TORNADO-AZU+/FMC+
AMC-module with Zynq UltraScale+ MPSoC FPGA and FMC+/HSPC site

Key Features
- AMC-module with Zynq UltraScale+ EG MPSoC for modular DSP systems
- Complies PICMG® 3.0 Rev.3.0, MicroTCA.0 R1.0, AMC.0 R2.0, IPMI 1.5, HPM.1 R1.0, VITA® 57.4-2018 and VITA® 57.1-2019 specifications
- Installs into MicroTCA® chassis and AdvancedTCA® carrier
- Up to 544Gbps aggregated bandwidth for AMC-to-AMC data transfer
- Remote control from host PC and Android® devices via 1GbE ports
- In-chassis AMC-to-AMC control communication via 1GbE ports
- FMC+/HSPC site for user adopted I/O via FMC submodule (AD/DA, etc.) with up to 384Gbps aggregated bandwidth via FMC GBT ports
- TASDK® tools for applications development and control
- Stand-alone operation from +12V power for embedded applications

Details
- Xilinx Zynq UltraScale+ EG-grade MPSoC (XCZU11EG, XCZU17EG, XCZU19EG) FPGA with six ARM® cores (PS), high-density logic (PL) and two transceiver pools (28Gbps/32Gbps GTY and 16Gbps GTH)
- VITA® 57.4-2018 FMC+/HSPC site for AMC submodule (160 I/O, 24 GBTs 16Gbps/lane) with variety of activation modes
- AMC Fabric-DEF ports 4-7/8-11 (28Gbps/lane) for data transfer with adjacent AMC-modules
- AMC Fabric-B ports 2-3 (16Gbps/lane, AMC.3 6Gbps SATA/SAS or "free" protocol) for direct in-chassis AMC-to-AMC data transfer with adjacent AMC-modules
- AMC Fabric-A 1GbE ports 0-1 from PS for remote device control and in-chassis AMC-to-AMC control communication
- PS x64 DDR4 memory (up to 8GB)
- PL x64 and x32 DDR4 memory banks (up to 8GB and 4GB)
- 2Gb PS NOR FLASH memory for applications and data
- 4Mb NVRAM memory for critical PS application data
- Removable M.2 2280 SSD SATA3 module (up to 2TB) for PS
- Front panel MicroSD card slot (up to 2TB) for PS
- Front-panel PS and PL controlled LEDs
- High-performance MMC controller with propriety TAMMC® Gen2 MMC-kernel, power/temperature monitoring, status indication and more, all for reliable and safe device operation and protection
- PS and MMC UART ports for remote control and management
- Embedded high-speed FPGA USB JTAG emulator, optional external JTAG

Development Tools
- TASDK® tools for TORNADO AMC modules with high-level API for quick development of PS/PL applications and host Windows, Linux and Android® remote control applications
- Linux, FreeRTOS, or "bare-metal" API for PS applications
- Pre-certified Express Logic ThreadX® RTOS for demanding applications
- PS and PL demos for device tests and user projects startup
- Xilinx SDK and Vivado tools and IP

Applications
- Telecommunication and cell telephony
- DSP systems
- RF, SDR, Radars and astrophysics
- Image processing
- Industrial, instrumentation and medical

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Zynq UltraScale MPSoC FPGA and on-board environment
- Xilinx Zynq UltraScale+ MPSoC FPGA: XCZU19EG-2FFVC7160E (28Gbps/16Gbps GTH, commercial temperature range). Other FPGA are optional with extended delivery time.
- On-board FMC DDR4 memory banks (specified during ordering):
  - Zynq/PS DDR4: 256M/512M/1Gx64 (2GB/4GB/8GB, 2400MTPS) (mandatory, specified during ordering).
  - Zynq/PL DDR4 bank #0: 256M/512M/1Gx64 (2GB/4GB/8GB, 2666MTPS) (optional, specified during ordering).
- Zynq/PS QSPI NOR FLASH memory: 128M/256Mx8 (10b/22b) (mandatory).
- Zynq/PS QSPI NVRAM memory: 256Mx8 (4Mb) (optional, specified during ordering).
- M.2 2280 SATA3 SSD memory module interface (2TB max capacity) (optional, specified during ordering).
- Front-panel MicroSD card slot (2TB max capacity) (optional, specified during ordering).
- Zynq/PS UART (available via front panel USB port).
- 8-bit external Zynq/PL XGPIO/0-7 (LVTTL 3V) with individual direction control (optional, specified during ordering).
- GTY transceivers available/used: 16/16 (25Gbps/28Gbps/32Gbps for FPGA with “1”-”2”-”3” speed grades correspondingly).
- GTH transceivers available/used: 32/26 (12Gbps/16.375Gbps for FPGA with “1”-”2”-”3” speed grades correspondingly).
- Zynq/PS bootmode: None, QSPI NOR FLASH, MicroSD card.
- Zynq/PS GTR transceivers available/used: 4/3 (2x AMC.2 Fabric-A 1GbE ports 0-1, 1x for M.2 SATA3 SSD module).
- Zynq/PL bitstream decryption key battery (optional, specified during ordering). User replaceable every 4 years.
- Debug port: Embedded high-speed USB JTAG emulator, external Xilinx JTAG emulator via adapter cable (14-pin, LVTTL 3V).

FMC+/HSPC site interface
- Complies VITA 57.4-2018 and VITAS7.1-2019 specifications.
- AMC Fabric-A ports 0-2 (up to 16Gbps/lane, connected to FPGA GTX transceivers).
- Number of GBT reference clocks: 6 (GBTCLK_M2C[0:5]_p/n).
- FMC power: 1Amax..3Amax@+12V (is set upon FMC activation mode).
- AMC status LEDs: BLUE LED, AMC LED1 (“Power” status), AMC LED2 (“Power” status).
- FMC sub-module activation via: MMC, various activation modes, small/large FMC FRU SEEPROM support, optional “no-FRU” activation.
- Number of I/O: 160 (LA[0:32]_p/n, HA[0:23]_p/n, HBA[21]_p/n).
- Number of I/O clocks: 4 (CLK_M2C[0:3]_p/n, CLKG23_BDIR_dir with CLK_DIR direction indicator).
- Number of FMC+ Reference Clocks: 2 (REFCLK_M2C_p/n, REFCLK_C2M_p/n). REFCLK_C2M_p/n is generated by low-jitter high-resolution clock synthesizer.
- Number of FMC+ Trigger signals: 2 (SYNC_M2C_p/n, SYNC_C2M_p/n).
- FMC Vadj voltage (I/O logic levels for LA/H/A/B I/O and CLK_M2C2CLK_BIDIR_dir clocks): 1.0V-1.8V with 0.1V increment (is set upon FMC activation mode).
- AMC F/C/V_M2C voltage: 0V-Vad.
- AMC VREF_A_M2C voltage range: 0V-Vad.
- AMC VREF_B_M2C voltage range: 0V-Vad.
- AMC FMC+/HSPC I/F IOB power consumption: 0.3Amax@VIO_B_M2C, 0.5mA@VREF_A_M2C, 0.5mA@VREF_B_M2C.
- Number of GBT transceivers: 24 (DP0[23]_p/n, up to 16Gbps/lane, connected to FPGA GTH transceivers).
- Number of GBT reference clocks: 6 (GBTCLK_M2C[0:5]_p/n).
- Zynq/PS DDR4: 256M/512M/1Gx64 (2GB/4GB/8GB, 2400MTPS) (mandatory, specified during ordering).
- AMC FCLKA, TLCKA, TCLKB, TCLKC, TCLKD clocks (connected to FPGA).
- AMC+12V P/P payload power or external +12V power for stand-alone applications: 0.9A (min) (11W), 2.5A (typ) (30W), 10A (max) (120W).
- Storage temperature (ambient): -40°C…+80°C.
- Operating temperature (ambient): 0°C…+55°C (FPGA with ‘E’ temperature grade), -40°C…+55°C (FPGA with ‘I’ temperature grade).
- Physical: Dimensions (specified during ordering): Single width either Full-size (F/S, 181 mm x 74 mm) (default) or Mid-size (M/S, 181 mm x 74 mm) AMC module.
- Weight: 0.4 kg.

Power and temperature
- AMC +12V P/P payload power or external +12V power for stand-alone applications: 0.9A (min) (11W), 2.5A (typ) (30W), 10A (max) (120W).
- AMC M/P management power: +3.3V @130mA (typ).
- Operating temperature (ambient): 0°C…+55°C (FPGA with ‘E’ temperature grade), -40°C…+55°C (FPGA with ‘I’ temperature grade).
- Storage temperature (ambient): -40°C…+80°C.

Ordering information
TAZUPFMCP1A/XCZU19EG2E/D4/F2/ES512N4/SSD1/T/SDF/12/1/1920/L1A17/FC+F+BF/SAS
TORNADO-AZU+/FMC+ rev.1A AMC-module, Xilinx Zynq UltraScale+ XCZU19EG-2FFVC7160E (XCZU19EG2E), 4GB (512Mx8) Zynq/PS DDR4 memory (D4), 2Gb (256Mb) Zynq/PS QSPI FLASH memory (F2), 512kb (64Kx8) Zynq/PS FC SEEPROM memory (ES512), 512Kx8 Zynq/PS nonvolatile QSPI NVRAM (N4), M.2 SSD 1TB memory module interface (SSD1), front panel MicroSD card slot (SD), 4GB (512Mx64) Zynq/PL DDR4 memory bank #1 (L1D4), 2GB (512Mb32) Zynq/PL DDR4 memory bank #2 (L2D4), 8-bit external Zynq/PL XGPIO/0-7 (LVTTL 3V) with individual direction control (optional, specified during ordering).

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