

COB Fine-Pitch Display

Product Technology Development White Paper

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Preface

Today, global digitalisation and intelligent transformation have entered uncharted waters. Large AI models, digital twins, the metaverse, ultra-high-definition video, smart government, smart security, smart transportation, and smart healthcare are developing rapidly, driving commercial display scenarios to upgrade comprehensively from “passive display” to “intelligent interaction, 7×24 high-reliability operation, ultra-high-definition fine presentation, and low-energy low-carbon operation.” Display devices are no longer mere image output tools, but the core visual terminals and data interaction gateways of digital systems across industries. Their image quality, operational stability, environmental adaptability, energy consumption, and maintenance costs directly determine the overall user experience and delivered value of industry digital systems.

In the commercial display arena, fine-pitch LED display, with its advantages of seamless splicing, ultra-high resolution, ultra-high brightness, customisable sizes, and long lifespan, is rapidly replacing DLP and LCD video walls to become the preferred solution for core scenarios such as command and dispatch, broadcast studios, high-end meetings, digital exhibition halls, and security monitoring. As pixel pitch continues to shrink, ultra-fine-pitch products such as P1.5, P1.2, P0.9, P0.7 and below are rapidly gaining popularity, fully exposing the technical shortcomings of the traditional SMD surface-mount packaging process.

Against this industrial backdrop, COB packaging technology has matured rapidly. By eliminating redundant processes such as traditional lamp bead brackets, wires, discrete packaging, and reflow soldering, flip-chip LED bare dies are directly die-bonded and packaged onto the PCB substrate, achieving an integrated, fully encapsulated structure that fundamentally redefines the physical structure, heat dissipation path, protection system, and optical performance of LED display products. Compared with traditional SMD solutions, COB offers clear advantages in display quality, environmental protection, operational reliability, energy saving, and full-lifecycle maintenance costs, perfectly matching the commercial display requirements of ultra-fine pitch, high density, high load, and complex operating conditions.

From the perspective of industrial development, COB is not merely an upgrade to a single packaging process, but represents the inevitable technology path for the LED display industry's transition from single-pixel packaging to panel-level packaging at scale. Since 2015, COB technology has gone through three stages — experimental exploration, industrial maturation, and large-scale commercial application — and has now achieved full-industry-chain collaboration, standardised processes, and diversified application scenarios, covering market needs from high-end commercial to industry-wide adoption. As core technologies such as flip-chip, driving technology, optical packaging, full encapsulation protection, and AI image calibration continue to iterate, COB product costs keep declining while performance keeps rising, officially entering a period of sustained, large-scale adoption.

In the next 3 to 5 years, flip-chip LED + COB + AI intelligent control will become the standardised technology platform for high-end ultra-high-definition displays, comprehensively replacing traditional indoor SMD fine-pitch products. It will penetrate deeply into all scenarios including government and enterprise meetings, emergency command, broadcast production, cultural tourism exhibition halls, smart transportation, energy security, education and healthcare, and virtual production, becoming the core support of visualized interaction infrastructure in the digital economy era.

Abstract

As the digital economy, artificial intelligence, and the ultra-high-definition (UHD) video industry accelerate, display terminals have evolved from traditional information display carriers into core gateways for digital twins, intelligent interaction, visualized dispatching, and virtual content production. As the mainstream solution for commercial UHD displays, fine-pitch LED display continues to evolve toward smaller pixel pitch, higher image quality, higher reliability, lower energy consumption, and lower total cost of ownership. Among these, COB (Chip on Board) technology, owing to its innovative packaging structure, refined processes, and substantial performance gains, has resolved the reliability, image quality, protection, and energy-consumption bottlenecks of traditional SMD surface-mount packaging in ultra-fine-pitch scenarios, and has become the leading technology route for high-end fine-pitch displays of P1.5 and below.

This white paper systematically reviews the iteration history of the LED display industry, the evolution of COB technology, and Absen's COB product technology layout and applications. It comprehensively analyses the core value and industrial inevitability of COB as a mainstream display technology, providing a reference for end users in product selection, for manufacturers in technology iteration, and for channel promotion, project bidding, and industry research.

01

Development History of LED Display Technology

Overall Development of the LED Display Industry

Since its inception, the LED display industry has continuously iterated around shrinking pixel pitch, advancing display quality, ensuring high operational reliability, minimizing full-lifecycle cost, and pursuing green, low-carbon and low-energy operation, with every technological change driven by breakthroughs in packaging processes, chip technology, driving solutions, and optical design, forming a clear three-generation industry iteration cycle.

Phase 1 : The DIP Era (1995–2010) — First-Generation Displays, Laying the Foundation

DIP (dual in-line package) through-hole packaging was the earliest industrialized technology of LED displays. LED leads are inserted directly into PCB holes and soldered for fixation. The process is simple, low cost, and offers high brightness, making it suitable for basic scenarios such as early outdoor announcements, fascia signs, and simple advertising screens. In this phase, pixel pitch was generally above P10, with low resolution, extremely strong image graininess, single colour, and poor contrast — sufficient only for text and simple graphics, and incapable of HD video playback. Meanwhile, products suffered from poor protection, bulky and heavy construction, extremely high power consumption, fragility, and troublesome maintenance, and were limited to low-requirement, low-frequency outdoor display scenarios, unable to enter the high-end indoor commercial market.

Phase 2 : The SMD Surface-Mount Era (2010–2018) — Indoor Popularization and the Rise of Fine Pitch

The maturity of SMD surface-mount packaging technology pushed LED displays from outdoor to indoor commercial markets. By packaging RGB three-colour lamp beads into integrated surface-mount devices, pixel volume was greatly reduced, allowing pixel pitch to keep shrinking while image uniformity, colour performance, and panel thinness and lightness improved significantly. After 2012, P4–P6 became mainstream indoor products, widely used in exhibition halls, meeting rooms, and monitoring rooms; in 2015, P2.5 products became popular, officially ushering in the era of fine-pitch LED commercial displays; in 2018, P1.5 products entered mass production, and fine-pitch LED displays began to comprehensively replace traditional DLP and LCD video walls as the core commercial display solution.

However, SMD surface-mount packaging has inherent structural defects: it relies on discrete lamp beads, metal brackets, wire bonding, and SMT reflow processes, resulting in a huge number of solder joints, multiple structural interfaces, high thermal resistance, and weak protection. In scenarios with pitch below P1.5, lamp bead size keeps shrinking, solder joint miniaturization is greatly challenged, production yield declines, failure rates rise, and anti-interference capability weakens. Impacts, static electricity, moisture, and dust can easily cause lamp loss, dead lamps, colour deviation, and screen artifacts. Meanwhile, high power consumption, significant temperature rise, and persistently high maintenance costs make it impossible to meet the core demands of high-end commercial use: 7×24 stable operation, close-range HD viewing, and adaptation to complex working conditions.

Phase 3 : The Fine-Pitch Panel Era (2018–Present) — The Rise of COB Technology

Since 2018, with UHD video industry policies taking effect and demand for resolution, image quality, and reliability in high-end commercial displays rising sharply, flip-chip LED technology developed rapidly and pixel pitch entered the fine-pitch range below P1.5. The traditional SMD process had hit its physical limits, unable to balance the demands of fine pitch, high reliability, high image quality, and low power consumption. COB packaging technology formally moved from the laboratory to industrialization. Through direct bare-die packaging and integrated encapsulation protection, it avoided the problems of SMD solder joint failure, lamp detachment, and insufficient protection, becoming the mainstream technology for fine-pitch LEDs. From 2019 to 2022, the yield, image quality, and stability of flip-chip COB products improved substantially, gradually landing in core scenarios such as broadcast studios, high-end meetings, and command centres.

Bottlenecks of Traditional SMD Fine-Pitch Packaging Technology

As pixel pitch enters the ultra-fine-pitch range below P1.2, the structural defects of traditional SMD surface-mount packaging are fully magnified, becoming the core bottleneck constraining the development of the high-end LED display industry, mainly in five dimensions:

Physical Size Limits of Lamp Beads

SMD relies on discretely packaged lamp beads. The lamp bead bracket, housing, and leads occupy fixed space; the smaller the pixel pitch, the higher the lamp bead packing density and the smaller the clearance between beads. The physical structure cannot be compressed indefinitely, making it difficult to support mass production of ultra-fine-pitch products at P0.9 and below — resolution improvement hits a physical ceiling.

Sharp Decline in Solder Joint Reliability

Every lamp bead of SMD products depends on solder joints for fixation. At ultra-fine pitch, the number of solder joints grows geometrically while their volume shrinks dramatically. Long-term powered operation, temperature cycling, and environmental vibration can easily cause cold joints, solder detachment, and oxidation, triggering single-point dead lamps, chain failures, and colour deviation, with failure rates climbing continuously in 7×24 operation scenarios.

Seriously Inadequate Environmental Protection

SMD lamp beads have a semi-open structure. Delamination gaps exist between the lamp bead and the PCB, allowing dust, moisture, static electricity, mould, and salt spray to easily intrude, accelerating device aging and frequent failures. Conventional SMD products typically offer only around IP40 protection, with weak environmental adaptability.

Low Ceiling of Image Quality

SMD lamp beads are individually packaged devices. Viewed at close range, obvious graininess appears, contrast is low, and colour deviation between left and right viewing angles is large, failing to meet professional-grade image quality requirements.

High System Power Consumption, Severe Temperature Rise, and Limited Lifespan

SMD products mainly use face-up (wire-bonded) LED chips. The LED chip is blocked by metal wires, resulting in low electro-optical conversion efficiency; at the same brightness, system power consumption is higher and heat generation greater. Long-term high-temperature operation accelerates chip aging and brightness depreciation and shortens service life. Meanwhile, energy and maintenance costs stay high, which is inconsistent with the dual-carbon, low-carbon development trend.

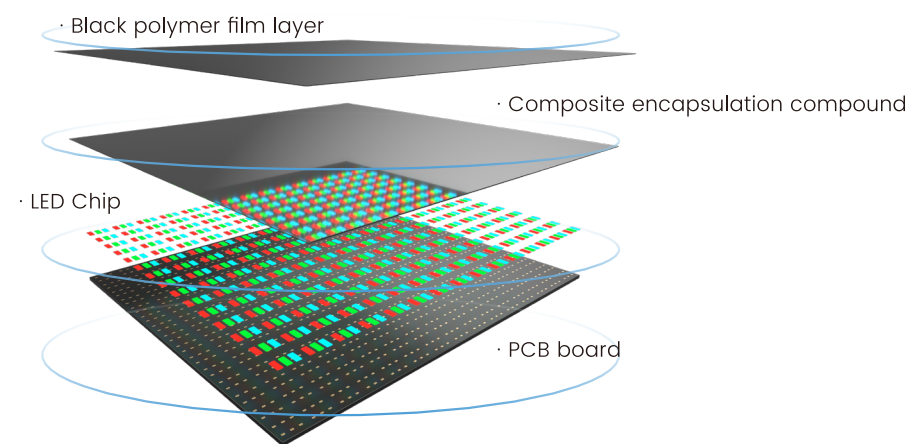
In summary, traditional SMD packaging cannot meet the high-end display requirements of ultra-high definition, high reliability, low energy consumption, and long lifespan. COB chip-on-board packaging technology has naturally become the industry's optimal solution.

02 Development History of COB Technology



Core Definition and Process Principles of COB Technology

COB (Chip On Board) is a bracket-free, lamp-bead-free, wire-free integrated LED packaging process. Its core definition is: micrometer-level flip-chip LED bare dies are directly die-bonded onto the PCB substrate, with composite encapsulant applied over the surface to form an integrated sealed display module, completely overturning the traditional SMD segmented production structure of “chip – packaged lamp bead – SMT soldering.”



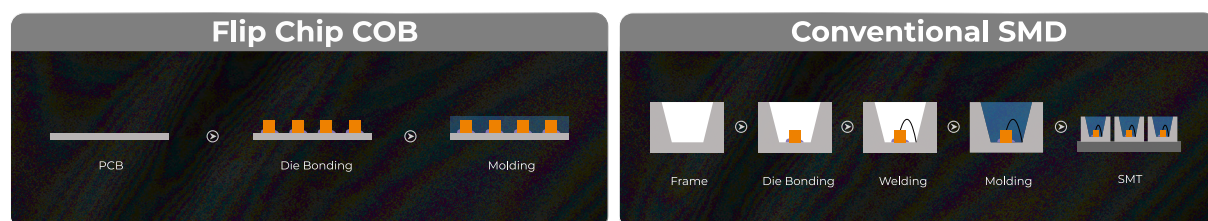
Complete Traditional SMD Process Flow

LED bare die → packaged into discrete lamp beads → lamp bead inspection and sorting → lamp bead taping and reeling → SMT placement on board → high-temperature reflow soldering → solder joint inspection → module packaging → system commissioning. The entire flow contains more than ten process steps and involves multi-layer structures of brackets, metal wires, solder joints, and packaging housings, resulting in many interface layers, many failure nodes, high thermal resistance, and weak protection.

Complete COB Process Flow

LED bare die → PCB substrate pretreatment → high-precision die bonding → SMT on the driver side → surface encapsulation → curing and forming → optical calibration → system assembly. The COB process directly eliminates the bracket production, lamp bead packaging, taping, placement, and reflow soldering steps of traditional SMD, and adds a high-protection encapsulant layer on the surface, fundamentally improving product reliability, optical consistency, and environmental protection capability.

Core advantages of the structural simplification: no brackets, no discrete lamp beads, no external solder joints, and panel-level packaging, achieving integrated structure, direct heat dissipation, fully sealed protection, and uniform optics, making it the optimal process for mass production of ultra-fine-pitch LEDs.



Three Stages of COB Technology Industrial Iteration

COB technology started in 2015 and, after nearly a decade of technology iteration, has progressed from laboratory prototypes and niche high-end applications to full-industry-chain maturity and all-scenario large-scale commercialization. Overall, it can be divided into three core development stages, while also clarifying the direction of future technology evolution.

Phase 1 : Technology Experiment and Exploration (2015–2018) — Prototype Landing and Niche Trials

This phase marked the infancy of COB technology. Industry players initially explored the direct bare-die packaging process; core technologies were not yet mature and industry chain supporting facilities were incomplete. On the technical level, there were problems such as low luminous efficacy, insufficient colour rendering, low yield, extremely difficult repair, and persistently high production costs. Products could not be mass-produced and could only be customised in small batches, with market prices far exceeding traditional SMD products. Application scenarios were extremely limited — only a small number of special scenarios with extremely high reliability requirements and cost insensitivity, such as core government command centres and military command and dispatch, with no entry into the civilian commercial market. The core value of this phase was to verify the feasibility of COB technology and lay the technical foundation for subsequent industrial iteration.

Phase 2 : COB Industrialization Maturation (2019–2022) — Process Breakthrough and Commercial Popularization

Starting in 2019, flip-chip technology, driving technology, black optical packaging processes, and automated die-bonding equipment achieved comprehensive breakthroughs. COB technology entered a rapid industrialization phase, officially ushering in the COB era. Core technological breakthroughs focused on four dimensions: first, large-scale application of flip-chip, which completely eliminated wire bonding and greatly reduced thermal resistance and failure rates; second, mature driving technology, which substantially reduced system power consumption and temperature rise; third, optimised black packaging processes, which greatly improved screen black consistency, contrast, and ambient-light anti-interference capability; and fourth, upgraded automated production equipment, which significantly improved product yield, continuously reduced production costs, and gradually standardised repair processes.

In this phase, COB products began entering the commercial market on a large scale, mainly covering mid-to-high-end scenarios such as high-end enterprise meetings, government exhibition halls, broadcast studios, and urban emergency command centres, gradually replacing traditional high-end SMD fine-pitch products. Industry users recognized COB's high reliability and high image quality value, and COB formally established its technological dominance in the high-end fine-pitch market.

Phase 3 : Large-Scale Commercialization of Flip-Chip COB (2023–Present) — All-Around Maturity, Industry-Wide Penetration

Since 2023, the COB industry chain has rapidly improved, and COB processes have entered an iteration stage of refinement, standardisation, and cost reduction, officially stepping into the COB commercial era. Pixel pitch has continued to shrink: P0.9 products have become the market mainstream, P0.7 products have grown rapidly at scale, and P0.6 ultra-high-definition products have achieved commercial deployment, comprehensively covering ultra-high-definition display needs.

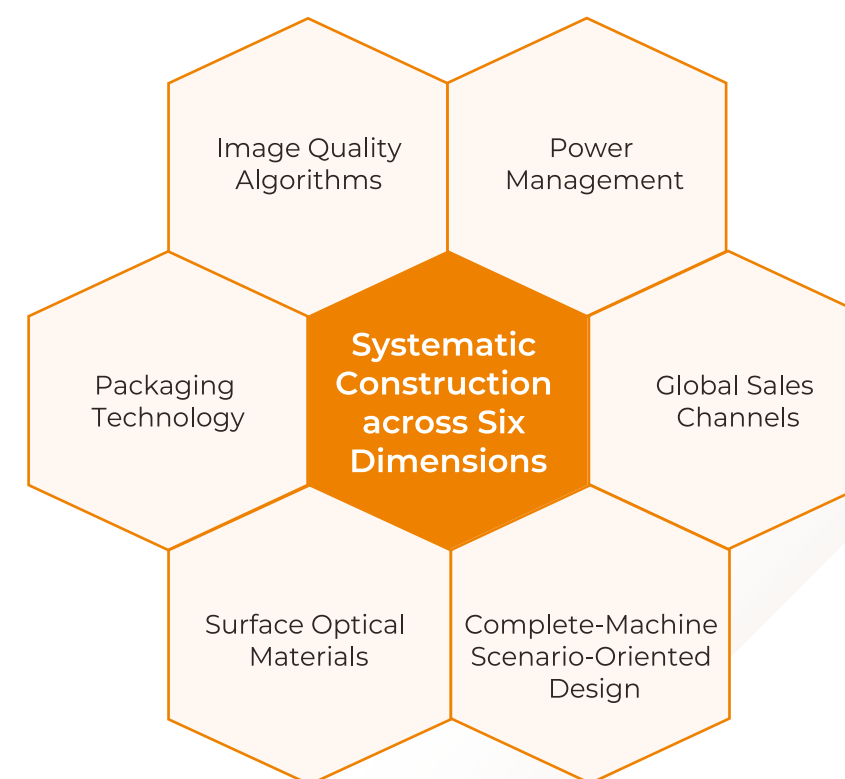
Meanwhile, product performance has been comprehensively upgraded, with wide colour gamut, ultra-high brightness, ultra-high contrast, and low power consumption fully delivered, adapting to complex scenario needs across industries. Across the industry chain — chips, driver ICs, PCB substrates, packaging materials, control systems, and automated equipment — standardisation has advanced and product costs have continued to decline, greatly improving cost-effectiveness. Application scenarios have penetrated from high-end special fields to government/enterprise, education, healthcare, transportation, energy, commercial retail, XR virtual production, and other industry-wide markets.

03

Absen's COB Product Technology Layout

Overview of Absen's COB Development Roadmap

Since 2016, Absen has foresightfully studied COB industry development trends and pioneered a long-term COB technology layout.



Over more than a decade, the company has adhered to full flip-chip COB as its core technology mainline, while systematically building out six dimensions: packaging processes, image quality algorithms, power management, surface optical materials, scenario-based complete machines, and global sales channels. It has achieved the complete industrial landing of COB from laboratory technology reserve to large-scale commercial application across all scenarios, establishing differentiated technology and product moats in the industry.

Milestone Development History (2016–Future)

2016

Forward-Looking Technology Reserve, Building the COB Underlying R&D Framework

Keeping pace with the world's Micro LED frontier development, Absen laid out the next-generation display technology track ahead of schedule, deeply collaborating with upstream chip and packaging material industry chain partners on joint R&D. Simultaneously, it launched laboratory validation of both IMD and COB dual-track basic processes, tackling underlying core challenges such as LED chip adaptation, panel ink-colour treatment, and surface protection coatings, laying a solid technology foundation for subsequent full flip-chip COB commercial products.

February 2021

Full Flip-Chip COB Core Route Established, Self-Developed HDR Image Quality System Finalized

Absen locked full flip-chip COB as its long-term core technology solution and completed the standardisation of the entire process set. With a dedicated ink-colour integrated treatment process, it addressed pain points such as reflection and poor ink-colour consistency of traditional displays at the hardware level; at the same time, it self-developed HDR image processing technology to improve both contrast and brightness, effectively reduce system power consumption, and comprehensively optimise colour reproduction and dynamic layering, establishing the benchmark for high-end COB image quality technology.

2022

Channel System Fully Expanded, COB Entering the Era of General-Purpose Display at Scale

With the KLCOB standardised series as the core carrier, Absen fully opened global distribution channel supply and improved multi-tier sales channels spanning distributors, integrators, and project channels. It pushed COB products from the high-end customised niche market toward the standardised general-purpose commercial market, accelerating the replacement iteration of traditional display products in the industry and officially entering the stage of large-scale popularization of general-purpose displays.

2024

Concentrated Breakthroughs in Core Underlying Technologies, Building an End-to-End Technology Moat

Entering a period of intensive technology iteration, Absen achieved multiple key technical breakthroughs in three areas: packaging, surface processes, and intelligent energy efficiency. The HTB new packaging and surface treatment technology was iterated and upgraded to optimise screen flatness, heat dissipation, and basic outdoor protection capability; the self-developed APMS intelligent power management system dynamically optimises system power consumption curves, reducing customers' long-term energy costs and extending system lifespan.

Future

Deep Exploration of End-to-End Intelligence, Building a Minimalist Integrated Display Ecosystem

Absen will continue to deepen frontier technology R&D in three directions — control systems, image quality computing power, and engineering deployment — driving COB toward intelligent, lightweight, and user-friendly iteration. R&D of highly integrated unified control systems simplifies peripheral accessories and cabling and reduces hardware deployment complexity; iteration of the self-developed UHD image engine deeply adapts 4K/8K ultra-high-definition content, optimising greyscale, colour, and dynamic picture performance; and an "engineering-free" intelligent commissioning system with built-in auto-calibration and one-click commissioning greatly lowers the commissioning threshold, achieving out-of-the-box use of standardised display equipment.

February 2018

First Commercial COB Product Launched, Completing Commercialization Validation

Absen officially released the first-generation P1.9 COB product to the global market, equipped with self-developed packaging substrate materials and HBB driving. The product achieved breakthroughs in three core metrics — ultra-high contrast, high brightness, and high system stability — marking Absen's key leap from COB laboratory R&D to volume commercial delivery and closing the loop on product commercialization.

September 2021

Clear Cobalt Global Launch, Leading the Industry in Surface Optical Coating Technology

Absen iteratively launched the Clear Cobalt series of high-end COB products, achieving major innovations in optical materials and surface processes: using a polymer black coating substrate to achieve an almost pure-black display effect and effectively suppress ambient light reflection; equipped with Absen's self-developed panel surface coating technology, the screen can reach a maximum brightness of up to 1,200 nits, combining deep black levels with high-brightness output capability, suitable for demanding professional scenarios such as control rooms, professional studios, and high-end government and enterprise meeting rooms.

2023

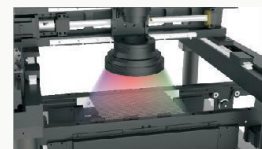
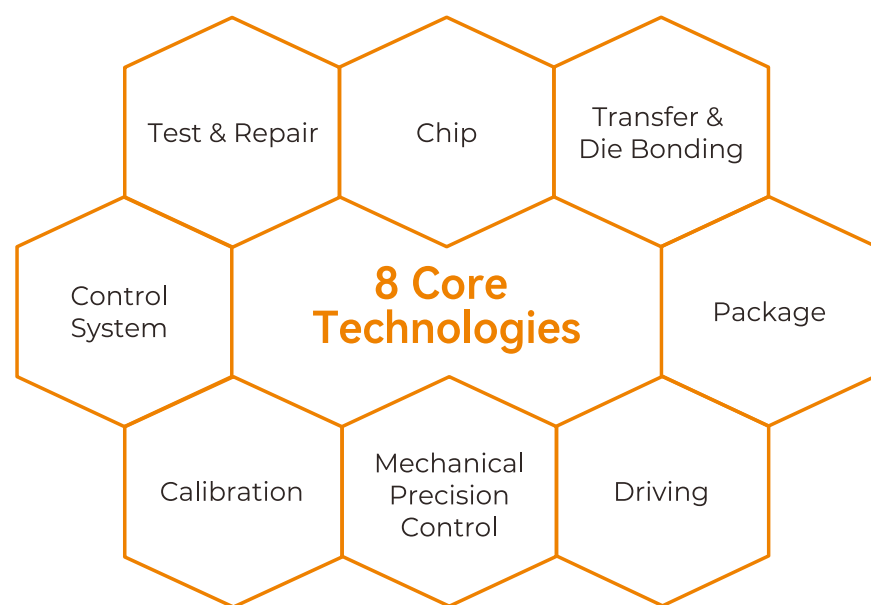
Indoor COB Matrix Fully Completed, Dual Technology Tracks Running in Parallel to Win the Commercial Meeting Market

Absen implemented a dual-track parallel COB R&D strategy to comprehensively enrich its indoor fine-pitch product system. It launched the full series of indoor COB fine-pitch products from P0.6 to P1.8, covering diverse needs from ultra-high-definition command centres to small and medium meeting rooms; for standardised complete machines, it released 108–216-inch COB integrated conference screens, achieving standardised delivery of complete machines and simplifying project deployment and commissioning; with a complete indoor product matrix, it accelerated replacement of the installed base and consolidated its core share of the indoor commercial display market.

2025

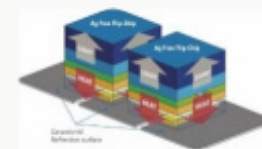
Scenario Boundaries Continuously Expanded, Full Coverage of Outdoor and Rental Tracks Achieved

Breaking the industry's inherent limitation that "COB is only suitable for indoor fixed-installation scenarios," Absen horizontally expanded into two incremental commercial tracks: Outdoor fine-pitch product line: launched P1.2–P1.5 outdoor-dedicated COB products, conquering outdoor application technical challenges such as wide temperature range, high protection, and long-term weather resistance; for rental scenarios, launched rental-dedicated COB panels in the same specifications, combining thin-and-light easy assembly/disassembly, fast splicing, and high-strength protection, covering stage performances, exhibitions and events, and temporary government and enterprise activities. With this, Absen achieved full COB product coverage across the four mainstream commercial scenarios: indoor meetings, command and control rooms, outdoor commercial, and event rental.



Jointly Developed High-Precision AOI Equipment Self-Developed Automated Rework Equipment

- AOI Inspection Efficiency & Accuracy
- Rework & Repair Accuracy
- Post-Repair Consistency
- Post-Repair Stability



Absen Self-Developed Algorithm for Chip Sorting

- Red Chip Yield
- Binning & Sorting
- Consistency at Low Current
- Miniature Size



10µm-Precision Chip Bonding Technology Co-Developed with Strategic Partners

- Efficiency
- Yield
- Precision
- Process Stability



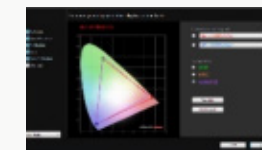
Ultra-Black Coating & High-Contrast Spraying Self-Developed Packaging Uniformity Control Tool

- Packaging Materials
- Equipment & Process
- Consistency Control
- Lifetime
- High Contrast



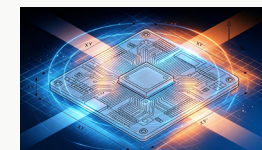
Absen Self-Developed 4K/8K +HDR Broadcast Control System Highly Integrated Control System

- High-Definition Image Quality
- High Resolution
- Easy Operation



Self-Developed Black Calibration Algorithm Self-Developed Color Gamut Management System

- Chip Uniformity Calibration
- Black & White Calibration
- Chroma Calibration
- Color Temperature Calibration
- Grayscale Calibration



Self-Developed Fine-Tuning Tool for X/Y/Z Tolerance

- PCB Size Control
- Physical Tolerance Control
- Edge Optical Reflection



Highly Integrated Common-Cathode Micro LED Driver Co-Developed with Partners

- AM & PM
- Low-Current Driving Accuracy
- High Integration
- High Refresh Rate
- High Grayscale
- Low Power Consumption

04

Absen Defines Products Based on Market Demand

With the rapid development of smart cities, professional AV, and ultra-high-definition industries, flip-chip COB fine-pitch has become the mainstream indoor display solution. Current market demand is clearly stratified, but industry products are generally homogenized, and a single model cannot satisfy diverse scenario needs: high-end broadcast and design scenarios lack professional-grade image quality and camera-friendly adaptation; large command centres urgently need long-term stable, low-maintenance-cost equipment; small and medium meeting rooms and retail stores lack lightweight solutions; and pain points of traditional display products such as reflection, heat, and high TCO continue to stand out.

Absen has a deep understanding of developments in the global COB fine-pitch display market and, based on the real-world needs of industry project implementation, has carried out targeted technology iteration and product matrix layout for all-scenario stratified pain points across different tracks including government/enterprise command and dispatch, professional broadcasting, and small and medium commercial applications.

Existing Industry Shortcomings and Market Demand Trends

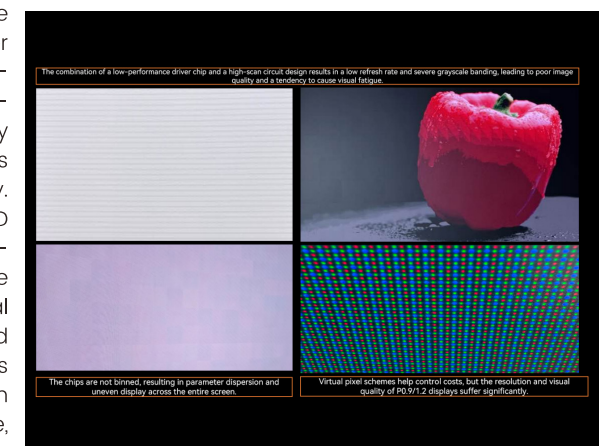
Severe Product Homogenization and Insufficient Differentiated Supply for Segmented Scenarios

At present, industry products are highly homogenised. Most manufacturers' core sources, hardware architectures, and nominal performance parameters tend to be identical; products only make minor changes in appearance and size, lacking differentiated innovation at the level of underlying technology, image quality solutions, and structural processes. This fails to match high-end customers' upgrade demands for ultra-high definition, high reliability, and long-term stability, nor can it meet the exclusive needs of various segmented scenarios or integrated supporting solution requirements, leaving the market stuck in undifferentiated low-price competition. Meanwhile, as vertical scenarios such as smart cities, virtual studios, transportation dispatch, and high-end commercial applications continue to refine, customer needs are moving toward personalization, specialisation, and customisation — no longer satisfied with generic standardised large screens. The market increasingly favours differentiated customised products with exclusive technology routes, dedicated image quality optimisation solutions, and flexible scenario adaptation; customised, high-spec innovative solutions with exclusive value for segmented scenarios have become the core growth direction of the industry.



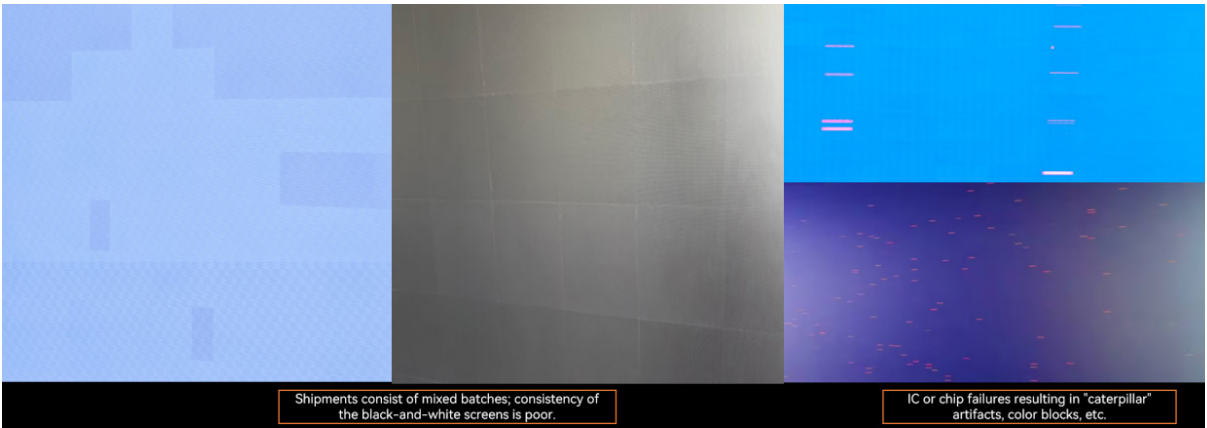
Price Competition Erodes Core Product Value, Industry Shifting to Competition in Image Quality and Comprehensive Solution Value

The current LED display industry is caught in intense price competition rather than competition on value. To lower quotes, manufacturers continuously cut spending on materials, processes, and quality control, causing display performance such as colour, greyscale, consistency, and stability to keep deteriorating, and customers in various scenarios can only passively compromise on picture quality. Long-term low-price competition not only squeezes R&D space, drags down the industry chain, and overdraws industry reputation, but also inflates the hidden maintenance costs of projects over their full life cycle. As professional demands in segmented scenarios such as command and dispatch, broadcast XR, and high-end commercial displays upgrade, customers' purchasing logic has shifted from simply comparing prices to evaluating full-lifecycle value, forming a rigid, non-negotiable demand for high-definition, accurate, long-term stable, high-quality images.



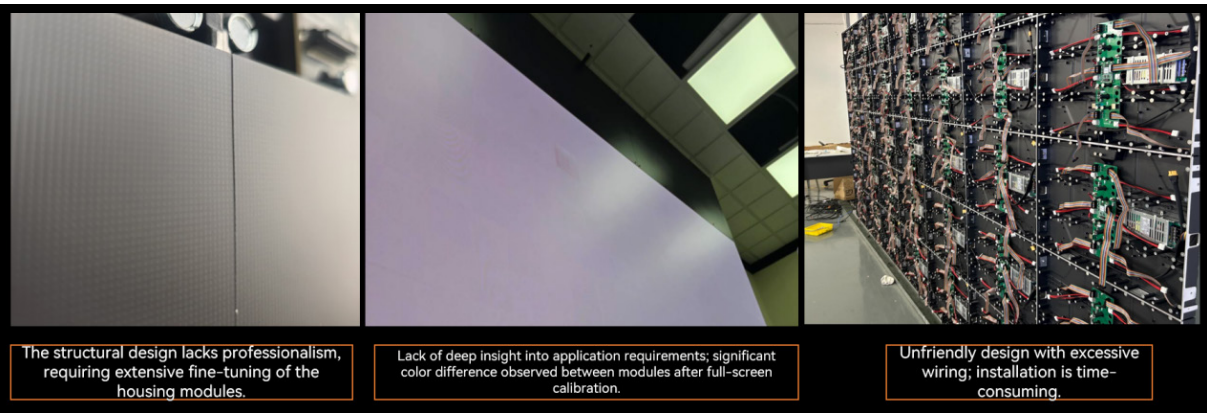
Mixed Product Quality Creates Rigid Demand for Standardized Quality Assurance

Product quality in the LED display market varies considerably, with good and poor offerings sold side by side. Even products from the same upstream panel manufacturer are divided into multiple material grades and process tiers based on cost. Many manufacturers choose low-grade components to compress costs and simplify factory QC and aging processes, directly leading to frequent quality problems such as colour spots and deviation, dark or dead lamps, driver faults, and picture decay. Many projects exhibit various image quality and hardware defects during on-site installation and commissioning; repeated rectification lengthens delivery cycles, and acceptance pass rates drop sharply. Once failures occur, there are also problems such as vague after-sales responsibility, slow repairs, and inconsistent replacement part quality, so customers' purchasing rights and long-term use experience cannot be effectively guaranteed. As procurement in professional scenarios such as government/enterprise dispatch, broadcast studios, and high-end commercial applications becomes more standardised, end customers increasingly value product brands, unified and stable quality, full-process traceable QC systems, and complete long-term after-sales guarantee mechanisms. Market demand is shifting toward brands with standardised tiered management, full-chain factory testing, and clear warranty compensation policies; low-quality non-standard products are gradually being eliminated. Establishing unified and reliable quality standards and complete customer protection systems has become an inevitable trend for high-quality industry development.



Cumbersome Construction and Commissioning Make User-Friendly Product Upgrades Imperative

Currently, most display products in the industry lack human-centred, integrated design; system structure and cabling layouts have not been simplified or optimised. Hardware assembly, line connection, colour parameter calibration, and signal synchronization commissioning processes are tedious and complex, with high operating thresholds, relying on professional technicians to complete full installation on site. Overall installation cycles are long, labor input is large, and project delivery efficiency is low, driving up integrators' labor and time costs. As batch project landing and rapid delivery demand surge, customers and integrators increasingly need products with lightweight modularization, quick-install structures, no complex commissioning, and visualized simple operation. Ease-of-use designs such as integrated prefabrication and standardised quick-connect cabling have become mainstream market demands; product solutions with low thresholds, high efficiency, and lightweight installation and commissioning will gradually replace traditional complex construction products.



Absen's Mainstream COB Product Portfolio

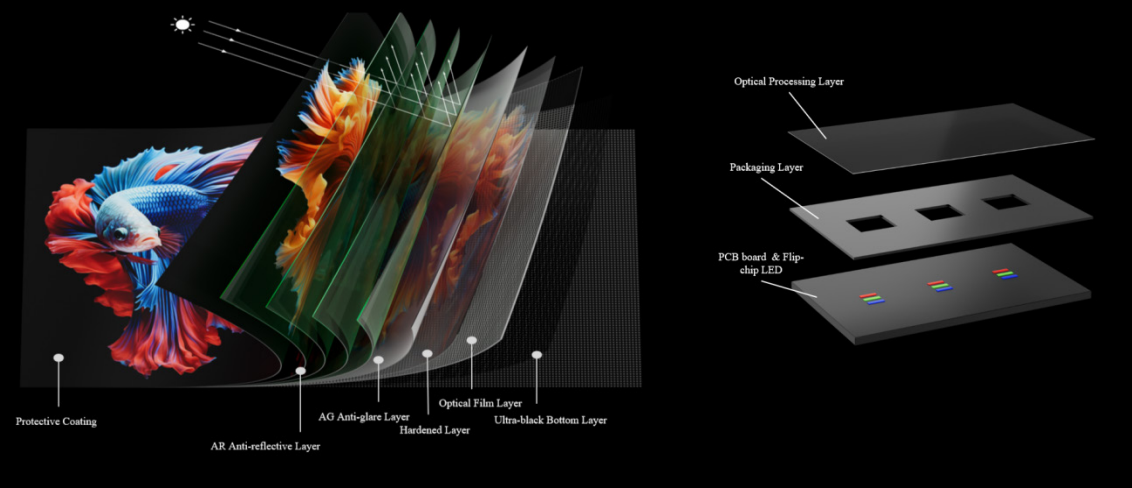
Relying on its self-developed flip-chip COB core packaging process, Absen has built a complete COB fine-pitch product matrix covering professional control rooms, high-end meeting rooms, broadcast studios, stage rental, retail digital signage, and outdoor HD light boxes across all tracks. Each series, built on the unified flip-chip COB underlying advantages of high reliability, high contrast, and strong protection, undergoes targeted technical optimisation for the image quality, stability, maintenance, and installation needs of different scenarios, covering everything from 0.6mm ultra-micro pitch to 1.8mm commercial pitch, and balancing differentiated application demands such as 7×24 uninterrupted duty, high display quality, quick-assemble rental, integrated vertical commercial use, and all-weather outdoor HD.



CL V3 • Redefining Vision with Flagship Image Quality

Absen CL V3 is a flip-chip COB flagship fine-pitch display screen for high-end indoor scenarios, fully adapted to close-range professional display scenarios including high-end meeting rooms, command centres, corporate lobbies, exhibition halls, flagship retail, and home theaters.

- 9-layer HTB ultra-black packaging process delivers an ultra-high contrast ratio of 30,000:1
- PWM+PAM hybrid driving achieves a peak brightness of 1,600 nits
- Over 95% DCI-P3 wide colour gamut with pixel-level precise colour calibration
- 7,680Hz ultra-high refresh rate with 22-bit high greyscale, smooth flicker-free images and no scan lines under camera
- AR+AG composite surface coating resists reflection and glare, with low blue light for eye comfort
- Ultra-thin die-cast aluminium 16:9 standard cabinet supporting full front maintenance
- Equipped with dual backup circuits and eight-star all-domain protection, it runs stably and uninterrupted 7×24, combining thin-light easy installation and long-term reliability



KLCOB V3 • True Brilliance, Excellence in All Domains

Absen KLCOB V3 is a professional flip-chip COB fine-pitch large display screen built for many application scenarios including command and dispatch, meetings, exhibitions, and commercial retail.

- Micrometer-level wire-free flip-chip LEDs with blackening packaging technology greatly enhance contrast
- Seam gap reduced by 37%, area light source with no grainy glare
- 20-bit high greyscale with 7,680Hz ultra-high refresh rate, 800 nits high-brightness output, complete restoration of light and dark details, and strong camera adaptability
- No flicker at low brightness, more eye-friendly for long-hour duty viewing
- A four-way collaborative energy-saving system combining flip-chip COB low power consumption, high-PF power supply, black-screen standby, and IC intelligent power adjustment saves over 40% energy overall
- The integrated fully-encapsulated structure greatly reduces solder joint failure points, cutting the failure rate by 50%, with a 100,000-hour ultra-long lifespan, extremely low repair rate, and significantly reduced maintenance costs
- Dual hot-redundant power and signal paths, an embedded active fire-suppression unit, and six-star all-domain protection eliminate black screens and electrical hazards, safeguarding uninterrupted operation of critical business
- A single cabinet weighs only 3.8kg with a thickness of 29.8mm; the thin-light cabinet can be quickly installed by one person, doubling construction efficiency
- Covers the full pitch range of P0.7–P1.5, compatible with mainstream control systems such as Nova and Barco, with an all-domain universal architecture and no adaptation barriers — one screen adapts to command halls, meeting rooms, exhibition halls, and more professional scenarios



iCon X V2 • Professional-Grade LED All-in-One, Fast to Install, Ready to Run, HD and Stable

Absen iCon X V2 is an integrated flip-chip COB professional display all-in-one built for government and enterprise meetings, smart classrooms, and corporate exhibition halls, available in standardised 136/163-inch system specifications, balancing high-definition visuals, rapid delivery, and long-term stable operation.

- 1.25/1.56mm fine-pitch COB panels with 5mm ultra-narrow bezels achieve a 98% ultra-high screen-to-body ratio, delivering a seamless visual connection
- 600 nits high brightness, 15,000:1 ultra-high contrast, DCI-P3 wide colour gamut coverage of over 90%, presenting 1.07 billion colours
- Multi-layer image optimisation algorithms deliver 2K+ ultra-clear image quality, with transparent and delicate light and dark details; the picture remains clear and vivid in bright meeting room environments
- Stable and reliable, with six-star protection, stronger impact resistance and stability
- The system uses an integrated pre-installed structure with accessories, cables, and decorative bezels pre-installed at the factory; two people can complete installation in half an hour, improving construction efficiency by 80% over traditional video walls
- Streamlined and optimised system architecture greatly reduces the probability of operational faults, with a built-in 8-core high-performance processor
- Supports quad-split screen and picture-in-picture multi-source simultaneous display, plug-and-play on all interfaces, perfect compatibility with various audio-video peripherals, and seamless integration with mainstream control systems such as Crestron and Extron
- One-click power on/off, signal switching, and brightness adjustment make the entire procurement, deployment, and maintenance process extremely simple and worry-free



15000:1
High contrast ratio

DCI-P3>90%
Cinematic color gamut

1.07 billion
Color display

Seven-star protection
Strong Against External Impact



AW Pro • Outdoor Ultra-High Definition, Clarity at Every Centimeter

Absen AW Pro is an outdoor flip-chip COB ultra-HD fine-pitch integrated light-box display screen built for high-end streetscape media, equipped with P1.25/P1.5 ultra-fine-pitch flip-chip COB panels, adapted to close-range outdoor display scenarios such as pedestrian streets, bus shelters, commercial plazas, and smart streetscape advertising.

- Ultra-high contrast of 19,000:1, 7,680Hz high refresh rate, and 3,500 nits ultra-high brightness
- Nano protection coating prevents outdoor yellowing and fading; close-up viewing delivers delicate and transparent images with true-to-life colour reproduction
- Five core modules integrated into the system, pre-installed and plug-and-play at the factory, with reserved industrial PC mounting positions, compatible with synchronous/asynchronous control systems, and flexible deployment in floor-standing, hanging, and pole-mounted forms
- IP65 high protection across the whole body with aluminium alloy air-duct silent heat dissipation structure, verified through 14-level wind resistance simulation, fearless of sun, rain, high and low temperatures, and other extreme outdoor environments
- With a remote cluster management system, it enables one-click content publishing, automatic brightness sensing adjustment, and real-time device status monitoring, greatly reducing later-stage maintenance costs



COB Technology



All-in-One Lightbox



All-Weather Protection



Smart Operations



AW1.2 Pro/AW1.5 Pro(Lightbox Configuration)

SA1.5 COB • Innovative COB Rental, Reshaping the Mini Vision

Absen SA1.5 COB is a Saturn SA series high-end rental flip-chip COB stage screen, equipped with a 1.56mm ultra-fine-pitch full flip-chip COB panel. Combining high-definition professional image quality, high-strength rental durability, and lightweight maintenance cost advantages, it is a next-generation high-definition display solution for high-end indoor rental performances, broadcast live streaming, and corporate galas.

- Six-star all-domain protection with multiple protective capabilities against impacts, moisture, dust, and ink-colour decay, improving stability by 40% over traditional SMD rental screens
- Full flip-chip LED technology reduces system power consumption by 30%
- Deep black coating + AG low-reflection panel keeps surface reflectance below 0.4%
- With 1,200 nits high brightness, 8,000:1 ultra-high contrast, 7,680Hz ultra-high refresh rate, and 99.9% DCI-P3 wide colour gamut, the 160° wide viewing angle delivers uniform and transparent images without reflection or stray shadows, perfectly suited to close-range shooting scenarios in studios, live broadcasts, high-end product launches, and large-scale performances
- 500×500mm double-layer die-cast magnesium alloy cabinet structure, only 7.2kg per cabinet, lightweight and deformation-resistant, with visual quick-lock splicing structure for efficient assembly and disassembly
- The full series is compatible with existing SA series accessories; COB equipment can be upgraded without changing inventory



- Full Flip-Chip COB Technology Applied
- Engineered for Durability and Security
- Versatile Applications
- Compatible with SA Series Accessories

05 Analysis of Absen COB Typical Case Studies



Real-World Cases Validate Product Value

In the current era of rapid COB product iteration in the industry, scenario pain points and implementation difficulties emerge endlessly. Standardized product solutions need to be refined through real business scenario implementation. To intuitively and concretely demonstrate Absen COB's core capabilities, adaptable scenarios, and delivery results, this chapter selects benchmark typical cases across multiple fields, focusing on real customer needs, business pain points, implementation paths, and delivered results, providing industry users with practical, replicable evidence for product selection, scenario implementation, and solution optimisation.

Case 1 : Top Industry Benchmark – The World's Largest Indoor COB Curved Screen (Computing Power Command Center)

The command centre of a well-known high-tech enterprise adopted Absen's KLCOB V2 series products with a 0.9mm pixel pitch and a total area of 395m². With a width of 55.8 metres and a height of 7.0875 metres, it precisely presents a smooth 264.17° curve, creating a seamless immersive surround-screen experience. The entire screen has 403 million pixels, a 59520×7560 ultra-HD pixel matrix, setting a record for single-screen pixel count.



Case 2 : Global Industry Leader Benchmark – GM Charlotte Technical Center COB Project, USA

General Motors' Charlotte Technical Center implemented an integrated display-and-control solution as a whole, selecting Absen CL series flip-chip COB micro-pitch display screens with a total area of 167.38m². Deployed across two core scenarios — a lobby brand image display and a core control room ultra-HD giant screen — it covers multiple application needs in one stop: brand image display, vehicle R&D data visualization, and global business command and dispatch.



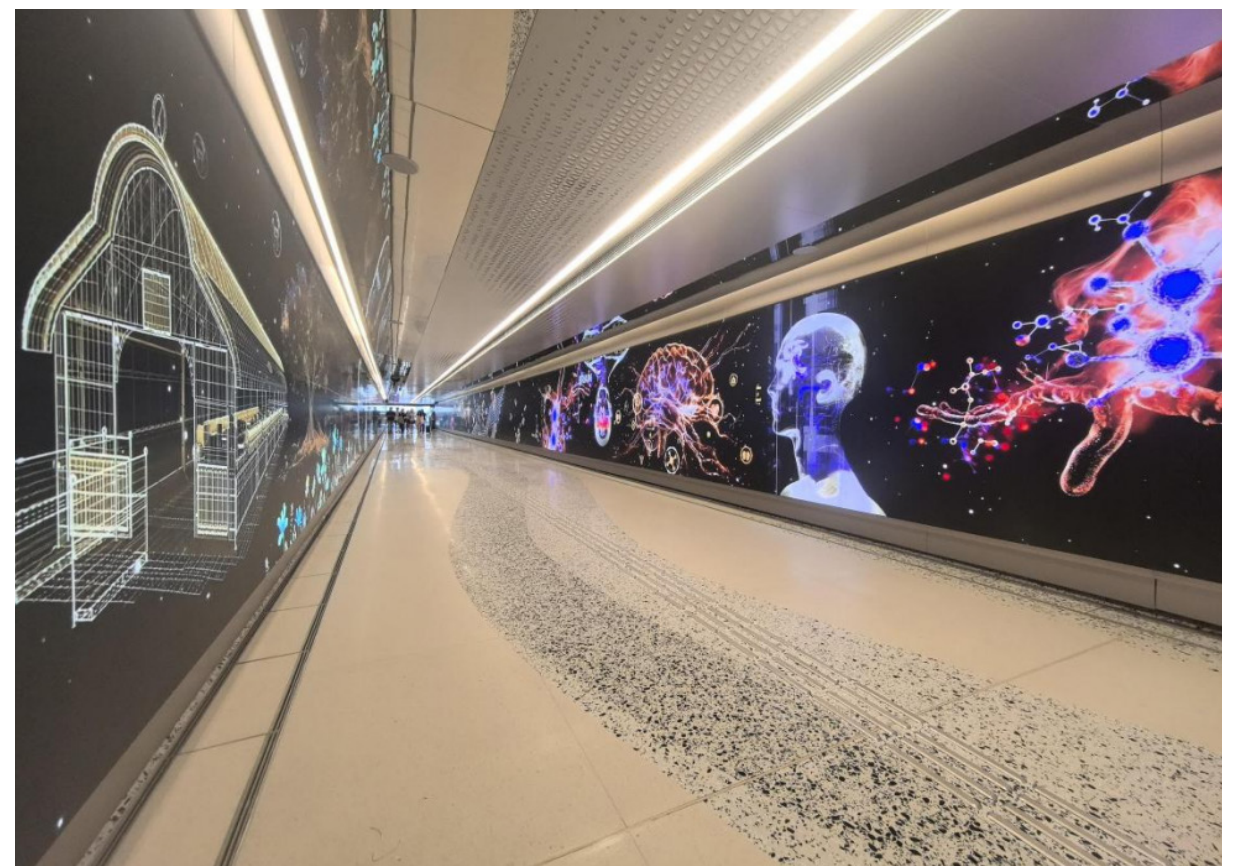
Case 3 : National Key Nuclear Scenario – Daya Bay Nuclear Power Plant COB Series

At the radiation monitoring and early-warning centre of Daya Bay Nuclear Power Plant — China's first commercial nuclear power plant with million-kilowatt units — a P0.9 flip-chip COB HD large screen with a total area of 14.58m² was deployed. Relying on the high-reliability packaging advantages of flip-chip COB, the product perfectly adapts to the nuclear plant's year-round, uninterrupted, stringent duty requirements, setting a benchmark for 7×24 stable display in nuclear power and becoming a landmark project of COB technology implementation in the energy security track.



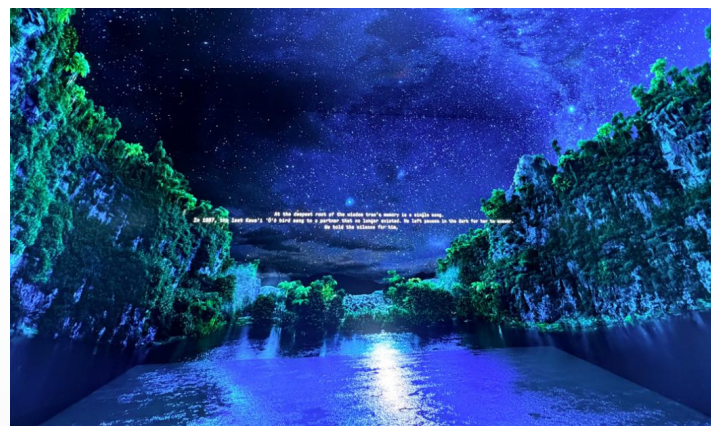
Case 4 : Transportation / Cultural Tourism Immersive COB Landmark – City University of Hong Kong Tomorrow Innovation Tunnel

In a core pedestrian tunnel in Hong Kong, China, KLCOB V2 COB built a 100-metre immersive double-sided giant screen with average daily footfall of 60,000 visitors — a benchmark of ultra-long immersive COB screens in urban cultural tourism public spaces.



Case 5 : Exemplar of COB Immersive Applications
– DATALAND Los Angeles AI Art Museum KLCOB Benchmark Case

Co-created by Absen and world-leading AI media artist Refik Anadol, DATALAND houses five art exhibition halls totaling 25,000 square feet. The venue adopts Absen's flagship-quality COB series large screens, using seamless splicing technology to ensure visual integrity. Based on high colour-accuracy reproduction and high-speed dynamic refresh rate, the screens precisely present the subtle light and shadow changes continuously generated by AI model calculations, ensuring smooth picture switching and clear layering.



Case 6 : Transportation Hub – Shanghai Metro
(Nanjing East Road + South Shaanxi Road Stations) COB Cases

This project landed at Shanghai's two core metro hubs — Nanjing East Road and South Shaanxi Road stations — becoming a benchmark flip-chip COB project in the underground commercial district, filling the gap in large-scale COB implementation in China's underground rail transit and creating a standardised reference model for smart large screens in underground passages nationwide. The entire line adopts KLCOB series products: Nanjing East Road station is equipped with a 170m² one-piece seamless COB large screen connecting the entrances and exits of the commercial district; South Shaanxi Road station, an interchange of three lines, hosts a 250m² combined COB display wall covering the core transfer passages. The total screen area of the project is 420m² with an average daily passenger flow of more than 800,000 people. The equipment operates long-term in an underground enclosed environment with high foot traffic, humidity, dust, and strong electromagnetic interference — a benchmark project verifying the reliability of COB products under underground transit conditions.



The successful implementation of numerous projects not only demonstrates the considerable technical strength of Absen COB products in image quality, quality, and ultra-low TCO full-lifecycle cost, but also, backed by the Absen-Care global full-lifecycle service system, builds a solid long-term operational guarantee for COB display projects worldwide.

Absen has built a global three-tier localized service network, with 15 first-level service centres and 25 second-level regional centres, connected with more than 1,000 authorized service partners, covering 165 countries and regions across six continents. Globally, more than 5,400 ACE-certified engineers implement a 7×24 all-day online response mechanism, reaching fault sites in core regions within 4 hours. Original spare parts are dispatched quickly and repair processes are managed under standardised control; the average on-site fault resolution cycle is only 3.3 days, and the online issue resolution rate reaches 97%. From pre-project site surveys and custom structural solution design, to on-site standardised installation and commissioning, and on-duty support at key opening milestones, to later-stage remote intelligent maintenance, regular inspections, engineer operation training, and extended warranty value-added services, Absen forms a closed-loop one-stop delivery capability. With unified strict service standards and localized rapid response capabilities, Absen solves industry pain points such as slow after-sales response, non-standard maintenance, and long spare parts cycles for domestic and international projects. With the dual confidence of technical products plus global fallback services, it ensures long-term stable and efficient operation of screens for every partner, minimizes later-stage maintenance investment, and endows projects with long-lasting and reliable commercial value.

Sincere Service
Excellent Experience

Please feel free to contact us, It's our honor to provide service for you.

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