aTCA-RN720

Rear Transition Module with two QSFP and four SFP+ service ports.

Users Guide

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Advance Technologies; Automate the World.

Revision History

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

Preface

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1 Introduction

The *aTCA-RN720* is a Rear Transition Module that provides two QSFP and four SFP+ service ports. The aTCA-RN720 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-RN720 can meet such needs by loading aggregated 120Gbps service ports to the front blade with QSFP and SFP+ ports.

This document is intended to provide a basic usage guide to customers using the aTCA-RN720 blade. Shown in Table 1-1 is a 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

2 Summary of Specifications

Summarized in Table 2-1 is the specifications of the aTCA-RN720.

Table 2-1 aTCA-RN720 Specifications

Feature	Function	Description
Physical	Dimensions	8U x 6HP x 70mm AdavancedTCA, single slot
	Compliance	PICMG3.0 Rev 3.0
I/O Interface	10Gbps Ethernet	2 x 40G QSFP + 4 × 10G SFP+ ports
	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 x 10G Serdes lanes for data transport 12V, 3.3V_Sub from front blade
Power	Power consumption	25Watt Max.
Environment	Temperature	+0 to 55°C (operating), -40to +85°C (non-operating)
	Relative Humidity	20 – 80 % (operating), 5-95% (non-operating)
Software	Shelf Management	IPMI v2.0

3 External Interfaces

The aTCA-RN720 has QSFP and SFP+ service ports and LED indicators available from the faceplate. The Zone 3 connectors connect to a front blade, the aTCA-N700 for example.

3.1 Front Panel Overview

The face plate of the main blade has 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: 2 QSFP and 4 SFP+ Ports

Figure 3-1 aTCA-RN720 Faceplate

3.2 Traffic Service Port

Up to two service ports are provided with QSFP receptacles and up to four service ports are provided with SFP+ receptacles. Either a fiber optic cable or a copper cable with a mating QSFP/SFP+ connector can be used to connect the RTM with remote blades or appliances. A 1G SFP module in place of the 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 from 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 and markers and their implications.

Table 3-1 Faceplate LEDs and Markers

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 pairs of 10G Serdes lanes are connected to the front blade. The Serdes lanes are configured for 2 x XLAUI, and 4x SFI interfaces. Table 3-2 and Table 3-3show 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

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	QSFP ports RX: Port 1
A2~H2	RTM_SFP_TX_P/N [0:3]	O	QSFP ports TX: Port 1
A3~H3	RTM_SFP_RX_P/N [4:7]	I	QSFP ports RX: Port 2
A4~H4	RTM_SFP_TX_P/N [4:7]	O	QSFP ports TX: Port 2
A5~H5	RTM_SFP_RX_P/N [8:11]	I	SFP+ ports RX: Port 3~6
A6~H6	RTM_SFP_TX_P/N [8:11]	O	SFP+ ports TX: Port 3~6
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

4 Installation and Operation

Before installing the aTCA-RN720, 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-RN720. Note that any front blade with identical Zone 3 pin assignment can use the aTCA-RN720.
- 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-RN720 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 a front blade monitoring is not available, an extra console may be connected through this header. Refer to Figure 4-1 for connections.

The J15 is provided for In System Programming (ISP) for the MMC as shown in Figure 4-2.

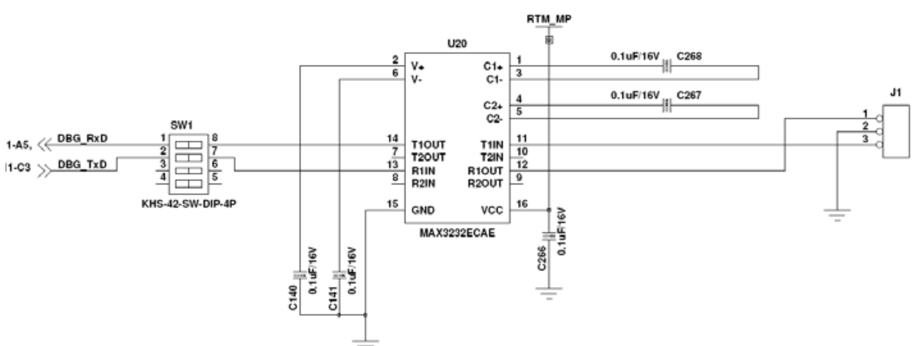


Figure 4-1 Header J1 and Switch SW1

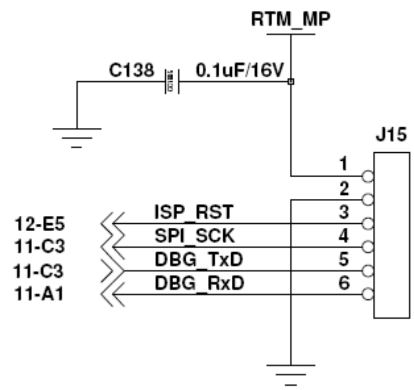


Figure 4-2 Header J15

4.1.2 DIP Switches

SW1 is provided for MMC to select different I/O connection between ISP interface and UART interface during 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-RN720 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 as the following procedures:

Step 1: The injector handles (top and bottom) shown in Figure 4-3should 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 reserved slot 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.

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

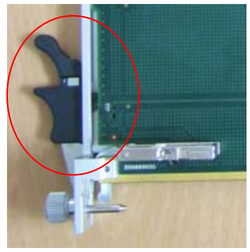
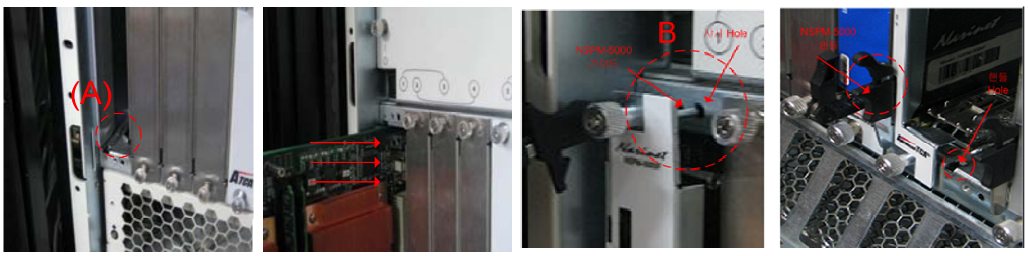


Figure 4-3 Injector (Bottom side)



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 in the following:

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.

4.2.3 Console/Management PC Connection

The aTCA-RN720 does not have its own faceplate outlet for the console connection. The management of the RTM is only through the front blade.

4.2.4 Service Port Connection

40G or 10G Ethernet traffic sources should be connected to corresponding QSFP 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 that comes at booting procedure may be the bootloader on the front blade. The bootloader initializes necessary devices on the front board including the RTM. Shown in Figure 4-5are the devices on the I2C Bus with their I2C addresses, respectively. The Local Management Processor on the front blade connected via Zone 3 interface is the master of the I2C Bus.

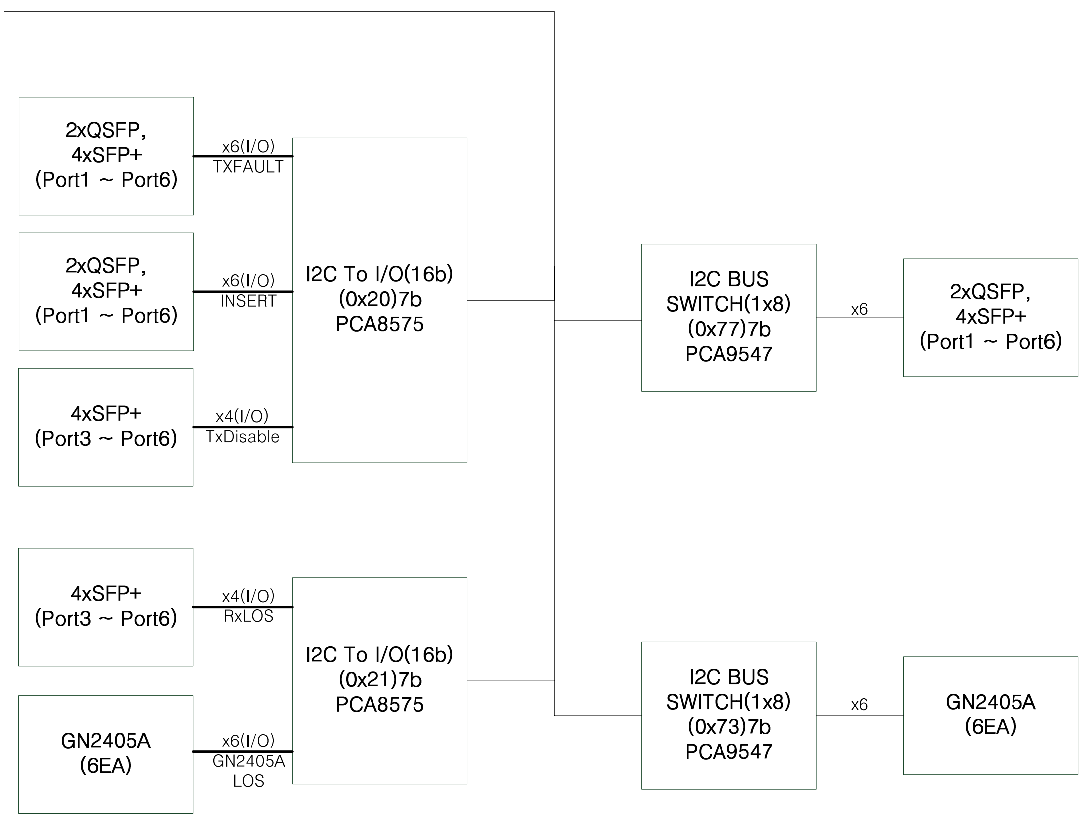


Figure 4-5 Devices on I2C Bus

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 3 and check the MUX addresses at the Uboot prompt.

=>i2c dev 3
=>i2c probe

(*screen capture of the results)

```
=> i2c dev 3
Setting bus to 3
=> i2c probe
Valid chip addresses: 16 20 21 50 73 77 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 3
=>i2c probe

/* Enable MUX(0x77) and check SFP address */
=>i2c mw 0x77 0x0 0x8; i2c probe
=>i2c mw 0x77 0x0 0x9; i2c probe
=>i2c mw 0x77 0x0 0xa; i2c probe
=>i2c mw 0x77 0x0 0xb; i2c probe
=>i2c mw 0x77 0x0 0xc; i2c probe
=>i2c mw 0x77 0x0 0xd; i2c probe

(*screen capture of the results)

```
=> i2c mw 0x77 0x0 0x8; i2c probe
Valid chip addresses: 16 20 21 50 73 77 7C
=> i2c mw 0x77 0x0 0x9; i2c probe
Valid chip addresses: 16 20 21 50 73 77 7C
=> i2c mw 0x77 0x0 0xa; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x77 0x0 0xb; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x77 0x0 0xc; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x77 0x0 0xd; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
```

=>i2c mw 0x77 0x0 0x8; i2c md 0x50 0x90 0x50
=>i2c mw 0x77 0x0 0x9; i2c md 0x50 0x90 0x50
=>i2c mw 0x77 0x0 0xa; i2c md 0x50 0x0 0x50
=>i2c mw 0x77 0x0 0xb; i2c md 0x50 0x0 0x50
=>i2c mw 0x77 0x0 0xc; i2c md 0x50 0x0 0x50
=>i2c mw 0x77 0x0 0xd; i2c md 0x50 0x0 0x50

(*screen capture of the results)

```
=> i2c mw 0x77 0x0 0x8; i2c md 0x50 0x90 0x50
0090: 00 00 00 00 46 49 4e 49 53 41 52 20 43 4f 52 50    ....FINISAR CORP
00a0: 20 20 20 20 00 00 90 65 46 54 4c 34 31 30 51 45        ...eFTL410QE
00b0: 31 43 20 20 20 20 20 20 41 20 42 68 07 d0 46 56    1C      A Bh..FV
00c0: 00 01 0c da 4d 4b 48 30 30 54 52 20 20 20 20 20    ....MKH00TR
00d0: 20 20 20 20 31 31 30 37 32 32 20 20 08 00 00 62        110722  ...b
=> i2c mw 0x77 0x0 0x9; i2c md 0x50 0x90 0x50
0090: 00 00 00 00 46 49 4e 49 53 41 52 20 43 4f 52 50    ....FINISAR CORP
00a0: 20 20 20 20 00 00 90 65 46 54 4c 34 31 30 51 45        ...eFTL410QE
00b0: 31 43 20 20 20 20 20 20 41 20 42 68 07 d0 46 56    1C      A Bh..FV
00c0: 00 01 0c da 4d 4b 48 30 30 54 36 20 20 20 20 20    ....MKH00T6
00d0: 20 20 20 20 31 31 30 37 32 32 20 20 08 00 00 46        110722  ...F
=> i2c mw 0x77 0x0 0xa; i2c md 0x50 0x0 0x50
0000: 03 04 07 10 00 00 00 00 00 00 00 06 67 00 00 00    ............g...
0010: 08 02 00 1e 53 75 6d 69 74 6f 6d 6f 45 6c 65 63    ....SumitomoElec
0020: 74 72 69 63 00 00 00 5f 53 50 50 35 31 30 30 53    tric..._SPP5100S
0030: 52 2d 47 4c 20 20 20 20 41 20 20 20 03 52 00 2e    R-GL    A   .R..
0040: 00 1a 00 00 32 33 54 35 30 36 31 30 31 35 39 34    ....23T506101594
=> i2c mw 0x77 0x0 0xb; i2c md 0x50 0x0 0x50
0000: 03 04 07 10 00 00 00 00 00 00 00 06 67 00 00 00    ............g...
0010: 08 02 00 1e 53 75 6d 69 74 6f 6d 6f 45 6c 65 63    ....SumitomoElec
0020: 74 72 69 63 00 00 00 5f 53 50 50 35 31 30 30 53    tric..._SPP5100S
0030: 52 2d 47 4c 20 20 20 20 41 20 20 20 03 52 00 2e    R-GL    A   .R..
0040: 00 1a 00 00 32 33 54 35 30 36 31 30 31 36 30 36    ....23T506101606
=> i2c mw 0x77 0x0 0xc; i2c md 0x50 0x0 0x50
0000: 03 04 07 20 00 00 02 00 00 00 00 06 67 02 0a 64    ... ........g..d
0010: 00 00 00 00 46 49 4e 49 53 41 52 20 43 4f 52 50    ....FINISAR CORP
0020: 2e 20 20 20 00 00 90 65 46 54 4c 58 31 34 37 31    .   ...eFTLX1471
0030: 44 33 42 43 56 20 20 20 41 20 20 20 05 1e 00 71    D3BCV   A   ...q
0040: 00 3a 00 00 41 4e 37 30 4b 59 38 20 20 20 20 20    .:..AN70KY8
=> i2c mw 0x77 0x0 0xd; i2c md 0x50 0x0 0x50
0000: 03 04 07 20 00 00 02 00 00 00 00 06 67 02 0a 64    ... ........g..d
0010: 00 00 00 00 46 49 4e 49 53 41 52 20 43 4f 52 50    ....FINISAR CORP
0020: 2e 20 20 20 00 00 90 65 46 54 4c 58 31 34 37 31    .   ...eFTLX1471
0030: 44 33 42 43 56 20 20 20 41 20 20 20 05 1e 00 71    D3BCV   A   ...q
0040: 00 3a 00 00 55 4b 33 30 42 48 4d 20 20 20 20 20    .:..UK30BHM
```

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 3
=>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)

```
=> i2c mw 0x73 0x0 0x8; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x73 0x0 0x9; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x73 0x0 0xa; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x73 0x0 0xb; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x73 0x0 0xc; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c mw 0x73 0x0 0xd; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 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 mw 0x73 0x0 0x8; i2c probe
Valid chip addresses: 16 20 21 50 51 73 77 7C
=> i2c md 0x16 0x9a 0x2
009a: 44 15    D.
=> i2c mw 0x16 0x9a 0xcafe.2
=> i2c md 0x16 0x9a 0x2
009a: ca fe    ..
=> i2c mw 0x16 0x9a 0x4415.2
=> i2c md 0x16 0x9a 0x2
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
=>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

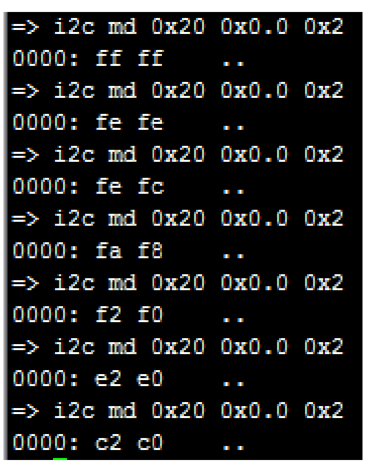
To check the I/O Device to the SFP module status, refer to the following example. Make sure that the corresponding SFP modules are present on the board.

15	14	13	12	11	10	9	8
SFP4 TXDISABLE	SFP3 TXDISABLE	SFP4 INSERT	SFP3 INSERT	SFP2 INSERT	SFP1 INSERT	QSFP2 INSERT	QSFP1 INSERT

7	6	5	4	3	2	1	0
SFP2 TXDISABLE	SFP1 TXDISABLE	SFP4 TXFAULT	SFP3 TXFAULT	SFP2 TXFAULT	SFP1 TXFAULT	QSFP2 TXFAULT	QSFP1 TXFAULT

=>i2c dev 3
=>i2c probe
=>i2c md 0x20 0x0.0 0x2

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


```
=> i2c md 0x20 0x0.0 0x2
0000: ff ff    ..
=> i2c md 0x20 0x0.0 0x2
0000: fe fe    ..
=> i2c md 0x20 0x0.0 0x2
0000: fe fc    ..
=> i2c md 0x20 0x0.0 0x2
0000: fa f8    ..
=> i2c md 0x20 0x0.0 0x2
0000: f2 f0    ..
=> i2c md 0x20 0x0.0 0x2
0000: e2 e0    ..
=> i2c md 0x20 0x0.0 0x2
0000: c2 c0    ..
```

4.4 IPMI Command

When the front blade is up and running the aTCA-RN720 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-RN720 at any state. Attached below are the example runs.

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: Norm
al State Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Norm
al State Change (0x0)
    Device ID String: "ANPI1-A"

98: FRU # 1
    Entity: (0xc0, 0x6d)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Norm
al State Change (0x0)
    Device ID String: "RTM2"
```

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: Norm
al State Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Norm
al State Change (0x0)
    Device ID String: "ANPI1-A"

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

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Feb 13 09:43:50 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M4->M6, Cause=0x1
0x0002: Event: at Feb 13 09:43:59 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M6->M1, Cause=0x0
#
```

Step 3. Activate the FRU and check the status.

```
# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Feb 13 10:02:08 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M4->M6, Cause=0x1
0x0002: Event: at Feb 13 10:02:10 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 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: Norm
al State Change (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Norm
al State Change (0x0)
    Device ID String: "ANPI1-A"

98: FRU # 1
    Entity: (0xc0, 0x6d)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Norm
al State Change (0x0)
    Device ID String: "RTM2"

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Feb 13 10:02:08 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M4->M6, Cause=0x1
0x0002: Event: at Feb 13 10:02:10 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M6->M1, Cause=0x0
0x0003: Event: at Feb 13 10:02:38 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M1->M2, Cause=0x3
0x0004: Event: at Feb 13 10:02:38 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 1 M2->M3, Cause=0x1
0x0005: Event: at Feb 13 10:02:38 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotS
wap: FRU 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 Feb 13 10:04:14 1970; from:(0x98,0,0); sensor:(0xc0,67); event:0x70(asserted): 0xA0 0x00 0x00
#
```

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 State Chan
ge (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal State Chan
ge (0x0)
    Device ID String: "ANPI1-A"

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

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Feb 13 10:06:12 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M4
->M5, Cause=0x2
0x0002: Event: at Feb 13 10:06:12 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M5
->M6, Cause=0x1
0x0003: Event: at Feb 13 10:06:14 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M6
->M1, Cause=0x0
#
```

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 State Chan
ge (0x0)

98: FRU # 0
    Entity: (0xa0, 0x60)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal State Chan
ge (0x0)
    Device ID String: "ANPI1-A"

98: FRU # 1
    Entity: (0xc0, 0x6d)
    Hot Swap State: M4 (Active), Previous: M3 (Activation In Process), Last State Change Cause: Normal State Chan
ge (0x0)
    Device ID String: "RTM2"

# clia sel board 13

Pigeon Point Shelf Manager Command Line Interpreter

0x0001: Event: at Feb 13 10:06:12 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M4
->M5, Cause=0x2
0x0002: Event: at Feb 13 10:06:12 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M5
->M6, Cause=0x1
0x0003: Event: at Feb 13 10:06:14 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M6
->M1, Cause=0x0
0x0004: Event: at Feb 13 10:07:22 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M1
->M2, Cause=0x2
0x0005: Event: at Feb 13 10:07:22 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M2
->M3, Cause=0x1
0x0006: Event: at Feb 13 10:07:22 1970; from:(0x98,0,0); sensor:(0xf0,1); event:0x6f(asserted): HotSwap: FRU 1 M3
->M4, Cause=0x0
#
```

4.4.4 Threshold Base Sensor Data

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

Step 1. Execute following command to get the information about threshold base sensor data.

```
# clia sensordata board 13 -f 1

Pigeon Point Shelf Manager Command Line Interpreter
```

(Discrete sensor data information is omitted).

```
98: LUN: 0, Sensor # 62 ("RTM2 +3.3V_MP")
    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

98: LUN: 0, Sensor # 63 ("RTM2 +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: 214 (0xd6)
    Processed data: 11.817500 Volts
    Status: 0x00

98: LUN: 0, Sensor # 64 ("RTM2 +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: 233 (0xe9)
    Processed data: 3.333650 Volts
    Status: 0x00

98: LUN: 0, Sensor # 65 ("RTM2 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: 30 (0x1e)
    Processed data: 30.000000 degrees C
    Status: 0x00

98: LUN: 0, Sensor # 66 ("RTM2 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: 24 (0x18)
    Processed data: 24.000000 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 # 62 ("RTM2 +3.3V_MP")
    Type: Threshold (0x01), "Voltage" (0x02)
        Lower Non-Critical Threshold, Raw Data: 0xdc ; Processed data: 3.147750 Volts
        Lower Critical Threshold, Raw Data: 0xd2 ; Processed data: 3.004750 Volts
        Upper Non-Critical Threshold, Raw Data: 0xf2 ; Processed data: 3.462350 Volts
        Upper Critical Threshold, Raw Data: 0xfc ; Processed data: 3.605350 Volts
        Upper Non-Recoverable Threshold, Raw Data: 0xff ; Processed data: 3.648250 Volts

98: LUN: 0, Sensor # 63 ("RTM2 +12V_A")
    Type: Threshold (0x01), "Voltage" (0x02)
        Lower Non-Critical Threshold, Raw Data: 0xcf ; Processed data: 11.432500 Volts
        Lower Critical Threshold, Raw Data: 0xc4 ; Processed data: 10.827500 Volts
        Lower Non-Recoverable Threshold, Raw Data: 0x6d ; Processed data: 6.042500 Volts
        Upper Non-Critical Threshold, Raw Data: 0xe5 ; Processed data: 12.642500 Volts
        Upper Critical Threshold, Raw Data: 0xf0 ; Processed data: 13.247500 Volts
        Upper Non-Recoverable Threshold, Raw Data: 0xff ; Processed data: 14.072500 Volts

98: LUN: 0, Sensor # 64 ("RTM2 +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 # 65 ("RTM2 Temp 1")
    Type: Threshold (0x01), "Temperature" (0x01)
        Lower Non-Critical Threshold, Raw Data: 0x0a ; Processed data: 10.000000 degrees C
        Lower Critical Threshold, Raw Data: 0x00 ; Processed data: 0.000000 degrees C
        Upper Non-Critical Threshold, Raw Data: 0x37 ; Processed data: 55.000000 degrees C
        Upper Critical Threshold, Raw Data: 0x46 ; Processed data: 70.000000 degrees C
        Upper Non-Recoverable Threshold, Raw Data: 0x50 ; Processed data: 80.000000 degrees C

98: LUN: 0, Sensor # 66 ("RTM2 Temp 2")
    Type: Threshold (0x01), "Temperature" (0x01)
        Lower Non-Critical Threshold, Raw Data: 0x00 ; Processed data: 0.000000 degrees C
        Lower Critical Threshold, Raw Data: 0xf6 ; Processed data: -10.000000 degrees C
        Upper Non-Critical Threshold, Raw Data: 0x2d ; Processed data: 45.000000 degrees C
        Upper Critical Threshold, Raw Data: 0x3c ; Processed data: 60.000000 degrees C
        Upper Non-Recoverable Threshold, Raw Data: 0x46 ; Processed data: 70.000000 degrees C
```

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             = Aug 10 07:29:00 2012 (8735489 minutes since 1996)
    Board Manufacturer        = Narinet, INC.
    Board Product Name        = NTPM-RTM2
    Board Serial Number       = NTP1R2MC00128003
    Board Part Number         = NTPM-RTM2-000
    FRU Programmer File ID    =

Product Info Area:
    Version     = 1
    Language Code             = 25
    Manufacturer Name         = Narinet, INC.
    Product Name              = NTPM-RTM2
    Product Part / Model#     = NTPM-RTM2-000
    Product Version           = R1
    Product Serial Number     = NTP1R2MC00128003
    Asset Tag                 =
    FRU Programmer File ID    = 00.00

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

    AMC Point-to-Point Connectivity Record (ID=0x19)
        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
#
#
```

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
<firmwareimg> 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
```

5 Architecture Overview

The aTCA-RN720 is composed of the several major components as illustrated in Figure 5-1: the MMC, the CPLD, the Retimers, the I2C Block and the QSFP/SFP+s. The QSFP/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 10G Serdes 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 the timer with equalizer function is essential to compensate the signals. The 40G interface XLAUI depends on four pairs of 10G Serdes links. The equalizer function of the Retimer compensates any frequency dependent loss on the path to extend the reachability of sensitive 10G 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 twelve of 10G interfaces, which result in12 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 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.

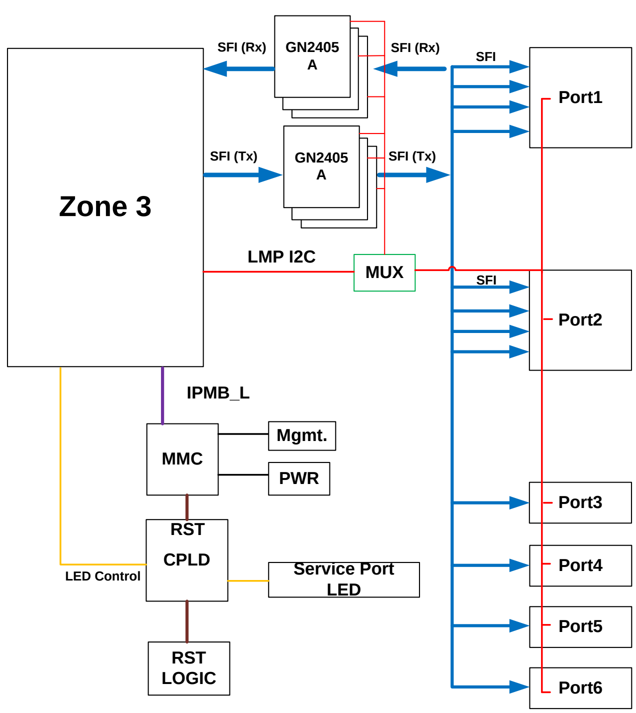


Figure 5-1 aTCA-RN720 Architecture

6 Data Path: Ports and Retimers

6.1 Overview

The retimers used on the board are 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 retimerGN2405A from Gennum. Shown in Figure 6-1are the six retimers and the QSFP/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 QSFP/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.

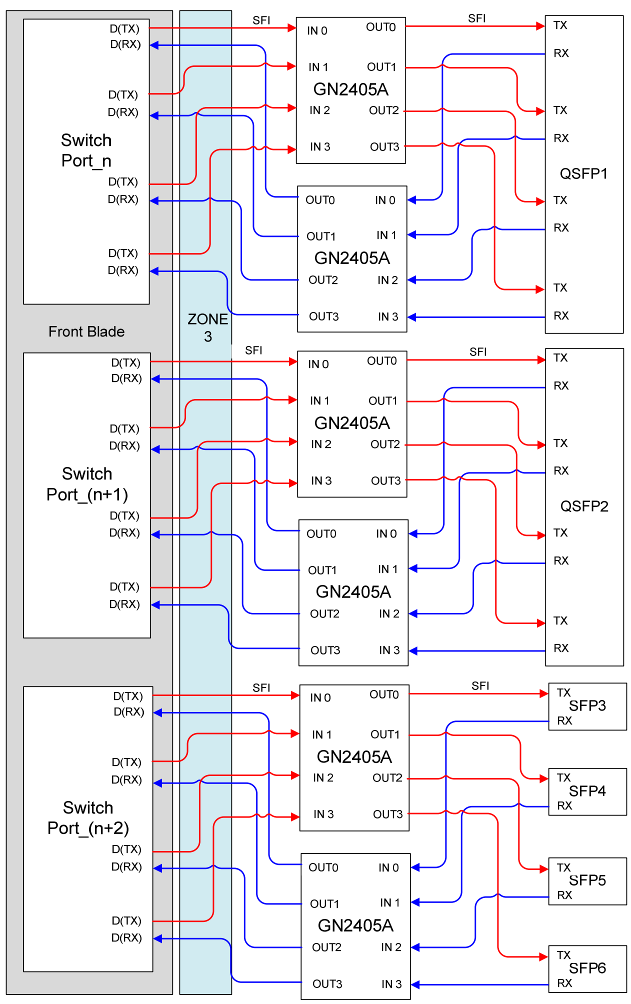


Figure 6-1 QSFP/SFP+ and Data Path

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 GN2405A are summarized as the following:

- 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

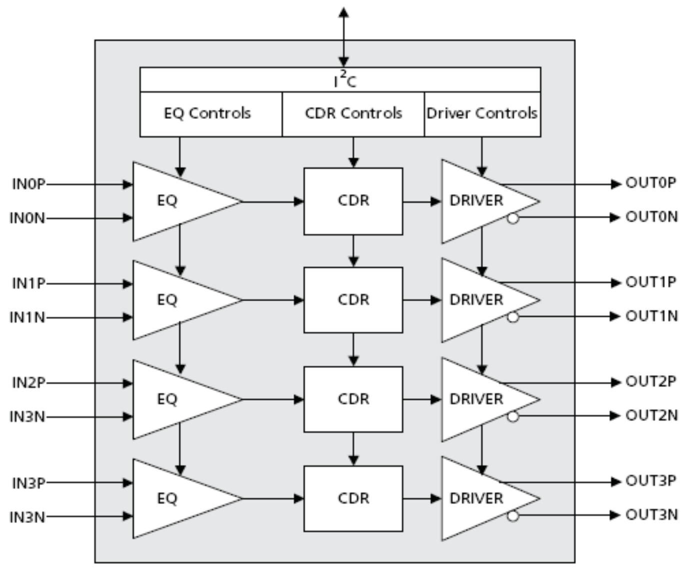


Figure 6-2 GN2405 Block diagram

The retimers are configured through an I2C bus. 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.

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
  - ⇨ 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(QSFP)@Top location
		P14 (58)		
		P14 (59)		
		P14 (60)		
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	P2(QSFP)
		P13 (54)		
		P13 (55)		
		P13 (56)		
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	P3 (SFP+)
		P12 (50)		P4 (SFP+)
		P12 (51)		P5 (SFP+)
		P12 (52)		P6 (SFP+)

7 Module Management Controller

7.1 Overview

Figure 7-1 shows the 7 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.

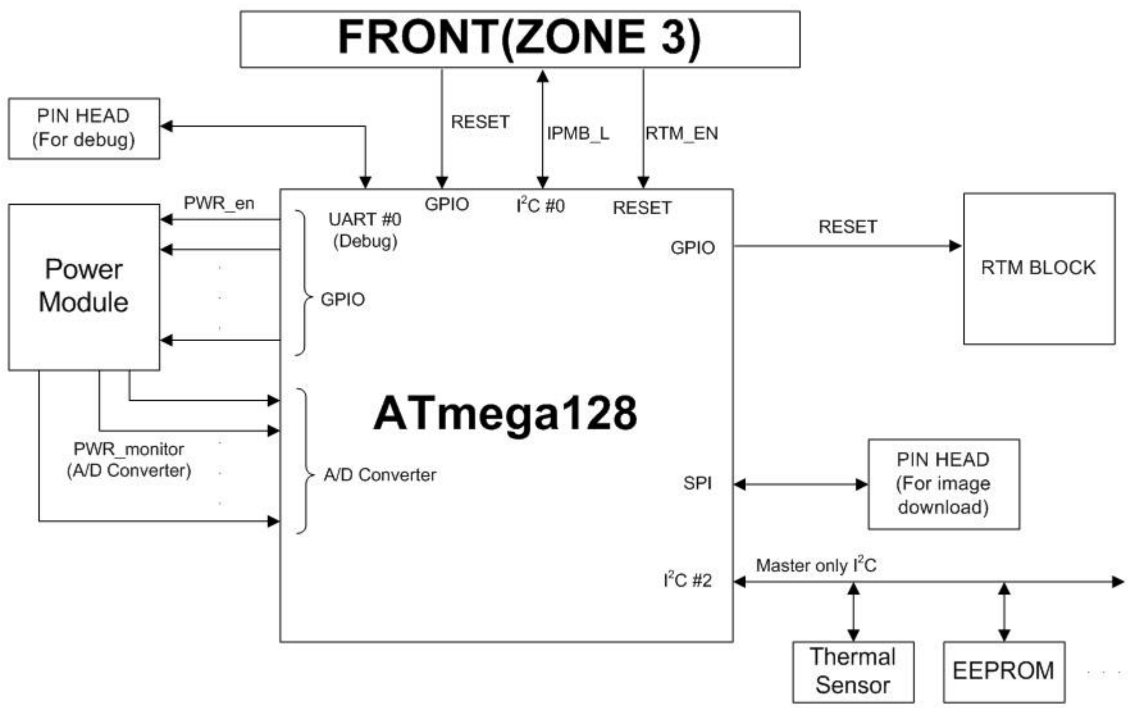


Figure 7-1 MMC Block

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 : FRU 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.

- 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

■ Cold Reset triggered by Shelf manager

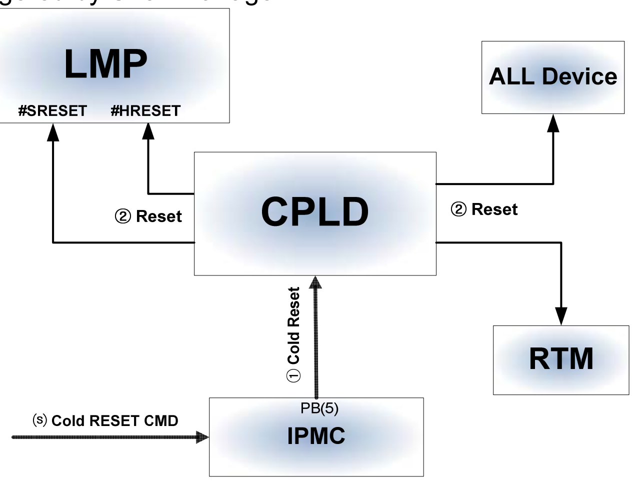


Figure 7-2 Cold Reset Procedure

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

■ Deactivate

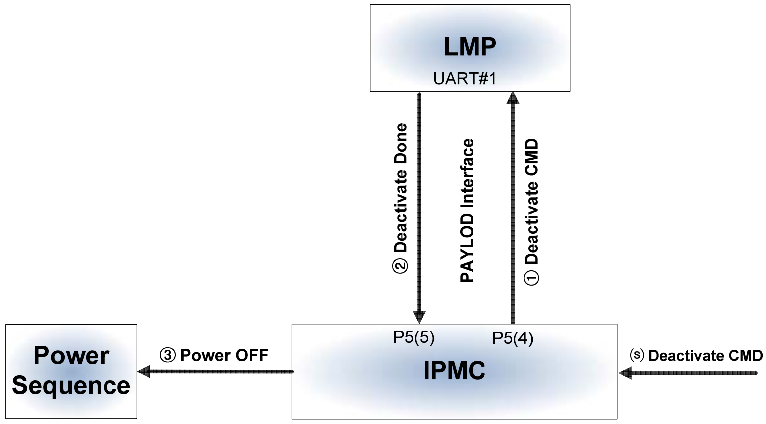


Figure 7-3 Deactivate Procedure

ⓢ 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

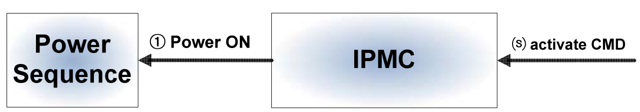


Figure 7-4 Activate Procedure

ⓢ 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

■ RTM Deactivate

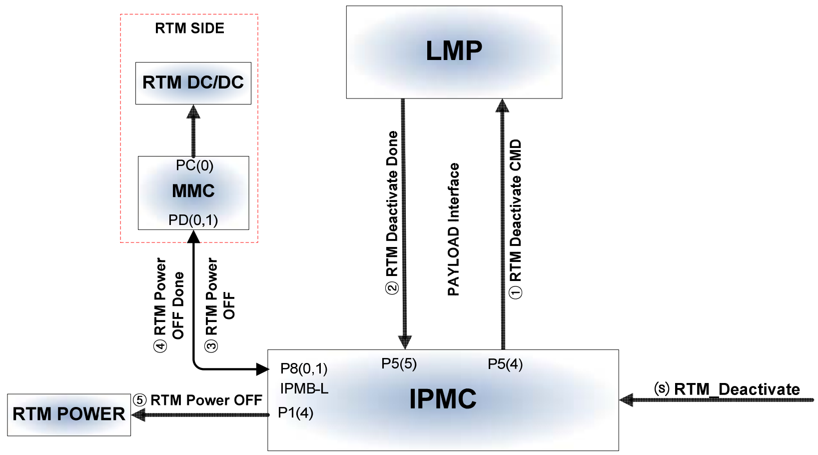


Figure 7-5 RTM Deactivate Procedure

ⓢ Shelf manager sends RTM Deactivate Command to IPMC.
①IPMC 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

■ RTM Activate

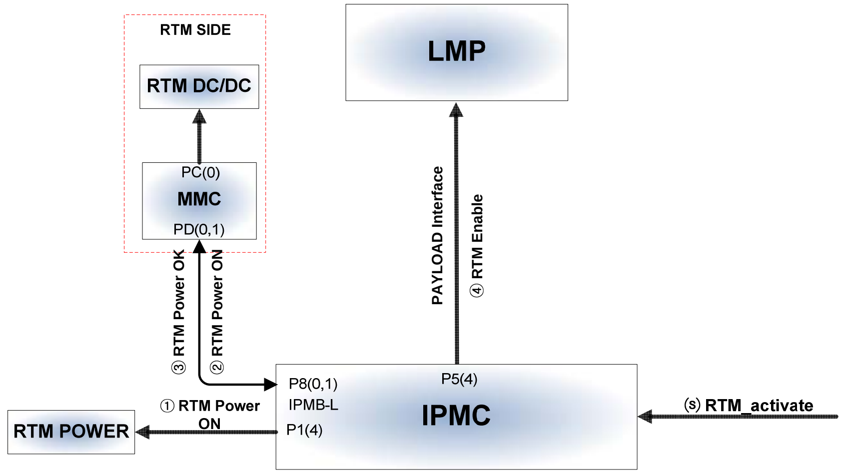


Figure 7-6 RTM Activate Procedure

ⓢ 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

- Shutdown triggered by LMP

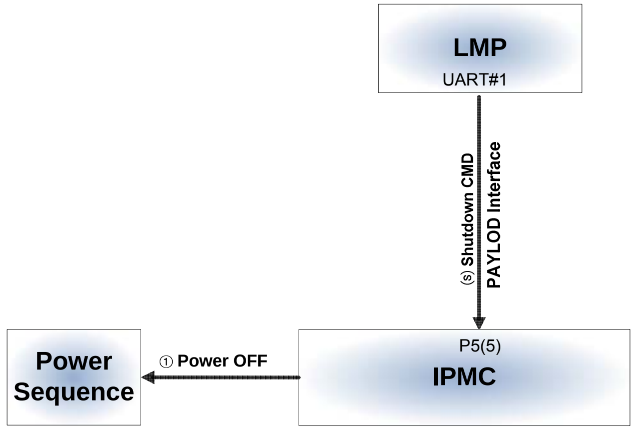


Figure 7-7 Shutdown Procedure

ⓢ 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

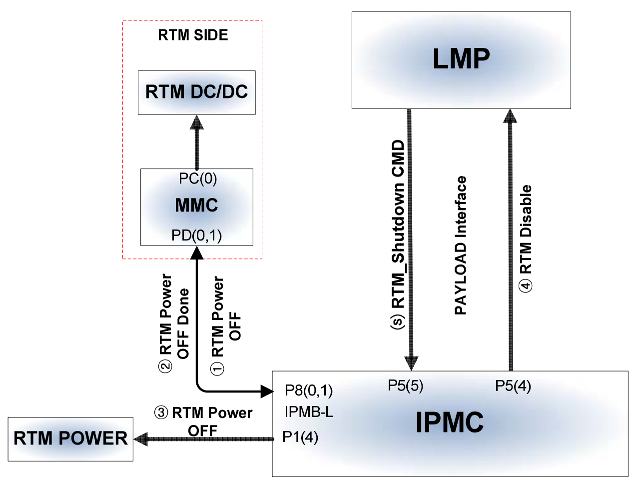


Figure 7-8 RTM Shutdown Procedure

ⓢ 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).

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

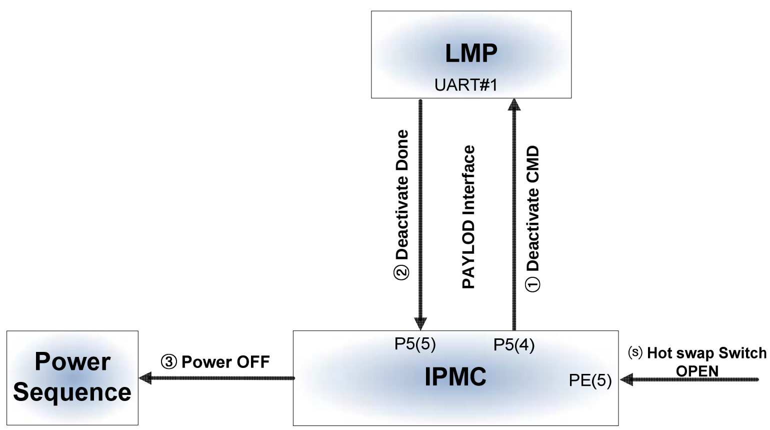


Figure 7-9 Hot Swap Procedure

ⓢ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

■ RTM Hot Swap

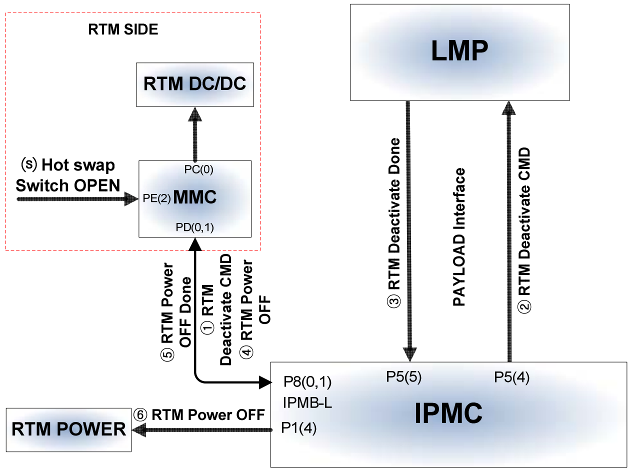


Figure 7-10 RTM Hot Swap Procedure

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

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
RTM2 +12V_A	UNR : +15V UC : +14V UNC : +12.6V LNC : +11.4V LC : +4.5V LNR : N/A	0.1V
RTM2 +3.3V_MP	UNR : 3.78V UC : +3.6V UNC : +3.46V LNC : 3.135V LC : +3V LNR : N/A	0.04V
RTM2 +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
RTM2 Inlet Temp	UNR : 70 ℃ UC :60 ℃ UNC :45 ℃	2℃
RTM2 SFP Temp	UNR : Tmax -ΔT + 10℃ UC : Tmax -ΔT UNC : Tmax -ΔT - 10℃	2℃

8 CPLD

The CPLD is used for various control purposes. Shown in Figure 8-1 is 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 QSFP/SFP+ status LEDs on the faceplate. The CPLD decodes the LED data[0:1] and distribute 6 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.

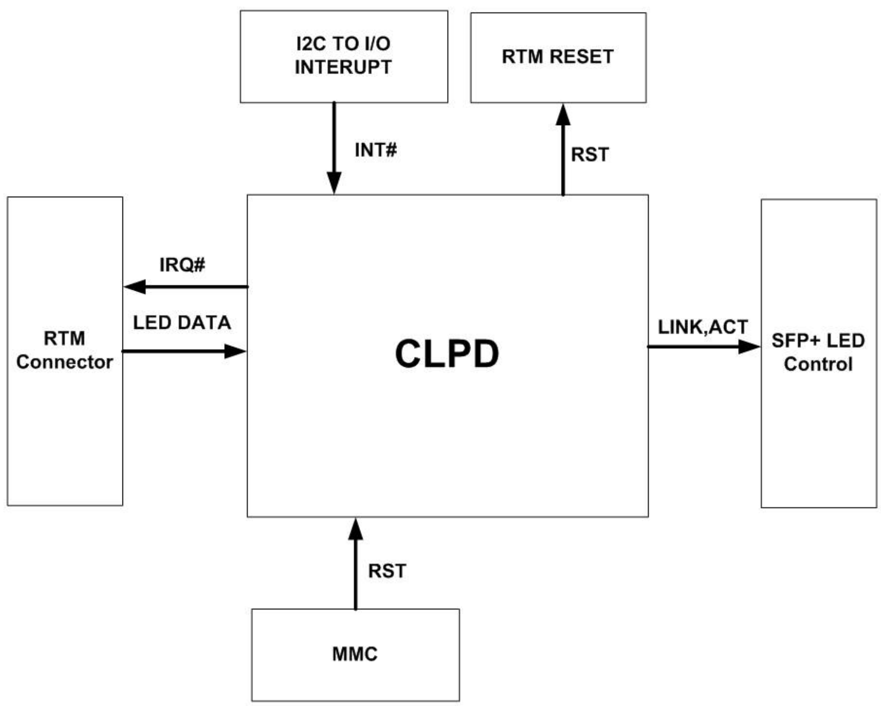


Figure 8-1 CPLD Block

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

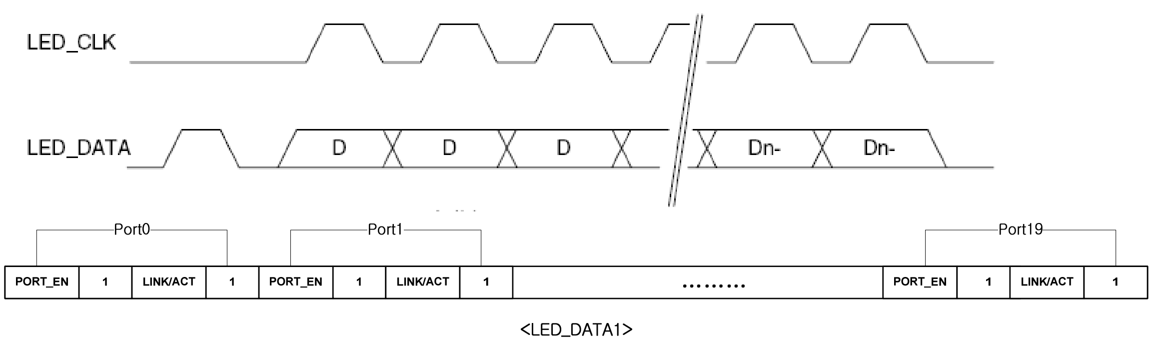
- Link Status: Up=1, Down = 0.
- Act Status: Act=1, No Act = 0.
- Link-En Status: Enable = 1, Disable = 0.

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***. The aTCA-N700 front blade sends the stream as in Figure 8-2 where the ports are arranged as in Table 8-2. The RTM CPLD picks up necessary port information and distributes to the corresponding QSFP/SFPs. 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.



(a) aTCA-N700 front blade

Figure 8-2 Zone 3 RTM_LED_DATA format

Table 8-2 LED_DATA1 Stream: aTCA-N700 front blade

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	Don't care	Don't care	X
	5			
	6			
	7			
Port 2	8	Don't care	Don't care	X
	9			
	10			
	11			

Data Port No.	DataBit	Description	Switch Serdes No.	Port Name.
Port 3	12	Don't care	Don't care	X
	13			
	14			
	15			
Port 4	16	PORT_EN	53	R-P02
	17	1		
	18	LINK/ACT		
	19	1		
Port 5	20	Don't care	Don't care	X
	21			
	22			
	23			
Port 6	24	Don't care	Don't care	X
	25			
	26			
	27			
Port 7	28	Don't care	Don't care	X
	29			
	30			
	31			
Port 8	32	PORT_EN	49	R-P03
	33	1		
	34	LINK/ACT		
	35	1		
Port 9	36	PORT_EN	50	R-P04
	37	1		
	38	LINK/ACT		
	39	1		
Port 10	40	PORT_EN	51	R-P05
	41	1		
	42	LINK/ACT		
	43	1		
Port 11	44	PORT_EN	52	R-P06
	45	1		
	46	LINK/ACT		
	47	1		
Port 12 ~Port 19	48	Don't care	Don't care	X
	~			
	79			

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. 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

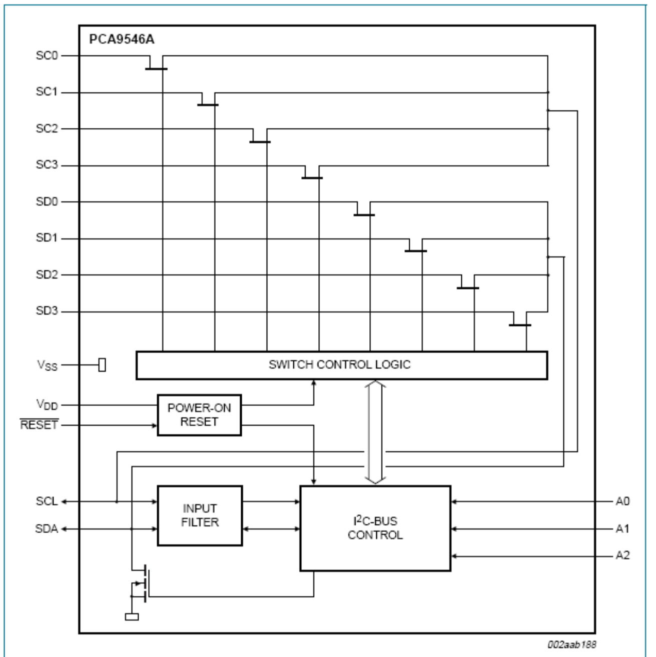


Fig 1. Block diagram of PCA9546A

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.

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

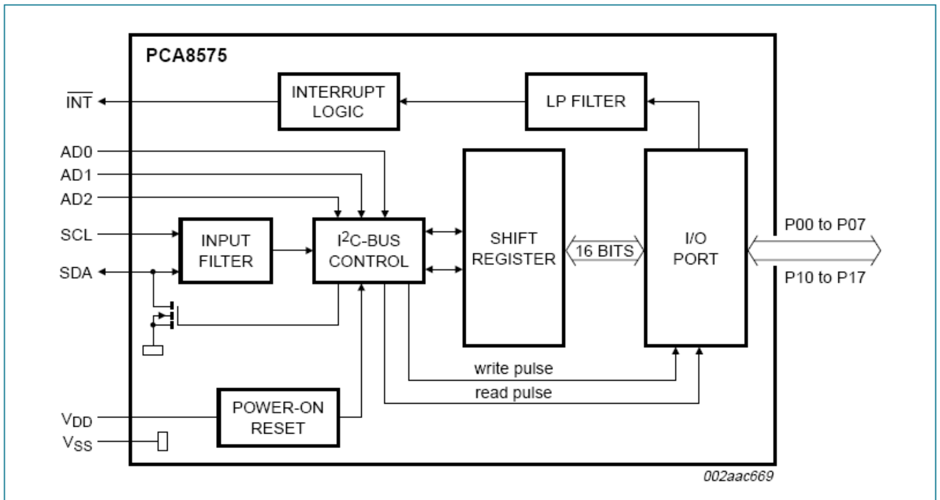


Fig 1. Block diagram of PCA8575

Figure 9-2 PCA8575 Block Diagram

10 Power and Reset

10.1 Power Consumption Budget

The RTM power consumption is estimated as 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
QSFP	0.55	1.3	1.815	4.29	2	1.1	2.6	3.63	8.58
SFP+	0.2	0.25	0.66	0.825	4	0.8	1	2.64	3.3
GN2405A	0.318	0.413	1.0494	1.3629	6	1.908	2.478	6.2964	8.1774
PCA8575	0.0001	0.0002	0.00033	0.00066	2	0.0002	0.0004	0.00066	0.00132
PCA9547	0.00002	0.00005	0.000066	0.000165	2	0.00004	0.0001	0.000132	0.00033
LCMXO256C-3MN100C	0.025	0.025	0.0825	0.0825	1	0.025	0.025	0.0825	0.0825
Total Current		1.96325			0	3.80824	6.0785		
Total Power			3.607296	7.198191	0			12.649692	20.14155

Switching Regulator & LDO	description	EFF	Total Current[A] 3.3V		Total Power	
			3.3	3.3	TYP.	MAX
NQR010A0X(10A)	12V -> 3.3V	89%	3.80824	6.0785	14.12044045	22.53825843
Total Power(Be considered Efficiency)					14.12044045	22.53825843

10.2 Power Distribution

The RTM 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 RTM2 power distribution block diagram.

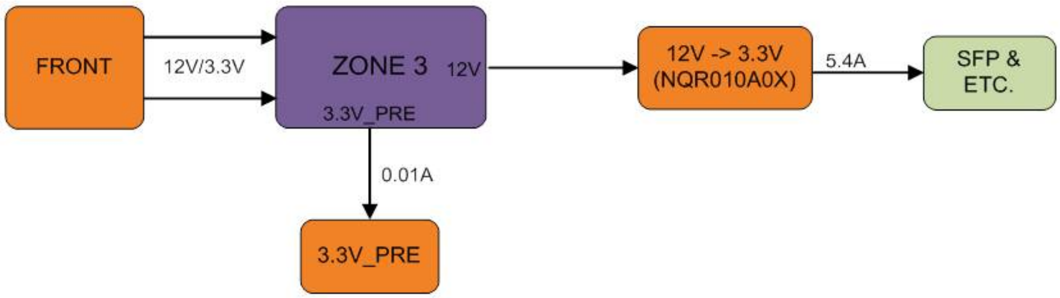


Figure 10-1 Power Distribution

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 RTM2 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.

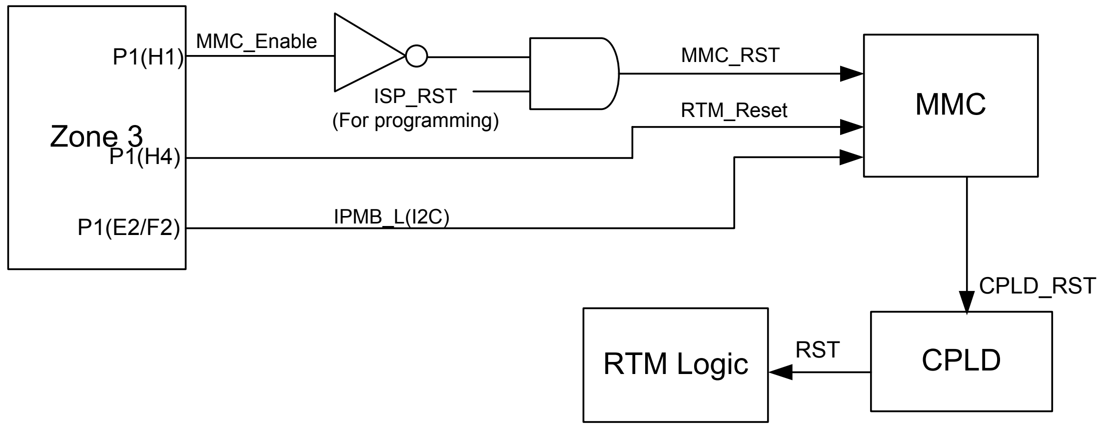
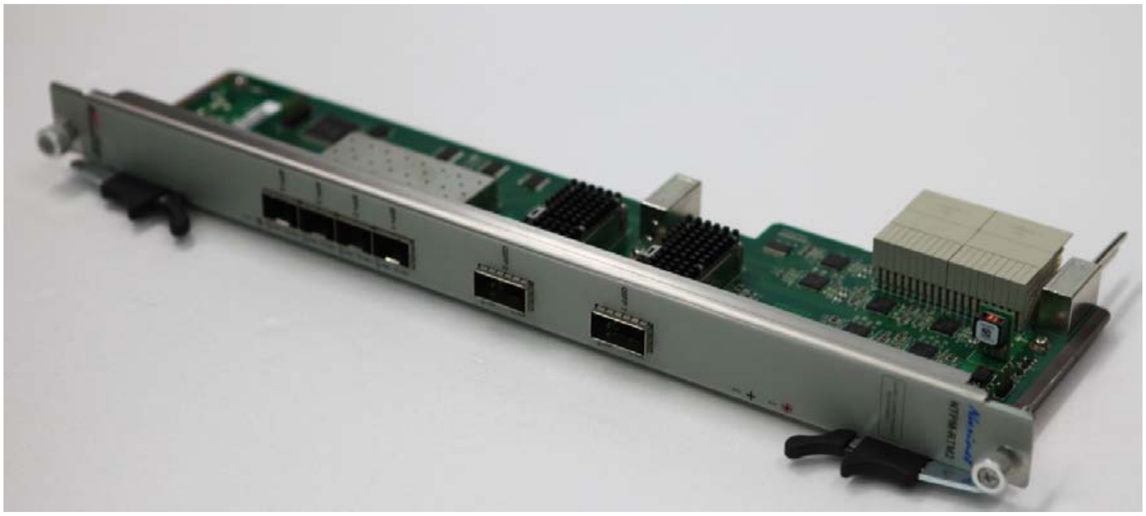


Figure 10-3 Reset Tree

11 Outline

11.1 Board Outline

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



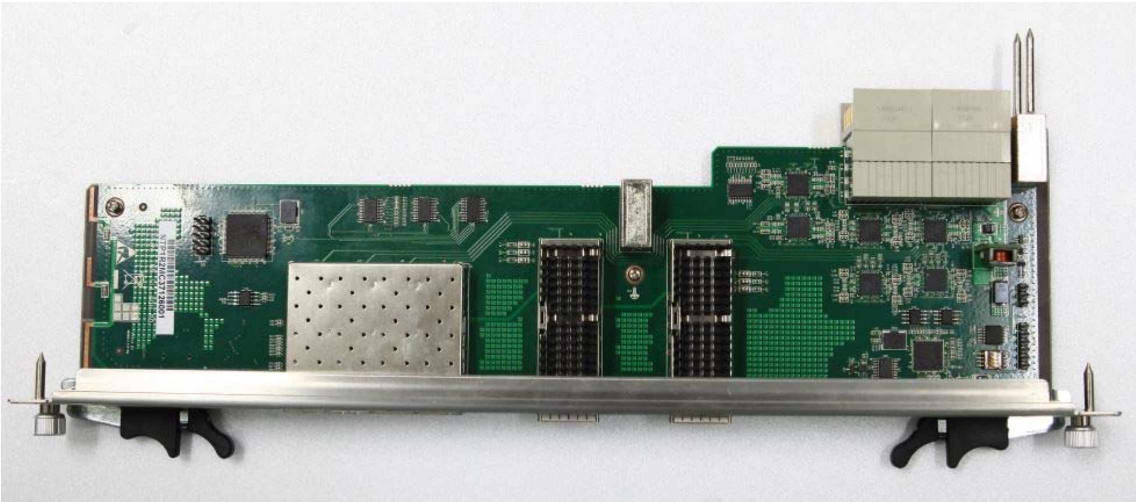


Figure 11-1 aTCA-RN720 photos

11.2 Layer Stack-up

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

Design Specifications			
Lyrs:	1L(Ref 2L) & 10L(Ref 9L)		
Line:	5.30mil		
Zo:	50Ω	Tol:	10%
Lyrs:	3L(Ref 2L & 4L)		
Line:	6.10mil		
Zo:	50Ω	Tol:	10%
Lyrs	8L(Ref 7L & 9L)		
Line	6.10mil		
Zo:	50Ω	Tol:	10%

Design Specifications			
Lyrs:	1L(Ref 2L) & 10L(Ref 9L)		
Line:	3.70mil	Space:	6.30mil
Zd:	100Ω	Tol:	10%
Lyrs:	3L(Ref 2L & 4L)		
Line:	4.35mil	Space:	5.65mil
Zd:	100Ω	Tol:	10%
Lyrs	8L(Ref 7L & 9L)		
Line	4.35mil	Space:	5.65mil
Zd:	100Ω	Tol:	10%

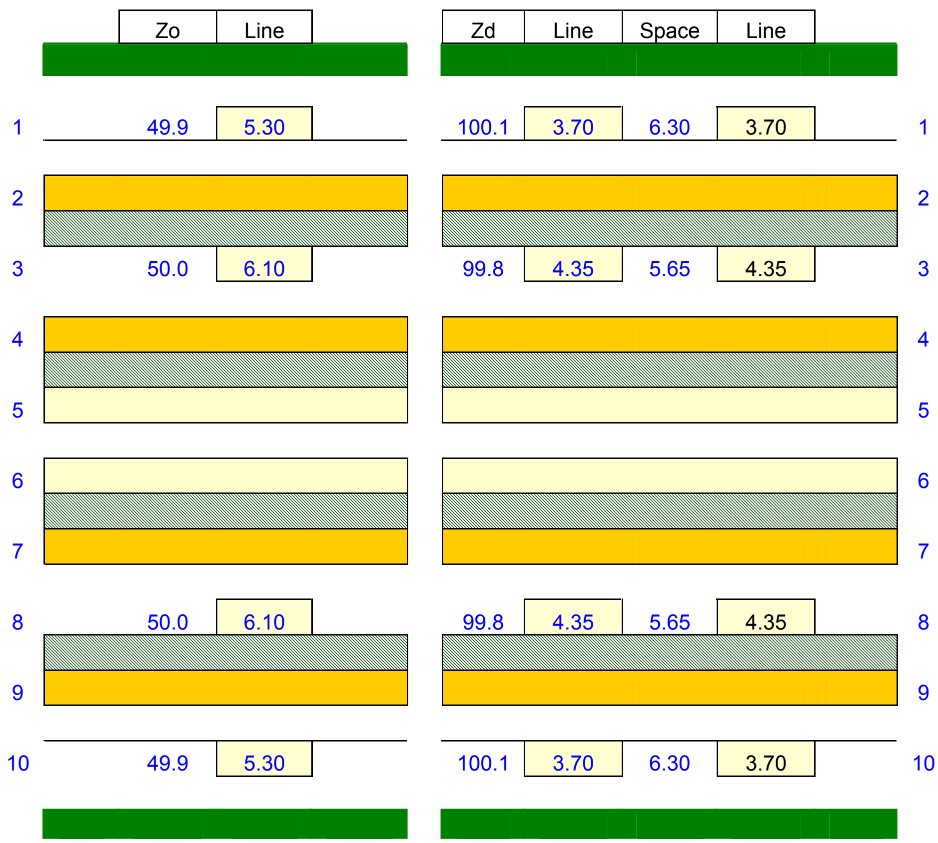


Figure 11-2 PCB Layer Stack-up

12 References

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

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.

Getting Service

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