CM25101HR

CM35101HR

PCI Express Utility Board

User's Manual

BDM-610020137 Rev. B

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AS9100 and ISO 9001 Certified

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Revision History

Rev A	Initial Release	
Rev B	Added RTD001 version with zero ohm LED resistors, corrected LED current sink specs, fixed some typos.	11/8/2017

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1 Introduction

1.1 Product Overview

The CM25101HR/CM35101HR is a utility module for use with PCIe/104 and PCI/104 Express cpuModules. It provides several convenient functions including LED Drivers, mSATA Slot, 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
- mSATA Carrier
  - Supports Full-Size and Half-Size
- USB UART
  - Provides a full RS-232 Serial Port
- Two USB Ports
  - From on-board hub connected to PCIe/104 bus

1.3 Ordering Information

The CM25101HR/CM35101HR is available with the following options:

Table 1: Ordering Options

Part Number	**For use with legacy Utility Connector (PS/2)**
CM25101HR	PCI/104-Express Utility Board
CM35101HR	PCIe/104 Utility Board
RTD001-CM25101HR	PCI/104-Express Utility Board with zero ohm resistors on aDIO LED drivers
RTD001-CM35101HR	PCIe/104 Utility Board with zero ohm resistors on aDIO LED drivers
Part Number	**For use with Utility Connector 2.0 (USB)**
CM25101HR-2.0	PCI/104-Express Utility Board
CM35101HR-2.0	PCIe/104 Utility Board
RTD001-CM25101HR-2.0	PCI/104-Express Utility Board with zero ohm resistors on aDIO LED drivers
RTD001-CM35101HR-2.0	PCIe/104 Utility Board 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		TBD	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	CN8-10, CN8-18, CN8-26		1.5K		Ω
R_{LED}	LED Current Limit Resistor 0402	CN8-12, CN8-20, CN8-28		1.3K		Ω
R_{LED}	LED Current Limit Resistor 0402	CN8-14, CN8-22, CN8-30		820		Ω
R_{LED}	LED Current Limit Resistor 0402	CN8-16, CN8-18, CN8-24, CN8-32		732		Ω
Iol	LED Sink Current	CN8-10, CN8-18, CN8-26			6	mA
Iol	LED Sink Current	CN8-12, CN8-20, CN8-28			7	mA
Iol	LED Sink Current	CN8-14, CN8-22, CN8-30			9	mA
Iol	LED Sink Current	CN8-16, CN8-18, CN8-24, CN8-32			9	mA
RTD001 version aDIO LED Drivers with zero ohm resistors						
Iol	LED Sink Current	CN8-18, CN8-20, CN8-22, CN8-24, CN8-26, CN8-28, CN8-30, CN8-32			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
Serial Transceivers						
V_{IH}	Input High Voltage	RS-232 mode	2.0		+15	V
V_{IL}	Input Low Voltage	RS-232 mode	-15		0.6	V
V_{OH}	Output High Voltage	RS-232 mode	5.0	5.5	7.0	V
V_{OL}	Output Low Voltage	RS-232 mode	-7.0	-5.5	-5.0	V
V_{TH}	Input Differential Threshold	RS-422/485 mode	-200	-125	-50	mV
R_{IN}	Input Resistance	RS-422/485 mode TERM = 0 $-7V \le V_{IN} \le 12V$	96			kΩ
R_{TERM}	Termination Resistance	RS-422/485 mode TERM = 1 $-7V \le V_{IN} \le 12V$	100	120	155	Ω
V_{OD}	Output Differential Voltage	RS-422/485 mode R_L=100Ω (RS-422) R_L=54Ω (RS-485)	 2.0 1.5			 V V
V_{CM}	Driver Common Mode Output Voltage	RS-422/485 mode			3.0	V

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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 55 g (0.12 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

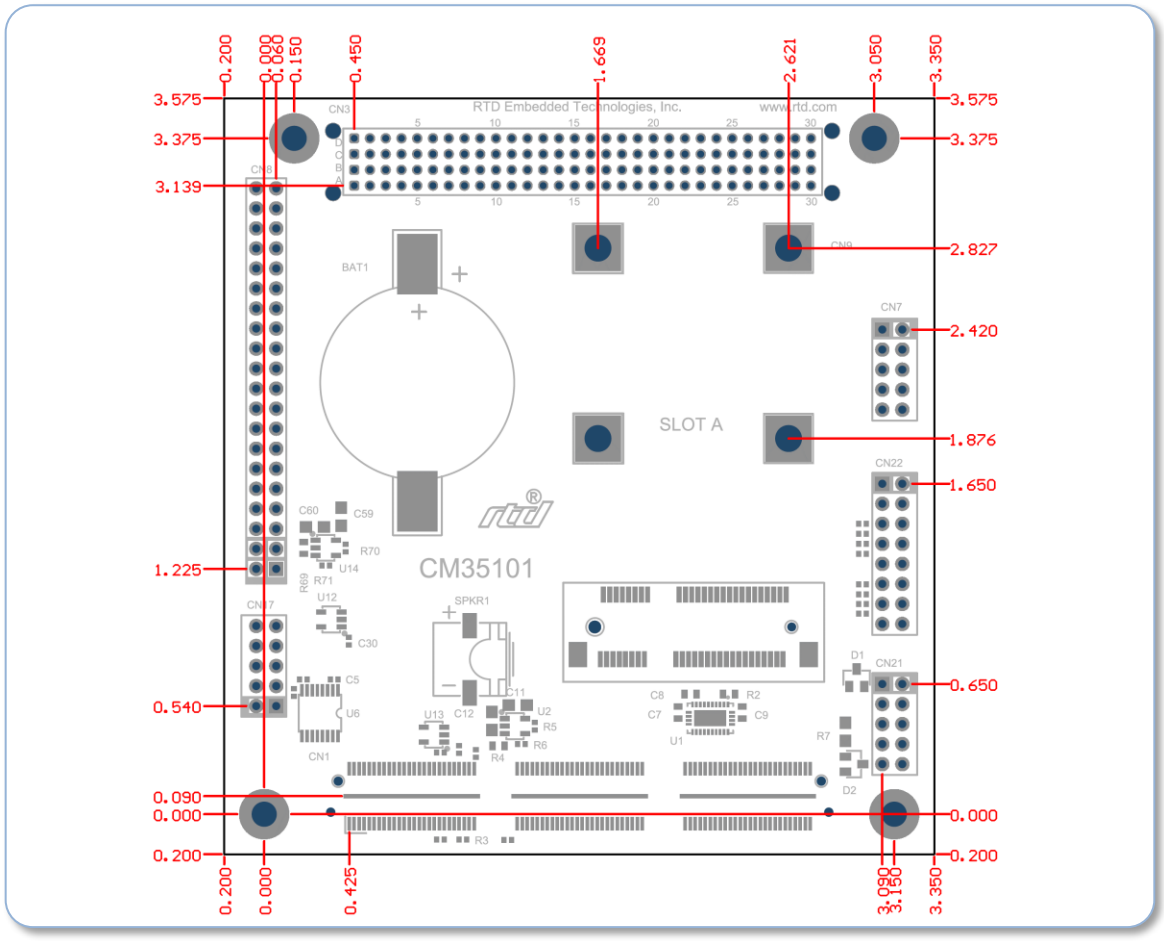

Figure 1: Board Dimensions

3.3 Connectors and Jumpers

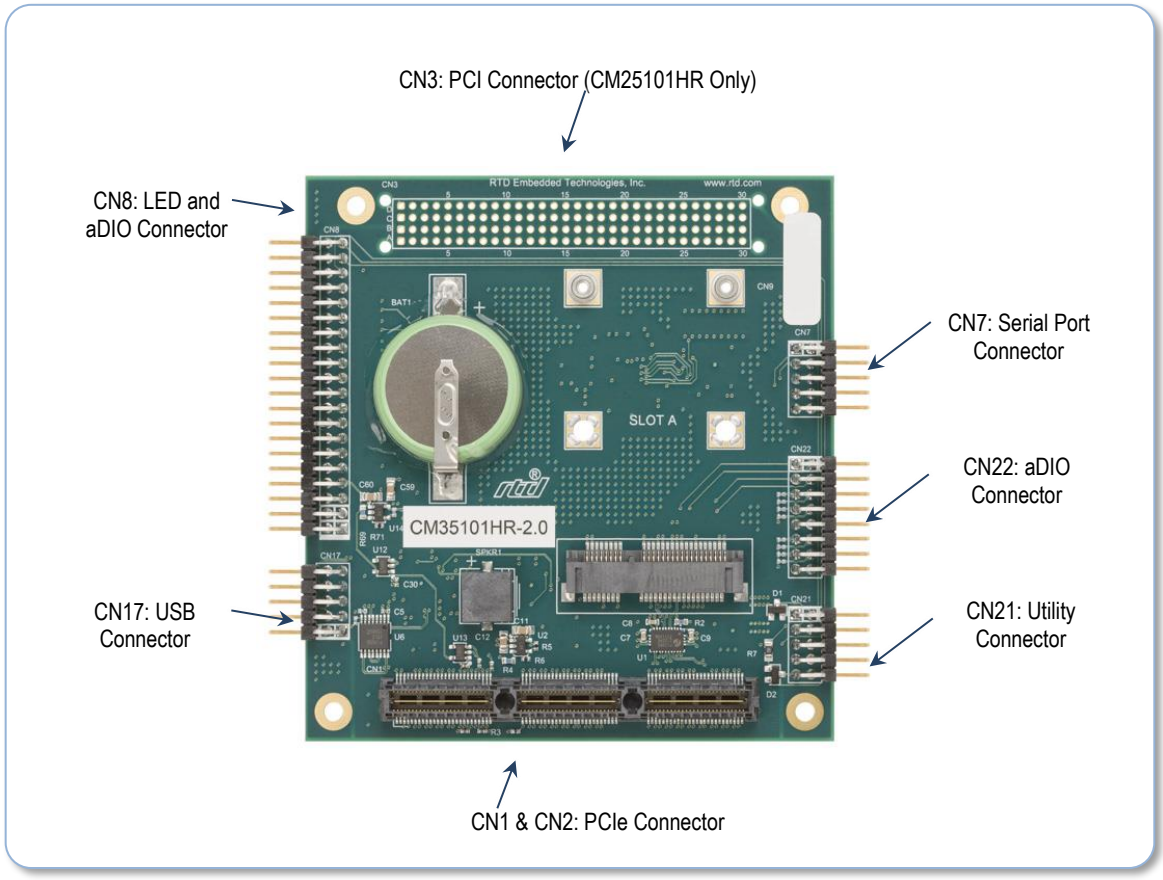

Figure 2: Board Connections

3.3.1 EXTERNAL I/O CONNECTORS

CN8: LED and aDIO Connector

This connector provides the LED drivers, aDIO signals, and Utility Port signals. The pin assignments are below.

Table 4: CN8 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)
17	User LED 1 Anode (+5V)			+5V Always
18	User LED 1 Green Cathode	Open-Drain LED Driver	1.5k *	aDIO P0-4
19	User LED 1 Anode (+5V)			+5V Always
20	User LED 1 Blue Cathode	Open-Drain LED Driver	1.3k *	aDIO P0-5
21	User LED 1 Anode (+5V)			+5V Always
22	User LED 1 Red Cathode	Open-Drain LED Driver	820 *	aDIO P0-6
23	User LED A Anode (+5V)			+5V Always
24	User LED A Cathode (Green)	Open-Drain LED Driver	732 *	aDIO P0-7
25	User LED 2 Anode (+5V)			+5V Always
26	User LED 2 Green Cathode	Open-Drain LED Driver	1.5k *	aDIO P1-0
27	User LED 2 Anode (+5V)			+5V Always
28	User LED 2 Blue Cathode	Open-Drain LED Driver	1.3k *	aDIO P1-1
29	User LED 2 Anode (+5V)			+5V Always
30	User LED 2 Red Cathode	Open-Drain LED Driver	820 *	aDIO P1-2
31	User LED B Anode (+5V)			+5V Always
32	User LED B Cathode (Green)	Open-Drain LED Driver	732 *	aDIO P1-3
33	Power LED Anode (+5V)			+5V Always
34	Power LED Cathode (Green)	Open-Drain LED Driver	732 *	GND
35	Utility RTC Battery (3.0V)	Diode-OR		CN21.9
36	Utility RTC Battery GND			GND
37	Utility Reset Button	Direct Connection		CN21.3
38	Utility Reset Button GND			GND
39	Utility Soft Power Button	Direct Connection		
40	Utility Soft Power Button GND			GND
*Note: Zero ohm resistor used on RTD001-CM35101HR and RTD001-CM25101HR				

CN21: Utility Port Connector

There are two versions of the Utility Port Connector pin assignments, depending on the part number ordered. Be sure that the pin assignments of match the CPU that is connected.

Table 5: CN21 Pin Assignments

Pin	Description
1	Speaker Input
2	5V for Speaker
3	Utility Reset Button
4	Utility Soft Power Button (CM25101HR/CM35101HR Only)
5	Utility Soft Power Button (CM25101HR/CM35101HR-2.0 Only)
6	Not Connected
7	GND
8	Not Connected
9	Utility RTC Battery
10	Not Connected

CN22: aDIO Connector

All of the signals from CN22 are connected to CN8. Refer to Table 4 above.

Table 6: CN22 Pin Assignments

Pin	Description
1	aDIO P0.0
2	aDIO P0.1
3	aDIO P0.2
4	aDIO P0.3
5	aDIO P0.4
6	aDIO P0.5
7	aDIO P0.6
8	aDIO P0.7
9	Not Connected
10	Not Connected
11	aDIO P1.0
12	aDIO P1.1
13	aDIO P1.2
14	aDIO P1.3
15	GND
16	aDIO 5V

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 7: 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

CN7: RS-232 Serial Port Connector

This connector provides a single RS-232 Serial Port. It is sourced from a USB UART.

Table 8: CN7 Pin Assignments

Pin	Description
1	DCD
2	DSR
3	RXD
4	RTS
5	TXD
6	CTS
7	DTR
8	RI
9	GND
10	GND

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 19)

The CM25101HR/CM35101HR is a "Universal" board, and can connect to either a Type 1 or Type 2 PCIe/104 connector.

CN3: PCI Connector

The PCI connector is the connection to PCI peripheral modules. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

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.

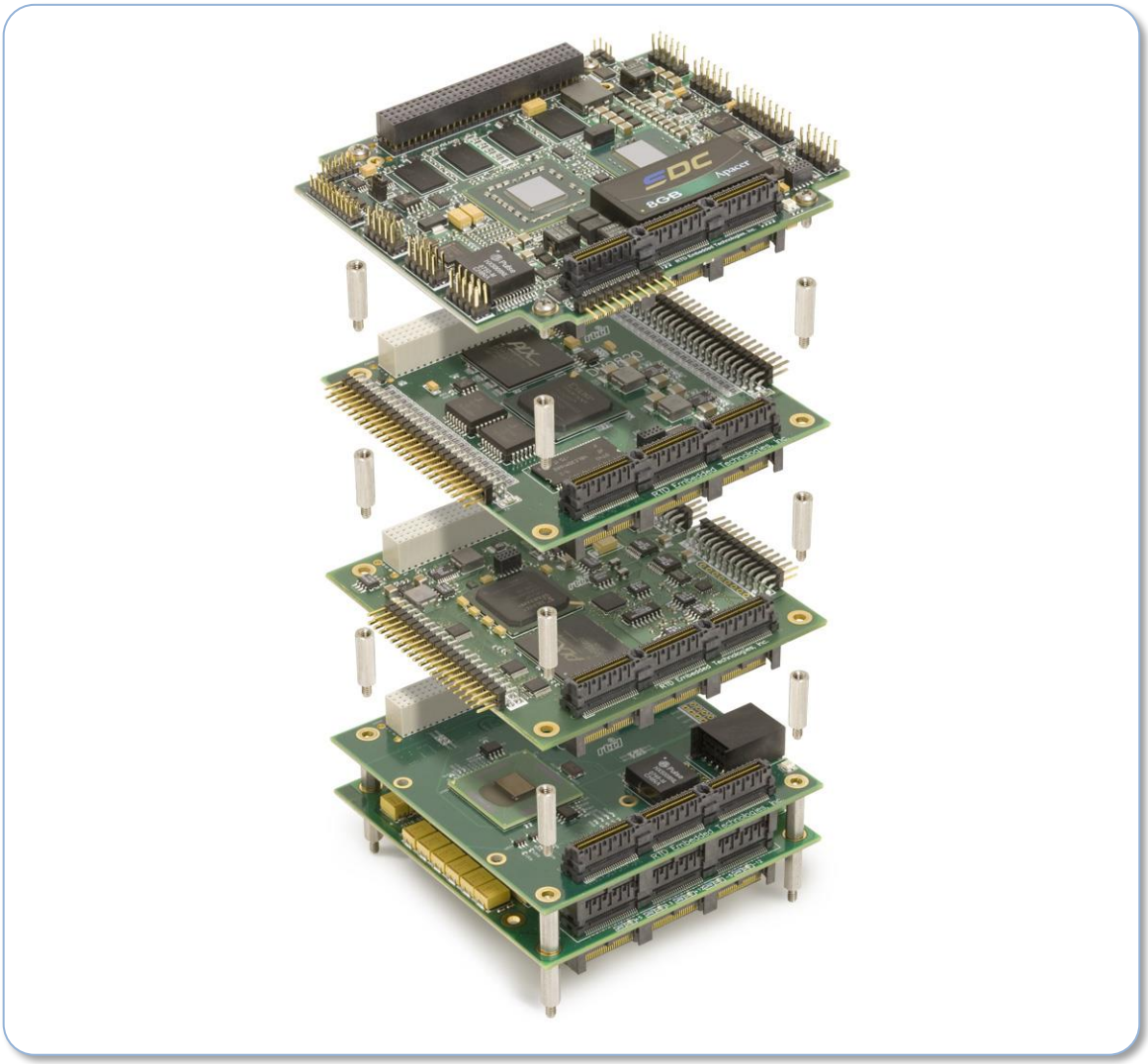

Figure 3: Example 104™ Stack

4 Functional Description

4.1 Block Diagram

The Figure below shows the functional block diagram of the CM25101HR/CM35101HR. The various parts of the block diagram are discussed in the following sections.

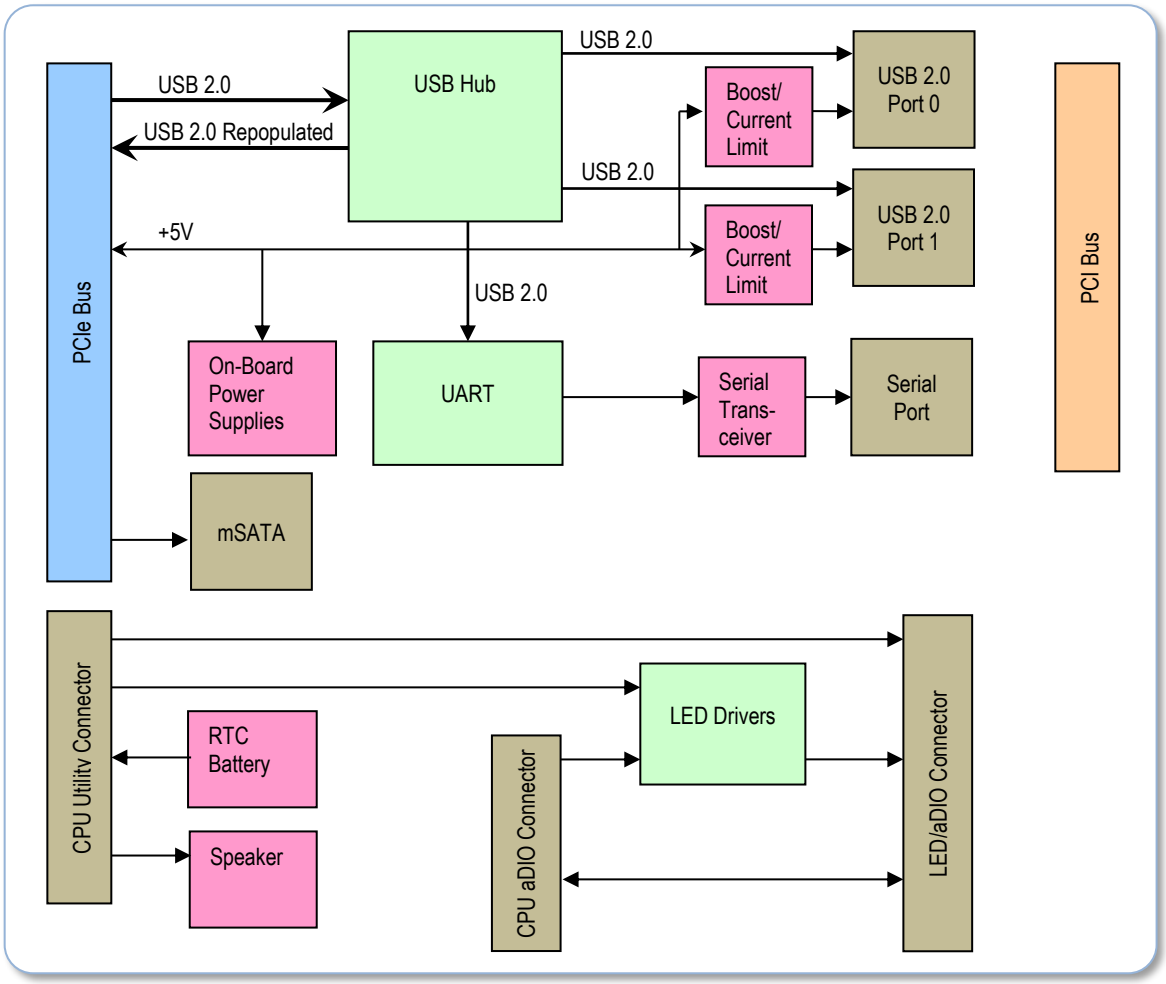

Figure 4: CM25101HR/CM35101HR Block Diagram

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-CM35101HR and RTD001-CM25101HR versions 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.

4.3 Serial Port

A single RS-232 serial port is provided with an FTDI FT232HL USB USART. Virtual COM Port (VCP) Drivers for this device are available from FTDI's website, http://www.ftdichip.com .

4.4 mSATA Slot

The mSATA allows for a rugged-mounted mass storage solution. It utilizes one of the SATA links provided by the CPU on the PCIe Connector.

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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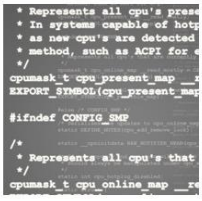

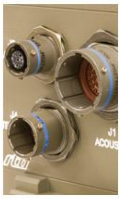
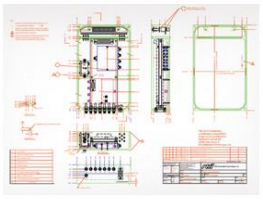

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