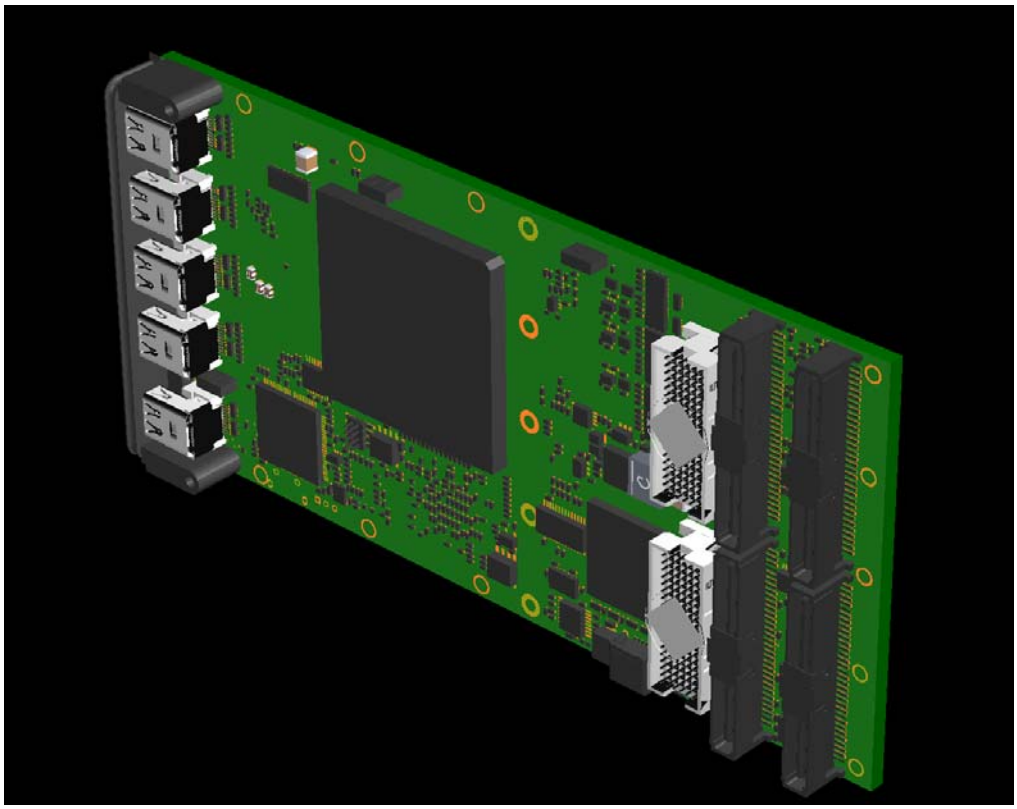
Rastergraf

MerlinPXC

Six Channel Graphics Controller
for PMC and XMC
with MIPI CSI-2 Video Input, USB 3.0,
and Front and Rear I/O including PIM

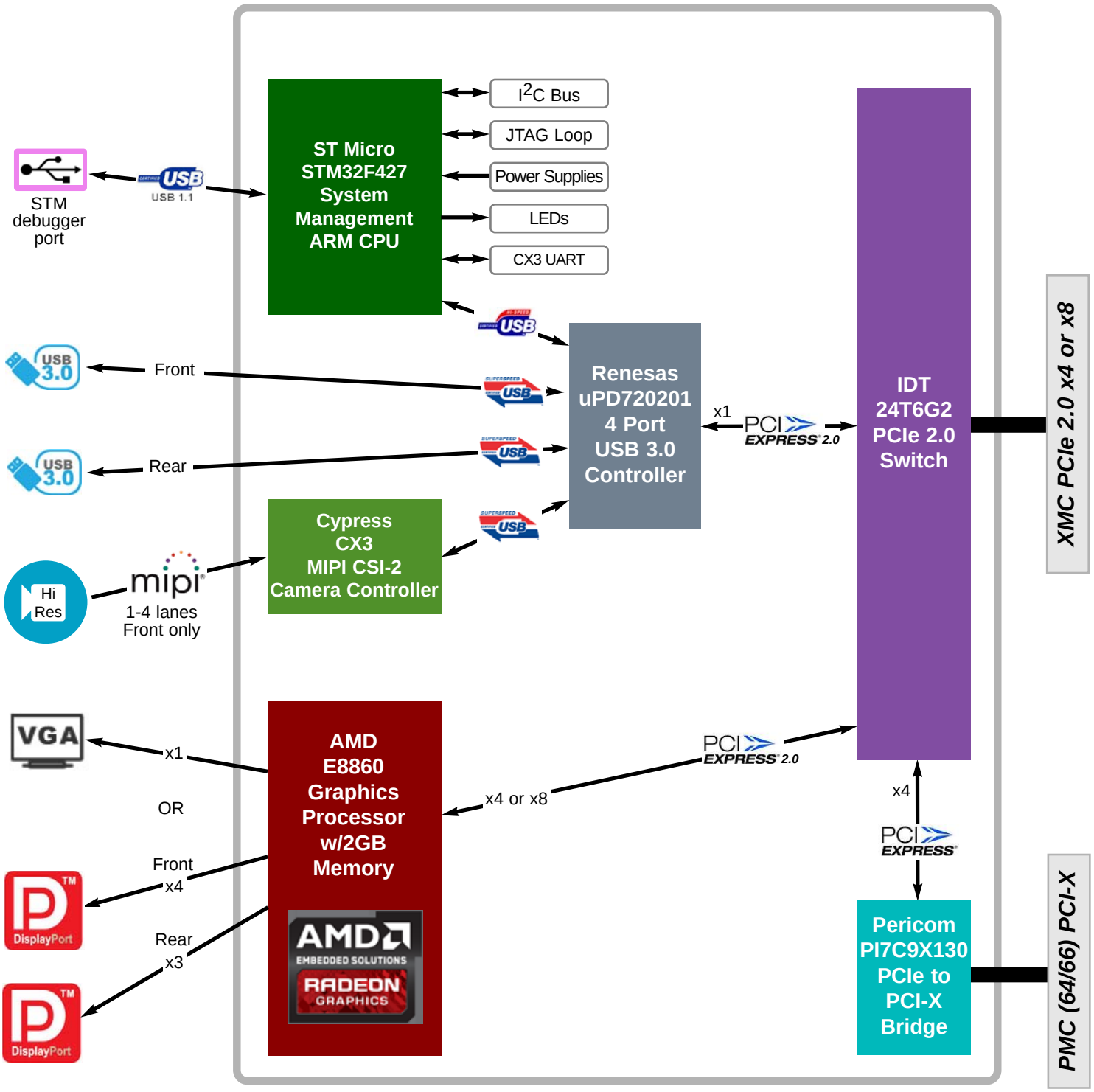
Support for Linux ■ Windows



Features

- 6 display channel AMD E8860 2D/3D graphics controller
- Dual host port interface: PMC (PCI-X) or XMC (x8 PCIe 2.0)
- Display resolution up to 4096 × 2160 per channel
- 2GB GDDR5 Graphics Memory On-chip
- x86 BIOS support
- Hardware support for DirectX 11.1, OpenGL 4.2, and OpenCL 1.2
- USB 2.0/3.0 (High & Super Speed) host controller
- 4 front panel miniDisplayPort (mDP) connectors
- Front panel USB MIPI CSI-2 1-4 Lane input port
- Front panel USB Micro B connector
- Front and/or Rear (Pn4/Pn6) Connector Access
- 3 DisplayPorts on Pn6 or Pn4
- USB 3.0 port on XMC, USB 2.0 port on PMC
- MerlinPIM provides full-function rear I/O access
- On-board ARM CPU provides comprehensive BIST support
- Extensive I^2C/SMbus and JTAG-based diagnostics
- Thermal sensors monitor E8860 and board temperatures
- Linux and Windows XP-10

Figure 1: MerlinPXC Block Diagram



MerlinPXC Overview

The MerlinPXC fulfills high performance requirements for a complete graphics and video acquisition solution found in Linux and Windows embedded systems.

It can be used in an XMC, PMC, or XMC/PMC footprint and can operate in XMC locations with VPWR set to 5V or 12V. In a dual-bus footprint, it defaults to XMC.

The MerlinPXC uses the AMD E8860 GPU, an advanced 3D graphics and multimedia engine with 2GB of high-speed GDDR5 memory. As implemented on the Merlin, the E8860 is linked to the host via an 8-bit PCIe 2.0 interface.

Extensive standards support includes OpenGL 4.2, Open CL 1.2, DirectX 11.1, dual-stream HD as well as H.264, VC-1, and MPEG-2 HD and MPEG-4 DivX and Xvid.

An IDT 24T6G2 PCIe 2.0 switch arbitrates between on-board PCIe devices and the XMC x8 PCIe 2.0 port. A Pericom 9X130 PCIe/PCI bridge supports PMC host interfaces up to 64-bit, 133 MHz PCI-X via a PCIe 1.0 x4 link.

The Merlin provides 4 DisplayPort 1.1a/1.2 outputs on the front panel and 3 on the rear I/O connectors. Multiple screens can be supported on each output by way of DP 1.2's higher link speeds and multi-stream transport function.

Low-cost external in-line "dongles" can transparently convert the mDP to DVI, VGA, NTSC/PAL, or a full-size DP connector.

High resolution video can be captured via the front panel MIPI CSI-2 port using a Cypress CX3-based processor linked to one of the Merlin's USB 3.0 ports.

All front panel connectors have latch retention. Most I/O functions are also available on a combination of the XMC Pn6 and PMC Pn4 connectors. See Table 1 for a summary of function availability.

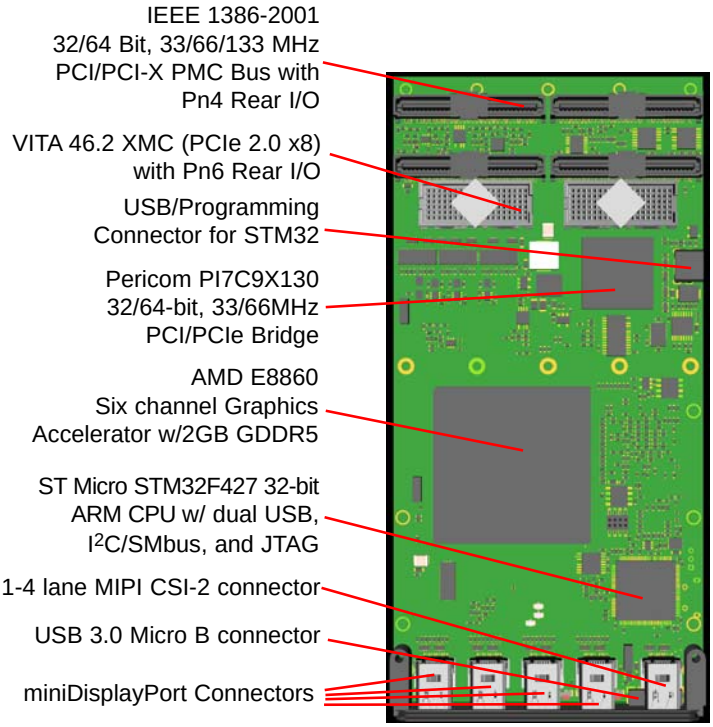
A "Personality Interface Module" (PIM) and a MIPI camera adapter boardlet are also available to ease connectivity to the Merlin (see page 6).

An ST Micro STM32F427 32-bit CPU provides Built-In Self Test (BIST) and monitoring of many Merlin functions using I^2C, UART, JTAG, and on-chip A/D converters. Reporting is done via LEDs and USB.

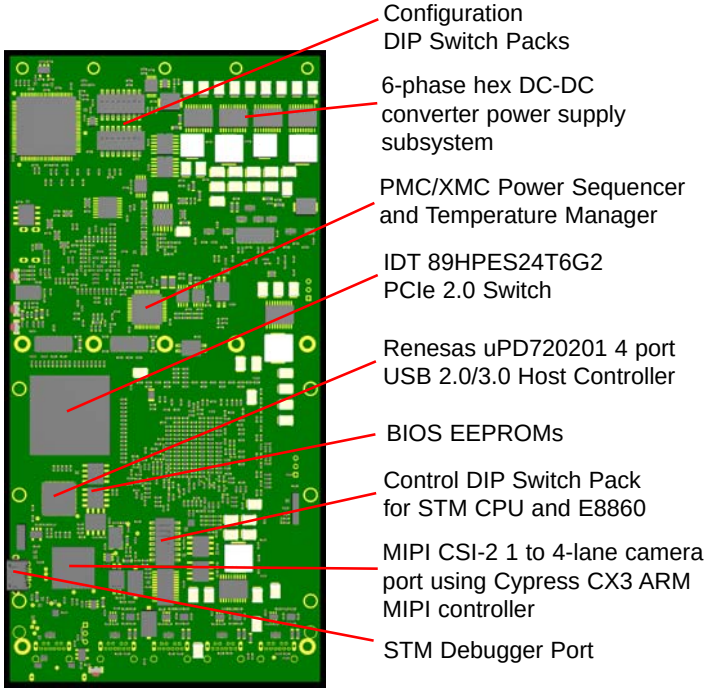
Depopulated single purpose boards include single port VGA-only and a 4-port DisplayPort-only models.

Embedded Life-Cycle Support

Rastergraf's support philosophy recognizes the lead-in and life-cycle requirements expected by the embedded computing market. Please contact Rastergraf for more information or consult our web page at *www.rastergraf.com*.



Top View



Bottom View

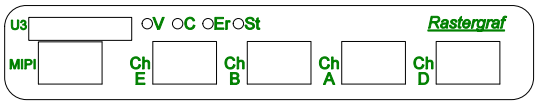
Note: CAD models shown photos are not available yet

MerlinPXC Versions

The MerlinPXC/2 includes the full feature set of the product line while the MerlinPXC/1x versions are display-only.

MerlinPXC/2: Up to 6 DisplayPorts plus MIPI in and USB 3.0

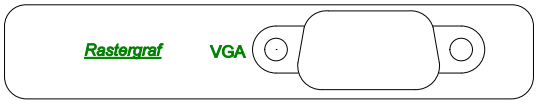
The MerlinPXC/2 front panel provides four Mini DisplayPort (mDP) connectors. In addition, it provides a MIPI CSI-2 1-4 lane camera input and a USB 3.0 port. Three mDP channels are available via the XMC or PMC rear I/O. One channel is shared between the front and rear for a total of six active mDP channels.



Special Order Versions

MerlinPXC/1V: Single VGA Analog Output

The MerlinPXC/1V provides one front panel VGA connector. Each channel supports VGA compatible RGBHV. Note that for multiple VGA applications, you can use a MerlinPXC/1D with external mDP to VGA dongles.



MerlinPXC/1D: 4x DisplayPort Digital Outputs

The MerlinPXC/1D provides four front panel DisplayPort (DP) outputs using Mini DisplayPort (mDP) connectors. Three DP channels are available via the XMC or PMC rear I/O.

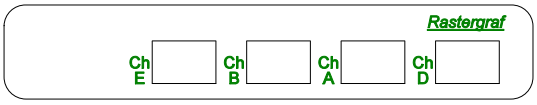
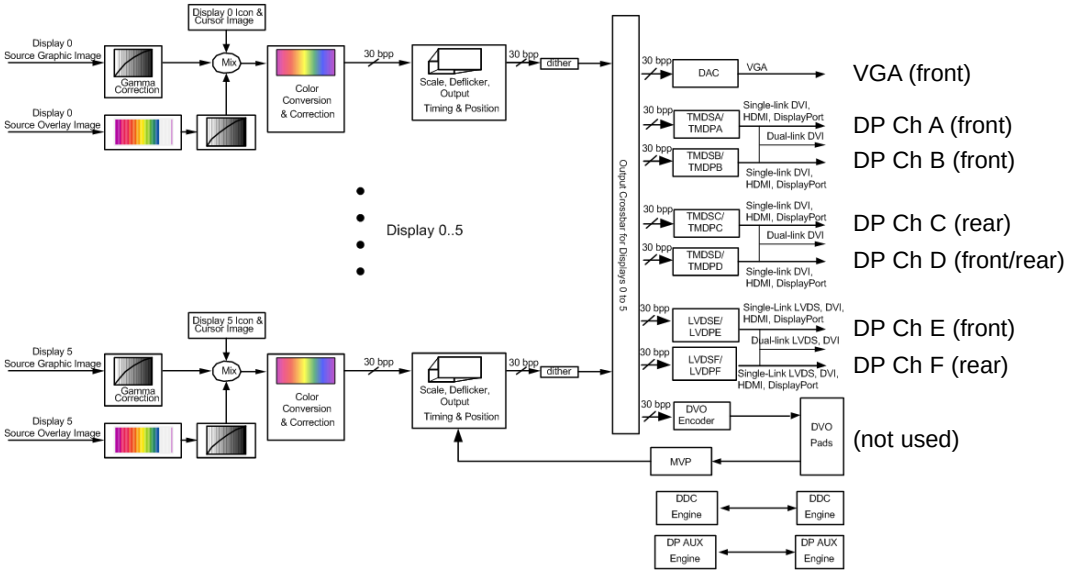


Table 1: Connectivity for the MerlinPXC Models

Merlin Version	XMC or PMC	MerlinPIM adapter or Cable(s)	Front Panel Display Ports Ch E/B/A/D	Rear I/O Display Ports Ch D/C/F	Front Panel RGBHV Graphics Out	Front Panel MIPI CSI-2 Input	Front Panel USB 2.0/3.0 host port	Rear I/O USB 2.0/3.0 host port
MerlinPXC/2	both	MIPI cable MerlinPIM Adapter	mDP-E/B/A/D	PMC Pn4 XMC Pn6		mMP	USB 3.0 Micro Type B	USB2.0: PMC Pn4 USB3.0: XMC Pn6
MerlinPXC/1V (special order version)	PMC	yes			VGA			
MerlinPXC/1D (special order version)	both	yes	mDP-E/B/A/D	PMC Pn4 XMC Pn6				

***** XMC version available by special order

Figure 2: E8860 Graphics Output Section



Video Input Capabilities

Hardware Notes

Since the E8860, USB (uPD720201) and MIPI (CX3) can run simultaneously, you MUST have at least a 64/66 PCI/PMC or x4 PCIe host to attain optimal performance.

Software Notes

Please see Software Support (page 8) for information about CX3 support.

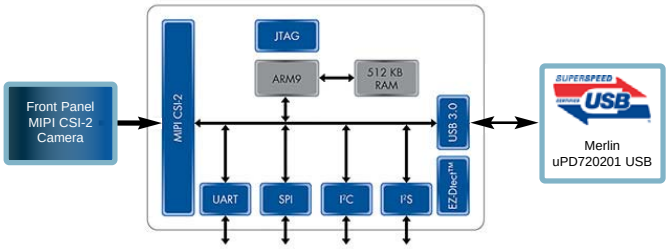
Table 2: MerlinPXC Video Input Sources

Video Mode	Capture Controller	Example Camera	Typical Resolution	Capture Rate (typ)	Capture Mode	Front/Rear Accessibility	Notes
MIPI CSI-2	CX3	OV5640M	2592x1944	15	16-bit YUV	front	
USB Port	external	Aptina MT9P031	1920 x 1080	25fps	16-bit YUV	both	Basler ace acA1920-25uc see: www.edmundoptics.com

MIPI CSI-2 Input Port

A high performance USB 3.0-based ***Cypress CX3*** peripheral controller supports a MIPI CSI-2 camera port with up to 4 input lanes. Access is limited to the front panel.

An adapter boardlet (page 6) enables easy connection to an Avnet WandCam OV5640 high-resolution camera.



USB 2.0/3.0 Host Controller

The MerlinPXC/2 uses the quad-port ***Renesas uPD720201 USB Host Controller*** which is USB 3.0 (SuperSpeed) compatible and supports data rates from 480 Mbit/s to 5Gbit/s.

Port Power

USB 3.0 specifies that 0.9A @5V be supplied. Due to the overall power requirements, the Merlin, which uses a TPS2051B USB power controller, delivers about 0.5A. Note that USB Charger port operation is NOT supported.

Host Wiring

To help ensure that the USB 3.0 will work reliably, the Merlin XMC Pn6 rear I/O connector differential pairs are carefully length-matched and follow pin assignments according to VITA 46.9 for X12d + X8d. Please be sure that your CPU or carrier is VITA 46.9 compliant as well.

Channel 1

USB channel 1 is connected to the STM32F427 BIST Subsystem CPU HS USB port. .

Channel 2

USB channel 2 is connected to the Cypress CX3 MIPI CSI-2 USB 3.0 peripheral controller (see above).

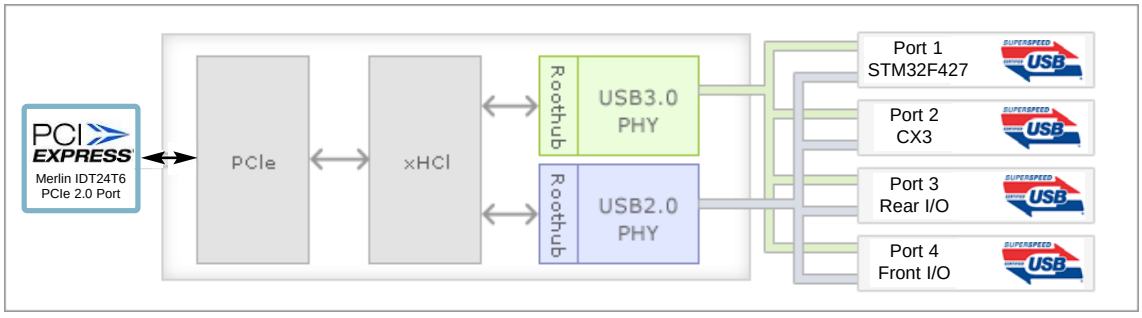
Channel 3

USB channel 3 is available on the rear I/O (XMC Pn6) connector of the MerlinPXC/2.

Channel 4

USB channel 4 is available on the front panel of the MerlinPXC/2.

Figure 3: uPD720201 Block Diagram



MerlinPIM Adapter

A “Personality Interface Module” (PIM) is available that is VITA 36d0_1 compatible. It enables the Merlin rear I/O functions to be accessed either via the XMC Pn6 and PMC Pn4 connector and can be used with VME, cPCI, and OpenVPX PIM Carriers. It includes the XMC XIM enhancement suggested by Extreme Engineering which enables additional I/O to be supported.

An alternate version includes a VME P2-style connector to enable the PIM to be used with Rastergraf and Technobox PMC and XMC carriers.

To help ensure that the PIM will work reliably, the Merlin XMC Pn6 and PMC Pn4 rear I/O connector differential pairs are carefully length-matched and follow pin assignments according to VITA 46.9 for X12d + X8d and P32d. For best results, be sure to use a CPU or carrier that is VITA 46.9.

Figure 5: MerlinPIM Block Diagram

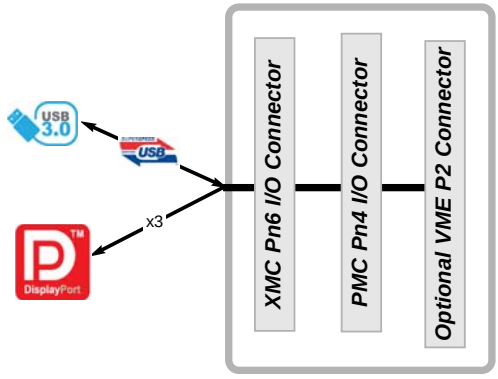
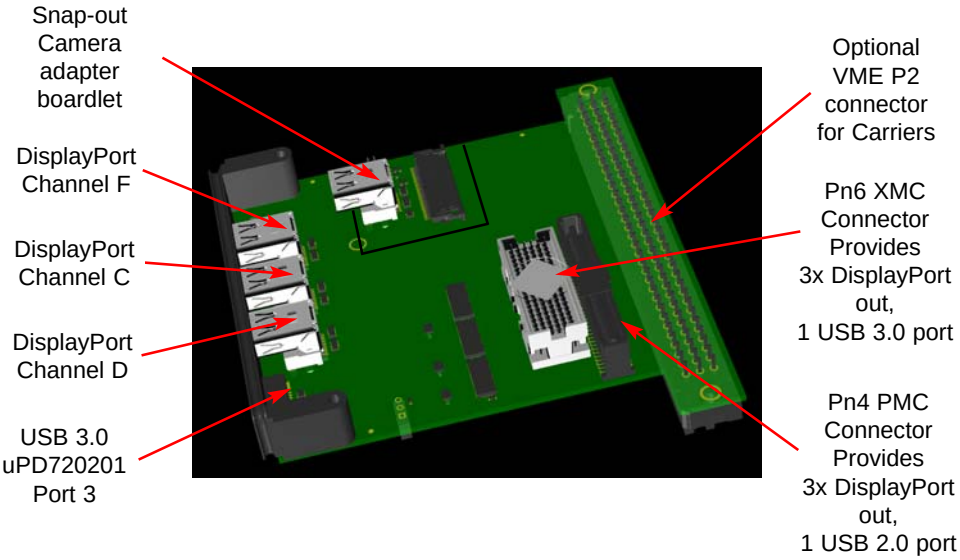


Figure 6: MerlinPIM Connectors



WandCam Adapter Boardlet

The snap-out boardlet contains an adapter that enables the use of an Avnet WandCam OV5640 MIPI CSI-2 camera.

Referring to the diagram below, the FPC (left hand) connector is linked to the WandCam via a short length of 0.5mm pitch FPC cable. The right hand connector links to the Merlin cable. This is actually a Mini DisplayPort connector, which we use because it is a perfect signal match for MIPI CSI-2, for which there is no standard connector.

Figure 7: WandCam Adapter Boardlet

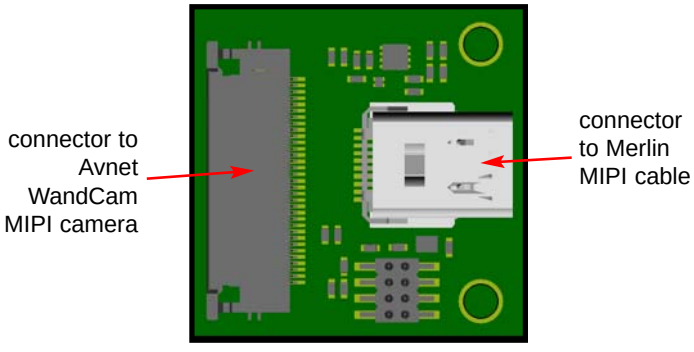


Figure 8: Avnet WandCam Front and Back Views

Systems Management

There are a number of subsystems on the MerlinPXC that are required to enable its correct and reliable operation. The startup of the power systems is set in motion by the leading edge of the system reset pulse. All host power must be stable at that time in order to ensure the proper operation of the board.

Power Supply Subsystem

By the very definition of a high-performance graphics board, the Merlin is NOT a low-power design. For it to meet its full design specification, the calculated power requirements are:

Host Bus	Voltage Input	Idle	Full Operation
PMC/XMC	3.3V	0.9A	2A
PMC	5V	2.45A	6.85A
XMC	VPWR=5V	2.45A	6.85A
	VPWR=12V	1.1A	3A

At the leading edge of system reset, logic selects PMC or XMC as the power source (XMC is default). Because it can deliver the most power, 5V is the power rail for the 6-phase hex DC-DC converter supply. When XMC VPWR=12V, a local DC-DC converter is enabled to down-convert it to 5V. There is small efficiency cost to doing this but it simplifies the overall design. An OVP shuts down the entire power section if local 5V exceeds 5.6V.

Temperature Monitoring Subsystem

An LM63 thermal sensor tied to an E8860 substrate diode monitors the E8860 and the area around it. An LM75 sensor monitors the DC-DC converters area. If a thermal condition is detected, an LED is lit and, if required, the board is shut down. Recovery is done by cycling system power.

Cooling Systems

Copper floods enhance the heat-spreading within the PCB. The 24T6 and E8860 PCIe bus widths (set on-board to x4 or x8) and the E8860 clock and core voltage also affect power dissipation. The BIST subsystem can adjust the GPU parameters when temperatures rise too high. This may be a more effective way to manage heat than adding a heat sink that may congest the air flow through the cardcage. Tests will have to be run in the customer system to determine the impact.

Built-In Self-Test (BIST) Controller

An ST Micro STM32F427 CPU is used to provide Built-In Self-Test (BIST) and real-time monitoring of many MerlinPXC functions using a combination of I^2C, JTAG, and A to D converters (ADC) for voltage measurements. The STM firmware includes support for boot-time register setup, device testing, and even CPLD reprogramming. The STM is connected to one of the uPD720201 USB ports so that it can be controlled by the host system.

Error Reporting

The simplest way that problems are reported is by LEDs:

On the MerlinPXC/2 front panel are:

- Green “V” LED, which is turned on when all on-board supplies are normal;
- Amber “C” LED driven by the CX3, slowly cycles on and off.
- Red “Er” LED, which is turned on if a thermal sensor is tripped or some other problem is detected;
- Green “St” LED driven by the STM, slowly cycles on and off.

On Side 2, along the board edge,

- Green, Amber, and Red LEDs driven by [STM OR 24T6 OR CPLD] control bits.

In addition to the LEDs, the STM can communicate with the host system via an Merlin USB port. No cabling to an CPU port is required.

System Management Connections

A Mini B USB connector located on the edge of the board enables access to the STM secondary USB port for use with USB peripheral devices.

A Micro AB USB connector is used as for debug but is NOT a USB port. It is used to support programming of the STM control store and to access the STM debug port.

Table 4: MerlinPXC BIST Test Nodes

Access Method	Devices	Testing Method
I^2C	CY22393 Clk, 9DB403 Clk Bfr, 2x CPLD, LM75, LM63 24LC256 EEPROM, ADS1015 4x ADC, MIPI Port, CX3 Controller, 9X130 PCI/PCIe Bridge, 24T6 PCIe Switch, E8860 Graphics	Verify and Initialize Control Registers
UART	Debug access to the CX3 Controller	Verify and Initialize Control Registers
JTAG	2x CPLD, 9X130 PCI/PCIe Bridge, 24T6 PCIe Switch, E8860 Graphics	ID and Boundary Test
HSYNC, VSYNC	E8860 Graphics	STM Counters
Voltage	Power Supply: VDD_CORE, VDDCI, VDDR1, VDD_095, VDD_105, VDD_18, ancillary supplies	STM A/D Inputs + ADS1015
Temperature	STM on-chip sensor, LM63 and LM75 Thermal Sensors, E8860 Substrate Diode	poll via I^2C registers

Software Support

Software support for the MerlinPXC includes the SDL Subroutine Library, Windows XP-10 drivers, and an x.org accelerated X Server with OpenGL and Xv video input extensions

Table 5: Software Support Matrix (consult factory for current availability)

		SDL	X	DirectX	Self Test using SDL	Multi-Head	OpenGL	x86 BIOS	USB
Windows XP-10				✓		✓	✓	✓	✓
Linux x86/PowerPC		✓	✓		✓	✓	✓	✓	✓

SDL Graphics Library

SDL is a graphics library designed to be a device-independent programming interface and is supported by the GNU C compiler and linker. SDL is ideally suited to demanding board level and embedded systems applications. Drivers are available for selected host CPU boards and operating systems.

SDL is easy to use. It includes a graphics primitives that interface to the GPU accelerated functions. All primitives are drawn as single pixel lines. Rectangles, polygons, circles, ellipses, and chords can be filled with a solid color or stipple patterns.

Complete information about SDL is contained in the Standard Drawing Library C Reference Manual that is available for download from our web site at http://www.rastergraf.com.

SDL Feature Summary

- DisplayPort output up to 4Kx2K
- Pixblits to/from the display and host memory
- Solid and dashed lines, polylines, and rectangles
- Polygons, ellipses, circles, sectors, chords
- Solid and Pattern Fills - Pixel Processing
- Proportional and Fixed Width Fonts
- Clipping Rectangle and Logical Origin
- 8/16/24 bpp

Built-In-Test

The Rastergraf SDL Subroutine Library includes a **BIT** module which tests the major devices and graphics memory, and a simple drawing engine test is also conducted.

uPD720201 and CX3 Support

The CX3 uses USB 3.0 links to connect to the host. On the Merlin, this is done via the on-board Renesas uPD720201 USB 3.0 Host Controller. There are a few details that must be attended to ensure satisfactory results:

Your OS must include a UVC (USB Video Class) driver.

A Windows XP-10 driver for the uPD720201 can be downloaded from Rastergraf. Most Linux distributions appear to have the driver built in.

To use the CX3, you have to install the Cypress SDKs for XP-10 or Linux from cypress.com and the Java Runtime Environment from java.com. You can download the Merlin-specific application images for the CX3 from the Rastergraf web site http://www.rastergraf.com.

Ruggedization

Rastergraf is not in the militarized business. The intent of the following table is to illustrate how the Rastergraf graphic boards fit into the standard ruggedized classes.

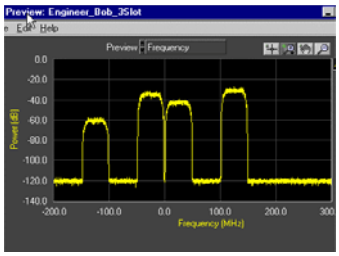
Rastergraf boards use standard distribution grade derated commercial temperature range or industrial temperature range components. No formal component tracking is maintained.

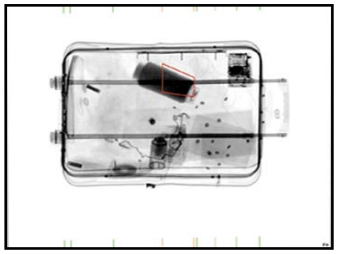
Table 6: Ruggedization Levels

Spec	Air-Cooled Level 0	Air-Cooled Level 50	Air-Cooled Level 100	Air-Cooled Level 200
Graphics Board(s)	Merlin Agate Falcon	Merlin Agate Falcon	Merlin Agate Falcon	Falcon (TBD)
Operating Temperature (4, 6)	0°C to 50°C	-20°C to 65°C	-40°C to 71°C	-40°C to 85°C
Storage Temperature	-40°C to 85°C	-40°C to 85°C	-55°C to 125°C	-55°C to 125°C
Humidity Operating	0 to 95% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing
Humidity Storage	0 to 95% condensing	0 to 100% condensing	0 to 100% condensing	0 to 100% condensing
Vibration Sine (1)	2 g peak 15-2 kHz	2 g peak 15-2 kHz	10 g peak 15-2 kHz	10 g peak 15-2 kHz
Vibration Random (2)	0.01 g2/Hz 15-2 kHz	0.02 g2/Hz 15-2 kHz	0.04 g2/Hz 15-2 kHz	0.04 g2/Hz 15-2 kHz
Shock (3)	20 g peak	20 g peak	30 g peak	30 g peak
Conformal Coat (5)	optional	optional	optional	optional
Ordering Option (7)	/CA or /CS	/A5A or /A5S	/A1A or /A1S	/A2A or /A2S

Notes:

1. Sine vibration based on a sine sweep duration of 10 minutes per axis in each of three mutually perpendicular axes. May be displacement limited from 15 to 44 Hz, depending on specific test equipment. **Shock and Vibration values are by design and not tested in production.**
2. Random vibration 60 minutes per axis, in each of three mutually perpendicular axes.
3. Three hits in each axis, both directions, 1/2 sine and saw tooth. Total 36 hits.
4. Standard air-flow is 8 cfm at sea level. Some higher-powered products may require additional airflow. Consult the factory for details.
5. Conformal coating type to be specified by customer. Consult the factory for details..
6. Temperature is measured at the card interior (not at edge) using on-board LM75 temperature monitor.
7. Last letter in ordering option: A for Acrylic Conformal Coating, S for Silicone Conformal Coating





Specifications

Graphics Controller	**AMD Radeon E8860** (AKA Adelaar, Venus Pro MCM, Dev ID 6822, 100-CG2514, 216-0846077) Support for DirectX 11.1, OpenGL 4.2, OpenCL 1.2, and Mantle
Display Memory	2GB GDDR5
Digital Graphics Outputs	Front Panel: 4x DisplayPort using Mini DisplayPort connectors. Channels A, B, D, and E. D shared with rear. Rear I/O (Pn6 or Pn4): 3x DisplayPort. Channels C, D, and F. Ch D shared with front.
Digital Monitor Support	up to 6x DisplayPort 1.2, up to 4Kx2K per display. DP 1.2 also supports multi-display per output.
VGA Maximum Dot Clock	400 MHz
VGA Horizontal Scan Rates	31.5 to 115 KHz
Analog Monitor Support	Single VGA (RGBHV) up to 1920x1200@24 bpp, non-interlaced.
BIOS PROM	64Kb Serial EEPROM stores power-up configuration (BIOS). Optional secondary BIOS EEPROM.
PMC/PCI Bus Interface	**Pericom PI7C9X130** 32/64-bit, 33-133 MHz PCI/PCI-X to PCIe 1.1 x4 Bridge Supports Universal PCI Bus signaling (5V and 3.3V) on the PMC side.
XMC/PCIe Bus Interface	**IDT 89HPES24T6G2** 6 port PCIe 2.0 PCIe switch; each port is x4 PCIe lanes. Ports 0&1: connected to XMC, x4 or x8, PCIe 2.0; (power save option: x4 only) Ports 2&3: connected to E8860, x4 or x8, PCIe 2.0; (power save option: x4 only) Port 4: connected to uPD720201, x1, PCIe 2.0; Port 5: not used
USB Host Controller	**Renesas uPD720201**, four port, USB 3.0/2.0 compliant, switched power control. 64Kb Serial EEPROM stores power-up configuration. Port assignment allocates: Port 1 to STM32F427 BIST controller; Port 2 to Cypress CX3 USB 3.0-based MIPI CSI-2 camera controller; Port 3 to user XMC rear I/O Pn6. USB 2.0 subset to user PMC rear I/O Pn4. Port 4 to front panel USB 3.0 Micro B connector.
MIPI CSI-2 Digitizer	**Cypress CX3** USB 3.0 based controller for MIPI CSI-2 1-4 lanes captures high resolution camera input.
Power Requirements	MerlinPXC can easily exceed the nominal power limits of PMC (7.5W). XMC really has no limits, being controlled by the amount of available cooling and host power supply capabilities. In order to achieve full operability, the MerlinPXC/2 requires host power as follows:

Host Bus	Voltage Input	Idle	Full Operation
PMC/XMC	3.3V	0.5A	2A
PMC	5V	1.75A	6.85A
XMC	VPWR=5V	1.75A	6.85A
	VPWR=12V	1.1A	3A

Environment	
Temperature	0°C to +70°C, operating; -55°C to +85°C, storage
Humidity	5% - 95% non-condensing
PMC/XMC Mechanical	IEEE 1386-2001 [*except Side 2 max component height is approx. 3.1 mm instead of 2.1 mm. This is not a significant issue.*]
Dimensions	149 mm x 74 mm
Front Panel I/O Connectors	MerlinPXC/1V: Single VGA MerlinPXC/1D: 4x Mini DisplayPort (mDP) MerlinPXC/2: 4x mDP + MIPI Input + USB 3.0
Maintenance Features	See Page 7

Non-standard Versions

If you have special configuration requirements that do not appear to be covered by the standard versions, please contact the sales department for assistance.

Ordering Information

Board Configurations

MerlinPXC/2 **Rastergraf P/N AE9-00763-4000**

Runs in XMC, PMC, or XMC/PMC sites. AMD Radeon E8860 Graphics Accelerator, 2GB GDDR5, 4x front panel Mini DisplayPort (mDP) connectors. BIOS supports digital displays for x86. Additional front panel connectors provides access to MIPI CSI-2 and a USB 3.0 Port. The rear access Pn4 (PMC) and Pn6 (XMC) provide 3x DisplayPorts and a USB port. No VGA support.

Special Order Versions

MerlinPXC/1V **Rastergraf P/N AE9-00763-0000**

PMC Only, AMD Radeon E8860 Graphics, 2GB GDDR5, single front panel VGA connector. No rear I/O support.

MerlinPXC/1D **Rastergraf P/N AE9-00763-1000**

Runs in XMC, PMC, or XMC/PMC sites. AMD Radeon E8860 Graphics, 2GB GDDR5, 4x front panel Mini DisplayPort connectors. No rear I/O support.

MerlinPXC/1M **Rastergraf P/N AE9-00763-2000**

Runs in XMC, PMC, or XMC/PMC sites. AMD Radeon E8860 Graphics, 2GB GDDR5, 4x front panel Mini DisplayPort connectors. Includes Pn4 Rear I/O

Notes: XMC version is available for /1V by special order.
Silicone or acrylic Conformal Coating is available. Please contact factory for more information.
Extended Temperature Testing is available. Please contact factory for more information.

Software

Windows XP-10 Drivers **Rastergraf P/N ASW-PMMS-0100**

OpenGL and DirectX accelerated display and video input drivers for Windows XP-10. USB driver for uPD720201.

Linux X Windows Driver **Rastergraf P/N ASW-PMLN-0300**

x.org-based X-Windows video input and graphics accelerated drivers for x86 or PowerPC Linux.

Rastergraf SDL **Rastergraf P/N ASW-PSDL-0400**

SDL Subroutine Library with video input and graphics drivers for x86/PPC Linux. API compatible with earlier SDL versions and Rastergraf/Peritek graphics boards.

Accessories (available from Rastergraf)

MerlinPIM Rear I/O Transition Adapter: **Rastergraf P/N AF2-00770-0000**

MerlinPIM Camera Adapter Boardlet: **Rastergraf P/N AF2-00770-00PD**

Enables connection to the Avnet OV5640 WandCam MIPI camera. It is used in conjunction with the Merlin MIPI Cable, which is a short Mini DisplayPort stub cable (mDP used for convenience only).

(see next page for more Accessories)

Accessories (tested but not sold by Rastergraf)

Mini DisplayPort (mDP) to DisplayPort Cable:
1 x mDP plug to 1 x DP plug, 6 ft.: **StarTech MDP2DPMM6**

Mini DisplayPort (mDP) to VGA Active Adapter (Dongle):
1 x mDP plug to VGA output (receptacle), 1920 x 1200: **StarTech MDP2VGA**

Mini DisplayPort (mDP) to DVI Single Link Active Adapter (Dongle):
1 x mDP plug to DVI-D output (receptacle), 1920 x 1200: **Startech MDP2DVIS** or **HIS HMDPSDVIEYE**

Mini DisplayPort (mDP) to NTSC/PAL Active Adapter (Dongle):
1 ea mDP plug and USB (for power) to
1 ea RCA (composite) and DIN (S-Video)
1024x768 maximum display resolution output
Vktech/Lenkeng LKV386 or **ViewHD VHDMDP2AV (same)**

Avnet WandCam OV5640 MIPI CSI-2 Camera:
Requires Cypress CX3 SDK software for XP/7/8 (free from Cypress), Rastergraf MIPI boardlet, and Mini DisplayPort Cable (mDP) is used for convenience). Cable should not be more than 1 meter. OV5640 camera supports up to 2592x1944@15fps. WandCam kit includes short FPC cable.

Go to http://www.em.avnet.com/en-us/design/drc/Pages/Wandcam.aspx **AES-WCAM-ADPT-G**

The Avnet picture shows both camera and controller but AES-WCAM-ADPT-G part number really includes just the camera and FPC cable.

Contact Us

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