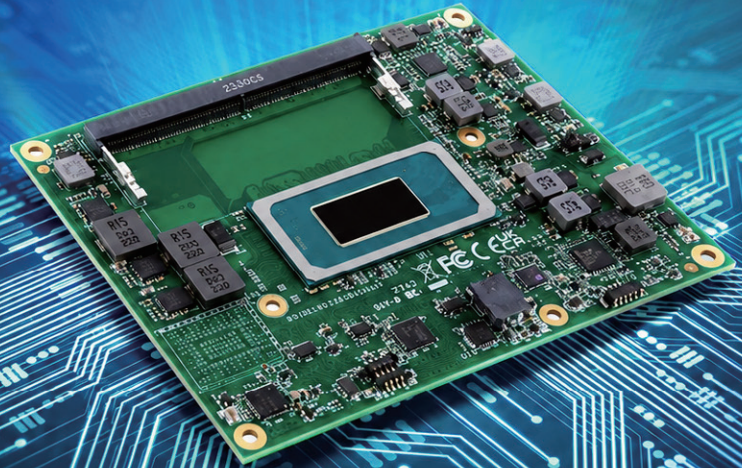


Part 03



COM Express × Edge Computing

Scalable and Upgradeable Intelligent Systems
with Modular Architecture

Presented by
Market Intelligence

2026

Table of Contents

1. Key Takeaways from Part 1 & Part 2

2. Portwell COM Express Success Stories

- Healthcare / Medical: Ultrasound Device
- Defense: Anti-Drone System
- Networking / Communication: Long-Range Wireless System
- Warehousing / Logistics: AGV / AMR

3. Part 3 Conclusion

4. Portwell DMS Service Concept

COM Express × Edge Computing

1. Key Takeaways from Part 1 & Part 2

In Part 1 and Part 2 of the COM Express series, we positioned COM Express within the IPC industry from the perspectives of technical specifications and platform strategy. Through the division of labor between a standardized Computer-on-Module and a customized carrier board, COM Express integrates the CPU, memory, BIOS, power management, and high-speed signal interfaces on the module side, while the carrier board is designed around application-specific LAN, USB, PCIe, CAN, COM, display, storage, and power interfaces. This enables equipment manufacturers to upgrade the computing core while maintaining the existing mechanical design and I/O architecture, reducing repeated design work, validation effort, and supply chain risk. In terms of form factor and type, Mini, Compact, Basic, and Extended address different space, power, and performance requirements. Type 6 is suitable for display, general-purpose I/O, machine vision, and industrial control; Type 7 focuses on high-speed Ethernet, PCIe, and high-throughput applications; and Type 10 is designed for low-power, small-form-factor embedded devices. Compared with SBC, COM-HPC, Qseven, and SMARC, COM Express offers a strong balance of mature ecosystem support, mid- to high-end performance, expansion flexibility, and long product life cycle.



Portwell supports this platform strategy with a product portfolio covering Type 6, Type 7, and Type 10, combined with carrier board design, BIOS customization, thermal planning, system validation, and long-term supply support. These capabilities help customers shorten development cycles and build platforms that can be upgraded over time.

2. Portwell COM Express Success Stories

• Vertical Market: Healthcare / Medical

Embedded Computing Platform Advances the Upgrade of Ultrasound Examination Devices

Medical Examination by Ultrasound Device

Options of Carrier Board

- PCOM-C605R
- PCOM-C60F

COM Express Module

- PCOM-B659

Responsive HMI for Streamlined Clinical Workflow

Advanced Image Processing for Diagnostics

- COM Express Type 6 Compact size module
- 13th Gen Intel® Core™ processor
- Up to 6x performance core + 8x efficient core, and up to 96x graphic execution units
- 2x DDR5-5200 SO-DIMM up to 96GB, 2x Gen4 x4, and 8x PCIe Gen3 x1
- 4x USB3.2 Gen2, 2x SATA, 3x DDI, VGA, eDP/LVDS

Portwell

As global healthcare services continue to move toward precision diagnostics, real-time medical image interpretation, and distributed care, ultrasound examination devices have become an essential medical platform that integrates image processing, data transmission, human-machine interaction, and system-level integration within clinical diagnostic workflows. With advantages such as real-time imaging, non-invasive examination, high deployment flexibility, and fast clinical procedures, ultrasound systems are widely used in general clinics, emergency rooms, obstetrics and gynecology,

cardiovascular examinations, abdominal examinations, bedside care, and mobile healthcare scenarios.

However, as imaging resolution continues to improve, probe signal processing becomes more complex, and clinical users demand more responsive operating interfaces and diagnostic assistance functions, the challenges facing ultrasound system developers have expanded into multiple areas. These include high-performance computing, compact system architecture, long-term availability, low-power thermal design, medical system integration, and product lifecycle management. For medical device manufacturers, implementing a stable and reliable core computing platform within a limited mechanical space, while supporting high-resolution image output, multi-interface peripheral connectivity, and future functional upgrades, has become a critical factor in ultrasound equipment design.

- **Core Computing Architecture for Ultrasound Devices: PCOM-B659**

To address the requirements of medical ultrasound examination devices for high performance, stability, and platform scalability, the Portwell PCOM-B659 COM Express Type 6 Compact module can serve as the core computing engine inside the equipment. It helps customers build an embedded platform that combines image processing, HMI operation, and system control capabilities.

Powered by the 13th Gen Intel® Core™ processor platform, PCOM-B659 supports up to 6 Performance-cores and 8 Efficient-cores, along with up to 96 graphics execution units. This enables the platform to handle ultrasound image signal processing, real-time image display, diagnostic workflow control, and multitasking applications. In clinical environments, ultrasound systems must present scanning images, parameter settings, measurement markers, and examination data in real time while physicians operate the probe. Therefore, the system platform must deliver fast response and stable graphics output.

Through its COM Express modular design, PCOM-B659 allows equipment developers to separate the core computing module from the customized carrier board. Based on different product line requirements, customers can select carrier board options such as PCOM-C605R or PCOM-C60F, accelerating prototype validation, feature development, and subsequent mass production deployment.

- **From Image Processing to HMI Operation, Enhancing the Value of Medical Devices**

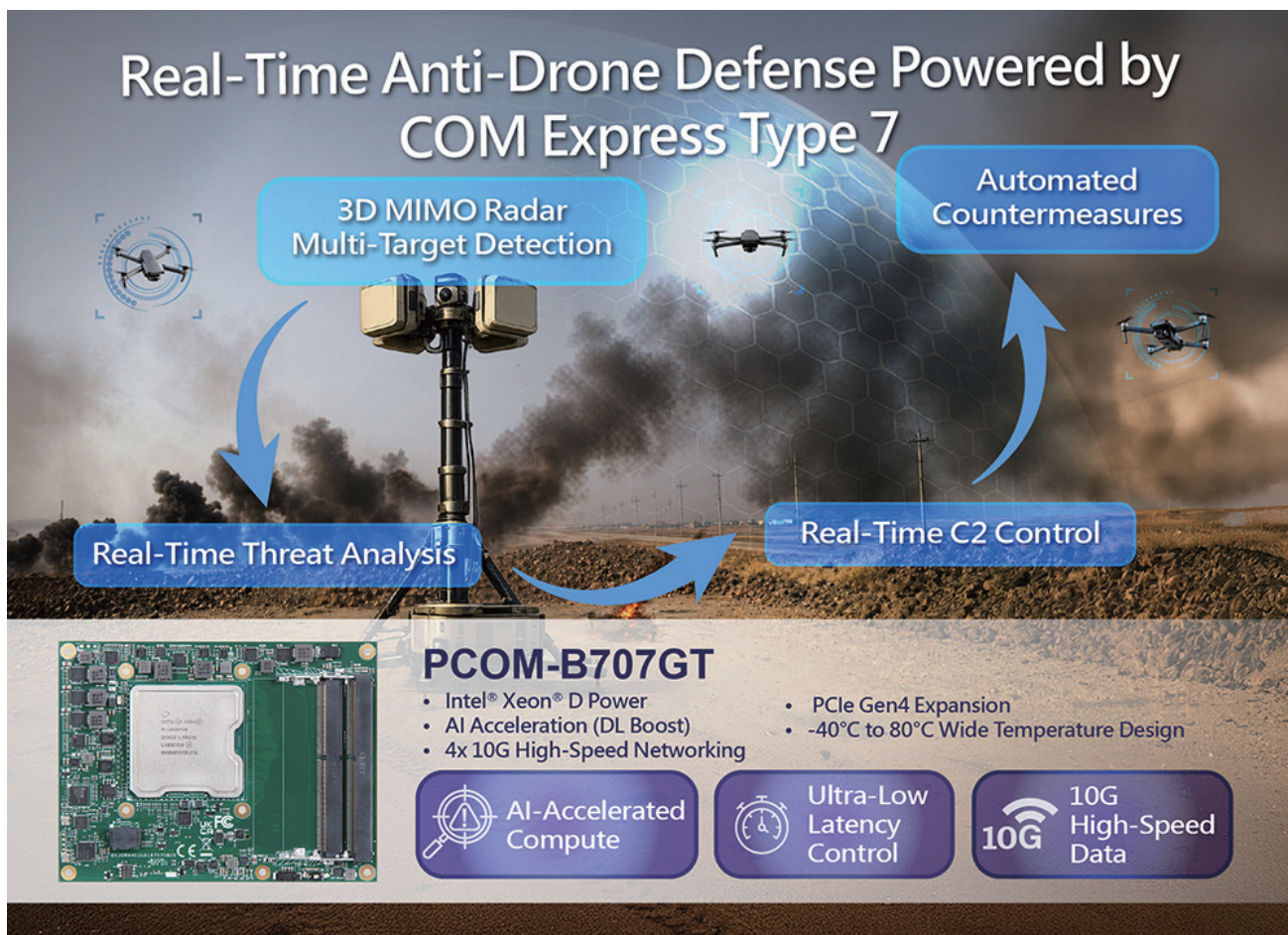
Within the ultrasound system architecture, PCOM-B659 supports a wide range of medical peripheral functions through comprehensive I/O and high-speed data channels. It supports DDR5-5200 SO-DIMM memory with a capacity of up to 96GB, which benefits image buffering, real-time data processing, and simultaneous operation of multiple applications. PCIe Gen4 x4 and PCIe Gen3 x1 can be used to connect image acquisition modules, signal

processing boards, AI acceleration modules, or high-speed storage devices. USB 3.2 Gen2 can support touch panels, scanners, external storage, medical peripherals, or maintenance interfaces. SATA can be used for system storage and examination data retention.

This architecture helps reduce duplicated development efforts across different device models. High-end ultrasound systems can leverage greater computing performance to support advanced image processing and diagnostic assistance functions, while mid-range or entry-level models can adjust product positioning through different carrier board and peripheral configurations. For clinical users, a stable and responsive HMI interface can shorten examination time and reduce waiting time during image adjustment, patient data entry, and reporting workflows. Real-time image processing capability also helps improve diagnostic efficiency and the overall examination experience.

- **Vertical Market: Defense**

High-Performance COM Express Type 7 Edge Computing Core Driving Real-Time Anti-Drone Defense



Amid the rapid surge in global military protection and security demands in 2026, effectively addressing low-altitude drone threats has emerged as a defining battlefield for mission-critical operations. Built on Portwell’ s COM Express Type 7 module platform, this solution, developed in collaboration with ecosystem partners, delivers a comprehensive anti-drone defense system for small unmanned aerial vehicles (UAVs). It integrates detection, tracking, and automated countermeasure capabilities, enabling millisecond-level decision response from target acquisition to prioritized threat neutralization, even in the most extreme environments.

COM Express Type 7 Driving High-Performance Anti-Drone Defense Architecture

In anti-drone applications that demand intensive data processing and real-time decision-making, the COM Express Type 7 Basic Size module provides a high-performance platform purpose-built for server-grade edge computing. It is ideally suited for high-throughput data streams and multi-sensor integration, delivering the capability to support low-latency data processing and real-time decision execution. Taking Portwell’ s PCOM-B707GT as an example, the module is powered by the Intel® Xeon® D-1800 series processor (up to 10 cores), providing a robust and reliable computing foundation for complex Multiple Hypothesis Tracking (MHT) algorithms and trajectory prediction. In addition, with four 10GBASE-KR high-speed network interfaces, the system ensures that massive data streams from multiple radars and sensors can be transmitted to the command center with near-zero latency, forming a bottleneck-free digital data pipeline. The module also supports a wide operating temperature range of -40°C to 80°C, ensuring stable performance across extreme deployment environments, including desert borders, high-altitude regions, and vehicle-mounted platforms.



High-Bandwidth Edge Processing for Multi-Target Detection

Combining 3D MIMO radar with MHT algorithms, the system achieves high-resolution, continuous tracking. The 10GBASE-KR bandwidth enables real-time processing of large-scale radar data. With Intel® DL Boost acceleration, it delivers precise multi-target detection and accurate 3D positioning in complex environments.



AI-Accelerated RF Analysis for Rapid Threat Identification

In dense RF environments, distinguishing threats must occur within milliseconds. The PCOM-B707GT features a processor with Intel® DL Boost support, enabling accelerated edge AI inference. It allows the system to rapidly analyze multi-dimensional RF features, enhancing signal identification and threat classification efficiency. With up to 64GB DDR4 ECC memory, the system maintains large-scale whitelists and authorization databases, ensuring friendly signals are preserved while threats are prioritized in real time.

3



Low-Latency C2 with Intel® TCC and Flexible I/O

- A web-based Command and Control (C2) system acts as the operational core:
- Real-time situational awareness
- Intel® TCC ensures near-zero latency in radar data visualization.
- Seamless device integration
- Interfaces including USB 3.2, USB 2.0, and UART support cameras, sensors, and HMI devices, enabling flexible deployment.

4



Millisecond-Level Anti-Drone Response Execution

Integrated with automated jamming systems, the platform supports multi-band disruption across ISM, GSM, LTE, and GNSS :

- High-speed response chain
- 4× 10GBASE-KR ensures rapid command transmission.
- Instant neutralization
- PCIe Gen 4 expansion enables immediate signal execution, achieving fully automated, real-time threat mitigation.

Effective anti-drone systems require high performance, rugged computing platforms. The PCOM-B707GT delivers 10GbE bandwidth, strong processing power, and wide-temperature reliability, making it a critical foundation for real-time threat prioritization and interception in modern defense scenarios.

- **Vertical Market: Networking / Communication**
Unmanned Object Control with Long-Range Wireless Communication



Unmanned Drones and Autonomous Platforms Move Toward Collaborative Operations, Making Long-Range Communication and Control Critical to System Architecture

As drones, unmanned surface objects, unmanned ground robots and remote monitoring systems are rapidly deployed across inspection, disaster prevention, port management, energy infrastructure, border surveillance, smart city and industrial safety applications, the unmanned object industry is increasingly moving toward system-level architectures that integrate long-range communication, multi-sensor data fusion, real-time image transmission, object recognition and tracking, as well as multi-device collaborative control.

In real-world deployments, drones can work together with ground control stations, edge AI systems, 5G NR communication devices, Wi-Fi/LRWM long-range wireless modules, switches and backend management platforms to enable image return, mission command delivery, target designation, route correction and abnormal event reporting. However, these applications also face multiple challenges, including long-distance communication stability, image latency, data synchronization between vehicle-side and ground-side systems, high-bandwidth exchange requirements for AI inference and communication data streams, and the need to design a high-performance control platform within limited space and power conditions.

The real challenge is how to build a core computing architecture that can operate reliably for extended periods in complex field environments, support high-speed I/O, provide flexible expansion and be rapidly deployed across different unmanned object applications.

PCOM-B706GT Integrated with Long-Range Wireless Systems Strengthens Unmanned Object Control and Data Transmission

Within a long-range wireless control architecture, Portwell's PCOM-B706GT can serve as the core computing module for unmanned object control, communication aggregation and edge data processing. It helps integrate drones, 5G X-Cell, LRWM long-range wireless modules, Wi-Fi, switches, ground control stations and edge AI systems into a complete mission control platform.

Designed as a COM Express Type 7 Basic module, the PCOM-B706GT is powered by the AMD Embedded Ryzen™ V3000 series processor and supports two DDR5 4800 MT/s SO-DIMM memory modules. This enables the system to meet the demands of real-time mission control, image data processing, communication packet switching and multitasking applications.

With support for up to 14x PCIe Gen 4 lanes, the system can flexibly connect to high-speed network controllers, image capture cards, AI accelerator modules, customized I/O carrier boards and high-speed storage devices. Optional on-module PCIe x2 NVMe storage further supports mission recording, image buffering, model data storage and system log retention. When drones perform image transmission, target designation and tracking missions in long-distance field environments, PCOM-B706GT can handle high-speed data exchange and system control tasks at the ground or edge control side. Through communication links such as 5G NR, LRWM and Wi-Fi, image data, sensor information and control commands can be transmitted among different devices in a real-time, stable and traceable manner.

Extending from Drones to Diverse Unmanned Platforms, Building a Scalable Edge Control Core

The value of PCOM-B706GT lies not only in its suitability for drone control systems, but also in its ability to extend to unmanned surface objects, unmanned ground robots, mobile monitoring equipment and remote automation platforms.

In drone applications, the system can support image return, mission monitoring, target positioning and control feedback. In unmanned surface object scenarios, it can be applied to port inspection, water area monitoring, environmental sensing and remote navigation control. In unmanned robot applications, it can support mobile inspection, equipment monitoring, site safety and multi-robot collaboration.

Through the modular architecture of COM Express Type 7, customers can design dedicated carrier boards based on specific field requirements, integrating LAN, PCIe, USB, COM, storage, wireless communication and power management into a single platform. This helps reduce design risks from prototype validation to mass production deployment.

For industrial applications, this modular strategy can effectively shorten development cycles while allowing core computing modules, hardware designs and software assets to be reused across different projects.

• Vertical Market: Warehousing / Logistics

Advancing Smart Logistics Applications with Highly Integrated Edge Computing



AGV/AMR 24/7 Automated Operations: Edge Control Platforms Become the Core

As smart manufacturing, e-commerce logistics, semiconductor warehousing, automotive parts distribution, and large-scale in-plant logistics continue to accelerate, AGVs and AMRs are evolving into intelligent mobile nodes capable of working collaboratively with warehouse management systems, dispatching systems, production line equipment, sensors, and cloud platforms. For field operations, the greatest value of unmanned handling robots lies in their ability to reliably perform material replenishment, pallet handling, semi-finished goods transfer, finished goods warehousing, and cross-zone transportation under 24/7 operating conditions. Through real-time path planning and system-level dispatching, they help improve overall logistics efficiency.

However, AGV/AMR deployment environments are typically highly dynamic, densely populated, and subject to stringent safety requirements. These systems must determine travel paths in real time among warehouse racks, conveyor lines, operators, forklifts, and other mobile equipment, while simultaneously processing multi-source data from LiDAR, IMU, radar, GNSS, cameras, and wireless communication modules. If the computing platform cannot integrate sensor information in real time, it may lead to delayed path decisions, insufficient obstacle avoidance response, inefficient fleet dispatching, or difficulties in equipment maintenance.

Edge Computing Architecture for Sensor Integration and Real-Time Decision-Making: PCOM-BA03

As AGV/AMR systems are increasingly deployed in smart warehousing, in-plant logistics, and unmanned material handling applications, real-time control, sensor integration, and long-term operational reliability have become essential requirements. Portwell PCOM-BA03 can serve as the core edge computing module for unmanned handling robots, helping customers build a low-power, highly reliable, and easy-to-integrate mobile control platform. Positioned as the central computing layer of an AGV/AMR system, PCOM-BA03 receives data from environmental imaging, route condition detection, and multiple sensors, then processes this information in real time to generate path decisions, route safety assessments, and obstacle avoidance results. This enables robots to operate continuously, autonomously, and safely in complex environments where warehouse racks, conveyor lines, operators, and other mobile equipment coexist.

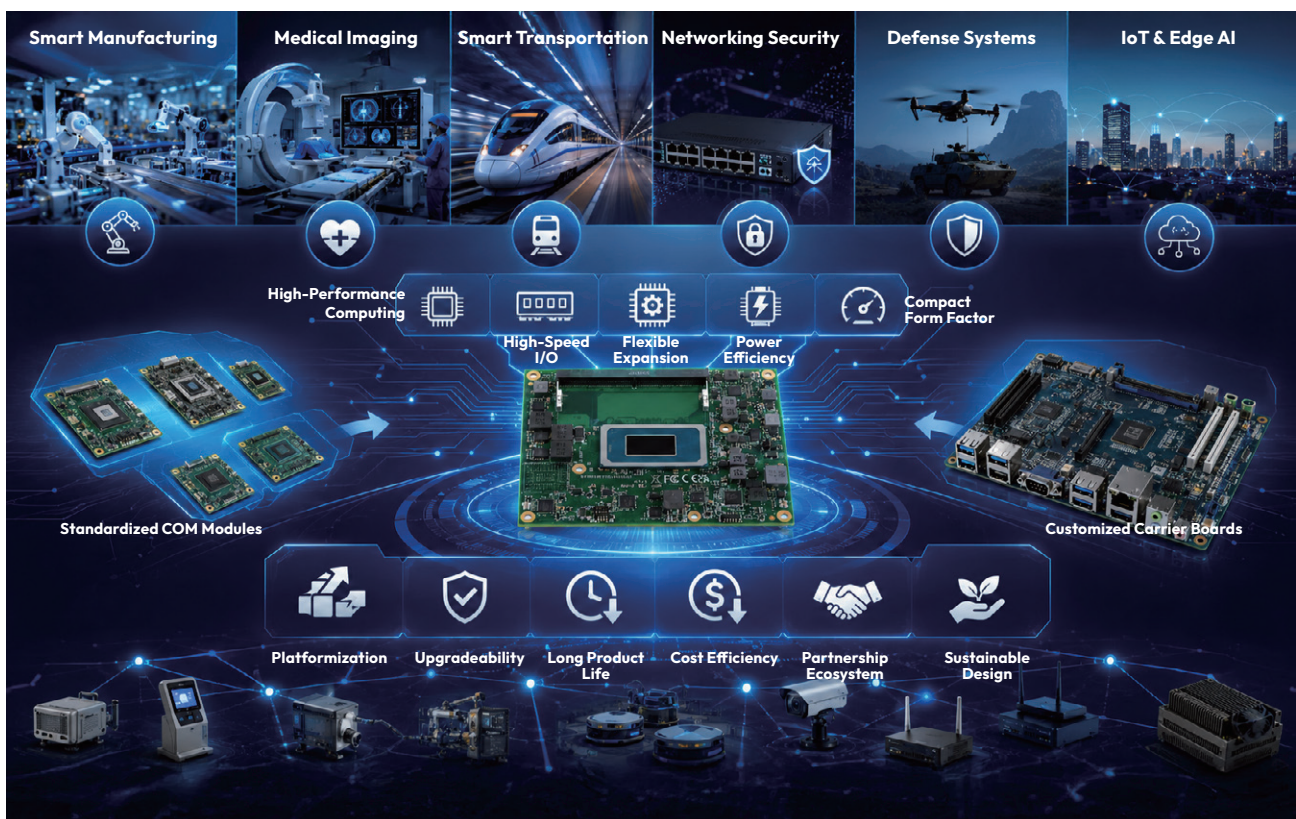
PCOM-BA03 adopts a Type 10 mini COM Express® module design and is powered by Intel® Atom™ x7000E/RE series processors. With its low-power and stable computing characteristics, it is well suited for AGV/AMR onboard systems where space is limited, thermal conditions are challenging, and continuous operation is required. The module supports onboard LPDDR5 up to 16GB, enabling efficient processing of multi-sensor data, route decision-making, and equipment status monitoring. It also supports onboard eMMC up to 256GB for storing system software, mission records, vehicle status data, and basic application programs. Compared with higher-power computing platforms, PCOM-BA03's 6W to 12W low-power design helps reduce the power load of onboard systems, contributing to longer AGV/AMR operating time and greater flexibility in thermal design.

From Single-Unit Control to Fleet Management: Enabling Greater System Development Flexibility and Business Value

For product applications, development cycle and platform scalability are critical factors that influence market competitiveness. The PCOM-BA03 adopts a modular architecture, helping customers maintain a relatively consistent system design logic across different product generations while adjusting carrier boards, I/O configurations, communication modules, and storage specifications according to application requirements. This allows the platform to more easily support various deployment scenarios, including warehouses, factories, logistics centers, ports, and outdoor environments.

In applications such as fleet management systems, equipment dispatch planning, equipment maintenance, and data monitoring and analytics, the management platform can access vehicle location, task status, battery information, route records, and abnormal events in real time, further optimizing dispatching sequences and logistics flow. When combined with data analytics, operators can also use historical task data to evaluate bottleneck routes, equipment utilization, and maintenance cycles, transforming AGVs and AMRs into valuable data nodes within the smart logistics system.

3. Part 3 Conclusion



From the perspective of technical positioning, COM Express is more than a compact board specification. It is an important architecture that helps industrial equipment move toward platformization, long product life cycles, and sustainable upgradeability. Across applications such as smart manufacturing, medical imaging, smart transportation, networking security, defense systems, IoT, and Edge AI, end devices must integrate

higher-performance computing, high-speed I/O, networking, storage, and diverse sensor interfaces within limited space, power, and thermal conditions. If a complete motherboard must be redesigned every time a processor generation changes or application requirements evolve, development schedules, validation costs, and supply chain risks will increase significantly.

The core value of COM Express lies in separating standardized computing cores from customized application interfaces. The COM module handles the CPU, memory, BIOS, power management, and high-speed signals, while the carrier board is designed around end-application interfaces such as LAN, USB, PCIe, CAN, COM, GPIO, M.2, display, and power. This allows equipment manufacturers to upgrade modules based on different performance, power, and market requirements while maintaining the existing mechanical design and I/O architecture, reducing platform transition risk.

From Type 6 and Type 7 to Type 10, COM Express can address industrial control, machine vision, Edge AI, high-speed networking, edge servers, and low-power embedded devices. Compared with SBCs, it provides greater upgradeability and customization flexibility.

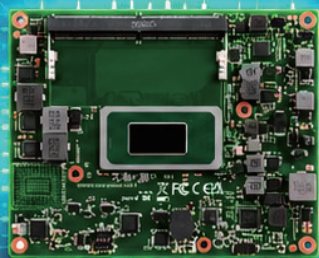
Compared with COM-HPC, it offers a more mature industrial deployment foundation and better cost balance. As demand rises for edge AI, high-speed interfaces, heterogeneous computing, and remote management, COM Express will continue to serve as an important platform foundation for industrial customers building smart devices that are sustainable, upgradeable, and ready for mass production.

4. Portwell DMS Service Concept

The service value of Portwell DMS (Design & Manufacturing Services) is to extend COM Express from a single module supply model into complete product realization capability. For industrial equipment customers, successful COM Express deployment depends not only on module specifications, but also on the integration of carrier board design, I/O configuration, power, thermal design, BIOS, firmware, mechanical design, validation, and mass-production maintenance. Portwell can support customers at the early project stage by helping select the appropriate Type 6, Type 7, or Type 10 module and planning the most suitable platform architecture according to performance, power consumption, form factor, AI acceleration, network bandwidth, and long-term supply requirements.

Through carrier board customization, BIOS/EC tuning, system validation, thermal design, and life-cycle management, Portwell DMS helps customers shorten development cycles, reduce revision risks, and ensure stable mass-production deployment in healthcare, transportation, defense, networking, industrial control, and smart logistics applications. This makes Portwell not only a hardware supplier, but also a technology partner that helps customers transform innovative applications into reliable industrial systems.





Portwell, Inc. Headquarters

No. 242, Bo'Ai St., Shu-Lin Dist,
New Taipei City 238, Taiwan
Tel: +886-2-7731-8888
Fax: +886-2-7731-9888
E-mail: info@portwell.com.tw
www.portwell.com.tw

Americas

American Portwell (Fremont, CA)

44200 Christy St., Fremont, CA 94538, USA
Tel: +1-510-403-3399
Fax: +1-510-403-3184
E-mail: info@portwell.com
www.portwell.com

Japan

Portwell Japan, Inc. (Tokyo)

〒112-0011 4-27-10, Sengoku, Bunkyo-ku,
Tokyo, Japan
Tel: +81-3-6902-9225
Fax: +81-3-6902-9226
E-mail: info@portwell.co.jp
www.portwell.co.jp

Portwell Japan, Inc. (Osaka)

〒532-0004 Ste.501 Nippo Shin-osaka Dai-2
Bldg, 1-8-33 Nishi-Miyahara, Yodogawa-ku
Osaka Japan
Tel: +81-6-4807-7721
Fax: +81-6-4807-7720
E-mail: info@portwell.co.jp
www.portwell.co.jp

Europe

European Portwell

Schillingweg 3, 2153 PL
Nieuw Vennep, The Netherlands
Tel: +31-252-620790
E-mail: info@portwell.eu
www.portwell.eu

KIOSK Embedded Systems GmbH

Am Technologiepark 8-10,
D-82229 Seefeld
Tel: +49-8152-3962-500
E-mail: info@portwell.eu
www.portwell.de

Portwell UK Ltd.

Office TH2
Trident House, Trident Park Basil
Hill Road, Didcot, OX11 7HJ, UK
Tel: +44(0)1235-750-760
Fax: +44(0)1235-750-761
E-mail: info@portwell.eu
www.portwell.eu

China

Shanghai Portwell

(201612), Room 1303-1, Building 33, No.258,
Xinhuan Highway, Songjiang District,
Shanghai
Tel: +86-21-5771-2505
Fax: +86-21-5772-2965
E-mail: info@portwell.com.cn
www.portwell.com.cn

Korea

Portwell Korea, Inc.

O-BIZ Tower 1901, No.126,
Beolmal-ro, Dongan-gu, Anyang-si,
Gyeonggi-do, Korea, 431-060
Tel: +82-31-450-3043
Fax: +82-31-450-3044
E-mail: info@portwell.co.kr
www.portwell.co.kr

India

Portwell India Technology Private Limited.

7/3, 3rd Floor, Jeet Dynasty, Swamy
Vivekananda Rd, Nagavarapalya, Bengaluru,
Karnataka 560093
Tel: +91-80-4078-2700
E-mail: enquiry@portwell.in
www.portwell.in



All brand names, product names, and logos may be trademarks or registered trademarks of their respective companies or mark holders.

www.portwell.com.tw