Global Semiconductor Market Update

A survey of research data and insights covering the semiconductor industry

2H 2021

Omdia Semiconductor Research Team

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Executive Summary

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Global Semiconductor Market Update – 2H 2021

- **Semiconductor industry overview**
  - Pandemic-driven consumption trends drove +10.4% YoY growth for semiconductors in 2020
    - Growth trends are expected to continue in 2021
    - 5G-related applications will continue to drive growth for years to come
  - Chip shortage contributed to softer Q1 pullback than normal for semis – but not far off historic trends
  - Consumption trends are little changed from pre-pandemic levels
- **Power Semiconductor**
  - Automotive rebound, 5G buildout, data center expansion, and the growth of AI continue to drive growth in power semis

- **Memory & Storage**
  - DRAM supply & demand are trending up
  - Ramp-up in NAND supply could reduce ASP increases
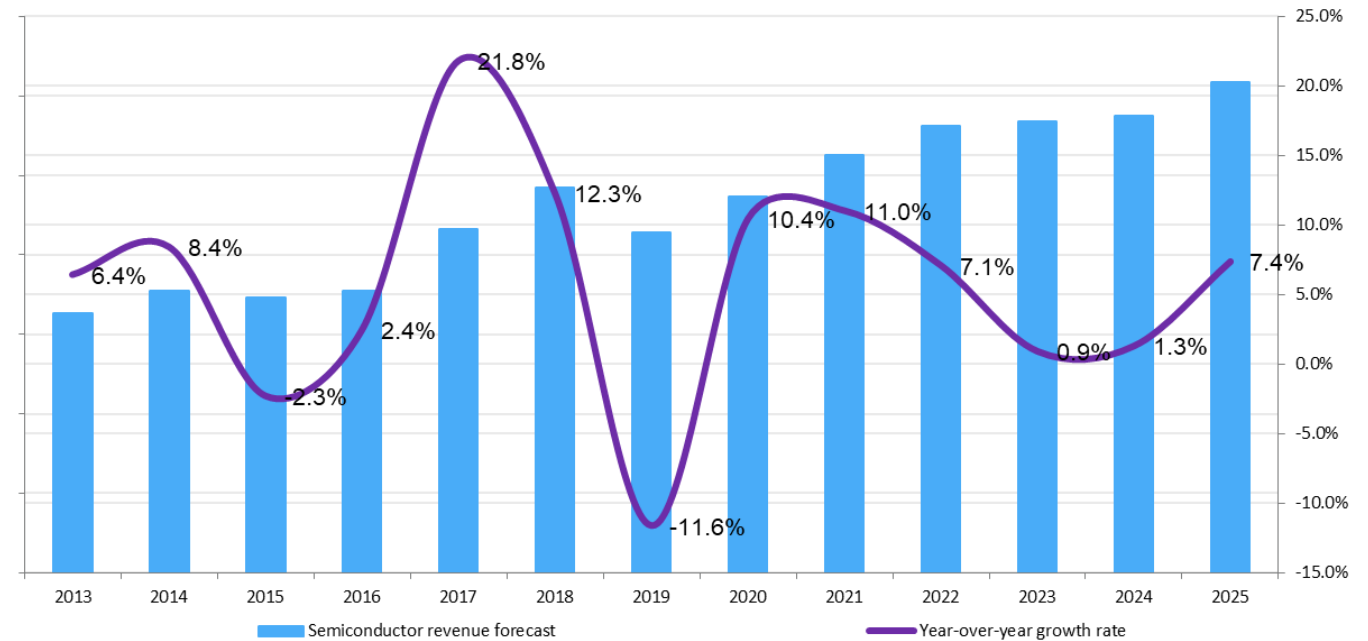- **Processors**
  - Notebook PCs and data center servers top growth drivers for MPUs
  - High-tier smartphones and data center servers lead drivers for growth in Processors for Graphics & AI
  - Stable growth for MCUs
  - SoCs represent processors' largest overall opportunity to target, slightly ahead of microprocessors.

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Industry Overview

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Semiconductor industry overview

- With remote working/learning demands due to COVID-19, the year 2020 concluded with +10.4% YoY growth for semiconductors, primarily due to the demands of electronics products such as PC/NBs, 5G smartphones, LCD TVs, gaming, networking/WiFi, datacenters/servers, etc.

- With the same demands lasting into 2021, plus the strong recovery of automotive components, Omdia forecasts that 2021 will have around +11.0% YoY growth compared to 2020. 5G-related applications will still be the driving force in the years to come.

- While the memory inventory adjustment completed in 4Q20 and demand started to pick up beginning in 1Q21, Omdia forecasts that memory will outperform the total semiconductor industry in 2021 and 2022.

Semiconductor revenue growth, 2013-2025

Bar chart legend: Semiconductor revenue forecast — Year-over-year growth rate

Growth rate values: 6.4% (2013), 8.4% (2014), -2.3% (2015), 2.4% (2016), 21.8% (2017), 12.3% (2018), -11.6% (2019), 10.4% (2020), 11.0% (2021), 7.1% (2022), 0.9% (2023), 1.3% (2024), 7.4% (2025)
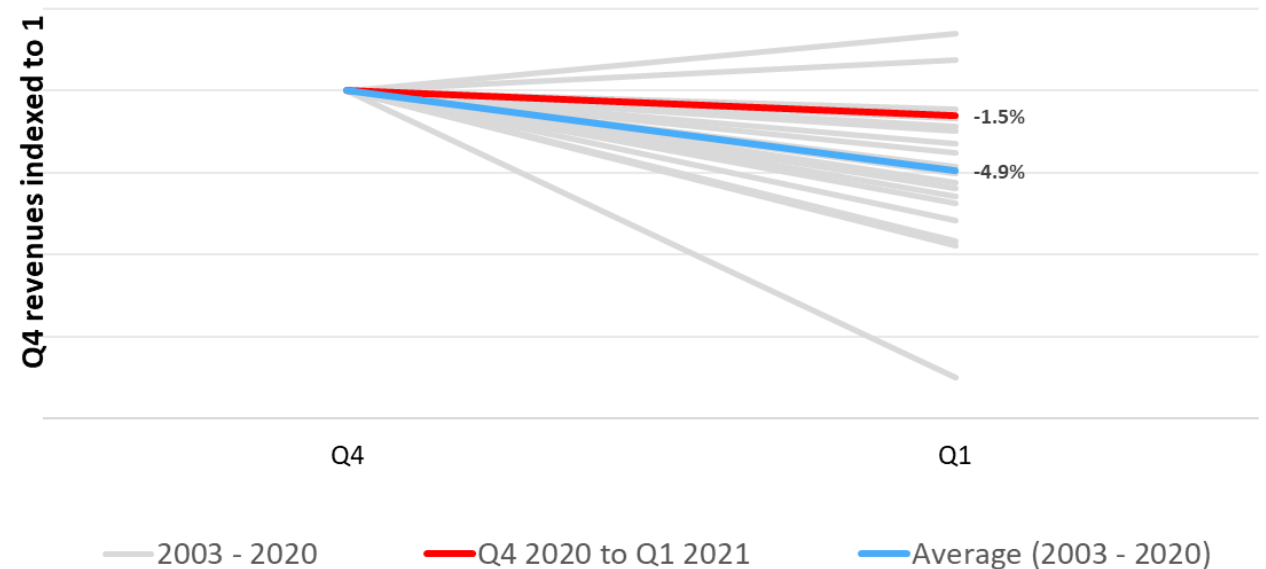
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1Q21 – was it really that short?

- Semiconductor revenues typically decline from Q4 to the following Q1, with an average 4.9% drop in revenues from 2003 through 2020, excluding the highly volatile memory segment

  - High demand in Q4 is typically followed by a pullback in Q1

- For 1Q 2021, semiconductor revenue declined just 1.5%, excluding memory

  - Despite the chip shortage putting the squeeze on supply, revenues still fell, albeit not by as much as the usual trend

- Note that *including memory*, semiconductor revenue in 1Q 2021 *rose* by 0.5% compared with 4Q 2020 – only the third time that has occurred since Omdia began tracking data in 2002

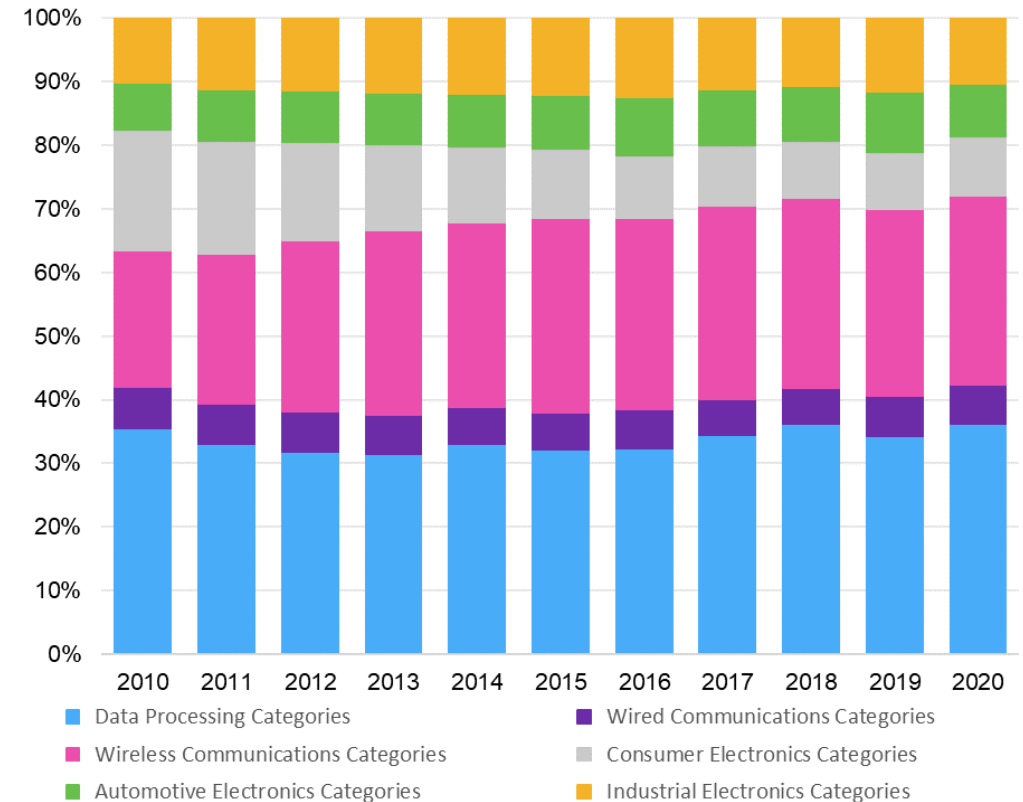**Semiconductor revenue (excluding memory) QoQ %**

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Is the post COVID-19 semiconductor landscape altered?

- The share of semiconductor revenue by application is largely the same today as it was immediately before the pandemic occurred
  - None of the major application groups changed by more than one percentage point in the three quarters after the global economy began reopening compared to the three years prior.

- The segment that gained the most was consumer, rising 0.68 percentage points after the crisis.

- With consumers spending much more of their lives at home due to work-from-home and educate-from-home, demand for consumer devices increased.

- The industrial semiconductor revenue segment was the application that saw the greatest negative impact, declining one percentage point, from 11% of the overall semiconductor market prior to the global pandemic to 10% after.

Semiconductor revenue share by application

Legend:
- Data Processing Categories
- Wired Communications Categories
- Wireless Communications Categories
- Consumer Electronics Categories
- Automotive Electronics Categories
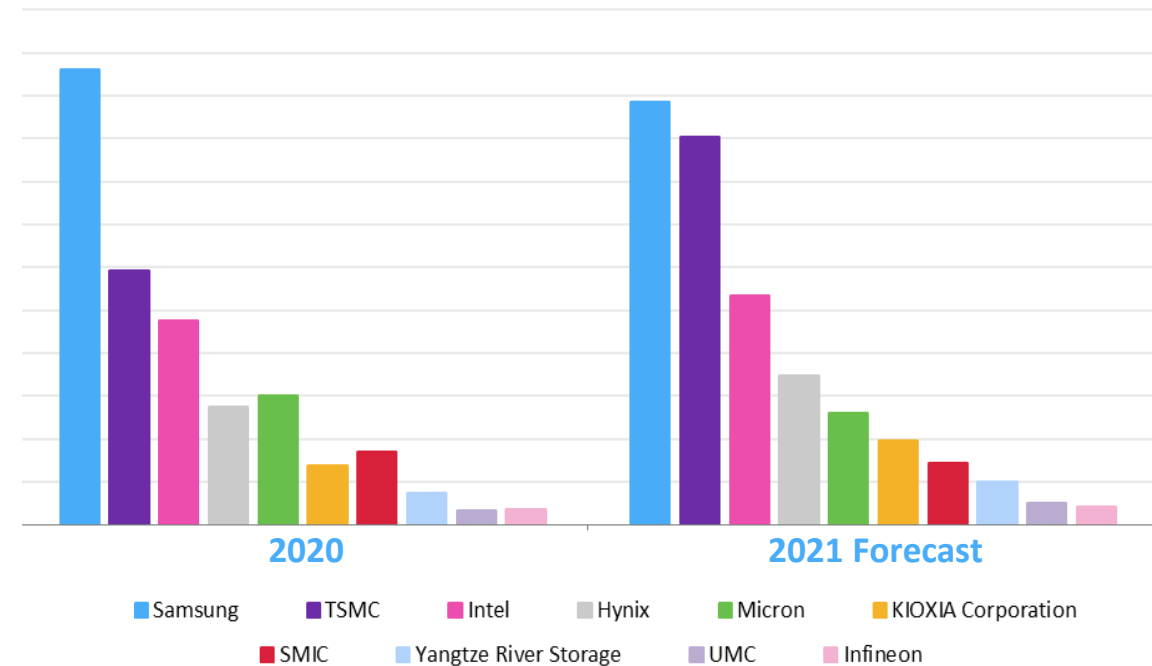- Industrial Electronics Categories

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More insights into ... 200mm wafer capacity

- For the past four years, the semiconductor industry has consistently experienced substantial growth, but the available global 200mm wafer capacity has only increased slightly. 200mm factories have been running at full utilization rates since 2017, yet very little additional capacity has been added.

- As a result, the entire semiconductor industry is faced with very high utilization of 200mm manufacturing and continuing demand for 200mm products, while foundry companies have been looking for opportunities to expand their 200mm capacities. There has been little progress.

- Omdia expects that IDMs will have to invest in additional manufacturing capacity. But due to the cost of 200mm capacity, Omdia predicts that the expansions will be 300mm fabs. The 200mm capacity situation will likely not be resolved quickly and will require a combination of technology transfers from 200mm to 300mm combined with 200mm foundry expansion.

**Capital Expenditure for Top 10 Semiconductor Manufacturers**

2020   2021 Forecast

■ Samsung   ■ TSMC   ■ Intel   ■ Hynix   ■ Micron   ■ KIOXIA Corporation
■ SMIC   ■ Yangtze River Storage   ■ UMC   ■ Infineon

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More insights into ... IDM Inventory

Integrated device manufacturers (IDMs) built inventory through 3Q20, but 4Q20 inventory levels decreased due to stronger than expected 4Q20 sales, mostly for Analog and Discrete technology products on 200mm
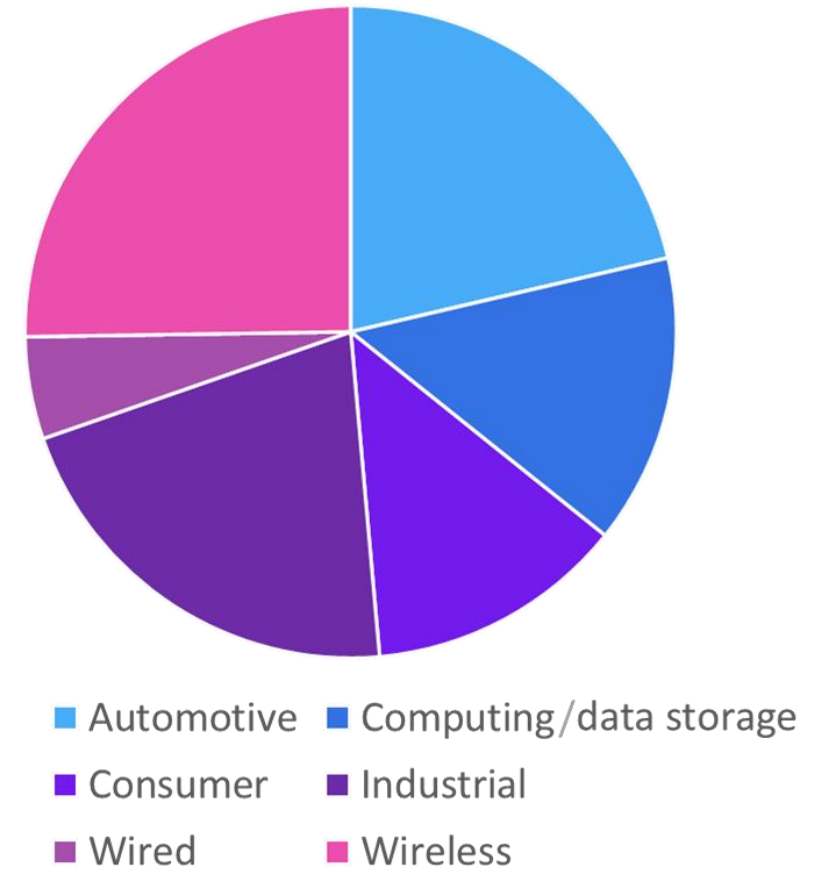
Total IDM inventory by stage of completion

Raw Material — WIP — Finished Goods — DOI
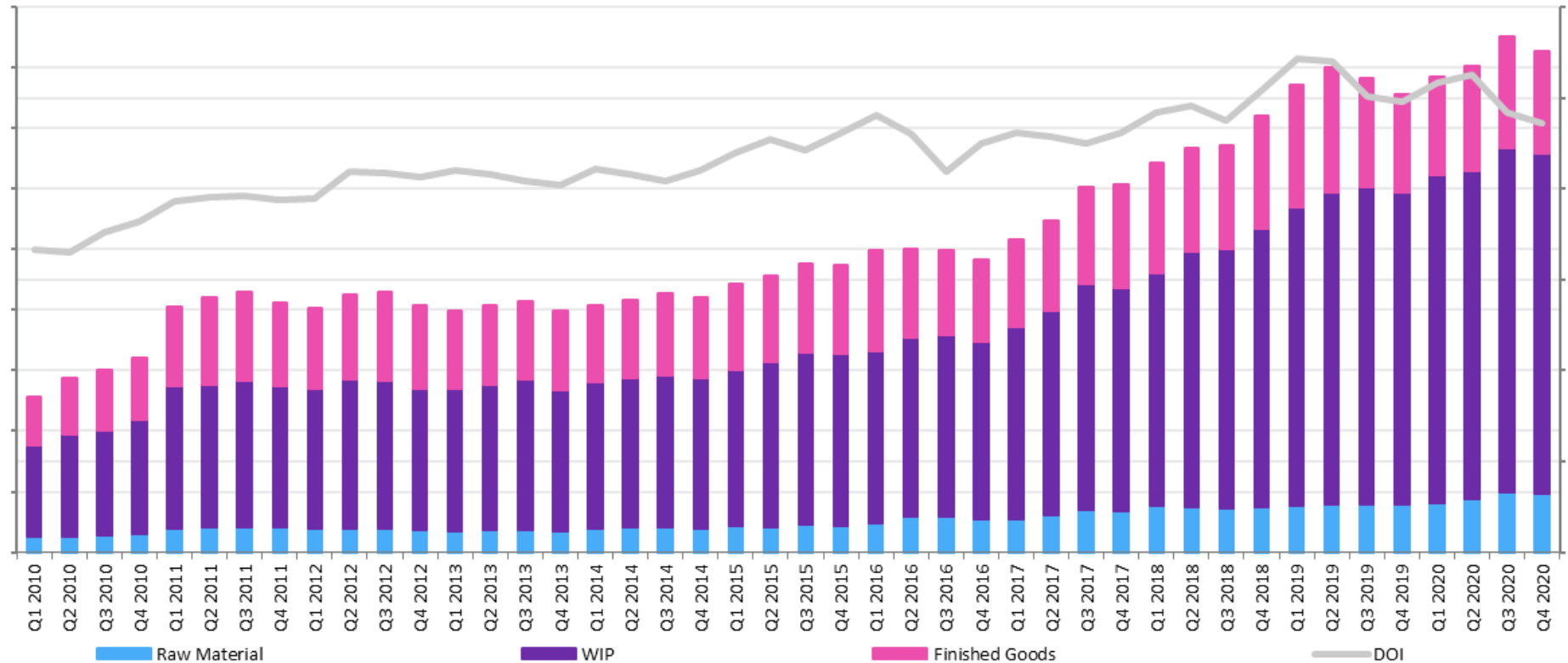
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Power Semiconductor

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Current Trends in Power Semiconductors

- Automotive builds are expected to rebound in 2021. Power IC growth opportunities are largest in components related to hybrid electric vehicle (HEV)/EV expansion such as battery management ICs (BMICs) and high current gate drivers.

- Carriers are building out 5G networks in phases to capture evolving standards. 5G-capable handsets will require more power IC components to handle new radios and features, increasing the need for power management ICs (PMICs) and BMICs.

- Data center and artificial intelligence (AI) markets are more attractive than ever. The at-home economy has driven data center installations to new highs. Average rack power is increasing, driving the need for new rack power standards with more complex multi-phase power stages for point-of-load.

- The pandemic has increased personal concern for health and safety plus raised concerns about security. The comfort level for telehealth is increasing, which provides opportunities for low-current drain power management solutions.

- Expect some supply chain realignment. No matter how current trade tensions are resolved, the security of supply confidence has been shaken at many companies. In some cases, factory relocations are happening along with a preference for more local supply. Suppliers need to be nimble to capture new opportunities that arise.
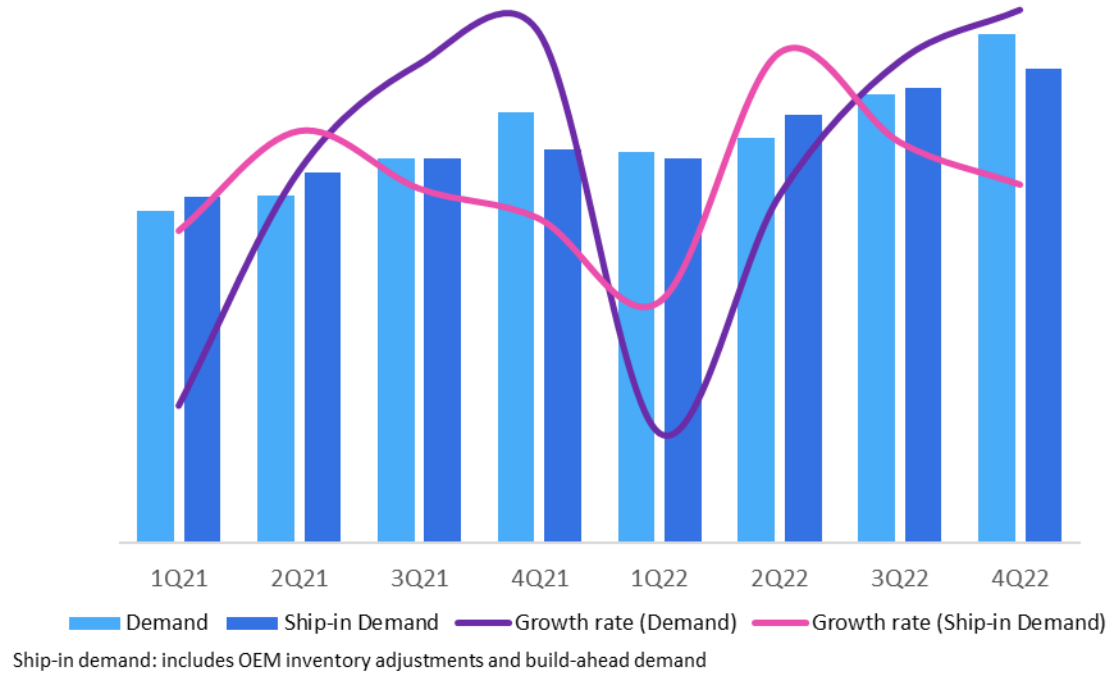
Power IC Market by Category

Legend:
- Automotive
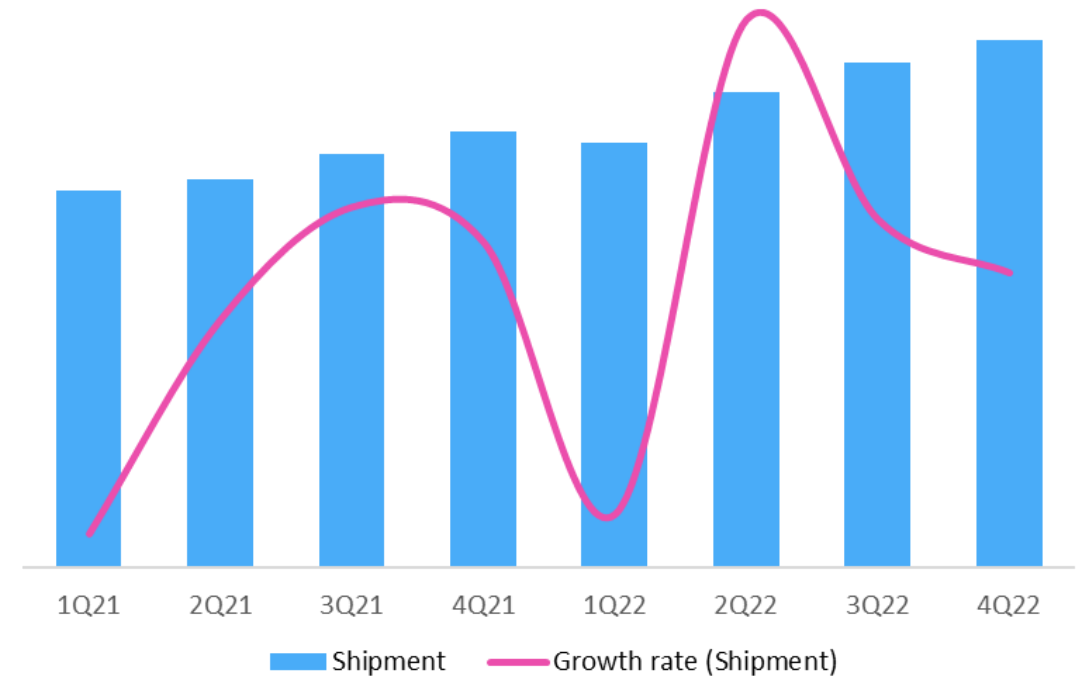- Computing/data storage
- Consumer
- Industrial
- Wired
- Wireless

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Memory & Storage

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DRAM Supply and Demand

DRAM demand

Demand | Ship-in Demand | Growth rate (Demand) | Growth rate (Ship-in Demand)

Ship-in demand: includes OEM inventory adjustments and build-ahead demand

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DRAM shipment

Shipment | Growth rate (Shipment)

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Both supply and demand are trending upward, and in 1H 2021 strong demand flows include buy-ahead.

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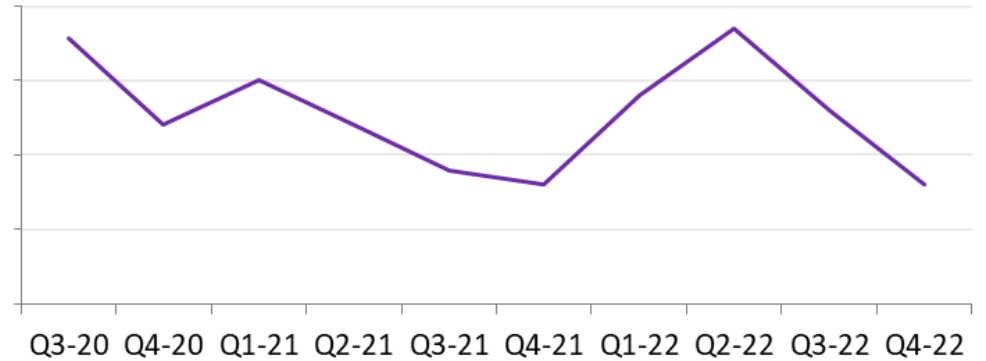
NAND 2021 Supply/Demand Summary

Supply

- 2021 NAND bit supply projected to see YoY increase in low 30% range, slightly under the current estimated NAND bit demand.

- Risks

  - The aggressive ramp could move the overall industry bit growth for 2021 to be on par with demand. Omdia will be monitoring any supply adjustments as they are announced.

  - This could reduce the rate of ASP increases previously projected for 2H21.
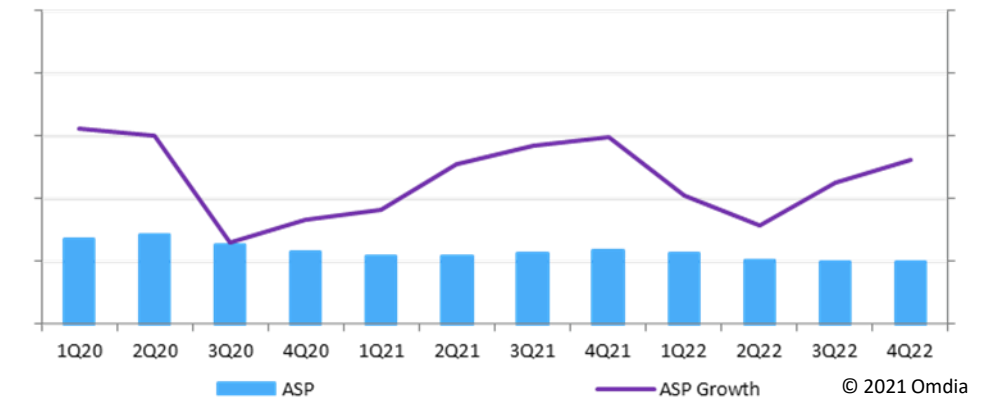
Demand Drivers

- Total NAND bit demand is projected to see YoY growth of 36.6%. All three major markets (enterprise, mobile, client) are projected to see sustained demand strength through the 2021.

- Risks

  - Should vaccinations continue to be distributed worldwide, there is risk that PC demand may neutralize later in 2021.

NAND supply/demand sufficiency

Q3-20 Q4-20 Q1-21 Q2-21 Q3-21 Q4-21 Q1-22 Q2-22 Q3-22 Q4-22

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NAND pricing

1Q20 2Q20 3Q20 4Q20 1Q21 2Q21 3Q21 4Q21 1Q22 2Q22 3Q22 4Q22

ASP — ASP Growth

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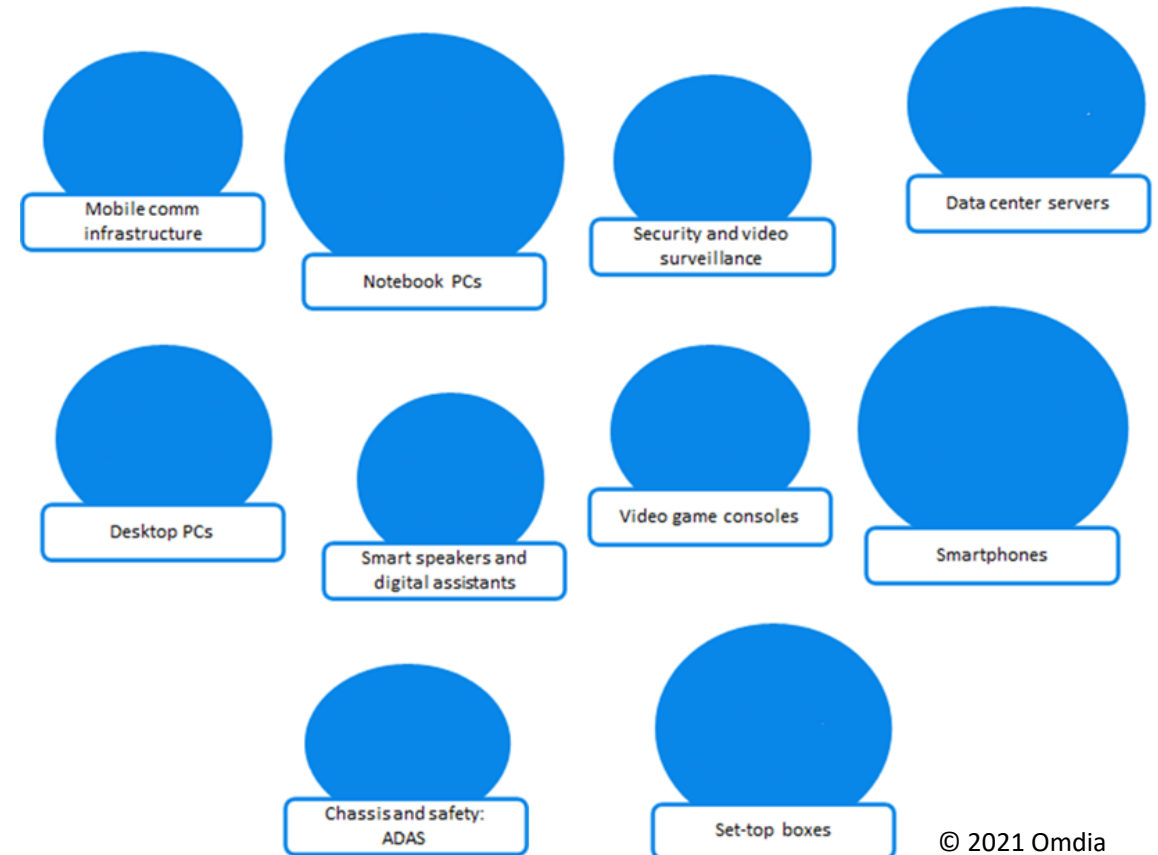© 2021 Omdia

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Processors

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MPU Market Forecast

- $66.3B market in 2020 projected to grow to $77.4B by 2025
  - Top MPU application markets to watch for growth potential
    - Enterprise Ethernet Switches & Routers (13.5% CAGR)
    - Broadcast & Streaming Video (11.2% CAGR)
    - Wireless LAN Equipment (19.1% CAGR)
    - Video Game Consoles (13.1%CAGR)

  - Top MPU application markets by revenue (2020/2025)
    1. Notebook PCs
    2. Data Center Servers
    3. Desktop PCs
    4. Mobile Communications Infrastructure

- MPU Market Product Announcements
  - Intel
    - 11th Generation Core series(Rocket Lake/Alder Lake)
    - 3rd Gen Xeon(Ice Lake)
  - AMD
    - EPYC 7003 series
  - NVidia
    - Bluefield-3
      - 400Gps Data Center Processor
      - 16x Arm A78 Cores

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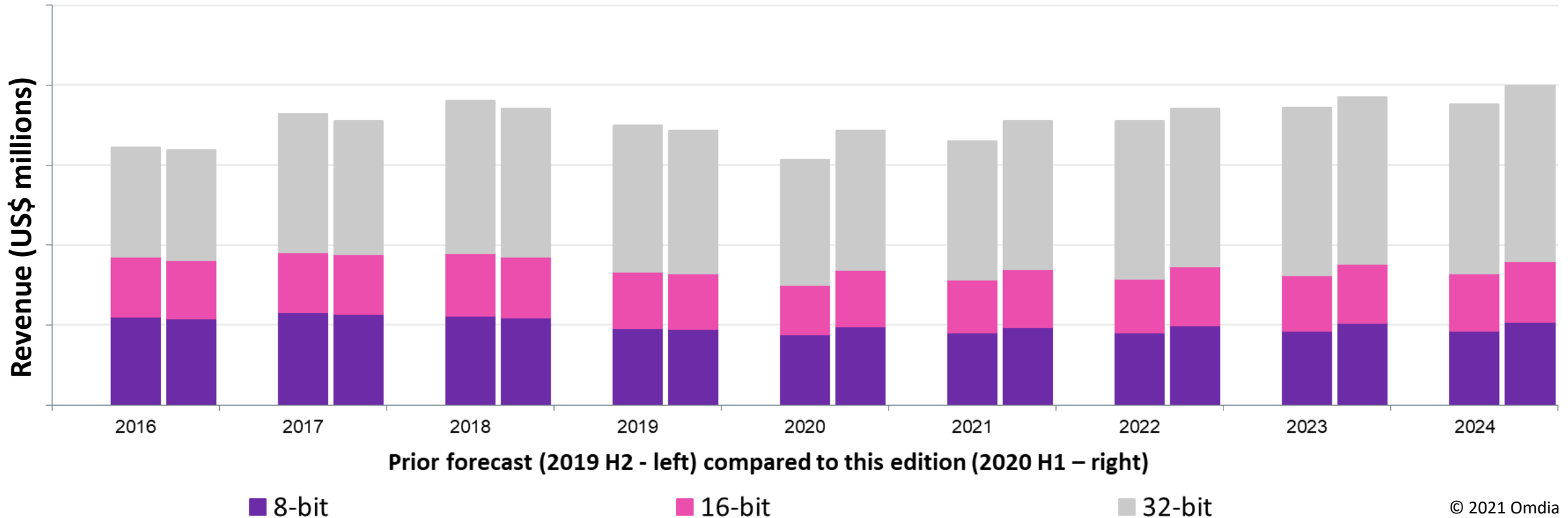OMDIA

Processors for Graphics & AI Market Forecast

- $66.4B market in 2020 projected to grow to $121B by 2025
  - Top Graphics & AI application markets to watch for growth potential:
    - Automotive Electronics | ADAS (40.2% CAGR)
    - Smart Speakers with Digital Assistants (38.7% CAGR)
    - High-tier Smartphones (14.2% CAGR)

  - Top application markets by revenue (2020/2025)
    1. High-tier Smartphones
    2. Data Center Servers
    3. Notebook PCs

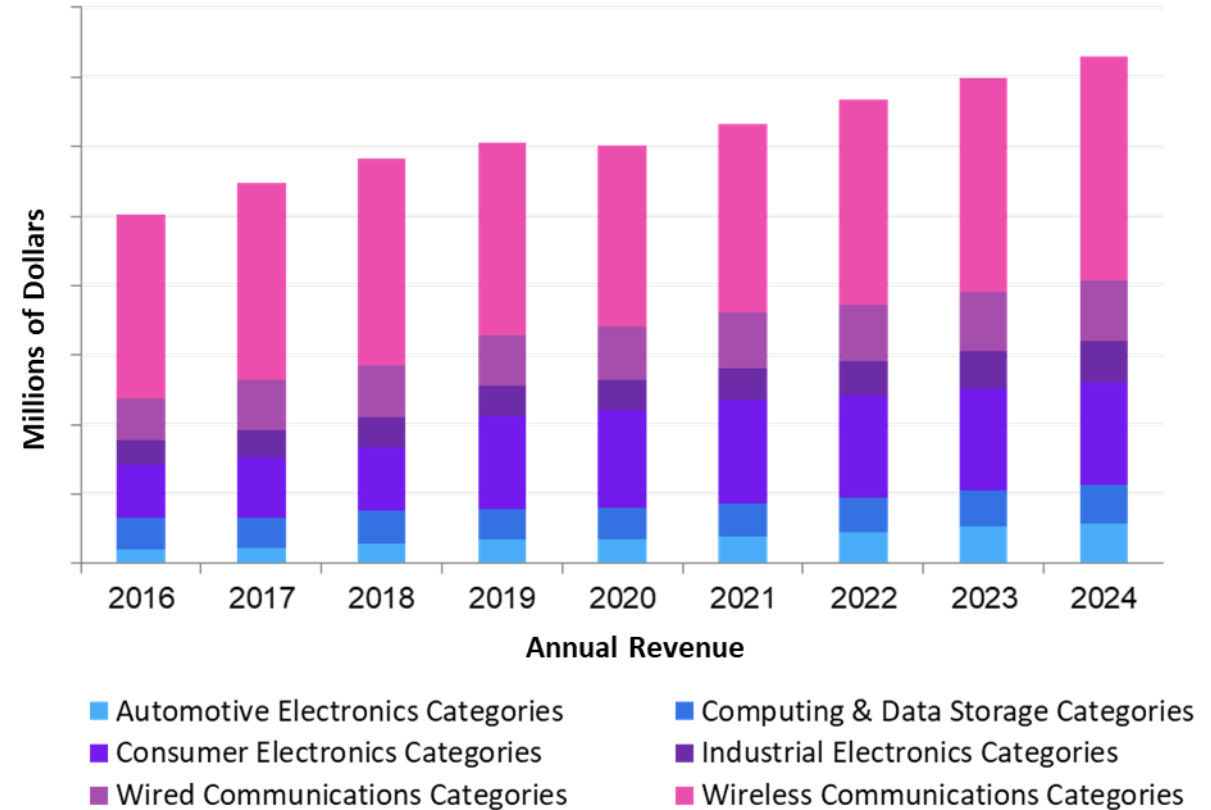**2020 top AI use cases for processors with graphics or AI integration**

Mobile comm infrastructure

Notebook PCs

Security and video surveillance

Data center servers

Desktop PCs

Smart speakers and digital assistants

Video game consoles

Smartphones

Chassis and safety: ADAS

Set-top boxes

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MCU Market Forecast Update

Prior forecast (2019 H2 - left) compared to this edition (2020 H1 – right)

■ 8-bit   ■ 16-bit   ■ 32-bit

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Omdia has predicted stability in the microcontroller market in 2020. However, Omdia still expects the market to continue to grow into 2021 and beyond, with 32-bit continuing to gain strength in the industry, and 8-bit and 16-bit holding steady in the market.

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SoC Market Update

- **SoCs represent processors' largest overall opportunity to target, slightly ahead of microprocessors.**

  - The market for SoCs recovered more quickly than the rest of the semiconductors market in 2019 to finish positive. A strong finish in Consumer and Automotive were able to overcome the Wireless market deficit.

  - Mobile devices continue to supply the largest demand, and their low 2019 performance put a strain on SoCs, but many other markets are showing greater growth potential.

  - Even with the impact of the global pandemic, SoCs revenues were expected to drop only 1% in 2020.

  - SoCs play a crucial role in the development of transformative technologies, including IoT and 5G, advanced human-machine interfaces (HMI), and Neural Networking algorithms for inferencing at the edge.

Annual Revenue

Legend:
- Automotive Electronics Categories
- Computing & Data Storage Categories
- Consumer Electronics Categories
- Industrial Electronics Categories
- Wired Communications Categories
- Wireless Communications Categories

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