

Taiwan EV Supply chain - 2021

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Jessie Lin, DIGITIMES Research, May 2021

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Introduction

Cars are going electric rapidly with many countries planning to ban sales of gasoline-powered vehicles and leading automakers stepping up investments into their electric vehicle (EV) business. Digitimes Research expects the global EV penetration rate to exceed 20% by 2025 and global EV sales to grow at a CAGR of 40% 2020 through 2025.

Eyeing the high growth of the global EV market, many Taiwan-based manufacturers are actively foraying into the automotive electronics sector. Based on Digitimes Research's observation, most electronics manufacturers and tier-1 suppliers with proven track records are expanding into autonomous driving (AD) solutions, charging piles, automotive displays or other core technologies.

Digitimes Research selects and explores a number of noteworthy vendors among the Taiwan-based electronics manufacturers and tier-1 suppliers that are expanding footprint into the automotive electronics sector. One thing they share in common is that they have shipped automotive electronics to customers and made their way into the supply chain of leading international automakers. For example, Quanta focuses on building computer solutions for autonomous vehicles with Tesla being its main customer. It is also endeavoring toward AIoT@Server platforms to meet autonomous vehicles' needs for massive data processing and high-speed data transmission.

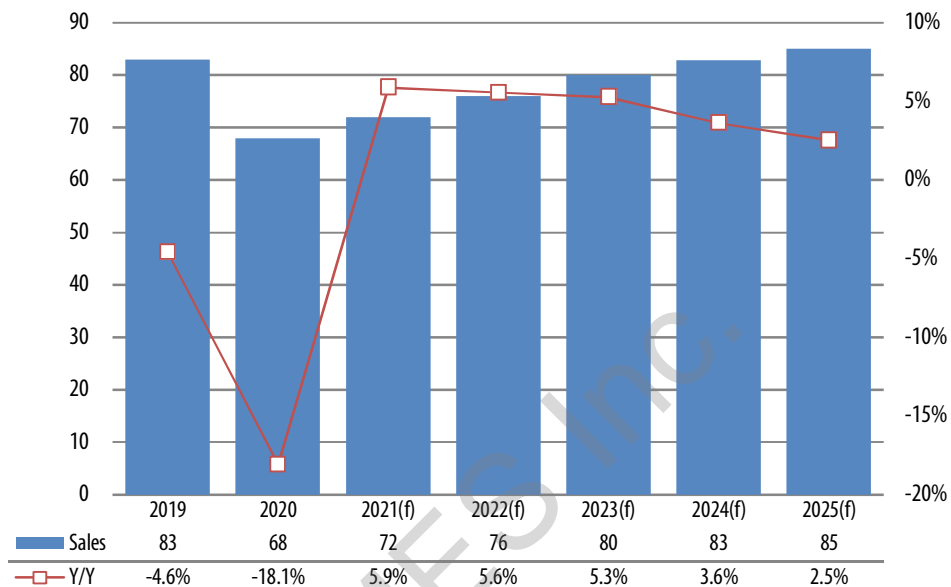
Leading power supply manufacturer Delta Electronics chose to start its automotive business with building and deploying charging piles. It has made itself a world-renowned charging pile supplier marketing its own brand. Delta is also expanding into EV power systems, working mainly with European automakers and tier-1 suppliers.

AUO, with a business focus on LCD panels, is the world's No. 3 automotive panel maker. Leveraging its excellent system integration capability, AUO has been shipping some products directly to automakers. Aside from LCD panels, in view of miniLED/microLED displays' multiple advantages, AUO engages in collaborations with Ennostar and PlayNitride to jointly develop automotive products. AUO expects to keep increasing its stake in Ennostar.

As a key provider of head-up displays (HUD) in the Greater China region, tier-1 supplier E-Lead Electronics is seeing its shipments surging in recent years. Its main customers include Hongqi and Geely. E-Lead has further developed a 3D AR HUD featuring realistic images, integration with dynamic autonomous vehicle information and projector miniaturization. The product is scheduled to go into volume production starting 2022.

Taiwan EV supply chain

Chart 1: Global auto sales, 2019-2025 (m units)



*Note: Only counting passenger vehicles and no commercial vehicles included.

Source: Auto associations worldwide, tier-1 suppliers, Digitimes Research, May 2021

Global auto sales are projected to grow only 5.9% year-over-year in 2021, coming short of expectation.

The COVID-19 set global vehicle sales on a sharp decline from 83 million units in 2019 to 68 million units in 2020, plunging 18.1% year-over-year.

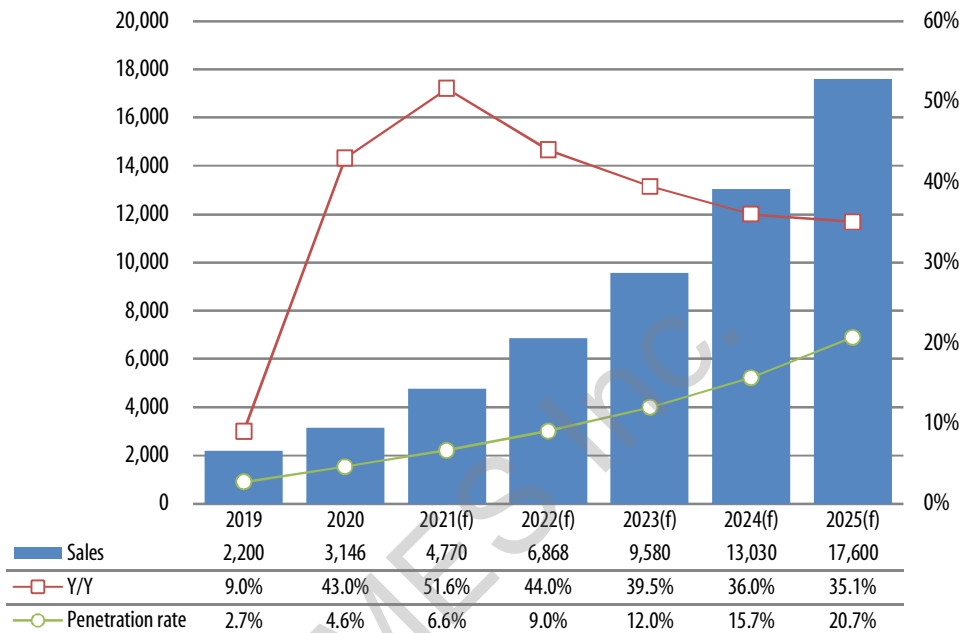
The release of long-deferred pent-up demand boosts vehicle sales in 2021. Digitimes Research originally forecast 75 million units of vehicle sales (10.3% annual growth) and adjusted the volume downward to 72 million units in view of the automotive chip shortage. In other words, the automotive chip shortage is expected to result in a sales decline of three million units.

Auto sales will gradually increase from 2022 onwards. Digitimes Research estimates auto sales will reach 76 million units by 2022 and 85 million units by 2025.

Auto sales are closely correlated with population and GDP growth.

Global EV sales

Chart 2: Global EV sales, 2019-2025 (m units)



**Note: Only counting passenger vehicles and no commercial vehicles included.*

**Note: Numbers including BEV and PHEV, but not HEV.*

Source: Auto associations worldwide, Digitimes Research, May 2021

As opposed to the gradual growth of the auto market, EV sales will enjoy double-digit annual growth.

A total of 3.146 million EVs were sold in 2020, soaring 43% year-over-year.

Driven by policy support, Europe and China, the world's No. 1 and No. 2 EV markets, outperformed the rest of the world by showing 142% and 18% year-over-year growth in EV sales, contributing to the large increase in global EV sales.

Global EV sales are projected to reach 4.77 million units in 2021.

In terms of first-quarter 2021 EV sales in major regional markets, 490,000 and 453,000 EVs were sold in China and Europe, respectively and 100,000 EVs in the US. EV sales in the three major regional markets increased several folds from the levels seen in the corresponding period of 2020.

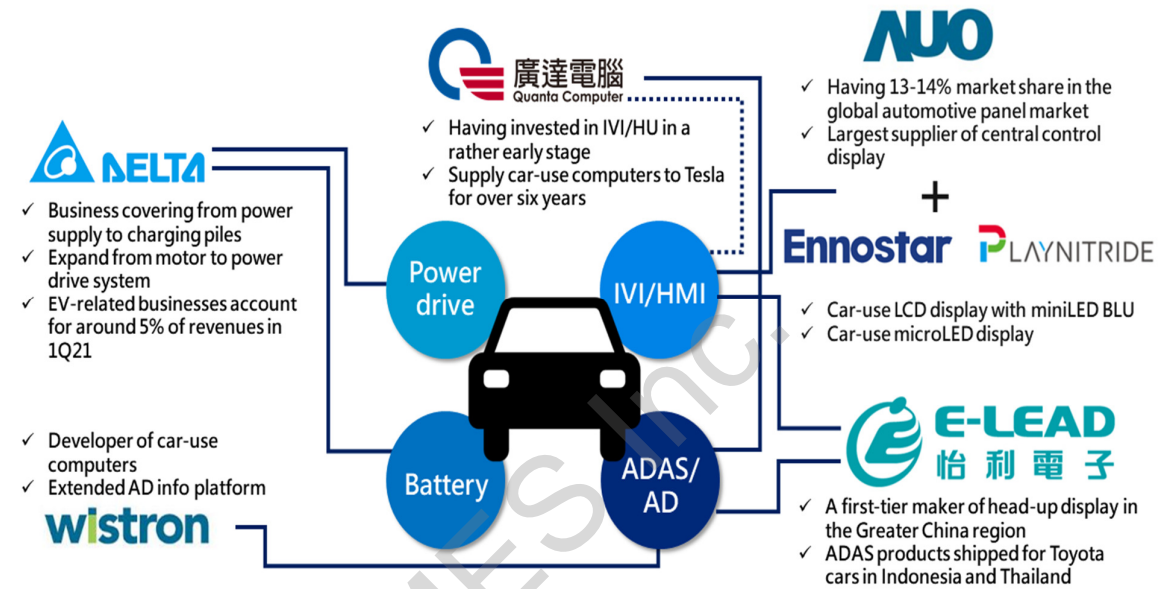
Digitimes Research expects EV sales to maintain at the first-quarter level going into the next few quarters and 2021 global EV sales to reach 4.77 million units as Europe and China extend their 2020 policies while the Biden administration actively promotes energy-saving EVs.

For long-term forecast, Digitimes Research projects global EV sales to come close to 18 million units by 2025, representing a more than 20% penetration rate.

Most leading countries plan to completely phase out gasoline-powered cars sometime between 2025 and 2035. Automakers therefore need to expand their EV production lines to meet the timeline. Major automakers have been picking up the pace of going electric and stepping up investments into their EV business.

Taiwan major EV component suppliers

Chart 3: Taiwan major EV component suppliers



Source: Companies, compiled by Digitimes Research, May 2021

Eyeing the 41% high CAGR of the global EV market 2020 through 2025, many Taiwan-based manufacturers are making active efforts toward the automotive electronics sector.

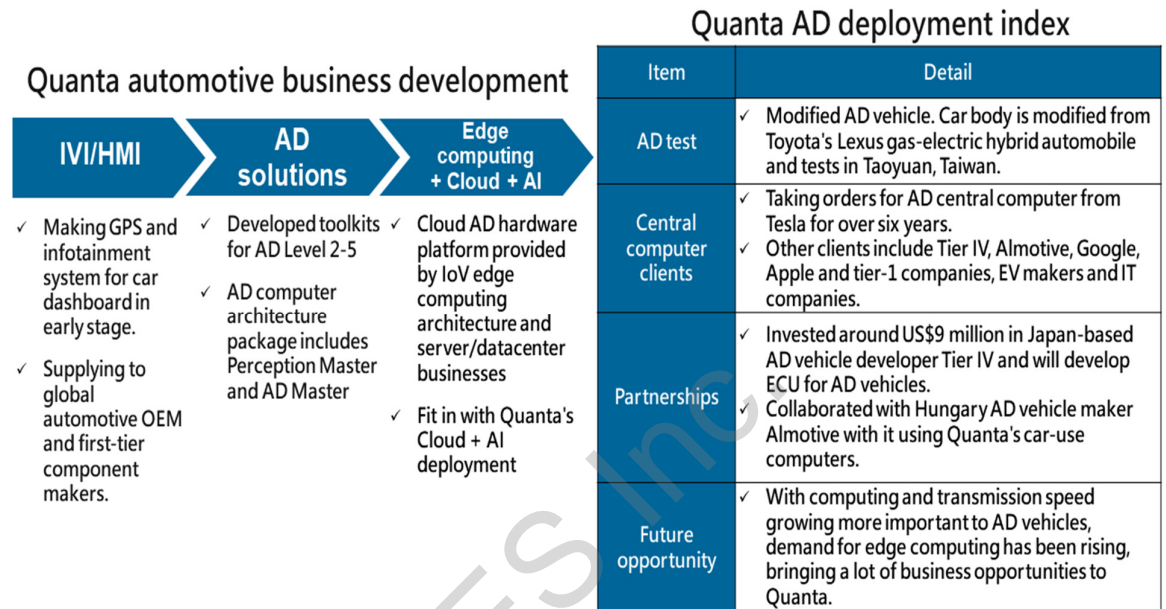
Digitimes Research selected and analyzed a number of noteworthy vendors including leading electronics manufacturers Quanta, Wistron, Delta and AUO as well as tier-1 supplier E-Lead.

Leveraging their core technologies, the leading electronics manufacturers have penetrated into the automotive electronics supply chain and delivered shipments of products for use in major automotive electronics including ADAS/AD, power systems and digital cockpit displays. They have made their way into the supply chain of leading international automakers.

As a tier-1 supplier, E-Lead is not only a key HUD supplier in Greater China but also a major supplier to Toyota in Indonesia and Thailand.

Quanta

Chart 4: Quanta auto business status



Source: Quanta, Digitimes Research, May 2021

Among the top-5 electronics companies in Taiwan, Quanta has made better progress in automotive electronics. It focuses on building computer solutions for autonomous vehicles.

Quanta has been supplying automotive computers mainly to Tesla for longer than six years.

Aside from Tesla, Quanta also provides automotive computers to many other customers including autonomous driving startups, EV manufacturers and IT developers.

Quanta is also endeavoring toward AIoT@Server platforms to meet autonomous vehicles' needs for massive data processing and high-speed data transmission.

Its efforts encompass developing IoV edge computing architecture and data center solutions that fulfill autonomous vehicles' cloud hardware infrastructure needs.

Digitimes Research expects Quanta's subsidiary QCT to take charge of this part of its business.

Wistron

Chart 5: Wistron auto business status

Supplies car-use computers to NIO and has a stake in the company

- Wistron is the main supplier of car-use computers to NIO:
 - ✓ Car-use computers are developed by WiBase, a joint venture between Wistron and iBase.
 - ✓ NIO was the 20th largest EV maker worldwide in 2020 with annual sales reaching 44,000 units.
 - ✓ With NIO's EV sales continuing to rise, Wistron expects EV-related sales to reach US\$200-300 million in 2021.
- Wistron acquired a stake in NIO's affiliates:
 - ✓ Invested in Xtronics Nanjing (33% stake) and Xtronics Kunshan (100% stake) via Wistron Kunshan.

Integrates group 5G, AI, IoT technologies to provide an AD info platform

- Subsidiaries related to car electronics:
 - ✓ WiAdvance: Public cloud platform and hybrid cloud architecture solutions.
 - ✓ Wiwynn: Datacenter, enterprise cloud computing solutions.
 - ✓ Wistron NeWeb: IoV-related network communication devices, car-use mmWave radar.
- ↓
- Developing HD maps and an AD vehicle info platform:
 - ✓ Providing car-road-cloud-integrated services in G-bus MIT AD vehicle team in Taiwan
 - ✓ Integrating big data from car-use computers, AIoT and communication devices to conduct analysis and transmit data back to the central control cloud platform for further study and compilation.
- Car-road-cloud-integrated platform usage case:
 - ✓ Taichung government's smart traffic mobile services.

Source: Wistron, compiled by Digitimes Research, May 2021

Wistron, another one of the top-5 electronics companies in Taiwan, also mainly supplies automotive computers to the automotive sector.

NIO is the biggest customer of Wistron's automotive computers. Wistron not just supplies products to NIO but also holds a stake in an NIO affiliate.

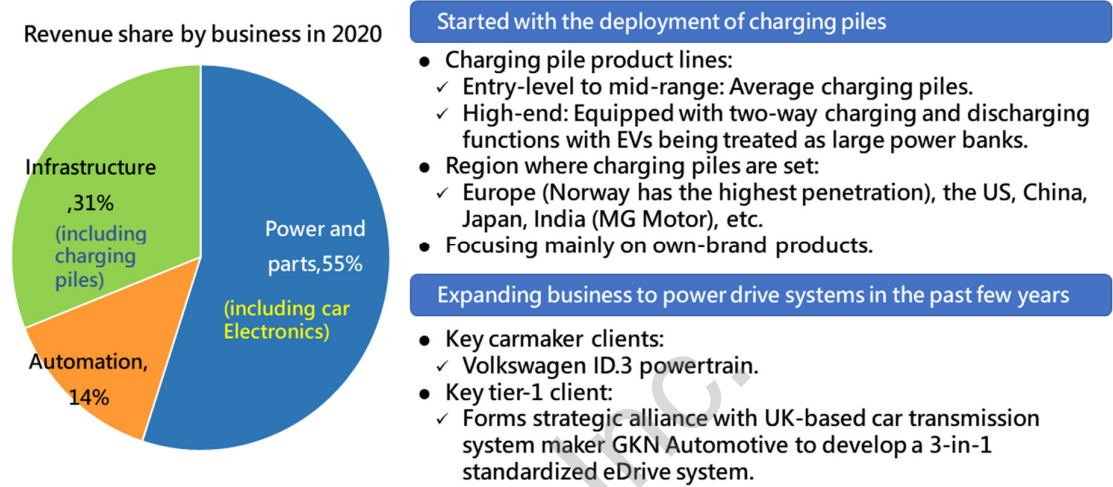
NIO enjoyed growing EV sales in recent years. It sold 43,728 EVs in 2020 and 20,060 EVs in the first quarter of 2021 (surging 422.7% from a year ago). Wistron predicts its 2021 EV revenues will amount to US\$200-300 million.

Wistron and its subsidiaries also pull together to develop an AIoT information integration platform for autonomous vehicles.

Apart from Wistron's automotive computer business, WiAdvance, Wiwynn and Wistron NeWeb of the Wistron Group also engage in business related to automotive electronics so Wistron pulls together corporate resources to develop its AIoT information integration platform for autonomous vehicles. This development path is similar to that of Quanta.

Delta

Chart 6: Delta auto business status



Source: Delta, compiled by Digitimes Research, May 2021

Delta' EV business is primarily operated by its power supply and components, and infrastructure divisions.

Its power supplies and components division is in charge of critical EV components including power supply modules, automotive chargers, DC/DC converters, traction inverters and traction motors.

EV charging piles are categorized under the infrastructure division.

Delta' efforts toward automotive business started with charging pile deployment.

Leveraging its presence in core components such as power supplies, Delta chose to begin its automotive business expansion by building and deploying charging piles. After more than 10 years of efforts, it has become a world-renowned charging pile supplier.

As opposed to other Taiwan-based suppliers that manufacture charging piles on an OEM or ODM basis, Delta sells charging piles under its own brand name.

Its charging piles are installed throughout a large part of the world. Delta also engages in close collaboration with a number of vendors.

It provides Japan's Kansai Electric Power two-way EV charging systems.

It works with France-based Groupe PSA in building charging infrastructure in Europe.

Delta is expanding into EV power systems in recent years.

Delta offers automotive electronics including power system components such as motors, power supplies, power converters, traction inverters and automotive heat dissipation systems, which can form modularized power system solutions.

Volkswagen is Delta' main EV customer and uses its power systems in the hot-selling ID.3 EV.

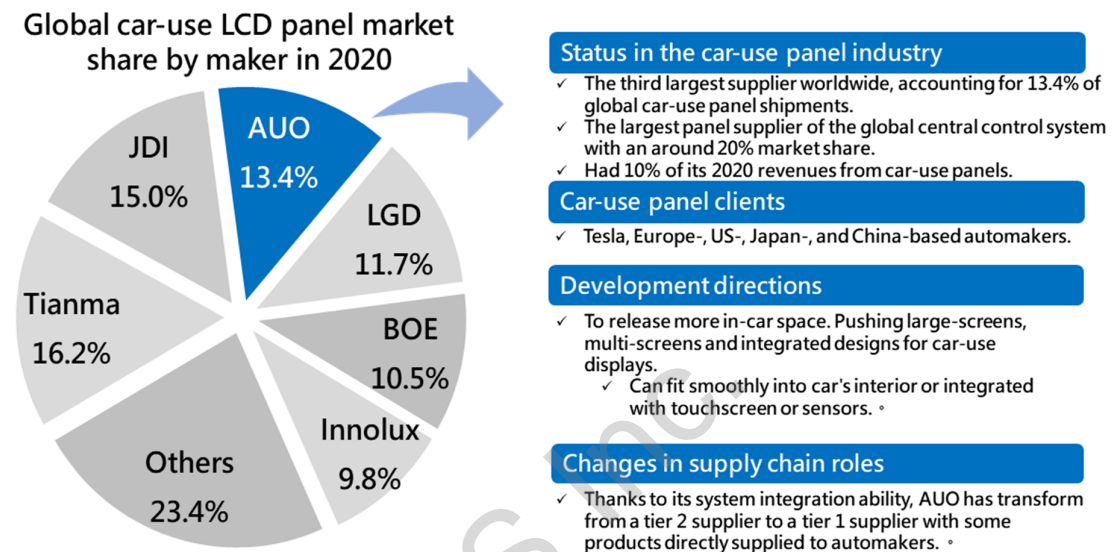
Delta also joins forces with UK-based tier-1 supplier GKN to co-develop a 3-in-1 power drive system, which is scheduled to enter volume production within three years.

The customers that Delta supplies critical EV power system components to additionally include European and American traditional automakers, Tesla and Japanese automakers.

Delta first set foot in the automotive electronics sector in 2008. Its EV-related businesses generated 3% of its total revenues in 2020. The share climbed to 5% as of first-quarter 2021.

AUO

Chart 7: AUO auto business status



Source: Omdia, AUO, Digitimes Research, May 2021

AUO registered a 13.4% share of the automotive LCD panel market in 2020, ranked No. 3. Among automotive LCD panels, AUO shipped the world's largest volume of panels for central control systems, representing about 20% of the market.

With over 10 years of effort toward automotive displays, AUO's automotive products contributed around 10% of its revenues in 2020.

AUO is a supplier not only to EV leader Tesla but also to seven of the world's top-10 automakers.

AUO's status in the automotive supply chain is gradually rising from tier-2 to tier-1.

AUO used to supply products to automakers through tier-1 vendors and is now supplying some of its products directly to automakers as a tier-1 vendor.

AUO has system integration capabilities, for example, to embed touch control or sensors with automotive displays or seamlessly bond automotive displays to car interiors, which enable it to ship some products directly to automakers.

In the case of infrared sensing, for instance, the display maker needs a good grasp of light path to allow the infrared sensor to detect the driver's face or hand gestures in the dark without being blocked by the steering wheel.

AUO's automotive displays are trending toward larger screens, multi-screens and integrated functions (for example, combining software features, edge computing, touch control, sensors and face ID). A future car may come with five or six displays.

AUO is in talks with automakers about partnership deals for 2024. The simple structure of EVs allows for bigger interiors. On top of that, autonomous vehicles enable hands-free driving. These factors will give rise to increasing in-vehicle information and entertainment demand.

Apart from LCD, miniLED/microLED are also the display technology AUO plans to use for its digital cockpit displays as they trend toward multi-screens design.

Chart 8: AUO partnerships with Ennostar and PlayNitride



Source: Companies, compiled by Digitimes Research, May 2021

MiniLED/microLED is solid-state lighting. Compared to conventional LCD, miniLED/microLED displays feature weather resistance, visibility under bright light and high contrast with a plurality of LEDs arranged in arrays so they are suitable for automotive applications.

AUO engages in collaboration with Ennostar's subsidiary Lextar to co-develop a 12.3-inch miniLED backlight automotive LCD.

Featuring brightness reaching 3,000nits, far superior to conventional automotive LCD (mostly under 1,000nits), the miniLED display is clearly readable in the presence of bright light.

With local dimming available on hundreds of zones, the miniLED display is more energy efficient than a conventional LCD with edge-lit LED backlight and achieves higher contrast.

The automotive LCD with miniLED backlight will enter volume production in one to two years.

AUO and Lextar are also jointly developing a 10.6-inch microLED display featuring a 61% transparency.

It achieves a transparency superior to transparent OLED displays and LCD (mostly lower than 50% transparency) while boasting a 180-degree viewing angle and nearly 100PPI (similar to TV pixel density).

The microLED display is mainly used on windshields and side windows to display additional information for drivers and passengers.

For example, drivers can read vehicle information such as speed and navigation chart displayed on the windshield.

Passengers get to know vehicle surroundings from information displayed on the side window (for example, when driving alongside Fuji Mountain, tour information will be displayed).

Automakers have expressed keen interest in the transparent microLED display.

AUO and PlayNitride team up to develop a high PPI free-form flexible microLED display.

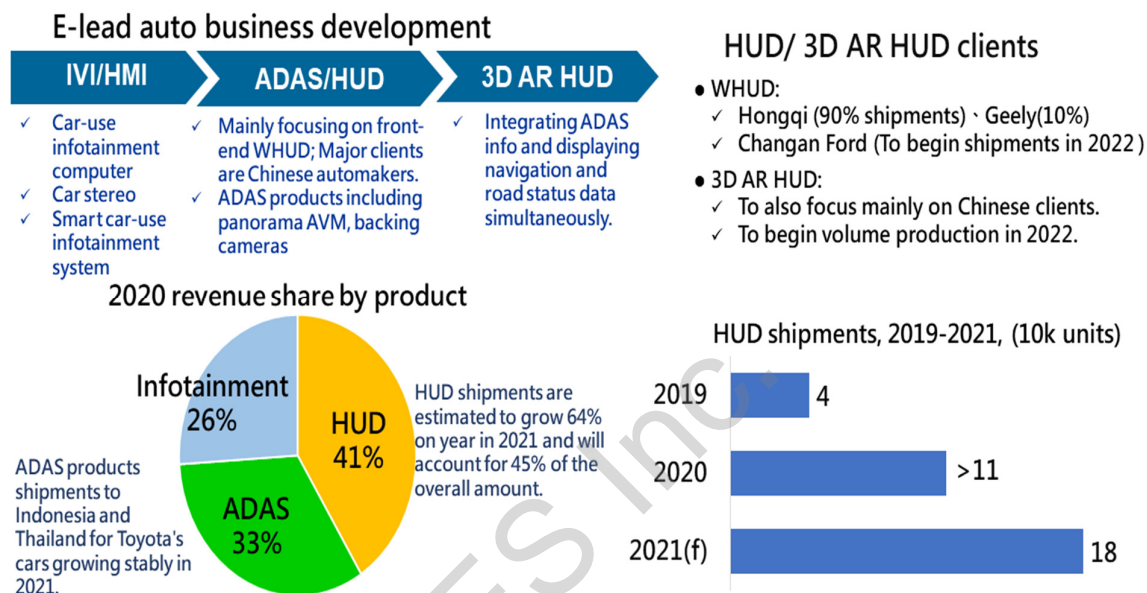
The display boasts a PPI exceeding 200 (at a fine resolution similar to LCD panels used for central control systems), wide color gamut and high brightness.

MicroLED displays can be lighter and slimmer than LCD because of their simpler structure so they can be designed with more flexibility in curvature and shape to better accommodate vehicle interiors.

AUO is optimistic toward the development of miniLED/microLED displays for automotive applications. Ennostar provides LED products to upstream, midstream and downstream supply chains. As Ennostar's largest shareholder with 8% of the company's shares, AUO will continue to increase its stake in Ennostar.

E-Lead

Chart 9: E-Lead auto business status



Source: E-Lead, Digitimes Research, May 2021

E-Lead' HUD products enjoy large growth and its ADAS products enjoy steady growth. The latter are mainly supplied to Toyota cars sold in Indonesia and Thailand.

E-Lead was established in 1983. Its automotive product offerings initially focused on infotainment computer and systems as well as car stereos and now extend to HUD and ADAS.

As E-Lead' major product line in 2020, HUD is expected to represent more than 45% of its 2021 revenues.

E-Lead' HUD is offered as a factory-installed product and mainly in the form of windshield HUD (WHUD).

As HUD helps ensure driver safety, E-Lead' HUD shipments have been increasing by several folds in recent years, projected to reach 180,000 units in 2021.

E-Lead is a leading HUD supplier in Greater China behind only Nippon Seiki, Denso and Continental in terms of shipment volumes.

China's automotive brands are E-Lead' main HUD customers. E-Lead ships 90% of its HUD products to Hongqi and 10% to Geely.

It has entered into a deal with Changan Ford to begin shipping its products in 2022.

E-Lead has completed the development of its 3D AR HUD, which was showcased at Shanghai International Automobile Industry Exhibition in April 2021. Volume production is scheduled for 2022 and the product will mainly be supplied to China-based automakers.

The 3D AR HUD features a field of view (FOV) of 12 degrees x 5 degrees and dynamically changeable virtual image distance (VID) between 1 and 200 meters. The projector is only six liters and can easily fit into the space in the engine compartment under the dashboard.

Product features:

Realistic 3D images that appear to be written directly on the road.

The embedded eye-tracking device allows the virtual images to be projected at a dynamically changeable distance between 1 and 200 meters.

Integrated with dynamic Level 3 autonomous driving information, the 3D AR HUD can draw the driver's attention to certain situations, for example, when another vehicle is coming too close or the driver needs to make a turn 20m down the road.