diodes.

(II) **Transistors** are three- or four-terminal devices capable of amplification, oscillation, frequency conversion, or switching of electrical currents. The operation of a transistor depends on the variation in resistivity between two of the terminals upon the application of an electric field to the third terminal. The applied control signal or field is weaker than the resulting action brought about by the change in resistance and thus amplification results.

Transistors include:

(1) Bipolar transistors, which are three-terminal devices consisting of two diode type junctions, and whose transistor action depends on both positive and negative charge carriers (hence, bipolar).

(2) Field effect transistors (also known as metal oxide semiconductors (MOS)), which may or may not have a junction, but which depend on the induced depletion (or enhancement) of available charge carriers between two of the terminals. The transistor action in a field effect transistor employs only one type of charge carrier (hence, unipolar). A parasitic body diode, which is produced in a MOS type transistor (also known as MOSFET), may operate as a freewheeling diode during inductive load switching. MOSFET which have four terminals are known as tetrodes.

(3) Insulated Gate Bipolar Transistors (IGBT), which are three-terminal devices consisting of a gate terminal and two load terminals (emitter and collector). By applying appropriate voltages across the gate and emitter terminals, current in one direction can be controlled, i.e. turned on and turned off. IGBT chips may be incorporated with diodes in a single package (packaged IGBT devices), which protect the IGBT device and allow it to continue to function as a transistor.

(III) **<u>Semiconductor-based transducers</u>**

As specified in Note 12 (a) (i) to this Chapter, these are devices in which the semiconductor substrate or material plays a critical and irreplaceable role in performing their function to convert any kind of physical or chemical phenomena or an action into an electrical signal or an electrical signal into any type of physical phenomenon or an action.

The semiconductor-based transducers have the character of an independent technical unit, and can be presented either as bare die products or in a package. The components forming a semiconductor-based transducer, including active or passive discrete components indivisibly attached that enable their construction or function, must be combined to all intents and purposes indivisibly, i.e., though some of the components could theoretically be removed and replaced, this would be uneconomic under normal manufacturing conditions. Non-semiconductor-based components ~~***which do not play a key role in transducers***~~ are allowed to be part of the transducer in situations when they contribute to the transducer's function as a sensor, actuator, resonator or oscillator~~.~~***, i.e. they create conditions for the transducing semiconductor components to be protected from, or coupled to, the outside world.***

The non-semiconductor based components could protect the transducer and modify the physical or chemical quantity at the same time. The embodiment of the non-semiconductor-based component are determined by the kind of physical or chemical quantity to be transduced, e.g. light, pressure, temperature, humidity, electromagnetic radiation, electric charge etc.

Typical examples of such ***non semiconductor-based*** components are, but not limited to, the following:

(i) the package, which typically consists of metal wires for interconnection (internal or external wirebond connections), a leadframe, an encapsulation, substrates etc.; or

(ii) components which enable or support the function like magnets, optical elements etc.

The definition of the expression "semiconductor-based" also includes elements in which the semiconductor material provides functionality to the transducer by its properties, which are not only semiconductor-specific. Such properties may include mechanical strength, flexibility, thermal conductivity, optical reflectivity, chemical resistivity, etc., in combination with its ability to be manufactured with high precision on a micrometer scale by using semiconductor technology (micro machining). Such elements may include, for example membranes, bars, cantilevers, cavities, mirrors, channels, etc., which enable transducer functions by thickness or elastic flexibility).

The materials used in semiconductor-based transducers include e.g., Silicon (Si), Germanium (Ge), Carbon (C), Silicon Germanium (SiGe), Silicon Carbide (SiC), Gallium Nitride (GaN), Gallium Arsenide (GaAs), Indium Gallium Arsenide InGaAs, Gallium Phosphide (GaP), Indium Phosphide (InP), Tin Telluride (SnTe), Zinc Oxide (ZnO) and Gallium Oxide (Ga_2O_3).

The expression "manufactured by semiconductor technology" means the application of area processing on a wafer level that may include grinding, polishing, doping, spin coating, imaging, CVD, PVD, galvanic, developing, stripping, etching, baking, printing.

The types of semiconductor-based transducers are:

(1) Semiconductor-based sensors, which are defined in Note 12 (a) (i) (3).

One example of a sensor is a Micro-Electro-Mechanical Systems (MEMS) element used in silicon microphones as a semiconductor-based acoustic sensor. The MEMS element is made up of a stiff and perforated backplate and a flexible membrane on silicon substrate, and its function is to convert sound waves into a variable electrical output. Sound waves are physical quantities that hit the membrane and bring it to vibration through which the varying electrical output is produced.

Another type of sensor is a gas sensor, which utilises the adsorption of electron donors/acceptors to change the resistance in graphene with an extremely high surface area.

(2) Semiconductor-based actuators, which are defined in Note 12 (a) (i) (4), e.g., electro-thermally actuated Micro-Electro-Mechanical Systems (MEMS) mirrors, which are typically used to deflect a laser beam in a broad range of applications, such as fibre-to-fibre optical switching, laser projectors, Light Detection and Ranging (LIDAR) in autonomous driving, laser tracking and position measurement, etc. Electro-thermally actuated mirrors are moved by heater elements, which act on semiconductor-based structures with different thermal expansion.

(3) **Semiconductor-based resonators,** which are defined in Note 12 (a) (i) (5), e.g., film bar acoustic wave resonators (FBAR), which are used in RF technology for multiplexing or channel selection in wireless devices.

(4) **Semiconductor-based oscillators**, which are defined in Note 12 (a) (i) (6), converting physical phenomena (stored energy of electromagnetic fields inside a resonator) into an electrical signal (output voltage with frequency depending on tuning voltage).

(IV) Other semiconductor devices

They include:

(1) **Thyristors**, consisting of four conductivity regions in semiconducting materials (three or more p n junctions) through which a direct current passes in a predetermined direction when a control pulse initiates conductivity. They are used as controlled rectifiers, as switches or as amplifiers and function as two interlocking, complementary transistors with a common collector/base junction.

(2) **Triacs** (bi-directional triode thyristors), consisting of five conductivity regions in semiconducting materials (four p n junctions) through which an alternating current passes when a control pulse initiates conductivity.

(3) **Diacs**, consisting of three conductivity regions in semiconducting materials (two p n junctions) and used to provide the pulses required to operate a triac.

(4) **Varactors** (or variable capacitance diodes).

(5) **Field effect devices**, such as gridistors.

(6) **Gunn effect devices**.

However, this group **does not include** semiconductor devices, which differ from those described above in that their operation depends primarily on temperature, pressure, etc., such as non-linear semiconductor resistors (thermistors, varistors, magneto resistors, etc.) (**heading 85.33**).

For photosensitive devices the operation of which depends on light rays (photodiodes, etc.), see group (B).

The devices described above fall in this heading whether presented mounted, that is to say, with their terminals or leads (for example pins, leads, balls, lands, bumps or pads mounted on a carrier, e.g., a substrate or a leadframe) or packaged (components), unmounted (elements) or even in the form of undiced discs (wafers). However, natural semiconductor materials (e.g., galena) are classified in this heading only when mounted.

The semiconductor-based transducers of this group, however, do not cover silicon based sensors, actuators, resonators, oscillators and combinations thereof, containing one or more monolithic, hybrid, multi-chip or multi-component integrated circuits as defined in Note 12 (b) (iv) (3) to this Chapter (**heading 85.42**).

The heading also excludes:

(a) Chemical elements (for example, silicon and selenium) doped for use in electronics, in forms unworked as drawn, or in the form of cylinders or rods (Chapter 28), when cut in the form of discs, wafers or similar forms (**heading 38.18**).

(b) Chemical compounds such as cadmium selenide and sulphide, indium arsenide, etc., containing certain additives (e.g., germanium, iodine) generally in a proportion of a few per cent, with a view to their use in electronics, whether in the form of cylinders, rods, etc., or cut into discs, wafers or similar forms (**heading 38.18**).

(c) Crystals doped for use in electronics, in the form of discs, wafers, or similar forms, polished or not, whether or not coated with a uniform epitaxial layer, provided they have not been selectively doped or diffused to create discrete regions (**heading 38.18**).

(d) Electronic integrated circuits (**heading 85.42**).

(e) Micro-assemblies of the moulded module, micromodule or similar types, consisting of discrete, active or both active and passive, components which are combined and interconnected (generally **Chapters 84, 85 or 90**).

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Annex 7

2023 GAMS Workshop on Regional Support

5 minc	**Welcome and Introduction by GAMS Chair**	**US GAMS Chair**
10 min	WSC Guidelines & Best Practices	Regional Support TF Chair
140 min	Presentation on Phase 3 Programs	GAMS Delegates
15 min	Coffee Break	
40 min	Presentation on Phase 1 and 2 Programs Identified for Further Information (listed in the Annex to the GAMS November 5, 2021 Chair man's summary)	GAMS Delegates
10 min	Update from the WSC on Government/Authorities Transfer Best Practice	Regional Support TF Chair
10 min	Regional support programs in 3rd countries	Regional Support TF Chair
10 min	Conclusions	US GAMS Chair