

**eBook**

# Agilex™ Solutions from iWave

Powering High-Performance Compute,  
Networking, AI & Signal Processing

---



# What is Agilex™?

Agilex™ is a next-generation FPGA and SoC FPGA platform designed to deliver high-performance compute, advanced networking, and low-latency acceleration for data-intensive and mission-critical applications. Built on advanced process technology, Agilex integrates high-density programmable logic, hardened processing subsystems, high-speed transceivers, and advanced memory interfaces into a single, scalable architecture.

Agilex™ FPGAs combine high-bandwidth connectivity, scalable compute, and deterministic acceleration to power next-generation embedded and data-centric systems.



## Why Agilex?


- High-performance FPGA acceleration
- Ultra-high-speed connectivity & bandwidth
- Deterministic, low-latency processing
- Scalable across Agilex™ product families
- Designed for mission-critical systems
- Long Lifecycle & Industrial support

# Agilex™ Applications



## Defense & Aerospace

Radar Systems & Phased Array Beamforming  
Satellite Communications  
Military & Secure Communication Systems



## Networking

High-Performance Computing (HPC)  
Data Center Interconnect (DCI)  
SmartNICs & Network Offload



## Test & Measurement

High-Speed Data Acquisition  
RF Test & Communications Test  
Wideband Radar Signal Processing



## Industrial

Smart Factory Automation & Edge Computing  
Robotics, Motor Drives & CNC Systems  
Machine Vision & Industrial AI

# Agilex™ System on Module

## What & Why ?

### Core Components

- Agilex™ SoC FPGA
- Quad Arm Cortex-A53 up to 1.5GHz
- Up to 4.1M Logic cells & 522K LUTs

### Memory & Storage

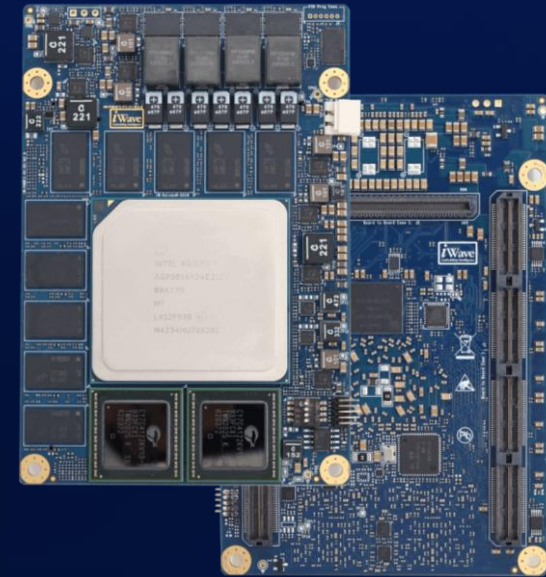
- Up to 8GB DDR4 RAM for HPS with ECC
- Up to 16GB DDR4 RAM for FPGA with ECC
- Up to 128GB eMMC Flash
- 1Gb QSPI Flash and up to 4Kb EEPROM

### Connectivity

- 3 x 400 pin B2B Connectors
- 64 x FGT transceivers up to 32G NRZ(58G PAM4)
- 8 x FHT transceivers up to 58G NRZ(112G PAM4)
- 16 x GXR transceivers supporting PCIe Gen5 x16
- Gigabit Ethernet, SD

### Power & Thermal

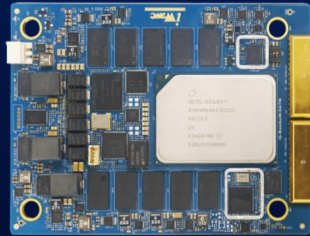
- Rugged Mechanical enclosure with thermal solution



### Why consider Agilex™ System on Module?

- Signal integrity, DDR tuning & power sequencing are proven
- Lower development cost with reduced risk, accelerating time to market
- Scalability across Agilex™ 3, 5, 7, and 9 Product Family
- Qualified, validated, and production-ready solution
- Hardware, BSP, software, and lifecycle management handled end-to-end.

# Agilex™ Boards & Solutions



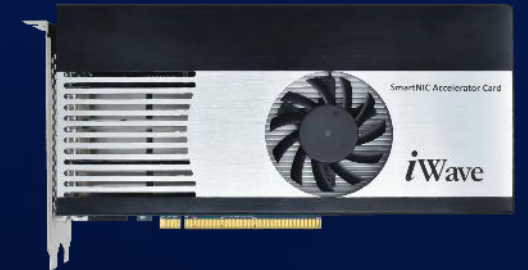
## System on Modules

An extensive portfolio of System on Modules across the Agilex™ product family ensuring the right product fit as per your requirements. The System on Modules are all pre-qualified, validated and production ready.



## 3U VPX and PCIe Cards

Agilex™ based COTS modules for the aerospace, defense, networking and industrial applications. The portfolio of PCIe Cards and 3U VPX Cards are available across different FPGA variants.

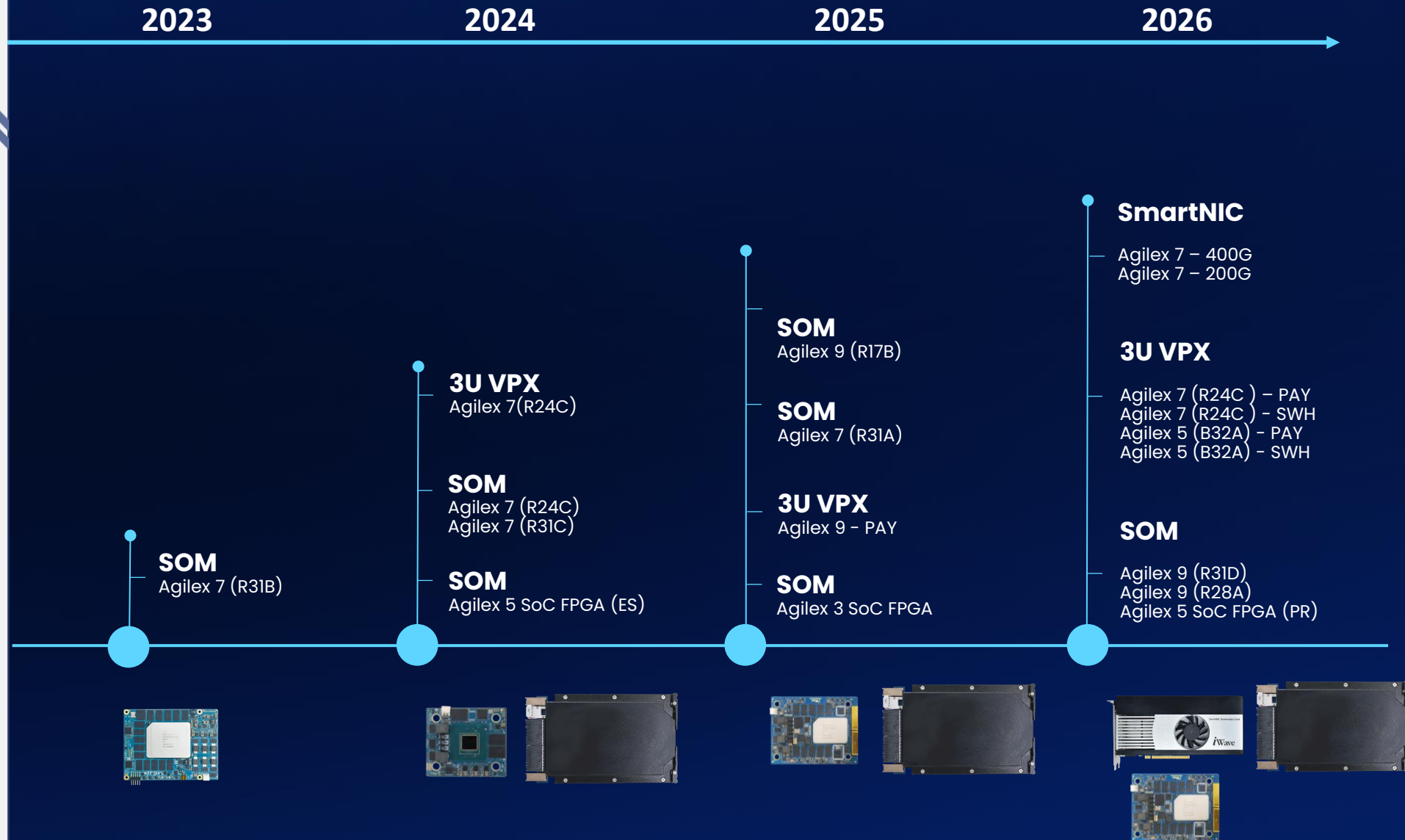


## Custom Design

iWave enables customers with custom carrier card and system design. iWave carries RF ODM expertise to enable your products from ideation to production.

# Agilex™ Product Roadmap

Performance



# System on Modules

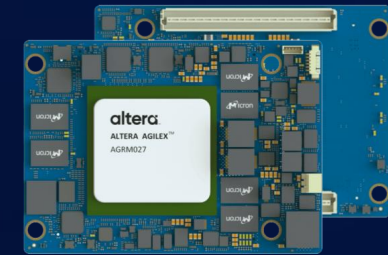
## iG-G67M



### Agilex™ 9 Wide-band

- 16 FGT transceivers up to 58Gbps PAM4
- 4 ADC channels up to 64Gsps
- 4 DAC channels up to 64Gbps

## iG-G78M



### Agilex™ 9 Mid-band

- 32 FGT transceivers up to 58Gbps PAM4
- 20 ADC channels up to 4Gsps
- 16 DAC channels up to 12Gbps

# Agilex™ 9 Wide-band



## Agilex™ 9 R17B Direct RF Soc FPGA

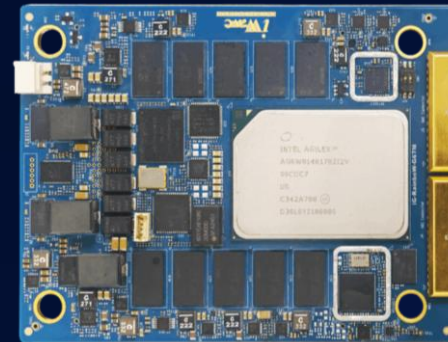
- Quad-core 64-bit ARM® Cortex®-A53 @1.4GHz
- Up to 1,437,240 Logic elements
- 16 x FGT Transceivers up to 58Gbps PAM4
- ADC x 4 & DAC x 4; Sampling rate @64Gsps

## High Performance Memory

- 8GB DDR4 with ECC for HPS (64bit + 8bit)
- 8GB DDR4 with ECC for FPGA (64bit + 8bit)

## Storage

- HPS 8bit eMMC (32GB Upgradable)
- SDM QSPI Flash (1Gb Upgradable)
- EEPROM (2Kb Upgradable)



## On SoM Features

- Gigabit Ethernet PHY x 1
- USB2.0 OTG through On SOM PHY x 1
- On Board Clock Generators
- FAN Header

## 2 x Board to Board Connectors

- FPGA IO's (55LVDS/110SE)
- 1 x RGMII Gigabit Ethernet
- 16 x FGT Transceivers up to 58Gbps PAM4

## General

- Power Input: 12V through B2B Connector2
- BSP Support: Linux BSP

# Agilex™ 9 Mid-band



## Agilex™ 9 R31D Direct RF Soc FPGA

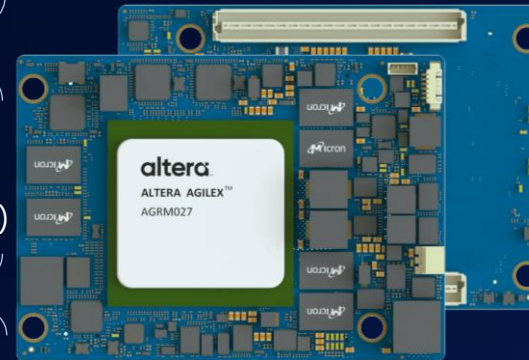
- Quad-core 64-bit ARM® Cortex®-A53 @1.4GHz
- Up to 2,692,760 Logic elements
- 32 x FGT transceivers up to 58Gbps PAM4
- 20 x ADC & 16 x DAC; @4Gsps & 64Gsps

## High Performance Memory

- 8GB DDR4 with ECC for HPS (64bit + 8bit)
- 2 x 8GB DDR4 with ECC for FPGA (64bit + 8bit)

## Storage

- HPS 8bit eMMC (32GB Upgradable)
- SDM QSPI Flash (1Gb Upgradable)
- EEPROM (2Kb Upgradable)



## On SoM Features

- Gigabit Ethernet PHY x 1
- USB2.0 OTG through On SOM PHY x 1
- On Board Clock Generators
- FAN Header

## 2 x Board to Board Connectors

- FPGA IOs (96LVDS/192SE)
- ADC x 16 (up to 4Gsps), ADC FB x 4 (up to 4Gsps)
- DAC x 16 (Up to 12Gsps)

## General

- Power Input: 12V through B2B Connector2
- BSP Support: Linux BSP

# System on Modules

## iG-G43M



### Agilex™ 7 R31A/B/C

- 16 GXR transceivers supporting PCIe Gen5
- 8 FHT transceivers up to 58G NRZ
- 64 FGT transceivers up to 32Gbps

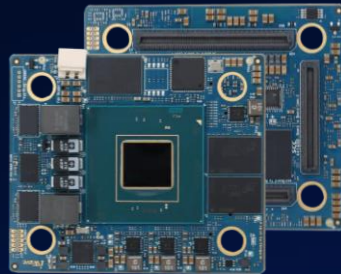
## iG-G51M



### Agilex™ 7 R24C

- 12 x FGT transceivers up to 58Gbps
- 4 x FGT transceivers up to 32Gbps
- 16 x FGT transceivers up to 17Gbps

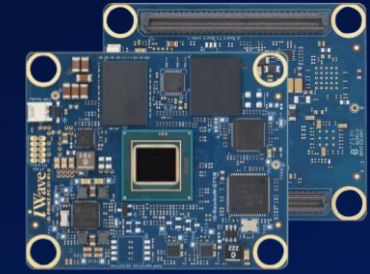
## iG-G58M



### Agilex™ 5

- 24 GTS transceivers up to 28.1Gbps
- 2.5G Ethernet PHY Transceiver
- Up to 656K Logic elements

## iG-G71M



### Agilex™ 3

- 4 Transceivers up to 12.5Gbps
- PCIe Gen3 connectivity interface
- Up to 135K Logic Elements

# Unique Features of Agilex™ SOM from iWave

iWave extends Altera Agilex capabilities with production-ready engineering features that reduce risk and accelerate deployment.

## Ultra-High-Speed Networking & Compute Scalability

- ✓ PCIe Gen5 and dual 400G Ethernet support for data-intensive workloads
- ✓ Up to 4.1M logic elements with QDR-IV memory for massive parallel processing
- ✓ Optimized for SmartNIC, data center, and telecom acceleration

## Precision Time Synchronization & Deterministic Networking

- ✓ On-SoM support for PTP and SyncE time synchronization
- ✓ External 10 MHz and 1PPS IN/OUT for multi-board and system-level sync
- ✓ Designed for low-latency, time-sensitive applications

## RF-Optimized Clocking & Power Architecture

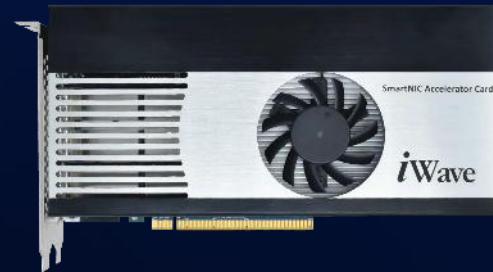
- ✓ On-SoM ultra-low-noise RF PLLs for ADC/DAC sampling and SYSREF generation
- ✓ Integrated clock generators for FPGA fabric and high-speed transceivers
- ✓ Low-noise power regulators ensure best-in-class RF performance

## Compact, Pin-Compatible & Deployment-Ready Designs

- ✓ Pin-compatible Agilex 5 and Agilex 3 SoMs for easy scalability
- ✓ Integrated 2.5G Ethernet and AVST x8 interfaces
- ✓ Compact form factor reduces carrier board complexity and cost
- ✓ Scalable across Agilex 3, 5, 7, and 9 product families

# SmartNIC Storage Accelerator Cards

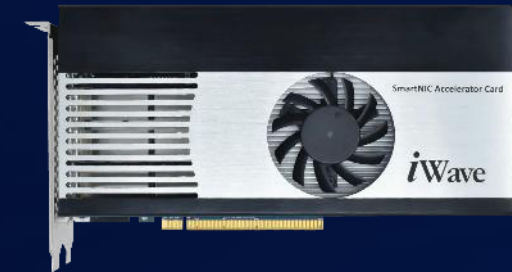
## G43-AFibre-400G



### Agilex™ 7 I-Series R and F Tiles SmartNIC – 400G

- 3/4 Length PCIe Gen5 x16 Host Interface
- Dual Gen4 M.2 NVMe Slots
- SlimSAS Connector – Dual PCIe Gen 4 x8
- Dual Front Panel QSFP56-DD Cage & Single Front Panel QSFP112-DD Cage

## G51-AFibre-200G



### Agilex™ 7 F-Series SmartNIC – 200G

- 3/4 Length PCIe Gen4 x16 Host Interface
- Single Gen4 x4 M.2 NVMe Slot
- With PCIe Gen3 x8
- Dual Front Panel QSFP-DD/QSFP28 Cages (200GbE)

# Agilex™ 3U VPX Card



## iG-G67V



### Agilex™ 9 Direct RF (Payload)

- Module Profile: MOD3-PAY-1FIUIS1SIU1U4F1J-16.6.13-n
- Slot Profile: SLT3-PAY-1FIUIS1SIU1U4F1J-14.6.13-n
- Slot Pitch: 1 inch Conduction Cooled

## iG-G51V



### Agilex™ 7 R24C (Payload)

- Module Profile: MOD3p-PAY-1FIUIS1SIU1U4F1J-16.6.13-1
- Slot Profile: Profile: SLT3-PAY-1FIUIS1SIU1U4F1J-14.6.13-n
- Slot Pitch: 1 inch Conduction Cooled

## iG-G51V



### Agilex™ 7 R24C (Switch)

- Module Profile: MOD3-SWH-4FIU7U1J-16.8.7-1
- Slot Profile: SLT3-SWH-4FIU7U1J-14.8.7-1
- Slot Pitch: 1 inch Conduction Cooled

## iG-G51V



### Agilex™ 7 R24C (Payload)

- Slot Profile: SLT3-PAY-1FIUIS1SIU1U4F1J-14.6.13-n
- Module Profile: MOD3-PAY-1FIUIS1SIU1U4F1J -16.6.13-n
- SOSA-aligned 3U-VPX Backplane Features

## iG-G58V



### Agilex™ 5 (Payload)

- Module Profile: MOD3p-PAY-1FIUIS1SIU1U4F1J-16.6.13-1
- Slot Profile: SLT3-PAY-1FIUIS1SIU1U4F1J-14.6.13-0
- Slot Pitch: 1 inch Conduction Cooled

## iG-G58V



### Agilex™ 5 (Switch)

- Module Profile: MOD3-SWH-4FIU7U1J-16.8.7-1
- Slot Profile: SLT3-SWH-4FIU7U1J-14.8.7-1
- Slot Pitch: 1 inch Conduction Cooled

# ODM Expertise

## Agilex FPGA System Design

- Expertise Across **Agilex™ 3, 5, 7 & 9**: Power architecture, DDR4 with ECC memory, high-speed transceivers, HPS-FPGA integration, external ADC/DAC integration
- QSFP-DD, JESDB204B/C, PCIe Gen4/Gen5, **Ethernet (up to 400G)**, power & thermal monitoring
- **Networking, data center** acceleration, medical, radar, wireless, industrial edge & VPX platforms

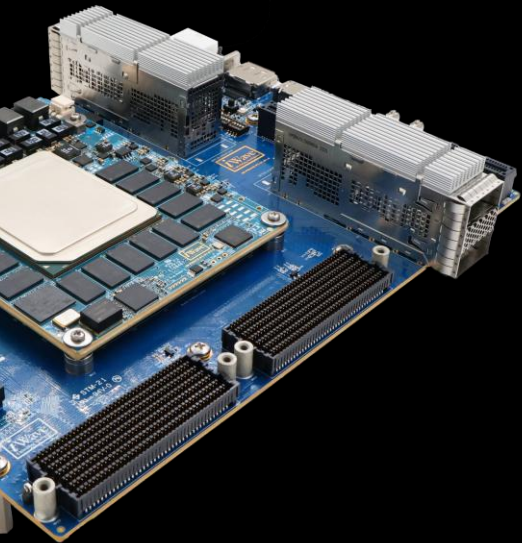
## High-Speed Interfaces & Data Processing

- Advanced **Transceiver up to 112Gbps** & High-Speed I/O Integration with Multi-lane high-speed transceivers with PCIe Gen4/Gen5 and multi-rate Ethernet up to 400G
- Direct RF & Wideband Data Capture (Agilex 9): **On-SoM RF clocking, low-noise power, synchronized sampling support**
- Time-Sensitive & Network Synchronization with **PTP, SyncE, external 10 MHz** & 1PPS support

## Production & System-Level Support

- **Ruggedization** for Aerospace & Defense customers
- **Turnkey Production Services** including SoM + Carrier + Enclosure + SI/PI + Testing + Compliance
- DFM (Design for Manufacturing) and DFT (Design for Test) best practices followed
- Product Longevity Support of up to **15+ Years**

# Software Features



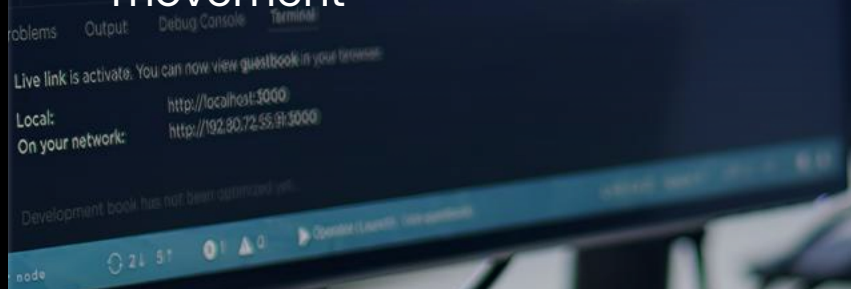
- Yocto-based Linux BSP for bootloader, kernel, and root filesystem; Altera HAL for bare-metal development on NIOS® V (RISC-V)
- Remote System Update (RSU) with factory and application image management for trusted fallback and safe recovery
- Linux FPGA Manager for dynamic FPGA configuration and partial reconfiguration from HPS
- Voltage and temperature monitoring via HPS-SDM mailbox interface
- Linux PCIe endpoint driver support for host acceleration and data movement

```
while (--i >= 0) {
    free_page(unsigned long)
}
kfree(group_info);

return NULL;
}

EXPORT_SYMBOL

void groups_free(struct group_info *group_info)
{
    if (group_info->blocks[0] < group_info->total_blocks)
        int i;
        for (i
```



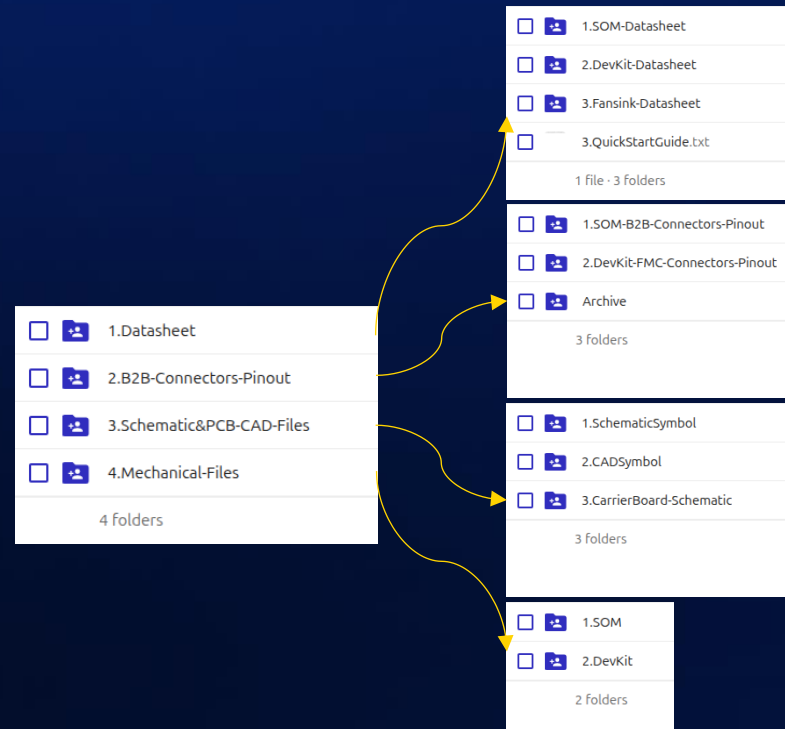
# Evaluation Platforms

**Available in multi form factor such as BRYNc, BRYN+, OREN, OREN+, REN, and REN+**

- QSFP Connector x 4 (2 x 400G, 1 x 200G & 1 x 100G)
- FMC+ High Pin count (HPC) connector x 3
- FMC High Pin Count (HPC) Connector x 1
- PCIe Gen4 x16 Connector x 1
- 4K HDMI 2.0 IN & OUT through HDMI Connector
- SDI Video IN & OUT through HD BNC Connector
- PMOD Connectors x 1
- Clock Synthesizers/Generators x 2
- QSFP28/QSFP+/QSFP Connector x 1
- Gigabit Ethernet through RJ45MagJack x 1
- USB2.0 OTG through Type C connector x 1
- Debug UART through Type C connector x 1
- 20 Pin Header (for HPS IOs)
- Micro SD Connector x 1
- JTAG Connector x 1



# Deliverables



```

Software+FPGA (Refer for Software & FPGA Deliverables)
├── 065 (Denotes the device based on FPGA Logic Density)
│   ├── iG58M-E065B5-4L002G-E032G-EAA-ES(R1.0) (iWave's Product part number denotes : A5E065B (-5 speed) B32A Agilex 5 SOC SOM with 2GB HPS LPDDR4, Dual 2GB FPGA LPDDR4, 32GB eMMC - SOM R1.0 Version)
│   │   ├── QPDS24.1 (Denotes Quartus 2024.1 version)
│   │   └── QPDS25.1 (Denotes Quartus 2025.1 version)
│   ├── iG58M-E065B5-4L002G-E032G-EBA-ES(R2.0) (iWave's Product part number denotes : A5E065B (-5 speed) B32A Agilex 5 SOC SOM with 2GB HPS LPDDR4, Dual 2GB FPGA LPDDR4, 32GB eMMC - SOM R2.0 Version)
│   │   ├── QPDS24.1 (Denotes Quartus 2024.1 version)
│   │   └── QPDS25.1 (Denotes Quartus 2025.1 version)
│   └── iG-G58M-R2.0-REL0.1-SD2.0-Q25.1-L6.12.11-065B (2025.1 Linux BSP for the part number's parent folder)
│       ├── Binaries
│       │   ├── extras
│       │   │   ├── Application-1
│       │   │   └── Application-2
│       │   └── Factory
│       ├── images
│       ├── Documents
│       │   ├── FPGAUserGuide
│       │   ├── ReleaseNotes
│       │   └── SoftwareUserGuide
│       ├── FPGA-Example-Design
│       ├── Source-Code
│       │   ├── Linux
│       │   ├── U-Boot
│       │   └── Yocto
│       ├── Tools
│       └── ClockFiles
  
```

# Case Study

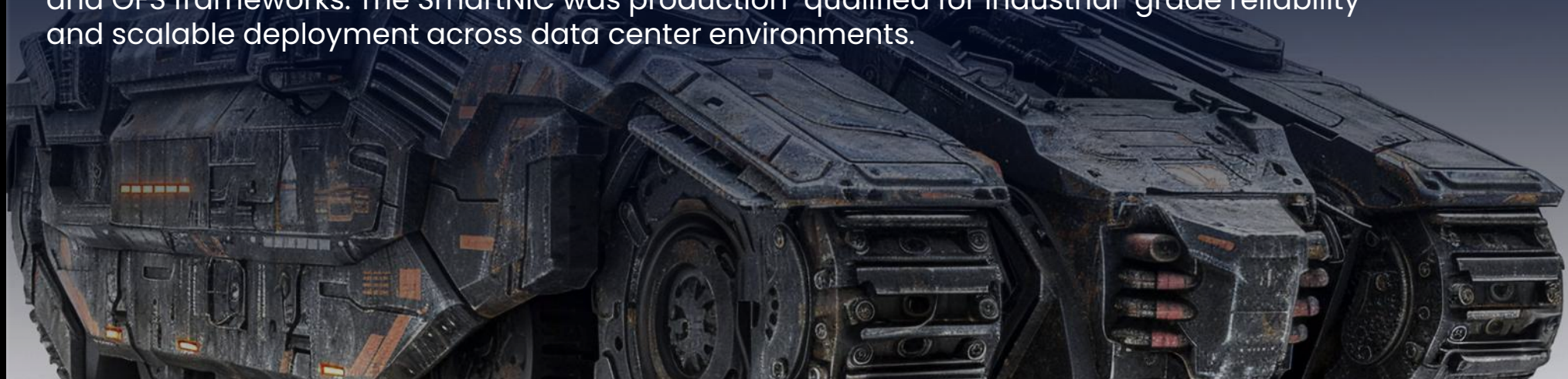
## Data Center Application Agilex™ 7 SmartNIC Solution

### Customer Background

A leading data center operator managing large-scale cloud and enterprise workloads aimed to enhance network throughput, minimize CPU overhead, and achieve greater scalability. Their infrastructure supported high-speed data transfers, virtualized environments, and storage-intensive applications that demanded ultra-low latency and exceptional reliability.

### iWave Scope of Work

iWave designed and delivered an Agilex™ 7-based SmartNIC featuring dual QSFP-DD ports supporting up to 200GbE, a PCIe Gen4 x16 interface, and on-board NVMe for storage acceleration. The solution included optimized FPGA logic, firmware, and driver stacks to offload networking, security, and storage workloads from the host CPU, with seamless support for DPDK and OFS frameworks. The SmartNIC was production-qualified for industrial-grade reliability and scalable deployment across data center environments.



# Case Study

## Multi Axis Motor Control Agilex™ 5 System on Module

### Customer Background

A leading industrial robotics company specializing in high-performance FPGA-based embedded control systems for motor drives, power electronics, and DC-DC converters.

### iWave Scope of Work

iWave delivered a production-ready Agilex™ 5 System on Module optimized for multi-axis motor control, combining power-efficient high performance with deterministic real-time control. The solution leveraged programmable logic for precise motor and actuator control while enabling machine vision and AI capabilities for intelligent sensing, quality inspection, and predictive industrial automation.

## Case Study

# Unmanned Aerial Vehicles (UAVs) Agilex™ 7 System on Module

## Customer Background

A leading aerospace technology company specializing in advanced unmanned aerial systems (UAS) sought a reconfigurable FPGA platform for next-generation UAV control and payload processing. Their application required deterministic real-time data processing, high-speed sensor interfacing, and reliability under extended operational conditions.

## iWave Scope of Work

iWave delivered an Agilex™ 7 R24C System on Module for unmanned vehicle platforms, integrating high-performance FPGA fabric, transceivers, and DDR4 memory in a compact form factor. The solution enabled high-speed Gigabit Ethernet and PCIe Gen4 connectivity for sensor payloads, telemetry, and real-time ground communication, supported by a comprehensive BSP and FPGA reference design. iWave also ensured long-term supply and production scalability to support large-scale UAV deployments.

# Resources

## Technical Articles

- [Article – Cyclone V to Agilex 5/3 Migration: A Seamless Transition with iWave SOM](#)
- [Article – Scalable Network Acceleration for 200G/400G/800G powered by Agilex 7 FPGAs](#)
- [Article – Agilex 5 SoM – Powering Edge AI with FPGA infused intelligence](#)
- [Article – Enabling Post Quantum Cryptography on Agilex 5 SOM](#)
- [Article – Remote System Update \(RSU\) on Agilex™ SoC FPGA System on Modules](#)
- [Press Release – iWave Introduces Agilex™ 7 \(R24C\) SOSA-Aligned 3U VPX Plug-in Modules](#)
- [Press Release – iWave Launches iG-G67M: SOM Powered by Altera’s Agilex™ 9 Direct RF-Series](#)
- [Press Release – iWave Launches iG-G71M: Altera Agilex™ 3 FPGA powered System on Module](#)

## Videos

- [Getting Started Video – Agilex 5 SoM and Evaluation Platform](#)
- [Unveiling the G51-AFibre-200G SmartNIC Performance & Core Functions](#)
- [Panel Discussion – iWave & Altera at Embedded World](#)
- [Product Launch – Agilex 9 Direct-RF FPGA System on Module & 3U VPX Systems](#)
- [Overview Video – Agilex 5 SOM enabling AI on the Edge](#)
- [Product Launch – Agilex 3 System on Module](#)
- [Product Launch – Introducing Agilex 5 System on Module](#)
- [Overview Video – Unveiling Agilex 7 System on Module for Advanced Computing](#)

## Case Studies

- [Case Study – Agilex 7 SmartNIC for Data Center Application](#)
- [Case Study – Agilex 5 SoM for Multi-Axis Motor Control](#)
- [Case Study – Agilex 7 SoM for Unmanned Aerial Vehicles \(UAVs\)](#)
- [Case Study – Network Security using Arria 10 SX 660 SOM](#)

# Thank You

We are here to

Accelerate Embedded Innovation

[mktg@iwave-global.com](mailto:mktg@iwave-global.com)

INDIA | USA | GERMANY | EUROPE | TAIWAN | KOREA | JAPAN | DUBAI