aTCA-RN710

Rear Transition Module with 12 SFP+ Service Ports

User's Guide

Manual Revision:	1.00
Revision Date:	November 6, 2013
Part Number:	50-1G030-1000

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Revision History

Version Number	Dates	Description
1.00	6/11/2013	Initial release

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Preface

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1 Introduction

The *aTCA-RN710* is a Rear Transition Module that provides 12 SFP+ service ports. The aTCA-RN710 is designed to be paired with the aTCA-N700 Traffic Management Blade, but it can be paired with any front blade which shares the same Zone 3 specifications.

When an ATCA front blade has high capacity processing capability requiring additional I/O ports through the RTM, the aTCA-RN710 can meet such needs by loading aggregated 120Gbps service ports to the front blade with SFP+ form factors for each port.

This document is intended to provide basic usage guide to customers to use the aTCA-RN710 blade. Shown in Table 1-1 are the selected set of abbreviations that are frequently used throughout the document.

Table 1-1 Glossary

Terms	Description
ATCA	Advanced Telecom Computing Architecture
Blade	A printed circuit board assembly that plugs into a chassis
E-keying	Standard defined by PICMG useful to verify whether the ATCA blade plugged in is compliant to the fabric link capabilities
FRU	Field Replaceable Unit
GPIO	General Purpose Input/Output
Hot-swap	Functions of replacing system components without shutting down the system
IPMB	Intelligent Platform Management Bus
IPMB-L	IPMB Local interface
IPMC	Intelligent Platform Management Controller
IPMI	Intelligent Platform Management Interface
JTAG	Joint Test Action Group
MAC	Media Access Controller
MMC	Module Management Controller
MTBF	Mean Time Between Failure
NPU	Network Processor Unit
OOS	Out Of Service
PHY	Physical Layer
PICMG	PCI Industrial Computer Manufacturers Group
RLDRAM	Reduced Latency Dynamic RAM
RTM	Rear Transition Module
SFI	SFP+ high speed serial electrical interface
SFP	Small Form Pluggable (1G interface)
SFP+	Small Form Pluggable Plus (10G interface)
UART	Universal Asynchronous Receiver-Transmitter

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2 Summary of Specifications

Summarized in Table 2-1 are the specifications of the aTCA-RN710.

Table 2-1 aTCA-RN710 Specifications

Feature	Function	Description
Physical	Dimensions	8U x 6HP x 70mm AdvancedTCA, single slot
	Compliance	PICMG3.0 Rev 3.0
I/O Interface	10Gbps Ethernet	12 × 10G SFP+ ports Each port configurable to 1Gbps SFP.
	10/100/1000BASE-T, Management	N/A
	Serial (UART), Console	N/A
Shelf Management	Blade Operation and Management	Intelligent type with MMC via IPMB-L IPMI v2.0
Backplane Connection	Zone 3	12 SFI lanes for data transport 12V, 3.3V_Sub from front blade
Power	Power consumption	25Watt Max.
Environment	Temperature	+0 to 55 °C (operating), -40 to +85 °C (non-operating)
	Relative Humidity	20 – 80 % (operating), 5-95% (non-operating)
Software	Shelf Management	IPMI v2.0

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3 External Interfaces

The aTCA-RN710 has SFP+ service ports and LED indicators available on the faceplate. The Zone 3 connectors connect to a front blade, for example the aTCA-N700.

3.1 Faceplate Overview

The faceplate of the main blade has the following components:

- LED-OOS: Out Of Service Indicator
- LED-Power Good: Power Good indicator
- LED-Hot Swap: Hot Swap Indicator
- Traffic Service Ports with LEDs: 12 SFP+ Ports



Figure 3-1 aTCA-RN710 Faceplate

3.2 Traffic Service Ports

Up to twelve service ports are provided with SFP+ receptacles. Either a fiber optic cable or a copper cable with a mating SFP+ connector can be used to connect the RTM with remote blades or appliances. The SFP+ ports support IEEE 802.3ae (Clause 52), IEEE 802.3aq (Clause 68). The different port types supported include 10GBASE-SR. Use of SFP modules in place of SFP+ is also possible. The RTM offers auto detection capability to configure the module automatically upon plugging in.

3.3 LEDs and Markers

Various LEDs for system status monitoring are available on the faceplate. Three mandatory LEDs include Power GOOD, OOS, and Hot-Swap per ATCA specifications. Other LEDs include link indication LEDs for service port activities associated with the service ports. Shown in Table 3-1 are the LEDs, their labels and their descriptions.

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Table 3-1 Faceplate LEDs

Name	Marker	Display	Description
HS LED		Blue Solid	DC-DC Power OFF(M1)
		Blue Short Blink	Hot swap Operation(M5/M6)
		Blue Long Blink	Hot swap Operation(M2)
		OFF	Normal Operation(M3/M4)
OOS LED		Red Solid	Out of Service(M1)
		Red Blink	Out of Service or Service Preparation (M5/M6)
		OFF	Normal Operation (M3/M4)
Power GOOD LED		Green Solid	Power GOOD
		OFF	Power Fail
Service Port	E	Green Solid	Enabled
		OFF	Not Enabled
	L/A	Green On	Link Up
		Green Blink	Link Activity
		OFF	Link Down

3.4 Zone 3 Interface

The two Zone 3 connectors are used for the front blade connection. For the data plane interface, Twelve Serdes lanes are routed to the Zone 3 connectors. The twelve Serdes lanes are connected to the front blade. The Serdes lanes are configured for twelve SFP+ 10G ports. Table 3-2 and Table 3-3 show the detailed signal definitions.

Table 3-2 Zone 3 Connector Pin-out: P1

Note*I/O is from the viewpoint of the Front Blade. Unspecified pins are N.C.

Pin No	Signal Name	I/O*	Description
A1~C1, A2~C2	RTM_12V	O	RTM 12V from Front Blade
D1	RTM_MP	O	RTM 3.3V from Front Blade
F1	RTM_INSERT	I	RTM Presence signal to IPMC (to GPIO)
H1	RTM_ENABLE	O	RTM Enable signal driven by IPMC (via GPIO). Implements ENABLE# per AMC.0 Section 3.6.
E2	RTM_SCL	O	IPMB-L from IPMC to RTM MMC
F2	RTM_SDA	O	IPMB-L from IPMC to RTM MMC
C4	IRQ_RTM	I	Interrupt to LMP
H4	RTM_RESET	O	Reset signal from LMP to RTM
A5	*DIAG_EN*	O	DIAG_TEST Enable
G6	LMP_RTM_SCL	O	LMP I2C for RTM
H6	LMP_RTM_SDA	I/O	LMP I2C for RTM

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Table 3-3 Zone 3 Connector Pin-out: P2

Pin No	Signal Name	I/O	Description
A1~H1	RTM_SFP_RX_P/N [0:3]	I	SFP+ ports RX: Port 1~4
A2~H2	RTM_SFP_TX_P/N [0:3]	O	SFP+ ports TX: Port 1~4
A3~H3	RTM_SFP_RX_P/N [4:7]	I	SFP+ ports RX: Port 5~8
A4~H4	RTM_SFP_TX_P/N [4:7]	O	SFP+ ports TX: Port 5~8
A5~H5	RTM_SFP_RX_P/N [8:11]	I	SFP+ ports RX: Port 9~12
A6~H6	RTM_SFP_TX_P/N [8:11]	O	SFP+ ports TX: Port 9~12
A7	RTM_LED_CLK0	O	LED control CLK from switch for the SFP+ ports
B7	RTM_LED_DATA0	O	LED data from switch for the SFP+ ports
C7	RTM_LED_CLK1	O	LED control CLK from switch for the SFP+ ports
D7	RTM_LED_DATA1	O	LED data from switch for the SFP+ ports

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4 Installation and Operation

Before installing the aTCA-RN710, make sure that the following are ready or checked to insure proper installation and operation:

- An ATCA chassis with a reserved slot for the front blade and the aTCA-RN710. Note that any front blade with identical Zone 3 pin assignment can use the aTCA-RN710.
- A console PC that runs a serial port monitoring or terminal emulation program
- Software: All the necessary firmware are programmed into the EEPROM/flash memories upon delivery of the board
- The aTCA-RN710 Users Guide, this document

4.1 Hardware Configuration Setting

For usual operation, users are not recommended to change any on-board hardware configuration setting, but there are some options on the board for those want to investigate more flexibility for testing.

4.1.1 Headers/Jumpers

The J1 Header is used for debugging using a local UART. When front blade monitoring is not available, an extra console may be connected through this header. Refer to Figure 4-1 for connection info. J15 is provided for In System Programming (ISP) for the MMC as shown in Figure 4-2.

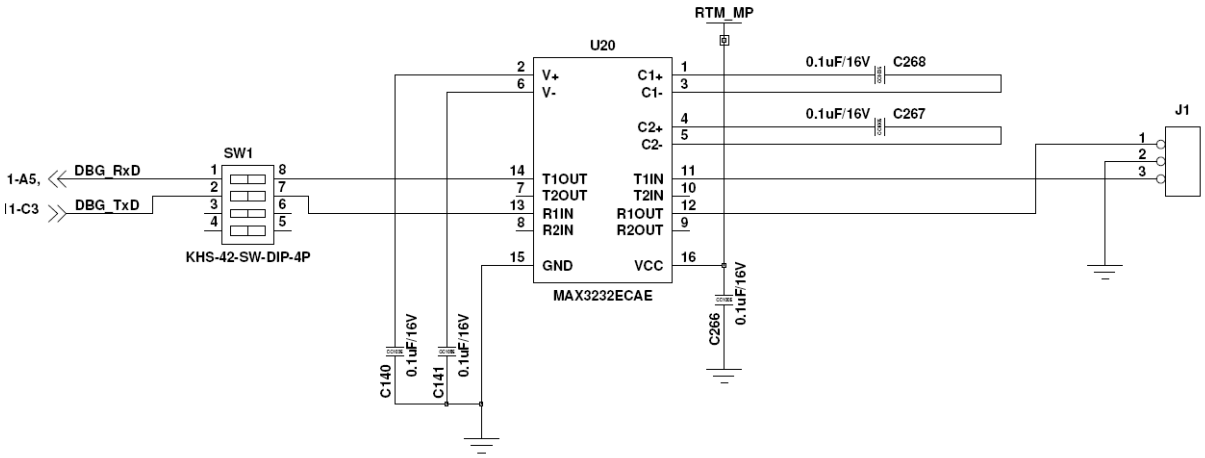


Figure 4-1 Header J1 and Switch SW1

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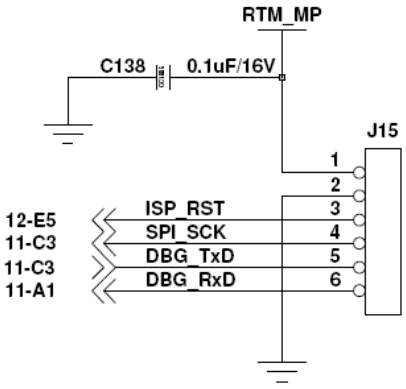


Figure 4-2 Header J15

4.1.2 DIP Switches

SW1 is provided for the MMC to select different I/O connection between the ISP interface and the UART interface during the debugging phase.

- MMC to UART: *Close* pin 1 and pin2.
- MMC to ISP interface: *Open* pin 1 and pin2

4.2 Hardware Installation

The steps required to install the aTCA-RN710 are the following: Front Blade installation, RTM plugging-in, Monitoring Station Connection, and Traffic Port connection.

4.2.1 Front Blade

For front blade installation, refer to the front blade user's manual.

4.2.2 RTM

The board should be plugged in using the following procedures:

Step 1: The injector handles (top and bottom) shown in Figure 4-3 should be opened to plug the board into a chassis slot.
Step 2: The board should be aligned on to the rail, marked as (A), in the slot reserved for the board.

Step 3: Slide the board into the chassis until the guide of the faceplate and the hole of the chassis meet as in (B)

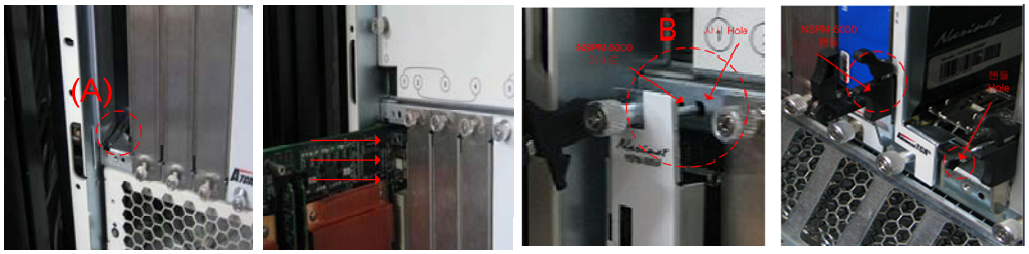
Step 4: Once the guide of the faceplate slides into the hole, close the upper injector handle so that the handle wedge goes into the handle hole and makes a click sound.

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Step 5: When the chassis is powered up and in operation (Hot Swap situation), during board installation the board starts booting up as soon as the handles are fully closed in Step 4.



Figure 4-3 Injector (Bottom side)



1 2 3 4

Figure 4-4 Plugging the Board

Note: After plugging in the board, make sure that the injector handle is locked into the hole on the faceplate. This will activate the hot swap switch and the booting will start.

To pull out the main board, follow the steps described as follows:

Step 1: The bottom side injector handle should be slightly pulled out to the front from the hole without pulling out the board.

Step 2: Once the injector handle is out from the hole, the Hot Swap switch becomes OPEN

Step 3: The Hot Swap LED (or Blue LED) should then start blinking and it will stay ON after several seconds, which indicates the READY status.

Step 4: At the READY status, completely open the top and the bottom handles and pull out the board from the chassis.

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4.2.3 Console/Management PC Connection

The aTCA-RN710 does not have its own faceplate outlet for the console connection. The management of the RTM is only available through the front blade.

4.2.4 Service Port Connection

1G or 10G Ethernet traffic sources should be connected to corresponding SFP or SFP+ ports via matching cable assemblies.

4.3 RTM Status Check at Bootloader

When all the hardware installation is done, one is able to run the commands through the front blade monitoring port. The first software functional module during the bootup procedure is the bootloader on the front blade. The bootloader initializes necessary devices on the front board including the RTM. Shown in Figure 4-5 and Table 4-1 are the devices on the I2C Bus, which are connected to the Front Blade. The P2041 in the figure is the Local Management Processor on the aTCA-N700 front blade, which may be different on a different front blade.

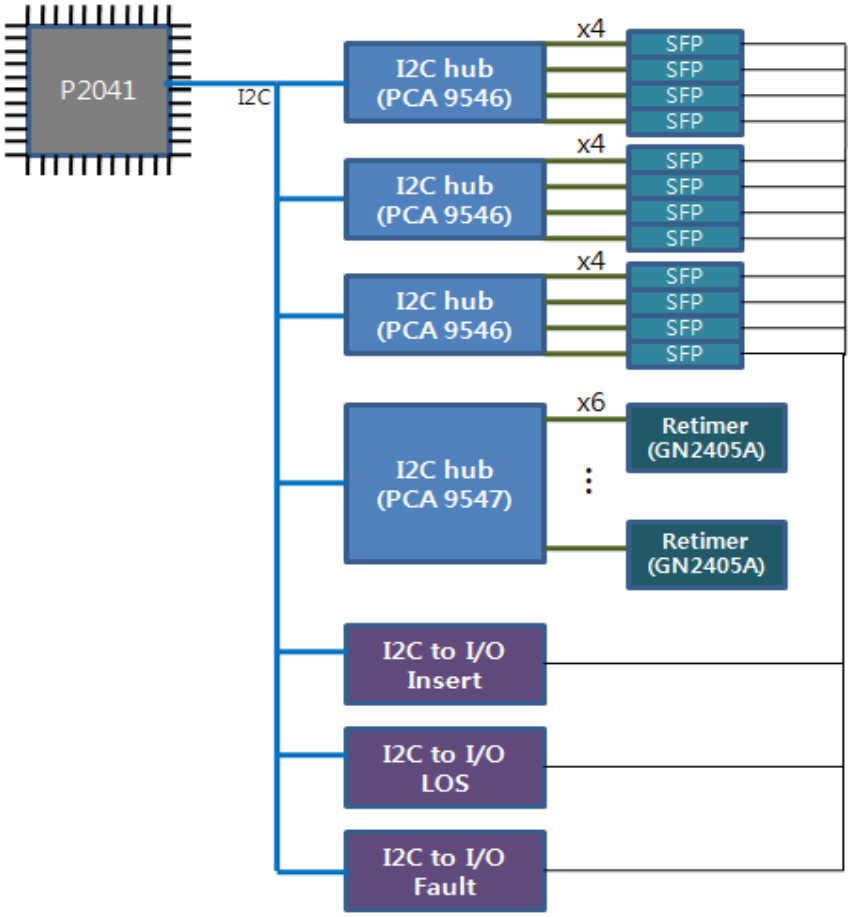


Figure 4-5 RTM devices on I2C Bus

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Table 4-1 I2C Devices

Device	I2C Address	Description
MUX(SFP)_0	0x70	MUX for SFP 0~3
MUX(SFP)_1	0x71	MUX for SFP 4~7
MUX(SFP)_2	0x72	MUX for SFP 8~11
MUX(Retimer)	0x73	MUX for 0~5ch and six retimers
SFP module	0x50 0x51	SFP register access address for info saving SFP register access address for user data saving
Retimer(GN2405)	0x16	MUX setting is required to access.
I2C to I/O(***Insert***)	0x20	Insert interrupt processing device
I2C to I/O(***LOS***)	0x21	LOS(Lost Of Signal) interrupt processing device
I2C to I/O(***Fault***)	0x22	Tx Fault interrupt processing device

The I2C devices are accessible by the Uboot bootloader I2C commands on the front blade, which are described in the following sections.

4.3.1 I2C Mux Access

To check the I2C Mux addresses select I2C bus 1 and check the MUX addresses at the Uboot prompt.

=> i2c dev 1
=> i2c probe

```
=> i2c probe
Valid chip addresses: 00 16 20 21 22 70 71 72 73 7C
```

4.3.2 SFP Module Access

To check the SFP module status enable the corresponding MUX and check SFP eeprom info as the following.

=> i2c dev 1
=> i2c probe

/* Reset MUX(0x70) to 0 and enable and check SFP address */
=> i2c mw 0x70 0x0 0x0; i2c mw 0x71 0x0 0x0; i2c mw 0x72 0x0 0x0
=> i2c mw 0x70 0x0 0x1; i2c probe
=> i2c mw 0x70 0x0 0x2; i2c probe
=> i2c mw 0x70 0x0 0x4; i2c probe
=> i2c mw 0x70 0x0 0x8; i2c probe
=> i2c mw 0x70 0x0 0x0

/* Reset MUX(0x71) to 0 and enable and check SFP address */
=> i2c mw 0x70 0x0 0x0; i2c mw 0x71 0x0 0x0; i2c mw 0x72 0x0 0x0
=> i2c mw 0x71 0x0 0x1; i2c probe
=> i2c mw 0x71 0x0 0x2; i2c probe
=> i2c mw 0x71 0x0 0x4; i2c probe
=> i2c mw 0x71 0x0 0x8; i2c probe
=> i2c mw 0x71 0x0 0x0

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/* Reset MUX(0x72) to 0 and enable and check SFP address */
=> i2c mw 0x70 0x0 0x0; i2c mw 0x71 0x0 0x0; i2c mw 0x72 0x0 0x0
=> i2c mw 0x72 0x0 0x1; i2c probe
=> i2c mw 0x72 0x0 0x2; i2c probe
=> i2c mw 0x72 0x0 0x4; i2c probe
=> i2c mw 0x72 0x0 0x8; i2c probe
=> i2c mw 0x72 0x0 0x0

(*screen capture of the results)

```
=> i2c mw 0x70 0x0 0x1; i2c md 0x50 0x0 0x30
dev: 70 addr: 0 alen: 1 length: 1
chip: 50, addr: 0, alen 1
0000: 03 04 07 00 00 00 01 20 40 0c 05 01 15 00 00 00    ....... @.......
chip: 50, addr: 10, alen 1
0010: 1e 0f 00 00 46 49 4e 49 53 41 52 20 43 4f 52 50    ....FINISAR CORP
chip: 50, addr: 20, alen 1
0020: 2e 20 20 20 00 00 90 65 46 54 4c 46 38 35 31 39    .   ...eFTLF8519
=> i2c mw 0x70 0x0 0x2; i2c md 0x50 0x0 0x30
dev: 70 addr: 0 alen: 1 length: 1
chip: 50, addr: 0, alen 1
0000: 03 04 07 00 00 00 01 20 40 0c 05 01 15 00 00 00    ....... @.......
chip: 50, addr: 10, alen 1
0010: 1e 0f 00 00 46 49 4e 49 53 41 52 20 43 4f 52 50    ....FINISAR CORP
chip: 50, addr: 20, alen 1
0020: 2e 20 20 20 00 00 90 65 46 54 4c 46 38 35 31 39    .   ...eFTLF8519
=> i2c mw 0x70 0x0 0x4; i2c md 0x50 0x0 0x30
dev: 70 addr: 0 alen: 1 length: 1
chip: 50, addr: 0, alen 1
0000: 03 04 07 20 00 00 00 00 00 00 03 67 00 0a 64    ... ........g..d
chip: 50, addr: 10, alen 1
0010: 00 00 00 00 53 4f 55 52 43 45 50 48 4f 54 4f 4e    ....SOURCEPHOTON
chip: 50, addr: 20, alen 1
0020: 49 43 53 20 00 00 00 00 53 50 50 31 30 45 4c 52    ICS ....SPP10ELR
=> i2c mw 0x70 0x0 0x8; i2c md 0x50 0x0 0x30
dev: 70 addr: 0 alen: 1 length: 1
chip: 50, addr: 0, alen 1
0000: 03 04 07 10 00 00 00 00 00 00 06 67 00 00 00    ...........g...
chip: 50, addr: 10, alen 1
0010: 08 02 00 1e 53 75 6d 69 74 6f 6d 6f 45 6c 65 63    ....SumitomoElec
chip: 50, addr: 20, alen 1
0020: 74 72 69 63 00 00 00 5f 53 50 50 35 31 30 31 53    tric..._SPP5101S
```

4.3.3 Retimer Access

To check the **Retimer** status, refer to the following example. More specific parameter settings for the retimer should refer to Section 6.2 and *GN2405A datasheet* from Gennum.

=> i2c dev 1
=> i2c mw 0x73 0x0 0x8; i2c probe
=> i2c mw 0x73 0x0 0x9; i2c probe
=> i2c mw 0x73 0x0 0xa; i2c probe
=> i2c mw 0x73 0x0 0xb; i2c probe
=> i2c mw 0x73 0x0 0xc; i2c probe
=> i2c mw 0x73 0x0 0xd; i2c probe

(*screen capture of the results)

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```
=> i2c mw 0x73 0x0 0x8; i2c probe
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 50 51 70 71 72 73 7C
=> i2c mw 0x73 0x0 0x9; i2c probe
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 50 51 70 71 72 73 7C
=> i2c mw 0x73 0x0 0xa; i2c probe
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 50 51 70 71 72 73 7C
=> i2c mw 0x73 0x0 0xb; i2c probe
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 50 51 70 71 72 73 7C
=> i2c mw 0x73 0x0 0xc; i2c probe
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 50 51 70 71 72 73 7C
=> i2c mw 0x73 0x0 0xd; i2c probe
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 50 51 70 71 72 73 7C
```

*/*retimer register read/write@address 0x9A*
*/*retimer 0*
=> i2c mw 0x73 0x0 0x8; i2c probe
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2

(*screen capture of the results)

```
=> i2c dev 1; i2c mw 0x73 0x0 0x8; i2c probe
Setting bus to 1
dev: 73 addr: 0 alen: 1 length: 1
Valid chip addresses: 00 16 20 21 22 70 71 72 73 7C
=> i2c md 0x16 0x9a 0x2
chip: 16, addr: 9a, alen 1
009a: 44 15    D.
=> i2c mw 0x16 0x9a 0xcafe.2
dev: 16 addr: 9a alen: 1 length: 2
=> i2c md 0x16 0x9a 0x2
chip: 16, addr: 9a, alen 1
009a: ca fe    ..
=> i2c mw 0x16 0x9a 0x4415.2
dev: 16 addr: 9a alen: 1 length: 2
=> i2c md 0x16 0x9a 0x2
chip: 16, addr: 9a, alen 1
009a: 44 15    D.
```

*/*retimer 1*
=> i2c mw 0x73 0x0 0x9; i2c probe
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2

*/*retimer 2*
=> i2c mw 0x73 0x0 0xa; i2c probe

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=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2

*/*retimer 3*
=> i2c mw 0x73 0x0 0xb; i2c probe
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2

*/*retimer 4*
=> i2c mw 0x73 0x0 0xc; i2c probe
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2

*/*retimer 5*
=> i2c mw 0x73 0x0 0xd; i2c probe
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2

4.3.4 I2C to I/O Device Access

To check the I/O Device to the SFP module status, refer to the following example. Make sure that the corresponding SFP modules are present on the board.

=> i2c dev 1
=> i2c probe
=> i2c md 0x20 0x0.0 0x2

(*screen capture of the results: ***Insert*** status)

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```
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: fe 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: fd 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: fb 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: f7 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: ef 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: df 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: bf 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: 7f 0f    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: ff 0e    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: ff 0d    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: ff 0b    ..
=> i2c md 0x21 0x0.0 0x2
chip: 21, addr: 0, alen 0
0000: ff 07    ..
```

4.4 IPMI Command

When the front blade is up and running the aTCA-RN710 is ready to receive commands from a shelf manager in the chassis. This section summarizes some command execution examples and their responses based on the factory environment. Actual commands may differ per different shelf manager at customer environment.

4.4.1 Deactivate and Activate

One can deactivate and activate the aTCA-RN710 at any state. Attached below are the example runs.

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Step 1. Make sure FRU Statue is at M4 by running clia command at the shelf manager.

```
# clia board 13

Pigeon Point Shelf Manager Command Line Interpreter

Physical Slot # 13
98: Entity: (0xa0, 0x60) Maximum FRU device ID: 0x01
    PICMG Version 2.3
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "NTPM-8000"

98: FRU # 1
    Entity: (0xc0, 0x6d)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "RTM1"
```

Step 2. Deactivate the FRU and check the status.

```
# clia deactivate 98 1

Pigeon Point Shelf Manager Command Line Interpreter

    Command issued via IPMB, status = 0 (0x0)
    Command executed successfully
# clia board 13

Pigeon Point Shelf Manager Command Line Interpreter

Physical Slot # 13
98: Entity: (0xa0, 0x60) Maximum FRU device ID: 0x01
    PICMG Version 2.3
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "NTPM-8000"

98: FRU # 1
    Entity: (0x0, 0x0)
    Hot Swap State: M1 (Inactive), Previous: M6 (Deactivation In Progress), Last State Change Cause: Norma
l State Change (0x0)
    Device ID String: " "

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Jul  7 20:40:04 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): Ho
RU 1 M4->M6, Cause=0x1
0x0002: Event: at Jul  7 20:40:15 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): Ho
RU 1 M6->M1, Cause=0x0
#
```


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Step 2. Activate the FRU and check the status.

```
# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Jul  7 20:40:04 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M4->M6, Cause=0x1
0x0002: Event: at Jul  7 20:40:15 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M6->M1, Cause=0x0
#
# clia activate 98 1

Pigeon Point Shelf Manager Command Line Interpreter

    Command issued via IPMB, status = 0 (0x0)
    Command executed successfully
# clia board 13

Pigeon Point Shelf Manager Command Line Interpreter

Physical Slot # 13
98: Entity: (0xa0, 0x60) Maximum FRU device ID: 0x01
    PICMG Version 2.3
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "NTPM-8000"

98: FRU # 1
    Entity: (0xc0, 0x6d)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "RTM1"
```

```
# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Jul  7 20:40:04 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M4->M6, Cause=0x1
0x0002: Event: at Jul  7 20:40:15 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M6->M1, Cause=0x0
0x0003: Event: at Jul  7 20:41:13 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M1->M2, Cause=0x3
0x0004: Event: at Jul  7 20:41:13 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M2->M3, Cause=0x1
0x0005: Event: at Jul  7 20:41:13 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M3->M4, Cause=0x0
#
```

4.4.2 Reset

One can execute cold reset. Attached below are the example runs.

Step 1. Run cold reset command at the shelf manager and check the status.

```
# clia frucontrol 98 1 cold_reset

Pigeon Point Shelf Manager Command Line Interpreter

    FRU Control: Controller 0x98, FRU ID # 1, command 0x00, status 0(0x0)
    Command executed successfully
# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Jul  7 21:28:44 2011; from:(0x98,0,0); sensor:(0xc5,52); event:0x3(asserted): 0xA1 0x00 0
x02
#
```


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4.4.3 Hot Swap

One can check proper Hot Swap operations of the RTM.

Step 1. Make sure that RTM is in normal operation and open the RTM Hot-swap handle switch and wait until the RTM Blue LED is on. Check the FRU status and SEL log.

```
# clia board 13

Pigeon Point Shelf Manager Command Line Interpreter

Physical Slot # 13
98: Entity: (0xa0, 0x60) Maximum FRU device ID: 0x01
    PICMG Version 2.3
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "NTPM-8000"

98: FRU # 1
    Entity: (0x0, 0x0)
    Hot Swap State: M1 (Inactive), Previous: M6 (Deactivation In Progress), Last State Change Cause: Norma
l State Change (0x0)
    Device ID String: " "

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Jul  7 20:51:05 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M4->M5, Cause=0x2
0x0002: Event: at Jul  7 20:51:06 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M5->M6, Cause=0x1
0x0003: Event: at Jul  7 20:51:16 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M6->M1, Cause=0x0
#
```


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Step 2. Close the RTM Hot-swap handle switch and wait until the RTM Blue LED goes off.

```
# clia board 13

Pigeon Point Shelf Manager Command Line Interpreter

Physical Slot # 13
98: Entity: (0xa0, 0x60) Maximum FRU device ID: 0x01
    PICMG Version 2.3
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "NTPM-8000"

98: FRU # 1
    Entity: (0xc0, 0x6d)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal Sta
te Change (0x0)
    Device ID String: "RTM1"

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Jul  7 20:51:05 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M4->M5, Cause=0x2
0x0002: Event: at Jul  7 20:51:06 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M5->M6, Cause=0x1
0x0003: Event: at Jul  7 20:51:16 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M6->M1, Cause=0x0
0x0004: Event: at Jul  7 20:52:39 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M1->M2, Cause=0x2
0x0005: Event: at Jul  7 20:52:39 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M2->M3, Cause=0x1
0x0006: Event: at Jul  7 20:52:40 2011; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: F
RU 1 M3->M4, Cause=0x0
```


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4.4.4 Threshold Base Sender Data

Threshold base sensor data such as voltages and temperatures are available for access though a shelf manager as the following examples.

```
# clia sensordata 98 47

Pigeon Point Shelf Manager Command Line Interpreter

98: LUN: 0, Sensor # 47 ("RTM1 +3.3V_PRE")
    Type: Threshold (0x01), "Voltage" (0x02)
    Belongs to entity (0xc0, 0x6d): FRU # 1
    Status: 0xc0
        All event messages enabled from this sensor
        Sensor scanning enabled
        Initial update completed
    Raw data: 218 (0xda)
    Processed data: 3.267500 Volts
    Status: 0x00

# clia sensordata 98 48

Pigeon Point Shelf Manager Command Line Interpreter

98: LUN: 0, Sensor # 48 ("RTM1 +12V_A")
    Type: Threshold (0x01), "Voltage" (0x02)
    Belongs to entity (0xc0, 0x6d): FRU # 1
    Status: 0xc0
        All event messages enabled from this sensor
        Sensor scanning enabled
        Initial update completed
    Raw data: 186 (0xba)
    Processed data: 11.844000 Volts
    Status: 0x00
# clia sensordata 98 49

Pigeon Point Shelf Manager Command Line Interpreter

98: LUN: 0, Sensor # 49 ("RTM1 +3.3V")
    Type: Threshold (0x01), "Voltage" (0x02)
    Belongs to entity (0xc0, 0x6d): FRU # 1
    Status: 0xc0
        All event messages enabled from this sensor
        Sensor scanning enabled
        Initial update completed
    Raw data: 232 (0xe8)
    Processed data: 3.319350 Volts
    Status: 0x00

# clia sensordata 98 50

Pigeon Point Shelf Manager Command Line Interpreter

98: LUN: 0, Sensor # 50 ("RTM1 Temp 1")
    Type: Threshold (0x01), "Temperature" (0x01)
    Belongs to entity (0xc0, 0x6d): FRU # 1
    Status: 0xc0
        All event messages enabled from this sensor
        Sensor scanning enabled
        Initial update completed
    Raw data: 39 (0x27)
    Processed data: 39.000000 degrees C
    Status: 0x00
```


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```
# clia sensordata 98 51

Pigeon Point Shelf Manager Command Line Interpreter

98: LUN: 0, Sensor # 51 ("RTM1 Temp 2")
    Type: Threshold (0x01), "Temperature" (0x01)
    Belongs to entity (0xc0, 0x6d): FRU # 1
    Status: 0xc0
        All event messages enabled from this sensor
        Sensor scanning enabled
        Initial update completed
    Raw data: 25 (0x19)
    Processed data: 25.000000 degrees C
    Status: 0x00
```

4.4.5 Sensor Threshold Values

Predefined threshold values for the sensors are available for access though a shelf manager as the following examples.

```
# clia getthreshold 98 -f 1

Pigeon Point Shelf Manager Command Line Interpreter

98: LUN: 0, Sensor # 47 ("RTM1 +3.3V_PRE")
    Type: Threshold (0x01), "Voltage" (0x02)
        Lower Non-Critical Threshold, Raw Data: 0xd2    Processed data: 3.147500 Volts
        Lower Critical Threshold, Raw Data: 0xc9    Processed data: 3.012500 Volts
        Upper Non-Critical Threshold, Raw Data: 0xe7    Processed data: 3.462500 Volts
        Upper Critical Threshold, Raw Data: 0xf1    Processed data: 3.612500 Volts
        Upper Non-Recoverable Threshold, Raw Data: 0xfd    Processed data: 3.792500 Volts

98: LUN: 0, Sensor # 48 ("RTM1 +12V_A")
    Type: Threshold (0x01), "Voltage" (0x02)
        Lower Non-Critical Threshold, Raw Data: 0xb4    Processed data: 11.460000 Volts
        Lower Critical Threshold, Raw Data: 0x48    Processed data: 4.548000 Volts
        Upper Non-Critical Threshold, Raw Data: 0xc6    Processed data: 12.612000 Volts
        Upper Critical Threshold, Raw Data: 0xdc    Processed data: 14.020000 Volts
        Upper Non-Recoverable Threshold, Raw Data: 0xec    Processed data: 15.044000 Volts

98: LUN: 0, Sensor # 49 ("RTM1 +3.3V")
    Type: Threshold (0x01), "Voltage" (0x02)
        Lower Critical Threshold, Raw Data: 0xdc    Processed data: 3.147750 Volts
        Upper Critical Threshold, Raw Data: 0xf3    Processed data: 3.476650 Volts
        Upper Non-Recoverable Threshold, Raw Data: 0xfc    Processed data: 3.605350 Volts

98: LUN: 0, Sensor # 50 ("RTM1 Temp 1")
    Type: Threshold (0x01), "Temperature" (0x01)
        Lower Non-Critical Threshold, Raw Data: 0x05    Processed data: 5.000000 degrees C
        Lower Critical Threshold, Raw Data: 0x00    Processed data: 0.000000 degrees C
        Lower Non-Recoverable Threshold, Raw Data: 0xf6    Processed data: -10.000000 degrees C
        Upper Non-Critical Threshold, Raw Data: 0x46    Processed data: 70.000000 degrees C
        Upper Critical Threshold, Raw Data: 0x50    Processed data: 80.000000 degrees C
        Upper Non-Recoverable Threshold, Raw Data: 0x5a    Processed data: 90.000000 degrees C
```


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4.4.6 FRU Information

RTM FRU information is available for access as in the following example.

```
# clia fruinfo 98 1

Pigeon Point Shelf Manager Command Line Interpreter

98: FRU # 1, FRU Info
Common Header:    Format Version = 1

Internal Use Area:
    Version = 1

Board Info Area:
    Version     = 1
    Language Code            = 25
    Mfg Date/Time            = Jun 29 00:00:00 2011 (8147520 minutes since 1996)
    Board Manufacturer       = Narinet, INC.
    Board Product Name       = NTPM-RTM1
    Board Serial Number      = NTP1R1PC00116001
    Board Part Number        = NTPM-RTM1-0000
    FRU Programmer File ID   =

Product Info Area:
    Version     = 1
    Language Code            = 25
    Manufacturer Name        = Narinet, INC.
    Product Name             = NTPM-RTM1
    Product Part / Model#    = NTPM-RTM1-0000
    Product Version          = R0
    Product Serial Number    = NTP1R1PC00116001
    Asset Tag                =
    FRU Programmer File ID   = 00.00

Multi Record Area:
    Module Current Requirements Record (ID=0x16)
        Version = 0

#
```

4.4.7 Faceplate LED

Face plate LEDs can be controlled by a shelf manager. See the following examples.

Step 1. Make the ***OOS LED*** blink.

```
# clia setfruledstate 98 1 1 blink 100 200

Pigeon Point Shelf Manager Command Line Interpreter

    Setting FRU's led state completed successfully, status = 0x0
#
```

Step 2. Make the ***RUN LED*** blink.

```
# clia setfruledstate 98 1 2 blink 100 200

Pigeon Point Shelf Manager Command Line Interpreter

    Setting FRU's led state completed successfully, status = 0x0
#
#
```


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4.4.8 HPM Upgrade

The MMC firmware can be upgraded by the IPMI tool. See the following example.

>ipimtool.exe –I lan –H <shelfmanager IP address> -T <ipmb-0 address> -B 0 –t 0x90 –b 7 hpm upgrade
<firmware img> activate

```
D:\MY_SVN\mmc_ntpm-rtm1_2_00_0002>ipmitool.exe -I lan -H 192.168.0.58 -T 0x8a -B
 0 -t 0x90 -b 7 hpm upgrade hpm1all.img activate
Password:

PICMG HPM.1 Upgrade Agent 1.0:

Validating firmware image integrity...OK
Performing preparation stage...
    Services may be affected during upgrade. Do you wish to continue? y/n y
OK
    Target Product ID     : 4002
    Target Manufacturer ID: 34443
Performing upgrade stage:
    Upgrading AVR-AMCm B/L
    with Version: Major: 2
                  Minor: 0
                  Aux  : 000 002 000 000
    Writing firmware: 100 % completed
    Upgrading AVR-AMCm F/W
    with Version: Major: 2
                  Minor: 0
                  Aux  : 000 002 000 000
    Writing firmware: 100 % completed
Performing activation stage:

Firmware upgrade procedure successful
D:\MY_SVN\mmc_ntpm-rtm1_2_00_0002>ipmitool.exe -I lan -H 192.168.0.58 -T 0x8a -B
 0 -t 0x90 -b 7 hpm compprop 0 1
Password:

PICMG HPM.1 Upgrade Agent 1.0:

Current Version:
 Major: 2
 Minor: 0
 Aux  : 000 002 000 000


D:\MY_SVN\mmc_ntpm-rtm1_2_00_0002>ipmitool.exe -I lan -H 192.168.0.58 -T 0x8a -B
 0 -t 0x90 -b 7 hpm compprop 0 3
Password:

PICMG HPM.1 Upgrade Agent 1.0:

Rollback FW Version:
 Major: 2
 Minor: 0
 Aux  : 000 001 000 000


D:\MY_SVN\mmc_ntpm-rtm1_2_00_0002>ipmitool.exe -I lan -H 192.168.0.58 -T 0x8a -B
 0 -t 0x90 -b 7 hpm compprop 1 1
Password:

PICMG HPM.1 Upgrade Agent 1.0:

Current Version:
 Major: 2
 Minor: 0
 Aux  : 000 002 000 000
```


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5 Architecture Overview

The aTCA-RN710 is composed of several major components as illustrated in Figure 5-1: the MMC, the CPLD, the Retimers, the I2C Block and the SFP+s. The SFP+ optic ports and the Retimers GN2405A from Gennum play a major role in the data plane. The data plane components are connected via the SFI interface, where 10Gbps data rate is supported by a pair of Serdes lanes per port. Since the SFI signals according to SFF8431 specification are not intended to travel over a backplane, the use of a retimer with equalizer function is essential to compensate the signals. The equalizer function of the Retimer compensates any frequency dependent loss on the path to extend the reachability of sensitive SFI signals on the board. The retimer function recovers clean edges of the signal distorted due to unwanted reflections on the impedance mismatch points such as the vias and the connectors along the traces on the board. The GN2405A on the board has both functions. The GN2405A supports two ports, thereby the board needs six devices to support 12 SFP+ ports, which result in 12 SFI TX links from the front blade to the RTM and another 12 SFI RX links from the RTM to the front blade. At the center of the control functions, there exists the Module Management Controller or the MMC. The MMC is responsible for the RTM management and interfaces with the front blade IPMC via IPMB-L to exchange management commands, and the FRU information's and the status. The CPLD sits in between the MMC and the devices to distribute the control signals such as Enable/Disable and Resets and collect various signals for the MMC. The I2C HUBs inside the I2C Block are used to extend a limited I2C bus from the Zone 3 connector to control many devices by duplicating its primary I2C Bus into secondary I2Cs.

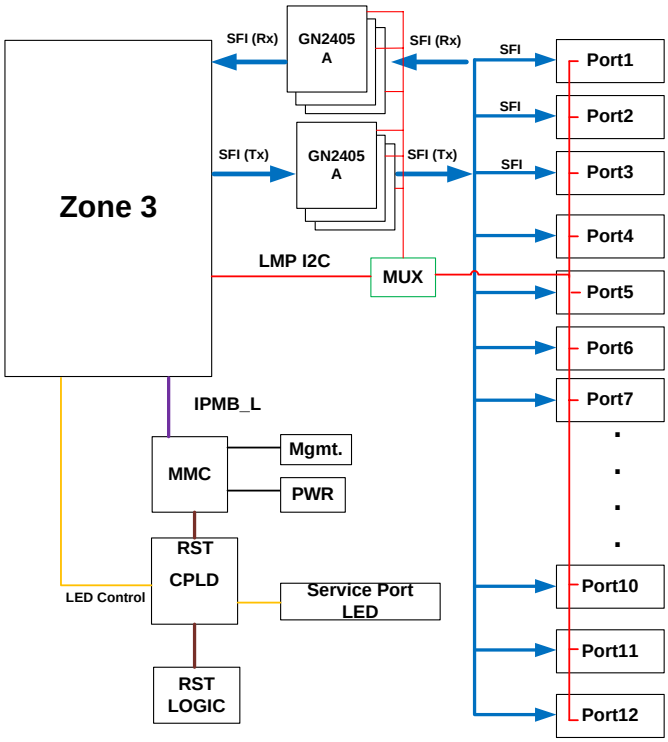


Figure 5-1 RTM1 Architecture

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6 Data Path: SFP+ and Retimer

6.1 Overview

The retimer used on the board is essential to improve the 10Gbps SFI signal quality. According to SFF 8431 specification, the SFI signal may not reach from a front blade to an RTM SFP+ port or vice versa, at viable quality after traversing a Zone 3 connector and several vias on the lossy PCB. The retimer along with equalization features compensates such losses and reflections. The retimer used on the board is quad retimer GN2405A from Gennum. Shown in Figure 6-1 are the six retimers and twelve SFP+ ports which are connected to the corresponding switch ports on the front blade via the Zone 3 connector(s). A single GN2405A covers dual SFI+ RX/TX paths in an asymmetric way. It is asymmetric in a sense that the path characteristic from the front blade (via Zone 3 connector) to the retimer input and the one from the SFP+ RX to the retimer input are significantly different. So each one of the path should be configured differently, meaning different adjustment may be applied for the different path characteristics for all the devices.

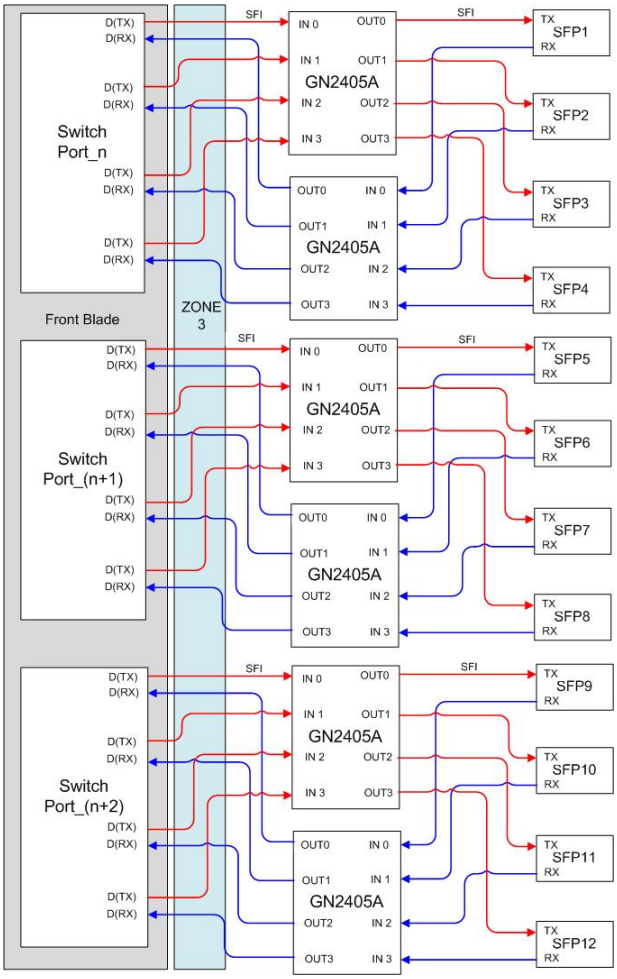


Figure 6-1 SFP+ and Data Path

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6.2 The Retimer, GN2405A

The GN2405A architecture is illustrated in Figure 6-2, showing quad entities for both RX and TX. The features of the GN2405A are summarized as follows:

- Quad Datacom Repeater / Retimer supporting four RX lanes and four TX lanes
- Continuous rate operation from 9.95Gb/s to 11.3Gb/s
- Support for 2.5Gb/s and 5Gb/s data rates
- Compensate for up to 28dB of loss
- Integrated 6dB equalizer at input
- On chip 100Ω differential I/O termination
- I2C Control Interface

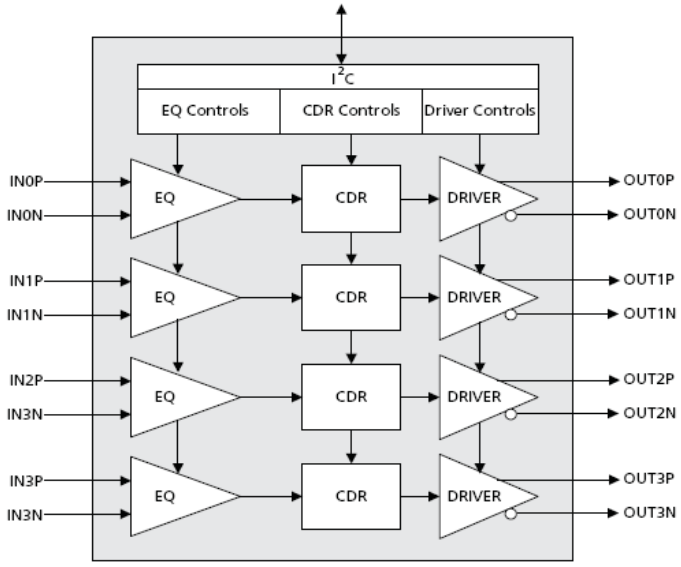


Figure 6-2 GN2405 Block diagram

The retimers are configured through an I2C bus. As can be seen in Figure 6-3, the configuration I2C bus is from the Zone 3 connector connects to the PCA9547 I2C HUB to reach to the retimers.
The retimers on the RTM I2C bus always function as a slave.

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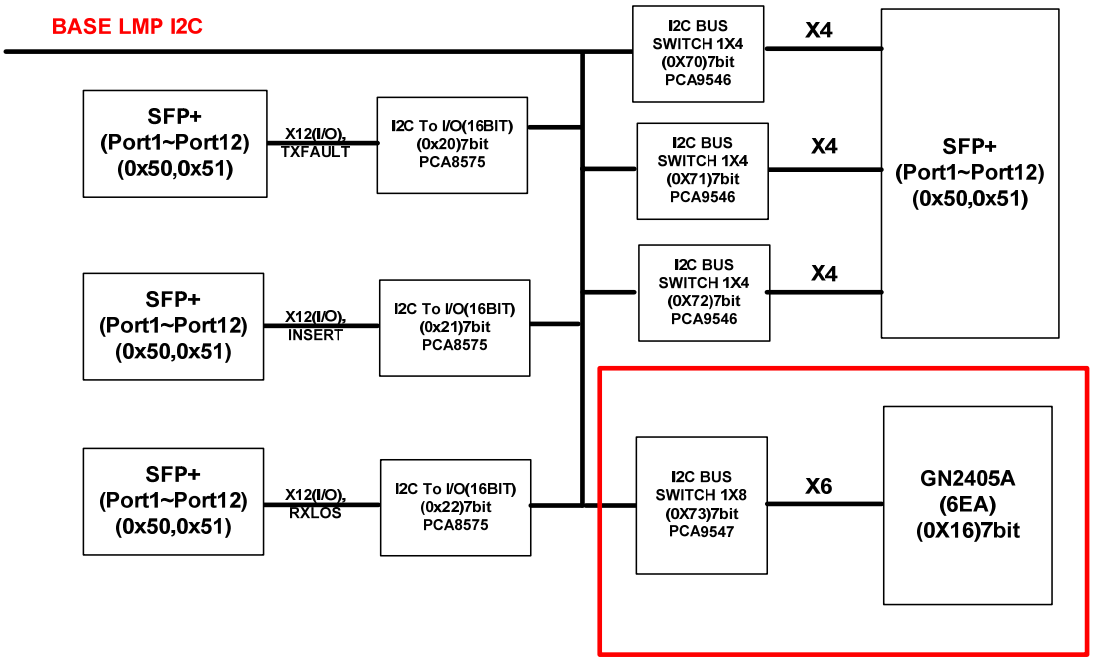


Figure 6-3 Retimer configuration access

6.3 Channel Configuration

The board specific channel configuration by the GN2405A is done through an I2C interface. The optimal operation setting at various conditions may be obtained through simulations and testing. Summarized below is the list of the controls that can be applied to the device. Refer to the *GN2405A datasheet* for the detailed setting values. The list of the tables is quoted from the datasheet as informative indications.

- **Loss of Signal (LOS)**: the device can control the de-assert threshold and the hysteresis for the LOS. The detailed setting may be found from the following list of tables in the datasheet.
  - ⇨ Table 5-2: LOS Range Settings
  - ⇨ Table 5-3: LOS Threshold Control Register Addresses
  - ⇨ Table 5-4: LOS De-assert Threshold Positive & LOS De-assert Threshold Negative Setting Register Address
  - ⇨ Table 5-5: LOS Hysteresis Setting Register Addresses
  - ⇨ Table 5-6: Typical LOS Threshold Settings (Range Select = Low, Hysteresis = 2)
  - ⇨ Table 5-7: Typical LOS Threshold Settings (Range Select = High, Hysteresis = 2)
  - ⇨ Table 5-8: LOS Indicator Register Addresses

- **Channel Power Down and Output Enable/Disable**: the device can control the channel power down and output driver enable/disable via the I2C. Setting details can be found from the following tables in the datasheet.
  - ⇨ Table 5-9: Channel Power Down Enable/Disable Register Addresses
  - ⇨ Table 5-10: Output Driver Disable/Enable Register Addresses

- **Data Rate Detection/Selection Enable/Disable**: the device can configure either a manual data rate selection or an automatic data rate selection, which has also an enable/disable option. Setting details can be found from the following tables in the datasheet.
  - ⇨ Table 5-11: Recommended Register Settings for Infiniband
  - ⇨ Table 5-12: Lock Period Control Settings
  - ⇨ Table 5-13: Rate Period Control Settings
  - ⇨ Table 5-14: Automatic Data Rate Detection Enable/disable & Manual Data Rate Setting

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⇨ Table 5-15: Automatic Data Rate Detect Block Power Down Register Addresses
⇨ Table 5-16: Clock Divider Block Power Down Register Addresses

- **Bypass Enable/Disable**: the device can configure the input to bypass the internal module and to go to the output directly which may be useful during test phase.
- **Loop Bandwidth Control**: the device can configure the Loop bandwidth of ranges 20MHz to 40MHz.
- **Output Swing Control**: the typical output swing range is in 385 mV_{ppD} ~ 1050 mV_{ppD} in ten steps.
- **Output Mute Override**: the output can be muted with an override enable/disable option.
- **Output De-emphasis**: Depending on the channel characteristics, the output de-emphasis level can be adjusted. The post-tap de-emphasis range is 0 ~ 350 mV_{ppD} and the pre-tap de-emphasis range is 0 ~ 350 $mV_{ppD.}$
- **Output Polarity Invert**: The output signal polarity can be inverted with a register setting.
- **Loss-of-Lock (LOL)**: The status of the PLL lock is visible through a register.

6.4 Port Mapping

The front blade (aTCA-N700) service port numbers, Zone 3 signals and its corresponding retimers are mapped as shown in Table 6-1. A different front blade may have different port numbers.

Table 6-1 Service Port Mapping

Zone 3 Pin Pos	Zone 3 Signal name	aTCA-N700 Switch Port (SerDes lane#)	Retimer #	Port Number (SFP+/SFP)
Conn P3: A1~H1, A2~H2	RTM_SFP_RX_P/N [0:3], RTM_SFP_TX_P/N [0:3]	P14 (57)	GN2405A#0 GN2405A#1	P1@Top location
		P14 (58)		P2
		P14 (59)		P3
		P14 (60)		P4
Conn P3: A3~H3, A4~H4	RTM_SFP_RX_P/N [4:7], RTM_SFP_TX_P/N [4:7]	P13 (53)	GN2405A#2 GN2405A#3	P5
		P13 (54)		P6
		P13 (55)		P7
		P13 (56)		P8
Conn P3: A5~H5, A6~H6	RTM_SFP_RX_P/N [8:11], RTM_SFP_TX_P/N [8:11]	P12 (49)	GN2405A#4 GN2405A#5	P9
		P12 (50)		P10
		P12 (51)		P11
		P12 (52)		P12@Bottom

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7 Module Management Controller

7.1 Overview

Figure 7-1 shows the Module Management Controller (MMC) and its associated components. The MMC is responsible for the RTM chassis management functions compliant to IPMI v2.0 specifications. The MMC interfaces with the IPMC on the front blade through the IPMB-L on the Zone 3 connector to exchange IPMI commands. The Interface with the CPLD is via the GPIO pins. The power distribution and monitoring of the voltage rails are the critical functions of the MMC.

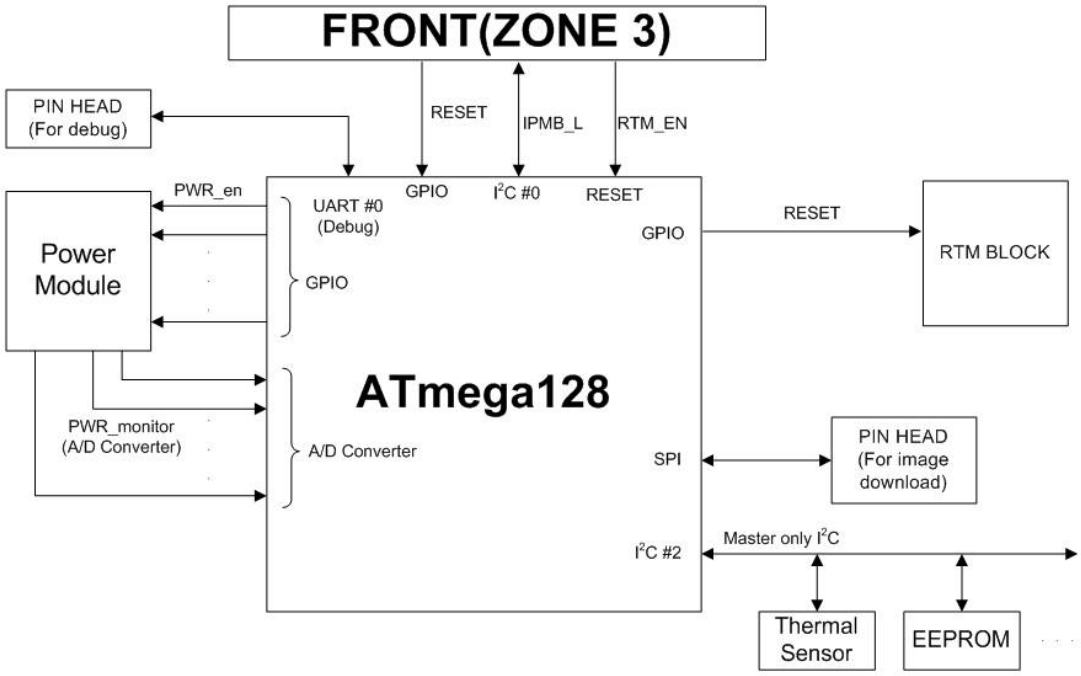


Figure 7-1 MMC Block Diagram

7.2 Features and Functions

Itemized below are the features and the functions of the MMC.

- RTM Management
  - ✓ Intelligent RTM depends on the MMC.
  - ✓ MMC communicates with the front blade IPMC via IPMB-L through a Hot-swap buffer: FR U information and Commands are exchanged.

- Programmable device (CPLD) Download Interface
  - ✓ The CPLD programming interface is connected to the MMC GPIO. Upon request from the IPMC, the MMC initiates the programming of the CPLD image downloaded to the RTM via IPMB-L interface.

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- Power Sequence
  - ✓ The MMC controls all the power rail enable/disable signals, which is essential to the power sequencing. The power sequencing therefore is controlled by the MMC.

- Power monitoring
  - ✓ All the power rail monitoring is done. Any violation of the threshold vales triggers an event and the MMC reports to the IPMC and shuts down the power to protect the board.

- FRU Information
  - ✓ The MMC provides a Master only I2C Interface which is connected to an EEPROM that contains RTM information, the log, and the alarms.

- Sensor
  - ✓ The on board sensors are connected to a Master only I2C Interface of the MMC and provide the collected information such as voltage and thermal values to the MMC per the MMC's request.

7.3 MMC Control Operation

Some of the major chassis management operations are described in Table 7-1 and detailed explanations follow.

Table 7-1 Board Shutdown and Reset Procedures (Front Blade + RTM)

No	Item	Description
1	Cold Reset	Cold reset Command from Shelf manager
2	Front Blade Deactivate	Front Blade Deactivate Command from Shelf manager
3	Front Blade Activate	Front Blade activate Command from Shelf manager
4	RTM Deactivate	RTM Deactivate Command from Shelf manager
5	RTM Activate	RTM activate Command from Shelf manager
6	Front blade shutdown	Front Blade Shutdown Command from LMP
7	RTM shutdown	RTM Shutdown Command from LMP
8	Front Hot swap	Open the Hot-swap switch of Front blade
9	RTM Hot swap	Open the Hot-swap switch of RTM

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■ Cold Reset triggered by Shelf manager

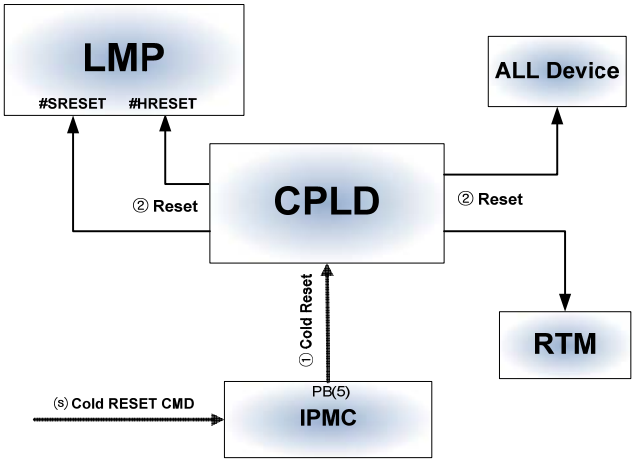


Figure 7-2 Cold Reset Procedure

(s) Shelf manager sends RESET command to IPMC.
① IPMC converts the command into Cold reset signal to FPGA.
② FPGA sends Resets to LMP and all Devices including RTM.
③ MMC in RTM receives the Reset and forward the Reset to selected devices in the RTM.

Table 7-2 Signals: Cold Reset Procedure

Signal Name	Descriptions
Cold RESET PB(5)	Cold RESET Command 0 : Cold RESET 1 : Normal operation
RESET	RESET Command 0 : RESET 1 : Normal operation

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■ Deactivate

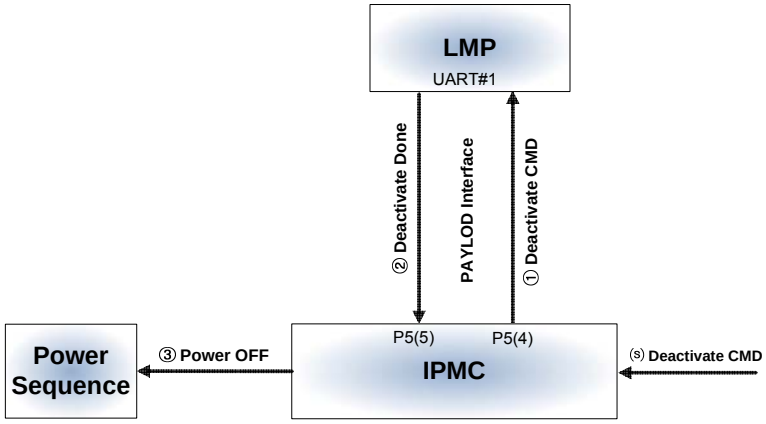


Figure 7-3 Deactivate Procedure

ⓢ Shelf manager sends Deactivate to IPMC.
① IPMC sends Deactivate to LMP via PAYLOAD Interface (UART).
② LMP completes the operation and sends the completion message via PAYLOAD Interface (UART) to IPMC.
③ IPMC initiates Power Down sequence to power off Front Blade and RTM.

Table 7-3 Signals: Deactivate Procedure

Signal Name	Status
PAYLOAD Interface P5(4),P5(5)	Deactivate Command - IPMI Message Deactivate Done Indicator - IPMI Message

■ Activate



Figure 7-4 Activate Procedure

ⓢ Shelf manager sends Active Command to IPMC.
① IPMC initiates Power ON sequence to power ON Front Blade and RTM.

Table 7-4 Signals: Activate Procedure

Signal Name	Status
PAYLOAD Interface P5(4),P5(5)	Activate Command - IPMI Message Deactivate Done Indicator - IPMI Message

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■ RTM Deactivate

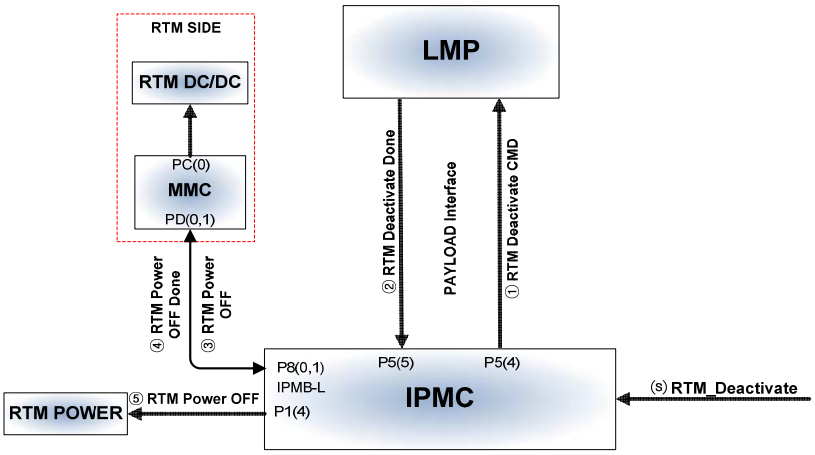


Figure 7-5 RTM Deactivate Procedure

ⓢ Shelf manager sends RTM Deactivate Command to IPMC.
① IPMC sends RTM Deactivate to LMP via PAYLOAD Interface (UART).
② LMP completes the operation and sends completion message to IPMC.
③ IPMC sends RTM Power OFF command to MMC via IPMB-L.
④ MMC completes RTM Power OFF operation and sends the completion message to IPMC.
⑤ IPMC turns off RTM Power 12V.

Table 7-5 Signals: RTM Deactivate Procedure

Signal Name	Status
PAYLOAD Interface P5(4),P5(5)	RTM Deactivate Command - IPMI Message RTM Deactivate Done Indicator - IPMI Message
IPMB-L P8(0),P8(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
P1(4)	RTM Power 12V OFF 0 : Power OFF 1 : Power ON
IPMB-L MMC : PD(0),PD(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
MMC : PC(0)	RTM Internal Power OFF 0 : Power ON 1 : Power OFF

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■ RTM Activate

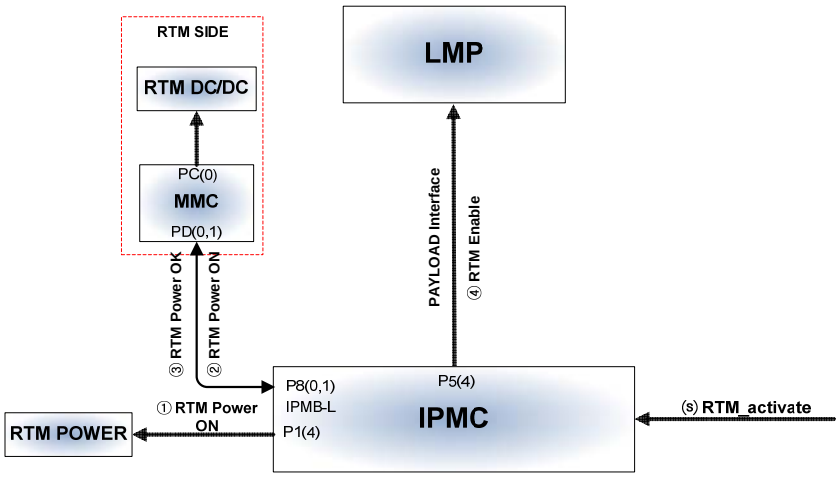


Figure 7-6 RTM Activate Procedure

ⓢ Shelf manager sends RTM Activate to IPMC.
① IPMC turns on RTM Power 12V.
② IPMC sends RTM Power ON Command to MMC via IPMB-L.
③ MMC sends Power OK to IPMC.
④ IPMC sends RTM Enable to LMP via PAYLOAD Interface (UART).

Table 7-6 Signals: RTM Activate Procedure

Signal Name	Status
PAYLOAD Interface P5(4),P5(5)	RTM Enable Indicator - IPMI Message
IPMB-L P8(0),P8(1)	RTM Power ON - IPMI Message RTM Power OK - IPMI Message
P1(4)	RTM Power 12V ON 0 : Power OFF 1 : Power ON
IPMB-L MMC : PD(0),PD(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
MMC : PC(0)	RTM Internal Power OFF 0 : Power ON 1 : Power OFF

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■ Shutdown triggered by LMP

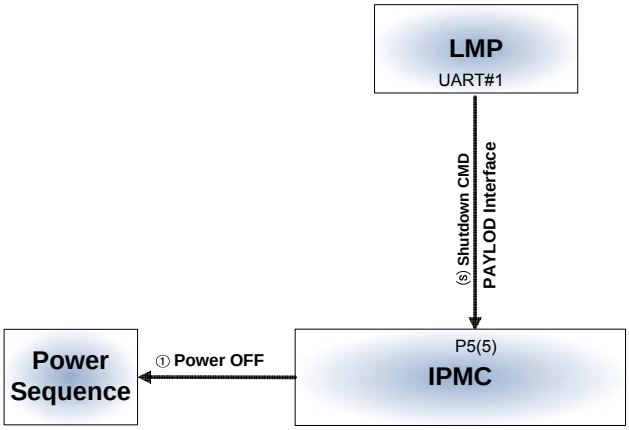


Figure 7-7 Shutdown Procedure

ⓢ LMP sends Shutdown Command to IPMC via PAYLOAD Interface (UART).
① IPMC initiates Power Down sequence to turn off Blade and RTM power.

Table 7-7 Signals: Shutdown Procedure

Signal Name	Status
PAYLOAD Interface P5(4),P5(5)	Shutdown Command - IPMI Message

■ RTM Shutdown triggered by LMP

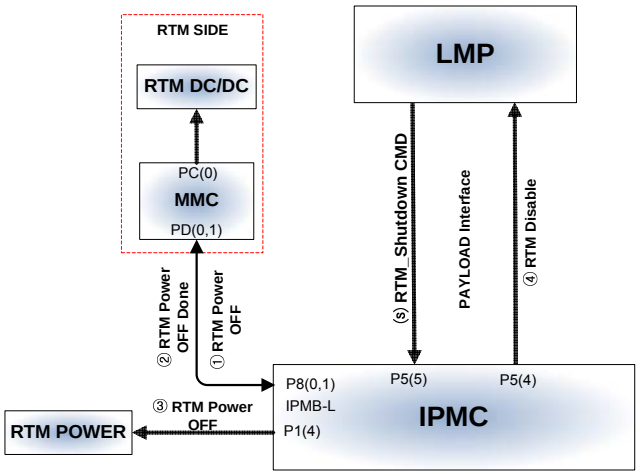


Figure 7-8 RTM Shutdown Procedure

ⓢ LMP sends RTM Shutdown to IPMC via PAYLOAD Interface (UART).
① IPMC sends RTM Power OFF to MMC via IPMB-L.
② MMC completes RTM Power OFF operation and sends the completion message to IPMC.
③ IPMC turns off RTM Power 12V.
④ IPMC sends RTM Disable information to LMP via PAYLOAD Interface (UART).

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Table 7-8 Signals: RTM Shutdown Procedure

Signal Name	Status
PAYLOAD Interface IPMC : P5(4),P5(5)	RTM Shutdown Command - IPMI Message RTM Disable Indicator - IPMI Message
IPMB-L IPMC : P8(0),P8(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
IPMC : P1(4)	RTM Power 12V OFF 0 : Power OFF 1 : Power ON
IPMB-L MMC : PD(0),PD(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
MMC : PC(0)	RTM Internal Power OFF 0 : Power ON 1 : Power OFF

■ Hot Swap

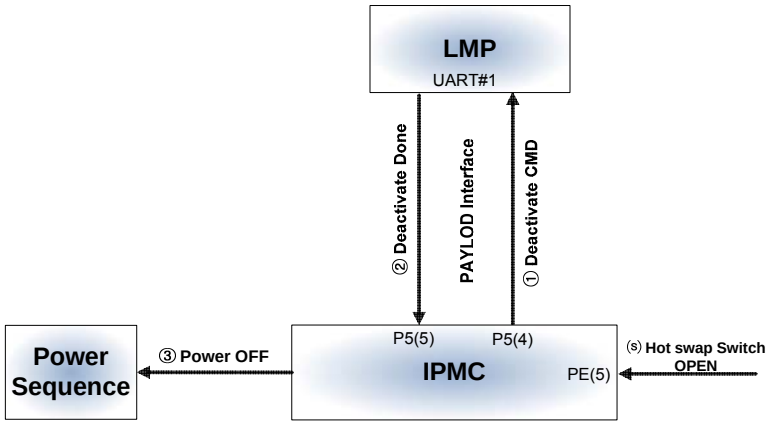


Figure 7-9 Hot Swap Procedure

ⓢ Hot swap Latch Open operation triggers a signal to IPMC.
① IPMC sends Deactivate command to PAYLOAD Interface (UART).
② LMP completes the operation and sends the completion message to IPMC via PAYLOAD Interface (UART).
③ IPMC initiates Power Down sequence and turns off Blade and RTM power.

Table 7-9 Signals: Hot Swap Procedure

Signal Name	Status
PAYLOAD Interface P5(4),P5(5)	Deactivate Command - IPMI Message Deactivate Done Indicator - IPMI Message
PE(5)	Hot swap Indicator 0 : Hot swap Indicator 1 : Normal operation

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■ RTM Hot Swap

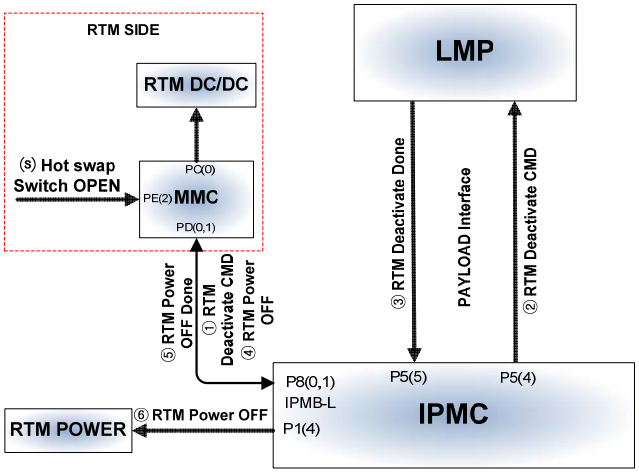


Figure 7-10 RTM Hot Swap Procedure

ⓢ RTM Hot swap switch open operation triggers a signal to MMC.
① MMC sends RTM Deactivate command to IPMC.
② IPMC forwards RTM Deactivate command to LMP via PAYLOAD Interface (UART).
③ LMP completes the operation and sends the completion message to IPMC via PAYLOAD Interface (UART).
④ IPMC sends RTM Power OFF to MMC via IPMB-L.
⑤ MMC completes operation and sends the completion message to IPMC.
⑥ IPMC turns off RTM Power 12V.

Table 7-10 Signals: RTM Hot Swap Procedure

Signal Name	Status
PAYLOAD Interface IPMC : P5(4),P5(5)	RTM Deactivate Command - IPMI Message RTM Deactivate Done Indicator - IPMI Message
IPMB-L IPMC : P8(0),P8(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
IPMC : P1(4)	RTM Power 12V OFF 0 : Power OFF 1 : Power ON
IPMB-L MMC : PD(0),PD(1)	RTM Power OFF - IPMI Message RTM Power OFF Done - IPMI Message
MMC : PC(0)	RTM Internal Power OFF 0 : Power ON 1 : Power OFF
MMC : PE(2)	Hot swap Indicator 0 : Hot swap Indicator 1 : Normal operation

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7.4 Sensor Threshold Values

7.4.1 Voltage Threshold

The voltage monitoring sensors are installed as summarized in Table 7-11.

Table 7-11 Sensor Voltage Threshold

Title	Thresholds	Hysteresis
RTM1 +12V_A	UNR : +15V UC : +14V UNC : +12.6V LNC : +11.4V LC : +4.5V LNR : N/A	0.1V
RTM1 +3.3V_MP	UNR : 3.78V UC : +3.6V UNC : +3.46V LNC : 3.135V LC : +3V LNR : N/A	0.04V
RTM1 +3.3V	UNR : 3.6V UC : +3.465V UNC : N/A LNC : N/A LC : +3.135V LNR : N/A	0.04V

7.4.2 Temperature Threshold

The temperature monitoring sensors are installed as in Table 7-12.

Table 7-12 Sensor Temperature Threshold

Title	Thresholds	Hysteresis
RTM1 Inlet Temp	UNR : 70 ℃ UC : 60 ℃ UNC : 45 ℃	2℃
RTM1 SFP Temp	UNR : Tmax -△T + 10℃ UC : Tmax -△T UNC : Tmax -△T - 10℃	2℃

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8 CPLD

The complex programmable logic device (CPLD) is used for various control purposes. Shown in Figure 8-1 are the interconnections to the associated devices on the board. The CPLD connects to the front blade with LED DATA and interrupt request signal IRQ. The LED data [0:1] come from the front blade switch. The front blade forwards these multiplexed LED status (link, activity) signals to the SFP+ status LEDs on the faceplate. The CPLD decodes the LED data[0:1] and distribute 12 pairs of individual (Enable, Link/Act) LED signals to each one of the SFP LEDs on the faceplate.

Also connected are the I2C HUBs to collect interrupt signals. The CPLD receives the reset signal from the MMC and distributes to the retimers and the I2C HUBs.
The target device of the CPLD is LC4064V-75TN48C from Lattice Semiconductor. The CPLD details can be found in the RTM1 CPLD datasheet.

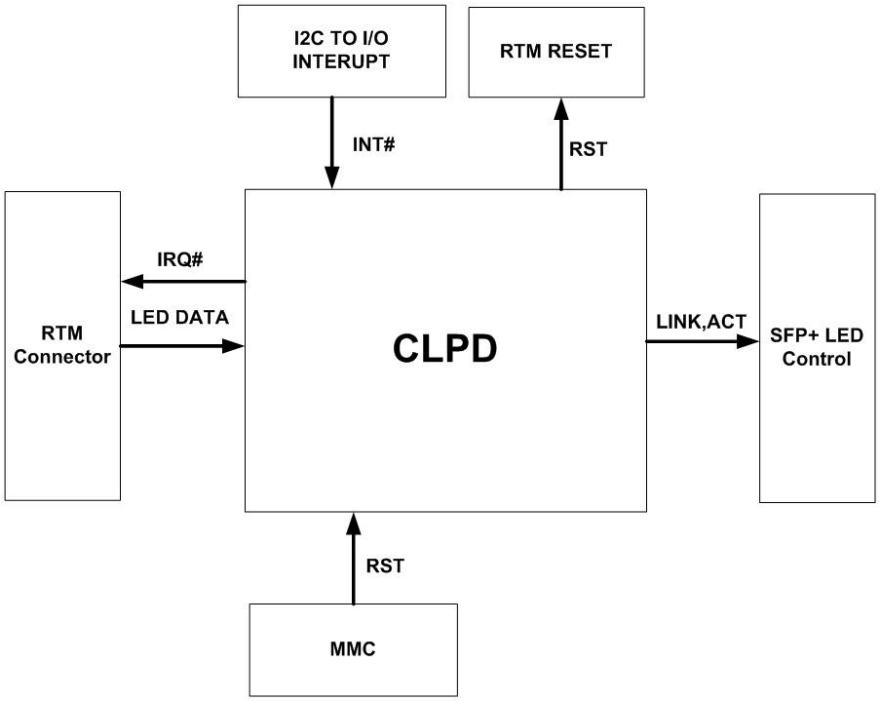


Figure 8-1 CPLD Block

The LED Data for each switch port (total of 23 ports) has the following attributes:

- Link Status: Up=1, Down = 0.
- Act Status: Act=1, No Act = 0.
- Link-En Status: Enable = 1, Disable = 0.

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The LED indication is mapped to the LED data values as shown in Table 8-1.

Table 8-1 LED Data and E and L/A LED Indication per Port

LINK-EN	LINK	ACT	Description	E status	L/A status
1	1	1	Link-en/Act	ON	BLINK
1	1	0	Link-en/Link	ON	ON
1	0	0	Link-en/No Link	ON	OFF
0	0	0	Link Disable /No Link	OFF	OFF

The LED DATA from the Zone 3 connector to the RTM is ***RTM_LED_DATA1***, formatted as in Figure 8-2 where the ports are arranged as in Table 8-2. The preamble is a LED_DATA HIGH pulse without a clock. The CPLD deserializes the LED data and drives corresponding SFP port LEDs accordingly. The switch serdes numbers are per aTCA-N700 front blade.

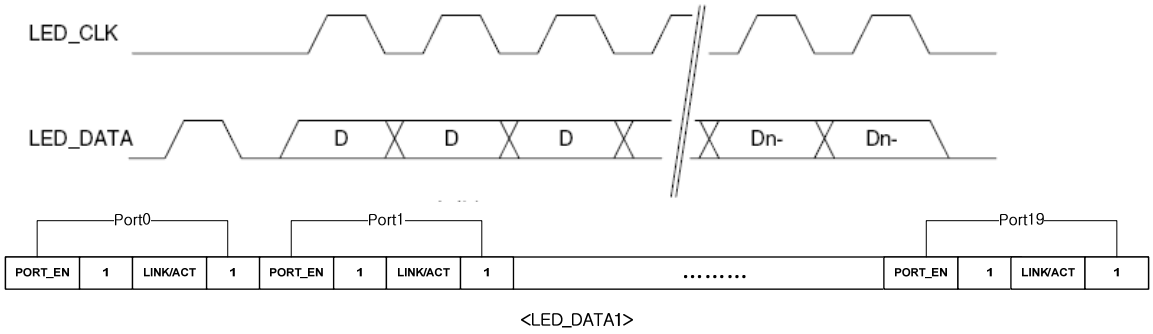


Figure 8-2 Zone 3 RTM_LED_DATA1 format

Table 8-2 LED Data per Port

(F: Front port, R: RTM port, F/R: Shared between Front/RTM)

Data Port No.	DataBit	Description	Switch Serdes No.	Port Name.
Port 0	0	PORT_EN	57	R-P01
	1	1		
	2	LINK/ACT		
	3	1		
Port 1	4	PORT_EN	58	R-P02
	5	1		
	6	LINK/ACT		
	7	1		
Port 2	8	PORT_EN	59	R-P03
	9	1		
	10	LINK/ACT		
	11	1		
Port 3	12	PORT_EN	60	R-P04
	13	1		
	14	LINK/ACT		
	15	1		
Port 4	16	PORT_EN	53	R-P05

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Data Port No.	DataBit	Description	Switch Serdes No.	Port Name.
	17	1		
	18	LINK/ACT		
	19	1		
Port 5	20	PORT_EN	54	R-P06
	21	1		
	22	LINK/ACT		
	23	1		
Port 6	24	PORT_EN	55	R-P07
	25	1		
	26	LINK/ACT		
	27	1		
Port 7	28	PORT_EN	56	R-P08
	29	1		
	30	LINK/ACT		
	31	1		
Port 8	32	PORT_EN	49	R-P09
	33	1		
	34	LINK/ACT		
	35	1		
Port 9	36	PORT_EN	50	R-P10
	37	1		
	38	LINK/ACT		
	39	1		
Port 10	40	PORT_EN	51	R-P11
	41	1		
	42	LINK/ACT		
	43	1		
Port 11	44	PORT_EN	52	R-P12
	45	1		
	46	LINK/ACT		
	47	1		
Port 12 ~Port 19	48 ~ 79	Don't care	Don't care	X

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9 I2C

The Zone 3 connector offers two I2C buses. I2C #1 (Conn P1_E2/F2: RTM_SCL/RTM_SDA) is from the front blade IPMC for IPMB-L connection and I2C #2 (Conn P2_G6/H6: LMP_SCL/LMP_SDA) is from the front blade switch for the SFP+ port link control.

- I2C #1 is connected only to the MMC on the RTM.
- I2C #2 is connected to the I2C switch for the front blade switch to control SFP related information (configuration and status gathering) directly or through the I2C IO Buffer.

I2C #2 from the front blade switch is connected to the four I2C HUBs as shown in Figure 9-3 (a). The I2C HUB on the board is PCA9546A from Phillips. PCA9546A is a 5-channel I2C Hub which enables extension of an I2C bus by buffering both the data (SDA) and the clock (SCL) lines, for the five buses of 400pF. The I2C bus capacitance limit of 400pF restricts the number of devices and bus length. Four I2C buses from each PCA9546A connect to the four SFP+ ports.
The features of the PCA9546A are:

- 1-of-4 bidirectional translating switches
- Supports hot insertion
- 0 Hz to 400 kHz clock frequency

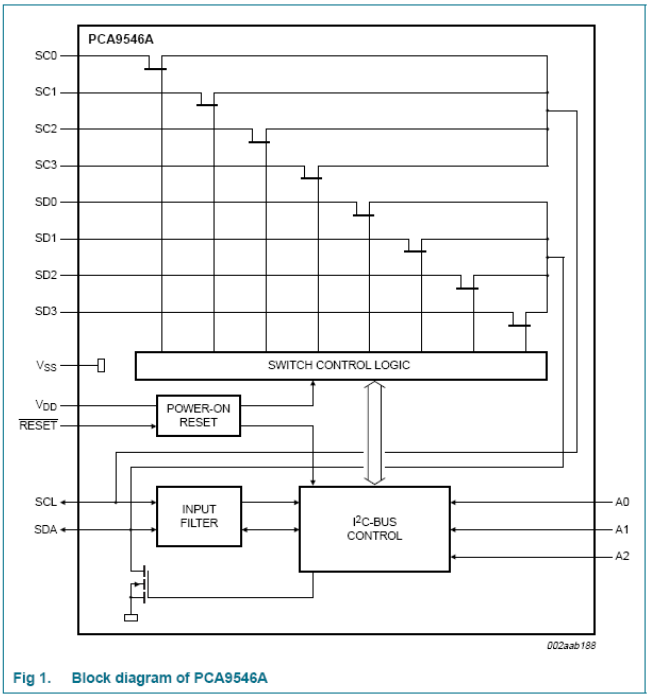


Figure 9-1 PCA9546A Block Diagram

One PCA9547 is used for the retimer configuration, where six I2C buses from the device connect to the six retimers each.
To collect the status signals such as TXFAULT, INSERT, and RXLOS for the SFP+ ports, three PCA8575 devices (I2C to I/O) are used on board as shown in Figure 9-3 (b).

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The features of the PCA8575 are:

- 400 kHz I2C-bus interface
- 2.3 V to 5.5 V operation with 5.5 V tolerant I/Os
- 16-bit remote I/O pins that default to inputs at power-up
- 8 programmable slave addresses using 3 address pins

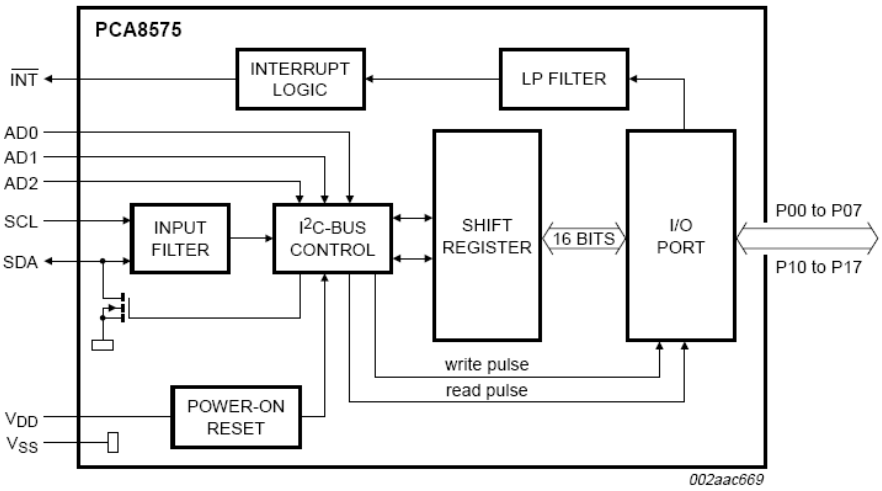
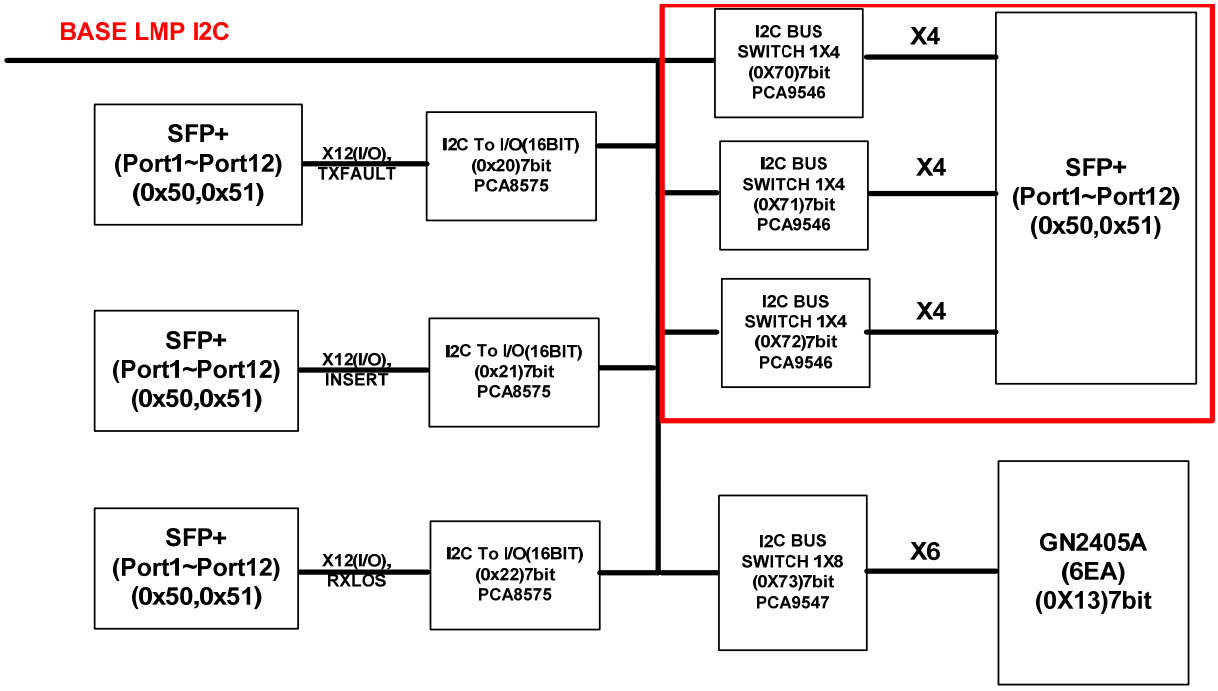


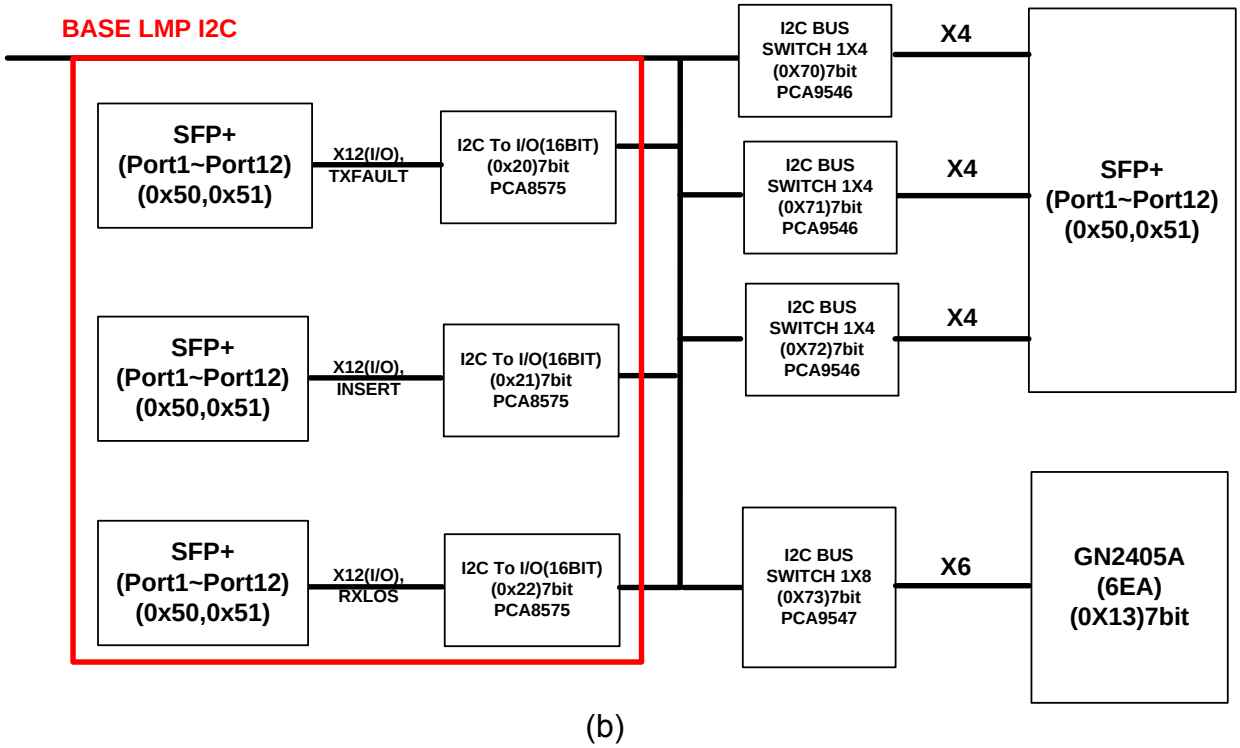
Fig 1. Block diagram of PCA8575

Figure 9-2 PCA8575 Block Diagram

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(a)



(b)

Figure 9-3 I2C Interconnections

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10 Power and Reset

10.1 Power Consumption Budget

RTM1 power consumption is estimated as shown in Table 10-1, where the total power consumption is well below the target maximum value 25 watts.

Table 10-1 Power Consumption Budget

Power Consumption(estimation)

Parts Number	Uint Current[A] 3.3V		Unit Power [W]		Quantity [EA]	Total Current[A] 3.3V		Total Power [W]	
	TYP.	MAX	TYP.	MAX		TYP.	MAX	TYP.	MAX
SFP+	0.2	0.25	0.66	0.825	12	2.4	3	7.92	9.9
CPLD	0.025	0.025	0.0825	0.0825	1	0.025	0.025	0.0825	0.0825
PCA8575	0.0002	0.0002	0.00066	0.00066	4	0.0008	0.0008	0.00264	0.00264
GN2405A	0.418	0.418	1.3794	1.3794	6	2.508	2.508	8.2764	8.2764
PCA9546A	0.00005	0.00005	0.000165	0.000165	3	0.00015	0.00015	0.000495	0.000495
PCA9547	0.00005	0.00005	0.000165	0.000165	1	0.00005	0.00005	0.000165	0.000165
Total Current		0.6933			0	4.934	5.534		
Total Power			2.12289	2.924856	0			16.2822	18.2622

Switching Regulator & LDO	description	EFF	3.3 Total Current[A] 3.3V	3.3	Total Power TYP.	Total Power MAX
NQR010A0X(10A)	12V -> 3.3V	89%	4.934	5.534	18.29460674	20.51932584
Total Power(Be considered Efficiency)					18.29460674	20.51932584

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10.2 Power Distribution

RTM1 receives the powers via a Zone 3 connector from the front blade. 12V and 3.3V_PRE are available from the Zone connector. The 3.3V_PRE is used for the MMC. The 12V is used as a source to generated necessary voltages including 3.3V on the board. Shown in Figure 10-1 is the RTM1 power distribution block diagram.

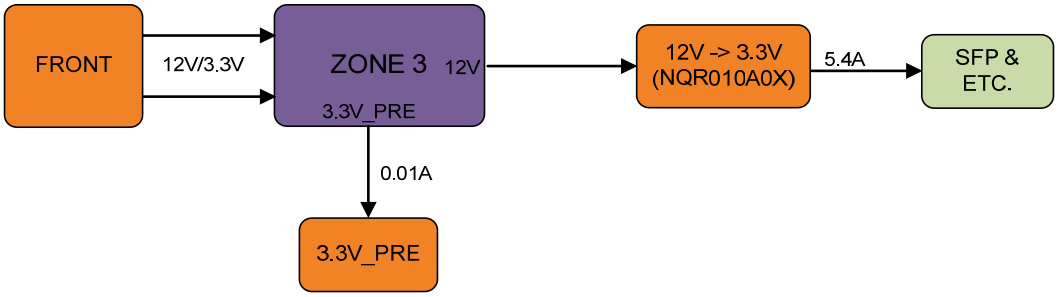


Figure 10-1 Power Distribution

10.3 Power Sequencing

The power sequencing and monitoring is done by the MMC. The MMC generates 3.3V_EN enable signal to the DC-DC converter as illustrated in Figure 10-2.



Figure 10-2 Power Sequence

10.4 Reset

Shown in Figure 10-3 is the RTM reset tree. The RTM1 reset commands come from the front blade, either by an IPMI Reset command or the hardware signals. The hardware signals are either RTM_ENABLE (Conn P1_H1) or RTM_RESET (Conn P1_H4). The RTM_ENABLE is for the MMC reset. The RTM_RESET signal is forwarded to the CPLD with passing to the MMC. The CPLD resets the other devices.

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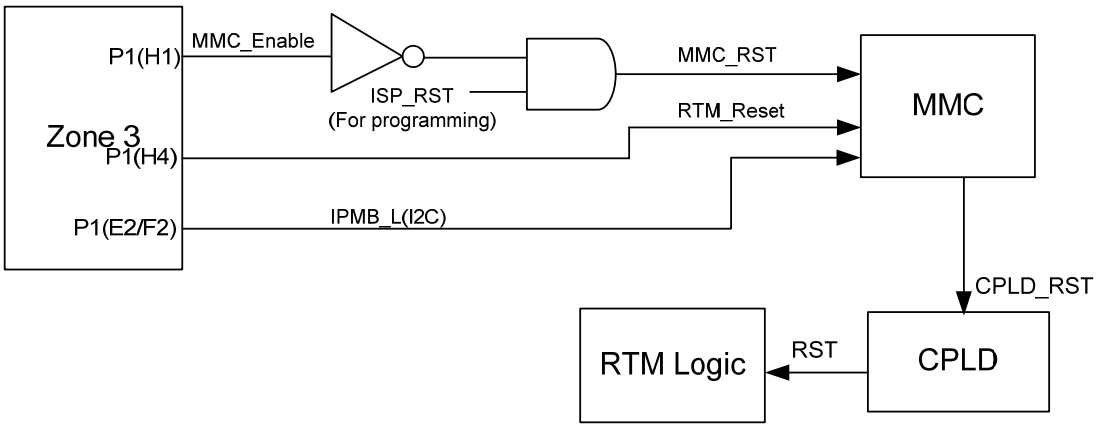


Figure 10-3 Reset Tree

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11 Outline

11.1 Board Outline

Some of the board pictures are shown in Figure 11-1.

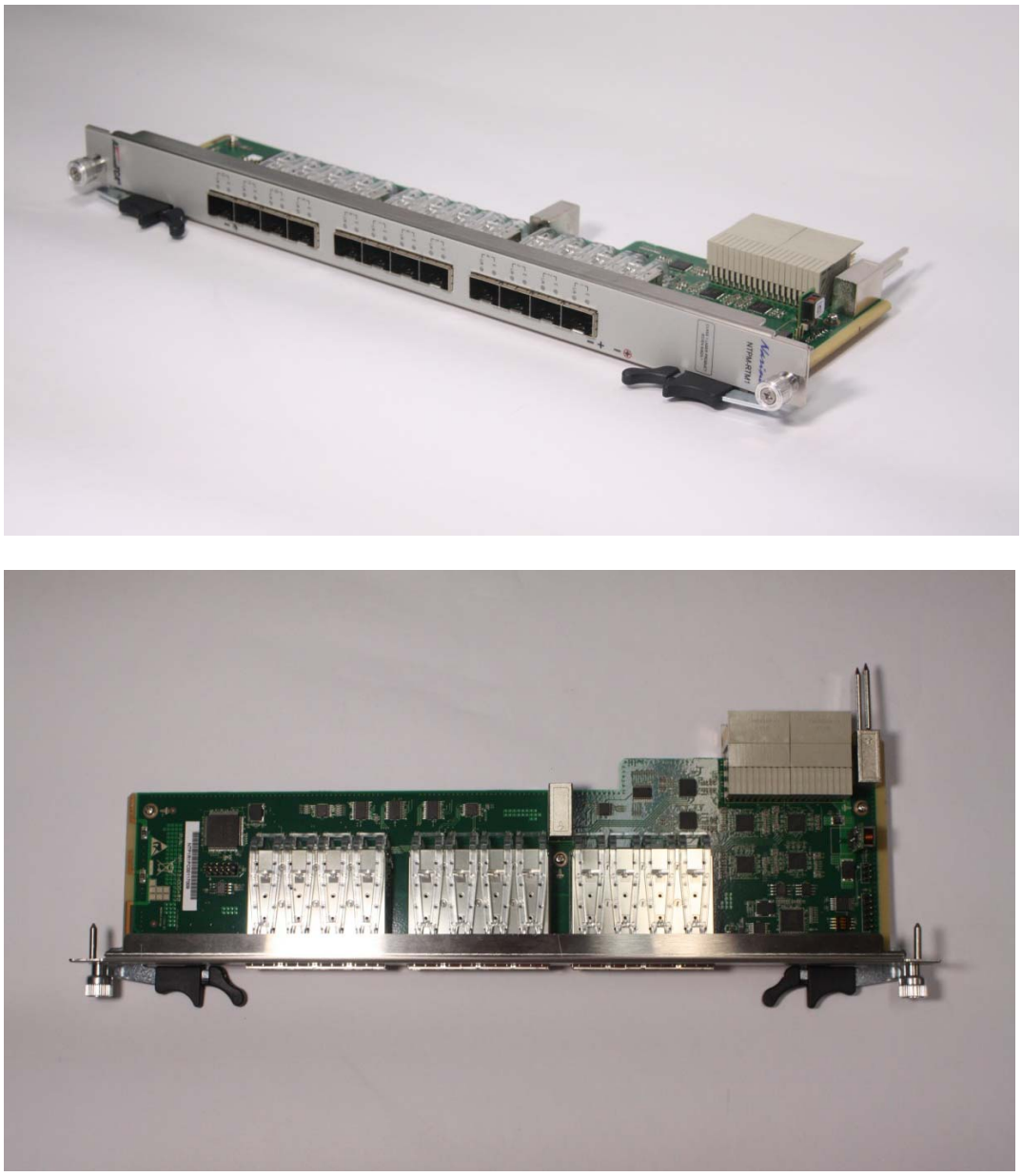


Figure 11-1 aTCA-RN710 photos

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11.2 Layer Stack-up

The layering of the PCB is illustrated in Figure 11-2. The blade has 10 layers of PCB laminate with FR408HR material, which has a low dielectric constant and low dissipation factor that are adequate to support 10Gbps SerDes signals.

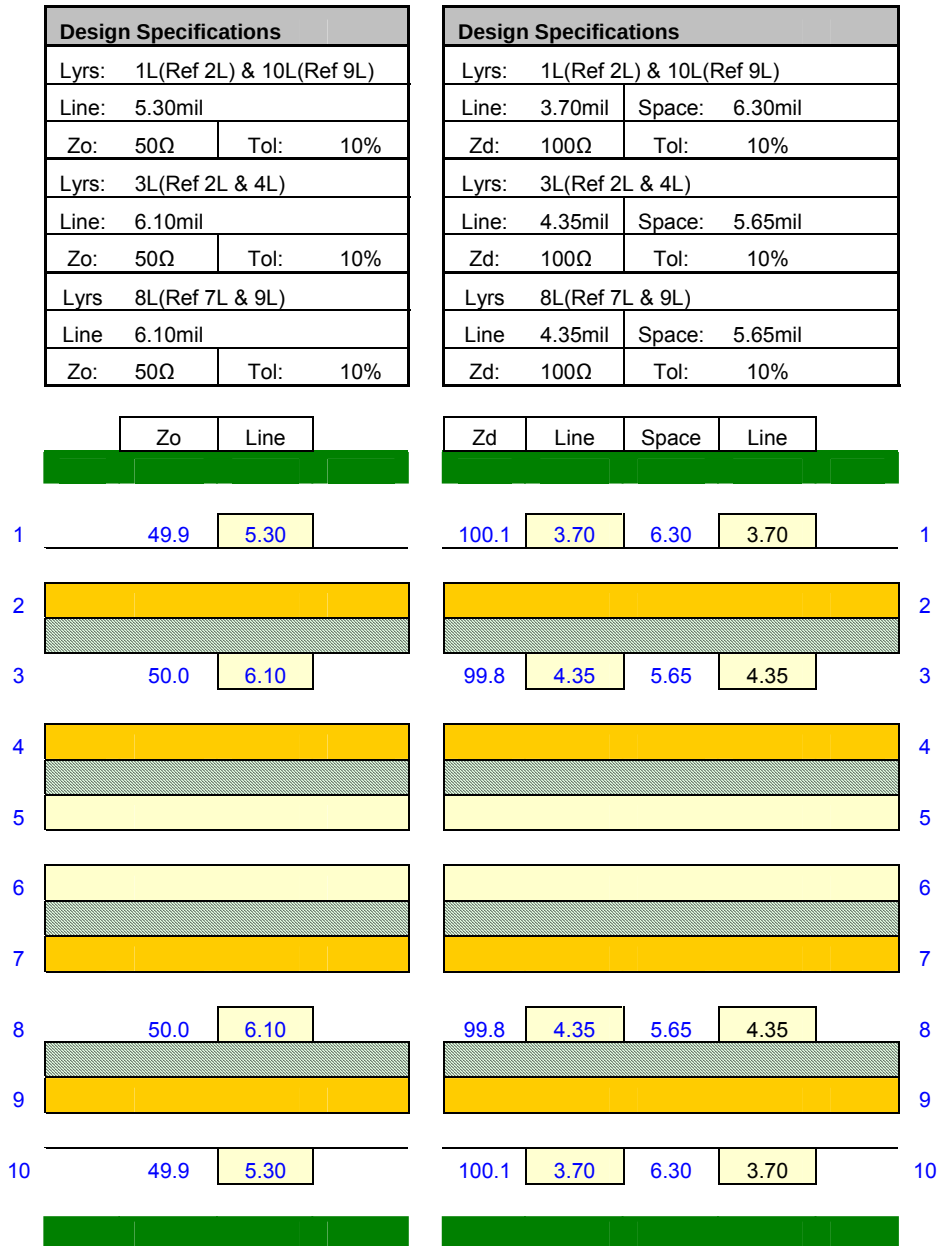


Figure 11-2 PCB Layer Stack-up

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12 References

1. aTCA-N700 Hardware User Manual Rev. 1.01, Oct. 2013

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Safety

1. Please read these safety instructions carefully.
2. Please keep this User‘s Manual for later reference.
3. One AC Inlets provided and service as Disconnect Devices, disconnect the equipment from both AC outlets use these AC Inlets before servicing or clearing. Use moisture sheet or cloth for cleaning.
4. For pluggable equipment, that the socket-outlet shall be installed near the equipment and shall be easily accessible.
5. Please keep this equipment from humidity.
6. Lay this equipment on a reliable surface when install. A drop or fall could cause injury.
7. Make sure the voltage of the power source when connect the equipment to the power outlet.
8. Place the power cord such a way that people can not step on it. Do not place anything over the power cord.
9. All cautions and warnings on the equipment should be noted.
10. If the equipment is not use for long time, disconnect the equipment from mains to avoid being damaged by transient overvoltage.
11. Never pour any liquid into openings; this could cause fire or electrical shock.
12. Never open the equipment. For safety reason, the equipment should only be opened by qualified service personnel.
13. If one of the following situations arises, get the equipment checked by a service personnel:
    a. The Power cord or plug is damaged.
    b. Liquid has penetrated into the equipment.
    c. The equipment has been exposed to moisture.
    d. The equipment has not work well or you can not get it work according to user‘s manual.
    e. The equipment has dropped and damaged.
    f. If the equipment has obvious sign of breakage.

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