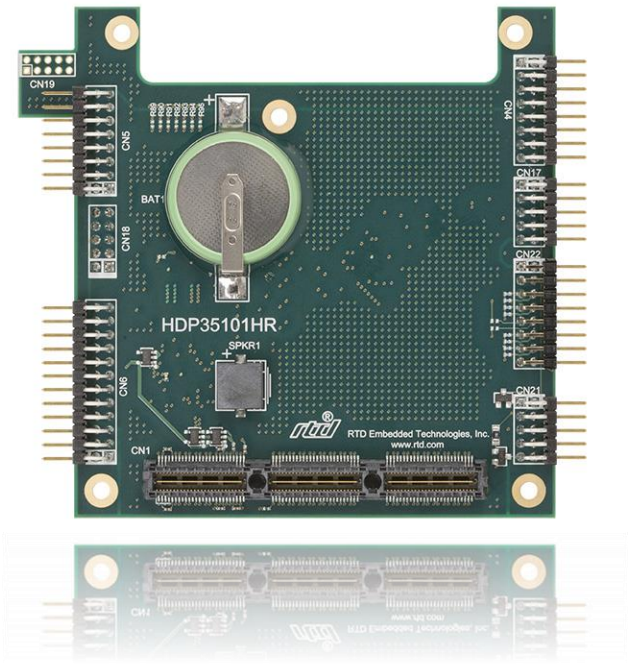
HDP35101HR

PCI Express Utility Board

User's Manual

BDM-610020147 Rev. C



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Revision History

Rev A	Initial Release
Rev B	Section 3.3.1: Correct pin assignments for CN6 and modify descriptions for pins 19, 21, 22, and 23
Rev C	Section 2.1: Added MTBF

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1 Introduction

1.1 Product Overview

The HDP35101HR is a utility module for use with PCIe/104 and PCI/104 Express cpuModules. It provides several convenient functions including LED Drivers, Real Time Clock battery, and Speaker.

1.2 Board Features

- Utility Port Breakout
  - Real Time Clock battery
  - Speaker
  - Connections for external Reset and Soft Power button
- LED Drivers
  - Reproduce CPU LED
  - Additional LEDs controlled from aDIO
- Two USB Ports
  - From on-board hub connected to PCIe/104 bus
- Access to the host cpuModule's VGA connector
  - The input VGA connector from the host cpuModule (selectable by ordering number) is routed across the board to an output VGA connector to permit ease of wiring in RTD enclosed systems

1.3 Ordering Information

The HDP35101HR is available with the following options:

Table 1: Ordering Options

Part Number	Description
HDP35101HR-BT	PCIe/104 Utility Board for stacking above RTD Intel Atom E3800 CPUs with 0.600" stack heights
HDP35101HR-CR	PCIe/104 Utility Board for stacking above RTD Intel Core i7 CPUs with 22mm stack heights
RTD001-HDP35101HR-BT	PCIe/104 Utility Board for stacking above RTD Intel Atom E3800 CPUs with 0.600" stack heights; with zero ohm resistors on aDIO LED drivers
RTD001-HDP35101HR-CR	PCIe/104 Utility Board for stacking above RTD Intel Core i7 CPUs with 22mm stack heights; with zero ohm resistors on aDIO LED drivers

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with your system, please try the steps in the Troubleshooting section of this manual.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
V_{cc12}	12V Supply Voltage		n/a	n/a	V
V_{cc-12}	-12V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled		2,620,499	Hours

2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
P	Power Consumption	V_{cc5} = 5.0V			TBD	W
I_{cc5}	5V Input Supply Current	Active			TBD	mA
LED Drivers						
R_{LED}	LED Current Limit Resistor 0402	CN5-10, CN6-18, CN6-26		1.5K		Ω
R_{LED}	LED Current Limit Resistor 0402	CN5-12, CN6-20, CN6-28		1.3K		Ω
R_{LED}	LED Current Limit Resistor 0402	CN5-14, CN6-22, CN6-30		820		Ω
R_{LED}	LED Current Limit Resistor 0402	CN5-16, CN6-18, CN6-24, CN6-32		732		Ω
Iol	LED Sink Current	CN5-10, CN6-18, CN6-26			6	mA
Iol	LED Sink Current	CN5-12, CN6-20, CN6-28			7	mA
Iol	LED Sink Current	CN5-14, CN6-22, CN6-30			9	mA
Iol	LED Sink Current	CN5-16, CN6-18, CN6-24, CN6-32			9	mA
RTD001 version aDIO LED Drivers with zero ohm resistors						
Iol	LED Sink Current	CN6-18, CN6-20, CN6-22, CN6-24, CN6-26, CN6-28, CN6-30, CN6-32			220	mA
Voh	LED Open-drain pull-up Voltage				50	VDC
PCIe Bus						
	Differential Output Voltage			0.8	1.2	V
	DC Differential TX Impedance			95.2	116.9	Ω
	Differential Input Voltage			0.175	3.3	V
	DC Differential RX Impedance			92.7	115.8	Ω
	Electrical Idle Detect Threshold			61	173	mV
USB Ports						
V_{PORT}	Port voltage output		4.75		5.25	V
I_{PORT}	Current Limit per port		0.9		2.0	A

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

STEP model is available upon request; contact RTD Tech Support for more information.

- Weight: Approximately 64 g (0.14 lbs.)
- Dimensions: 100.79 mm L x 95.89 mm W (3.968 in L x 3.775 in W)

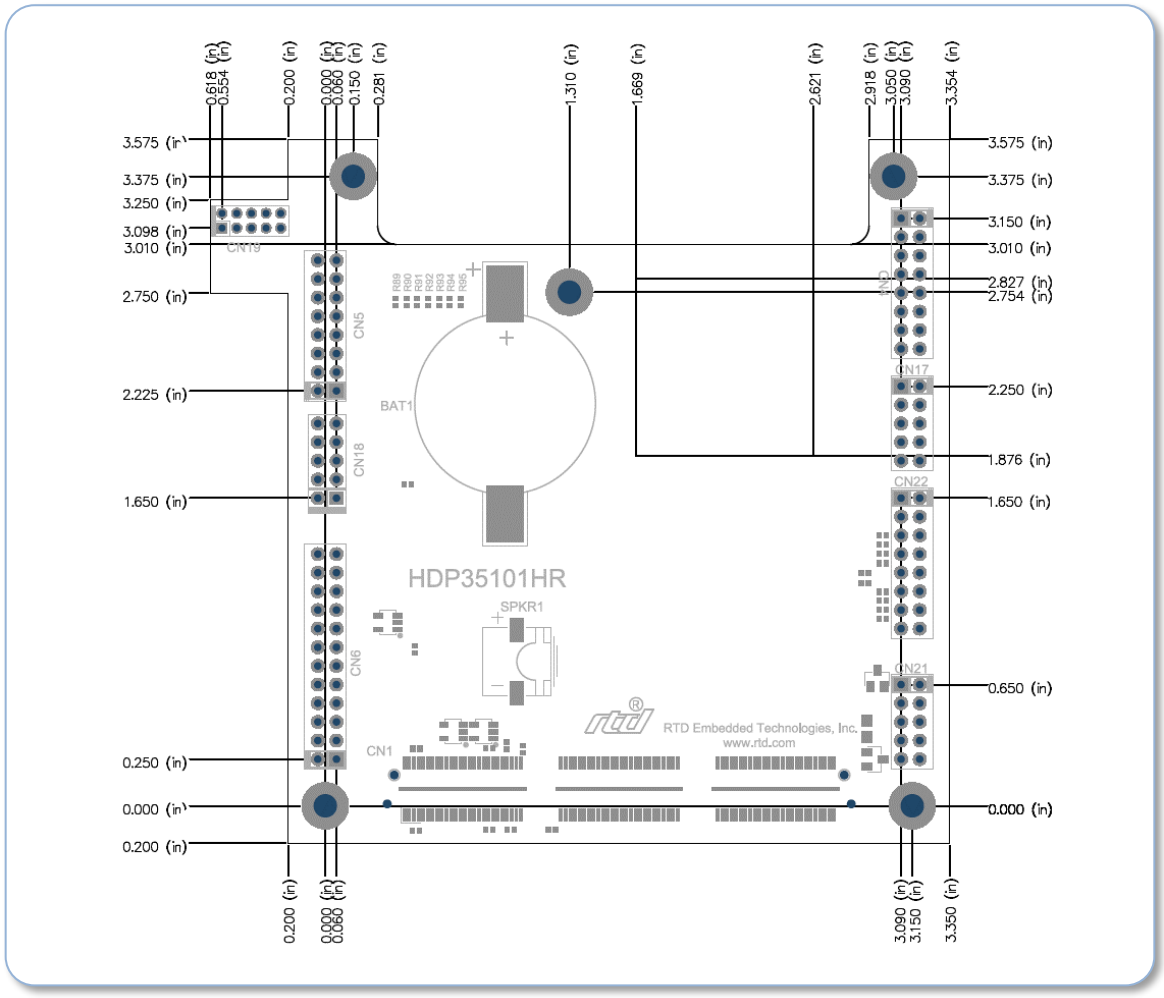

Figure 1: Board Dimensions

3.3 Connectors and Jumpers

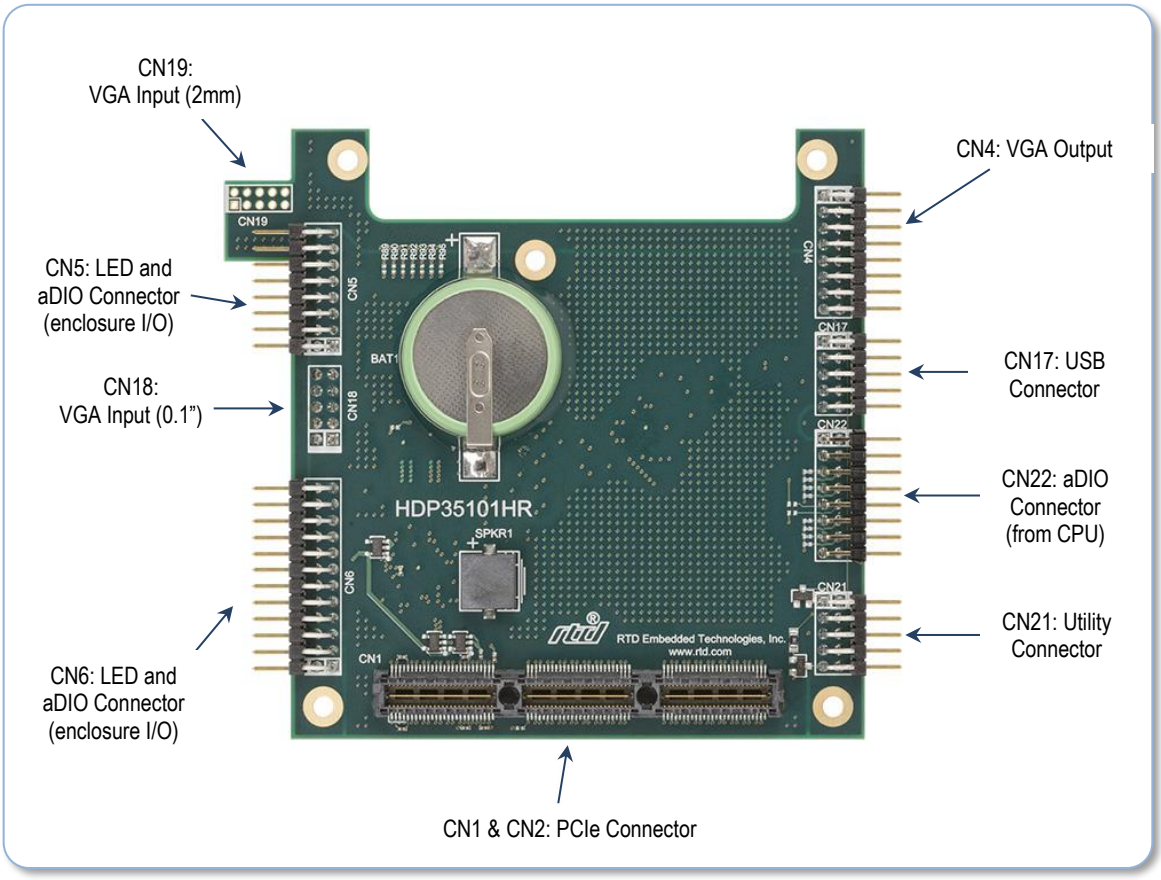

Figure 2: Board Connections

3.3.1 EXTERNAL I/O CONNECTORS

CN5 & CN6: LED and aDIO Connectors

These connectors provide the LED drivers, aDIO signals, and Utility Port signals. The pin assignments are below.

Table 4: CN5 Pin Assignments

Pin	Description	Type	Series Resistor	Source
1	GND			
2	aDIO 5V	Direct Connection		CN22.16 (aDIO +5V)
3	aDIO_P0_0	Direct Connection		CN22.1 (aDIO P0.0)
4	aDIO_P0_1	Direct Connection		CN22.2 (aDIO P0.1)
5	aDIO_P0_2	Direct Connection		CN22.3 (aDIO P0.2)
6	aDIO_P0_3	Direct Connection		CN22.4 (aDIO P0.3)
7	CPU Status LED Anode (+5V)			+5V Always
8	CPU Status LED Green Cathode	Open-Drain LED Driver	1.5k	CN21 (CPU)
9	CPU Status LED Anode (+5V)			+5V Always
10	CPU Status LED Blue Cathode	Open-Drain LED Driver	1.3k	CN21 (CPU)
11	CPU Status LED Anode (+5V)			+5V Always
12	CPU Status LED Red Cathode	Open-Drain LED Driver	820	CN21 (CPU)
13	CPU LAN 1 Link/Act LED Anode (+5V)			+5V Always
14	CPU LAN 1 Link/Act LED Cathode (Green)	Open-Drain LED Driver	732	CN21 (CPU)
15	CPU LAN 2 Link/Act LED Anode (+5V)			+5V Always
16	CPU LAN 2 Link/Act LED Cathode (Green)	Open-Drain LED Driver	732	CN21 (CPU)

Table 5: CN6 Pin Assignments

Pin	Description	Type	Series Resistor	Source
1	User LED 1 Anode (+5V)			+5V Always
2	User LED 1 Green Cathode	Open-Drain LED Driver	1.5k *	aDIO P0-4
3	User LED 1 Anode (+5V)			+5V Always
4	User LED 1 Blue Cathode	Open-Drain LED Driver	1.3k *	aDIO P0-5
5	User LED 1 Anode (+5V)			+5V Always
6	User LED 1 Red Cathode	Open-Drain LED Driver	820 *	aDIO P0-6
7	User LED A Anode (+5V)			+5V Always
8	User LED A Cathode (Green)	Open-Drain LED Driver	732 *	aDIO P0-7
9	User LED 2 Anode (+5V)			+5V Always
10	User LED 2 Green Cathode	Open-Drain LED Driver	1.5k *	aDIO P1-0
11	User LED 2 Anode (+5V)			+5V Always
12	User LED 2 Blue Cathode	Open-Drain LED Driver	1.3k *	aDIO P1-1
13	User LED 2 Anode (+5V)			+5V Always
14	User LED 2 Red Cathode	Open-Drain LED Driver	820 *	aDIO P1-2
15	User LED B Anode (+5V)			+5V Always
16	User LED B Cathode (Green)	Open-Drain LED Driver	732 *	aDIO P1-3
17	Power LED Anode (+5V)			+5V Always
18	Power LED Cathode (Green)	Open-Drain LED Driver	732 *	GND
19	Utility RTC Battery (3.0V)	Diode-OR		CN21.9, RTC Battery
20	Utility RTC Battery GND			GND
21	Reserved			
22	Ground			GND
23	Utility Soft Power Button	Direct Connection		CN21
24	Utility Soft Power Button GND			GND
*Note: Zero ohm resistor used on RTD001-HDP35101HR				

CN17: USB Connector

This connector provides two USB 2.0 ports. They are sourced from a USB hub that is connected to the PCIe/104 connector.

Table 6: CN17 Pin Assignments

Pin	Description
1	VCC1
2	VCC2
3	DATA1-
4	DATA2-
5	DATA1+
6	DATA2+
7	GND1
8	GND2
9	SHIELD1
10	SHIELD2

CN21: Utility Port Connector

Review the pin assignments below to ensure that they match those of the CPU being connected.

Table 7: CN21 Pin Assignments

Pin	Description	Connector Mapping
1	Speaker Input	n/a
2	5V for Speaker	CN6
3	Utility Reset Button	n/a
4	*Reserved*	
5	Utility Soft Power Button	CN6
6	Not Connected	n/a
7	GND	*Various*
8	Not Connected	n/a
9	Utility RTC Battery	n/a
10	Not Connected	n/a

CN22: aDIO Connector

The signals of CN22 are connected to either CN5 or CN6.

Table 8: CN22 Pin Assignments

Pin	Description	Connector Mapping
1	aDIO P0.0	CN5
2	aDIO P0.1	CN5
3	aDIO P0.2	CN5
4	aDIO P0.3	CN5
5	aDIO P0.4	CN6 (via LED driver)
6	aDIO P0.5	CN6 (via LED driver)
7	aDIO P0.6	CN6 (via LED driver)
8	aDIO P0.7	CN6 (via LED driver)
9	*Not Connected*	
10	*Not Connected*	
11	aDIO P1.0	CN6 (via LED driver)
12	aDIO P1.1	CN6 (via LED driver)
13	aDIO P1.2	CN6 (via LED driver)
14	aDIO P1.3	CN6 (via LED driver)
15	GND	CN5, CN6
16	aDIO 5V	CN5

CN4, CN18, CN19: VGA Connectors

Connector CN4 provides access to the host cpuModule's VGA connection via either input connector CN18 or connector CN19.

Table 9: CN4 Pin Assignments

Pin	Signal	Description	CN4 Direction
1	VSYNC	Vertical Sync	In
2	HSYNC	Horizontal Sync	In
3	DDCSCL	Monitor Communications Clock	In
4	DDCSDA	Monitor Communications Data	Bidirectional
5	PWR	+5 V (may be current limited)	In
6	GND	Ground	-
7	GND	Ground	-
8	RED	Red Analog Output	In
9	GND	Ground	-
10	GREEN	Green Analog Output	In
11	GND	Ground	-
12	BLUE	Blue Analog Output	In
13	GND	Ground	-
14	GND	Ground	-
15	RSVD	*Reserved*	-
16	RSVD	*Reserved*	-

Whether the board has CN18 or CN19 populated depends on the ordering option.

Connector CN18 is a 0.1" pitch connector which stacks above RTD's Intel E3800 cpuModule. Connector CN19 is a 2mm pitch connector which stacks above RTD's Intel Core i7. Resistor options exist on the board to eliminate signal stubs to the unused connector, ensuring that only the source input connector is routed to the output connector, CN4.

Table 10: CN18 & CN19 Pin Assignments

Pin	Signal	Description	CN18 and CN19 Direction	CN4 Direction
1	VSYNC	Vertical Sync	Out	In
2	HSYNC	Horizontal Sync	Out	In
3	DDCSCL	Monitor Communications Clock	Out	In
4	RED	Red Analog Output	Out	In
5	DDCSDA	Monitor Communications Data	Bidirectional	Bidirectional
6	GREEN	Green Analog Output	Out	In
7	PWR	+5 V (may be current limited)	Out	In
8	BLUE	Blue Analog Output	Out	In
9	GND	Ground	-	-
10	GND	Ground	-	-

3.3.2 Bus Connectors

CN1 (Top) & CN2 (Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 18)

The HDP35101HR is a "Universal" board, and can connect to either a Type 1 or Type 2 PCIe/104 connector.

3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

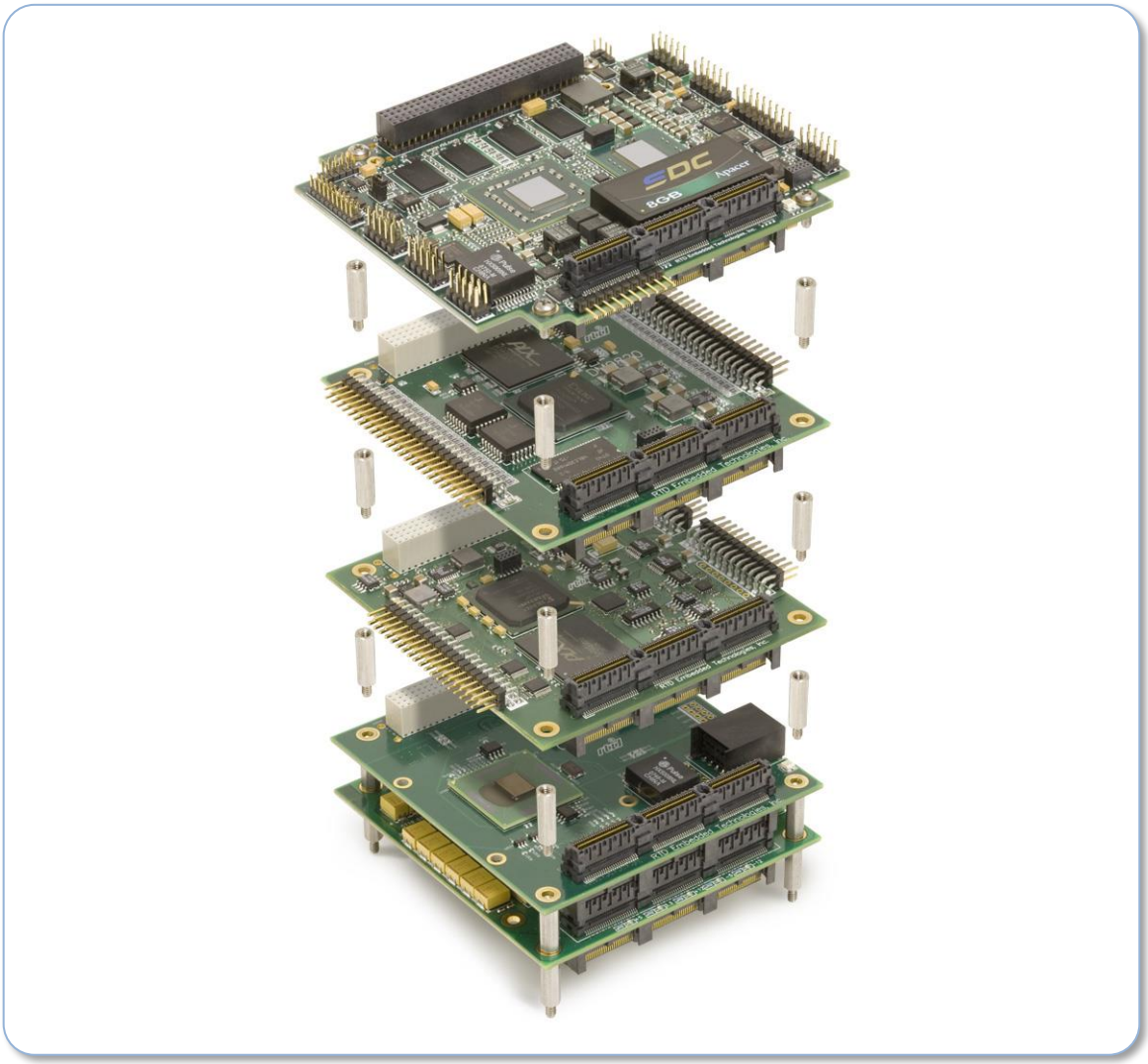

Figure 3: Example 104™ Stack

4 Functional Description

4.1 Block Diagram

The Figure below shows the functional block diagram of the HDP35101HR. The various parts of the block diagram are discussed in the following sections.

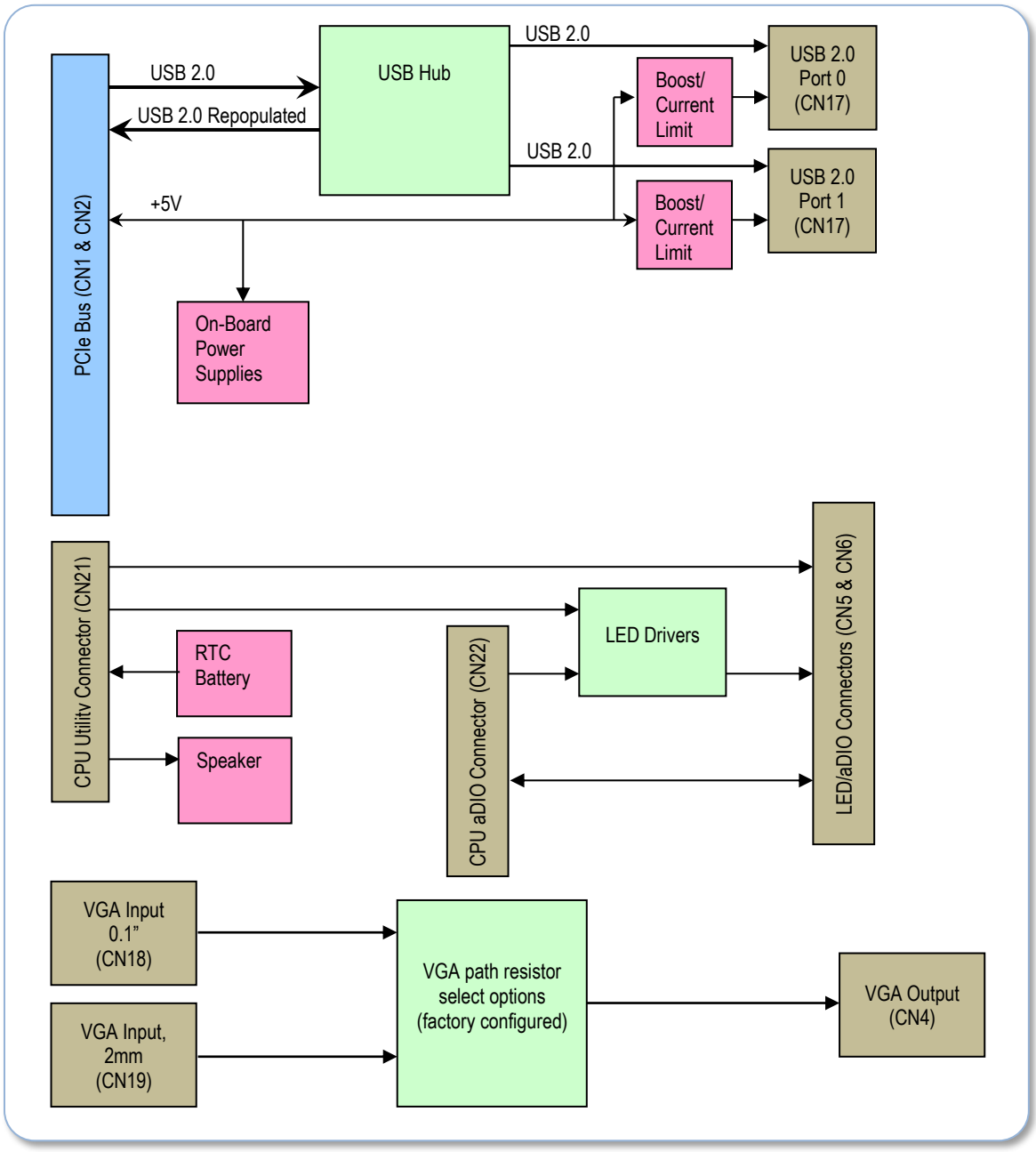

Figure 4: HDP35101HR Block Diagram

4.2 LED Drivers

The LED Drivers provide a low-side switch for the cathode of the LED. Continuous 5V is provided for the anode. The 5V supply is available in standby and soft-off, as well as the active power state. A current limiting resistor is also provided for each LED. The resistors are designed for a Wilbrecht CRM1-RTS0037A Panel Mount RGB LED, or Wilbrecht CRM1-RTS0040A Panel Mount Green LED.

The RTD001-HDP35101HR version use zero ohm resistors for the aDIO LED drivers. They can be used as open-drain current sinks. They can sink 220mA @ 50VDC. If driving inductive loads, like relays, you need to have a diode across the relay coil to prevent damage to the FETs.

5 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

6 Additional Information

6.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

6.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

7 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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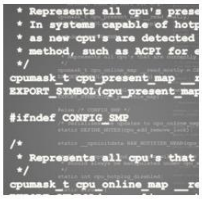

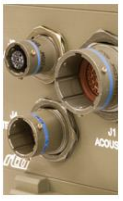
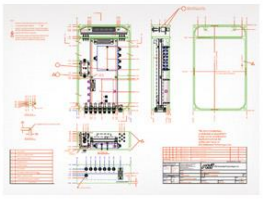

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