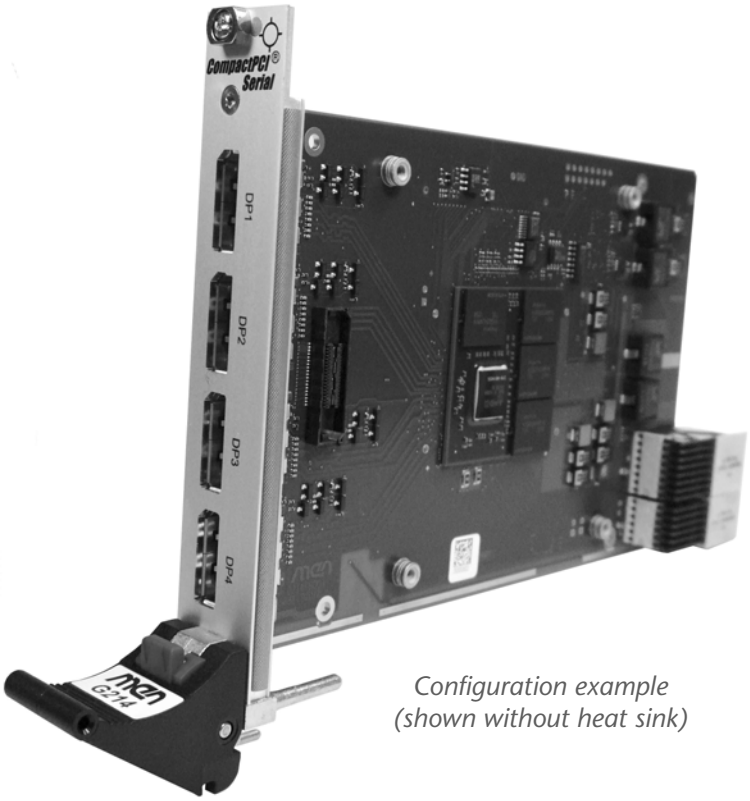
Embedded Solutions

G214 – 3U CompactPCI Serial Multi-Display Controller



Configuration example (shown without heat sink)

User Manual

mikro elektronik gmbh · nürnberg

G214 – 3U CompactPCI Serial Multi-Display Controller

The G214 is a 4HP/3U CompactPCI® Serial peripheral board based on the AMD Radeon™ E6760 GPU. The board is an easy way to provide a CompactPCI® Serial system with high-end graphics features that are not offered by regular CPU chipsets. The supported high resolutions and multi-display output make the board ideal to meet the visual requirements of central control rooms, video surveillance systems or digital signage applications. All board components are carefully selected to offer long-term availability for at least 7 years.

AMD Eyefinity multi-display technology supports up to 6 display outputs: Four DisplayPort® 1.2 interfaces with a maximum resolution of 4096x2560 at 60 Hz and 24 bpp are available at the board's front panel, another two DisplayPort® 1.1a interfaces with a maximum resolution of 2560x1600 are optional (widening the front panel to 8HP). Alternatively, DisplayPort® 1.2 supports daisy chaining of compatible displays. If the connected panels support the same resolutions, they can be addressed as a "single large surface", effectively functioning as one monitor with a very large resolution.

The advanced, programmable 3D graphics engine of the AMD Radeon™ E6760 supports Microsoft® DirectX® 11 and comes with a third generation unified video decoder, enabling dual HD decode of H.264, VC-1, MPEG4 and MPEG2 compressed video streams. The GPU is also an ideal solution for embedded applications requiring compute intensive general purpose graphics processing unit (GPGPU) capabilities. With 480 processing elements, it delivers up to 576 GFLOPs peak single precision floating point performance for ultrasound, radar and video imaging applications. The GPGPU capabilities are enabled by AMD Accelerated Processing (APP) technology, the industry standard OpenCL™ programming language and the AMD APP Software Development Kit (SDK).

Using passive DisplayPort® adapters, up to two HDMI or DVI-D monitors can be connected. Single-link DVI-D and HDMI 1.4a are supported. With active adapters, all six DisplayPort® interfaces can be used. Active adapters are also available for dual-link DVI-D and VGA.

Technical Data

Graphics

- AMD Radeon™ E6760 graphics processor
  - 600 MHz max. graphics engine operating frequency
- 6 SIMD engines x 80 processing elements = 480 shaders
- Floating Point Performance (single precision, peak): 576 GFLOPS
- Display Engine: AMD EyeSpeed visual acceleration, AMD Eyefinity, AMD HD3D technologies
- DirectX® 11
- Shader Model 5.0
- OpenGL® 4.1
- OpenCL™ compliant: AMD APP, OpenCL™ 1.1, DirectCompute 11
- Unified Video Decoder 3 for H.264, VC-1, MPEG-2, MPEG-4 part 2 decode

Memory

- 128-bit wide, 1 GB, GDDR5
- Operating frequency: 800 MHz / 3.2 Gbps

Front Connections (Standard)

- 4 DisplayPort® 1.2 interfaces
  - Maximum resolution: 4096x2560 pixels at 24 bpp / 60 Hz

Miscellaneous

- Temperature sensor
- Reset via CompactPCI® Serial connector

CompactPCI® Serial

- Compliance with CompactPCI® Serial PICMG CPCI-S.0 Specification
- Peripheral slot
- Host interface: 4 or 8 PCI Express® lanes

Electrical Specifications

- Supply voltage/power consumption:
  - +12 V (9..16 V), 35 W max.

Mechanical Specifications

- Dimensions: conforming to CompactPCI® Serial specification for 3U boards
- Front panel: 4 HP with ejector
- Weight: approx. 260 g (with heat sink)

Environmental Specifications

- Temperature range (operation):
  - 0..+60°C
  - Airflow: min. 1.0 m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3,000 m
- Shock: 50 m/s², 30 ms
- Vibration (function): 1 m/s², 5 Hz – 150 Hz
- Vibration (lifetime): 7.9 m/s², 5 Hz – 150 Hz
- Conformal coating on request

MTBF

- 150,000+ h (tbc.) @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Conforming to EN 55022 (radio disturbance), IEC 61000-4-2 (ESD), IEC 61000-4-3 (electromagnetic field immunity), IEC 61000-4-4 (burst), IEC 61000-4-5 (surge) and IEC 61000-4-6 (conducted disturbances)

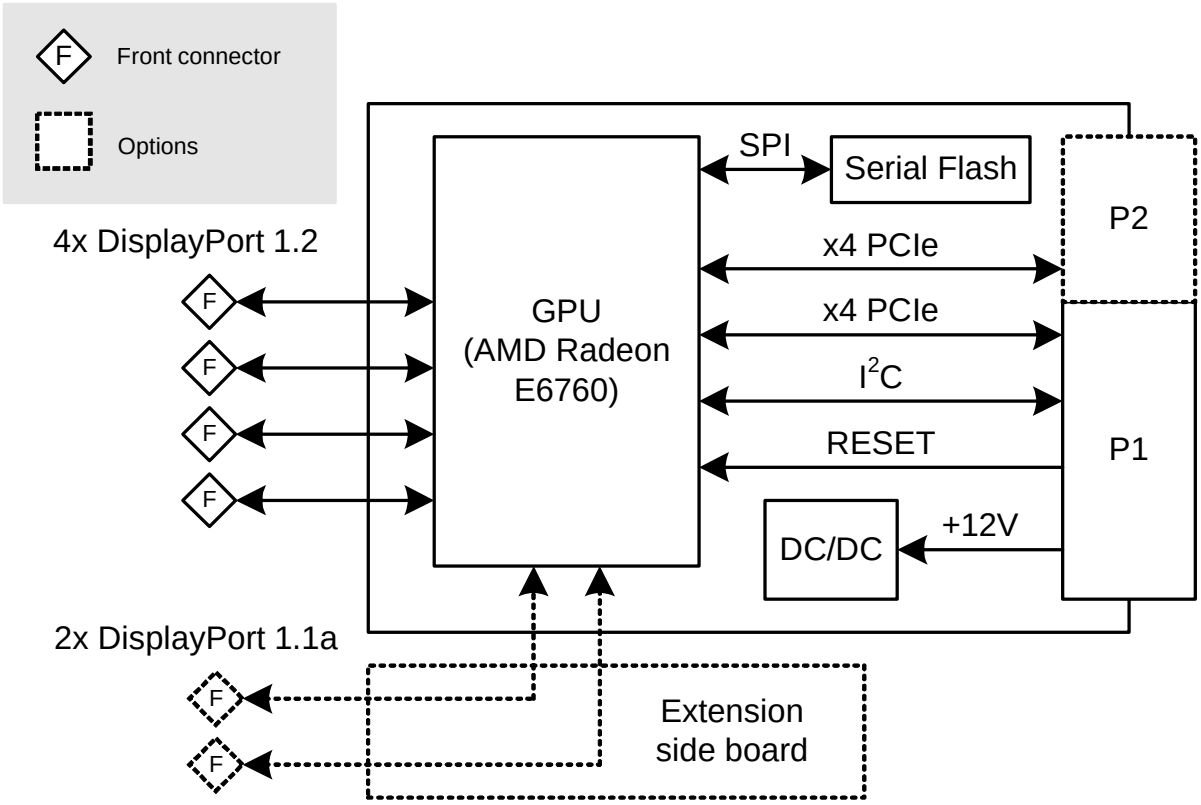
Electrical Safety Standards

- Conforming to EN 50155 (insulation measurement 10.2.9.1, voltage withstand 10.2.9.2), EN 60950 (information technology equipment), EN 50124-1 (Annex B) (voltage withstand)

Software Support

- Windows® Vista™
- Windows® 7
- Linux
- For more information on supported operating system versions and drivers see online data sheet.

Block Diagram



Configuration Options

Graphics

- 2 additional DisplayPort® 1.1a interfaces
  - Maximum resolution 2560x1600 at 24 bpp / 60 Hz
  - Available via standard connectors on 8HP front panel

CompactPCI Serial

- Only P1 connector assembled
  - When more than a x4 PCIe® connection is not required / not possible

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

For available standard configurations see online data sheet.

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2011-12-16

Conventions

This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics — Folder, file and function names are printed in *italics*.

bold — **Bold** type is used for emphasis.

`monospace` — A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment — Comments embedded into coding examples are shown in green color.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ# /IRQ — Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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Figures

Tables

1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Map of the Board

Figure 1. *Map of the board – top view*

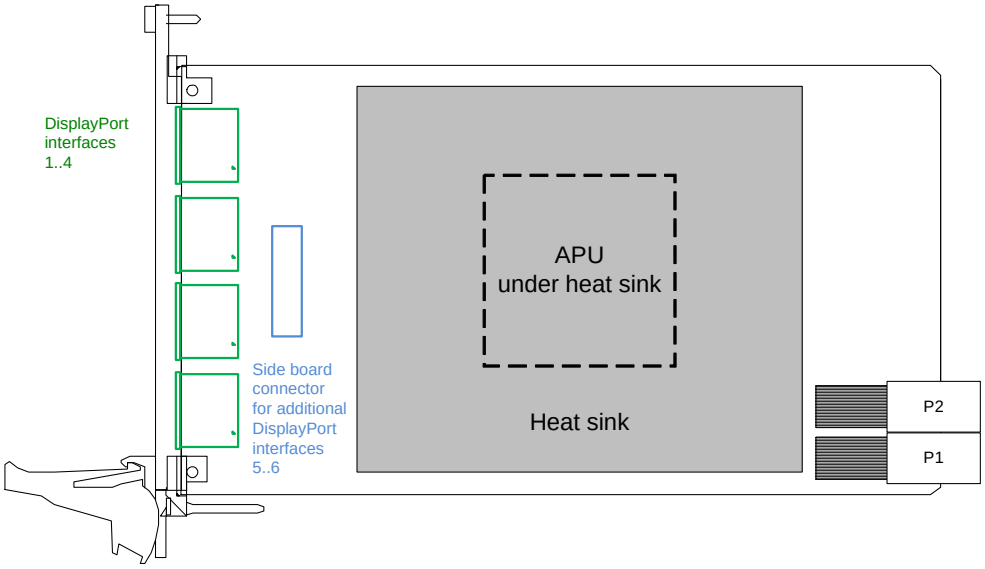
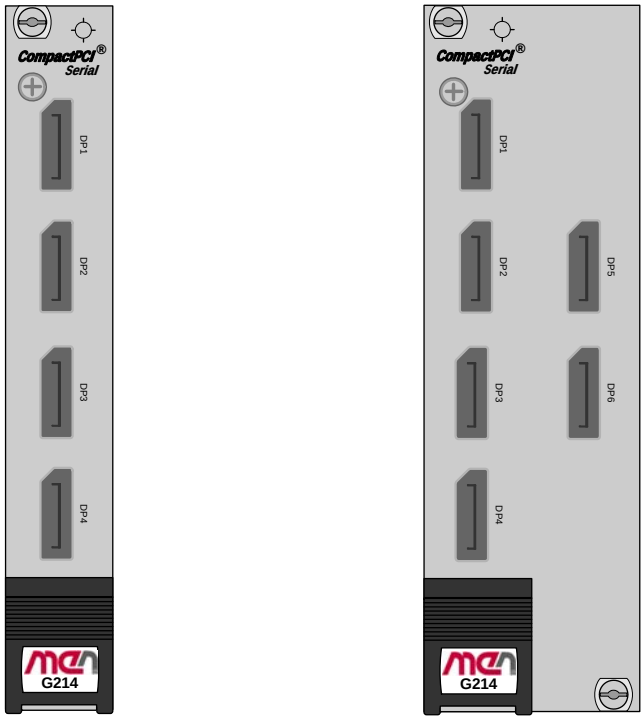


Figure 2. *Front panel - standard 4HP model and optional 8HP model*



1.2 Integrating the Board into a System

You can use the following check list when installing the board in a system for the first time and with minimum configuration.

- ☑ Power down the system.
- ☑ Insert the G214 into a peripheral slot of your CompactPCI Serial system, making sure that the CompactPCI Serial connectors are properly aligned.

  Note: The peripheral slots of every CompactPCI Serial system are marked by a circle with a plus sign behind it ⌖ on the backplane and/or at the front panel.
- ☑ Power up the system.
- ☑ You can now install driver software for the G214 graphics controller.

1.3 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation.

You can find any driver software available for download on MEN's website.

2 Functional Description

2.1 Power Supply

The G214 is supplied with +12V (-3%/+5%) via the CompactPCI Serial bus.

2.2 Reset Behavior

The G214 can be reset using the *RST#* signal on the backplane.

2.3 Thermal Considerations

A suitable heat sink is provided to meet thermal requirements.

Please note that if you use any other heat sink than that supplied by MEN, or no heat sink at all, warranty on functionality and reliability of the G214 may cease. If you have any questions or problems regarding thermal behavior, please contact MEN.

2.4 Graphics

The G214 is based on the AMD Radeon E6760 GPU (Graphics Processing Unit).

2.4.1 Display Port Interfaces

The standard G214 offers four DisplayPort 1.2 interfaces at the board's 4HP front panel. Two more DisplayPort 1.1a interfaces can be made available via an optional side board, requiring a wider 8HP front panel for the additional connectors.

Connector types:

- 20-pin DisplayPort receptacle
- Mating connector:
  20-pin DisplayPort plug

Table 1. *Pin assignment of 20-pin DisplayPort connector*

	20	POWER	19	RETURN PWR
	18	HOTPLUG	17	AUX-
	16	GND	15	AUX+
	14	CONFIG2	13	CONFIG1
	12	LANE_3-	11	GND
	10	LANE_3+	9	LANE_2-
	8	GND	7	LANE_2+
	6	LANE_1-	5	GND
	4	LANE_1+	3	LANE_0-
	2	GND	1	LANE_0+

Table 2. *Signal mnemonics of 20-pin DisplayPort connector*

Signal	Direction	Function
GND	-	Ground
AUX-, AUX+	in/out	Bi-directional half-duplex auxiliary channels for device management and device control
CONFIG1, CONFIG2	-	Connected to Ground
HOTPLUG	in	Hot Plug Detect
LANE_[3..0]+, LANE_[3..0]-	out	Main Link data lanes
POWER	out	Power for connector (3.3 V, 500 mA)
RETURN PWR	-	Return for Power

2.4.2 Connecting Multiple Displays

The G214 supports can output a maximum of six independent images via its DisplayPort connectors.

If more than one DisplayPort interface is used, the type of PCIe connection limits the possible maximum resolutions. The following table shows the maximum resolutions for one through six active DisplayPort interfaces. It shows the possible resolution when every connected DisplayPort is used with the same resolution.

Note: Reducing the resolution of one DisplayPort can free resources to increase the resolution of another DisplayPort.

Table 3. *Maximum resolution with x8 PCI Express connection*

Number of active DisplayPort interfaces	Color depth in bits per pixel at 60 Hz		
	18 bpp	24 bpp	30 bpp
1x DisplayPort 1.2	4096 x 2560	4096 x 2560	3840 x 2400
2x DisplayPort 1.2	4096 x 2560	4096 x 2560	3072 x 1920
3x DisplayPort 1.2	3072 x 1920	3072 x 1920	2560 x 1600
4x DisplayPort 1.2	3072 x 1920	2560 x 1600	2560 x 1600
With optional DisplayPort 1.1a interfaces			
4x DisplayPort 1.2 + 1x DisplayPort 1.1	3072 x 1920	2560 x 1600	1920 x 1200
4x DisplayPort 1.2 + 2x DisplayPort 1.1	2560 x 1600	1920 x 1200	1920 x 1200

Table 4. *Maximum resolution with x4 PCI Express connection*

Number of active DisplayPort interfaces	Color depth in bits per pixel at 60 Hz		
	18 bpp	24 bpp	30 bpp
1x DisplayPort 1.2	4096 x 2560	4096 x 2560	3840 x 2400
2x DisplayPort 1.2	3072 x 1920	2560 x 1600	2560 x 1600
3x DisplayPort 1.2	2560 x 1600	1920 x 1200	1920 x 1200
4x DisplayPort 1.2	1920 x 1200	1920 x 1200	1600 x 1200
With optional DisplayPort 1.1a interfaces			
4x DisplayPort 1.2 + 1x DisplayPort 1.1	1920 x 1200	1600 x 1200	1280 x 720
4x DisplayPort 1.2 + 2x DisplayPort 1.1	1920 x 1200	1280 x 720	1280 x 720

2.4.3 Daisy-Chaining Displays with DisplayPort 1.2

DisplayPort 1.2 simplifies display connectivity with multi-streaming technology (MST), enabling daisy-chaining of displays compatible with DisplayPort 1.2 and the use of MST hubs to drive multiple displays via a single DisplayPort connector.

The resolution for each display connected via MST is limited by the maximum pixel rate for a single link. The table below shows the maximum megapixels per second for DisplayPort links using all four DisplayPort lanes.

Table 5. *Maximum pixel rates at 5.4 GHz link rate (DisplayPort 1.2)*

Color depth in bits per pixel	18 bpp	24 bpp	30 bpp
Max. megapixel rate	957 MP/s	718 MP/s	574 MP/s

For example, a single DisplayPort 1.2 link can support two 2560x1600 displays at 60Hz and 30 bpp with one cable, or four displays at 1920x1200. With a color depth of 24 bpp, up to six displays at 1600x1200 are possible.

Keep in mind that the G214 supports a maximum of six independent images and that maxing out the throughput of one DisplayPort interface by connecting multiple displays may require reducing the resolution or color depth of other interfaces.

2.5 AMD Eyefinity Multi-Display Technology

The G214 supports AMD Eyefinity technology, making it possible to address up to six connected displays as a "single large surface", appearing as one very large screen area to the application. For this, the output resolution for all displays must be identical.

For further information on AMD Eyefinity technology and helpful hints for setting up an Eyefinity multi-display system, please refer to the AMD website:

http://www.amd.com/eyefinity

2.6 Other Graphics Interfaces

Many third-party suppliers offer adapters from DisplayPort to other graphics interfaces. The maximum resolution depends on the adapter used. Supported interfaces include:

- HDMI
- Single-link DVI
- Dual-link DVI
- VGA

Up to two passive adapters to DVI-D (single link) or HDMI are supported by the G214. There is no limit to the number of active adapters used.

2.7 PCI Express

The G214 connects to the system's CPU board via a PCI Express 2.1 interface. Depending on the peripheral slot used, a x8 or x4 PCIe connection is established. The supported data rates are up to 500 MB/s per lane, i.e., up to 4 GB/s with a fat pipe connection (see Chapter 2.8 CompactPCI Serial for more information on peripheral slot types).

2.8 CompactPCI Serial

The G214 is a CompactPCI Serial peripheral board. It uses one or two x4 PCI Express links at the backplane according to the CompactPCI Serial specification (PICMG CPCI-S.0). In standard CompactPCI Serial systems, the PCI Express x8 connection is only available when the board is installed in peripheral slots 1 and 2 (fat pipe). Slots 3 to 8 only allow for a x4 PCIe connection, the technical limitations of which are detailed in Table 4, Maximum resolution with x4 PCI Express connection on page 15. As an option, the G214 is also available with only the P1 connector assembled for cases when more than a x4 PCIe connection is not required or not possible.

For the pin assignment and a detailed description of the signals refer to the CompactPCI Serial specification.

3 Appendix

3.1 Literature and Web Resources

- G214 data sheet with up-to-date information and documentation: www.men.de/products/02G214-.html

3.2 Finding out the Product's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or design revisions of the G214. You can find information on the article number, the design revision and the serial number on a label attached to the board.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 3. *Labels giving the product's article number, revision and serial number*