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Public Comments

November 8, 2021

Bureau of Industry and Security
Office of Technology Evaluation
United States Department of Commerce

Re: Notice of Request for Public Comments on Risks in the Semiconductor Supply Chain
Docket No. BIS 2021-0036 or RIN 0694-XCO84

Dear Sir or Madame,

BorgWarner is a global product leader in sustainable mobility solutions for the vehicle market. Our company's origins date back to the 1880s in the United States (U.S.) and we have grown to a publicly-traded company, employing 50,000 people worldwide in 23 countries. As an American company headquartered in Auburn Hills, Michigan, we employ over 7,000 people in 18 manufacturing and technical centers in eight states across the U.S.

BorgWarner appreciates this opportunity to offer the following responses to the second question posed in the Department's RIF pertaining to *"intermediate and end users of semiconductor products or integrated circuits:"*

a. Identify your type of business and the types of products you sell.
BorgWarner is an original equipment supplier of sustainable mobility solutions to nearly every major automotive OEM in the world and operate manufacturing facilities, serving customers in Europe, the Americas and Asia. Our products help improve vehicle performance, propulsion efficiency, stability, and air quality. We manufacture and sell these products worldwide, primarily to original equipment manufacturers (OEMs) of passenger cars, SUVs, vans, and light trucks. Our products are also sold to OEMs of commercial vehicles and off-highway vehicles. Additionally, we manufacture and sell our products to certain tier one vehicle systems suppliers and into the aftermarket for light, commercial and off-highway vehicles.

b. What are the (general) applications for the semiconductor products and integrated circuits that you purchase?

BorgWarner manufactures components and technologies for all major types of vehicle propulsion systems. BorgWarner's products with semiconductors include components and systems we produce and components we purchase for integration into a component or system in a vehicle (Figure 1).

Figure 1: BorgWarner Products with Semiconductors

Product	General Application	Produced by BorgWarner	Purchased from supplier
[ ]	[ ]	[	
[ ]	[ ]		
[ ]	[ ]		
[ ]	[ ]		
[ ]	[ ]		
[ ]	[ ]		
[ ]	[ ]		
[ ]	[		]

c. For the semiconductor products that your organization purchases, identify those that present the greatest challenge for your organization to acquire. Then for each product, identify the product attributes and purchases in 2019 and 2021, as well as average monthly orders in 2021. Then estimate the quantity of each product your organization would purchase in the next six months barring any production constraints as well as the amount your organization expects to actually be able to purchase. For each of your organization's top semiconductor products, estimate each product's lead times and your organization's inventory for (a) 2019 and (b) currently (in days). Provide an explanation of any current delays or bottlenecks.

The requested data is difficult to segregate for several reasons:

- In 2019, BorgWarner had not yet acquired Delphi Technologies.
- Our 2021 data reflect new products, resulting from both BorgWarner's shift and significant acceleration into e-products for the electric vehicle market and BorgWarner's acquisition of Delphi Technologies and other acquisitions.
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Therefore, we offer the following data by total volume of purchases that were budgeted for 2020 (budgeted before the COVID-19 pandemic) and estimated 2021 volumes (Figure 2).

Figure 2: BorgWarner 2020 (Budgeted) and 2021 Semiconductor Volumes

Semiconductor Type	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]

[Application Specific Integrated Circuits, Application Specific Standard Parts]	[ ]	[ ]	[ ]	[ ]
[Discretes]	[ ]	[ ]	[ ]	[ ]
[Memory]	[ ]	[ ]	[ ]	[ ]
[Microcontrollers]	[ ]	[ ]	[ ]	[ ]
[MEMS]	[ ]	[ ]	[ ]	[ ]
Standard Logic]	[ ]	[ ]	[ ]	[ ]
[Transceivers/Receivers/ Transmitters]	[ ]	[ ]	[ ]	[ ]
[Grand Total]	**[ ]**	**[ ]**	**[ ]**	**[ ]**

As vehicles become more technologically advanced, it is believed that the demand for semiconductors will increase incrementally. Investments in the semiconductor supply chain need to be made to support this future demand. Moreover, improvements to the speed and cost to produce semiconductor products must be global in scope and impact.

d. What are the primary disruptions or bottlenecks that have affected your ability to provide products to customers in the last year?

As is the case with nearly all tier-one suppliers to the automotive industry, the current business environment and market conditions in which we operate are extremely challenging in the short term. U.S. automotive suppliers like BorgWarner continue to face rising costs and increased prices due to, among other things, semiconductor shortages, COVID-19 shutdowns in some parts of the world, delays at domestic and international ports, and overall inflation in packaging, freight, and raw materials costs. All of these factors have stressed the supply chain to the point of limiting production outputs in the U.S. and globally.

The main contributors to the semiconductor shortage are:

- The shortage of wafers driven by the auto industry's self-imposed production stoppages at the onset of the COVID-19 pandemic in early 2020.
- High demand due to remote work and school: With a significant portion of the workforce and K-12 schools working remotely as a result of COVID-19-related orders and regulations, the demand for consumer electronics, such as personal computers, also increased. Semiconductor producers shifted their focus to wafers for personal computers and other consumer electronics.
- Large companies and governments buying and reserving capacity at the beginning of the pandemic.
- COVID-19 outbreaks in regions like Malaysia, where high concentrations of semiconductor manufacturers are located, caused disruption to production.

- Weather-related disruptions in other regions, such as the winter storms in Texas and earthquakes in Japan, also caused production shutdowns.
- A significant number of suppliers are located in Asia and experienced a number of events that disrupted their production capabilities in 2020. In Japan, accidental facility fires occurred at several supplier sites.
- As a strategy to achieve its CO_2 emissions targets in China, the government-initiated brownouts of the electrical grid caused disruptions to its semiconductor suppliers' production. Manufacturers are typically only given a few hours' notice prior to such brownouts, providing them little time to prepare. With the Winter Olympics approaching in 2022, these regions could continue to see more brownouts.
- The lack of confidence of semiconductor suppliers that the demands from the Automotive industry, therefore, the semiconductor industry were (and still are) hesitant to invest.

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] These delays are due to capacity issues resulting from, among other things, the imbalance of significantly more imports coming from China than exports leaving the U.S., added regulatory scrutiny at the ports due to COVID-19, and shortages of chassis (containers) and other cargo-related equipment. There appears to be no relief in sight as the U.S. is heading into its peak retail holiday season. The demand continues to outpace capacity and pricing continues to increase.

The U.S. government's pandemic rescue incentives have helped to temporarily alleviate these impacts through 2020-2021. However, with the rescue incentives ending, the impacts are now becoming visible to industry. [

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Because of these port back-ups and delays, suppliers have had to manage overtime, shutdowns, significant price increases, and limited volumes. [

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e. Is your organization limiting production due to lack of available semiconductors? Explain.

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f. What percentage of your current production has your organization had to defer, delay, reject, or suspend in the past year? Explain.

We are able to offer the following industry sales volume data:

- 2020 Global light vehicle production was 74.6M units.[i]
- 2021 Global light vehicle production was forecast to be 84.3M units in January 2021. The latest market view is 74.8M units. Roughly ~10M (-11%) units are forecasted to have been lost as a result of supply chain disruptions in 2021. Semiconductors are the major reason, but there are also a number of other challenges the industry is facing: plastics, resins and rubber shortages, lack of container capacity, port side bottlenecks, steel supplies & prices, etc. [ii]

g. Is your organization considering or carrying out new investments to mitigate semiconductor sourcing difficulties? Explain.

In some circumstances, we are investing in dual sourcing (using two suppliers for a given material, component, or product), which requires significant engineering, capital, and time. It is important to understand that adding or switching to new suppliers takes significant time and effort. For the automotive industry, the quality and consistency of materials and components are of utmost importance because they can impact, among other things, vehicle performance. Our technologies can take many years to refine and often require specialized materials in engineering and production. Our products are calibrated with our customer's propulsion systems and validated for performance and durability upon initial designs. Before a product is approved by our customer for production, our engineers must validate its performance. The testing process encompasses production validation, engineering studies, results analyses, and final reporting to our customer. If a new supplier passes these tests, BorgWarner engineers present data, analyses, and conclusions to our customers, who have the final decision to approve our new supplier. In total, this process could take up to twelve months or more. If a supplier fails a test, this time-frame could double.

Furthermore, due to the technical nature of the products, our customers may also require their own extensive independent testing and validation of any and all suppliers to ensure adequate product performance, which adds further time and costs. [

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As a tier-one supplier, BorgWarner typically manages the input and output of products between our downstream suppliers and our customers. [

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h. What semiconductor product types are most in short supply and by what estimated percentage relative to your demand? What is your view of the root cause?

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A recent Wall Street Journal report summarizes the ongoing issues as follows: *Semiconductor manufacturers are facing their own supply chain problem. Chip makers can't ramp up production fast enough to meet unprecedented global demand because of short supplies of key materials and pandemic-driven factory shutdowns in Southeast Asia. The production constraints are slowing deliveries to customers and may cut into earnings at the manufacturers despite the clamor for chips... IHS Markit projects the chip market is unlikely to see supply and demand equilibrium before the middle of next year*.[iii]

The problem is even more acute in certain segments of the chip market. MCU controllers—a key component in automobiles—are now averaging lead-times of around 32 weeks, according to Susquehanna's data. That is nearly three times the historical norm. (But this is only to produce them when there is capacity available. But the main problem today is that there is not enough capacity.) *As a result, car makers continue to cut production targets; market research firm IHS Markit reduced its light-vehicle production forecast for next year by 9.3% on Sept. 16.*[iv]

The number of semiconductors in a modern car, from the ignition to the braking system, can exceed a thousand. As the global chip shortage drags on, car makers from General Motors to Tesla find themselves forced to adjust production and rethink the entire supply chain. For instance, materials such as substrates—used to tie components of a single chip together—are in short supply.[v]

Our view the root cause of semiconductor shortages can be linked to increased global demand and barriers to investment and complexity of semiconductor manufacturing.

Increased Global Demand:
Regarding increased global demand, as we mentioned above, the COVID-19 pandemic has impacted production levels and the overall increased demand for semiconductors. After idling plants due to COVID-19 in early 2020, many vehicle manufacturers revised their forecasts downward. During that time, semiconductor producers shifted their production accordingly by either idling capacity to reflect current demand or refocusing their production

to other sectors. When the automotive industry restarted, the demand for vehicles outperformed the industry forecast. This increase in vehicle demand, coupled with higher levels of electrification and electric vehicles in production, resulted in a demand for semiconductors that was higher than it had been in previous years. However, semiconductor manufacturers that refocused their production to other sectors could not quickly shift their production back to the automotive industry as production lead times can be upwards of 52 weeks.

Semiconductor production capacity is typically allocated according to the relative aggregate demand of an industry. Semiconductor companies may be cautious to commit production capacity to industries where utilization is relatively low. The automotive industry's semiconductor utilization only makes up approximately ten percent of the global market and this utilization may decline in overall volume within semiconductor industry. The automotive industry was the only sector with a net decrease of revenue through the COVID-19 pandemic, leading to a further reduction of semiconductor utilization to about 8% of the global market, with an overall semiconductor market growth of about 9%.[vi]

Barriers to investment and complexity of semiconductor manufacturing :
Semiconductor foundries, which conduct the front-end manufacturing process, are capital intensive operations. High capital costs create barriers to entry. U.S. semiconductor manufacturing capacity has been stable for many years, but most new and advanced capacity is located overseas.[vii] The semiconductor business is complex and requires wafer manufacturing (front end, blank substrates), assembly, and testing (back end). These three segments were once integrated as one business but are now segregated into three interconnected businesses within the semiconductor production industry. The assembly and testing (back end) business is dependent on wafer production, and both activities must be in equilibrium in order to supply to various industries.

In addition to its production complexity, semiconductor manufacturing requires extraordinary amounts of upfront capital expenditures with a relatively slower return on investment than other businesses.

i. Has your organization changed its material and/or equipment purchasing levels or practices in the past three years?
See our response to question g.

j. What single change (and to which portion of the supply chain) would most significantly increase your ability to purchase semiconductors in the next six months?

The U.S. needs to work together with other countries to diversify supply. Increasing and diversifying the supply of components and materials around the globe, including in the U.S., is vital to domestic vehicle parts manufacturers. Industry needs access to a stable supply of semiconductors, especially as vehicles become more technologically advanced and electrified. Increasing semiconductor production in the U.S. will help but is not a long-term solution.

We encourage international collaboration and positive trade relationships between the U.S. and other countries. Certain trade actions are still hurting the industry: Sec 301 China Tariffs continue to negatively impact our company; Sec 232 Steel & Aluminum Tariffs should be removed; USMCA automotive rules of origin (ROO) do not align with global supply capability and should be adjusted with more flexibility for industry. [

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Positive financial incentives are critical to encourage domestic semiconductor production. BorgWarner appreciates the CHIPS Act/United States Innovation and Competition Act (allocates $2B of the $52B of federal funding for U.S. automotive semiconductor production) to help incentivize semiconductor production in the U.S.

k. What percentage of your orders are fulfilled by distributors versus though direct purchase orders to semiconductor product manufacturers?

At most, [ ] of our printed circuit board assembly (PCBA) orders come from distributors. In other cases, we may purchase from electronic manufacturing supplier (EMS, who are the producers of PCBA), outsource, or produce our own PCBA.

l. For the semiconductor products your organization purchases, how long (in months) are the typical purchase commitments? How, if at all, do your organization's purchase commitments differ for products in short supply?

Typically, our commitments to our suppliers are [ ] under normal conditions. Our OE customers provide forecasts, [
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m. Has your organization faced ''decommits'' (defined as a notification from a supplier that expected or committed supply will not be delivered in the agreed-upon time and quantity) in recent months? If this is a significant issue, please explain (e.g., nature of product, supplier, impact).

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We appreciate this opportunity to offer this information and hope this data is helpful to the Department of Commerce. Thank you for your consideration.

Kind regards,

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[i] IHS Markit. October 2021.
[ii] IBID.
[iii] *Chip Shortage Not Great for Chip Makers Either*. Wall Street Journal. October 18, 2021.
[iv] *Car Companies Buckle Up for Extended Chip Shortage*. Wall Street Journal. October 18, 2021.
[v] IBID
[vi] *Automotive Semiconductor Shortage*. McKinsey & Company. July 2021.
[vii] *Semiconductors: U.S. Industrial, Global Competition, and Federal Policy*. Congressional Research Office. October 26, 2021.