Parvus DuraCOR 310

Rugged Miniature Modular Mission Computer with Quad-core NXP ARM CPU

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Key Features

- Miniature SWaP-optimized quad-core NXP i.MX6 ARM processor system:
  - + Size: ~39 in³ volume (approx)
  - + Weight: < 1.5 lb (< 0.68 kgs)
  - + Power: < 10W (estimated)
- Rugged IP67 chassis with micro-mini MIL-performance circular connectors
- Modular I/O architecture: up to three slots for PCIe Mini-Cards (for add-on I/O)
- Rugged Flash storage (mSATA / microSD card / removable 2.5" SATA SSD)
- 28 VDC MIL-1275/704/DO-160 power supply for aircraft and ground vehicles; optional 50 ms power hold-up
- Qual testing pending for extreme MIL-STD-810G/DO-160 thermal, shock, vibration, altitude, humidity; also MIL-STD-461F/DO-160G EMI/EMC

Applications

- In-vehicle and airborne rugged mobile computing and sensor integration
- Low-power, multi-core embedded processing based on ARM architecture
- SWaP-constrained platforms: fixed-wing, rotary, manned and unmanned aircraft, and tactical ground vehicles
- Outdoor and underground platforms
- C4ISR technology refresh and LRU upgrades

Overview

The Parvus® DuraCOR® 310 is an ultra-small form factor (SFF) tactical mission computer based on a low-power, four-core NXP i.MX6Quad ARM® processor equipped with a rugged Flash disk and PCIe-Mini Card I/O expansion slots. At less than 40 in³ in volume, 1.5 lb in weight, and 10W power, this miniature multi-core rugged Commercial Off the Shelf (COTS) processor is an ideal solution for size, weight, power and cost (SWaP-C) sensitive mobile, airborne, ground, manned and unmanned vehicle and sensor applications. Optimized for high performance energy efficient processing, the unit boasts a quad-core CPU with HD-class video acceleration, including OpenGL®, OpenCL™, and OpenVG™ accelerators.

The ultra-reliable and modular design of the DuraCOR 310 features high mechanical robustness and I/O flexibility to meet the needs of civil and military and aerospace platforms. The unit features an industrial-grade ARM-based Computer-on-Module (COM) tightly integrated with a Flash SSD and system carrier board, which provides a full complement of standard vetronics I/O interfaces (including CANbus, USB, Ethernet, Serial, DIO, Video, and Audio), as well as up to three slots for optional add-on Mini-PCIe I/O modules. In addition to internal mSATA and microSD card slots, the system offers an optional removable 2.5" SATA SSD storage option for high capacity storage and information assurance requirements. Like other DuraCOR models, the 310 leverages both an ecosystem of rugged COTS Mini-PCIe modules (including MIL-STD-1553 and ARINC429 avionics databus interfaces) and Curtiss-Wright's responsive, cost-competitive application engineering services to deliver Modified COTS (MCOTS) variants quickly and without a traditional NRE fee.

The unique combination of small size, low-power multi-core processing, and flexible I/O of the DuraCOR 310 delivers new capabilities for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) applications. This compact system supports a wide operating temperature range of -40 to +71°C (-40 to +160°F) without fans or active cooling requirements. It thrives in extreme shock/vibration conditions, high altitude, and humidity, making it well suited for mobile, tactical, aerospace, and ground vehicle applications. Reliably designed for use on-board aircraft and vehicle platforms, the unit will undergo comprehensive qualification testing to MIL-STD-810G, MIL-STD-461F, MIL-STD-1275D, MIL-STD-704F and RTCA/DO-160G test conditions for environmental, power and EMI (thermal, shock, vibration, dust, water, humidity, altitude, power spikes/surges, conducted/radiated emissions and susceptibility).

Housed in a rugged sealed IP67-rated (dust and water proof) aluminium chassis with MIL-performance circular connectors, the DuraCOR 310 features advanced EMI filtering and power conditioning to protect against input vehicle/aircraft voltage surges, spikes and transients. In addition, optional 50ms power hold-up capabilities are supported for MIL-STD-704F aircraft power switch-over requirements.

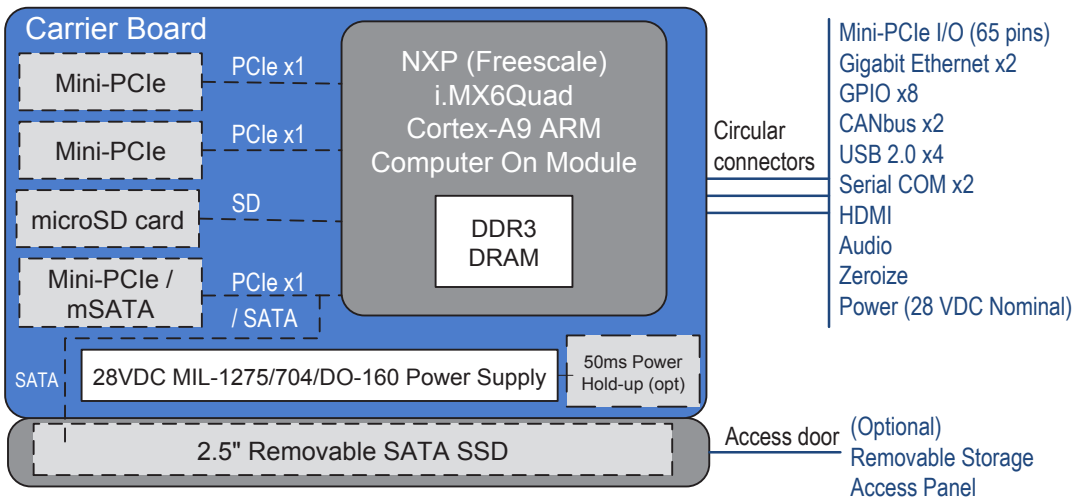

Figure 1: DuraCOR 310 block diagram

Features

Energy efficient CPU/GPU

- Low-power NXP i.MX6Quad ARM Cortex®-A9 processor with 4-cores @ 800 MHz/each
- 3 x independent Graphics Processor Units (GPUs) with 2D/3D/vector-based graphics acceleration
- Open-architecture COM module-based, optimized for energy-efficient SoC designs

Connectivity, I/O and storage

- 2 x GbE
- 4 x USB 2.0, 2 x RS-232/422, 6 x DIO, 2 x CAN
- HDMI video, stereo audio
- 3 x PCIe-Mini Card slots
- Other pre-integrated I/O configurations by special order, i.e. 1553, ARINC429, more serial/USB/Ethernet ports
- Internal mSATA / microSD card slots on carrier board or removable 2.5” SATA SSD in add-on storage module

Modular/expandable

- Up to 3 x Mini-PCIe I/O card slots pre-routed to 65 spare pins on circular connectors for add-on I/O modules
- I/O integration services available for turnkey solutions

Rugged mechanical design

- Designed for MIL-STD-810G and DO-160G shock, vibration, thermal, altitude, humidity, dust, water
- -40 to +71°C fanless extended temp operation with no moving parts (passive natural convection)
- Corrosion-resistant, aluminum chassis sealed for water immersion and dust exposure (equivalent to IP67 rating)
- Circular micro-miniature MIL-DTL-38999-like connectors for reliable I/O connections
- Filtered, transient and EMI-protected MIL-STD-1275/704/DO-160 compliant power supply for aircraft and vehicle “dirty power” input; optional 50ms power hold-up
- Qual-testing pending for MIL-STD-461F and DO-160 EMI/EMC (conducted and radiated emissions and susceptibility)
- Conformal coating for humidity/tin-whisker mitigation

Target Applications

- Civil and military tactical mission processing (server/computer) in ground vehicle, fixed wing or rotary aircraft, maritime vessels, outdoor, underground, other demanding embedded computing platforms
- Extending energy-efficient, high-performance, multi-core ARM computing architecture into embedded computing applications with harsh temperature, shock, vibration, altitude, dust, water environmental and EMI conditions
- SWaP-constrained mobile, tactical, airborne, vehicle, and sensor processing, including new builds and retrofit (C4ISR technology refresh) upgrades
- Commercial and military aerospace platforms requiring compliance to MIL-STD-810G, MIL-STD-461F, MIL-STD-1275D, MIL-STD-704F, CE Mark, RTCA/DO-160

Related Products

- DuraCOR 311: miniature quad-core Intel® Atom™ mission processor
- DuraNET 20-11: miniature 8-port GbE switch
- DuraDBH-672: combined quad-core ARM processor + 16-port GbE switch

Multi-Core ARM Processor

- NXP (Freescale) i.MX6 Quad Cortex-A9, 4-core @ 800 MHz, 1024K L2 cache, 32-bit architecture
- 3 x independent, integrated GPUs: Vivante GC2000 3D GPU (supports OpenGL/OpenCL), Vivante GC320 2D graphics accelerator, and Vivante GC355 OpenVG 1.1 vector GPU (Vivante GC2000 has four cores and achieves 24 GFLOPS)
- RAM memory: 2 GB DDR3

Standard I/O Interfaces

Ethernet

- 2 x GbE LAN interfaces
- Optional additional ports (via Mini-PCIe cards)

Serial

- 2 x RS-232/422 serial ports
- Optional additional ports (via Mini-PCIe module)

USB

- 4 x USB 2.0 ports
- Optional additional ports (via Mini-PCIe module)

Video

- High definition video output: 1x HMDI
- iMX6 integrated graphics accelerators for 2D/3D/Vector graphics, including 1080p HD video
- Optional VGA interface, video frame grabber, video encoder (via Mini-PCIe cards)

Audio

- Stereo audio (left/right) and microphone (left/right)

GPIO

- 6 x general-purpose digital I/O
- Optional additional ports (via Mini-PCIe modules)

CANbus

- 2x CANbus ports
- Optional additional ports (via Mini-PCIe cards)

Figure 2: Front view

Figure 3: Top view

Figure 4: Side view

Figure 5: Rear view

Figure 6: Optional removable 2.5” SATA SSD media support

Figure 7: No tools required for removal of SSD

I/O Expansion

- Up to 3 x slots for Mini-PCIe card I/O modules (for optional MIL-STD-1553, ARINC 429, video frame grabber, additional serial, Ethernet, CAN, USB ports, civilian GPS, or Wi-Fi, etc.)
- 65 pins available on circular connectors for Mini-PCIe I/O signals
- Application engineering services available for pre-integrated I/O modules

Storage

- 1 x slot for mSATA Flash SSD on internal carrier board (16 to ~480 GB capacity)
- 1 x slot for microSD card on internal carrier board (8 to ~64 GB capacity)
- Optional removable 2.5” SATA SSD in add-on storage segment (64 GB to ~2 TB capacity)

Operating System

- Pre-installed Linux distribution
- Special order option: Windows® Embedded Compact

Security

- i.MX6 processor features hardware-enabled security capabilities, such as secure high assurance boot, cryptographic acceleration and assurance (AES-128, AES-256, DES, 3DES, ARC4, hashing, authentication), TrustZone trusted execution environment, and more
- Declassification: data zeroization support to erase non-volatile Flash memory (initiated by offboard signal trigger)

Physical Specifications

- Weight:
  - Base system, exclusive of Mini-PCIe or mSATA modules: ~1.5 lb (0.68 kgs)
  - System with integrated removable storage segment, excluding SSDs/Mini-PCIe modules: ~2.25 lb (1.02 kgs)
- Dimensions (H x D x W, excluding connectors and mounting feet):
  - Base system: ~1.4 x 5.2 x 5.4” (3.6 x 13.2 x 13.6 cm)
  - With 2.5” storage add-on: ~2.1 x 5.2 x 5.4” (5.4 x 13.2 x 13.6 cm)
- Chassis: aluminium alloy, corrosion resistant
- Cooling: passive, natural convection (fanless)
- Ingress protection: dust and water proof (similar to IP67)
- Finish: black anodize finish per MIL-A-8625, Type II, Class 2
- Connectors: micro-miniature MIL-DTL-38999-like Amphenol 2M series connectors with environmental sealing (50%+ smaller/lighter than traditional 38999s)
- Installation: 4 x mounting holes

Power Compliance

- 28 VDC nominal power; input range: 9 to 36 VDC (est)
- MIL-STD-704F 28 VDC compliant for aircraft electrical operation: over/under voltages, spikes, surges for normal, transfer, abnormal, emergency, starting, and power failure
  - + Optional support for 50 ms power hold-up capacitance (per MIL-STD-704) for aircraft power switch-over requirements
- MIL-STD-1275D 28 VDC compliant for ground vehicle operation: steady state DC voltage variations, no fault/ single fault conditions, ripple voltage susceptibility on input power leads, imported voltage spikes, overvoltage and under voltage surges, starting disturbances, ESD immunity
- RTCA/DO-160 compliant for aircraft operation (Sections 16-18, 25): power input, voltage spikes, audio frequency conducted susceptibility-power inputs, electrostatic discharge
- Power consumption (estimated): <10W

EMI/EMC Compliance

Qualification testing pending for MIL-STD-461G, DO-160, and CE Mark:

- Conducted emissions: MIL-STD-461F, CE102, power leads, 10 KHz to 10 MHz, basic curve, Fig CE102-1; RTCA/DO-160G Sec. 21; conducted RF emissions, 150 kHz to 152 MHz, category L; figures 21-1, 21-2; CE Mark (EN55022 power line conducted emissions)
- Conducted susceptibility: MIL-STD-461F, CS101, power leads, 30 Hz to 150 KHz, Curve 2, Figure CS101-1 (28V and below); CS114; bulk cable injection, 10k to 200 MHz; Curve 3, Figure 1; CS115; bulk cable injection, impulse excitation; impulse, Figure 1; CS116; damped sinusoidal transients, cables/power leads, 10k to 100 MHz; transient, Figures 1-2; RTCA/DO-160G Sec. 20; conducted susceptibility, 10 kHz to 400 MHz, category M; Figure 20-6
- Radiated emissions: MIL-STD-461F, RE102; electric field, 10 kHz to 18 GHz, Fixed Wing Internal < 25 meters, Figure RE102-3; MIL-STD-461F, RS103; electric field, 2 MHz to 18 GHz, 200 V/m, Table VII, RS103 limits; CE Mark (EN55022 power line radiated emissions)
- Radiated susceptibility, RS103, electric field, 2 MHz to 18 GHz, 200 V/m, Table VII, RS103 limits
- Immunity per CE EMC directive EN55024 (test procedures EN 61000-4-X)

Environmental Compliance

Qualification testing pending per MIL-STD-810G and RTCA/DO-160G:

- Operating temperature: -40 to +71°C (-40 to +160°F) ambient (per MIL-STD-810G Methods 501.5 and 502.5) and -40 to +70°C (per DO-160G, Sect 4 Cat A2 and D2 and Section 4.5.5, Category V/Table 4-1)
- Storage temperature: -55 to +85°C (per DO-160G, Sect 4, Cat A2) and -40 to +85°C (-40 to +185°F) per MIL-STD-810G Meth 502.5 and Meth 501.5
- Humidity (operating/transport): up to 95% RH @ 40°C, non-condensing (per MIL-STD-810G, Meth 507.5, Proc II; DO-160G, Sect 6, Cat B, Sect 6.3.2)
- Operating shock: 40 g, 11 ms, 3 pos/neg per axis, 18 terminal peak shock pulses per MIL-STD-810G Meth 516.6, Procedure I; 6 g, 11 ms, terminal peak shock pulses per DO-160G, Sect 7, Class A)
- Crash hazard shock: 75 g, 11 ms, 12 terminal peak shock pulses, 2 pos/neg per axis (per MIL-STD-810G Method 516.6, Procedure V)
- Random vibration: 3 axes, 1 hour/axis (per MIL-STD-810G, Method 514, per Procedures I and II and DO-160G Section 8, Cat S, Curve B3 per combined jet-helo-tracked vehicle profile)
- Operating altitude: up to +50,000 ft (15,240 meters) (per DO-160G, Section 4, Category D2, Section 4.6.1) and +30,000 ft (9,144 meters) (per MIL-STD-810G, Method500.5, Procedures I-II)
- Ingress (dust/sand): no ingress (designed for compliance to IP67, MIL-STD-810G Method 510.5, Procedure I and II, DO-160G, Section 12, Cat S)
- Water immersion: no leakage per 1 meter submersion, 30 minutes (similar to IP67 and MIL-STD-810G, Method 512.5, Procedure I, 1 meter, 30 minutes)

Other Specifications

Reliability

- Designed and manufactured using AS9100 aerospace grade, ISO 9001:2000 certified quality program
- No moving parts, no active cooling required
- Conformal coated PCBs for humidity/tin-whisker mitigation, staked components, under-filled BGA
- Built in Test (BIT) self-diagnostics capabilities to detect critical systems faults via initial Power-On Self-Test (POST) and Continuous BIT (CBIT)
- Mean Time Between Failure (MTBF) calculated per MIL-HDBK-217F: TBD

Export jurisdiction

- ITAR-free: EAR Commerce Department controlled (dual-use)

Regulatory compliance

- European CE Mark pending (including EN55022, EN55024, RoHS2)

Warranty

- 1 year return to depot warranty
- Extended multi-year service agreements available (basic to priority service levels)

Ordering Information

Note: Due to system modularity, numerous configuration variants are possible.

Sample system ordering codes:

- C310-01: DuraCOR 310, i.MX6Quad, 2 GB RAM, 16 GB Flash, Linux
- C310-02: DuraCOR 310, i.MX6Quad, 2 GB RAM, 32 GB Flash, Linux
- C310-03: DuraCOR 310, i.MX6Quad, 2 GB RAM, 64 GB Flash, Linux
- C310-04: DuraCOR 310, i.MX6Quad, 2 GB RAM, 128 GB Flash, Linux
- C310-05: DuraCOR 310, i.MX6Quad, 2 GB RAM, 256 GB Flash, Linux

Breakout cable set

- CBL-C310: Optional starter breakout cable set mates with circular connectors transitioning to traditional commercial connectors (i.e. RJ-45/DB-9/USB/HDMI) for lab/testing purposes

Development Kit

- DTK-C310-02: Development Kit for DuraCOR 310, i.MX6Quad, 32 GB Flash, Linux, commercial connector breakout, AC/DC power
  - + DTK includes system carrier board integrated with CPU module, mSATA storage, and I/O breakout board to facilitate rapid software integration and lab-use prototyping

Special order options

- Turnkey, pre-integrated Mini-PCIe I/O modules (e.g. MIL-1553, ARINC429, etc) available with Application Engineering MCOTS services
- Connector caps, mechanical changes, custom metal finishes, ESS screening
- Program-specific delta qual tests (additional MIL-certifications and environmental testing)

Mechanical Envelope Drawings