The Open IP ODM

Silicom Ltd.
Connectivity Solutions

Rangeley Communications Collateral Value Engineered (RCC-VE) Platform

User Manual

Revision: 1.00

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Revision History

Date	Revision	Section	Remarks
08/28/2014	1.00		- Initial Draft

Table of Contents

1 RANGELEY COMMUNICATIONS COLLATERAL – VALUED ENGINEERED (RRC-VE) PLATFORM DESCRIPTION

1.1 Overview

The RCC-VE platform is based on the Intel Intel Atom™ C2000 processor (previously referred to as Rangeley/Avoton) . The C2000 is a multi-core (up to 4 for RCC-VE) Intel Atom based SOC product featuring high levels of I/O integration and an Intel QuickAssist hardware acceleration engine. The C2000 is targeted for the routers and security communications market segment. The RCC-VE platform demonstrates a low cost implementation of a C2000 in an embedded, lower power, and small form factor solution. The RCC-VE block diagram is shown in Figure 1.

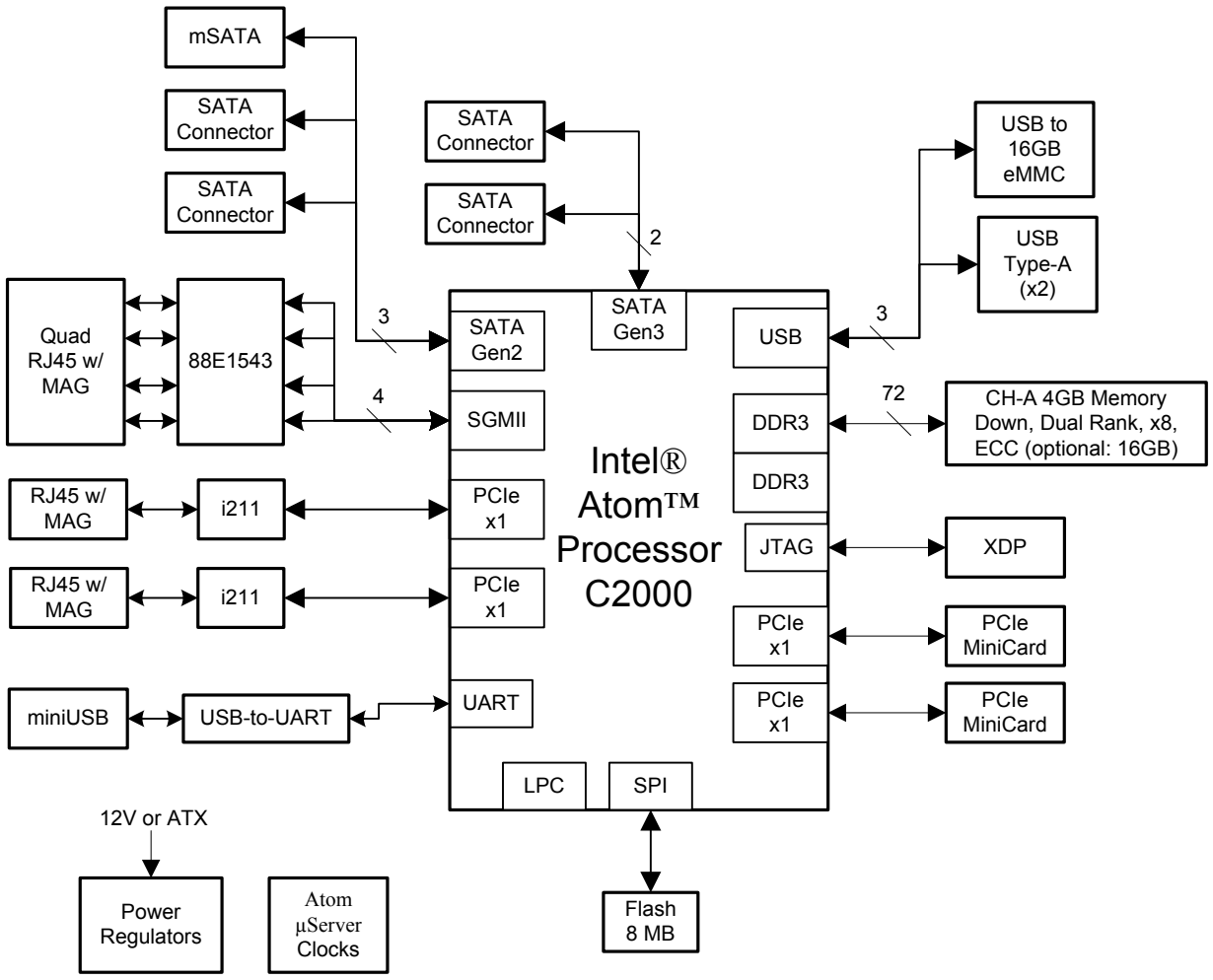


Figure 1 – RCC-VE Block Diagram

1.2 Feature Summary

Feature	Description
Board Form Factor	Mini-ITX (6.7" X 6.7")
Processor	Intel Atom™ C2000. Supported SKU's C2558, C2538, C2518, C2358, C2338, C2350, C2530, C2550
Memory	Dev kits have 4GB of DDR3L Memory Down, 1600MT/s, ECC. OEM build options for 2GB, 4GB, 8GB and 16GB with or without ECC.
PCIe	Two PCIe Mini Slots. One slot supports a SIM card.
Ethernet	Dev kits have six 10/100/1000Mbps RJ45. OEM build options for 1, 2, 4 , 5 or 6x Gb Ethernet ports.
SATA Support	One mSATA Gen2 port Two internal SATA Gen3 port Three internal SATA Gen2 ports
USB	Two USB 2.0 Host (Type-A) One USB 2.0 host on 0.1" header
On-board Storage	Dev kis have 16GB eMMC (USB). OEM build options for 4, 8, 16 or 32GB 8MB SPI FLASH (Boot device)
Console	Mini USB (USB-to-UART Bridge)
Debug	XDP Connector
Misc	4-wire fan controller with temperature monitor on boards with 4 core 1.7 GHz or higher CPUs (2 core CPUs and 4 core 1.25 GHz CPU are fanless) Optional CR2032 RTC backup battery
Enclosure	6 ⅞" x 7" x 1 ½"
Power Supply	40W 100-240VAC to 12V DC
Ambient Operating Temperature Range (Fanless)	Temperature is 0°C to 45°C ambient outside enclosure (CPU SKU C2558) Temperature is 0°C to 70°C ambient outside enclosure (all other CPU SKUs) Higher temperature operation may be achieved with fan cooling, when needed

1.3 Enclosure Reference

Figures 2 and 3 show Silicom's standard desktop enclosure for RCC-VE. This enclosure is anodized aluminum, available in blue, red, and black. Custom OEM branding and labeling is a available in volume. Silicom also has in-process 19" rack mount enclosures that will be available.

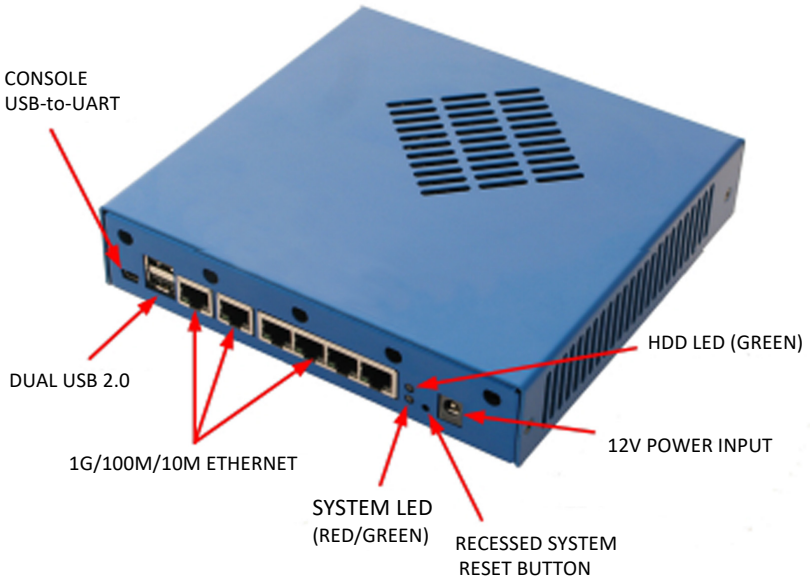


Figure 2 – RCC-VE I/O

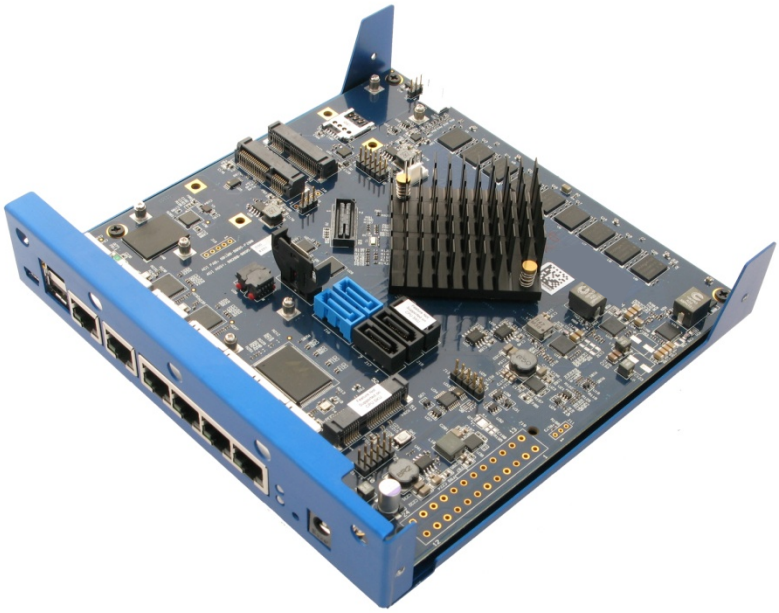


Figure 3 - Inside Enclosure

1.4 Component Layout Reference

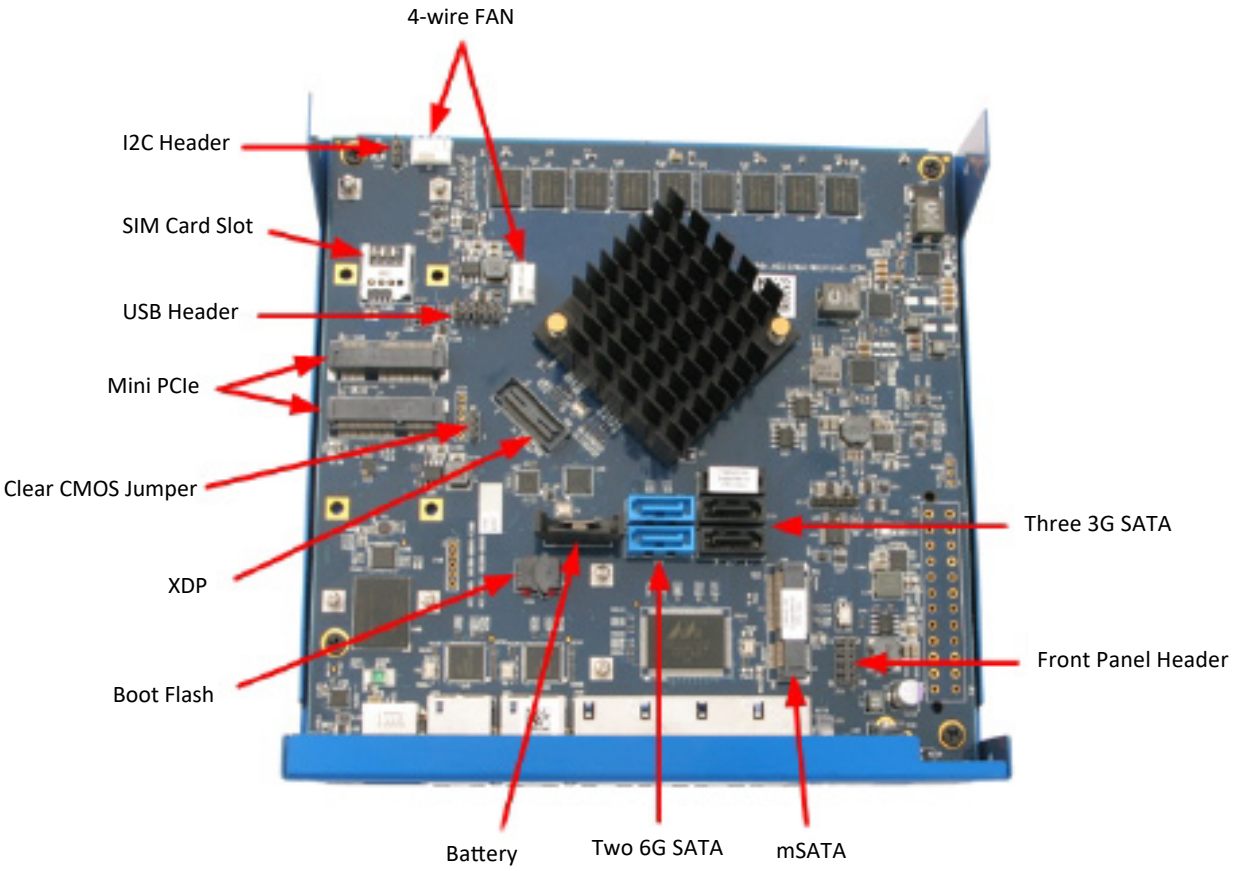


Figure 4 - Component Layout, Internal Connectors

1.5 Component Overview

1.5.1 C2000 Processor

The RCC-VE system supports all 4-core and 2-core C2000 processors, but not 8-core processors. Please refer to the latest Intel documentation on the processor for the SKU features. 8-core CPU support from Silicom is provided by the RCC platform.

1.5.2 Memory

The RCC-VE supports one channel of memory down DDR3 1600MT/s. ADI stock dev kits have a DDR3 configuration of 4GB, dual rank, 1600MT/s, ECC, 1.35V. OEM build options include 2GB 4GB, 8GB, and 16GB. ECC support is also available.

The boot loader determines memory characteristics by reading the SPD EEPROM on the board. The memory channel is routed like a UDIMM and the SPD EEPROM is based on a UDIMM with similar characteristics (Micron MT18KSF51272AZ-1G6).

1.5.3 Ethernet

The RCC-VE supports up to six 1000/100/10Base-T Ethernet ports. Two Ethernet ports are connected to the CPU through Intel i211 PCIe MAC/PHY IC's. Four Ethernet ports are connected to the CPU's on-chip Gb MACs through a Marvell 88E1543 quad SGMII/PHY. RCC-VE is available in OEM quantities with 1, 2, 4, 5, or 6x Gb Ethernet ports. Each RJ45 has built-in LED's with the following configuration.

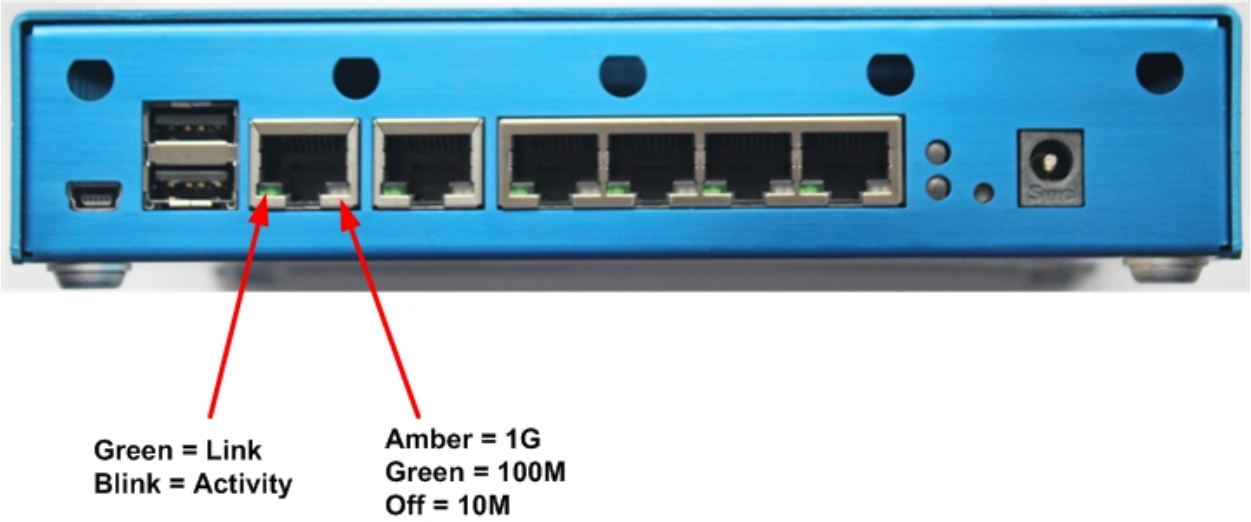
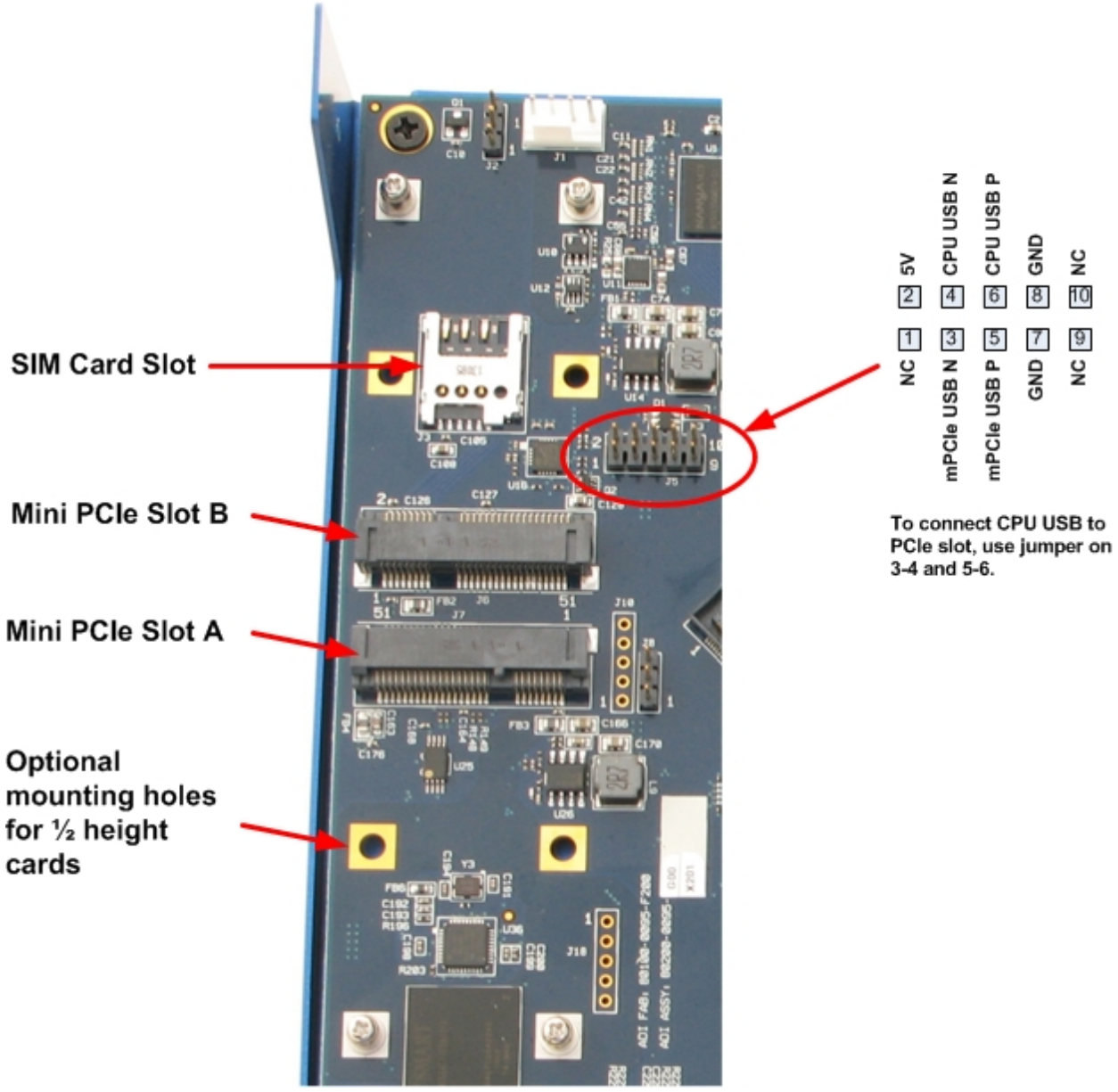


Figure 5 RJ45 LED's

1.5.4 PCI Express Mini Slots

The RCC-VE board has two PCI Express mini slots for expandability. They are called slot 'A' and 'B'. Slot 'B' has support for an on-board SIM card. Each slot has mounting standoff/screws for full-length cards. There are also mounting holes available for half-length cards for OEM builds. Slot 'B' can be connected to a USB port on the CPU by using jumpers on connector J5 as shown in the following picture.



1.5.5 SATA

The RCC-VE can support up to four SATA generation-2 ports (up to 3Gbps) and two SATA generation-3 ports (up to 6Gbps). The number of SATA ports is dependent on the CPU SKU used on the RCC-VE board. The generation-2 ports are divided between an mSATA port and three standard SATA connectors (color black). The generation-3 ports are on two standard SATA connectors (color blue). These connections are shown in Figure 4.

1.5.6 USB

The CPU supports four USB host ports. Two USB 2.0 host ports are located on the front-panel. A third USB port is used for the eMMC flash. The fourth USB port is located on connector J5 and can be connected to the PCI Express mini slot through a jumper.

1.5.7 eMMC Flash

Stock RCC-VE dev kits built by Silicom have a 16GB eMMC flash soldered to the board. eMMC is accessible through a USB-to-MMC controller. OEM build options exist for 4, 8, 16, or 32GB of eMMC.

1.5.8 SPI Flash

A 8MB SPI flash is on the RCC-VE and it contains the CPU descriptor and boot loader. For stock Silicom dev kit units, the SPI flash device is socketed to allow users to update in an external programmer. For OEM production units, SPI flash is soldered directly to the board without a socket.

1.5.9 Console Port

The RCC-VE has console connection on the front panel via a mini-USB connector. The on-board device is a USB-to-UART controller (Silicon Laboratories CP2104). The user will need to install the driver for this device on their host computer to use this console port.

1.5.10 Battery

The RCC-VE has a battery holder for an optional CR2032 coin cell battery to provide RTC backup during power outages.

1.5.11 XDP Connector

Stock RCC-VE dev kit units from Silicom have a standard XDP 60-pin “Mictor” connector for accessing the CPU debug port. This connector is omitted on volume OEM units.

1.5.12 Status LED’s

There are LED’s on the front-panel for SATA activity and for system status. They are shown in Figure 6.

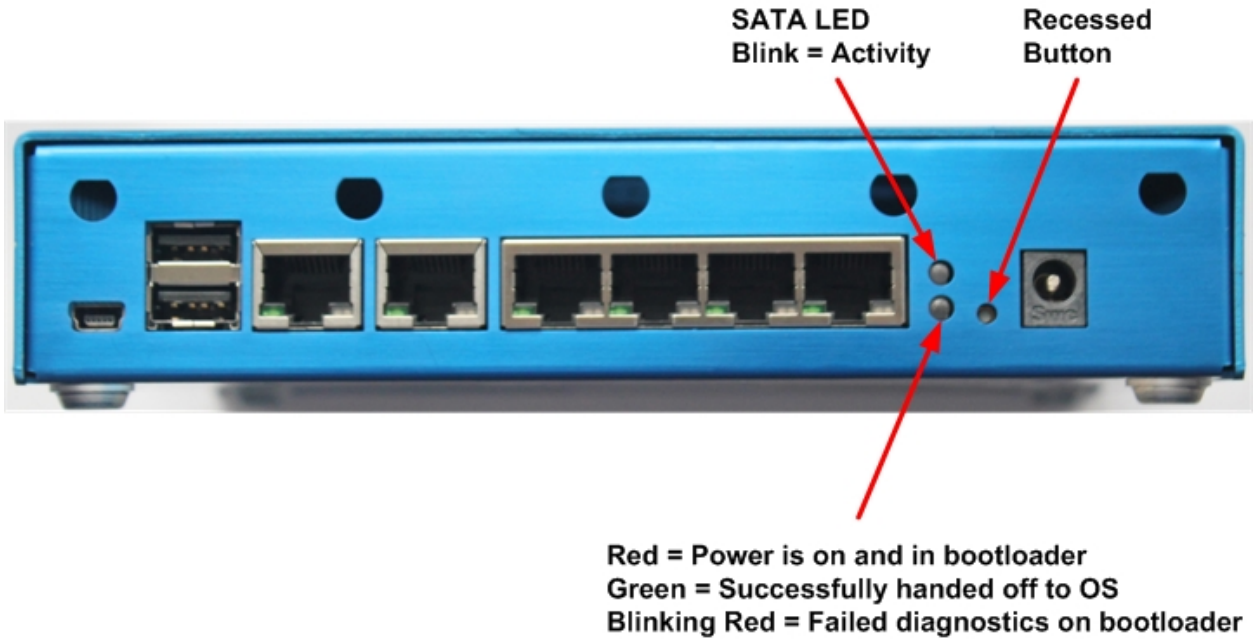


Figure 6 SATA and Status LED

1.5.13 Front-Panel Button

There is a recessed front-panel button that is normally connected to the system reset. The board has a population option to allow this button to be connected to a CPU GPIO. The button is shown in Figure 6.

1.5.14 CMOS Jumper

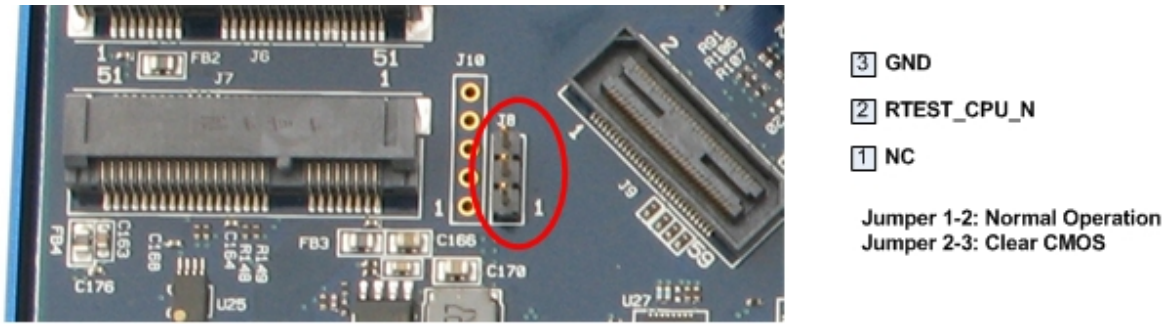
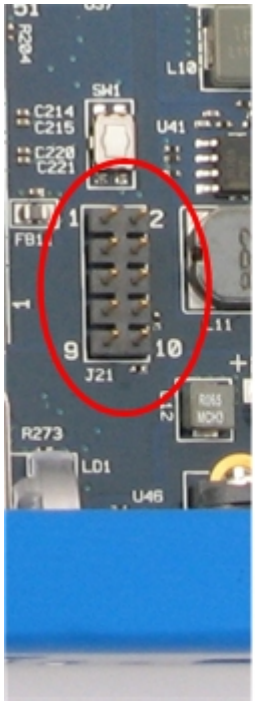


Figure 7 CMOS Jumper

1.5.15 Optional Panel Header

The RCC-VE has a header that can be used to connect common panel connections.



3.3V	1	2	GND
POWER BUTTON	3	4	GND
RESET BUTTON	5	6	GND
SYSTEM LED	7	8	5V Pull-up
SATA LED	9	10	5V Pull-up

Figure 8 Optional Panel Header

1.5.16 Fan Controller

The RCC-VE has an optional fan controller and temperature monitor. The fan controller is a Microchip EMC2104 that can monitor three external temperatures, one internal temperature, and control two 4-wire fans. The temperature sensors and fan connections are shown in Figure 9.

2-core versions of RCC-VE are fanless, so 2-core boards do not have the fan controller populated. Boards built with the 4-core 1.25 GHz 9.5W TDP CPUs are also fanless and do not have the fan controller. Boards with 4-core 2.4 GHz CPUs (C2558) can operate fanlessly up to 45C ambient in the standard RCC-VE enclosure (without peripheral cards installed). If 45C is sufficient, then C2558 based RCC-VE systems can also be fanless, though C2558-based boards have the fan controller chip installed.

When >45C ambient operating temperatures are required with the C2558 CPU, a small amount of airflow (~2-3 CFM) usually will be required. However even then, just a small fan is needed to assist with natural convection. Generally, a small exhaust fan blowing heated air out of the enclosure will be sufficient, and there is no need to use CPU heatsinks with integrated fans or take measures to direct airflow directly across the CPE heatsink.

The standard RCC-VE metal enclosure has provisions for fan cooling, when needed. Contact your Silicom reseller for more information on thermal design and cooling requirements for RCC-VE.

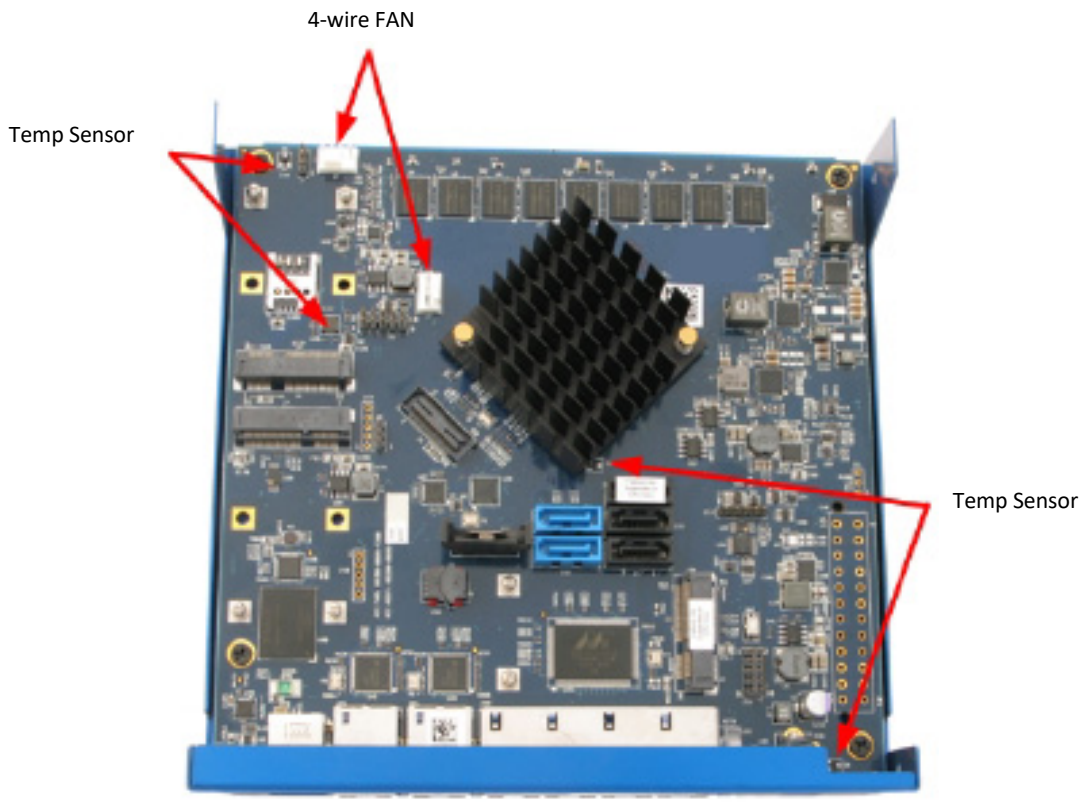


Figure 9 Temperature Sensors and Fan Connectors

1.5.17 SMBus/I2C Connector

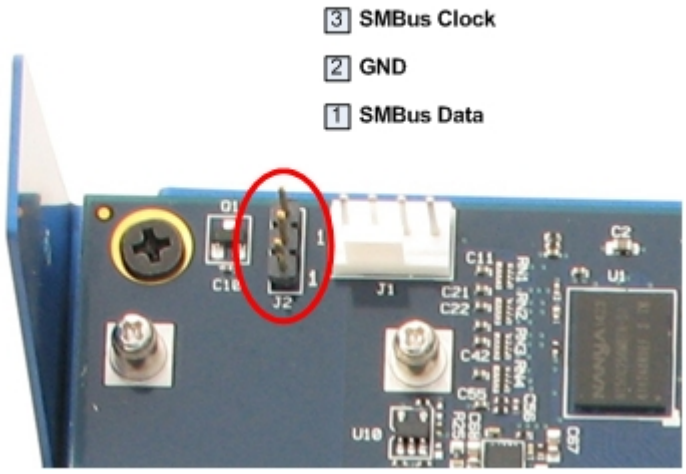


Figure 10 SMBus/I2C Header

2 RCC-VE SETUP AND USE

2.1 Serial Port Drivers

The RCC-VE has a USB-to-UART bridge for the CPU console. The device used is a Silicon Labs CP2104. Before connecting the RCC-VE system, the host computer will need to install drivers for the CP2104. Follow these instructions:

1. Go to the following address:
   http://www.silabs.com/products/interface/usbtouart/Pages/usb-to-uart-bridge.aspx
2. Select **Tools** tab.
3. Select drivers for your OS. For Windows, select **CP210x_VCP_Windows.zip**
4. Download and following instructions for installing driver
5. Use the provided USB Mini-B cable and connect the RCC system console to the host computer
6. Verify that host computer can see two additional serial ports
7. The first serial port added to the host computer will connect to the FPGA management console. The second serial port will connect to the CPU console.

The user will need to use a terminal emulator (i.e. Hyperterminal, PuTTy) to connect to the consoles. The settings for the terminal should be the following:

- Speed = 115,200
- Data Bits = 8
- Parity = None
- Stop Bits = 1
- Flow Control = None
- Preferred emulation mode is ANSI

2.2 Booting preinstalled Linux

The RCC-VE system comes with Linux preinstalled on the on-board eMMC flash.

1. Connect host computer to console using settings described in section 2.1.
2. Connect AC power cable
3. System should boot to Linux login prompt within 60 seconds. Type ***root*** when at command prompt. The default password is ***password***.

2.3 Booting to another device

The RCC-VE comes with Coreboot/FSP/SeaBIOS in the booting SPI Flash. During the booting process, press F12 when requested to select another boot device.

2.4 Updating SPI Flash

There are two methods for updating the SPI flash. They are discussed in the following two sections.

2.4.1 External Programmer

RCC-VE development kit boards feature a socket to hold the boot loader is the SPI flash, allowing it to be removed and optionally programmed in an external device programmer. Standard production versions of RCC-VE omit the SPI flash socket, and the SPI flash device is soldered directly to the board. Refer to Section 2.4.2 to update the SPI flash from Linux.

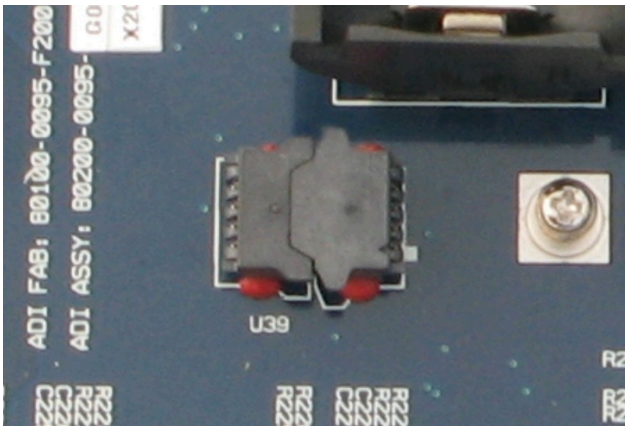


Figure 11 Socketed SPI Flash

The SPI Flash (Winbond W25Q64FV) can be removed from the socket and programmed in an external programmer. The programmer used at Silicom is the following:

- Dediprog SF100 (http://www.dediprog.com/pd/spi-flash-solution/sf100)
- Dediprog SF100 Bottom Board (http://www.dediprog.com/pd/programmer-accessories/SF100-Bottom-Board)
- Dediprog Socket Adapter SPI-127-SOP008-207mil-01AW (http://www.dediprog.com/pd/socket-adaptor/513)

2.4.2 Updating from Linux

A modified version of the utility flashrom (http://flashrom.org/) has been included on the eMMC Linux installation. This version has been updated to work with the Intel C2000 chipset. This utility can update all 8MB of the device. The following command will update the SPI Flash with the file **coreboot.bin.**

./flashrom -p internal:ich_spi_force=yes -c "W25Q64.V" -w coreboot.bin -V -o write_debug.log

It is important **NOT TO POWER CYCLE DURING THIS UPDATE!!!** A power cycle during the update could corrupt the flash and it may only be recoverable by programming the flash with an external programmer.

This update will take a few minutes to complete. At the end of a successful update, the program will report the following:

Erase/write done.
Verifying flash... VERIFIED.

Once the update is complete, power cycle the system.

2.5 Updating CPU EEPROM

The C2000 chipset has an external EEPROM that is used for setting up network parameters and some other default states within in the C2000. Intel occasionally sends out an update for this EEPROM. Below is the procedure for updating this device.

1. Download the latest Intel Network Connection Tools from the Intel Business Portal (IBP) (Document #348742).
2. Copy the Linux_x64\OEM_Mfg files from the downloaded tools to Linux installation.
3. Use the tool **eeupdate64e** to identify the Intel network devices on the system

```
[root@localhost network_tools]# ./eeupdate64e

Using: Intel (R) PRO Network Connections SDK v2.23.8
EEUPDATE v5.23.13.00
Copyright (C) 1995 - 2014 Intel Corporation
Intel (R) Confidential and not for general distribution.

Driverless Mode

Warning: No Adapter Selected

NIC Bus Dev Fun Vendor-Device  Branding string
=== === === === ============= ================================================
  1   0  20  00   8086-1F41    Intel(R) Ethernet Connection I354
  2   0  20  01   8086-1F41    Intel(R) Ethernet Connection I354
  3   0  20  02   8086-1F41    Intel(R) Ethernet Connection I354
  4   0  20  03   8086-1F41    Intel(R) Ethernet Connection I354
  5   3  00  00   8086-1539    Intel(R) I211 Gigabit Network Connection
  6   4  00  00   8086-1539    Intel(R) I211 Gigabit Network Connection
```

4. Identify the first NIC that has the Vendor-Device number of 8086-1F41. This is the internal MAC of the C2000. In the above example, this is NIC 1. The following command will update the EEPROM with the file **Dev_start_Atom_C2000_4port_SGMII_NoMNG_1-08.txt** which is provided by Intel.

```
./eeupdate64e /nic=1 /d= Dev_start_Atom_C2000_4port_SGMII_NoMNG_1-08.txt
```

5. A successful update is shown below.

```
Using: Intel (R) PRO Network Connections SDK v2.23.8
EEUPDATE v5.23.13.00
Copyright (C) 1995 - 2014 Intel Corporation
Intel (R) Confidential and not for general distribution.

Driverless Mode


NIC Bus Dev Fun Vendor-Device  Branding string
=== === === === ============= ================================================
  1   0  20  00   8086-1F41    Intel(R) Ethernet Connection I354
  2   0  20  01   8086-1F41    Intel(R) Ethernet Connection I354
  3   0  20  02   8086-1F41    Intel(R) Ethernet Connection I354
  4   0  20  03   8086-1F41    Intel(R) Ethernet Connection I354
  5   3  00  00   8086-1539    Intel(R) I211 Gigabit Network Connection
  6   4  00  00   8086-1539    Intel(R) I211 Gigabit Network Connection

Warning: EEPROM image file size smaller than EEPROM size
Writing EEPROM.  PLEASE DO NOT INTERRUPT THIS PROCESS.
 1:  EEPROM image (excluding MAC Address) updated successfully.
 1:  Updating Checksum and CRCs...Done.
```

6. Power cycle board.
7. Note that this update only needs to be performed on one NIC in the C2000 as all four share one EEPROM.

2.6 Updating i211 NVRAM

The Intel i211 MAC/PHY has an Integrated Non-Volatile Memory (iNVM) that contains the initial settings for the device. Intel occasionally sends out an update for this EEPROM. Below is the procedure for updating this device.

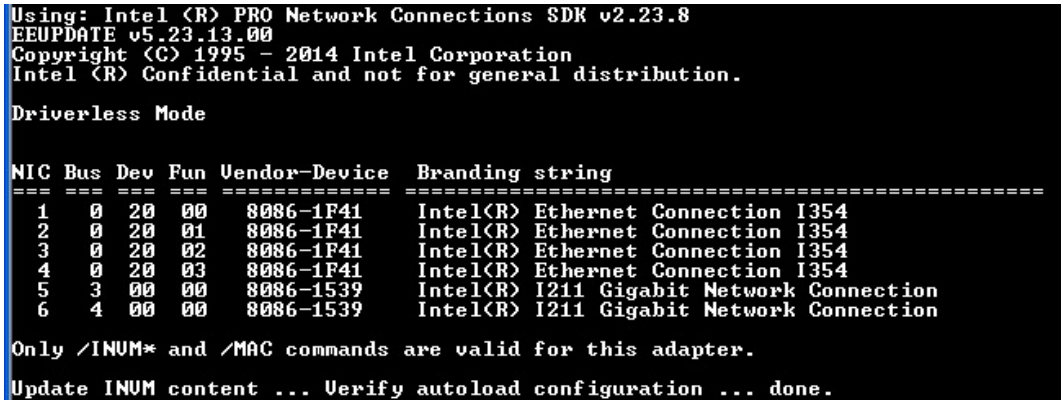
1. Download the latest Intel Network Connection Tools from the Intel Business Portal (IBP) (Document #348742).
2. Copy the Linux_x64\OEM_Mfg files from the downloaded tools to Linux installation.
3. Use the tool **eeupdate64e** to identify the Intel network devices on the system

```
[root@localhost network_tools]# ./eeupdate64e


Using: Intel (R) PRO Network Connections SDK v2.23.8
EEUPDATE v5.23.13.00
Copyright (C) 1995 - 2014 Intel Corporation
Intel (R) Confidential and not for general distribution.

Driverless Mode

Warning: No Adapter Selected

NIC Bus Dev Fun Vendor-Device  Branding string
=== === === === ============= ================================================
  1   0  20  00   8086-1F41    Intel(R) Ethernet Connection I354
  2   0  20  01   8086-1F41    Intel(R) Ethernet Connection I354
  3   0  20  02   8086-1F41    Intel(R) Ethernet Connection I354
  4   0  20  03   8086-1F41    Intel(R) Ethernet Connection I354
  5   3  00  00   8086-1539    Intel(R) I211 Gigabit Network Connection
  6   4  00  00   8086-1539    Intel(R) I211 Gigabit Network Connection
```

4. Identify the NIC devices that have the Vendor-Device number of 8086-1539. In the above example, this is NIC 5 and NIC 6. The following command will update the EEPROM with the file **I211_Invm_NoAPM_v0.6.txt** that is provided by Intel.

```
./eeupdate64e /nic=5 /invmupdate /file= I211_Invm_NoAPM_v0.6.txt
```

5. A successful update is shown below.



6. Repeat the above steps for the NIC 6.
7. Power cycle board.

3 SUPPORT

Support related to the RCC-VE system (i.e. Hardware, Firmware, etc.) will be provided by your Silicom reseller that provided your system. Additionally, RCC-VE development kits come with a standard support package that includes free technical support (up to 3 hours) from Silicom's tech support team.

Some customers may need extra support to handle hardware or software development tasks such as system-level design issues when integrating an Silicom product into a larger system (thermal, regulatory, mechanical, etc.), software porting, debug or testing efforts, or design customization. Customers may also require design review or consulting services to quickly ramp up their engineering and manufacturing teams. For these customers Silicom offers a variety of extended support packages to meet their specific requirements.

Support Package	Key Features	ADI Part Number
Standard Development Kit Support	• 90 day standard kit warranty • Unlimited access to ADI's web-based support site • Phone & Email Support during warranty and support period (3 business day response) • Up to 3 hours of support problem solving during the support period	DKSS
Premium Development Kit Support	• Extends product warranty and support period to 1 year • Unlimited access to Silicom's web-based support site • Phone & Email Support during warranty and support period (1 business day response) • Up to 40 hours of support problem solving and hardware/software engineering assistance during the support period	DKPS-040
Hourly Support Packages	• Up to 8 hours of support problem solving and engineering assistance over 1 year	HSP-008
	• Up to 16 hours of support problem solving and engineering assistance over 1 year	HSP-016
	• Up to 40 hours of support problem solving and engineering assistance over 1 year	HSP-040
	• Up to 100 hours of support problem solving and engineering assistance over 1 year	HSP-100
	• Up to 400 hours of support problem solving and engineering assistance over 1 year	HSP-400
	• Up to 1000 hours of support problem solving and engineering assistance over 1 year	HSP-1000

Table 1 - Silicom Support Plans

For questions related to the Intel CPU silicon, please contact your Intel representative.