Can the Auto Industry Avoid Another Chip Shortage?

automoblog.net/can-auto-industry-avoid-another-chip-shortage/

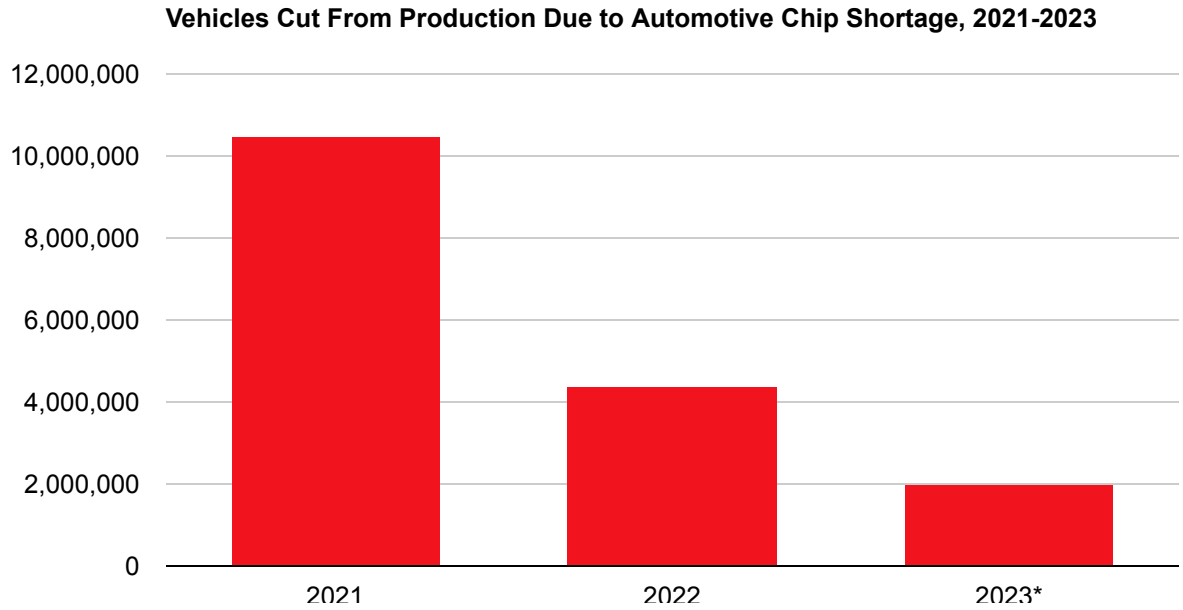
While many components of the automotive supply chain have faced disruptions over the last several years, few have been as impactful as the semiconductor shortage. The shortage caused automakers to remove millions of vehicles from production schedules and cost hundreds of billions in lost revenue.

By most assessments, the current chip shortage is still an issue but is on the path to recovery. As the final quarter of 2023 approaches, automakers are removing fewer and fewer vehicles from production. But the current chip shortage caught the industry completely off-guard, which means that the next one could strike at any time and without warning. Is the auto industry prepared?

The Chip Shortage Upended the Auto Industry and Still Isn't Over

Since the onset of COVID-19 and the global automotive supply chain issues that followed, the chip shortage has had a profound impact on the automotive industry. According to data from supply chain analyst AutoForecast Solutions, the semiconductor shortage forced

manufacturers around the world to remove nearly 15 million vehicles from production schedules in 2021 and 2022. As a result of the shortage, the auto industry lost an estimated $210 billion in 2021 alone.



Year	Vehicles Cut From Production
2021	10,500,000
2022	4,400,000
2023*	2,004,000

Automakers weren't the only ones impacted. As the chip shortage started to reduce the supply of new vehicles, people looking to buy a car were hit with skyrocketing prices. According to data from the U.S. Bureau of Labor Statistics (BLS), the consumer price index (CPI) of new vehicles rose only 0.47% in the five years between January 2015 and January 2020. In the three-and-a-half years since then, the new vehicle CPI has risen 22%.

The dramatic increase in new vehicle prices pushed many buyers toward used cars. This, in turn, caused an even bigger spike in used vehicle prices. Between January 2015 and January 2020, the used vehicle CPI actually decreased by 4.5%. Since then, it has increased by 41.7%.

More than three years after the start of supply chain issues, the chip shortage has started to wane in 2023. After removing 10.5 million units from production in 2021 and 4.4 million in 2022, automakers have only cut 524,000 in the first half of this year.

While this represents a noteworthy improvement over the past two years, removing more than half a million vehicles from production is still a substantial loss. According to AutoForecast Solutions, which tracks the impact of the chip shortage, the industry is likely to see bigger losses by the end of the year. Following recent announcements of more cuts in Asia and North America, the organization estimated that the number of vehicles cut from production globally will surpass 2 million by the end of 2023.

A Perfect Storm of Factors Created the Current Chip Shortage

One of the biggest reasons that the current chip shortage has had such a massive impact on the auto industry is that it hit the industry by surprise. While some may have seen a pandemic as possible, few could have predicted how COVID-19 would affect industries and supply chains around the world.

But COVID was only one of several factors that combined to create the current shortage. Unlike the virus, other contributing factors now seem like red flags in retrospect.

Just-in-Time Manufacturing

The practice of just-in-time (JIT) manufacturing – also known as lean manufacturing – began as early as the 1950s and took off in the 1980s. By 2019, the practice had become more or less the standard way of operating for auto manufacturers.

Instead of producing a surplus and hoping to sell the units produced, the JIT model attempts to match production to demand. In this model, manufacturers essentially only produce products that have already been ordered. This method is intended to reduce waste and improve manufacturing efficiency.

This model proved successful for automakers when there were no major supply chain disruptions. But once factories and shipping hubs around the world started to see closures due to the pandemic, companies were left without a robust reserve stock to fall back on. Since the JIT model was used by companies that make cars, components for vehicles, and even parts of components, the effect of production stoppages compounded quickly. The result was disruptions at nearly every step in the auto supply chain, including in semiconductor manufacturing.

Geopolitical Struggles

Leading up to the semiconductor shortage, tensions were escalating between several major countries around the world. A trade war between the U.S. and China officially began in 2018 when the Trump administration imposed tariffs and other trade barriers against the country. While the two sides reached an agreement in 2019, tensions continued and many of the tariffs introduced in 2018 still remain to this day.

The trade conflict heated up again in January 2023 when the U.S. and EU announced that they would block the export of technology to China that would allow companies there to manufacture advanced semiconductor chips. This came just five months after the U.S. passed the Inflation Reduction Act, which included massive subsidies and tax credits intended to incentivize domestic production of electric vehicle (EV) components.

Russia's invasion of Ukraine also contributed to the shortage. Before the invasion, Ukraine produced around half of the world's purified neon gas, which is a critical material in the manufacturing of semiconductor chips. Conflict in the region caused Ukrainian companies to stop production and severely impacted supply lines.

Increased Semiconductor Demand

In the years before the shortage, automakers were using more and more semiconductor chips in each vehicle. Newer technologies like advanced driver assistance systems (ADAS), onboard diagnostics systems, and communication and entertainment systems rely heavily on the use of semiconductors. Automakers also increasingly use chips to perform tasks that were previously mechanical, such as speed regulation and even basic functions such as braking.

Additionally, EVs had started to take up a rapidly increasing share of the market. Since they are highly computerized, EVs use about twice as many chips on average as internal combustion engine (ICE) vehicles. The growth of the EV sector wasn't limited to the U.S., either. EV sales skyrocketed throughout North America, Europe, and Asia leading up to 2020.

These two trends combined to result in a dramatic increase in demand for semiconductors. After the shortage began, more manufacturers were left with fewer chips to use and longer wait times to get them.

The Semiconductor Supply Chain Is Changing

The automotive supply chain – and especially the semiconductor supply chain – has undergone significant changes since the onset of the chip shortage. Losses caused by the shortage exposed how critical a reliable supply of semiconductors is to automakers and parts suppliers. It also underscored how fragile that supply chain could be.

Throughout the industry, companies have begun signing large contracts with semiconductor suppliers to lock in a consistent supply. In February, General Motors (GM) announced a long-term partnership with GlobalFoundries to produce components for its vehicle semiconductors. Then, in July, Stellantis signed $11.2 billion worth of contracts with companies that include Infineon Technologies, NXP Semiconductors, and Qualcomm, among others.

It's not just auto manufacturers that are scrambling. American automotive component manufacturer BorgWarner announced in July that it was expanding its deal with chip manufacturer Onsemi to secure a supply of chips for its power modules used in traction inverters. German manufacturer Bosch announced that it was buying assets of TSI Semiconductor, including the company's plant in Roseville, California. The company said that it intends to invest $1.5 billion to optimize the site for automotive semiconductor production. This followed an announcement that the company was spending $274.5 million to expand a Reutlingen, Germany, semiconductor fab.

Bosch's investment in the California plant is an example of another trend that's developing in the semiconductor supply chain. The uncertain state of international supply chains has aided a shift toward domestically produced chips that aren't subject to political struggles or international trade policy. Companies like Wolfspeed had already been growing their chipmaking operations in the U.S. before the shortage, but that growth has accelerated in the last few years.

With the passing of the Inflation Reduction Act, the federal government made billions of dollars in subsidies available to companies who committed to producing EV components domestically – including semiconductors. One section of the new law, known as the Creating Helpful Incentives to Produce Semiconductors (CHIPS) Act, appropriates $54.2 billion for domestic chip production.

As a result, companies have made massive investments in domestic semiconductor manufacturing. In an August press release, the White House said that companies have announced $166 billion in investments in semiconductor manufacturing since the law's passage.

Some companies have also started to move away from the JIT manufacturing model that left so many without a supply cushion over the past several years. Automakers and parts manufacturers have begun to revamp the model by using AI and integrated data processing to make better predictions about manufacturing needs. Companies such as Toyota have started to grow their semiconductor inventory to help weather future lapses in production.

Threats to the Semiconductor Supply Chain Still Exist

Many of these tactics address the root causes of the current chip shortage. However, several of the issues behind the current shortage have yet to be resolved.

The trade war between the U.S. and China has shown no signs of cooling and semiconductors have become one of the central sources of tension in recent years. In October 2022, the Biden administration announced tight restrictions on selling semiconductors and related products to Chinese businesses and individual citizens, requiring special licenses issued by the federal government to do so.

The Chinese Ministry of Commerce hit back in July, announcing that it would restrict the export of gallium and germanium – two materials critical to the production of semiconductors. Currently, China produces roughly 90% of the world's gallium and 60% of its germanium. In August, Biden took things a step further by signing an executive order that bans U.S. investment in Chinese projects related to advanced technology that includes semiconductors.

Russia's invasion of Ukraine has continued to limit that country's ability to produce and move goods. The country was producing 70% of the world's neon gas before the invasion and 90% of the neon gas used in the U.S. While countries like Japan, China, and South Africa also produce neon gas, the current conflict in Ukraine will continue to severely limit supplies into the foreseeable future.

Demand for semiconductors also appears to only be increasing. While cars in general are using more chips in their construction, the explosion in the number of EVs sold in recent years has translated into exponential growth in semiconductor demand. Experts predict that more than 2 million additional EVs will hit the road between 2023 and 2028. If this prediction holds true, the U.S. auto industry alone will need 3 billion more semiconductors than it would if those cars were ICE-powered vehicles.

The Chip Supply Chain Is Now More Resilient, but Questions Loom

Manufacturers in the automotive industry have clearly recognized the need to rethink their semiconductor supply chains. Companies have taken steps like securing large contracts with producers to bolster chip inventory and shifting toward domestic producers to reduce potential variables in the supply chain. These changes and others should help to minimize the impact of future disruptions to production or logistics.

Even so, the semiconductor supply chain is still at the mercy of factors beyond manufacturers' control. Escalating trade tensions between the U.S. and China could result in more policies and regulations that force companies to make major changes to supply lines. Explosive growth in the EV sector could push demand beyond capacity as manufacturers have yet to catch up from the current shortage. And the current rush by manufacturers to lock down semiconductor supplies could reduce the number of chips that are not claimed under contract, thereby making the semiconductor supply chain less flexible in the future.

The shortage emphasized the vital importance of semiconductors to the modern automotive industry. It also highlighted some factors that made the supply chain so fragile leading up to the shortage. The ongoing presence of these factors, as well as new challenges on the horizon, accentuate the need for the auto industry to continue making the chip supply chain more robust and resilient in preparation for the next massive, unpredictable event.