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Single Board Computers
Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.

Mercury’s BuiltSAFE™ products bring the highest level of flight-safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

Mercury’s MFCC-8558 BuiltSAFE board is a DAL-C safety certifiable XMC 2.0 Single Board Computer (SBC) engineered for the most stringent aerospace and defense applications that may require certification to DO-178C/DO-254. The MFCC 8558 can be delivered with all documentation, certification evidence and supporting artifacts required to prove compliance for avionics certification.

Leveraging the MFCC-8558 ensures a smooth development process supported by Mercury’s safety engineering team and their deep domain expertise. The MFCC-8558 BuiltSAFE SBC has been engineered with DAL safety certification in mind from the top down, systematically applying DO-178C/DO-254 best design practices. The MFCC-8558 has a comprehensive set of Power-On, Continuous and Initiated Built-In-Tests and hardware components that physically disconnect maintenance interfaces during missions for built in reliability.

Pre-integration

The MFCC-8558 BuiltSAFE SBC is engineered for seamless integration with complementary building blocks with XMC 2.0 compatible mezzanine sites. Pre-integrated with BuiltSAFE 3U OpenVPX modules such as Mercury’s VGP-2870 video and graphic processor card or AVIO-2353 avionics I/O card, the MFCC-8558 becomes a powerful DAL-C (DO-178C/DO-254) certifiable subsystem that is packaged in a single 3U OpenVPX slot. This approach is ideal for computation intensive video/graphics or I/O intense avionic applications.
BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

Technical Specifications

Compliance

XMC 2.0 (VITA-61), XMC PCIe (VITA 42.3)
Certifiable up to DAL-C (DO-178C/DO-254) – Higher upon request
Certifiable board support package: VxWorks®653 (partitioned)

Power Consumption

minimum typical maximum
- 15W 20W

Processor

NXP QorIQ T2080 four dual threaded e6500 cores
AltVec unit

Memory

4 GB DDR3L at 14.4 GB/s peak with ECC protection
4 GB Flash EPROM (NAND)
512MB Flash EPROM (NOR)
256 KB FRAM NVRAM

Links/Connections

3x PCIe Gen2 x1 on XMC-P6
1x PCIe Gen2 x4 on XMC-P5
1x SGMII on XMC-P6 (DAL-C) (1)
2x UARTs on XMC-P6 (2)
Maintenance or DAL-E only interfaces (disabled when on mission)
1x 1000BASE-BX interface on XMC-P6
1x USB 2.0 HOST on XMC-P6
1x SGMII interface on XMC-P6
4x UARTs over USB on XMC-P6 (2)
1x USB 2.0 OTG on XMC-P6
1x SATA 2.0 on XMC-P6

(1) DAL-C certifiable in Fast Ethernet mode
(2) Mutually exclusive

Ruggedization Levels

☐ A1: 0°C to 55°C
☐ C4: -40°C to 85°C

Safety Optimized Board Management Controller

Voltage monitoring
Temperature monitoring (thermal sensors on critical positions)
Elapsed time and real-time counter
Watchdog (short and long period)
Error reporting
Reset management
Certifiable board support package
Initialization sequence
Built-In Tests

Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits, standards</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-operating temperature</td>
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<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>-1,500 to 60,000 feet</td>
<td></td>
</tr>
<tr>
<td>May require conformal coating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fungus resistance</td>
<td>No nutrient materials</td>
<td></td>
</tr>
<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC-J-STD-001 class 3</td>
<td></td>
</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
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</tr>
<tr>
<td>Optional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td></td>
</tr>
<tr>
<td>ROHS variants as an option</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

MFCC-8558 NXP QorIQ T2080 processor XMC

Software

☐ VxWorks653 board support package
☐ Linux board support package

Safety Artifacts

☐ DO-178C certification kit*
☐ DO-254 certification kit*

* Please consult factory

Note: If the MFCC-8558 is to be used on a VME/PCI carrier, please contact factory

* The required air-flow is defined separately for each product
Related Hardware Products

AVIO-2353  3U OpenVPX avionics I/O board
VGP-2870  3U OpenVPX video I/O and graphic processor
CB3P-6357A0  3U OpenVPX carrier board for MFCC-8557/8
RTM-8557A0  Rear Transition Module for CB3P-6357A0 + MFCC-8557/8 integration
ACS-6076  Forced air-cooled 4-slot payload, 3U OpenVPX sealed conduction-cooled enclosure (0.8", 0.85", 1" pitch, 250 Watts) with MIL connectors
ROCK-2  3U OpenVPX, low-SWaP, rugged, modular, pre-qualified subsystems

Less space for more functions

Mission Computer featuring stacked XMCs for low-SWaP
Mercury's BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

Mercury’s BuiltSAFE MFCC-8557 is a DAL C (other upon request) certifiable XMC 2.0 Single Board Computer (SBC) engineered for the most stringent aerospace and defense applications that require certification to DO-178C/DO-254. The MFCC-8557 can be delivered with all documentation, certification evidence and supporting artifacts required to prove compliance for avionics certification.

Leveraging the MFCC-8557 ensures a smooth development process supported by Mercury’s safety engineering team and their deep domain expertise. The BuiltSAFE MFCC-8557 has been engineered with DAL safety certification in mind from the top down, with DO-178C/DO-254 best design practices systematically applied throughout all phases of development.

The BuiltSAFE MFCC-8557 features a comprehensive set of Power-On, Continuous and Initiated Built-In-Tests and hardware components that physically disconnect maintenance interfaces during missions for built in reliability.

BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
Pre-integration

The MFCC-8557 is engineered for seamless integration feature complementary building blocks with XMC 2.0 compatible mezzanine sites. Pre-integrated with our BuiltSAFE VGP-2870 or AVIO-2353, the MFCC-8557 becomes a powerful DAL-C (DO-178C/DO-254) certifiable subsystem that is packaged in a single 3U OpenVPX™ slot. This approach is ideally suitable for computation intensive video/graphics or I/O intense avionic applications.

Technical Specifications

**Compliance**
XMC (VITA-42) XMC 2.0 (VITA-61), XMC PCIe (VITA-42.3)
Certifiable up to DAL-C (DO-178C/DO-254)
Certifiable board support package: VxWorks®653 (partitioned)

**Power Consumption**

<table>
<thead>
<tr>
<th>minimum</th>
<th>typical</th>
<th>maximum</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>12</td>
<td>18</td>
<td>Watts</td>
</tr>
</tbody>
</table>

**Processor**
Freescale QorIQ P3041 @ 1.5 GHz

**Memory**
2/4 GB DDR3L @ 10.6 GB/s peak with ECC protection
2 GB Flash EPROM (NAND)
256 MB Flash EPROM (NOR) for mission
256 MB Flash EPROM (NOR) for maintenance
256 KB FRAM NVRAM
32 MB EEPROM SPI

**Links/Connections**
3x PCIe Gen2 x1 on XMC-P6
1x PCIe Gen2 x4 on XMC-P5
1x SGMII interface on XMC-P6 (1)
2x UARTs on XMC-P6 (2)
Maintenance or DAL-E only interfaces (disabled when on mission)
1x 1000BASE-BX interface on XMC-P6
1x SGMII interface on XMC-P6
1x USB 2.0 OTG on XMC-P6
1x USB 2.0 HOST on XMC-P6
4x UARTs over USB on XMC-P6 (2)
1x SATA 2.0 on XMC-P6

(1) DAL-C certifiable in Fast Ethernet mode
(2) Mutually exclusive

**Safety Optimized Board Management**
Voltage monitoring
Temperature monitoring (thermal sensors on critical positions)
Elapsed time and real-time counter
Watchdog (short and long period)
Error reporting
Reset management
Certifiable board support package
Initialization sequence
Built-in tests

**Product Ordering**
MFCC-8557
Freescale QorIQ P3041 processor XMC

**Memory**
- 2 GB
- 4 GB

**Connector**
- XMC (VITA-42)
- XMC 2.0 (VITA-61)

**Environmental**
- A1 : 0°C to 55°C
- C4 : -40°C to 85°C

**Software**
- VxWorks653 board support package
- Linux board support package

**Safety Artifacts**
- DO-178C certification kit (consult factory for more information)
- DO-254 certification kit (consult factory for more information)

Note: If the MFCC-8557 is used on a VME/CPCI carrier, please contact factory

**Related Hardware Products**
AVIO-2353 3U OpenVPX™ avionic I/O board
VGP-2870 3U OpenVPX video I/O and graphic processor
ROCK-2 3U OpenVPX, low-SWaP, rugged, modular, pre-qualified subsystems
CB3P-6357 3U OpenVPX carrier board for MFCC-8557/B
RTM-8557A0 Rear Transition Module for pre-integration CB3P-6357A0 + MFCC-8557/B
### Ruggedization Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4</td>
<td>Extended range CC</td>
<td>Conduction</td>
<td>-40°C to 85°C [CC4]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.1 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>40g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

### Environmental Specifications

<table>
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<tr>
<th>Condition</th>
<th>Limits, standards</th>
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### Less space for more functions

Mission computer featuring stacked XMCs for low-SWaP

![Mission computer diagram](image)
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

Mercury’s BuiltSAFE MFCC-8556 is a powerful processing solution packaged in a PMC/XMC form-factor for airborne conduction-cooled applications. The MFCC-8556 is designed for the most demanding missions, combining high compute power and flight-worthiness capabilities in harsh environments.

The MFCC-8556 is Mercury’s sixth generation PMC/XMC PowerPC multi-function processing solution, featuring a fast dual-core processor with high-speed links and bridges (PCIe, GbE) and an optional user-programmable FPGA for application development.

An Advanced Board Management Controller is implemented for configuration management, event logging and other supporting tasks. It monitors and controls the system continuously, ensuring reliability and safety even in the case of failure conditions.

**BuiltSAFE for Avionics**

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
Technical Specifications

Compliance
PMC: VITA 20, VITA 32
XMC: VITA 42

Power Consumption
minimum typical maximum units
- 8 12 [1] Watts

Processor
Freescale QorIQ P2020 (2 cores) @ 1.0 GHz

Memory
512 MB/2 GB DDR3 SDRAM @ 6.4 GB/s peak with ECC protection
2 GB Flash (NAND)
128 MB Flash (NOR)
256 KB NVRAM

User Programmable FPGA I/O
Xilinx Spartan-6 LXT FPGA with 128 MB DDR3 SDRAM (B) (D) (G)
User-specific I/O lines on PMC-P4/XMC-P6 (B) (D) (G) (L)

Buses
1x 32-bit PCI 3.0 bus at 33/66 MHz on PMC-P1/P2 (B) (G) (L)

Links / Connections
1x PCIe x2 on XMC-P5 (VITA 42.3) (B) (G)
3x high-speed links on user-programmable FPGA to XMC-P6 (B) (D) (G)
2x 1000Base-T on PMC-P4/XMC-P6 (B) (D) (G)
1x USB 2.0 host / device on PMC-P4/XMC-P6 (B) (D) (G)
2x RS-232 on PMC-P4/XMC-P6 (B) (D) (G)
1x RS-232 on XMC-P5 (B) (D) (G)
1x selectable RS-422/485 on PMC-P4/XMC-P6 (B) (D) (G) (L)

(1) Without FPGA user functionality
(8), (C), (D), (G), (L) and (P) applies to B, C, D, G, L and P model options

Advanced Board Management Controller
CPU speed control logic
Advanced power management
Voltage and current monitoring
Temperature monitoring (thermal sensors on critical positions)
Advanced error reporting and logging

Development / Debug
Onboard JTAG test port

Ruggedization Levels

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<tr>
<td>Fungus resistance</td>
<td>No nutrient materials</td>
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<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC-J-STD-001 class 3</td>
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</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
<td>Optional</td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
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<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

MFCC-556BF Conduction-cooled PMC with QorIQ P2020 @ 1.0 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT 128 MB DDR3
MFCC-8556DF Conduction-Cooled XMC with QorIQ P2020 @ 1.0 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT with 128 MB DDR3
MFCC-8556LF Conduction-cooled PMC with QorIQ P2020 @ 1.0 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, (pin-out: MFCC-8448 compatible)
MFCC-8556PF Conduction-cooled XMC with QorIQ P2020 @ 1.0 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (no XMC-P6)
MFCC-8556DH Conduction-cooled XMC with QorIQ P2020@1.0GHz 2GB DDR3, 2GB NAND, 128MB NOR, 256KB NVRAM, Spartan-6 LXT with 120MB DDR3

Conformal coating versions of these boards are also available.

OWW-36410A VxWorks® BSP for MFCC-8550/56
OWW-36410E VxWorks 653 BSP for MFCC-8550/56
OWX-36410L Linux® Toolbox for MFCC-8550/56

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Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury's solutions power a wide variety of critical defense and intelligence programs.

Mercury's BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink communications save time and cost while decreasing risk.

The BuiltSAFE MFCC-8550 is an air-cooled PMC/XMC processor module for ground applications. It is designed for the most demanding applications requiring high compute capabilities.

The MFCC-8550 combines a fast, dual-core, multi-function PowerPC processor, high-speed links and bridging (PCIe, Gigabit Ethernet) with a programmable FPGA for application development.

An Advanced Board Management Controller (aBMC) is implemented for configuration management, event logging and other supporting tasks. It monitors and controls the system continuously, ensuring reliability and safety even in the case of failure conditions.

BuiltSAFE for Avionics

Mercury's expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
Technical Specifications

Compliance
PrPMC: VITA 20, VITA 32
XMC: VITA 42

Power Consumption
Minimum typical maximum units
- 8 12* Watts
* Without user FPGA functionality

Processor
Freescale QorIQ P2020 (2 cores) @ 1.2 GHz

Memory
512 MB DDR3 SDRAM @ 6.4 GB/s peak with ECC protection
2 GB Flash (NAND)
128 MB Flash (NOR)
256 KB NVRAM

User-Programmable FPGA/User I/O Lines
Xilinx Spartan-6 LXT FPGA with 128 MB DDR3 SDRAM
31x user-specific LVDS pairs (six pairs clock capable) on PMC-P4

Buses
1x 32-bit PCI 3.0 bus at 33/66 MHz on PMC-P1/P2

Links/Connections
1x PCIe x2 on XMC-P5 (VITA 42.3)
3x high-speed links on user-programmable FPGA to XMC-P6
2x 1000Base-T on RJ-45 connectors
1x USB 2.0 host/device on XMC-P6 connector
1x USB 2.0 host/device on mini USB connector
1x RS-485 on µDB9 connector
2x RS-232 on XMC-P6 connector

Advanced Board Management Controller
CPU speed control logic
Advanced power management
Voltage and current monitoring
Temperature monitoring (thermal sensors on critical positions)
Advanced error reporting and logging

Development/Debug
Onboard JTAG test port

Ruggedization Levels

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<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Commercial AC</td>
<td>Forced Air*</td>
<td>0°C to 56°C [AC1]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.04 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>20g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

* The required airflow is defined separately for each product

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<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
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<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
<td>Optional</td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

MFCC-8550GF  Air-cooled PrPMC with QorIQ P2020 @ 1.2 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT with 128 MB DDR3

MFCC-8550HF  Air-cooled XMC with QorIQ P2020 @ 1.2 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT with 128 MB DDR3

MFCC-8550IF  Air-cooled PrPMC/XMC with QorIQ P2020 @ 1.2 GHz, 512 MB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT with 128 MB DDR3

OWW-36410A  VxWorks® BSP for MFCC-8550/56

OWW-36410E  VxWorks 653 BSP for MFCC-8550/56

OWX-36410L  Linux® Toolbox for MFCC-8550/56

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Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE™ MFCC-8570 is an XMC mezzanine powered by an Intel Quad Core i7 Gen 5 dual-threaded (8-threads) processor (Broadwell microarchitecture). Protected for rough deployment within a rugged conduction-cooled package, these mezzanines are ideally suited to data/graphics-intensive applications.

**Built for processing-intensive, data-intensive and graphic-intensive applications**

The Intel Iris Pro Graphics 6200 GPU is embedded in the Core™ i7 processor to offer high-performance, advanced GPU functions and may be applied to GPGPU tasks using OpenCL™. The BuiltSAFE™ MFCC-8570 embeds 8GB of DDR3 ECC memory (25.6GB/s throughput) and 8GB of on-board SATA flash memory enabling applications to generate and/or process large amount of data.
Technical Specifications

Compliance
XMC PCIe (VITA 42.3), XMC 2.0 (VITA 61)
XMC VPWR +12V
XMC Signal mapping to Open VPX (VITA 46.9)
P2w1-X24s+X8d+X12d on XMC-P6

Power Consumption
35Watts typical (1)

Processor
Intel Core i7 Gen5 (5850EQ) @ 2.7GHz (Turbo boost @ 3.4GHz)
Quad-Core, dual-threaded (8-threads total) Broadwell microarchitecture

Memory (other options available)
8GB of DDR3 ECC (with 25.6GB/s throughput)
8GB of on-board SSD (2)
And 8GB of on-board SATA flash memory

I/Os
Expansion links
PCIe Gen2 x8 on XMC-P5 (3)

High speed links
2x Gigabit Ethernet 1000Base-KX on XMC-P6
1x USB 3.0 on XMC-P6
1x SATA 2.0 on XMC-P6

Video out
HDMI on XMC-P6

Others (4)
2x USB 2.0
1x RS-232
1x RS-422/485
6x user GPIO
2x SPI on XMC-P6
1x PPS on XMC-P6

Environmental Specification

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4</td>
<td>Extended range CC</td>
<td>Conduction</td>
<td>-40°C to 85°C [CC4]</td>
<td>5-100 Hz: increase at 3 dB/ octave, 100-1000 Hz: 0.1 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>40g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

Board Management
Built-In-Test (Bios and software)
Temperature monitoring (thermal sensors on critical positions)
Watchdog (short and long period)
Error reporting
Reset management
Consumption monitoring
Voltage monitoring
1x I2C with IPMI support on XMC-P5

Security Features
Non-volatile memory write protection
Trusted Platform Module (TPM)

Additional Features
Real Time Clock

Software
Yocto 2.0 BSP
Red Hat Enterprise Linux 7 BSP

Product Ordering and Options
MFCC-8570 3U OpenVPX Intel Core i7 Gen5 Single Board Computer
Memory 8GB SSD
XMC to VPX Signal Mapping VITA 46.9

Environmental
-40°C to 75°C at thermal interface

Software
Linux® Yocto 2.0 BSP
Red Hat Enterprise Linux 7 BSP

PCle
PCIe Gen2
PCIe Gen3 (3)

XMC
VITA 42
VITA 61 (5)

Related Hardware Products
ACS-6076 Forced air-cooled 4-slot payload 3U VPX sealed conduction-cooled enclosure (0.8", 0.85", 1" Pitch, 250 Watts) with MIL connectors
ROCK-2 3U OpenVPX, SWaP-optimized, rugged, modular, pre-qualified, COTS subsystems

(1) Power consumption is kept under 35W by controlling the processors frequency
(2) Other sizes available upon request
(3) PCIe Gen3 available on VITA 61 connectors upon request
(4) Please contact factory for other configurations
(5) Available upon request
Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.

Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE RIOV-2478 is a 3U conduction-cooled, OpenVPX Single Board Computer for airborne applications. It is specifically designed for the most demanding applications, combining high compute and flight-worthiness capabilities within harsh environments.

The BuiltSAFE RIOV-2478 is a second generation 3U OpenVPX PowerPC compute platform. It combines a multi-core processor with modern interconnect high-speed links and an onboard crosspoint switch. It features a QorIQ P3/P4 processor designed for combined data and control plane processing. The processor design is suited for applications, which are highly compute-intensive, I/O intensive or both. The crosspoint switch permits flexibility of the payload profile configuration in accordance with VITA standards enabling support of PCIe, GbE and 10GbE over OpenVPX and XMC.

An Advanced Board Management Controller (aBMC) is implemented for event logging and other supporting tasks.

BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.
## Technical Specifications

### Compliance
3U OpenVPX (VITA 65)/VPX (VITA 46) / VPX REDI (VITA 48)
Conduction-cooled VPX (VITA 48.2)

### Power Consumption

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>24(JP) / 40</td>
<td>50</td>
<td>Watts</td>
<td></td>
</tr>
</tbody>
</table>

(JP) Applies to “JP” model

### Processor
Freescale QorIQ P4080 (8 cores) @ 1.2 GHz
Freescale QorIQ P3041 (4 cores) @ 800 MHz @ 1.3 GHz

### Memory
1/2/4 GB DDR3 SDRAM
2 GB Flash (NAND)
128 MB Flash (NOR)
256 KB NVRAM

### Switches/Bridges
1x crosspoint switch (40x40)

### High-Speed Links/Connections
Up to 3x PCIe x4 Gen2 on VPX-P1/P2 (VITA 46.4) and XMC-J5 (VITA 42.3)
Up to 8x SGMII on OpenVPX-P1/P2 and XMC-J5
Up to 2x XAUI on OpenVPX-P1/P2 (VITA 46.7) and XMC-J5 (VITA 42.6)
1x UART on OpenVPX-P2
3x COM port via mini USB connector
1x Aurora debug on OpenVPX-P2

### User I/O Lines
20x user-specific I/O lines on XMC-J6 to OpenVPX-P2

### Sites
One XMC site (VITA 42.2, 42.3, 42.6)
Advanced Board Management Controller
CPU speed control logic

### Advanced Power Management
Voltage and current monitoring
Temperature monitoring (thermal sensors on critical positions)
Advanced error reporting and logging
Development/Debug
Rear I/O transition module (CPU COP debug, GbE, 10GbE, Aurora debug)

### Ruggedization Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3</td>
<td>Rugged CC</td>
<td>Conduction</td>
<td>-40°C to 70°C [CC3]</td>
<td>6-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.1 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>40g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

### Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits, standards</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-operating temperature</td>
<td>-55°C to 105°C [C4]</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>-1,500 to 60,000 feet</td>
<td>May require conformal coating</td>
</tr>
<tr>
<td>Fungus resistance</td>
<td>No nutrient materials</td>
<td></td>
</tr>
<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC J-STD-001 class 3</td>
<td></td>
</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
<td>Optional</td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

### Product Ordering

- **RIOV-2478AF** Conduction-cooled 3U OpenVPX SBC with QorIQ P4080 @ 1.2 GHz, 2 MB L3, 2 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1" Pitch, 2LM)
- **RIOV-2478JR** Conduction-cooled 3U OpenVPX SBC with QorIQ P3041 @ 800 MHz, 1 MB L3, 4 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1" pitch)
- **RIOV-2478JP** Conduction-cooled 3U OpenVPX SBC with QorIQ P3041 @ 800 MHz, 1 MB L3, 4 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1" pitch, no crosspoint switch)
- **OWW-30780B** VxWorks® BSP for RIOV-2473/78
- **OWW-30780D** VxWorks 653 BSP for RIOV-2473/78
- **OWX-30780L** Linux® Toolbox for RIOV-2473/78

Note: Rear I/O Transition Module available upon request

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3262.02E-0218-ds-RIOV-2478
Mercury's BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE RIOV-2473 is an air-cooled 3U OpenVPX Single Board Computer for ground applications. It is specifically designed for the most demanding applications, which require very high compute capabilities.

The BuiltSAFE RIOV-2473 is a second generation 3U OpenVPX PowerPC compute platform. It combines a multi-core processor with modern interconnect high-speed links and an onboard crosspoint switch. It features a QorIQ P3/P4/P5 processor designed for combined data and control plane processing. The processor design is well suited for applications which are highly compute-intensive, I/O intensive or both. The crosspoint switch gives flexibility to the payload profile configuration in accordance to OpenVPX, enabling support of PCIe, GbE and 10GbE over VPX.

An Advanced Board Management Controller (aBMC) is implemented for event logging and other supporting tasks.

BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
Technical Specifications

Compliance
3U OpenVPX (VITA 65)/VPX (VITA 46)/VPX REDI (VITA 48)
Commercial air-cooled VPX (VITA 48.1)

Power Consumption
minimum typical maximum units
- 40 50 Watts

Processor
Freescale QorIQ P3041 (4 cores) @ 1.3 GHz
Freescale QorIQ P4080 (8 cores) @ 1.2 GHz
Freescale QorIQ P5020 (2 cores) @ 2.0 GHz
(A) Applies to “A” model
(J) Applies to “J” model
(R) Applies to “R” model

Memory
1/2/8 GB DDR3 SDRAM
2 GB Flash (NAND)
128 MB Flash (NOR)
256 KB NVRAM

Switches/Bridges
1x crosspoint switch (40x40)

High-Speed Links/Connections
Up to 3x PCIe x4 Gen2 on VPX-P1/P2 (VITA 46.4)
Up to 8x SGMII on VPX-P1/P2
Up to 2x XAUI on VPX-P1/P2 (VITA 46.7)
1x UART on VPX-P2
3x COM port via mini USB connector
1x Aurora debug on VPX-P2

Advanced Board Management Controller
CPU speed control logic
Advanced power management
Voltage and current monitoring
Temperature monitoring (thermal sensors on critical positions)
Advanced error reporting and logging

Development/Debug
Rear I/O transition module (CPU COP debug, GbE, 10GbE, Aurora debug)

Ruggedization Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Commercial AC</td>
<td>Forced Air*</td>
<td>0°C to 55°C [AC1]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.04 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>20g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

*The required air-flow is defined separately for each product.

Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits, standards</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-operating temperature</td>
<td>-65°C to 105°C [C4]</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>-1,500 to 60,000 feet</td>
<td>May require conformal coating</td>
</tr>
<tr>
<td>Fungus resistance</td>
<td>No nutrient materials</td>
<td></td>
</tr>
<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC-J-STD-001 class 3</td>
<td></td>
</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830 Optional</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

| RIOV-2473AF | Commercial air-cooled 3U OpenVPX SBC with QorIQ™ P4080 @ 1.2 GHz, 2 MB L3, 2 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1” Pitch) |
| RIOV-2473AH | Commercial air-cooled 3U OpenVPX SBC with QorIQ P4080 @ 1.2 GHz, 2 MB L3, 8 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1” Pitch) |
| RIOV-2473JE | Commercial air-cooled 3U OpenVPX SBC with QorIQ P3041 @ 1.3GHz, 1 MB L3, 1 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1” Pitch) |
| RIOV-2473RF | Commercial air-cooled 3U OpenVPX SBC with QorIQ P5020 @ 1.2GHz, 2 MB L3, 2 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM (1pitch) |
| OWW-30780B | VxWorks® BSP for RIOV-2473/78 |
| OWW-30780D | VxWorks 653 BSP for RIOV-2473/78 |
| OWX-30780L | Linux® Toolbox for RIOV-2473/78 |
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The BuiltSAFE RIO6-8096 is a 6U, conduction-cooled VME64x Single Board Computer for airborne applications. It is specifically designed for the most demanding applications, combining very high compute and flight-worthiness capabilities within harsh environments.

The BuiltSAFE RIO6 family is a sixth generation 6U VME64x PowerPC compute platform combining a fast dual-core processor with modern interconnect high-speed links and bridges (PCIe, Gigabit Ethernet).

The BuiltSAFE RIO6-8096 provides a PCIe x4 connection over the VME-P0 connection, allowing the insertion of modern interconnect technology into any system based on a VME64x backplane with a P0 connector.

For an easy configuration of the I/O pinout and support of legacy pinouts a static routing module (FlexIO) is placed between the different I/O sources and the backplane. Combined with the onboard FPGA-based PCIe to VME bridge FlexIO makes the RIO6-8096 a versatile fit for legacy placements requiring additional compute performance.

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Technical Specifications

**Compliance**
Conduction-cooled 6U VME64x

**Power Consumption**
25 Watts (typical)

**Processor**
Freescale QorIQ P2010 (1 core)

**Memory**
1/4 Gb DDR3 SDRAM at 6.4 GB/s peak with ECC protection
2 GB Flash (NAND)
128 MB Flash (NOR)
256 KB NVRAM

**FPGA/User-Programmable/User I/O Lines**
Xilinx, Spartan-6 LX100T user-programmable FPGA with dual 128 MB DDR3 SDRAM and 8 MB Flash (SPI)
32 user-specific I/O lines on PMC-J14 to VME-P2
48 user-specific I/O lines on PMC-J24 to VME-P2
64 user-specific I/O lines on FPGA to CES FlexIO

**I/O Customization**
1x CES FlexIO static routing module (interconnect between PMCs/XMCs, VME-P2 and user FPGA)

**Buses**
1x 64-bit VME64x 2aSST bus on VME-P1/P2
1x 64-bit PCI 3.0 bus at 33/66 MHz on PMC-J11/J12/J13/J21/J22/J23
High-Speed Links/Connections
1x PCIe x4 on VME-P0
3x PCIe x4 on XMC-J15/J25/J26 (1x each) (VITA 42.3)
3x 10/100Base-TX/1000Base-T on VME-P2
1x USB 2.0 host on VME-P2
2x RS-232 on VME-P2
4 high-speed links on FPGA to XMC-J16(1)

(1) Depends on FPGA configuration

**Sites**
2x PMC/XMC sites (VITA 42.3)

**Board Management Controller**
Power management
Board start-up and voltage monitoring
Temperature monitoring (thermal sensors on critical positions)
Development/Debug
Onboard JTAG test port
Rear I/O transition module
Xilinx ChipScope Pro FPGA debugging tool

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**Ruggedization Levels**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>C4</td>
<td>Extended range CC</td>
<td>Conduction</td>
<td>-40°C to 85°C [CC4]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.1 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
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**Environmental Specifications**

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<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
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<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IRC-CC-830</td>
<td>Optional</td>
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<tr>
<td>Materials</td>
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<td>Flammability</td>
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<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

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**Product Ordering**

RI06-8096AF Conduction-cooled 6U VME SBC with QorIQ P2010 @ 1.0 GHz, 512 KB L2, 1 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT
RI06-8096EF Conduction-cooled 6U VME SBC with QorIQ P2010 @ 1.0 GHz, 512 KB L2, 4 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT
OWW-30920B VxWorks® BSP for RI06-809x
OWW-30930E VxWorks 653 BSP for RI06-809x
OWX-30930D Linux® Toolbox for RI06-809x

**Related Hardware Products**

BPA-6513A0 Passive blackplane adaptor for high-speed links (3 slots)
ISC-8422R0 Low-power, conduction-cooled 6U VME PMC/XMC carrier board for RI06-8096
RTM-6290A0 Rear I/O Transition Module for RI06-8096/97 (3x RJ45: 3x GbE, 2x µDB9: 2x RS-232, 6x µDB9: 6x RS-422/485, 1x DB9: service interface, 1x USB Type A: 1x USB 2.0, 5x Harting: 5x 16x GPIO)

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Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.

**BuiltSAFE™ RIO6-8093**

Freescale® QorIQ® P2 6U VME Single Board Computer (SBC)

- Board Management Controller (BMC)
- Freescale® QorIQ® P2020 processor
- Xilinx Spartan®-6 LXT user-programmable FPGA
- Static routing module (FlexIO™)
- 2x PMC/XMC sites
- Rugged air-cooled packaging

Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE RIO6-8093 is an air-cooled, 6U VME Single Board Computer for ground applications. It is specifically designed for the most demanding applications, which require very high compute capabilities.

The BuiltSAFE RIO6-8093 is a sixth generation 6U VME PowerPC compute platform. It combines a fast dual-core processor with modern interconnect high-speed links and bridges (PCIe, Gigabit Ethernet) and programmable FPGA for application development.

The BuiltSAFE RIO6-8093 provides a PCI connection over the VME-P0 connector. This additional bus routed on the backplane enables VMEbus offload for operations such as splitting the data plane from the control plane.

For an easy configuration of the I/O pinout and support of legacy pinouts a static routing module (FlexIO) is placed between the different I/O sources and the backplane. Combined with the onboard FPGA-based PCIe to VME bridge FlexIO makes the RIO6-8093 a versatile fit for legacy placements requiring additional compute performance.

BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

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Technical Specifications

Compliance
Air-cooled 6U VME64x
Power Consumption
25 Watts (typical)

Processor
Freescale QorIQ P2020 (2 cores) @ 1.0 GHz

Memory
1 GB DDR3 SDRAM at 6.4 GB/s peak with ECC protection
2 GB Flash (NAND)
128 MB Flash (NOR)
256 KB NVRAM

FPGA/User-Programmable/User I/O Lines
Xilinx Spartan-6 LX100T FPGA with dual 128 MB DDR3 SDRAM, 4 GB Flash (NAND) and 8 MB Flash (SPI)
32x user-specific I/O lines on PMC-J14 to VME-P2
48x user-specific I/O lines on PMC-J24 to VME-P2
64x user-specific I/O lines on FPGA to CES FlexIO

IO Customization
1x FlexIO static routing module (interconnect between PMCs/XMCs, VME-P2 and user FPGA)

Buses
1x 64-bit VME64x 2xSST bus on VME-P1/P2
1x 64-bit PCI 3.0 bus at 33/66 MHz on VME-P0
1x 64-bit PCI 3.0 bus at 33/66 MHz on PMC-J11/J12/J13/J21/J22/J23

High-Speed Links/Connections
3x PCIe x4 on XMC-J15/J25/J26 (1x each) (VITA 42.3)
2x 10/100Base-T /1000Base-T on RJ45 connector
1x USB 2.0 host on USB connector
2x RS-232 on µDB9 connectors (COM0 supports external trigger input/output) (T)
4x high-speed links on FPGA to XMC-J16 (T)
(T) “T” model only
(1) Depends on FPGA configuration

Sites
2x PMC/XMC sites (VITA 42.3)

Board Management Controller
Power management
Board start-up and voltage monitoring
Temperature monitoring (thermal sensors on critical positions)

Development/Debug
Onboard JTAG test port
Xilinx ChipScope Pro FPGA debugging tool

Ruggedization Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
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</thead>
<tbody>
<tr>
<td>A1</td>
<td>Commercial AC</td>
<td>Forced Air*</td>
<td>0°C to 55°C [AC1]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.04 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>20g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits, standards</th>
<th>Comments</th>
</tr>
</thead>
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<td>Non-operating temperature</td>
<td>-55°C to 105°C [C4]</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>-1,500 to 60,000 feet</td>
<td>May require conformal coating</td>
</tr>
<tr>
<td>Fungus resistance</td>
<td>No nutrient materials</td>
<td></td>
</tr>
<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC J-STD-001 class 3</td>
<td></td>
</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
<td>Optional</td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

- **RIO6-8093AF** Air-cooled 6U VME SBC with QorIQ P2020 @ 1.0 GHz,
  512 KB L2, 1 GB DDR3, 2 GB NAND, 128 MB NOR,
  256 KB NVRAM, Spartan-6 LXT

- **RIO6-8093TF** Air-cooled 6U VME SBC with QorIQ P2020 @ 1.0 GHz,
  512 KB L2, 1 GB DDR3, 2 GB NAND, 128 MB NOR,
  256 KB NVRAM, Spartan-6 LXT, external trigger input/output on front panel

- **OWW-30920B** VxWorks® BSP for RIO6-809x
- **OWW-30930E** VxWorks 653 BSP for RIO6-809x
- **OWX-30930D** Linux® Toolbox for RIO6-809x

Related Hardware Products

- **BPA-6413A0** Passive blackpane adaptor (2 slots)
- **BPA-6414A0** Passive blackpane adaptor (3 slots)
- **PEB-6416A0** 6U VME PMC carrier board
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink communications save time and cost while decreasing risk.

The BuiltSAFE RIO6-8092 is a sixth generation 6U VME PowerPC compute platform. It combines a fast dual-core processor with modern interconnect high-speed links and bridges (PCIe, Gigabit Ethernet) and a user-programmable FPGA for application development.

The BuiltSAFE RIO6-8092 provides a PCI connection over the VME-P0 connector. This additional bus routed on the backplane enables VMEbus offload for operations such as splitting the data plane from the control plane.

For an easy configuration of the I/O pinout and support of legacy pin-outs a static routing module (FlexIO) is placed between the different I/O sources and the backplane. Combined with the onboard FPGA-based PCIe to VME bridge FlexIO makes the RIO6-8092 a versatile fit for legacy placements requiring additional compute performance.

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Compliance
Conduction-cooled 6U VME64x
Power Consumption
25 Watts (typical)

Processor
Freescale QorIQ P2020 (2 cores) @ 1.0 GHz

Memory
1 GB DDR3 SDRAM @ 6.4 GB/s peak with ECC protection
2 GB Flash (NAND)
128 MB Flash (NOR)
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FPGA/User-Programmable/User I/O Lines
Xilinx Spartan-6 LX100T FPGA with dual 128 MB DDR3 SDRAM, 4 GB Flash (NAND) and 8 MB Flash (SPI)
32x user-specific I/O lines on PMC-J14 to VME-P2
48x user-specific I/O lines on PMC-J24 to VME-P2
64x user-specific I/O lines on FPGA to FlexIO

I/O Customization
1x CES FlexIO static routing module (interconnect between PMCs/XMCs, VME-P2 and user FPGA)

Buses
1x 64-bit VME64x 2xSST bus on VME-P1/P2
1x 32-bit PCI 3.0 bus at 33/66 MHz on VME-P0
1x 64-bit PCI 3.0 bus at 33/66 MHz on PMC-J11/J12/J13/J21/J22/J23

High-Speed Link Connections
3x PCIe x4 on XMC-J15/J25/J26 (1x each) (VITA 42.3)
2x 10/100Base-TX / 1000Base-T on VME-P2
1x USB 2.0 host on VME-P0
2x RS-232 on VME-P2
4 high-speed links on FPGA to XMC-J16 (optional)

Sites
2 PMC/XMC sites (VITA 42.3)

Board Management Controller
Power management
Board start-up and voltage monitoring
Temperature monitoring (thermal sensors on critical positions)

Development / Debug
Onboard JTAG test port
Xilinx ChipScope Pro FPGA debugging tool

Ruggedization Levels

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<tbody>
<tr>
<td>C4</td>
<td>Extended range CC</td>
<td>Conduction</td>
<td>-40°C to 85°C [CC4]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.1 g²/Hz, 1000-2000 Hz: decrease at 6 dB/octave</td>
<td>40g, 11ms saw-tooth, three axes</td>
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<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
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<td>ROHS variants as an option</td>
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<td>Flammability</td>
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<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
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</table>

Product Ordering

RI06-8092AF  Conduction-cooled 6U VME SBC with QorIQ P2020 @ 1.0 GHz, 512 KB L2, 1 GB DDR3, 2 GB NAND, 128 MB NOR, 256 KB NVRAM, Spartan-6 LXT (VME-P0: 32-bit PCI)
OWW-30920B  VxWorks® BSP for RI06-809x
OWW-30930E  VxWorks® 653 BSP for RI06-809x
OWX-30930D  Linux Toolbox for RI06-809x

Related Hardware Products

DBG-6206A0  Rear I/O debugging board for RI03-8066/RI06-8092
(1x RJ45: 1x FETH, 2x µDB9: 2x RS-232) (1)

(1) For other rear I/O configuration please contact Mercury

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The BuiltSAFE RIO4-8072 is a commercial, air-cooled 6U VME/VME64x Single Board Computer. It is available in three and five-row DIN connector versions and requires only +5V power, therefore it will fit in any VME enclosure.

The RIO4-8072 is the fourth generation of Mercury 6U VME PowerPC computing platform. Multiple models of the RIO4-8072 are available, according to the type of VME-P0 interface. Some models can be equipped with customer-specific I/O lines, communication or serial lines on the VME-P0.

For easy configuration of the I/O pinout and support of legacy pinout requirements a static routing module (FlexIO™) is placed in between the different I/O sources and the backplane connector. Combined with the onboard FPGA-based PCIe to VME bridge, FlexIO makes the BuiltSAFE RIO4-8072 ideal for legacy replacement in ground air-cooled applications.

BuiltSAFE for Avionics

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Technical Specifications

Compliance

Air-cooled 6U VME64x

Power Consumption

<table>
<thead>
<tr>
<th>Minimum</th>
<th>typical</th>
<th>maximum</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>18</td>
<td>27</td>
<td>Watts</td>
</tr>
</tbody>
</table>

Processor

Freescale® MPC7448 at 1.0 GHz

Memory

256/512 MB DDR2 SDRAM at 1.3 GB/s peak
128 MB Flash (NAND)
64 MB Flash (NOR)
32 KB NVRAM

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FPGA/User-Programmable/User I/O Lines
Xilinx Virtex-5 LX30 user-programmable FPGA
(8kLUTs-6 free for user-defined applications)
16x user-specific I/O lines on VME-P2 (A) (D) (H)
64x user-specific I/O lines on PMC-J14 to VME-P2 (A) (D) (H) (R)
32x user-specific I/O lines on PMC-J24 to VME-P0 (A) (R)

Switches/Bridges
1x FlexIO static routing model (backplane configurable pin-out) (C) (P)

Buses
1x 64-bit VME64x 2xSST bus on VME-P1/P2
1x 32/64-bit PCI 2.2 bus at 33 MHz on VME-P0 (optional)
1x 64-bit PCI 2.2 bus at 33 MHz on PMC-J11/J12/J13/J21/J22/J23 (A) (D) (H) (R)
1x 64-bit PCI 2.2 bus at 33/66 MHz on PMC-J11/J12/J13/J21/J22/J23 (C) (P)
One 32-bit PCI 2.2 bus at 55 MHz on Ethernet

High-Speed Links / Connections
1x 10/100Base-TX / 1000Base-T on RJ45 connector (C) (P)
2x 10/100Base-TX / 1000Base-T on RJ45 connectors (A) (D) (H) (R)
2x RS-232 on μDB9 connector
(A) Applies to “A” Model
(C) Applies to “C” Model
(D) Applies to “D” Model
(H) Applies to “H” Model
(P) Applies to “P” Model
(R) Applies to “R” Model

PMC/XMC Sites
2x PMC sites (+5V tolerant)

Board Management Controller
Voltage monitoring
Temperature monitoring (thermal sensors on critical positions)

Development/Debug
Onboard JTAG test port
Xilinx ChipScope Pro FPGA debugging tool

Ruggedization Levels

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<th>Level</th>
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<td>A1</td>
<td>Commercial AC</td>
<td>Forced Air*</td>
<td>0°C to 55°C [AC1]</td>
<td>5-100 Hz increase at 3 dB/octave, 100-1000 Hz: 0.04 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
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<td>Conformal coating</td>
<td>IPC-CC-830 Optional</td>
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<td>Materials</td>
<td>REACH compliant ROHS variants as an option</td>
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<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
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</table>

Product Ordering
RI04-8072AD  Air-cooled 6U VME SBC with MPC7448 @ 1 GHz, 1 MB L2, 256 MB, DDR2, 128 MB NAND, 64 MB NOR, 32 KB NVRAM, Virtex-5 LX (custom VME-P0)
RI04-8072CE  Air-cooled 6U VME SBC with MPC7448 @ 1 GHz, 1 MB L2, 512 MB, DDR2, 128 MB NAND, 64 MB NOR, 32 KB NVRAM, Virtex-5 LX (Pinout: v1)
RI04-8072DE  Air-cooled 6U VME SBC with MPC7448 @ 1 GHz, 1 MB L2, 512 MB, DDR2, 128 MB NAND, 64 MB NOR, 32 KB NVRAM, Virtex-5 LX (no VME-P0)
RI04-8072PE  Air-cooled 6U VME SBC with MPC7448 @ 1 GHz, 1 MB L2, 512 MB, DDR2, 128 MB NAND, 64 MB NOR, 32 KB NVRAM, Virtex-5 LX (Pinout: v2)
RI04-8072RE  Air-cooled 6U VME SBC with MPC7448 @ 1 GHz, 1 MB L2, 512 MB, DDR2, 128 MB NAND, 64 MB NOR, 32 KB NVRAM, Virtex-5 LX (3 rows, no VME-P0)

Related Hardware Products
DGB-6207P0  Rear I/O Transition Board for RI04-8072C/P

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Mercury’s BuiltSAFE CIOV-2231 is a 3U OpenVPX Single Board Computer featuring an Intel Core i7 Gen5 processor with Quad-Core, dual-threaded (8-threads) over the Broadwell microarchitecture. Designed for extreme temperature range, shock and vibration, the CIOV-2231 is made for data and graphic intensive processing applications within conduction-cooled systems.

**Data and graphic processing power**

The Intel Iris™ Pro Graphics 6200 GPU embedded in the Core i7 processor delivers high-performance GPU capabilities and GPGPU programming options using OpenCL™. The BuiltSAFE CIOV-2231 has 16GB of DDR3 ECC memory (25.6GB/s throughput) and up to 32 GB of on-board SATA flash memory for intense data processing. The BuiltSAFE CIOV-2231 has two SATA III interfaces and Intel Rapid Storage Technology with support for RAID 0 and RAID 1 enabling the CIOV-2231 to deliver enhanced storage speed and reliability.

**Video capture and serial interfaces for ISR**

The BuiltSAFE CIOV-2231’s FPGA provides additional functionality including digital video capture, RS232/422/485 serial data links and GPIO for advanced ISR functionality.

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Flexible PCIe

With various PCIe Gen3 configurations (1x 8-lane, 2x 4-lane, 4x 2-lane) and support for Non-Transparent Bridge (NTB) port the CIOV-2231 supports multiple scenarios including communicating with similar HPEC SBCs, driving a BuiltSAFE VGP-2870 for additional GPGPU performance or interconnecting with an AVIO-2353 for avionics applications. The CIOV-2231 supports a 4x PCIe Gen2 configuration for full mesh PCIe network support, enabling near deterministic communication with up to three boards over the OpenVPX backplane.

Technical Specifications

Compliance
3U VPX (VITA 46)/OpenVPX (VITA 65 /VPX REDI (VITA 48) OpenVPX (VITA 75): multiple peripheral slot profiles

Power Consumption

<table>
<thead>
<tr>
<th>minimum</th>
<th>typical</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>70</td>
<td>Watts</td>
</tr>
</tbody>
</table>

Processor

Intel Core i7 Gen5 (5850EQ) @ 2.7GHz (Turbo Boost to 3.4GHZ)

Memory

16GB of DDR3 ECC
16GB of on-board SSD

I/O

Expansion links
- PCIe Gen3 1x8, 2x4, 4x2 from PCIe switch (with NTB port support) to OpenVPX-P1 (AA)
- 4x PCIe Gen2 (full mesh PCIe network) to OpenVPX-P1 (BA)

High speed links
- 2x GbE 1000Base-KX/BX on VPX-P1
- 3x USB 2.0 on VPX-P1
- 1x USB 3.0 on VPX-P2
- 2x SATA III on VPX-P2

Video Out
- 2x DisplayPort/HDMI on VPX-P2
- 1x VGA on VPX-P2

Video In
- 2x HD/SD-SDI on VPX-P1

Others
- 2x COM ports
- 6x user GPIO

(1) Please contact factory for more information
(2) Other sizes available upon request
(3) Please contact factory for other configurations
(AA) Applies to “AA” configuration
(BA) Applies to “BA” configuration

Board Management

Built-In-Test (BIOS and software)
Temperature monitoring
Watchdog
Error reporting
Reset management
Debug and maintenance mode
Distributed clock for system integration (ROCK-2)
Trusted Platform Module

Software

Linux® BSP
Windows® Embedded BSP

Product Ordering and Options

CIOV-2231 3U OpenVPX Intel Core i7 Gen5 Single Board Computer

Memory
- 16GB SSD
- 32GB SSD

Environmental
- A1: 0°C to 55°C
- C4: -40°C to 85°C

Development

Rear Transition Module capability

Slot profile
- Standard
- ROCK-2 compatible

Software
- Linux BSP
- Windows BSP

Related Hardware Products

ACS-6076 Forced air-cooled, 4-slot payload, 3U OpenVPX sealed conduction-cooled subsystem (0.8", 0.85", 1” pitch, 250 Watts) with MIL connectors
AVIO-2353 3U OpenVPX avionics I/O board
VGP-2870 3U OpenVPX video I/O and graphic processor
ROCK-2 3U OpenVPX, low-SWaP, rugged, modular, pre-qualified subsystems
### Ruggedization Levels

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<td>Conduction</td>
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* The required air-flow is defined separately for each product

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The CIO5-2040 is a 6U OpenVPX Single Board Computer (SBC) integrating two Intel Core i7 Gen5 processors. It is specifically designed for the most demanding networking and computing applications deployed in space-constrained environments requiring conduction-cooled equipment.

The CIO5-2040 is built to withstand extreme temperatures, shock and vibrations with an operating temperature range of -40°C to +85°C. With six SATA III, four GbE and four 10GbE it offers high data throughput to access storage and communicate over Ethernet.
BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

Technical Specifications

Compliance
6U VPX (VITA 46)/OpenVPX (VITA 65)
Conduction-cooled (VITA 48.2)
Slot profile SLT6-PAY-4F1Q2U2T-10.2.1

Power Consumption
Typical 110W

Processor
2x Intel Core i7 Gen5 (E5860EQ) @ 2.7 GHz (4 cores)
Intel QM87 Express chipset

Memory
2x 16GB DDR3L ECC (one per CPU node)
2x removable storage mezzanines with two independent 32GB flash

I/Os
High speed Links
- 2x GbE 1000Base-T (one per CPU node)
- 2x GbE 1000Base-X (one per CPU node)
- 4x 10GbE 10GBase-KX4, Intel 82599 NIC (two per CPU node)
- 3x PCIe x8 Gen3 links

Connections
- 6x SATA @ 6Gbps (three per CPU node)
- 2x USB 3.0 (one per CPU node)
- 8x USB 2.0 (four per CPU node)

Video
- Four HDMI (two per CPU node)

Other
- GPIOs
- Serial port RS232 (one per CPU node)

Board Management
Reset
Sensors
IPMI

Software
Board support package
- Windows
- Linux
Built-in Tests (PBIT, CBIT and IBIT)

Product Ordering
CIO5-2040AAA40LC Dual Intel Core i7 Gen5 6U OpenVPX Single Board Computer with two 16GB of DDR3L ECC, 0.85” pitch

Ruggedization Levels

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<tr>
<td>Quality</td>
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<td></td>
</tr>
</tbody>
</table>
Graphics and video cards
Mercury's BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

Mercury’s BuiltSAFE VGP-2870 is a DAL C (other levels upon request) certifiable E8860–powered GPGPU processing engine for the most stringent aerospace and defense applications that require certification to DO-178C/DO-254. The VGP-2870 can be delivered with all documentation, certification evidence and supporting artifacts required to prove compliance for avionics certification. Leveraging the VGP-2870 ensures a smooth development process supported by Mercury’s safety engineering team and their deep domain expertise. The BuiltSAFE VGP-2870 has been engineered with DAL safety certification in mind from the top down, with DO-178C/DO-254 best design practices systematically applied throughout all phases of development.

Driven through via OpenVPX PCIe bus, the Avionics VGP-2870 GPGPU processing module is capable of performing 2D and 3D graphic generation functions and operate as a GPGPU for intensive data computation. Featuring 6 independent video outputs and 2 video inputs, the BuiltSAFE VGP-2870 can overlay captured video stream with generated 2D and 3D graphics elements all within safety-critical environments. The BuiltSAFE VGP-2870 is engineered for the most stringent aerospace and defence applications.

Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.
Low-SWaP processing subsystems
With Mercury’s BuiltSAFE MFCC-8557 XMC processor installed, the VGP-2870 turns into a powerful subsystem, tailorable to compute-intensive video and graphics applications - all packed in a single 3U, OpenVPX slot. The BuiltSAFE VGP-2870 and the MFCC-8557 capture, overlay, record and stream from a single 3U OpenVPX slot solution instead of the industry two slot approach, reducing cost and SWaP while increasing reliability.

Technical Specifications

Compliance
3U OpenVPX (VITA 65)/VPX-REDI (VITA 48)
XMC baseline 2.0 (VITA 61), XMC PCIe (VITA 42.3)
Certifiable to DAL-C (DC-178C/DO-254)
Peripheral slot profile SLT3-PER-1F-14.3.2

Power Consumption
<table>
<thead>
<tr>
<th>minimum</th>
<th>typical</th>
<th>maximum</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>42</td>
<td>50</td>
<td>Watts</td>
</tr>
</tbody>
</table>

Processor
AMD Radeon E8860 GPU @ 625 MHz
512 KB internal L2 cache with ECC protection
H.264/AVC compression

Memory
2 GB GDDR5 dedicated video memory (72 GB/s peak)
256 MB DDR3 processing memory

Software
VxWorks®653 with OpenGL SC 1.0 (Safety Critical)
Linux for Intel® processors
Built-in test interface and logging

FPGA
Xilinx Kintex®-7 FPGA
256 MB DDR3 SDRAM dedicated to video capture and output formatting

High-Speed Links / Connections
1x PCIe Gen2 x4 from PCIe switch to VPX-P1
1x XMC 2.0 (VITA 61) site to interface an MFCC-8557
  3x PCIe Gen2 x1 on XMC-J16
  1x PCIe Gen2 x4 on XMC-J15
  1x SGMII interface on XMC-J16
  1x 1000BASE-BX interface on XMC-J16
  1x USB 2.0 OTG on XMC-J16
  1x USB for serial link on XMC-J16
  1x SATA II on XMC-J16

Safety Optimized Board Management
Voltage monitoring
Temperature monitoring (thermal sensors on critical positions)
Elapsed time counter
Error reporting
Reset management

Video Inputs (1)
2x HD/SD-SDI
1x SD analog video: CVBS, S-Video, RGB, STANAG-3350

Video Outputs (1)
2x DVI on VPX
3x DisplayPort on VPX
1x SD analog: CVBS, S-Video, STANAG-3350
2x HD/SD-SDI

(1) Depends on configuration. See “Video IO Configuration” table for more information.

Product Ordering
VGP-2870 3U OpenVPX video I/O graphics processor

Environmental

| A1 | 0°C to 55°C |
| C4 | -40°C to 85°C |

Safety Artifacts

| D0-254(2) | D0-178C(3) |

Software
VxWorks 653 (PowerPC)

| OpenGL ES driver |
| OpenGL ES runtime license |
| OpenGL SC driver |

Linux (Intel)

| OpenGL driver (without capture) |
| Windows 7 (Intel) |
| OpenGL ES driver |

Video IO configuration

(2) Please consult factory
(3) Only two simultaneous video inputs

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<tr>
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<th>In</th>
</tr>
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<tr>
<td>DP</td>
<td>DVI</td>
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<tr>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Default</td>
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<tr>
<td>Analog</td>
<td>1</td>
</tr>
</tbody>
</table>

Related Hardware Products
AVIO-2353 3U OpenVPX avionic I/O board
MFCC-8557 Freescale QorIQ™ P3041 XMC safety critical Single Board Computer
ROCK-2 3U OpenVPX low-SWaP, rugged, modular, pre-qualified subsystems
## Ruggedization Levels

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## Less space for more functions

Mission computer featuring stacked XMCs for low-SWaP

![Mission computer diagram]

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INNOVATION THAT MATTERS™

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**Corporate Headquarters**
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(978) 967-1401 ● (866) 627-6951 ● Fax (978) 256-3599
Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.

**BuiltSAFE™ VPP-8112**

*Video I/O and Processor XMC*

- TI DaVinci™ TMS320DM8148 digital media processor (ARM® Cortex-A8 CPU, DSP, GPU, video coprocessors)
- Video coprocessor with H.264 video compression/decompression
- Commercial Air-Cooled
- And Rugged Conduction-Cooled packaging

Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE VPP-8112 is a video I/O and processor XMC providing multiple video input/output channels and powerful image processing capabilities in a small air-cooled or conduction-cooled package. It is a powerful video acquisition, processing and display solution for harsh environmental conditions.

The VPP-8112 is based on the latest generation DaVinci™ media processor, which allows flexible I/O and powerful processing options at very low power. The DaVinci System-On-Chip combines a powerful ARM® core with a floating point DSP, a GPU, and a video/image coprocessor supporting various video compression formats.

The BuiltSAFE VPP-8112 is able to operate in both root complex and end-point modes. In the latter case, the board is delivered with a device driver for VxWorks® and Linux® hosts, and the complete firmware for the supported features. Optionally, an embedded Linux toolkit is available for advanced integrations, allowing the implementation of proprietary algorithms in the media processor.

**BuiltSAFE for Avionics**

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.
Technical Specifications

Compliance
Air-cooled XMC (VITA 42) (A)
Conduction-cooled XMC (VITA 42) (B)
(A) Applies to A model
(B) Applies to B model

Power Consumption
Minimum typical maximum units
- 8 18 Watts

Processor
Texas Instruments DaVinci™ TMS320DM8148 digital media processor
Up to 1 GHz ARM® Cortex-A8 RISC processor
TMS320C674x floating point VLIW DSP
SGX530 3D Graphics Processing Unit (GPU)
Video image coprocessor with H.264 video compression/decompression
(capable of real-time H.264 compression of up to 1x 1080p60 stream
or multiple streams at lower resolution and/or lower frame rate)

Embedded Linux Operating System

Memory
512 MB DDR3 SDRAM at 3.2 GB/s peak (1 GB and 2 GB factory options)
1 GB Flash EPROM (NAND)

Inputs
2x SD analog video: CVBS/YPbPr on P4/P6
2x SD/HD analog/digital video: CVBS/YPbPr / RGBHV / HDMI 1.3 on P4/P6
Simultaneous capture of two streams up to UXGA/1080p

Outputs
2x SD analog video: CVBS on P4
1x HDMI 1.3 on P6

High-Speed Links / Connections
1x PCIe x1 Gen1 on P5
2x 10/100/1000Base-T Ethernet on P4 or 2x 1000Base-X/SGMII on P6
(1x Ethernet port disables 1x SD video input, support for
SFP optical transceivers)
1x SATA II on P6 for external storage
2x USB 2.0 host on P6
1x RS-232 on P4
2x RS-232 on P
CANbus
I2C expansion interface
I2C management interface
(FRU EEPROM and voltage, current, temperature monitoring)

Development/Debug
Evaluation carrier board

Ruggedization Levels

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Product Ordering

VPP-8112AE Conduction-cooled video I/O and processor XMC (DaVinci)
VPP-8112BE Air-cooled video I/O and processor XMC (DaVinci)
DGW-31120B VxWorks driver and video API for VPP-8112
DGX-31120L Linux driver and video API for VPP-8112

Related Hardware Products

RTM-6222R0 Rear I/O video Transition Module for VPP-8112 on
ISC-8422R
TCF-1012A0 Test carrier fixture for VPP-8112
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink commss processing save time and cost while decreasing risk.

The BuiltSAFE VCP-8166 is a H.264/AVC Codec PMC/XMC mezzanine for video applications requiring air-cooled or conduction-cooled equipment. It is specifically designed for the most demanding applications, combining hard real-time video compression with very low-latency processing within harsh environments.

The video coding functionality provided by the VCP-8166 is designed to guarantee smooth real-time, low-latency coding for up to two full HD channels in parallel. For lower resolutions, up to three video channels can be processed at the same time. The streams can come from the two HD/SD-SDI inputs and from either the analog or the HDMI inputs. Compressed video is forward to other components of the system via PCI or PCIe. The BuiltSAFE VCP-8166 is supplied with Mercury’s video API which enables the control of various parameters of the compression algorithm.

For integration in 3U OpenVPX based systems, Mercury provides the BuiltSAFE VVC-6331 video carrier board which accommodates the VCP-8166.

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

### Technical Specifications

#### Compliance
- Air-cooled PMC [1]
- Conduction-cooled PMC [1]
- Air-cooled XMC (VITA 42) [2]
- Conduction-cooled XMC (VITA 42) [3]
- ITU-T H.264/ISO/IEC 14496-10 (AVC)
- SMPTE 259M/SMPTE 274M/SMPTE 292M/SMPTE 296M
Power Consumption

<table>
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<th>Minimum</th>
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</thead>
<tbody>
<tr>
<td>-</td>
<td></td>
<td></td>
<td>Watts</td>
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Memory
Dual 128 MB DDR2 SDRAM at 1 GB/s peak for FPGA
Dual 128 MB DDR2 SDRAM at 1 GB/s peak for H.264 processor
128 MB Flash (NOR)
512 KB Flash (SPI)

FPGA/User-Programmable/User I/O Lines
Xilinx Spartan-6 LX100T FPGA
2x user-specific I/O lines on XMC-P6

Encoder Performance

2x 1080p30, 2x 720p60, 3x 720p30, 3x 480p30
Simultaneous encoding
Interlaced formats are supported

Inputs
2x SD/HD-SDI on XMC-P6
1x HDMI 1.3 on XMC-P6
1x Analog video (PAL, RGB, monochrome CVBS) on XMC-P6/PMC-P4

Switches / Bridges
1x PCIe x1 to PCI bridge (A) (B)

Buses
One 32-bit PCI 3.0 bus at 33/66 MHz on PMC-P1/P2 (A) (B)
High-Speed Links / Connections
1x PCIe x1 on XMC-P5 (VITA 42.3) (C) (D)

Development/Debug
Onboard JTAG test port
Rear I/O transition module
Xilinx ChipScope Pro FPGA debugging tool

Ruggedization Levels

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<th>Level</th>
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</thead>
<tbody>
<tr>
<td>A3</td>
<td>Rugged AC</td>
<td>Forced air*</td>
<td>-40°C to 70°C [AC3]</td>
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* The required air-flow is defined separately for each product

Advanced Board Management Controller
Advanced power management
Voltage and current monitoring
Temperature monitoring (thermal sensors on critical positions)

Environmental Specifications

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Product Ordering
VCP-8166AA Air-cooled H.264/AVC Codec PMC
VCP-8166BA Conduction-cooled H.264/AVC Codec PMC
VCP-8166CA Air-cooled H.264/AVC Codec XMC
VCP-8166DA Conduction-cooled H.264/AVC Codec XMC
DGW-31160A VxWorks® 653 driver for VCP-8166
DGW-31160B VxWorks® driver for VCP-8166
DGX-31160L Linux® driver and video API library for VCP-8166
SWW-31150B Video API library for VCP-8166

Related Hardware Products
RTM-6487A0 Rear I/O Transition Module for video boards
(8x SMB, 3x micro HDMI, 2x VGA, 2x mini Stereo Jack, 1x CameraLink, 1x RJ45, 1x mini USB)
WVC-6331 3U OpenVPX video PMC/XMC carrier board for VCP-8166

* The required air-flow is defined separately for each product

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Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE VCP-2864 is a 3U OpenVPX low-latency frame grabber module for video applications requiring rugged air or conduction cooling. It is specifically designed for the most demanding applications. Two SDI and a Camera Link input interfaces enables the VCP-2864 to simultaneously capture up to three HD video streams and forward them to a PCIe output. Filters can be applied to the captured streams to crop frames or scale down the stream frame rate. A JPEG 2000 compression (consult factory) engine is available on-board with the ability to compress one HD or two SD streams. Additionally, the BuiltSAFE VGP-2864 can output two HD video streams via SDI. One of the streams is received via PCIe, while the other one is received via HDMI.

The built-in XMC site has been primarily designed to house an BuiltSAFE VCP-8166DA: a Mercury video capture/H.264 compression mezzanine card. Together with the VCP-2864, this mezzanine card adds a forth HD stream that can be simultaneously captured from this single 3U OpenVPX slot solution. The H.264 compression engine enables the additional stream captured by the VCP-8166DA mezzanine to be compressed before being forwarded to PCIe output.

A Board Management Controller (BMC) is implemented for configuration management and other supporting tasks.

**BuiltSAFE for Avionics**

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
Technical Specifications

Compliance
3U OpenVPX (VITA 65)/VPX (VITA 46)/VPX REDI (VITA 48)
Air-cooled VPX (VITA 48.1): “B/DA21LN” model
Conduction-cooled VPX (VITA 48.2): “C/DA41LN” model
SMpte 292M/SMpte 274M/SMpte 296M
HDMI 1.3

Power Consumption
Minimum typical maximum units
- 11 13 Watts

Memory
Dual 128 MB DDR3 SDRAM at 5.3 GB/s peak for FPGA
32 MB Flash SPI (Quad SPI)

FPGA/User-Programmable/User I/O Lines
Xilinx Kintex™-7 FPGA
User-specific I/O lines on VPX-P2

Frame Grabber
Raw video in parallel: up to 2x 1080p30 (HD-SDI) and 1x Base Configuration Camera Link input SXGA @ 60 fps

Inputs
1x HDMI 1.3 on VPX-P2/XMC-J6
2x HD-SDI on VPX-P2/XMC-J6
1x Analog video: CVBS monochrome/RGBHV on VPX-P2/XMC-J6
1x Camera Link on VPX-P1

Outputs
1x HDMI 1.3 on VPX-P2/XMC-J6
2x HD-SDI on VPX-P/XMC-J6

Switches / Bridges
1x PCIe Gen2 switch (6 ports)

High-Speed Links/Connections
2x PCIe x4 on VPX-P1 (VITA 46.4)
1x PCIe x8 on XMC-J5 (VITA 42.3)

Sites
1x XMC site (VITA 42.3) for VCP-8166DA native support

Board Management Controller (BMC)
Power management
Temperature sensing (thermal sensors on critical positions)

Development / Debug
Onboard JTAG test port
Rear I/O transition module
Xilinx ChipScope Pro FPGA debugging tool

Ruggedization Levels

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Product Ordering

| VCP-2864AB0 | Air-cooled 3U OpenVPX frame grabber module (1” Pitch) |
| VCP-2864CD0 | Conduction-cooled 3U OpenVPX frame grabber module (0.8” - 1” Pitch) |
| VCP-2864DA21LN | Air-cooled 3U OpenVPX JPEG 2000 Codec module (1” Pitch) |
| VCP-2864DA41LN | Conduction-cooled 3U OpenVPX JPEG 2000 Codec module (0.8” - 1” Pitch) |
| DGX-34280D | Linux® Toolbox and video API library for VCP-2864 |

Related Hardware Products

| RTM-6487A0 | Rear I/O Transition Module for video module (8x SMB, 3x micro HDMI, 2x VGA, 2x mini Stereo Jack, 1x CameraLink, 1x RJ45, 1x mini USB) |
| VCP-8166DA | Conduction-cooled H.264/AVC Codec XMC |
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The BuiltSAFE VCP-8162 is a rugged, conduction-cooled XMC frame grabber mezzanine for video applications. It is specifically designed for the most demanding applications, combining hard real-time video capture for two video channels in parallel and rugged packaging.

The VCP-8162 has different SDI input solutions (two onboard, two on XMC-P6) compatible with HD input signals at up to 1.5 Gb/s. Other analog video input formats are also available. The video coding functionality provided by the BuiltSAFE VCP-8162 is designed to guarantee smooth real-time, low-latency coding up to HD formats. Digitized video is available from the processor board via PCIe. Up to two HD-SDI or two analog video inputs or a combination of one SDI and one analog can be processed simultaneously.

BuiltSAFE for Avionics

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Technical Specifications

Compliance
Conduction-cooled XMC (VITA 42)
SMPTE 292M, SMPTE 296M

Power Consumption
Minimum  typical  maximum  units
-  21.5  25  Watts

Memory
512 MB DDR2 SDRAM at 6.4 GB/s peak
FPGA/User-Programmable/User I/O Lines
Xilinx Virtex-5 FX70T FPGA

Inputs
2x onboard HD-SDI (SMPTE 292M, SMPTE 296M)
2x HD-SDI on XMC-P6 (SMPTE 292M, SMPTE 296M)
8x analog video: CVBS (up to 8), RGB/YUV (up to 2), S-Video (up to 4)
on XMC-P6 (consult factory)
Simultaneous capture of up to 2x HD-SDI or 2x analog video or a combination of 1x HD-SDI and 1x analog video
Synchronization on green [RGB inputs], or separate horizontal/vertical synchronization inputs

High-Speed Links / Connections
1x PCIe x8 on XMC-P5 (VITA 42.3

Ruggedization Levels

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Product Ordering

VCP-8162B0  Conduction-cooled frame grabber XMC module
DGW-34620E  VxWorks® 653 driver for VCP-8162
DGX-34620D  Linux® driver for VCP-8162

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INNOVATION THAT MATTERS™

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Corporate Headquarters
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Modules for I/O and Add-on
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE AVIO-2353 is a 3U OpenVPX module with a comprehensive I/O interfaces that are optimized for avionic mission computers. Driven through the OpenVPX PCIe bus and featuring MIL-STD-1553, ARINC-429, RS232/422/485 and GPIOs, the AVIO-2353 provides all the standard interfaces used to communicate with avionic sensors and other platform processing subsystems. Utilizing Mercury’s FlexIO™ technology, the BuiltSAFE AVIO-2353 I/O pinout is easily customized to specific application requirements. The BuiltSAFE AVIO-2353 is equipped with an XMC site for extended resources and design flexibility.

Low-SWaP

When pre-integrated with an BuiltSAFE MFCC-8557 processor XMC module, the AVIO-2353 turns into a powerful processing subsystem optimized for C4ISR applications - all packed in a single 3U OpenVPX slot. Engineered for interoperability, the BuiltSAFE AVIO-2353 and MFCC-8557 form a seamless pre-integrated solution that interacts with sensors, acquiring/processing data and sharing it on a network or other standard avionic buses – all being at the core of C4ISR applications. Fitting in a single 3U OpenVPX slot, the BuiltSAFE AVIO-2353 and the MFCC-8557 form an efficient cost and SWaP solution.

Safety by design

The BuiltSAFE AVIO-2353 can be delivered with all documentation, certification evidence and supporting artifacts required to prove compliance for avionics certification. Leveraging the AVIO-2353 ensures a smooth development process supported by Mercury’s safety engineering team and their deep domain expertise. The BuiltSAFE AVIO-2353 has been engineered with DAL safety certification in mind from the top down, with DO-178C/DO-254 best design practices systematically applied throughout all phases of development.

(1) For more information contact factory.

Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.
BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

Technical Specifications

Compliance

3U OpenVPX (VITA 65)/VPX REDI (VITA 48)
XMC 2.0 (VITA 61), XMC PCIe (VITA 42.3)
Certifiable up to DAL-C (DO-178C/DO-254)
Peripheral slot profile SLT3-PER-1U-14.3.3

Power Consumption

minimum typical maximum units
- 11 18 Watts

I/O default configuration

2 dual redundant MIL-STD-1553 channel controllers/terminals (BC, RT and MT)
16 receiving and 8 transmitting ARINC-429 channels for high and low speed
10 configurable RS232/RS422/RS485 serial channels
5 LVTTL compatible 5V tolerant GPIOs

High-Speed Links/Connections

1x PCIe Gen2 x1 from PCIe switch to OpenVPX-P1
1x XMC 2.0 (VITA 61) site to interface an BuiltSAFE MFCC-8557
  3x PCIe Gen2 x1 on XMC-J16
  1x PCIe Gen2 x4 on XMC-J15
  1x SGMII interface on XMC-J16
  1x 1000BASE-BX interface on XMC-J16
  1x USB 2.0 OTG on XMC-J16
  1x USB for serial link on XMC-J16

Built-in Test

On all interfaces

Safety Optimized Board Management

Voltage monitoring
Temperature monitoring (thermal sensors on critical positions)
Elapsed time and event counter
Error reporting
Reset management
Environmental Specification

Ruggedization Levels

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Product Ordering

AVIO-2353 3U OpenVPX avionic communication interface board

I/O (1)
- 1 channel dual redundant MIL-STD-1553
- 2 channel dual redundant MIL-STD-1553

Environmental
- A1 : 0°C to 55°C
- C4 : -40°C to 85°C

Software
- VxWorks®653 driver
- Linux driver (2)

Safety Artifacts
- DO-178C (2)
- DO-254 (2)

(1) For other configurations contact factory
(2) Contact factory for more information
Related Hardware Products

MFCC-8557  Freescale QorIQ™ P3041 XMC safety critical Single Board Computer
VGP-2870  3U OpenVPX video I/O and graphic processor
ROCK-2  3U OpenVPX low-SWaP optimized, rugged, modular, pre-qualified subsystems

Less space for more functions

Mission computer featuring stacked XMCs for low-SWaP

![Diagram of AVIO-2353 mission computer](image-url)
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The BuiltSAFE RSL-5222 is a serial I/O PMC module for ground/airborne applications requiring conduction or air-cooled processing. The RSL-5222 is a high-performance, low-SWaP solution that is optimized to meet the most demanding communication applications with up to 8 high-speed asynchronous/synchronous serial channels.

Configured by hardware, each port is fully programmable and supports most serial I/O protocols. Mercury’s FlexIO™ technology enables the PMC-P4 I/O to be matched to specific applications. The RSL-5222 supports a wide variety of physical interfaces, which can be individually selected as RS-232 or RS-422/485 without hardware configuration.

BuiltSAFE for Avionics

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Technical Specifications

Compliance
PMC (VITA 20)
IEEE 1386.1

Power Consumption
Typ. 4W

User defined I/O
User-specific I/O lines on PMC-P4
FlexIO module for flexible pin-out connectivity of serial channels/GPIO

High-Speed Links / Connections
4x or 8x software selectable channels:
Maximum data rate of 2 Mb/s (asynchronous) or 10 Mb/s (synchronous)
RS-232: RxO, RxC, TxO, TxC
RS-422/485: RxO_H/L, TxO_H/L, TxC_H/L
Synchronous/asynchronous UART, HDLC, SDLC, 9-bit protocol
Up to 16x GPIO (3V3TTL)

FIFOs:
Receive: 1KB, each channel
Transmit: 1KB, each channel

Oscillator:
14.7456 MHz to support standard asynchronous baud rates
User-supplied oscillator location is available for custom baud rate generation

Bus
One 32-bit PCI 3.0 bus at 33MHz on PMC-P1/P2 (5V tolerant)

Ruggedization Levels

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<td>Commercial AC</td>
<td>Forced air*</td>
<td>0°C to 55°C [AC1]</td>
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<tr>
<td>Conformal coating</td>
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</tr>
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<td>Quality</td>
<td>EN 9100:2008</td>
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</tr>
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</table>

Product Ordering
RSL-5222GD Conduction-cooled serial I/O PMC
(8 programmable synchronous/asynchronous channels)
RSL-5222GE Air-cooled serial I/O PMC
(8 programmable synchronous/asynchronous channels)
with mechanicals (1)
SWW-39220B VxWorks® driver license for RSL-5222G
(1) I/O signals only available on connector PMC-P4

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BuiltSAFE™ FDISK-8432

Flash Disk Storage XMC Mezzanine

- Up to 256 GB high-throughput flash disk storage
- Board Management Controller (BMC)
- Conduction-Cooled

Mercury's BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE FDISK-8432 is a conduction-cooled Flash Disk XMC for embedded applications. It is specifically designed for the most demanding applications, combining high-performance mass data storage and low power consumption within harsh environments.

The FDISK-8432 is a controller-based solid state storage solution, optimized for low-latency and high throughput. The ECC error correction and the wear leveling increases the reliability and device lifetime, while parallel processing of accesses to NAND Flash improves performance.

The PCIe interface is implemented in a controller which also provides built-in monitoring and test facilities. The controller performs bulk transfers without loading the host CPU. The embedded flash file system is accessible through standard I/O calls in Linux® or VxWorks®653.

BuiltSAFE for Avionics

Mercury's expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
Technical Specifications

Compliance
Conduction-cooled XMC (VITA 42)

Power Consumption
Minimum  typical  maximum  units
-  6.9  6.9  Watts

Storage
64/128/256 GB Flash EPROM (NAND) with ECC protection
Embedded flash file system
Embedded wear leveling

Switches/Bridges
1x PCIe x4 to SATA II bridge

High-Speed Links/Connections
1x PCIe x4 on XMC-P5 (VITA 42.3)
1x SATA II on XMC-P6 to SMT connector
1x SATA II on SMT connector

Connectors
1x onboard SMT connectors

Board Management Controller
Board start-up and voltage monitoring
Temperature monitoring (thermal sensors on critical positions)

Ruggedization Levels

<table>
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<tr>
<th>Level</th>
<th>Description</th>
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<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
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<td>C3</td>
<td>Rugged CC</td>
<td>Conduction</td>
<td>-40°C to 70°C (CC3)</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.1 g^2/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
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</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

FDISK-8432BA  Conduction-Cooled Flash Disk Storage XMC (64 GB)
FDISK-8432CA  Conduction-Cooled Flash Disk Storage XMC (128 GB)
FDISK-8432DA  Conduction-Cooled Flash Disk Storage XMC (256 GB)
DGW-8432  VxWorks Driver for FDISK-8432
DGX-8432  Linux Toolbox for FDISK-8432
DG6-8432  VxWorks653 Driver for FDISK-8432
Mercury Mission Systems International is bringing the highest level of flight-safety assurance for aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time/cost and decrease risk.

The CB3P-6231 is a 3U OpenVPX™ PCIe switch PMC/XMC carrier board (VITA 46.9) for use with Mercury’s ROCK-2 chassis and backplanes. The carrier offers PCIe Gen1/Gen2/Gen3 lane switching capability, between PMC or XMC connectors and the backplane. The CB3P-6231 is packaged for commercial air-cooled and rugged conduction-cooled applications.

The carrier supports PMC (in monarch and non-monarch modes) or XMC mezzanines. PMC-J4 and XMC-J6 signal mapping to the Open-VPX-P2 connectors complies with VITA 46.9 P2w1 profiles: P2w1-P64s and P2w1-X24s+X8d+X12d respectively, PMC-J1/J2/J3 are connected to the PCIe switch through a PCIe to PCI/PCI-X bridge.

Additionally, the Avionics CB3P-6231 is available in air-cooled format for laboratory development purpose.
Technical Specifications

Compliance
3U OpenVPX VITA 65
Backplane switch profile SLT3-SWH-4F-14.4.4 (B2)
VPX-REDI VITA 48
XMC VITA 42 (XMC VITA 61 on request)
XMC PCIe VITA 42.3
PMC IEEE 1386
P PMC VITA 32
PC I-X for PMCs and P PMC s VITA 39
PMC/XMC Signal Mapping to OpenVPX to VITA 46.9
P2w1-Ps on PMC-J4
P2w1-X24s+X8d+X12d on XMC-J6

Power Consumption
Minimum typical maximum units
- 7 12 Watts

Input/Output
Access to XMC-J6 I/O to VPX-P2 complaint with 46.9 P2w1-X24s+X8d+X12d
Access to all I PMC-J4 I/O to VPX-P2 complaint with VITA 46.9 P2w1-P64s

Switch/Bridges
1x PCIe Gen1/Gen2/Gen3 switch, 32-lanes
1x PCIe x4 to PCI/PCI-X bridge

High-Speed Links/Connections
4x PCIe x4 on OpenVPX connector (B2)
1x PCIe x4 on XMC-J5
1x PCIe x4 on PCIe to PCI bridge (for PMC)

Sites (1)
1x XMC site
1x PMC site

Ruggedization Levels

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<tr>
<td>A1</td>
<td>Commercial AC</td>
<td>Forced Air*</td>
<td>0°C to 55°C [AC1]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.04 g^2/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>20g, 11ms saw-tooth, three axes</td>
</tr>
<tr>
<td>C4</td>
<td>Extended range CC</td>
<td>Conduction</td>
<td>-40°C to 85°C [CC4]</td>
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* The required air-flow is defined separately for each product

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Product Ordering
CB3P-6231A244LN 3U OpenVPX PMC/XMC carrier board, ROCK-2 compatible, extended range conduction-cooled packaging, 0.8” pitch, XMC site VITA 42 (10mm stacking)
CB3P-6231B214LN 3U OpenVPX PMC/XMC carrier board, switch profile SLT3-SWH- 4F-14.4.4, commercial air-cooled packaging, 0.8” pitch, XMC site VITA 42 (10mm stacking)
CB3P-6231B244LN: 3U OpenVPX PMC/XMC carrier board, switch profile SLT3-SWH- 4F-14.4.4, extended range conduction-cooled packaging, 0.8” pitch, XMC site VITA 42 (10mm stacking)

Related Hardware Products
FDISK-8432 Flash disk storage XMC
RSL-5222 Serial I/O PMC
VCP-8162 Dual channel XMC frame grabber (2)
VCP-8166 H.264/AVC Codec PMC/XMC (2)
VCP-8166MA MPEG-2 Codec PMC/XMC with optional H.264/AVC support (2)
ROCK-Z 3U OpenVPX, SWaP-optimized, rugged, modular, pre-qualified, COTS chassis

(1) User I/O connector of XMC and PMC sites are mutually exclusive
(2) Contact Mercury for more information
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE ISC-8422 is a rugged, conduction-cooled 6U VME PMC/XMC Carrier Board for airborne applications requiring conduction-cooled equipment. It is specifically designed for the most demanding applications in harsh environments.

The ISC-8422 is ideally suited to link legacy VME systems to modern PCIe-based system architectures. In modular distributed measurement applications, such as aircraft test benches, the BuiltSAFE ISC-8422 may be used to secure investments in VME/PMC-based systems, while taking full advantage of the bandwidth and switch capabilities offered by PCIe-based architectures. ISC-8422 offer a PCIe expansion/chaining solution for RIO6-8096 processor boards.

BuiltSAFE for Avionics
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Technical Specifications

Compliance
Conduction-cooled 6U VME64x

Power Consumption
Minimum  typical  maximum  units
-  5  18  Watts

Switches / Bridges
One PCIe x4 to PCI/PCI-X bridge

Buses
Two 64-bit PCI 3.0/PCI-X buses at up to 133 MHz on PMC-J11/J12/J13/J21/J22/J23

High-Speed Links/Connections
1x PCIe x8 on VME-P0
1x PCIe x8 on XMC-J15 (VITA 42.3)
1x PCIe x4 on XMC-J25 (VITA 42.3)

PMC/XMC Sites
Two PMC/XMC sites (VITA 42.3)

Advanced Board Management Controller
Temperature monitoring (thermal sensors on critical positions) on I2C
Elapsed time counter

Development /Debug
Onboard JTAG test port

Ruggedization Levels

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<td>Quality</td>
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</table>

Product Ordering
ISC-8422R0  Low-power conduction-cooled 6U VME PMC/XMC carrier board for RIO5 / RIO6 (VME-P0: 1x PCIe x8, XMC: VPP-8112)

Related Hardware Products
DBG-6288B0  Rear I/O debugging board for ISC-8422/RIO5-8086 (2x CPU COP; 2x iPass; 2x RJ45; 2x µDB9)
DBG-6288B0  Rear I/O debugging board for ISC-8422/RIO5-8088 (2x CPU COP; 2x RJ45; 2x µDB9)
VPP-8112  Video I/O and processor XMC
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The BuiltSAFE ARINC-8429 is an ARINC 429 mezzanine that is available as either a commercial air-cooled or rugged conduction-cooled solution. It is specifically designed for ARINC 429 connection requirements in mission systems.

The ARINC-8429 can be mounted on most air or conduction-cooled processor or carrier boards. It offers up to thirty-two channels, which can be independently programmed to operate at either high or low speed. Each channel is supported with a Cyclic-Data-Buffer, 1k deep/32 bits wide. Additionally, each receive channel is supported by a high-resolution time-stamp, which is stored in a separate cyclic buffer, one for each channel, in parallel with the received data. Optionally, the receive data and time-stamp data can be stored in the form of a Current Value Table (CVT), addressed by channel/sdi/label.

ARINC input/output is via either the front-panel SCSI 68-pin female connector or PMC-P4.

**BuiltSAFE for Avionics**

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**Technical Specifications**

**Compliance**

General purpose air-cooled PMC (D)(E)(F)(G)

Rugged conduction-cooled PMC (X)

ARINC 429 Specification (part 1 - 16)

(D) Applies to “D” model

(E) Applies to “E” model

(F) Applies to “F” model

(G) Applies to “G” model

(X) Applies to “X” model

**Power Consumption**

<table>
<thead>
<tr>
<th>Minimum</th>
<th>typical</th>
<th>maximum</th>
</tr>
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<tbody>
<tr>
<td>-</td>
<td>11</td>
<td>18</td>
</tr>
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</table>

Power Consumption in Watts
Interface

Up to 32x ARINC 429 interface channels
ARINC 429 input/output either to front-panel SCSI connector or PMC-P4
Each channel is supported by a 1 k deep/32 bits wide Cyclic-Data-Buffer
Direct access to Cyclic-Data-Buffer read/write pointers
Direct access to board registers and data memory
PCI interrupts on board events
Receiver Current Value Table
Error detection
Time-stamping logic with 1 µs precision
Bit rate selectable by software on a per channel basis

Buses

One 32-bit PCI 2.1 bus at 33 MHz on PMC-P1/P2

Connectors

One SCSI 68-pin female connector on front-panel (D) (E) (F) (G)
(D) Applies to “D” model
(E) Applies to “E” model
(F) Applies to “F” model
(G) Applies to “G” model

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Product Ordering

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARINC-8429XA</td>
<td>Conduction-Cooled ARINC 429 PMC (16 Rx/6 Tx)</td>
</tr>
<tr>
<td>DXW-31290C</td>
<td>VxWorks®653 Driver for ARINC-8429</td>
</tr>
<tr>
<td>DXW-31290D</td>
<td>VxWorks Driver for ARINC-8429</td>
</tr>
<tr>
<td>CERT-8429S</td>
<td>ARINC-8429 DO-178B certification kit (consult factory)</td>
</tr>
</tbody>
</table>

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BuiltSAFE™ PEB-6416

6U VME64x PMC Carrier Board

• Two PMC/PrPMC sites
• Connects additional PMCs/PrPMCs via second PCI
• Commercial Air-Cooled

Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE PEB-6416 is a commercial, air-cooled VME carrier board for scalable architecture systems. It is the third generation of Mercury VME PMC carrier boards, providing two 32-bit PMC sites.

Two PEB-6416 can be connected via a second PCI, allowing for up to six PMCs or PrPMCs to be controlled by the same VME processor board. Each BPA is a rear-mounted module which provides a second PCI bus connection between either single or multiple VME processor boards and the PEB-6416 local cluster. It is mounted on the VME-P0 connectors and is available in either two slot (BPA-6413) or three slot (BPA-6414) versions.

BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

Technical Specifications

Compliance
Commercial air-cooled 6U VME64x

Power Consumption

<table>
<thead>
<tr>
<th>Minimum</th>
<th>typical</th>
<th>maximum</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>2</td>
<td>-</td>
<td>Watts</td>
</tr>
</tbody>
</table>

FPGA/User-programmable/User I/O lines
64x user-specific I/O lines on PMC-J14 to VME-P2
32x user-specific I/O lines on PMC-J24 to VME-P2

Buses
1x 64-bit PCI 2.1 bus at 33 MHz on VME-P0
1x 64-bit PCI 2.1 bus at 33 MHz on PMC-J11/J12/J13/J21/J22/J23

PMC/XMC Sites
2x PMC sites (+ 5V tolerant)

Development/Debug
Onboard JTAG test port

Mercury Systems is a leading commercial provider of secure sensor and mission processing subsystems. Optimized for customer and mission success, Mercury’s solutions power a wide variety of critical defense and intelligence programs.
Ruggedization Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Commercial AC</td>
<td>Forced Air+</td>
<td>0°C to 55°C [AC1]</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.04 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>20g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits, standards</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-operating temperature</td>
<td>-55°C to 105°C [C4]</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>-1,500 to 60,000 feet</td>
<td>May require conformal coating</td>
</tr>
<tr>
<td>Fungus resistance</td>
<td>No nutrient materials</td>
<td></td>
</tr>
<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC J-STD-001 class 3</td>
<td></td>
</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830 Optional</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>

Product Ordering

PEB-6416A0 Commercial air-cooled 6U VME PMC carrier board for RIO6-8093

Related Hardware Products

BPA-6413A0 2-Slot backplane adapter for PEB-6416/18
BPA-6414A0 3-Slot backplane adapter for PEB-6416/18
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE PEB-6426 is a rugged, conduction-cooled 6U VME64x PMC carrier board for airborne applications. It is specifically designed for the most demanding applications, combining a scalable architecture for deployment in harsh environments.

The PEB-6426 is the third generation of Mercury VME PMC carrier boards and provides two 32-bit PMC/PrPMC sites. Two BuiltSAFE PEB-6426 can be connected via a second PCI, allowing for up to six PMCs or PrPMCs to be controlled by the same VME processor board.

Mercury’s BuiltSAFE BPA-6425 is a rear-mounted module, which is used to provide a second PCI bus connection between either single or multiple VME processor boards and the PEB-6426 local cluster. It is mounted on the VME-P0 connectors and is available in either 2-slot or 3-slot versions.

**BuiltSAFE for Avionics**

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.

**Technical Specifications**

**Compliance**

Conduction-cooled 6U VME64x

**FPGA/User-Programmable/User I/O Lines**

32x user-specific I/O lines on PMC-J14 to VME-P2
48x user-specific I/O lines on PMC-J24 to VME-P2

**Buses**

1x 64-bit PCI 2.2 bus at 33 MHz on VME-P0
1x 32-bit PCI 2.2 bus at 33 MHz on PMC-J11/J12/J21/J22
# Ruggedization Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cooling Type</th>
<th>Operating Temperature</th>
<th>Vibration (1 hour per axis)</th>
<th>Operating Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3</td>
<td>Rugged CC</td>
<td>Conduction</td>
<td>-40°C to 70°C (CC3)</td>
<td>5-100 Hz: increase at 3 dB/octave, 100-1000 Hz: 0.1 g²/Hz, 1000-2000Hz: decrease at 6 dB/octave</td>
<td>40g, 11ms saw-tooth, three axes</td>
</tr>
</tbody>
</table>

# Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits, standards</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Non-operating temperature</td>
<td>-55°C to 105°C (C4)</td>
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<td>Fungus resistance</td>
<td>No nutrient materials</td>
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</tr>
<tr>
<td>Workmanship</td>
<td>IPC-A-160 class 3</td>
<td></td>
</tr>
<tr>
<td>Soldering</td>
<td>IPC J-STD-001 class 3</td>
<td></td>
</tr>
<tr>
<td>PCB Manufacturing</td>
<td>IPC-A-600 class 3</td>
<td></td>
</tr>
<tr>
<td>Conformal coating</td>
<td>IPC-CC-830</td>
<td>Optional</td>
</tr>
<tr>
<td>Materials</td>
<td>REACH compliant</td>
<td>ROHS variants as an option</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Class V-0</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EN 9100:2008</td>
<td></td>
</tr>
</tbody>
</table>
Packaged COTS Systems
Mercury’s BuiltSAFE™ products bring the highest level of flight safety assurance to aerospace and defense applications. Our proven, reusable Design Assurance Level (DAL) certified artifacts for mission computing, avionics, networking and datalink comms processing save time and cost while decreasing risk.

The BuiltSAFE ROCK-2A is a development platform for conduction-cooled boards used in the BuiltSAFE ROCK-2 series of pre-integrated processing subsystems. The development platform’s front-panel is populated with commercial connectors for easy accessibility from test and development benches. Both the hardware and software are identical across the BuiltSAFE ROCK-2 development (ROCK-2A) and rugged airborne (ROCK-2B/C) platforms, enabling our customer’s applications to migrate from one platform to the other without modification.

Pre-integration with interoperable building blocks

The BuiltSAFE ROCK-2 series uses our BuiltSAFE Series of interoperable processing, graphics and I/O building blocks to provide all the functions required for modern C4ISR and avionics applications.

Works right out of the box

The BuiltSAFE ROCK-2A development platform includes a software package with all the development tools required to build an application right out of the box. The board support package integrates all the drivers required for VxWorks® 653. Other operating systems, including Linux® and VxWorks will be soon available.

I/O Interconnects

Mercury’s BuiltSAFE ROCK-2A’s front-panel and underlying I/O board are designed for customization enabling application specific I/O interconnects to be quickly implemented.

BuiltSAFE for Avionics

Mercury’s expertise and experience in safety certifiable solutions has been built on successful execution of dozens of programs over three decades. This domain knowledge is the foundation of our BuiltSAFE portfolio of open architecture modules, systems and software for avionics, communications, video servers, and mission computing.
## Technical Specifications

### Compliance
OpenVPX (VITA 65)
Backplane’s peripheral slot profile SLT3-PER-1F-14.3.2

### Power Consumption

<table>
<thead>
<tr>
<th></th>
<th>minimum</th>
<th>typical</th>
<th>maximum</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40</td>
<td>150</td>
<td>180</td>
<td>Watts</td>
</tr>
</tbody>
</table>

### Memory
Up to 512GB flash disk

### Interfaces
- ARINC 429 Tx/Rx for high and low speed
- Dual redundant MIL-STD-1553
- RS232/422/485 configurable serial channels
- Fast Ethernet (100BASE-T)
- Gigabit Ethernet (1000BASE-T)
- USB 2.0 HOST
- USB 2.0 OTG
- Discrete I/O
- Digital and/or analog video inputs
- Digital and/or video outputs

### Software
- Maintenance/Mission mode
- Board Support Package
  - VxWorks®653, Linux
  - Built In Tests (PBIT, CBIT and IBIT)
- Drivers
  - MIL-STD-1553
  - ARINC 429
  - RS232/422/485
  - Gigabit Ethernet
  - DSIO
  - USB
  - Audio
  - Video
- APIs
  - OpenGL SC, Mission File System, Inter Process Communication

### Dimensions
Without connectors: 132.6 x 269 x 390 mm (W x H x D)

### Weight
Typical 8Kg

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## Product Ordering

| ROCK-2A000201 | 3U OpenVPX mission computer development platform with 1x Freescale P3041 processor board, 1x avionics I/O board and 1x video and graphics board |
| ROCK-2A000401 | 3U OpenVPX mission computer development platform with 1x Freescale P3041 processor board, 1x Intel Core i7 Gen5 processor board and 1x avionics I/O board |

### Related BuiltSAFE Hardware Products
- BuiltSAFE ROCK-2B/C Qualified Airborne 3U OpenVPX mission computer with, 1x Freescale P3041 processor board, 1x avionics I/O board and 1x video and graphics board
- MFCC-8557 Freescale QorIQ™ P3041 XMC safety-certifiable Single Board Computer
- AVIO-2353 3U OpenVPX avionics I/O board
- VGP-2870 3U OpenVPX video I/O and graphic processor
- CIOV-2231 3U OpenVPX Intel Core i7 Gen 5 Single Board Computer

### Environmental Specification

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limits/Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-40°C to +70°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-55°C to +85°C</td>
</tr>
</tbody>
</table>

(1) For Intel CPU only
(2) Depends on payload
(3) Contact factory for more information

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Supported Operating Systems - Board Support Package

**VxWorks**

Mercury’s VxWorks® BSP has been completely re-developed to provide a uniform interface throughout all our Avionics Series building blocks. Today, the user can take advantage of advances in technology without an application-porting effort. It is configurable and supports different VxWorks operating systems, including Tornado II / VxWorks 5.5 and Workbench /VxWorks 6.

VxWorks 653 (Wind River solution for ARINC 653 compliant applications)

VxWorks 653 enables applications at different certification levels (up to DO-178B Level A) to run safely on the same hardware. Mercury provides development tools for prototyping all the way through to certification. This BSP comes in two versions: extended (for development) and a small footprint version (with optional certification material). Mercury includes a variety of drivers for the ARINC 653 environment.

**Linux**

A general-purpose Unix®-like operating system developed by a broad community and available under the terms of the GPL. Mercury’s Linux® toolbox package is based on the Linux kernel. It contains the Mercury-patched kernel, an embedded user space, Mercury-supplied drivers and libraries, as well as compilers for native and cross development, for Linux/x86.

**DO-178C**

Mercury certifiable packages include software certifiable code, plus all of the DO-178C certification evidence to enable the customer to complete the certification process to the specified level, up to Level A. In order to facilitate aircraft certification, the software is bundled with supporting documentation referred to as “certification artifacts”, which demonstrates that the software has been developed and tested in accordance with DO-178C guidelines.

SBC Monitors

**PPCMon 5**

A low-level Mercury monitor is included with our processor boards. The monitor’s primary purpose is to load an operating system from the network or on-board storage. It is also responsible for initial diagnostics and initialization. It can update on-board programmable logic and perform in-depth diagnostics.

**PPCMon 6**

Mercury’s boot-rom is available for our fourth, fifth and sixth generation boards. It is a feature-rich software product which runs at the board start-up. It includes an extensive built-in help system with practical examples on how to use the different commands.

Tools

Specific complementary software tools are available on request including CLM (Configuration Loading Monitoring Tool), Inter Process Communication with Multicore Extension, Time Synchronization and High-Speed “DO-178 ready” IPC Communication.

Specific Board Support Packages on Request

**Integrity**

Integrity® is the first commercial embedded real-time operating system dedicated to safety critical applications. It has multiple levels of safety, including a fully protected time and memory protection architecture. The Mercury Integrity BSP includes safety-critical real-time operating system features, such as IPv6 support, DO-178B Level A certifiable elements (optional) and ARINC 653 APEX API (optional).

**LynxOS**

A Unix-like real-time operating system. Our LynxOS bundled package includes the required hardware and software for a native development system and the BSP, drivers and libraries for all the hardware components, including VME, PCI, DMA, etc. It comes with examples and utility programs, as well as the LynxOS development license and the LynxOS and Mercury documentation packages.