

# Material Solutions for Advanced Driver Assistance Systems

## Creating Competitive Advantage in eMobility, Modern Vehicle, and Autonomous Applications

Recent decades have seen a revolution in automotive safety, helping preserve the lives of countless drivers and passengers worldwide. OEMs are now turning to advanced electronics and artificial intelligence to continue to improve modern vehicle safety. Features that help mitigate the effect of driver inattentiveness, inexperience, and error that were once just luxury vehicle options are now standard options on most new models on the progressive journey to full level 5 autonomy. These features are

known today as advanced driver assistance systems (ADAS).

This paper addresses current trends and projections for the ADAS market and explores engineering and design challenges. It will aid engineers in understanding the role of material applications in improving system development and fostering design creativity.

## ADAS MARKET TRENDS AND PREDICTIONS

ADAS currently incorporates technologies such as video transmitter (VTX) sensors, ultrasound, cameras, radar, and lidar. These technologies are at the core of many safety and convenience features that have become common in modern vehicles, such as blind-spot detection, emergency braking, adaptive cruise control, lane departure warning, and parking assist.

According to a report by Fortune Business Insights, the ADAS market is forecast to grow from USD \$27.52 billion in 2021 to \$58.59 billion in 2028. This represents a CAGR of 11.4%.

Multiple factors are driving this growth.

- **Consumer demand** — According to a 2022 survey by AutoPacific, 75% of consumers want features such as automatic emergency braking, with 40% of respondents over age 60 wanting it regardless of price. 80% of respondents want rear cross-traffic alert with rearward emergency braking.
- **Technological innovation** — Artificial intelligence (AI) and improved automation promise to take ADAS features to even greater levels in the future. Next-generation ADAS will enable the driver to further disengage from the act of driving in certain situations. The end game is the Level 5 fully autonomous vehicle, in which the passengers cede complete control to the vehicle's AI.
- **Regulation** — To date, ADAS has not been addressed by regulation in the U.S. However, a law in the EU, which took effect in 2022, mandates electronic safety features in new motor vehicles. These features include lane-keeping assistance, advanced emergency braking, speed assistance, parking cameras, and data recorders.

The continued adoption of ADAS technology requires components to be easy to assemble, lightweight, durable, and cost-effective. ADAS and supporting

components must perform flawlessly across a wide range of environmental conditions, including exposure to fuels and chemicals, temperature extremes, road salt, and UV light. They must also be durable to last the length of a vehicle's life. According to the U.S. Department of Transportation, the average age of vehicles on U.S. roadways is now 12.1 years.

## KEY ENGINEERING CHALLENGES FOR ADAS

Many OEMs and tier suppliers specify the use of functional materials featuring pressure-sensitive adhesives to address various engineering challenges related to ADAS design. These functional materials include gaskets, thermal interface materials (TIM), electrical and thermally insulative materials, films for light management and lens protection, and die-cut tapes for general bonding.

Boyd is a global market leader in functional materials for eMobility, autonomous, and transportation industries. We provide these materials both independently and in collaboration with partners such as Avery Dennison Performance Tapes. A leading manufacturer of pressure-sensitive tape products serving a wide range of industries, Avery Dennison has a long track record in the highly regulated automotive space. Many of the solutions in the Avery Dennison Automotive Electronics portfolio meet OEM specifications related to vehicle systems.

### CHALLENGE: PARTICLE AND FLUID INGRESS

ADAS and other vehicle electronics subjected to moisture or debris can short and fail, dramatically increasing warranty claims. Particle and fluid ingress protection is therefore a critical consideration in application requirements.

Boyd's filters, IP seals, waterproofing technologies, particle guards, plugs, caps, and surface protecting

solutions prevent debris from entering sensitive electronic components, controlled environments, and fluid systems. Adding particle and ingress

protection improves ADAS reliability and reduces maintenance requirements by preventing fouling or contamination of these highly engineered systems.

Where applicable, pressure-sensitive adhesive tapes can be

used to provide a thin and instant bonding solution while increasing dimensional stability and durability of these applications. Such tapes are available through the Avery Dennison portfolio.

### CHALLENGE: BONDING

Many ADAS applications rely on adhesives for bonding of components. Compared to mechanical fasteners, adhesives are less expensive, lighter, and easier to apply. They're also reliable, durable, and resistant to environments such as chemicals, extreme temperatures, and UV light.

Boyd designs highly engineered [bonding and adhesive systems](#) for ADAS, including a broad range of tapes, optically clear adhesives, and pressure-sensitive adhesives. These systems typically adhere various substrates together or permanently affix components into an assembly. High-performance adhesive and bonding materials are essential components in nearly every industry where managing costs, improving assembly efficiency, increasing durability, and decreasing weight are crucial.

Boyd has preferred access to the broadest range of expert adhesive and tape suppliers worldwide, including the Avery Dennison portfolio. We also laminate custom formulations for unique applications. Our ability to mix and match materials with our world-class precision converting processes like rotary die

cutting, kiss-cutting, slitting and more create custom composite tape solutions for any application.

### CHALLENGE: EMI SHIELDING AND RFI PROTECTION

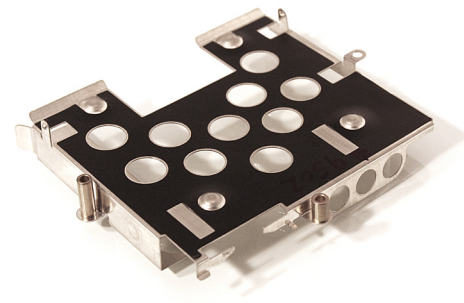
Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI) reduce electronic signal integrity and strength, which can cause disturbances and poor performance in sensitive communication systems and devices. EMI can be a severe safety concern in ADAS applications. Robust engineering design is needed to prevent and protect against it.

[EMI/RFI shielding solutions](#) from Boyd reduce electronic malfunction susceptibility by blocking unwanted external electromagnetic waves or by preventing internal electromagnetic waves from emitting and interfering with other circuits or devices in and around ADAS components.

These solutions balance electrical conductivity, dielectric permittivity, magnetic permittivity, and physical geometry to inhibit the

transmission of EMI/RFI. Generally, shielding first deflects electromagnetic waves with reflective surfaces. This process heats the shield, making moderate electrical and thermal conductivity important characteristics of EMI/RFI shielding.

Boyd's LectroShield metal foils and conductive foams, elastomers, and adhesives are designed to manage interference energy, improving reliability and efficiency in ADAS component and system performance. With our design expertise, manufacturing quality, service reliability, and global supply chain management, Boyd's comprehensive and optimized EMI/RFI shielding solutions help you exceed your reliability and performance requirements. Our vast application experience and engineering support ensure your EMI challenges



are solved cost-effectively and efficiently. Enhance customer satisfaction and safety, ensure regulatory approval, and reduce warranty claims with Boyd's EMI/RFI shielding solutions.

### **CHALLENGE: NVH MITIGATION AND SHOCK ABSORPTION**

ADAS and other electronic systems are subject to extreme noise, vibration, harshness (NVH), and shock caused by road conditions and extreme environments. These forces wear down mechanical



and bonded joints, pit mating surfaces, and generally expose ADAS components to extreme wear and tear in an accelerated time period. This wearing can negatively impact ADAS performance, customer satisfaction, and safety.

Boyd offers a wide variety of solutions to reduce NVH, absorb shock, and ruggedize ADAS components. These include products from the Avery Dennison Performance Tapes portfolio. Boyd and Avery Dennison's solutions address critical issues such as acoustic absorption, buzz/squeak/rattle mitigation, and vibration damping. By selecting the right material, manufacturing process, and geometry, Boyd enables designers to improve ADAS performance, safety, and longevity.

### **CHALLENGE: THERMAL INTERFACE**

A critical element of any effective thermal management system, [Thermal Interface Materials \(TIMs\)](#) are used to manage heat in ADAS and other electronic systems.

Boyd provides a full array of thermal interface materials. These range from soft materials like gap fillers, phase change materials, and thermal grease, to less compliant materials like thermal rubber pads, films, and thermally conductive hardware. Our

broad portfolio contains many options that include electrically isolating properties, reinforcement, carriers, and various hardesses to meet different application requirements.

Many of these materials can be combined with high-performance pressure-sensitive adhesives from the Avery Dennison portfolio. Avery Dennison offers multiple bonding solutions, including high-wet-out adhesives that help lower thermal impedance between the TIM and the heat source and flame-retardant adhesives that are UL 94 V-0 compliant.

### **CHALLENGE: PREVENT SPARK VOLTAGE**

ADAS and other modern vehicle electronics use more power and incorporate more smart internal technologies than ever before. Increasing power density in smaller spaces with higher voltage components requires robust electrical isolation. Immense internal energy must be isolated to prevent spark voltage between internal components that can lead to electronic device shorting or fire.

Boyd's dielectric materials are designed as an electrical shield or barrier. These electrically insulating barriers prevent component damage from spark voltage, extend device lifetimes, and maintain safe use environments for consumers.

[Electrical insulation](#) can be designed from a wide variety of materials into entirely custom configurations that fit seamlessly into your ADAS design. Boyd's dielectric insulators include UL 94 ratings for vertical and horizontal burn tests, helping you pass UL certification and testing. We're experts in identifying suitable raw materials to surpass electrical and flammability requirements and evaluating your product design environment to find efficiencies.

### **CHALLENGE: PROTECTION FROM EXCESSIVE HEAT EXPOSURE**

OEMs continually design more powerful, higher performing components and vehicle systems. Increasing power density in smaller spaces increases

thermal density and output or exhaust heat within the vehicle and its electronics. This incremental waste heat is detrimental to the safety and efficiency of critical ADAS and other electronic systems.

There are many factors to consider when selecting heat shield and thermal insulation solutions, including optimal material selection, unique geometry design, and assembly to help manage excess waste heat. Boyd's Engineered Material experts collaborate with customers to identify critical performance needs and recommend the best raw materials that exceed environmental and use exposures.

We produce these solutions using industry-leading, precision-converting capabilities. The results are fully integrated insulation and shielding solutions customized for an ADAS application.

These solutions can be combined with pressure-sensitive adhesive transfer tapes from providers such as Avery Dennison. We combine the performance benefits of multiple materials into one easy-to-install deliverable.

### CHALLENGE: LABELING AND BRANDING

Modern vehicles present a challenging environment for [durable brand, safety, and warranty labels](#). Labels must be easy to apply and, if necessary, easy to adjust on an assembly line. They must often be durable enough to last the vehicle's life and able to withstand chemical and fuel exposure, temperature extremes, UV light, and other environmental conditions.

Additionally, labels are often placed in areas that require dielectric insulation to meet UL and other industry-specific requirements.

Boyd's specialty is integrating Pantone color matching on thin films for durable and dependable label graphics. These labels can also incorporate high-performance adhesives, electrical insulation, and UL 94 flame-rated solutions. We help reduce component complexity by combining branding,

communication of crucial information, and electrical insulation into a single, high-quality, dependable solution. By integrating multiple functions into a single label, Boyd helps enhance your brand, ADAS safety, and warranty management with reduced supply chain complexity and total lowest landed cost.

Boyd has a half-century of [custom badging, trim, and label manufacturing](#) experience using state-of-the-art coating, embossing, and etching technologies. We make designs come to life and stay beautiful even in the most challenging conditions. Where appropriate, we use high-performance pressure-sensitive adhesives, such as those from Avery Dennison. Their solutions include a wide range of acrylic foam, polyethylene, and low surface energy foam tapes approved for many OEM applications.



### CHALLENGE: HMI ENHANCEMENT AND PROTECTION

Human-machine interface (HMI) includes [graphic displays and touchscreens](#) in eMobility applications. These provide safety information to drivers and passengers. ADAS can use the vehicle's HMI for



both input and output of critical information. HMI is expected to be easily viewable regardless of

conditions — from direct sunlight to pitch dark — in which glare, reflection, or privacy may be an environmental factor and safety concern.

Boyd's surface protection and [display enhancement solutions](#) improve HMI contrast, vivacity, visibility, and lifetime performance for ultimate safety.

## BOYD ADAS MATERIAL SOLUTIONS

**Die-cut adhesive tapes for bonding** — Adhesive formulations that bond with nominal applied pressure for efficient and reliable permanent or reusable securement.

**Protective films** — Specialized, thin films that protect surfaces against scratching and chipping from moderate, everyday use.

**EMI/RF shielding tapes and gaskets** — EMI and RFI shielding solutions improve electronic performance by blocking errant electromagnetic waves. Commonly feature conductive foils, foams, elastomers, and adhesives.

**Waterproof gaskets** — Waterproof gasket materials improve reliability and prevent moisture ingress for long-term performance.

**Impact-absorbing gaskets** — Gaskets absorb shock and impact from drops, collisions, and extended vibration.

**Thermal interface materials (TIMs)** — TIMs are a critical element of any effective thermal management system as they transfer heat between solid surfaces.

**Electrical insulation** — Isolates internal energy in densely-packed electronics to prevent spark voltage that can lead to device failure or fire.

**Thermal insulation** — Prevents heat transfer towards sensitive components. Boyd's heat shield products are lightweight, low profile, flexible and reliable.

**Labels** — Clear, long-lasting badging and decals differentiate products while providing customers critical information such as UL compliance, safety instruction, or water indication.

**Branding/logo affixation** — State-of-the-art coating, embossing, and etching technologies to make designs come to life and stay beautiful even in the most challenging environmental conditions.

**Light management films** — Films help reduce glare and control reflections. This is critical for screens in eMobility environments with varying levels and sources of both natural and artificial light.

**Optical encoders for lidar sensors** — Encoder disks placed within a sensor to help it accurately gauge position and rotation when the sensor emits a pulse of light.

# BOYD

## About Boyd

Boyd is the trusted global innovator of sustainable solutions that make our customers' products better, safer, faster, and more reliable. Our innovative engineered materials and thermal solutions advance our customers' technology to maximize performance in 5G infrastructure and the world's most advanced data centers; enhance reliability and extend range for electric and autonomous vehicles; advance the accuracy of cutting-edge personal healthcare and diagnostic systems; enable performance-critical aircraft and defense technologies; and accelerate innovation in next-generation electronics and human-machine-interface. Core to Boyd's global manufacturing is a deep commitment to protect the environment with sustainable, scalable, lean, strategically located regional operations that reduce waste and minimize carbon footprint. We empower our employees, develop their potential, and inspire them to do the right things with integrity and accountability to champion our customers' success.

Boyd's focus on innovation and customer partnerships ensures that our material solutions for ADAS applications are as innovative as the vehicles they support and will perform reliably over the lifetime of the vehicle for unyielding safety. Our commitment to eMobility and autonomous vehicle research and development ensures our innovation stays ahead of the next generation's requirements.

To receive more information, please visit [www.boydcorp.com](http://www.boydcorp.com)

## Ready to start your next project?

### Contact Boyd

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