## FPGA SmartNIC FB2CDG1@AGM39D-2 Intel® based

Dual port QSFPDD56 2×400G PCIe Gen5 x16 Intel® Agilex™ M-series Based

### Product Description

The Silicom FB2CDG1@AGM39D-2 ThunderFjord B is a high-performance programmable PCIe Server adapter based on the Altera® Agilex™ M-series AGMF039 FPGA (option for AGMF032).

The Altera Agilex-M™ is an extremely powerful FPGA which also features up to on-chip 32GB HBMe2 memory providing an unprecedented 2 x 2.6 Tbps HBMe2 bandwidth. The combination of lightning fast logic and equally fast memory ensures a platform that can deliver.

The card FB2CDG1@AGM39D-2 is equipped with 2 x QSFPDD56 for supporting 2x 400GE, as well as a wide range of other link speed combinations like 16×10/25GE or even 8x100G with the appropriate breakout modules.

The FB2CDG1@AGM39D-2 ThunderFjord features 2 x AcceleRate® Slim Cable Assembly (ARC6) connectors with 2x 8x28Gbps from Samtec. The ARC6 connectors add unprecedented flexibility in host bandwidth and network connectivity. Silicom offers an adaptor an additional PCIe Gen4 x16 connector that can be employed for additional host bandwidth. The same connectors can alternatively be used with Fireflytm flyover cables for connecting additional 2x 8xFSFP28 or 2x 2xFQSFP28 for higher Ethernet link capacity to the solution in appliances. Silicom offers a 4xFQSFP28 bracket for easy utilization of the expansion option. The AR6-16 can alternatively be used for direct connection of two boards, connect multiple cards in series or daisy chain, or connect to other products with suitable interface.

The AGM FPGA series features CXL 1.1 and 2.0, providing heterogeneous processing and computing in performance-intensive workloads like AI, machine learning and analytics. Additionally, the AGM FPGA device includes Quad-core 64 bit Arm Cortex A53 processor.

### Target Applications

- **Network Security & Telemetry**
  - Virtual Firewall (vFW)
  - DDoS Mitigation
  - IP Security (IPsec)
  - Transport Layer Security (TLS)
  - Packet monitoring and analytics
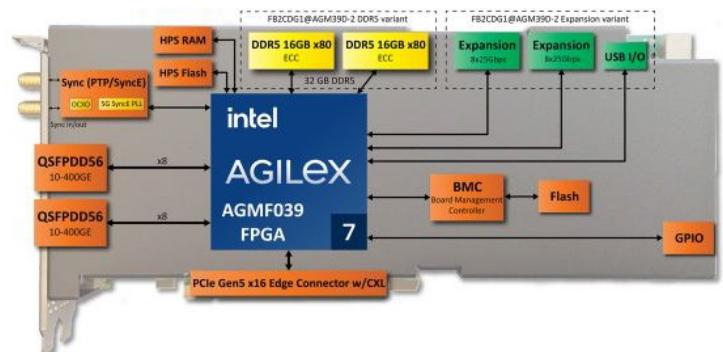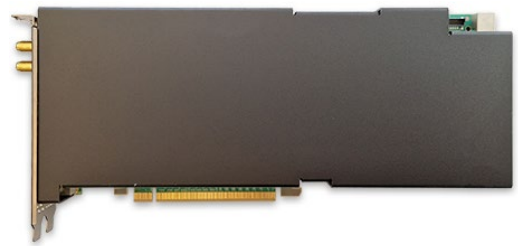
- **Network Functions**
  - 5G/6G User Plane Function (UPF)
  - 5G Access Gateway Function (AGF)
  - Virtual Broadband Network Gateway (vBNG)
  - Virtual Application Delivery Controller
  - Carrier Grade Network Address Translation (CGNAT)
  - Cloud Gateway
  - Application Access Gateway

- **Application acceleration**
  - AI/ML inference offload
  - Data analysis offload
  - Sensor aggregation and analysis
  - Sensor recording

## Key Features

**Silicom FPGA SmartNIC FB2CDG1@AGM39D-2**

- Intel® Agilex™ AGMF039 FPGA with Quad-core 64 bit Arm Cortex A53 processor
- 2 x QSFPDD56 ports
- HBM2e: 32GB
- 2 x AcceleRate® Slim Cable Assembly (ARC6) expansion connectors each with 8x28Gbps
- PCIe x16 Gen5 w/CXL
- 5G SyncE PLL with Silicom TimeSync Solution (STS)
- Dedicated 4GB DDR5 ECC RAM for HPS
- GPIO
- Intel® Max® 10 Board Management Controller
- 1 x PPS/10MHz SMA connector
- Dual slot passive heat sink (single slot optionable)
- On-board power and temperature sensors
- FPGA controlled link and status LEDs

## Technical Specifications

| Network Interface | |
|---|---|
| **IEEE standard** | - IEEE 802.3 400GbE, 200GbE, 100GbE, 25GbE, 10GbE |
| **Interfaces** | - Physical interface: 2 x QSFPDD56 slots<br>- Multimode SR4/SR8 (850nm), Single Mode LR4/LR8 (1310nm) or DAC (Twinax)<br>- Data rate: 2×400, 4×200, 2×200, 1×400, 4×100, 8x100G via CU DAC, 16×25, 16×10 GE<br>- Optional ARC-6 expansion: 4xQSFP28 (4x100GE) PCI adaptor (no PCI slot requirement)<br>- Optional ARC-6 expansion: Two 2xFlyover–QSFP28 cable assembly (4x100GE max)<br>- Optional ARC-6 expansion: Two 8xFlyover–SFP28 cable assembly (16×10/25GE max) |
| **Host Interface** | |
| **PCI bus** | - PCIe 5.0 x16 |

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| | • Optional ARC-6 expansion: PCI Gen4 x16 cable assembly |

**General Technical Specifications**

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| **FPGA Details** | **Intel® Agilex™ AGMF039 (AGMF032 option)**<br><br>• R47A package, with 3 x F and 1 x R tile<br>• Fabric speed grade -2, Transceiver Speedgrade -1 for CXL support<br>• Quad-core 64 bit Arm Cortex*-A53<br>• 32GB HBM2e (16GB option)<br>• 3 x 600GE HIPs (F-tiles), 2 for front ports, 1 usable for expansion connectors |
| **Configuration** | • Configuration flash can be made to support multiple boot images for automatic fallback to factory default image<br>• Upload of FPGA configuration to flash via PCIe – with supported image and tool |
| **On-chip Memory** | • HBM2e, 32GB in Agilex™ M-series FPGA |
| **On-board Memory** | • DDR5, 4GB ECC for HPS |
| **Expansion Connectors** | **2 x 32pin ARC6–16 connector for 2x 8×28Gbps**<br><br>• Expand with additional network ports<br>    o via Silicom 4xFQSFP28 adaptors<br>    o via up to 2x 8x28Gbps Flyover SFP28 cables<br>• Allows an extra x16 PCIe Gen4 via adapter for extra Host PCI BW and resources<br>• Interconnect with other products, in P2P or daisy chain configuration |
| **On-board Clock** | • PCIe clock: 100 MHz<br>• DPLL ZL30793<br>• Jitter cleaner<br>• 8 output reprogrammable clock generator (PLL) with SyncE support<br>• Optional expansion via secondary bracket with 4x SMA connector (PPS/10MHz/In/Out) |
| **Additional Board Support** | • On-board power and temperature sensors (via SMBus/I2C)<br>• LEDs for board status and board management |
| **Physical Dimensions** | • Weight: ~1600 g<br>• Full height, 123.4 mm<br>• ¾ length, 254.0 mm (+bracket)<br>• Dual Slot |
| **Environment** | • Storage temperature: -10C to 60C<br>• Operating temperature: 0C to 40C |

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|---|---|
| | • Hardware compliance: RoHS, FCC Class A, CE, UL |
| **Thermal Design** | • Passive dual heat sink<br>• Passive single slot heat sink maybe provided.<br>• Reduces thermal capacity, limiting processing capacity |
| **Power/TDP** | • Max power (TDP) 225 W, with standard server airflow for cooling<br>• Typical power consumption 100W – 150W<br>• The combined server-PCIe card solution may be limited in average power consumption by thermal constraints. Maximum supported is higher then TDP if adequate cooling is provided. Typical use case is fully dependent on FPGA implementation.<br>• High power connector 2×6 with 4 sideband signals for PCI AUX power (PCIe CEM 5.1)<br>• 65 W max from the PCie slot, 345 W max from the 12V high power Aux connector *) (including optical modules) |
| **Port LEDs** | • 2 x Link/ ACT for the 2 x QSFPDD56, on bracket<br>• 1 x multi color status LED, on bracket |
| **Time Synchronization** | • Silicom TimeSync Solution (STS)<br>• IEEE 1588-2019, G8273.2, G8273.4 (T-BC/T-TSC), G8262(SyncE)<br>• 1PPS In/Out, 10Mhz In/Out (optional)<br>• DPLL ZL30793<br>• OCXO<br>• PTP stack: LinuxPTP (ptp4l) on HPS or x86<br>• Optional expansion via secondary bracket with 4x SMA connector (PPS/10MHz/In/Out) |
| **Board Management** | • Intel® Max® 10 FPGA Board Management Controller<br>• Voltage level monitoring<br>• Thermal shut-down protection<br>• Over current protection on 12V input |
| **Supported frameworks** | • Silicom Board support package<br>• Intel Application Stack Accelerator Function (ASAF) framework<br>• Intel OFS and OPAE (tbd)<br>• Silicom PacketMover<br>• DYNANIC from Brnologic |

| P/N | Description |
|---|---|
| FB2CDG1@AGM32A-20XP2 | AGM 032, 2x 8x32Gbps connector, 16GB HBM<br>Expansion connector: supporting 16x28Gbps for Ethernet or PCIe Gen4x16 |
| FB2CDG1@AGM32B-20XP2 | AGM 032, 2x 8x32Gbps connector, 32GB HBM<br>Expansion connector: supporting 16x28Gbps for Ethernet or PCIe Gen4x16 |
| FB2CDG1@AGM39C-20XP2 | AGM 039, 2x 8x32Gbps connector, 16GB HBM<br>Expansion connector: supporting 16x28Gbps for Ethernet or PCIe Gen4x16 |
| FB2CDG1@AGM39D-20XP2 | AGM 039, 2x 8x32Gbps connector, 32GB HBM<br>Expansion connector: supporting 16x28Gbps for Ethernet or PCIe Gen4x16 |
| FBF4CG@FLYN-ULN | 4xQSFP28 expansion PCI adaptor with 2xARC6-16 and sideband connector 250mm |
| FBF4CG@FLYN-USN | 4xQSFP28 expansion PCI adaptor with 2xARC6-16 and sideband connector 400mm |
| CBL000341 | 2xARC6-16 to PCIE edge PCIeGen4 x16 |
| FB-SYNC-4S-EXT | Sync extension bracket with 4x SMA connector |